Oracle® Essbase

Database Administrator's Guide

Release 11.1.2.4
Contents

Documentation Accessibility .......................................................... 39
Documentation Feedback ............................................................. 41
Part I. Understanding Essbase ......................................................... 43
Chapter 1. Introducing Essbase ........................................................ 45
  Introduction ............................................................................. 45
  Essbase Product Components .................................................. 45
    Essbase ................................................................................ 46
    Sample Essbase Applications .............................................. 46
  Administration Services ......................................................... 46
  Essbase Studio ......................................................................... 47
  Provider Services .................................................................... 47
  Smart View ............................................................................. 47
  Application Programming Interface (API) ................................ 47
  Developer Products ................................................................. 47
  Lifecycle Management .............................................................. 48
  Key Features ........................................................................... 49
    Integration with Existing Infrastructure .................................. 49
    Data Integration ................................................................... 49
    Ease of Server and Database Administration ............................ 49
    Mission Critical Applications in Web-based Environments ........ 50
    Powerful Querying ............................................................... 50
    Calculations ......................................................................... 50
    Write-Back and Security ....................................................... 50
    Ease of Development ............................................................ 50
Chapter 2. Quick Start for Implementing Essbase ................................. 53
Chapter 3. Understanding Multidimensional Databases ......................... 59
  OLAP and Multidimensional Databases ...................................... 59
  Dimensions and Members ....................................................... 60
<table>
<thead>
<tr>
<th>Administration Services Architecture</th>
<th>107</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deploying Administration Services</td>
<td>108</td>
</tr>
<tr>
<td>Starting Administration Services</td>
<td>108</td>
</tr>
<tr>
<td>About Administration Services Users</td>
<td>109</td>
</tr>
<tr>
<td>Connecting to Administration Services</td>
<td>109</td>
</tr>
<tr>
<td>Adding Essbase Administration Servers to Enterprise View</td>
<td>109</td>
</tr>
<tr>
<td>Adding Essbase Servers to Enterprise View</td>
<td>110</td>
</tr>
<tr>
<td>About Essbase Server Connections and Ports</td>
<td>110</td>
</tr>
<tr>
<td>About Essbase Administration Server</td>
<td>110</td>
</tr>
</tbody>
</table>

**Part II. Designing and Creating Applications and Databases** ........................................ 113

**Chapter 6. Creating Applications and Databases** ........................................ 115

| Process for Creating Applications and Databases | 115 |
| Understanding Applications and Databases | 116 |
| Understanding Database Artifacts | 116 |
| Understanding Database Outlines | 117 |
| Understanding Data Sources | 117 |
| Understanding Rules Files for Data Load and Dimension Build | 117 |
| Understanding Calculation Scripts | 118 |
| Understanding Report Scripts | 118 |
| Understanding Security Definitions | 118 |
| Understanding LROs | 118 |
| Understanding Member Select Definitions | 118 |
| Understanding Triggers Definitions | 119 |
| Creating Applications and Databases | 119 |
| Creating an Application | 119 |
| Creating a Database | 120 |
| Annotating a Database | 120 |
| Using Substitution Variables | 120 |
| Rules for Setting Substitution Variable Names and Values | 122 |
| Setting Substitution Variables | 123 |
| Deleting Substitution Variables | 123 |
| Updating Substitution Variables | 124 |
| Copying Substitution Variables | 124 |
| Using Location Aliases | 124 |
| Creating Location Aliases | 125 |
| Editing or Deleting Location Aliases | 125 |
Chapter 7. Creating and Changing Database Outlines ............................................ 127
  Process for Creating Outlines .................................................... 127
  Creating and Editing Outlines ............................................. 128
  Locking and Unlocking Outlines ........................................... 129
  Adding Dimensions and Members to an Outline ......................... 129
  Setting Data Storage Properties ........................................... 130
  Positioning Dimensions and Members ..................................... 130
    Moving Dimensions and Members ......................................... 130
  Sorting Dimensions and Members ........................................ 131
  Verifying Outlines .......................................................... 131
  Saving Outlines .............................................................. 133
    Saving an Outline with Added Standard Dimensions ............... 133
    Saving an Outline with One or More Deleted Standard Dimensions 133
    Creating Sub-Databases Using Deleted Members .................... 133

Chapter 8. Creating and Working With Duplicate Member Outlines ...................... 135
  Creating Duplicate Member Names in Outlines .......................... 135
  Restrictions for Duplicate Member Names and Aliases in Outlines ... 136
  Syntax for Specifying Duplicate Member Names and Aliases ......... 137
    Using Fully Qualified Member Names .................................. 137
    Qualifying Members by Differentiating Ancestor ..................... 138
    Using Shortcut Qualified Member Names ............................... 138
    Using Qualified Member Names in Unique Member Name Outlines .... 139
  Working with Duplicate Member Names ................................... 139

Chapter 9. Setting Dimension and Member Properties ..................................... 141
  Setting Dimension Types ..................................................... 141
    Creating a Time Dimension ............................................... 142
    Creating an Accounts Dimension ...................................... 142
    Creating a Country Dimension ........................................ 145
    Creating Currency Partitions ......................................... 145
    Creating Attribute Dimensions ....................................... 146
  Setting Member Consolidation .............................................. 146
  Calculating Members with Different Operators ........................... 147
  Determining How Members Store Data Values .............................. 147
    Understanding Stored Members ....................................... 148
    Understanding Dynamic Calculation Members ....................... 148
    Understanding Label Only Members ................................... 149
    Understanding Shared Members ....................................... 149
  Setting Aliases ............................................................... 153
Understanding Attribute Calculation and Shared Members ........................................ 181
Differences Between Calculating Attribute Members and Non-Attribute (Stored and Dynamic Calc) Members ................................................................. 182
Varying Attributes .................................................................................................. 182
About Varying Attributes ..................................................................................... 182
Implementing Varying Attributes ..................................................................... 184
Functions Supporting Varying Attributes ......................................................... 185
Limitations of Varying Attributes .................................................................... 185

Chapter 11. Linking Objects to Essbase Data ......................................................... 187
Understanding LROs ......................................................................................... 187
Understanding LRO Types and Data Cells ...................................................... 188
Setting Up Permissions for LROs ................................................................... 188
Viewing and Deleting LROs ............................................................................. 189
Exporting and Importing LROs ...................................................................... 190
Limiting LRO File Sizes for Storage Conservation ......................................... 190

Chapter 12. Working with Typed Measures ......................................................... 191
About Typed Measures ...................................................................................... 191
Working with Text Measures ........................................................................... 192
  Text Measures Overview and Workflow ...................................................... 192
  Text List Objects and Text List Members .................................................... 192
Working with Date Measures .......................................................................... 193
  Date Measures Overview ............................................................................ 193
  Implementing Date Measures .................................................................... 194
  Functions Supporting Date Measures ......................................................... 194
Performing Database Operations on Text and Date Measures ....................... 195
  Loading, Clearing, and Exporting Text and Date Measures ...................... 195
  Consolidating Text and Date Measures ....................................................... 196
  Retrieving Data With Text and Date Measures ........................................... 197
  Limitations of Text and Date Measures ....................................................... 197
Working with Format Strings ........................................................................... 198
  Overview of Format Strings .................................................................... 198
  Implementing Format Strings .................................................................... 198
  MDX Format Directive ............................................................................... 199
  Functions Supporting Format Strings ........................................................ 199
  Limitations of Format Strings .................................................................... 200

Chapter 13. Drilling Through to Oracle Applications ........................................ 201
  Overview of Drill-through to Oracle Applications ...................................... 201
<table>
<thead>
<tr>
<th>Understanding Drill-through URLs</th>
<th>202</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill-through URL Name</td>
<td>202</td>
</tr>
<tr>
<td>Drill-through URL XML</td>
<td>202</td>
</tr>
<tr>
<td>List of Drillable Regions</td>
<td>202</td>
</tr>
<tr>
<td>Level 0 Boolean Flag</td>
<td>203</td>
</tr>
<tr>
<td>Creating and Managing Drill-through URLs</td>
<td>203</td>
</tr>
</tbody>
</table>

**Chapter 14. Designing and Building Currency Conversion Applications**

<table>
<thead>
<tr>
<th>About Currency Conversion</th>
<th>205</th>
</tr>
</thead>
<tbody>
<tr>
<td>About the Sample Currency Application</td>
<td>206</td>
</tr>
<tr>
<td>Structure of Currency Applications</td>
<td>206</td>
</tr>
<tr>
<td>Main Database</td>
<td>207</td>
</tr>
<tr>
<td>Currency Database</td>
<td>209</td>
</tr>
<tr>
<td>Conversion Methods</td>
<td>210</td>
</tr>
<tr>
<td>Building Currency Conversion Applications and Performing Conversions</td>
<td>211</td>
</tr>
<tr>
<td>Creating Main Database Outlines</td>
<td>211</td>
</tr>
<tr>
<td>Preparing Main Database Outlines</td>
<td>211</td>
</tr>
<tr>
<td>Generating Currency Database Outlines</td>
<td>212</td>
</tr>
<tr>
<td>Linking Main and Currency Databases</td>
<td>212</td>
</tr>
<tr>
<td>Converting Currency Values</td>
<td>212</td>
</tr>
<tr>
<td>Tracking Currency Conversions</td>
<td>216</td>
</tr>
<tr>
<td>Troubleshooting Currency Conversion</td>
<td>217</td>
</tr>
</tbody>
</table>

**Chapter 15. Designing Partitioned Applications**

<table>
<thead>
<tr>
<th>Understanding Essbase Partitioning</th>
<th>219</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partition Types</td>
<td>219</td>
</tr>
<tr>
<td>Parts of a Partition</td>
<td>220</td>
</tr>
<tr>
<td>Data Sources and Data Targets</td>
<td>221</td>
</tr>
<tr>
<td>Overlapping Partitions</td>
<td>222</td>
</tr>
<tr>
<td>Substitution Variables in Partition Definitions</td>
<td>223</td>
</tr>
<tr>
<td>Attributes in Partitions</td>
<td>223</td>
</tr>
<tr>
<td>Version and Encoding Requirements</td>
<td>224</td>
</tr>
<tr>
<td>Partition Design Requirements</td>
<td>224</td>
</tr>
<tr>
<td>Benefits of Partitioning</td>
<td>225</td>
</tr>
<tr>
<td>Partitioning Strategies</td>
<td>225</td>
</tr>
<tr>
<td>Guidelines for Partitioning a Database</td>
<td>225</td>
</tr>
<tr>
<td>Guidelines for Partitioning Data</td>
<td>226</td>
</tr>
<tr>
<td>Security for Partitioned Databases</td>
<td>227</td>
</tr>
<tr>
<td>Using Backup and Restore and Transaction Logging and Replay with Partitioned Databases</td>
<td>228</td>
</tr>
<tr>
<td>Partition Type</td>
<td>Page</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Replicated Partitions</td>
<td>228</td>
</tr>
<tr>
<td>Rules for Replicated Partitions</td>
<td>229</td>
</tr>
<tr>
<td>Advantages of Replicated Partitions</td>
<td>230</td>
</tr>
<tr>
<td>Disadvantages of Replicated Partitions</td>
<td>230</td>
</tr>
<tr>
<td>Performance Considerations for Replicated Partitions</td>
<td>230</td>
</tr>
<tr>
<td>Replicated Partitions and Port Usage</td>
<td>232</td>
</tr>
<tr>
<td>Transparent Partitions</td>
<td>232</td>
</tr>
<tr>
<td>Rules for Transparent Partitions</td>
<td>233</td>
</tr>
<tr>
<td>Advantages of Transparent Partitions</td>
<td>234</td>
</tr>
<tr>
<td>Disadvantages of Transparent Partitions</td>
<td>234</td>
</tr>
<tr>
<td>Performance Considerations for Transparent Partitions</td>
<td>235</td>
</tr>
<tr>
<td>Calculating Transparent Partitions</td>
<td>236</td>
</tr>
<tr>
<td>Performance Considerations for Transparent Partition Calculations</td>
<td>237</td>
</tr>
<tr>
<td>Transparent Partitions and Member Formulas</td>
<td>237</td>
</tr>
<tr>
<td>Transparent Partitions and Port Usage</td>
<td>238</td>
</tr>
<tr>
<td>Linked Partitions</td>
<td>238</td>
</tr>
<tr>
<td>Advantages of Linked Partitions</td>
<td>239</td>
</tr>
<tr>
<td>Disadvantages of Linked Partitions</td>
<td>240</td>
</tr>
<tr>
<td>Drill Across and Linked Partitions</td>
<td>240</td>
</tr>
<tr>
<td>Linked Partitions and Port Usage</td>
<td>240</td>
</tr>
<tr>
<td>Case Studies for Designing Partitioned Databases</td>
<td>240</td>
</tr>
<tr>
<td>Case Study 1: Partitioning an Existing Database</td>
<td>241</td>
</tr>
<tr>
<td>Case Study 2: Connecting Existing Related Databases</td>
<td>242</td>
</tr>
<tr>
<td>Case Study 3: Linking Two Databases</td>
<td>244</td>
</tr>
</tbody>
</table>

**Chapter 16. Creating and Maintaining Partitions**

| Process for Creating Partitions | 245  |
| Choosing a Partition Type       | 245  |
| Setting up the Data Source and the Data Target | 246  |
| Setting the User Name and Password | 247  |
| Defining a Partition Area       | 247  |
| Mapping Members                 | 247  |
| Mapping Members with Different Names | 248  |
| Mapping Data Cubes with Extra Dimensions | 248  |
| Mapping Shared Members          | 250  |
| Importing Member Mappings       | 250  |
| Mapping Attributes Associated with Members | 250  |
| Creating Advanced Area-Specific Mappings | 252  |
| Validating Partitions           | 253  |
Part III. Building Dimensions and Loading Data

Chapter 17. Understanding Data Loading and Dimension Building

Introduction
Process for Data Loading and Dimension Building
Data Sources
Supported Data Sources
Items in a Data Source
Rules Files
Situations that Do and Do Not Need a Rules File
Data Sources that Do Not Need a Rules File
Formatting Ranges of Member Fields
Formatting Columns
Security and Multiple-User Considerations

Chapter 18. Working with Rules Files

Process for Creating Data Load Rules Files
Process for Creating Dimension Build Rules Files
Combining Data Load and Dimension Build Rules Files
Creating Rules Files
Setting File Delimiters
Naming New Dimensions
Selecting a Build Method
Setting and Changing Member and Dimension Properties
Using Data Prep Editor to Set Dimension and Member Properties
Using the Data Source to Work with Member Properties
Setting Field Type Information
Field Types and Valid Build Methods
Rules for Assigning Field Types
Setting Dimension Build Operational Instructions
Chapter 21. Understanding Advanced Dimension Building Concepts

Understanding Build Methods .................................................. 319
Using Generation References ................................................... 320
Using Level References ......................................................... 322
Using Parent-Child References ............................................... 324
Adding a List of New Members ............................................... 326
Adding Members Based On String Matches .............................. 326
Adding Members as Siblings of the Lowest Level ....................... 327
Adding Members to a Specified Parent .................................. 328
Building Attribute Dimensions and Associating Attributes .......... 329
Building Attribute Dimensions .............................................. 330
Associating Attributes ......................................................... 330
Updating Attribute Associations ......................................... 332
Removing Attribute Associations ......................................... 332
Working with Multilevel Attribute Dimensions ....................... 332
Working with Numeric Ranges .............................................. 334
Reviewing the Rules for Building Attribute and Base Dimensions . 338
Building Shared Members by Using a Rules File ....................... 339
Sharing Members at the Same Generation ......................... 340
Sharing Members at Different Generations ......................... 342
Sharing Non-Level 0 Members .............................................. 344
Building Multiple Roll-Ups by Using Level References ............. 345
Creating Shared Roll-Ups from Multiple Data Sources ............ 346
Building Duplicate Member Outlines ................................... 347
Uniquely Identifying Members Through the Rules File ................ 348
Building Qualified Member Names Through the Rules File ........... 348
Chapter 31. Using Parallel Calculation ........................................ 501
Using CALCPARALLEL Parallel Calculation ................................. 502
  Essbase Analysis of Feasibility ........................................ 502
  CALCPARALLEL Parallel Calculation Guidelines ........................ 502
  Relationship Between CALCPARALLEL Parallel Calculation and Other Essbase Features ........................................ 503
Checking Current CALCPARALLEL Settings ................................ 506
Enabling CALCPARALLEL Parallel Calculation ............................... 507
Identifying Additional Tasks for Parallel Calculation ...................... 508
Tuning CALCPARALLEL with Log Messages ................................. 509
  Monitoring CALCPARALLEL Parallel Calculation ................... 509
Using FIXPARALLEL Parallel Calculation .................................... 511

Chapter 32. Developing Custom-Defined Calculation Macros ............... 513
Understanding Custom-Defined Macros ..................................... 513
Naming Custom-Defined Macros ........................................ 513
Creating Custom-Defined Macros ......................................... 514
Using Custom-Defined Macros ........................................ 515
Viewing Custom-Defined Macros ........................................ 515
Updating Custom-Defined Macros ....................................... 515
Copying Custom-Defined Macros ....................................... 516
Removing Custom-Defined Macros ...................................... 516
Refreshing the Catalog of Custom-Defined Macros ...................... 517

Chapter 33. Developing Custom-Defined Calculation Functions .............. 519
Process for Creating Custom-Defined Functions ............................ 519
Custom-Defined Function Requirements .................................. 520
Creating and Compiling a Java Class ..................................... 521
Installing Java Classes on Essbase Server ................................ 522
Registering Custom-Defined Functions ................................... 523
Using Registered Custom-Defined Functions ............................ 524
Updating Custom-Defined Functions ......................................  524
Viewing Custom-Defined Functions ......................................  525
Removing Custom-Defined Functions .....................................  526
Copying Custom-Defined Functions ......................................  526
Performance Considerations for Custom-Defined Functions ..........  527
Memory Considerations for Custom-Defined Functions ..............  527

Part V. Retrieving Data .............................................................  529

Chapter 34. Understanding Report Script Basics ..........................  531
Working With a Simple Report Script .....................................  531
Understanding How Report Writer Works .................................  533
  Report Extractor ..................................................  534
  Parts of a Report ................................................  535
  Parts of a Report Script .......................................  536
Planning Reports .....................................................  536
Considering Security and Multiple-User Issues .........................  537
Reviewing the Process for Creating Report Scripts ....................  537
Creating Report Scripts ...............................................  538
Saving Report Scripts ................................................  538
Executing Report Scripts ................................................  539
Copying Report Scripts ................................................  539
Developing Free-Form Reports ............................................  539

Chapter 35. Developing Report Scripts .....................................  543
Understanding Extraction Commands .....................................  543
Understanding Formatting Commands .....................................  544
Understanding Report Script Syntax .....................................  544
Designing the Page Layout ..................................................  545
  Creating Page, Column, and Row Headings .........................  546
  Modifying Headings .............................................  547
  Creating Symmetric and Asymmetric Reports .......................  548
Formatting .................................................................  549
  Formatting Report Pages .......................................  549
  Formatting Page, Column, and Row Headings ....................  550
Adding Totals and Subtotals .............................................  553
Changing How Data Is Displayed ........................................  557
Selecting and Sorting Members ............................................  560
  Selecting Members ...............................................  560
  Selecting Members by Using Generation and Level Names .......  561
creating and using named sets and calculated members ........................................ 592
  calculated members ........................................................................ 592
  named sets ........................................................................ 594
  using iterative functions .......................................................... 594
  working with missing data ......................................................... 595
  using substitution variables in mdx queries ..................................... 597
  querying for properties .............................................................. 597
  querying for member properties ................................................ 598
  the value type of properties ..................................................... 599
  null property values ............................................................... 600

chapter 37. copying data subsets and exporting data ........................................ 603
  process for creating a database subset ......................................... 603
  create an application and database ............................................. 604
  copy the outline file from the source database .......................... 604
  create an output file containing the required data subset .............. 605
  load the output file into the new database .................................. 606
  exporting data ........................................................................ 607
  exporting data using maxl ........................................................ 607
  exporting text data using calculation scripts ............................... 608
  exporting text data using report scripts ..................................... 609

chapter 38. retrieving relational data ....................................................... 613
  integrating relational databases with essbase .............................. 613
  xolap overview ...................................................................... 613
  xolap workflow ..................................................................... 614
  guidelines for using xolap ........................................................ 614
  restrictions for xolap .............................................................. 614
  usages not supported in xolap ................................................ 615
  optimizing xolap .................................................................... 615

part vi. designing and managing a security system ................................. 617

chapter 39. user management and security in epm system security mode .......... 619
  using essbase in epm system security mode ............................... 619
  security for users and groups in epm system security .................. 620
  epm system security migration and upgrade considerations .......... 620
  user security considerations after epm system security migration and upgrade .... 621
  essbase user roles for shared services ....................................... 623
  essbase projects, applications, and databases in shared services ....... 624
  essbase users and groups in shared services ............................... 626
### Part VII. Enabling Multi-Language Applications Through Unicode

#### Chapter 42. Understanding the Essbase Unicode Implementation
- **About Unicode**
- **When to Use Unicode-Mode Applications**
- **Locales and the ESSLANG Variable**
- **Unicode and Non-Unicode Application Modes**
- **Unicode and Non-Unicode Essbase Server Modes**
- **Increased Name Lengths**
- **Compatibility Between Different Versions of Client Programs and Essbase Applications**
- **Unicode-Enabled C API**
- **Identification of Text Encoding andLocale**
- **Unicode-Enabled Administration Tools**
- **Retrieval Tools**
  - **Report Script**
  - **Spreadsheet**
  - **SQL Interface**
  - **Sample_U.Basic**

#### Chapter 43. Administering Unicode-Mode Applications
- **Setting Up a Computer for Unicode Support**
- **Defining Password Security**
- **Naming Applications and Databases**
- **Managing Unicode-Mode Essbase Servers**
  - **Setting Essbase Server to Unicode Mode**
  - **Viewing the Unicode-Related Mode of Essbase Server**
- **Managing Unicode-Mode Applications**
  - **Creating Unicode-Mode Applications**
  - **Migrating Applications to Unicode Mode**
  - **Backing Up and Restoring Databases Between Unicode and Non-Unicode Applications**
  - **Viewing the Unicode-Related Mode of an Application**
- **Using Control Characters in Report Scripts**
- **Working with Partitions**
- **Working with Logs**
Chapter 48. Managing Database Settings

Understanding the Essbase Server Kernel ........................................ 755
Understanding Buffered I/O and Direct I/O ..................................... 756
Viewing the I/O Access Mode .................................................... 756
Setting the I/O Access Mode .................................................... 756
Understanding Kernel Components ............................................. 757
Index Manager ........................................................................ 757
Allocation Manager .................................................................... 758
Data Block Manager ................................................................... 759
LRO Manager ........................................................................... 759
Lock Manager ........................................................................... 759
Transaction Manager ............................................................... 760
Understanding Kernel Startup ...................................................... 760
Understanding the Precedence of Database Settings ....................... 760
Understanding How Essbase Reads Settings ................................... 761
Viewing Most-Recently Entered Settings ....................................... 761
Customizing Database Settings .................................................. 762
Specifying and Changing Database Settings .................................. 762
Using alter database in MaxL ..................................................... 763
Using SETDBSTATEITEM in ESSCMD ......................................... 763

Chapter 49. Allocating Storage and Compressing Data

Storage Allocation ..................................................................... 765
Checking Index and Data File Sizes ............................................. 765
Specifying Disk Volumes ........................................................... 766
Reviewing an Example of Specifying Volumes to Control Storage ........ 769
Data Compression .................................................................... 770
Bitmap Data Compression ......................................................... 771
RLE Data Compression .............................................................. 771
zlib Compression ..................................................................... 772
Index Value Pair Compression .................................................... 773
Deciding Which Compression Type to Use ................................... 773
Changing Data Compression Settings ......................................... 774
Checking the Compression Ratio ................................................ 775
Data Block Size ........................................................................ 775

Chapter 50. Ensuring Data Integrity ................................................ 777

Understanding Transactions ....................................................... 777
Using Formulas ..................................................... 866
Consolidating .................................................... 866
Using Simple Formulas ............................................. 867
Using Complex Formulas ........................................... 867
Optimizing Formulas on Sparse Dimensions in Large Database Outlines ..... 868
Constant Values Assigned to Members in a Sparse Dimension ................. 869
Nonconstant Values Assigned to Members in a Sparse Dimension .............. 869
Using Cross-Dimensional Operators ................................... 870
Managing Formula Execution Levels ...................................... 871
Using Bottom-Up Calculation ........................................... 871
Bottom-Up and Top-Down Calculation ..................................... 872
Forcing a Bottom-Up Calculation ........................................ 873
Hybrid Aggregation Mode in Block Storage Databases .......................... 873
Managing Caches to Improve Performance ................................... 873
Working with the Block Locking System .................................... 874
Using SET LOCKBLOCK and CALCLOCKBLOCK ......................... 875
Managing Concurrent Access for Users ..................................... 875
Using Two-Pass Calculation ............................................ 876
Understanding Two-Pass Calculation ..................................... 876
Reviewing a Two-Pass Calculation Example .................................... 876
Understanding the Interaction of Two-Pass Calculation and Intelligent Calculation ...................................................... 878
Choosing Two-Pass Calculation Tag or Calculation Script .................... 879
Enabling Two-Pass on Default Calculations .................................. 879
Creating Calculation Scripts for Two-Pass and Intelligent Calculation ........... 880
Choosing Between Member Set Functions and Performance ..................... 883
Consolidating #MISSING Values ........................................ 884
Understanding #MISSING Calculation .................................. 884
Changing Consolidation for Performance ................................... 885
Removing #MISSING Blocks ............................................. 886
Identifying Additional Calculation Optimization Issues ........................... 886

Chapter 58. Optimizing Reports and Other Types of Retrieval ................. 889
Changing Buffer Size .................................................. 889
Setting the Retrieval Buffer Size ........................................ 889
Setting the Retrieval Sort Buffer Size .................................... 890
Setting Numeric Precision .............................................. 890
Generating Symmetric Reports ........................................ 891
Improving Retrieval Performance on Large Dimensions ........................ 891
Organizing Members to Optimize Data Extraction ................................ 892
Understanding Reports for Outlines That Contain Dynamic or Transparent Members .......................................................... 892
Limiting LRO File Sizes .......................................................... 893

Chapter 59. Running Essbase on Oracle Exalytics In-Memory Machine ................................................ 895
About Running Essbase on Oracle Exalytics In-Memory Machine ................................................ 895
Virtual Memory and Swap Space Considerations ........................................................... 895
Increase in Page File Size when Essbase Runs on Oracle Exalytics In-Memory Machine ................................. 895

Part X. Creating, Calculating, and Managing Aggregate Storage Databases .............................................. 897

Chapter 60. Comparison of Aggregate and Block Storage ........................................................................... 899
Introduction ........................................................ 899
Inherent Differences .................................................. 900
Outline Differences ................................................... 900
Calculation Differences ................................................ 902
Partitioning Differences ............................................... 902
Data Load Differences ................................................. 903
Query Differences .................................................... 903
Feature Differences ................................................... 904
Hybrid Aggregation .................................................. 905

Chapter 61. Aggregate Storage Applications, Databases, and Outlines ................................................. 907
Introduction ................................................................ 907
Process for Creating Aggregate Storage Applications ........................................................................ 907
Creating Aggregate Storage Applications, Databases, and Outlines ............................................. 908
Hierarchies ................................................................ 909
Attribute Dimensions .................................................. 914
Design Considerations for Attribute Queries .............................................................................. 915
Design Considerations for Aggregate Storage Outlines .............................................................. 916
Query Design Considerations for Aggregate Storage ........................................................................ 916
64-bit Dimension Size Limit for Aggregate Storage Database Outline .............................................. 916
Understanding the Compression Dimension for Aggregate Storage Databases ........................................ 919
Verifying Outlines ......................................................... 921
Outline Paging .......................................................... 922
Outline Paging Limits ................................................... 922
Compacting the Aggregate Storage Outline File .............................................................................. 924
Developing Formulas on Aggregate Storage Outlines ........................................................................ 924
Using MDX Formulas .................................................. 925
Formula Calculation for Aggregate Storage Databases ........................................................................ 927
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula Syntax for Aggregate Storage Databases</td>
<td>927</td>
</tr>
<tr>
<td>Creating Formulas on Aggregate Storage Outlines</td>
<td>928</td>
</tr>
<tr>
<td>Composing Formulas on Aggregate Storage Outlines</td>
<td>929</td>
</tr>
<tr>
<td>Using a Transparent Partition for Write-Back to Aggregate Storage Databases</td>
<td>931</td>
</tr>
<tr>
<td>Chapter 62. Aggregate Storage Time-Based Analysis</td>
<td>935</td>
</tr>
<tr>
<td>Introduction</td>
<td>935</td>
</tr>
<tr>
<td>Understanding Date-Time Dimensions</td>
<td>936</td>
</tr>
<tr>
<td>Understanding Linked Attributes</td>
<td>937</td>
</tr>
<tr>
<td>Designing and Creating an Outline for Date-Time Analysis</td>
<td>939</td>
</tr>
<tr>
<td>Preparing for Creating Date-Time Dimensionality</td>
<td>939</td>
</tr>
<tr>
<td>Understanding Date-Time Calendars</td>
<td>940</td>
</tr>
<tr>
<td>Modifying or Deleting Date-Time Dimensions</td>
<td>942</td>
</tr>
<tr>
<td>Verification Rules for Date-Time Dimensions</td>
<td>942</td>
</tr>
<tr>
<td>Verification Rules for Linked Attribute Dimensions</td>
<td>943</td>
</tr>
<tr>
<td>Loading Data Mapped to Dates</td>
<td>943</td>
</tr>
<tr>
<td>Analyzing Time-Based Data</td>
<td>944</td>
</tr>
<tr>
<td>Using Smart View to Analyze Time-Related Data</td>
<td>944</td>
</tr>
<tr>
<td>Analyzing Time-Based Metrics with MDX</td>
<td>945</td>
</tr>
<tr>
<td>Chapter 63. Loading, Calculating, and Retrieving Aggregate Storage Data</td>
<td>947</td>
</tr>
<tr>
<td>Introduction</td>
<td>947</td>
</tr>
<tr>
<td>Preparing Aggregate Storage Databases</td>
<td>949</td>
</tr>
<tr>
<td>Building Dimensions in Aggregate Storage Databases</td>
<td>949</td>
</tr>
<tr>
<td>Understanding Exclusive Operations on Aggregate Storage Databases</td>
<td>952</td>
</tr>
<tr>
<td>Loading Data into Aggregate Storage Databases</td>
<td>954</td>
</tr>
<tr>
<td>Clearing Data from an Aggregate Storage Database</td>
<td>965</td>
</tr>
<tr>
<td>Copying an Aggregate Storage Application</td>
<td>969</td>
</tr>
<tr>
<td>Combining Data Loads and Dimension Builds</td>
<td>969</td>
</tr>
<tr>
<td>Calculating Aggregate Storage Databases</td>
<td>969</td>
</tr>
<tr>
<td>Outline Factors Affecting Data Values</td>
<td>970</td>
</tr>
<tr>
<td>Block Storage Calculation Features That Do Not Apply to Aggregate Storage Databases</td>
<td>970</td>
</tr>
<tr>
<td>Calculation Order</td>
<td>971</td>
</tr>
<tr>
<td>Aggregating an Aggregate Storage Database</td>
<td>974</td>
</tr>
<tr>
<td>Performing Time Balance and Flow Metrics Calculations in Aggregate Storage Accounts Dimensions</td>
<td>985</td>
</tr>
<tr>
<td>Retrieving Aggregate Storage Data</td>
<td>988</td>
</tr>
<tr>
<td>Attribute Calculation Retrievals</td>
<td>989</td>
</tr>
<tr>
<td>Retrieval Tools Supporting Aggregate Storage Databases</td>
<td>989</td>
</tr>
<tr>
<td>Chapter 64. Performing Custom Calculations and Allocations on Aggregate Storage Databases</td>
<td>991</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Performing Custom Calculations and Allocations on Aggregate Storage Databases</td>
<td>991</td>
</tr>
<tr>
<td>Custom Calculations on Aggregate Storage Databases</td>
<td>992</td>
</tr>
<tr>
<td>List of Custom Calculations Criteria</td>
<td>993</td>
</tr>
<tr>
<td>Writing Custom Calculations</td>
<td>994</td>
</tr>
<tr>
<td>Executing Custom Calculations</td>
<td>994</td>
</tr>
<tr>
<td>Sample Use Case for Custom Calculations</td>
<td>995</td>
</tr>
<tr>
<td>Allocations on Aggregate Storage Databases</td>
<td>997</td>
</tr>
<tr>
<td>List of Allocation Criteria</td>
<td>997</td>
</tr>
<tr>
<td>Understanding Regions</td>
<td>999</td>
</tr>
<tr>
<td>Specifying Allocation Criteria</td>
<td>1000</td>
</tr>
<tr>
<td>Setting the POV</td>
<td>1000</td>
</tr>
<tr>
<td>Setting the Range</td>
<td>1001</td>
</tr>
<tr>
<td>Setting the Amount</td>
<td>1002</td>
</tr>
<tr>
<td>Setting the Basis</td>
<td>1004</td>
</tr>
<tr>
<td>Setting the Target</td>
<td>1005</td>
</tr>
<tr>
<td>Setting the Allocation Method</td>
<td>1005</td>
</tr>
<tr>
<td>Setting the Rounding Method</td>
<td>1008</td>
</tr>
<tr>
<td>Setting the Offset</td>
<td>1009</td>
</tr>
<tr>
<td>Balancing Allocations</td>
<td>1009</td>
</tr>
<tr>
<td>Understanding Settings for Basis and Target Time Span</td>
<td>1009</td>
</tr>
<tr>
<td>Examples of Aggregate Storage Allocations</td>
<td>1016</td>
</tr>
<tr>
<td>Sample Use Case for Aggregate Storage Allocations</td>
<td>1018</td>
</tr>
<tr>
<td>Avoiding Data Inconsistency When Using Formulas</td>
<td>1020</td>
</tr>
<tr>
<td>Understanding Data Load Buffers for Custom Calculations and Allocations</td>
<td>1020</td>
</tr>
<tr>
<td>Understanding Offset Handling for Custom Calculations and Allocations</td>
<td>1021</td>
</tr>
<tr>
<td>Understanding Credit and Debit Processing for Custom Calculations and Allocations</td>
<td>1022</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 65. Managing Aggregate Storage Applications and Databases</th>
<th>1023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Storage Security</td>
<td>1023</td>
</tr>
<tr>
<td>Managing Storage for Aggregate Storage Applications</td>
<td>1024</td>
</tr>
<tr>
<td>Working with Tablespaces</td>
<td>1024</td>
</tr>
<tr>
<td>Defining Tablespaces</td>
<td>1025</td>
</tr>
<tr>
<td>Managing the Aggregate Storage Cache</td>
<td>1025</td>
</tr>
<tr>
<td>Improving Performance When Building Aggregate Views on Aggregate Storage Databases</td>
<td>1026</td>
</tr>
<tr>
<td>Aggregate Storage Database Restructuring</td>
<td>1027</td>
</tr>
<tr>
<td>Levels of Aggregate Storage Database Restructuring</td>
<td>1028</td>
</tr>
<tr>
<td>Outline-Change Examples</td>
<td>1030</td>
</tr>
</tbody>
</table>
Exporting Aggregate Storage Databases ................................... 1033
Calculating the Number of Stored Dimension Levels in an Aggregate Storage Outline .......................................................... 1034

Part XI. Appendixes .............................................................. 1035

Appendix A. Limits ............................................................... 1037
Name and Related Artifact Limits ....................................... 1037
Data Load and Dimension Build Limits ................................... 1040
Aggregate Storage Database Limits ....................................... 1040
Block Storage Database Limits .......................................... 1041
Drill-through to Oracle Applications Limits ......................... 1041
Other Size or Quantity Limits .......................................... 1042

Appendix B. Setting Up Sample Applications ............................. 1043
Introduction .................................................................. 1043
Loading Data into Sample Databases ................................... 1044
Providing User Access to Sample Applications ....................... 1044
Preparing the Aggregate Storage Sample Application ............... 1045
Preparing the Partitioning Sample Applications ..................... 1045
Setting the Environment ............................................... 1045
Creating the Partition User ............................................. 1046
Changing Embedded User Names in Sample Partition Definitions ........................................ 1046

Appendix C. Troubleshooting Essbase Errors .............................. 1049
Understanding Fatal Error Handling .................................. 1049
Recovering from Dense Restructure Failures ....................... 1050
Recovering from Sparse Restructure Failure ....................... 1050
Synchronizing Member Names in Report Scripts and Database Outlines ........................................ 1050
Handling Essbase Server Problems When Running Multiple Reports ........................................ 1051
References .................................................................. 1051

Appendix D. Estimating Disk and Memory Requirements ............. 1053
Introduction .................................................................. 1053
Understanding How Essbase Stores Data .............................. 1053
Determining Disk Space Requirements ................................ 1054
Calculating the Factors to Be Used in Sizing Disk Requirements ........................................ 1055
Estimating Disk Space Requirements for One Database ............ 1059
Estimating the Total Essbase Server Disk Space Requirement .......................... 1066
Determining Memory Requirements .................................... 1067
Factors to Be Used in Sizing Memory Requirements ............... 1068
Appendix I. Essbase Features No Longer Supported or Deprecated in Previous Releases ................................................................. 1107

About Features that Are No Longer Supported or Deprecated ........................................................................................................... 1107

Essbase 11.1.2.4 ........................................................................................................................................................................... 1107
Essbase 11.1.2.3.503 ........................................................................................................................................................................... 1108
Essbase 11.1.2.3.500 ........................................................................................................................................................................... 1108
Essbase 11.1.2.3 ........................................................................................................................................................................... 1108
Essbase 11.1.2.2.100 ........................................................................................................................................................................... 1108
Essbase 11.1.2.2.000 ........................................................................................................................................................................... 1108
Essbase 11.1.2.1 ........................................................................................................................................................................... 1109
Essbase 11.1.1.4 ........................................................................................................................................................................... 1109
Essbase 9.3.3 ........................................................................................................................................................................... 1110
Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc.

Access to Oracle Support

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info or visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs if you are hearing impaired.
Documentation Feedback

Send feedback on this documentation to: epmdoc_ww@oracle.com

Follow EPM Information Development on these social media sites:
LinkedIn - http://www.linkedin.com/groups?gid=3127051&goback=.gmp_3127051
Twitter - http://twitter.com/hyperionepminfo
Facebook - http://www.facebook.com/pages/Hyperion-EPM-Info/102682103112642
Google+ - https://plus.google.com/106915048672979407731/#106915048672979407731/posts
YouTube - http://www.youtube.com/user/OracleEMWebcasts
Part I

Understanding Essbase

In Understanding Essbase:

- Introducing Essbase
- Quick Start for Implementing Essbase
- Understanding Multidimensional Databases
- Case Study: Designing a Single-Server, Multidimensional Database
- About Administration Services
Introduction

Oracle Essbase products help you deliver critical business information to the right people at the right time. With Essbase, you can quickly integrate data from multiple data sources, and then distribute that information to users in a format tailored to their needs. With the ability to interact with and explore data in real time, along familiar business dimensions, you can perform speed-of-thought analytics.

Essbase Product Components

Subtopics

- Essbase
- Sample Essbase Applications
- Administration Services
- Essbase Studio
- Provider Services
- Smart View
- Application Programming Interface (API)
- Developer Products
- Lifecycle Management

Essbase products incorporate powerful architectural features to handle a wide range of analytic applications across large multiuser environments. Essbase architecture includes three tiers. The client tier includes Essbase Server clients, such as Oracle Smart View for Office and Administration Services Console. The middle tier includes services, such as Oracle Hyperion Provider Services and Oracle Essbase Administration Services. The database tier is made up of Essbase Servers. Communication between the client and middle tiers, and the middle and database tiers, is through HTTP. Communication between the client and database tiers is
through TCP/IP or HTTP. Communication between data sources and the metadata catalog with the middle and database tiers is through ODBC and JDBC drivers.

**Essbase**

Essbase—a multi-threaded OLAP database software that takes advantage of symmetric multiprocessing hardware platforms—is based on Web-deployable, thin-client architecture. The server acts as a shared resource, handling all data storage, caching, calculations, and data security. The Essbase Server client needs only to retrieve and view data that resides on a server.

All Essbase application components, including database outlines and calculation scripts, application control, and multidimensional database information, reside on a server. With Essbase, you can configure server disk storage to span multiple disk drives, enabling you to store large databases. Essbase requires a server to run a multi-threaded operating system so a server can efficiently manage simultaneous requests. A server also runs a server agent process that acts as a traffic coordinator for all user requests to applications.

Aggregate storage databases provide an alternative to block storage databases and enable dramatic increases in database dimensionality. Using aggregate storage, Essbase serves a wide range of analytic needs—financial analysis, planning, budgeting, sales analysis, marketing analysis, supply-chain analysis, profitability analytics—all from a single analytic infrastructure.

MaxL—a multidimensional database access language that is part of Essbase Server—provides a flexible way to automate Essbase administration and maintenance tasks.

To install and configure Essbase, see the *Oracle Enterprise Performance Management System Installation and Configuration Guide*.

**Sample Essbase Applications**

Essbase provides a set of sample applications and associated databases that you can use to learn about Essbase features, and which are the basis for many of the examples given in this document.

Sample applications are installed with Essbase Server.

To use the sample applications, see Appendix B, “Setting Up Sample Applications.”

**Administration Services**

Administration Services—the database and system administrators’ interface to Essbase—provides a single-point-of-access console to multiple Essbase Servers. Using Administration Services Console, you can design, develop, maintain, and manage multiple Essbase Servers, applications, and databases. You can preview data from within the console without having to open a client application, such as Smart View. You can also use custom Java plug-ins to leverage and extend key functionality.
**Essbase Studio**

Oracle Essbase Studio simplifies cube construction by delivering a single environment for performing tasks related to data modeling, cube designing, and analytic application construction. With a wizard-driven user interface, Essbase Studio supports modeling of the various data source types from which Essbase applications are typically built.

A single common metadata repository, or catalog, captures all metadata related to all Essbase applications built in the enterprise and allows the reuse of metadata at the lowest level of granularity. The catalog makes Essbase Studio inherently aware of the common metadata that is shared across the various applications enterprise wide.

Essbase Studio supports several drill-through options: relational databases, custom SQL, URLs (including Oracle Business Intelligence Enterprise Edition and Oracle Hyperion Financial Data Quality Management URLs), and Java methods. Essbase Studio also supports lineage tracking through a rich graphical view of metadata relationships, allowing users to follow application lineages to their metadata components and through to the data sources from which they were sourced.

**Provider Services**

Provider Services is a middle-tier data-source provider to Essbase for Java API, Smart View, and XMLA clients. Provider Services supports highly concurrent analytical scenarios and provides scalability and reliability in a distributed Web-enabled enterprise environment.

**Smart View**

Smart View provides a common Microsoft Office interface for Essbase, Oracle Hyperion Financial Management, Oracle Hyperion Planning, and Oracle Hyperion Enterprise Performance Management Workspace data. Using Smart View, you can view, import, manipulate, distribute, and share data in Microsoft Excel, Word, and PowerPoint interfaces.

**Application Programming Interface (API)**

Essbase API—the developers’ interface to Essbase—enables you to create customized applications. The *Oracle Essbase API Reference* provides a complete listing of API functions.

**Developer Products**

Essbase developer products enable the rapid creation, management, and deployment of tailored enterprise analytic applications, whether or not users have programming knowledge.

The products (for example, Application Builder and Oracle Hyperion Application Builder for .NET) provide a comprehensive set of application programming interfaces, drag-and-drop components, and services.
Lifecycle Management

Oracle Hyperion Enterprise Performance Management System Lifecycle Management provides a consistent way for Oracle Enterprise Performance Management System products to migrate an application, a repository, or individual artifacts across product environments and operating systems. Generally, the Lifecycle Management interface in Oracle Hyperion Shared Services Console is consistent for all EPM System products that support Lifecycle Management. However, EPM System products display different artifact listings and export and import options in the Lifecycle Management interface.

Lifecycle Management features:

- Viewing applications and folders
- Searching for artifacts
- Migrating directly from one application to another
- Migrating to and from the file system
- Saving and loading migration definition files
- Viewing selected artifacts
- Auditing migrations
- Viewing the status of migrations
- Importing and exporting individual artifacts for quick changes on the file system

In addition to providing the Lifecycle Management interface in Shared Services Console, there is a command-line utility called Lifecycle Management Utility that provides an alternate way to migrate artifacts from source to destination. The Lifecycle Management Utility can be used with a third-party scheduling service such as Windows Task Scheduler or Oracle Enterprise Manager.

Lastly, there is a Lifecycle Management Application Programming Interface (API) that enables users to customize and extend the Lifecycle Management functionality.

For detailed information about Lifecycle Management, see the Oracle Enterprise Performance Management System Lifecycle Management Guide.
Key Features

Subtopics

- Integration with Existing Infrastructure
- Data Integration
- Ease of Server and Database Administration
- Mission Critical Applications in Web-based Environments
- Powerful Querying
- Calculations
- Write-Back and Security
- Ease of Development

Integration with Existing Infrastructure

Essbase products integrate with your existing business intelligence infrastructure. Essbase products meet the enterprise analytic demands of users for critical business information with a minimum of information technology (IT) overhead, and therefore enable organizations to realize maximum return on their existing IT investments:

- Provides an extensible architecture
- Supports a comprehensive range of data sources, hardware and operating system platforms, access interfaces, and development languages
- Enables analytic applications to be deployed across a local or wide area network and across an intranet or Internet

Data Integration

Essbase products enable organizations to leverage data in their data warehouses, legacy systems, online transaction processing (OLTP) systems, enterprise resource planning (ERP) systems, e-business systems, customer relationship management (CRM) applications, Web log files and other external data sources. For database integration, Essbase Studio provides a suite of graphical tools, data integration services, and a metadata catalog that tie into relational databases or data warehouse environments.

Ease of Server and Database Administration

Essbase products provide a cross-platform administration console, Administration Services Console. This console gives you detailed control over the Essbase environment:

- You can manage multiple servers and databases.
- You can use MaxL, a syntactical language command shell with a PERL extension module, to automate batch maintenance.
Mission Critical Applications in Web-based Environments

A middle-tier framework extends the power of Essbase products by creating a Web-enabled, distributed platform for Essbase applications, hence serving the analysis needs of large numbers of users in Web-based environments. Provider Services provides clustering and failover support, extending the scalability and reliability of the platform, and supports mission-critical applications in a 24 x 7 environment.

Powerful Querying

Large communities of business users can interact with data in real time to quickly analyze business performance. Using Essbase products, you can organize and present data along familiar business dimensions, enabling users to view and explore the data intuitively and turn it into actionable information.

Calculations

Essbase includes powerful calculation features for demanding analytic requirements. A rich library of functions makes it easy to define advanced and sophisticated business logic and relationships. Essbase gives users the flexibility to build, customize, and extend the calculator through custom-defined macros and functions, as well as the ability to span calculations across databases. On multiprocessor systems, a DBA can configure a single calculation request to use multiple threads to accomplish the calculation, providing enhanced calculation speed.

Aggregate storage databases provide an alternative to block storage databases and enable dramatic improvements in database aggregation time for certain types of applications.

Write-Back and Security

Essbase provides unique multi-user read and write capabilities, including data update and multi-user recalculation. Business users with front-end tools can write data back to a server and recalculate the data on a server using calculation scripts—key functionality to support sophisticated modeling and planning applications.

The robust, multilevel security model provides server-, database-, and cell-level security. Full control of data access, views, and write capabilities are managed through administration. EPM System security allows you to integrate with a variety of external user directories including LDAP-enabled directories such as Oracle Internet Directory and Microsoft Active Directory, and relational databases.

Ease of Development

Essbase offers many key advantages to help users develop effective multidimensional applications. Users can:

- Design and manage applications using a graphical interface to control most server functions.
- Quickly add dimensions, change calculations, and modify hierarchies to reflect new business developments. In addition, the dynamic dimension builder automatically defines and dynamically loads large amounts of data, including data from spreadsheets, flat files, and supported relational database tables directly into a database.
- Define key calculations without having to write a program.
- Define security for individuals and groups and customize views and retrieval procedures for each user without writing a program.
Quick Start for Implementing Essbase

Some information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

- Chapter 60, “Comparison of Aggregate and Block Storage”
- Oracle Enterprise Performance Management System Installation and Configuration Guide, if you are upgrading from a previous version of Essbase

The following table provides a process map for implementing Essbase. Each step in the process is described at a high level, with references to where you can obtain more detailed information.

**Table 1  A Process Map**

<table>
<thead>
<tr>
<th>Process Step</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learn the fundamentals of Essbase and distributed OLAP.</td>
<td>● Chapter 1, “Introducing Essbase”</td>
</tr>
<tr>
<td></td>
<td>● Chapter 3, “Understanding Multidimensional Databases”</td>
</tr>
<tr>
<td></td>
<td>● Chapter 6, “Creating Applications and Databases”</td>
</tr>
<tr>
<td></td>
<td>● Chapter 10, “Working with Attributes”</td>
</tr>
<tr>
<td></td>
<td>● Chapter 15, “Designing Partitioned Applications”</td>
</tr>
<tr>
<td></td>
<td>● Attend an Essbase training class; contact your software vendor.</td>
</tr>
<tr>
<td>Assess your needs and requirements.</td>
<td>Your budget, forecasting, and other financial reports with notes on how you want to improve them</td>
</tr>
<tr>
<td>Have a clear idea of your data analysis needs and which calculations and reports you want to run.</td>
<td></td>
</tr>
<tr>
<td>Analyze your data from a multidimensional perspective:</td>
<td>● Chapter 3, “Understanding Multidimensional Databases”</td>
</tr>
<tr>
<td>● Where are your data sources?</td>
<td>● Oracle Essbase SQL Interface Guide</td>
</tr>
<tr>
<td>● What type is the data? Is it detailed, relational data, or is it higher-level, hierarchical data that can be used for analysis?</td>
<td>● ODBC drivers documentation</td>
</tr>
<tr>
<td>● In what format is the data?</td>
<td></td>
</tr>
<tr>
<td>● How will you access the data? If you must access relational data, you may need Oracle Essbase SQL Interface.</td>
<td></td>
</tr>
<tr>
<td>Install Essbase.</td>
<td>Oracle Enterprise Performance Management System Installation and Configuration Guide</td>
</tr>
<tr>
<td>Process Step</td>
<td>Reference</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Design your application and database.</td>
<td>Chapter 4, “Case Study: Designing a Single-Server, Multidimensional Database”</td>
</tr>
<tr>
<td>• Identify business and user requirements, including security.</td>
<td></td>
</tr>
<tr>
<td>• Identify source data and determine the scope of the Essbase database.</td>
<td></td>
</tr>
<tr>
<td>• Choose whether to leave data in a relational database and access the data</td>
<td></td>
</tr>
<tr>
<td>with XOLAP, or to load all data.</td>
<td></td>
</tr>
<tr>
<td>• Define standard dimensions and designate sparse and dense storage.</td>
<td></td>
</tr>
<tr>
<td>• Identify any need for attribute dimensions.</td>
<td></td>
</tr>
<tr>
<td>• Identify any need for currency conversion applications that track data in</td>
<td></td>
</tr>
<tr>
<td>different currencies.</td>
<td></td>
</tr>
<tr>
<td>• Define calculations needed for outline dimensions and members.</td>
<td></td>
</tr>
<tr>
<td>• Identify any need to monitor data changes in the database. You monitor</td>
<td></td>
</tr>
<tr>
<td>data changes using the Essbase triggers feature.</td>
<td></td>
</tr>
<tr>
<td>Estimate the size of your database, check disk space, and ensure that the</td>
<td>• Appendix A, “Limits”</td>
</tr>
<tr>
<td>sizes of the index, data files, and data caches in memory are adequate.</td>
<td>• Appendix D, “Estimating Disk and Memory Requirements”</td>
</tr>
<tr>
<td>Create an application and a database.</td>
<td>Chapter 6, “Creating Applications and Databases”</td>
</tr>
<tr>
<td>Design a currency application.</td>
<td>Chapter 14, “Designing and Building Currency Conversion Applications”</td>
</tr>
<tr>
<td>Build an outline for your database.</td>
<td>Chapter 7, “Creating and Changing Database Outlines”</td>
</tr>
<tr>
<td>Assign alias names to your members.</td>
<td>Chapter 9, “Setting Dimension and Member Properties”</td>
</tr>
<tr>
<td>Build the dimensions. Decide whether your data loads will introduce new</td>
<td>• Chapter 17, “Understanding Data Loading and Dimension Building”</td>
</tr>
<tr>
<td>members into the outline. If so, consider dynamically building your</td>
<td>• Chapter 18, “Working with Rules Files”</td>
</tr>
<tr>
<td>dimensions using a rules file and a data source. If not, set up regular</td>
<td></td>
</tr>
<tr>
<td>data loads.</td>
<td></td>
</tr>
<tr>
<td>Load your data. You can load data in these ways:</td>
<td>• Chapter 17, “Understanding Data Loading and Dimension Building”</td>
</tr>
<tr>
<td>• Free-form</td>
<td>• Chapter 18, “Working with Rules Files”</td>
</tr>
<tr>
<td>• With a rules file</td>
<td>• Chapter 19, “Using a Rules File to Perform Operations on Records, Fields, and Data”</td>
</tr>
<tr>
<td></td>
<td>• Chapter 20, “Performing and Debugging Data Loads or Dimension Builds”</td>
</tr>
<tr>
<td></td>
<td>• Chapter 21, “Understanding Advanced Dimension Building Concepts”</td>
</tr>
<tr>
<td>Process Step</td>
<td>Reference</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
</tbody>
</table>
| Calculate your database. | ● Chapter 22, “Calculating Essbase Databases”
| ● Decide on a type of calculation: outline or calculation script, or a combination | ● Chapter 23, “Developing Formulas for Block Storage Databases”
| ● Ensure that relationships between members and member consolidations in the database outline are correct. | ● Chapter 24, “Reviewing Examples of Formulas for Block Storage Databases”
| ● Consider whether tagging some members as Dynamic Calc or using Intelligent Calculation will improve calculation efficiency. | ● Chapter 25, “Defining Calculation Order”
| ● Consider which members you should tag as two-pass calculation to ensure correct calculation results. | ● Chapter 27, “Dynamically Calculating Data Values”
| | ● Chapter 28, “Calculating Time Series Data”
| | ● Chapter 29, “Developing Calculation Scripts for Block Storage Databases”
| | ● Chapter 30, “Reviewing Examples of Calculation Scripts for Block Storage Databases”
| | ● Chapter 32, “Developing Custom-Defined Calculation Macros”
| | ● Chapter 33, “Developing Custom-Defined Calculation Functions” |
| Learn about dynamic calculations and how they can improve performance. | Chapter 27, “Dynamically Calculating Data Values” |
| View data with Smart View, other Oracle tools, or third-party tools. | ● See the Oracle Smart View for Office User’s Guide
| | ● For third-party tools, see vendor documentation |
| Learn about Partitioning. Think about whether your data can benefit from being decentralized into connected databases. | ● Chapter 15, “Designing Partitioned Applications”
| | ● Chapter 16, “Creating and Maintaining Partitions” |
| Link files or cell notes to data cells. | Chapter 11, “Linking Objects to Essbase Data” |
| Copy or export data subsets. | Chapter 37, “Copying Data Subsets and Exporting Data” |
| Back up and restore your data. | Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide |
| Allocate storage and specify Essbase kernel settings for your database. | ● Chapter 48, “Managing Database Settings”
| ● Data compression: Specify data compression on disk and the compression scheme. | ● Chapter 49, “Allocating Storage and Compressing Data”
<p>| ● Cache sizes: You can specify the index, data file, and data cache sizes. To prevent a slowdown of the operating system, ensure that the sum of index and data cache sizes for all the active databases on the server is not more than two-thirds of the system’s RAM. | |
| ● Cache memory locking: You can lock the memory that is used for the index, data file, and data caches into physical memory. | |
| ● Disk volumes: You can specify the storage location of Essbase index files and data files, appropriate disk volume names, and configuration parameters. | |
| ● Isolation level: Specify committed or uncommitted access. | |</p>
<table>
<thead>
<tr>
<th>Process Step</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generate a report.</td>
<td>● Chapter 34, “Understanding Report Script Basics”</td>
</tr>
<tr>
<td>• Choose a type of report: structured or free-form.</td>
<td>● Chapter 35, “Developing Report Scripts”</td>
</tr>
<tr>
<td>• Plan the elements of the report, such as page layout, column number,</td>
<td>● Chapter 37, “Copying Data Subsets and Exporting Data”</td>
</tr>
<tr>
<td>member identity, data value format, and title content.</td>
<td></td>
</tr>
<tr>
<td>• For a structured report, create page, column, and row headings</td>
<td></td>
</tr>
<tr>
<td>(unnecessary for free-form reports).</td>
<td></td>
</tr>
<tr>
<td>• Create and test a report script using Administration Services Report</td>
<td></td>
</tr>
<tr>
<td>Script Editor or any other text editor.</td>
<td></td>
</tr>
<tr>
<td>• Save the report on Essbase Server or on a client computer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Chapter 49, “Allocating Storage and Compressing Data”</td>
</tr>
<tr>
<td></td>
<td>● Chapter 52, “Monitoring Performance”</td>
</tr>
<tr>
<td>Automate routine operations by using MaxL or ESSCMD.</td>
<td>● Chapter 51, “Using MaxL Data Definition Language”</td>
</tr>
<tr>
<td></td>
<td>● Appendix E, “Using ESSCMD”</td>
</tr>
<tr>
<td>• Create a security plan for your environment based on database security</td>
<td>● Chapter 41, “Controlling Access to Database Cells Using Security Filters”</td>
</tr>
<tr>
<td>needs.</td>
<td></td>
</tr>
<tr>
<td>• Create users and groups and assign them administrative or data-access</td>
<td></td>
</tr>
<tr>
<td>permissions, if necessary.</td>
<td></td>
</tr>
<tr>
<td>• Define common data access permissions at the scope of the server,</td>
<td></td>
</tr>
<tr>
<td>applications, databases, or data-cell levels.</td>
<td></td>
</tr>
<tr>
<td>• To define global application or database permissions, select the relevant</td>
<td></td>
</tr>
<tr>
<td>application or application and database and adjust the settings.</td>
<td></td>
</tr>
<tr>
<td>Maintain your applications.</td>
<td>● Chapter 45, “Running Essbase Servers, Applications, and Databases”</td>
</tr>
<tr>
<td></td>
<td>● Chapter 46, “Managing Applications and Databases”</td>
</tr>
<tr>
<td></td>
<td>● “Using Essbase Logs” on page 726</td>
</tr>
<tr>
<td></td>
<td>● Chapter 48, “Managing Database Settings”</td>
</tr>
<tr>
<td></td>
<td>● Chapter 49, “Allocating Storage and Compressing Data”</td>
</tr>
<tr>
<td></td>
<td>● Chapter 50, “Ensuring Data Integrity”</td>
</tr>
<tr>
<td></td>
<td>● Oracle Hyperion Enterprise Performance Management System Backup and</td>
</tr>
<tr>
<td></td>
<td>Recovery Guide</td>
</tr>
<tr>
<td>Process Step</td>
<td>Reference</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
</tbody>
</table>
| Analyze and improve performance and troubleshoot errors if they occur. | - Chapter 52, "Monitoring Performance"
| Ensure that block size is not excessively large. | - Chapter 53, "Improving Essbase Performance"
| Set the correct size for the index, data file, data, and calculator caches. | - Chapter 54, "Optimizing Essbase Caches"
| Validate the database to ensure data integrity. | - Chapter 55, "Optimizing Database Restructuring"
| Consider using partitioning to distribute data across multiple cubes for better scalability and performance. | - Chapter 56, "Optimizing Data Loads"
| Ensure that disk space is adequate to allow the application to grow over time. | - Chapter 57, "Optimizing Calculations"
| Archive data from Essbase Server on a regular basis. | - Chapter 26, "Understanding Intelligent Calculation"
| Enable logging for spreadsheet update to ensure that log files are updated after archiving. | - Chapter 58, "Optimizing Reports and Other Types of Retrieval"
| If sorting on retrievals, increase the size of the retrieval sort buffer. | |
OLAP and Multidimensional Databases

Online analytical processing (OLAP) is a multidimensional, multiuser, client-server computing environment for users who need to analyze enterprise data. Finance departments use OLAP for applications such as budgeting, activity-based costing (allocations), financial performance analysis, and financial modeling. Sales departments use OLAP for sales analysis and forecasting. Marketing departments use OLAP for market research analysis, sales forecasting, promotions analysis, customer analysis, and market/customer segmentation. Typical manufacturing OLAP applications include production planning and defect analysis.

Important to all of these applications is the ability to provide managers the information that they need to make effective decisions about an organization’s strategic directions. A successful OLAP application provides information as needed; that is, it provides “just-in-time” information for effective decision-making.

Providing such information requires more than a base level of detailed data. Just-in-time information is computed data that usually reflects complex relationships and is often calculated on the fly. Analyzing and modeling complex relationships are practical only if response times are consistently short. In addition, because the nature of data relationships may not be known in advance, the data model must be flexible. A truly flexible data model ensures that OLAP systems can respond to changing business requirements as needed for effective decision making.

Although OLAP applications are found in widely divergent functional areas, all require the following key features:

- Multidimensional views of data
- Calculation-intensive capabilities
- Time intelligence
Key to OLAP systems are multidimensional databases, which not only consolidate and calculate data; but also provide retrieval and calculation of a variety of data subsets. A multidimensional database supports multiple views of data sets for users who need to analyze the relationships between data categories. For example, a marketing analyst might ask following questions:

- How did Product A sell last month? How does this figure compare to sales in the same month over the last five years? How did the product sell by branch, region, and territory?
- Did this product sell better in particular regions? Are there regional trends?
- Did customers return Product A last year? Were the returns due to product defects? Did the company manufacture the products in a specific plant?
- Did commissions and pricing affect how salespeople sold the product? Did certain salespeople sell more?

In multidimensional databases, the number of data views is limited only by the database outline, the structure that defines all elements of the database. Users can pivot the data to see information from a different viewpoint, drill down to find more detailed information, or drill up to see an overview.

Dimensions and Members

Subtopics

- Outline Hierarchies
- Dimension and Member Relationships
- Standard Dimensions and Attribute Dimensions
- Sparse and Dense Dimensions
- Selection of Dense and Sparse Dimensions

This section introduces the concepts of outlines, dimensions, and members within a multidimensional database. If you understand dimensions and members, you are well on your way to understanding the power of a multidimensional database.

A dimension represents the highest consolidation level in the database outline. The database outline presents dimensions and members in a tree structure to indicate a consolidation relationship. For example, in Figure 1 on page 61, Year is a dimension (of type Time) and Qtr1 is a member.

Essbase has standard dimensions and attribute dimensions.

Standard dimensions represent the core components of a business plan and often relate to departmental functions. Typical standard dimensions: Time, Accounts, Product Line, Market, and Division. Dimensions change less frequently than members.

Attribute dimensions are associated with standard dimensions. Through attribute dimensions, you group and analyze members of standard dimensions based on the member attributes (characteristics). For example, you can compare the profitability of noncaffeinated products that are packaged in glass to the profitability of noncaffeinated products packaged in cans.
Members are the individual components of a dimension. For example, Product A, Product B, and Product C might be members of the Product dimension. Each member has a unique name. Essbase can store the data associated with a member (referred to as a stored member in this chapter), or it can dynamically calculate the data when a user retrieves it.

**Outline Hierarchies**

All Essbase database development begins with creating a database outline, which accomplishes the following:

- Defines the structural relationships between members in an Essbase database
- Organizes data in the database
- Defines the consolidations and mathematical relationships between items

Essbase uses the concept of members to represent data hierarchies. Each dimension consists of one or more members. The members, in turn, may consist of other members. When you create a dimension, you tell Essbase how to consolidate the values of its individual members. Within the tree structure of the database outline, a consolidation is a group of members in a branch of the tree.

For example, many businesses summarize their data monthly, rolling up monthly data to obtain quarterly figures and rolling up quarterly data to obtain annual figures. Businesses may also summarize data by zip code, city, state, and country. Any dimension can be used to consolidate data for reporting purposes.

In the Sample.Basic database included with Essbase Server, for example, the Year dimension comprises five members: Qtr1, Qtr2, Qtr3, and Qtr4, each storing data for an individual quarter, plus Year, storing summary data for the year. Qtr1 comprises four members: Jan, Feb, and Mar, each storing data for a month, plus Qtr1, storing summary data for the quarter. Similarly, Qtr2, Qtr3, and Qtr4 comprise the members that represent the individual months plus the member that stores the quarterly totals.

The database outline in Figure 1 uses a hierarchical structure to represent the data consolidations and relationships in Qtr, as described in the previous paragraph.

![Hierarchical Structure](image)

Some dimensions consist of relatively few members, while others may have hundreds or even thousands of members. Essbase does not limit the number of members within a dimension and enables the addition of new members as needed.
Dimension and Member Relationships

Essbase uses hierarchical (generations and level; and roots and leaves) and family history (parents, children, and siblings; and descendants and ancestors) terms to describe the roles and relationships of the members in a database outline. The subtopics in this section reference the outline show in Figure 2 on page 62 in describing the position of the members.

Figure 2 Member Generation and Level Numbers

![Diagram of member generation and level numbers]

* The level of Measures depends on the branch

Parents, Children, and Siblings

Figure 2 illustrates the following parent, child, and sibling relationships:

- A parent is a member that has a branch below it. For example, Margin is a parent member for Sales and Cost of Goods Sold.
- A child is a member that has a parent above it. For example, Sales and Cost of Goods Sold are children of the parent Margin.
- Siblings are child members of the same immediate parent, at the same generation. For example, Sales and Cost of Goods Sold are siblings (they both have the parent Margin), but Marketing (at the same branch level) is not a sibling, because its parent is Total Expenses.

Descendants and Ancestors

Figure 2 on page 62 illustrates the following descendant and ancestral relationships:

- Descendants are members in branches below a parent. For example, Profit, Inventory, and Ratios are descendants of Measures. The children of Profit, Inventory, and Ratios are also descendants of Measures.
- Ancestors are members in branches above a member. For example, Margin, Profit, and Measures are ancestors of Sales.
**Roots and Leaves**

Figure 2 on page 62 illustrates the following root and leaf member relationships:

- The root is the top member in a branch. Measures is the root for Profit, Inventory, Ratios, and the children of Profit, Inventory, and Ratios.
- Leaf members have no children. They are also referred to as level 0 members. For example, Opening Inventory, Additions, and Ending Inventory are leaf members.

**Generations and Levels**

Figure 2 on page 62 illustrates the following generations levels:

- Generation refers to a consolidation level within a dimension. A root branch of the tree is generation 1. Generation numbers increase as you count from the root toward the leaf member. In Figure 2, Measures is generation 1, Profit is generation 2, and Margin is generation 3. All siblings of each level belong to the same generation; for example, both Inventory and Ratios are generation 2.

  Figure 3 shows part of the Product dimension with its generations numbered. Product is generation 1, 100 is generation 2, 100-10 is generation 3, and 100-10-12 and 100-10-16 are generation 4.

- Level also refers to a branch within a dimension; levels reverse the numerical ordering used for generations. Levels count up from the leaf member toward the root. The root level number varies depending on the depth of the branch. In Figure 2, Sales and Cost of Goods Sold are level 0. All other leaf members are also level 0. Margin is level 1, and Profit is level 2. Notice that the level number of Measures varies depending on the branch. For the Ratios branch, Measures is level 2. For the Total Expenses branch, Measures is level 3.

  Figure 4 shows part of the Product dimension with its levels numbered. 100 is level 2, 100-10 is level 1, and 100-10-12 and 100-10-16 are level 0.
**Generation and Level Names**

To ease report maintenance, you can assign a name to a generation or level and then use the name as a shorthand for all members in that generation or level. Because changes to an outline are automatically reflected in a report, when you use generation and level names, you do not need to change the report if a member name is changed or deleted from the database outline.

**Standard Dimensions and Attribute Dimensions**

Essbase has standard dimensions and attribute dimensions. This chapter focuses on standard dimensions, because Essbase does not allocate storage for attribute dimension members. Instead, it dynamically calculates the members when the user requests data associated with them.

An attribute dimension is a special type of dimension that is associated with a standard dimension. See Chapter 10, “Working with Attributes.”

**Sparse and Dense Dimensions**

Most data sets of multidimensional databases have two characteristics:

- Data is *not* smoothly and uniformly distributed.
- Data does *not* exist for the majority of member combinations. For example, all products may not be sold in all areas of the country.

Essbase maximizes performance by dividing the standard dimensions of an application into two types: dense dimensions and sparse dimensions. This division allows Essbase to cope with data that is not smoothly distributed, without losing the advantages of matrix-style access to the data. Essbase speeds data retrieval while minimizing memory and disk requirements.

Most multidimensional databases are inherently sparse; they lack data values for the majority of member combinations. A sparse dimension is one with a low percentage of available data positions filled.

For example, the outline of the Sample.Basic database in Figure 5 includes the Year, Product, Market, Measures, and Scenario dimensions. Product represents the product units, Market represents the geographical regions in which the products are sold, and Measures represents the accounts data. Because not every product is sold in every market, Market and Product are chosen as sparse dimensions.

Most multidimensional databases also contain dense dimensions. A dense dimension has a high probability that one or more cells is occupied in every combination of dimensions. For example, in the Sample.Basic database, accounts data exists for almost all products in all markets, so Measures is chosen as a dense dimension. Year and Scenario are also chosen as dense dimensions. Year represents time in months, and Scenario represents whether the accounts values are budget or actual values.

Caffeinated, Intro Date, Ounces, Pkg Type and Population are attribute dimensions. See Chapter 10, “Working with Attributes.”
### Selection of Dense and Sparse Dimensions

In most data sets, existing data tends to follow predictable patterns of density and sparsity. If you match patterns correctly, you can store the existing data in a reasonable number of fairly dense data blocks, rather than in many highly sparse data blocks.

By default, a new dimension is set sparse. To help you determine whether dimensions should be dense or sparse, Essbase provides an automatic configuration feature.

#### To select automatic configuration of dense and sparse dimensions:

See “Setting Dimensions as Dense or Sparse” in the [Oracle Essbase Administration Services Online Help](https://www.oracle.com/support/docset/essbase/admin/).

Essbase can make recommendations for the sparse-dense configuration of dimensions based on the following factors:

- The time and accounts tags on dimensions
- The probable size of the data blocks
- Characteristics that you attribute to the dimensions

You can apply a recommended configuration, or you can turn off automatic configuration and manually set the sparse or dense property for each dimension. Attribute dimensions are always sparse dimensions. Keep in mind that you can associate attribute dimensions only with sparse standard dimensions.

**Note:** The automatic configuration of dense and sparse dimensions provides only an estimate. It cannot take into account the nature of the data that you will load into your database or multiple user considerations.
**Dense-Sparse Configuration for Sample.Basic**

Consider the Sample.Basic database, which represents data for The Beverage Company (TBC). Because TBC does not sell every product in every market, the data set is reasonably sparse. Data values do not exist for many combinations of members in the Product and Market dimensions. For example, if Caffeine Free Cola is not sold in Florida, data values do not exist for the combination Caffeine Free Cola (100-30) -> Florida, so Product and Market are sparse dimensions. Therefore, if no data values exist for a specific combination of members in these dimensions, Essbase does not create a data block for the combination.

However, consider combinations of members in the Year, Measures, and Scenario dimensions. Data values almost always exist for some member combinations on these dimensions. For example, data values exist for the member combination Sales -> January -> Actual, because at least some products are sold in January. Thus, Year and, similarly, Measures and Scenario, are dense dimensions.

The sparse-dense configuration of the standard dimensions in the Sample.Basic database may be summarized:

- The sparse standard dimensions are Product and Market.
- The dense standard dimensions are Year, Measures, and Scenario.

Essbase creates a data block for each unique combination of members in the Product and Market dimensions (see “Data Storage” on page 70). Each data block represents data from the dense dimensions. The data blocks likely will have few empty cells.

For example, consider the sparse member combination Caffeine Free Cola (100-30), New York, in **Figure 6**:

- If accounts data (represented by the Measures dimension) exists for this combination for January, it probably exists for February and for all members in the Year dimension.
- If a data value exists for one member on the Measures dimension, it is likely that other accounts data values exist for other members in the Measures dimension.
- If Actual accounts data values exist, it is likely that Budget accounts data values exist.

**Figure 6  Dense Data Block for Sample.Basic Database**

[Diagram showing dense data block]

66
Dense and Sparse Selection Scenarios

Subtopics

- Scenario 1: All Sparse Standard Dimensions
- Scenario 2: All Dense Standard Dimensions
- Scenario 3: Dense and Sparse Standard Dimensions
- Scenario 4: A Typical Multidimensional Problem

The following scenarios show how a database is affected when you select different standard dimensions. Assume that these scenarios are based on typical databases with at least seven dimensions and several hundred members.

**Scenario 1: All Sparse Standard Dimensions**

If you make all dimensions sparse, Essbase creates data blocks that consist of single data cells that contain single data values. An index entry is created for each data block and, therefore, in this scenario, for each existing data value.

This configuration produces an index that requires a large memory. The more index entries, the longer Essbase searches for a specific block.

**Figure 7  Database with All Sparse Standard Dimensions**

![Database with All Sparse Standard Dimensions](image)

Large, complex index  Single-celled blocks

**Scenario 2: All Dense Standard Dimensions**

If you make all dimensions dense, as shown in Figure 8, Essbase creates one index entry and one large, sparse block. In most applications, this configuration requires thousands of times more storage than other configurations. Essbase must load the entire memory when it searches for a data value, which requires enormous memory.
Scenario 3: Dense and Sparse Standard Dimensions

Based on your knowledge of your company’s data, you have identified all your sparse and dense standard dimensions. Ideally, you have approximately equal numbers of sparse and dense standard dimensions. If not, you are probably working with a nontypical data set, and you must do more tuning to define the dimensions.

Essbase creates dense blocks that can fit into memory easily and creates a relatively small index, as shown in Figure 9. Your database runs efficiently using minimal resources.

Scenario 4: A Typical Multidimensional Problem

Consider a database with four standard dimensions: Time, Accounts, Region, and Product. In the following example, Time and Accounts are dense dimensions, and Region and Product are sparse dimensions.

The two-dimensional data blocks shown in Figure 10 represent data values from the dense dimensions: Time and Accounts. The members in the Time dimension are J, F, M, and Q1. The members in the Accounts dimension are Rev, Exp, and Net.
Essbase creates data blocks for combinations of members in the sparse standard dimensions (providing that at least one data value exists for the member combination). The sparse dimensions are Region and Product. The members of the Region dimension are East, West, South, and Total US. The members in the Product dimension are Product A, Product B, Product C, and Total Product.

Figure 11 shows 11 data blocks. No data values exist for Product A in the West and South, for Product B in the East and West, or for Product C in the East. Therefore, Essbase has not created data blocks for these member combinations. The data blocks that Essbase has created have few empty cells. This example effectively concentrates all sparseness into the index and concentrates all data into fully utilized blocks. This configuration provides efficient data storage and retrieval.

Next, consider a reversal of the dense and sparse dimension selections. In the following example, Region and Product are dense dimensions, and Time and Accounts are sparse dimensions.

In Figure 12, the two-dimensional data blocks represent data values from the dense dimensions: Region and Product. In the West region, data is not available for Product A and Product B. Data is also not available for Total Product in US.
Essbase creates data blocks for combinations of members in the sparse standard dimensions (providing that at least one data value exists for the member combination). The sparse standard dimensions are Time and Accounts.

**Figure 13** shows 12 data blocks. Data values exist for all combinations of members in the Time and Accounts dimensions; therefore, Essbase creates data blocks for all member combinations. Because data values do not exist for all products in all regions, the data blocks have many empty cells. Data blocks with many empty cells store data inefficiently.

![Data Blocks Created for Sparse Members on Time and Accounts](image)

### Data Storage

**Subtopics**

- Data Values
- Data Blocks and the Index System
- Multiple Data Views

Each data value in a multidimensional database is stored in one cell. A particular data value is referenced by specifying its coordinates along *each* standard dimension.

**Note:** Essbase does not store data for attribute dimensions. Essbase dynamically calculates attribute dimension data when a user retrieves the data.

Consider the simplified database shown in **Figure 14**. This database has three dimensions: Accounts, Time, and Scenario:

- The Accounts dimension has four members: Sales, COGS, Margin, and Margin%.
- The Time dimension has four quarter members, and Qtr1 has three month members
- The Scenario dimension has two child members: Budget for budget values and Actual for actual values.
**Data Values**

The intersection of one member from one dimension with one member from each of the other dimensions represents a data value. The example in Figure 15 has three dimensions (Accounts, Time, and Scenario); therefore, the dimensions and data values in the database can be represented as a cube.

As illustrated in Figure 16, when you specify Sales, you are specifying the slice of the database that contains eight Sales values, where Sales intersect with Actual and Budget.

Slicing a database amounts to fixing one or more dimensions at a constant value while allowing the other dimensions to vary.

As illustrated in Figure 17, when you specify Actual Sales, you are specifying the slice of the database that contains four Sales values, where Actual and Sales intersect.
A data value is stored in one cell in the database. To refer to a specific data value in a multidimensional database, you specify its member on each dimension. In Figure 18, the cell containing the data value for Sales, Jan, Actual is shaded. The data value can also be expressed using the cross-dimensional operator (->) as Sales -> Actual -> Jan.

**Data Blocks and the Index System**

Essbase uses two types of internal structures to store and access data: data blocks and the index system.

Essbase creates a data block for each unique combination of sparse standard dimension members (providing that at least one data value exists for the sparse dimension member combination). The data block represents all the dense dimension members for its combination of sparse dimension members.

Essbase creates an index entry for each data block. The index represents the combinations of sparse standard dimension members. It contains an entry for each unique combination of sparse standard dimension members for which at least one data value exists.

For example, in the Sample.Basic database outline shown in Figure 19, Product and Market are sparse dimensions.
If data exists for Caffeine Free Cola in New York, Essbase creates a data block and an index entry for the sparse member combination of Caffeine Free Cola (100-30) -> New York. If Caffeine Free Cola is not sold in Florida, Essbase does not create a data block or an index entry for the sparse member combination: Caffeine Free Cola (100-30) -> Florida.

The data block Caffeine Free Cola (100-30) -> New York represents all the Year, Measures, and Scenario dimensions for Caffeine Free Cola (100-30) -> New York.

Each unique data value can be considered to exist in a cell in a data block. When Essbase searches for a data value, it uses the index to locate the appropriate data block. Then, within the data block, it locates the cell containing the data value. The index entry provides a pointer to the data block. The index handles sparse data efficiently because it includes only pointers to existing data blocks.

Figure 20 shows part of a data block for the Sample.Basic database. Each dimension of the block represents a dense dimension in the Sample.Basic database: Time, Measures, and Scenario. A data block exists for each unique combination of members of the Product and Market sparse dimensions (providing that at least one data value exists for the combination).

Each data block is a multidimensional array that contains a fixed, ordered location for each possible combination of dense dimension members. Accessing a cell in the block does not involve sequential or index searches. The search is almost instantaneous, resulting in optimal retrieval and calculation speed.

Essbase orders the cells in a data block according to the order of the members in the dense dimensions of the database outline.
The block in Figure 21 represents the three dense dimensions from within the combination of the sparse members d22 and e3, from the preceding database outline. In Essbase, member combinations are denoted by the cross-dimensional operator. The symbol for the cross-dimensional operator is \( \rightarrow \), so \( d22 \rightarrow e3 \) denotes the block for d22 and e3. The intersection of A, b21, and c3 is written as \( A \rightarrow b21 \rightarrow c3 \).

Essbase creates a data block for every unique combination of the members of the sparse dimensions D and E (providing that at least one data value exists for the combination).

Data blocks, such as the one in Figure 21, may include cells that do not contain data values. A data block is created if at least one data value exists in the block. Essbase compresses data blocks with missing values on disk, expanding each block fully as it brings the block into memory. Data compression is optional but is enabled by default. See “Data Compression” on page 770.

By carefully selecting dense and sparse standard dimensions, you can ensure that data blocks do not contain many empty cells, minimizing disk storage requirements and improving performance. In Essbase, empty cells are known as #MISSING data.
Multiple Data Views

A multidimensional database supports multiple views of data sets for users who need to analyze the relationships between data categories. Slicing the database in different ways gives you different perspectives of the data. For example, in Figure 22, the slice for Jan examines all data values for which the Year dimension is fixed at Jan.

The slice in Figure 23 shows data for the month of Feb:

The slice in Figure 24 shows data for profit margin:

The Essbase Solution

To create an optimized Essbase database, ask:

- How does your company use the data?
- How will you build and order the dimensions?
- Which data compression scheme will you use?
• How will you create and order calculations?

See these topics:

• Planning the development of your multidimensional database, see Chapter 4, “Case Study: Designing a Single-Server, Multidimensional Database.”

• Selecting dense and sparse dimensions, see “Selection of Dense and Sparse Dimensions” on page 65.

• Loading data, see Chapter 17, “Understanding Data Loading and Dimension Building.”

• Compressing data and optimizing your database, see “Data Compression” on page 770.

• Calculating your database, see Chapter 22, “Calculating Essbase Databases.”
Case Study: Designing a Single-Server, Multidimensional Database

In This Chapter

Process for Designing a Database ................................................................. 77
Case Study: The Beverage Company ............................................................ 78
Analyzing and Planning .............................................................................. 79
Drafting Outlines ...................................................................................... 90
Checking System Requirements ................................................................. 95
Loading Test Data ..................................................................................... 95
Defining Calculations ............................................................................... 96
Defining Reports ....................................................................................... 104
Verifying the Design ................................................................................ 105

Some information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases. Also see Chapter 60, “Comparison of Aggregate and Block Storage.”

Process for Designing a Database

To implement a multidimensional database, you install Essbase, and then you design and create an application and databases. You analyze data sources and define requirements carefully and decide whether a single-server approach or a partitioned, distributed approach better serves your needs. For criteria that you can review to decide whether to partition an application, see “Guidelines for Partitioning a Database” on page 225.

Using a case study, this chapter provides an overview of the database planning process and discusses working rules that you can follow to design a single-server, multidimensional database solution for your organization. See Chapter 6, “Creating Applications and Databases.”

Figure 25 on page 78 illustrates the cyclical process of designing a database, which includes the following basic steps:

1. Analyze business needs and design a plan.

   The application and database that you create must satisfy the information needs of your users and your organization. Therefore, you identify source data, define user information access needs, review security considerations, and design a database model. See “Analyzing and Planning” on page 79.

2. Draft a database outline.
The outline determines the structure of the database—what information is stored and how different pieces of information interrelate. See “Drafting Outlines” on page 90.

3. Check system requirements.

How you meet system requirements and define system parameters affects the efficiency and performance of the database. See “Checking System Requirements” on page 95.

4. Load test data into the database.

After an outline and a security plan are in place, you load the database with test data to enable the later steps of the process. See “Loading Test Data” on page 95.

5. Define calculations.

You test outline consolidations and write and test formulas and calculation scripts for specialized calculations. See “Defining Calculations” on page 96.

6. Define reports.

Users access data through print and online reports and spreadsheets or on the Web. If you plan to provide predefined reports to users, you design report layouts and run reports. See “Defining Reports” on page 104.

7. Verify with users.

To ensure that the database satisfies your user goals, solicit and carefully consider user opinions. See “Verifying the Design” on page 105.

8. Repeat the process.

To fine-tune the design, repeat steps 1 through 7.

---

**Case Study: The Beverage Company**

This chapter bases the database planning process on the needs of a fictitious company called *The Beverage Company* (TBC) and uses TBC as an example to demonstrate how to build an
Essbase database. TBC is a variation of the Sample.Basic application that is included with the Essbase installation.

TBC manufactures, markets, and distributes soft drink products internationally. Analysts at TBC prepare budget forecasts and compare performance to budget forecasts monthly. The financial measures that analysts track are profit and loss and inventory.

TBC uses spreadsheet packages to prepare budget data and perform variance reporting. Because TBC plans and tracks a variety of products over several markets, the process of deriving and analyzing data is tedious. Last month, analysts spent most of their time entering and rekeying data and preparing reports.

TBC has determined that Essbase is the best tool for creating a centralized repository for financial data. The data repository will reside on a server that is accessible to analysts throughout the organization. Users can access the server and load data from various sources and retrieve data as needed. TBC has a variety of users, so TBC expects that different users will have different security levels for accessing data.

Analyzing and Planning

The design and operation of an Essbase multidimensional database are key to achieving a well-tuned system that enables you to analyze business information efficiently. Given the size and performance volatility of multidimensional databases, developing an optimized database is critical. A detailed plan that outlines data sources, user needs, and prospective database elements can save you development and implementation time.

The planning and analysis phase involves these tasks:

- “Analyzing Source Data” on page 80
- “Identifying User Requirements” on page 80
- “Planning for Security in a Multiple User Environment” on page 81
- “Creating Database Models” on page 81

When designing a multidimensional application, consider these factors:

- How information flows within the company—who uses which data for what purposes
- The types of reporting the company does—what types of data must be included in the outline to serve user reporting needs

Note: Defining only one database per application enables enhanced memory usage and ease of database administration. Applications that use the optional Essbase Currency Conversion module are an exception to this recommendation. Currency conversion applications generally consist of a main database and a separate currency database (see Chapter 14, “Designing and Building Currency Conversion Applications”).
Analyzing Source Data

First, evaluate the source data to be included in the database. Think about where the data resides and how often you plan to update the database with the data. This up-front research saves time when you create the database outline and load data into the Essbase database.

Determine the scope of the database. If an organization has thousands of product families containing hundreds of thousands of products, you may want to store data values only for product families. Interview members from each user department to find out what data they process, how they process data today, and how they want to process data in the future.

Carefully define reporting and analysis needs.

- How do users want to view and analyze data?
- How much detail should the database contain?
- Does the data support the desired analysis and reporting goals?
- If not, what additional data do you need, and where can you find it?

Determine the location of the current data.

- Where does each department currently store data?
- Is data in a format that Essbase can use?
- Do departments store data in relational databases on Windows or UNIX servers, or in Excel spreadsheets?
- Who updates the database and how frequently?
- Do those who need to update data have access to it?

Ensure that the data is ready to load into Essbase.

- Does data come from a single source or multiple sources?
- Is data in a format that Essbase can use? For a list of valid data sources that you can load into Essbase, see “Data Sources” on page 266.
- Is all data that you want to use readily available?

Identifying User Requirements

Discuss information needs with users. Review the information they use and the reports they must generate for review by others. Determine the following requirements:

- What types of analysis do users require?
- What summary and detail levels of information do users need?
- Do some users require access to information that other users should not see?
Planning for Security in a Multiple User Environment

Consider user information needs when you plan how to set up security permissions. End your analysis with a list of users and permissions.

Use this checklist to plan for security:

- Who are the users and what permissions should they have?
- Who should have load data permissions?
- Which users can be grouped, and as a group, given similar permissions?


Creating Database Models

Subtopics

- Identifying Analysis Objectives
- Determining Dimensions and Members
- Analyzing Database Design

Next, create a model of the database on paper. To build the model, identify the perspectives and views that are important to your business. These views translate into the dimensions of the database model.

Most businesses analyze the following areas:

- Time periods
- Accounting measures
- Scenarios
- Products
- Distribution channels
- Geographical regions
- Business units

Use the following topics to help you gather information and make decisions.

Identifying Analysis Objectives

After you identify the major areas of information in a business, the next step in designing an Essbase database is deciding how the database enables data analysis:

- If analyzing by time, which time periods are needed? Should the analysis include only the current year or multiple years? Should the analysis include quarterly and monthly data? Should it include data by season?
If analyzing by geographical region, how do you define the regions? Do you define regions by sales territories? Do you define regions by geographical boundaries such as states and cities?

If analyzing by product line, should you review data for each product? Can you summarize data into product classes?

Regardless of the business area, you must determine the perspective and detail needed in the analysis. Each business area that you analyze provides a different view of the data.

**Determining Dimensions and Members**

You can represent each business view as a separate standard dimension in the database. If you need to analyze a business area by classification or attribute, such as by the size or color of products, you can use attribute dimensions to represent the classification views.

The dimensions that you choose determine what types of analysis you can perform on the data. With Essbase, you can use as many dimensions as you need for analysis. A typical Essbase database contains at least seven standard dimensions (nonattribute dimensions) and many more attribute dimensions.

When you know approximately what dimensions and members you need, review the following topics and develop a tentative database design:

- “Relationships Among Dimensions” on page 82
- “Example Dimension-Member Structure” on page 83
- “Checklist for Determining Dimensions and Members” on page 84

After you determine the dimensions of the database model, choose the elements or items within the perspective of each dimension. These elements become the members of their respective dimensions. For example, a perspective of time may include the time periods that you want to analyze, such as quarters, and within quarters, months. Each quarter and month becomes a member of the dimension that you create for time. Quarters and months represent a two-level hierarchy of members and their children. Months within a quarter consolidate to a total for each quarter.

**Relationships Among Dimensions**

Next, consider the relationships among the business areas. The structure of an Essbase database makes it easy for users to analyze information from many perspectives. A financial analyst, for example, may ask the following questions:

- What are sales for a particular month? How does this figure compare to sales in the same month over the last five years?
- By what percentage is profit margin increasing?
- How close are actual values to budgeted values?
In other words, the analyst may want to examine information from three perspectives—time, account, and scenario. The sample database in Figure 26 represents these three perspectives as three dimensions, with one dimension represented along each of the three axes:

- A time dimension—which comprises Jan, Feb, Mar, and the total for Qtr1—is displayed along the X-axis.
- An accounts dimension, which consists of accounting figures such as Sales, COGS, Margin, and Margin%, is displayed along the Y-axis.
- Another dimension, which provides a different point of view, such as Budget for budget values and Actual for actual values, is displayed along the Z-axis.

The cells within the cube, where the members intersect, contain the data relevant to all three intersecting members; for example, the actual sales in January.

**Example Dimension-Member Structure**

Table 2 shows a summary of the TBC business areas that the planner determined would be dimensions. The dimensions represent the major business areas to be analyzed. The planner created three columns, with the dimensions in the left column and members in the two right columns. The members in column 3 are subcategories of the members in column 2. In some cases, members in column 3 are divided into another level of subcategories; for example, the Margin of the Measures dimension is divided into Sales and COGS.

Table 2  TBC Sample Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Members</th>
<th>Child Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>Qtr1</td>
<td>Jan, Feb, Mar</td>
</tr>
<tr>
<td>Year</td>
<td>Qtr2</td>
<td>Apr, May, Jun</td>
</tr>
<tr>
<td>Year</td>
<td>Qtr3</td>
<td>Jul, Aug, Sep</td>
</tr>
<tr>
<td>Year</td>
<td>Qtr4</td>
<td>Oct, Nov, Dec</td>
</tr>
<tr>
<td>Measures</td>
<td>Profit</td>
<td>Margin: Sales, COGS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Expenses: Marketing, Payroll, Miscellaneous</td>
</tr>
<tr>
<td>Measures</td>
<td>Inventory</td>
<td>Opening Inventory, Additions, Ending Inventory</td>
</tr>
</tbody>
</table>
In addition, the planner added two attribute dimensions to enable product analysis based on size and packaging:

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Members</th>
<th>Child Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meas</td>
<td>Ratios</td>
<td>Margin %, Profit %, Profit per Ounce</td>
</tr>
<tr>
<td>Prod</td>
<td>Colas (100)</td>
<td>Cola (100-10), Diet Cola (100-20), Caffeine Free Cola (100-30)</td>
</tr>
<tr>
<td>Prod</td>
<td>Root Beer (200)</td>
<td>Old Fashioned (200-10), Diet Root Beer (200-20), Sarsaparilla (200-30), Birch Beer (200-40)</td>
</tr>
<tr>
<td>Prod</td>
<td>Cream Soda (300)</td>
<td>Dark Cream (300-10), Vanilla Cream (300-20), Diet Cream Soda (300-30)</td>
</tr>
<tr>
<td>Prod</td>
<td>Fruit Soda (400)</td>
<td>Grape (400-10), Orange (400-20), Strawberry (400-30)</td>
</tr>
<tr>
<td>Mar</td>
<td>West</td>
<td>California, Nevada, Oregon, Utah, Washington</td>
</tr>
<tr>
<td>Mar</td>
<td>South</td>
<td>Louisiana, New Mexico, Oklahoma, Texas</td>
</tr>
<tr>
<td>Mar</td>
<td>Central</td>
<td>Colorado, Illinois, Iowa, Missouri, Ohio, Wisconsin</td>
</tr>
<tr>
<td>Scen</td>
<td>Actual</td>
<td>N/A</td>
</tr>
<tr>
<td>Scen</td>
<td>Budget</td>
<td>N/A</td>
</tr>
<tr>
<td>Scen</td>
<td>Variance</td>
<td>N/A</td>
</tr>
<tr>
<td>Scen</td>
<td>Variance %</td>
<td>N/A</td>
</tr>
</tbody>
</table>

In addition, the planner added two attribute dimensions to enable product analysis based on size and packaging:

Table 3  TBC Sample Attribute Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Members</th>
<th>Child Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ounces</td>
<td>Large</td>
<td>64, 32, 20</td>
</tr>
<tr>
<td></td>
<td>Small</td>
<td>16, 12</td>
</tr>
<tr>
<td>Pkg Type</td>
<td>Bottle</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Can</td>
<td></td>
</tr>
</tbody>
</table>

**Checklist for Determining Dimensions and Members**

Use the following checklist when determining the dimensions and members of your model database:

- What are the candidates for dimensions?
- Do any of the dimensions classify or describe other dimensions? These dimensions are candidates for attribute dimensions.
- Do users want to qualify their view of a dimension? The categories by which they qualify a dimension are candidates for attribute dimensions.
- What are the candidates for members?
• How many levels does the data require?
• How does the data consolidate?

Analyzing Database Design

Subtopics
• Dense and Sparse Dimensions
• Standard and Attribute Dimensions
• Dimension Combinations
• Repetition in Outlines
• Interdimensional Irrelevance
• Reasons to Split Databases
• Checklist to Analyze the Database Design

While the initial dimension design is still on paper, you should review the design according to a set of guidelines. The guidelines help you fine-tune the database and leverage the multidimensional technology. The guidelines are processes or questions that help you achieve an efficient design and meet consolidation and calculation goals.

The number of members needed to describe a potential data point should determine the number of dimensions. If you are not sure whether you should delete a dimension, keep it and apply more analysis rules until you feel confident about deleting or keeping it.

Use the information in the following topics to analyze and improve your database design.

Dense and Sparse Dimensions

Which dimensions are sparse and which dense affects performance. For an introduction, see “Sparse and Dense Dimensions” on page 64. See “Designing an Outline to Optimize Performance” on page 93.

Standard and Attribute Dimensions

For simplicity, the examples in this topic show alternative arrangements for what initially was designed as two dimensions. You can apply the same logic to all combinations of dimensions.

Consider the design for a company that sells products to multiple customers over multiple markets; the markets are unique to each customer:

<table>
<thead>
<tr>
<th></th>
<th>Cust A</th>
<th>Cust B</th>
<th>Cust C</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>100</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Illinois</td>
<td>N/A</td>
<td>150</td>
<td>N/A</td>
</tr>
<tr>
<td>California</td>
<td>N/A</td>
<td>N/A</td>
<td>30</td>
</tr>
</tbody>
</table>

Cust A is only in New York, Cust B is only in Illinois, and Cust C is only in California. The company can define the data in one standard dimension:

Market
New York
Cust A
However, if you look at a larger sampling of data, you may see that many customers can be in each market. Cust A and Cust E are in New York; Cust B, Cust M, and Cust P are in Illinois; Cust C and Cust F are in California. In this situation, the company typically defines the large dimension, Customer, as a standard dimension and the smaller dimension, Market, as an attribute dimension. The company associates the members of the Market dimension as attributes of the members of the Customer dimension. The members of the Market dimension describe locations of the customers.

Customer (Standard dimension)
- Cust A (Attribute: New York)
- Cust B (Attribute: Illinois)
- Cust C (Attribute: California)
- Cust E (Attribute: New York)
- Cust F (Attribute: California)
- Cust M (Attribute: Illinois)
- Cust P (Attribute: Illinois)

Market (Attribute dimension)
- New York
- Illinois
- California

Consider another situation. Again, the company sells products to multiple customers over multiple markets, but the company can ship to a customer that has locations in different markets:

<table>
<thead>
<tr>
<th></th>
<th>Cust A</th>
<th>Cust B</th>
<th>Cust C</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>100</td>
<td>75</td>
<td>N/A</td>
</tr>
<tr>
<td>Illinois</td>
<td>N/A</td>
<td>150</td>
<td>N/A</td>
</tr>
<tr>
<td>California</td>
<td>150</td>
<td>N/A</td>
<td>30</td>
</tr>
</tbody>
</table>

Cust A is in New York and California. Cust B is in New York and Illinois. Cust C is only in California. Using an attribute dimension does not work in this situation; a customer member cannot have multiple attribute members. Therefore, the company designs the data in two standard dimensions:

Customer
- Cust A
- Cust B
- Cust C

Market
- New York
- Illinois
- California

**Dimension Combinations**

Break each combination of two dimensions into a two-dimensional matrix. For example, proposed dimensions at TBC (as listed in Table 2 on page 83) include the following combinations:

- Year across Measures
- Year across Product
- Year across Market
- Year across Scenario
- Measures across Product
- Measures across Market
- Measures across Scenario
- Market across Product
- Market across Scenario
- Scenario across Product
- Ounces across Pkg Type

Ounces and Pkg Type, as attribute dimensions associated with the Product dimension, can be considered with the Product dimension.

To help visualize each dimension, draw a matrix and include a few of the first-generation members. Figure 27 shows a simplified set of matrixes for three dimensions.

Figure 27  Analyzing Dimensional Relationships

For each combination of dimensions, ask three questions:
- Does it add analytic value?
- Does it add utility for reporting?
- Does it avoid an excess of unused combinations?

For each combination, the answers to the questions help determine whether the combination is valid for the database. Ideally, the answer to each question is yes. If not, consider rearranging the data into more-meaningful dimensions. As you work through this process, discuss information needs with users.

Repetition in Outlines

The repetition of elements in an outline often indicates a need to split dimensions. The following examples show you how to avoid repetition.
In Figure 28 on page 88, the left column, labeled “Repetition,” shows Profit, Margin, Sales, COGS, and Expenses repeated under Budget and Actual in the Accounts dimension. The right column, labeled “No Repetition,” separates Budget and Actual into another dimension (Scenario), leaving just one set of Profit, Margin, Sales, COGS, and Expenses members in the Accounts dimension. This approach simplifies the outline and provides a simpler view of the budget and actual figures of the other dimensions in the database.

![Figure 28 Example of Eliminating Repetition By Creating a Scenario Dimension](image)

In Figure 29 on page 88, the left column, labeled “Repetition,” uses shared members in the Diet dimension to analyze diet beverages. Members 100–20, 200–20, and 300–20 are repeated: once under Diet, and once under their respective parents. The right column, labeled “No Repetition,” simplifies the outline by creating a Diet attribute dimension of type Boolean (True or False). All members are shown only once, under their respective parents, and are tagged with the appropriate attribute (“Diet: True” or “Diet: False”).

![Figure 29 Example of Eliminating Repetition By Creating an Attribute Dimension](image)

Attribute dimensions also provide additional analytic capabilities. See “Designing Attribute Dimensions” on page 171.

**Interdimensional Irrelevance**

Interdimensional irrelevance occurs when many members of a dimension are irrelevant across other dimensions. Essbase defines irrelevant data as data that Essbase stores only at the summary (dimension) level. In such a situation, you may be able to remove a dimension from the database and add its members to another dimension or split the model into separate databases.

For example, TBC considered analyzing salaries as a member of the Measures dimension. But salary information often proves irrelevant in the context of a corporate database. Most salaries
are confidential and apply to individuals. The individual and the salary typically represent one cell, with no reason to intersect with any other dimension.

TBC considered separating employees into a separate dimension. Table 4 shows an example of how TBC analyzed the proposed Employee dimension for interdimensional irrelevance. Members of the proposed Employee dimension (represented in the table header row) are compared with members of the Measures dimension (represented in the left-most column). The Measures dimension members (such as Revenue) apply to All Employees; only the Salary measure is relevant to individual employees.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Example of Interdimensional Irrelevance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Joe Smith</td>
</tr>
<tr>
<td>Revenue</td>
<td>Irrelevance</td>
</tr>
<tr>
<td>Variable Costs</td>
<td>Irrelevance</td>
</tr>
<tr>
<td>COGS</td>
<td>Irrelevance</td>
</tr>
<tr>
<td>Advertising</td>
<td>Irrelevance</td>
</tr>
<tr>
<td>Salaries</td>
<td>Relevance</td>
</tr>
<tr>
<td>Fixed Costs</td>
<td>Irrelevance</td>
</tr>
<tr>
<td>Expenses</td>
<td>Irrelevance</td>
</tr>
<tr>
<td>Profit</td>
<td>Irrelevance</td>
</tr>
</tbody>
</table>

**Reasons to Split Databases**

Because individual employee information is irrelevant to the other information in the database, and also because adding an Employee dimension would substantially increase database storage needs, TBC created a separate Human Resources (HR) database. The new HR database contains a group of related dimensions and includes salaries, benefits, insurance, and 401(k) plans.

There are many reasons for splitting a database; for example, suppose that a company maintains an organizational database that contains several international subsidiaries in several time zones. Each subsidiary relies on time-sensitive financial calculations. You can split the database for groups of subsidiaries in the same time zone to ensure that financial calculations are timely. You can also use a partitioned application to separate information by subsidiary.

**Checklist to Analyze the Database Design**

Use the following checklist to analyze the database design:

- Have you minimized the number of dimensions?
- For each dimensional combination, did you ask:
  - Does it add analytic value?
  - Does it add utility for reporting?
Does it avoid an excess of unused combinations?
Did you avoid repetition in the outline?
Did you avoid interdimensional irrelevance?
Did you split the databases as necessary?

Drafting Outlines

Subtopics

- Dimension and Member Properties
- Dimension Types
- Member Storage Properties
- Checklist for Dimension and Member Properties
- Designing an Outline to Optimize Performance

Now you can create the application and database and build the first draft of the outline in Essbase. The draft defines all dimensions, members, and consolidations. Use the outline to design consolidation requirements and identify where you need formulas and calculation scripts.

Note: Before you create a database and build its outline, create an Essbase application in which to add the database.

The TBC planners issued the following draft for a database outline. In this plan, Year, Measures, Product, Market, Scenario, Pkg Type, and Ounces are dimension names. Observe how TBC anticipated consolidations, calculations and formulas, and reporting requirements. The planners also used product codes rather than product names to describe products.

- **Year.** TBC needs to collect data monthly and summarize the monthly data by quarter and year. Monthly data, stored in members such as Jan, Feb, and Mar, consolidates to quarters. Quarterly data, stored in members such as Qtr1 and Qtr2, consolidates to Year.

- **Measures.** Sales, Cost of Goods Sold, Marketing, Payroll, Miscellaneous, Opening Inventory, Additions, and Ending Inventory are standard measures. Essbase can calculate Margin, Total Expenses, Profit, Total Inventory, Profit %, Margin %, and Profit per Ounce from these measures. TBC needs to calculate Measures on a monthly, quarterly, and yearly basis.

- **Product.** The Product codes are 100-10, 100-20, 100-30, 200-10, 200-20, 200-30, 200-40, 300-10, 300-20, 300-30, 400-10, 400-20, and 400-30. Each product consolidates to its respective family (100, 200, 300, and 400). Each consolidation allows TBC to analyze by size and package, because each product is associated with members of the Ounces and Pkg Type attribute dimensions.

- **Market.** Several states make up a region; four regions make up a market. The states are Connecticut, Florida, Massachusetts, New Hampshire, New York, California, Nevada, Oregon, Utah, Washington, Louisiana, New Mexico, Oklahoma, Texas, Colorado, Illinois,
Iowa, Missouri, Ohio, and Wisconsin. Each state consolidates into its region—East, West, South, or Central. Each region consolidates into Market.

- **Scenario.** TBC derives and tracks budget versus actual data. Managers must monitor and track budgets and actuals, as well as the variance and variance percentage between them.

- **Pkg Type.** TBC wants to see the effect that product packaging has on sales and profit. Establishing the Pkg Type attribute dimension enables users to analyze product information based on whether a product is packaged in bottles or cans.

- **Ounces.** TBC sells products in different sizes in ounces in different markets. Establishing the Ounces attribute dimension helps users monitor which sizes sell better in which markets.

The following topics present a review of the basics of dimension and member properties and a discussion of how outline design affects performance.

## Dimension and Member Properties

The properties of dimensions and members define the roles of the dimensions and members in the design of the multidimensional structure. These properties include the following:

- Dimension types and attribute associations. See “Dimension Types” on page 91.
- Data storage properties. See “Member Storage Properties” on page 92.
- Consolidation operators. See “Consolidation of Dimensions and Members” on page 96.
- Formulas. See “Formulas and Functions” on page 100.

For a complete list of dimension and member properties, see Chapter 9, “Setting Dimension and Member Properties.”

## Dimension Types

A dimension type is a property that Essbase provides that adds special functionality to a dimension. The most commonly used dimension types: time, accounts, and attribute. This topic uses the following dimensions of the TBC database to illustrate dimension types.

**Database:** Design
- Year (Type: time)
- Measures (Type: accounts)
- Product
- Market
- Scenario
- Pkg Type (Type: attribute)
- Ounces (Type: attribute)

*Table 5* defines each Essbase dimension type.
### Table 5  Dimension Types

<table>
<thead>
<tr>
<th>Dimension Types</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Specifies no particular dimension type.</td>
</tr>
<tr>
<td>Time</td>
<td>Defines the time periods for which you report and update data. You can tag only one dimension as time. The time dimension enables several accounts dimension functions, such as first and last time balances.</td>
</tr>
</tbody>
</table>
| Accounts        | Contains items that you want to measure, such as profit and inventory, and makes Essbase built-in accounting functionality available. Only one dimension can be defined as accounts.  
For discussion of two forms of account dimension calculation, see "Accounts Dimension Calculations" on page 99. |
| Attribute       | Contains members that can be used to classify members of another, associated dimension.  
For example, the Pkg Type attribute dimension contains a member for each type of packaging, such as bottle or can, that applies to members of the Product dimension. |
| Country         | Contains data about where business activities take place. In a country dimension, you can specify the currency used in each member.  
For example, Canada has three markets—Vancouver, Toronto, and Montreal, which use the same currency, Canadian dollars. |
| Currency partition | Separates local currency members from the base currency defined in the application. This dimension type is used only in the main database and is only for currency conversion applications. The base currency for analysis may be U.S. dollars, and the local currency members may contain values that are based on the currency type of their region. |

### Member Storage Properties

You can specify data storage properties for members; data storage properties define where and when consolidations are stored. For example, by default, members are tagged as store data. Essbase sums the values of store data members and stores the result at the parent level.

You can change the default logic for each member by changing the data storage property tag for the member. For example, you can change a store data member to a label only member. Members with the label only tag, for example, do not have data associated with them.

Table 6 describes the effect that Essbase data storage properties have on members.

### Table 6  Essbase Data Storage Properties

<table>
<thead>
<tr>
<th>Data Storage Properties</th>
<th>Effects on Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store data</td>
<td>The member stores data. Store data is the default storage property.</td>
</tr>
<tr>
<td>Dynamic Calc</td>
<td>The data associated with the member is not calculated until requested by a user. The calculated data is not stored; it is discarded after the request is completed.</td>
</tr>
<tr>
<td>Dynamic Calc and Store</td>
<td>The data associated with the member is not calculated until it is requested by a user. The calculated data is then stored.</td>
</tr>
<tr>
<td>Shared member</td>
<td>The data associated with the member comes from another member with the same name.</td>
</tr>
<tr>
<td>Data Storage Properties</td>
<td>Effects on Members</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Never share</td>
<td>The data associated with the member is duplicated with the parent and its child if an implied shared relationship exists.</td>
</tr>
<tr>
<td>Label only</td>
<td>Although a label only member has no data associated with it, a label only member can display a value. The label only tag groups members and eases navigation and reporting. Typically, label only members are not calculated. For example, in the Measures dimension, the member Ratios has three children, Margin%, Profit%, and Profit per Ounce. The member Ratios defines a category of members. When consolidated, Margin%, Profit%, and Profit per Ounce do not roll up to a meaningful figure for Ratios. Hence, Ratios is tagged as label only.</td>
</tr>
</tbody>
</table>

**Checklist for Dimension and Member Properties**

- Can you identify a time dimension?
- Can you identify an accounts dimension?
- Does the data include foreign currencies? If so, did you identify a currency partition dimension?
- Can you identify qualities or characteristics of dimensions that should be defined as separate attribute dimensions?
- Which members require special data storage properties?

**Designing an Outline to Optimize Performance**

Subtopics

- Optimizing Query Performance
- Optimizing Calculation Performance
- Meeting the Needs of Both Calculation and Retrieval

Position attribute dimensions at the end of the outline. Position dense dimensions before sparse dimensions.

The position of dimensions in an outline and the storage properties of dimensions can affect two areas of performance—how quickly calculations are run and how long it takes users to retrieve information.

Use the following topics to understand performance optimization basics.

**Optimizing Query Performance**

To optimize query performance, use the following guidelines when you design an outline:

- If the outline contains attribute dimensions, ensure that the attribute dimensions are the only sparse Dynamic Calc dimensions in the outline.
- In the outline, place the more-queried sparse dimensions before the less-queried sparse dimensions.
The outline in Figure 30 is designed for optimum query performance:

- Because the outline contains attribute dimensions, the storage property for standard dimensions and all standard dimensions members is set as store data.
- As the most-queried sparse dimension, the Product dimension is the first of the sparse dimensions. Base dimensions are typically queried more than other dimensions.

Optimizing Calculation Performance

To optimize calculation performance, order the sparse dimensions in the outline by their number of members, starting with the dimension that contains the fewest.

See “Designing for Calculation Performance” on page 859.

The outline in Figure 31 is designed for optimum calculation performance:

- The smallest standard dimension that is sparse, Market, is the first of the sparse dimensions in the outline.
- The largest standard dimension that is sparse, Product, is immediately above the first attribute dimension. If the outline did not contain attribute dimensions, the Product dimension would be at the end of the outline.

Meeting the Needs of Both Calculation and Retrieval

Although they contain the same dimensions, the example outlines in Figure 30 on page 94 and Figure 31 on page 94 are different. To determine the best outline sequence for a situation, prioritize the data retrieval requirements of the users against the time needed to run calculations.
on the database. How often do you expect to update and recalculate the database? What is the
nature of user queries? What is the expected volume of user queries?

A possible workaround is initially to position the dimensions in the outline to optimize
calculation. After you run the calculations, you can manually resequence the dimensions to
optimize retrieval. When you save the outline after you reposition its dimensions, choose to
restructure the database by index only. Before you run calculations again, resequence the
dimensions in the outline to optimize calculation.

Checking System Requirements

Now you are ready to determine the system requirements for the database.

- Ensure that you have enough disk space.
  See “Determining Disk Space Requirements” on page 1054.
- Ensure that you have enough memory.
  See “Determining Memory Requirements” on page 1067.
- Ensure that your caches are set correctly.
  See Chapter 54, “Optimizing Essbase Caches.”

Loading Test Data

Before you can test calculations, consolidations, and reports, you need data in the database.
During the design process, loading mocked-up data or a subset of real data provides flexibility
and shortens the time required to test and analyze results.

Detailed instructions for loading data are in the following chapters:

- Chapter 17, “Understanding Data Loading and Dimension Building”
- Chapter 18, “Working with Rules Files”
- Chapter 19, “Using a Rules File to Perform Operations on Records, Fields, and Data”
- Chapter 20, “Performing and Debugging Data Loads or Dimension Builds”
- Chapter 21, “Understanding Advanced Dimension Building Concepts”

If you are satisfied with your database design after the preliminary test, test load the complete
set of real data with which you will populate the final database. Use the test rules files if possible.
This final test may reveal source data problems that were not anticipated during earlier design
process phases.
Defining Calculations

Subtopics

- Consolidation of Dimensions and Members
- Tags and Operators on Example Measures Dimension
- Accounts Dimension Calculations
- Formulas and Functions
- Dynamic Calculations
- Two-Pass Calculations
- Checklist for Calculations

Calculations are essential to derive certain types of data. Data that is derived from a calculation is called calculated data; basic noncalculated data is called input data.

The following topics use the Product and Measures dimensions of the TBC application to illustrate several types of common calculations that are found in many Essbase databases.

For information on block storage calculations, see the following chapters:

- Chapter 22, “Calculating Essbase Databases”
- Chapter 33, “Developing Custom-Defined Calculation Functions”
- Chapter 26, “Understanding Intelligent Calculation”

Consolidation of Dimensions and Members

Subtopics

- Effect of Position and Operator on Consolidation
- Consolidation of Shared Members
- Checklist for Consolidation

When you define members of standard dimensions, Essbase automatically tags the members with the + consolidation operator (plus sign representing addition), meaning that during consolidation members are added. As appropriate, you can change a member consolidation property to one of the operators shown in Table 7, “Consolidation Operators,” on page 98.

Consolidation is the most frequently used calculation in Essbase. This topic uses the Product dimension to illustrate consolidations.

The TBC application has several consolidation paths:

- Individual products roll up to product families, and product families consolidate into Product. The TBC outline also requires multiple consolidation paths; some products must consolidate in multiple categories.
- States roll up to regions, and regions consolidate into Market.
- Months roll up into quarters, and quarters consolidate into Year.
The following topics discuss consolidation in greater detail:

- “Effect of Position and Operator on Consolidation” on page 97
- “Consolidation of Shared Members” on page 98
- “Checklist for Consolidation” on page 98

Consolidation operators define how Essbase rolls up data for each member in a branch to the parent. For example, using the default addition (+) operator, Essbase adds 100-10, 100-20, and 100-30 and stores the result in their parent, 100, as shown in Figure 32.

### Effect of Position and Operator on Consolidation

Essbase calculates the data of a branch in top-down order. For example, if you have, in order, two members tagged with an addition (+) operator and a third member tagged with a multiplication (*) operator, Essbase adds the first two and multiplies that sum by the third.

Because Essbase always begins with the top member when it consolidates, the order and the labels of the members is important. See “Calculating Members with Different Operators” on page 147.

### Table 7

<table>
<thead>
<tr>
<th>Product</th>
<th>Operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 (+) (Alias: Cola)</td>
<td></td>
</tr>
<tr>
<td>100-10 (+) (Alias: Cola)</td>
<td></td>
</tr>
<tr>
<td>100-20 (+) (Alias: Diet Cola)</td>
<td></td>
</tr>
<tr>
<td>100-30 (+) (Alias: Caffeine Free Cola)</td>
<td></td>
</tr>
<tr>
<td>200 (+) (Alias: Root Beer)</td>
<td></td>
</tr>
<tr>
<td>200-10 (+) (Alias: Old Fashioned)</td>
<td></td>
</tr>
<tr>
<td>200-20 (+) (Alias: Diet Root Beer)</td>
<td></td>
</tr>
<tr>
<td>200-30 (+) (Alias: Stranger)</td>
<td></td>
</tr>
<tr>
<td>200-40 (+) (Alias: Birch Beer)</td>
<td></td>
</tr>
<tr>
<td>300 (+) (Alias: Cream Soda)</td>
<td></td>
</tr>
<tr>
<td>300-10 (+) (Alias: Diet Cream)</td>
<td></td>
</tr>
<tr>
<td>300-20 (+) (Alias: Vanilla Cream)</td>
<td></td>
</tr>
<tr>
<td>300-30 (+) (Alias: Diet Cream)</td>
<td></td>
</tr>
<tr>
<td>400 (+) (Alias: Fruit Soda)</td>
<td></td>
</tr>
<tr>
<td>400-10 (+) (Alias: Grape)</td>
<td></td>
</tr>
<tr>
<td>400-20 (+) (Alias: Orange)</td>
<td></td>
</tr>
<tr>
<td>400-30 (+) (Alias: Strawberry)</td>
<td></td>
</tr>
<tr>
<td>Diet (-) (Alias: Diet Drinks)</td>
<td></td>
</tr>
<tr>
<td>100-20 (+) (Shared Member)</td>
<td></td>
</tr>
<tr>
<td>200-20 (+) (Shared Member)</td>
<td></td>
</tr>
<tr>
<td>300-30 (+) (Shared Member)</td>
<td></td>
</tr>
</tbody>
</table>

The Product dimension contains mostly addition (+) operators, which indicate that each group of members is added and rolled up to the parent. Diet has a tilde (~) operator, which indicates that Essbase does not include the Diet member in the consolidation to the parent, Product. The Diet member consists entirely of members that are shared. The TBC product management group wants to be able to isolate Diet drinks in reports, so TBC created a separate Diet member that does not impact overall consolidation.
### Table 7  Consolidation Operators

<table>
<thead>
<tr>
<th>Consolidation Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plus sign (+)</td>
<td>The default operator. Essbase adds the member to the result of previous calculations performed on members of the branch.</td>
</tr>
<tr>
<td>Dash (–)</td>
<td>Essbase multiplies the member by -1 and then adds the product to the result of previous calculations performed on members of the branch.</td>
</tr>
<tr>
<td>Asterisk (*)</td>
<td>Essbase multiplies the member by the result of previous calculations performed on members of the branch.</td>
</tr>
<tr>
<td>Forward slash (/)</td>
<td>Essbase divides the member into the result of previous calculations performed on members of the branch.</td>
</tr>
<tr>
<td>Percent sign (%)</td>
<td>Essbase divides the member into the sum of previous calculations performed on members of the branch. The result is multiplied by 100.</td>
</tr>
<tr>
<td>Tilda (~)</td>
<td>Essbase does not use the value of the member in the consolidation to its parent.</td>
</tr>
<tr>
<td>Caret (^)</td>
<td>Essbase does not use the value of the member in any consolidation in any dimension except attribute dimensions.</td>
</tr>
</tbody>
</table>

### Consolidation of Shared Members

Shared members also affect consolidation paths. The shared member concept enables two members with the same name to share the same data. The shared member stores a pointer to data contained in the other member, so Essbase stores the data only once. Shared members must be in the same dimension. Data can be shared by multiple members.

### Checklist for Consolidation

Use the following checklist to help define consolidation:

- Did you identify the consolidations in the outline?
- Did you tag each member with the proper consolidation operator?
- Did you specify a shared member tag for designated members?
- Would shared members be more efficient if designed within an attribute dimension (other than shared)?

### Tags and Operators on Example Measures Dimension

The Measures dimension is the most complex dimension in the TBC outline because it uses both time and accounts data. It also contains formulas and special tags to help Essbase calculate the outline. This topic discusses the formulas and tags that TBC included in the Measures dimension (the dimension tagged as accounts).

Look closely at the Measures dimension tags defined by TBC (in Figure 33). Many of the properties of the Measures dimension are discussed in previous topics of this chapter: addition (+), subtraction (–), and no consolidation (–) operators, and accounts and label only tags:
The Inventory and Ratios member names assist the user in data navigation. They do not contain data and therefore receive a label only tag.

The Measures dimension itself has a label only tag. Some members of Measures have a Dynamic Calc tag. Dynamic calculations are discussed in “Dynamic Calculations” on page 102.

Some members of Measures have a time balance tag (TB First or TB Last). Time balance tags are discussed in “Setting Time Balance Properties” on page 143.

Figure 33  TBC Measures Dimension

<table>
<thead>
<tr>
<th>Measures Accounts (Label Only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit (+) (Dynamic Calc)</td>
</tr>
<tr>
<td>Margin (+) (Dynamic Calc)</td>
</tr>
<tr>
<td>Sales (+)</td>
</tr>
<tr>
<td>COGS (+) (Expense Reporting)</td>
</tr>
<tr>
<td>Total Expenses (+) (Dynamic Calc) (Expense Reporting)</td>
</tr>
<tr>
<td>Marketing (+) (Expense Reporting)</td>
</tr>
<tr>
<td>Payroll (+) (Expense Reporting)</td>
</tr>
<tr>
<td>Misc (+) (Expense Reporting)</td>
</tr>
<tr>
<td>Inventory (+) (Label Only)</td>
</tr>
<tr>
<td>Opening Inventory (+) (TB First) (Expense Reporting)</td>
</tr>
<tr>
<td>Additions (+) (Expense Reporting)</td>
</tr>
<tr>
<td>Ending Inventory (+) (TB Last) (Expense Reporting)</td>
</tr>
<tr>
<td>Ratios (-) (Label Only)</td>
</tr>
<tr>
<td>Margin % (-) (Dynamic Calc)</td>
</tr>
<tr>
<td>Profit % (-) (Dynamic Calc)</td>
</tr>
<tr>
<td>Expense % (-) (Dynamic Calc)</td>
</tr>
<tr>
<td>Margin % Sales;</td>
</tr>
<tr>
<td>Profit % Sales;</td>
</tr>
<tr>
<td>Margin % Sales;</td>
</tr>
<tr>
<td>Profit % Sales;</td>
</tr>
<tr>
<td>Profit % Sales;</td>
</tr>
</tbody>
</table>

Accounts Dimension Calculations

Subtopics

- Time Balance Properties
- Variance Reporting

This topic discusses two forms of calculations for a dimension tagged as accounts, time balance properties and variance reporting.

Time Balance Properties

Note the two tags in the Measures dimension of Table 9—TB first and TB last. These tags, called time balance tags or properties, provide instructions to Essbase about how to calculate the data in a dimension tagged as accounts. Using the tags requires a dimension tagged as accounts and a dimension tagged as time. The first, last, average, and expense tags are available exclusively for use with accounts dimension members.

In the TBC Measures dimension, Opening Inventory data represents the inventory that TBC carries at the beginning of each month. The quarterly value for Opening Inventory equals the Opening value for the quarter. Opening Inventory requires the time balance tag, TB first.

Ending Inventory data represents the inventory that TBC carries at the end of each month. The quarterly value for Ending Inventory equals the ending value for the quarter. Ending Inventory requires the time balance tag, TB last. Table 8 defines the time balance tags for the accounts dimension.
### Table 8: Accounts Member Tags

<table>
<thead>
<tr>
<th>Tags</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Balance Last</td>
<td>The value for the last child member is carried to the parent. For example, March is carried to Qtr1.</td>
</tr>
<tr>
<td>Time Balance First</td>
<td>The value for the first child is carried to the parent. For example, Jan is carried to Qtr1.</td>
</tr>
</tbody>
</table>

In **Table 9**, Qtr1 (second column from the right) and Year (right-most column) show how consolidation in the time dimension is affected by time balance properties in the accounts dimension. Data is shown for the first quarter only.

### Table 9: TBC Consolidations Affected by Time Balance Properties

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounts Member1</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>36</td>
<td>Qtr1 + Qtr2 + Qtr3 + Qtr4</td>
</tr>
<tr>
<td>Accounts Member2 (TB First)</td>
<td>20</td>
<td>25</td>
<td>21</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Accounts Member3 (TB Last)</td>
<td>25</td>
<td>21</td>
<td>30</td>
<td>30</td>
<td>Value of Qtr4</td>
</tr>
</tbody>
</table>

Normally, the calculation of a parent in the time dimension is based on the consolidation and formulas of children of the parent. However, if a member in an accounts branch is marked as TB First, any parent in the time dimension matches the member marked as TB First.

For examples, see “Setting Time Balance Properties” on page 143.

### Variance Reporting

One TBC Essbase requirement is the ability to perform variance reporting on actual versus budget data. The variance reporting calculation requires that any item that represents an expense to the company must have an expense reporting tag. Inventory members, Total Expense members, and the COGS member each receive an expense reporting tag for variance reporting.

Essbase provides two variance reporting properties—expense and nonexpense. The default is nonexpense. Variance reporting properties define how Essbase calculates the difference between actual and budget data in members with the @VAR or @VARIPE function in their member formulas.

When you tag a member as expense, the @VAR function calculates Budget – Actual. For example, if the budgeted amount is $100 and the actual amount is $110, the variance is –10.

Without the expense reporting tag, the @VAR function calculates Actual – Budget. For example, if the budgeted amount is $100 and the actual amount is $110, the variance is 10.

### Formulas and Functions

Formulas calculate relationships between members in the database outline. You can apply formulas to members in the outline, or you can place formulas in a calculation script. This topic explains how TBC optimized the performance of its database by using formulas.
Functions are predefined routines that perform specialized calculations and return sets of members or sets of data values. Formulas comprise operators and functions, as well as dimension names, member names, and numeric constants.

Essbase supports the following operators:

- Mathematical operators that perform arithmetic operations
- Conditional operators that build logical conditions into calculations
- Cross-dimensional operators that point to data values of specific database member combinations

The Essbase functions include more than 100 predefined routines to extend the calculation capabilities of Essbase. Essbase supports the following functions:

- Boolean functions, which provide a conditional test by returning a TRUE or FALSE value
- Mathematical functions, which perform specialized mathematical calculations
- Relationship functions, which look up data values within a database during a calculation based on the position of the current member
- Range functions, which declare a range of members as an argument to another function or to a command
- Financial functions, which perform specialized financial calculations
- Member set functions, which are based on a specified member and which generate lists of members
- Allocation functions, which allocate values that are input at a parent level across child members
- Forecasting functions, which manipulate data for the purpose of smoothing data, interpolating data, or calculating future values
- Statistical functions, which calculate advanced statistics
- Date and time functions, which use date and time characteristics in calculation formulas
- Calculation mode functions, which specify the calculation mode that Essbase uses to calculate a formula

The Measures dimension uses the following formulas:

- Margin = Sales – COGS
- Total Expenses = Marketing + Payroll + Miscellaneous
- Profit = Margin – Total Expenses
- Profit % = Profit % Sales
- Margin % = Margin % Sales
- Profit per Ounce = Profit / @ATTRIBUTEVAL(@NAME(Ounces))

Essbase uses consolidation operators to calculate the Margin, Total Expenses, and Profit members. The Margin% formula uses a % operator, which means “express Margin as a
percentage of Sales.” The Profit% formula uses the same % operator. The Profit per Ounce formula uses a division operator (/) and a function (@ATTRIBUTEVAL) to calculate profitability by ounce for products sized in ounces.

Note: In the Profit per Ounce formula, the @NAME function is also used to process the string “Ounces” for the @ATTRIBUTEVAL function.

For a complete list of operators, functions, and syntax, see the Oracle Essbase Technical Reference. Also see Chapter 23, “Developing Formulas for Block Storage Databases”.

Dynamic Calculations

When you design the overall database calculation, you may want to define a member as a Dynamic Calc member. When you tag a member as Dynamic Calc, Essbase calculates the combinations of that member when you retrieve the data, instead of precalculating the member combinations during the regular database calculation. Dynamic calculations shorten regular database calculation time but may increase retrieval time for dynamically calculated data values.

In Figure 34, the TBC Measures dimension contains several members tagged as Dynamic Calc—Profit, Margin, Total Expenses, Margin %, and Profit %.

Figure 34 TBC Measures Dimension, Dynamic Calc Tags

When an overall database calculation is performed, the Dynamic Calc members and their corresponding formulas are not calculated. These members are calculated when a user requests them, for example, from Smart View. Essbase does not store the calculated values; it recalculates the values for any subsequent retrieval. However, you can choose to store dynamically calculated values after the first retrieval.

To decide when to calculate data values dynamically, consider your priorities in the following areas:

- Optimum regular calculation time (batch calculation)
- Low disk space usage
- Reduced database restructure time
- Speedy data retrieval for users
Reduced backup time

See Chapter 27, “Dynamically Calculating Data Values”.

Two-Pass Calculations

In the TBC database, Margin % and Profit % contain the label two-pass. This default label indicates that some member formulas must be calculated twice to produce the desired value. The two-pass property works only on members of the dimension tagged as accounts and on members tagged as Dynamic Calc and Dynamic Calc and Store.

The following example illustrates why Profit % (based on the formula Profit % Sales) has a two-pass tag. The tables have five columns (column headers are labeled left to right as Dimension, Jan, Feb, Mar, and Qtr1) and three rows (labeled as Profit, Sales, and Profit %). Jan, Feb, Mar, and Qtr1 are members of the Year dimension. Profit, Sales, and Profit % are members of the Measures (accounts) dimension.

Table 10 on page 103 defines the initial data to load into Essbase. The data values for Profit -> Jan, Profit -> Feb, and Profit -> Mar are 100. The data value for Sales -> Jan, Sales -> Feb, and Sales -> Mar are 1000.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>N/A</td>
</tr>
<tr>
<td>Sales</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>N/A</td>
</tr>
<tr>
<td>Profit %</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

First, Essbase calculates the Measures dimension. In Table 11 on page 103, the data values for Profit % -> Jan, Profit % -> Feb, and Profit % -> Mar are 10%.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Sales</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Profit %</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Next, Essbase calculates the Year dimension. The data rolls up across the dimension. In Table 12 on page 104, the data values for Profit -> Qtr1 (300) and Sales -> Qtr1 (3000) are correct. The data value for Profit % -> Qtr1 (30%) is incorrect because Profit % is tagged as a two-pass calculation.
Essbase then recalculates profit percentage at each occurrence of the member Profit %. In Table 13 on page 104, the data value for Profit % -> Qtr1 (10%) is correct after the second pass.

**Checklist for Calculations**

Use the following checklist when you define a calculation:

- Does the default calculation logic achieve accurate results?
- Which members require formulas?
- Which members require time balance tags?
- Which members require variance reporting?
- Which members require two-pass calculation?
- Which members can be tagged as Dynamic Calc?

**Note:** The Essbase triggers feature enables efficient monitoring of data changes in a database. See “Understanding Triggers Definitions” on page 119.

**Defining Reports**

To ensure that the design meets user information requirements, you must view data as users view it. Users typically view data through spreadsheets, printed reports, or reports published on the Web. Oracle and its partners offer many tools for producing the reporting systems that users use.

Several tools can help you display and format data quickly, and test whether the database design meets user needs. You can use the Report Script Editor in Administration Services Console to write report scripts quickly. Those familiar with spreadsheets can use Smart View (which requires Provider Services).
During the design phase, check for the following things:

- Grouping and sequencing of data. Do the intersections enabled by the design provide the data that users need?
- Levels of totals. What consolidation levels are required by, for example, a Smart View user who drills down and up through the hierarchy of the outline design?
- Attribute reporting. Does the database design facilitate an analysis that is based on the characteristics or attributes of specific dimensions or members? For example, do you need to compare sales by specific combinations of size and packaging, such as comparing the sales of 16-ounce bottled colas with the sales of 32-ounce bottled colas?

Be sure to use the appropriate tool to create and test predesigned use reports against the test data. The reports that you design should provide information that meets your original objectives. The reports should be easy to use, providing the right combinations of data and the right amount of data. Because reports with too many columns and rows are difficult to use, you may need to create several reports instead of one all-inclusive report.

**Verifying the Design**

After you analyze the data and create a preliminary design, check all aspects of the design with users. You should already have verified that the database satisfies the users’ analysis and reporting needs. Ensure that the database satisfies all of their goals.

Do the calculations provide the information they need? Are they able to generate reports quickly? Are they satisfied with consolidation times? In short, ask users if the database works for them.

Near the end of the design cycle, test with real data. Does the outline build correctly? Does all data load? If the database fails in any area, repeat the steps of the design cycle to identify the cause of the problem.

Essbase provides several sources of information to help you isolate problems. Sources include application and Essbase Server logs, exception logs, and database information accessible from Administration Services. Look at documentation topics relevant to your problem; for example, topics about security, calculations, reports, or general error messages. Use the index of this guide for help in solving problems. Look up such terms as troubleshooting, logs, optimizing, performance, recovery, resources, errors, and warnings.

Most likely, you will need to repeat one or more steps of the design process to arrive at the ideal database solution.
About Administration Services

Introduction

Administration Services is the cross-platform administration tool for Essbase. Administration Services consists of a Java middle-tier server, called Essbase Administration Server, and a Java client console, called Administration Services Console.

Administration Services Console is the graphical user interface (GUI) that enables administrators to manage the Essbase environment from one navigation tree, called Enterprise View. The console provides wizards, editors, and other tools to help administrators view, manage, and maintain a unique set of Essbase Servers. The console includes a data preview grid that enables you to preview data without having to switch from the console to another program.

Administration Services Architecture

Administration Services works with Essbase Servers in a three-tiered system consisting of a client user interface (UI), a middle-tier server, and one or more Essbase Servers. The middle tier coordinates interactions and resources between the UI and Essbase Servers. The tiers, which may or may not be on the same computer or platform, include the following components, as illustrated below:
Client tier (Administration Services Console): A Java-based client console provides a UI to manage the Essbase environment.

Middle tier (Essbase Administration Server): A Java-based server maintains communication, session, and security information for connections to Essbase Servers.

Database tier (Essbase Server): One or more Essbase Servers store and process multidimensional database information. Essbase Servers are installed separately from Administration Services.

**Deploying Administration Services**

Administration Services can be deployed in a variety of scenarios. For example, you can install Essbase Server on a computer running UNIX and install Essbase Administration Server and Administration Services Console on a computer running Windows, or you can install Essbase Administration Server and Administration Services Console on separate computers and platforms. The middle tier Essbase Administration Server also supports the substitution of certain third-party products within the existing framework (for example, application servers and relational databases).

See the *Oracle Enterprise Performance Management System Installation and Configuration Guide*.

**Starting Administration Services**

To start Administration Services, start Essbase Administration Server, and then start Administration Services Console. See “Starting Administration Services” in the *Oracle Essbase Administration Services Online Help*. 
About Administration Services Users

Existing Essbase users cannot use Administration Services until they have also been created as users on Essbase Administration Server. You can use the User Setup Wizard to step you through the process of creating Essbase Administration Server users and associating them with the appropriate Essbase Servers. You do not need to create Excel spreadsheet users on Essbase Administration Server.

To create Administration Services users:
See “User Setup Wizard” in the Oracle Essbase Administration Services Online Help.

Connecting to Administration Services

In Administration Services, connections to individual Essbase Servers are handled by the middle tier Essbase Administration Server. When you start Administration Services, if Essbase Server is started, you are automatically connected to each Essbase Server you added to Enterprise View. See “About Essbase Connections and Ports” in the Oracle Essbase Administration Services Online Help.

You can connect to different instances of Essbase Server simultaneously from Administration Services Console.

Your Administration Services user name and password may be different than your Essbase Server user name and password. If you do not know your Administration Services user name and password, see your Administration Services administrator.

After your initial connection to Administration Services, you can use the User Setup Wizard to create Administration Services users and add Essbase Servers to each user’s Enterprise View. See “Connecting to Administration Services” in the Oracle Essbase Administration Services Online Help.

Adding Essbase Administration Servers to Enterprise View

Each time you connect to Administration Services, the Essbase Administration Servers you have chosen are displayed in Enterprise View, which is the navigation tree in the left navigation pane. Each user can populate Enterprise View with a unique set of Essbase Administration Servers.

To add Essbase Administration Servers to Enterprise View:
See “Adding Essbase Administration Servers to Enterprise View” in the Oracle Essbase Administration Services Online Help.
Adding Essbase Servers to Enterprise View

Each time you connect to Administration Services, the Essbase Servers you have chosen are displayed in Enterprise View, which is the navigation tree in the left navigation pane. Each user can populate Enterprise View with a unique set of Essbase Servers. You can use the following methods to add Essbase Servers to Enterprise View:

- In Enterprise View, right-click an Essbase Server node, and select Add Essbase Server.
- Select File, then Wizards, then User Setup. Follow the wizard instructions.
- For an existing server, edit the server’s properties.

You can also create custom views of the Enterprise View tree in separate tabs in the navigation pane. See “About Custom Views” in the Oracle Essbase Administration Services Online Help.

To add Essbase Servers to Enterprise View:
See “Adding Essbase Servers to Enterprise View” in the Oracle Essbase Administration Services Online Help.

About Essbase Server Connections and Ports

The number of ports available for an Essbase Server represents the number of licensed concurrent connections. Essbase provides one reserve port for the system administrator. A system administrator uses the reserve port to log out one or more users when all other ports are in use. See Chapter 45, “Running Essbase Servers, Applications, and Databases.”

In Administration Services, a port is in use only when an Essbase Server connection is established. See “About Essbase Connections and Ports” in the Oracle Essbase Administration Services Online Help.

About Essbase Administration Server

The middle tier Essbase Administration Server provides business logic to support cross-server operations, persistence of user preferences, and access to Essbase Servers. A system administrator creates users on Essbase Administration Server, and then Essbase Administration Server manages their connections to Essbase.

In Enterprise View, the node name for Essbase Administration Server is the same as the server computer name.

Essbase Administration Server has several configurable communication ports, which are different from Essbase Server ports. If one of the default communication ports is in use by another application, you must specify another port value in order to run Essbase Administration Server.

Note: If you change the value for the Essbase Administration Server port, you must specify the new port value when you log on to Administration Services Console.
To change a default port value:

See “Specifying Communication Ports for Administration Server” in the Oracle Essbase Administration Services Online Help.
Part II

Designing and Creating Applications and Databases

In Designing and Creating Applications and Databases:

- Creating Applications and Databases
- Creating and Changing Database Outlines
- Creating and Working With Duplicate Member Outlines
- Setting Dimension and Member Properties
- Working with Attributes
- Linking Objects to Essbase Data
- Working with Typed Measures
- Drilling Through to Oracle Applications
- Designing and Building Currency Conversion Applications
- Designing Partitioned Applications
- Creating and Maintaining Partitions
Creating Applications and Databases

In This Chapter

Process for Creating Applications and Databases .................................................... 115
Understanding Applications and Databases .......................................................... 116
Understanding Database Artifacts ...................................................................... 116
Creating Applications and Databases .................................................................. 119
Using Substitution Variables ............................................................................ 120
Using Location Aliases .................................................................................. 124

Some information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

- Chapter 60, “Comparison of Aggregate and Block Storage”
- Chapter 61, “Aggregate Storage Applications, Databases, and Outlines”

Process for Creating Applications and Databases

To create an application and database:

1. **Design the application.**
   
   See “Quick Start for Implementing Essbase” on page 53.

2. **Create an application.**
   
   See “Creating an Application” on page 119.

3. **Create a database.**
   
   See “Creating a Database” on page 120.

4. **If necessary, set substitution variables at the Essbase Server, application, or database level.**
   
   See “Using Substitution Variables” on page 120.

5. **If necessary, set a location alias for the database.**
   
   See “Using Location Aliases” on page 124.

6. **Create the outline.**
Understanding Applications and Databases

An Essbase application is a management structure that contains one or more Essbase databases and related files. Essbase applications and databases reside on an Essbase Server. The server computer can store multiple applications.

An Essbase database is a data repository that contains a multidimensional data storage array. A multidimensional database supports multiple views of data so that users can analyze the data and make meaningful business decisions. See “Understanding Multidimensional Databases” on page 59 and “Storage Allocation” on page 765.

Understanding Database Artifacts

Subtopics

- Understanding Database Outlines
- Understanding Data Sources
- Understanding Rules Files for Data Load and Dimension Build
- Understanding Calculation Scripts
- Understanding Report Scripts
- Understanding Security Definitions
- Understanding LROs
- Understanding Member Select Definitions
- Understanding Triggers Definitions

Files that are related to databases are called artifacts (or objects). Database artifacts perform actions against one or more Essbase databases, such as defining calculations or reporting against data. By default, artifacts are stored in their associated database folder on the Essbase Server, and can also be saved to a client computer or to other available network directories. You cannot, however, load data or calculate data on a client computer.

Essbase provides the following common types:

- A database outline (a storage structure definition)
- Data sources
- Rules for loading data and building dimensions dynamically (rules files)
- Scripts that define how to calculate data (calculation scripts)
- Scripts that generate reports on data (report scripts)
- Security definitions
- Linked reporting objects (LROs)
- Partition definitions
Some of these artifacts are optional, such as calculation scripts and LROs. See “Application and Database File Types” on page 706.

In Administration Services Console, database artifacts are displayed under their associated applications or database in the Enterprise View tree.

**Understanding Database Outlines**

Database outlines define the structure of a multidimensional database, including all the dimensions, members, aliases, properties, types, consolidations, and mathematical relationships. The structure defined in the outline determines how data is stored in the database.

When a database is created, Essbase creates an outline for that database automatically. The outline has the same name as the database (dbname.otl). For example, when the Basic database is created within the Sample application, an outline is created in the following directory:

```
ARBORPATH/app/sample/basic/basic.otl
```

See “Creating a Database” on page 120 and Chapter 7, “Creating and Changing Database Outlines.”

**Understanding Data Sources**

A data source is external data that is loaded into an Essbase database. The common types of data sources include the following:

- Text files
- Spreadsheet files
- Spreadsheet audit log files
- External databases, such as an SQL database

See “Supported Data Sources” on page 266.

**Understanding Rules Files for Data Load and Dimension Build**

An Essbase database contains no data when it is created. Data load rules files are sets of operations that Essbase performs on data from an external data source file as the data is loaded, or copied, into the Essbase database. Dimension build rules files create or modify the dimensions and members in an outline dynamically based on data in an external data source. Rules files are typically associated with a particular database, but you can define rules for use with multiple databases. One rules file can be used for both data loads and dimension builds. Rules files have a .rul extension.

See “Rules Files” on page 271 and Chapter 18, “Working with Rules Files.”
Understanding Calculation Scripts

Calculation scripts are text files that contain sets of instructions telling Essbase how to calculate data in the database. Calculation scripts perform calculations different from the consolidations and mathematical operations that are defined in the database outline. Because calculation scripts perform specific mathematical operations on members, they are typically associated with a particular database. You can, however, define a calculation script for use with multiple databases. Calculation scripts files have a .csc extension.

See Chapter 29, “Developing Calculation Scripts for Block Storage Databases.”

Understanding Report Scripts

Report scripts are text files that contain data retrieval, formatting, and output instructions to create a report from the database. Report scripts are typically associated with a particular database, but you can define a report script for use with multiple databases. Report scripts have a .rep extension.


Understanding Security Definitions

Essbase provides a comprehensive system for managing access to applications, databases, and other artifacts. Each application and database contains its own security definitions that restrict user access.


Understanding LROs

An LRO is an artifact associated with a specific data cell in an Essbase database. LROs can enhance data analysis capabilities by providing additional information on a cell.

An LRO can be any of the following:

- A paragraph of descriptive text (a “cell note”)
- A separate file that contains text, audio, video, or graphics
- A URL for a Web site
- A link to data in another Essbase database

See Chapter 11, “Linking Objects to Essbase Data.”

Understanding Member Select Definitions

In Smart View, users can define and save member retrievals with the member selection feature. Member specification files have a .sel extension.
Understanding Triggers Definitions

The triggers feature enables efficient monitoring of data changes in a database. If data breaks rules that you specify in a trigger, Essbase logs relevant information in a file or, for some triggers, sends an e-mail alert; for example, to notify the sales manager if, in the Western region, sales for a month fall below sales for the equivalent month in the previous year.

See “Monitoring Data Changes Using Triggers” on page 721.

Creating Applications and Databases

Subtopics

- Creating an Application
- Creating a Database
- Annotating a Database

Create an application and then create its databases. You can annotate the databases.

Creating an Application

When you create an application on the Essbase Server, Essbase creates a subdirectory for the application on the Essbase Server in the ARBORPATH/app directory. The new subdirectory has the same name as the application; for example, ARBORPATH/app/app1. In Administration Services Console, applications and databases are displayed in a tree structure in Enterprise View.

Before naming the application, see “Naming Conventions for Applications and Databases” on page 1093.

You can also create an application that is a copy of an existing application. See “Copying or Migrating Applications” on page 710.

To create an application, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>CREATEAPP</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Creating a Database

When you create a database, Essbase creates a subdirectory for the database within the application directory. The new subdirectory has the same name as the database; for example, ARBORPATH/app/app1/dbname1. In Administration Services Console, applications and databases are displayed in a tree structure in Enterprise View.

You can create normal databases or currency databases. Except for databases requiring use of the Currency Conversion option, creating one database per application is recommended. See Chapter 14, “Designing and Building Currency Conversion Applications.”

Before naming the database, see “Naming Conventions for Applications and Databases” on page 1093.

To create a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>CREATEDB</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Annotating a Database

A database note can provide useful information when you need to broadcast messages to users about the status of a database, deadlines for updates, and so on. Users can view database notes in Smart View.

To annotate a database:

See “Annotating Databases” in the Oracle Essbase Administration Services Online Help.

Using Substitution Variables

Subtopics

- Rules for Setting Substitution Variable Names and Values
- Setting Substitution Variables
- Deleting Substitution Variables
- Updating Substitution Variables
- Copying Substitution Variables

Substitution variables are global placeholders for regularly changing information. Because changes to a variable value are reflected everywhere the variable is used, manual changes are reduced.
For example, many reports depend on reporting periods; if you generate a report based on the current month, you must update the report script manually every month. With a substitution variable, such as `CurMnth`, set on the server, you can change the assigned value each month to the appropriate time period. When you use the variable name in a report script, the information is dynamically updated when you run the final report.

You can use substitution variables with both aggregate storage and block storage applications (unless otherwise noted) in the following areas:

- **Aggregate storage outline formulas**
  See “Using MDX Formulas” on page 925.

- **Block storage outline formulas**
  See “Using Substitution Variables in Formulas” on page 385.

- **Calculation scripts (block storage databases only)**
  Substitution variables and runtime substitution variables are supported in calculation scripts. See Chapter 29, “Developing Calculation Scripts for Block Storage Databases.”

- **Report scripts**

- **Data load rules file header definitions and field definitions. You can enter variable names for dimension and member names.**
  See these topics, “Setting Headers in the Rules File” and “Mapping Field Names,” in the Oracle Essbase Administration Services Online Help.

- **Partition definitions**
  See “Substitution Variables in Partition Definitions” on page 223.

- **Data source name (DSN) specifications in rules files for SQL data sources**
  See Oracle Essbase SQL Interface Guide.

- **SELECT, FROM, or WHERE clauses in rules files for SQL data sources**
  See Oracle Essbase SQL Interface Guide.

- **Security filters**
  See “Filtering Using Substitution Variables” on page 645.

- **MDX statements**
  See “Using Substitution Variables in MDX Queries” on page 597.

- **Smart View**
  See the Oracle Smart View for Office User’s Guide.

You can set substitution variables on the Essbase Server using Administration Services, MaxL, or ESSCMD. Set the variable at any of the following levels:

- **Essbase Server**—providing access to the variable from all applications and databases on the Essbase Server
Rules for Setting Substitution Variable Names and Values

The following rules apply to substitution variable names and values:

- The substitution variable name must comprise alphanumeric characters or underscores ( _) and cannot exceed the limit specified in Appendix A, “Limits.”
- The substitution variable name cannot include nonalphanumeric characters, such as hyphens (-), asterisks (*), and slashes (/). Do not use spaces, punctuation marks, or brackets ([ ] ) in substitution variable names used in MDX.
- If substitution variables with the same name exist at server, application, and database levels, the order of precedence for the variables: a database-level substitution variable supersedes an application-level variable, which supersedes a server-level variable.
- The substitution variable value may contain any character except a leading ampersand (&). The substitution variable value cannot exceed the limit specified in Appendix A, “Limits.”
- To set a substitution variable value to a duplicate member name, use the qualified member name enclosed in double quotation marks; for example, a value for &Period could be “[2006].[Qtr1]”.
- When specifying use of a substitution variable, do not insert a substitution variable as a part of a qualified name. For example, it is invalid to specify “[2004].[&CurrentQtr]”.
- If a substitution variable value is a member name that begins with a numeral or contains spaces or any of the special characters listed in “Naming Conventions in Calculation Scripts, Report Scripts, Formulas, Filters, and Substitution and Environment Variable Values” on page 1098, different rules apply for how you enter the variable:
  - Enclose the member-name value in brackets ([ ] ) if it is used in MDX statements.
  - Enclose the member-name value in quotation marks (” ” ) if it is not used in MDX statements.
- If a substitution variable value is numeric, different rules apply for how you enter the variable:
  - If it is not used in MDX statements, enclose a substitution variable value in quotation marks; for example, if the variable name is Month, and its corresponding value is 01 (corresponding to January), place quotation marks around 01 (“01”). Substitution variables usually are used with block storage databases; they are not used in MDX statements.
  - If it is used in MDX statements only, such as in formulas in aggregate storage outlines, and the value is numeric or a member name, do not enclose the value in quotation marks.
Note: If a substitution variable value is numeric or a member name starting with a numeral or containing the special characters referred to above is to be used both in MDX and non-MDX situations, create two substitution variables, one without the value enclosed in quotation marks and one with the value in quotation marks.

Setting Substitution Variables

You can set substitution variables on the Essbase Server at the server, application, or database level. Before setting a substitution variable, see “Rules for Setting Substitution Variable Names and Values” on page 122.

To set a substitution variable, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Managing Substitution Variables</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter system</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>alter application</td>
<td></td>
</tr>
<tr>
<td></td>
<td>alter database</td>
<td></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>CREATEVARIABLE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

To ensure that a new substitution variable value is available in formulas, partition definitions, and security filters, stop and restart the application. All other uses of substitution variables are dynamically resolved when used.

Deleting Substitution Variables

You may need to delete a substitution variable that is no longer used.

To delete a substitution variable, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Managing Substitution Variables</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter system</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>alter application</td>
<td></td>
</tr>
<tr>
<td></td>
<td>alter database</td>
<td></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>DELETEVARIABLE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Updating Substitution Variables

You can modify or update existing substitution variables. Before updating a substitution variable, see “Rules for Setting Substitution Variable Names and Values” on page 122.

To update a substitution variable, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Managing Substitution Variables</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter system</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>alter application</td>
<td></td>
</tr>
<tr>
<td></td>
<td>alter database</td>
<td></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>UPDATEVARIABLE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Copying Substitution Variables

You can copy substitution variables to any Essbase Server, application, or database to which you have appropriate access.

To copy a substitution variable:

See “Copying Substitution Variables” in the Oracle Essbase Administration Services Online Help.

Using Location Aliases

Subtopics

● Creating Location Aliases
● Editing or Deleting Location Aliases

A location alias is a descriptor for a data source. A location alias maps an alias name for a database to the location of that database. A location alias is set at the database level and specifies an alias, a server, an application, a database, a user name, and a password. Set the location alias on the database on which the calculation script is run.

After you create a location alias, you can use the alias to refer to that database. If the location of the database changes, edit the location definition accordingly.

You can use location aliases only with the @XREF and @XWRITE functions. With @XREF, you can retrieve a data value from another database to include in a calculation on the current database. In this case, the location alias points to the database from which the value is to be retrieved. With @XWRITE, you can write values to another Essbase database, or to the same database. See the Oracle Essbase Technical Reference.
The following considerations apply when using location aliases in secure (SSL) mode:

- To enable Essbase to use SSL connectivity, you must set ENABLESECUREMODE to TRUE.
- If the location alias is being set up to a secure port, you must append :secure to the server name specification. For example, using MaxL,

  create location alias EasternDB from Sample.Basic to East.Sales at Easthost: 6423:secure as User1 identified by password1;

### Creating Location Aliases

You can create a location alias for a particular database.

➤ To create a location alias, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Location Aliases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create location alias</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>CREATELLOCATION</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

### Editing or Deleting Location Aliases

You can edit or delete location aliases that you created.

➤ To edit or delete a location alias, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Editing or Deleting Location Aliases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display location alias</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>drop location alias</td>
<td></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LISTLOCATIONS</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>DELETELOCATION</td>
<td></td>
</tr>
</tbody>
</table>
Some information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

- Chapter 60, “Comparison of Aggregate and Block Storage”
- Chapter 61, “Aggregate Storage Applications, Databases, and Outlines”

All examples in this chapter are based on the Sample.Basic database.

**Process for Creating Outlines**

This section provides an overview of creating outlines using Outline Editor. For information about Outline Editor, see the *Oracle Essbase Administration Services Online Help*.

For basic information about outlines, see Chapter 3, “Understanding Multidimensional Databases.”

1. **Create a database.** The new database automatically contains a blank outline.
   - See “Creating Applications and Databases” on page 119.
2. **Open the outline.**
   - See “Creating and Editing Outlines” on page 128.
3. **Add dimensions and members to the outline.**
Creating and Editing Outlines

The database outline defines the structure of the database. Outline Editor displays the dimension hierarchy of an outline visually.

When a database is created, Essbase creates an outline for that database automatically. The outline has the same name as the database (dbname.otl) and is stored in the database directory on Essbase Server. You can create content in the new outline in the following ways:

- In Outline Editor, open the empty outline created by default when you create a database and add content manually.
  
  See “Opening and Editing Outlines” in the Oracle Essbase Administration Services Online Help.

- Copy an existing outline to the current database and change the existing outline.

- Create content using data sources and rules files.
  
  See Chapter 17, “Understanding Data Loading and Dimension Building.”

Caution! If you open the same outline with two instances of the Administration Services Console using the same login ID, each save overwrites the changes of the other instance. Oracle does not recommend this practice, as it can be difficult to keep track of the changes that are saved or overwritten.

To create an outline or open an existing outline, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Opening and Editing Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
To copy an existing outline, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESSCMD</td>
<td>CREATEDB</td>
<td><em>Oracle Essbase Technical Reference</em></td>
</tr>
</tbody>
</table>

Locking and Unlocking Outlines

In Outline Editor, an outline is always locked when it is opened in edit mode. Essbase unlocks the outline when the outline is closed. When an outline is locked, Essbase does not allow other users to save over, rename, delete, or edit the outline. When you attempt to edit a locked outline, you are given an option to view the outline in Outline Viewer.

If you have Administrator permissions, you can unlock a locked outline. Before you forcefully unlock a locked outline, make sure that no one else is working with it.

Note: Essbase uses a different process for locking and unlocking outlines than for other database artifacts. See “Locking and Unlocking Artifacts” on page 714.

To unlock an outline, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Outlines</td>
<td><em>Oracle Essbase Administration Services Online Help</em></td>
</tr>
<tr>
<td>MaxL</td>
<td>create database as</td>
<td><em>Oracle Essbase Technical Reference</em></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>COPYDB</td>
<td><em>Oracle Essbase Technical Reference</em></td>
</tr>
</tbody>
</table>

Adding Dimensions and Members to an Outline

You can add dimensions and member hierarchies to an outline in several ways:

- Manually, using Outline Editor
- With a data source and rules file, using Data Prep Editor

Before naming dimensions and members, see “Naming Conventions for Applications and Databases” on page 1093.
To add dimensions and members to an outline using Outline Editor

See “Adding Dimensions to Outlines” and “Adding Members to Dimensions” in the Oracle Essbase Administration Services Online Help.

To add dimensions and members to an outline using Data Prep Editor:

See “Creating Dimension Build Rules Files” in the Oracle Essbase Administration Services Online Help.

To add dimensions and members dynamically (using a rules file) from Outline Editor:

See “Updating an Outline Dynamically Using a Rules File” in the Oracle Essbase Administration Services Online Help.

Setting Data Storage Properties

When you create dimensions and save an outline, Essbase automatically sets the new dimensions in the outline as sparse. You can change the dimension storage type according to the optimal configuration for the database.

Set as sparse any standard dimensions with which you plan to associate attribute dimensions. See “Selection of Dense and Sparse Dimensions” on page 65.

To set data storage properties using Outline Editor:

See “Setting Dimensions as Dense or Sparse” in the Oracle Essbase Administration Services Online Help.

Positioning Dimensions and Members

Dimensions are the highest level of organization in an outline. Dimensions contain members, which you can nest inside of other members in a hierarchy. See “Dimensions and Members” on page 60.

The following sections describe how to position dimensions and members in the outline.

Note: The relative locations of dimensions in an outline can affect calculation and retrieval performance times. See “Designing an Outline to Optimize Performance” on page 93.

Moving Dimensions and Members

After you create dimensions and members, you can rearrange them within the outline. Before moving members and dimensions in an outline, consider the following information:

● The positions of dimensions and members in an outline can affect performance.

See “Optimizing Outline Performance” on page 172.
Moving dimensions and members can affect the performance of calculations and retrievals. See “Designing an Outline to Optimize Performance” on page 93.

Moving members could move a shared member before the actual member in the outline (which is not recommend).

If you add, delete, or move nonattribute dimensions or members, Essbase restructures the database, and you must recalculate the data.

Position attribute dimensions at the end of the outline. Otherwise, during outline verification, Essbase prompts you to move them there.

To position dimensions and members using Outline Editor:

See “Manipulating Dimensions and Members in an Outline” in the Oracle Essbase Administration Services Online Help.

Sorting Dimensions and Members

You can have Essbase arrange dimensions within an outline or members within a dimension in alphabetical order (A–Z) or reverse alphabetical order (Z–A). For a list of consequences of sorting dimensions and members, see “Moving Dimensions and Members” on page 130.

When you sort level 0 members of numeric attribute dimensions in outlines, the members are sorted by their values. For example, Figure 36 shows text and numeric versions of the Sizes attribute dimension after sorting the members in ascending order. The members of the numeric attribute dimension (on the right) are sequenced by the numeric values of the members; the member 8 is before the other members. In the text attribute dimension (on the left), because the characters are sorted left to right, the member 8 is after the member 24.

You cannot sort Boolean attribute dimensions. See “Understanding Attribute Types” on page 166.

To sort members using Outline Editor:

See “Sorting Members” in the Oracle Essbase Administration Services Online Help.

Verifying Outlines

You can verify an outline automatically when you save it, or you can verify the outline manually anytime. When verifying an outline, Essbase checks the following items:
• All member and alias names are valid. Members and aliases cannot have the same name as other members, aliases, generations, or levels.

  See “Naming Conventions for Applications and Databases” on page 1093.

• Only one dimension is tagged as accounts, time, currency type, or country.

• Shared members are valid.

  See “Understanding the Rules for Shared Members” on page 150.

• Level 0 members are not tagged as label only.

• Label-only members have not been assigned formulas.

• A descendant of a label only member is not tagged as Dynamic Calc.

  See “Understanding Label Only Members” on page 149.

• The currency category and currency name are valid for the currency outline.

• Dynamic Calc members in sparse dimensions do not have more than 100 children.

• If a parent member has one child, and if that child is a Dynamic Calc member, the parent member must also be Dynamic Calc.

• If a parent member has one child, and if that child is a Dynamic Calc, two-pass member, the parent member must also be Dynamic Calc, two-pass.

• The two names of members of Boolean attribute dimensions are the same as the two Boolean attribute dimension member names defined for the outline.

• The level 0 member name of a date attribute dimension must match the date format name setting (mm-dd-yyyy or dd-mm-yyyy). If the dimension has no members, because the dimension name is the level 0 member, the dimension name must match the setting.

• The level 0 member name of a numeric attribute dimension is a numeric value. If the dimension has no members, because the dimension name is the level 0 member, the dimension name must be a numeric value.

• Attribute dimensions are located at the end of the outline, following all standard dimensions.

• Level 0 Dynamic Calc members of standard dimensions have a formula.

• Formulas for members are valid.

During outline verify, Essbase also performs the following conversions to appropriate numeric attribute dimension member names and displays them in the outline:

• It moves minus signs in member names from the front to the end of the name; for example, –1 becomes 1–.

• It strips out leading or trailing zeroes in member names; for example, 1.0 becomes 1, and 00.1 becomes 0.1.

  See “Understanding Attribute Types” on page 166.

➢ To verify an outline:

  See “Verifying Outlines” in the Oracle Essbase Administration Services Online Help.
Saving Outlines

Subtopics

- Saving an Outline with Added Standard Dimensions
- Saving an Outline with One or More Deleted Standard Dimensions
- Creating Sub-Databases Using Deleted Members

You can save outlines to the Essbase Server or to a client computer or network. By default, Essbase saves outlines to the database directory on Essbase Server. If you are saving changes to an outline, Essbase may restructure the outline. For example, if you change a member name from Market to Region, Essbase moves data stored in reference to Market to Region. Each time that you save an outline, Essbase verifies the outline to ensure that it is correct.

To save an outline:

See “Saving Outlines” in the Oracle Essbase Administration Services Online Help.

Saving an Outline with Added Standard Dimensions

If you add one or more new standard (nonattribute) dimensions, any data that existed previously in the database must be mapped to a member of each new dimension before the outline can be saved. For example, adding a dimension called Channel to the Sample.Basic outline implies that all previous data in Sample.Basic is associated with a particular channel or the sum of all channels.

Saving an Outline with One or More Deleted Standard Dimensions

If you delete one or more standard (nonattribute) dimensions, the data associated with only one member of each deleted dimension must be retained and associated with a member of one of the other dimensions. For example, removing a dimension called Market from the outline implies that all of the data that remains in the database after the restructure operation is associated with a single, specified member of the Market dimension.

If you delete an attribute dimension, Essbase deletes the associations to its base dimension. See Chapter 10, “Working with Attributes.”

Creating Sub-Databases Using Deleted Members

To create a sub-database:

1. Delete a dimension from an existing outline.
2. Save the database using a different name, and specify the member to keep.

Only one member can be kept when a dimension is deleted. See “Saving an Outline with One or More Deleted Standard Dimensions” on page 133.
Creating and Working With Duplicate Member Outlines

In This Chapter

- Creating Duplicate Member Names in Outlines ....................................................... 135
- Restrictions for Duplicate Member Names and Aliases in Outlines ................................. 136
- Syntax for Specifying Duplicate Member Names and Aliases ....................................... 137
- Working with Duplicate Member Names ........................................................................ 139

The information in this chapter applies to block storage and aggregate storage databases.

Also see:

- Chapter 6, “Creating Applications and Databases”
- Chapter 7, “Creating and Changing Database Outlines”

Creating Duplicate Member Names in Outlines

You can use duplicate names in an outline only if the outline has the allow duplicate members option enabled.

When you enable duplicate member names in an outline, Essbase displays multiple members in the outline using the same name. Create the names in the usual way. See “Naming Conventions for Dimensions, Members, and Aliases” on page 1094.

When you save the outline, Essbase validates and saves the outline with the duplicate member names. A qualified name format differentiates the duplicate member names.

Figure 37 shows an example of a duplicate member outline in which the New York state member and the New York city member appear in the outline as New York.

Figure 37  Duplicate Member Name “New York”

The qualified member names for the example in Figure 37 are [State].[New York] and [City].[New York]. See “Syntax for Specifying Duplicate Member Names and Aliases” on page 137.
To create an outline that enables duplicate member names, or to convert a unique member name outline to a duplicate member name outline, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Duplicate Member Name Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Note: Save outline changes before converting the outline to a duplicate member name outline. You cannot convert an outline that has unsaved changes. After converting an outline to a duplicate member outline, save it before proceeding with other outline changes. A duplicate member outline cannot be converted back to a unique member outline.

Within a duplicate member outline, you can tag particular dimensions, generations, and levels as unique or duplicate to restrict the use of duplicate member names within a database. Doing so enables you to specify member name uniqueness at a more granular level in a duplicate member outline.

When you create a duplicate member outline, by default, all dimensions in the outline are tagged as duplicate.

When duplicate members are enabled in a dimension, you can tag particular generations or levels within the dimension as unique. If a member is assigned conflicting properties, the unique property takes precedence.

To enable or disable duplicate member names in a dimension:

See “Tagging a Dimension as Unique” in the Oracle Essbase Administration Services Online Help.

To disable duplicate member names in a particular generation or level of a dimension:

See “Naming Generations and Levels” in the Oracle Essbase Administration Services Online Help

Note: Duplicate member outline attribute dimensions do not have prefixes or suffixes attached that apply to attribute dimensions in unique outlines. For example, in a duplicate member Boolean attribute dimension, members do not include dimension, parent, grandparent, or ancestors affixed to the TRUE and FALSE members. See “Setting Prefix and Suffix Formats for Member Names of Attribute Dimensions” on page 173.

Restrictions for Duplicate Member Names and Aliases in Outlines

When creating duplicate member names and aliases in database outlines, the following must always be unique:
• Dimension names
• Generation names and level names
• Siblings under a parent member

If you are using aliases, this additional restriction applies: an alias table that contains duplicate alias names is valid only with a duplicate member outline.

Note: Do not use quotation marks (" "), brackets ([ ]), or tabs in member, dimension, or alias names. For example, you cannot create a member name “[New York].[Area 1]”. Outline verification does not display an error for member names that contain the invalid sequence of characters, and you can save the outline; however, Essbase cannot accurately query the data.

Syntax for Specifying Duplicate Member Names and Aliases

Although duplicate member names appear in the outline, each nonshared member name uniquely identifies a member in the database. A qualified name format differentiates the duplicate member names. When using Administration Services editors, you can select the qualified member name for an outline tree. You can view the qualified member name for a duplicate member in the Outline Viewer Member Properties dialog box in Administration Services. A qualified name must be used to specify a duplicate member name.

A qualified member or alias name can be specified in any of the following formats:

• Fully qualified member name
• Member name qualified by differentiating ancestor
• Shortcut qualified member name

Note: A qualified name must comprise all alias names or all member names. You cannot mix member names and alias names in a qualified name.

Using Fully Qualified Member Names

A fully qualified member name comprises the duplicate member or alias name and all ancestors up to and including the dimension name. Each name must be enclosed in brackets ([ ]) and separated by a period (.). The syntax is as follows:

[DimensionMember].[Ancestors...].[DuplicateMember]

For example:

[Market].[East].[State].[New York]
[Market].[East].[City].[New York]
Qualifying Members by Differentiating Ancestor

A member name qualified by differentiating ancestor uses the member or alias name and all ancestors up to and including the ancestor that uniquely identifies the duplicate member or alias. The top ancestor in the path will always be a unique member name. Each name must be enclosed in brackets ([ ]) and separated by a period (.). The syntax is as follows:

\[
[\text{DifferentiatingAncestor}].[\text{Ancestors...}].[\text{DuplicateMember}]
\]

For example:

\[
[\text{State}].[\text{New York}]
\]

\[
[\text{City}].[\text{New York}]
\]

Using Shortcut Qualified Member Names

Essbase internally constructs shortcut qualified names for members in duplicate member outlines. These can be inserted into scripts using Administration Services by right-clicking the member and selecting **Insert member name**. You can also manually insert shortcut qualified names into scripts, spreadsheets, or MDX queries.

Essbase uses the syntax shown in **Table 14** to construct shortcut qualified names. Using the same syntax that Essbase uses when you reference members in scripts, spreadsheets, and MDX queries is optimal but not required.

**Table 14  Shortcut Qualified Name Syntax**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Qualified Name Syntax</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duplicate member names exist at generation 2</td>
<td>([\text{DimensionMember}].[\text{DuplicateMember}])</td>
<td>([\text{Year}].[\text{Jan}])</td>
</tr>
<tr>
<td></td>
<td></td>
<td>([\text{Product}].[\text{Jan}])</td>
</tr>
<tr>
<td>Duplicate member names exist in an outline but are unique within a dimension</td>
<td>([\text{DimensionMember}@[\text{DuplicateMember}])</td>
<td>([\text{Year}@[\text{Jan}])</td>
</tr>
<tr>
<td>Duplicate member names have a unique parent</td>
<td>([\text{ParentMember}].[\text{DuplicateMember}])</td>
<td>([\text{East}].[\text{New York}])</td>
</tr>
<tr>
<td>Duplicate member names exist at generation 3</td>
<td>([\text{DimensionMember}].[\text{ParentMember}].[\text{DuplicateMember}])</td>
<td>([\text{Products}].[\text{Personal Electronics}].[\text{Televisions}])</td>
</tr>
<tr>
<td>Duplicate member names exist at a named generation or level, and the member is unique at its generation or level</td>
<td>([\text{DimensionMember}@[\text{GenLevelName}].[\text{DuplicateMember}])</td>
<td>([2006}@[\text{Gen1}].[\text{Jan}])</td>
</tr>
<tr>
<td>In some scenarios, the differentiating ancestor method is used as a shortcut.</td>
<td>([\text{DifferentiatingAncestor}].[\text{Ancestors...}].[\text{DuplicateMember}])</td>
<td>([2006}].[\text{Qtr1}].[\text{Jan}]</td>
</tr>
</tbody>
</table>
Using Qualified Member Names in Unique Member Name Outlines

Qualified member names are also applicable for referencing member names in a unique member name outline (an outline with duplicate member names not enabled). Qualified member names can be used to differentiate shared members from their original members.

For example, in the Sample Basic database, the member [100-20] is an original member under parent [100], and has a shared member associated with it under parent [Diet]. The shared member [100-20] can be referred to explicitly, using the unique name [Diet].[100-20], as shown in the following query:

```sql
SELECT
    {Sales}
ON COLUMNS,
    {{[Diet].[100-20]}} PROPERTIES MEMBER_UNIQUE_NAME
ON ROWS
FROM Sample.Basic;
```

Working with Duplicate Member Names

This topic describes the syntax for defining duplicate member names in Administration Services.

To specify duplicate member names in:

- Smart View, see the Oracle Smart View for Office User’s Guide
- API, see the Oracle Essbase API Reference

To use duplicate member names in MaxL and MDX, see the Oracle Essbase Technical Reference.

Note: If an alias name and member name are the same but do not represent the same member, searching by alias name is not supported in clients (for example Administration Services or the API).

In Administration Services, if you use the member selection tool to insert a duplicate member name from the outline tree, the qualified member name is inserted automatically.

If you type a duplicate member name directly into an editor, type the qualified member name and enclose the qualified name in double quotation marks (" "). For example,

"[State].[New York]"

In MDX and MaxL qualified member names are not enclosed in quotation marks. See “Inserting Dimension and Member Names in MDX Scripts” in the Oracle Essbase Administration Services Online Help. The Administration Services Data Preview feature does not support duplicate member outlines.
Some information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

● Chapter 60, “Comparison of Aggregate and Block Storage”
● Chapter 61, “Aggregate Storage Applications, Databases, and Outlines”

Setting Dimension Types

Subtopics

● Creating a Time Dimension
● Creating an Accounts Dimension
● Creating a Country Dimension
● Creating Currency Partitions
● Creating Attribute Dimensions

When you tag a dimension as a specific type, the dimension can access built-in functionality designed for that type. For example, if you define a dimension as accounts, you can specify accounting measures for members in that dimension. Essbase calculates the two primary dimension types, time and accounts, before other dimensions in the database. By default, all dimensions are tagged as none.
To set a dimension type:
See “Setting the Dimension Type” in the Oracle Essbase Administration Services Online Help.

The following sections describe the dimension types.

**Creating a Time Dimension**

Tag a dimension as time if it contains members that describe how often you collect and update data. In the Sample.Basic database, for example, the Year dimension is tagged as time, as are its descendants—all Qtr members and the months (such as Jan). The time dimension also enables several accounts dimension functions, such as first and last time balances.

Rules when tagging a dimension as time:
- You can tag only one dimension in an outline as time.
- All members in the time dimension inherit the time property.
- You can add time members to dimensions that are not tagged as time.
- You can create an outline that does not have a time dimension.

To tag a dimension as time:
See “Tagging a Time Dimension” in the Oracle Essbase Administration Services Online Help.

**Creating an Accounts Dimension**

Tag a dimension as accounts if it contains items that you want to measure, such as profit or inventory.

Rules when tagging a dimension as accounts:
- You can tag only one dimension in an outline as accounts.
- All members in the accounts dimension inherit the accounts property.
- You can specify that members of the accounts dimension are calculated on the second pass through an outline. See “Setting Two-Pass Calculations” on page 157.
- You can create an outline that does not have an accounts dimension.

To tag a dimension as accounts:
See “Tagging an Accounts Dimension” in the Oracle Essbase Administration Services Online Help.

The following sections describe built-in functionality for accounts dimensions.
Setting Time Balance Properties

If an accounts dimension member uses the time balance property, it affects how Essbase calculates the parent of that member in the time dimension. By default, a parent in the time dimension is calculated based on the consolidation and formulas of its children. For example, in the Sample.Basic database, the Qtr1 member is the sum of its children (Jan, Feb, and Mar). However, setting a time balance property causes parents, for example Qtr1, to roll up differently.

To set time balance properties:

See “Setting Time Balance Properties” in the Oracle Essbase Administration Services Online Help.

Example of Time Balance as None

"None" is the default value. When you set the time balance property as none, Essbase rolls up parents in the time dimension in the usual way—the value of the parent is based on the formulas and consolidation properties of its children.

Example of Time Balance as First

Set the time balance as “first” when you want the parent value to represent the value of the first member in the branch (often at the beginning of a time period).

For example, assume that a member named OpeningInventory represents the inventory at the beginning of the time period. If the time period was Qtr1, OpeningInventory represents the inventory at the beginning of Jan; that is, the OpeningInventory for Qtr1 is the same as the OpeningInventory for Jan. For example, if you had 50 cases of Cola at the beginning of Jan, you also had 50 cases of Cola at the beginning of Qtr1.

Tag OpeningInventory as first, as shown in the following example consolidation:

```
OpeningInventory (TB First), Cola, East, Actual, Jan(+), 50
OpeningInventory (TB First), Cola, East, Actual, Feb(+), 60
OpeningInventory (TB First), Cola, East, Actual, Mar(+), 70
OpeningInventory (TB First), Cola, East, Actual, Qtr1(+), 50
```

Example of Time Balance as Last

Set the time balance as “last” when you want the parent value to represent the value of the last member in the branch (often at the end of a time period).

For example, assume that a member named EndingInventory represents the inventory at the end of the time period. If the time period is Qtr1, EndingInventory represents the inventory at the end of Mar; that is, the EndingInventory for Qtr1 is the same as the EndingInventory for Mar. For example, if you had 70 cases of Cola at the end of Mar, you also had 70 cases of Cola at the end of Qtr1.

Tag EndingInventory as last, as shown in the following example consolidation:

```
EndingInventory (TB Last), Cola, East, Actual, Jan(+), 50
EndingInventory (TB Last), Cola, East, Actual, Feb(+), 60
EndingInventory (TB Last), Cola, East, Actual, Mar(+), 70
EndingInventory (TB Last), Cola, East, Actual, Qtr1(+), 70
```
Example of Time Balance as Average

Set the time balance as “average” when you want the parent value to represent the average value of its children.

For example, assume that a member named AverageInventory represents the average of the inventory for the time period. If the time period was Qtr1, then AverageInventory represents the average of the inventory during Jan, Feb, and Mar.

Tag AverageInventory as average, as shown in the following example consolidation:

- AverageInventory (TB Average), Cola, East, Actual, Jan(+), 60
- AverageInventory (TB Average), Cola, East, Actual, Feb(+), 62
- AverageInventory (TB Average), Cola, East, Actual, Mar(+), 67
- AverageInventory (TB Average), Cola, East, Actual, Qtr1(+), 63

Setting Skip Properties

If you set the time balance as first, last, or average, set the skip property to tell Essbase what to do when it encounters missing values or values of 0.

Table 15 describes how each setting determines what Essbase does when it encounters a missing or zero value.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Essbase Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Does not skip data when calculating the parent value.</td>
</tr>
<tr>
<td>Missing</td>
<td>Skips #MISSING data when calculating the parent value.</td>
</tr>
<tr>
<td>Zeros</td>
<td>Skips data that equals zero when calculating the parent value.</td>
</tr>
<tr>
<td>Missing and Zeros</td>
<td>Skips #MISSING data and data that equals zero when calculating the parent value.</td>
</tr>
</tbody>
</table>

If you mark a member as last with a skip property of missing or missing and zeros, the parent of that time period matches the last nonmissing child. In the following example, EndingInventory is based on the value for Feb, because Mar does not have a value.

- Cola, East, Actual, Jan, EndingInventory (Last), 60
- Cola, East, Actual, Feb, EndingInventory (Last), 70
- Cola, East, Actual, Mar, EndingInventory (Last), #MI
- Cola, East, Actual, Qtr1, EndingInventory (Last), 70

Setting Variance Reporting Properties

Variance reporting properties determine how Essbase calculates the difference between actual and budget data in a member with the @VAR or @VARPER function in its member formula. Any member that represents an expense to the company requires an expense property.

When you are budgeting expenses for a time period, the actual expenses should be less than the budget. When actual expenses are greater than budget expenses, the variance is negative. The @VAR function calculates Budget – Actual. For example, if budgeted expenses are $100, and you spend $110, the variance is -10.
When you are budgeting nonexpense items, such as sales, the actual sales should be more than
the budget. When actual sales are less than budget, the variance is negative. The @VAR function
calculates Actual – Budget. For example, if budgeted sales were $100, and you made $110 in
sales, the variance is 10.

By default, members are nonexpense.

➤ To set variance reporting properties:
See “Setting Variance Reporting Properties” in the Oracle Essbase Administration Services Online
Help.

Setting Essbase Currency Conversion Properties

Currency conversion properties define categories of currency exchange rates. These properties
are used only in currency databases on members of accounts dimensions. See Chapter 14,
“Designing and Building Currency Conversion Applications.”

➤ To set currency conversion properties:
See “Assigning Currency Categories to Accounts Members” in the Oracle Essbase Administration
Services Online Help.

Creating a Country Dimension

Use country dimensions to track business activities in multiple countries. If you track business
activity in the U.S. and Canada, for example, the country dimension should contain states,
provinces, and countries. If a dimension is tagged as country, you can set the currency name
property. The currency name property defines what type of currency this market region uses.

In a country dimension, you can specify the currency used in each member. For example, in the
Interntl application and database shipped with Essbase, Canada has three markets—Vancouver,
Toronto, and Montreal—which use Canadian dollars.

This dimension type is used for currency conversion applications. See Chapter 14, “Designing
and Building Currency Conversion Applications.”

➤ To tag a dimension as country:
See “Tagging a Country Dimension” in the Oracle Essbase Administration Services Online Help.

Creating Currency Partitions

Use currency partition members to separate local currency members from a base currency
defined in the application. If the base currency for analysis is U.S. dollars, for example, the local
currency members would contain values based on the currency type of the region, such as
Canadian dollars.
This dimension type is used for currency conversion applications. See Chapter 14, “Designing and Building Currency Conversion Applications.”

To tag a dimension as currency partition:
See “Creating a Currency Partition” in the Oracle Essbase Administration Services Online Help.

Creating Attribute Dimensions

Use attribute dimensions to report and aggregate data based on characteristics of standard dimensions. In the Sample.Basic database, for example, the Product dimension is associated with the Ounces attribute dimension. Members of the Ounces attribute dimension categorize products based on their size in ounces.

Review the rules for using attribute dimensions in Chapter 10, “Working with Attributes.”

To tag a dimension as an attribute:
See “Tagging an Attribute Dimension” in the Oracle Essbase Administration Services Online Help.

Setting Member Consolidation

Member consolidation properties, which are listed in Table 16 on page 146, determine how children roll up into their parents. By default, new members are given the addition (+) operator, meaning that members are added. For example, Jan, Feb, and Mar figures are added and the result stored in their parent, Qtr1.

Note: Essbase does not use consolidation properties with members of attribute dimensions. See “Calculating Attribute Data” on page 177.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>Adds the member to the result of previous calculations performed on other members. + is the default operator.</td>
</tr>
<tr>
<td>-</td>
<td>Multiplies the member by -1 and adds it to the sum of previous calculations performed on other members.</td>
</tr>
<tr>
<td>*</td>
<td>Multiplies the member by the result of previous calculations performed on other members.</td>
</tr>
<tr>
<td>/</td>
<td>Divides the member into the result of previous calculations performed on other members.</td>
</tr>
<tr>
<td>%</td>
<td>Divides the member into the sum of previous calculations performed on other members. The result is multiplied by 100 to yield a percentage value.</td>
</tr>
<tr>
<td>~</td>
<td>Does not use the member in the consolidation to its parent.</td>
</tr>
<tr>
<td>^</td>
<td>Does not use the member in any consolidation in any dimension except attribute dimensions.</td>
</tr>
</tbody>
</table>
To set member consolidation properties:

See “Setting Member Consolidation Properties” in the Oracle Essbase Administration Services Online Help.

## Calculating Members with Different Operators

When siblings have different operators, Essbase calculates the data in top-down order. Consider the following members:

<table>
<thead>
<tr>
<th>Parent1</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Member1 (+)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Member2 (+)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Member3 (-)</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Member4 (*)</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Member5 (%)</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Member6 (/)</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Member7 (~)</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

Essbase calculates Member1 through Member4 as follows:

\[
(((\text{Member1} + \text{Member2}) + (-1)\text{Member3}) \times \text{Member4}) = X \\
(((10 + 20) + (-25)) \times 40) = 200
\]

If the result of this calculation is X, Member5 consolidates as follows:

\[
(X / \text{Member5}) \times 100 = Y \\
(200 / 50) \times 100 = 400
\]

If the result of the Member1 through Member4 calculation is Y, Member6 consolidates as follows:

\[
Y / \text{Member6} = Z \\
400 / 60 = 66.67
\]

Because Member7 is set to No Consolidation (~), Essbase ignores Member7 in the consolidation.

## Determining How Members Store Data Values

You can determine how and when Essbase stores the data values for a member. For example, you can tell Essbase to calculate the value for a member only when a user requests it, and then discard the data value. Table 17 describes each storage property.

### Table 17  Choosing Storage Properties

<table>
<thead>
<tr>
<th>Storage Property</th>
<th>Behavior</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store</td>
<td>Stores the data value with the member.</td>
<td>&quot;Understanding Stored Members&quot; on page 148</td>
</tr>
<tr>
<td>Dynamic Calc and Store</td>
<td>Does not calculate the data value until a user requests it, and then stores the data value.</td>
<td>&quot;Understanding Dynamic Calculation Members&quot; on page 148</td>
</tr>
<tr>
<td><strong>Storage Property</strong></td>
<td><strong>Behavior</strong></td>
<td><strong>See</strong></td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>Dynamic Calc</td>
<td>Does not calculate the data value until a user requests it, and then discards the data value.</td>
<td>&quot;Understanding Dynamic Calculation Members&quot; on page 148</td>
</tr>
<tr>
<td>Never share</td>
<td>Does not allow members to be shared implicitly. Members tagged as Never share can only be explicitly shared. To explicitly share a member, create the shared member with the same name and tag it as shared.</td>
<td>&quot;Understanding Implied Sharing&quot; on page 152</td>
</tr>
<tr>
<td>Label only</td>
<td>Creates members for navigation only; that is, members that contain no data values.</td>
<td>&quot;Understanding Label Only Members&quot; on page 149</td>
</tr>
<tr>
<td>Shared member</td>
<td>Shares values between members. For example, in the Sample.Basic database, the 100-20 member is stored under the 100 parent and shared under Diet parent.</td>
<td>&quot;Understanding Shared Members&quot; on page 149</td>
</tr>
</tbody>
</table>

➢ To set member storage properties:

See “Setting Member Storage Properties” in the *Oracle Essbase Administration Services Online Help*.

**Understanding Stored Members**

Stored members contain calculated values that are stored with the member in the database after calculation. By default, members are set as stored.

➢ To define a member as stored:

See “Setting Member Storage Properties” in the *Oracle Essbase Administration Services Online Help*.

**Understanding Dynamic Calculation Members**

When a member is Dynamic Calc, Essbase does not calculate the value for that member until a user requests it. After the user views it, Essbase does not store the value for that member. If you tag a member as Dynamic Calc and Store, Essbase performs the same operation as for a Dynamic Calc member but then stores the data value. See Chapter 27, “Dynamically Calculating Data Values.”

Essbase automatically tags members of attribute dimensions as Dynamic Calc. You cannot change this setting.

➢ To tag a member as Dynamic Calc:

See “Setting Member Storage Properties” in the *Oracle Essbase Administration Services Online Help*. 148
Understanding Label Only Members

Label only members have no associated data. Use them to group members or to ease navigation and reporting from Smart View. Typically, you should give label only members the “no consolidation” property. See “Setting Member Consolidation” on page 146.

You cannot associate attributes with label only members. If you tag a base dimension member that has attribute associations as label only, Essbase removes the attribute associations and displays a warning message.

A descendent of a label only member cannot be tagged as Dynamic Calc. In the following example, when verifying the outline, Essbase issues an error message indicating that ChildB cannot be tagged as label only:

```
ParentA = Label Only
ChildB = Label Only
DescendantC = Dynamic Calc
```

Tagging DescendantC as Store Data or Dynamic Calc and Store resolves the issue.

To tag a member as label only:

See “Setting Member Storage Properties” in the Oracle Essbase Administration Services Online Help.

Understanding Shared Members

Subtopics

- Understanding the Rules for Shared Members
- Understanding Shared Member Retrieval During Drill-Down
- Understanding Implied Sharing

The data values associated with a shared member come from another member with the same name. The shared member stores a pointer to data contained in the other member, and the data is stored only once. To define a member as shared, an actual nonshared member of the same name must exist. For example, in the Sample.Basic database, the 100-20 member under 100 stores the data for that member. The 100-20 member under Diet points to that value.

Shared members typically are used to calculate the same member across multiple parents; for example, to calculate a Diet Cola member in both the 100 and Diet parents.

Using shared members lets you use members repeatedly throughout a dimension. Essbase stores the data value only once, but it displays in multiple locations. Storing the data value only once saves space and improves processing efficiency.

To tag a member as shared:

See “Setting Member Storage Properties” in the Oracle Essbase Administration Services Online Help.
Read the following sections to learn more about shared members.

**Note:** Members with the same name may be duplicate members instead of shared members. See Chapter 8, “Creating and Working With Duplicate Member Outlines.”

**Understanding the Rules for Shared Members**

Rules when creating shared members:

- Shared members must be in the same dimension. For example, both 100-20 members in the Sample.Basic database are in the Product dimension.
- Shared members cannot have children.
- An unlimited number of shared members can have the same name.
- UDAs or formulas cannot be assigned to shared members.
- You can create a shared member for a member with a duplicate member name. Specify the duplicate member name for which you want to create the shared member. The qualified name of the duplicate member, on which the shared member is based, is displayed in the Member Properties dialog box. See “Defining Shared Members” in the Oracle Essbase Administration Services Online Help.
- Attributes cannot be associated with shared members.
- If accounts properties are assigned to shared members, the values for those accounts properties are taken from the base member, even if the accounts properties on the shared member are changed.
- Aliases can be assigned to shared members.
- An actual member must be located in a dimension before its shared member.
- Avoid complex relationships between actual and shared members that will be part of an attribute calculation, or a calculation may return unexpected results. See “Understanding Attribute Calculation and Shared Members” on page 181.

**Note:** You cannot create a shared member and the member on which it is based under the same parent. In a duplicate member outline, siblings must be unique.

**Note:** In grid clients (for example, Smart View), shared members can easily be differentiated from their base members, because you can specify for them to be displayed with a qualified name (for example, [Parent].[Child]). Shared members can be displayed with qualified names even if you have not set the outline to enable duplicate member names. Additionally, you can use qualified member names to search for shared members in the grid or using member selection.
Understanding Shared Member Retrieval During Drill-Down

Essbase retrieves shared members during drill-down, depending on their location in the spreadsheet. Essbase follows three rules during this type of retrieval:

- Essbase retrieves stored members (not their shared member counterparts) by default.
- Essbase retrieves from the bottom of a spreadsheet first.
- If the parent of a shared member is a sibling of the stored member counterpart of one of the shared members, Essbase retrieves the stored member.

Example of Shared Members from a Single Dimension

If you create a test dimension with all shared members based on the members of the dimension East from the Sample.Basic outline, the outline would be similar to the one shown in Figure 38:

If you retrieve only the children of East, all results are from stored members because Essbase retrieves stored members by default.

If, however, you retrieve data with the children of test above it in the spreadsheet, Essbase retrieves the shared members:

New York
Massachusetts
Florida
Connecticut
New Hampshire
test

If you move test above its last two children, Essbase retrieves the first three children as shared members, but the last two as stored members. Similarly, if you insert a member in the middle of the list above which was not a sibling of the shared members (for example, California inserted between Florida and Connecticut), Essbase retrieves shared members only between the nonsibling and the parent (in this case, between California and test).
Example of Retrieval with Crossed Generation Shared Members

You can modify the Sample.Basic outline to create a shared member whose stored member counterpart is a sibling to its own parent, as shown in Figure 39:

![Figure 39 Retrieval with Crossed Generation Shared Members](Image)

Essbase retrieves the members in this order because test is a parent of west and a sibling of west’s stored member counterpart, West.

Understanding Implied Sharing

The shared member property defines a shared data relationship explicitly. Some members are shared even if you do not explicitly set them as shared. These members are implied shared members.

Essbase assumes (or implies) a shared member relationship in the following situations:

- **A parent has only one child.** In this situation, the parent and the child contain the same data. Essbase ignores the consolidation property on the child and stores the data only once —thus the parent has an implied shared relationship with the child. In the following example, the parent 500 has only one child, 500-10, so the parent shares the value of that child:

  500 (+)
  500-10 (+)

- **A parent has only one child that consolidates to the parent.** If the parent has four children, but three are marked as no consolidation, the parent and child that consolidates contain the same data. Essbase ignores the consolidation property on the child and stores the data only...
once—thus the parent has an implied shared relationship with the child. In the following example, the parent 500 has only one child, 500-10, that rolls up to it. The other children are marked as No Consolidate (~), so the parent implicitly shares the value of 500-10.

500 (+)
  500-10 (+)
  500-20 (~)
  500-30 (~)

If you do not want a member to be shared implicitly, mark the parent as Never Share so that the data is duplicated instead. See “Understanding Shared Members” on page 149 for an explanation of how shared members work.

Setting Aliases

The information about aliases and alias tables applies to block storage and aggregate storage databases.

An alias is an alternate name for a member or shared member. For example, members in the Product dimension in the Sample.Basic database are identified both by product codes, such as 100, and by more descriptive aliases, such as Cola. Aliases, stored in alias tables, can improve the readability of outlines or reports.

You can set multiple aliases for a member using alias tables. For example, you can use different aliases for different kinds of reports—users may be familiar with 100-10 as Cola, but advertisers and executives may be familiar with it as The Best Cola. This list shows products in the Sample.Basic database that have two descriptive alias names:

<table>
<thead>
<tr>
<th>Product</th>
<th>Default</th>
<th>Long Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10</td>
<td>Cola</td>
<td>The Best Cola</td>
</tr>
<tr>
<td>100-20</td>
<td>Diet Cola</td>
<td>Diet Cola with Honey</td>
</tr>
<tr>
<td>100-30</td>
<td>Caffeine Free Cola</td>
<td>All the Cola, none of the Caffeine</td>
</tr>
</tbody>
</table>

Alias Tables

Aliases are stored in one or more tables as part of a database outline. An alias table maps a specific, named set of alias names to member names. When you create a database outline, Essbase creates an empty alias table named Default. If you do not create any other alias tables, the aliases that you create are stored in the Default alias table.

You can create an alias table for each set of outline members. When you view the outline or retrieve data, you can use the alias table name to indicate which set of alias names you want to see. Identifying which alias table contains the names that you want to see while viewing an outline is called making an alias table the active alias table. See “Setting an Alias Table as Active” on page 155.

For Unicode-mode applications, setting up a separate alias table for each user language enables users to view member names in their own language. See Chapter 42, “Understanding the Essbase Unicode Implementation.”
Creating Aliases

You can provide an alias for any member. Alias names must follow the same rules as member names. See “Naming Conventions for Dimensions, Members, and Aliases” on page 1094.

You can use any of the following methods to create aliases in an existing alias table:

- To manually assign an alias to a member while editing an outline, see “Creating Aliases for Dimensions and Members” in the Oracle Essbase Administration Services Online Help.
- To use dimension build and a data source to add aliases to an alias table, see “Defining a Rules File for Adding Aliases” in the Oracle Essbase Administration Services Online Help.
- To import alias values from an alias table source file created in a predefined format, see “Importing and Exporting Alias Tables” on page 156.

Creating and Managing Alias Tables

Named alias tables enable you to display different aliases in different situations. See:

- “Creating an Alias Table” on page 154
- “Setting an Alias Table as Active” on page 155
- “Working with Alias Table Language Codes” on page 155
- “Copying an Alias Table” on page 155
- “Renaming an Alias Table” on page 156
- “Clearing and Deleting Alias Tables” on page 156
- “Importing and Exporting Alias Tables” on page 156

Creating an Alias Table

An alias table contains a list of aliases to use for outline members. These requirements apply:

- You can create up to 32 alias tables for a block storage or aggregate storage outline.
- The naming conventions for alias table names are the same as those for dimensions. See “Naming Conventions for Dimensions, Members, and Aliases” on page 1094.
- Name-length restrictions depend on the Unicode-related mode of the application. See Appendix A, “Limits.”
- The name of the system-generated default alias table, which is Default, cannot be changed; however, the name of alias tables that you create can be changed.
- Optional. You can specify multiple language codes for an alias table. When you create an alias table, a language code is not specified. See “Working with Alias Table Language Codes” on page 155.

To create an alias table:

See “Creating Alias Tables” in the Oracle Essbase Administration Services Online Help.
A new alias table is empty. To add aliases to an alias table and assign them to members, see “Creating Aliases” on page 154.

To assign language codes to an alias table:
See “Working with Alias Table Language Codes” on page 155.

Working with Alias Table Language Codes

You can specify multiple language codes for an alias table. When you create an alias table, a language code is not specified. To assign language codes to an alias table, use the C-API or VB-API versions of the SetAliasTableLanguage API. (You cannot set a language code for the default alias table.)

To get the set of language codes associated with an alias table, use the C-API or VB-API versions of the GetAliasTableLanguages API.

To clear the language codes associated with an alias table, use the C-API or VB-API versions of the ClearAliasTableLanguages API.

When clearing aliases from an alias table, language codes are removed from the alias table.
When copying an alias table, language codes are removed from the copied alias table.
When renaming an alias table, language codes are preserved in the renamed alias table.

See the Oracle Essbase API Reference.

Setting an Alias Table as Active

The active alias table contains the aliases that Essbase currently displays in the outline.

To view a list of alias tables in the outline and to set the current alias table, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting the Active Alias Table for Outline Editor</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>query database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>alter database</td>
<td></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LISTALIASES</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>SETALIASES</td>
<td></td>
</tr>
</tbody>
</table>

Copying an Alias Table

To copy an alias table, the table must be persisted in the database directory. To copy artifacts that are not persisted in the database directory, use the EXPORT ESSCMD command.

When you copy an alias table, language codes associated with that alias table are removed from the copied alias table. See “Working with Alias Table Language Codes” on page 155.
To copy alias tables, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Alias Tables</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter object</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>COPYOBJECT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Renaming an Alias Table**

When you rename an alias table, language codes associated with that table are preserved in the renamed alias table. See “Working with Alias Table Language Codes” on page 155.

To rename an alias table, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Renaming Alias Tables</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter object</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>RENAMEOBJECT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Clearing and Deleting Alias Tables**

You can delete an alias table from the outline, or you can clear all the aliases from an alias table without deleting the alias table itself. To clear or delete alias tables, see “Deleting and Clearing Alias Tables” in the Oracle Essbase Administration Services Online Help.

When you clear the aliases from an alias table, language codes associated with that alias table are removed. See “Working with Alias Table Language Codes” on page 155.

**Importing and Exporting Alias Tables**

You can import a correctly formatted text file into Essbase as an alias table. Alias table import files have the .alt extension. Alias table import files should have the following structure:

- The first line in the file starts with $ALT_NAME. Add one or two spaces followed by the name of the alias table. If the alias table name contains a blank character, enclose the name in single quotation marks.
- The last line of the file must be $END.
- Each line between the first and the last lines contains two values separated by one or more spaces or tabs. The first value must be the name of an existing outline member; the second value is the alias for the member.
- Any member or alias name that contains a blank or underscore must be enclosed in double quotation marks.
The following is an example of an alias table import file:

```
$ALT_NAME 'Quarters'
Qtr1 Quarter1
Jan January
Feb February
Mar March
$END
```

You can also export an alias table from the Essbase outline to a text file. The export file contains aliases and the corresponding member names—qualified member names for duplicate members.

To import or export alias tables, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Importing Alias Tables</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td></td>
<td>Exporting Alias Tables</td>
<td></td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LOADALIAS</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>UNLOADALIAS</td>
<td></td>
</tr>
</tbody>
</table>

### Setting Two-Pass Calculations

By default, Essbase calculates outlines from the bottom up—first calculating the values for the children and then the values for the parent. Sometimes, however, the values of the children may be based on the values of the parent or the values of other members in the outline. To obtain the correct values for these members, Essbase must first calculate the outline and then recalculate the members that are dependent on the calculated values of other members. The members that are calculated on the second pass through the outline are called two-pass calculations.

See “Using Bottom-Up Calculation” on page 871.

For example, to calculate the ratio between Sales and Margin, Essbase needs first to calculate Margin, which is a parent member based on its children, including Sales. To ensure that the ratio is calculated based on a freshly calculated Margin figure, tag the Margin % ratio member as a two-pass calculation. Essbase calculates the database once and then calculates the ratio member again. This calculation produces the correct result.

Although two-pass calculation is a property that you can give to any nonattribute member, it works only on the following members:

- Accounts dimension members
- Dynamic Calc members
- Dynamic Calc and Store members.

If two-pass calculation is assigned to other members, Essbase ignores it.
To tag a member as two-pass:

See “Setting Two-Pass Calculation Properties” in the Oracle Essbase Administration Services Online Help.

Creating Formulas

You can apply formulas to standard dimensions and members. You cannot set formulas for attribute dimensions and their members. The formula determines how Essbase calculates the outline data. See Chapter 23, “Developing Formulas for Block Storage Databases.”

To add formulas to a dimension or member:

See “Creating and Editing Formulas in Outlines” in the Oracle Essbase Administration Services Online Help.

Naming Generations and Levels

You can create names for generations and levels in an outline, such as a word or phrase that describes the generation or level. For example, you might create a generation name called Cities for all cities in the outline. See “Dimension and Member Relationships” on page 62.

Use generation and level names in calculation scripts or report scripts wherever you need to specify either a list of member names or generation or level numbers. For example, you could limit a calculation in a calculation script to all members in a specific generation. See Chapter 29, “Developing Calculation Scripts for Block Storage Databases”.

You can define only one name for each generation or level. When you name generations and levels, follow the same naming rules as for members. See “Naming Conventions for Dimensions, Members, and Aliases” on page 1094.

To name generations and levels using Outline Editor:

See “Naming Generations and Levels” in the Oracle Essbase Administration Services Online Help.

Creating UDAs

You can create user-defined attributes (UDA) for members. For example, you might create a UDA called Debit. Use UDAs in the following places:

- Calculation scripts. After you define a UDA, you can query a member for its UDA in a calculation script. For example, you can multiply all members with the UDA Debit by –1 so that they display as either positive or negative (depending on how the data is currently stored). See Chapter 29, “Developing Calculation Scripts for Block Storage Databases.”

- Data loading. You can change the sign of the data as it is loaded into the database based on its UDA. See “Flipping Field Signs” on page 304.
To perform a calculation, selectively retrieve data based on attribute values, or provide full
crosstab, pivot, and drill-down support in the spreadsheet, create attribute dimensions instead
of UDAs. See “Comparing Attributes and UDAs” on page 169.

**Note:** On aggregate storage databases, using UDAs to define member groups greatly decreases
the execution speeds of Essbase functions. To avoid this performance loss, use attribute
dimensions to define member groups.

Rules when creating UDAs:

- You can define multiple UDAs per member.
- You cannot set the same UDA twice for one member.
- You can set the same UDA for different members.
- A UDA name can be the same as a member, alias, level, or generation name. Follow the same
  naming rules as for members. See “Naming Conventions for Dimensions, Members, and
  Aliases” on page 1094.
- You cannot create a UDA on shared members.
- You cannot create a UDA on members of attribute dimensions.
- A UDA applies to the specified member only. Descendants and ancestors of the member do
  not automatically receive the same UDA.

➤ To add UDAs to a member:

See “Working with UDAs” in the *Oracle Essbase Administration Services Online Help.*

**Adding Comments**

You can add comments to dimensions and members. Comments can contain 255 characters
maximum. Outline Editor displays comments to the right of the dimension or member in the
following format:

```
/* comment */
```

➤ To add comments to a dimension or member:

See “Setting Comments on Dimensions and Members” in the *Oracle Essbase Administration
Services Online Help.*
Process for Creating Attributes

Attributes describe characteristics of data such as product size and color. Through attributes, you can group and analyze members of dimensions based on their characteristics. This chapter describes how to create and manage attributes in an Essbase Server outline.

When working with attributes in Outline Editor, perform the following tasks:

1. Create a dimension.

   See “Adding Dimensions and Members to an Outline” on page 129. In the outline, position the attribute dimensions after all standard dimensions.
2. Tag the dimension as an attribute dimension and set attribute dimension type as text, numeric, Boolean, or date.
   See “Creating Attribute Dimensions” on page 146.

3. Add members to the attribute dimension.
   See “Adding Dimensions and Members to an Outline” on page 129.

4. Associate a base dimension with the attribute dimension.
   See “Understanding the Rules for Attribute Dimension Association” on page 165.

5. Associate members of the base dimension with members of the attribute dimension.
   See “Understanding the Rules for Attribute Member Association” on page 165.

6. If necessary, set up the attribute calculations.
   See “Calculating Attribute Data” on page 177.

**Understanding Attributes**

You can use the Essbase attribute feature to retrieve and analyze data not only from the perspective of dimensions, but also in terms of characteristics, or attributes, of those dimensions. For example, you can analyze product profitability based on size or packaging, and you can make more effective conclusions by incorporating market attributes, such as the population of each market region, into the analysis.

Such an analysis could tell you that decaffeinated drinks sold in cans in small markets (populations less than 6,000,000) are less profitable than you anticipated. For more details, you can filter the analysis by specific attribute criteria, including minimum or maximum sales and profits of different products in similar market segments.

A few ways analysis by attribute provides depth and perspective, supporting better-informed decisions:

- You can select, aggregate, and report on data based on common features (attributes).
- By defining attributes as having a text, numeric, Boolean, or date type, you can filter (select) data using type-related functions such as AND, OR, and NOT operators and <, >, and = comparisons.
- You can use the numeric attribute type to group statistical values by attribute ranges; for example, population groupings such as <500,000, 500,000–1,000,000, and >1,000,000.
- Through the Attribute Calculations dimension automatically created by Essbase, you can view sums, counts, minimum or maximum values, and average values of attribute data. For example, when you enter Avg and Bottle into a spreadsheet, Essbase retrieves calculated values for average sales in bottles for all the column and row intersections on the sheet.
- You can perform calculations using numeric attribute values in calculation scripts and member formulas; for example, to determine profitability by ounce for products sized by the ounce.
You can create crosstabs of attribute data for the same dimension, and you can pivot and drill down for detail data in spreadsheets.

An attribute crosstab is a report or spreadsheet showing data consolidations across attributes of the same dimension. The crosstab example below displays product packaging as columns and the product size in ounces as rows. At their intersections, you see the profit for each combination of package type and size.

From this information, you can see which size-packaging combinations were most profitable in the Florida market.

<table>
<thead>
<tr>
<th>Product Year Florida Profit Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottle   Can Pkg Type</td>
</tr>
<tr>
<td>======   ====== ========</td>
</tr>
<tr>
<td>32       946 N/A 946</td>
</tr>
<tr>
<td>20       791 N/A 791</td>
</tr>
<tr>
<td>16       714 N/A 714</td>
</tr>
<tr>
<td>12       241 2,383 2,624</td>
</tr>
<tr>
<td>Ounces   2,692 2,383 5,075</td>
</tr>
</tbody>
</table>

Understanding Attribute Dimensions

Products have attributes that are characteristics of the products, such as a product’s size and packaging. Attribute members reside in attribute dimensions. An attribute dimension has the word Attribute next to its name in the outline.

Figure 40 shows part of the Sample.Basic outline featuring the Product dimension and three attribute dimensions: Caffeinated, Ounces, and Pkg Type. To the right of the Product dimension, the terms Caffeinated, Ounces, and Pkg Type show that these attribute dimensions are associated with the Product dimension.
A standard dimension is any dimension that is not an attribute dimension. When an attribute dimension is associated with a standard dimension, the standard dimension is the base dimension for that attribute dimension. In Figure 40, the Product dimension is the base dimension for the Caffeinated, Ounces, and Pkg Type attribute dimensions.

**Note:** Attribute dimensions and members are Dynamic Calc, so Essbase calculates attribute information at retrieval time. Attribute data is not stored in the database.

**Understanding Members of Attribute Dimensions**

Members of an attribute dimension are potential attributes of the members of the associated base dimension. After you associate a base dimension with an attribute dimension, you associate members of the base dimension with members of the associated attribute dimension. The Market dimension member Connecticut is associated with the 6000000 member of the Population attribute dimension. That makes 6000000 an attribute of Connecticut.

In the outline, the information next to a base dimension member shows the attributes of that member. For example, Figure 40 shows that product 100-10 has three attributes—it has caffeine, is sold in 12-ounce containers, and is sold in cans.

**Understanding the Rules for Base and Attribute Dimensions and Members**

Rules regarding members of attribute dimensions and their base dimensions.

- You can tag only sparse dimensions as attribute dimensions.
- Before you can save an outline to the server, each attribute dimension must be associated with a standard, sparse dimension as its base dimension.
- Attribute dimensions must be the last dimensions in the outline.
- Attribute dimensions have a type setting—text, numeric, Boolean, or date. Text is the default setting. Although assigned at the dimension level, the type applies only to the level 0 members of the dimension. See “Understanding Attribute Types” on page 166.
- If you remove the attribute tag from a dimension, Essbase removes prefixes or suffixes from its member names. Prefixes and suffixes are not visible in the outline. See “Setting Prefix and Suffix Formats for Member Names of Attribute Dimensions” on page 173.
- A base dimension member can have many attributes, but only one attribute from each attribute dimension.
  
  For example, product 100-10 can have size and packaging attributes, but only one size and only one type of packaging.
- You cannot associate an attribute with an implied shared member, the child of which is tagged as shared.

You can use attribute values in calculations in the following comparisons:
Understanding the Rules for Attribute Dimension Association

When you associate an attribute dimension with a standard dimension, the standard dimension is the base dimension for that attribute dimension.

- An attribute dimension must be associated with a sparse standard dimension.
- A standard dimension can be a base dimension for multiple attribute dimensions.
- An attribute dimension can be associated with only one base dimension.

For example, you might have a Size attribute dimension with members Small, Medium, and Large. If you associate the Size attribute dimension with the Product dimension, you cannot also associate the Size attribute dimension with the Market dimension. Tracking size-related information for the Market dimension requires another attribute dimension with a different name; for example, MarketSize, with the MarketSize attribute dimension associated with the Market dimension.

Understanding the Rules for Attribute Member Association

When you associate a member of an attribute dimension with a member of a base dimension, follow these rules:

- You cannot associate multiple members from the same attribute dimension with the same base dimension member. For example, the Bottle and Can package types cannot both be associated with the product 100-30.
- You can associate members from different attribute dimensions with the same member of a base dimension. For example, a decaffeinated cola product (100-30) sold in 16-ounce bottles has three attributes: Caffeinated:False; Ounces:16; and Pkg Type:Bottle.
- After attributes are associated with base dimension members, if you cut or copy and paste base dimension members to another outline location, the attribute associations are lost.
- Essbase does not require that each member of a base dimension be associated with a member of an attribute dimension.
- All base dimension members associated with members of a particular attribute dimension must be at the same level.

For example, in Figure 41, all Market dimension members that have Population attributes are at level 0. You cannot associate East, which is a level 1 member, with a Population
attribute, because the other members of the Market dimension that have Population attributes are level 0 members.

Figure 41  
Association of Attributes with the Same Level Members of the Market Dimension

- The level 0 members of attribute dimensions are the only members that you can associate with base dimension members.

For example, in the Population attribute dimension, you can associate only level 0 members such as 3000000, 6000000, and 9000000, with members of the Market dimension. You cannot associate a level 1 member such as Small.

The name of the level 0 member of an attribute dimension is the attribute value. The only members of attribute dimensions that have attribute values are level 0 members.

You can use the higher-level members of attribute dimensions to select and group data. For example, you can use Small, the level 1 member of the Population attribute dimension, to retrieve sales in both the 3000000 and 6000000 population categories.

Understanding Attribute Types

Attribute dimensions have a text, numeric, Boolean, or date type that enables different functions for grouping, selecting, or calculating data. Although assigned at the dimension level, the attribute type applies only to level 0 members of the attribute dimension.

- The default attribute type is text. Text attributes enable the basic attribute member selection and attribute comparisons in calculations. When you perform such comparisons, Essbase compares characters. For example, the package type Bottle is less than the package type Can, because B precedes C in the alphabet. In Sample.Basic, Pkg Type is an example of a text attribute dimension.

- The names of level 0 members of numeric attribute dimensions are numeric values. You can include the names (values) of numeric attribute dimension members in calculations. For example, you can use the number of ounces specified in the Ounces attribute to calculate profit per ounce for each product.

You can also associate numeric attributes with ranges of base dimension values; for example, to analyze product sales by market population groupings—states with 3,000,000 population or less in one group, states with a population between 3,000,001 and 6,000,000 in another group, and so on. See “Setting Up Member Names Representing Ranges of Values” on page 175.
All Boolean attribute dimensions in a database contain only two members. The member names must match the settings for the database; for example, True and False. If multiple Boolean attribute dimensions exist, specify a prefix or suffix member name format to ensure unique member names; for example, Caffeinated_True and Caffeinated_False. See “Setting Boolean Attribute Member Names” on page 174.

You can use date attributes to specify the date format—month-day-year or day-month-year—and to sequence information accordingly. See “Changing the Member Names in Date Attribute Dimensions” on page 175. You can use date attributes in calculations. For example, you can compare dates in a calculation that selects product sales from markets established since 10-12-1999.

Essbase supports date attributes from January 1, 1970, through January 1, 2038.

### Comparing Attribute and Standard Dimensions

In general, attribute dimensions and their members are similar to standard dimensions and their members. You can provide aliases and member comments for attributes. Attribute dimensions can include hierarchies, and you can name generations and levels. You can perform the same spreadsheet operations on attribute dimensions and members as on standard dimensions and members; for example, to analyze data from different perspectives, you can retrieve, pivot, and drill down in the spreadsheet.

Table 18 describes major differences between attribute and standard dimensions and their members.

#### Table 18 Differences Between Attribute and Standard Dimensions

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Attribute Dimensions</th>
<th>Standard Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td>Sparse. An attribute dimension's base dimension also must be sparse</td>
<td>Can be dense or sparse</td>
</tr>
<tr>
<td>Storage property</td>
<td>Can be Dynamic Calc only. Therefore, not stored in the database. The outline does not display this property.</td>
<td>Can be Store Data, Dynamic Calc and Store, Dynamic Calc, Never Share, or Label Only</td>
</tr>
<tr>
<td>Position in outline</td>
<td>Must be the last dimensions in the outline</td>
<td>Must be above all attribute dimensions in the outline</td>
</tr>
<tr>
<td>Partitions</td>
<td>Cannot be defined along attribute dimensions, but you can use attributes to define a partition on a base dimension</td>
<td>Can be defined along standard dimensions</td>
</tr>
<tr>
<td>Formulas (on members)</td>
<td>Cannot be associated</td>
<td>Can be associated</td>
</tr>
<tr>
<td>Shared members</td>
<td>Not allowed</td>
<td>Allowed</td>
</tr>
<tr>
<td>Two-pass calculation member property</td>
<td>Not available</td>
<td>Available</td>
</tr>
<tr>
<td>Functionality</td>
<td>Attribute Dimensions</td>
<td>Standard Dimensions</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Two-pass calculation with runtime formula</td>
<td>If a member formula contains a runtime-dependent function associated with an attribute member name, and the member with the formula is tagged as two-pass, calculation skips the member and issues a warning message. Runtime-dependent functions include: @CURRMBR, @PARENT, @PARENTVAL, @SPARENTVAL, @MDPARENTVAL, @ANCEST, @ANCESTVAL, @SANCESTVAL, and @MDANCESTVAL. See “Understanding Two-Pass Calculations on Attribute Dimensions” on page 169.</td>
<td>Calculation is performed on standard members with runtime formulas and tagged two-pass.</td>
</tr>
<tr>
<td>Two-pass, multiple dimensions: Calculation order</td>
<td>Order of calculation of members tagged two-pass depends on order in outline. The last dimension is calculated last.</td>
<td>Calculation result is not dependent on outline order for members tagged two-pass in multiple dimensions.</td>
</tr>
<tr>
<td>Two-pass calculation with no member formula</td>
<td>Calculation skipped, warning message issued. Therefore, member intersection of two-pass tagged members and upper-level members may return different results from calculation on standard dimensions. See “Understanding Two-Pass Calculations on Attribute Dimensions” on page 169.</td>
<td>Available</td>
</tr>
<tr>
<td>Dense Dynamic Calc members in nonexisting stored blocks</td>
<td>Calculations skip dense dimensions if they are on nonexisting stored blocks. For attributes to work on dense members, data blocks for the dense members must exist. When retrieving data on a dense member that has a Dynamic Calc formula and no attributes, Essbase dynamically creates the data block and returns a value. However, if the Dynamic Calc dense member has an attribute, doing a retrieve on the attribute member results in #MISSING, because Essbase skips the dynamic calculation on the dense member and, therefore, the data block is not created. To identify nonexisting stored blocks, export the database or run a query to find out whether the block has data.</td>
<td>Available</td>
</tr>
<tr>
<td>UDAs on members</td>
<td>Not allowed</td>
<td>Allowed</td>
</tr>
<tr>
<td>Consolidations</td>
<td>For all members, calculated through the Attribute Calculations dimension members: Sum, Count, Min, Max, and Avg. Consolidation operators in the outline are ignored during attribute calculations.</td>
<td>Consolidation operation indicated by assigning the desired consolidation symbol to each member</td>
</tr>
<tr>
<td>Member selection facilitated by Level 0 member typing</td>
<td>Available types include text, numeric, Boolean, and date.</td>
<td>All members treated as text</td>
</tr>
<tr>
<td>Associations</td>
<td>Must be associated with a base dimension</td>
<td>N/A</td>
</tr>
<tr>
<td>Spreadsheet drill-downs</td>
<td>List the base dimension data associated with the selected attribute. For example, drilling down on the attribute Glass displays sales for each product packaged in glass, where Product is the base dimension for the Pkg Type attribute dimension.</td>
<td>List lower or sibling levels of detail in the standard dimensions. For example, drilling down on QTR1 displays a list of products and their sales for that quarter.</td>
</tr>
</tbody>
</table>
Understanding Two-Pass Calculations on Attribute Dimensions

The following example, based on the Product dimension in the Sample.Basic database, illustrates how two-pass calculations work on attribute dimensions. Assume member “400–30” is tagged as two-pass.

If member “400-30” has the following member formula:

```plaintext
="400–10"
```

Essbase executes the formula when performing a retrieve on “400-30.”

If “400-30” has the following member formula:

```plaintext
=@CURRMBR("Market");
```

Essbase skips the calculation because the formula includes the @CURRMBR runtime function, which is not allowed, and issues the following error message:

```
Two-pass calc skipped on member [400-30] in attribute calc
```

If “400-30” does not have a member formula, the same error message is generated because a member tagged as two-pass must have a formula.

Comparing Attributes and UDAs

Attributes and UDAs enable analysis based on characteristics of the data. Attributes provide greater capability than UDAs. The tables in this topic describe the differences between attributes and UDAs in these areas of functionality:

- Data storage (Table 19 on page 169)
- Data retrieval (Table 20 on page 169)
- Data conversion (Table 21 on page 170)
- Calculation scripts (Table 22 on page 170)

Table 19  Data Storage—Comparing Attributes and UDAs

<table>
<thead>
<tr>
<th>Data storage</th>
<th>Attributes</th>
<th>UDAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>You can associate with sparse dimensions.</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>You can associate with dense dimensions.</td>
<td>Not supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Table 20  Data Retrieval—Comparing Attributes and UDAs

<table>
<thead>
<tr>
<th>Data Retrieval</th>
<th>Attributes</th>
<th>UDAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>You can group and retrieve consolidated totals by attribute or UDA value. For example, associate the value High Focus Item to various members of the Product dimension and use that term to retrieve totals and details for only those members.</td>
<td>Supported Simple</td>
<td>Supported More difficult to implement, requiring additional calculation scripts or commands</td>
</tr>
</tbody>
</table>
Data Retrieval

You can categorize attributes in a hierarchy and retrieve consolidated totals by higher levels in the attribute hierarchy; for example, if each product has a size attribute such as 8, 12, 16, or 32, and the sizes are categorized as small, medium, and large. You can view the total sales of small products.

You can create crosstab views displaying aggregate totals of attributes associated with the same base dimension.

You can use Boolean operators AND, OR, and NOT with attribute and UDA values to refine a query. For example, you can select decaffeinated drinks from the 100 product group.

Because attributes have a text, Boolean, date, or numeric type, you can use appropriate operators and functions to work with and display attribute data. For example, you can view sales totals of all products introduced after a specific date.

You can group numeric attributes into ranges of values and let the dimension building process automatically associate the base member with the appropriate range. For example, you can group sales in various regions based on ranges of their populations—less than 3 million, between 3 million and 6 million, and so on.

Through the Attribute Calculations dimension, you can view aggregations of attribute values as sums, counts, minimums, maximums, and averages.

You can use an attribute in a calculation that defines a member. For example, you can use the weight of a product in ounces to define the profit per ounce member of the Measures dimension.

You can retrieve specific base members using attribute-related information.

<table>
<thead>
<tr>
<th>Data Retrieval</th>
<th>Attributes</th>
<th>UDAs</th>
</tr>
</thead>
</table>
| You can categorize attributes in a hierarchy and retrieve consolidated totals by higher levels in the attribute hierarchy; for example, if each product has a size attribute such as 8, 12, 16, or 32, and the sizes are categorized as small, medium, and large. You can view the total sales of small products. | Supported  | Supported
| More difficult to implement             |            |                       |
| You can create crosstab views displaying aggregate totals of attributes associated with the same base dimension. | Supported  | Not supported
| You can show a crosstab of all values of each attribute dimension. |                     |                       |
| You can use Boolean operators AND, OR, and NOT with attribute and UDA values to refine a query. For example, you can select decaffeinated drinks from the 100 product group. | Supported  | Supported
| Because attributes have a text, Boolean, date, or numeric type, you can use appropriate operators and functions to work with and display attribute data. For example, you can view sales totals of all products introduced after a specific date. | Supported  | Not supported
| You can group numeric attributes into ranges of values and let the dimension building process automatically associate the base member with the appropriate range. For example, you can group sales in various regions based on ranges of their populations—less than 3 million, between 3 million and 6 million, and so on. | Supported  | Not supported
| Through the Attribute Calculations dimension, you can view aggregations of attribute values as sums, counts, minimums, maximums, and averages. | Supported  | Not supported
| You can use an attribute in a calculation that defines a member. For example, you can use the weight of a product in ounces to define the profit per ounce member of the Measures dimension. | Supported  | Not supported
| You can retrieve specific base members using attribute-related information. | Supported  | Supported
| Powerful conditional and value-based selections |                       | Limited to text string matches only |

Table 21  Data Conversion—Comparing Attributes and UDAs

Data Conversion

Based on the value of a UDA, you can change the sign of the data as it is loaded into the database. For example, you can reverse the sign of all members with the UDA Debit.

<table>
<thead>
<tr>
<th>Data Conversion</th>
<th>Attributes</th>
<th>UDAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on the value of a UDA, you can change the sign of the data as it is loaded into the database. For example, you can reverse the sign of all members with the UDA Debit.</td>
<td>Not supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Table 22  Calculation Scripts—Comparing Attributes and UDAs

Calculation Scripts

You can perform calculations on a member if its attribute or UDA value matches a specific value. For example, you can increase the price by 10% of all products with the attribute or UDA of Bottle.

You can perform calculations on base members whose attribute value satisfies conditions that you specify. For example, you can calculate the Profit per Ounce of each base member.

<table>
<thead>
<tr>
<th>Calculation Scripts</th>
<th>Attributes</th>
<th>UDAs</th>
</tr>
</thead>
</table>
| You can perform calculations on a member if its attribute or UDA value matches a specific value. For example, you can increase the price by 10% of all products with the attribute or UDA of Bottle. | Supported  | Supported
| You can perform calculations on base members whose attribute value satisfies conditions that you specify. For example, you can calculate the Profit per Ounce of each base member. | Supported  | Not supported |
Designing Attribute Dimensions

Subtopics

- Using Attribute Dimensions
- Using Alternative Design Approaches
- Optimizing Outline Performance

Essbase provides multiple ways to design attribute information into a database. Most often, defining characteristics of the data through attribute dimensions and their members is the best approach. The following sections discuss when to use attribute dimensions, when to use other features, and how to optimize performance when using attributes.

Using Attribute Dimensions

For the most flexibility and functionality, use attribute dimensions to define attribute data. Using attribute dimensions provides the following features:

- Sophisticated, flexible data retrieval
  You can view attribute data only when you want to; you can create meaningful summaries through crosstabs; and, using type-based comparisons, you can selectively view only the data that you want to see.

- Additional calculation functionality
  Not only can you perform calculations on the names of members of attribute dimensions to define members of standard dimensions, you can also access five types of consolidations of attribute data—sums, counts, averages, minimums, and maximums.

- Economy and simplicity
  Because attribute dimensions are sparse, Dynamic Calc, they are not stored as data. Compared to using shared members, outlines using attribute dimensions contain fewer members and are easier to read.

See “Understanding Attributes” on page 162.

Using Alternative Design Approaches

In some situations, consider one of the following approaches:

- UDAs. Although UDAs provide less flexibility than attributes, you can use them to group and retrieve data based on its characteristics. See “Comparing Attributes and UDAs” on page 169.

- Shared members. For example, to include a seasonal analysis in the Year dimension, repeat the months as shared members under the appropriate season; Winter: Jan (shared member), Feb (shared member), and so on. A major disadvantage of using shared members is that the outline becomes large if the categories repeat many members.
Standard dimensions and members. Additional standard dimensions provide flexibility but add storage requirements and complexity to a database. For guidelines on evaluating the impact of additional dimensions, see “Analyzing and Planning” on page 79.

Table 23 describes situations in which you might consider an alternative approach to managing attribute data in a database.

### Table 23 Considering Alternatives to Attribute Dimensions

<table>
<thead>
<tr>
<th>Situation</th>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze attributes of dense dimensions</td>
<td>UDAs or shared members</td>
</tr>
<tr>
<td>Perform batch calculation of data</td>
<td>Shared members or members of separate, standard dimensions</td>
</tr>
<tr>
<td>Define the name of a member of an attribute dimension as a value that results from a formula</td>
<td>Shared members or members of separate, standard dimensions</td>
</tr>
<tr>
<td>Define attributes that vary over time</td>
<td>Members of separate, standard dimensions. For example, to track product maintenance costs over time, the age of the product at the time of maintenance is important. However, using the attribute feature, you could associate only one age with the product. You need multiple members in a separate dimension for each time period that you want to track.</td>
</tr>
<tr>
<td>Minimize retrieval time with large numbers of base-dimension members</td>
<td>Batch calculation with shared members or members of separate, standard dimensions.</td>
</tr>
</tbody>
</table>

### Optimizing Outline Performance

Outline layout and content can affect attribute calculation and query performance. For general outline design guidelines, see “Designing an Outline to Optimize Performance” on page 93.

To optimize attribute query performance, consider the following design tips:

- Ensure that attribute dimensions are the only sparse Dynamic Calc dimensions in the outline.
- Locate sparse dimensions after dense dimensions in the outline. Place the most-queried dimensions at the beginning of the sparse dimensions and attribute dimensions at the end of the outline. In most situations, base dimensions are queried most.

See “Optimizing Calculation and Retrieval Performance” on page 180.

### Building Attribute Dimensions

To build an attribute dimension, tag the dimension as an attribute and assign the dimension a type. Then associate the attribute dimension with a base dimension. Finally, associate each level 0 member of the attribute dimension with a member of the associated base dimension.

- To build an attribute dimension:

See “Defining Attributes” in the Oracle Essbase Administration Services Online Help.
To view the dimension, attribute value, and attribute type of a specific attribute member, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Viewing Attribute Information in Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>query database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETATTRINFO</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Setting Member Names in Attribute Dimensions

Subtopics

- Setting Prefix and Suffix Formats for Member Names of Attribute Dimensions
- Setting Boolean Attribute Member Names
- Changing the Member Names in Date Attribute Dimensions
- Setting Up Member Names Representing Ranges of Values
- Changing the Member Names of the Attribute Calculations Dimension

When you use the attribute feature, Essbase establishes default member names; for example, the system-defined True and False precludes other member names of True and False. You can change these system-defined names for the database. Date attributes and numeric attributes also can be duplicated. To avoid duplicate name confusion, you can establish settings for qualifying member names in attribute dimensions. The outline does not show the fully qualified attribute names, but you can see the full attribute names anywhere you select members, such as when you define partitions or select information to be retrieved.

Define the member name settings before you define or build the attribute dimensions. Changing the settings after the attribute dimensions and members are defined could result in invalid member names.

The following sections describe how to work with the names of members of attribute dimensions:

**Note:** If you partition on outlines containing attribute dimensions, the name format settings of members described in this section must be identical in the source and target outlines.

Setting Prefix and Suffix Formats for Member Names of Attribute Dimensions

The information in this section does not apply to duplicate member attribute dimensions.

The names of members of Boolean, date, and numeric attribute dimensions are values. It is possible to encounter duplicate attribute values in different attribute dimensions.

- Boolean example
If you have multiple Boolean attribute dimensions in an outline, the two members of each of those dimensions have the same names, by default, True and False.

- Date example
  If you have multiple date attribute dimensions, some member names in both dimensions could be the same. For example, the date on which a store opens in a certain market could be the same as the date on which a product was introduced.

- Numeric example
  The attribute value for the size of a product could be 12, and 12 also could be the value for the number of packing units for a product. This example results in two members with the name 12.

You can define unique names by attaching a prefix or suffix to member names in Boolean, date, and numeric attribute dimensions in the outline. You can affix the dimension, parent, grandparent, or all ancestors to the attribute name. For example, by setting member names of attribute dimensions to include the dimension name as the suffix, attached by an underscore, the member value 12 in the Ounces attribute dimension assumes the unique, full attribute member name 12_Ounces.

By default, Essbase assumes that no prefix or suffix is attached to the names of members of attribute dimensions.

The convention that you select applies to the level 0 member names of all numeric, Boolean, and date attribute dimensions in the outline. You can define aliases for these names if you want to display shorter names in retrievals.

- To define prefix and suffix formats:
  See “Defining a Prefix or Suffix Format for Members of Attribute Dimensions” in the Oracle Essbase Administration Services Online Help.

## Setting Boolean Attribute Member Names

When you set the dimension type of an attribute dimension as Boolean, Essbase automatically creates two level 0 members with the names specified for the Boolean attribute settings. The initial Boolean member names in a database are set as True and False. To change these default names, for example, to Yes and No, define the member names for Boolean attribute dimensions before you create Boolean attribute dimensions in the database.

Before you can set an attribute dimension type as Boolean, you must delete all existing members in the dimension.

- To define the database setting for the names of members of Boolean attribute dimensions:
  See “Setting Member Names for Boolean Attribute Dimensions” in the Oracle Essbase Administration Services Online Help.
Changing the Member Names in Date Attribute Dimensions

You can change the format of members of date attribute dimensions. For example, you can use the following date formats:

- **mm-dd-yyyy**: October 18, 2007 is displayed as 10-18-2007.
- **dd-mm-yyyy**: October 18, 2007 is displayed as 18-10-2007.

If you change the date member name format, the names of existing members of date attribute dimensions may be invalid. For example, if the 10-18-2007 member exists, and you change the format to dd-mm-yyyy, outline verification will find this member invalid. If you change the date format, you must rebuild the date attribute dimensions.

To change member names in date attribute dimensions:

See “Setting the Member Name Format of Date Attribute Dimensions” in the Oracle Essbase Administration Services Online Help.

Setting Up Member Names Representing Ranges of Values

Members of numeric attribute dimensions can represent single numeric values or ranges of values:

- **Single-value example**: the member 12 in the Ounces attribute dimension represents the single numeric value 12; you associate this attribute with all 12-ounce products. The outline includes a separate member for each size; for example, 16, 20, and 32.
- **Range of values example**: the Population attribute dimension, as shown in Figure 42:

![Figure 42 Population Attribute Dimension and Members](image)

In this outline, the members of the Population attribute dimension represent ranges of population values in the associated Market dimension. The 3000000 member represents populations from zero through 3,000,000; the 6000000 member represents populations from 3,000,001 through 6,000,000; and so on. A setting for the outline establishes that each numeric member represents the top of its range.
You can also define this outline setting so that members of numeric attribute dimensions are the bottoms of the ranges that they represent. For example, if numeric members are set to define the bottoms of the ranges, the 3000000 member represents populations from 3,000,000 through 5,999,999, and the 6000000 member represents populations from 6,000,000 through 8,999,999.

When you build the base dimension, Essbase automatically associates members of the base dimension with the appropriate attribute range. For example, if numeric members represent the tops of ranges, Essbase automatically associates the Connecticut market, with a population of 3,269,858, with the 6000000 member of the Population attribute dimension.

In the dimension build rules file, specify the size of the range for each member of the numeric attribute dimension. In the above example, each attribute represents a range of 3,000,000.

To define ranges in numeric attribute dimensions:

See “Assigning Member Names to Ranges of Values” in the Oracle Essbase Administration Services Online Help.

Note: Oracle recommends that numeric attribute dimension member names contain no more than six decimal positions. Otherwise, because of precision adjustments, an outline may not pass verification.

Changing the Member Names of the Attribute Calculations Dimension

To avoid duplicating names in an outline, you may need to change the name of the Attribute Calculations dimension or its members.

Sum, Count, Min, Max, and Avg—the names of the members that Essbase creates in the Attribute Calculations dimension—are not considered reserved words because you can change these names in the Attribute Calculations dimension and then use the default name in an attribute or standard dimension. Follow these guidelines:

- If the outline is tagged as a duplicate member outline, you can use the default names to name other base or attribute members.
- If the outline is tagged as a unique member outline, you should avoid using Sum, Count, Min, Max, and Avg as member names. For example, if you use Max in a standard dimension and then create an attribute dimension, in which Essbase creates the Max member in the Attribute Calculations dimension, Essbase detects a duplicate name and returns an error message indicating the name is already in use.

Regardless of the name that you use for a Attribute Calculations dimension member, its function remains the same. For example, Count, the second member, always counts.
To change member names in the Attribute Calculations dimension:

See “Changing Member Names of Attribute Calculations Dimensions” in the Oracle Essbase Administration Services Online Help.

Calculating Attribute Data

Subtopics

- Understanding the Attribute Calculations Dimension
- Understanding the Default Attribute Calculations Members
- Viewing an Attribute Calculation Example
- Accessing Attribute Calculations Members Using the Spreadsheet
- Optimizing Calculation and Retrieval Performance
- Using Attributes in Calculation Formulas
- Understanding Attribute Calculation and Shared Members
- Differences Between Calculating Attribute Members and Non-Attribute (Stored and Dynamic Calc) Members

Essbase calculates attribute data dynamically at retrieval time, using members from a system-defined dimension created by Essbase. Using this dimension, you can apply different calculation functions, such as a sum or an average, to the same attribute. You can also perform specific calculations on members of attribute dimensions; for example, to determine profitability by ounce for products sized by the ounce.

The following information assumes that you understand the concepts of attribute dimensions and Essbase calculations, including dynamic calculations. See the following sections.

Understanding the Attribute Calculations Dimension

When you create the first attribute dimension in the outline, Essbase also creates the Attribute Calculations dimension comprising five members with the default names Sum, Count, Min (minimum), Max (maximum), and Avg (average). You can use these members in spreadsheets or in reports to dynamically calculate and report on attribute data, such as the average yearly sales of 12-ounce bottles of cola in the West.

The Attribute Calculations dimension is not visible in the outline. You can see it wherever you select dimension members, such as in Smart View.

The attribute calculation dimension has the following properties:

- System-defined
  
  When you create the first attribute dimension in an application, Essbase creates the Attribute Calculations dimension and its members (Sum, Count, Min, Max, and Avg). Each member represents a type of calculation to be performed for attributes.

  See “Understanding the Default Attribute Calculations Members” on page 179.

- Label only
Like all label only dimensions, the Attribute Calculations dimension shares the value of its first child, Sum.

See “Member Storage Properties” on page 92.

- **Dynamic Calc**
  The data in the Attribute Calculations dimension is calculated when a user requests it and is then discarded. You cannot store calculated attribute data in a database.

  See Chapter 27, “Dynamically Calculating Data Values.”

- **Not displayed in Outline Editor**
  The Attribute Calculations dimension is not displayed in Outline Editor. Members from this dimension can be viewed in spreadsheets and in reports.

There is no consolidation along attribute dimensions. You cannot tag members from attribute dimensions with consolidation symbols (for example, + or -) or with member formulas in order to calculate attribute data. As Dynamic Calc members, attribute calculations do not affect the batch calculation in terms of time or calculation order.

To calculate attribute data at retrieval time, Essbase performs the following tasks:

1. Finds the base-dimension members associated with the attribute-dimension members present in the current query
2. Dynamically calculates the sum, count, minimum, maximum, or average for the attribute-member combination for the current query
3. Displays the results in the spreadsheet or report
4. Discards the calculated values—that is, the values are not stored in the database

  **Note:** Essbase excludes #MISSING values when calculating attribute data.

For example, as shown in Figure 43, a spreadsheet user specifies two members of attribute dimensions (Ounces_16 and Bottle) and an Attribute Calculations member (Avg) in a spreadsheet report. Upon retrieval, Essbase dynamically calculates the average sales values of all products associated with these attributes for the current member combination (Actual -> Sales -> East -> Qtr1):

![Figure 43 Retrieving an Attribute Calculations Member](image)

See “Accessing Attribute Calculations Members Using the Spreadsheet” on page 180.
Understanding the Default Attribute Calculations Members

The Attribute Calculations dimension contains five members (Sum, Count, Min, Max, and Avg) that are used to calculate and report attribute data:

- **Sum**—Calculates a sum, or total, of the values for a member with an attribute or combination of attributes.
- **Count**—Calculates the number of members with the specified attribute or combination of attributes, for which a data value exists. Count includes only those members that have data blocks in existence. To calculate a count of all members with certain attributes, regardless of whether they have data values, use the @COUNT function in combination with the @ATTRIBUTE function. See the Oracle Essbase Technical Reference.
- **Avg**—Calculates a mathematical mean, or average, of the nonmissing values for an specified attribute or combination of attributes (Sum divided by Count).
- **Min**—Calculates the minimum data value for a specified attribute or combination of attributes.
- **Max**—Calculates the maximum data value for a specified attribute or combination of attributes.

**Note:** Each of these calculations excludes #MISSING values.

You can change these default member names, subject to the same naming conventions as standard members. See “Changing the Member Names of the Attribute Calculations Dimension” on page 176.

Viewing an Attribute Calculation Example

As an example of how Essbase calculates attribute data, consider the following yearly sales data for the East:

<table>
<thead>
<tr>
<th>Base-Dimension Member</th>
<th>Associated Attributes</th>
<th>Sales Value for Attribute-Member Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cola</td>
<td>Ounces_12, Can</td>
<td>23205</td>
</tr>
<tr>
<td>Diet Cola</td>
<td>Ounces_12, Can</td>
<td>3068</td>
</tr>
<tr>
<td>Diet Cream</td>
<td>Ounces_12, Can</td>
<td>1074</td>
</tr>
<tr>
<td>Grape</td>
<td>Ounces_32, Bottle</td>
<td>6398</td>
</tr>
<tr>
<td>Orange</td>
<td>Ounces_32, Bottle</td>
<td>3183</td>
</tr>
<tr>
<td>Strawberry</td>
<td>Ounces_32, Bottle</td>
<td>5664</td>
</tr>
</tbody>
</table>

Figure 44 on page 180 shows how calculated attribute data might look in a spreadsheet report. You can retrieve multiple Attribute Calculations members for attributes. For example, you can calculate Sum, Count, Avg, Min, and Max for bottles and cans.
Accessing Attribute Calculations Members Using the Spreadsheet

You can access members from the Attribute Calculations dimension in Smart View. From the spreadsheet, users can view Attribute Calculations dimension members using any of the following methods:

- Entering members directly into a sheet
- Selecting members from the Query Designer
- Entering members as an EssCell parameter

See the Oracle Smart View for Office User’s Guide.

Optimizing Calculation and Retrieval Performance

To optimize attribute calculation and retrieval performance, consider the following:

- The calculation order for attribute calculations is the same as for dynamic calculations. For an outline, see “Calculation Order for Dynamic Calculation” on page 435.
- Because Essbase calculates attribute data dynamically at retrieval time, attribute calculations do not affect the performance of the overall (batch) database calculation.
- Tagging base-dimension members as Dynamic Calc may increase retrieval time.
- When a query includes the Sum member and an attribute-dimension member whose associated base member is tagged as two-pass, retrieval time may be slow.
- To maximize attribute retrieval performance, use any of the following techniques:
  - Configure the outline using the tips in “Optimizing Outline Performance” on page 172.
  - Drill down to the lowest level of base dimensions before retrieving data. For example, in Smart View, turn on the Navigate Without Data feature, drill down to the lowest level of the base dimensions included in the report, and then retrieve data.
  - When the members of a base dimension are associated with several attribute dimensions, consider grouping the members of the base dimension according to their attributes. For example, in the Sample.Basic database, you can group all 8-ounce products.
Using Attributes in Calculation Formulas

In addition to using the Attribute Calculations dimension to calculate attribute data, you can use calculation formulas on members of standard or base dimensions to perform specific calculations on members of attribute dimensions; for example, to determine profitability by ounce for products sized by the ounce.

You cannot associate formulas with members of attribute dimensions.

**Note:** Some restrictions apply when using attributes in formulas associated with two-pass members. See the rows about two-pass calculations in Table 18 on page 167 and “Understanding Two-Pass Calculations on Attribute Dimensions” on page 169.

Table 25 lists functions you can use to perform specific calculations on attributes:

<table>
<thead>
<tr>
<th>Function</th>
<th>Type of Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ATTRIBUTE</td>
<td>Generate a list of all base members with a specific attribute. For example, generate a list of members that have the Bottle attribute, and then increase the price for those members.</td>
</tr>
<tr>
<td>@ATTRIBUTEVAL</td>
<td>Return the value of the level 0 attribute member that is associated with the base member being calculated.</td>
</tr>
<tr>
<td>@ATTRIBUTEBVAL</td>
<td>From a numeric or date attribute dimension (using @ATTRIBUTEVAL)</td>
</tr>
<tr>
<td>@ATTRIBUTESVAL</td>
<td>From a Boolean attribute dimension (using @ATTRIBUTEBVAL)</td>
</tr>
<tr>
<td></td>
<td>From a text attribute dimension (using @ATTRIBUTESVAL)</td>
</tr>
<tr>
<td></td>
<td>For example, return the numeric value of a size attribute (for example, 12 for the member 12 under Ounces) for the base member being calculated (for example, Cola).</td>
</tr>
<tr>
<td></td>
<td>For an additional example using @ATTRIBUTEVAL in a formula, see “Calculating an Attribute Formula” on page 390.</td>
</tr>
<tr>
<td>@TODATE</td>
<td>Convert a date string to numbers for a calculation. For example, use @TODATE in combination with the @ATTRIBUTEVAL function to increase overhead costs for stores opened after a certain date.</td>
</tr>
<tr>
<td>@WITHATTR</td>
<td>Generate a list of base dimension members associated with attributes or varying attributes that satisfy the conditions that you specify. For example, generate a list of products that are greater than or equal to 20 ounces, and then increase the price for those products.</td>
</tr>
</tbody>
</table>

Understanding Attribute Calculation and Shared Members

Attribute calculations start at level 0 and stop at the first stored member. Therefore, if your outline has placed a stored member between two shared members in an outline hierarchy, the calculation results may not include the higher shared member.

In the following example, when an attribute calculation is performed, the calculation starts with level 0 Member 2 and stops when it encounters the first stored member, which is Member A. Therefore, Member 1 would not be included in the calculation.

Member 1 (stored)
Member A (stored)
To avoid unexpected results with attribute calculation, avoid mixing shared and stored members. For this example, if Member 2 were not shared, or Member 1 did not have a corresponding shared member elsewhere in the outline, calculation results would be as expected.

**Differences Between Calculating Attribute Members and Non-Attribute (Stored and Dynamic Calc) Members**

The calculation of attribute dimension members is designed to work differently than the calculation of stored or Dynamic Calc members in standard dimensions.

The basis of this difference:

- **Members in standard dimensions**: The value of a parent member is based on aggregating the values of the parent member's child members, whether the child members are level 0 or upper-level members. All child member values contribute to the value of the parent member.

- **Members in attribute dimensions**: For each parent member for which an attribute aggregation is requested, the parent member’s descendant list is expanded to include the dependent level 0 data blocks that need to be aggregated to calculate the value of the parent member.

Given these differences, the result of aggregating attribute dimension members might differ from the result of aggregating standard dimension members, if shared members are involved and there are multiple aggregation paths.

To workaround this issue, remove duplicate shared members under the aggregating attribute hierarchy or remodel the outline so that there are not multiple aggregation paths.

**Varying Attributes**

**Subtopics**

- About Varying Attributes
- Implementing Varying Attributes
- Functions Supporting Varying Attributes
- Limitations of Varying Attributes

**About Varying Attributes**

A product typically has attributes that describe or define the product. For example, a product could have an attribute describing the size of the product in ounces and an attribute describing the flavor of the product. In such a scenario, Product would be a base dimension while Ounces and Flavor would be attribute dimensions.
A varying attribute enables you to track two values in relation to a third dimension called an independent dimension. You could, for example, track your product in eight ounces over a year. In this scenario, Time is the independent dimension. The value of this third factor can vary (hence the name). For example, you could track your product over a year, a quarter, or a month.

**Note:** There are two types of independent dimensions: continuous and discrete. The members in a continuous dimension reflect continuity. For example, week, month, and quarter reflect the continuity in a time dimension. The members in a discrete dimension do not imply continuity. For example, California, Texas, and Ohio in a market dimension do not have a relationship based on continuity.

As another example, consider this scenario: The sales representative for a client changes in midyear. Table 26 lists the customer sales totals and sales representative assignments over six months:

<table>
<thead>
<tr>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000</td>
<td>6000</td>
<td>2000</td>
<td>1000</td>
<td>1000</td>
<td>7000</td>
</tr>
<tr>
<td>Jones</td>
<td>Jones</td>
<td>Jones</td>
<td>Smith</td>
<td>Smith</td>
<td>Smith</td>
</tr>
</tbody>
</table>

In this example, Sales Representative is the varying attribute. Data retrievals show that the sales representative Jones sold the customer a total of $12,000 worth of products from March through May and the sales representative Smith then sold a total of $9,000 worth of products to the customer from June through August. Without the use of the varying attribute, the only known sales representative would be the current representative Smith to whom all sales ($21,000) would be credited.

Varying attributes offer alternate ways of grouping your members. For example, you can use color to group SKUs. In this scenario, the attribute dimension Color is associated with SUBSKU:

```
Product_H     
  Family      
    SKU       
      SUBSKU  
    Color     
      SUBSKU  
```

When Color is set as a varying attribute, the retrieval results would be similar to the values in Table 27:

<table>
<thead>
<tr>
<th>SUBSKU</th>
<th>SKU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>100</td>
</tr>
<tr>
<td>White</td>
<td>400</td>
</tr>
<tr>
<td>White</td>
<td>600</td>
</tr>
<tr>
<td>SUBSKU</td>
<td>SKU</td>
</tr>
<tr>
<td>--------</td>
<td>-----</td>
</tr>
<tr>
<td>Black</td>
<td>200</td>
</tr>
<tr>
<td>Black</td>
<td>300</td>
</tr>
<tr>
<td>Silver</td>
<td>500</td>
</tr>
</tbody>
</table>

Varying attributes must meet the following guidelines:

- They must have multiple chains.
- Leaf levels must match.

You can enable an outline to support varying attributes. You can define attribute dimensions to function as varying attributes. You can also edit varying attributes to reflect the type of information you need.

**Implementing Varying Attributes**

Varying attributes are supported for aggregate and block storage databases. You implement varying attributes at the database level.

Use the following workflow to enable and use varying attributes:

1. In the outline properties, enable varying attributes.
2. In the member properties for the base dimension, go to the Attributes tab and identify the independent dimension (the dimension upon which varying attributes depend).
   
   For example, if the sales representative attribute association for Customer A gets changed in May, then Year would be the independent dimension.
3. Specify the type of independent dimension: continuous or discrete. An example of a continuous independent dimension is one that is based on time. A discrete independent dimension has no continuity; for example, in a Market dimension, California, Texas, and Ohio do not have a relationship based on continuity.
4. Associate the independent dimension with a varying attribute. Optionally select a range and an association mode.

   A range can be assigned for which the attribute association is true. For example, you can assign a time range for which the attribute association applies: Jane is an Engineer from July 2007–June 2008.

   An association mode tells Essbase how to handle conflicting associations of a varying attribute with its independent dimension. The following association modes are available: Overwrite, NoOverwrite, and Extend.
5. Save and restructure the outline.
6. Perform the following maintenance tasks as needed:
   - Add new varying attribute associations to independent members (for example, add a new job title for an employee).
- Remove independent member associations.
- View existing independent dimension member associations (for example, see for which Months the company had a replacement sales manager).
- Disassociate attribute dimensions from base dimensions.

**Functions Supporting Varying Attributes**

The following Report Writer commands are designed to work with varying attributes.

- `<PERSPECTIVE`
- `<WITHATTREX`
- `<ATTRIBUTEVA`

The following calculation functions and command work with varying attributes.

- `@WITHATTR`
- `@ISATTRIBUTE`
- `@ISMBRWITHATTR`
- `SET SCAPERSPECTIVE`

The following MDX functions are designed to work with varying attributes.

- `AttributeEx`
- `WithAttrEx`
- The WITH PERSPECTIVE keywords

See the *Oracle Essbase Technical Reference*.

**Limitations of Varying Attributes**

Continuous independent dimensions must act as a single dimension, for example Year and Month. Unconnected continuous independent dimensions are not supported.

Continuous independent dimensions and members must be specified last.

Independent members must be stored, level 0 members.

A varying attribute cannot be included in a FIX command if no perspective is specified in the calculation script.

Independent members that denote the start/end of a range:

- Cannot be deleted
- Cannot be shared or label only
- Must be level 0
- Cannot be moved to another dimension
• Cannot be moved into other ranges

Independent members that are newly moved or added cannot be used to denote a range until the outline is saved.
Linking Objects to Essbase Data

In This Chapter

Understanding LROs ..................................................................................... 187
Understanding LRO Types and Data Cells ............................................................. 188
Setting Up Permissions for LROs ....................................................................... 188
Viewing and Deleting LROs .............................................................................. 189
Exporting and Importing LROs .......................................................................... 190
Limiting LRO File Sizes for Storage Conservation ..................................................... 190

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases. Also see Chapter 60, “Comparison of Aggregate and Block Storage.”

Understanding LROs

You can link various kinds of data with any cell in an Essbase database, using a linked reporting object (LRO). This ability is similar to attaching a file to e-mail. An LRO provides improved support for planning and reporting applications and can enhance your data analysis capabilities.

LROs are objects (alternatively called artifacts) that you associate with specific data cells in an Essbase database. Users create, retrieve, and edit linked objects through Smart View. You can link an unlimited number of objects to a cell. The objects are stored on the Essbase Server, where they are available to any user with the appropriate access permissions. For the maximum sizes of the types of linked objects described in Table 28, see Appendix A, “Limits.”

<table>
<thead>
<tr>
<th>Object Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell note</td>
<td>A text annotation</td>
</tr>
<tr>
<td>File</td>
<td>An external file, such as a Microsoft Word document, an Excel spreadsheet, a scanned image, an audio clip, or an HTML file (for example, mypage.htm).</td>
</tr>
<tr>
<td>Linked partition</td>
<td>A set of data cells that you can link to in another Essbase database.</td>
</tr>
</tbody>
</table>
For example, a sales manager may attach cell notes to recently updated budget items. A finance manager may link a spreadsheet containing supporting data for this quarter’s results. A product manager may link bitmap images of new products. A sales manager may link the URL of a company’s Web site to quickly access the information on the Web site.

**Understanding LRO Types and Data Cells**

LROs are linked to data cells—not to the data contained in the cells. The link is based on a member combination in the database. Adding or removing links to a cell does not affect the cell contents.

When a user links an object to a cell, Essbase stores in the object catalog information about the type of object, the name of the last user to modify the object, and the date the object was modified.

How Essbase stores the LRO depends on the LRO type:

- If the object is a cell note, the text is stored as part of the object description in the catalog entry.
- If the object is a file, Essbase stores the contents of the file in the database directory on the Essbase Server, giving it an `.lro` extension. Essbase imposes no restrictions on the data formats of linked files and performs no file-type checking. It is up to the user’s client computer to render the file after retrieving it from the Essbase Server.
- If the object is a URL, Essbase stores it as part of the object description in the catalog entry. When the user tries to view the URL, Essbase does a preliminary syntax check; then the default Web browser checks for the existence of the URL.
- If the object is a linked partition, it is available through the Essbase Partitioning module.

Before you perform tasks related to LROs, be aware of these facts:

- Essbase uses the database index to locate and retrieve linked objects. If you clear all data values from a database, the index is deleted, and so are the links to linked objects. If you restructure a database, the index is preserved, as are the links to linked objects.
- Shared members share data values but not LROs, because LROs are linked to specific member combinations, and shared members do not have identical member combinations. To link an object to shared members, link it to each shared member individually.
- You cannot change the member combination associated with any linked object. To move an object to another member combination, delete it, and then use Smart View to re-link the object to the desired member combination.

**Setting Up Permissions for LROs**

Users who add, edit, and delete LROs through client interfaces must have the appropriate permissions in the active database. If the object is a linked partition, the user must also have the required permissions in the database containing the linked partition. Table 29 lists the permissions required for several different tasks.
Table 29  Permissions Required for LRO Tasks

<table>
<thead>
<tr>
<th>Task</th>
<th>Permission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add a linked object to a database</td>
<td>Read-write</td>
</tr>
<tr>
<td>View an existing linked object</td>
<td>Read</td>
</tr>
<tr>
<td>Edit an existing linked object</td>
<td>Read-write</td>
</tr>
<tr>
<td>Delete a linked object</td>
<td>Read-write</td>
</tr>
<tr>
<td>Export the LRO catalog to a file</td>
<td>Read</td>
</tr>
<tr>
<td>Import the LROs from the LRO-catalog file</td>
<td>Read-write</td>
</tr>
</tbody>
</table>

To prevent users from linking files to data cells without changing user access to other data in a database, you can set the maximum file size for linked files to 1. Users can then create cell notes, link to a URL, or view linked partitions but can attach only files smaller than 1 KB.

➢ To set the maximum LRO file size for an application:

See “Limiting LRO File Sizes” in the Oracle Essbase Administration Services Online Help.

Viewing and Deleting LROs

Users work with LROs on a cell-by-cell basis through Smart View. That is, they select a cell and open the Linked Reporting Objects dialog box, which displays the objects linked to the selected cell. With Administration Services, you can view LROs, and you can delete all LROs for the entire database. You can also view LROs based on selection criteria such as user name and last modification date. For example, you can purge all objects older than a certain date or remove the objects belonging to a user who has left the company.

➢ To view a list of the linked objects for a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Managing LROs</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>query database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LISTLINKEDOBJECTS</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

➢ To delete the linked objects for a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Managing LROs</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Exporting and Importing LROs

To improve backup and data-migration capabilities, you can export and re-import LROs from data intersections in a database.

To export and import linked objects for a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Exporting LROs</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>Administration Services</td>
<td>Importing LROs</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>export lro</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>MaxL</td>
<td>import lro</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Limiting LRO File Sizes for Storage Conservation

Because Essbase stores linked files in a repository on the server, by default, the size is unlimited. Limiting the file size prevents users from taking up too much of the server resources by storing extremely large objects. You can set the maximum linked file size for each application. If a user attempts to link a file that is larger than the limit, an error message displays.

To prevent users from attaching anything except very small files, enter 1. Setting the file size to 1 lets users link only cell notes, URLs, and files smaller than 1 KB.

Note: The maximum file size setting applies only to linked files and does not affect cell notes or URLs. The lengths of the cell note, URL string, and LRO descriptions are fixed. For the maximum sizes of these objects, see Appendix A, “Limits.”

To limit the size of a linked object, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Limiting LRO File Sizes</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETAPPSTATE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
About Typed Measures

Typed measures extend the analytical capabilities of Essbase. In addition to numeric values, measures can also be associated with text- or date-typed values.

Text measures are tagged as “text” in whichever dimension measures are represented. They enable cell values to contain one of an enumerated list of text labels. These labels are defined, at the outline level, using a mapping artifact called a text list.

Date measures are tagged as “date” in the dimension where measures are represented. Date measures enable cell values in the form of a formatted date.

The following general guidelines apply to both text and date measures:

- Add them to the existing measures dimension; for example, Accounts.
- Do not consolidate them. By default, text and date measures are assigned the never consolidate operator (^).
- If the measure is not designed to be consolidated, queries should be made at the same level at which data was loaded.
- After you enable an outline to support typed measures, it cannot be reverted back to an outline that does not support typed measures.
- Text and date measures functionality applies to both aggregate storage and block storage applications.
Working with Text Measures

Subtopics

- Text Measures Overview and Workflow
- Text List Objects and Text List Members

Text Measures Overview and Workflow

Text measures extend the analytical capabilities of Essbase beyond numerical data to text-based content. Storage and analysis of textual content can be useful when a cell needs to have one of a finite list of textual values; for example, a product may be sold in five different colors. The color is a text measure whose value must be one of those five colors. Any color not represented in the finite list would be considered by Essbase to be out of range.

You create text measures at the database level. Text measures are made possible by your mapping of a set of text strings to corresponding numeric IDs. These mappings are contained in database-level text list objects that you create.

Use the following workflow to enable and use text measures:

1. In the outline properties, enable typed measures.
2. Create a text list object to store the available text values and map each text value to an ordinal number, so that Essbase can work with the text values. Optionally, map Missing and Out of Range to ordinal numbers.

   **Note:** Each numeric value can have only one text value mapped to it.

3. Create a text measure in the outline (in the Accounts dimension), and in the member properties:
   a. Define it as type Text.
   b. Associate it with the text list object.

See “Performing Database Operations on Text and Date Measures” on page 195.

Text List Objects and Text List Members

A cell that corresponds to a text measure can have one of a finite list of up to 1024 valid text values. Internally, Essbase needs to store the text values as numbers. Therefore, a mapping of text values to numeric values is required. You define the mapping between the text and numeric values by creating a text list object. A text list object consists of a list of text values and a numeric value that corresponds to each text value.

For example, you can create a text list object called “Customer Satisfaction Level” with the contents in Table 30. The Name column contains the possible text values for a text measure, and the ID column represents the internal numeric value used by Essbase.
## Working with Date Measures

### Subtopics
- Date Measures Overview
- Implementing Date Measures
- Functions Supporting Date Measures

### Date Measures Overview

Date measures enable members to be associated with date-type values. The ability to process dates in the measures dimension can be useful for types of analysis that are difficult to represent using the Time dimension.

For example, an application that analyzes asset depreciation may need to track acquisition dates for a series of capital assets. The company has been in business for fifty years, so the acquisition dates span too large a period to allow for feasible Time dimension modeling (the Time dimension only covers five years).

In addition to their ability to represent values spanning large time periods, date measures can also capture date values with smaller granularity than is captured in the Time dimension, such as hours and minutes.
Implementing Date Measures

Date measures are supported for aggregate and block storage databases. You create date measures at the database level.

Use the following workflow to enable and use date measures:

1. In the outline properties, enable typed measures.
2. In the outline properties, select a date format (for example, yyyy-mm-dd). All date measures in the outline must use the same format.
3. Create a date measure in the outline (in the Accounts dimension), and in the member properties, define it as type Date.

For example, in ASOsamp.Sample, you can enable typed measures for the outline, select a date format, and add a measure named IntroDate defined as type Date.

The date values are stored internally as numeric values, although you load them into Essbase as formatted date strings. When queried, date measures are displayed according to the selected date format.

See “Performing Database Operations on Text and Date Measures” on page 195.

Functions Supporting Date Measures

The following MDX functions are useful for calculations based on date measures.

- DateDiff
- DatePart
- DateRoll
- FormatDate
- GetFirstDate
- GetLastDate
- ToDate
- ToDateEx
- Today

The following calculation functions are useful for calculations based on date measures.

- @DATEDIFF
- @DATEPART
- @DATEROLL
- @FORMATDATE
- @TODATEEX
- @TODAY
Performing Database Operations on Text and Date Measures

Subtopics
- Loading, Clearing, and Exporting Text and Date Measures
- Consolidating Text and Date Measures
- Retrieving Data With Text and Date Measures
- Limitations of Text and Date Measures

This section explains how to perform common database operations when using text and date measures.

Loading, Clearing, and Exporting Text and Date Measures

To load data to text or date measures, follow the same procedure as for loading data to members with numeric measures. The input data should contain formatted date values, or text values corresponding to the text list object that is associated with the text measure.

If you attempt to load text values that are not present in the text list object associated with that member, Essbase issues a warning message.

In aggregate storage databases, values can only be loaded at the input level; this restriction applies equally to text and date measures. In block storage databases, text and date values can be loaded at any level.

Use the following guidelines when loading text and date values into an aggregate storage database. These guidelines will help eliminate invalid aggregations.

- Use Replace mode.

  **Note:** Replace mode is set when committing the buffer. In MaxL, use the *override values* grammar of the import data statement. In Administration Services Console, use the *overwrite existing values* option in the Data Load dialog box. In the Essbase API, use the *ulCommitType* field of EssLoadBufferTerm.

- Use a single load buffer to load all values associated with date/text measures.

- Use the aggregate_use_last aggregation method.
Caution! The aggregate_use_last method has significant performance impact, and is not intended for large data loads. If your data load is larger than one million cells, consider separating the numeric data into a separate data load process (from any typed measure data). The separate data load can use aggregate_sum instead.

Aggregate_use_last is set when creating the load buffer. In MaxL, see the PROPS terminal that is part of the initialize load_buffer grammar in the alter database statement. In Administration Services Console, select the aggregate use last check box in the Data Load dialog box. In the Essbase API, use the ulDuplicateAggregationMethod field of EssLoadBufferInit.

- Avoid loading #MISSING values to text/date measures in incremental data load mode. When a #MISSING value is loaded to a cell with a non-Missing value in incremental load, it is replaced with a zero value. The zero value may not have the same meaning as the #MISSING value for date/text measures. Use full data load if you need to load #MISSING values to date/text measures.

If mixed (numeric and text or date) data are being loaded, either ensure that Replace mode is sufficient for your numeric data, or create a separate data load process for the numeric data.

You can load text or date values with or without rules files. When a rules file is not used, you must distinguish text or date values from member names by enclosing the text values in double quotation marks and prefixing them with the string #Txt:.

Here is an example of a line of data in a free-form data load file:

"100-10" "New York" "Cust Index" #Txt:"Highly Satisfied"

The text value "Highly Satisfied" is pre-fixed with #Txt: to differentiate it from member names such as "New York".

The "#Txt" prefix is also required for date measures when a rules file is not used for data load.

You can clear, lock and send, and export text or date values just as you perform those operations on numeric values.

**Consolidating Text and Date Measures**

By default, text measures are assigned the ^ operator (never consolidate). Text and date measures are not consolidated to higher level members along non Accounts dimensions.

If you tag a text or date measure with an operator other than ^, it will be consolidated along other dimensions based on its internal numeric value. This is not recommended for aggregate storage databases, because only the + operator is supported, and the aggregated values likely will not have any validity for text or date measures. Additionally, Essbase does not translate out-of-range values to #OUTOFRANGE during consolidation.

For block storage databases, you can write calculation scripts that consolidate text measures in a custom fashion. You might want to consolidated text measures when they represent ranking measures. For example, consider a text list named "CustomerSatisfaction", which contains mappings such as Excellent=5, Good=4, Fair=3, Poor=2, Bad=1. The values are loaded at level
0. You can consolidate values to parent levels by taking an average of values at child levels. For example, the value of “CustomerSatisfaction” at [Qtr1] is the average of values at [Jan], [Feb], [Mar].

**Retrieving Data With Text and Date Measures**

Text or date measures can be queried in the same way as numerical measures, using Smart View, Grid API clients, Report Writer, and MDX. The corresponding cells are displayed with the appropriate text values or formatted date values.

The following Report Writer commands are designed to work with numeric data, and are not supported for text or date measures:

- RESTRICT
- TOP
- BOTTOM
- SORT* commands
- CALCULATE COLUMN
- CALCULATE ROW

The MDX function EnumValue and the calculation function @ENUMVALUE are designed specifically for getting the text value of text measures. These functions can be useful in MDX scripts, calc scripts, or formulas, when you need to do operations based on the text value of a member rather than its internally stored numeric value. See the *Oracle Essbase Technical Reference*

**Limitations of Text and Date Measures**

An outline restructure does not restructure text lists. If the mapping of numeric to text values in a text list is changed, the change will be reflected in the text data already present in the database for that text list. Therefore, when adding items to a text list, add them to the top or bottom of the list so as to avoid altering the mapping numbers of existing text list items.

Text and date measures are not supported across partitions.

Shared members and implied shared members inherit the text or date type of the original member.
Working with Format Strings

Subtopics

- Overview of Format Strings
- Implementing Format Strings
- MDX Format Directive
- Functions Supporting Format Strings
- Limitations of Format Strings

Overview of Format Strings

Using format strings, you can format the values (cell contents) of Essbase database members in numeric type measures so that they appear, for query purposes, as text, dates, or other types of predefined values. The resultant display value is the cell’s formatted value (FORMATTED_VALUE property in MDX).

The underlying real value is numeric, and this value is unaffected by the associated formatted value. Format strings enable you to display more meaningful values in place of raw numeric values. For example, using a text based formatted value, you might display data cells as “High,” “Medium,” and “Low.”

Text and date type values are additionally supported using the built-in text and date measure types. Format strings add more flexibility to your implementation, in that you can apply format strings to members in multiple dimensions, whereas with text and date measures, you can only apply one or the other to a single measures dimension. You can apply format strings to numeric dimensions; you do not have to type the dimension as text or date.

Format strings can be applied to either aggregate storage or block storage databases.

Format strings can be defined on the following members:

- All members in Measures dimension
- Members associated with explicit formula strings on other dimensions

Implementing Format Strings

Format strings are supported for aggregate and block storage databases. You implement format strings at the database level.

Use the following workflow to enable and use format strings:

1. In the outline properties, enable typed measures.
2. In the Accounts dimension, create a measure whose members you want to format, and in its member properties, edit the Associate Format String field to create an MDX format directive. For the syntax to create an MDX format directive, see “MDX Format Directive” on page 199.
**MDX Format Directive**

A format string is defined by the following syntax:

\[
\text{format\_string\_expression} = \text{MdxFormat} (\text{string\_value\_expression})
\]

where \text{string\_value\_expression} is a valid MDX string value expression as described in the MDX specification documented in the *Oracle Essbase Technical Reference*.

Most MDX expressions can be used to specify format strings; however, format strings cannot contain references to values of data cells other than the current cell value being formatted. The current cell value can be referenced using the MDX \text{CellValue} function.

Essbase treats members with invalid format strings as if there is no format string defined. Outlines can be saved with invalid format strings. Essbase generates a warning if a query consists of a member with an invalid format string.

If a member is not associated with a format string, default format rules are applied. The default format rules format a cell based on whether the measure is numeric, text, or date type. For numeric measures, the default formatted value is the text version of that number. For text measures, the default formatted value is the text value based on the associated text list object. For date values, the default format is a date string formatted according the date format string defined in the outline properties.

**Functions Supporting Format Strings**

The following MDX functions can be useful when applying format strings to a measure. Format strings are applied as MDX expressions, in both aggregate and block storage databases.

- **EnumText**, returns the text list label associated with the internal numeric value.
- **EnumValue**, returns the internal numeric value for a text list label.
- **CellValue**, returns the internal numeric value of the current cell.
- **NumToStr**, converts a value to a decimal string.

The `@ENUMVALUE` calculation function can be useful when writing calculation scripts for a block storage database that has text measures or format strings. This function returns the text list label associated with the internal numeric value.

The MaxL alter session set dml_output statement has a clause `set formatted_value on | off`. By default, formatted values are displayed in queries, but this statement can be used to turn off the display of formatted values.

The OUTFORMATTEDVALUES Report Writer command returns formatted cell values in a report.

For information about these functions, commands, and statements, see the *Oracle Essbase Technical Reference*. 
Limitations of Format Strings

Format strings are not supported across partitions.

Shared members and implied shared members cannot have separate format strings; they inherit the format string of the original member.
Overview of Drill-through to Oracle Applications

Essbase provides URL-based drill-through access from Essbase client reporting interfaces (such as Smart View or Oracle Hyperion Financial Reporting) to information located on Oracle Enterprise Resource Planning (ERP) applications and Enterprise Performance Management (EPM) applications.

This documentation discusses the ability to drill through to information hosted on Oracle ERP and EPM applications, which differs from the concept of drill-through as described in Essbase Studio documentation. In this documentation, drill-through refers to the ability of an Essbase database cell to link to information contained in another Oracle application. In Essbase Studio documentation, drill-through refers to linking a multidimensional database cell to further data; for example, to transaction-level data that is stored in a relational source.

When you deploy an Essbase database using Oracle General Ledger or Oracle Hyperion EPM Architect, you use the Essbase API to populate the Essbase database with information about which Essbase database cells are valid regions enabled for drill-through access to the enterprise-reporting applications.

For each Essbase drillable region of an Essbase database, you enable drill-through access by means of a URL. Use the Essbase API to populate the Essbase database with the URL information, as well as the drillable-region information. The URL displays to users of the Essbase client interfaces as a link associated to a cell which provides access to related information hosted by Oracle ERP and EPM applications.

For example, in Smart View, a cell represents actual sales data for Cola in the New York market in January. Color-coding on the cell indicates that there are reports associated with the cell. This particular cell could have multiple links associated through which the user can scroll. Each link is enabled by a URL. When the user clicks on a link, the URL is validated, and a launch page, hosted by the ERP or EPM application, displays in a Web browser.
Understanding Drill-through URLs

ERP and EPM applications create a drill-through URL using Essbase. The drill-through URL is stored in the Essbase database file as metadata.

The number of drill-through URLs per database is limited to 255.

**Note:** It is the responsibility of the Administrators of the ERP and EPM applications to define drill-through definitions and host the Web pages that they wish to use as targets of drill-through URLs.

See the following topics, which describe the components of drill-through URLs:

- “Drill-through URL Name” on page 202
- “Drill-through URL XML” on page 202
- “List of Drillable Regions” on page 202
- “Level 0 Boolean Flag” on page 203

**Drill-through URL Name**

The drill-through URL name is an identifier to manage the defined drill-through URL. This name can be different from the URL display name visible to the end user through Essbase clients.

**Drill-through URL XML**

The drill-through URL XML is a block of XML information structured in a protocol that enables Essbase to link specified database regions to information on Oracle ERP and EPM applications. This URL XML is transparent to the end users querying the application. The URL XML is populated by the ERP or EPM applications that deployed the Essbase database. It is not recommended that the Administrator edit the URL XML; however, Essbase does provide the interface to edit the URL XML. The XML block contains the drill-through URL display name, as well as a URL enabling the hyperlink from a cell to a Web interface to occur.

**List of Drillable Regions**

The list of drillable regions is a member specification defining areas of the database that should allow drill-through using the specified URL. The administrator defines the list of drillable regions using a member specification of members from one or more dimensions. Define the member specification using the same Essbase member-set calculation language that you use for defining security filters. For example, the following is a valid member specification, indicating all eastern states, except New York, for months of Qtr1: `@REMOVE(@DESCENDANTS("Eastern Region"), "New York"), @CHILDREN(Qtr1)`.

The number of drillable regions in a drill-through URL is limited to 256. The number of characters per drillable region is limited to 65536.
**Level 0 Boolean Flag**

This flag indicates whether the URL applies only to level 0 descendents of the region specified by the list of drillable regions.

For example, if the level 0 flag is enabled for drillable region DESCENDANTS("Market"), @CHILDREN(Qtr1), then the URL is applicable for all states of Market during all months of Qtr1, and for all level 0 members across remaining dimensions.

**Creating and Managing Drill-through URLs**

For more information about the MaxL statements and APIs referenced in this section, see the *Oracle Essbase Technical Reference* and the *Oracle Essbase API Reference*, respectively.

Use the following MaxL statements to manage drill-through URLs:

- create drillthrough
- alter drillthrough
- display drillthrough
- drop drillthrough

Use the following Essbase API structures and functions to manage the drill-through URLs on the Essbase database:

- **C Main API Structure:** ESS_DURLINFO_T
- **C Main API functions:**
  - EssCreateDrillThruURL
  - EssDeleteDrillThruURL
  - EssGetDrillThruURL
  - EssGetCellDrillThruReports
  - EssListDrillThruURLs
  - EssMDXIsCellGLDrillable
  - EssUpdateDrillThruURL
- **C Grid API structure:** ESSG_DATA_T
- **C Grid API function:** EssGGetIsCellDrillable
- **Visual Basic API structure:** ESB_DURLINFO_T
- **Visual Basic API functions:**
  - EsbCreateDrillThruURL
  - EsbUpdateDrillThruURL
  - EsbDeleteDrillThruURL
  - EsbListDrillThruURLs
To manage drill-through URLs in Administration Services, see these topics in the Oracle Essbase Administration Services Online Help:

- “Managing Drill-through Definitions”
- “Edit Drill-through Definitions Dialog Box”
About Currency Conversion

The Essbase Currency Conversion feature enables you to translate financial data from one currency into another. Currency conversion facilitates comparisons among countries and enables consolidation of financial data from locations that use different currencies.

For example, consider an organization that analyzes profitability data from the UK, reported in pounds, and from Japan, reported in yen. Comparing local currency profitability figures would be meaningless. To understand the relative contribution of each country, you must convert pounds into yen, yen into pounds, or both into another currency.

As another example, reporting total profitability for North America requires standardization of the local currency values that constitute the North America total. Assuming that the U.S., Mexico, and Canada consolidate into Total North America, the profitability total is meaningless if data is kept in local currencies. The Total North America sum is meaningful only if local currencies are converted to a common currency before consolidation.

The Essbase installation includes the option to install the Sample currency application, which consists of two databases, Interntl and Xchgrate. If you do not have access to these databases, contact your Essbase administrator. See Appendix B, “Setting Up Sample Applications.”
About the Sample Currency Application

The Sample currency application builds on the business scenario introduced in Chapter 4, “Case Study: Designing a Single-Server, Multidimensional Database,” as the Beverage Company (TBC) expands its business outside the U.S. TBC adds the following markets:

- Three locations in Canada: Toronto, Vancouver, and Montreal
- Four locations in Europe: the UK, Germany, Switzerland, and Sweden

In addition, TBC adds a new member, U.S., a consolidation of data from the U.S. regions: East, West, South, and Central.

Data for each TBC market location is captured in local currency. U.S. dollar values are derived by applying exchange rates to local values.

TBC must analyze actual data in two ways:

- Actuals are converted at actual exchange rates.
- Actuals are converted at budget exchange rates to analyze variances due to exchange rates.

After all actuals are processed, budget data is converted with budget exchange rates.

The TBC currency application consists of the main database (Interntl) and the currency database (Xchgrate). On Essbase Server, the databases are in the Sample application. If you do not have access to the databases, contact your Essbase administrator.

Structure of Currency Applications

In a business application requiring currency conversion, the main database is divided into at least two slices. One slice handles input of the local data, and another slice holds a copy of the input data converted to a common currency.

Essbase holds the exchange rates required for currency conversion in a separate currency database. The currency database outline, automatically generated by Essbase from the main database after you assign the necessary tags, typically maps a given conversion ratio onto a section of the main database. After the currency database is generated, it can be edited like any other Essbase database.

The relationship between the main database and the currency database is illustrated in Figure 45.
Main Database

To enable Essbase to generate the currency database outline automatically, you modify dimensions and members in the main database outline. In the Sample currency application, the main database is Interntl.

The main database outline can contain from 3 to $n$ dimensions. At minimum, the main database must contain the following dimensions:

- A dimension tagged as time. Tagging a dimension as time generates a dimension in the currency database that is identical to the time dimension in the main database. In the Sample.Interntl database, the dimension tagged as time is Year.

- A dimension tagged as accounts. Tagging a dimension as accounts and assigning currency categories to its members creates a dimension in the currency database that contains members for each of the individual currency categories. Category assignment enables the application of different exchange rates to various accounts or measures. In the Sample.Interntl database, the dimension tagged as accounts is Measures.

Each descendant of a member inherits the currency category tag of its ancestor. A member or sub-branch of members also can have its own category.

For example, profit and loss (P&L) accounts may use exchange rates that differ from the rates used with balance sheet accounts. In addition, some accounts may not require conversion. For example, in the Sample.Interntl database, members such as Margin% and Profit% require no conversion. You tag members not to be converted as No Conversion. The No Conversion tag is not inherited.

- A market-related dimension tagged as country. Tagging a dimension as country and assigning currency names to individual countries creates a member in the currency database for each currency. In the Sample.Interntl database, the Market dimension is tagged as country. The currency name for this dimension is USD (U.S. dollars), because all local currencies must be converted to USD, the company’s common currency.

Because multiple members can have the same currency name, the number of currency names is typically less than the total number of members in the dimension. As shown in Table 31 on page 208, the Sample.Interntl database uses only six currency names for the 15 members in the Market dimension. Each of the children of the member Europe uses a different currency and, therefore, must be assigned an individual currency name. However, the U.S.
dimension and its four regional members all use the same currency. The same is true of the
Canada member and its three city members. When the children of a given member share a
currency, you must define a currency name for only the parent member.

<table>
<thead>
<tr>
<th>Dimensions and Members</th>
<th>Currency Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market - Country</td>
<td>USD (U.S. dollar)</td>
</tr>
<tr>
<td>U.S.</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td></td>
</tr>
<tr>
<td>South</td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>CND (Canadian dollar)</td>
</tr>
<tr>
<td>Toronto</td>
<td></td>
</tr>
<tr>
<td>Vancouver</td>
<td></td>
</tr>
<tr>
<td>Montreal</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>GBP (British pound)</td>
</tr>
<tr>
<td>UK</td>
<td>EUR (Euro)</td>
</tr>
<tr>
<td>Germany</td>
<td>CHF (Swiss franc)</td>
</tr>
<tr>
<td>Switzerland</td>
<td>SEK (Swedish krona)</td>
</tr>
<tr>
<td>Sweden</td>
<td></td>
</tr>
</tbody>
</table>

When preparing a main database outline for currency conversion, you can create an optional
currency partition to tell Essbase which slice of the database holds local currency data and which
holds data to be converted. The dimension that you tag as currency partition contains members
for both local currency values and converted values. Local currency data is converted to common
currency data using currency conversion calculation scripts. In the Sample.Internl database,
the Scenario dimension is the currency partition dimension.

For instructions on how to use currency partition dimensions, see “Keeping Local and Converted
Values” on page 213.

**Note:** A currency conversion partition applies only to the Currency Conversion option. It is not
related to the Partitioning option that enables data to be shared between databases by
using a replicated, linked, or transparent partition.

Report scripts enable the creation of reports that convert data when the report is displayed, as
discussed under “Converting Currencies in Report Scripts” on page 215.

**Note:** For a list of methods used to create the main database outline, see “Creating Main
Database Outlines” on page 211.
Currency Database

By assigning currency tags to members in the main database outline, you enable Essbase to generate the currency database automatically. In the Sample currency application, the currency database is Xchgrate.

**Note:** In the currency database, all level 0 members must be stored, non-dynamic-calc members. This means that the database the currency database is generated from must also have all level 0 members as stored, non-dynamic-calc members.

A currency database always consists of the following three dimensions, with an optional fourth dimension:

- A dimension tagged as time, which is typically the same as the dimension tagged as time in the main database. This allows the currency database to track currency fluctuations over time and to accurately convert various time slices of the main database. In the Sample.Xchgrate database, the dimension tagged as time is Year.

  Each member of the time dimension in the main database must be defined in the currency database. Values by time period in the main database usually are converted to the exchange rates of their respective time period from the currency database (although you can convert data values against the exchange rate of any period).

- A dimension tagged as country, which contains the names of currencies relevant to the markets (or countries) defined in the main database. Each currency name defined in the main database must also exist in the currency database. The currency names define the country-to-exchange rate mapping when conversion occurs.

  In the Sample.Xchgrate database, the country dimension is CurName. Table 32 lists the currency names in the CurName dimension:

<table>
<thead>
<tr>
<th>Dimension and Members</th>
<th>Alias Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CurName - Country</td>
<td>U.S. dollar</td>
</tr>
<tr>
<td>USD</td>
<td>Canadian dollar</td>
</tr>
<tr>
<td>CND</td>
<td>British pound</td>
</tr>
<tr>
<td>GBP</td>
<td>Euro</td>
</tr>
<tr>
<td>EUR</td>
<td>Swiss franc</td>
</tr>
<tr>
<td>CHF</td>
<td>Swedish krona</td>
</tr>
<tr>
<td>SEK</td>
<td></td>
</tr>
</tbody>
</table>

- A dimension tagged as accounts, which enables the application of various rates to members of the dimension tagged as accounts in the main database. The categories defined for the accounts dimension in the main database are used to form the members in the accounts dimension of the currency database. For example, it may be necessary to convert Gross Profit and Net Profit using one category of rates, while other accounts use a different set of rates.
In the Sample.Xchgrate database, the dimension tagged as accounts is CurCategory, and the account categories included are P&L (Profit & Loss) and B/S (Balance Sheet).

- A currency database, which typically includes an optional currency type dimension, which enables different scenarios for currency conversion. Typically, an application has different exchange rates for different scenarios, such as actual, budget, and forecast. To convert data between scenarios, select which type of rate to use.

The currency type dimension is created when you generate the currency outline and is not directly mapped to the main database. Therefore, member names in this dimension need not match member names of the main database.

In the Sample.Xchgrate database, the currency type dimension is CurType. CurType includes actual and budget scenarios.

**Note:** For information about creating the currency database outline, see “Building Currency Conversion Applications and Performing Conversions” on page 211.

### Conversion Methods

Different currency applications have different conversion requirements. Essbase supports two conversion methods:

- **Overwriting local values with converted values.**

  Some applications require that only converted values be stored in the main database. Local values are entered, and the conversion operation overwrites local values with common currency values. This method assumes that there is no requirement for reporting or analyzing local currencies.

  Because this operation overwrites data, load local values and recalculate the data each time you perform a conversion. This method is useful only for single (not ongoing) conversions.

- **Keeping local and converted values.**

  Most applications require that data be stored in both local and common currency (converted) values. This method permits reporting and analyzing local data, and data modifications and recalculations are easier to control. To use this method, define a currency partition (see “Main Database” on page 207).

Either of these methods may require a currency conversion at report time. Report time conversion enables analysis of various exchange rate scenarios without actually storing data in the database. The Currency Conversion module enables performance of ad hoc conversions. You perform ad hoc conversions by using a report script, as discussed in “Converting Currencies in Report Scripts” on page 215.
Building Currency Conversion Applications and Performing Conversions

To build a currency conversion application and perform conversions, use the following process:

1. Create or open the main database outline.
   See “Creating Main Database Outlines” on page 211.
2. Prepare the main database outline for currency conversion.
   See “Preparing Main Database Outlines” on page 211.
3. Generate the currency database outline.
   See “Generating Currency Database Outlines” on page 212.
4. Link the main and currency databases.
   See “Linking Main and Currency Databases” on page 212.
5. Convert currency values.
   See “Converting Currency Values” on page 212.
6. Track currency conversions.
   See “Tracking Currency Conversions” on page 216.
7. If necessary, troubleshoot currency conversion.
   See “Troubleshooting Currency Conversion” on page 217.

Creating Main Database Outlines

To create a main database outline, create or open an Essbase database outline, modify the outline as needed, and save the outline for use in the currency conversion application.

To create an outline or open an existing outline, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Opening and Editing Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>CREATEDB</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Preparing Main Database Outlines

After you create or open the main database outline, modify dimensions and members to enable Essbase to generate the currency database outline automatically. See “Main Database” on page 207.
To prepare a main database outline:
See “Preparing the Main Database Outline for Currency Conversion” in the Oracle Essbase Administration Services Online Help.

Generating Currency Database Outlines
After you verify and save the main database outline, you can generate the currency outline. The currency outline contains dimensions, members, currency names, and currency categories previously defined in the main database outline. The currency database outline is basically structured and ready to use after being generated but may require additions to make it complete.

To generate a currency database outline:
See “Generating a Currency Database Outline” in the Oracle Essbase Administration Services Online Help.

Linking Main and Currency Databases
To perform a currency conversion calculation, Essbase must recognize a link between the main and currency databases. Generating a currency outline does not automatically link a main database with a currency database. When you link the databases, you specify the conversion calculation method and the default currency type member.

To link main and currency databases:
See “Linking a Database to a Currency Database” in the Oracle Essbase Administration Services Online Help.

Converting Currency Values
After you create a currency conversion application, you convert data values from a local currency to a common, converted currency by using the CCONV command in calculation scripts. For example, you might convert data from a variety of currencies into USD (U.S. dollars). You can convert the data values back to the original, local currencies by using the CCONV TOLOCALRATE command.

You can convert all or part of the main database using the rates defined in the currency database. You can overwrite local values with converted values, or you can keep both local and converted values in the main database, depending on your tracking and reporting needs.

Note: When running a currency conversion, ensure that the data being converted is not simultaneously being updated by other user activities (for example, a calculation, data load, or currency conversion against the same currency partition). Concurrent activity on the data being converted may produce incorrect results. Essbase does not display a warning message in this situation.
Note: When you convert currencies using the CCONV command, the resulting data blocks are marked as dirty for the purposes of Intelligent Calculation. Thus, Essbase recalculates all converted blocks when you recalculate the database.

To see sample currency conversion calculation scripts, see the Oracle Essbase Technical Reference.

Overwriting Local Values with Converted Values

To overwrite local values, you need not create a currency partition dimension in the main database. Use the CCONV command in a calculation script to convert all data in the database:

The following calculation script converts the values in the database to USD:

CCONV USD;
CALC ALL;

If required, you can specify a currency name that contains the required exchange rate. The following calculation script converts the values in the database to USD, using the exchange rate for Jan as defined in the currency database:

CCONV Jan->USD;
CALC ALL;

The CALC ALL command is required in the examples shown because the CCONV command converts only currencies. It does not consolidate or calculate members in the database.

The following calculation script uses the “Act xchg” rate to convert the converted values back to their original local currency values:

CCONV TOLOCALRATE "Act xchg";
CALC ALL;

Note: You cannot use the FIX command unless you are using a currency partition dimension and the CCTRACK configuration setting is TRUE in the essbase.cfg file.

Keeping Local and Converted Values

You can keep local and converted values in a database. In the main database, you must define the members that store the local and converted values by creating a currency partition dimension (see “Main Database” on page 207). The currency partition dimension has one partition for local values and one for converted values.

To create a calculation script that copies local data to a converted partition and calculates the data:

1 Use the DATACOPY command to copy data from the local to the converted partition.
2 Use the FIX command to calculate only the converted partition and use the CCONV command to convert the data.
Note: When using a currency partition dimension, you must FIX on a member of the dimension to use the CCONV command.

3 Use the CALC command to recalculate the database.

The following example is based on the Sample.Interntl database and the corresponding Sample.Xchgrate currency database. Figure 46 shows the currency partition from the Sample.Interntl database.

Figure 46 Calculating Local and Converted Currency Conversions

The following calculation script performs three currency conversions for Actual, Budget, and Actual @ Bud XChg data values:

/* Copy data from the local partition to the master partition (for converted values) */

DATACOPY Act TO Actual;
DATACOPY Bud TO Budget;

/* Convert the Actual data values using the "Act xchg" rate */

FIX(Actual)
  CCONV "Act xchg"->US$;
ENDFIX

* Convert the Budget data values using the "Bud xchg" rate */

FIX(Budget)
  CCONV "Bud xchg"->US$;
ENDFIX

/* Convert the "Actual @ Bud XChg" data values using the "Bud xchg" rate */

FIX("Actual @ Bud XChg")
  CCONV "Bud xchg"->US$;
ENDFIX

/* Recalculate the database */

CALC ALL;
CALC TWOPASS;

The following calculation script converts the Actual and Budget values back to their original local currency values:

FIX(Actual)
  CCONV TOLOCALRATE "Act xchg";
ENDFIX

FIX(Budget)
CONV TOLOCALRATE "Bud xchg";
ENDFIX
CALC ALL;

Note: When you convert currencies using the CCONV command, the resulting data blocks are marked as dirty for the purposes of Intelligent Calculation. Thus, Essbase recalculates all converted blocks when you recalculate the database.

Calculating Databases
If you execute a CALC ALL command to consolidate the database after running a conversion, meaningful total-level data is generated in the converted base rate partition, but the local rate partition contains a meaningless consolidation of local currency values. To prevent meaningless consolidation, use the calculation command SET UPTOLOCAL, which restricts consolidations to parents with the same defined currency. For example, all cities in the U.S. use dollars as the unit of currency. Therefore, all children of U.S. consolidate to U.S. Consolidation stops at the country level, however, because North America contains countries that use other currencies.

Converting Currencies in Report Scripts
You can convert currencies in report scripts, using the CURRENCY command to set the output currency and the currency type. For the syntax and definitions of Report Writer commands, see the Oracle Essbase Technical Reference.

Note: Essbase cannot perform "on the fly" currency conversions across transparent databases. If two transparent partition databases are calculated using different conversions, you cannot perform currency conversions in reports.

The following Sample report contains first-quarter Budget Sales for colas, using the January exchange rate for the Peseta currency.

<table>
<thead>
<tr>
<th>Illinois Sales Budget</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>100-20</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>100-30</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>100</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Currency: Jan->Peseta->Act xchg
Currency: Jan->Peseta->Act xchg

<table>
<thead>
<tr>
<th>Illinois Sales Budget</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>100-20</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>100-30</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>100</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Use the following script to create the Sample currency conversion report:

```html
<Page (Market, Measures, Scenario)
(SupCurHeading)
  Illinois Sales Budget
  <Column (Year)
  <children Qtr1
    <Currency "Jan->Peseta->Act xchg"
    <Ichildren Colas
    !
  (CurHeading)
  Illinois Sales Budget
  <Column (Year)
  <children Qtr1
  !
```

## Tracking Currency Conversions

You can use the CCTRACK configuration setting in the `essbase.cfg` file to control whether Essbase tracks the currency partitions that have been converted and the exchange rates that have been used for the conversions. Tracking currency conversions has the following advantages:

- Enables conversion to occur at report time through Report Writer
- Enables conversion of a converted currency back to its original, local rate using the `CONV TOLOCALRATE` command
- Prevents data inaccuracies due to accidental reconversion of data during a currency calculation

By default, CCTRACK is turned on. Essbase tracks which currency partitions have been converted and which have not. The tracking is done at the currency partition level: a database with two partitions has two flags, each of which can be “converted” or “unconverted.” Essbase does not store a flag for member combinations within a partition.

When using a currency partition, and when CCTRACK is set to TRUE (the default) in `essbase.cfg`, you must FIX on a single currency partition member. You cannot FIX on multiple members, because CCTRACK works at the currency partition member level and marks as converted or unconverted all data associated with the currency partition member. For example, in the Sample.Basic database, the following example is valid:

```sql
FIX(Actual)
  CCONV "Act xchg"->US$;
ENDFIX
```

In the Sample.Basic database, if you were able to use a FIX command to convert the actual values for only the members Jan and Feb, the database would have converted and unconverted data in the same currency partition, causing a data consistency issue.

## Reasons to Turn Off CCTRACK

For increased efficiency when converting currency data between currency partitions, consider turning off CCTRACK. For example, if you load data for the current month into the local

216
partition, use the DATACOPY command to copy the entire currency partition that contains the updated data, and then run the conversion on the currency partition.

**Note:** Always do a partial data load to the local partition and use the DATACOPY command to copy the *entire* currency partition to the converted partition before running the currency conversion. Updating data directly into the converted partition causes incorrect results.

### Methods for Turning Off CCTRACK

You can turn off CCTRACK in three ways:

- Use the SET CCTRACKCALC ON|OFF command in a calculation script to turn off CCTRACK temporarily. You can use this command at calculation time to increase flexibility and efficiency during currency conversion.

- Use the CLEARCCTRACK calculation command to clear the internal exchange rate tables created by CCTRACK. You can use the command inside a FIX statement to clear the exchange rates for a currency partition. Use the command after a data load to reset the exchange rate tables so that they are ready for future currency conversion calculations.

- Set CCTRACK to FALSE in the `essbase.cfg` file. Setting CCTRACK to FALSE turns off the tracking system and has the following results:
  - The `CCONV` command assumes that data is unconverted (is in local currency). If you accidentally run the `CCONV` command multiple times on the same data, the resulting data is inaccurate.
  - Similarly, the currency report options assume that the data is unconverted (is in local currency). If the data already has been converted in the database, it is reconverted at report time, resulting in inaccurate data.
  - The restrictions on using the FIX and DATACOPY commands in currency conversions do not apply.

**Note:** When running a currency conversion, ensure that the data being converted is not simultaneously being updated by other user activities (for example, a calculation, data load, or currency conversion against the same currency partition). Concurrent activity on the data being converted may produce incorrect results. Essbase does not display a warning message in this situation.

### Troubleshooting Currency Conversion

See “Troubleshooting Currency Conversion” in the *Oracle Essbase Administration Services Online Help.*
In This Chapter

- Understanding Essbase Partitioning ......................................................... 219
- Partition Design Requirements ............................................................... 224
- Replicated Partitions ........................................................................... 228
- Transparent Partitions .......................................................................... 232
- Linked Partitions .................................................................................. 238
- Case Studies for Designing Partitioned Databases ............................... 240

Understanding Essbase Partitioning

A partition is the region of a database that is shared with another database. An Essbase partitioned application can span multiple servers, processors, or computers.

Partition Types

Table 33 lists the types of partitions that are supported in Essbase:

<table>
<thead>
<tr>
<th>Partition Type</th>
<th>Description</th>
<th>Applies To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replicated</td>
<td>A copy of a portion of the data source that is stored in the data target.</td>
<td>Block storage databases</td>
</tr>
<tr>
<td></td>
<td>See “Replicated Partitions” on page 228.</td>
<td>Aggregate storage databases</td>
</tr>
<tr>
<td>Transparent</td>
<td>Allows users to access data from the data source as though it were stored in the data target. The data is, however, stored at the data source, which can be in another application or Essbase database, or on another Essbase Server.</td>
<td>Block storage databases</td>
</tr>
<tr>
<td></td>
<td>See “Transparent Partitions” on page 232.</td>
<td>Aggregate storage databases</td>
</tr>
<tr>
<td>Linked</td>
<td>Sends users from a cell in one database to a cell in another database. Linked partitions give users a different perspective on the data.</td>
<td>Block storage databases</td>
</tr>
<tr>
<td></td>
<td>See “Linked Partitions” on page 238.</td>
<td>Aggregate storage databases</td>
</tr>
</tbody>
</table>

Use the information in Table 34 to help you choose which type of partition to use:
Table 34  Features Supported by Partition Type

<table>
<thead>
<tr>
<th>Feature</th>
<th>Replicated</th>
<th>Transparent</th>
<th>Linked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up-to-the-minute data</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Reduced network traffic</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Reduced disk space</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Increased calculation speed</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smaller databases</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Improved query speed</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Invisible to end users</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Access to databases with different dimensionality</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Easier to recover</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less synchronization required</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Ability to query data based on its attributes</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Ability to use front-end tools that are not distributed OLAP-aware</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Easy to perform frequent updates and calculations</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to update data at the data target</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>View data in a different context</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Perform batch updates and simple aggregations</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Parts of a Partition

Partitions contain the following parts, as illustrated in Figure 47 and described in Table 35 on page 221.

Figure 47  Parts of a Partition
### Table 35  Parts of a Partition

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of partition</td>
<td>A flag indicating whether the partition is replicated, transparent, or linked.</td>
</tr>
<tr>
<td>Data source information</td>
<td>The server, application, and database name of the data source.</td>
</tr>
<tr>
<td>Data target information</td>
<td>The server, application, and database name of the data target.</td>
</tr>
<tr>
<td>Login and password</td>
<td>The login and password information for the data source and the data target. This information is used for internal requests between the two databases to execute administrative and end-user operations.</td>
</tr>
<tr>
<td>Shared areas</td>
<td>A definition of one or more areas, or regions, shared between the data source and the data target. To share multiple noncontiguous portions of a database, define multiple areas in a single partition. This information determines which parts of the data source and data target are shared so that Essbase can put the proper data into the data target and keep the outlines for the shared areas synchronized.</td>
</tr>
<tr>
<td>Member mapping information</td>
<td>A description of how the members in the data source map to members in the data target. Essbase uses this information to determine how to put data into the data target if the data target and the data source use different names for some members and dimensions.</td>
</tr>
<tr>
<td>State of the partition</td>
<td>Information about whether the partition is up-to-date and when the partition was last updated.</td>
</tr>
</tbody>
</table>

### Data Sources and Data Targets

Partitioned databases contain at least one data source (the primary site of the data) and at least one data target (the secondary site of the data). One database can serve as the data source for one partition and the data target for another partition. When defining a partition, you map cells in the data source to their counterparts in the data target.

An Essbase database can contain many partitions, as well as data that is not shared with any other Essbase database. You can define partitions between the following databases:

- Different databases in different applications, as long as each database uses the same language and the same Unicode-related mode.
  
  The applications can be on the same computer or different computers.

- Different databases in one block storage application.
  
  This practice is not recommended, because the full benefits of partitioning databases are realized when each database is in a separate application.
You can define only one partition of each type between the same two databases. For example, you can create only one replicated partition between the Sampeast.East and Samppart.Company databases. The East or Company databases can, however, contain many replicated partitions that connect to other databases.

One database can serve as the data source or data target for multiple partitions. To share data among many databases, create multiple partitions, each with the same data source and a different data target, as shown in Figure 49:

![Figure 49 Data Shared at Multiple Targets](image)

Table 36 lists the combinations of block storage and aggregate storage databases as data target and data source that are supported by each partition type:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
<th>Replicated</th>
<th>Transparent</th>
<th>Linked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block storage</td>
<td>Block storage</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Aggregate storage</td>
<td>Block storage</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Aggregate storage</td>
<td>Aggregate storage</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Block storage</td>
<td>Aggregate storage</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Overlapping Partitions**

An overlapping partition occurs when similar data from multiple databases is the data source for one data target in a partition.

For example, IDESC East, Sales from database 1 and Boston, Sales from database 2 are mapped to IDESC East, Sales and Boston, Sales in database 3. Because Boston is a member of the East dimension, the data for Boston mapped to database 3 from database 1 and database 2 overlap. This data overlap results in an overlapping partition, as shown in Figure 50:
An overlapping partition is allowed in linked partitions but is invalid in replicated and transparent partitions and generates an error message during validation.

Substitution Variables in Partition Definitions

Using substitution variables in partition definitions enables you to base the partition definition on different members at different times. Substitution variables act as global placeholders for information that changes regularly; each variable has an assigned value, which the Database Manager can change anytime. For example, you can define a substitution variable named Curmonth and change the substitution variable value to the member name for each month throughout the year to Jan, Feb, Mar, and so on. In this example, using a substitution variable reduces the partition size because you need not include all months in the partition definition area to access data from one month.

To specify a substitution variable in an area definition or in a mapping specification, use the Use text editor or Use inline editing option. Insert “&” at the beginning of the substitution variable name; for example, &Month. Essbase uses substitution values when you verify the partition. When you perform any process that uses partitioned data, Essbase resolves the substitution variable name to its value. The substitution variable name is displayed when you view the partition definition. See “Using Substitution Variables” on page 120.

Note: When using substitution variables in partition definitions, the variable value remains fixed in the partition definition until after the application is restarted. For example, if the value of &Curmonth is Jan and you change the value to Feb, the value in the partition definition stays at Jan until you restart the application.

Attributes in Partitions

For block storage databases, you can use attribute functions for partitioning on attribute values, but you cannot partition an attribute dimension. Use attribute values to partition a database to access members of a dimension according to their characteristics.

For example, in the Sample.Basic database, you cannot partition the Pkg Type attribute dimension, but you can create a partition that contains all the members of the Product dimension.
that are associated with either or both members (Bottle and Can) of the Pkg Type dimension. If you create a partition that contains members associated with Can, you can access data only on Product members that are packaged in cans; namely, 100-10, 100-20, and 300-30.

**Note:** Retrieving data on attribute members of block storage databases may result in missing data. See the entry for “Dense Dynamic Calc members in nonexisting stored blocks” in Table 18, “Differences Between Attribute and Standard Dimensions,” on page 167.

You can use the @ATTRIBUTE command and the @WITHATTR command to define partitions. For example, to extract data on all members of the Product dimension that are associated with the Caffeinated attribute dimension, you can create a partition such as @ATTRIBUTE (Caffeinated). But you cannot partition the Caffeinated attribute dimension.

Based on the previous example, this partition is correct:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ATTRIBUTE(Caffeinated)</td>
<td>@ATTRIBUTE(Caffeinated)</td>
</tr>
</tbody>
</table>

This partition is incorrect:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caffeinated</td>
<td>Caffeinated</td>
</tr>
</tbody>
</table>

For more information about these commands, see the *Oracle Essbase Technical Reference.* Also see Chapter 10, “Working with Attributes.”

**Version and Encoding Requirements**

Version: Both ends (the source and target) of the partition must be on the same release level of Essbase Server for these partition types:

- Replicated
- Transparent
- Linked

Encoding: The application mode—Unicode mode or non-Unicode mode—of both ends of the partition must be the same for these partition types:

- Replicated
- Transparent

**Partition Design Requirements**

Use the information in this section to carefully design partitions before implementing them.
**Benefits of Partitioning**

Partitioning can provide the following benefits:

- For block storage databases, data synchronization across multiple databases
  Essbase tracks changes made to data values in a partition and provides tools for updating the data values in related partitions.

- Outline synchronization across multiple databases (except when an aggregate storage database is the target of a transparent partition)
  Essbase tracks changes made to the outlines of partitioned databases and provides tools for updating related outlines.

- Ability for user navigation between databases with differing dimensionality
  When users drill across to the new database, they can drill down to more-detailed data.

**Partitioning Strategies**

Based on user requirements, select a partitioning strategy:

- Partition applications from the top down.
  Use top-down partitioning to split a database onto multiple processors, servers, or computers, which can improve the scalability, reliability, and performance of databases. To achieve the best results with top-down partitioning, create a separate application for each partitioned database.

- Partition applications from the bottom up.
  Use bottom-up partitioning to manage data flow between multiple related databases, which can improve the quality and accessibility of the data in databases.

- Partition databases according to attribute values associated with base dimensions (a standard dimension associated with one or more attribute dimensions).
  Use this strategy to extract data based on the characteristics of a dimension, such as flavor or size.

**Note:** You cannot partition attribute dimensions. See “Attributes in Partitions” on page 223.

**Guidelines for Partitioning a Database**

Use the following information to help you determine whether to partition a database.

- Partition a database when:
  - The data should be closer to the people who are using it.
  - A single failure would be catastrophic.
It takes too long to perform calculations after new data is loaded, and you want to improve performance by spreading calculations across multiple processors or computers.

Users want to see the data in different application contexts, and you want to control how users navigate between databases.

You need to synchronize information from different sources.

You plan to add new organizational units that would benefit from having their own databases.

Users must wait as other users access the database.

You want to save disk space by giving users access to data stored in a remote location.

You want to reduce network traffic by replicating data in several locations.

You need to control database outlines from a central location.

You need client write-back functionality on an aggregate storage database.

See “Using a Transparent Partition for Write-Back to Aggregate Storage Databases” on page 931.

Do not partition a database when:

- You have disk space, network bandwidth, and administrative resource concerns.
- You perform complex allocations where unit level values are derived from total values.
- You are required to keep all databases online at all times.

Keeping databases online can be a problem if you have databases in several time zones, because peak user load may differ between time zones. Using linked and transparent partitions exacerbate this problem, but using replicated partitions might help.

- Databases are in different languages or Unicode-related modes.

Essbase can partition databases only if each database uses the same language, or each database uses the same Unicode or non-Unicode mode.

Guidelines for Partitioning Data

When designing a partitioned database, use the following information to help you determine which data to include in each partition:

- Which database should be the data source and which the data target? The database that “owns” the data, where the data is updated and where most of the detail data is stored, should be the data source.

- Are some parts of the database accessed more frequently than others?

- What data can you share among sites?

- How granular must the data be at each location?

- How frequently is the data accessed, updated, or calculated?

- What are the available resources: disk space, CPUs, and network resources?
How much data must be transferred over the network? How long does it take?

Is the data stored in one or multiple locations?

Is the data accessed in one or multiple locations?

Is there information in separate databases that should be accessed from a central location? How closely are groups of data related?

See “Case Studies for Designing Partitioned Databases” on page 240.

Security for Partitioned Databases

Users accessing replicated, transparent, or linked partitions may need to view data stored in multiple databases. The following sections describe how to set up security so that users do not view or change inappropriate data.

Setting up End-User Security

Create the required end users with the correct filters.

1. Create accounts for users at the data target.
2. Create read and write filters at the data target to determine what end users can view and update.
   
3. If you are creating a replicated partition, determine whether users can make changes to a replicated partition at the data target. The update setting (which allows or disallows updates) overrides user filters that allow users to update data.

   See the Oracle Essbase Administration Services Online Help.

   - When creating replicated partitions using the create replicated partition MaxL statement, if you do not specify the update allow grammar, replicated partitions cannot be updated by default. See the Oracle Essbase Technical Reference.

   - When creating replicated partitions using Administration Services Console, by default, replicated partitions can be updated. See the Oracle Essbase Administration Services Online Help.
4. If you are creating a linked partition, create accounts for users at the data source. Users accessing linked databases may need to connect to multiple databases.

   See “Drill Across and Linked Partitions” on page 240.

Setting up Administrator Security

The administrative account performs all read and write operations requested by the data target for the data source. For example, when end users request data at the data target, the administrative account retrieves the data. When end users update data at the data target, the administrative account logs into the data source and updates the data there.
You can create filters on the administrative account and on the end users. Filters on the administrative account can ensure that no one at the data target can view or update inappropriate data. For example, the administrator at the corporate database can restrict write access on certain cells to avoid relying on administrators in the regions to set up security correctly for each end user.

Create the required administrative users with the correct filters.

1. Create an administrative account at the data source and data target.
   
   See "Setting the User Name and Password" on page 247.

   Essbase uses this account to log onto the data source to retrieve data and to perform outline synchronization operations.

2. Create read and write filters to determine which data administrators can view and update.
   

   - For replicated partitions, set up read filters at the data source to determine which data Essbase reads when replicating, and set up write filters at the data target to determine which data Essbase writes to when replicating.

   - For transparent partitions, set up read filters at the data source to determine which data Essbase retrieves for end users, and set up write filters at the data source to determine which data Essbase updates for end users.

### Using Backup and Restore and Transaction Logging and Replay with Partitioned Databases

If you are using Essbase backup and restore and transaction logging and replay features with partitioned databases, there are guidelines that you must follow. See the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.

### Replicated Partitions

A replicated partition is a copy of a portion of the data source that is stored in the data target. Some users can then access the data in the data source while others access it in the data target.

For example, in the Samppart and Sampeast sample applications, the DBA at The Beverage Company (TBC) created a replicated partition between the East database and the Company database containing Actual, Budget, Variance, and Variance%. Users in the eastern region now store their budget data locally. Because they do not have to retrieve this data live from corporate headquarters, response times are faster, and they have more control over the downtimes and administration of local data. See “Case Study 1: Partitioning an Existing Database” on page 241.

Changes to the data in a replicated partition flow from the data source to the data target. Changes made to replicated data in the data target do not flow back to the data source. If users change the data at the data target, Essbase overwrites their changes when the DBA updates the replicated partition.
When a replicated partition is defined, the DBA can select a setting to prevent the data in the replicated portion of the data target from being updated. The update setting (which allows or disallows updates) takes precedence over access provided by security filters and is also honored by batch operations, such as data load and calculation. The default behavior of the update setting depends on whether you create the replicated partition using MaxL or Administration Services Console. See “Setting up End-User Security” on page 227.

Use a replicated partition to achieve any of the following goals:

- Decrease network activity
- Decrease query response times
- Decrease calculation times
- Recover more easily from system failures

**Rules for Replicated Partitions**

Replicated partitions must follow these rules:

- You must be able to map the shared replicated areas of the data source and data target outlines, although the shared areas need not be identical. You must tell Essbase how each dimension and member in the data source maps to each dimension and member in the data target.

  The data source and data target outlines for the non-shared areas do not have to be mappable.

- Because none of the areas that you use as a replicated partition target can come from a transparent partition source, you cannot create a replicated partition on top of a transparent partition, as shown in Figure 51:

  ![Invalid Replicated Partition](image)

- The cells in the data target of a replicated partition cannot come from two data sources; the cells in one partition must come from one database. To replicate cells from multiple databases, create a different partition for each data source.

  The cells in a data target can be the data source for a different replicated partition. For example, if the Samppart.Company database contains a replicated partition from the Sampeast.East database, you can replicate the cells in Sampeast.East into a third database, such as Sampwest.West.

- You cannot use attribute members to define a replicated partition. For example, associated with the Market dimension, the Market Type attribute dimension members are Urban, Suburban, and Rural. You cannot define a partition on Urban, Suburban, or Rural, because
A replicated partition contains dynamic data, not stored data. Therefore, an attempt to map attributes in replicated partitions results in an error message. However, you can use the WITHATTR command to replicate attribute data.

Advantages of Replicated Partitions

- Because data is stored closer to end users, in the data target, replicated partitions can decrease network activity, resulting in improved retrieval times for users.
- The data is more easily accessible to all users. Some users access the data at the data source, others at the data target.
- Failures are not as catastrophic. Because the data is in multiple places, if one database fails, only the users connected to that database are unable to access the information. Data is still available at and can be retrieved from the other sites.
- Local DBAs can control the downtime of their local databases. For example, because users in the eastern region are accessing their own replicated data instead of the Company database, DBAs can bring down the Company database without affecting users in the eastern region.
- Because only the relevant data is kept at each site, databases can be smaller. For example, users in the eastern region can replicate only the eastern budget information, instead of accessing a larger company database containing budget information for all regions.

Disadvantages of Replicated Partitions

- You need more disk space because data is stored in multiple locations.
- Because the DBA must manually refresh data regularly, users may not see the latest version of the data.

Performance Considerations for Replicated Partitions

To improve the performance of replicated partitions, follow these guidelines:

- Do not replicate members that are dynamically calculated in the data source, because Essbase must probe the outline to find dynamically calculated members and their children to determine how to perform the calculation.
- Do not replicate derived data from the data source. Instead, replicate the lowest practical level of each dimension and perform the calculations on the data target after you complete the replication.

For example, to replicate the database along the Market dimension:

- Define the shared area as the lowest-level members of the Market dimension that you care about, for example, East, West, South, and Central and the level 0 members of the other dimensions.
After you complete the replication, calculate the values for Market and the upper-level values in the other dimensions at the data target.

Sometimes you cannot calculate derived data at the data target. In that case, replicate it from the data source. For example, you cannot calculate derived data at the data source if the data meets any of the following criteria:

- Requires that data outside the replicated area be calculated.
- Requires calculation scripts from which you cannot extract only the portion to be calculated at the data target.
- Is being replicated onto a computer with little processing power, such as a laptop.

To optimize the replication of an aggregate storage database when the aggregate storage database is the target and a block storage database is the source and the two outlines are identical, use one of these methods:

- The `REPLICATIONASSUMEIDENTICALOUTLINE` configuration setting in `essbase.cfg`. The setting can be enabled at the server, application, or database level. The syntax for the setting is as follows:
  ```plaintext
  REPLICATIONASSUMEIDENTICALOUTLINE [appname [dbname]] TRUE | FALSE
  ```
  When updating the `essbase.cfg` file, you must stop and then restart Essbase Server for the changes to take effect.

- The `alter database` MaxL statement with the `replication_assume_identical_outline` grammar. The statement can be enabled only at the database level. The syntax for the statement is as follows:
  ```plaintext
  alter database appname.dbname enable | disable replication_assume_identical_outline;
  ```
  When using the `alter database` statement, you do not need to stop and restart the aggregate storage application.

Both optimization methods affect only the target aggregate storage application; the source block storage application is not affected. The methods do not apply to block storage replication.

- Partitioning along a dense dimension takes longer than partitioning along a sparse dimension. When Essbase replicates data partitioned along a dense dimension, it must access every block in the data source and then create each block in the data target during the replication operation.

- You cannot replicate data into a member that is dynamically calculated at the data target. Essbase does not load or replicate into Dynamic Calc and Dynamic Calc and Store members, because these members do not contain data until a user requests it at runtime. Essbase avoids sending replicated data for both dynamic dense and dynamic sparse members on the replication target, because this data is not stored on the data target.

To replicate only the data values that have changed instead of the entire partition, see “Populating or Updating Replicated Partitions” on page 258.
Replicated Partitions and Port Usage

With replicated partitions, users connect to the target database only. When data is updated on the target database, the process of replicating data from the source database to the target database utilizes one port and this connection is based on the user name declared in the partition definition (partition user).

Note: Because of the short-term nature of replication, replicated partitions and ports are rarely a problem.

Transparent Partitions

A transparent partition allows users to manipulate data that is stored remotely as if it were part of the local database. The remote data is retrieved from the data source each time that users at the data target request it. Users do not need to know where the data is stored, because they see it as part of their local database.

Because data is retrieved directly from the data source, users see the latest version. When they update the data, their updates are written back to the data source. This process means that other users at the data source and the data target have immediate access to those updates.

With a transparent partition, users at the data source and at the data target may notice slower performance as more users access the source data.

For example, the DBA at TBC can use a transparent partition to calculate each member of the Scenario dimension on a separate computer. This process reduces the elapsed time for the calculation while providing users with the same view of the data. See “Case Study 1: Partitioning an Existing Database” on page 241.

Use a transparent partition to achieve the following goals:

- Show users the latest version of the data
- Allow users at the data target to update data
- Decrease disk space
Rules for Transparent Partitions

Transparent partitions must follow these rules:

- The shared transparent areas of the data source and data target outlines need not be identical, but you must be able to map the dimensions in them. You must tell Essbase how each dimension and member in the data source maps to each dimension and member in the data target.

- The data source and data target outlines for the nonshared areas need not be mappable, but attribute associations must be identical. Otherwise, users can get incorrect results for some retrievals. For example, if product 100-10-1010 is associated with the Grape Flavor attribute on the source, but product 100-10-1010 is not associated with Grape on the target, the total of sales for all Grape flavors in New York is incorrect.

- The partition definition must contain only stored members. You cannot use attribute dimensions or members to define a transparent partition. For example, the Market Type attribute dimension, which is associated with the Market dimension, has members Urban, Suburban, and Rural. You cannot define a partition on Urban, Suburban, or Rural.

- If a cell is mapped from the data source to an aggregate storage database as the target, all the cell’s dependents must also be mapped to the same partition definition.

- You can create a transparent partition on top of a replicated partition. In other words, you can create a transparent partition target using a replicated partition source, as shown in Figure 53.

- As illustrated in Figure 54, you cannot create a transparent partition on top of multiple other partitions. In other words, you cannot create a transparent partition target from multiple sources because each cell in a database must be retrieved from only one location—either the local disk or a remote disk.
Carefully consider any formulas you assign to members in the data source and data target.

**Advantages of Transparent Partitions**

Transparent partitions can solve many database problems, but transparent partitions are not always the ideal partition type.

- You need less disk space, because you are storing the data in one database.
- The data accessed from the data target is always the latest version.
- When the user updates the data at the data source, Essbase makes those changes at the data target.
- Individual databases are smaller, so they can be calculated more quickly.
- The distribution of the data is invisible to the end user and the end user’s tools.
- You can load the data from either the data source or data target.
- You can enable write-back functionality for aggregate storage databases by creating a transparent partition between an aggregate storage database as the source and a block storage database as the target.

See “Using a Transparent Partition for Write-Back to Aggregate Storage Databases” on page 931.

**Disadvantages of Transparent Partitions**

If these disadvantages are too serious, consider using replicated or linked partitions instead.

- Transparent partitions increase network activity, because Essbase transfers the data at the data source across the network to the data target. Increased network activity results in slower retrieval times for users.
- Because more users are accessing the data source, retrieval time may be slower.
- If the data source fails, users at both the data source and the data target are affected. Therefore, the network and data source must be available whenever users at the data source or data target need them.
You can perform some administrative operations only on local data. For example, if you archive the data target, Essbase archives only the data target and not the data source. The following administrative operations work only on local data in block storage databases:

- CLEARDATA calculation command
- DATACOPY calculation command
- EXPORT command
- VALIDATE command
- BEGINARCHIVE and ENDARCHIVE commands
- Restructure operations in Administration Services

When you perform a calculation on a transparent partition, Essbase performs the calculation using the current values of the local data and transparent dependents. Essbase does not recalculate the values of transparent dependents, because the outlines for the data source and the data target may be so different that such a calculation is inaccurate. To calculate all partitions, issue a CALC ALL command for each individual partition, and then perform a CALC ALL command at the top level using the new values for each partition.

Consider this example:

- The data target outline contains a Market dimension with East, West, South, and Central members
- The data source outline contains an East dimension with New York and New Jersey members

If you tried to calculate the data target outline, you would assume that East was a level 0 member. In the data source, however, East is derived by adding New York and New Jersey. Any calculations at the data target, however, would not know this information and could not reflect changes made to New York and New Jersey in the data source. To perform an accurate calculation, therefore, calculate East in the data source and then calculate the data target.

Formulas assigned to members in the data source may produce calculated results that are inconsistent with formulas or consolidations defined in the data target, and vice versa.

---

**Performance Considerations for Transparent Partitions**

To improve the performance of transparent partitions, consider the following guidelines when creating the partition:

- Partitioning along dense dimensions in a transparent partition can greatly slow performance, because dense dimensions are used to determine the structure and contents of data blocks. If a database is partitioned only along a dense dimension at the target, Essbase must compose data blocks by performing network calls for the remote data in the transparent partition and to the disk I/O for the local portion of the block.
To improve performance, consider including one or more sparse dimensions in the area definition so that the number of blocks required is limited to combinations with the sparse members.

- Basing transparent partitions on the attribute values of a dimension can increase retrieval time, because attributes are associated with sparse dimensions. In such cases, partitioning at a level higher than the level that is associated with attributes improves retrieval time. For example, in the Product dimension of the Sample.Basic database, if children 100-10, 200-10, and 300-10 (level 0) are associated with attributes, then partition their parents 100, 200, and 300 (level 1) for better retrieval performance.

- Loading data into the data source from the data target can greatly slow performance. If possible, load data into the data source locally.

- Retrieval time is slower because users access the data over the network.

- When a transparent partition is the target, consider using these configuration settings:
  - For requests sent from a data source to a transparent partition target (whether a block storage or aggregate storage database), you can log transaction response times using the ENABLE_DIAG_TRANSPARENT_PARTITION configuration setting in the essbase.cfg file. Logging these messages is helpful when troubleshooting response times that are too slow.
  - When the transparent partition target is an aggregate storage database, you can specify the maximum size of the request grid and the response grid, using the MAX_REQUEST_GRID_SIZE and MAX_RESPONSE_GRID_SIZE configuration settings.

- Partitioning base dimensions can greatly slow performance.

- See “Performance Considerations for Transparent Partition Calculations” on page 237.

## Calculating Transparent Partitions

When you perform a calculation on a transparent partition, Essbase performs the calculation using the current values of the local data and transparent dependents. When calculating local data that depends on remote data, Essbase performs a bottom-up calculation. The bottom-up calculation can be done only if the calculator cache on the target database is used properly. See “Using Bottom-Up Calculation” on page 871.

Increasing the memory assigned to the calculator cache greatly improves calculation performance with transparent partitions. When a calculation is started, a message in the application log file indicates whether the calculator cache is enabled or disabled on the target database. Using the calculator cache on the target database reduces the number of blocks that are requested from the data source during calculation. Reducing the blocks requested, in turn, reduces the network traffic that is generated by transferring blocks across the network. See “Sizing the Calculator Cache” on page 828.
Performance Considerations for Transparent Partition Calculations

Calculating data on the data target can greatly slow performance when the data target must retrieve each dependent data block across the network, and then perform the calculation.

Performance with transparent calculations also may slow if Essbase must perform a top-down calculation on any portion of the data target that contains top-down member formulas. When the data target does not contain top-down member formulas, Essbase can perform a bottom-up calculation on the data target, which is much faster.

When Essbase performs the calculation on the data source, it can always perform a bottom-up calculation. For a comparison of top-down and bottom-up calculations, see "Using Bottom-Up Calculation" on page 871.

Consider using these calculation alternatives:

- If you are absolutely sure that a target partition calculation script does not involve access to remote data, you can use the SET REMOTECALC OFF calculation command in the calculation script to stop retrieval efforts from the source partition. See the Oracle Essbase Technical Reference.
- Dynamic Calc or Dynamic Calc and Store members as parents of the transparent data so that the data is calculated on the fly when it is retrieved. This process reduces the batch processing time. Essbase performs the calculation only when users request it.
- A replicated layer between the low-level transparent data and high-level local data.

Consider these performance strategies:

- Keep the partition fully within the calculator cache area (see “Sizing the Calculator Cache” on page 828), which means that any sparse members in the partition definition must be contained within the calculator cache. For example, in the Sample.Basic database, if a partition definition includes @IDESC(East), all descendants of East must be within the calculator cache.
- Enable the calculator cache, and assign a sufficient amount of memory to it.
- Do not use complex formulas on any members that define the partition. For example, in Sample.Basic, assigning a complex formula to New York or New Jersey (both children of East) forces Essbase to use the top-down calculation method. See “Bottom-Up and Top-Down Calculation” on page 872.

Transparent Partitions and Member Formulas

If the data target and data source outlines are identical except for different member formulas, ensure that the partition definition produces the calculation results you want.

For example, suppose that the data source and data target outlines both contain a Market dimension with North and South members, and children of North and South. On the data target, Market is calculated from the data for the North and South members (and their children) on the data source. If any of these members on the data source contains member formulas, these
formulas are calculated, affecting the calculated value of Market on the data target. These results may be different from how the Market member are calculated from the North and South members on the data target, where these formulas may not exist.

Ensure that any formulas you assign to members in the data source and data target produce the results you want.

**Transparent Partitions and Port Usage**

One port is used for every unique user and machine combination. If a user defines several transparent partitions on one server, using the same user name, then only one port is occupied.

In a transparent partition, when a user (user1) drills into an area in the target that accesses source data, user1 is using the user name declared in the partition definition (partition user) to access the data from the source database. This access causes the use of an additional port because different users (user1 and partition user) are connecting to the application.

If a second user (user2) connects to the target database and drills down to access source data, user2 also uses the user name declared in the partition definition (partition user). Because the partition user is already connected to the source database, an additional port is not needed for the partition user, as long as user2 is accessing the same source database.

**Linked Partitions**

A linked partition connects two databases with a data cell. When you click the linked cell in the data target, you drill across to a second database—the data source—and view the data there. For example, if you are using Smart View, a new spreadsheet that displays the dimensions from the linked database opens when you launch a linked partition. From there, you can drill down into the dimensions of the linked database.

Unlike replicated or transparent partitions, linked partitions do not restrict you to viewing data in the same dimensionality as the target database. The database that you link to can contain different dimensions than the database from which you connected. With linked partitions, data is not physically transferred from the source to the target. Instead, a data cell or range of cells on the target provides a link point to a cell or range of cells on the source.

To prevent users from seeing privileged data, establish security filters on the data source and the data target. See “Security for Partitioned Databases” on page 227.
There are no performance considerations for linked partitions, beyond optimizing the performance of each linked database.

For example, if TBC grew into a large company, it might have several business units. Some data, such as profit and sales, exists in each business unit. TBC can store profit and sales in a centralized database so that the profit and sales for the entire company are available at a glance. The DBA can link business unit databases to the corporate database. See “Case Study 3: Linking Two Databases” on page 244.

A user in such a scenario can perform these tasks:

- View the general profit and sales at the corporate level in a spreadsheet at the data target.
- Drill across to individual business units, such as East (this action opens a new spreadsheet).
- Drill down in the new spreadsheet to more-detailed data.

For linked partitions, the spreadsheet that the user first views is connected to the data target, and the spreadsheet that opens when the user drills across is connected to the data source. This setup is the opposite of replicated and transparent databases, in which users move from the data target to the data source.

Use a linked partition to connect databases with different dimensionality.

**Advantages of Linked Partitions**

- You can view data in a different context; that is, you can navigate between databases containing many dimensions.
- You need not keep the data source and data target outlines closely synchronized, because less of the outline is shared.
- A single data cell can allow the user to navigate to multiple databases. For example, the Total Profit cell in the Accounting database can link to the Profit cells in the databases of each business unit.
- Performance may improve, because Essbase accesses the database directly, not through a data target.
Disadvantages of Linked Partitions

You must create an account for users on each database or use default access to the destination database (such as through a guest account). See “Drill Across and Linked Partitions” on page 240.

Drill Across and Linked Partitions

When a user clicks on a linked cell in a linked partition, a spreadsheet opens and displays the linked database. This process is called drill across. To facilitate drill-across access, you can use the following strategies:

- Create accounts for each user on each database. For example, if Mary accesses data in a Company database and an East database, create an account with the same login and password for Mary on the Company and East databases.

- Create a default account that users can use when accessing target databases. For example, if users access data through a data source named Company and a data target named East, create a guest account for the East database with the appropriate permissions. Use the guest account login and password as the default login when creating the linked partition.

When a user drills across on data to a data target, Essbase logs the user into the data target using the following steps:

1. Checks whether the user has an account on the data target with the same name and password. If so, Essbase logs in the user using that account.
2. Checks whether you specified a default account on the data target when you created the partition. If you did, Essbase logs the user in using that account.
3. Opens a login window prompting the user to enter a new login and password. After the user enters a valid login and password, Essbase logs the user in using that account.

Linked Partitions and Port Usage

When accessing a linked partition, Essbase tries to use the end user’s (user1) login information to connect to the source database. If user1 does not have access to the source database, Essbase looks for the linked partition default user name and password. If these defaults are not specified, user1 is asked to enter login information to access the source database. Port usage varies depending on the number of user names being used to access the various source and target databases (and whether those databases are contained within the same or different servers).

Case Studies for Designing Partitioned Databases

The following sections describe examples of partitioning a database:
Case Study 1: Partitioning an Existing Database

Assume that TBC, the fictional soft drink company upon which the Sample.Basic database is based, started out with a centralized database. As the eastern region grew, however, this solution was no longer feasible. The networks to the eastern region could not handle the large data flow. Users were constantly waiting for data that they needed in order to make decisions. One day, the network went down, and users at the eastern region could not access the data.

Everyone agreed that the eastern region needed to access its own data directly, without going through the company database. In addition, TBC decided to change where budgeting information was stored. The corporate budget stays at company headquarters, but the eastern region budget moves to the eastern region’s database.

So, assume that TBC decided to ask you to partition their large centralized database into two smaller databases—Company and East.

This example is based on the Samppart sample application (which contains the Company database) and the Sampeast sample application (which contains the East database).

Figure 57 shows a subset of the partitioned databases. The arrows indicate flow from the data source to the data target. The Company database is the data source for the Corp_Budget member and the data target for the East and the East Actual members. The East database is the data source for its East and Actual members and the data target for the Corp_Budget member.

Figure 57 Data Flow from Data Source to Data Target

To create a partition based on this example:

1. **Determine which data to partition.**

   The Sample.Basic database contains five standard dimensions—Year, Measures, Product, Market, and Scenario.
   
   - Partition the database along the East member of the Market dimension to give the eastern region more control over the contents of its database.
   
   - Partition the database along the Actual and Corp_Budget members of the Scenario dimension.

2. **Choose the data source and the data target.**
For Corp_Budget, use Company as source and East as Target, because the company owns the corporate budget—it is the source.

For Eastern Region and Actual, East is the source and Company is the target, because the eastern region needs to update its market and actual information.

3 Decide which type of partition to use.

- For East, use transparent because the data target (Company) needs up-to-the-minute data.
- For Corp_Budget, use transparent because the data target (East) needs up-to-the-minute data.
- For East Actual, use replication because the data target (Company) does not need up-to-the-minute data.

4 Create the partitioned databases by performing the following tasks.

- Create the Sampeast application.
- Create the East database by cutting the Company outline and pasting it into the East outline. Then delete the extra members (South, West, and Central) and promote East.
- If necessary, edit existing data sources, rules files, calculation scripts, report scripts, and outlines.
- Create the partitions.
- Load data into the new partitions.

After the corporate database is partitioned, users and DBAs see the following benefits:

- Faster response times, because they are competing with fewer users for the data and they are accessing the data locally
- Easier maintenance, because DBAs can control the downtime of their local databases
- Access to more data, because users can connect to both the eastern and corporate budgets
- Higher-quality data, because the corporate budget and eastern budget are now synchronized—they use the same data.

**Case Study 2: Connecting Existing Related Databases**

Assume that TBC has several databases, such as Inventory, Payroll, Marketing, and Sales. Users viewing the Sample.Basic database want to share data with and navigate to those other databases. You, the DBA, want to synchronize related data. It is impractical to combine all of the databases into one database, for the following reasons:

- So many users access it that performance is slow.
- You cannot find downtime to administer the database.
- No one has control over his own data, because it is centrally managed.
- The database is very sparse, because so much of the data is unrelated.
By connecting the databases instead, you can:

- Leverage work that has already been completed
- Synchronize the data

**Note:** This example is not included with Essbase.

To connect multiple databases:

1. **Determine which data to connect. First, connect the Inventory database.**
   - Replicate the Opening_Inventory and Ending_Inventory members from the Measures dimension of the Inventory database into the Measures dimension of the Sample.Basic database.
   - Do not replicate the Number_On_Hand, Number_Shipped, and Number_Returned members in the Measures dimension of the Inventory database to the Sample.Basic database.
   - Add a link to the Inventory database so that users can view these more-detailed measures, if necessary.
   - Create a partition containing data from the Payroll, Marketing, and Sales databases in the Sample.Basic database.

2. **Choose the data source and data target.**
   In the case of the Opening_Inventory and Ending_Inventory members, the Inventory database is the data source and the Sample.Basic database is the data target.

3. **Decide which type of partition to use.**
   Use a replicated partition for the Opening_Inventory and Ending_Inventory members because the network connection is slow.

4. **Connect the Payroll, Marketing, and Sales databases. Perform steps step 1 through step 3 for each database.**

5. **Create the partitioned databases by performing the following tasks:**
   - Edit existing data sources, rules files, calculation scripts, report scripts, and outlines
   - Create the partitions
   - If necessary, load data into the new partitions

Now that the Sample.Basic database is partitioned, users and DBAs see the following benefits:

- Easier maintenance, because DBAs can control the downtime of local databases.
- Access to more data; users can link to new databases.
- Higher-quality data, because the databases are now synchronized (they use the same data).
Case Study 3: Linking Two Databases

Assume that TBC has two main databases—Sample.Basic and TBC.Demo. Both databases have similar outlines, but TBC.Demo has two additional dimensions:

- Channel, which describes where a product is sold
- Package, which describes how the product is packaged

The DBA for Sample.Basic notices that more users are requesting that she add channel information to Sample.Basic. But, because she does not own the data for channel information, she is reluctant to do so. Instead, she decides to allow her users to link to the TBC.Demo database, which already contains this information.

Note: This example is not shipped with Essbase.

To link two databases:

1. **Determine which data to link.**
   
   The DBA decides to link the Product dimension of Sample.Basic to the Product dimension of TBC.Demo.
   
   Users can then drill across to TBC.Demo and view the Channel and Package information.

2. **Choose the data source and the data target.**
   
   Because users start at the Sample.Basic database, it is considered the data target. Because users move to TBC.Demo, it is considered the data source.

   Note: This setup is the opposite of replicated and transparent databases, in which users move from the data target to the data source.

3. **Decide which type of partition to use.**
   
   Use a linked partition because the databases have different dimensionality.

4. **Create the partition:**
   
   - Establish a link from the Product member of Sample.Basic to the Product dimension of TBC.Demo. Remember to map the extra dimensions from TBC.Demo—Channel and Product—to void in Sample.Basic.
     
     See “Mapping Data Cubes with Extra Dimensions” on page 248.
   
   - Set up a guest account on TBC.Demo that gives the users who connect from Sample.Basic permissions to access the Channel and Package dimensions.

   To assign accounts to linked partitions, see “Choosing a Partition Type” on page 245.

After the databases are linked, users and DBAs see the following benefits:

- Users have access to more data.
- The DBA for Sample.Basic need not maintain TBC.Demo; she needs only to check the link periodically to make sure that it still works.
Creating and Maintaining Partitions

In This Chapter

- Process for Creating Partitions ................................................................. 245
- Choosing a Partition Type ........................................................................ 245
- Setting up the Data Source and the Data Target ........................................... 246
- Setting the User Name and Password ........................................................... 247
- Defining a Partition Area ........................................................................... 247
- Mapping Members .................................................................................... 247
- Validating Partitions ............................................................................... 253
- Saving Partitions ..................................................................................... 254
- Process for Maintaining Partitions ............................................................... 254
- Populating or Updating Replicated Partitions ............................................... 258
- Editing and Deleting Partitions .................................................................. 260
- Viewing Partition Information ................................................................... 260
- Partitioning and SSL ............................................................................... 260
- Troubleshooting Partitions ....................................................................... 261

Process for Creating Partitions

When you build a partition, each database in the partition uses a partition definition file to record all information about the partition, such as its data source, data target, and the areas to share. Partition creation requires Database Manager permissions or higher.

After you have created a partition, load and calculate the database that contains the partition. Loading and calculating the partition may require you to change existing rules files and calculation scripts. See Chapter 17, “Understanding Data Loading and Dimension Building” and Chapter 22, “Calculating Essbase Databases.”

Choosing a Partition Type

Decide which type of partition to create:

- Replicated
- Transparent
- Linked
Setting up the Data Source and the Data Target

Define the data source and data target, including specifying the source application and database, the target application and database, and the location of each. For a list of supported block and aggregate storage data source and data target combinations for each partition type, see “Data Sources and Data Targets” on page 221.

To set up the data source and the data target:

1. **Specify the names of the application and database for the data source and data target.**
   See “Specifying Connection Information for Partitions” in the Oracle Essbase Administration Services Online Help.

2. **Specify the locations of the Essbase Servers on which the data source and data target reside.**
   See “Specifying Connection Information for Partitions” in the Oracle Essbase Administration Services Online Help.

   If you want to use network aliases for the data source or data target names, ensure that the aliases are propagated to all computers on your system. Otherwise, use the full server name.

   To propagate an alias to all the computers on your system, edit the hosts file (you need root or administrative privileges) for the operating system you are using:
   
   - Windows: %WINDIR%/system32/drivers/etc/hosts
   - UNIX: /etc/hosts

   In the hosts file, add an entry using the following syntax:

   `IP_address hostname.domainname alias [alias]`

   The following example specifies one alias:

   `172.234.23.1 myhost.mydomain abcdefg.hijk.123`

   This example specifies multiple aliases:

   `172.234.23.1 myhost.mydomain abcdefg.hijk.123 lmnopqrs.tuvw.456`

   **Note:** Do not use localhost as an alias to specify source and target server names.

3. **Optional:** Enter a note to describe the data source or data target.
   See “Specifying Connection Information for Partitions” in the Oracle Essbase Administration Services Online Help.

4. **Optional:** Specify the outline to which you can make changes.

   By default, all changes made on the data source outline overwrite the data target outline when you synchronize the outlines. You can, however, specify that changes made to the data target outline overwrite the data source outline when you synchronize the outlines.
Setting the User Name and Password

You must specify a user name and password for Essbase to use when it communicates between the data source and the data target. The user name and password must be identical on the data source and the data target. Essbase uses this user name and password to:

- Transfer data between the data source and the data target for replicated and transparent partitions. Local security filters apply to prevent end users from seeing privileged data.
- Synchronize database outlines for all partition types.

See “Security for Partitioned Databases” on page 227.

To set the user name and password for the data source and the data target:

See “Specifying Connection Information for Partitions” in the Oracle Essbase Administration Services Online Help.

Defining a Partition Area

You can define or edit the areas of the data source to share with the data target in a partition. An area is a subcube within a database and a partition comprises one or more areas. For example, an area could be all Measures at the lowest level for Actual data in the Eastern region.

When you define a replicated area, ensure that the data source and data target contain the same number of cells. The shape of the two partitions must match. For example, if the area in the data source covers 18 cells, the data target should contain an area covering 18 cells into which to put those values. The cell count does not include the cells of attribute dimensions.

You can use substitution variables in a partition area definition, which provides flexibility in sharing different data at different times. See “Substitution Variables in Partition Definitions” on page 223.

Note: Use member names instead of their aliases to create area definitions. Although Essbase validates the aliases, the partitions will not work.

To define a partition area:

See “Defining Areas in Partitions” in the Oracle Essbase Administration Services Online Help.

Mapping Members

To create a partition, Essbase must be able to map all shared data source members to data target members. Oracle recommends that data source member names and data target member names
are the same to reduce maintenance requirements for the partition, especially when the partition is based on member attributes.

If the data source and data target contain the same number of members and use the same member names, Essbase automatically maps the members. You need only validate, save, and test the partitions. If Essbase cannot map automatically, you must map manually.

Map data source members to data target members in any of the following ways:

- Enter or select member names manually. (When you type a duplicate member name, type the qualified member name and enclose it in double quotation marks; for example, 
  "[State].[New York]"
- Import the member mappings from an external data file.
- Create area-specific mappings.

**Note:** You can use substitution variables for member names in mapping specifications. See “Substitution Variables in Partition Definitions” on page 223.

To map members, see “Defining Global Mappings in Partitions” in the *Oracle Essbase Administration Services Online Help*.

### Mapping Members with Different Names

If the data source outline and data target outline contain different members, or if the members have different names in each outline, you must map the data source members to the data target members. In the following example, the first two member names are identical, but the third member name is different:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Product</td>
</tr>
<tr>
<td>Cola</td>
<td>Cola</td>
</tr>
<tr>
<td>Year</td>
<td>Year</td>
</tr>
<tr>
<td>1998</td>
<td>1998</td>
</tr>
<tr>
<td>Market</td>
<td>Market</td>
</tr>
<tr>
<td>East</td>
<td>East_Region</td>
</tr>
</tbody>
</table>

Because you know that East in the data source corresponds to East_Region in the data target, map East to East_Region. Then, all references to East_Region in the data target point to East in the data source. For example, if the data value for Cola, 1998, East is 15 in the data source, the data value for Cola, 1998, East_Region is 15 in the data target.

### Mapping Data Cubes with Extra Dimensions

The number of dimensions in the data source and data target may vary. The following example illustrates a case where there are more dimensions in the data source outline than in the data target outline:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Product</td>
</tr>
</tbody>
</table>

248
You can map member 1997 of the Year dimension to Void in the data target. First, define the areas of the data source to share with the data target:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>@DESCENDANTS(Market), 1997</td>
<td>@DESCENDANTS(Market)</td>
</tr>
</tbody>
</table>

Then, map the data source member to Void in the data target:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>Void</td>
</tr>
</tbody>
</table>

“Void” is displayed automatically; manually entering “Void” may cause errors.

If you do not include at least one member from the extra dimension in the area definition, you will receive an error message when you attempt to validate the partition.

**Note:** When you map a member from an extra dimension, the partition results reflect data only for the mapped member. In the above example, the Year dimension contains three members: 1999, 1998, and 1997. If you map member 1997 from the data source to the data target, the partition results reflect Product and Market data only for 1997. Product and Market data for 1998 and 1999 will not be extracted.

The following example illustrates a case where the data target includes more dimensions than the data source:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Cola Market East</td>
<td>Product Cola Market East</td>
</tr>
<tr>
<td>Year 1997</td>
<td>Year 1997</td>
</tr>
</tbody>
</table>

In such cases, first define the shared areas of the data source and the data target:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>@IDESCENDANTS(Product)</td>
<td>@IDESCENDANTS(Product), East</td>
</tr>
</tbody>
</table>

You can then map member East from the Market dimension of the data target to Void in the data source:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Void</td>
<td>East</td>
</tr>
</tbody>
</table>

If member East from the Market dimension in the data target is not included in the target areas definition, you will receive an error message when you attempt to validate the partition.
Mapping Shared Members

When you create a replicated or transparent partition using a shared member, use the actual member names in the mapping. Essbase maps the actual member from the data source.

Importing Member Mappings

You can import member mappings from a text file. Mapping files must have the .txt extension. A sample member file must contain all of the following (except extra columns):

- Data source members column (left)—lists the member names in the data source. Member names containing spaces must be in quotation marks.
- Data target members column (center)—lists the member names in the data target. Member names containing spaces must be in quotes.
- Non-member column (left)—missing members. Use it to map an extra member in the data source to Void in the data target or to map an extra member in the data target to Void in the data source.
- Separators (between the columns)—tabs or spaces to separate columns.
- Extra column (right)—the file can contain extra columns that do not contain member names.

To import member mappings:

See “Importing Member Mappings for Partitions” in the Oracle Essbase Administration Services Online Help.

Mapping Attributes Associated with Members

You must accurately map attribute dimensions and members from the data source to the data target to ensure that the partition is valid.
Note: You cannot map members of attributes dimension in replicated partitions (see “Rules for Replicated Partitions” on page 229). You can, however, map attributes in transparent and linked partitions (see “Attributes in Partitions” on page 223).

In the following example, the outline for the data source contains a Product dimension with a member 100 (Cola). Children 100-10 and 100-20 are associated with member TRUE of the Caffeinated attribute dimension, and child 100-30 is associated with member FALSE of the Caffeinated attribute dimension.

The data target outline has a Product dimension with a member 200 (Cola). Children 200-10 and 200-20 are associated with member Yes of the With_Caffeine attribute dimension, and child 200-30 is associated with No of the With_Caffeine attribute dimension.

First define the areas to be shared from the data source to the data target:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>@DESCENDANTS(100)</td>
<td>@DESCENDANTS(200)</td>
</tr>
<tr>
<td>@DESCENDANTS(East)</td>
<td>@DESCENDANTS(East)</td>
</tr>
</tbody>
</table>

Then map the attributes:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>100–10</td>
<td>200–10</td>
</tr>
<tr>
<td>100–20</td>
<td>200–20</td>
</tr>
<tr>
<td>100–30</td>
<td>200–30</td>
</tr>
<tr>
<td>Caffeinated</td>
<td>With Caffeine</td>
</tr>
<tr>
<td>Caffeinated_True</td>
<td>With_Caffeine_True</td>
</tr>
<tr>
<td>Caffeinated_False</td>
<td>With_Caffeine_False</td>
</tr>
</tbody>
</table>

If you map attribute Caffeinated_True to attribute With_Caffeine_No, you receive an error message during validation. You must associate caffeinated cola from the data source to caffeinated cola in the data target.

An attribute dimension or an attribute member can exist in the outline of the data source but not in the outline of the data target, or in the outline of the data target but not in the outline for the data source. For example:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caffeinated</td>
<td></td>
</tr>
<tr>
<td>True</td>
<td></td>
</tr>
<tr>
<td>False</td>
<td></td>
</tr>
</tbody>
</table>

In such cases, you have the following choices:

- Create the Caffeinated attribute dimension and its members in the outline of the data target and associate them with the Product dimension. You can then map the attributes from the data source to the data target.
- Map the Caffeinated attribute dimension in the data source to Void in the data target.

For a comprehensive discussion of attributes, see Chapter 10, “Working with Attributes.” For a general discussion of attributes in partitions, see “Attributes in Partitions” on page 223.
Creating Advanced Area-Specific Mappings

If you can map all of the members in your data source to their counterparts in the data target using standard member mapping, you need not perform advanced area-specific mapping.

If, however, you need to control how Essbase maps members at a more granular level, you may need to use area-specific mapping, which maps members in one area to members in another area only in the context of a particular area map.

Use area-to-area mapping to do the following:

- Map data differently depending on where it is coming from.
- Map multiple members in the data source to a single member in the data target.

Because Essbase cannot determine how to map multiple members in the data source to a single member in the data target, you must logically determine how to divide your data until you can apply one mapping rule to that subset of the data. Then use that rule in the context of area-specific mapping to map the members.

To create area-specific mappings:

See “Defining Area-Specific Member Mappings in Partitions (Optional)” in the Oracle Essbase Administration Services Online Help.

Example 1: Advanced Area-Specific Mapping

The data source and data target contain the following dimensions and members:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Product</td>
</tr>
<tr>
<td>Cola</td>
<td>Cola</td>
</tr>
<tr>
<td>Market</td>
<td>Market</td>
</tr>
<tr>
<td>East</td>
<td>East</td>
</tr>
<tr>
<td>Year</td>
<td>Year</td>
</tr>
<tr>
<td>1998</td>
<td>1998</td>
</tr>
<tr>
<td>1999</td>
<td>1999</td>
</tr>
<tr>
<td>Scenario</td>
<td>Actual</td>
</tr>
<tr>
<td></td>
<td>Budget</td>
</tr>
</tbody>
</table>

The data source does not have a Scenario dimension. Instead, it assumes that past data is actual data and future data is forecast, or budget, data.

You know that 1998 in the data source should correspond to 1998, Actual in the data target and 1999 in the data source should correspond to 1999, Budget in the data target. So, for example, if the data value for Cola, East, 1998 in the data source is 15, the data value for Cola, East, 1998, Actual in the data target should be 15.

Because mapping works on members, not member combinations, you cannot simply map 1998 to 1998, Actual. Define the area (1998 and 1998, Actual) and then create area-specific mapping rules for that area.

Because the data source does not have Actual and Budget members, you also must map these members to Void in the data target.
Example 2: Advanced Area-Specific Mapping

You also can use advanced area-specific mapping if the data source and data target are structured very differently but contain the same kind of information.

This strategy works, for example, if your data source and data target contain the following dimensions and members:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>Customer_Planning</td>
</tr>
<tr>
<td>NY</td>
<td>NY_Actual</td>
</tr>
<tr>
<td>CA</td>
<td>NY_Budget</td>
</tr>
<tr>
<td>CA_Actual</td>
<td>CA_Budget</td>
</tr>
</tbody>
</table>

You know that NY and Actual in the data source should correspond to NY_Actual in the data target and NY and Budget in the data source should correspond to NY_Budget in the data target. So, for example, if the data value for NY, Budget in the data source is 28, the data value for NY_Budget in the data target should be 28.

Because mapping works on members, not member combinations, you cannot simply map NY, Actual to NY_Actual. Define the area (NY and Actual, and NY_Actual) and then create area-specific mapping rules for that area.

Because the data target does not have NY and CA members, you must also map these members to Void in the data target so that the dimensionality is complete when going from the data source to the data target.

Validating Partitions

When you create a partition, validate it to ensure its accuracy before you use it. Database Manager permissions or higher are required. After you validate, save the partition definition. If necessary, you can edit an existing partition.

When Essbase validates a partition definition, it checks on the Essbase Server for the data source and the data target to ensure that:

- The area definition is valid (contains no syntax errors).
- The specified data source members are valid and map to valid members in the data target.
- All connection information is correct; that is, the server names, database names, application names, user names, and password information.
- For linked partitions, the default user name and password that you provide are correct.
- For replicated and transparent partitions, a replication target does not overlap with a replication target; a replication target does not overlap with a transparent target; and a transparent target does not overlap with a transparent target.
- For replicated and transparent partitions, the cell count for the partition is the same on the data source and the data target.
For replicated and transparent partitions, the area dimensionality matches the data source and the data target.

You must validate a transparent partition that is based on attribute values to ensure that the results are complete. Essbase does not display an error message when results are incomplete.

After you validate, save the partition; the partition definition is saved to two `.ddb` files, on the data source server and the data target server.

To validate a partition, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Validating Partitions</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>VALIDATEPARTITIONDEFFILE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>MaxL</td>
<td>create partition</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Saving Partitions**

After you validate the partition definition, you can save the partition definition to any of the following locations:

- To both the data source server and the data target server. The partition definition is stored in two `.ddb` files.
- To a client machine. The partition definition is stored in a `.ddb` file.

**Note:** Although you can save a partition with mapping errors, operations using that partition will fail until the mapping errors are fixed.

To save a partition definition:

See “Saving Partitions” in the *Oracle Essbase Administration Services Online Help*.

**Process for Maintaining Partitions**

**Subtopics**

- Testing Partitions
- Synchronizing Outlines

The following sections describe how to maintain partitions.
Testing Partitions

To test a partition:

- View data targets using Smart View or another tool to ensure that the user sees the correct data.
- When testing a linked partition, ensure that Essbase links you to the expected database and that the default user name and password work correctly.

Synchronizing Outlines

Subtopics

- Setting the Source Outline and the Target Outline
- Performing Block Storage Outline Synchronization
- Tracking Changes
- Updating Shared Members During Outline Synchronization

When you partition a database, Essbase must be able to map each dimension and member in the data source outline to the appropriate dimension and member in the data target outline. After you map the two outlines to each other, Essbase can make the data in the data source available from the data target, as long as the outlines are synchronized and the partition definitions are up-to-date.

If you make changes to one outline, the two outlines are no longer synchronized. Although Essbase makes whatever changes it can to replicated and transparent partitions when the outlines are not synchronized, Essbase may not be able to make the data in the data source available in the data target.

Essbase tracks changes that you make to block storage outlines and provides tools to keep your block storage outlines synchronized.

**Note:** Essbase does not enable automatic synchronization of aggregate storage outlines. You must manually make the same changes to the source and target outlines.

Setting the Source Outline and the Target Outline

Before you can synchronize block storage outlines, you must determine which outline is the source outline and which is the target outline.

- The source outline is the outline from which outline changes are taken.
- The target outline is the outline to which outline changes are applied.

By default, the source outline is from the same database as the data source; that is, outline and data changes flow in the same direction. For example, if the East database is the data source and the Company database is the data target, the default source outline is East.
You can also use the data target outline as the source outline. Consider this method if the structure of the outline (its dimensions, members, and properties) is maintained centrally at a corporate level, while the data values in the outline are maintained at the regional level (for example, East). Administrators can make changes in the Company outline and apply those changes to each regional outline when the outline is synchronized.

- If you make changes to the shared area in the source outline, you can propagate them to the target outline when you synchronize the outlines.
- If you make changes to the target outline, those changes cannot be propagated back to the source outline when you synchronize the outlines. To move these changes up to the source outline, make those changes in Outline Editor. See Chapter 7, “Creating and Changing Database Outlines.”

Essbase updates as many changes as possible to the target outline. If Essbase cannot apply all changes, a warning message prompts you to see the application log for details. Messages that pertain to outline synchronization are prefixed with OUTLINE SYNC. See “Viewing the Essbase Server and Application Logs” on page 739.

To set the source outline, see “Setting up the Data Source and the Data Target” on page 246.

**Performing Block Storage Outline Synchronization**

To synchronize block storage outlines, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Synchronizing Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>refresh outline</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETPARTITIONOTLCHANGES</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>APPLYOTLCHANGEFILE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RESETOTLCHANGETIME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PURGEOTLCHANGEFILE</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** For synchronizing non-Unicode-mode outlines with multibyte characters, you can use only non-Unicode clients such as ESSCMD or MaxL statements executed through the MaxL Shell.

Outline synchronization cannot be performed on an outline containing a Dynamic Calc member that has many (approximately 100 or more) children.

**Tracking Changes**

This topic describes the process for changing the source outline and synchronizing the target outline with the source outline.

- When you make changes to the source outline, Essbase takes the following actions:
1. Records the changes in a change log named `essxxxx.chg`, where `xxxxx` is the number of the partition. If you have multiple partitions on a source outline, Essbase creates a change log for each partition.

2. Creates or updates the outline change timestamp for that partition in the partition definition (.ddb) file. Each partition defined against the source outline has a separate timestamp in the .ddb file.

- **When you pull changes from the outline source, Essbase takes the following actions:**
  
  1. Compares the last updated timestamp in the target outline .ddb file to the last updated timestamp in the source outline backup (.dbb) file. Essbase updates the target timestamp when it finishes synchronizing the outlines using the last updated time on the source outline, even if the two outlines are on servers in different time zones.
  
  2. If the source outline has changed since the last synchronization, Essbase retrieves those changes from the source outline change log and places them in the target outline change log. The change logs may have different names on the source outline and the target outline.

- **When you select the changes to apply to the target outline, Essbase takes the following actions:**
  
  1. Applies the changes to the target outline.
  
  2. Updates the timestamp in the target outline’s .ddb file, using the time from the source outline.

---

**Caution!** If you choose not to apply some changes, you cannot apply those changes later.

---

**Updating Shared Members During Outline Synchronization**

An actual member and its shared members in the source outline are propagated to the target outline if at least one actual or shared member is defined in the partition area. As illustrated in Figure 59, the partition definition is `@IDESC("Diet")`. The parent 100 and its children (100-10, 100-20, 100-30) are not defined in the partition area. The parent `Diet` and its children (100-10, 100-20, 100-30) are defined in the partition area. The children of `Diet` are shared members of the actual members.
If you make a change to an actual member in the undefined partition area, such as adding an alias to the 100-10 actual member, that change is propagated to the target outline because it is associated with a shared member in the defined partition area.

The reverse is also true. If a shared member is not in the partition area and its actual member is, a change to the shared member in the undefined area is propagated to the target outline.

Any change made to a member that does not have at least one actual member (or shared member) in the defined partition area is not propagated to the target outline. For example, in Figure 59, a change to the parent 100 is not propagated to the target outline because it is in the undefined partition area and does not have an associated shared member in the defined partition area.

If a shared member is included in the partition area, it is recommended to include its parent. In the above example, the parent Diet is included in the outline because its children are shared members and in the defined partition area.

Implied shared members are treated the same as shared members during outline synchronization. Actual members and their implied shared members in the source outline are propagated to the target outline if at least one actual or implied shared member is defined in the partition definition.

Using the partition definition as @CHILD("A") in the example in Figure 60, A1 and A2 are in the defined partition area, and A11, A21, and A22 are in the undefined partition area. Although A11 (implied shared member) is in the undefined partition area, a change to A11 is propagated to the target outline because its parent, A1, is in the defined partition area. The change to the children A21 and A22 is not propagated to the target outline because these members are not defined in the partition area and are not associated with a member that is in the defined partition area.

The reverse is true again. If A1 is not defined in the partition area and its implied shared member is, any change to A1 is propagated to the target outline.

Figure 60  Implied Shared Members and Outline Synchronization

Populating or Updating Replicated Partitions

The administrator should regularly update data in a replicated partition. How frequently you update replicated partitions depends on user requirements for up-to-the-minute data. Essbase keeps track of when the data source was last changed and when the data target was last updated so that you can determine when to update replicated partitions. This information is saved at the data source. The administrator of either the data source site or data target site can be responsible for replicating data.
Essbase also tracks which cells in a partition are changed:

- Faster—Only the cells that have changed since the last replication
- Slower—All cells

The slower update is useful under certain conditions; for example, updating all cells to recover lost data at the target.

Follow these guidelines:

- Unless you update all cells, replication does not update target data when the source data has not changed since the last replication.
- By default, Essbase replicates #MISSING cells. If you do not want to replicate #MISSING cells, you can use the DISABLEREPLMISSINGDATA configuration setting in the essbase.cfg file. See the Oracle Essbase Technical Reference.
- If you deleted data blocks on the data source, Essbase updates all data cells at the data target, even if you choose to update only changed cells. You can delete data blocks at the data source using any of these methods:
  - Using the CLEARDATA command in a calculation script
  - Using “Clear combinations” in your rules file during a data load
  - Issuing CLEAR UPPER, CLEAR INPUT or RESETDB commands in Administration Services;
  - Restructuring the database keeping only level 0 or input data
  - Deleting sparse members

You can replicate:

- All data targets connected to a data source.
  For example, if you replicate all data targets connected to the Sampeast.East database, Essbase updates the Budget, Actual, Variance, and Variance % members in the Samppart.Company database:
- From all data sources connected to a data target.
  For example, if you replicate from all data sources connected to the Samppart.Company database, Essbase pulls the Budget, Actual, Variance, and Variance % members from the Sampeast.East database and updates them in the Samppart.Company database.

To update a replicated partition, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Replicating Data</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>refresh replicated partition</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Editing and Deleting Partitions

When you edit a partition, you use the same interface as for creating the partition.

When you delete a partition, Essbase deletes the partition definition from the .ddb file on the data source and data target servers.

➤ To edit or delete a partition:

See “Opening the Create or Edit Partition Window” and “Deleting Partitions” in the Oracle Essbase Administration Services Online Help.

Viewing Partition Information

➤ To view information about a partition, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Opening the Create or Edit Partition Window</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display partition</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>PRINTPARTITIONDEFFILE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Partitioning and SSL

The following considerations apply when partitioning in secure (SSL) mode:

- The partition source and target must have the same security protocol; for example, both or neither use SSL.
- To enable Essbase to use SSL connectivity, you must set ENABLESECUREMODE to TRUE.
- Consider setting CLIENTPREFERREDMODE to SECURE.

If CLIENTPREFERREDMODE is not set, or is set to FALSE, but ENABLESECUREMODE is set to TRUE, you can securely create and refresh partitions in MaxL by adding :secure to the HOST-NAME string. For example,

```plaintext
login esbuser esbpassword on "localhost:6423:secure";
```
## Troubleshooting Partitions

The following table lists common problems that you may encounter when using partitions.

### Table 37  Troubleshooting Problems with Partitions

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>When replicating to multiple data targets, some are not replicated.</td>
<td>The connection between the data source and one of the data targets was lost during the replication operation.</td>
<td>Retry the replication operation. If one database is unavailable, replicate into only the available databases.</td>
</tr>
<tr>
<td>Not all information arrived at the data target.</td>
<td>The data source and the data target outlines are no longer mappable.</td>
<td>Synchronize outlines for the data source and the data target and try again.</td>
</tr>
<tr>
<td>A new or recently changed partition is validated and saved but does not function.</td>
<td>The partition may have a circular dependency. If database A is the source for database B, database B cannot be source for database A for the same slice.</td>
<td>Edit the partition definition to remove the circular dependency.</td>
</tr>
<tr>
<td>You keep running out of ports. Partitions connect to other databases using ports.</td>
<td></td>
<td>Purchase more ports.</td>
</tr>
<tr>
<td>When you try to access a partition, you cannot connect to it.</td>
<td>Someone has deleted, renamed, or moved the application containing the database to which you are trying to connect.</td>
<td>Edit the partition having problems to specify the new application name or location.</td>
</tr>
<tr>
<td>Partitioned databases no longer can connect to each other.</td>
<td>Your host names may not match. Did you use the hosts file to provide aliases to your local machine? See “Setting up the Data Source and the Data Target” on page 246.</td>
<td>Ensure that the host names are synchronized between the servers.</td>
</tr>
<tr>
<td>Essbase overwrites user edits. Users are changing data at a replicated partition that you overwrite each time you update the partition.</td>
<td>Users are changing data at a replicated partition that you overwrite each time you update the partition.</td>
<td>Set the partition to disallow user updates, or explain to users why their data disappears.</td>
</tr>
<tr>
<td>Administration Services does not reflect outline changes; that is, it lists the outlines as being in sync although one outline has changed.</td>
<td>Was the target outline changed, but not the source outline? Essbase propagates changes only to the source outline. Does the outline change affect a defined partition? Essbase does not propagate changes to the outline that do not affect any partitions.</td>
<td>Examine the partition definition.</td>
</tr>
<tr>
<td>Data is confusing.</td>
<td>Your partition may not be set up correctly.</td>
<td>Check your partition to ensure that you are partitioning the data that you need.</td>
</tr>
<tr>
<td>Moved members or dimensions in the source outline are not reflected properly in a synchronized target outline.</td>
<td>Moving a dimension past a dimension that is not in the partition may not get propagated to the target during outline synchronization. Also, moving a member past a member that is not in the partition may not get propagated.</td>
<td>Structure your outline so that members and dimensions are not moved across partitions. If doing so is not possible, change the target outline to reflect the source outline moved members or dimensions.</td>
</tr>
</tbody>
</table>
Part III

Building Dimensions and Loading Data

In Building Dimensions and Loading Data:

- Understanding Data Loading and Dimension Building
- Working with Rules Files
- Using a Rules File to Perform Operations on Records, Fields, and Data
- Performing and Debugging Data Loads or Dimension Builds
- Understanding Advanced Dimension Building Concepts
Understanding Data Loading and Dimension Building

In This Chapter

Introduction........................................................................................................ 265
Process for Data Loading and Dimension Building........................................266
Data Sources.................................................................................................... 266
Rules Files....................................................................................................... 271
Situations that Do and Do Not Need a Rules File............................................ 272
Data Sources that Do Not Need a Rules File.................................................. 273
Security and Multiple-User Considerations.................................................... 276

The information in this chapter applies to block storage databases and aggregate storage database. As some rules file options and data source requirements vary for aggregate storage databases, also see “Preparing Aggregate Storage Databases” on page 949.

Introduction

An Essbase database contains dimensions, members, and data values.

- Loading data is the process of adding data values to an Essbase database from a data source, such as a Microsoft Excel spreadsheet or SQL database. If the data source is not perfectly formatted, you need a rules file to load the data values.

- Building dimensions is the process of loading dimensions and members to an Essbase database outline by using a data source and a rules file. You can also use Outline Editor to add dimensions and members manually.

- If you use the Essbase API, XML outline editing enables you to use an XML file to make basic changes to the database outline without needing to use a rules file nor invoke the Outline API. To perform XML outline editing, you reference a provided .xsd file, create an .xml file, and call the C Main API function EssBuildDimXML (or the Java API method buildDimensionXml). For more information, see EssBuildDimXML in the Oracle Essbase API Reference.

To use the XML outline editing feature, aggregate storage outlines that were created in an earlier release of Essbase must first be migrated to the current release. Once an aggregate storage outline is migrated, it cannot be edited in an earlier release client. Block storage outlines created in an earlier release of Essbase can use XML outline editing without needing to migrate the outline.
In the remainder of this chapter, all content pertains to non-API methods of data loading and dimension building.

**Process for Data Loading and Dimension Building**

To load data values or dimensions and members into an Essbase database, follow these steps:

1. Set up the data source.
   - If you are not using a rules file, you must set up the data source outside Essbase. See “Data Sources” on page 266.
2. If necessary, set up the rules file.
   - See “Rules Files” on page 271.
3. Perform the data load or dimension build.
   - See Chapter 20, “Performing and Debugging Data Loads or Dimension Builds.”

**Data Sources**

Data sources contain the information that you want to load into the Essbase database. A data source can contain:

- Data values
- Information about members, such as member names, member aliases, formulas, and consolidation properties
- Generation and level names
- Currency name and category
- Data storage properties
- Attributes
- UDAs

The following sections describe the components of any kind of data source.

**Supported Data Sources**

Essbase supports the following types of data sources:

- Text files (flat files) from text backups or external sources
- SQL data sources
- Essbase export files (export files do not need a rules file to load)
- Microsoft Excel spreadsheet files
- Spreadsheet audit log files
Note: When using spreadsheet files to load data or build an outline in Essbase, the spreadsheet files must reside on a Windows computer, regardless of the tool you use. Spreadsheet files that reside on a UNIX computer or are transferred via FTP to a UNIX computer are not supported. If Essbase Administration Server is installed on a UNIX computer, data loads and dimension builds from client-side spreadsheet files are not supported.

To avoid rules file, data load, and dimension build errors, remove formatting in Microsoft Excel data source files; for example, in Excel, set color to “Automatic” and “No Fill,” and remove font settings such as bold and italic.

Items in a Data Source

As illustrated in Figure 61, a data source comprises records, fields, and field delimiters.

- A record is a structured row of related fields.
- A field is an individual value.
- A delimiter indicates that a field is complete and that the next character in the record starts another field.

Essbase reads data sources starting at the top and proceeding from left to right.

Figure 61 Records and Fields

As illustrated in Figure 62, data sources can contain dimension fields, member fields, member combination fields, and data fields.

Figure 62 Kinds of Fields

- Dimension fields identify the dimensions of the database, such as Market. Use dimension fields to tell Essbase the order of the dimensions in the data source. In Figure 62, for example, the dimension fields are Market, Product, Year, Measures, and Scenario. Fields in the Market
column, such as Texas, are members of the Market dimension, and fields in the Product column, such as 100-10, are members of the Product dimension. Although you can set dimension fields in the data source, usually you define dimension fields in the rules file.

- Member fields identify the members or member combinations of the specified dimensions. Use member fields to tell Essbase to which members to map new data values, or which members to add to the outline. In Figure 62, for example, Texas, 100-10, Jan, Sales, and Actual are member fields.

- Data fields contain the numeric data values that are loaded into the intersections of the members of the database. Each data value must map to a dimension intersection. In Figure 62, for example, 42 is the data value that corresponds to the intersection of Texas, 100-10, Jan, Sales, and Actual.

You can specify information in the header and in an individual record. In the following example, 100 is the data value that corresponds to the intersection of Jan, Actual, Cola, East, Sales, and 200 is the data value that corresponds to the intersection of Jan, Actual, Cola, West, Sales.

<table>
<thead>
<tr>
<th>Jan, Actual</th>
<th>Cola</th>
<th>East</th>
<th>Sales</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cola</td>
<td>East</td>
<td>Sales</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>Cola</td>
<td>South</td>
<td>Sales</td>
<td></td>
<td>300</td>
</tr>
</tbody>
</table>

Data fields are used only for data loading; dimension builds ignore data fields.

The following sections describe each item in a data source.

Valid Dimension Fields

In a data load, if the data source does not identify every dimension in the Essbase database, the rules file must identify the missing dimensions. For example, the Sample.Basic database has a dimension for Year. If several data sources arrive with monthly numbers from different regions, the month itself may not be specified in the data sources. You must specify the month in the data source header or the rules file. See “Defining Header Records” on page 295.

A dimension field must contain a valid dimension name. If you are not performing a dimension build, the dimension must already exist in the database. If you are performing a dimension build, the dimension name can be new, but the new name must be specified in the rules file.

Valid Member Fields

A member field can contain the name of a valid member or an alias. In Figure 62 on page 267, for example, Texas and Ohio are valid members of the Market dimension. A blank member field inherits the member name from the previous record. Essbase must know how to map each member field of the data source to a member of the database.

To be valid, a member field must meet the following criteria:

- The member field must contain or inherit a valid member name or member property. See “Using the Data Source to Work with Member Properties” on page 283. If you are not
performing a dimension build, the member must already exist in the outline. If you are performing a dimension build, the member can be new.

- Either the data source or the rules file must specify which dimension each member field maps to.
- A member field can map to a single member name, such as Jan (which is a member of the Year dimension), or to a member combination, such as Jan, Actual (which are members of the Year and Scenario dimensions).
- Member names that contain the same character as the file delimiter must be surrounded by double quotation marks. For example, if the data source is delimited by spaces, ensure that a member containing spaces, such as “New York,” is enclosed by double quotation marks. If you are performing a data load without a rules file, member names containing some other characters also must be enclosed by quotation marks. See “Data Sources that Do Not Need a Rules File” on page 273.

When a rules file is not used, blank dimension and member fields are valid. When Essbase encounters a blank dimension or member field while loading data without a rules file, it uses the last dimension or member name encountered for that dimension or member column.

**Note:** While it processes each record in a data source for a data load, Essbase does not check to ensure that a member specified in a member field belongs to the dimension specified for the dimension field. Essbase loads the data value to the data cell identified by the member combination in the record. In Figure 62 on page 267, for example, if the second record reversed Jan and Sales (Texas, '100-10', Sales, Jan, Actual, 42), Essbase would load 42 to the correct data cell. The exception is for fields in the rules file set as dimension reference method.

**Valid Data Fields**

If you are performing a dimension build, skip this section. Data fields are ignored during a dimension build.

Either the data source or the rules file must contain enough information for Essbase to determine where to put each data value. A data field contains the data value for its intersection in the database. In Figure 62 on page 267, for example, 42 is a data field. It is the dollar sales of 100-10 (Cola) in Texas in January.

In a data field, Essbase accepts numbers and their modifiers, with no spaces or separators between them, and the text strings #MI and #MISSING, as listed in Table 38.

<table>
<thead>
<tr>
<th>Valid Modifiers</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency symbols:</td>
<td>$12 is a valid value.</td>
</tr>
<tr>
<td>- Dollar $</td>
<td>$ 12 is not a valid value because there is a space between the dollar sign and the 12.</td>
</tr>
<tr>
<td>- Euro €</td>
<td></td>
</tr>
<tr>
<td>- Yen ¥</td>
<td></td>
</tr>
<tr>
<td>Valid Modifiers</td>
<td>Examples</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------</td>
</tr>
<tr>
<td>Parentheses around numbers to indicate a negative number</td>
<td>(12)</td>
</tr>
<tr>
<td>Minus sign before numbers. Minus signs after numbers are not valid.</td>
<td>-12</td>
</tr>
<tr>
<td>Decimal point</td>
<td>12.3</td>
</tr>
<tr>
<td>Large numbers with or without commas</td>
<td>1,345,218 and 1345218 are valid values.</td>
</tr>
<tr>
<td>#MI or #MISSING to represent missing or unknown values</td>
<td>See “Placing Text in Empty Fields” on page 300.</td>
</tr>
</tbody>
</table>

If the data source contains a member field for every dimension and one field that contains data values, you must define the field that contains data values as a data field in the rules file. To read the following data source into the Sample.Basic database, for example, define the last field as a data field.

<table>
<thead>
<tr>
<th>Jan</th>
<th>Cola</th>
<th>East</th>
<th>Sales</th>
<th>Actual</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb</td>
<td>Cola</td>
<td>East</td>
<td>Sales</td>
<td>Actual</td>
<td>200</td>
</tr>
</tbody>
</table>

To define a data field:

See “Defining Columns as Data Fields” in the Oracle Essbase Administration Services Online Help.

If the data source contains blank fields for data values, replace them with #MI or #MISSING. If there is no value in the data field (or the value is #MISSING), Essbase does not change the existing data value in the database. Essbase does not replace current values with empty values.

Valid Delimiters

You must separate fields from each other with delimiters. If you are loading data without a rules file, you must use spaces to delimit fields.

If you are using a rules file, delimiters can be any of the following:

- Tabs (default)
- Spaces
- New lines
- Carriage returns
- Commas

Extra Delimiters Without a Rules File

In data sources that are loaded without a rules file, Essbase ignores extra delimiters. In the following example, the fields are separated by spaces. Essbase ignores the extra spaces between the fields.

<table>
<thead>
<tr>
<th>East</th>
<th>Cola</th>
<th>Actual</th>
<th>Jan</th>
<th>Sales</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>Cola</td>
<td>Actual</td>
<td>Feb</td>
<td>Sales</td>
<td>21</td>
</tr>
<tr>
<td>East</td>
<td>Cola</td>
<td>Actual</td>
<td>Mar</td>
<td>Sales</td>
<td>30</td>
</tr>
</tbody>
</table>

270
**Extra Delimiters with a Rules File**

In data sources that are loaded with a rules file, Essbase reads extra delimiters as empty fields. For example, if you try to use a rules file to load the file below into the Sample.Basic database, the load fails. Essbase reads the extra comma between East and Cola in the first record as an extra field. Essbase then puts Cola into Field 3. In the next record, however, Cola is in Field 2. Essbase expects Cola to be in Field 3 and stops the data load.

```
East,,Cola,Actual,Jan,Sales,10
East,Cola,Actual,Feb,Sales,21
East,Cola,Actual,Mar,Sales,30
```

To resolve the problem, delete the extra delimiter from the data source.

**Valid Formatting Characters**

Essbase views some characters in the data source as formatting characters only. Essbase ignores the characters listed in Table 39:

<table>
<thead>
<tr>
<th>Formatting Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>==</td>
<td>Multiple equal signs, such as for double underlining</td>
</tr>
<tr>
<td>--</td>
<td>Multiple minus signs, such as for single underlining</td>
</tr>
<tr>
<td>_ _</td>
<td>Multiple underscores</td>
</tr>
<tr>
<td>==</td>
<td>Multiple IBM PC graphic double underlines (ASCII character 205)</td>
</tr>
<tr>
<td>_ _</td>
<td>Multiple IBM PC graphic single underlines (ASCII character 196)</td>
</tr>
</tbody>
</table>

Ignored fields do not affect the data load or dimension build.

For example, Essbase ignores the equal signs in the following data source and loads the other fields normally.

```
East  Actual  "100-10"
Sales  Marketing
      =====  =========
Jan    10     8
Feb    21     16
```

**Rules Files**

Rules define operations that Essbase performs on data values or on dimensions and members when it processes a data source. Use rules to map data values to an Essbase database or to map dimensions and members to an Essbase outline.
Rules are stored in rules files. A rules file defines which build method to use, whether data values or members are sorted or are in random order, and how to transform data values or members before loading them. It is best to create a separate rules file for each dimension.

Essbase reads the data values or members in the data source, changes them based on the rules in the rules file, and loads the changed data values into the database and the changed members into the outline. Essbase does not change the data source. You can reuse a rules file with any data source that requires the same set of rules.

After you create a dimension build rules file, you may want to automate the process of updating dimensions. See Appendix E, “Using ESSCMD.”

**Situations that Do and Do Not Need a Rules File**

You need a rules file if the data source does not map perfectly to the database or if you are performing any of the following tasks:

- Loading data from a SQL data source
- Building dimensions
  - Adding dimensions and members to the database
  - Changing existing dimensions and members in the database
- Changing the data in any way, including the following:
  - Ignoring fields or strings in the data source
  - Changing the order of fields by moving, joining, splitting, or creating fields
  - Mapping the data in the data source to the database by changing strings
  - Changing the data values in the data source by scaling data values or by adding data values to existing data values in the data source
  - Setting header records for missing values
  - Rejecting an invalid record and continuing the data load

You do not need a rules file if you are performing a data load and the data source maps perfectly to the database. See “Data Sources that Do Not Need a Rules File” on page 273.
**Note:** If you are using a rules file, the number of fields in each record in the rules file must match. See “Dealing with Missing Fields in a Data Source” on page 309.

### Data Sources that Do Not Need a Rules File

If you are performing a dimension build, skip this section.

If a data source contains all of the information required to load the data values in it into the database, you can load the data source directly in a free-form data load.

To load a data value successfully, Essbase must encounter one member from each dimension before encountering the data value. For example, in Figure 62, Essbase loads the data value 42 into the database with the members Texas, 100-10, Jan, Sales, and Actual. If Essbase encounters a data value before a member of each dimension is specified, it stops loading the data source.

To map perfectly, a data source must contain all of the following and nothing else:

- One or more valid members from each dimension. A member name must be enclosed in quotation marks if it contains any of the following:
  - Spaces
  - Numeric characters (0–9)
  - Dashes (minus signs, hyphens)
  - Plus signs
  - Ampersands (&)

  If you are performing a data load without a rules file, when Essbase encounters an invalid member field, it stops the data load even if the Abort on Error flag is not set to true. Essbase loads all fields read before the invalid field into the database, resulting in a partial load of the data values. See “Loading Dimension Build and Data Load Error Logs” on page 753.

- One or more valid data values. See “Valid Data Fields” on page 269.

  If the data source contains blank fields for data values, replace the blank fields with #MI or #MISSING. Otherwise, the data values may not load correctly.

- Valid delimiters. See “Valid Delimiters” on page 270.

The fields in the data source must be formatted in an order that Essbase understands. The simplest way to format a record is to include a member from each dimension and a data field, as illustrated below:

```
Sales "100-10" Ohio Jan Actual 25
Sales "100-20" Ohio Jan Actual 25
Sales "100-30" Ohio Jan Actual 25
```

An incorrectly formatted data source will not load. You can edit the data source using a text editor and fix the problem. If you must perform many edits (such as moving several fields and records), consider using a rules file to load the data source. See “Rules Files” on page 271.

The following sections describe more complicated ways to format free-form data sources.
Formatting Ranges of Member Fields

If you are performing a dimension build, skip this section.

You can express member names as ranges within a dimension. For example, Sales and COGS form a range in the Measures dimension. Ranges of member names can handle a series of values.

A data source can contain ranges from multiple dimensions at a time. In the example below, Jan and Feb form a range in the Year dimension and Sales and COGS form a range in the Measures dimension.

<table>
<thead>
<tr>
<th>Actual</th>
<th>Texas</th>
<th>Sales</th>
<th>COGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>Feb</td>
<td>Jan</td>
<td>Feb</td>
</tr>
<tr>
<td>&quot;100-10&quot;</td>
<td>98</td>
<td>89</td>
<td>26</td>
</tr>
<tr>
<td>&quot;100-20&quot;</td>
<td>87</td>
<td>78</td>
<td>23</td>
</tr>
</tbody>
</table>

Notice that Sales is defined for the first two columns and COGS for the last two columns.

The following sections describe additional types of ranges.

Setting Ranges Automatically

If you are performing a dimension build, skip this section.

When Essbase encounters multiple members from the same dimension with no intervening data fields, it sets up a range for that dimension. The range stays in effect until Essbase encounters another member name from the same dimension, at which point Essbase replaces the range with the new member or new member range.

The following example contains a range of Jan to Feb in the Year dimension. It remains in effect until Essbase encounters another member name, such as Mar. When Essbase encounters Mar, the range changes to Jan, Feb, Mar.

<table>
<thead>
<tr>
<th>Texas</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>Jan</td>
</tr>
<tr>
<td>&quot;100-10&quot;</td>
<td>98</td>
</tr>
<tr>
<td>&quot;100-20&quot;</td>
<td>87</td>
</tr>
</tbody>
</table>

Handling Out of Range Data Values

If you are performing a dimension build, skip this section.

When Essbase encounters a member range, it assumes that there is a corresponding range of data values. If the data values are not in the member range, the data load stops. Essbase loads any data fields read before the invalid field into the database, resulting in a partial data load.

The following example contains more data fields than member fields in the defined range of members. The data load stops when it reaches the 10 data field. Essbase loads the 100 and 120 data fields into the database.

<table>
<thead>
<tr>
<th>Cola</th>
<th>Actual</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan</td>
<td>Feb</td>
</tr>
<tr>
<td>Sales</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>COGS</td>
<td>30</td>
<td>34</td>
</tr>
</tbody>
</table>
Interpreting Duplicate Members in a Range

If you are performing a dimension build, skip this section.

Structure ranges in the source data so that Essbase interprets them correctly. If a member appears more than once in a range, Essbase ignores the duplicates.

The following example shows duplicate members for Actual, Budget, Sales, and Budget and two ranges: Actual to Budget and Sales to COGS. Essbase ignores the duplicate instances of Actual, Budget, Sales, and COGs (for example, in the second line in the example, the second Actual and second Actual are ignored):

```
Cola   East
       Actual   Budget   Actual   Budget
       Sales    Sales    COGS     COGS
Jan    108     110     49      50
Feb    102     120     57      60
```

For Actual, the first member of the first range, Essbase maps data values to each member of the second range (Sales and COGS). Essbase then proceeds to the next value of the first range, Budget, similarly mapping values to each member of the second range. As a result, Essbase interprets the file as shown below:

```
Cola   East
       Actual   Budget
       Sales    COGS    Sales    COGS
Jan    108     110     49      50
Feb    102     120     57      60
```

Reading Multiple Ranges

If you are performing a dimension build, skip this section.

As Essbase scans a file, it processes the most recently encountered range first when identifying a range of data values. The example above contains two ranges: Actual and Budget and Sales and COGS. While reading the file from left to right and top to bottom, Essbase encounters the Actual and Budget range first and the Sales and COGS range second. Because the Sales and COGS range is encountered second, Essbase puts data fields in the Sales and COGS part of the database first.

Formatting Columns

If you are performing a dimension build, skip this section.

Files can contain columns of fields. Essbase supports loading data from symmetric columns or asymmetric columns.
Symmetric Columns

If you are performing a dimension build, skip this section. Dimension builds require a rules file.

Symmetric columns have the same number of members under them. In the following example, each dimension column has one column of members under it. For example, Product has one column under it (100-10 and 100-10) and Market has one column under it (Texas and Ohio).

<table>
<thead>
<tr>
<th>Product</th>
<th>Measures</th>
<th>Market</th>
<th>Year</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;100-10&quot;</td>
<td>Sales</td>
<td>Texas</td>
<td>Jan</td>
<td>Actual</td>
</tr>
<tr>
<td>&quot;100-10&quot;</td>
<td>Sales</td>
<td>Ohio</td>
<td>Jan</td>
<td>Actual</td>
</tr>
</tbody>
</table>

The columns in the following file are also symmetric, because Jan and Feb have the same number of members under them:

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>Budget</td>
</tr>
<tr>
<td>Actual</td>
<td>Budget</td>
</tr>
</tbody>
</table>

Asymmetric Columns

If you are performing a dimension build, skip this section.

Asymmetric columns have different numbers of members under them. In the following example, the Jan and Feb columns are asymmetric because Jan has two columns under it (Actual and Budget) and Feb has one column under it (Budget):

<table>
<thead>
<tr>
<th>Jan</th>
<th>Jan</th>
<th>Feb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>Budget</td>
<td>Actual</td>
</tr>
<tr>
<td>Actual</td>
<td>Budget</td>
<td></td>
</tr>
</tbody>
</table>

If a file contains asymmetric columns, label each column with the appropriate member name.

The example above is valid because the Jan label is now over Actual and Budget. It is clear to Essbase that both columns map to Jan.

The following example is not valid because the column labels are incomplete. The Jan label must appear over the Actual and Budget columns.

<table>
<thead>
<tr>
<th>Jan</th>
<th>Jan</th>
<th>Feb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>Budget</td>
<td>Actual</td>
</tr>
<tr>
<td>Actual</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Security and Multiple-User Considerations

Essbase supports concurrent multiple users reading and updating the database; therefore, users can use the database while you are dynamically building dimensions, loading data, or calculating the database. In a multi-user environment, Essbase protects data by using the security system described in Chapter 39, “User Management and Security in EPM System Security Mode”.

- Security Issues
The security system prevents unauthorized users from changing the database. Only users with write access to a database can load data values or add dimensions and members to the database. Write access can be provided globally or by using filters.

- **Multi-User Data Load Issues**
  
  You can load data values while multiple users are connected to a database. Essbase uses a block locking scheme for handling multi-user issues. When you load data values, Essbase does the following:
  
  - Locks the block it is loading into so that no one can write to the block.
    
    See Chapter 50, “Ensuring Data Integrity” for information on Essbase transaction settings, such as identifying whether other users get read-only access to the locked block or noting how long Essbase waits for a locked block to be released.
  
  - Updates the block.
    
    See “Data Locks” on page 778 for information on whether Essbase unlocks a block when its update is complete or waits for the entire data load to complete before unlocking the block.

- **Multi-User Dimension Build Issues**

  You cannot build dimensions while other users are reading or writing to the database. After you build dimensions, Essbase restructures the outline and locks the database for the duration of the restructure operation.
Process for Creating Data Load Rules Files

To create a data load rules file:

1. Determine whether to use the same rules file for data loads and dimension builds.
   
   See “Combining Data Load and Dimension Build Rules Files” on page 280.

2. Create a rules file.
   
   See “Creating Rules Files” on page 281.

3. Set the file delimiters for the data source.
   
   See “Setting File Delimiters” on page 282.

4. Map each rules file field to the data source and define field properties.
   
   See “Defining Data Load Field Properties” on page 288.
5. If necessary, set record, field, and data operations to change the data in the data source during loading.
   See Chapter 19, “Using a Rules File to Perform Operations on Records, Fields, and Data.”
   See “Setting Dimension Build Operational Instructions” on page 288.

**Process for Creating Dimension Build Rules Files**

To create a dimension build rules file:

1. Determine whether to use the same rules file for data loads and dimension builds.
   See “Combining Data Load and Dimension Build Rules Files” on page 280.
2. Create a rules file.
   See “Creating Rules Files” on page 281.
3. Set the file delimiters for the data source.
   See “Setting File Delimiters” on page 282.
4. If you are creating a dimension, name the dimension.
   See “Naming New Dimensions” on page 282.
5. Select the build method.
   See “Selecting a Build Method” on page 282.
6. If necessary, change or set the properties of members and dimensions you are building.
   See “Setting and Changing Member and Dimension Properties” on page 283.
7. If necessary, set record and field operations to change the members in the data source during loading.
   See Chapter 19, “Using a Rules File to Perform Operations on Records, Fields, and Data.”
8. Set field type information, including field type, field number, and dimension.
   See “Setting Field Type Information” on page 285.
   See “Setting Dimension Build Operational Instructions” on page 288.

**Combining Data Load and Dimension Build Rules Files**

Before building a rules file, you must decide whether the rules file will be used for data loads and dimension builds, for only data loads, or for only dimension builds. After you create a rules file, you cannot separate it into two rules files. Similarly, you cannot merge two rules files into one file.
Use the same rules file for both data load and dimension build if you plan to load the data source and build new dimensions simultaneously.

Use separate rules files for data load and dimension build under any of the following circumstances:

- To build an outline from scratch
- To perform different field operations during the data load and dimension build
- To reuse the data load or dimension build rules file separately
- To use data sources that contain no data values, only dimensions

## Creating Rules Files

A rules file tells Essbase what changes to make to the data source and outline during a data load or dimension build.

**Note:** In rules files, record size is limited to 64 KB.

To create a rules file:

1. **If you are creating the rules file on the Essbase Server, connect to the server.**
   
   Connecting to the server is not necessary if you are creating the rules file on the client.

2. **Open Data Prep Editor.**
   
   See “Creating Rules Files” or “Opening Rules Files” in the Oracle Essbase Administration Services Online Help.
   
   You can open Data Prep Editor with a new or existing rules file. After you open Data Prep Editor, put the editor in the correct mode. See “About Data Prep Editor” in the Oracle Essbase Administration Services Online Help.

3. **Open the data source.**
   
   In Data Prep Editor, you can open data sources such as text files, spreadsheet files, and SQL data sources. Data Prep Editor displays the data source, enabling you to see what needs to be changed.

   - To open text files and spreadsheet files, see “Opening Data Files” in the Oracle Essbase Administration Services Online Help.
   
   - To open SQL data sources, see “Opening SQL Databases” in the Oracle Essbase Administration Services Online Help.

   To open an SQL data source, use SQL Interface. The Oracle Essbase SQL Interface Guide provides information on supported environments, installation, and connection to supported data sources. Contact your Essbase administrator for more information.

   You can define a substitution variable for the data source name (DSN). When you open a SQL data source, you can select the substitution variable for the value you want to use as the DSN. For example, you can create a substitution variable named Payroll_detail
and create a rules file that specifies Payroll_detail as the substitution variable for the data source name. Before performing the data load or dimension build, you must set the value for Payroll_detail to the data source name you want to use; for example, an Oracle or IBM DB2 database. When a data load or dimension build is performed, the substitution variable value that Essbase Server finds at that time is used. See “Using Substitution Variables” on page 120.

**Note:** When you open an SQL data source, the rules fields default to the SQL data source column names. If the names are not the same as the Essbase dimension names, map the fields to the dimensions. See “Changing Field Names” on page 300.

### Setting File Delimiters

A file delimiter is the character (or characters) used to separate fields in the data source. By default, a rules file expects fields to be separated by tabs. You can set the file delimiter as a comma, tab, space, fixed-width column, or custom value. Acceptable custom values are characters in the standard ASCII character set, numbered from 0 through 127. Usually, setting file delimiters is what you do first after opening a data source.

**Note:** You do not need to set file delimiters for SQL data.

- To set file delimiters:

  See “Setting File Delimiters” in the *Oracle Essbase Administration Services Online Help*.

### Naming New Dimensions

If you are not creating a dimension in the rules file, skip this section.

If you are creating a dimension, you must name it in the rules file. See “Naming Conventions for Dimensions, Members, and Aliases” on page 1094.

If you are creating an attribute dimension, the base dimension must be a sparse dimension already defined in the outline or the rules file. See Chapter 10, “Working with Attributes.”

- To name a new dimension:

  See “Using Rules Files To Name Dimensions” in the *Oracle Essbase Administration Services Online Help*.

### Selecting a Build Method

If you are not performing a dimension build, skip this section.
If you are building a new dimension or adding members to an existing dimension, you must specify a build method for each dimension that you are creating or modifying. For information about each build method, see “Understanding Build Methods” on page 319.

To select a build method:

See “Specifying Build Methods” in the Oracle Essbase Administration Services Online Help.

**Setting and Changing Member and Dimension Properties**

**Subtopics**

- Using Data Prep Editor to Set Dimension and Member Properties
- Using the Data Source to Work with Member Properties

If you are not performing a dimension build, skip this section.

If you are performing a dimension build, you can set or change the properties of the members and dimensions in the outline. Some changes affect all members of the selected dimension, some affect only the selected dimension, and some affect all dimensions in the rules file.

You can set or change member and dimension properties using the Data Prep Editor or change the member properties in the data source.

**Using Data Prep Editor to Set Dimension and Member Properties**

If you are not performing a dimension build, skip this section.

To set dimension properties:

See “Setting Dimension Properties” in the Oracle Essbase Administration Services Online Help.

To set member properties:

See “Setting Member Properties” in the Oracle Essbase Administration Services Online Help.

**Using the Data Source to Work with Member Properties**

You can modify the properties of new and existing members during a dimension build by:

- Including member properties in a field in the data source
- Leaving the data source field empty to reset the property to the default value, or to remove the formula or UDA
In Administration Services Console, the following dimension build options control whether the value in the data source property field is applied to the associated member:

- Allow property changes
- Allow formula changes
- Allow UDA changes

In the data source, put the properties in the field directly following the field containing the members that the properties modify. For example, to specify that the Margin member not roll up into its parent and not be shared:

1. Position the ~ property (which indicates that the member should not roll up into its parent) and the N property (which indicates that the member should not be shared) after the Margin % field. For example:
   
   Margin%  Margin%  ~ N  Sales

2. Set the field type for the properties fields to Property.
   
   See “Setting Field Type Information” on page 285.

Removing a formula, UDA, or attribute, or resetting a property to its default value, includes the following additional steps:

- In Administration Services Console, select the Delete when the field is empty option for the Property field on the Dimension Build Properties tab of the Field Properties dialog box. (This option is ignored if the appropriate dimension property is not selected in the Dimension Build dialog box.)
- Leave the field NULL or empty in the data source.

Table 40 lists all member codes used in the data source to assign properties to block storage outline members. (For a list of properties that can be assigned to aggregate storage outline members, see “Rules File Differences for Aggregate Storage Dimension Builds” on page 950.)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>Express as a percentage of the current total in a consolidation</td>
</tr>
<tr>
<td>*</td>
<td>Multiply by the current total in a consolidation</td>
</tr>
<tr>
<td>+</td>
<td>Add to the current total in a consolidation</td>
</tr>
<tr>
<td>-</td>
<td>Subtract from the current total in a consolidation</td>
</tr>
<tr>
<td>/</td>
<td>Divide by the current total in a consolidation</td>
</tr>
<tr>
<td>~</td>
<td>Exclude from the consolidation</td>
</tr>
<tr>
<td>^</td>
<td>Exclude from all consolidations in all dimensions</td>
</tr>
<tr>
<td>A</td>
<td>Treat as an average time balance item (applies to accounts dimensions only)</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>B</td>
<td>Exclude data values of zero or #MISSING in the time balance (applies to accounts dimensions only)</td>
</tr>
<tr>
<td>E</td>
<td>Treat as an expense item (applies to accounts dimensions only)</td>
</tr>
<tr>
<td>F</td>
<td>Treat as a first time balance item (applies to accounts dimensions only)</td>
</tr>
<tr>
<td>L</td>
<td>Treat as a last time balance item (applies to accounts dimensions only)</td>
</tr>
<tr>
<td>M</td>
<td>Exclude data values of #MISSING from the time balance (applies to accounts dimensions only)</td>
</tr>
<tr>
<td>N</td>
<td>Never allow data sharing</td>
</tr>
<tr>
<td>O</td>
<td>Tag as label only (store no data)</td>
</tr>
<tr>
<td>S</td>
<td>Set member as stored member (non-Dynamic Calc and not label only)</td>
</tr>
<tr>
<td>T</td>
<td>Require a two-pass calculation (applies to accounts dimensions only)</td>
</tr>
<tr>
<td>V</td>
<td>Create as Dynamic Calc and Store</td>
</tr>
<tr>
<td>X</td>
<td>Create as Dynamic Calc</td>
</tr>
<tr>
<td>Z</td>
<td>Exclude data values of zero from the time balance (applies to accounts dimensions only)</td>
</tr>
</tbody>
</table>

## Setting Field Type Information

### Subtopics

- Field Types and Valid Build Methods
- Rules for Assigning Field Types

If you are not performing a dimension build, skip this section.

In a dimension build, each field in the data source is part of a column that describes an outline member. Fields can contain information about:

- Member names
- Member properties
- Attribute associations

For Essbase to process this information, you must specify the following information when setting field types:

- Field type
  
The type of field to expect in that column, such as a generation field or an alias field. The field type depends on the data source and the build method (see “Understanding Build Methods” on page 319).

- Dimension
The dimension to which the members of that column belong.

- Generation or level number
  The generation or level number of the members of that column.

To set field type information:
See “Setting Field Types” in the *Oracle Essbase Administration Services Online Help*.

### Field Types and Valid Build Methods

Table 41 lists field types and valid build methods.

<table>
<thead>
<tr>
<th>Field Type</th>
<th>What the Field Contains</th>
<th>Valid Build Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alias</td>
<td>An alias</td>
<td>Generation, level, and parent-child references&lt;br&gt;Note: The alias value will not be assigned to the new member if Member update dimension build is set to Remove unspecified and the data source for a new member contains the alias value of a removed member.</td>
</tr>
<tr>
<td>Property</td>
<td>A member property.</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td></td>
<td>See Table 40, “Member Property Codes,” on page 284.</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>Formula</td>
<td>A formula</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>Currency name</td>
<td>(Block storage outlines only) A currency name</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>Currency category</td>
<td>(Block storage outlines only) A currency category</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>UDA</td>
<td>A UDA</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>Attribute parent</td>
<td>In an attribute dimension, the name of the parent member of the attribute member in the following field</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>The name of a specific attribute dimension</td>
<td>A member of the specified attribute dimension. This member is associated with a specified generation or level of the selected base dimension.</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>Generation</td>
<td>The name of a member in the specified generation</td>
<td>Generation references</td>
</tr>
<tr>
<td>Duplicate generation</td>
<td>The name of a member with a shared member as a child</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>Duplicate generation alias</td>
<td>The alias for the shared member</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>Level</td>
<td>The name of a member in a level</td>
<td>Level references</td>
</tr>
<tr>
<td>Duplicate level</td>
<td>The name of a member with a shared member as a child</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>Duplicate level alias</td>
<td>The alias for the shared member</td>
<td>Generate Build Methods</td>
</tr>
<tr>
<td>Field Type</td>
<td>What the Field Contains</td>
<td>Valid Build Methods</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Parent</td>
<td>The name of a parent</td>
<td>Parent-child reference</td>
</tr>
<tr>
<td>Child</td>
<td>The name of a child</td>
<td></td>
</tr>
</tbody>
</table>

1Field types whose names begin with duplicate (such as duplicate generation and duplicate level alias), are not related to duplicate member names described in Chapter 8, “Creating and Working With Duplicate Member Outlines”.

## Rules for Assigning Field Types

Table 42 lists the rules for selecting valid field types, depending on the build method.

### Table 42  Rules for Assigning Field Types Based on Build Method

<table>
<thead>
<tr>
<th>Build Method</th>
<th>Rules for Assigning Field Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• If GEN numbers do not start at 2, the first member of the specified generation must exist in the outline.</td>
</tr>
<tr>
<td></td>
<td>• GEN numbers must form a contiguous range. For example, if GEN 3 and GEN 5 exist, you must also define GEN 4.</td>
</tr>
<tr>
<td></td>
<td>• Put DUGEN fields immediately after GEN fields.</td>
</tr>
<tr>
<td></td>
<td>• Put DUGENALIAS fields immediately after DUPGEN fields.</td>
</tr>
<tr>
<td></td>
<td>• Group GEN fields sequentially within a dimension. For example:</td>
</tr>
<tr>
<td></td>
<td>GEN2,PRODUCT  GEN3,PRODUCT  GEN4,PRODUCT</td>
</tr>
<tr>
<td></td>
<td>• Put attribute association fields after the base field with which they are associated, and specify the generation number of the associated base dimension member. For example:</td>
</tr>
<tr>
<td></td>
<td>GEN2,PRODUCT  GEN3,PRODUCT  OUNCES3,PRODUCT</td>
</tr>
<tr>
<td></td>
<td>The generation number must correspond to the generation of the member in the outline for which the field provides values. For example, the 3 in GEN3,PRODUCT shows that the values in the field are third-generation members of the Product dimension. The 2 in ALIAS2, POPULATION shows that the values in the field are associated with the second-generation member of the Population dimension.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> When using the generation build method to create a duplicate member dimension, the maximum number of generations is 20.</td>
</tr>
<tr>
<td>Level</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Put DUGLEVEL fields immediately after LEVEL fields.</td>
</tr>
<tr>
<td></td>
<td>• Put DUGLEVELALIAS fields immediately after the DUGLEVEL fields.</td>
</tr>
<tr>
<td></td>
<td>• Each record must contain a level 0 member. If a level 0 member is repeated on a new record with a different parent, Essbase rejects the record unless you select the Allow Moves member property. See “Setting and Modifying Member Properties” in the Oracle Essbase Administration Services Online Help.</td>
</tr>
<tr>
<td></td>
<td>• Group level fields sequentially within a dimension.</td>
</tr>
<tr>
<td></td>
<td>• Put the fields for each roll-up in sequential order.</td>
</tr>
<tr>
<td></td>
<td>• Use a single record to describe the primary and secondary roll-ups.</td>
</tr>
<tr>
<td></td>
<td>• Put attribute association fields after the base field with which they are associated, and specify the level number of the associated base dimension member. For example:</td>
</tr>
<tr>
<td></td>
<td>LEVEL3,PRODUCT  OUNCES3,PRODUCT  LEVEL2,PRODUCT</td>
</tr>
<tr>
<td></td>
<td>• The level number must correspond to the level of the member in the outline for which the field provides values. For example, the 3 in LEVEL3,PRODUCT shows that the values in the field are level 3 members of the Product dimension. The 2 in ALIAS2, POPULATION shows that the values in the field are associated with the second level of the Population dimension.</td>
</tr>
</tbody>
</table>
Parent-child

If field type is parent or child, enter 0 (zero) in the Number text box.

Attribute dimension name

The generation or level number must correspond to the generation or level of the associated base member in the outline. For example, the 3 in OUNCES3, PRODUCT shows that the values in the field are the members of the Ounces attribute dimension that are associated with the third-generation member of the Product dimension in the same source data record.

If necessary, move the fields to the required locations. See “Moving Fields” on page 298.

To move fields:

See “Moving Fields” in the Oracle Essbase Administration Services Online Help.

Setting Dimension Build Operational Instructions

If you are not performing a dimension build, skip this section.

Within the rules file, you define operations to be performed after the data source has been read:

- Whether to sort members after Essbase has processed and added all members from the data source
- Whether to add the members to the existing outline or to remove unspecified members from the outline
  
Removing unspecified members is available only with the generation reference, level reference, and parent-child reference build methods.

Note: Outlines are invalid if removing members results in level 0 Dynamic Calc members without formulas.

Defining Data Load Field Properties

You must map each rules file field to the corresponding outline member, or as a data field or ignored field. Other field characteristics may also apply.

For duplicate member outlines, you must specify the method (level reference, generation reference, or dimension reference) that Essbase uses to map the field.

- Level and generation references: The data source contains multiple fields within the duplicate member dimension to uniquely identify duplicate members.
  - Use the level reference method when fields within a dimension are organized bottom-up in the data source.
  - Use the generation reference method when fields within a dimension are organized top-down in the data source. For example:

```plaintext
gen2,Market, gen3,Market, Product, Year, Measures, Scenario, *data*
State,"New York","100-10",Jan,Sales,Actual,42
```
Dimension reference: If an outline contains a duplicate member name in different dimensions—for example, a member name such as Other can be meaningful in different dimensions—you can use the dimension reference method. When you set a field to use the dimension reference method, you also identify the dimension to which members in that field belong. When the dimension reference method is specified for a field, Essbase checks to ensure that members in the field belong to the dimension specified for the field.

To specify generation, level, or dimension references for data loads:
See “Mapping Field Names” in the Oracle Essbase Administration Services Online Help.

Performing Operations on Records, Fields, and Data

A rules file enables you to perform operations on records, fields, and data values before loading them into the database without changing the data source. See Chapter 19, “Using a Rules File to Perform Operations on Records, Fields, and Data.”

Validating, Saving, and Printing

Subtopics

- Requirements for Valid Data Load Rules Files
- Requirements for Valid Dimension Build Rules Files
- Copying Rules Files
- Printing Rules Files

Rules files are validated to ensure that the members and dimensions in the rules file map to the outline. Validation cannot ensure that the data source loads properly.

To validate a rules file:
See “Validating Rules Files” in the Oracle Essbase Administration Services Online Help.

If the rules file is correct, you can perform a data load or dimension build. See Chapter 20, “Performing and Debugging Data Loads or Dimension Builds.”

If the rules file is not valid, see the appropriate topic for each rules file type:

- Data load: “Requirements for Valid Data Load Rules Files” on page 290
- Dimension build: “Requirements for Valid Dimension Build Rules Files” on page 290

To save a rules file:
See “Saving Rules Files” in the Oracle Essbase Administration Services Online Help.
Requirements for Valid Data Load Rules Files

For a data load rules file to validate, all of the following questions must be answered “yes.”

- Is the rules file associated with the correct outline?
  See “Validating Rules Files” in the Oracle Essbase Administration Services Online Help.
- Does each record in the data source contain only one member from each dimension?
  See “Items in a Data Source” on page 267.
- Are all member and dimension names spelled correctly?
- Are all members surrounded by quotation marks if they contain numbers or file delimiters?
  See “Valid Member Fields” on page 268.
- Are there no extra delimiters in the data source?
  See “Extra Delimiters with a Rules File” on page 271.
- Is the member that each data field maps to spelled correctly in the rules file?
  See “Changing Field Names” on page 300.
- Are the file delimiters correctly placed?
  See “Valid Delimiters” on page 270.
- Is the member in the field name a valid member?
  See “Mapping Fields” on page 299.
- Is the dimension name used in only one field (for example, not in a field name and the header)?
  You can map a single data value to only one set of members.
- Is only one field defined as a data field?
  See “Defining Columns as Data Fields” on page 302.
- Is the UDA used for sign flipping in the associated outline?
  See “Flipping Field Signs” on page 304.

Requirements for Valid Dimension Build Rules Files

For a dimension build rules file to validate, all of the following questions must be answered “yes.”

- Is the rules file associated with the correct outline?
  See “Validating Rules Files” in the Oracle Essbase Administration Services Online Help.
- Does each record contain only one member from each dimension?
  See “Items in a Data Source” on page 267.
- Are all member and dimension names spelled correctly?
- Are all members enclosed in quotation marks if they contain numbers or file delimiters?
See “Valid Member Fields” on page 268.

- Are there no extra delimiters in the data source?
  See “Extra Delimiters with a Rules File” on page 271.

- Are the reference numbers sequential?
  See “Rules for Assigning Field Types” on page 287.

- Are there no repeated generations?
  See “Rules for Assigning Field Types” on page 287.

- Is each field type valid for the build method?
  See “Field Types and Valid Build Methods” on page 286.

- Are all the fields in correct order?
  See “Rules for Assigning Field Types” on page 287.

- Does each child field have a parent field?

- Do all dimension names exist in the outline or the rules file?

- Are any dimensions specified in both the header record in the rules file and the header record in the data source?
  Dimensions can be specified in either the header in the rules file or the header in the data source, but not in both. See “Defining Header Records” on page 295.

## Copying Rules Files

You can copy rules files to applications and databases on any Essbase Server, according to your permissions. You can also copy rules files across servers as part of application migration.

To copy a rules file, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Rules Files</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter object</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>COPYOBJECT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

## Printing Rules Files

You can print the entire contents and properties of a data load or dimension build rules file. You can also specify properties and settings to print.

To print a rules file:

See “Printing Rules Files” in the Oracle Essbase Administration Services Online Help.
Performing Operations on Records

Subtopics

- Selecting Records
- Rejecting Records
- Combining Multiple Select and Reject Criteria
- Setting the Records Displayed
- Defining Header Records

You can perform operations at the record level. For example, you can reject certain records before they are loaded into the database. See the following sections.

Selecting Records

You can specify which records Essbase loads into the database or uses to build dimensions by setting selection criteria. Selection criteria are string and number conditions that must be met by one or more fields within a record for Essbase to load the record. If a field or fields in the record do not meet the selection criteria, Essbase does not load the record. You can define one or more selection criteria. For example, to load only 2003 Budget data from a data source, create a selection criterion to load only records in which the first field is Budget and the second field is 2003. If you define selection criteria on multiple fields, you can specify how Essbase combines the criteria. See “Combining Multiple Select and Reject Criteria” on page 294.
To select a record:
See “Selecting Records” in the Oracle Essbase Administration Services Online Help.

Rejecting Records
You can specify which records Essbase ignores by setting rejection criteria. Rejection criteria are string and number conditions that, when met by one or more fields within a record, cause Essbase to reject the record. You can define one or more rejection criteria. If no field in the record meets the rejection criteria, Essbase loads the record. For example, to reject Actual data from a data source and load only Budget data, create a rejection criterion to reject records in which the first field is Actual.

To reject a record:
See “Rejecting Records” in the Oracle Essbase Administration Services Online Help.

Combining Multiple Select and Reject Criteria
When you define select and reject criteria on multiple fields, you can specify how Essbase combines the rules across fields: whether the criteria are connected logically with AND or with OR. If you select AND from the Boolean group, the fields must match all of the criteria. If you select OR, the fields must match only one of the criteria. The global Boolean setting applies to all select or reject operations in the rules file, for data load and dimension build fields.

Note: If selection and rejection criteria apply to the same record (you define select and reject criteria on the same record), the record is rejected.

To determine how to combine select and reject criteria on multiple fields:
See “Combining Selection and Rejection Criteria” in the Oracle Essbase Administration Services Online Help.

Setting the Records Displayed
You can specify the number of records, and the first record, that Essbase displays in Data Prep Editor. When you specify the first record, Essbase skips all preceding records. For example, if you enter 5 as the starting record, Essbase does not display records 1 through 4.

Note: Essbase treats header records the same as data records when counting the records to skip.

To set the records displayed:
See “Setting How Records Are Displayed” in the Oracle Essbase Administration Services Online Help.
Defining Header Records

Data sources can contain:

- **Data records**, which contain member fields and data fields
- **Header records**, which describe the contents of the data source and how to load values from the data source to the database

Rules files contain records that translate the data of the data source to map it to the database. As part of that information, rules files can also contain header records. For example, the Sample.Basic database has a dimension for Year. If several data sources arrive with monthly numbers from different regions, the month itself might not be specified in the data sources. You must set header information to specify the month.

You can create a header record using one of the following methods:

- Define header information in the rules file.
  
  Rules file headers are used only during data loading or dimension building and do not change the data source. Header information set in a rules file is not used if the rules file also points to header records in the data source.

- Define header information in the data source and, in the rules file, point to the header records.
  
  Placing header information in the data source makes it possible to use the same rules file for multiple data sources with different formats, because the data source format is specified in the data source header (not in the rules file).
  
  When you add one or more headers to the data source, you must also specify in the rules files the location of the headers in the data source. The rules file tells Essbase to read the header information as a header record (not as a data record). You can also specify the type of header information in each header record.
  
  Header information defined in the data source takes precedence over header information defined in the rules file.

- To define a header in the rules file:
  
  See “Specifying Data-Source Members in Rules Files” in the Oracle Essbase Administration Services Online Help.

- To define a header in the data source:
  
  See “Setting Headers in the Data Source” in the Oracle Essbase Administration Services Online Help.

Data Source Headers

You can build dimensions dynamically by adding header information to the top record of the data source and by specifying the location of the header record in the rules file.
The header record lists field definitions for each field. The field definition includes the field type, the field number, and the dimension name into which to load the fields. Figure 64 illustrates the format of a header record:

**Figure 64** Header Record with Three Field Definitions

If the file delimiter is a comma, enclose each field definition in quotation marks (" ").

After you set the header information in the data source, you must specify the location of the header information in the rules file. If a rules file refers to header information in a data source, Essbase uses the information in the data source—rather than the information in the rules file—to determine field types and dimensions.

**Valid Data Source Header Field Types**

Valid field types, which must be in capital letters:

- GEN, DUPGEN, and DUPGENALIAS
- LEVEL, DUPLEVEL, and DUPLEVELALIAS
- PARENT, CHILD
- PROPERTY
- ALIAS
- FORMULA
- CURNAME
- CURCAT
- UDA
- ATTRPARENT
- The name of an attribute dimension, such as CAFFEINATED

Each field type that you set requires a field number. When the field type is the name of an attribute dimension, the field number cannot be greater than 9. See “Setting Field Type Information” on page 285.
Performing Operations on Fields

Subtopics
- Ignoring Fields
- Ignoring Strings
- Arranging Fields
- Mapping Fields
- Changing Field Names

You can perform operations at the field level. For example, you can move a field to a new position in the record. See the following sections.

Ignoring Fields
You can ignore all fields of a specified column of the data source. The fields still exist in the data source, but they are not loaded into the Essbase database. For example, the Sample.Basic database has five standard dimensions: Year, Product, Market, Measures, and Scenario. If the data source has an extra field that is not a member of any dimension, such as Salesperson, you can tell Essbase to ignore the Salesperson field.

➢ To ignore all fields in a column:
See “Ignoring Fields” in the Oracle Essbase Administration Services Online Help.

Ignoring Strings
You can ignore any field in the data source that matches a string, called a token. When you ignore fields based on string values, the fields are ignored everywhere they appear in the data source, not just in a particular column. For example, in a data source that is a computer-generated report in text format, special ASCII characters might be used to create horizontal lines between pages or boxes around headings. These special characters can be defined as tokens to be ignored.

➢ To ignore all instances of a string:
See “Ignoring Fields Based on String Matches” in the Oracle Essbase Administration Services Online Help.

Arranging Fields
You can set the order of the fields in the rules file to be different from the order of the fields in the data source. The data source is unchanged. See the following sections.
Moving Fields

You can move fields to a different location using a rules file. For example, you can specify the first field in the data source to be the third field during the data load or dimension build.

In some instances, moved fields may appear to merge. If you move a field that contains empty cells, and the moved field becomes the last field in the record, as shown below, the field may merge with the field to its left.

1<tab>2<tab>3
1<tab>2<tab>(null)

To prevent merging, replace the empty cell with a delimiter.

➢ To move fields:

See “Moving Fields” in the Oracle Essbase Administration Services Online Help.

Joining Fields

You can join multiple fields into one field. The new field is given the name of the first field in the join. For example, if a data source has separate fields for product number (100) and product family (-10), you must join the fields (100-10) before loading them into the Sample.Basic database.

Before you join fields, move the fields to join into the order in which you want them joined. See “Moving Fields” in the Oracle Essbase Administration Services Online Help.

➢ To join fields:

See “Joining Fields” in the Oracle Essbase Administration Services Online Help.

Creating a Field by Joining Fields

You can join fields by placing the joined fields into a new field. This procedure leaves the original fields intact. Creating a field is useful if you need to concatenate fields of the data source to create a member.

For example, if a data source has separate fields for product number (100) and product family (-10), you must join the fields (100-10) before you load them into the Sample.Basic database.

If, however, you want to preserve the two existing fields in the data source, you can create a field (100-10) using a join. The data source now includes all three fields (100, -10, and 100-10).

Before you join fields, move the fields to join into the order in which you want them joined. See “Moving Fields” in the Oracle Essbase Administration Services Online Help.

➢ To create a field by joining existing fields:

See “Creating Fields Using Joins” in the Oracle Essbase Administration Services Online Help.
Copying Fields

You can create a copy of a field while leaving the original field intact. For example, if, during a single dimension build, you want to define a multilevel attribute dimension and associate attributes with members of a base dimension, you must copy some of the fields. See “Working with Multilevel Attribute Dimensions” on page 332.

To copy a field, select one field and then create a field using a join:

See “Creating Fields Using Joins” in the Oracle Essbase Administration Services Online Help.

Splitting Fields

You can split a field into two fields. For example, if a data source for the Sample.Basic database has a field containing UPC100-10-1, you can split “UPC” out of the field and ignore it. Then, only 100-10-1, the product number, is loaded.

To split a field:

See “Splitting Fields” in the Oracle Essbase Administration Services Online Help.

Creating Additional Text Fields

You can create a text field between two fields. You might create a text field to insert text between fields that are to be joined. For example, if one field contains 100 and one contains 10-1, you can insert a text field with a dash between the two fields and then join the three fields to create the 100-10-1 member of the Product dimension.

To create a field and populate it with text:

See “Using Text to Create Fields” in the Oracle Essbase Administration Services Online Help.

Undoing Field Operations

You can undo the last field operation that you performed, such as move, split, join, create using text, or create using join, by using Undo command (select Edit, then Undo). You can undo field operations even if you have performed other actions. Undoing field operations is sequential, starting with the most recently performed operation.

To undo one or more field operations:

See “Undoing Field Operations” in the Oracle Essbase Administration Services Online Help.

Mapping Fields

This section applies to data load only. If you are performing a dimension build, skip this section.
You use a rules file to map data source fields to Essbase member names during a data load. You can map fields in a data source directly to fields in the Essbase database during a data load by specifying which field in the data source maps to which member or member combination in the Essbase database. The data source is not changed.

**Note:** When you open a SQL data source, the fields default to the SQL data source column names. If the SQL column names and the Essbase dimension names are the same, you need not map the column names.

To map fields:

See “Mapping Field Names” in the *Oracle Essbase Administration Services Online Help*.

### Changing Field Names

To load a data source, you must specify how the fields of the data source map to the dimensions and members of the database. Rules files can translate fields of the data source so that the fields match member names each time the data source is loaded. This process does not change the data source.

The rules file:

- Maps member fields of the data source to dimensions and members of the database
- Maps data fields of the data source to member names or member combinations (such as Jan, Actual) of the database

See the following sections.

### Replacing Text Strings

You can replace text strings so that the fields map to Essbase member names during a data load or dimension build. The data source is not changed. For example, if the data source abbreviates New York to NY, you can have the rules file replace each NY with New York.

To replace a text string:

See “Replacing Field Names” in the *Oracle Essbase Administration Services Online Help*.

### Placing Text in Empty Fields

You may want to replace empty fields in a column with text. For example, if empty fields in the column represent default values, you can insert the default values or insert #MI to represent missing values.

To replace an empty field with text:

See “Placing Text in Empty Fields” in the *Oracle Essbase Administration Services Online Help*. 
Changing the Case of Fields

You can change the case of a field so that the field maps to Essbase member names during a data load or dimension build. The data source is not changed. For example, if the data source capitalizes a field (for example, JAN) that is in lowercase in the database (jan), you can have the rules file change the field to lowercase.

➤ To change the case of values in a field:

See “Changing Case of Fields” in the Oracle Essbase Administration Services Online Help.

Dropping Leading and Trailing Spaces

You can drop leading and trailing spaces from around fields of the data source. A field value containing leading or trailing spaces does not map to a member name, even if the name within the spaces is an exact match.

By default, Essbase drops leading and trailing spaces.

➤ To drop spaces around a field:

See “Dropping Spaces Around Fields” in the Oracle Essbase Administration Services Online Help.

Converting Spaces to Underscores

You can convert spaces in fields of the data source to underscores to make the field values match the member names of the database.

➤ To change spaces to underscores:

See “Converting Spaces to Underscores” in the Oracle Essbase Administration Services Online Help.

Adding Prefixes or Suffixes to Field Values

You can add prefixes and suffixes to each field value of the data source. For example, you can add 2002 as the prefix to all member names in the Year dimension.

➤ To add prefix or suffix values to a field:

See “Adding Prefixes and Suffixes” in the Oracle Essbase Administration Services Online Help.
Performing Operations on Data

Subtopics

- Defining Columns as Data Fields
- Adding to and Subtracting from Existing Values
- Clearing Existing Data Values
- Replacing All Data
- Scaling Data Values
- Flipping Field Signs

This section applies to data load only. If you are performing a dimension build, skip this section.

You can perform operations on the data in a field; for example, moving a field to a new position in the record. See the following sections.

Defining Columns as Data Fields

This section applies to data load only. If you are performing a dimension build, skip this section.

If each record in the data source contains a column for every dimension and one data column, you must define the data column as a data field, as shown in the following example:

<table>
<thead>
<tr>
<th>Market</th>
<th>Product</th>
<th>Year</th>
<th>Measures</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas</td>
<td>100-10</td>
<td>Jan</td>
<td>Sales</td>
<td>Actual</td>
</tr>
<tr>
<td>Texas</td>
<td>100-20</td>
<td>Jan</td>
<td>Sales</td>
<td>Actual</td>
</tr>
<tr>
<td>Texas</td>
<td>100-10</td>
<td>Jan</td>
<td>Sales</td>
<td>Actual</td>
</tr>
</tbody>
</table>

You can define only one field in a record as a data field.

To define a data field:

See “Defining Columns as Data Fields” in the Oracle Essbase Administration Services Online Help.

Adding to and Subtracting from Existing Values

This section is for data load only. If you are performing a dimension build, skip this section.

By default, Essbase overwrites the existing values of the database with the values of the data source, but you can determine how newly loaded data values affect existing data values.

You can use incoming data values to add to or subtract from existing database values. For example, if you load weekly values, you can add them to create monthly values in the database.

Using this option makes recovery more difficult if the database crashes while loading data, although Essbase lists the number of the last row committed in the application log. See “Contents of the Application Log” on page 729.
For block storage databases, set the Commit Row database transaction option to 0 to prevent difficult recoveries. This setting causes Essbase to view the entire load as a single transaction and to commit the data only when the load is complete. See “Understanding Isolation Levels” on page 777.

Using Administration Services Console, you can add to and subtract from existing values in block storage and aggregate storage databases. Using MaxL, you can only add to and subtract from existing values in aggregate storage databases only.

To add to or subtract from existing data values, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Adding to Data Values</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>Administration Services</td>
<td>Subtracting from Data Values</td>
<td></td>
</tr>
<tr>
<td>MaxL</td>
<td>import data (aggregate storage)</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Clearing Existing Data Values**

This section is for data load only. If you are performing a dimension build, skip this section.

You can clear existing data values from the database before you load new values. By default, Essbase overwrites the existing values of the database with the new values of the data source. If you are adding and subtracting data values, however, Essbase adds or subtracts the new data values to and from the existing values.

Before adding or subtracting new values, make sure that the existing values are correct. Before loading the first set of values into the database, make sure that there is no existing value.

For example, assume that the Sales figures for January are calculated by adding the values for each week in January:

\[
\text{January Sales} = \text{Week 1 Sales} + \text{Week 2 Sales} + \text{Week 3 Sales} + \text{Week 4 Sales}
\]

When you load Week 1 Sales, clear the database value for January Monthly Sales. If there is an existing value, Essbase performs the following calculation:

\[
\text{January Sales} = \text{Existing Value} + \text{Week 1 Sales} + \text{Week 2 Sales} + \text{Week 3 Sales} + \text{Week 4 Sales}
\]

You can also clear data from fields that are not part of the data load. For example, if a data source contains data for January, February, and March, and you want to load only the March data, you can clear January and February data.

To clear existing values:

See “Clearing Existing Data Values” in the *Oracle Essbase Administration Services Online Help*.

**Note:** If you are using transparent partitions, clear the values using the steps that you use to clear data from a local database.
Replacing All Data

This section applies to loading data into an aggregate storage database only. If you are loading data into a block storage database or performing a dimension build, skip this section.

In an aggregate storage database, Essbase can remove all of the data in the database or all of the data in each incremental data slice in a database, and replace the data with the contents of a specified data load buffer. This functionality is useful when working with data sets that are small enough to reload completely, or when working with data that can be separated into large, static data sets that are never updated and small, volatile data sets in which you need to track changes.

To replace all data, see “Replacing Database or Incremental Data Slice Contents” on page 962 and “Replacing the Contents of an Aggregate Storage Database” in the Oracle Essbase Administration Services Online Help.

Scaling Data Values

This section is for data load only. If you are performing a dimension build, skip this section.

You can scale data values if the values of the data source are not in the same scale as the values of the database.

For example, assume the real value of sales is $5,460. If the Sales data source tracks the values in hundreds, the value is 54.6. If the Essbase database tracks the real value, you must multiply the value coming in from the Sales data source (54.6) by 100 to have the value display correctly in the Essbase database (as 5460).

➢ To scale data values:

See “Scaling Data Values” in the Oracle Essbase Administration Services Online Help.

Flipping Field Signs

This section is for data load only. If you are performing a dimension build, skip this section.

You can reverse, or flip, the value of a data field by flipping its sign. Sign flips are based on the UDAs of the outline. When loading data into the accounts dimension, for example, you can specify that any record whose accounts member has a UDA of Expense change from a plus sign to a minus sign. See “Creating UDAs” on page 158.

➢ To reverse a field sign:

See “Flipping Signs” in the Oracle Essbase Administration Services Online Help.
Prerequisites for Data Loads and Dimension Builds

You can load data or members from one or more external data sources to an Essbase Server. You can load data without updating the outline, update the outline without loading data, or load data and build dimensions simultaneously. Before you load data or build dimensions, ensure that the following items are in place:

- An Essbase database
- A connection to the appropriate Essbase Server
- One or more valid data sources
  - See “Data Sources” on page 266.
- A rules files, if you are using one
  - See “Rules Files” on page 271.
- If you are not using a rules file, a data source correctly formatted for free-form data loading
  - See “Data Sources that Do Not Need a Rules File” on page 273.

Performing Data Loads or Dimension Builds

When you use Administration Services to perform a data load or dimension build, you can execute the load or build in the background so that you can continue working during the load.
or build. You can then check the status of the background process to see when the load or build has completed. See “Loading Data and Building Dimensions” in the *Oracle Essbase Administration Services Online Help*.

If you are using multiple data sources in a dimension build, to reduce total processing time you can perform a deferred-restructure dimension build. See “Performing Deferred-Restructure Dimension Builds” on page 307.

**Note:** If you are loading data into a transparent partition, follow the same steps as for loading data into a local database.

To load data or build dimensions, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Loading Data and Building Dimensions</td>
<td><em>Oracle Essbase Administration Services Online Help</em></td>
</tr>
<tr>
<td>MaxL</td>
<td>For data loading: <strong>import data</strong></td>
<td><em>Oracle Essbase Technical Reference</em></td>
</tr>
<tr>
<td></td>
<td>For dimension building: <strong>import dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>For data loading: <strong>IMPORT</strong></td>
<td><em>Oracle Essbase Technical Reference</em></td>
</tr>
<tr>
<td></td>
<td>For dimension building: <strong>BUILDDIM</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Stopping Data Loads or Dimension Builds**

You can stop a data load or dimension build before it completes. You should not stop a data load or dimension build unless it is necessary. If a data load or dimension build process is terminated, Essbase displays the file name as partially loaded.

If you initiate a data load or dimension build from a client and terminate the data load or dimension build from the server, it could take time before the client responds to the termination request. Because Essbase reads the source file until all source data is read, the amount of time depends on the file size and the amount of source data that Essbase has processed. If the process is terminated from the computer that initiated it, termination is immediate.

**Note:** If you are adding to or subtracting from data values during a data load to a block storage database, use the Committed Isolation Level setting, if possible. If the data load is terminated, this setting rolls the data load back to its previous state. See “Understanding Isolation Levels” on page 777. If you stop a data load that is adding to or subtracting from data values, see “Recovering from an Essbase Server Crash” on page 312.

To stop a data load or dimension build before it completes, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Disconnecting User Sessions and Requests</td>
<td><em>Oracle Essbase Administration Services Online Help</em></td>
</tr>
</tbody>
</table>
Tips for Loading Data and Building Dimensions

Subtopics

- Performing Deferred-Restructure Dimension Builds
- Determining Where to Load Data
- Dealing with Missing Fields in a Data Source
- Loading a Subset of Records from a Data Source
- Saving and Reusing Data Load Options
- Optimizing Name Lookup and Insertion During Dimension Build and Outline Editing

This section contains topics to help you load data and build dimensions.

Performing Deferred-Restructure Dimension Builds

Skip this section if you are loading data only or are using a single data source for a dimension build.

By default, each time you make changes to an outline, Essbase considers the type of change and restructures the database if needed. Restructuring the database rebuilds the database, which takes time, requires more disk space for its process, and can cause file defragmentation. For information about the types of changes and types of restructuring that can be required, see the following topics:

- For block storage outlines, see “Optimizing Database Restructuring” on page 839.
- For aggregate storage outlines, see “Aggregate Storage Database Restructuring” on page 1027.

Deferred-restructure dimension builds, also known as incremental dimension builds, read multiple data sources for dimension builds and delay restructuring until all data sources have been processed. The following methods for performing deferred-restructure builds use different approaches to specifying the action:

- Administration Services enables you to list all data sources in a single dialog box.

  When the files listed are all dimension builds, a deferred-restructure dimension build option is available. Selecting this option delays restructuring until all sources have been processed. The outline is validated after each dimension build is processed. See “Loading Data and Building Dimensions” in the Oracle Essbase Administration Services Online Help.

- MaxL enables you to include all of the data sources within one import database statement.
You can control whether outline validation is performed for each file. You must enable outline validation for the last file. See “import database” and “import dimension” in the MaxL section of the Oracle Essbase Technical Reference.

- ESSCMD requires several commands:
  - BEGINCBUILDDIM, to indicate that a deferred-restructure dimension build is to be performed
  - INCBUILDDIM for each data source, to indicate that the data sources to be included in the dimension build
  - ENDBUILDDIM, to trigger restructuring, if needed

In all cases, the data sources are processed in the order in which they are listed.

**Note:** MaxL and ESSCMD enable you to enforce or suppress outline verification for each file. To ensure a valid outline, ensure that the last build verifies the outline. Deferred-restructure dimension builds in Administration Services verify the outline after each data source is processed.

### Determining Where to Load Data

Skip this section if you are building dimensions or working with an aggregate storage database.

If you load data into a parent member, when you calculate the database, the consolidation of the children’s data values can overwrite the parent data value. To prevent overwriting:

- If possible, do not load data directly into a parent.
- If you must load data into a parent member, ensure that Essbase knows not to consolidate #MISSING values from the children of the parent into the parent.

To set the consolidation, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Aggregating Missing Values During Calculation</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>Calculation Script</td>
<td>SET AGGMISSG</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

The methods in this table work only if the child values are empty (#MISSING). If the children have data values, the data values overwrite the data values of the parent. See “Consolidating #MISSING Values” on page 884.
Note: You cannot load data into Dynamic Calc, Dynamic Calc and Store, or attribute members. For example, if Year is a Dynamic Calc member, you cannot load data into it. Instead, load data into Qtr1, Qtr2, Qtr3, and Qtr4, which are not Dynamic Calc members.

Dealing with Missing Fields in a Data Source

Each record in the data source must have the same number of data value fields to perform a data load. If data values are missing, the data load processes incorrectly. For example, the following file is invalid, because there is no value under Apr:

```
Actual  Ohio  Sales  Cola
Jan   Feb   Mar   Apr
10    15    20
```

To fix the file, insert #MISSING or #MI into the missing field:

```
Actual  Ohio  Sales  Cola
Jan   Feb   Mar   Apr
10    15    20    #MI
```

See “Placing Text in Empty Fields” on page 300.

Note: If a dimension field or member field is missing, Essbase uses the value that it used previously for that dimension or member field. See “Missing Dimension or Member Fields” on page 316.

If a rules file has extra blank fields, join the empty fields with the field next to them. See “Joining Fields” on page 298.

In aggregate storage databases, values can be loaded only to level 0 cells. Specifying #MISSING or #MI as a value in the data source removes the associated cell if it is present in the database. For information about data load differences for aggregate storage databases, see “Preparing Aggregate Storage Databases” on page 949.

Loading a Subset of Records from a Data Source

You can load a subset of records in a data source during a data load or a dimension build. For example, you can load records 250 to 500 without loading the other records of the data source.

To load a subset of records:

1. **Using a text-editing tool, number the records in the data source.**
2. **Set the rules file to ignore the column containing the record number.**
   See “Ignoring Fields” on page 297.
3. **Define a rejection criterion that rejects all records except those that you want to load.**
   For example, reject all records for which the ignored column is fewer than 250 or greater than 500. See “Rejecting Records” on page 294.
Note: You cannot reject more records than the error log can hold. By default, the limit is 1000. You can change the limit by setting DATAERRORLIMIT in the "essbase.cfg" file. See the Oracle Essbase Technical Reference.

Saving and Reusing Data Load Options

If you perform data loads and dimension builds through Administration Services, and you use the same data source files and rules files each time, you can save the source and rules file options specified in the Data Load dialog box and reuse them later.

By default, the file options are saved in the "ARBORPATH" directory on the client in an XML file that you name. To use a file of saved options, you can open the file. The saved files and their options are added to the list in the currently open Data Load dialog box.

Tip: You can use the data load options file as a template; after opening a data load options file, you can modify any specifications.

See “Loading Data and Building Dimensions” in the Oracle Essbase Administration Services Online Help.

Optimizing Name Lookup and Insertion During Dimension Build and Outline Editing

A new hashtable implementation optimizes the performance of name lookup and insertion when building dimensions and editing outlines. This hashtable implementation has an increased memory footprint.

To configure the hashtable, use the ESTIMATEDHASHSIZE configuration setting. This setting specifies, in millions, the estimated number of member name and alias name strings that are loaded into memory.

The ESTIMATEDHASHSIZE configuration setting applies to block and aggregate storage applications.
Debugging Data Loads and Dimension Builds

Subtopics

- Verifying that Essbase Server Is Available
- Verifying that the Data Source Is Available
- Checking Error Logs
- Recovering from an Essbase Server Crash
- Resolving Problems with Data Loaded Incorrectly
- Creating Rejection Criteria for End of File Markers
- Understanding How Essbase Processes a Rules File
- Understanding How Essbase Processes Missing or Invalid Fields During a Data Load

If a data source does not correctly load into Essbase Server, ensure that you are connected to the appropriate application and database and that you are loading the correct data source.

If you still encounter problems, see the following topics. After you correct the problems, you can reload the records that did not load by reloading the error log. See “Loading Dimension Build and Data Load Error Logs” on page 753.

Verifying that Essbase Server Is Available

To help identify that the problem is with Essbase and not with the server or network, try to access the server without using Essbase. Check whether:

- The server is running.
  
  Try connecting to the server without using Essbase. If you cannot, check with your system administrator.

- Essbase Server is running.
  
  Check with your Essbase administrator.

- The client is connected to the server.
  
  Try connecting to the server from the client without using Essbase.

Verifying that the Data Source Is Available

If Essbase cannot open the data source that you want to load, ensure that the following conditions are true:

- The data source is open (for example, is someone editing the data source?).
  
  Essbase can load only data sources that are not locked by another user or application.

- The data source has the correct file extension.
  
  Text files must have a .txt extension; rules files must have an .rul extension.

- The data source name and the path name are correct.
Check for misspellings.

- The data source is in the specified location.
  Ensure that no one has moved or deleted the data source.

- If you are using a SQL data source:
  - The connection information (such as the user name, password, and database name) is correct.
  - You can connect to the SQL data source without using Essbase.

### Checking Error Logs

If a data load or dimension build fails, the error log can be a valuable debugging tool. See “Understanding and Viewing Dimension Build and Data Load Error Logs” on page 751.

If there is no error log, check whether the following conditions exist:

- The person running the data load set up an error log.
  By default, when using a rules file, Essbase creates an error log.

- The data source and Essbase Server are available.
  See “Verifying that Essbase Server Is Available” on page 311 and “Verifying that the Data Source Is Available” on page 311

- Essbase Server crashed during the data load.
  If so, you probably received a timeout error on the client. See “Recovering from an Essbase Server Crash” on page 312.

- The application log exists.
  See “Essbase Server and Application Logs” on page 727.

If the error log exists but is empty, Essbase does not think that an error occurred during loading. Check whether the following conditions exist:

- The rules file contains selection or rejection criteria that rejected every record in the data source.
  See “Selecting Records” on page 293 and “Rejecting Records” on page 294.

- The rules file validates properly.
  See “Requirements for Valid Data Load Rules Files” on page 290 and “Requirements for Valid Dimension Build Rules Files” on page 290.

### Recovering from an Essbase Server Crash

If the server crashes while you are loading data, Essbase sends you a timeout error. The recovery procedures that you must perform depend on the type of load you are performing and the Isolation Level database transaction setting (see “Understanding Isolation Levels” on page 777):
If you are overwriting the values of the data source, reload the data source when the server is running again.

If you are adding to or subtracting from existing values in the data source and the Isolation Level setting is:

- Committed, reload the data source when the server is running again.
- Uncommitted, determine how much data Essbase loaded before the crash:
  1. Compare the values of the data source with the values of the database.
  2. If the values that you are adding to or subtracting from have not changed, reload the data source.
  3. If the values that you are adding to or subtracting from have changed, clear the values that loaded and reload the previous data sources. If, for example, you derive monthly sales figures by adding the sales figures for each week as they are loaded, clear the sales figures from the database and reload the sales figures for each week up to the current week.

Resolving Problems with Data Loaded Incorrectly

If the data source loads without error, but the data in the database is wrong, check whether the following conditions exist:

- You loaded the correct data source.
  
  If so, check the data source again to make sure that it contains the correct values.

- There are blank fields in the data source.
  
  You must insert #MI or #MISSING into a data field that has no value. Otherwise, the data source may not load correctly. To replace a blank field with #MI or #MISSING using a rules file, see “Placing Text in Empty Fields” on page 300.

- The data source is formatted correctly.
  
  - All ranges are set up properly.
  
  - The data is clean. For example, as it processes the data source, Essbase recognizes member names and knows the dimensions they belong to. If a data source record inadvertently includes a member from a dimension for which there is a member named in the header record, the new member name replaces the header record member for that dimension. In the following example data source, Essbase recognizes Florida as a member of the Market dimension. The values in the last four records are interpreted as Florida values instead of Texas values.

<table>
<thead>
<tr>
<th>Jan</th>
<th>Actual</th>
<th>Texas</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;100-10&quot;</td>
<td>51.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;100-20&quot;</td>
<td>102.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;100-20&quot;</td>
<td>335.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Florida</td>
<td>96.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;200-20&quot;</td>
<td>276.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;200-20&quot;</td>
<td>113.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;200-10&quot;</td>
<td>167.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• There are any implicitly shared members (when a parent and child share the same data value) of which you were unaware.
  This situation occurs if a parent has only one child or only one child rolls up into the parent.
  See “Understanding Implied Sharing” on page 152.

• You added incoming data to existing data instead of replacing incoming data with existing data.
  See “Adding to and Subtracting from Existing Values” on page 302.

• You selected or rejected any records that you did not intend to select or reject.
  See “Selecting Records” on page 293 and “Rejecting Records” on page 294.

• The sign is reversed (for example, a minus sign instead of a plus sign) and whether you performed sign flips on any UDAs.
  See “Flipping Field Signs” on page 304.

• You cleared data combinations that you did not intend to clear.
  See “Clearing Existing Data Values” on page 303.

• You scaled the incoming values incorrectly.
  See “Scaling Data Values” on page 304.

• All member and alias names are fewer than 79 characters long.

Note: You can check data by exporting it, by running a report on it, or by using a spreadsheet. If exporting or running reports, see Chapter 35, “Developing Report Scripts” and Appendix E, “Using ESSCMD.” If using a spreadsheet, see Oracle Smart View for Office User’s Guide.

Creating Rejection Criteria for End of File Markers

A SQL data source may have an end of file marker made up of special characters that cause a data load or dimension build to fail. To fix this problem, define a rejection criterion to reject the problem record.

➢ To define rejection criteria:

1 Find the end of file marker in the SQL data source.

2 Determine how to search for the end of file marker using the Essbase search command.
  This task may be difficult, because the end of file marker may be composed of one or more special characters.
  See “Ignoring Fields By Specifying Tokens” in the Oracle Essbase Administration Services Online Help.

3 Define a rejection criterion that rejects the end of file marker.
  See “Rejecting Records” in the Oracle Essbase Administration Services Online Help.
Understanding How Essbase Processes a Rules File

Sometimes, you can track down problems with dimension builds by understanding how Essbase initializes the rules file and processes the data source.

Essbase performs the following steps to initialize a rules file:

1. Validates the rules file against the associated outline.
2. Validates the dimensions. This process includes ensuring that the build method and field types are compatible and that each dimension name is unique. Member names must be either unique or shared.
3. Adds new dimensions defined in the rules file to the outline.
4. Reads header records specified in the data source.

Then Essbase performs the following operations on each record of the data source during a data load or dimension build:

1. Sets the file delimiters for all records.
2. Applies field operations to the data in the order in which the operations are defined in the rules file.
   
   Field operations include joins, moves, splits, and creating fields using text and joins. To see the order in which field operations are defined in the rules file, see “Performing Operations on Fields” on page 297.
3. Essbase applies all properties for each field, applying all properties to field1 before proceeding to field2. Essbase applies field properties in the following order:
   a. Ignores fields set to be ignored during data load
   b. Ignores fields set to be ignored during dimension build
   c. Flags the data field
   d. Applies field names
   e. Applies field generations
   f. Performs all replaces in the order in which they are defined in the rules file
   g. Drops leading and trailing spaces
   h. Converts spaces to underscores
   i. Applies suffix and prefix operations
   j. Scales data values
   k. Converts text to lowercase
   l. Converts text to uppercase
4. Adds members, or member information, or both, to the outline
5. If you chose to skip lines, Essbase skips the number of lines that you specified; otherwise, Essbase proceeds to the first record.
6. Essbase performs selection or rejection criteria in the order in which the criteria are defined in the rules file. Essbase loads or rejects individual records of the data source based on the specified criteria.

Understanding How Essbase Processes Missing or Invalid Fields During a Data Load

The following sections describe how Essbase processes invalid fields during a data load.

Missing Dimension or Member Fields

If a dimension or member field is missing, Essbase uses the value that it used previously for that dimension or member field. If there is no previous value, Essbase aborts the data load.

For example, when you load the following file into the Sample.Basic database, Essbase maps the Ohio member field into the Market dimension for all records, including the records that have Root Beer and Diet Cola in the Product dimension.

<table>
<thead>
<tr>
<th>Jan</th>
<th>Sales</th>
<th>Actual</th>
<th>Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cola</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Root Beer&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Diet Cola&quot;</td>
</tr>
</tbody>
</table>

Essbase stops the data load if no prior record contains a value for the missing member field. For example, if you try to load the following file into the Sample.Basic database, the data load stops, because the Market dimension (Ohio, in the previous example) is not specified.

<table>
<thead>
<tr>
<th>Jan</th>
<th>Sales</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cola</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;Root Beer&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;Diet Cola&quot;</td>
</tr>
</tbody>
</table>

For information on restarting the load, see “Loading Dimension Build and Data Load Error Logs” on page 753.

Unknown Member Fields

If you are performing a data load and Essbase encounters an unknown member name, Essbase rejects the entire record. If there is a prior record with a member name for the missing member field, Essbase continues to the next record. If there is no prior record, the data load stops. For example, when you load the following file into the Sample.Basic database, Essbase rejects the record containing Ginger Ale because it is not a valid member name. Essbase loads the records containing Cola, Root Beer, and Cream Soda. If Ginger Ale were in the first record, however, the data load would stop.

<table>
<thead>
<tr>
<th>Jan, Sales, Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio   Cola</td>
</tr>
<tr>
<td>&quot;Root Beer&quot;</td>
</tr>
<tr>
<td>&quot;Ginger Ale&quot;</td>
</tr>
<tr>
<td>&quot;Cream Soda&quot;</td>
</tr>
</tbody>
</table>
**Note:** If you are performing a dimension build, you can add the new member to the database. See “Performing Data Loads or Dimension Builds” on page 305.

For information on restarting the load, see “Loading Dimension Build and Data Load Error Logs” on page 753.

### Invalid Data Fields

If you are performing a data load, when Essbase encounters an invalid data field, it stops the data load. Essbase loads all fields read before the invalid field into the database, resulting in a partial data load. For example, in the following file, Essbase stops the data load when it encounters the 15- data value. Essbase loads the Jan and Feb Sales records but not the Mar and Apr Sales records.

<table>
<thead>
<tr>
<th>East</th>
<th>Cola</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>Jan</td>
<td>$10</td>
</tr>
<tr>
<td></td>
<td>Feb</td>
<td>$21</td>
</tr>
<tr>
<td></td>
<td>Mar</td>
<td>$15-</td>
</tr>
<tr>
<td></td>
<td>Apr</td>
<td>$16</td>
</tr>
</tbody>
</table>

For information on continuing the load, see “Loading Dimension Build and Data Load Error Logs” on page 753.
Understanding Advanced Dimension Building Concepts

In This Chapter

Understanding Build Methods ................................................................. 319
Using Generation References ................................................................. 320
Using Level References ........................................................................... 322
Using Parent-Child References ............................................................... 324
Adding a List of New Members ................................................................. 326
Building Attribute Dimensions and Associating Attributes .................. 329
Building Shared Members by Using a Rules File ...................................... 339
Building Duplicate Member Outlines ...................................................... 347

All examples in this chapter are based on the Sample.Basic database.

Understanding Build Methods

The build method that you select depends on the type of data in the data source and determines the algorithm that Essbase uses to add, change, or remove dimensions, members, and aliases in the outline.

Use the guidelines in Table 43 to select the appropriate build method for the data source:

Table 43  Build Method Guidelines

<table>
<thead>
<tr>
<th>Type of Data in Each Record</th>
<th>Examples</th>
<th>Desired Operation</th>
<th>Build Method</th>
<th>Field Type Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top-down data</td>
<td>Year, Quarter, Month</td>
<td>Modify the properties of existing dimensions and members</td>
<td>Generation references</td>
<td>The generation number for each field.</td>
</tr>
<tr>
<td>Each record specifies the parent's name, the child's name, the children of that child, and so on.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Bottom-up data              | Month, Quarter, Year | ● Create shared members that roll up into different generations  
● Modify the properties of existing dimensions and members | Level references | The level number for each field. |
<p>| Each record specifies the name of the member, the name of its parent, the name of its parent's parent, and so forth. |</p>
<table>
<thead>
<tr>
<th>Type of Data in Each Record</th>
<th>Examples</th>
<th>Desired Operation</th>
<th>Build Method</th>
<th>Field Type Information</th>
</tr>
</thead>
</table>
| Parent followed by its child | Cola, Diet Cola | - Create shared members that roll up into different generations  
- Share non-level 0 members  
- Modify properties of existing dimensions and members | Parent-child references | Whether a field is parent or child. The field number is 0. |
| A list of new members | Jan, Feb, Mar, April | Add all members as children of an existing parent (possibly a “dummy” parent) | Add as child of the specified parent | |
| | 800-10, 800-20 | Add all members at the end of the dimension | Add as sibling at the lowest level | |
| | 800-10, 800-20 | Add each new member to the dimension that contains similar members | Add as sibling to a member with a matching string | |
| A list of base dimension members and their attributes | Cola 16oz Can, Root Beer 14oz Bottle | Add members to an attribute dimension and associate the added members with the appropriate members of the base dimension | Generation, level, or parent-child references, depending on the organization of the source data | The number for each field.  
The number is either the generation or level number of the associated member of the base dimension or zero. |

1. Using a level references build, you cannot create an alias that has the same name as its member. This restriction does not apply if you use other build methods, including the generation references build method.

Using Generation References

Top-down data sources are organized left to right from the highest level to the lowest level. Each record begins with the most general information and progresses to the most specific information. The name of the new member is at the end of the record. When using a top-down data source, use the generation references build method. In the rules file, specify the generation number and the field type of each field of the data source.

Essbase numbers members within a dimension according to the hierarchical position of the member within the dimension. The numbers are called generation references. A dimension is always generation 1. All members at the same branch in a dimension are called a generation. Generations are numbered top-down according to their position relative to the dimension; that is, relative to dimension 1.

For example, as illustrated in Figure 65, the Product dimension is generation 1. Product has a 100 member, which is generation 2. 100 has members, such as 100-10, which are generation 3. To use the generation references build method, specify the generation reference number in the rules file.
The top half of Figure 66 shows a top-down data source (GENREF.TXT). The data source is used to build the Product dimension. The bottom half shows the rules file for the data source (GENREF.RUL). The rules file specifies the generation number for each field in the data source. See “Setting Field Type Information” on page 285.

Figure 66 Rules File for Generation Build

<table>
<thead>
<tr>
<th></th>
<th>GEN2</th>
<th>GEN3</th>
<th>Product</th>
<th>GEN4</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>500</td>
<td>500-10</td>
<td>500-10-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>500</td>
<td>500-10</td>
<td>500-10-20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>500</td>
<td>500-20</td>
<td>500-20-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>500</td>
<td>500-20</td>
<td>500-20-15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>500</td>
<td>500-20</td>
<td>500-20-20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 67 shows the tree that Essbase builds from the GENREF.TXT data source and GENREF.RUL rules file:

Dealing with Empty Fields

When you use the generation references build method, you can choose to process null values. Null processing specifies what actions Essbase takes when it encounters empty fields, also known as null fields, in the data source.

If null processing is not enabled, Essbase rejects all records with null values and writes an error to the error log.

If null processing is enabled, Essbase processes nulls as in the following ways:

- **Missing field**: If the null occurs where Essbase expects a GENERATION field, Essbase promotes the next GENERATION field to replace the missing field.
In the following example, there is no field in the GEN3,Products column:

<table>
<thead>
<tr>
<th>GEN2,Products</th>
<th>GEN3,Products</th>
<th>GEN4,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td></td>
<td>100-10a</td>
</tr>
</tbody>
</table>

When Essbase reads the record, it promotes the GEN4 field (100-10a) to GEN3, as if the data source looked like the following example:

<table>
<thead>
<tr>
<th>GEN2,Products</th>
<th>GEN3,Products</th>
<th>GEN4,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td></td>
<td>100-10a</td>
</tr>
</tbody>
</table>

- **Missing field before secondary field:** If a null occurs directly before a secondary field, Essbase ignores the secondary field. (Secondary field types are alias, property, formula, duplicate generation, duplicate generation alias, currency name, currency category, attribute parent, UDA, and name of an attribute dimension.)

In the following example, there is no field in the GEN2, Products or the ALIAS2,Products column:

<table>
<thead>
<tr>
<th>GEN2,Products</th>
<th>ALIAS2,Products</th>
<th>GEN3,Products</th>
<th>GEN4,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cola</td>
<td>100-10</td>
<td>100-10a</td>
<td></td>
</tr>
</tbody>
</table>

When Essbase reads the record, it ignores the ALIAS2 field and promotes the GEN3 field (100-10) to GEN2 and the GEN4 field (100-10a) to GEN3, as if the data source looked like the following example:

<table>
<thead>
<tr>
<th>GEN2,Products</th>
<th>ALIAS2,Products</th>
<th>GEN3,Products</th>
<th>GEN4,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10</td>
<td>Cola</td>
<td>100-10a</td>
<td></td>
</tr>
</tbody>
</table>

- **Missing secondary field:** If the null occurs where Essbase expects a secondary field, Essbase ignores the secondary null field and continues loading.

In the following example, there is no field in the ALIAS2, Products column:

<table>
<thead>
<tr>
<th>GEN2,Products</th>
<th>ALIAS2,Products</th>
<th>GEN3,Products</th>
<th>GEN4,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100-10</td>
<td>100-10a</td>
<td></td>
</tr>
</tbody>
</table>

When Essbase reads the record, it ignores the ALIAS2 field and loads the other fields.

**Using Level References**

In a bottom-up data source, each record defines a single member of a dimension. The definition begins with the most specific information about the member and provides progressively more general information. A typical record specifies the name of the new member, then the name of its parent, then its parent’s parent, and so forth.

Levels are defined from a bottom-up hierarchical structure. For example, in the outline in Figure 68, the lowest-level members are at the bottoms of the branches of the Product dimension.
To build the outline in Figure 68, you can use the following bottom-up data source:

100-10-12  100-10  100
100-20-12  100-20  100

In a level reference build, the lowest-level members are sequenced left to right. Level 0 members are in the first field, level 1 members are in the second field, and so on. This organization is the opposite of how data is presented for generation references (top-down).

In the following example, the rules file uses the level reference build method to add members to the Product dimension. The rules file specifies the level number and the field type for each field of the data source (see “Setting Field Type Information” on page 285). The first column of the data source contains new members (600-10-11, 600-20-10, and 600-20-18). The second column contains the parents of the new members (600-10 and 600-20), and the third column contains parents of the parents (600).

For example, to build the tree in Figure 70, use Figure 69 to set up the data source (LEVEL.TXT) and the rules file (LEVEL.RUL).
Dealing with Empty Fields

When you use the level references build method, you can choose to process null values. Null processing specifies what actions Essbase takes when it encounters empty fields, also known as null fields, in the data source.

If null processing is not enabled, Essbase rejects all records with null values and writes an error to the error log.

If null processing is enabled, Essbase processes nulls in the following ways:

- **Missing field**: If a null occurs where Essbase expects a LEVEL field, Essbase promotes the next LEVEL field to replace the missing field.

  In the following example, there is no field in the LEVEL0, Products column:

<table>
<thead>
<tr>
<th>LEVEL0,Products</th>
<th>LEVEL1,Products</th>
<th>LEVEL2,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

  When Essbase reads the record, it promotes the LEVEL1 field (100-10) to LEVEL0 and the LEVEL2 field (100) to LEVEL1, as if the data source looked like the following example:

<table>
<thead>
<tr>
<th>LEVEL0,Products</th>
<th>LEVEL1,Products</th>
<th>LEVEL2,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

- **Missing field before a secondary field**: If a null occurs directly before a secondary field, Essbase ignores the secondary field. (Secondary field options are alias, property, formula, duplicate level, duplicate level alias, currency name, currency category, attribute parent, UDA, and a name of an attribute dimension.)

  In the following example, there is no field in the LEVEL0, Products column:

<table>
<thead>
<tr>
<th>LEVEL0,Products</th>
<th>ALIAS0,Products</th>
<th>LEVEL1,Products</th>
<th>LEVEL2,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10a</td>
<td>100-10</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

  When Essbase reads the record, it ignores the ALIAS0 field and promotes the LEVEL1 field (100-10) to LEVEL0 and the LEVEL2 field (100) to LEVEL1, as if the data source looked like the following example:

<table>
<thead>
<tr>
<th>LEVEL0,Products</th>
<th>ALIAS0,Products</th>
<th>LEVEL1,Products</th>
<th>LEVEL2,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10</td>
<td>Cola</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

- **Missing secondary field**: If a null occurs where Essbase expects a secondary field, Essbase ignores the secondary null field and continues loading.

  In the following example, there is no field in the ALIAS0, Products column:

<table>
<thead>
<tr>
<th>LEVEL0,Products</th>
<th>ALIAS0,Products</th>
<th>LEVEL1,Products</th>
<th>LEVEL2,Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10</td>
<td>100-10</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

  When Essbase reads the record, it ignores the ALIAS0 field and loads the other fields.

Using Parent-Child References

Use the parent-child references build method when every record of the data source specifies the name of a new member and the name of the parent to which you want to add the new member.
Members in a database exist in a parent-child relationship. Figure 71 shows part of the Product dimension with its parent and children relationships identified. Product is the parent of 100. 100 is the child of Product and the parent of 100-10, 100-10-12, and 100-10-16. 100-10, 100-10-12, and 100-10-16 are the children of 100.

A parent-child data source must contain at least two columns: a parent column and a child column, in that order. The data source can include columns with other information (for example, the alias, the attributes, or the properties of the new member). A record within a parent-child data source cannot specify multiple parents or multiple children, and cannot reverse the order of the parent and child columns.

In a parent-child build, the rules file specifies which column is the parent and which column is the child. For example, the top half of Figure 72 shows a data source (PARCHIL.TXT), in which each record specifies the name of a parent and the name of its child, in that order. The bottom half of the figure shows the rules file (PARCHIL.RUL) that specifies which column is the parent and which column is the child. Additionally, this example associates aliases with the child field.

Figure 73 shows the tree that Essbase builds from this data source and rules file.

Note: For duplicate member situations, the parent field must contain the qualified member name. See “Building Qualified Member Names Through the Rules File” on page 348.
Adding a List of New Members

If a data source consists of a list of new members and does not specify their ancestors, Essbase must decide where in the outline to add them. Essbase provides the following build methods for this type of data source:

- Add each new member as a sibling of the existing member whose text most closely matches its own.
  
  See “Adding Members Based On String Matches” on page 326.

- Add each new member as a sibling of the lowest-level existing member.
  
  See “Adding Members as Siblings of the Lowest Level” on page 327.

- Add all new members as children of a specified parent (generally a “dummy” parent).
  
  See “Adding Members to a Specified Parent” on page 328.

After Essbase adds all new members to the outline, it may be necessary to move the new members into their correct positions using Outline Editor. See “Positioning Dimensions and Members” on page 130.

Note: Essbase does not support concurrent attribute association with the Add as build methods.

Adding Members Based On String Matches

You can add new members from a data source to an existing dimension by matching strings with existing members. When Essbase encounters a new member in a data source, it scans the outline for a member name with similar text and adds the new member as a sibling of the member with the closest string match.

For example, the data source in Figure 74 (SIBSTR.TXT) contains two new members (100-11 and 200-22) to add to the Product dimension. The new members are similar to strings in the Product dimension: they contain three digits, one dash, and two digits.

To add the example members to the database, set the values in Table 44 in the rules file:

Table 44  Example of Adding Members Using String Matches

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field 1 (Product)</td>
<td>• Do not select a field type for the field</td>
<td>“Setting Field Type Information” on page 285</td>
</tr>
<tr>
<td></td>
<td>• Set the dimension for the field to Product (field 1 is displayed as</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Product, as shown in Figure 73)</td>
<td></td>
</tr>
<tr>
<td>Fields 2 through 6</td>
<td>Ignore the fields</td>
<td>“Ignoring Fields” on page 297</td>
</tr>
<tr>
<td>Product dimension</td>
<td>Select the “Add as sibling of matching string” build method</td>
<td>“Selecting a Build Method” on page 282</td>
</tr>
</tbody>
</table>
Figure 74 Rules File Fields Set to Add Members as Siblings with String Matches

```
1  100-11 Texas Sales 100 120 100
2  200-22 Texas Sales 111 154 100
```

Figure 75 shows the tree that Essbase builds from this data source and rules file. 100-11 is added as a sibling of 100 and 200-22 is added as a sibling of 200.

Figure 75 Tree for Adding Members as Siblings with String Matches

Adding Members as Siblings of the Lowest Level

You can add new members from a data source as siblings of members that reside at the lowest level of a dimension—at the level 0 branch. When Essbase encounters a new member in a data source, it scans the outline for the level 0 branch of members and adds the new member as a sibling of these members.

Note: If the outline contains multiple groups of members at this level, Essbase adds the new member to the first group of members that it encounters.

For example, the data source (SIBLOW.TXT) and the rules file (SIBLOW.RUL) in Figure 76 contain new members (A100-10 and A100-99) to add to the Measures dimension.

Figure 76 Rules File Fields Set to Add Members as Siblings of the Lowest Level

```
1  100-10 Texas A100-10 100 120 100
2  200-20 Texas A100-99 111 154 100
```

To add the example members dynamically to the database, set the values shown in Table 45 in the rules file:
Table 45  Example of Adding Members as Siblings of the Lowest Level

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field 3 (Measures)</td>
<td>• Do not select a field type for the field</td>
<td>“Setting Field Type Information” on page 285</td>
</tr>
<tr>
<td></td>
<td>• Set the dimension for the field to Measures (field 3 is displayed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>as Measures, as shown in Figure 76)</td>
<td></td>
</tr>
<tr>
<td>Fields 1, 2, 4, 5, and 6</td>
<td>Ignore the fields</td>
<td>“Ignoring Fields” on page 297</td>
</tr>
<tr>
<td>Measures dimension</td>
<td>Select the “Add as sibling of lowest level” build method</td>
<td>“Selecting a Build Method” on page 282</td>
</tr>
</tbody>
</table>

Figure 77 shows the tree that Essbase builds from this data source and rules file. A100–20 and A100–99 are added as siblings of Margin.

Adding Members to a Specified Parent

You can add all new members as children of a specified parent, generally a “dummy” parent. After Essbase adds all new members to the outline, review the added members and move or delete them in Outline Editor.

When Essbase encounters a new member in the data source, it adds the new member as a child of the parent that you define. The parent must be part of the outline before you start the dimension build.

For example, the data source in Figure 78 (SIBPAR.TXT) contains two new members (600-54 and 780-22) for the Product dimension (field 1). Assume that you previously added a member called NewProducts under the Products dimension.

Figure 78  Rules File Fields Set to Add Members as a Child of a Specified Parent

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>600-54</th>
<th>Texas</th>
<th>Sales</th>
<th>100</th>
<th>120</th>
<th>180</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>780-22</td>
<td>Texas</td>
<td>Sales</td>
<td>111</td>
<td>154</td>
<td>180</td>
</tr>
</tbody>
</table>

To add the example members to the database under the NewProducts member, set the values shown in Table 46 in the rules file:
Table 46  Example of Adding Members as a Child of a Specified Parent

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field 1 (Product)</td>
<td>• Do not select a field type for the field</td>
<td>&quot;Setting Field Type Information&quot; on page 285</td>
</tr>
<tr>
<td></td>
<td>• Set the dimension for the field to Product (field 1 is displayed as Product, as shown in Figure 78)</td>
<td></td>
</tr>
<tr>
<td>Fields 2 through 6</td>
<td>Ignore the fields</td>
<td>&quot;Ignoring Fields&quot; on page 297</td>
</tr>
<tr>
<td>Product dimension</td>
<td>Select the “Add as child of” build method</td>
<td>“Selecting a Build Method” on page 282</td>
</tr>
<tr>
<td></td>
<td>Enter NewProducts in the Add as Child of text box.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 79 shows the tree that Essbase builds from this data source and rules file. 600-54 and 780-22 are added as siblings of NewProducts.

Figure 79   Tree for Adding Members as a Child of a Specified Parent

Building Attribute Dimensions and Associating Attributes

When a data source contains attribute information, you must use one or more rules files to build attribute dimensions and to associate attributes with members of their base dimensions.

You can use rules files to build attribute dimensions dynamically, to add and delete members, and to establish or change attribute associations.

Working with attributes involves the following operations:

• If the base dimension does not exist, you must build it.
• You must build the attribute dimension.
• You must associate members of the base dimension with members of the attribute dimension.

You can use any of the following approaches to perform these operations:

• Build the base and attribute dimensions and perform the associations all simultaneously. Doing so, you use a single rules file to build the base dimension and one or more attribute dimensions to associate each attribute with the appropriate member of the base dimension.
Because this approach uses a single rules file, it can be the most convenient. Use this approach if the base dimension does not exist and each source data record contains all attribute information for each member of the base dimension.

- Build the attribute dimension and perform the associations in one rules file. Assuming that the base dimension is built in a separate step or that the base dimension already exists, you can build an attribute dimension and associate the attributes with the members of the base dimension in one step. You need only to define the attribute associations in the rules file. See “Associating Attributes” on page 330.

- Build the attribute dimension and then perform the associations using separate rules files. Assuming that the base dimension is built in a separate step or that the base dimension already exists, you can build an attribute dimension and associate the attributes with the members of the base dimension in separate steps. Build the attribute dimension, and then associate the attribute members with members of the base dimension. Use this approach when you build numeric attribute dimensions that are multilevel or that have members that represent different-sized ranges.

The following sections describe how to build attribute dimensions.

**Building Attribute Dimensions**

Before you build attribute dimensions in a database, you must define the attribute member name formats for the outline. See “Setting Member Names in Attribute Dimensions” on page 173.

You can build attribute dimensions in one of the following ways:

- The same way in which you build standard dimensions.
  See “Process for Data Loading and Dimension Building” on page 266.

- Simultaneously, as you associate attributes with members of the base dimension.
  See “Associating Attributes” on page 330.

Essbase does not support concurrent attribute association with the Add as build methods.

When you define the rules file for building attribute dimensions, specify the base dimension and the name of the attribute dimension file.

**Associating Attributes**

Whether you build the attribute dimension and associate the attribute members with the members of the base dimension in one step or in separate steps, define the fields as described in this section.

**Note:** If you are working with a multilevel attribute dimension or with an attribute dimension of the type numeric, Boolean, or date, the rules file requires an additional field. See “Working with Multilevel Attribute Dimensions” on page 332.
Every record of the source data must include at least two columns: one for the member of the base dimension and one for the attribute value of the base dimension member. In the same source data record you can include additional columns for other attributes that you want to associate with the member of the base dimension. You must position the field for the member of the base dimension before any of the fields for the members of the attribute dimension.

Define the field type for the attribute dimension member as the name of the attribute dimension, use the generation or level number of the associated member of the base dimension, and specify the base dimension name. For example, as shown in the ATTRPROD.RUL file in Figure 80, the field definition Ounces3,Product specifies that the field contains members of the Ounces attribute dimension. Each member of this field is associated with the data field that is defined as the generation 3 member of the base dimension Product. Based on this field definition, Essbase associates the attribute 64 with the 500-10 member.

Figure 80  Rules File for Associating Attributes

<table>
<thead>
<tr>
<th></th>
<th>Caffeinated3,Product</th>
<th>Ounces3,Product</th>
<th>Product</th>
<th>Ounces3,Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>500</td>
<td>500-10</td>
<td>64</td>
<td>True</td>
</tr>
<tr>
<td>2</td>
<td>500</td>
<td>500-20</td>
<td>64</td>
<td>False</td>
</tr>
</tbody>
</table>

You can have Essbase use the attribute columns to build the members of the attribute dimensions. In Data Prep Editor, in the Dimension Build Settings tab of the Dimension Build Settings dialog box, clear the Do not create members option for the base dimension. See “Setting Member Properties” in the Oracle Essbase Administration Services Online Help.

When you are working with numeric ranges, you may need to build attribute dimensions and perform associations in separate steps. See “Working with Numeric Ranges” on page 334.

The Caffeinated3,Product field in Figure 80 shows how to associate attributes from additional single-level attribute dimensions. Because the base dimension is already specified, you need only to define an additional field for each attribute that you want to associate with the member of the base dimension.

The file in Figure 80 associates attributes as shown in the outline in Figure 81. Member 64 is a new member of the Ounces attribute dimension. Members 500, 500-10, and 500-20 are new members of the base dimension, Product, and are associated with member 64.

Figure 81  Associating Attributes

Member 64 is a new member of the Ounces attribute dimension. Members 500, 500-10, and 500-20 are new members of the base dimension, Product, and are associated with member 64.
Updating Attribute Associations

You can also use the rules file shown in Figure 80 on page 331 to change attribute associations. Ensure that you allow association changes. In Data Prep Editor, on the Dimension Build Settings tab of the Dimension Build Settings dialog box, check Allow association changes for the base dimension. See “Setting Member Properties” in the Oracle Essbase Administration Services Online Help.

Note: For duplicate member situations, the field to which the attribute is associated must contain the qualified member name. See “Building Qualified Member Names Through the Rules File” on page 348.

Removing Attribute Associations

To remove attribute associations, use the same process as for updating them, plus the following steps:

- In the Dimension Build Properties tab of the Field Properties dialog box, select Delete when the field is empty for the attribute field. (This option is ignored if Allow association changes is not selected.)
- Leave the field empty or NULL in the data source.

Working with Multilevel Attribute Dimensions

Multilevel, numeric, Boolean, and date attribute dimensions can have duplicate level 0 members. For example, associated with a Product dimension, you can have a Size attribute dimension with two levels. Level 1 categorizes sizes by men or by women. The level 0 members (attributes) are the actual sizes. You can have a member named 8 under Women and member named 8 under Men.

When an attribute is part of a multilevel numeric, Boolean, or date attribute dimension, the source data must include columns for all generations or levels of the attribute dimension. In the rules file, you must make copies of all fields that comprise the levels of the attribute dimension. Define the first set of attribute fields to build the attribute dimension. Define the second set of attribute fields to associate the attributes with the appropriate base dimension members. To ensure association with the correct attribute, indicate the parent field for the attribute field by making a copy of the parent field and setting the copy of the parent field as the field type Attribute Parent.

The position of the fields in the rules file is important.

- Place the copied attribute dimension field or fields that define the association immediately to the right of the field for the members of the base dimension.
- For a multilevel attribute dimension, place the attribute parent field immediately to the left of the field that is the child of the attribute parent.
The following steps describe how to define the fields in the rules file to build a multilevel attribute dimension and associate its members with members of its base dimension. This example uses the level references build method.

1. In the rules file, in field 1 and field 2, define the attribute dimension fields in the same way in which you define standard dimensions; specify type (level or generation), number, and dimension name.

   Essbase uses field1 and field2 to build the attribute dimension.

2. Define the fields for building the base dimension.

   In the following example, you are defining the level 0 and level 1 fields for the Product dimension. Figure 82 shows the fields of the rules file at this stage.

   Figure 82 Defining Multilevel Attribute Dimensions Before Adding the Association Fields

```
1  7 Women 00-023 100
2  8 Women 00-054 100
3  9 Men   00-165 300
4  9 Men   00-216 300
5  9 Men   00-343 400
```

<table>
<thead>
<tr>
<th>LEVEL0,Size</th>
<th>LEVEL1,Size</th>
<th>LEVEL0,Product</th>
<th>LEVEL1,Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Women</td>
<td>100-023</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2  Women</td>
<td>100-054</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3  Men</td>
<td>300-165</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>4  Men</td>
<td>300-216</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>5  Men</td>
<td>400-343</td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>

3. To define the association, make a copy of the field that contains the level 0 attribute.

   In the current example, make a copy of field 1.

   a. Use the attribute dimension name as the field type and specify the generation or level number of the member of the base dimension with which Essbase associates the attribute; for example, Size0.

   b. Specify the base dimension; for example, Product.

   c. Move the new field immediately to the right of the field for the base dimension with which Essbase associates the attribute.

      In the current example, move the new field to the right of the field Level0, Product.

4. Make a copy of the field containing the parent of the attribute field.

   In the current example, make a copy of field 2.

   a. Set the field type of the new field as Attribute Parent and specify the generation or level number of the base member with which you want Essbase to associate the attribute; for example, ATTRPARENT0.

   b. Specify the attribute dimension; for example, Size.

   c. Move the ATTRPARENT field immediately to the left of the attribute association field that you created in step 3.

As shown in Figure 83, the rules file now contains the field definitions to build the attribute dimension Size and to associate the members of Size with the appropriate members of the base dimension Product.
When you run a dimension build with the data shown in Figure 83, Essbase builds the Size attribute dimension and associates its members with the appropriate members of the base dimension. Figure 84 shows the updated outline.

### Working with Numeric Ranges

In many cases, you can use one rules file in a dimension build operation to dynamically build attribute dimensions for numeric ranges and to associate the members of the base dimension with the ranges. In the following situations, however, you must use two rules files: one to build the attribute dimension and one to associate the attributes with the appropriate members of the base dimension:

- When the range size is different for different members.
  - For example, you can define small ranges for towns and cities with smaller populations, larger ranges for mid-sized cities, and ranges greater than 1,000,000 for cities with large populations.

- When the ranges are members of a multilevel attribute dimension.
  - For example, the Population attribute dimension can have level 1 members that categorize the population ranges as Towns, Cities, and Metropolitan Areas.

The Population attribute dimension shown in Figure 85 demonstrates both situations. Population is a multilevel, numeric attribute dimension with level 0 members representing ranges of different sizes.
You must use one rules file to build the Population dimension and another rules file to associate the Population dimension members as attributes of members of the base dimension.

**Building Attribute Dimensions that Accommodate Ranges**

First, create a rules file that uses the generation, level, or parent-child build method to build the attribute dimension. In the rules file, specify the following information:

- The name of the attribute dimension and its associated base dimension.
- The fields for building the attribute dimension.

See “Setting Field Type Information” on page 285.

The source data must be in attribute sequence, in ascending order. If ranges have different sizes, the source data must include a record for every attribute range.

**Note:** In later builds, you cannot insert attribute members between existing members.

To use the generation method to build the outline in **Figure 85**, you must sequence the source data in ascending sequence, based on the numeric attribute value. Define the fields in a rules file as shown in **Figure 86**. Additionally, **Figure 86** shows how to associate aliases with attributes.
Associating Base Dimension Members with Their Range Attributes

After you build the numeric attribute dimension ranges, you need a rules file to associate the members of the base dimension with their attributes. The source data includes fields for the members of the base dimension and fields for the data values that Essbase uses to associate the appropriate Population attribute.

Define the rules file as shown in Figure 87.

Figure 87 Rules File for Associating Numeric Range Attributes

<table>
<thead>
<tr>
<th>CEN3, Market</th>
<th>GEN2, Market</th>
<th>Population3, Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>Albany, GA</td>
<td>117286</td>
</tr>
<tr>
<td>East</td>
<td>Boston, MA</td>
<td>2227707</td>
</tr>
<tr>
<td>East</td>
<td>Hartford, CT</td>
<td>1984524</td>
</tr>
<tr>
<td>West</td>
<td>Oakland, CA</td>
<td>2200629</td>
</tr>
<tr>
<td>Central</td>
<td>Rapid City, SD</td>
<td>67115</td>
</tr>
<tr>
<td>Central</td>
<td>St. Joseph, MO</td>
<td>97236</td>
</tr>
<tr>
<td>West</td>
<td>Tacoma, WA</td>
<td>657272</td>
</tr>
</tbody>
</table>

When you define the association field (for example, Population3, Market), place the attribute members within a range. In Data Prep Editor, on the Dimension Build Properties tab of the Field Properties dialog box, select “Place attribute members within a numeric range.”

Note: Figure 87 includes a city, Boston, whose population of 3,227,707 is outside the ranges of the attribute dimension in Figure 85 on page 335, where the ranges extend only to 3,000,000. To allow for values in the source data that are outside the ranges in the attribute dimension, enter a range size, such as 1000000. Essbase uses the range size to add members to the attribute dimension above the existing highest member or below the existing lowest member, as needed.

Caution! After you associate members of the base dimension with members of the attribute dimension, if you manually insert new members into the attribute dimension or rename members of the attribute dimension, you may invalidate existing attribute associations. Consider an example where numeric range attributes are defined as “Tops of ranges” and an attribute dimension contains members 100, 200, 500, and 1000. A base dimension member with the value 556 is associated with the attribute 1000. If you rename a attribute dimension member from 500 to 600, the base dimension member with the value 556 now has an invalid association. This base member is still associated with the attribute 1000 when it should be associated with the attribute 600. If you manually insert new members or rename existing members, to ensure that associations are correct, rerun the dimension build procedure and associate the base members with the changed attribute dimensions. For example, rerunning the attribute association procedure correctly associates the member of the base dimension with the value 556 with the new attribute 600.
Ensuring the Validity of Associations

To ensure the validity of attribute associations, you must select the correct dimension building options and perform the builds in the proper sequence.

- **Adding or Changing Members of the Attribute Dimension**: After you associate members of a base dimension with their numeric attribute ranges, if you manually insert new members or rename existing members in the attribute dimension, ensure that associations between attributes and base members are correct by performing one of the following tasks:
  - Rerun the dimension build procedure that associates the base members with the changed attribute dimension.
  - Use Outline Editor to manually review and fix, as needed, the associations of all base dimensions.

- **Deleting Members from the Attribute Dimension**: You can delete all members of an attribute dimension so that you can rebuild the dimension with new data. In Data Prep Editor, on the Dimension Building Properties tab on the Field Properties dialog box, click the Ranges button and select *Delete all members of this attribute dimension*. Essbase uses the start value and range size value to rebuild the attribute dimension. To ensure proper attribute association, on the Dimension Build Settings tab of the Dimension Build Settings dialog box, you must select the *Allow association changes* option for the base dimension.

- **Adding Members to the Base Dimension**: You can use the same rules file to add new members to the base dimension and to associate the new members with their numeric range attributes simultaneously. Provide a value for the range size. In Data Prep Editor, on the Dimension Build Properties tab in the Field Properties dialog box, click the Ranges button and specify the range size for the attribute dimension.

  If Essbase encounters a base dimension value that is greater than the highest attribute member by more than the range size or is lower than the lowest attribute member by more than the range size, it creates members in the attribute dimension to accommodate the out-of-range values.

  For example, in *Figure 88*, the numeric range attributes are defined as “Tops of ranges.” The highest value member of the Population attribute dimension is 3000000. If the source data includes a record with the population 4,420,000, and the range size is 1000000, Essbase adds two members to the attribute dimension, 4000000 and 5000000, and associates the base member with the value of 4,420,000 with the 5000000 attribute.

*Figure 88  Dynamically Adding Attribute Range Members*
When you add range members and base dimension members simultaneously, Essbase does not create aliases for the new members of the attribute dimension. If you want aliases that describe the range values for the new members of the attribute dimension, you must add the aliases in a separate operation.

**Reviewing the Rules for Building Attribute and Base Dimensions**

The information in this section describes areas unique to defining and associating attributes through a dimension build.

**Getting Ready**

- Before running a dimension build, you must define the attribute member name formats for the outline.
  
  See “Setting Member Names in Attribute Dimensions” on page 173.

- Defining new attribute dimensions in a rules file is different from defining new standard dimensions in a rules file.

**Defining Fields in Rules Files**

Rules files that are used to build single-level attribute dimensions require fewer field types than rules files that build and associate members of multilevel attribute dimensions.

- For single-level attribute dimensions, define the field that contains the attribute values as the field to be associated with the members of the base dimension. A dimension build uses the defined field to add new members to the attribute dimension.

  See “Associating Attributes” on page 330.

- For multilevel attribute dimensions, Essbase requires fields that define each generation or level in the attribute dimension and fields that define the associations. Use the new field type, Attribute Parent, to identify fields that are parent members for the attribute members being associated.

  See “Working with Multilevel Attribute Dimensions” on page 332.

**Controlling Adding New Attribute Members**

When Essbase encounters attribute data values that are not members of the attribute dimension, it automatically adds the values as new members. To prevent adding new members to attribute dimensions, in the Dimension Build Settings tab of the Dimension Build Settings dialog box, select the **Do not create members** option for the attribute dimension.

See “Setting Member Properties” in the *Oracle Essbase Administration Services Online Help*.

**Controlling Associations**

You can control the following associations:

- Making changes to attribute associations
In Data Prep Editor, in the Dimension Build Settings tab of the Dimension Build Settings dialog box, select the **Allow association changes** option for the attribute dimension.

See “Setting Member Properties” in the *Oracle Essbase Administration Services Online Help*.

- Enabling automatic association of base members with attributes that represent ranges of values

In Data Prep Editor, on the Dimension Building Properties tab of the Field Properties dialog box, click the **Ranges** button and define the size of the range.

See “Setting Field Type Information” on page 285.

- Concurrent attribute associations

Use any build method except the **Add as build** methods.

See “Understanding Build Methods” on page 319.

**Note:** Because attributes are defined only in the outline, the data load process does not affect them.

### Building Shared Members by Using a Rules File

The data associated with a shared member comes from an actual member with the same name as the shared member. Because the shared member stores a pointer to data contained in the actual member, the data is shared between the members and is stored only once.

For example, member 100-20 (Diet Cola) rolls up into the 100 family and into the Diet family.

**Figure 89 Shared Members in the Sample.Basic Database**

![Diagram of shared members in the Sample.Basic Database]

You can share members among as many parents as you want. Diet Cola has two parents (100 and Diet), but you can define it to roll up into more parents.

You can share members at multiple generations in the outline. In **Figure 89**, Diet Cola is shared by two members at generation 2 in the outline, but it can be shared by a member at generation 3 and a member at generation 4, as shown in Figure 94 on page 342.

Creating shared members at different generations in the outline is easy in Outline Editor; creating shared members using dimension build is more difficult. You must pick the build method and format the data source carefully.
The following sections describe how to build shared members in the outline by using a data source and a rules file.

- “Sharing Members at the Same Generation” on page 340
- “Sharing Members at Different Generations” on page 342
- “Sharing Non-Level 0 Members” on page 344
- “Building Multiple Roll-Ups by Using Level References” on page 345
- “Creating Shared Roll-Ups from Multiple Data Sources” on page 346

**Note:** You should not create an outline in which a shared member is located before the actual member with which it is associated. If you do this, you will encounter an error while validating the outline. However, during a dimension build, you can select an option in the Dimension Build Settings–Dimension Build Settings Tab to have Essbase fix the error by making the top-most shared member the primary member and the former primary member a shared member. See the *Oracle Essbase Administration Services Online Help*.

### Sharing Members at the Same Generation

Members that are shared at the same generation roll up into the same branch. 100-20 (Diet Cola) is shared by two parents (100 and Diet). Both parents roll up into the same branch (the Product dimension), and both parents are at generation 2, as shown in Figure 90:

**Figure 90  Sample Outline: Members Shared at the Same Generation**

<table>
<thead>
<tr>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
</tr>
<tr>
<td>20D</td>
</tr>
<tr>
<td>30D</td>
</tr>
<tr>
<td>40D</td>
</tr>
<tr>
<td>Diet</td>
</tr>
<tr>
<td>100-20 (c) (Shared Member)</td>
</tr>
<tr>
<td>20D-20 (c) (Shared Member)</td>
</tr>
<tr>
<td>30D-20 (c) (Shared Member)</td>
</tr>
<tr>
<td>40D-20 (c) (Shared Member)</td>
</tr>
</tbody>
</table>

Sharing members at the same generation is the simplest way to share members, and can be accomplished using generation, level, or parent-child references. See:

- “Using Generation References to Create Same Generation Shared Members” on page 341
- “Using Level References to Create Same Generation Shared Members” on page 341
- “Using Parent-Child References to Create Same Generation Shared Members” on page 342

Sample data source and rules files are provided for each build method. The result for each build method is shown in Figure 90.
Using Generation References to Create Same Generation Shared Members

To create shared member parents at the same generation by using the generation references build method, define the field type for the parent of the shared members as DUPGEN. A duplicate generation is a generation with shared members for children. Use the same GEN number as the primary member.

For example, to create the Diet parent and share members 100-20, 200-20, 300-20, and 400-20, use the sample data source file (SHGENREF.TXT) and set up the rules file so that the fields look like the sample rules file (SHGENREF.RUL) shown in Figure 91. 100 is the Cola family, 200 is the Root Beer family, 300 is the Cream Soda family, and -20 appended to the family name (for example, 100–20) indicates a diet version of the soda.

Figure 91 Sample Rules File: Members Shared at the Same Generation Using Generation References

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEN2,Product</td>
<td>DUPGEN2,Product</td>
<td>GEN3,Product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>100</td>
<td>Diet</td>
<td>100-20</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>Diet</td>
<td>200-20</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>300</td>
<td>Diet</td>
<td>300-20</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>400</td>
<td>Diet</td>
<td>400-20</td>
<td></td>
</tr>
</tbody>
</table>

Using Level References to Create Same Generation Shared Members

To create shared members of the same generation by using the level references build method, first ensure that the primary and any secondary roll-ups are specified in one record. You can specify as many secondary roll-ups as you want, as long as they are all in one record.

Define the field type for the shared member as LEVEL. Then enter the level number. To create a shared member of the same generation, set the level number of the secondary roll-up to have the same number of levels as the primary roll-up. While processing the data source, Essbase creates a parent at the specified level and inserts the shared members under it.

For example, to create the shared members 100-20 (Diet Cola), 200-20 (Diet Root Beer), 300-20 (Diet Cream Soda), and 400-20 (Diet Fruit Soda), use the sample data source file (SHLEV.TXT) and set up the rules file so that the fields look like the sample rules file (SHLEV.RUL) shown in Figure 92.

Figure 92 Sample Rules File: Members Shared at the Same Generation Using Level References

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100-20</td>
<td>100</td>
<td>Diet</td>
</tr>
<tr>
<td></td>
<td>200-20</td>
<td>200</td>
<td>Diet</td>
</tr>
<tr>
<td></td>
<td>300-20</td>
<td>300</td>
<td>Diet</td>
</tr>
<tr>
<td></td>
<td>400-20</td>
<td>400</td>
<td>Diet</td>
</tr>
</tbody>
</table>
Using Parent-Child References to Create Same Generation Shared Members

To create shared members of the same generation by using the parent-child references build method, define the PARENT and CHILD field types. Ensure that Essbase is set up to allow sharing (in the Dimension Build Settings tab of the Dimension Build Settings dialog box, clear the Do not share option). When sharing is enabled, Essbase automatically creates duplicate members under a new parent as shared members.

Figure 93  Sample Rules File: Members Shared at the Same Generation Using Parent-Child References

<table>
<thead>
<tr>
<th></th>
<th>Parent</th>
<th>Child</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>100-20</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>200-20</td>
</tr>
<tr>
<td>3</td>
<td>300</td>
<td>300-20</td>
</tr>
<tr>
<td>4</td>
<td>Diet</td>
<td>Diet-200-20</td>
</tr>
<tr>
<td>5</td>
<td>Diet-220-20</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Diet-300-20</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Diet-400-20</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Diet-500-20</td>
<td></td>
</tr>
</tbody>
</table>

Sharing Members at Different Generations

Sometimes you want shared members to roll up into parents that are at different generations in the outline. For example, in Figure 94, the shared members roll up into parents at generation 2 (Diet) and at generation 3 (TBC and Grandma’s). This outline assumes that TBC (The Beverage Company) buys some beverages from outside vendors: it buys 200-20 (Diet Root Beer) from a vendor named Grandma’s.

Figure 94  Sample Outline: Members Shared at Different Generations

Product
- 100
  - 200
  - 300
  - Diet
    - 100-20 (Shared Member)
    - 200-20 (Shared Member)
    - 300-20 (Shared Member)

Vendors
- TBC
  - 100-20 (Shared Member)
  - 200-20 (Shared Member)
- Grandma’s
  - 200-20 (Shared Member)

Sharing members at different generations can be accomplished using level or parent-child references. See:

- “Using Level References to Create Different Generation Shared Members” on page 343
- “Using Parent-Child References to Create Different Generation Shared Members” on page 343
Sample data source and rules files are provided for each build method. The result for each build method is shown in Figure 94.

**Using Level References to Create Different Generation Shared Members**

To create shared members of different generations by using the level references build method, ensure that primary and secondary roll-ups are specified in one record. You can specify as many secondary roll-ups as you want, as long as they are all in one record.

Define the field type for the shared member as LEVEL. Then enter the level number. While processing the data source, Essbase creates a parent at the specified level and inserts the shared members under it.

For example, to share the products 100-20, 200-20, and 300-20 with a parent called Diet and two parents called TBC and Grandma’s, use the sample data file and the rules file shown in Figure 95:

**Using Parent-Child References to Create Different Generation Shared Members**

To create shared members at different generations using the parent-child references build method, define the PARENT and CHILD field types. Ensure that Essbase is set up to allow sharing (on the Dimension Build Settings tab of the Dimension Build Settings dialog box, clear the Do not share option). When sharing is enabled, Essbase automatically creates duplicate members under a new parent as shared members.

---

**Figure 95 Sample Rules File: Members Shared at Different Generations Using Level References**

<table>
<thead>
<tr>
<th>LEVEL1,Product</th>
<th>LEVEL1,Product</th>
<th>LEVEL1,Product</th>
<th>LEVEL1,Product</th>
<th>LEVEL1,Product</th>
<th>LEVEL1,Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 100-20</td>
<td>100 Diet</td>
<td>TBC Vendors</td>
<td>2 200-20</td>
<td>200 Diet</td>
<td>TBC Vendors</td>
</tr>
<tr>
<td>3 300-20</td>
<td>300 Diet</td>
<td>TBC Vendors</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 96 Sample Rules File: Members Shared at Different Generations Using Parent-Child References**

<table>
<thead>
<tr>
<th>PARENT,Prod</th>
<th>CHILD0,Prod</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 100</td>
<td>100-20</td>
</tr>
<tr>
<td>2 200</td>
<td>200-20</td>
</tr>
<tr>
<td>3 300</td>
<td>300-20</td>
</tr>
<tr>
<td>4 Diet</td>
<td>100-20</td>
</tr>
<tr>
<td>5 Diet</td>
<td>200-20</td>
</tr>
<tr>
<td>6 Diet</td>
<td>300-20</td>
</tr>
</tbody>
</table>
Sharing Non-Level 0 Members

Sometimes you want to share non-level 0 members (members that are not at the lowest generation). For example, in Figure 97, 100, 200, and 300 are shared by TBC and Grandma’s. This outline assumes that TBC buys some of its product lines from outside vendors; it buys 200 (all root beer) from a vendor named Grandma’s.

Figure 97 Sample Outline: Non-Level 0 Members Shared at Different Generations

<table>
<thead>
<tr>
<th>Product</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Soda</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Diet</td>
<td></td>
</tr>
<tr>
<td>100-20</td>
<td>(Shared Member)</td>
</tr>
<tr>
<td>200-20</td>
<td>(Shared Member)</td>
</tr>
<tr>
<td>300-20</td>
<td>(Shared Member)</td>
</tr>
<tr>
<td>Vendors</td>
<td></td>
</tr>
<tr>
<td>TBC</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>(Shared Member)</td>
</tr>
<tr>
<td>200</td>
<td>(Shared Member)</td>
</tr>
<tr>
<td>Grandma’s</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>(Shared Member)</td>
</tr>
</tbody>
</table>

Sharing non-level 0 members can be accomplished using level or parent-child references. See:

- “Using Level References to Create Non-Level 0 Shared Members” on page 344
- “Using Parent-Child References to Create Non-Level 0 Shared Members” on page 345

Sample data source and rules files are provided for each build method. The result for each build method is shown in Figure 97.

**Using Level References to Create Non-Level 0 Shared Members**

To create shared non-level 0 members by using the level references build method, ensure that primary and secondary roll-ups are specified in one record. You can specify unlimited secondary roll-ups, as long as they are all in one record.

Define the field type for the parent of the shared member as duplicate level (DUPLEVEL), and then enter the level number. To create a shared member of the same generation, set the level number of the secondary roll-up to have the same number of levels as the primary roll-up. While processing the data source, Essbase creates a parent at the specified level and inserts the shared members under it.

For example, to share the product lines 100, 200, and 300 with a parent called Soda and parents called TBC and Grandma’s, use the sample data file and rules file shown in Figure 98. This data source and rules file work only if the Diet, TBC, and Grandma’s members exist in the outline. The DUPLEVEL field is always created as a child of the dimension (at generation 2), unless the named level field already exists in the outline.
Using Parent-Child References to Create Non-Level 0 Shared Members

The parent-child references build method is the most versatile for creating shared members. It does not have any restrictions on the position of the shared members in the outline, unlike the generation references and level references build methods.

To create non-level 0 shared members at the same generation using the parent-child references build method, define the PARENT and CHILD field types. Ensure that Essbase is set up to allow sharing (clear Do Not Share in the Dimension Build Settings tab of the Dimension Build Settings dialog box). When sharing is enabled, Essbase automatically creates duplicate members under a new parent as shared members.

Building Multiple Roll-Ups by Using Level References

To enable the retrieval of totals from multiple perspectives, you can also put shared members at different levels in the outline by using the level references build method. For example, the rules file (LEVELMUL .RUL) shown in Figure 100 and Figure 101 specifies build instructions for levels in the Product dimension:
Because the record is so long, this second graphic shows the rules file scrolled to the right to show the extra members:

When you run the dimension build using the data in Figure 101, Essbase builds the outline shown in Figure 102:

This example enables analysis not only by package type (Cans), but also by packaging material (comparing sales of aluminum cans and steel cans).

Because Product is a sparse dimension, you can use an alternative outline design to enable retrieval of the same information. For example, consider creating a multilevel attribute dimension for package type with Steel and Aluminum as level 0 members under Can. For outline design guidelines, see “Analyzing Database Design” on page 85.

Creating Shared Roll-Ups from Multiple Data Sources

In many situations, the data for a dimension is in multiple data sources. If you are building dimensions from multiple data sources and want to create multiple roll-ups, load the first data source using the most appropriate build method, and then load all other data sources using the parent-child references build method. Ensure that Essbase is set up to allow sharing (clear Do Not Share on the Dimension Build Settings tab of the Dimension Build Settings dialog box).

For example, using the following Product data source:
"Soft Drinks"   Cola
"Soft Drinks"   "Root Beer"
Cola            TBC
"Root Beer"     Grandma’s

Essbase builds the outline illustrated in **Figure 103**:

**Figure 103** Sample Outline: Soft Drinks

```
Product
  Soft Drinks
    Cola
    TBC
    Root Beer
    Grandma’s
```

Then load the second data source below to relate the products to the vendors using the parent-child build method. Ensure that Essbase is set up to allow sharing.

Vendor   TBC
Vendor   Grandma’s

Essbase builds the outline illustrated in **Figure 104**:

**Figure 104** Sample Outline: Vendors (Shared Roll-Ups)

```
Product
  Soft Drinks
    Cola
    TBC
    Root Beer
    Grandma’s
  Vendor
    TBC (Shared Member)
    Grandma’s (Shared Member)
```

**Building Duplicate Member Outlines**

Duplicate member outlines contain multiple members with the same name, where the values are not shared. In unique member outlines, only shared members can have the same name. See Chapter 8, “Creating and Working With Duplicate Member Outlines.”

The rules file enables you to set whether dimensions, levels, and generations in a duplicate member outline are unique or can include duplicate members.

➤ To set dimension uniqueness during a dimension build:

See “Setting Dimension Properties” in the *Oracle Essbase Administration Services Online Help*.

In the rules file, generation or level uniqueness is set on the Generation/Level Names tab of the Dimension Properties dialog box.

➤ To set generation or level uniqueness during a dimension build:

See “Setting Dimension Properties” in the *Oracle Essbase Administration Services Online Help*. 
Uniquely Identifying Members Through the Rules File

To ensure that duplicate member outline hierarchies are built correctly, use qualified member names in the data source or use the rules file to construct qualified member names from fields in the data source.

In most situations, the reference method and arrangement of fields provide enough information for Essbase to map data source columns to members in a duplicate member outline. The dimension build rules file for duplicate member is similar to the rules file for unique member outlines.

The following operations require more complex rules files for qualified member names:

- **Parent-child dimension builds**: The parent-child build method requires two fields, one for parent and one for child. For duplicate member situations the parent field must contain the qualified member name. Parent-child dimension builds on duplicate member outlines do not support attribute association. To ensure that attributes are associated with the correct members, perform the associations in a separate pass, using a generation-reference or level-reference rules file.

- **Association of attributes to existing members in the outline**: For duplicate member situations, the field to which the attribute is associated must contain the qualified member name.

Building Qualified Member Names Through the Rules File

If the data source does not contain the qualified member name as a field, you can use the rules file to edit and join multiple fields resulting in qualified member names.

To create qualified member names, use the Field Edits tab of the Data Source Properties dialog box to copy, move, and join fields, and to create brackets and periods. For example, you can assign population attributes to existing city members in a duplicate member dimension. You can use move, join, and create operations to build the qualified name.

For example, the cities in the following data source already exist in the outline. You want to associate with the cities the population attributes in the last column of this four-column data source:

<table>
<thead>
<tr>
<th>City</th>
<th>State</th>
<th>City</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>&quot;Kansas City&quot;</td>
<td>Kansas</td>
<td>706010</td>
</tr>
<tr>
<td>Central</td>
<td>&quot;Kansas City&quot;</td>
<td>Missouri</td>
<td>1070052</td>
</tr>
<tr>
<td>East</td>
<td>&quot;New York&quot;</td>
<td>&quot;New York&quot;</td>
<td>8104079</td>
</tr>
</tbody>
</table>

Editing this source through the rules file to build qualified names and sequence the field columns properly involves the following edits:

- **Using Create using text operations**, create one field each for the following text elements:
  - `[ `  
  - `].[ `  
  - `].[ `  
  - `] `
Using Move operations, move the fields to the following sequence:

1  2         3     4        5    6            7   8
[   Central   ].[   Kansas   ].[  Kansas City  ]  706010

Using Join operations, join together fields 1 2 3 4 5 6 7 to create the single field to which the attributes are to be associated: [Central].[Kansas].[Kansas City]. The rules file now shows two fields:

1                                 2
[Central].[Kansas].[Kansas City]  706010
In Calculating Data:

- Calculating Essbase Databases
- Developing Formulas for Block Storage Databases
- Reviewing Examples of Formulas for Block Storage Databases
- Defining Calculation Order
- Understanding Intelligent Calculation
- Dynamically Calculating Data Values
- Calculating Time Series Data
- Developing Calculation Scripts for Block Storage Databases
- Reviewing Examples of Calculation Scripts for Block Storage Databases
- Using Parallel Calculation
- Developing Custom-Defined Calculation Macros
- Developing Custom-Defined Calculation Functions
Calculating Essbase Databases

In This Chapter

About Database Calculation ................................................................. 353
About Multidimensional Calculation Concepts .......................................... 355
Setting the Default Calculation .............................................................. 358
Calculating Databases ........................................................................ 358
Canceling Calculations ......................................................................... 359
Parallel and Serial Calculation ............................................................... 359
Security Considerations ....................................................................... 359

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

- Chapter 60, “Comparison of Aggregate and Block Storage.”
- “Calculating Aggregate Storage Databases” on page 969

About Database Calculation

A database contains two types of values:

- Values that you enter, called input data
- Values that are calculated from input data

For example:

- You enter regional sales figures for a variety of products. You calculate the total sales for each.
- You enter the budget and actual values for the cost of goods sold for several products in several regions. You calculate the variance between budget and actual values for each product in each region.
- The database contains regional sales figures and prices for all products. You calculate what happens to total profit if you increase the price of one product in one region by 5%.

Small differences in the precision of cell values may occur between calculations run on different platforms, due to operating system math library differences.
Note: Most computers represent numbers in binary, and therefore can only approximately represent real numbers. Because binary computers cannot hold an infinite number of bits after a decimal point, numeric fractions such as one-third (0.3333...) cannot be expressed as a decimal with a terminating point. Fractions with a denominator of the power of two (for example, 0.50) or ten (0.10) are the only real numbers that can be represented exactly. See IEEE Standard 754 for Floating-Point Representation (IEEE, 1985).

Essbase offers two methods for calculating a database:

- Outline calculation
- Calculation script calculation

The method that you choose depends on the type of calculation that you want to perform.

**Outline Calculation**

Outline calculation is the simplest calculation method. Essbase bases the calculation of the database on the relationships between members in the database outline and on any formulas that are associated with members in the outline.

For example, Figure 105 shows the relationships between the members of the Market dimension in the Sample.Basic database. The values for New York, Massachusetts, Florida, Connecticut, and New Hampshire are added to calculate the value for East. The values for East, West, South, and Central are added to calculate the total value for Market.

![Figure 105 Relationship Between Members of the Market Dimension](image)

Figure 106 shows the Scenario dimension from the Sample.Basic database. The Variance and Variance % members are calculated by using the formulas attached to them.

![Figure 106 Calculation of Variance and Variance %](image)

It may be more efficient to calculate some member combinations when you retrieve the data instead of calculating the member combinations during the regular database calculation. You
can use dynamic calculations to calculate data at retrieval time. See Chapter 27, “Dynamically Calculating Data Values.”

**Calculation Script Calculation**

Calculation script calculation is the second method of calculation. Using a calculation script, you can choose exactly how to calculate a database. For example, you can calculate part of a database or copy data values between members.

A calculation script contains a series of calculation commands, equations, and formulas. For example, the following calculation script increases the actual marketing expenses in the New York region by 5%.

```plaintext
FIX (Actual, "New York")
    Marketing = Marketing * 1.05;
ENDFIX;
```

See Chapter 29, “Developing Calculation Scripts for Block Storage Databases.”

**About Multidimensional Calculation Concepts**

Figure 107, which is based on a simplified database, illustrates the nature of multidimensional calculations:

```
Figure 107  Calculating a Multidimensional Database

Accounts
    Margin (+)
    Sales (*)
    COGS ()
    Margin% (+) [Two Pass Calc] Margin % Sales;

Time
    Qtr1 (+)
    Jan (+)
    Feb (+)
    Mar (+)
    Qtr2 (+)
    Qtr3 (+)
    Qtr4 (+)

Scenario (Label Only)
    Actual (+)
    Budget (+)
```

The database has three dimensions—Accounts, Time, and Scenario.

The Accounts dimension has four members:

- Sales and COGS are input values
- Margin = Sales - COGS
- Margin% = Margin % Sales (Margin as a percentage of Sales)

The Time dimension has four quarters. The example displays only the members in Qtr1—Jan, Feb, and Mar.

The Scenario dimension has two child members—Budget for budget values and Actual for actual values.
The outline in Figure 107 is illustrated as a three-dimensional cube in Figure 108:

An intersection of members (one member on each dimension) represents a data value; a data value is stored in one cell in the database. To refer to a specific data value in a multidimensional database, you must specify each member on each dimension. In Essbase, member combinations are denoted by a cross-dimensional operator (->). Create the cross-dimensional operator using a hyphen (-) and a greater-than symbol (>). Do not include a space between the cross-dimensional operator and members.

The single cell containing the data value for Sales, Jan, Actual, as shown in Figure 109, is written as Sales -> Jan -> Actual.

When you refer to Sales, you are referring to a slice of the database containing eight values, as shown in Figure 110, which are:

- Sales -> Jan -> Actual
- Sales -> Feb -> Actual
- Sales -> Mar -> Actual
- Sales -> Qtr1 -> Actual
- Sales -> Jan -> Budget
- Sales -> Feb -> Budget
- Sales -> Mar -> Budget
- Sales -> Qtr1 -> Budget
When you refer to Actual Sales, you are referring to four values, as shown in Figure 111, which are:

- Sales -> Jan -> Actual
- Sales -> Feb -> Actual
- Sales -> Mar -> Actual
- Sales -> Qtr1 -> Actual

When Essbase calculates the formula “Margin% = Margin % Sales,” it takes each Margin value and calculates it as a percentage of its corresponding Sales value.

Essbase cycles through the database and calculates Margin% as follows:

1. Margin -> Jan -> Actual as a percentage of Sales -> Jan -> Actual.
   The result is placed in Margin% -> Jan -> Actual.
2. Margin -> Feb -> Actual as a percentage of Sales -> Feb -> Actual.
   The result is placed in Margin% -> Feb -> Actual.
   The result is placed in Margin% -> Mar -> Actual.
4. Margin -> Qtr1 -> Actual as a percentage of Sales -> Qtr1 -> Actual.
   The result is placed in Margin% -> Qtr1 -> Actual.
5. Margin -> Jan -> Budget as a percentage of Sales -> Jan -> Budget.
   The result is placed in Margin% -> Jan -> Budget.
6. Essbase continues cycling through the database until it has calculated Margin% for every combination of members in the database.

See Chapter 25, “Defining Calculation Order.”

**Setting the Default Calculation**

By default, the calculation for a database is a CALC ALL of the database outline. CALC ALL consolidates all dimensions and members and calculates all formulas in the outline.

You can, however, specify any calculation script as the default database calculation. Thus, you can assign a frequently used script to the database rather than loading the script each time you want to perform its calculation. If you want a calculation script to work with calculation settings defined at the database level, you must set the calculation script as the default calculation.

To set the default calculation, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting the Default Calculation</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDEFAULTCALCFILE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Calculating Databases**

If you have Calculation permissions, you can calculate a database.

When you use Administration Services to calculate a database, you can execute the calculation in the background so that you can continue working as the calculation processes. You can then check the status of the background process to see when the calculation is complete.

To calculate a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Calculating Block Storage Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>execute calculation</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>CALC, CALCDEFAULT, and CALCLINE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>Smart View</td>
<td>Calculating a Database</td>
<td>Oracle Smart View for Office User's Guide</td>
</tr>
</tbody>
</table>
Canceling Calculations

To stop a calculation before Essbase completes it, click the **Cancel** button while the calculation is running.

When you cancel a calculation, Essbase performs one of the following operations:

- Reverts all values to their previous state
- Retains any values calculated before the cancellation

How Essbase handles the cancellation depends on the Essbase Kernel Isolation Level settings. See “Understanding Isolation Levels” on page 777.

Parallel and Serial Calculation

Essbase supports parallel and serial calculations:

- **Serial calculation** (default): All steps in a calculation run on a single thread. Each task is completed before the next is started.
- **Parallel calculation**: The Essbase calculator can analyze a calculation, and, if appropriate, assign tasks to multiple CPUs (up to four).

See Chapter 31, “Using Parallel Calculation.”.

Security Considerations

To calculate a database, you must have Calculate permissions for the database outline. With calculate permissions, you can calculate any value in the database, and you can calculate a value even if a security filter denies you read and update permissions. Carefully consider providing users with calculate permissions.

Using Formulas and Formula Calculations ............................................................ 361
Process for Creating Formulas .......................................................................... 362
Understanding Formula Syntax ......................................................................... 363
Using Functions in Formulas ............................................................................ 367
Using Substitution and Environment Variables in Formulas ................................. 384
Using Formulas on Partitions ........................................................................... 385
Displaying Formulas ..................................................................................... 386

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

- Chapter 24, “Reviewing Examples of Formulas for Block Storage Databases”
- “Developing Formulas on Aggregate Storage Outlines” on page 924
- Chapter 29, “Developing Calculation Scripts for Block Storage Databases”
- Chapter 57, “Optimizing Calculations”

All of the examples in this chapter are based on the Sample.Basic database.

For more information about the functions referenced in this chapter, see the Oracle Essbase Technical Reference.

Using Formulas and Formula Calculations

Formulas calculate relationships between members in a database outline. With formulas, you can:

- Apply formulas to members in the database outline. Use this method if you do not need to control database calculations carefully for accuracy or performance. This method limits formula size to less than 64 KB.
  
  See “Using Functions in Formulas” on page 367.
- Place formulas in a calculation script. Use this method if you need to control database calculations carefully.
Figure 112 shows the Measures dimension from the Sample.Basic database. The Margin %, Profit %, and Profit per Ounce members are calculated using the formulas applied to them.

For formulas applied to members in a database outline, Essbase calculates formulas when you perform the following actions:

- Run a default (CALC ALL) calculation of a database.
- Run a calculation script that calculates the member containing the formula; for example, a CALC DIM of the dimension containing the member, or the member itself. See Chapter 29, “Developing Calculation Scripts for Block Storage Databases.”

For a formula in a calculation script, Essbase calculates the formula when it occurs in the calculation script.

If a formula is associated with a dynamically calculated member, Essbase calculates the formula when the user requests the data values. In a calculation script, you cannot calculate a dynamically calculated member or make a dynamically calculated member the target of a formula calculation. See Chapter 27, “Dynamically Calculating Data Values.”

Using dynamically calculated members in a formula on a database outline or in a calculation script can significantly affect calculation performance. Performance is affected because Essbase interrupts the regular calculation to perform the dynamic calculation.

You cannot use substitution variables in formulas that you apply to the database outline. See “Using Substitution Variables in Formulas” on page 385.

**Process for Creating Formulas**

You use Formula Editor, a tab in the Member Properties dialog box in Outline Editor, to create formulas. You can type the formulas directly into the formula text area, or you can use the Formula Editor UI features to create the formula.

Formulas are plain text. If required, you can create a formula in the text editor of your choice and paste it into Formula Editor.

To create a formula:

1. In Outline Editor, select the member to which to apply the formula.
2. Open Formula Editor.

See “Creating and Editing Formulas in Outlines” in the Oracle Essbase Administration Services Online Help.
Understanding Formula Syntax

When you create member formulas, follow these rules:

- End each statement in the formula with a semicolon (;). For example:
  
  \[ \text{Margin} \% \text{ Sales;} \]

- Use only saved outline member names. If a substitution variable is used for a member name, the substitution variable value must be a saved outline member name.

- Enclose a member name in double quotation marks (""") if the member name meets any of the following conditions:
  
  - Contains spaces. For example:
    
    "Opening Inventory" = "Ending Inventory" - Sales + Additions;
  
  - Is the same as an operator, function name, or keyword.
    
    See “Naming Conventions in Calculation Scripts, Report Scripts, Formulas, Filters, and Substitution and Environment Variable Values” on page 1098.
  
  - Includes any nonalphanumeric character. For example, hyphens (-), asterisks (*), and slashes (/).
  
  - Is all numeric or starts with one or more numerals. For example, "100" or "10Prod"

For a full list of member names that must be enclosed in quotation marks, see “Naming Conventions in Calculation Scripts, Report Scripts, Formulas, Filters, and Substitution and Environment Variable Values” on page 1098.

- End each IF statement in a formula with an ENDIF statement.

  For example, the following formula contains a simple IF...ENDIF statement. You can apply this formula to the Commission member in a database outline:

  \[
  \text{IF(Sales < 100)}
  \quad \text{Commission} = 0;
  \quad \text{ENDIF;}
  \]
If you are using an IF statement nested within another IF statement, end each IF with an ENDIF. For example:

"Opening Inventory"
(IF (@ISMBR(Budget))
  IF (@ISMBR(Jan))
    "Opening Inventory" = Jan;
  ELSE
    "Opening Inventory" = @PRIOR("Ending Inventory");
  ENDIF;
ENDIF;

- You do not need to end ELSE or ELSEIF statements with ENDIFs. For example:

  IF (@ISMBR(@DESCENDANTS(West)) OR @ISMBR(@DESCENDANTS(East))
    Marketing = Marketing * 1.5;
  ELSEIF (@ISMBR(@DESCENDANTS(South)))
    Marketing = Marketing * .9;
  ELSE Marketing = Marketing * 1.1;
  ENDIF;

  **Note:** If you use ELSE IF (with a space) rather than ELSEIF (one word) in a formula, you must supply an ENDIF for the IF statement.

- Ending ENDIF statements with a semicolon (;) is not required, but it is a good practice.

When writing formulas, you can check the syntax using the Formula Editor syntax checker. See “Checking Formula Syntax” on page 367.

See:
- “Operators” on page 364
- “Dimension and Member Names” on page 365
- “Constant Values” on page 365
- “Nonconstant Values” on page 365
- “Basic Equations” on page 366
- “Checking Formula Syntax” on page 367

## Operators

Table 47 lists the types of operators you can use in formulas:

<table>
<thead>
<tr>
<th>Operator Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical</td>
<td>Perform common arithmetic operations. For example, you can add, subtract, multiply, or divide values. See <strong>Mathematical Operations</strong> on page 372.</td>
</tr>
<tr>
<td>Operator Type</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Conditional</td>
<td>Control the flow of formula executions based on the results of conditional tests. For example, you can use an IF statement to test for a specified condition. See “Conditional Tests” on page 369.</td>
</tr>
<tr>
<td>Cross-dimensional</td>
<td>Point to the data values of specific member combinations. For example, you can point to the sales value for a specific product in a specific region. See “Working with Member Combinations Across Dimensions” on page 379.</td>
</tr>
</tbody>
</table>

For information about using operators with #MISSING, zero, and other values, see the “Essbase Functions” section in the *Oracle Essbase Technical Reference*.

**Dimension and Member Names**

You can include dimension and member names in a formula. For example:

- Scenario
- 100-10
- Feb

**Constant Values**

You can assign a constant value to a member. For example:

```
California = 120;
```

In this formula, California is a member in a sparse dimension and 120 is a constant value. Essbase automatically creates all possible data blocks for California and assigns the value 120 to all data cells. Many thousands of data blocks may be created.

To assign constants in a sparse dimension to only those intersections that require a value, use a FIX statement. See “Constant Values Assigned to Members in a Sparse Dimension” on page 869.

**Nonconstant Values**

If you assign anything other than a constant to a member in a sparse dimension, and no data block exists for that member, new blocks may not be created unless Essbase is enabled to create blocks on equations. By default, Create Blocks on Equations is disabled.

For example, to create blocks for West that did not exist before running the calculation, you must enable Create Blocks on Equations for this formula:

```
West = California + 120;
```
**Note:** If Create Blocks on Equations is disabled for a database and data blocks exist for members on either the left- or right-side of the equation, the formula produces results.

You can enable Create Blocks on Equations at the database level, whereby blocks are always created, or you can control block creation within calculation scripts using the SET CREATEBLOCKONEQ ON | OFF calculation command.

To enable the Create Blocks on Equations feature for all calculation scripts for a specific database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Enabling Create Blocks on Equations</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>Maxl</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Because unnecessary blocks can be created when Create Blocks on Equations is enabled at the application or database level, calculation performance can be affected. To control block creation within a calculation script, use the SET CREATEBLOCKONEQ ON | OFF calculation command. See “Nonconstant Values Assigned to Members in a Sparse Dimension” on page 869.

**Basic Equations**

You can apply a mathematical operation to a formula to create a basic equation. The equation can be in the database outline or in a calculation script.

The syntax for an equation:

\[
\text{member} = \text{mathematical\_operation};
\]

*member* is a member name from the database outline and *mathematical\_operation* is any valid mathematical operation.

In the following example, Essbase cycles through the database, subtracting the values in COGS from the values in Sales, and placing the results in Margin:

\[
\text{Margin} = \text{Sales} - \text{COGS};
\]

The following example shows how to use an equation in the database outline and in a calculation script. In the outline, apply the following formula to a Markup member:

\[
(\text{Retail} - \text{Cost}) \% \text{Retail};
\]

Then, in a calculation script, use this formula:

\[
\text{Markup} = (\text{Retail} - \text{Cost}) \% \text{Retail};
\]

Essbase cycles through the database, subtracting the values in Cost from the values in Retail, calculating the resulting values as a percentage of the values in Retail, and placing the result in Markup.
Checking Formula Syntax

Essbase includes Essbase Server-based formula syntax checking that tells you about syntax errors in formulas. For example, Essbase tells you if you have mistyped a function name. Unknown names can be validated against a list of custom-defined macro and function names. If you are not connected to a server or the application associated with the outline, Essbase may connect you to validate unknown names.

A syntax checker cannot tell you about semantic errors in a formula. Semantic errors occur when a formula does not work as you expect. To find semantic errors, run the calculation and check the results to ensure that they are as you expect.

Essbase displays the syntax checker results at the bottom of the Formula Editor. If Essbase finds no syntax errors, it displays the “No errors” message.

If Essbase finds one or more syntax errors, it displays the number of the line that includes the error and a brief description of the error. For example, if you do not include a semicolon end-of-line character at the end of a formula, Essbase displays a message similar to the following message:

Error: line 1: invalid statement; expected semicolon

If a formula passes validation in Formula Editor or Outline Editor, but Essbase Server detects semantic errors when the outline is saved, check the following:

- The incorrect formula is saved as part of the outline, even though it contains errors.
- Essbase Server writes a message in the application log that indicates what the error is and displays the incorrect formula.
- Essbase Server writes an error message to the comment field of the member associated with the incorrect formula. The message indicates that the incorrect formula was not loaded. You can view this comment in Outline Editor by closing and reopening the outline.
- If you do not correct the member formula, and a calculation that includes that member is run, the formula is ignored during the calculation.

After you have corrected the formula and saved the outline, the message in the member comment is deleted. You can view the updated comment when you reopen the outline.

To check formula syntax:

See “Creating and Editing Formulas in Outlines” in Oracle Essbase Administration Services Online Help.

Using Functions in Formulas

Functions are predefined routines that perform specialized calculations and return sets of members or data values. Table 48 lists the types of functions you can use in formulas:
<table>
<thead>
<tr>
<th>Function Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boolean</td>
<td>Provide a conditional test by returning a TRUE (1) or FALSE (0) value. For example, you can use the @ISMBR function to determine whether the current member matches any members specified. See “Conditional Tests” on page 369.</td>
</tr>
<tr>
<td>Mathematical</td>
<td>Perform specialized mathematical calculations. For example, you can use the @AVG function to return the average value of a list of members. See “Mathematical Operations” on page 372.</td>
</tr>
<tr>
<td>Relationship</td>
<td>Look up data values within a database during a calculation. For example, you can use the @ANCESTVAL function to return the ancestor values of a specified member combination. See “Member Relationship Functions” on page 373.</td>
</tr>
<tr>
<td>Range</td>
<td>Declare a range of members as an argument to another function or command. For example, you can use the @SUMRANGE function to return the sum of all members within a specified range. See “Range Functions” on page 374.</td>
</tr>
<tr>
<td>Financial</td>
<td>Perform specialized financial calculations. For example, you can use the @INTEREST function to calculate simple interest or the @PTD function to calculate period-to-date values. See “Financial Functions” on page 374.</td>
</tr>
<tr>
<td>Specifying member lists and ranges</td>
<td>Specify multiple members or a range of members. For example, the @ISMBR function tests to see if a member that is currently being calculated matches any of a list or range of specified members. See “Specifying Member Lists and Ranges” on page 376.</td>
</tr>
<tr>
<td>Generating member lists</td>
<td>Generate a list of members that is based on a specified member. For example, you can use the @ICHILDREN function to return a specified member and its children. See “Generating Member Lists” on page 376.</td>
</tr>
<tr>
<td>Character string manipulation</td>
<td>Manipulate character strings for member and dimension names. For example, you can generate member names by adding a character prefix to a name or removing a suffix from a name, or by passing the name as a string. See “Manipulating Member Names” on page 379.</td>
</tr>
<tr>
<td>Member combinations across dimensions</td>
<td>Point to data values of specific member combinations by using the cross-dimensional operator (-&gt;). See “Working with Member Combinations Across Dimensions” on page 379.</td>
</tr>
<tr>
<td>Interdependent values</td>
<td>For formulas that require values from members of the same dimension, but for which the required values have not yet been calculated. See “Using Interdependent Values” on page 380.</td>
</tr>
</tbody>
</table>

368
<table>
<thead>
<tr>
<th>Function Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variance percentages</td>
<td>Calculate a variance or percentage variance between budget and actual values.</td>
</tr>
<tr>
<td></td>
<td>See “Calculating Variances or Percentage Variances Between Actual and Budget Values” on page 381.</td>
</tr>
<tr>
<td>Allocation</td>
<td>Allocate values that are input at a parent level across child members. You can allocate values within the same dimension or across multiple dimensions. For example, you can use the @ALLOCATE function to allocate sales values that are input at a parent level to the children of the parent; the allocation of each child is determined by its share of the sales of the previous year. See “Allocating Values” on page 382.</td>
</tr>
<tr>
<td>Statistical</td>
<td>Calculate advanced statistics. For example, you can use the @RANK function to calculate the rank of a specified member or a specified value in a data set. See “Statistical Functions” on page 383.</td>
</tr>
<tr>
<td>Date and time</td>
<td>Use date and time characteristics in calculation formulas. For example, you can use the @TODATE function to convert date strings to numbers that can be used in calculation formulas. See “Date and Time Function” on page 384.</td>
</tr>
<tr>
<td>Calculation mode</td>
<td>Specify calculation modes that Essbase is to use to calculate a formula—cell, block, bottom-up, and top-down. See “Calculation Mode Function” on page 384.</td>
</tr>
<tr>
<td>Custom-defined</td>
<td>This type enables you to perform functions that you develop for calculation operations. These custom-developed functions are written in the Java programming language and are called by the Essbase calculator framework as external functions. See “Custom-Defined Functions” on page 384.</td>
</tr>
</tbody>
</table>

**Note:** Abbreviations of functions are not supported. Some commands may work in an abbreviated form, but if another function has a similar name, Essbase may use the wrong function. Use the complete function name to ensure correct results.

### Conditional Tests

You can define formulas that use a conditional test or a series of conditional tests to control the flow of calculation.

The **IF** and **ENDIF** commands define a *conditional block*. The formulas between the **IF** and the **ENDIF** commands are executed only if the test returns **TRUE** (1). If the test returns **FALSE** (0), you can use the **ELSE** and **ELSEIF** commands to specify alternative actions. The formulas following each **ELSE** command are executed only if the previous test returns **FALSE** (0). Conditions following each **ELSE** command are executed only if the previous **IF** command returns **FALSE** (0). See “Understanding Formula Syntax” on page 363.
When you use a conditional formula in a calculation script, enclose it in parentheses and associate it with a member in the database outline, as shown in the examples in this section.

In conjunction with an IF command, you can use functions that return TRUE or FALSE (1 or 0, respectively) based on the result of a conditional test. These functions are known as Boolean functions.

Use Boolean functions to determine which formula to use. The decision is based on the characteristics of the current member combination. For example, to restrict a certain calculation to the members in the Product dimension that contain input data, preface the calculation with an IF test based on @ISLEV(Product,0).

If one of the function parameters is a cross-dimensional member, such as @ISMBR(Sales - > Budget), all of the parts of the cross-dimensional member must match the properties of the current cell to return a value of TRUE (1).

Table 49 lists Boolean functions that specify conditions:

<table>
<thead>
<tr>
<th>Function</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ISACCTYPE</td>
<td>Current member has a specified accounts tag (for example, an Expense tag)</td>
</tr>
<tr>
<td>@ISANCEST</td>
<td>Current member is an ancestor of the specified member</td>
</tr>
<tr>
<td>@SIANCEST</td>
<td>Current member is an ancestor of the specified member, or the specified member itself</td>
</tr>
<tr>
<td>@ISCHILD</td>
<td>Current member is a child of the specified member</td>
</tr>
<tr>
<td>@SCHILD</td>
<td>Current member is a child of the specified member, or the specified member itself</td>
</tr>
<tr>
<td>@ISDESC</td>
<td>Current member is a descendant of the specified member</td>
</tr>
<tr>
<td>@IDESSEQ</td>
<td>Current member is a descendant of the specified member, or the specified member itself</td>
</tr>
<tr>
<td>@ISGEN</td>
<td>Current member of the specified dimension is in the generation specified</td>
</tr>
<tr>
<td>@ISLEV</td>
<td>Current member of the specified dimension is in the level specified</td>
</tr>
<tr>
<td>@ISMBR</td>
<td>Current member matches any of the specified members</td>
</tr>
<tr>
<td>@ISPARENT</td>
<td>Current member is the parent of the specified member</td>
</tr>
<tr>
<td>@ISIPARENT</td>
<td>Current member is the parent of the specified member, or the specified member itself</td>
</tr>
<tr>
<td>@ISSAMEGEN</td>
<td>Current member (of the same dimension as the specified member) is in the same generation as the specified member</td>
</tr>
<tr>
<td>@ISSAMELEV</td>
<td>Current member (of the same dimension as the specified member) is in the same level as the specified member</td>
</tr>
<tr>
<td>@ISSIBLING</td>
<td>Current member is a sibling of the specified member</td>
</tr>
<tr>
<td>@ISISIBLING</td>
<td>Current member is a sibling of the specified member, or the specified member itself</td>
</tr>
<tr>
<td>@ISUDA</td>
<td>A specified UDA exists for the current member of the specified dimension</td>
</tr>
</tbody>
</table>
When you place formulas on the database outline, you can use only the IF, ELSE, ELSEIF, and ENDIF commands and Boolean functions to control the flow of the calculations. You can use additional control commands in a calculation script.

For information about how to develop calculation scripts and how to use them to control how Essbase calculates a database, see Chapter 29, “Developing Calculation Scripts for Block Storage Databases.” For information on individual Essbase functions and calculation commands, see the Oracle Essbase Technical Reference.

**Examples of Conditional Tests**

You can apply the following formula to a Commission member in the database outline.

In the following example, the formula calculates commission at 1% of sales if the sales are greater than 500000:

```
IF(Sales > 500000)
    Commission = Sales * .01;
ENDIF;
```

If you place the formula in a calculation script, you must associate the formula with the Commission member as shown:

```
Commission (IF(Sales > 500000)
    Commission = Sales * .01;
ENDIF;)
```

Essbase cycles through the database, performing these calculations:

1. The IF statement checks to see if the value of Sales for the current member combination is greater than 500000.
2. If Sales is greater than 500000, Essbase multiplies the value in Sales by 0.01 and places the result in Commission.

In the next example, the formula tests the ancestry of the current member and then applies the appropriate Payroll calculation formula:

```
IF(@ISIDESC(East) OR @ISIDESC(West))
    Payroll = Sales * .15;
ELSEIF(@ISIDESC(Central))
    Payroll = Sales * .11;
ELSE
    Payroll = Sales * .10;
ENDIF;
```

If you place the formula in a calculation script, you must associate the formula with the Payroll member as shown:

```
Payroll(IF(@ISIDESC(East) OR @ISIDESC(West))
    Payroll = Sales * .15;
ELSEIF(@ISIDESC(Central))
    Payroll = Sales * .11;
ELSE
    Payroll = Sales * .10;
ENDIF;)
```
Essbase cycles through the database, performing the following calculations:

1. The IF statement uses the @ISIDESC function to check whether the current member on the Market dimension is a descendant of either East or West.

2. If the current member on the Market dimension is a descendant of East or West, Essbase multiplies the value in Sales by 0.15 and moves on to the next member combination.

3. If the current member is not a descendant of East or West, the ELSEIF statement uses the @ISIDESC function to check whether the current member is a descendant of Central.

4. If the current member on the Market dimension is a descendant of Central, Essbase multiplies the value in Sales by 0.11 and moves to the next member combination.

5. If the current member is not a descendant of East, West, or Central, Essbase multiplies the value in Sales by 0.10 and moves to the next member combination.

See “About Multidimensional Calculation Concepts” on page 355. For information on the @ISIDESC function, see the Oracle Essbase Technical Reference.

**Mathematical Operations**

Table 50 lists mathematical functions, which allow you to perform many mathematical operations in formulas:

<table>
<thead>
<tr>
<th>Function</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ABS</td>
<td>Return the absolute value of an expression</td>
</tr>
<tr>
<td>@AVG</td>
<td>Return the average value of the values in the specified member list</td>
</tr>
<tr>
<td>@EXP</td>
<td>Return the value of e (the base of natural logarithms) raised to power of the specified expression</td>
</tr>
<tr>
<td>@FACTORIAL</td>
<td>Return the factorial of an expression</td>
</tr>
<tr>
<td>@INT</td>
<td>Return the next-lowest integer value of a member or expression</td>
</tr>
<tr>
<td>@LN</td>
<td>Return the natural logarithm of a specified expression</td>
</tr>
<tr>
<td>@LOG</td>
<td>Return the logarithm to a specified base of a specified expression</td>
</tr>
<tr>
<td>@LOG10</td>
<td>Return the base-10 logarithm of a specified expression</td>
</tr>
<tr>
<td>@MAX</td>
<td>Return the maximum value among the expressions in the specified member list</td>
</tr>
<tr>
<td>@MAXS</td>
<td>Return the maximum value among the expressions in the specified member list, with the ability to skip zero and #MISSING values</td>
</tr>
<tr>
<td>@MIN</td>
<td>Return the minimum value among the expressions in the specified member list</td>
</tr>
<tr>
<td>@MINS</td>
<td>Return the minimum value among the expressions in the specified member list, with the ability to skip zero and #MISSING values</td>
</tr>
<tr>
<td>@MOD</td>
<td>Return the modulus produced by the division of two specified members</td>
</tr>
</tbody>
</table>
### Function

<table>
<thead>
<tr>
<th>Function</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>@POWER</td>
<td>Return the value of the specified member raised to the specified power</td>
</tr>
<tr>
<td>@REMAINDER</td>
<td>Return the remainder value of an expression</td>
</tr>
<tr>
<td>@ROUND</td>
<td>Return the member or expression rounded to the specified number of decimal places</td>
</tr>
<tr>
<td>@SUM</td>
<td>Return the summation of values of all specified members</td>
</tr>
<tr>
<td>@TRUNCATE</td>
<td>Return the truncated value of an expression</td>
</tr>
<tr>
<td>@VAR</td>
<td>Return the variance (difference) between two specified members.</td>
</tr>
<tr>
<td></td>
<td>See “Calculating Variances or Percentage Variances Between Actual and Budget Values” on page 381.</td>
</tr>
<tr>
<td>@VARPER</td>
<td>Return the percentage variance (difference) between two specified members.</td>
</tr>
<tr>
<td></td>
<td>See “Calculating Variances or Percentage Variances Between Actual and Budget Values” on page 381.</td>
</tr>
</tbody>
</table>

### Member Relationship Functions

Table 51 lists relationship functions, which allow you to use the member combination that Essbase is currently calculating to look up specific values:

<table>
<thead>
<tr>
<th>Table 51</th>
<th>List of Member Relationship Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Look-up Value</td>
</tr>
<tr>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>@ANCESTVAL</td>
<td>Ancestor values of the specified member combination</td>
</tr>
<tr>
<td>@ATTRIBUTEVAL</td>
<td>Numeric value of the attribute from the specified numeric or date attribute dimension associated with the current member</td>
</tr>
<tr>
<td>@ATTRIBUTESVAL</td>
<td>Text value of the attribute from the specified text attribute dimension associated with the current member</td>
</tr>
<tr>
<td>@ATTRIBUTEBVAL</td>
<td>Value (TRUE or FALSE) of the attribute from the specified Boolean attribute dimension associated with the current member</td>
</tr>
<tr>
<td>@CURGEN</td>
<td>Generation number of the current member combination for the specified dimension</td>
</tr>
<tr>
<td>@CURLEV</td>
<td>Level number of the current member combination for the specified dimension</td>
</tr>
<tr>
<td>@GEN</td>
<td>Generation number of the specified member</td>
</tr>
<tr>
<td>@LEV</td>
<td>Level number of the specified member</td>
</tr>
<tr>
<td>@MDANCESTVAL</td>
<td>Ancestor values of the specified member combination across multiple dimensions</td>
</tr>
<tr>
<td>@SANCESTVAL</td>
<td>Shared ancestor values of the specified member combination</td>
</tr>
<tr>
<td>@PARENTVAL</td>
<td>Parent values of the specified member combination</td>
</tr>
<tr>
<td>@MDPARENTVAL</td>
<td>Parent values of the specified member combination across multiple dimensions</td>
</tr>
<tr>
<td>@SPARENTVAL</td>
<td>Shared parent values of the specified member combination</td>
</tr>
<tr>
<td>Function</td>
<td>Look-up Value</td>
</tr>
<tr>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>@XREF</td>
<td>Data value from another database to be used for calculation of a value from the current database</td>
</tr>
<tr>
<td>@XWRITE</td>
<td>Used to write values to another Essbase database, or to the same database</td>
</tr>
</tbody>
</table>

For information about specific Essbase functions, see the *Oracle Essbase Technical Reference*.

**Range Functions**

Table 52 lists range functions, which allow you to execute a function for a range of members:

<table>
<thead>
<tr>
<th>Table 52</th>
<th>List of Range Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td><strong>Calculation</strong></td>
</tr>
<tr>
<td>@AVGRANGE</td>
<td>The average value of a member across a range of members</td>
</tr>
<tr>
<td>@CURRMBRRANGE</td>
<td>A range of members that is based on the relative position of the member combination Essbase is currently calculating</td>
</tr>
<tr>
<td>@MAXRANGE</td>
<td>The maximum value of a member across a range of members</td>
</tr>
<tr>
<td>@MAXSRANGE</td>
<td>The maximum value of a member across a range of members, with the ability to skip zero and #MISSING values</td>
</tr>
<tr>
<td>@MDSHIFT</td>
<td>The next or ( n )th member in a range of members, retaining all other members identical to the current member across multiple dimensions</td>
</tr>
<tr>
<td>@MINRANGE</td>
<td>The minimum value of a member across a range of members</td>
</tr>
<tr>
<td>@MINSRANGE</td>
<td>The minimum value of a member across a range of members, with the ability to skip zero and #MISSING values</td>
</tr>
<tr>
<td>@NEXT</td>
<td>The next or ( n )th member in a range of members</td>
</tr>
<tr>
<td>@NEXT</td>
<td>The next or ( n )th member in a range of members, with the option to skip #MISSING, zero, or both values</td>
</tr>
<tr>
<td>@PRIOR</td>
<td>The previous or ( n )th previous member in a range of members</td>
</tr>
<tr>
<td>@PRIORS</td>
<td>The previous or ( n )th previous member in a range of members, with the option to skip #MISSING, zero, or both values</td>
</tr>
<tr>
<td>@SHIFT</td>
<td>The next or ( n )th member in a range of members, retaining all other members identical to the current member and in the specified dimension</td>
</tr>
<tr>
<td>@SUMRANGE</td>
<td>The summation of values of all specified members across a range of members</td>
</tr>
</tbody>
</table>

**Financial Functions**

Table 53 on page 375 lists financial functions, which allow you to include financial calculations in formulas:
### Table 53  List of Financial Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ACCUM</td>
<td>An accumulation of values up to the specified member</td>
</tr>
<tr>
<td>@COMPOUND</td>
<td>The proceeds of a compound interest calculation</td>
</tr>
<tr>
<td>@COMPOUNDDOUGH</td>
<td>A series of values that represent the compound growth of the specified member across a range of members</td>
</tr>
<tr>
<td>@DECLINE</td>
<td>Depreciation for a specific period, calculated using the declining balance method</td>
</tr>
<tr>
<td>@DISCOUNT</td>
<td>A value discounted by the specified rate, from the first period of the range to the period in which the amount to discount is found</td>
</tr>
<tr>
<td>@GROWTH</td>
<td>A series of values that represents the linear growth of the specified value</td>
</tr>
<tr>
<td>@INTEREST</td>
<td>The simple interest for a specified member at a specified rate</td>
</tr>
<tr>
<td>@IRR</td>
<td>The Internal Rate of Return on a cash flow that is calculated across the time dimension or a specified range of members and must contain at least one investment (negative) and one income (positive). Includes an initial guess of 0.07 (the initial guess cannot be configured).</td>
</tr>
<tr>
<td>@IRRREX</td>
<td>The Internal Rate of Return on a cash flow that is calculated across the time dimension or a specified range of members and must contain at least one investment (negative) and one income (positive). Includes functionality to configure the initial guess and the number of iterations the algorithm can make.</td>
</tr>
<tr>
<td>@NPV</td>
<td>The Net Present Value of an investment (based on a series of payments and incomes)</td>
</tr>
<tr>
<td>@PTD</td>
<td>The period-to-date values of members in the dimension tagged as time</td>
</tr>
<tr>
<td>@SLN</td>
<td>The amount per period that an asset in the current period may be depreciated (calculated across a range of periods). The depreciation method used is straight-line depreciation.</td>
</tr>
<tr>
<td>@SYD</td>
<td>The amount per period that an asset in the current period may be depreciated (calculated across a range of periods). The depreciation method used is sum of the year's digits.</td>
</tr>
</tbody>
</table>

**Note:** One member formula cannot contain multiple financial functions (for example, @NPV and @SLN, or multiple instances of @NPV). A member formula that requires multiple financial functions must be broken into separate formulas so that each formula contains only one financial function (for example, `MemberName(@NPV(...));MemberName(@NPV(...))`).

### Member-Related Functions

This section discusses creating formulas that refer to members.

- “Specifying Member Lists and Ranges” on page 376
- “Generating Member Lists” on page 376
- “Manipulating Member Names” on page 379
Specifying Member Lists and Ranges

In some functions, you may need to specify multiple members, or you may need to specify a range of members. For example, the @ISMBR function tests to see if a member that is currently being calculated matches any of a list or range of specified members.

Table 54 lists the syntax for specifying members:

<table>
<thead>
<tr>
<th>Member List or Range</th>
<th>Syntax</th>
</tr>
</thead>
<tbody>
<tr>
<td>One member</td>
<td>The member name.</td>
</tr>
<tr>
<td>For example:</td>
<td>Mar2001</td>
</tr>
<tr>
<td>A list of members</td>
<td>A comma-delimited (,) list of member names.</td>
</tr>
<tr>
<td>A range of all members at the same level, between and including the two defining members</td>
<td>The two defining member names separated by a colon (:). For example:</td>
</tr>
<tr>
<td>Jan2000:Dec2000</td>
<td></td>
</tr>
<tr>
<td>A range of all members in the same generation, between and including the two defining members</td>
<td>The two defining member names separated by two colons (::). For example:</td>
</tr>
<tr>
<td>Q1_2000::Q4_2000</td>
<td></td>
</tr>
<tr>
<td>A function-generated list of members or a range of members</td>
<td>For a list of member list contents and corresponding functions, see &quot;Generating Member Lists&quot; on page 376.</td>
</tr>
<tr>
<td>A combination of ranges and list</td>
<td>Separate each range, list, and function with a comma (,). For example:</td>
</tr>
<tr>
<td>Q1_97::Q4_98, FY99, FY2000</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td>8SIBLINGS(Dept01), Dept65:Dept73, Total_Dept</td>
</tr>
</tbody>
</table>

If you do not specify a list of members or a range of members in a function that requires either, Essbase uses the level 0 members of the dimension tagged as time. If no dimension is tagged as time, Essbase displays an error message.

Generating Member Lists

Member set functions allow you to generate member lists that are based on a specified member or member list. Table 55 lists member set functions:
<table>
<thead>
<tr>
<th><strong>Function</strong></th>
<th><strong>Contents of Member List</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>@ALLANCESTORS</td>
<td>All ancestors of the specified member, including ancestors of the specified member as a shared member. This function does not include the specified member.</td>
</tr>
<tr>
<td>@IALLANCESTORS</td>
<td>All ancestors of the specified member, including ancestors of the specified member as a shared member. This function includes the specified member.</td>
</tr>
<tr>
<td>@ANCEST</td>
<td>The ancestor of the specified member at the specified generation or level</td>
</tr>
<tr>
<td>@ANCESTORS</td>
<td>All ancestors of the specified member (optionally, up to the specified generation or level), but not the specified member</td>
</tr>
<tr>
<td>@ANCESTORS</td>
<td>All ancestors of the specified member (optionally, up to the specified generation or level), including the specified member</td>
</tr>
<tr>
<td>@ANCESTORS</td>
<td>All ancestors of the specified list of members (optionally, up to the specified generation or level), but not including the specified members</td>
</tr>
<tr>
<td>@ANCESTORS</td>
<td>All ancestors of the specified list of members (optionally, up to the specified generation or level), including the specified members</td>
</tr>
<tr>
<td>@ATTRIBUTE</td>
<td>All base-dimension members that are associated with the specified attribute-dimension member</td>
</tr>
<tr>
<td>@WITHATTR</td>
<td>All base members that are associated with attributes that satisfy the specified conditions</td>
</tr>
<tr>
<td>@BETWEEN</td>
<td>All members whose name string value fall between, and are inclusive of, two specified string tokens</td>
</tr>
<tr>
<td>@CHILDREN</td>
<td>All children of the specified member, but not including the specified member</td>
</tr>
<tr>
<td>@CHILDREN</td>
<td>All children of the specified member, including the specified member</td>
</tr>
<tr>
<td>@CURRMBR</td>
<td>The current member being calculated for the specified dimension</td>
</tr>
<tr>
<td>@DESCENDANTS</td>
<td>All descendants of the specified member (optionally, up to the specified generation or level), but not the specified member nor descendants of shared members</td>
</tr>
<tr>
<td>@DESCENDANTS</td>
<td>All descendants of the specified member (optionally, up to the specified generation or level), including the specified member, but not descendants of shared members</td>
</tr>
<tr>
<td>@LDESCENDANTS</td>
<td>All descendants of the specified list of members (optionally, down to the specified generation or level), but not including the specified members</td>
</tr>
<tr>
<td>@LDESCENDANTS</td>
<td>All descendants of the specified list of members (optionally, down to the specified generation or level), including the specified members</td>
</tr>
<tr>
<td>@RDESCENDANTS</td>
<td>All descendants of the specified member (optionally, up to the specified generation or level), including descendants of shared members, but not the specified member</td>
</tr>
<tr>
<td>@RDESCENDANTS</td>
<td>All descendants of the specified member (optionally, up to the specified generation or level), including the specified member and descendants of shared members</td>
</tr>
<tr>
<td>@EQUAL</td>
<td>Member names that match the specified token name</td>
</tr>
<tr>
<td>@NOTEQUAL</td>
<td>Member names that do not match the specified token name</td>
</tr>
<tr>
<td>@EXPAND</td>
<td>Expands a member search by calling a member set function for each member in a member list</td>
</tr>
<tr>
<td>Function</td>
<td>Contents of Member List</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>@GENMBRS</td>
<td>All members of the specified generation in the specified dimension</td>
</tr>
<tr>
<td>@LEVMBRS</td>
<td>All members of the specified level in the specified dimension</td>
</tr>
<tr>
<td>@LIKE</td>
<td>Member names that match the specified pattern.</td>
</tr>
<tr>
<td>@LIST</td>
<td>Separate lists of members to be processed by functions that require multiple list arguments</td>
</tr>
<tr>
<td>@MATCH</td>
<td>All members that match the specified wildcard selection</td>
</tr>
<tr>
<td>@MBRCOMPARE</td>
<td>Member names that match the comparison criteria</td>
</tr>
<tr>
<td>@MBRPARENT</td>
<td>Parent of the specified member</td>
</tr>
<tr>
<td>@MEMBER</td>
<td>The member with the name that is provided as a character string</td>
</tr>
<tr>
<td>@MERGE</td>
<td>A merged list of two member lists to be processed by another function</td>
</tr>
<tr>
<td>@PARENT</td>
<td>The parent of the current member being calculated in the specified dimension</td>
</tr>
<tr>
<td>@RANGE</td>
<td>A member list that crosses the specified member from one dimension with the specified member range from another dimension</td>
</tr>
<tr>
<td>@REMOVE</td>
<td>A list of members from which some members have been removed</td>
</tr>
<tr>
<td>@RELATIVE</td>
<td>All members of the specified generation or level that are above or below the specified member</td>
</tr>
<tr>
<td>@SHARE</td>
<td>A member list that identifies all shared members among the specified members</td>
</tr>
<tr>
<td>@SIBLINGS</td>
<td>All siblings of the specified member, but not the specified member</td>
</tr>
<tr>
<td>@ISIBLINGS</td>
<td>All siblings of the specified member, including the specified member</td>
</tr>
<tr>
<td>@LSIBLINGS</td>
<td>All siblings that precede the specified member in the database outline, but not the specified member</td>
</tr>
<tr>
<td>@RSIBLINGS</td>
<td>All siblings that follow the specified member in the database outline, but not the specified member</td>
</tr>
<tr>
<td>@ILSIBLINGS</td>
<td>All siblings that precede the specified member in the database outline, including the specified member</td>
</tr>
<tr>
<td>@IRSIBLINGS</td>
<td>All siblings that follow the specified member in the database outline, including the specified member</td>
</tr>
<tr>
<td>@SHIFTSIBLING</td>
<td>The sibling at the specified distance from the member</td>
</tr>
<tr>
<td>@NEXTSIBLING</td>
<td>The next, or right-most, sibling of the member</td>
</tr>
<tr>
<td>@PREVSIBLING</td>
<td>The previous, or left-most, sibling of the member</td>
</tr>
<tr>
<td>@UDA</td>
<td>All members that have a common UDA defined on Essbase Server</td>
</tr>
<tr>
<td>@XRANGE</td>
<td>A member list that identifies the range of members between (and inclusive of) two specified single or cross-dimensional members at the same level</td>
</tr>
</tbody>
</table>
**Manipulating Member Names**

You can work with member names as character strings. Table 56 on page 379 lists character string manipulation functions:

<table>
<thead>
<tr>
<th>Function</th>
<th>Character String Manipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>@CONCATENATE</td>
<td>Create a character string that is the result of appending a member name or specified character string to another member name or character string</td>
</tr>
<tr>
<td>@NAME</td>
<td>Return a member name as a string</td>
</tr>
<tr>
<td>@SUBSTRING</td>
<td>Return a substring of characters from another character string or from a member name</td>
</tr>
</tbody>
</table>

**Working with Member Combinations Across Dimensions**

Use the cross-dimensional operator to point to data values of specific member combinations. Create the cross-dimensional operator using a hyphen (-) and a greater-than symbol (>). Do not include a space between the cross-dimensional operator and members.

*Figure 113* is a simplified illustration of a multidimensional cube, in which Jan is the first column on the X axis, Sales is the fourth and top-most row on the Y axis, and Actual is the first row on the Z axis. In this example, Sales -> Jan -> Actual is the intersection of a single data value.

The following example, which allocates miscellaneous expenses to each product in each market, illustrates how to use the cross-dimensional operator. The value of Misc Expenses for all products in all markets is known. The formula allocates a percentage of the total Misc Expenses value to each Product -> Market combination. The allocation is based on the value of Sales for each product in each market.

```
Misc_Expenses = Misc_Expenses -> Market -> Product * (Sales / (Sales -> Market -> Product));
```

Essbase cycles through the database, performing these calculations:

1. Divides the Sales value for the current member combination by the total Sales value for all markets and all products (Sales -> Market -> Product).
2. Multiplies the value calculated in step 1 by the Misc_Expenses value for all markets and all products (Misc_Expenses -> Market -> Product).

3. Allocates the result to Misc_Expenses for the current member combination.

Using the cross-dimensional operator can have significant performance implications. For optimization guidelines, see “Using Cross-Dimensional Operators” on page 870.

**Value-Related Functions**

This section discusses formulas related to values.

- “Using Interdependent Values” on page 380
- “Calculating Variances or Percentage Variances Between Actual and Budget Values” on page 381
- “Allocating Values” on page 382

**Using Interdependent Values**

Essbase optimizes calculation performance by calculating formulas for a range of members in the same dimension simultaneously. Some formulas, however, require values from members of the same dimension, and Essbase may not yet have calculated the required values.

A good example is that of cash flow, in which the opening inventory is dependent on the ending inventory from the previous month.

The values for Opening Inventory and Ending Inventory must be calculated on a month-by-month basis. Assume you want to achieve the results shown in **Table 57:**

<table>
<thead>
<tr>
<th>Table 57</th>
<th>Data Values for Cash Flow Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan</td>
</tr>
<tr>
<td>Opening Inventory</td>
<td>100</td>
</tr>
<tr>
<td>Sales</td>
<td>50</td>
</tr>
<tr>
<td>Addition</td>
<td>70</td>
</tr>
<tr>
<td>Ending Inventory</td>
<td>120</td>
</tr>
</tbody>
</table>

Assuming that the Opening Inventory value for January is loaded into the database, the following calculations are required to get the results in **Table 57:**

1. January Ending = January Opening – Sales + Additions
2. February Opening = January Ending
3. February Ending = February Opening – Sales + Additions
4. March Opening = February Ending
5. March Ending = March Opening – Sales + Additions

You can calculate the required results by applying interdependent, multiple equations to one member in the database outline.
The following formula, applied to the Opening Inventory member in the database outline, calculates the correct values:

```
IF (NOT @ISMBR (Jan))
    "Opening Inventory" = @PRIOR("Ending Inventory");
ENDIF;
"Ending Inventory" = "Opening Inventory" - Sales + Additions;
```

If you place the formula in a calculation script, you must associate the formula with the Opening Inventory member as shown:

```
"Opening Inventory"
(IF (NOT @ISMBR (Jan))
    "Opening Inventory" = @PRIOR("Ending Inventory");
ENDIF;)
"Ending Inventory" = "Opening Inventory" - Sales + Additions;
```

Essbase cycles through the months, performing the following calculations:

1. The IF statement and @ISMBR function check that the current member on the Year dimension is not Jan. This step is necessary because the Opening Inventory value for Jan is an input value.
2. If the current month is not Jan, the @PRIOR function obtains the value for the Ending Inventory for the previous month. This value is then allocated to the Opening Inventory of the current month.
3. The Ending Inventory is calculated for the current month.

**Note:** To calculate the correct results, you must place the above formula on one member, Opening Inventory. If you place the formulas for Opening Inventory and Ending Inventory on their separate members, Essbase calculates Opening Inventory for all months and then Ending Inventory for all months. This organization means that the value of the Ending Inventory of the previous month is not available when Opening Inventory is calculated.

### Calculating Variances or Percentage Variances Between Actual and Budget Values

You can use the @VAR and @VARPER functions to calculate a variance or percentage variance between budget and actual values.

You may want the variance to be positive or negative, depending on whether you are calculating variance for members on the accounts dimension that are expense or nonexpense items:

- Expense items. You want Essbase to show a positive variance if the actual values are less than the budget values (for example, if actual costs are less than budgeted costs).
- Nonexpense items. You want Essbase to show a negative variance if the actual values are less than the budget values (for example, if actual sales are less than budgeted sales).

By default, Essbase assumes that members are nonexpense items and calculates the variance accordingly.
To tell Essbase that a member is an expense item:

1. In Outline Editor, select the member.
   
The member must be on the dimension tagged as accounts.

2. Open Formula Editor.
   
   See “Creating and Editing Formulas in Outlines” in the Oracle Essbase Administration Services Online Help.

3. Tag the member as an expense item.
   
   See “Setting Variance Reporting Properties” on page 144.

When you use the @VAR or @VARPER functions, Essbase shows a positive variance if the actual values are less than the budget values. For example, in Sample.Basic, the children of Total Expenses are expense items. The Variance and Variance % members of the Scenario dimension calculate the variance between the Actual and Budget values. See Figure 114.

### Allocating Values

Allocation functions allow you to allocate values that are input at the parent level across child members in the same dimension or in different dimensions. The allocation is based on a variety of specified criteria.

<table>
<thead>
<tr>
<th>Table 58</th>
<th>List of Allocation Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Allocated Values</td>
</tr>
<tr>
<td>@ALLOCATE</td>
<td>Values from a member, cross-dimensional member, or value across a member list within the same dimension.</td>
</tr>
<tr>
<td>@MDALLOCATE</td>
<td>Values from a member, cross-dimensional member, or value across multiple dimensions.</td>
</tr>
</tbody>
</table>

For examples of calculation scripts using @ALLOCATE, see “Allocating Costs Across Products” on page 491; using @MDALLOCATE, see “Allocating Values Across Multiple Dimensions” on page 494.
Forecasting Functions

Forecasting functions allow you to manipulate data for the purposes of interpolating data or calculating future values. Table 59 lists the functions that forecast values:

<table>
<thead>
<tr>
<th>Function</th>
<th>Data Manipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>@MOVAVG</td>
<td>Apply a moving average to a data set and replace each term in the list with a trailing average. This function modifies the data set for smoothing purposes.</td>
</tr>
<tr>
<td>@MOVMAX</td>
<td>Apply a moving maximum to a data set and replace each term in the list with a trailing maximum. This function modifies the data set for smoothing purposes.</td>
</tr>
<tr>
<td>@MOVMED</td>
<td>Apply a moving median to a data set and replace each term in the list with a trailing median. This function modifies the data set for smoothing purposes.</td>
</tr>
<tr>
<td>@MOVMIN</td>
<td>Apply a moving minimum to a data set and replace each term in the list with a trailing minimum. This function modifies the data set for smoothing purposes.</td>
</tr>
<tr>
<td>@MOVSUM</td>
<td>Apply a moving sum to a data set and replace each term with a trailing sum. This function modifies the data set for smoothing purposes.</td>
</tr>
<tr>
<td>@MOVSUMX</td>
<td>Apply a moving sum to a data set and replace each term with a trailing sum. Specify how to assign values to members before you reach the number to sum. This function modifies the data set for smoothing purposes.</td>
</tr>
<tr>
<td>@SPLINE</td>
<td>Apply a smoothing spline to a set of data points. A spline is a mathematical curve that is used to smooth or interpolate data.</td>
</tr>
<tr>
<td>@TREND</td>
<td>Calculate future values and base the calculation on curve-fitting to historical values.</td>
</tr>
</tbody>
</table>

For information about specific Essbase functions, see the Oracle Essbase Technical Reference.

Statistical Functions

Statistical functions allow you to calculate advanced statistics in Essbase.

<table>
<thead>
<tr>
<th>Function</th>
<th>Calculated Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>@CORRELATION</td>
<td>The correlation coefficient between two parallel data sets</td>
</tr>
<tr>
<td>@COUNT</td>
<td>The number of values in the specified data set</td>
</tr>
<tr>
<td>@MEDIAN</td>
<td>The median, or middle number, in the specified data set</td>
</tr>
<tr>
<td>@MODE</td>
<td>The mode, or the most frequently occurring value, in the specified data set</td>
</tr>
<tr>
<td>@RANK</td>
<td>The rank of the specified member or value in the specified data set</td>
</tr>
<tr>
<td>Function</td>
<td>Calculated Value</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>@STDEV</td>
<td>The standard deviation, based upon a sample, of the specified members</td>
</tr>
<tr>
<td>@STDEVP</td>
<td>The standard deviation, based upon the entire population, of the specified members</td>
</tr>
<tr>
<td>@STDEV RANGE</td>
<td>The standard deviation, crossed with a range of members, of the specified members</td>
</tr>
<tr>
<td>@VARIANCE</td>
<td>The variance, based upon a sample, of the specified data set</td>
</tr>
<tr>
<td>@VARIANCEP</td>
<td>The variance, based upon the entire population, of the specified data set</td>
</tr>
</tbody>
</table>

**Date and Time Function**

The date function allows you to use dates with other functions.

@TODATE: Convert date strings to numbers that can be used in calculation formulas

**Calculation Mode Function**

The calculation mode function allows you to specify which calculation mode that Essbase uses to calculate a formula.

@CALCMODE: Specify the calculation mode (cell, block, bottom-up, or top-down) that Essbase uses to calculate a formula

**Note:** You can also use the configuration setting CALCMODE to set calculation modes to BLOCK or BOTTOMUP at the database, application, or server level. See the Oracle Essbase Technical Reference.

**Custom-Defined Functions**

You can create custom-defined functions, to be used in formulas and calculation scripts, to perform calculations not otherwise supported by the Essbase calculation scripting language. Custom-developed functions must be written in the Java programming language and registered on the Essbase Server. The Essbase calculator framework calls them as external functions.

Custom-defined functions are displayed in the functions tree in Calculation Script Editor, where you can select them to insert into a formula.

See Chapter 33, “Developing Custom-Defined Calculation Functions.”

**Using Substitution and Environment Variables in Formulas**

Substitution variables are used to reference information that changes frequently; environment variables are used as placeholders for user-specific system settings. See:
Using Substitution Variables in Formulas

Substitution variables act as placeholders for information that changes regularly; for example, time-period information. You can use substitution variables in formulas that you apply to the database outline.

When the outline is calculated, Essbase replaces the substitution variable with the value that you have assigned to it. You can create and assign values to substitution variables using Administration Services, MaxL, or ESSCMD.

You can set substitution variables at the server, application, and database levels. Essbase must be able to access the substitution variable from the application and database on which you are running the calculation scripts. See “Using Substitution Variables” on page 120.

To use a substitution variable in a formula, enter an ampersand (&), followed by the substitution variable name.

Essbase treats any text string preceded by & as a substitution variable.

For example, assume that the substitution variable UpToCurr is defined as Jan:Jun. You can use the following @ISMBR function as part of a conditional test:

@ISMBR(&UpToCurr)

At the time Essbase calculates the outline, it replaces the substitution variable, as shown:

@ISMBR(Jan:Jun)

Note: Substitution variables used in formulas for new outline members do not pass verification unless the outline is saved.

Using Environment Variables in Formulas

In outline member formulas, you can use system environment variables as placeholders for user-specific system settings. Because environment variables are defined at the operating system level, they are available to all formulas on Essbase Server.

Using environment variables in formulas is the same as using them in calculation scripts. See “Using Environment Variables in Calculation Scripts and Formulas” on page 471.

Note: Environment variables cannot be used in MDX queries or in member formulas that are within aggregate storage outlines.

Using Formulas on Partitions

A partitioned application can span multiple Essbase Servers, processors, or computers.
You can use formulas in partitioning, just as you use formulas on your local database. If, however, a formula you use in one database references a value from another database, Essbase must retrieve the data from the other database when calculating the formula; therefore, ensure that the referenced values are up-to-date and carefully consider the performance impact on the overall database calculation. See “Writing Calculation Scripts for Partitions” on page 482.

With transparent partitions, carefully consider how you use formulas on the data target. See “Transparent Partitions and Member Formulas” on page 237 and “Performance Considerations for Transparent Partitions” on page 235.

See Chapter 15, “Designing Partitioned Applications” and Chapter 16, “Creating and Maintaining Partitions”.

### Displaying Formulas

To display a formula, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating and Editing Formulas in Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETMBRCALC</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>MaxL</td>
<td>query database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Reviewing Examples of Formulas for Block Storage Databases

24

In This Chapter

Calculating Period-to-Date Values ................................................................. 387
Calculating Rolling Values ........................................................................ 388
Calculating Monthly Asset Movements ....................................................... 389
Testing for #MISSING Values ................................................................... 390
Calculating an Attribute Formula ............................................................... 390

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

• Chapter 60, “Comparison of Aggregate and Block Storage”
• “Developing Formulas on Aggregate Storage Outlines” on page 924
• Chapter 30, “Reviewing Examples of Calculation Scripts for Block Storage Databases”

Calculating Period-to-Date Values

If the outline includes a dimension tagged as accounts, you can use the @PTD function to calculate period-to-date values.

This example uses the Inventory branch of the Measures dimension from the Sample.Basic database, as shown:

Inventory (~) (Label Only)
  Opening Inventory (+) (TB First) (Expense Reporting)
    IF(NOT @ISMBR(Jan))
  Additions (~) (Expense Reporting)
  Ending Inventory (~) (TB Last) (Expense Reporting)

To calculate period-to-date values for the year and for the current quarter, add two members to the Year dimension: QTD for quarter-to-date and YTD for year-to-date. For example:

QTD (~) @PTD(Apr:May)
YTD (~) @PTD(Jan:May);

Assuming that the current month is May, add this formula to the QTD member:

@PTD(Apr:May);
And add this formula on the YTD member:

@PTD(Jan:May)

Essbase sums the values for the range of months, as appropriate. Opening Inventory, however, has a time balance tag, First, and Ending Inventory has a time balance tag, Last. Essbase takes these values and treats them accordingly. See “Calculating First, Last, and Average Values” on page 445.

Table 61 provides an example of the calculation results for the members in the Inventory branch and for the Sales member:

<table>
<thead>
<tr>
<th>Measures-&gt;Time</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>QTD</th>
<th>YTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening Inventory</td>
<td>100</td>
<td>110</td>
<td>120</td>
<td>110</td>
<td>140</td>
<td>110</td>
<td>100</td>
</tr>
<tr>
<td>Additions</td>
<td>110</td>
<td>120</td>
<td>100</td>
<td>160</td>
<td>180</td>
<td>340</td>
<td>670</td>
</tr>
<tr>
<td>Sales</td>
<td>100</td>
<td>110</td>
<td>110</td>
<td>130</td>
<td>190</td>
<td>320</td>
<td>640</td>
</tr>
<tr>
<td>Ending Inventory</td>
<td>110</td>
<td>120</td>
<td>110</td>
<td>140</td>
<td>130</td>
<td>130</td>
<td>130</td>
</tr>
</tbody>
</table>

The values for Sales and Additions have been summed.

Opening Inventory has a First tag. For QTD, Essbase takes the first value in the current quarter, which is Apr. For YTD, Essbase takes the first value in the year, which is Jan.

Ending Inventory has a Last tag. For QTD, Essbase takes the last value in the current quarter, which is May. For YTD, Essbase takes the last value in the year, which is also May.

Note: You can also use Dynamic Time Series members to calculate period-to-date values. See Chapter 28, “Calculating Time Series Data.”

**Calculating Rolling Values**

You can use the @AVGRANGE function to calculate rolling averages and the @ACCUM function to calculate rolling year-to-date values.

For example, assume that a database contains monthly Sales data values and that the database outline includes the members AVG_Sales and YTD_Sales.

You would add this formula to the AVG_Sales member:

@AVGRANGE(SKIPNONE, Sales, @CURRMBRRANGE(Year, LEV, 0, , 0));

And you would add this formula on the YTD_Sales member:

@ACCUM(Sales);

Essbase calculates the average Sales values across the months in the dimension tagged as time. The SKIPNONE parameter means that all values are included, even #MISSING values. Essbase places the results in AVG_Sales. See “Consolidating #MISSING Values” on page 884.
Table 62 shows the results when Essbase calculates the cumulative Sales values and places the results in YTD_Sales:

<table>
<thead>
<tr>
<th>Measures -&gt; Time</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>600</td>
</tr>
<tr>
<td>AVG_Sales</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>#MISSING</td>
</tr>
<tr>
<td>YTD_Sales</td>
<td>100</td>
<td>300</td>
<td>600</td>
<td>#MISSING</td>
</tr>
</tbody>
</table>

The values for AVG_Sales are averages of the months-to-date. For example, AVG_Sales -> Mar is an average of Sales for Jan, Feb, and Mar.

The values for YTD_Sales are the cumulative values up to the current month. So YTD_Sales -> Feb is the sum of Sales -> Jan and Sales -> Feb.

### Calculating Monthly Asset Movements

You can use the @PRIOR function to calculate values based on a previous month’s value.

For example, assume that a database contains assets data values that are stored on a month-by-month basis. You can calculate the difference between the assets values of successive months (the asset movement) by subtracting the previous month’s value from the present month’s value.

Assume these three members manage the asset values for the database:

- Assets for the monthly asset values
- Asset_MVNT for the asset movement values
- Opening_Balance for the asset value at the beginning of the year

For Jan, the Asset_MVNT value is calculated by subtracting the Opening_Balance value from the Jan value.

You would add this formula on the Asset_MVNT member:

```plaintext
IF(@ISMBR(Jan)) Asset_MVNT = Assets - Opening_Balance;
ELSE Asset_MVNT = Assets - @PRIOR(Assets);
ENDIF;
```

Table 63 shows the results when Essbase calculates the difference between the values of assets in successive months:

<table>
<thead>
<tr>
<th>Assets -&gt; Time</th>
<th>Opening_Balance</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
<td>1200</td>
<td>1400</td>
<td>1300</td>
<td>1800</td>
</tr>
<tr>
<td>Asset_MVNT</td>
<td>200</td>
<td>-100</td>
<td>500</td>
<td></td>
</tr>
</tbody>
</table>

Essbase cycles through the months, performing these calculations:
1. The IF statement and @ISMBR function check whether the current member on the Year dimension is Jan. This check is necessary because the Asset_MVNT value for Jan cannot be calculated by subtracting the previous month’s value.

2. If the current member on the Year dimension is Jan, Essbase subtracts the Opening_Balance from the Jan -> Assets value and places the result in Jan -> Asset_MVNT.

3. If the current member on the Year dimension is not Jan, the @PRIOR function obtains the value for the previous month’s assets. Essbase subtracts the previous month’s assets from the current month’s assets. It places the result in the current month’s Asset_MVNT value.

Testing for #MISSING Values

You can test for #MISSING values in a database. See “Consolidating #MISSING Values” on page 884.

Assume that a database outline contains a member called Commission. Commission is paid at 10% of sales when the Sales value for the current member combination is not #MISSING. When applied to a Commission member in the database outline, the following formula calculates Commission:

```
IF(Sales <> #MISSING) Commission = Sales * .1;
   ELSE Commission = #MISSING;
ENDIF;
```

If you place the formula in a calculation script, you must associate it with the Commission member as shown:

```
Commission(IF(Sales <> #MISSING) Commission = Sales * .1;
   ELSE Commission = #MISSING;
ENDIF;);
```

Essbase cycles through the database, performing the following calculations:

1. The IF statement checks the value of the Sales member for the current member combination.
2. If Sales is not #MISSING, Essbase multiplies the value in the Sales member by 0.1 and places the result in the Commission member.
3. If Sales is #MISSING, Essbase places #MISSING in the Commission member.

Calculating an Attribute Formula

You can perform specific calculations on attribute-dimension members in a database. See “Calculating Attribute Data” on page 177.

For example, to calculate profitability by ounce for products sized in ounces, you can use the @ATTRIBUTEVAL function in a calculation formula. In the Sample.Basic database, the Ratios branch of the Measures dimension contains a member called Profit per Ounce. The formula on this member:

```
Profit/@ATTRIBUTEVAL(@NAME(Ounces));
```

Essbase cycles through the Products dimension, performing the following calculations:

1. For each base member that is associated with a member from the Ounces attribute dimension, the @ATTRIBUTEVAL function returns the numeric attribute value (for example, 12 for the member 12 under Ounces).

   **Note:** The @NAME function is required to process the string “Ounces” before passing it to the @ATTRIBUTEVAL function.

2. Essbase then divides Profit by the result of @ATTRIBUTEVAL to yield Profit per Ounce.

   **Note:** See “Using Attributes in Calculation Formulas” on page 181. For more information about the @ATTRIBUTEVAL function, see the *Oracle Essbase Technical Reference.*
The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

- Chapter 60, “Comparison of Aggregate and Block Storage”
- “Sparse and Dense Dimensions” on page 64
- “Generations and Levels” on page 63
- “Understanding How Dynamic Calculation Changes Calculation Order” on page 435

Data Storage in Data Blocks

Essbase stores data values in data blocks. Essbase creates a data block for each unique combination of sparse dimension members (providing that at least one data value exists for the combination).

Each data block contains all the dense dimension member values for its unique combination of sparse dimension members.

In the Sample.Basic database, the Year, Measures, and Scenario dimensions are dense; the Product and Market dimensions are sparse. Figure 115 shows an outline of the dimensions in the Sample.Basic database:
Note: Sample.Basic also contains five attribute dimensions. These dimensions are sparse, Dynamic Calc, meaning that attribute data is not stored in the database. See Chapter 10, “Working with Attributes.”

Essbase creates a data block for each unique combination of members in the Product and Market dimensions (providing that at least one data value exists for the combination). For example, it creates one data block for the combination of 100-10, New York. This data block contains all the Year, Measures, and Scenario values for 100-10, New York. Figure 116 shows an outline of the Product and Market dimensions in the Sample.Basic database:

In Essbase, member combinations are denoted by the cross-dimensional operator. The symbol for the cross-dimensional operator is -> (a hyphen followed by a greater-than symbol). So 100-10, New York is written as 100-10 -> New York.

You can categorize data blocks in the following ways:

- **Input**
  These blocks are created by loading data to cells in a block. Input blocks can be created for (1) sparse, level 0 member combinations or (2) sparse, upper-level member combinations, when at least one of the sparse members is a parent-level member. Input blocks can be level 0 or upper-level blocks.

- **Noninput**
  These blocks are created through calculations. For example, in Sample.Basic, the East -> Cola block is created during a sparse calculation process (that is, the block did not exist before calculation).

- **Level 0**
  These blocks are created for sparse member combinations when all of the sparse members are level 0 members. For example, in Sample.Basic, New York -> Cola is a level 0 block because New York and Cola are level 0 members of their respective sparse dimensions. Level
0 blocks can be input or noninput blocks; for example, a level 0 noninput block is created during an allocation process, where data is loaded at a parent level and then allocated down to level 0.

- Upper level

These blocks are created for sparse member combinations when at least one of the sparse members is a parent-level member. Upper-level blocks can be input or noninput blocks.

See “Generations and Levels” on page 63 and “Data Blocks and the Index System” on page 72.

**Member Calculation Order**

Essbase calculates a database at the data block level, bringing one or more blocks into memory and calculating the required values within the block. Essbase calculates the blocks in order, according to their block numbers. The database outline tells Essbase how to order the blocks. Within each block, Essbase calculates the values in order according to the hierarchy in the database outline. Therefore, overall, Essbase calculates a database based on the database outline.

When you perform a default calculation (CALC ALL) on a database, Essbase calculates the dimensions in this order:

- If both a dimension tagged as accounts and a dimension tagged as time exist, and if formulas are applied to members on the accounts dimension, Essbase calculates in this order:
  1. Dimension tagged as accounts
  2. Dimension tagged as time
  3. Other dense dimensions (in the order in which they are displayed in the database outline)
  4. Other sparse dimensions (in the order in which they are displayed in the database outline)

- Otherwise, Essbase calculates in this order:
  1. Dense dimensions (in the order in which they are displayed in the database outline)
  2. Sparse dimensions (in the order in which they are displayed in the database outline)

**Note:** Attribute dimensions, which are not included in the database consolidation, do not affect calculation order. See Chapter 10, “Working with Attributes.”

In the Sample.Basic database, the dimensions are calculated in this order: Measures, Year, Scenario, Product, and Market.

You can override the default order by using a calculation script. See Chapter 29, “Developing Calculation Scripts for Block Storage Databases.”
Understanding the Effects of Member Relationships

The order of calculation within each dimension depends on the relationships between members in the database outline. Within each branch of a dimension, level 0 values are calculated first followed by their level 1, parent value. Then the level 0 values of the next branch are calculated, followed by their level 1, parent value. The calculation continues in this way until all levels are calculated.

Figure 117 shows the Year dimension from the Sample.Basic database. The calculation order is shown on the left. This example assumes that the parent members are not tagged as Dynamic Calc. See Chapter 27, “Dynamically Calculating Data Values.”

Figure 117 Year Dimension from the Sample.Basic Database

<table>
<thead>
<tr>
<th>17</th>
<th>Year Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Qtr 1 (+)</td>
</tr>
<tr>
<td>1</td>
<td>Jan (+)</td>
</tr>
<tr>
<td>2</td>
<td>Feb (+)</td>
</tr>
<tr>
<td>3</td>
<td>Mar (+)</td>
</tr>
<tr>
<td>8</td>
<td>Qtr 2 (+)</td>
</tr>
<tr>
<td>5</td>
<td>Apr (+)</td>
</tr>
<tr>
<td>6</td>
<td>May (+)</td>
</tr>
<tr>
<td>7</td>
<td>Jun (+)</td>
</tr>
<tr>
<td>12</td>
<td>Qtr 3 (+)</td>
</tr>
<tr>
<td>9</td>
<td>Jul (+)</td>
</tr>
<tr>
<td>10</td>
<td>Aug (+)</td>
</tr>
<tr>
<td>11</td>
<td>Sep (+)</td>
</tr>
<tr>
<td>16</td>
<td>Qtr 4 (+)</td>
</tr>
<tr>
<td>13</td>
<td>Oct (+)</td>
</tr>
<tr>
<td>14</td>
<td>Nov (+)</td>
</tr>
<tr>
<td>15</td>
<td>Dec (+)</td>
</tr>
</tbody>
</table>

Jan is the first member in the first branch. Jan has no formula, so it is not calculated. The same applies to Feb and Mar, the other two members in the branch.

Essbase calculates Qtr1 by consolidating Jan, Feb, and Mar. In this example, these members are added.

Essbase then calculates the Qtr2 through Qtr4 branches in the same way.

Finally, Essbase calculates the Year member by consolidating the values of Qtr1 through Qtr4. These members are added.

Determining Member Consolidation

You can choose how Essbase consolidates members by applying any calculation operator (+, -, /, *, %, ~, ^) to the members in the database outline.

If an accounts member has a time balance tag (First, Last, or Average), Essbase consolidates it accordingly. See “Calculating First, Last, and Average Values” on page 445.

If a parent member has a label only operator, Essbase does not calculate the parent from its children.

If a member has a ~ operator, Essbase does not consolidate the member up to its parent.

If a member has a ^ operator, Essbase does not consolidate the member in any dimension.
Note: If you use dynamic calculations, Essbase may use a different calculation order. See “Calculation Order for Dynamic Calculation” on page 435.

Ordering Dimensions in the Database Outline

To ensure the required calculation results, consider the calculation order of the dimensions in the database outline if you do either of these tasks:

- Use calculation operators to divide (/), multiply (*), or calculate percentages (%) for members in the database outline.
- Place formulas on members in the database outline.

You need not consider calculation order if you use only calculation operators to add (+) and subtract (–) members in the database outline and you do not use formulas in the outline.

Placing Formulas on Members in the Database Outline

If you place formulas on members in the database outline, consider the calculation order of the dimensions. A formula that is attached to a member on one dimension may be overwritten by a subsequent calculation on another dimension.

For example, the Sample.Basic database has a Measures dimension, tagged as accounts, and a Year dimension, tagged as time. Measures is calculated first and Year second. If you attach a formula to Margin on the Measures dimension, Essbase calculates the formula when it calculates the Measures dimension. Essbase then overwrites the formula when it consolidates the Year dimension. See “Cell Calculation Order” on page 402.

Using the Calculation Operators *, /, and %

If you use calculation operators to multiply ( * ), divide ( / ), and calculate percentages ( % ) for members in the database outline, consider the calculation order of the dimensions. The required calculated values may be overwritten by a subsequent calculation on another dimension.

For example, the Sample.Basic database has a Measures dimension, tagged as accounts, and a Year dimension, tagged as time. Measures is calculated first and Year second. If you multiply members on the Measures dimension, the calculated results may be overwritten when Essbase consolidates values on the Year dimension. See “Cell Calculation Order” on page 402.

When you use a multiplication ( * ), division ( / ), or percentage ( % ) operator to consolidate members, carefully order the members in the branch to achieve the required result.

Figure 118 shows calculations operators as they appear in an outline. Assume that the user wants to divide the total of Child 2 and Child 3 by Child 1. However, if Child 1 is the first member, Essbase starts with Child 1, starting with the value #MISSING, and dividing it by Child 1. The result is #MISSING. Essbase then adds Child 2 and Child 3. Obviously, this result is not the required one.
To calculate the correct result, make Child 1 the last member in the branch.

You can apply a formula to a member on the database outline to achieve the same result. However, it is far more efficient to use these calculation operators on members as shown in Figure 118.

**Avoiding Forward Calculation References**

To obtain the calculation results you expect, ensure that the outline does not contain forward calculation references. *Forward calculation references* occur when the value of a calculating member is dependent on a member that Essbase has not yet calculated. In these cases, Essbase may not produce the required calculation results.

For example, consider the Product dimension shown in Figure 119, which has three forward calculation references: two shared members (P100–20 and P300–20) and one nonshared member (P500–20):

In Outline Editor, when you verify the outline, Essbase identifies shared members with forward calculation references. Verifying the outline does not identify nonshared members that have forward calculation references. You can save and use an outline containing forward calculation references.

➢ To verify the outline:

See “Verifying Outlines” in the Oracle Essbase Administration Services Online Help.
Consider the five members under Diet. The members P100-20, P300-20, and P500-20 have forward calculation references:

- **P100-20 (+) (Shared Member):** Essbase calculates the shared member P100-20 before it calculates the actual member P100-20. Because the actual member P100-20 has children, Essbase must calculate the actual member by adding its children before it can accurately calculate the shared member P100-20.

- **P300-20 (+) (Shared Member):** Essbase calculates the shared member P300-20 before it calculates the actual member P300-20. Because the actual member P300-20 has a formula, Essbase must calculate the actual member before it can accurately calculate the shared member P300-20.

- **P500-20 (+) ("P200-20" + "P300-20"):** The formula applied to P500-20 references members that Essbase has not yet calculated. One referenced member, P300-20, has its own formula, and Essbase must calculate P300-20 before it can accurately calculate P500-20. The members P200-20 and P400-20 calculate correctly, because they do not have forward calculation references.

- **P200-20 (+) (Shared Member):** P200-20 is not a forward calculation reference, although Essbase calculates the shared member P200-20 before it calculates the actual member P200-20. The actual member P200-20 has no calculation dependencies (no children and no formula). Therefore, Essbase does not need to calculate the actual member before the shared member. Essbase simply takes the value of the actual member.

- **P400-20 (+) ("P200-10" * 2):** P400-20 is not a forward calculation reference, although the formula that is applied to P400-20 references a member that Essbase has not yet calculated. The member referenced in the formula does not itself have calculation dependencies. P200-10 is the only member in the formula, and P200-10 does not itself have children or a formula. Essbase accurately calculates P400-20.

To get accurate calculation results for P100-20, P300-20, and P500-20, change the order of members in the outline. By placing the Diet shared members after the Regular members, as shown in Figure 120, you ensure that Essbase calculates the members in the required order.

---

**Figure 120  Changed Product Dimension Without Forward Calculation References**

<table>
<thead>
<tr>
<th>Product</th>
<th>Regular (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P100 (+)</td>
<td>P100-10 (+)</td>
</tr>
<tr>
<td></td>
<td>P100-20 (+)</td>
</tr>
<tr>
<td></td>
<td>P100-20-01 (+)</td>
</tr>
<tr>
<td></td>
<td>P100-20-02 (+)</td>
</tr>
<tr>
<td>P200 (+)</td>
<td>P200-10 (+)</td>
</tr>
<tr>
<td></td>
<td>P200-20 (+)</td>
</tr>
<tr>
<td>P300 (+)</td>
<td>P300-10 (+)</td>
</tr>
<tr>
<td></td>
<td>P300-20 (+)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diet (-)</th>
<th>P100-20 (+) (Shared Member)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P200-20 (+) (Shared Member)</td>
<td></td>
</tr>
<tr>
<td>P300-20 (+) (Shared Member)</td>
<td></td>
</tr>
<tr>
<td>P400-20 (+) (&quot;P200-10&quot; * 2)</td>
<td></td>
</tr>
<tr>
<td>P500-20 (+) (&quot;P200-20&quot; + P300-20);</td>
<td></td>
</tr>
</tbody>
</table>
Now Essbase calculates:

- The actual member P100-20 before it calculates the shared member P100-20. So, P100-20 no longer has a forward calculation reference.
- The actual member P300-20 before the shared member P300-20. So, P300-20 no longer has a forward calculation reference.
- The referenced member with a formula, P300-20, before the member P500-20. So, P500-20 no longer has a forward calculation reference.

**Block Calculation Order**

Essbase calculates blocks in the order in which the blocks are numbered. Essbase takes the first sparse dimension in a database outline as a starting point. It defines the sparse member combinations from this first dimension.

In the Sample.Basic database, Product is the first sparse dimension in the database outline.

**Figure 121  Dimensions in the Sample.Basic Database**

Database: Basic (Current Alias Table: Default)
- Year Time (Active Dynamic Time Series Members: H-T-D, Q-T-D) (Dynamic Calc)
- Measures Accounts (Label Only)
- Product
- Market
- Scenario (Label Only)

**Note:** The attribute dimensions in the Sample.Basic outline (not shown in the figure above), are not included in the database consolidation and do not affect block calculation order. See Chapter 10, “Working with Attributes.”.

As shown in Figure 122, Product has 19 members (excluding the shared members, for which Essbase does not create data blocks). Therefore, the first 19 data blocks in the database are numbered according to the calculation order of members in the Product dimension.
The other sparse dimension is Market. The first 19 data blocks contain the first member to be calculated in the Market dimension, which is New York. Table 64 shows the sparse member combinations of each Product member and New York, for the first five of these 19 data blocks:

Table 64  Sparse Member Combinations: Data Blocks 0 Through 4

<table>
<thead>
<tr>
<th>Block Number</th>
<th>Product Member</th>
<th>Market Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Cola (100-10)</td>
<td>New York</td>
</tr>
<tr>
<td>1</td>
<td>Diet Cola (100-20)</td>
<td>New York</td>
</tr>
<tr>
<td>2</td>
<td>Caffeine Free Cola (100-30)</td>
<td>New York</td>
</tr>
<tr>
<td>3</td>
<td>Colas (100)</td>
<td>New York</td>
</tr>
<tr>
<td>4</td>
<td>Old Fashioned (200-10)</td>
<td>New York</td>
</tr>
</tbody>
</table>

The next member in the Market dimension is Massachusetts. Essbase creates the next 19 data blocks for sparse combinations of each Product member and Massachusetts. Table 65 shows the sparse member combinations for the block numbers 19 through 23:

Table 65  Sparse Member Combinations: Data Blocks 19 Through 23

<table>
<thead>
<tr>
<th>Block Number</th>
<th>Product Member</th>
<th>Market Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Cola (100-10)</td>
<td>Massachusetts</td>
</tr>
<tr>
<td>20</td>
<td>Diet Cola (100-20)</td>
<td>Massachusetts</td>
</tr>
<tr>
<td>21</td>
<td>Caffeine Free Cola (100-30)</td>
<td>Massachusetts</td>
</tr>
<tr>
<td>22</td>
<td>Colas (100)</td>
<td>Massachusetts</td>
</tr>
<tr>
<td>23</td>
<td>Old Fashioned (200-10)</td>
<td>Massachusetts</td>
</tr>
</tbody>
</table>
Essbase continues until blocks have been created for all combinations of sparse dimension members for which at least one data value exists.

Essbase creates a data block only if at least one value exists for the block. For example, if no data values exist for Old Fashioned Root Beer (200-10) in Massachusetts, then Essbase does not create a data block for 200-10 -> Massachusetts. However, Essbase does reserve the appropriate block number for 200-10 -> Massachusetts in case data is loaded for that member combination in the future.

When you run a default calculation (CALC ALL) on a database, each block is processed in order, according to its block number. If you have Intelligent Calculation turned on, and if the block does not need to be calculated, then Essbase skips the block and moves to the next block. For information about how intelligent calculation is used to optimize performance, see Chapter 26, “Understanding Intelligent Calculation.”

Data Block Renumbering
Essbase renumbers the data blocks when you make any of these changes:

- Move a sparse dimension
- Add a sparse dimension
- Change a dense dimension to a sparse dimension
- Move any member in a sparse dimension
- Delete any member in a sparse dimension
- Add a member to a sparse dimension

Cell Calculation Order
Each data block contains all the dense dimension member values for its unique combination of sparse dimension members. Each data value is contained in a cell of the data block.

The order in which Essbase calculates the cells within each block depends on how you have configured the database. How you have configured the database defines the member calculation order of dense dimension members within each block. It also defines the calculation order of blocks that represent sparse dimension members.

See the following examples.

Cell Calculation Order: Example 1
In this example, which is the simplest case, these conditions are true:

- No dimensions have time or accounts tags.
- The setting for consolidating #MISSING values is turned on.
- Market and Year are dense dimensions.
Essbase calculates dense dimensions in the order in which they are defined in the database outline. Assume that the Year dimension is positioned in the database outline before the Market dimension and is calculated first.

Table 66 shows a subset of the cells in a data block:

<table>
<thead>
<tr>
<th>Year-Market</th>
<th>New York</th>
<th>Massachusetts</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>112345</td>
<td>68754</td>
<td>3</td>
</tr>
<tr>
<td>Feb</td>
<td>135788</td>
<td>75643</td>
<td>4</td>
</tr>
<tr>
<td>Mar</td>
<td>112234</td>
<td>93456</td>
<td>5</td>
</tr>
<tr>
<td>Qtr1</td>
<td>1</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

Data values have been loaded into the following input cells:
- Jan -> New York
- Feb -> New York
- Mar -> New York
- Jan -> Massachusetts
- Feb -> Massachusetts
- Mar -> Massachusetts

Essbase calculates the following cells. In Table 66, the calculation order for these cells is represented by the numbers 1 through 6 that appear in the cells:
1. Qtr1 -> New York
2. Qtr1 -> Massachusetts
3. Jan -> East
4. Feb -> East
5. Mar -> East
6. Qtr1 -> East

Qtr1 -> East has multiple consolidation paths; it can be consolidated on Market or on Year. When consolidated on Market, it is a consolidation of Qtr1 -> New York and Qtr1 -> Massachusetts. When consolidated on Year, it is a consolidation of Jan -> East, Feb -> East, and Mar -> East.

Essbase knows that Qtr1 -> East has multiple consolidation paths. Therefore, it calculates Qtr1 -> East only once by consolidating the values for Qtr1 and uses the consolidation path of the dimension calculated last (in this example, the Market dimension), as shown in Table 67.
Table 67  Calculation Order Example 1: Results

<table>
<thead>
<tr>
<th>Year-Market</th>
<th>New York</th>
<th>Massachusetts</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>112345</td>
<td>68754</td>
<td>181099</td>
</tr>
<tr>
<td>Feb</td>
<td>135788</td>
<td>75643</td>
<td>211431</td>
</tr>
<tr>
<td>Mar</td>
<td>112234</td>
<td>93456</td>
<td>205690</td>
</tr>
<tr>
<td>Qtr1</td>
<td>360367</td>
<td>237853</td>
<td>598220</td>
</tr>
</tbody>
</table>

Based on the calculation order, if you place a member formula on Qtr1 in the database outline, Essbase ignores it when calculating Qtr1 -> East. If you place a member formula on East in the database outline, the formula is calculated when Essbase consolidates Qtr1 -> East on the Market consolidation path.

If required, you can use a calculation script to calculate the dimensions in the order you choose. See Chapter 29, “Developing Calculation Scripts for Block Storage Databases.”

Cell Calculation Order: Example 2

In this example, these conditions are true:

- No dimensions have time or accounts tags.
- The setting for consolidating #MISSING values is turned off (the default).
- Market and Year are dense dimensions.

Essbase calculates dense dimensions in the order in which they are defined in the database outline. Assume that the Year dimension is positioned in the database outline before the Market dimension and is calculated first.

Table 68 shows a subset of the cells in a data block:

Table 68  Calculation Order Example 2: Input Cells and Calculated Cells

<table>
<thead>
<tr>
<th>Year-Market</th>
<th>New York</th>
<th>Massachusetts</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>112345</td>
<td>68754</td>
<td>4</td>
</tr>
<tr>
<td>Feb</td>
<td>135788</td>
<td>75643</td>
<td>5</td>
</tr>
<tr>
<td>Mar</td>
<td>112234</td>
<td>93456</td>
<td>6</td>
</tr>
<tr>
<td>Qtr1</td>
<td>1</td>
<td>2</td>
<td>3/7</td>
</tr>
</tbody>
</table>

Data values have been loaded into the following input cells:

- Jan -> New York
- Feb -> New York
- Mar -> New York
Essbase calculates the Qtr1 cells for New York, Massachusetts, and East and the East cells for Jan, Feb, and March. In Table 68, the calculation order for these cells is represented by the numbers 1 through 7 that appear in the cells:

1. Qtr1 -> New York
2. Qtr1 -> Massachusetts
3. Qtr1 -> East
4. Jan -> East
5. Feb -> East
6. Mar -> East
7. Qtr1 -> East

Qtr1 -> East is calculated on both the Year and Market consolidation paths. First, Qtr1 -> East is calculated as a consolidation of Qtr1 -> New York and Qtr1 -> Massachusetts. Second, Qtr1 -> East is calculated as a consolidation of Jan -> East, Feb -> East, and Mar -> East.

The results, as shown in Table 69, are identical to the results for example 1 (see Table 67 on page 404). However, Qtr1 -> East has been calculated twice. This fact is significant when you need to load data at parent levels (see “Cell Calculation Order: Example 3” on page 405).

### Table 69  Calculation Order Example 2: Results

<table>
<thead>
<tr>
<th>Year-Market</th>
<th>New York</th>
<th>Massachusetts</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>112345</td>
<td>68754</td>
<td>181099</td>
</tr>
<tr>
<td>Feb</td>
<td>135788</td>
<td>75643</td>
<td>211431</td>
</tr>
<tr>
<td>Mar</td>
<td>112234</td>
<td>93456</td>
<td>205690</td>
</tr>
<tr>
<td>Qtr1</td>
<td>360367</td>
<td>237853</td>
<td>598220</td>
</tr>
</tbody>
</table>

Based on the calculation order, if you place a member formula on Qtr1 in the database outline, its result is overwritten when Essbase consolidates Qtr1 -> East on the Market consolidation path. If you place a member formula on East in the database outline, the result is retained, because the Market consolidation path is calculated last.

### Cell Calculation Order: Example 3

In this example, these conditions are true:

- No dimensions have time or accounts tags.
- The setting for consolidating #MISSING values is turned off (the default).
Data values have been loaded at parent levels.

Market and Year are dense dimensions.

Essbase calculates dense dimensions in the order in which they are defined in the database outline. Assume that the Year dimension is positioned in the database outline before the Market dimension and is calculated first.

Table 70 shows a subset of the cells in a data block:

**Table 70  Calculation Order Example 3: Input Cells and #MISSING Values**

<table>
<thead>
<tr>
<th>Year-Market</th>
<th>New York</th>
<th>Massachusetts</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>181099</td>
</tr>
<tr>
<td>Feb</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>211431</td>
</tr>
<tr>
<td>Mar</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>205690</td>
</tr>
<tr>
<td>Qtr1</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td></td>
</tr>
</tbody>
</table>

The cells are calculated in the same order as in “Cell Calculation Order: Example 2” on page 404. Qtr1 -> East is calculated on both the Year and Market consolidation paths.

Because the setting for consolidating #MISSING values is turned off, Essbase does not consolidate the #MISSING values. Thus, the data that is loaded at parent levels is not overwritten by the #MISSING values below it.

However, if any of the child data values are not #MISSING, these values are consolidated and overwrite the parent values. For example, if Jan -> New York contains 50000.00, this value overwrites the values loaded at parent levels.

The results, as shown in Table 71, show that Essbase first correctly calculates the Qtr1 -> East cell by consolidating Jan -> East, Feb -> East, and Mar -> East, and then calculates on the Market consolidation path. However, it does not consolidate the #MISSING values in Qtr1 -> New York and Qtr1 -> Massachusetts; therefore, the value in Qtr1 -> East is not overwritten.

**Table 71  Calculation Order Example 3: Results**

<table>
<thead>
<tr>
<th>Year-Market</th>
<th>New York</th>
<th>Massachusetts</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>181099</td>
</tr>
<tr>
<td>Feb</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>211431</td>
</tr>
<tr>
<td>Mar</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>205690</td>
</tr>
<tr>
<td>Qtr1</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>598220</td>
</tr>
</tbody>
</table>

Essbase must calculate the Qtr1 -> East cell twice to ensure that a value is calculated for the cell. If Qtr1 -> East is calculated according to only the last consolidation path, the result is #MISSING, which is not the required result.
Cell Calculation Order: Example 4

In this example, these conditions are true:

- The Year dimension is tagged as time.
- The Measures dimension is tagged as accounts.

Essbase calculates a dimension tagged as accounts first, followed by a dimension tagged as time. Therefore, in this example, Measures is calculated before Year.

- The setting for consolidating #MISSING values is turned off (the default).
- The Marketing, Payroll, and Misc Expenses values have been loaded at the Qtr1, parent level.

Figure 123 shows the Profit branch of the Measures dimension in the Sample.Basic database. This example assumes that Total Expenses is not a Dynamic Calc member.

Figure 123  Profit Branch of the Measures Dimension

Table 72 shows a subset of the cells in a data block:

Table 72  Calculation Order Example 4: Input Cells, #MISSING Values, and Calculated Cells

<table>
<thead>
<tr>
<th>Measures/Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>31538</td>
<td>32069</td>
<td>32213</td>
<td>13</td>
</tr>
<tr>
<td>COGS</td>
<td>14160</td>
<td>14307</td>
<td>14410</td>
<td>14</td>
</tr>
<tr>
<td>Margin</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>10/15</td>
</tr>
<tr>
<td>Marketing</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>15839</td>
</tr>
<tr>
<td>Payroll</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>12168</td>
</tr>
<tr>
<td>Misc</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>233</td>
</tr>
<tr>
<td>Total Expenses</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>11/16</td>
</tr>
<tr>
<td>Profit</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12/17</td>
</tr>
</tbody>
</table>

The following cells have multiple consolidation paths:

- Margin -> Qtr1
- Total Expenses -> Qtr1
- Profit -> Qtr1
Because the setting for consolidating \#MISSING values is turned off, Essbase does not consolidate the \#MISSING values. Thus, any data that is loaded at parent levels is not overwritten by the \#MISSING values and Essbase calculates the cells with multiple consolidation paths twice.

The results are shown in Table 73:

<table>
<thead>
<tr>
<th>Measures/Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>31538</td>
<td>32069</td>
<td>32213</td>
<td>95820</td>
</tr>
<tr>
<td>COGS</td>
<td>14160</td>
<td>14307</td>
<td>14410</td>
<td>42877</td>
</tr>
<tr>
<td>Margin</td>
<td>17378</td>
<td>17762</td>
<td>17803</td>
<td>52943</td>
</tr>
<tr>
<td>Marketing</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>15839</td>
</tr>
<tr>
<td>Payroll</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>12168</td>
</tr>
<tr>
<td>Misc</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>233</td>
</tr>
<tr>
<td>Total Expenses</td>
<td></td>
<td></td>
<td></td>
<td>28240</td>
</tr>
<tr>
<td>Profit</td>
<td>17378</td>
<td>17762</td>
<td>17803</td>
<td>12/17</td>
</tr>
</tbody>
</table>

Based on the calculation order, if you place a member formula on, for example, Margin in the database outline, its result is overwritten by the consolidation on Qtr1.

**Cell Calculation Order for Formulas on a Dense Dimension**

The cell calculation order within a data block is not affected by formulas on members. When Essbase encounters a formula in a data block, it locks any other required data blocks, calculates the formula, and proceeds with the data block calculation.

When placing a formula on a dense dimension member, carefully consider the cell calculation order. As described in the examples above, the dimension calculated last overwrites previous cell calculations for cells with multiple consolidation paths. If required, you can use a calculation script to change the order in which the dimensions are calculated. See Chapter 29, “Developing Calculation Scripts for Block Storage Databases” and Chapter 23, “Developing Formulas for Block Storage Databases.”

**Calculation Passes**

Whenever possible, Essbase calculates a database in one calculation pass through the database. Thus, it reads each of the required data blocks into memory only once, performing all relevant calculations on the data block and saving it. However, in some situations, Essbase must perform multiple calculation passes through a database. On subsequent calculation passes, Essbase brings data blocks back into memory, performs further calculations on them, and saves them again.
When you perform a default, full calculation of a database (CALC ALL), Essbase attempts to calculate the database in one calculation pass. If you have dimensions that are tagged as accounts or time, Essbase may have to do multiple calculation passes through the database.

Table 74 shows the number of calculation passes Essbase performs if you have dimensions that are tagged as time or accounts, and you have at least one formula on the accounts dimension:

### Table 74 Calculation Passes For Accounts and Time Dimension

<table>
<thead>
<tr>
<th>Dimension Tagged As Accounts</th>
<th>Dimension Tagged As Time</th>
<th>Calculation Passes</th>
<th>During each calculation pass, Essbase calculates based on:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dense or Sparse</td>
<td>None</td>
<td>1</td>
<td>All dimensions</td>
</tr>
<tr>
<td>Dense</td>
<td>Dense</td>
<td>1</td>
<td>All dimensions</td>
</tr>
<tr>
<td>Dense</td>
<td>Sparse</td>
<td>2</td>
<td>Pass 1: Accounts and time dimensions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pass 2: Other dimensions</td>
</tr>
<tr>
<td>Sparse</td>
<td>Sparse</td>
<td>2</td>
<td>Pass 1: Accounts and time dimensions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pass 2: Other dimensions</td>
</tr>
<tr>
<td>Sparse</td>
<td>Dense</td>
<td>2</td>
<td>Pass 1: Accounts dimension</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pass 2: Other dimensions</td>
</tr>
</tbody>
</table>

If you are using formulas that are tagged as Two-Pass, Essbase may need to do an extra calculation pass to calculate these formulas. See “Using Two-Pass Calculation” on page 876.

When you use a calculation script to calculate a database, the number of calculation passes Essbase needs to perform depends upon the calculation script. See “Calculation Passes” on page 408 and “Understanding Multiple-Pass Calculations” on page 422. Also see “Grouping Formulas and Calculations” on page 467.

If the isolation level is set for committed access, and multiple passes are required, Essbase writes data values at the end of each pass. Data retrievals that occur between passes can pick up intermediate values.

When you calculate a database, Essbase automatically displays the calculation order of the dimensions for each pass through the database and tells you how many times Essbase has cycled through the database during the calculation. Essbase displays this information in the ESSCMD window and in the application log.

To display the application log, see “Viewing the Essbase Server and Application Logs” on page 739.

For each data block, Essbase decides whether to do a dense or a sparse calculation. The type of calculation it chooses depends on the type of values within the data block. When you run a default calculation (CALC ALL) on a database, each block is processed in order, according to its block number.

Essbase calculates the blocks using this procedure:
If you have Intelligent Calculation turned on, and if the block does not need to be calculated (if it is marked as clean), Essbase skips the block and moves to the next block. See Chapter 26, “Understanding Intelligent Calculation.”

If the block needs recalculating, Essbase checks to see if the block is a level 0, an input, or an upper-level block. See “Data Storage in Data Blocks” on page 393.

If the block is a level 0 block or an input block, Essbase performs a dense calculation on the block. Each cell in the block is calculated. See “Cell Calculation Order” on page 402.

If the block is an upper-level block, Essbase either consolidates the values or performs a sparse calculation on the data block.

The sparse member combination of each upper-level block contains at least one parent member. Essbase consolidates or calculates the block based on the parent member’s dimension. For example, if the upper-level block is for Product -> Florida from the Sample.Basic database, then Essbase chooses the Product dimension.

If the sparse member combination for the block has multiple parent members, Essbase chooses the last dimension in the calculation order that includes a parent member. For example, if the block is for Product -> East, and you perform a default calculation on the Sample.Basic database, Essbase chooses the Market dimension, which contains East. The Market dimension is last in the default calculation order because it is placed after the Product dimension in the database outline. See “Member Calculation Order” on page 395.

Based on the chosen sparse dimension, Essbase either consolidates the values or performs a sparse calculation on the data block:

- If a formula is applied to the data block member on the chosen sparse dimension, Essbase performs a formula calculation on the sparse dimension. Essbase evaluates each cell in the data block. The formula affects only the member on the sparse dimension, so overall calculation performance is not significantly affected.
- If the chosen sparse dimension is a default consolidation, Essbase consolidates the values, taking the values of the previously calculated child data blocks.

**Calculation of Shared Members**

Shared members are those that share data values with other members. For example, in the Sample.Basic database, Diet Cola, Diet Root Beer, and Diet Cream are consolidated under two parents: under Diet and under their product types—Colas, Root Beer, and Cream Soda. The members under the Diet parent are shared members, as shown in Figure 124. See “Understanding Shared Members” on page 149.
A calculation on a shared member is a calculation on the actual member. If you use the FIX command to calculate a subset of a database and the subset includes a shared member, Essbase calculates the actual member.

```
Product

100 (+) (Alias: Colas)
  100-10 (+) (Alias: Cola)
  100-20 (+) (Alias: Diet Cola)
  100-30 (+) (Alias: Caffeine Free Cola)

200 (+) (Alias: Root Beer)
  200-10 (+) (Alias: Old Fashioned)
  200-20 (+) (Alias: Diet Root Beer)
  200-30 (+) (Alias: Sarsaparilla)
  200-40 (+) (Alias: Birch Beer)

300 (+) (Alias: Cream Soda)
  300-10 (+) (Alias: Dark Cream)
  300-20 (+) (Alias: Vanilla Cream)
  300-30 (+) (Alias: Diet Cream)

400 (+) (Alias: Fruit Soda)

Diet (-) (Alias: Diet Drinks)
  100-20 (+) (Shared Member)
  200-20 (+) (Shared Member)
  300-30 (+) (Shared Member)
```
Introducing Intelligent Calculation

By default, when Essbase performs a full calculation of a database, it tracks which data blocks it calculates. If you then load a subset of data, on subsequent calculations, Essbase calculates only the data blocks that have not been calculated and the calculated blocks that require recalculation because of the new data. This process is called Intelligent Calculation.

By default, Intelligent Calculation is turned on. You can change this default setting in essbase.cfg. See the Oracle Essbase Technical Reference.

You can also turn Intelligent Calculation on or off in a calculation script. See “Turning Intelligent Calculation On and Off” on page 416.

For information on other calculation optimization methods, see:

- Chapter 15, “Designing Partitioned Applications”
- Chapter 27, “Dynamically Calculating Data Values”
- Chapter 57, “Optimizing Calculations”

Benefits of Intelligent Calculation

Intelligent Calculation is designed to provide significant calculation performance benefits for these types of calculations:

- A full calculation of a database (CALC ALL), with some exceptions.
  
  See “Limitations of Intelligent Calculation” on page 415.

- A calculation script that calculates all members in one CALC DIM statement.

- For database calculations that cannot use Intelligent Calculation for the full calculation, you may be able to use Intelligent Calculation for part of the calculation.
For example, to significantly improve calculation performance for a case in which you calculate a database by doing a default consolidation and then an allocation of data, enable Intelligent Calculation for the default consolidation and then disable Intelligent Calculation for the allocation.

Assuming that Intelligent Calculation is turned on (the default), create a calculation script to perform these steps for a partial Intelligent Calculation:

- Enable Intelligent Calculation, if it is disabled
- Use CALC ALL to calculate the database
- Use the SET UPDATECALC command to disable Intelligent Calculation
- Allocate data
- Optionally, enable Intelligent Calculation again

### Intelligent Calculation and Data Block Status

To provide Intelligent Calculation, Essbase checks the status of the data blocks in a database. Data blocks have a calculation status of clean or dirty. Essbase marks a data block as clean after certain calculations.

When Intelligent Calculation is enabled, Essbase calculates only dirty blocks and their dependent parents. When disabled, Essbase calculates all data blocks, regardless of whether they are marked as clean or dirty.

### Marking Blocks as Clean

Essbase marks data blocks as clean in these types of calculations:

- A full calculation (CALC ALL) of a database (the default calculation).
- A calculation script that calculates all the dimensions in one CALC DIM statement.

For example, the following calculation script calculates all members in the Sample.Basic database:

```plaintext
CALC DIM(Measures, Product, Market, Year, Scenario);
```

Compare this calculation script to a calculation script that calculates all the members with two CALC DIM statements:

```plaintext
CALC DIM(Measures, Product);
CALC DIM(Market, Year, Scenario);
```

Using two CALC DIM statements causes Essbase to do at least two calculation passes through the database. In this calculation, Essbase does not, by default, mark the data blocks as clean. Because Intelligent Calculation depends on accurate clean and dirty status, you must manage these markers carefully. See “Maintaining Clean and Dirty Status” on page 415.

Essbase marks calculated data blocks as clean only in the situations described above, unless you use the SET CLEARUPDATESTATUS command in a calculation script. See “Using the SET CLEARUPDATESTATUS Command” on page 417.
Marking Blocks as Dirty

Essbase marks a data block as dirty in these situations:

- Calculating the data block for a partial calculation of the database only if SET CLEARUPDATESTATUS AFTER is not part of the partial calculation statement in the calculation script
- Loading data into the data block
- Restructuring the database (for example, by adding a member to a dense dimension)
- Copying data to the data block; for example, using DATACOPY

Maintaining Clean and Dirty Status

To use Intelligent Calculation when calculating a subset of a database or when performing multiple calculation passes through a database, consider carefully the implications of how Essbase marks data blocks as clean. When using Intelligent Calculation, you must accurately maintain the clean and dirty status of the data blocks to ensure that Essbase recalculates the database as efficiently as possible.

For example, when you calculate a subset of a database, the newly calculated data blocks are not marked as clean by default. You can ensure that the newly calculated blocks are marked as clean by using the SET CLEARUPDATESTATUS AFTER command in a calculation script. Before creating the calculation script, see “Using the SET CLEARUPDATESTATUS Command” on page 417 and the Oracle Essbase Technical Reference.

Limitations of Intelligent Calculation

Consider the following limitations and situations when using Intelligent Calculation:

- Intelligent Calculation works on a data block level and not on a cell level. For example, if you load a data value into one cell of a data block, the whole data block is marked as dirty.
- A CALC ALL that requires two passes through the database may calculate incorrectly. The problem occurs because blocks that are marked clean during the first pass are skipped during the second pass. To avoid this problem, turn Intelligent Calculation off or perform a CALC DIM for each dimension (rather than a CALC ALL for the database). A CALC ALL requires two passes through the database in either of these situations:
  - When the accounts dimension is sparse
  - When the accounts dimension is dense, the time dimension is sparse, and there is at least one more dense dimension in the outline
- Changing a formula on the database outline or changing an accounts property on the database outline does not cause Essbase to restructure the database. Therefore, Essbase does not mark the affected blocks as dirty. You must recalculate the appropriate data blocks. See “Changing Formulas and Accounts Properties” on page 425.
- Whenever possible, Essbase calculates formulas that are tagged as two-pass and in the dimension tagged as accounts as part of the main calculation of a database. You may,
however, need to use a calculation script to calculate some formulas twice. When you use a
calculation script, disable Intelligent Calculation before recalculating formulas.

- When SET CREATENONMISSINGBLK is set to ON in a calculation script, Intelligent
  Calculation is turned off, and affected blocks are calculated whether they are marked clean
  or dirty.

**Considerations for Essbase Intelligent Calculation on Oracle Exalytics In-Memory Machine**

The following functionality applies only to Essbase running on an Oracle Exalytics In-Memory
machine.

Status bits for Intelligent Calculation on a block storage database are not persisted. Therefore,
Intelligent Calculation works as intended only if both of the following conditions are true:

- The whole index fits in the index cache
- Related calculation scripts that use Intelligent Calculation complete within the lifetime of
  the Essbase Server

For Intelligent Calculation, set the index cache size large enough to fit the whole index and to
account for future index growth due to data load or calculation.

**Using Intelligent Calculation**

This section provides information on turning Intelligent Calculation on and off and using
Intelligent Calculation with different types of calculations.

**Turning Intelligent Calculation On and Off**

By default, Intelligent Calculation is turned on. To change the default, use the UPDATECALC
setting in the `essbase.cfg` file.

To turn Intelligent Calculation on and off for the duration of a calculation script, use the SET
UPDATECALC command in a calculation script.

See the *Oracle Essbase Technical Reference*.

**Using Intelligent Calculation for a Default, Full Calculation**

Intelligent Calculation provides significant performance benefits when you do a full calculation
(CALC ALL) of a database. If you do a full calculation, leave Intelligent Calculation turned on
(the default) to take advantage of its performance benefits.

➢ To check the current calculation setting:

See “Setting the Default Calculation” in the *Oracle Essbase Administration Services Online Help*. 
Caution! When using Intelligent Calculation, note the information in “Limitations of Intelligent Calculation” on page 415.

Calculating for the First Time

When you do the first full calculation of a database, Essbase calculates every block. The performance is the same whether Intelligent Calculation is on or off.

Recalculating

When you do a full recalculation of a database with Intelligent Calculation turned on, Essbase checks each block to see whether it is marked as clean or dirty. See “Intelligent Calculation and Data Block Status” on page 414.

Checking data blocks has a 5% to 10% performance overhead, which is insignificant when compared to the performance gained by enabling Intelligent Calculation.

If, however, you recalculate a database in which more than approximately 80% of the values have changed, the overhead of Intelligent Calculation may outweigh the benefits. In this case, disable Intelligent Calculation.

Using Intelligent Calculation for a Calculation Script, Partial Calculation

Essbase marks a data block as clean when it calculates the data block on a full calculation (CALC ALL) or when it calculates all dimensions in one CALC DIM command. See “Marking Blocks as Clean” on page 414.

In any other calculations, Essbase does not mark calculated data blocks as clean, unless you use the SET CLEARUPDATESTATUS command in a calculation script. For example, if you calculate a subset of a database or calculate a database in two calculation passes, Essbase does not mark the calculated blocks as clean, unless you use the SET CLEARUPDATESTATUS command.

The following calculation scripts do not cause Essbase to mark the calculated data blocks as clean:

```
FIX("New York")
    CALC DIM(Product, Measures);
ENDFIX
CALC DIM(Measures, Product);
CALC DIM(Market, Year, Scenario);
```

Use SET CLEARUPDATESTATUS to avoid unnecessary recalculations.

Using the SET CLEARUPDATESTATUS Command

In some cases, Essbase does not mark calculated blocks as clean; for example, if you calculate a subset of a database or calculate a database in two calculation passes. To manually mark data
blocks as clean for purposes of Intelligent Calculation, use the SET CLEARUPDATESTATUS command in a calculation script. Read this section, and also see “Intelligent Calculation and Data Block Status” on page 414.

**Understanding SET CLEARUPDATESTATUS**

The SET CLEARUPDATESTATUS command has three parameters—AFTER, ONLY, and OFF.

- **SET CLEARUPDATESTATUS AFTER;**
  Essbase marks calculated data blocks as clean, even if it is calculating a subset of a database.

- **SET CLEARUPDATESTATUS ONLY;**
  Essbase marks the specified data blocks as clean but does not calculate the data blocks. This parameter provides the same result as AFTER, but without calculation.

- **SET CLEARUPDATESTATUS OFF;**
  Essbase calculates the data blocks but does not mark the calculated data blocks as clean. Data blocks are not marked as clean, even on a full calculation (CALC ALL) of a database. The existing clean or dirty status of the calculated data blocks remains unchanged.

**Choosing a SET CLEARUPDATESTATUS Setting**

When you use the SET CLEARUPDATESTATUS command to mark calculated data blocks as clean, be aware of these recommendations before selecting the parameter (AFTER, ONLY, OFF):

- Only calculated data blocks are marked as clean.

- Do not use the SET CLEARUPDATESTATUS AFTER command with concurrent calculations unless you are certain that the concurrent calculations do not need to calculate the same data block or blocks. If concurrent calculations attempt to calculate the same data blocks, with Intelligent Calculation enabled, Essbase does not recalculate the data blocks if the data blocks are already marked clean by the other concurrent calculation. See “Handling Concurrent Calculations” on page 421.

- When Essbase calculates data blocks on a first calculation pass through a database, it marks the data blocks as clean. If you try to calculate the same data blocks on a subsequent pass with Intelligent Calculation enabled, Essbase does not recalculate the data blocks, because they are already marked as clean.

**Reviewing Examples That Use SET CLEARUPDATESTATUS**

Assume a scenario using the Sample.Basic database:

- Sparse dimensions are Market and Product.

- New York is a member on the sparse Market dimension.

- Intelligent Calculation is turned on (the default).
These examples show different ways of using SET CLEARUPDATESTATUS:

**Example 1: CLEARUPDATESTATUS AFTER**

SET CLEARUPDATESTATUS AFTER;
FIX("New York")
  CALC DIM(Product);
ENDFIX

In this example, Essbase searches for dirty parent data blocks for New York (for example New York -> Colas, in which Colas is a parent member on the Product dimension). It calculates these dirty blocks and marks them as clean. Essbase does not mark the level 0 data blocks as clean, because they are not calculated. For information on level 0 blocks, see Chapter 25, “Defining Calculation Order.”

**Example 2: CLEARUPDATESTATUS ONLY**

SET CLEARUPDATESTATUS ONLY;
FIX("New York")
  CALC DIM(Product);
ENDFIX

Essbase searches for dirty parent data blocks for New York (for example New York -> Colas, in which Colas is a parent member on the Product dimension). Essbase marks the dirty parent data blocks as clean but does not calculate the data blocks. Essbase does not mark the level 0 data blocks as clean because they are not calculated. For example, if New York -> 100-10 (a level 0 block) is dirty, it remains dirty.

**Example 3: CLEARUPDATESTATUS OFF**

SET CLEARUPDATESTATUS OFF;
CALC ALL;
CALC TWOPASS;
SET CLEARUPDATESTATUS ONLY;
CALC ALL;

In this example, Essbase first calculates all the dirty data blocks in the database. The calculated data blocks remain dirty. Essbase does not mark them as clean.

Essbase then calculates the members tagged as two-pass that are in the dimension tagged as accounts. Because the data blocks are still marked as dirty, Essbase recalculates them. Again, it does not mark the calculated data blocks as clean.

Essbase then searches for all the dirty blocks in the database and marks them as clean. It does not calculate the blocks, although a CALC ALL command is used.
Calculating Data Blocks

Essbase creates a data block for each unique combination of sparse dimension members, provided that at least one data value exists for the combination. Each data block represents all dense dimension member values for that unique combination of sparse dimension members.

For example, in the Sample.Basic database, the Market and Product dimensions are sparse. Therefore, the data block New York -> Colas represents all the member values on the Year, Measures, and Scenario dimensions for the sparse combination New York -> Colas.

These sections assume that you are familiar with the concepts of upper-level, level 0, and input data blocks. See “Data Storage in Data Blocks” on page 393.

Calculating Dense Dimensions

When you calculate a dense dimension and do not use a FIX command, Essbase calculates at least some of the data values in every data block in the database.

For example, the following calculation script is based on the Sample.Basic database:

```
SET CLEARUPDATESTATUS AFTER;
CALC DIM(Year);
```

This script calculates the Year dimension, which is a dense dimension. Because Year is dense, every data block in the database includes members of the Year dimension. Therefore, Essbase calculates data values in every data block. Because the script uses the SET CLEARUPDATESTATUS AFTER command, Essbase marks all data blocks as clean.

Calculating Sparse Dimensions

When you calculate a sparse dimension, Essbase may not need to calculate every data block in the database.

For example, the following calculation script is based on the Sample.Basic database:

```
SET CLEARUPDATESTATUS AFTER;
CALC DIM(Product);
```

This script calculates the Product dimension, which is a sparse dimension. Because Product is sparse, a data block exists for each member on the Product dimension. For example, one data block exists for New York -> Colas and another for New York -> 100-10.

Level 0 Effects

The data block New York -> 100-10 is a level 0 block; it does not represent a parent member on either sparse dimension (Market or Product). The data values for New York -> 100-10 are input values; they are loaded into the database. Therefore, Essbase does not need to calculate this data block. Nor does Essbase mark the data block for New York -> 100-10 as clean, even though the script uses the SET CLEARUPDATESTATUS AFTER command.
Note: Essbase calculates level 0 data blocks if a corresponding sparse, level 0 member has a formula applied to it.

If you load data into a database, the level 0 data blocks into which you load data are marked as dirty. If you subsequently calculate only a sparse dimension or dimensions, the level 0 blocks remain dirty, because Essbase does not calculate them. Therefore, when you recalculate only a sparse dimension or dimensions, Essbase recalculates all upper-level data blocks, because the upper-level blocks are marked as dirty if their child blocks are dirty, although the upper-level blocks were originally clean.

Upper-Level Effects

Colas is a parent-level member on the Product dimension. Essbase must calculate values for Colas, so Essbase calculates this data block. Because the script uses the SET CLEARUPDATESTATUS AFTER command, Essbase marks the data block as clean.

When Essbase calculates a sparse dimension, it recalculates an upper-level data block if the block is dependent on one or more dirty child blocks.

Unnecessary Calculation

You can avoid unnecessary calculation by calculating at least one dense dimension. When you calculate a dense dimension and do not use the FIX command, data values are calculated in every data block, including the level 0 blocks. So the level 0 blocks are marked as clean.

Handling Concurrent Calculations

If concurrent calculations attempt to calculate the same data blocks, and Intelligent Calculation is turned on, Essbase may not recalculate the data blocks, because they are already marked as clean.

In the following example, based on the Sample.Basic database, Actual and Budget are members of the dense Scenario dimension. Because Scenario is dense, each data block in the database contains Actual and Budget values. If User 1 runs the following calculation script, Essbase calculates the Actual values for all data blocks that represent New York. Essbase marks the calculated data blocks as clean, although not all the data values in each calculated block have been calculated. For example, the Budget values have not been calculated.

```
SET CLEARUPDATESTATUS AFTER;
FIX("New York", Actual)
   CALC DIM(Product, Year);
ENDFIX
```

If User 2 runs the following calculation script to calculate the Budget values for New York, Essbase does not recalculate the specified data blocks, because they are already marked as clean. The calculation results for Budget are not correct.

```
SET CLEARUPDATESTATUS AFTER;
FIX("New York", Budget)
```
One way to solve this problem is to make the Scenario dimension sparse. Then the Actual and Budget values are in different data blocks; for example, New York -> Colas -> Actual and New York -> Colas -> Budget. In this case, the second calculation script correctly calculates Budget data block.

Running concurrent calculations might require an increase in the data cache. See “Sizing the Data Cache” on page 827.

Understanding Multiple-Pass Calculations

Whenever possible, Essbase calculates a database in one calculation pass through the database. See “Calculation Passes” on page 408.

When you use a calculation script to calculate a database, the number of calculation passes that Essbase performs depends upon the calculation script. See “Intelligent Calculation and Data Block Status” on page 414 and “Grouping Formulas and Calculations” on page 467.

For example, assume that Essbase calculates data blocks on a first calculation pass through a database and marks them as clean. If you attempt to calculate the same data blocks on a subsequent pass and Intelligent Calculation is enabled, Essbase does not recalculate the data blocks, because they are already marked as clean.

Reviewing Examples and Solutions for Multiple-Pass Calculations

These examples describe situations that produce incorrect calculation results and provide a solution to obtain correct results. They are based on the Sample.Basic database and assume that Intelligent Calculation is turned on.

Example 1: Intelligent Calculation and Two-Pass

This calculation script does a default calculation and then a two-pass calculation:

```
CALC ALL;
CALC TWOPASS;
```

Error

Essbase calculates the dirty data blocks in the database and marks all the data blocks as clean. Essbase then needs to recalculate the members tagged as two-pass in the dimension tagged as accounts. However, Essbase does not recalculate the specified data blocks because they are already marked as clean. The calculation results are not correct.

Solution

You can calculate the correct results by disabling Intelligent Calculation for the two-pass calculation.
Example 2: SET CLEARUPDATESTATUS and FIX

This calculation script calculates data values for New York. The calculation is based on the Product dimension:

```plaintext
SET CLEARUPDATESTATUS AFTER;
FIX("New York")
    CALC DIM(Product);
ENDFIX
CALC TWOPASS;
```

Error

Essbase performs the following processes:

1. Essbase cycles through the database calculating the dirty data blocks that represent New York. The calculation is based on the Product dimension. Thus, Essbase calculates only the blocks that represent a parent member on the Product dimension (for example, New York -> Colas, New York -> Root Beer, and New York -> Fruit Soda), and then only calculates the aggregations and formulas for the Product dimension.

2. Because the SET CLEARUPDATESTATUS AFTER command is used, Essbase marks the calculated data blocks as clean, although not all data values in each calculated block have been calculated.

3. Essbase should recalculate the members tagged as two-pass in the dimension tagged as accounts; however, some of these data blocks are already marked as clean from the calculation in the previous step. Essbase does not recalculate the data blocks that are marked as clean. The calculation results are not correct.

Solution

You can calculate the correct results by disabling Intelligent Calculation for the two-pass calculation.

Example 3: SET CLEARUPDATESTATUS and Two CALC DIM Commands

This calculation script bases the database calculation on the Product and Year dimensions. Because two CALC DIM commands are used, Essbase does two calculation passes through the database:

```plaintext
SET CLEARUPDATESTATUS AFTER;
CALC DIM(Product);
CALC DIM(Year);
```

Error

Essbase performs the following processes:

1. Essbase cycles through the database calculating the dirty data blocks. The calculation is based on the Product dimension, as in “Example 2: SET CLEARUPDATESTATUS and FIX” on page 423.
2. Because the SET CLEARUPDATESTATUS AFTER command is used, Essbase marks the calculated data blocks as clean, although not all data values in each calculated block have been calculated.

3. Essbase should recalculate the data blocks. The recalculation is based on the Year dimension. However, as a result of the calculation in the previous step, some data blocks are already marked as clean, and Essbase does not recalculate them. The calculation results are not correct.

Solution

You can calculate the correct results by using one CALC DIM command to calculate the Product and Year dimensions. Essbase calculates both dimensions in one calculation pass through the database.

The following calculation script calculates the correct results:

```
SET CLEARUPDATESTATUS AFTER;
CALC DIM(Product, Year);
```

Note: When you calculate several dimensions in one CALC DIM command, Essbase calculates the dimensions in the default calculation order and not in the order in which you list them in the command. See “Member Calculation Order” on page 395.

Example 4: Two Calculation Scripts

This example calculates data values for New York but calculates based on two dimensions using two calculation scripts. The first calculation script calculates the Product dimension:

```
SET CLEARUPDATESTATUS AFTER;
FIX("New York")
    CALC DIM(Product);
ENDFIX
```

Essbase calculates the data blocks that include New York. Because the calculation is based on the Product dimension, Essbase calculates only the dirty blocks that include a parent member on the Product dimension (for example, New York -> Colas, New York -> Root Beer, and New York -> Fruit Soda), and calculates only the aggregations and formulas for the Product dimension.

Because of the CLEARUPDATESTATUS AFTER command, Essbase marks the calculated data blocks as clean, although not all data values in each calculated block have been calculated.

The second calculation script calculates the Year dimension:

```
SET CLEARUPDATESTATUS AFTER;
FIX("New York")
    CALC DIM(Year);
ENDFIX
```

Essbase calculates the data blocks that represent New York. Because the calculation is based on the Year dimension, which is a dense dimension, Essbase should calculate all data blocks that include New York, although within each block Essbase calculates only the aggregations and formulas for the Year dimension.
Error

As a result of the first calculation, some data blocks for New York are already marked as clean. Essbase does not recalculate these data blocks with the second calculation script because the data blocks are marked as clean. The calculation results are not correct.

Solution

You can calculate the correct results by telling Essbase not to mark the calculated data blocks as clean. The following calculation script calculates the correct results:

```
SET CLEARUPDATESTATUS OFF;
FIX("New York")
  CALC DIM(Product);
ENDFIX
SET CLEARUPDATESTATUS AFTER;
FIX("New York")
  CALC DIM(Year);
ENDFIX
```

With the SET CLEARUPDATESTATUS OFF command, Essbase calculates dirty data blocks but does not mark them as clean, unlike the SET CLEARUPDATESTATUS AFTER command.

This solution assumes that the data blocks are not marked as clean from a previous partial calculation of the database.

You can ensure that all data blocks are calculated, regardless of their status, by disabling Intelligent Calculation. The following calculation script calculates all specified data blocks, regardless of their clean or dirty status:

```
SET UPDATECALC OFF;
FIX("New York")
  CALC DIM(Year, Product);
ENDFIX
```

Because you have not used the SET CLEARUPDATESTATUS AFTER command, Essbase does not mark calculated data blocks as clean.

Understanding the Effects of Intelligent Calculation

Using Intelligent Calculation may have implications for how you administer a database. This section discusses the implications of each action.

Changing Formulas and Accounts Properties

Because neither changing a formula in the database outline nor changing an accounts property in the database outline causes Essbase to restructure the database, data blocks affected by such a change are not marked as dirty. For example, if you change a time balance tag in the dimension tagged as accounts, Essbase does not restructure the database and does not mark the affected blocks as dirty.
When you subsequently run a default calculation with Intelligent Calculation turned on, the changes are not calculated. To recalculate the appropriate data blocks, use a calculation script to perform any of the following tasks:

- Disable Intelligent Calculation and calculate the member formula that has changed.
- Disable Intelligent Calculation and use the FIX command to calculate the appropriate subset of a database.
- Disable Intelligent Calculation and perform a default CALC ALL on a database.

**Using Relationship and Financial Functions**

If you use relationship functions (for example, @PRIOR or @NEXT) or financial functions (for example, @ACCUM, @NPV, or @INTEREST) in a formula on a sparse dimension or a dense dimension, Essbase always recalculates the data block that contains the formula.

See the *Oracle Essbase Technical Reference*.

**Restructuring Databases**

When you restructure a database (for example, by adding a member to a dense dimension), all data blocks potentially need recalculating. Therefore, Essbase marks all data blocks as dirty. When you calculate the restructured database, all blocks are calculated.

*Note:* Changing a formula in the database outline or changing an accounts property in the database outline does not cause Essbase to restructure the database. You must recalculate the appropriate data blocks. See “Changing Formulas and Accounts Properties” on page 425.

**Copying and Clearing Data**

When you copy values to a data block by using the DATACOPY command, the resulting data block is marked as dirty. Essbase calculates the block when you recalculate a database.

When you clear data values by using the CLEARDATA and CLEARBLOCK commands, Essbase clears all the blocks regardless of how they are marked.

**Converting Currencies**

When you convert currencies using the CCONV command, the resulting data blocks are marked as dirty. Essbase calculates all converted blocks when you recalculate a database.
Understanding Dynamic Calculation

When you design the overall database calculation, it may be more efficient to calculate some member combinations when you retrieve their data, instead of precalculating the member combinations during a batch database calculation. Dynamically calculating some values in a database can significantly improve the performance of an overall database calculation.

In Essbase, you can define a member to have a *dynamic calculation*. This definition tells Essbase to calculate a data value for the member as users request it. Dynamic calculation shortens batch database calculation time, but may increase retrieval time for the dynamically calculated data values. See “Reducing the Impact on Retrieval Time” on page 438.

In Essbase you specify dynamic calculations on a per-member basis. You can define a member in the database outline as one of two types of a dynamically calculated member:

- Dynamic Calc
- Dynamic Calc and Store
Understanding Dynamic Calc Members

For a member tagged as Dynamic Calc, Essbase does not calculate its data value during a batch database calculation (for example, during a CALC ALL). Instead, Essbase calculates the data value upon retrieval (for example, when you retrieve the data into Smart View.)

Specifically, Essbase calculates a data value dynamically when you request the data value in either of two ways:

- By retrieving the data value into Smart View
- By running a report script that displays the data value

Essbase does not store the calculated value; it recalculates the value for each subsequent retrieval.

Understanding Dynamic Calc and Store Members

Essbase calculates the data value for a member tagged as Dynamic Calc and Store when you retrieve the data, in the same way as for a Dynamic Calc member. For a Dynamic Calc and Store member, however, Essbase stores the data value that is calculated dynamically. Subsequent retrievals of that data value do not require recalculation, unless Essbase detects that the value needs recalculating.

Recalculation of Data

When Essbase detects that the data value for a Dynamic Calc and Store member needs recalculating, it places an indicator on the data block that contains the value, so that Essbase knows to recalculate the block on the next retrieval of the data value.

Essbase places the indicator on the data block containing the value and not on the data value itself, meaning that Essbase tracks Dynamic Calc and Store members at the data block level. See “Data Blocks and the Index System” on page 72.

If the data block needs recalculating, Essbase detects the need and places an indicator on the data block when any of the following situations occur:

- You perform a batch calculation.
- You restructure the database.
- You use the CLEARBLOCK DYNAMIC calculation command.
  
  See the Oracle Essbase Technical Reference.

Essbase recalculates the indicated data blocks when you next retrieve the data value.

Effect of Updated Values on Recalculation

Because Essbase does not detect that a data block needs recalculating and does not place an indicator on the data block when you update the data, updated blocks are recalculated only during the next batch calculation. Consider these scenarios:
● You do a data load.

● You do data submission from a spreadsheet.

If you load data into the children of a Dynamic Calc and Store member, and the member is a consolidation of its child members, Essbase does not know to recalculate the Dynamic Calc and Store member during the next retrieval. The parent member is recalculated only during the next batch calculation.

After loading data, you must perform a batch calculation of the database or use the CLEARBLOCK DYNAMIC calculation command to ensure that the Dynamic Calc and Store members are recalculated. See the Oracle Essbase Technical Reference.

Retrieving the Parent Value of Dynamically Calculated Child Values

If you retrieve a parent value that is calculated from Dynamic Calc or Dynamic Calc and Store child members, Essbase must dynamically calculate the child member combinations before calculating the parent value. Essbase does not store the child values, even if they are Dynamic Calc and Store members.

For example, assume that Market is a parent member and that East and West are Dynamic Calc and Store child members that consolidate up to Market. When you retrieve a data value for Market, Essbase calculates East and West, even though you have not specifically retrieved them. However, Essbase does not store the values of East or West.

Benefitting from Dynamic Calculation

Dynamically calculating some database values can significantly improve the performance of an overall database calculation.

By calculating some data values dynamically, you reduce:

● Batch calculation time of the database, because Essbase has fewer member combinations to calculate.

● Disk usage, because Essbase stores fewer calculated data values. Database size and index size are also reduced.

● Database restructure time. For example, adding or deleting a Dynamic Calc member in a dense dimension does not change the data block size, so Essbase does not need to restructure the database. See “Restructuring Databases” on page 442.

● Time required to back up the database. Because database size is reduced, Essbase takes less time to perform a backup.

Data values that Essbase calculates dynamically can take longer to retrieve. You can estimate the retrieval time for dynamically calculated members. See “Reducing the Impact on Retrieval Time” on page 438.
Using Dynamic Calculation

You can tag any member as Dynamic Calc or Dynamic Calc and Store, except the following members:

- Level 0 members that do not have a formula
- Label-only members
- Shared members

Which members you choose to calculate dynamically depends on the database structure and on the balance between (1) the need for reduced calculation time and disk usage and (2) the need for speedy data retrieval for users. See “Choosing Values to Calculate Dynamically” on page 430.

In Outline Editor, you can see which members are Dynamic Calc and which are Dynamic Calc and Store. Figure 125 shows Dynamic Calc members.

![Figure 125 Sample.Basic Outline Showing Dynamic Calc Members](Image)

In Smart View, users can display visual cues to distinguish dynamically calculated values. See the Oracle Smart View for Office User’s Guide.

When developing spreadsheets that include dynamically calculated values, spreadsheet designers may want to use the spreadsheet Navigate Without Data option, so that Essbase does not dynamically calculate and store values while test spreadsheets are built.

Choosing Values to Calculate Dynamically

Dynamically calculating some data values decreases calculation time and disk usage and reduces database restructure time but increases retrieval time for dynamically calculated data values.

Use the guidelines described in the following sections when deciding which members to calculate dynamically.

Dense Members and Dynamic Calculation

Consider making the following changes to members of dense dimensions:

- Tag upper-level members of dense dimensions as Dynamic Calc.
- Try tagging level 0 members of dense dimensions with simple formulas as Dynamic Calc, and assess the increase in retrieval time.

Simple formulas do not require Essbase to perform an expensive calculation. Formulas containing financial functions or cross-dimensional operators (->) are complex formulas.
Do not tag members of dense dimensions as Dynamic Calc and Store.

**Sparse Members and Dynamic Calculation**

Consider making the following changes to members of sparse dimensions:

- Tag some upper-level members of sparse dimensions that have six or fewer children as Dynamic Calc or Dynamic Calc and Store.
- Tag sparse-dimension members with complex formulas as Dynamic Calc or Dynamic Calc and Store.
  
  A complex formula requires Essbase to perform an expensive calculation. For example, any formula that contains a financial function is a complex formula. See “Using Complex Formulas” on page 867.
- Tag upper-level members in a dimension that you frequently restructure as Dynamic Calc or Dynamic Calc and Store.
- Do not tag upper-level, sparse-dimension members that have 20 or more descendants as Dynamic Calc or Dynamic Calc and Store.

See “Choosing Between Dynamic Calc and Dynamic Calc and Store” on page 433.

**Two-Pass Members and Dynamic Calculation**

To reduce the time needed to perform batch calculations, tag two-pass members as Dynamic Calc. You can tag any Dynamic Calc or Dynamic Calc and Store member as two-pass, even if it is not on an accounts dimension. See “Using Two-Pass Calculation” on page 876.

For information about the interaction of members tagged as two-pass and attribute members, see “Comparing Attribute and Standard Dimensions” on page 167.

For information about how querying on a two-pass member in a dense dimension impacts the dynamic calculator cache, see “Two-Pass Members and Dynamic Calculation” on page 431.

**Parent-Child Relationships and Dynamic Calculation**

If a parent member has one child member, and you tag the child as Dynamic Calc, you must also tag the parent as Dynamic Calc. Similarly, if you tag the child as Dynamic Calc and Store, you must also tag the parent as Dynamic Calc and Store. However, if a parent member has one child member, and the parent is a Dynamic Calc or Dynamic Calc and Store member, you do not have to tag the child as Dynamic Calc or Dynamic Calc and Store.

**Calculation Scripts and Dynamic Calculation**

When Essbase calculates a CALC ALL or CALC DIM statement in a calculation script, it bypasses the calculation of Dynamic Calc and Dynamic Calc and Store members.
Similarly, if a member set function (for example, @CHILDREN or @SIBLINGS) is used to specify the list of members to calculate, Essbase bypasses the calculation of any Dynamic Calc or Dynamic Calc and Store members in the resulting list.

If you specify a Dynamic Calc or Dynamic Calc and Store member explicitly in a calculation script, the calculation script fails. You cannot do a calculation script calculation of a Dynamic Calc or Dynamic Calc and Store member. To use a calculation script to calculate a member explicitly, do not tag the member as Dynamic Calc.

For example, the following calculation script is valid only if Qtr1 is not a Dynamic Calc member:

```
FIX (East, Colas)
Qtr1;
ENDFIX
```

**Formulas and Dynamically Calculated Members**

You can include a dynamically calculated member in a formula when you apply the formula to the database outline. For example, if Qtr1 is a Dynamic Calc member, you can place the following formula on Qtr1 in the database outline:

```
Qtr1 = Jan + Feb;
```

You cannot make a dynamically calculated member the target of a formula calculation in a calculation script; Essbase does not reserve memory for a dynamically calculated value and, therefore, cannot assign a value to it. For example, if Qtr1 is a Dynamic Calc or Dynamic Calc and Store member, Essbase displays a syntax error if you include the following formula in a calculation script:

```
Qtr1 = Jan + Feb;
```

If Qtr1 is a Dynamic Calc or Dynamic Calc and Store member and Year is neither Dynamic Calc nor Dynamic Calc and Store, you can use the following formula in a calculation script:

```
Year = Qtr1 + Qtr2;
```

This formula is valid because Essbase does not assign a value to the dynamically calculated member.

**Note:** When you reference a dynamically calculated member in a formula in the database outline or in a calculation script, Essbase interrupts the regular calculation to do the dynamic calculation. This interruption can significantly reduce calculation performance.

**Scripts and Dynamically Calculated Members**

The preprocessing phase of a calculation script cannot determine whether an outline contains dense Dynamic Calc members. If a script contains runtime-dependent formulas, Essbase must calculate all dense Dynamic Calc members when the script is executed. Using the SET FRMLRTDYNAMIC OFF calculation command improves performance by stopping calculation of these Dynamic Calc members. See the Oracle Essbase Technical Reference.
Dynamically Calculated Children

If the calculation of a member depends on the calculation of Dynamic Calc or Dynamic Calc and Store child members, Essbase must calculate the child members first during the batch database calculation in order to calculate the parent. Therefore, regular calculation time is not reduced. This requirement applies to members of sparse dimensions and members of dense dimensions.

For example, in Figure 126, Qtr1 is a Dynamic Calc member. Its children, Jan, Feb, and Mar, are not dynamic members. Its parent, Year, is not a dynamic member. When Essbase calculates Year during a batch database calculation, it must consolidate the values of its children, including Qtr1. Therefore, it must take the additional time to calculate Qtr1, although Qtr1 is a Dynamic Calc member.

Choosing Between Dynamic Calc and Dynamic Calc and Store

In most cases, you can optimize calculation performance and reduce disk usage by using Dynamic Calc members instead of Dynamic Calc and Store members. However, in specific situations, using Dynamic Calc and Store members is optimal.

Recommendations for Sparse Dimension Members

In most cases, to calculate a sparse dimension member dynamically, tag the member as Dynamic Calc instead of Dynamic Calc and Store. When Essbase calculates data values for a member combination that includes a Dynamic Calc member, Essbase calculates only the requested values of the relevant data block. These values can be a subset of the data block.

However, when Essbase calculates data values for a member combination that includes a Dynamic Calc and Store member, Essbase must calculate and store the whole data block, even if the requested data values are a subset of the data block. Thus, the calculation takes longer and the initial retrieval time is greater.

Essbase stores only the data blocks that contain the requested data values. If Essbase must calculate intermediate data blocks to calculate the requested data blocks, it does not store the intermediate blocks.

Calculating the intermediate data blocks can significantly increase the initial retrieval time. For example, in the Sample.Basic database, Market and Product are the sparse dimensions. Assume that Market and the children of Market are Dynamic Calc and Store members. When a user retrieves the data value for the member combination Market -> Cola -> Jan -> Actual -> Sales,
Essbase calculates and stores the Market -> Cola data block. To calculate and store Market -> Cola, Essbase calculates the intermediate data blocks—East -> Cola, West -> Cola, South -> Cola, and Central -> Cola. Essbase does not store these intermediate data blocks.

**Recommendations for Members with Specific Characteristics**

Using Dynamic Calc and Store may slow initial retrieval; however, subsequent retrievals are faster than for Dynamic Calc members. Use Dynamic Calc and Store instead of Dynamic Calc for the following members:

- An upper-level sparse dimension member with children on a remote database.
  
  Essbase must retrieve the value from the remote database, which increases retrieval time. See “**Dynamically Calculating Data in Partitions**” on page 443.

- A sparse dimension member with a complex formula.
  
  A complex formula requires Essbase to perform an expensive calculation. Any formula that contains a financial function or a cross-dimensional member is a complex formula.

- If users frequently retrieve an upper-level member of a sparse dimension, speedy retrieval is important.

For example, in the Sample.Basic database, if most users retrieve data at the Market level, you probably want to tag Market as Dynamic Calc and Store and its children as Dynamic Calc.

**Recommendations for Dense Dimension Members**

Use Dynamic Calc members for dense dimension members. Defining members as Dynamic Calc and Store on a dense dimension provides only a small decrease in retrieval time and in batch calculation time. In addition, database size (disk usage) does not decrease significantly because Essbase reserves space in the data block for the data values of the members.

**Recommendations for Data with Many Concurrent Users**

Use Dynamic Calc members for data with concurrent users. If many users are concurrently retrieving Essbase data, the initial retrieval time for Dynamic Calc and Store members can be significantly longer than for Dynamic Calc members.
Dynamic Calc and Store member retrieval time increases as the number of concurrent user retrievals increases. However, Dynamic Calc member retrieval time does not increase as concurrent user retrievals increase.

If many users are concurrently accessing data, you may see significantly faster retrieval times if you use Dynamic Calc members instead of Dynamic Calc and Store members.

**Understanding How Dynamic Calculation Changes Calculation Order**

Using dynamically calculated data values changes the order in which Essbase calculates the values and can have implications for how you administer a database.

**Calculation Order for Dynamic Calculation**

When Essbase dynamically calculates data values, it calculates the data in an order different from the batch database calculation order.

During batch calculations, Essbase calculates the database in the following order:

1. Dimension tagged as accounts
2. Dimension tagged as time
3. Other dense dimensions (in the order in which they appear in the database outline)
4. Other sparse dimensions (in the order in which they appear in the database outline)
5. Two-pass calculations

See Chapter 25, “Defining Calculation Order.”

For dynamically calculated values, on retrieval, Essbase calculates the values by calculating the database in the following order:

1. Sparse dimensions
   - If the dimension tagged as time is sparse and the database outline uses time series data, Essbase bases the sparse calculation on the time dimension.
   - Otherwise, Essbase bases the calculation on the dimension that it normally uses for a batch calculation.
2. Dense dimensions
   a. Dimension tagged as accounts, if dense
   b. Dimension tagged as time, if dense
   c. Time series calculations
   d. Remaining dense dimensions
   e. Two-pass calculations
   f. Attributes
If your data retrieval uses attribute members, the last step in the calculation order is the summation of the attributes. Attribute calculation performs on-the-fly aggregation on data blocks that match the attribute members specified in the query. When the query contains two-pass calculation members, attribute calculation applies the two-pass calculation member formula after all the aggregated values are collected. This two-pass calculation uses the data values from the attribute calculation, not the values in a real data block.

The use of attribute members in your query causes Essbase to disregard the value of the Time Balance member in the dynamic calculations. During retrievals that do not use attributes, the value of the Time Balance member is applied to the calculations. The difference in calculation procedure between the use and nonuse of attribute members generates different results for any upper-level time members that are dynamically calculated.

During retrievals that do not use attributes, these dynamically calculated members are calculated in the last step and, therefore, apply the time balance functionality properly. However, during retrievals that do use attributes, the summation of the attribute is the last step applied. The difference in calculation order produces two different, predictable results for upper-level time members that are dynamically calculated.

### Calculation Order for Dynamically Calculating Two-Pass Members

Consider the following information to ensure that Essbase produces the required calculation result when it dynamically calculates data values for members tagged as two-pass (see “Using Two-Pass Calculation” on page 876).

If multiple Dynamic Calc or Dynamic Calc and Store dense dimension member are tagged as two-pass, Essbase performs the dynamic calculation in the first pass, and then calculates the two-pass members in this order:

1. Two-pass members in the accounts dimension, if any exist
2. Two-pass members in the time dimension, if any exist
3. Two-pass members in the remaining dense dimensions in the order in which the dimensions appear in the outline

For example, in the Sample.Basic database, assume the following:

- Margin% in the dense Measures dimension (the dimension tagged as accounts) is tagged as Dynamic Calc and two-pass.
- Variance in the dense Scenario dimension is tagged as Dynamic Calc and two-pass.

Essbase calculates the accounts dimension member first. So, Essbase calculates Margin% (from the Measures dimension) and then calculates Variance (from the Scenario dimension).

If Scenario is a sparse dimension, Essbase calculates Variance first, following the regular calculation order for dynamic calculations. Essbase then calculates Margin%. See “Calculation Order for Dynamic Calculation” on page 435.
This calculation order does not produce the required result, because Essbase needs to calculate Margin % -> Variance using the formula on Margin %, and not the formula on Variance. You can avoid this problem by making Scenario a dense dimension. This problem does not occur if the Measures dimension (the accounts dimension) is sparse, because Essbase still calculates Margin% first.

**Calculation Order for Asymmetric Data**

Because the calculation order used for dynamic calculations differs from the calculation order used for batch database calculations, in some database outlines, you may get different calculation results if you tag certain members as Dynamic Calc or Dynamic Calc and Store. These differences happen when Essbase dynamically calculates asymmetric data.

Symmetric data calculations produce the same results no matter which dimension is calculated.

Using the data set in Table 75, the calculation for Qtr1 -> Profit produces the same result whether you calculate along the dimension tagged as time or the dimension tagged as accounts.

Calculating along the time dimension, add the values for Jan, Feb, and Mar:

\[ 50 + 100 + 150 = 300 \]

Calculating along the accounts dimension, subtract Qtr1 -> COGS from Qtr1 -> Sales:

\[ 600 - 300 = 300 \]

**Table 75  Example of a Symmetric Calculation**

<table>
<thead>
<tr>
<th>Time -&gt; Accounts</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>600</td>
</tr>
<tr>
<td>COGS</td>
<td>50</td>
<td>100</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td>Profit (Sales – COGS)</td>
<td>50</td>
<td>100</td>
<td>150</td>
<td>300</td>
</tr>
</tbody>
</table>

Asymmetric data calculations calculate differently along different dimensions.

Using the data set in Table 76, the calculation for East -> Sales produces the correct result when you calculate along the Market dimension, but produces an incorrect result when you calculate along the accounts dimension. Calculating along the Market dimension, adding the values for New York, Florida, and Connecticut produces the correct results:

\[ 50 + 100 + 100 = 250 \]

Calculating along the accounts dimension, multiplying the value East -> Price by the value East -> UnitsSold produces incorrect results:

\[ 15 \times 50 = 750 \]

**Table 76  Example of an Asymmetric Calculation**

<table>
<thead>
<tr>
<th>Market -&gt; Accounts</th>
<th>New York</th>
<th>Florida</th>
<th>Connecticut</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>UnitsSold</td>
<td>10</td>
<td>20</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>
In the following outline, East is a sparse dimension, and Accounts is a dense dimension:

East
- New York (+)
- Florida (©)
- Connecticut (+)

Accounts
- UnitsSold (-)
- Price (-)
- Sales (-) UnitsSold * Price;

If East and Sales are tagged as Dynamic Calc, Essbase calculates a different result than it does if East and Sales are not tagged as Dynamic Calc.

If East and Sales are not Dynamic Calc members, Essbase produces the correct result by calculating these dimensions:
1. Dense Accounts dimension—calculating the values for UnitsSold, Price, and Sales for New York, Florida, and Connecticut
2. Sparse East dimension—aggregating the calculated values for UnitsSold, Price, and Sales for New York, Florida, and Connecticut to obtain the Sales values for East

If East and Sales are Dynamic Calc members, Essbase produces an incorrect result by calculating these dimensions:
1. Sparse East dimension—aggregating the values for UnitsSold, Price, and Sales for New York, Florida, and Connecticut to obtain the values for East
2. Values for East -> Sales—taking the aggregated values in the East data blocks and performing a formula calculation with these values to obtain the value for Sales

To avoid this problem and ensure that you obtain the required results, do not tag the Sales member as Dynamic Calc or Dynamic Calc and Store.

Reducing the Impact on Retrieval Time

The increase in retrieval time when you dynamically calculate a member of a dense dimension is not significant unless the member contains a complex formula. The increase in retrieval time may be significant when you tag members of sparse dimensions as Dynamic Calc or Dynamic Calc and Store.

The following sections discuss ways you can analyze and manage the effect of Dynamic Calc members on a database.

Note: For a list of functions that have the most significant effect on query retrieval, see “Choosing Between Member Set Functions and Performance” on page 883.
**Displaying a Retrieval Factor**

To help you estimate any increase in retrieval time, Essbase calculates a retrieval factor for a database outline when you save the outline. Essbase calculates this retrieval factor based on the dynamically calculated data block that is the most expensive for Essbase to calculate. The retrieval factor takes into account only aggregations. It does not consider the retrieval impact of formulas.

The retrieval factor is the number of data blocks that Essbase must retrieve from the disk or from the database to calculate the most expensive block. If the database has Dynamic Calc or Dynamic Calc and Store members in dense dimensions only (no Dynamic Calc or Dynamic Calc and Store members in sparse dimensions), the retrieval factor is 1.

An outline with a high retrieval factor (for example, greater than 2000) can cause long delays when users retrieve data. However, the actual impact on retrieval time also depends on how many dynamically calculated data values a user retrieves. The retrieval factor is only an indicator. In some applications, using Dynamic Calc members may reduce retrieval time because the database size and index size are reduced.

Essbase displays the retrieval factor value in the application log.

To view an estimated retrieval factor, see “Viewing the Essbase Server and Application Logs” on page 739.

A message similar to this sample indicates a retrieval factor:

```
[Wed Sep 20 20:04:13 2000] Local/Sample///Info (1012710)
Essbase needs to retrieve [1] Essbase kernel blocks in order to calculate the top dynamically-calculated block.
```

This message tells you that Essbase needs to retrieve one block to calculate the most expensive dynamically calculated data block.

**Displaying a Summary of Dynamically Calculated Members**

When you add Dynamic Calc or Dynamic Calc and Store members to a database outline and save the outline, Essbase provides a summary of how many members are tagged as Dynamic Calc and Dynamic Calc and Store. Essbase displays the summary in the application log.

To view a summary of dynamically calculated members, see “Viewing the Essbase Server and Application Logs” on page 739.

A message similar to this sample is displayed:

```
[Wed Sep 20 20:04:13 2000] Local/Sample///Info(1007125)
The number of Dynamic Calc Non-Store Members = [ 8 6 0 0 2]

[Wed Sep 20 20:04:13 2000] Local/Sample///Info(1007126)
The number of Dynamic Calc Store Members = [ 0 0 0 0 0]
```

This message tells you that there are eight Dynamic Calc members in the first dimension of the database outline, six in the second dimension, and two in the fifth dimension. Dynamic Time Series members are included in this count.

This example does not include Dynamic Calc and Store members.
Increasing Retrieval Buffer Size

When you retrieve data into Smart View or use Report Writer to retrieve data, Essbase uses the retrieval buffer to optimize the retrieval. Essbase processes the data in sections. Increasing the retrieval buffer size can significantly reduce retrieval time because Essbase can process larger sections of data simultaneously.

By default, the retrieval buffer size is 10 KB. However, you may speed retrieval time if you set the retrieval buffer size greater than 10 KB. See “Setting the Retrieval Buffer Size” on page 889.

To set the retrieval buffer size, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting the Size of Retrieval Buffers</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Using Dynamic Calculator Caches

By default, when Essbase calculates a Dynamic Calc member in a dense dimension (for example, for a query), it writes all blocks needed for the calculation into an area in memory called the dynamic calculator cache. When Essbase writes these blocks into the dynamic calculator cache, it expands them to include all Dynamic Calc members in the dense dimensions.

If a query includes a two-pass calculation member in a dense dimension, the query needs one dynamic calculator cache for each block retrieved.

Using the Essbase dynamic calculator cache enables centralized control of memory usage for dynamic calculations. Managing data blocks in the dynamic calculator cache also reduces the overall memory space requirement and can improve performance by reducing the number of calls to the operating system to do memory allocations.

**Note:** The dynamic calculator cache and the calculator cache use different approaches to optimizing calculation performance. See “Sizing the Calculator Cache” on page 828.

Reviewing Dynamic Calculator Cache Usage

Essbase writes two messages to the application log for each data retrieval. In the following example, the first message describes the total time required for the retrieval:

[Thu Aug 03 14:33:00 2005]Local/Sample/Basic/aspen/Info(1001065)
Regular Extractor Elapsed Time : [0.531] seconds

[Thu Aug 03 14:33:00 2005]Local/Sample/Basic/aspen/Info(1001401)
If a dynamic calculator cache is used, a second message displays the number of blocks calculated within the data calculator cache (Dyn.Calc.Cache: $n$) and the number of blocks calculated in memory outside dynamic calculator cache (non-Dyn.Calc.Cache: $n$).

To determine whether the dynamic calculator cache is being used effectively, review both messages and consider your essbase.cfg settings. For example, if the message indicates that blocks were calculated outside and in a dynamic calculator cache, you may increase the DYNALCCACHEMAXSIZE setting. If the specified maximum size is all that you can afford for all dynamic calculator caches on the server, and if using memory outside the calculator cache to complete dynamically calculated retrievals results in unacceptable delays (for example, because of swapping or paging activity), set DYNALCCACHEWAITFORBLK to TRUE.

You can use the query database MaxL statement with the performance statistics grammar to view a summary of dynamic calculator cache activity. See the Oracle Essbase Technical Reference.

### Using Dynamic Calculations with Standard Procedures

Using dynamic calculations with standard Essbase procedures affects these processes:

- **Clearing data and data blocks**
  
  You can use the CLEARBLOCK DYNAMIC command to remove data blocks for Dynamic Calc and Store member combinations.

  You can use the CLEARDATA command to mark Dynamic Calc and Store data blocks, so that Essbase knows to recalculate the blocks. The CLEARDATA command has no effect on data values for Dynamic Calc members.

- **Copying data**
  
  You cannot copy data to a dynamically calculated data value. You cannot specify a Dynamic Calc or Dynamic Calc and Store member as the target for the DATACOPY calculation command.

- **Converting currencies**
  
  You cannot specify a Dynamic Calc or Dynamic Calc and Store member as the target for the CCONV command.

- **Loading data**
  
  When you load data, Essbase does not load data into member combinations that contain a Dynamic Calc or Dynamic Calc and Store member. Essbase skips these members during data load and does not display an error message.

  To place data into Dynamic Calc and Dynamic Calc and Store members, after loading data, ensure that Essbase recalculates Dynamic Calc and Store members. See “Effect of Updated Values on Recalculation” on page 428.

- **Exporting data**
  
  Essbase does not calculate dynamically calculated values before exporting data. Essbase does not export values for Dynamic Calc members. Essbase exports values for Dynamic Calc and
Store members only if a calculated value exists in the database from a previous user retrieval of the data.

- Reporting data

ESBESSE cannot use the SPARSE data extraction method for dynamically calculated members. The SPARSE data extraction method optimizes performance when a high proportion of the reported data rows are #MISSING. See the <SPARSE command in the Oracle Essbase Technical Reference.

- Including dynamic members in calculation scripts

When calculating a database, ESBESSE skipping the calculation of any Dynamic Calc or Dynamic Calc and Store members. ESBESSE displays an error message if you attempt to do a member calculation of a Dynamic Calc or Dynamic Calc and Store member in a calculation script. See “Calculation Scripts and Dynamic Calculation” on page 431.

Creating Dynamic Calc and Dynamic Calc and Store Members

To create Dynamic Calc and Dynamic Calc and Store members using Outline Editor:

See “Setting Member Storage Properties” in the Oracle Essbase Administration Services Online Help.

To create Dynamic Calc and Dynamic Calc and Store members during a dimension build, in the dimension build data file, use the property X for Dynamic Calc and the property V for Dynamic Calc and Store. See “Using the Data Source to Work with Member Properties” on page 283.

Restructuring Databases

When you add a Dynamic Calc member to a dense dimension, ESBESSE does not reserve space in the data block for the member’s values. Therefore, ESBESSE does not need to restructure the database. However, when you add a Dynamic Calc and Store member to a dense dimension, ESBESSE does reserve space in the relevant data blocks for the member’s values and, therefore, must restructure the database.

When you add a Dynamic Calc or a Dynamic Calc and Store member to a sparse dimension, ESBESSE updates the index but does not change the relevant data blocks. See “Index Manager” on page 757.

ESBESSE can save changes to the database outline significantly faster if it does not have to restructure the database.

In the following cases, ESBESSE does not restructure the database or change the index (ESBESSE saves only the database outline, which is very fast):

- Add, delete, or move a dense dimension Dynamic Calc member.
Essbase does restructure the database if the member is Dynamic Calc and Store.

- Change the storage property of a dense dimension member from Dynamic Calc and Store member to a nondynamic storage property.
- Change the storage property of a sparse dimension Dynamic Calc or Dynamic Calc and Store member to a nondynamic storage property.
- Rename any Dynamic Calc or Dynamic Calc and Store member.

In the following cases, Essbase does not restructure the database but does restructure the database index, which is significantly faster:

- Add, delete, or move sparse dimension Dynamic Calc or Dynamic Calc and Store members.
- Change the storage property of a dense dimension member from a nondynamic value to Dynamic Calc and Store.

In the following cases, Essbase restructures the database:

- Add, delete, or move a dense dimension Dynamic Calc and Store member.
  
  Essbase does not restructure the database if the member is Dynamic Calc.
- Change a dense dimension Dynamic Calc and Store member to a Dynamic Calc member.
- Change a dense dimension Dynamic Calc member to a Dynamic Calc and Store member.
- Change the storage property of a nondynamic member in a dense dimension to Dynamic Calc.
- Change the storage property of a dense dimension from Dynamic Calc member to a nondynamic value.
- Change the storage property of a nondynamic member in a sparse dimension Dynamic Calc or Dynamic Calc and Store.

See “Types of Database Restructuring” on page 840.

**Dynamically Calculating Data in Partitions**

You can define Dynamic Calc and Dynamic Calc and Store members in transparent, replicated, or linked regions of the partitions. See Chapter 15, “Designing Partitioned Applications”.

For example, if you tag an upper-level, sparse dimension member with children that are on a remote database (transparent database partition) as Dynamic Calc and Store, because Essbase retrieves child values from the other database, retrieval time is increased. You can use Dynamic Calc instead of Dynamic Calc and Store; however, the impact on subsequent retrieval time might be too great.

For example, assume that the local database is the Corporate database, which has transparent partitions to the regional data for East, West, South, and Central. You can tag the parent member Market as Dynamic Calc and Store.
In a transparent partition, the definition on the remote database takes precedence over any definition on the local database. For example, if a member is tagged as Dynamic Calc in the local database but not in the remote database, Essbase retrieves the value from the remote database and does not do the local calculation.

If you are using a replicated partition, consider using Dynamic Calc members instead of Dynamic Calc and Store members. When calculating replicated data, Essbase does not retrieve the child blocks from the remote database; therefore, the impact on retrieval time is not great.

**Note:** When Essbase replicates data, it checks the time stamp on each source data block and each corresponding target data block. If the source data block is more recent, Essbase replicates the data in the data block. However, for dynamically calculated data, data blocks and time stamps do not exist. Therefore, Essbase always replicates dynamically calculated data.
Introduction

Time series calculations assume that you have Dynamic Time Series members defined in the outline. Calculating time series data is helpful in tracking inventory by calculating the first and last values for a time period, and in calculating period-to-date values.

Calculating First, Last, and Average Values

Using time balance and variance reporting tags on the dimension tagged as accounts, you can tell Essbase how to perform time balance calculations on accounts data.

Essbase usually calculates a dimension tagged as time by consolidating or calculating the formulas on the parent’s children. However, you can use accounts tags, such as time balance and variance reporting tags, to consolidate a different kind of value. For example, if you tag a parent member in the accounts dimension with a time balance property of First, Essbase calculates the member by consolidating the value of the member’s first child. For example, in the Sample.Basic database, the Opening Inventory member in the Measures dimension (the accounts dimension) has a time balance property of First. This member represents the inventory at the beginning of the time period. If the time period is Qtr1, Opening Inventory represents the inventory available at the beginning of Jan (the first member in the Qtr1 branch).

To use accounts tags, you must have a dimension tagged as accounts and a dimension tagged as time. You use the First, Last, and Average tags (time balance properties) and the Expense tag (variance reporting property) only on members of a dimension tagged as accounts. The dimensions you tag as time and accounts can be either dense or sparse dimensions.
For cells of time balance account members, a member in any dimension other than the time dimension that is set with the ^ consolidation operator is excluded from the Average calculation; the member is, however, included in First and Last calculations.

**Note:** If you are using Intelligent Calculation, changing accounts tags in the database outline does not cause Essbase to restructure the database. You may have to tell Essbase explicitly to recalculate the required data values. See “Changing Formulas and Accounts Properties” on page 425.

### Specifying Accounts and Time Dimensions

When you tag a dimension as accounts, Essbase knows that the dimension contains members with accounts tags. When you tag a dimension as time, Essbase knows that this dimension is the one on which to base the time periods for the accounts tags.

As shown in Figure 128, the Measures dimension is tagged as accounts, and the Year dimension is tagged as time.

**Figure 128** Sample Basic Outline Showing Accounts and Time Tags

Database: Basic (Current Alias Table: Default)
- Year Time (Active Dynamic Time Series Members: H-T-D, Q-T-D) (Dynamic Calc)
- Measures Accounts (Label Only)
- Product
- Market
- Scenario (Label Only)

See “Creating a Time Dimension” on page 142 and “Creating an Accounts Dimension” on page 142.

### Reporting the Last Value for Each Time Period

For an accounts dimension member, you can tell Essbase to move the last value for each time period up to the next level. To report the last value for each time period, set the member’s time balance property as Last. (The tag displays as TB Last in the database outline.)

As shown in Figure 129, the accounts member Ending Inventory is tagged as TB Last. Ending Inventory consolidates the value for the last month in each quarter and uses that value for that month’s parent. For example, the value for Qtr1 is the same as the value for Mar.
For information on tagging an accounts member as Last, see “Setting Time Balance Properties” on page 143.

By default, Essbase does not skip #MISSING or zero (0) values when calculating a parent value. You can choose to skip these values. For a discussion of how and why to skip #MISSING values, see “Skipping #MISSING and Zero Values” on page 448.

Reporting the First Value for Each Time Period

For an accounts dimension member, you can tell Essbase to move the first value for each time period up to the next level. To report the first value for each time period, set the member’s time balance property as First. (The tag displays as TB First in the database outline.)

As shown in Figure 130, the accounts member Opening Inventory is tagged as TB First. Opening Inventory consolidates the value of the first month in each quarter and uses that value for that month’s parent. For example, the value for Qtr1 is the same as the value for Jan.

For information on tagging an accounts member as First, see “Setting Time Balance Properties” on page 143.

By default, Essbase does not skip #MISSING or zero (0) values when calculating a parent value. You can choose to skip these values. See “Skipping #MISSING and Zero Values” on page 448.
**Reporting the Average Value for Each Time Period**

For an accounts dimension member, you can tell Essbase to average values across time periods and consolidate the average up to the next level. For example, you can tell Essbase to average the values for Jan, Feb, and Mar and then use that value for the Qtr1 value. To report the average value for each time period, set the member’s time balance property as Average.

For information on tagging an accounts member as Average, see “Setting Time Balance Properties” on page 143.

By default, Essbase does not skip #MISSING or zero (0) values when it calculates a parent value. Thus, when it calculates the average, Essbase aggregates the child values and divides by the number of children, regardless of whether the children have #MISSING or zero values. You can tell Essbase to skip #MISSING and zero values. See “Skipping #MISSING and Zero Values” on page 448.

**Skipping #MISSING and Zero Values**

You can tell Essbase how to treat #MISSING and zero (0) values when doing time balance calculations. A #MISSING value is a marker in Essbase that indicates that the data in this location does not exist, does not contain any meaningful value, or was never entered.

By default, Essbase does not skip #MISSING or 0 (zero) values when calculating a parent value.

You can override this default by setting a skip property. See “Setting Skip Properties” on page 144.

For example, if you tag an accounts dimension member as Last and Skip Missing, then Essbase consolidates the last nonmissing child to the parent. Consider the example in Table 77:

<table>
<thead>
<tr>
<th>Accounts Member (Last, Skip Missing)</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60</td>
<td>70</td>
<td>#MI</td>
<td>70</td>
</tr>
</tbody>
</table>

Tagging an account as Average and Skip Missing may produce different results from tagging that account as Average and Skip None. A calculation performed with Average and Skip None produces correct results because no data is skipped. But because grandparents with children are consolidated by summing the averages, results of a calculation on an account with Average and Skip Missing is incorrect unless you use Dynamic Calc or Two-Pass tags.

**Considering the Effects of First, Last, and Average Tags**

Table 78 shows how Essbase consolidates the time dimension based on the time balance (TB) First, Last, and Average tags on accounts dimension members.
Table 78  Example of the Effects of (TB) First, Last and Average

<table>
<thead>
<tr>
<th>Accounts -&gt; Time</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounts Member1</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>36</td>
</tr>
<tr>
<td>Accounts Member2 (TB First)</td>
<td>20</td>
<td>25</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Accounts Member3 (TB Last)</td>
<td>25</td>
<td>21</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Accounts Member4 (TB Average)</td>
<td>20</td>
<td>30</td>
<td>28</td>
<td>26</td>
</tr>
</tbody>
</table>

| Accounts Member1 | Value of Jan + Feb + Mar |
| Accounts Member2 (TB First) | Value of Jan |
| Accounts Member3 (TB Last) | Value of Mar |
| Accounts Member4 (TB Average) | Average of Jan, Feb, Mar |

Placing Formulas on Time and Accounts Dimensions

If you place a member formula on a time or accounts dimension, it may be overwritten by a time balance calculation.

Table 79 shows an example in which Opening Inventory is tagged as First:

Table 79  Example of the Effects of (TB) First

<table>
<thead>
<tr>
<th>Measures -&gt; Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening Inventory: First</td>
<td>30000</td>
<td>28000</td>
<td>27000</td>
<td>30000</td>
</tr>
</tbody>
</table>

Because Opening Inventory is tagged as First, Essbase calculates Opening Inventory for Qtr1 by taking the Opening Inventory for Jan value. Any member formula that is placed on Qtr1 in the database outline is overwritten by this time balance calculation.

Calculating Period-to-Date Values

You can calculate period-to-date values for data. For example, you can calculate the sales values for the current quarter up to the current month. If the current month is May, using a standard calendar quarter, the quarter total is the total of the values for April and May.

In Essbase, you can calculate period-to-date values in the following ways:

- During a batch calculation, using the @PTD function
- Dynamically, when a user requests the values, using Dynamic Time Series members
- As part of an MDX query, using the DTS function

This section explains how to use Dynamic Time Series members to dynamically calculate period-to-date values. Using Dynamic Time Series members is almost always the most efficient method. For an example, see “Calculating Period-to-Date Values” on page 387.
Using Dynamic Time Series Members

To calculate period-to-date values dynamically, you must use a Dynamic Time Series member for a period on the dimension tagged as time. See “Specifying Accounts and Time Dimensions” on page 446.

You do not create the Dynamic Time Series member directly in the database outline. Instead, you enable a predefined Dynamic Time Series member and associate it with an appropriate generation number.

For example, to calculate quarter-to-date values, you enable the Q-T-D member and associate it with the generation to which you want to apply the Dynamic Time Series member. In Sample.Basic, the generation containing quarters is generation number 2, which contains the Qtr1, Qtr2, Qtr3, and Qtr4 members. Essbase creates a Dynamic Time Series member called Q-T-D and associates it with generation 2. The Q-T-D member calculates monthly values up to the current month in the quarter. See “Enabling Dynamic Time Series Members” on page 451.

Dynamic Time Series members are not displayed as members in the database outline. Instead, Essbase lists the currently active Dynamic Time Series members in a comment on the time dimension. In the outline in Figure 131, H-T-D (history-to-date) and Q-T-D (quarter-to-date) are active. H-T-D is associated with generation 1; Q-T-D is associated with generation 2.

Figure 131   Sample.Basic Outline Showing Dynamic Time Series

Year Time (Active Dynamic Time Series Members: H-T-D, Q-T-D (Dynamic Calc))
  Qtr1 (+) (Dynamic Calc)
  Qtr2 (+) (Dynamic Calc)
    Apr (+)
    May (+)
    Jun (+)
  Qtr3 (+) (Dynamic Calc)
  Qtr4 (+) (Dynamic Calc)

Essbase provides eight predefined Dynamic Time Series members:

- HTD (history-to-date)
- Y-T-D (year-to-date)
- S-T-D (season-to-date)
- P-T-D (period-to-date)
- Q-T-D (quarter-to-date)
- M-T-D (month-to-date)
- W-T-D (week-to-date)
- D-T-D (day-to-date)

These members provide up to eight levels of period-to-date reporting. How many and which members you use depends on the data and the database outline.

For example, if the database contains hourly, daily, weekly, monthly, quarterly, and yearly data, you can report day-to-date (D-T-D), week-to-date (W-T-D), month-to-date (M-T-D), quarter-to-date (Q-T-D), and year-to-date (Y-T-D) information.
If the database contains monthly data for the last five years, you can report year-to-date (Y-T-D) and history-to-date (H-T-D) information, up to a specific year.

If the database tracks data for seasonal time periods, you can report period-to-date (P-T-D) or season-to-date (S-T-D) information.

You can associate a Dynamic Time Series member with any generation in the time dimension except the highest generation number, regardless of the data. For example, you can use the P-T-D member to report quarter-to-date information. You cannot associate Dynamic Time Series members with level 0 members of the time dimension.

**Note:** Oracle recommends that you avoid assigning time balance properties (First, Last, Average, Skip Missing) to members set for dynamic calculations if you plan to use these members in Dynamic Time Series calculations. Doing so may retrieve incorrect values for the parent members in your accounts dimension.

### Enabling Dynamic Time Series Members

To use Dynamic Time Series members, you must enable them. If required, you can specify aliases for Dynamic Time Series members. See “Specifying Alias Names for Dynamic Time Series Members” on page 452.

To enable Dynamic Time Series members:

See “Enabling Dynamic Time Series Members” in the *Oracle Essbase Administration Services Online Help*.

**Note:** The number of generations displayed depends on the number of generations in the time dimension. You cannot associate Dynamic Time Series members with the highest generation (level 0 members).

After you enable Dynamic Time Series members in the database outline, Essbase adds a comment to the dimension tagged as time; for example, the Year dimension from Sample.Basic showing H-T-D and Q-T-D defined:

```
Year Time (Active Dynamic Time Series Members: H-T-D, Q-T-D) (Dynamic Calc)
```

### Disabling Dynamic Time Series Members

To disable a Dynamic Time Series member, tell Essbase not to use the predefined member.

To disable Dynamic Time Series members:

See “Disabling Dynamic Time Series Members” in the *Oracle Essbase Administration Services Online Help*. 
Specifying Alias Names for Dynamic Time Series Members

You can specify alias names for predefined Dynamic Time Series members, such as QtrToDate, for the Q-T-D Dynamic Time Series member. You can then use the alias names to retrieve the Dynamic Time Series members in Smart View or in a report.

You can create up to eight alias names for each Dynamic Time Series member. Essbase saves each alias name in the Dynamic Time Series alias table that you specify.

➢ To create aliases for Dynamic Time Series members:

See “Creating Aliases for Dynamic Time Series Members” in the Oracle Essbase Administration Services Online Help.

For information on specifying and displaying alias names, see “Setting Aliases” on page 153.

Applying Predefined Generation Names to Dynamic Time Series Members

When you enable a Dynamic Time Series member and associate it with a generation number, Essbase creates a predefined generation name for that generation number. See “Naming Generations and Levels” on page 158.

➢ To display generation and level names:

See “Naming Generations and Levels” in the Oracle Essbase Administration Services Online Help.

Table 80 lists the Dynamic Time Series members and their corresponding generation names:

<table>
<thead>
<tr>
<th>Member</th>
<th>Generation Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-T-D</td>
<td>Day</td>
</tr>
<tr>
<td>H-T-D</td>
<td>History</td>
</tr>
<tr>
<td>M-T-D</td>
<td>Month</td>
</tr>
<tr>
<td>P-T-D</td>
<td>Period</td>
</tr>
<tr>
<td>Q-T-D</td>
<td>Quarter</td>
</tr>
<tr>
<td>S-T-D</td>
<td>Season</td>
</tr>
<tr>
<td>W-T-D</td>
<td>Week</td>
</tr>
<tr>
<td>Y-T-D</td>
<td>Year</td>
</tr>
</tbody>
</table>
These member and generation names are reserved for use by Essbase. If you use one of these generation names to create a generation name on the time dimension, Essbase automatically creates and enables the corresponding Dynamic Time Series member for you.

For example, in Sample.Basic, you can create a generation name called Quarter for generation number 2. Quarter contains quarterly data in the members Qtr1, Qtr2, and so on. When you create the generation name Quarter, Essbase creates and enables a Dynamic Time Series member called Q-T-D.

**Retrieving Period-to-Date Values**

When you retrieve a Dynamic Time Series member, you must tell Essbase the time period up to which you want to calculate the period-to-date value. This time period, known as the *latest time period*, must be a level 0 member on the time dimension.

Use the following methods to specify the latest time period:

- For a specific member, in Smart View, specify the latest period member name. Place that name after the Dynamic Time Series member or alias name. For example, Q-T-D(May) returns the quarter-to-date value by adding values for April and May.
- For a retrieval, use one of the following methods to specify the latest time period:
  - Use the <LATEST command in Report Writer.
  - Specify the Select DTS Member option in Smart View.

  The member-specific setting—for example, Q-T-D(May)—takes precedence over the <LATEST or Latest Time Series option setting.

In the example in Figure 132, Q-T-D(May) displays the period-to-date value for May that is obtained by adding the values for Apr and May (8644 + 8929 = 17573).

**Figure 132  Spreadsheet Showing Period-To-Date Value for May**

<table>
<thead>
<tr>
<th>Measures</th>
<th>Product</th>
<th>Market</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qtr1</td>
<td>24713</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td>8644</td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>8929</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jun</td>
<td>9534</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qtr2</td>
<td>27107</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qtr3</td>
<td>27912</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qtr4</td>
<td>26800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>106522</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-T-D(May)</td>
<td>17573</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Using Dynamic Time Series Members in Transparent Partitions**

To optimize query time across transparent partitions for outlines containing Dynamic Time Series members, use the `essbase.cfg` setting `TARGETTIMESERIESOPT`. 
See the *Oracle Essbase Technical Reference* and Chapter 16, “Creating and Maintaining Partitions.”
The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

- Chapter 30, “Reviewing Examples of Calculation Scripts for Block Storage Databases”
- Chapter 23, “Developing Formulas for Block Storage Databases”
- Chapter 57, “Optimizing Calculations”
- Chapter 64, “Performing Custom Calculations and Allocations on Aggregate Storage Databases”

All of the examples in this chapter are based on the Sample.Basic database.

For more information about the calculation commands referenced in this chapter, see the Oracle Essbase Technical Reference.
Using Calculation Scripts

A calculation script, which contains a series of calculation commands, equations, and formulas, allows you to define calculations other than those defined by the database outline.

In a calculation script, you can perform a default calculation (CALC ALL) or a calculation of your choosing (for example, you can calculate part of a database or copy data values between members).

You must write a calculation script to perform any of the following tasks:

- Calculate a subset of a database
  See “Calculating a Subset of a Database” on page 474.
- Change the calculation order of the dense and sparse dimensions in a database
- Perform a complex calculation in a specific order or perform a calculation that requires multiple iterations through the data (for example, some two-pass calculations require a calculation script)
- Perform any two-pass calculation on a dimension without an accounts tag
  See “Using Two-Pass Calculation” on page 876.
- Perform a currency conversion
  See Chapter 14, “Designing and Building Currency Conversion Applications.”
- Calculate member formulas that differ from formulas in the database outline (formulas in a calculation script override formulas in the database outline)
- Use an API interface to create a custom calculation dynamically
- Use control of flow logic in a calculation (for example, to use the IF…ELSE…ENDIF or the LOOP…ENDLOOP commands)
- Clear or copy data from specific members
  See “Copying Data” on page 474.
- Define temporary variables for use in a database calculation
  See “Declaring Data Variables” on page 462.
- Force a recalculation of data blocks after you have changed a formula or an accounts property on the database outline
- Control how Essbase uses Intelligent Calculation when calculating a database
  See Chapter 26, “Understanding Intelligent Calculation.”

The following calculation script calculates the Actual values from the Year, Measures, Market, and Product dimensions:

```
FIX (Actual)
  CALC DIM(Year, Measures, Market, Product);
ENDFIX
```

Using Calculation Script Editor in Administration Services Console, you can create calculation scripts by:
● Entering the calculation script in the text area of the script editor
● Using the user interface features of the script editor to build the script
● Creating the script in a text editor and pasting the script text into Calculation Script Editor

See “About Calculation Script Editor” in the Oracle Essbase Administration Services Online Help.

Calculation scripts created using Administration Services are given a .csc extension by default. If you run a calculation script from Administration Services or Smart View, the file must have a .csc extension. However, because a calculation script is a text file, you can use MaxL or ESSCMD to run any text file as a calculation script.

A calculation script can also be a string defined in memory and accessed through the API on an Essbase client or an Essbase Server. Therefore, from dialog boxes, you can dynamically create a calculation script that is based on user selections.

Process for Creating Calculation Scripts

Use this process to create a calculation script:

1. Create a calculation script or open an existing calculation script.
   See “Creating Scripts” or “Opening Scripts” in the Oracle Essbase Administration Services Online Help.

2. Enter or edit the contents of the calculation script.
   See “About Calculation Script Editor” in the Oracle Essbase Administration Services Online Help for information about:
   ● Associating a script with an outline
   ● Searching an outline tree for members
   ● Inserting dimensions, members, and aliases in a script from an outline tree
   ● Inserting functions and commands in a script from a tree
   ● Using syntax autocompletion
   ● Checking script syntax
   ● Executing scripts
   ● Viewing color-coded script elements
   ● Searching for text in a script
   ● Changing fonts

3. Validate the calculation script.
   See “Checking Syntax” on page 460.

4. Save the calculation script.
   See “Saving Calculation Scripts” on page 484.
5. Execute the calculation script.
   See “Executing Calculation Scripts” on page 484.

6. Check the results of the calculation script.
   See “Checking Calculation Results” on page 485.

7. If necessary, perform other operations on the calculation script.
   In the Oracle Essbase Administration Services Online Help, see the following topics:
   - “Locking and Unlocking Objects”
   - “Copying Scripts”
   - “Renaming Scripts”
   - “Deleting Scripts”
   - “Printing Scripts”

## Understanding Calculation Script Syntax

Essbase provides a flexible set of commands that you can use to control how a database is calculated. You can construct calculation scripts from commands and formulas.

When you create a calculation script, you must apply the following rules:

- End each formula or calculation script command with a semicolon (;). For example:
  
  **Example 1**
  
  ```
  CALC DIM(Product, Measures);
  ```

  **Example 2**
  
  ```
  DATACOPY Plan TO Revised_Plan;
  ```

  **Example 3**
  
  ```
  "Market Share" = Sales % Sales -> Market;
  ```

  **Example 4**
  
  ```
  IF (Sales <> #MISSING)
      Commission = Sales * .9;
  ELSE
      Commission = #MISSING;
  ENDIF;
  ```

You do not need to end the following commands with semicolons:

- IF
- ENDIF
- ELSE
- ELSIF
- FIX
- ENDFIX
- EXCLUDE
Note: Although not required, Oracle recommends ending each ENDIF statement in a
formula with a semicolon.

- Enclose a member name in double quotation marks (" "), if that member name meets any
  of the following conditions:

  - Contains spaces.
    
    For example, in the following formula, Opening Inventory and Ending Inventory are
    enclosed in double quotation marks:

    "Opening Inventory" = "Ending Inventory" - Sales + Additions;

  - Is the same as an operator, function name, or keyword.
    
    See “Naming Conventions in Calculation Scripts, Report Scripts, Formulas, Filters, and
    Substitution and Environment Variable Values” on page 1098.

  - Includes any nonalphanumeric character, such as a hyphen (-), asterisk (*), or slash
    (/).
    
    See “Naming Conventions in Calculation Scripts, Report Scripts, Formulas, Filters, and
    Substitution and Environment Variable Values” on page 1098.

  - Contains only numerals or starts with a numeral.
    
    For example: “100” or “10Prod”

  - Begins with an ampersand (&). The leading ampersand (&) is reserved for substitution
    variables. If a member name begins with &, enclose the name in quotation marks.

    Note: Do not enclose substitution variables in quotation marks in a calculation script.

  - Contains a dot (.)
    
    For example: 1999.Jan or .100

- If you are using an IF statement or an interdependent formula, enclose the formula in
  parentheses to associate it with the specified member.

For example, the following formula is associated with the Commission member in the
database outline:

    Commission
    (IF(Sales < 100)
     Commission = 0;
    ENDIF;)

- End each IF statement in a formula with an ENDIF statement.

  For example, the previous formula contains a simple IF...ENDIF statement.

- If you are using an IF statement that is nested within another IF statement, end each IF with
  an ENDIF statement.

  For example:
"Opening Inventory"
(IF (@ISMBR(Budget))
   IF (@ISMBR(Jan))
       "Opening Inventory" = Jan;
   ELSE
       "Opening Inventory" = @PRIOR("Ending Inventory");
   ENDIF;
ENDIF;)

- You do not need to end ELSE or ELSEIF statements with ENDIF statements.
  For example:

  Marketing
  (IF (@ISMBR(@DESCENDANTS(West)) OR @ISMBR(@DESCENDANTS(East)))
     Marketing = Marketing * 1.5;
   ELSEIF(@ISMBR(@DESCENDANTS(South)))
     Marketing = Marketing * .9;
   ELSE
     Marketing = Marketing * 1.1;
   ENDIF;)

  Note: If you use ELSE IF (with a space) rather than ELSEIF (one word) in a formula, you
  must supply an ENDIF for the IF statement.

- End each FIX statement with an ENDFIX statement.
  For example:

  FIX(Budget,@DESCENDANTS(East))
     CALC DIM(Year, Measures, Product);
  ENDFIX

- End each EXCLUDE statement with an ENDEXCLUDE statement.

When you write a calculation script, use the Calculation Script Editor syntax checker to validate
the syntax. See “Checking Syntax” on page 460.

Adding Comments
You can include comments to annotate calculation scripts. Essbase ignores these comments
when it runs the calculation script.

To include a comment, start the comment with /* and end the comment with */. For example:

/* This calculation script comment
   spans two lines. */

Checking Syntax
Essbase includes a syntax checker that flags syntax errors (such as a mistyped function name) in
a calculation script. The results are displayed in the messages panel in Administration Services
Console.

If syntax errors are not found, Essbase indicates the syntax check succeeded.
If syntax errors are found, Essbase indicates the syntax check failed and displays one error at a time. Typically, an error message includes the line number in which the error occurred and a brief description. For example, if a semicolon end-of-line character is missing at the end of a calculation script command, Essbase displays a message similar to this one:

```
Error: line 1: invalid statement; expected semicolon
```

When you reach the last error, Essbase displays the following message:

```
No more errors
```

To check the syntax of a calculation script in Calculation Script Editor:

See “Checking Script Syntax” in the Oracle Essbase Administration Services Online Help.

**Note:** The syntax checker cannot determine semantic errors, which occur when a calculation script does not work as you expect. To find semantic errors, run the calculation and check the results to ensure they are as you expect. See “Checking Calculation Results” on page 485.

### Using Calculation Commands

The topics in this section discuss calculation commands, grouped by functionality. See:

- “Calculating the Database Outline” on page 461
- “Controlling the Flow of Calculations” on page 462
- “Declaring Data Variables” on page 462
- “Specifying Global Settings for a Database Calculation” on page 463

### Calculating the Database Outline

Table 81 lists the calculation commands that perform a database calculation based on the structure and formulas in the database outline.

<table>
<thead>
<tr>
<th>Command</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALC ALL</td>
<td>The entire database, based on the outline</td>
</tr>
<tr>
<td>CALC DIM</td>
<td>A specified dimension or dimensions</td>
</tr>
<tr>
<td>CALC TWOPASS</td>
<td>All members tagged as two-pass on the dimension tagged as accounts</td>
</tr>
<tr>
<td><code>membername</code></td>
<td>The formula applied to a member in the database outline, where <code>membername</code> is the name of the member to which the formula is applied</td>
</tr>
<tr>
<td>CALC AVERAGE</td>
<td>All members tagged as Average on the dimension tagged as accounts</td>
</tr>
<tr>
<td>CALC FIRST</td>
<td>All members tagged as First on the dimension tagged as accounts</td>
</tr>
</tbody>
</table>
### Controlling the Flow of Calculations

Table 82 lists the commands that manipulate the flow of calculations:

<table>
<thead>
<tr>
<th>Command</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIX...ENDFIX</td>
<td>Calculate a subset of a database by inclusion</td>
</tr>
<tr>
<td>EXCLUDE...ENDEXCLUDE</td>
<td>Calculate a subset of a database by exclusion</td>
</tr>
<tr>
<td>LOOP...ENDLOOP</td>
<td>Specify the number of times that commands are iterated</td>
</tr>
<tr>
<td>FIXPARALLEL...ENDFIXPARALLEL</td>
<td>Enable parallel calculation on a block of commands</td>
</tr>
</tbody>
</table>

You can also use the IF and ENDIF commands to specify conditional calculations.

**Note:** Essbase does not allow branching from one calculation script to another calculation script.

### Declaring Data Variables

Table 83 lists the commands that declare temporary variables and, if required, set their initial values. Temporary variables store the results of intermediate calculations.

You can also use substitution variables in a calculation script. See "Using Substitution Variables in Calculation Scripts" on page 468.

<table>
<thead>
<tr>
<th>Command</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARRAY</td>
<td>Declare one-dimensional array variables</td>
</tr>
<tr>
<td>VAR</td>
<td>Declare a temporary variable that contains a single value</td>
</tr>
<tr>
<td>THREADPARVAR and TASKPARVAR</td>
<td>Declare a temporary variable that can be used within a FIXPARALLEL block.</td>
</tr>
</tbody>
</table>

Values stored in temporary variables exist only while the calculation script is running. You cannot report on the values of temporary variables.

Variable and array names are character strings that contain any of the following characters:

- Letters a–z
- Numerals 0–9
Typically, arrays are used to store variables as part of a member formula. The size of the array variable is determined by the number of members in the corresponding dimension. For example, if the Scenario dimension has four members, the following command creates an array called Discount with four entries:

```
ARRAY Discount[Scenario];
```

You can use multiple arrays at a time.

### Specifying Global Settings for a Database Calculation

Table 84 lists the commands that define calculation behavior:

<table>
<thead>
<tr>
<th>Command</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET AGGMISSG</td>
<td>Specify how Essbase treats #MISSING values during a calculation.</td>
</tr>
<tr>
<td>SET CACHE</td>
<td>Adjust the default calculator cache size.</td>
</tr>
<tr>
<td>SET CALCPARALLEL</td>
<td>Enable parallel calculation. See “Enabling CALCPARALLEL Parallel Calculation” on page 507.</td>
</tr>
<tr>
<td>SET CALCTASKDIMS</td>
<td>Increase the number of dimensions used to identify tasks for parallel calculation. See “Identifying Additional Tasks for Parallel Calculation” on page 508.</td>
</tr>
<tr>
<td>SET CLEARUPDATESTATUS</td>
<td>Control how Essbase marks data blocks for Intelligent Calculation. See “Using the SET CLEARUPDATESTATUS Command” on page 417.</td>
</tr>
<tr>
<td>SET CREATEBLOCKEQ</td>
<td>Turn on and turn off the Create Blocks on Equation setting, which controls the creation of blocks when you assign nonconstant values to members of a sparse dimension. See “Nonconstant Values Assigned to Members in a Sparse Dimension” on page 869.</td>
</tr>
<tr>
<td>SET CREATENONMISSINGBLK</td>
<td>Enable calculations on potential data blocks and save these blocks when the result is not #MISSING.</td>
</tr>
<tr>
<td>SET FRMLBOTTOMUP</td>
<td>Optimize the calculation of sparse dimension formulas in large database outlines. See “Optimizing Formulas on Sparse Dimensions in Large Database Outlines” on page 868.</td>
</tr>
<tr>
<td>SET LOCKBLOCK</td>
<td>Specify the maximum number of blocks that Essbase can lock concurrently when calculating a sparse member formula.</td>
</tr>
<tr>
<td>SET MSG</td>
<td>Display messages to trace a calculation.</td>
</tr>
<tr>
<td>SET NOTICE</td>
<td></td>
</tr>
<tr>
<td>SET RUNTIMESUBVARS</td>
<td>Declare runtime substitution variables that are used in a calculation script. See “Using Runtime Substitution Variables in Calculation Scripts” on page 469.</td>
</tr>
<tr>
<td>SET UPDATECALC</td>
<td>Turn on and turn off Intelligent Calculation. See “Turning Intelligent Calculation On and Off” on page 416.</td>
</tr>
<tr>
<td>SET UPTOLOCAL</td>
<td>For currency conversions, restrict consolidations to parents that have the same defined currency. See “Calculating Databases” on page 215.</td>
</tr>
</tbody>
</table>
A SET command in a calculation script stays in effect until the next occurrence of the same SET command.

In the following calculation script, Essbase displays messages at the detail level \((\text{SET MSG DETAIL;}\) \) when calculating the Year dimension and displays messages at the summary level \((\text{SET MSG SUMMARY;}\) \) when calculating the Measures dimension:

\[
\begin{align*}
\text{SET MSG DETAIL;} \\
\text{CALC DIM(Year);} \\
\text{SET MSG SUMMARY;} \\
\text{CALC DIM(Measures);} \\
\end{align*}
\]

Some SET calculation commands trigger additional passes through the database.

In the following calculation script, Essbase calculates member combinations for Qtr1 with SET AGGMISSG turned on, and then does a second calculation pass through the database and calculates member combinations for East with SET AGGMISSG turned off:

\[
\begin{align*}
\text{SET AGGMISSG ON;} \\
\text{Qtr1;} \\
\text{SET AGGMISSG OFF;} \\
\text{East;} \\
\end{align*}
\]

Also see “Using Two-Pass Calculation” on page 876.

**Using Formulas in Calculation Scripts**

You can place member formulas in a calculation script. When you do, the formula overrides conflicting formulas that are applied to members in the database outline.

In a calculation script, you can perform both of these operations:

- Calculate a member formula on the database outline
- Define a formula

To calculate a formula that is applied to a member in the database outline, use the member name followed by a semicolon (\(;)\). For example, the following command calculates the formula applied to the Variance member in the database outline:

\[
\text{Variance;} 
\]

To override values that result from calculating an outline, manually apply a formula that you define in a calculation script. For example, the following formula cycles through the database, adding the values in the members Payroll, Marketing, and Misc, and placing the result in the Expenses member. The formula overrides any formula placed on the Expenses member in the database outline:

\[
\text{Expenses} = \text{Payroll} + \text{Marketing} + \text{Misc}; 
\]

**Note:** You cannot apply formulas to shared members or label only members.
Basic Equations

You can use equations in a calculation script to assign a value to a member. The syntax for an equation:

\[ \text{member} = \text{mathematical_expression}; \]

*member* is a member name from the database outline and *mathematical_expression* is any valid mathematical expression.

Essbase evaluates the expression and assigns the value to the specified member.

In the following example, Essbase cycles through the database, subtracting the values in COGS from the values in Sales, and placing the result in Margin:

\[ \text{Margin} = \text{Sales} - \text{COGS}; \]

In this example, Essbase cycles through the database, subtracting the values in Cost from the values in Retail, calculating the resulting values as a percentage of the values in Retail, and placing the results in Markup:

\[ \text{Markup} = (\text{Retail} - \text{Cost}) \% \text{Retail}; \]

You can also use the > (greater than) and < (less than) logical operators in equations.

In the following example, if February sales are greater than January sales, Sales Increase Flag results in a value of 1; if false, the result is a value of 0:

\[ \text{Sales Increase Flag} = \text{Sales -> Feb} > \text{Sales -> Jan}; \]

Conditional Equations

When you use an IF statement as part of a member formula in a calculation script, you must:

- Associate the IF statement with a single member
- Enclose the IF statement in parentheses

In the following example, the entire IF...ENDIF statement is enclosed in parentheses and associated with the Profit member, Profit (IF(...)):

\[ \text{Profit} (\text{IF (Sales > 100)} \]

\[ \text{... Profit = (Sales - COGS) * 2;... ELSE} \]
\( \text{Profit} = (\text{Sales} - \text{COGS}) \times 1.5; \)

ENDIF;)

Essbase cycles through the database and performs the following calculations:

1. The IF statement checks whether the value of Sales for the current member combination is greater than 100.
2. If Sales is greater than 100, Essbase subtracts the value in COGS from the value in Sales, multiplies the difference by 2, and places the result in Profit.
3. If Sales is less than or equal to 100, Essbase subtracts the value in COGS from the value in Sales, multiplies the difference by 1.5, and places the result in Profit.

### Interdependent Formulas

When you use an interdependent formula in a calculation script, the same rules apply as for the IF statement. You must:

- Associate the formula with a single member
- Enclose the formula in parentheses

In the following example, the entire formula is enclosed in parentheses and associated with the Opening Inventory member:

"Opening Inventory"

(IF(NOT ISMBR (Jan))
   "Opening Inventory" = @PRIOR("Ending Inventory");
ENDIF;)

"Ending Inventory" = "Opening Inventory" - Sales + Additions;

### Using a Calculation Script to Control Intelligent Calculation

Assume that you have a formula on a sparse dimension member, and the formula contains either of the following type of function:

- Relationship (for example, @PRIOR or @NEXT)
- Financial (for example, @NPV or @INTEREST)

Essbase always recalculates the data block that contains the formula, even if the data block is marked as clean for the purposes of Intelligent Calculation.

See “Calculating Data Blocks” on page 420 and Chapter 26, “Understanding Intelligent Calculation.”
Grouping Formulas and Calculations

You may achieve significant calculation performance improvements by carefully grouping formulas and dimensions in a calculation script. See:

- “Calculating a Series of Member Formulas” on page 467
- “Calculating a Series of Dimensions” on page 467

Calculating a Series of Member Formulas

When you calculate formulas, be sure to use parentheses correctly.

In the following example, incorrectly placed parentheses causes Essbase to perform two calculation passes through the database: once calculating the formulas on the members Qtr1 and Qtr2; and once calculating the formula on Qtr3:

(Qtr1;
 Qtr2;)
 Qtr3;

In contrast, the following configurations cause Essbase to cycle through the database only once, calculating the formulas on the members Qtr1, Qtr2, and Qtr3:

Qtr1;
 Qtr2;
 Qtr3;

or

(Qtr1;
 Qtr2;
 Qtr3;)

Similarly, the following formulas cause Essbase to cycle through the database once, calculating both formulas in one pass:

Profit = (Sales - COGS) * 1.5;
Market = East + West;

Calculating a Series of Dimensions

When calculating a series of dimensions, you can optimize performance by grouping the dimensions wherever possible.

For example, the following formula causes Essbase to cycle through the database only once:

CALC DIM(Year, Measures);

In contrast, the following syntax causes Essbase to cycle through the database twice, once for each CALC DIM command:

CALC DIM(Year);
CALC DIM(Measures);
Substitution variables are used to reference information that changes frequently; environment variables are used as placeholders for user-specific system settings.

For general information on substitution variables, see “Using Substitution Variables” on page 120.

Using Substitution Variables in Calculation Scripts

When you include a substitution variable in a calculation script, Essbase replaces the substitution variable with the value you specified for the substitution variable. Substitution variables are useful, for example, when you reference information or lists of members that change frequently.

You create and specify values for substitution values in Administration Services.

You can create substitution variables at the server, application, and database levels. To use a substitution variable in a calculation script, the substitution variable must be available to the calculation script. For example, a database-level substitution variable is available only to calculation scripts within the database; a server-level substitution variable is available to any calculation script on the server.

In a calculation script, insert an ampersand (&) before a substitution variable. Essbase treats any string that begins with a leading ampersand as a substitution variable, replacing the variable with its assigned value before parsing the calculation script.

For example, in Sample.Basic, to calculate Qtr1 as the current quarter:

- Create a substitution variable for the current quarter (&CurQtr) and assign it the value Qtr1
- Create a calculation script that uses the &CurQtr substitution variable. For example:

```csharp
FIX(&CurQtr)
    CALC DIM(Measures, Product);
ENDFIX
```

Also see “Using Runtime Substitution Variables in Calculation Scripts” on page 469.
Using Runtime Substitution Variables in Calculation Scripts

Subtopics
- Logging Runtime Substitution Variables
- Specifying Data Type and Input Limit for Runtime Substitution Variables

Similar to substitution variables, a runtime substitution variable can be included in a calculation script wherever substitution variables are allowed. In the calculation script, an ampersand (&) must precede the name of the runtime substitution variable.

Runtime substitution variables are different from substitution variables in that every runtime substitution variable used in a calculation script must be declared in the SET RUNTIMESUBVARS calculation command. In SET RUNTIMESUBVARS, the name of a runtime substitution variable is required. Specifying a default value for the runtime substitution variable is optional. Also optional is a description of the runtime substitution variable’s data type and data input limit, which is a string in the <RTSV_HINT>rtsv_description</RTSV_HINT> tag.

In this example of SET RUNTIMESUBVARS, three runtime substitution variables are declared: myMarket, salesNum, and PointD. Default values are specified for myMarket and pointD (for example, the value of myMarket is “New York”). The declaration for salesNum does not include a default value but does include a description in the <RTSV_HINT> tag.

```
SET RUNTIMESUBVARS
{
    myMarket = "New York";
    salesNum <RTSV_HINT>salesNum: Input the value as an integer, such as 100</RTSV_HINT>;
    pointD = "Actual"->"Final";
};
```

At runtime, values can be provided for runtime substitution variables that do not have a default value, and default values that are specified in the SET RUNTIMESUBVARS command can be overwritten, using one of these methods:

- MaxL: execute calculation statement with the with runtimesubvars grammar, in which runtime substitution variables are specified as a string of key/value pairs.
- EssCalcWithRuntimeSubVars API, in which runtime substitution variables are specified as a string of key/value pairs.
- EssCalcFileWithRuntimeSubVars API, in which runtime substitution variables can be specified in a text file on the client computer or as a string of key/value pairs.

When specifying runtime substitution variables as a string of key/value pairs, the string must be enclosed with single quotation marks, and key/value pairs must be separated by a semicolon, including a semicolon after the last runtime substitution variable in the string and before the terminal single quotation mark. In this example of a runtime substitution variable string, the name and value of four runtime substitution variables are specified (for example, the value of the runtime substitution variable named “a” is 100):

```
'a=100;b=@CHILDREN("100");c="Actual"->"Final";d="New York";
```
When specifying runtime substitution variables in a text file, create the text file with an `.rsv` extension on the client computer. (Essbase does not support runtime substitution variable files located on the Essbase Server computer.) Each line in the file specifies one runtime substitution variable as a key/value pair and must end with a semicolon. In this example of an `.rsv` file, the name and value of four runtime substitution variables are specified (for example, the value of the runtime substitution variable named “a” is 100):

```
a=100;
b=200;
c=@CHILDREN("100");
d=@TODATE("DD/MM/YY","10/11/12");
```

When a calculation is executed, runtime substitution variable values are determined in the following order:

1. Values specified through the MaxL execute calculation statement with the `with runtimesubvars` grammar, or the `EssCalcWithRuntimeSubVars`, or `EssCalcFileWithRuntimeSubVars` APIs.
2. Default values specified in the SET RUNTIMESUBVARS calculation command.

Consider these guidelines when using runtime substitution variables:

- If you declare a runtime substitution variable in SET RUNTIMESUBVARS but do not use the runtime substitution variable in the calculation script, Essbase ignores the unused runtime substitution variable declaration (no warning or exception is generated).
- Runtime substitution variables have a higher precedence than substitution variables. Therefore, if a substitution variable and a runtime substitution variable have the same name (for example, `myProduct`), the value of the runtime substitution variable overwrites the value of the substitution variable.
- If multiple runtime substitution variables have the same name but have different values, only the value of the first instance of the runtime substitution variable is used; all other subsequent values are ignored.

The rules for setting names and values for runtime substitution variables are the same as for substitution variables. See “Rules for Setting Substitution Variable Names and Values” on page 122.

**Logging Runtime Substitution Variables**

To log runtime substitution variables that are used in a calculation script, set the `ENABLERTSVLOGGING` configuration setting in `essbase.cfg` to TRUE. Logging can be implemented at the Essbase Server, application, or database level.

Runtime substitution variable log entries are written to the application log file. Essbase writes one entry to the application log for each string of key/value pairs (or a list of key/value pairs specified in an `.rsv` file when using the `EssCalcFileWithRuntimeSubVars` API).

In the following example, two runtime substitution variables (Entity and Currency) and their values are logged in one entry:
Executing calc script 'calcprofit.csc' with runtime substitution variables (Entity = "MyCompany"; Currency = "USD");

Specifying Data Type and Input Limit for Runtime Substitution Variables

In the SET RUNTIMESUBVARS calculation command, the runtime substitution variable declaration can include the <RTSV_HINT>rtsv_description</RTSV_HINT> tag, in which rtsv_description is a string that describes the data type and data input limit (for example, an integer not greater than 100) for the runtime substitution variable. The </RTSV_HINT> string is not used in the calculation.

The EssGetRuntimeSubVars API retrieves all of the information (name, value, and description) that is specified in the runtime substitution variable declaration in SET RUNTIMESUBVARS. The <RTSV_HINT> string can then be used to prompt a user to input a value at runtime or to validate input data before passing the value to the calculation script.

In this example of SET RUNTIMESUBVARS, each declaration specifies only the name and description of the runtime substitution variable; a default value is not specified:

```
SET RUNTIMESUBVARS
{
  myMarket <RTSV_HINT>myMarket: Input the value as a string, such as "New York"</RTSV_HINT>;
  salesNum <RTSV_HINT>salesNum: Input the value as an integer, such as 100</RTSV_HINT>;
  pointD <RTSV_HINT>pointD: Input the value as a member combination, such as "Actual"-"Final"</RTSV_HINT>;
};
```

Using Environment Variables in Calculation Scripts and Formulas

In calculation scripts, you can use system environment variables as placeholders for user-specific system settings. Because environment variables are defined at the operating system level, they are available to all calculation scripts on Essbase Server.

Note: Environment variables cannot be used in MDX queries.

To declare a system environment variable, see your operating system documentation.

To use an environment variable in a calculation script, insert the dollar sign ($) character before the environment variable name. Essbase treats any string that begins with a leading dollar sign as an environment variable, replacing the variable with its assigned value before parsing the calculation script. If a member name begins with $, enclose the name in quotation marks.

When using environment variables in calculation scripts, follow these guidelines:

- Environment variable names:
  - Must consist of alphanumeric characters or underscores (_)

471
Cannot include nonalphanumeric characters, such as hyphens (-), asterisks (*), and slashes (/)

Cannot exceed 320 bytes for Unicode-mode applications and 320 characters for non-Unicode mode applications

- Environment variable values:
  - May contain any character except a leading dollar sign ($)
  - Whether numeric or non-numeric, must be enclosed in quotation marks (" "). For example:
    
    MY_PROD="100"
    
    ENV_FILE="E:\temp\export1.txt"

    For non-numeric values, if you do not enclose the value in quotation marks when you define the environment variable, Essbase automatically encloses the value with quotation marks when the environment variable is passed.

    For numeric values, Essbase does not automatically enclose the value with quotation marks when the variable is passed because Essbase cannot determine if you intend to pass a numeric value or a member name. For example, if you use a calculation script statement such as 'sales = $MY_SALES' where MY_SALES=700, the intent is to pass the numeric value of 700. If, however, Essbase encloses MY_SALES in quotation marks, MY_SALES is treated as a member name. The member name would be passed, not the numeric value, causing an error. If you want the numeric value of the variable to be treated as a string, you must enclose the value with quotation marks when you define the environment variable.

  - Cannot exceed 256 bytes for Unicode-mode applications and 256 characters for non-Unicode mode applications

For example, you can use an environment variable to define the path and filename for an export file when exporting a block of data to a flat file. In the following calculation script, the path and filename (E:\temp\export1.txt) are explicitly defined:

```
SET DATAEXPORTOPTIONS
{
    DATAEXPORTLEVEL "ALL";
    DATAEXPORTOVERWRITEFILE ON;
};

FIX ("New York", "100-10");
    DATAEXPORT "File" ",", "E:\temp\export1.txt";
ENDFIX;
```

You can declare an environment variable (ENV_FILE) to reference the path and filename (ENV_FILE="E:\temp\export1.txt") and use the following syntax in the calculation script:

```
DATAEXPORT "File" ",", $ENV_FILE;
```

Essbase replaces the environment variable with the value taken from the user's environment.

In the following example, another environment variable (CurrMbr) is defined to export only Sales values (CurrMbr="Sales"): 
SET DATAEXPORTOPTIONS
{
   DATAEXPORTLEVEL "ALL";
   DATAEXPORTOVERWRITEFILE ON;
};
FIX ("New York", "100-10", $CurrMbr);
   DATAEXPORT "File ", $ENV_FILE;
ENDFIX;

Environment variables can also be used to parse arguments passed to RUNJAVA, an Essbase utility in which custom-defined functions can be called directly from a calculation script. For example, you can use environment variables to get user e-mail addresses.

In the following example, the RUNJAVA statement sends an e-mail notification to explicitly-defined users (to@somedomain.com and cc@mydomain.com):

RUNJAVA com.hyperion.essbasecalculator.EssbaseAlert "localhost" "to@somedomain.com" "cc@mydomain.com" "" "Mail Subject" "Mail Body" ""

You can declare environment variables for the users (ENV_TOMAIL="to@somedomain.com" and ENV_CCMAIL="to@mydomain.com") and use the following syntax in the calculation script:

RUNJAVA com.hyperion.essbasecalculator.EssbaseAlert "localhost" $ENV_TOMAIL $ENV_CCMAIL "" "Mail Subject" "Mail Body" ""

### Clearing and Copying Data

**Subtopics**

- Clearing Data
- Copying Data

You can clear a subset of data from a database and copy data values from one set of members to another set of members.

### Clearing Data

**Table 85** lists the commands that clear data:

<table>
<thead>
<tr>
<th>Command</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEARDATA</td>
<td>Change the values of the cells you specify to #MISSING; the data blocks are not removed. Use the FIX command with the CLEARDATA command to clear a subset of a database.</td>
</tr>
<tr>
<td>CLEARBLOCK</td>
<td>Remove the entire contents of a block, including all the dense dimension members. Essbase removes the entire block, unless CLEARBLOCK is inside a FIX command on members within the block.</td>
</tr>
<tr>
<td>CLEARBLOCK UPPER</td>
<td>Remove consolidated level blocks.</td>
</tr>
<tr>
<td>Command</td>
<td>Calculation</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CLEARBLOCK</td>
<td>Remove blocks containing derived values. Applies to blocks that are completely created by a calculation operation, not to blocks into which any values were loaded.</td>
</tr>
<tr>
<td>NONINPUT</td>
<td></td>
</tr>
<tr>
<td>DYNAMIC</td>
<td>Remove blocks for Dynamic Calc and Store member combinations.</td>
</tr>
<tr>
<td>EMPTY</td>
<td>Remove empty blocks.</td>
</tr>
</tbody>
</table>

The following calculation script command yields different results depending on whether the Scenario dimension is dense or sparse:

```plaintext
FIX(Actual)
  CLEARBLOCK NONINPUT;
ENDFIX
```

- **Dense**: The command removes all data cells that do not contain input data values and that intersect with the member Actual from the Scenario dimension.
- **Sparse**: The command removes only the blocks whose Scenario dimension member is Actual.

The following formula clears all the Actual data values for Colas:

```plaintext
CLEARDATA Actual -> Colas;
```

To clear an entire database, see “Clearing Data” in the *Oracle Essbase Administration Services Online Help*.

## Copying Data

The DATACOPY calculation command copies data cells from one range of members to another range of members in a database. The two ranges must be the same size. For example, the following formula copies Actual values to Budget values:

```plaintext
DATACOPY Actual TO Budget;
```

You can use the FIX command to copy a subset of values. For example, the following formula copies Actual values to Budget values for the month of January only:

```plaintext
FIX (Jan)
  DATACOPY Actual TO Budget;
ENDFIX
```

See “Using the FIX Command” on page 475.

## Calculating a Subset of a Database

To calculate a subset of a database, use one of the following methods:

- Create a formula using member set functions to calculate lists of members.
See “Calculating Lists of Members” on page 475.

- Use the FIX...ENDFIX commands to calculate a range of values by inclusion.
  See “Using the FIX Command” on page 475.
- Use the EXCLUDE...ENDEXCLUDE commands to calculate a range of values by exclusion.
  See “Using the Exclude Command” on page 477.

Note: When Intelligent Calculation is turned on, the newly calculated data blocks are not marked as clean after a partial calculation of a database. When you calculate a subset of a database, you can use the SET CLEARUPDATESTATUS AFTER command to ensure that the newly calculated blocks are marked as clean. Using this command ensures that Essbase recalculates the database as efficiently as possible using Intelligent Calculation. See Chapter 26, “Understanding Intelligent Calculation.”

Calculating Lists of Members

Member set functions generate a list of members that is based on a member you specify. For example, the @DESCENDANTS function generates a list of all the descendants of a specified member. When you use a member set function in a formula, Essbase generates a list of members before calculating the formula.

In the following example, using the @DESCENDANTS command on the member Total Expenses generates a list of these members—Total Expenses, itself, and its descendants, which are Marketing, Payroll, and Misc:

@DESCENDANTS("Total Expenses");

Using the FIX Command

Use the FIX command to define which members to include in the calculation.

The following example calculates only the Budget values for only the descendants of East (New York, Massachusetts, Florida, Connecticut, and New Hampshire):

FIX(Budget,@DESCENDANTS(East))
    CALC DIM(Year, Measures, Product);
ENDFIX

The following example fixes on member combinations for the children of East that have a UDA of New Mkt:

FIX(@CHILDREN(East) AND @UDA(Market,"New Mkt"))
    Marketing = Marketing * 1.1;
ENDFIX

The following example uses a wildcard match (???) to fix on member names that end in the characters -10, which are members 100-10, 200-10, 300-10, and 400-10:

FIX(@MATCH(Product, "???-10"))
    Price = Price * 1.1;
ENDFIX
When you use the FIX command only on a dense dimension, Essbase retrieves the entire block that contains the required value or values for the members that you specify. I/O is not affected, and the calculation performance time is improved.

When you use the FIX command on a sparse dimension, Essbase retrieves the block for the specified sparse dimension members. I/O may be greatly reduced.

Essbase cycles through the database once for each FIX command that you use on dense dimension members. When possible, combine FIX blocks to improve calculation performance.

For example, by using one FIX command, the following calculation script causes Essbase to cycle through the database only once, calculating both the Actual and the Budget values:

```
FIX(Actual,Budget)
    CALC DIM(Year, Measures);
ENDFIX
```

In contrast, by using two FIX commands, the following calculation script causes Essbase to cycle through the database twice: once calculating the Actual data values and once calculating the Budget data values:

```
FIX(Actual)
    CALC DIM(Year, Measures);
ENDFIX
FIX(Budget)
    CALC DIM(Year, Measures);
ENDFIX
```

You cannot FIX on a subset of a dimension that you calculate within a FIX command. For example, the following calculation script returns an error message because the CALC DIM operation calculates the entire Market dimension, although the FIX above it fixes on specific members of the Market dimension:

```
FIX(@CHILDREN(East) AND @UDA(Market,"New Mkt"))
    CALC DIM(Year, Measures, Product, Market);
ENDFIX
```

FIX commands can be nested within other FIX command blocks. However, using nested FIX commands incorrectly can result in incorrect results. For example, the intent of the following calculation script is to assign 1 to all children of East and then assign 2 to New York:

```
FIX (@CHILDREN(EAST))
   ''100-10''=1;
   FIX (''New York'')
      ''100-10''=2;
ENDFIX
```

However, the nested FIX command fixes on a subset of the dimension that is specified by the FIX command above it (which is not allowed); therefore, the script assigns 2 to all children of East because the script runs as if it were written as:

```
FIX (@CHILDREN(EAST), 'New York')
   ''100-10''=1;
   ''100-10''=2;
ENDFIX
```
Rather than using nested FIX commands, use two separate FIX command blocks. For example:

```
FIX (@CHILDREN(EAST))
  ''100-10''=1;
ENDFIX

FIX (''New York'')
  ''100-10''=2;
ENDFIX
```

The FIX command has restrictions. See the *Oracle Essbase Technical Reference*.

**Using the Exclude Command**

Use the EXCLUDE...ENDEXCLUDE command to define which members to exclude from the calculation. Sometimes it is easier to specify which members not to include in a calculation than to define which members to include.

*Note:* The EXCLUDE command has restrictions. See the *Oracle Essbase Technical Reference*.

**Exporting Data Using the DATAEXPORT Command**

The DATAEXPORT command enables calculation scripts to export data in binary or text, or directly to a relational database. A set of data-export-related calculation commands qualify what data to export and provide various output and formatting options.

*Note:* DATAEXPORT to binary files is not supported across Essbase releases or between 32-bit and 64-bit operating systems.

The following command sequence shows the typical calculation script structure for exporting data:

```
SET DATAEXPORTOPTIONS
  {
    DATAEXPORTLEVEL parameters;
    DATAEXPORTDYNAMICCALC ON | OFF;
    DATAEXPORTNONEXISTINGBLOCKS ON | OFF;
    DATAEXPORTDECIMAL n;
    DATAEXPORTPRECISION n;
    DATAEXPORTCOLFORMAT ON | OFF;
    DATAEXPORTCOLHEADER dimensionName;
    DATAEXPORTDIMHEADER ON | OFF;
    DATAEXPORTRELATIONALFILE ON | OFF;
    DATAEXPORTOVERWRITEFILE ON | OFF;
    DATAEXPORTDRYRUN ON | OFF;
  };
DATAEXPORTCOND parameters;
FIX
  (fixMembers)
```
The following tables list the SET DATAEXPORTOPTIONS commands, which are all optional:

- **Table 86**—Content options
- **Table 87**—Output format options
- **Table 88**—Processing options

### Table 86  SET DATAEXPORTOPTIONS Commands: Content Options

<table>
<thead>
<tr>
<th>Command</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATAEXPORTLEVEL</td>
<td>Specify a data value: ALL, LEVEL0, or INPUT</td>
</tr>
<tr>
<td></td>
<td>In specifying the data value for the DataExportLevel option, use these guidelines:</td>
</tr>
<tr>
<td></td>
<td>• The values are case-insensitive. For example, you can specify LEVEL0 or level0.</td>
</tr>
<tr>
<td></td>
<td>• Enclosing the value in quotation marks is optional. For example, you can specify LEVEL0 or “LEVEL0”.</td>
</tr>
<tr>
<td></td>
<td>• If the value is not specified, Essbase uses the default value of ALL.</td>
</tr>
<tr>
<td></td>
<td>• If the value is incorrectly expressed (for example, LEVEL 0 or LEVEL2), Essbase uses the default value of ALL.</td>
</tr>
<tr>
<td>DATAEXPORTDYNAMICALC</td>
<td>Control export of dynamically calculated values</td>
</tr>
<tr>
<td>DATAEXPORTNONEXISTINGBLOCKS</td>
<td>Specify whether to export data from all potential data blocks or only from existing data blocks</td>
</tr>
<tr>
<td>DATAEXPORTDECIMAL</td>
<td>Specify the number of decimal positions in the exported values</td>
</tr>
<tr>
<td>DATAEXPORTPRECISION</td>
<td>Specify the total number of positions in the exported values</td>
</tr>
</tbody>
</table>

### Table 87  SET DATAEXPORTOPTIONS Commands: Output Format Options

<table>
<thead>
<tr>
<th>Command</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATAEXPORTCOLFORMAT</td>
<td>Specify columnar or noncolumnar format</td>
</tr>
<tr>
<td>DATAEXPORTCOLHEADER</td>
<td>Specify a dense dimension for the column header</td>
</tr>
<tr>
<td>DATAEXPORTDIMHEADER</td>
<td>Include a header record that lists all dimension names in the same order as the data in the file</td>
</tr>
<tr>
<td>DATAEXPORTRELATIONALFILE</td>
<td>Format the text export file for importing the data into a relational database</td>
</tr>
</tbody>
</table>

### Table 88  SET DATAEXPORTOPTIONS Commands: Processing Options

<table>
<thead>
<tr>
<th>Command</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATAEXPORTOVERWRITEFILE</td>
<td>Specify whether an existing file with the same name and location is replaced</td>
</tr>
<tr>
<td>DATAEXPORTDRYRUN</td>
<td>Enable validating the set of calculation commands and viewing export statistics—including a time estimate—without having to perform the entire export process</td>
</tr>
</tbody>
</table>
To develop a calculation script that exports a subset of data:

1. Specify the SET DATAEXPORTOPTIONS command to define options for export content (see Table 86 on page 478), format (see Table 87 on page 478), and process (see Table 88 on page 478).

2. Use a DATAEXPORTCOND command to select data based on data values.

3. Use FIX...ENDFIX or EXCLUDE...ENDEXCLUDE calculation commands to select a slice of the database to be exported.

4. Within the FIX...ENDFIX or EXCLUDE...ENDEXCLUDE group, include the DATAEXPORT command.
   
   If you are using the DATAEXPORT command to insert the exported data directly into a relational database, see “Exporting Data into a Relational Database” on page 479.

5. Use the DATAIMPORTBIN calculation command to import a previously exported binary export file.

   **Note:** DATAIMPORTBIN is not supported across Essbase releases or between 32-bit and 64-bit operating systems.

The SET DATAIMPORTIGNORETIMESTAMP calculation command enables you to manage the import requirement for a matching outline timestamp.

Other export methods include using ESSCMD, MaxL, and Administration Services Console for database backup. Report Writer can be used to select and format a database subset, creating an output text file (see “Exporting Text Data Using Report Scripts” on page 609).

### Exporting Data into a Relational Database

When using the DATAEXPORT command to export data for direct insertion into a relational database:

- The table to which the data is to be written must exist prior to data export
- Table and column names cannot contain spaces

By default, when inserting exported data, Essbase uses the row-insert method, in which each row is inserted one at a time. To improve performance, you can use the batch-insert method if your relational database and the ODBC driver support the functionality.

**Note:** 64-bit Essbase does not support using the DATAEXPORT batch-insert method to export data directly into a SQL data source.

To enable batch insert, set the DATAEXPORTENABLEBATCHINSERT configuration setting in `essbase.cfg` to TRUE. To control the number of rows that are inserted simultaneously (instead of letting Essbase determine the batch size), use the DEXPSQLROWSIZE configuration setting to specify the number of rows in a batch (from 2 to 1000). If Essbase cannot determine whether the relational database and the ODBC driver support batch insert, it uses the row-insert method, and DEXPSQLROWSIZE (if set) is ignored.
Advantages and Disadvantages of Exporting Data Using a Calculation Script

Compared to using other methods to export data, using a calculation script has the following advantages and disadvantages:

- **Advantages**
  - Enables exporting a subset of data
  - Supports multiple targets: flat files, relational databases, and binary files
  - Provides options for type, format, or data
  - As part of a calculation script, can be deployed in a batch process
  - Can be very fast when the dynamic calculation export option (DATAEXPORTDYNAMICCALC) is not used because DATAEXPORT directly accesses Kernel storage blocks in memory
  - Provides, through binary export/import, a faster way to back up and restore data because the compressed format used by binary export requires less storage for the export files
  - Can be used as a debug tool to trace batch calculation results by using the DATAEXPORT command before and after other calculation commands to track data changes

- **Disadvantages**
  - Contains limited data formatting options compared to Report Writer formatting
  - Works with stored members and Dynamic Calc members only, with no support for attribute members and alias names
  - Not supported for aggregate storage databases
  - Cannot export data directly to the client
  - Can significantly impact performance when exporting dynamic calculation data (DATAEXPORTDYNAMICCALC) is used, unless DATAEXPORTNONEXISTINGBLOCKS is set to ON.

Enabling Calculations on Potential Blocks

When you use a formula on a dense member in a dense dimension, if the resultant values are from a dense dimension and the operand or operands are from a sparse dimension, Essbase does not automatically create the required blocks.
In the following example, assume that you want to create budget sales and expense data from existing actual data. Sales and Expenses are members in the dense Measures dimension; Budget and Actual are members in the sparse Scenario dimension.

\[
\text{FIX(Budget)} \left\{ \\
\quad (\text{Sales} = \text{Sales} -> \text{Actual} \times 1.1; \\
\quad \text{Expenses} = \text{Expenses} -> \text{Actual} \times .95;) \\
\text{ENDFIX}
\right.
\]

Sales and Expenses, the results of the equations, are dense dimension members; the operand, Actual, is in a sparse dimension. Because Essbase executes dense member formulas only on existing data blocks, the calculation script does not create the required data blocks and Budget data values are not calculated for blocks that do not already exist.

You can solve the problem using the following techniques:

- “Using DATACOPY to Copy Existing Blocks” on page 481
- “Using SET CREATENONMISSINGBLK to Calculate All Potential Blocks” on page 482

### Using DATACOPY to Copy Existing Blocks

Use the DATACOPY command to create a block for each existing block, and then perform calculations on the new blocks. For example:

\[
\text{DATACOPY Sales} -> \text{Actual} \text{ TO } \text{Sales} -> \text{Budget}; \\
\text{DATACOPY Expenses} -> \text{Actual} \text{ TO } \text{Expenses} -> \text{Budget}; \\
\text{FIX(Budget)} \left\{ \\
\quad (\text{Sales} = \text{Sales} -> \text{Actual} \times 1.1; \\
\quad \text{Expenses} = \text{Expenses} -> \text{Actual} \times .95;) \\
\text{ENDFIX}
\right.
\]

Essbase creates blocks that contain the Budget values for each corresponding Actual block that exists. After the DATACOPY commands are finished, the remaining part of the script changes the values.

Using DATACOPY works well in these situations:

- There is a mathematical relationship between values in existing blocks and their counterparts created by the DATACOPY.

  For example, in the preceding example, the Budget values can be calculated based on the existing Actual values.

  \[
  \text{Caution!} \quad \text{DATACOPY creates the new blocks with identical values in all cells from the source blocks. If the formula performs only on a portion of the block, these copied cells remain at the end of the calculation, potentially resulting in unwanted values.}
  \]

- None of the blocks that are copied contain only #MISSING values.

  If #MISSING values exist, blocks are written that contain only #MISSING values. Unneeded #MISSING blocks require Essbase resource and processing time.
Using SET CREATENONMISSINGBLK to Calculate All Potential Blocks

If you are concerned about unwanted values, instead of using DATACOPY, you can use the SET CREATENONMISSINGBLK ON calculation command, which calculates all potential blocks in memory and then stores only the calculated blocks that contain data values. The SET CREATENONMISSINGBLK calculation command can be useful when calculating values on dense or sparse dimensions.

The following example creates budget sales and expense data from existing actual data. Sales and Expenses are members in the dense Measures dimension; Budget and Actual are members in the sparse Scenario dimension.

\[
\text{FIX(Budget)}
\]
\[
\text{SET CREATENONMISSINGBLK ON}
\]
\[
\quad (\text{Sales} = \text{Sales} \rightarrow \text{Actual} \times 1.1; \quad \text{Expenses} = \text{Expenses} \rightarrow \text{Actual} \times .95;)
\]
\[
\text{ENDIFX}
\]

Note: If SET CREATEBLOCKONEQ ON is set for sparse dimensions, SET CREATENONMISSINGBLK ON temporarily overrides SET CREATEBLOCKONEQ ON until a SET CREATENONMISSINGBLK OFF command is encountered or the calculation script is completed. See “Nonconstant Values Assigned to Members in a Sparse Dimension” on page 869.

The advantage of using the SET CREATENONMISSINGBLK command is that, when applied on dense members, only data cells that are affected by the member formula are saved. The disadvantage is that too many potential blocks may be materialized in memory, possibly affecting calculation performance. When you use this command, limit the number of potential blocks; for example, by using FIX to restrict the scope of the blocks to be calculated.

Using Calculation Scripts on Partitions

See:

- “Writing Calculation Scripts for Partitions” on page 482
- “Controlling Calculation Order for Partitions” on page 483

Writing Calculation Scripts for Partitions

A partitioned application can span multiple servers, processors, or computers.

You can achieve significant calculation performance improvements by partitioning applications and running separate calculations on each partition. When using partitioning:

- Evaluate the performance impact on the overall database calculation. To improve performance, you can:
Redesign the overall calculation to avoid referencing remote values that are in a transparent partition in a remote database.

Dynamically calculate a value in a remote database.

See “Dynamically Calculating Data in Partitions” on page 443.

Replicate a value in the database that contains the applicable formula.

For example, if replicating quarterly data for the Eastern region, replicate only the values for Qtr1, Qtr2, Qtr3, and Qtr4, and calculate the parent Year values locally.

Ensure that a referenced value is up-to-date when Essbase retrieves it. Choose one of the options previously discussed (redesign, dynamically calculate, or replicate) or calculate the referenced database before calculating the formula.

See Chapter 15, “Designing Partitioned Applications” and Chapter 16, “Creating and Maintaining Partitions.”

Controlling Calculation Order for Partitions

You must calculate databases in a specific order to ensure that Essbase calculates the required results.

Figure 133 illustrates partitions in which you view information from the West, Central, and East databases transparently from the Corporate database:

West, Central, and East contain only actual values. Corporate contains actual and budgeted values. Although you can view West, Central, and East data in the Corporate database, the data exists only in the West, Central, and East databases—it is not duplicated in the Corporate database.

Therefore, when Essbase calculates Corporate, it must take the latest values from West, Central, and East. To obtain the required results, you must calculate West, Central, and East before you calculate Corporate.

Saving, Executing, and Copying Calculations Scripts

See:
Saving Calculation Scripts

You can save a calculation script in the following locations:

- As a file on a client computer.
- As an artifact on an Essbase Server, which allows other users to access the calculation script. You can associate the script with the following artifacts:
  - An application and all the databases within the application, which lets you run the script against any database in the application.
    Calculation scripts associated with an application are saved in the ARBORPATH/app/appname directory on the Essbase Server computer.
  - A database, which lets you run the script against the specified database.
    Calculation scripts associated with a database are saved in the ARBORPATH/app/appname/dbname directory on the Essbase Server computer.

See “Using Essbase to Manage Artifacts” on page 713.

To save a calculation script using Calculation Script Editor:

See “Saving Scripts” in the Oracle Essbase Administration Services Online Help.

Executing Calculation Scripts

Before you can execute a calculation script in Administration Services, you must save it as an artifact on an Essbase Server, a client computer, or a network. See “Saving Calculation Scripts” on page 484.

When you use Administration Services to execute a calculation script, you can execute the calculation in the background so that you can continue working as the calculation processes. You can then check the status of the background process to see when the calculation has completed. See “Executing Calculation Scripts” in the Oracle Essbase Administration Services Online Help.

To execute a calculation script, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Executing Calculation Scripts</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>execute calculation</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Copying Calculation Scripts

You can copy calculation scripts to applications and databases on any Essbase Server, according to your permissions. You can also copy scripts across servers as part of application migration.

To copy a calculation script, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESSCMD</td>
<td>RUNCALC</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>Smart View</td>
<td>Calculating Data</td>
<td>Oracle Smart View for Office User's Guide</td>
</tr>
</tbody>
</table>

Checking Calculation Results

After you execute a calculation script, you can check the results of the calculation in Smart View. Essbase provides the following information about the executed calculation script:

- Calculation order of the dimensions for each pass through the database
- Total calculation time

To display more-detailed information, you can use the SET MSG SUMMARY, SET MSG DETAIL, and SET NOTICE commands in a calculation script. See “Specifying Global Settings for a Database Calculation” on page 463.

You can use these messages to understand how the calculation is performed and to tune it for the next calculation.

Where you view this information depends on the tool used to execute the calculation script.

- Administration Services and Smart View—Application log
  See “Viewing the Essbase Server and Application Logs” on page 739.
- MaxL—Standard output (command-line window)
  The amount of information depends on the message level set in MaxL Shell.
- ESSCMD—ESSCMD window or standard output (command-line window)
  The amount of information depends on the message level set in ESSCMD.
Estimating Disk Size for a Calculation

You can estimate the disk size required for a single CALC ALL for a full data load or a partial data load by using the ESTIMATEFULLDBSIZE configuration setting.

In This Chapter

<table>
<thead>
<tr>
<th>Example</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>About These Calculation Script Examples</td>
<td>487</td>
</tr>
<tr>
<td>Calculating Variance</td>
<td>487</td>
</tr>
<tr>
<td>Calculating Database Subsets</td>
<td>488</td>
</tr>
<tr>
<td>Loading New Budget Values</td>
<td>489</td>
</tr>
<tr>
<td>Calculating Product Share and Market Share Values</td>
<td>490</td>
</tr>
<tr>
<td>Allocating Costs Across Products</td>
<td>491</td>
</tr>
<tr>
<td>Allocating Values within a Dimension</td>
<td>492</td>
</tr>
<tr>
<td>Allocating Values Across Multiple Dimensions</td>
<td>494</td>
</tr>
<tr>
<td>Goal-Seeking Using the LOOP Command</td>
<td>496</td>
</tr>
<tr>
<td>Forecasting Future Values</td>
<td>499</td>
</tr>
</tbody>
</table>

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see Chapter 60, “Comparison of Aggregate and Block Storage.”

**About These Calculation Script Examples**

All examples in this chapter are based on the Sample.Basic database.

For examples that use the Intelligent Calculation commands SET UPDATECALC and SET CLEARUPDATESTATUS, see “Reviewing Examples That Use SET CLEARUPDATESTATUS” on page 418 and “Reviewing Examples and Solutions for Multiple-Pass Calculations” on page 422.

**Calculating Variance**

This example includes a calculation of the variance percentage between Budget and Actual values.

Figure 134 shows an outline in which Variance and Variance % are tagged as Dynamic Calc, two-pass members.
During a default calculation, Essbase aggregates the values on the Market and Product dimensions. Because percentage values do not aggregate correctly, the Variance % formula must be recalculated after the default calculation.

Because Variance % is tagged as a Dynamic Calc, two-pass member, Essbase dynamically calculates Variance % values when they are retrieved. The dynamic calculation overwrites the incorrect values with the correctly calculated percentages.

If you choose not to tag Variance % as a Dynamic Calc, two-pass member, use the following calculation script—which assumes that Intelligent Calculation is turned on (the default)—to perform a default calculation and to recalculate the formula on Variance %:

```
CALC ALL;
SET UPDATECALC OFF;
SET CLEARUPDATESTATUS AFTER;
"Variance %";
```

Essbase performs the following actions:

1. Performs a default calculation of the database (CALC ALL).
2. Turns off Intelligent Calculation (SET UPDATECALC OFF).
3. Marks the calculated blocks calculated by the variance formula of the calculation script as clean, even though the variance calculation is a partial calculation of the database (CLEARUPDATESTATUS AFTER).
4. Cycles through the database calculating the formula for Variance %.

See “Choosing Two-Pass Calculation Tag or Calculation Script” on page 879 and “Using Two-Pass Calculation” on page 876.

For information on calculating statistical variance, see the Oracle Essbase Technical Reference.

**Calculating Database Subsets**

This example shows how a regional Marketing manager can calculate her respective area of the database. The calculation script uses @DESCENDENTS(East) to limit the calculations to the East region, as it calculates the Year, Measures, and Product dimensions for each child of East.

Figure 135 shows an outline of the East, West, South, and Central members in the Market dimension:
Figure 135  East, West, South, and Central Members in the Market Dimension

Example script:

/* Calculate the Budget data values for the descendants of East */

FIX(Budget, @DESCENDANTS(East))
   CALC DIM(Year, Measures, Product);
ENDFIX

/* Consolidate East */

FIX(Budget)
   @DESCENDANTS(East);
ENDFIX

Essbase performs the following actions:
1. Fixes on the Budget values of the descendants of East.
2. Calculates the Year, Measures, and Product dimensions in one pass of the database for all Budget values of the descendants of East.
3. Fixes on the Budget values for all members on the other dimensions.
4. Aggregates the descendants of East and places the result in East.

**Loading New Budget Values**

This example calculates Budget values and then recalculates the Variance and Variance % members.

Example script:

/* Calculate all Budget values */

FIX(Budget)
   CALC DIM(Year, Product, Market, Measures);
ENDFIX

/* Recalculate the Variance and Variance % formulas, which requires two passes */

Variance;
"Variance %";

Essbase performs the following actions:
1. Fixes on the Budget values.
2. Calculates all Budget values.
   The CALC DIM command is used to calculate all the dimensions except for the Scenario dimension, which contains Budget.
3. Calculates the formula applied to Variance in the database outline.
4. Calculates the formula applied to Variance % in the database outline.

**Calculating Product Share and Market Share Values**

This example calculates product share and market share values for each market and each product. The share values are calculated as follows:

- Each member as a percentage of the total
- Each member as a percentage of its parent

Assume that you added four members to the Measures dimension:

- Market Share
- Product Share
- Market %
- Product %

Example script:

```plaintext
/* First consolidate the Sales values to ensure that they are accurate */

FIX(Sales)
   CALC DIM(Year, Market, Product);
ENDFIX

/* Calculate each market as a percentage of the total market for each product */
"Market Share" = Sales % Sales -> Market;

/* Calculate each product as a percentage of the total product for each market */
"Product Share" = Sales % Sales -> Product;

/* Calculate each market as a percentage of its parent for each product */
"Market %" = Sales % @PARENTVAL(Market, Sales);

/* Calculate each product as a percentage its parent for each market */
"Product %" = Sales % @PARENTVAL(Product, Sales);

Essbase performs the following actions:
1. Fixes on the Sales values and consolidates all the Sales values.

   The CALC DIM command is used to calculate the Year, Market, and Product dimensions. The Measures dimension contains the Sales member and therefore is not consolidated. The Scenario dimension is label only and therefore does not need to be consolidated.
2. Cycles through the database and calculates Market Share by taking the Sales value for each product in each market for each month and calculating this Sales value as a percentage of total Sales in all markets for each product (Sales -> Market).

3. Calculates Product Share by taking the Sales value for each product in each market for each month and calculating this Sales value as a percentage of total Sales of all products in each market (Sales -> Product).

4. Calculates Market % by taking the Sales value for each product in each market for each month and calculating this Sales value as a percentage of the Sales value of the parent of the current member on the Market dimension.
   The @PARENTVAL function is used to obtain the Sales value of the parent on the Market dimension.

5. Calculates Product % by taking the Sales value for each product in each market for each month, and calculating this Sales value as a percentage of the Sales value of the parent of the current member on the Product dimension.
   The @PARENTVAL function is used to obtain the Sales value of the parent on the Product dimension.

Allocating Costs Across Products

This example allocates overhead costs to each product in each market for each month. Overhead costs are allocated based on each product’s Sales value as a percentage of the total Sales for all products.

Assume that you added two members to the Measures dimension:

- OH_Costs for the allocated overhead costs
- OH_TotalCost for the total overhead costs

Example script:

/* Declare a temporary array called ALLOCQ based on the Year dimension */
ARRAY ALLOCQ[Year];

/* Turn the Aggregate Missing Values setting off. If this is your system default, omit this line */
SET AGGMISSG OFF;

/* Allocate the overhead costs for Actual values */
FIX(Actual)
   OH_Costs (ALLOCQ=Sales/Sales->Product; OH_Costs = OH_TotalCost->Product * ALLOCQ);

/* Calculate and consolidate the Measures dimension */
   CALC DIM(Measures);
ENDFIX
Essbase performs these calculations:

1. Creates a one-dimensional array called ALLOCQ to store the value of Sales as a percentage of total Sales temporarily for each member combination.

   The size of ALLOCQ is based on the number of members in the Year dimension.

2. #MISSING values are not aggregated to their parents (SET AGGMISSG OFF). Data values stored at parent levels are not overwritten.

   If SET AGGMISSG OFF is your system default, omit this line. See “Consolidating #MISSING Values” on page 884.

   - Fixes on the Actual values.
   - Cycles through the member combinations for Actual and calculates OH_Costs.
   - Takes the Sales value for each product in each market for each month and calculates it as a percentage of total Sales for all products in each market (Sales -> Product). The result is placed in ALLOCQ.
   - Takes the total overhead costs for all products (OH_TotalCost -> Product) and multiplies it by the value it has just placed in ALLOCQ. The result is placed in OH_Costs.

   Note that both equations are enclosed in parentheses ( ) and associated with the OH_Costs member: OH_Costs (equation1; equation2;).

3. Calculates and consolidates the Measures dimension.

**Allocating Values within a Dimension**

This example uses the @ALLOCATE function to allocate budgeted total expenses across expense categories for two products. The budgeted total expenses are allocated based on the actual values for the previous year.

Assume that you made the following changes, as shown in the outline in Figure 136:

- Added a child, Lease, under Total Expenses in the Measures dimension
- Added a child, PY Actual, to the Scenario dimension
- Removed the Dynamic Calc tag from the Total Expenses member
Assume that data values of 1000 and 2000 are loaded into Budget -> Total Expenses for Colas and Root Beer, respectively. These values must be allocated to each expense category, evenly spreading the values based on the nonmissing children of Total Expenses from PY Actual. The allocated values must be rounded to the nearest dollar.

Example script:

```/* Allocate budgeted total expenses based on prior year */

FIX("Total Expenses")
  Budget = @ALLOCATE(Budget->"Total Expenses", @CHILDREN("Total Expenses"),"PY Actual",,
                     spread,SKIPMISSING,roundAmt,0,errorsToHigh)
ENDFIX
```

The results of the calculation script:

<table>
<thead>
<tr>
<th></th>
<th>Budget</th>
<th>PY Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td>334</td>
<td>150</td>
</tr>
<tr>
<td>Payroll</td>
<td>#MI</td>
<td>#MI</td>
</tr>
<tr>
<td>Lease</td>
<td>333</td>
<td>200</td>
</tr>
<tr>
<td>Misc</td>
<td>333</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td><strong>1000</strong></td>
<td><strong>450</strong></td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Root Beer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td>Payroll</td>
<td>500</td>
<td>200</td>
</tr>
<tr>
<td>Lease</td>
<td>500</td>
<td>200</td>
</tr>
<tr>
<td>Misc</td>
<td>500</td>
<td>400</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td><strong>2000</strong></td>
<td><strong>1100</strong></td>
</tr>
</tbody>
</table>

* Rounding errors are added to this value.

Essbase cycles through the database, performing the following calculations:

1. Fixes on the children of Total Expenses.
   
   Using a FIX statement with @ALLOCATE may improve calculation performance.

2. For Budget -> Colas -> Marketing, divides 1 by the count of nonmissing values for each expense category in PY Actual -> Colas for each month.
In this case, 1 is divided by 3, because there are 3 nonmissing expense values for Budget -> Colas.

3. Takes the value from step 2 (.333), multiplies it by the value for Budget -> Colas -> Total Expenses (1000), and rounds to the nearest dollar (333). The result is placed in Budget -> Colas -> Marketing.

4. Repeats steps 2 and 3 for each expense category for Budget -> Colas and then for Budget -> Root Beer.

5. As specified in the calculation script, rounds allocated values to the nearest whole dollar.

Essbase makes a second pass through the block to make the sum of the rounded values equal to the allocation value (for example, 1000 for Budget -> Colas -> Total Expenses). In this example, there is a rounding error of 1 for Budget -> Colas -> Total Expenses, because the expense categories add up to 999, not 1000, which is the allocation value. Because all allocated values are identical (333), the rounding error of 1 is added to the first value in the allocation range, Budget -> Colas -> Marketing (thus a value of 334).

### Allocating Values Across Multiple Dimensions

This example uses the `@MDALLOCATE` function to allocate a loaded value for budgeted total expenses across three dimensions. The budgeted total expenses are allocated based on the actual values of the previous year.

Assume that you made the following changes:

- Added a child, PY Actual, to the Scenario dimension
- Copied data from Actual into PY Actual
- Cleared data from Budget

For this example, a value of 750 (for Budget -> Total Expenses -> Product -> East -> Jan) must be allocated to each expense category for the children of product 100 across the states in the East. The allocation uses values from PY Actual to determine the percentage share that each category should receive.

Example script:

```plaintext
/* Allocate budgeted total expenses based on prior year, across 3 dimensions */

SET UPDATECALC OFF;
FIX (East, "100", "Total Expenses")
   BUDGET = @MDALLOCATE(750,3,@CHILDREN("100"),@CHILDREN("Total Expenses"),@CHILDREN(East),"PY Actual",,share);
ENDFIX
```

The values for PY Actual:

<table>
<thead>
<tr>
<th></th>
<th>Marketing</th>
<th>Payroll</th>
<th>Misc</th>
<th>Total Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-10</td>
<td>New York</td>
<td>94</td>
<td>51</td>
<td>145</td>
</tr>
<tr>
<td></td>
<td>Massachusetts</td>
<td>23</td>
<td>31</td>
<td>55</td>
</tr>
</tbody>
</table>

494
Essbase cycles through the database, performing these calculations:

1. Fixes on East, the children of 100, and Total Expenses.

   Using a FIX statement with @MDALLOCATE may improve calculation performance.

2. Before performing the allocation, determines what share of 750 (the value to be allocated) each expense category should receive, for each product-state combination, using the shares of each expense category from PY Actual. Starting with PY Actual -> 100-10 -> New York, Essbase divides the value for the first expense category, Marketing, by the value for PY Actual-> 100-10 -> East -> Total Expenses to calculate the percentage share of that category.

   For example, Essbase divides the value for PY Actual -> 100-10 -> New York -> Marketing (94) by the value for PY Actual -> 100-10 -> East -> Total Expenses (460), which yields a percentage share of approximately 20.4% for the Marketing category.

3. Repeats step 2 for each expense category, for each product-state combination.

4. During the allocation, Essbase uses the percentage shares calculated in step 2 and step 3 to determine what share of 750 should be allocated to each child of Total Expenses from Budget, for each product-state combination.

   For example, for Marketing, Essbase uses the 20.4% figure calculated in step 2, takes 20.4% of 750 (approximately 153), and places the allocated value in Budget -> 100-10 -> New York -> Marketing (see the results that follow this procedure).

5. Repeats step 4 for each expense category and for each product-state combination, using the percentage shares from PY Actual calculated in step 2 and step 3.

6. Consolidates the expense categories to yield the values for Total Expenses.

The results of the allocation for Budget:

<table>
<thead>
<tr>
<th>Jan Budget</th>
<th>Marketing</th>
<th>Payroll</th>
<th>Misc</th>
<th>Total Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>100–10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New York</td>
<td>153.26</td>
<td>83.15</td>
<td>0</td>
<td>236.41</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>37.50</td>
<td>50.54</td>
<td>1.63</td>
<td>89.67</td>
</tr>
</tbody>
</table>
Goal-Seeking Using the LOOP Command

This example shows how to calculate the sales value you must reach to obtain a certain profit on a specific product. In this case, the calculation script adjusts the Budget value of Sales to reach a goal of 15,000 Profit for Jan.

As shown in the outline in Figure 137, assume that no members are tagged as Dynamic Calc, and that the Profit per Ounce member (under Ratios in the Measures dimension) is not included in the calculation.

Assume that, before running the goal-seeking calculation script, the data values are:

<table>
<thead>
<tr>
<th>Product, Market, Budget</th>
<th>Jan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit</td>
<td>12,278.50</td>
</tr>
<tr>
<td>Margin</td>
<td>30,195.50</td>
</tr>
<tr>
<td>Sales</td>
<td>49,950.00</td>
</tr>
<tr>
<td>COGS</td>
<td>19,755.00</td>
</tr>
<tr>
<td>Total Expenses</td>
<td>17,917.00</td>
</tr>
<tr>
<td>Marketing</td>
<td>3,515.00</td>
</tr>
<tr>
<td>Payroll</td>
<td>14,402.00</td>
</tr>
</tbody>
</table>
Example script:

/* Declare the temporary variables and set their initial values*/

VAR
    Target = 15000,
    AcceptableErrorPercent = .001,
    AcceptableError,
    PriorVar,
    PriorTar,
    PctNewVarChange = .10,
    CurTarDiff,
    Slope,
    Quit = 0,
    DependencyCheck,
    NxtVar;

/*Declare a temporary array variable called Rollback based on the Measures dimension */

ARRAY Rollback [Measures];

/* Fix on the appropriate member combinations and perform the goal-seeking calculation*/

FIX(Budget, Jan, Product, Market)
    LOOP (35, Quit)
        Sales (Rollback = Budget;
        AcceptableError = Target * (AcceptableErrorPercent);
        PriorVar = Sales;
        PriorTar = Profit;
        Sales = Sales + PctNewVarChange * Sales;)
        CALC DIM(Measures);
        Sales (DependencyCheck = PriorVar - PriorTar;
        IF(DependencyCheck <> 0) CurTarDiff = Profit - Target;
        IF(@ABS(CurTarDiff) > @ABS(AcceptableError))
            Slope = (Profit - PriorTar) / (Sales - PriorVar);
            NxtVar = Sales - (CurTarDiff / Slope);
            PctNewVarChange = (NxtVar - Sales) / Sales;
        ELSE
            Quit = 1;
        ENDIF;
        ELSE
            Budget = Rollback;
            Quit = 1;
        ENDIF;)
    ENDLOOP
    CALC DIM(Measures);
ENDFIX

 Essbase performs the following calculations:

1. Declares the required temporary variables using the VAR command. Where appropriate, the initial values are set.
2. Declares a one-dimensional array called Rollback to store the Budget values.
   The size of Rollback is based on the number of members in the Measures dimension.

3. Fixes on the Jan -> Budget values for all Product and Market members.

4. Ensures that the commands between LOOP and ENDLOOP are cycled through 35 times
   for each member combination. If, however, the Quit variable is set to 1, the LOOP is broken
   and the calculation continues after the ENDLOOP command.

5. Cycles through the member combinations, performing the following calculations:
   a. Places the Budget -> Sales value in the Rollback temporary array variable.
   b. Calculates the acceptable error, by multiplying the Target value (15000) by the
      AcceptableErrorPercent value (0.001). The result is placed in the AcceptableError
      variable.
   c. Retains the current Sales value, and places the Sales value for the current member
      combination in the PriorVar temporary variable.
   d. Retains the current Profit value, and places the Profit value for the current member
      combination in the PriorTar temporary variable.
   e. Calculates a new Sales value by multiplying the PctNewVarChange value (0.1) by the
      current Sales value, and adding the current Sales value. The result is placed in Sales.
   f. Calculates and consolidates the Measures dimension.
   g. Subtracts the PriorTar value from the PriorVar value, and places the result in the
      DependencyCheck temporary variable.
   h. Checks that DependencyCheck is not 0 (zero) (IF).
      - If DependencyCheck is not 0, subtracts the Target value (15000) from the current
        Profit and places the result in the CurTarDiff temporary variable.
        The IF command checks whether the absolute value (irrespective of the + or –
        sign) of CurTarDiff is greater than the absolute value of AcceptableError:
          - If greater than AcceptableError, calculates the Slope, NxtVar, and
            PctNewVarChange temporary variables.
          - If not greater than AcceptableError, breaks the LOOP command by setting
            the value of Quit to 1. The calculation continues after the ENDLOOP
            command.
      - If DependencyCheck is 0, places the value in the Rollback array into Budget.
        Essbase breaks the LOOP command by setting the value of Quit to 1. The
        calculation continues after the ENDLOOP command.

6. Calculates and consolidates the Measures dimension.

The results for product 100-10:

<table>
<thead>
<tr>
<th>Product, Market, Budget</th>
<th>Jan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit</td>
<td>15,000.00</td>
</tr>
<tr>
<td>Margin</td>
<td>32,917.00</td>
</tr>
<tr>
<td>Sales</td>
<td>52,671.50</td>
</tr>
<tr>
<td>COGS</td>
<td>19,755.00</td>
</tr>
</tbody>
</table>
Forecasting Future Values

This example uses a linear regression forecasting method to produce a trend (@TREND), or line, that starts with the known data values from selected previous months and continues with forecasted values based on the known values, and shows how to check the results of the trend for “goodness of fit” to the known data values. In this case, the calculation script forecasts sales data for June–December, assuming that data currently exists only up to May.

Assume that the Measures dimension contains an additional child, ErrorLR, where the goodness-of-fit results are placed.

Example script:

```plaintext
Sales
(@TREND(@LIST(Jan, Mar, Apr), @LIST(1, 3, 4),,
   @RANGE(ErrorLR, @LIST(Jan, Mar, Apr)),
   @LIST(6, 7, 8, 9, 10, 11, 12),
   Jun:Dec, LR));
```

Table 89 describes the parameters used in the forecasting calculation script:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@LIST(Jan, Mar, Apr)</td>
<td>Represents the Ylist, or the members that contain the known data values. The @LIST function groups the three members as a comma-delimited list and keeps the list separate from other parameters.</td>
</tr>
<tr>
<td>@LIST(1, 3, 4)</td>
<td>Represents the Xlist, or the underlying variable values. Because Feb and May are skipped, Essbase numbers the Ylist values as 1, 3, 4.</td>
</tr>
<tr>
<td>,</td>
<td>The extra comma after the Xlist parameter indicates that a parameter (weightList) was skipped. This example uses a default weight of 1.</td>
</tr>
<tr>
<td>@RANGE(ErrorLR, @LIST(Jan, Mar, Apr))</td>
<td>Represents the errorList, or the member list where results of the goodness of fit of the trend line to Ylist are placed. The values placed in errorList are the differences between the data points in Ylist and the data points on the trend line that is produced. The @RANGE function combines the ErrorLR member with Ylist (Jan, Mar, Apr) to produce a member list.</td>
</tr>
<tr>
<td>@LIST(6, 7, 8, 9, 10, 11, 12)</td>
<td>Represents the XforecastList, or the underlying variable values for which the forecast is sought. This example forecasts values consecutively for Jun–Dec, so the values are 6, 7, 8, 9, 10, 11, 12.</td>
</tr>
</tbody>
</table>
Parameter | Description
--- | ---
Jun:Dec | Represents the YforecastList, or the member list into which the forecast values are placed. This example forecasts values for Jun–Dec, based on the values for Jan, Mar, and Apr.
LR | Specifies the Linear Regression method.

Essbase cycles through the database, performing the following calculations:

1. Finds the known data values on which to base the trend (Sales for Jan, Mar, Apr), as specified by the Ylist and Xlist parameters.
2. Calculates the trend line using Linear Regression and places the results in Sales for Jun–Dec, as specified by the YforecastList parameter.
3. Calculates the goodness of fit of the trend line for the data values for Jan, Mar, and Apr, and places the results in ErrorLR for those months.

For example, the value in ErrorLR for Jan (4.57) means that after Essbase calculates the trend line, the difference between the Sales value for Jan (2339) and the Jan value on the trend line is 4.57. The ErrorLR values for Feb and May are #MISSING, because these months were not part of Ylist.

The results of the calculation script:

<table>
<thead>
<tr>
<th>100 West Actual</th>
<th>ErrorLR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td></td>
</tr>
<tr>
<td>Jan 2339</td>
<td>4.57</td>
</tr>
<tr>
<td>Feb #MI</td>
<td></td>
</tr>
<tr>
<td>Mar -13.71</td>
<td></td>
</tr>
<tr>
<td>Apr 2332</td>
<td>9.14</td>
</tr>
<tr>
<td>May #MI</td>
<td></td>
</tr>
<tr>
<td>Jun 2315.14</td>
<td>#MI</td>
</tr>
<tr>
<td>Jul 2311.29</td>
<td>#MI</td>
</tr>
<tr>
<td>Aug 2307.49</td>
<td>#MI</td>
</tr>
<tr>
<td>Sep 2303.57</td>
<td>#MI</td>
</tr>
<tr>
<td>Oct 2299.71</td>
<td>#MI</td>
</tr>
<tr>
<td>Nov 2295.86</td>
<td>#MI</td>
</tr>
<tr>
<td>Dec #MI</td>
<td></td>
</tr>
</tbody>
</table>
Essbase provides two ways of invoking a calculation on a block storage database:

- The calculation may be implicitly specified by the outline itself.
- The calculation may be explicitly specified by a calculation script that you create. The script contains formulas and calculation instructions.

Regardless of how a calculation is triggered, Essbase can execute the calculation in one of two modes:

- **Serial calculation** is the default. With serial calculation, each calculation pass is scheduled to run on a single processor. If invoked from a calculation script, the calculations are executed sequentially in the order in which they appear in the calculation script.

- **Parallel calculation** breaks each calculation pass into sub-tasks. The sub-tasks that can run independently of one another are scheduled to run simultaneously on up to 64 or 128 threads. Block storage databases running on 32-bit platforms support up to 64 threads. Block storage databases running on 64-bit platforms and aggregate storage databases (whether running on 32-bit or 64-bit platforms) support up to 128 threads. Each thread may be on a different processor.

**Note:** Parallel calculation operations do not dynamically create threads, but instead use a set number of threads from a pre-created pool of threads. You can customize the size of the thread pool. For more information, see the WORKERTHREADS configuration setting topic in the *Oracle Essbase Technical Reference*. 
Using CALCPARALLEL Parallel Calculation

Subtopics

- Essbase Analysis of Feasibility
- CALCPARALLEL Parallel Calculation Guidelines
- Relationship Between CALCPARALLEL Parallel Calculation and Other Essbase Features
- Checking Current CALCPARALLEL Settings
- Enabling CALCPARALLEL Parallel Calculation
- Identifying Additional Tasks for Parallel Calculation
- Tuning CALCPARALLEL with Log Messages
- Monitoring CALCPARALLEL Parallel Calculation

To change from the default serial calculation to CALCPARALLEL parallel calculation, you change one or two configuration settings and restart the server, or add an instruction to the calculation script.

See “Enabling CALCPARALLEL Parallel Calculation” on page 507.

The following topics discuss the details of parallel calculation.

Essbase Analysis of Feasibility

Essbase evaluates whether using parallel calculation is possible before each calculation pass for which you have enabled parallel calculation.

Essbase analyzes the outline and the calculation requested for each calculation pass. Remember that one calculation may require multiple passes. Some situations may create the need for multiple passes, including dynamic calculation, the presence of a member tagged as two-pass, or calculations that create certain kinds of interdependencies. See “Calculation Passes” on page 408.

If Essbase determines that parallel calculation is possible, Essbase splits the calculation into smaller tasks that are independent of each other. During the calculation, Essbase performs the smaller tasks simultaneously.

However, Essbase uses serial calculation even if parallel calculation is enabled if there are complex interdependencies between formulas that participate in the pass. Such interdependencies render parallel calculation impossible.

CALCPARALLEL Parallel Calculation Guidelines

Outline structure and application design determine whether enabling parallel calculation can improve calculation performance. Before you enable CALCPARALLEL parallel calculation, review the following guidelines, which will help you get the full benefit of parallel calculation:

- Use the uncommitted access isolation level. Parallel calculation is not supported if you use the committed access isolation level. See “Uncommitted Access” on page 781.
One or more formulas present in a calculation may prevent Essbase from using CALCPARALLEL parallel calculation even if it is enabled. For a description of formulas that may force serial calculation regardless of parallel calculation settings, see “Formula Limitations” on page 504.

Calculation tasks are generated along the last \( n \) sparse dimensions of an outline. These sparse dimensions used to identify tasks are called task dimensions. The number of task dimensions, \( n \), is either selected dynamically by Essbase, or you can override the number by specifying a value for CALCTASKDIMS in the essbase.cfg file.

Order the sparse dimensions in an outline from smallest to largest, based on actual size of the dimension (as reported by the MaxL statement `query database DBS-NAME get dbstats dimension`). This ordering recommendation is consistent with recommendations for optimizing calculator cache size and consistent with other outline recommendations. For a description of situations that may need to use additional dimensions (more than the last sparse dimension) and for instructions on how to increase the number of sparse dimensions used, see “Identifying Additional Tasks for Parallel Calculation” on page 508.

CALCPARALLEL parallel calculation is effective on non-partitioned applications and these partitioned applications:
- Replicated partitions
- Linked partitions
- Transparent partitions if the calculation occurs at the target database. The number of sparse dimensions specified by CALCTASKDIMS in the essbase.cfg file or by SET CALCTASKDIMS in a calculation script must be set at 1. For information on limitations imposed by the use of parallel calculation with transparent partitions, see “Transparent Partition Limitations” on page 505; for information on using CALCTASKDIMS or SET CALCTASKDIMS, see “Identifying Additional Tasks for Parallel Calculation” on page 508.

If you have selected incremental restructuring for a database and have made outline changes that are pending a restructure, do not use parallel calculation. Unpredictable results may occur.

Update transactions, such as calculations and data updates, are more resource-consuming requests than MDX queries or report scripts. When a storage device is fast, Essbase allows more parallel calculation threads to get reasonable throughput; when a storage device is slower, Essbase may need to have a smaller number of parallel calculation or other update threads. You can use the `essbase.cfg` setting MAXACTIVEUPDATETRANSACTIONS to control the number of update transactions. For more information, see the topic for MAXACTIVEUPDATETRANSACTIONS in the Oracle Essbase Technical Reference.

### Relationship Between CALCPARALLEL Parallel Calculation and Other Essbase Features

The following topics discuss the relationship between CALCPARALLEL parallel calculation and other Essbase functionality.
**Retrieval Performance**

Placing the largest sparse dimension at the end of the outline for maximum parallel calculation performance may slow retrieval performance. See “Optimizing Query Performance” on page 93.

**Formula Limitations**

The presence of some formulas may force serial calculation. The following formula placements likely will force serial calculation:

- A formula on a dense member, including all stored members and any Dynamic Calc members upon which a stored member may be dependent, that causes a dependence on a member of the dimension that is used to identify tasks for parallel calculation.

- A formula that contains references to variables declared in a calculation script that uses @VAR, @ARRAY, @XREF, or @XWRITE. Consider using FIXPARALLEL.

- A sparse dimension member formula using @XREF, and the dimension for the sparse member is fully calculated. @XREF does not force serial calculation when it is on dense Dynamic Calc members that are not dependent on other stored members during the batch calculation.

- A member formula that causes a circular dependence. For example, member A has a formula referring to member B, and member B has a formula referring to member C, and member C has a formula referring to member A.

- A formula on a dense or sparse member with a dependency on a member or members from the dimension used to identify tasks for parallel processing.

- A sparse dimension member formula that contains references to members from other sparse dimensions.

If you need to use a formula that might prevent parallel calculation, consider using FIXPARALLEL. Otherwise, you can either mark the member of the formula as Dynamic Calc, or exclude the formula from the scope of the calculation. To see whether a formula is preventing parallel calculation, check the application log. For relevant error messages, see “Monitoring CALCParallel Parallel Calculation” on page 509.

**Calculator Cache**

At the start of a calculation pass, Essbase checks the calculator cache size and the degree of parallelism and then uses the calculator cache bitmap option appropriate for maximum performance. Therefore, the bitmap option used for parallel calculation may be different from that used for serial calculation.

For example, assume Essbase performs a serial calculation and uses multiple bitmaps and a single anchoring dimension. Without explicit change of the calculator cache size, Essbase might perform a parallel calculation using only a single bitmap and a single anchoring dimension.

You can determine the calculator cache mode that controls the bitmap options by checking the application log at the start of each calculation pass for an entry similar to the following:
Multiple bitmap mode calculator cache memory usage has a limit of [50000] bitmaps.

When using parallel calculation in multiple bitmap mode, you may encounter high memory usage. If so, you can use the configuration setting PARCALCMULTIPLEBITMAPMEMOPT to optimize memory use in multiple bitmap mode. This setting can be used with, or separately from, MULTIPLEBITMAPMEMCHECK. To enable PARCALCMULTIPLEBITMAPMEMOPT, add the following line to your essbase.cfg file:

```
PARCALCMULTIPLEBITMAPMEMOPT TRUE
```

See “Sizing the Calculator Cache” on page 828.

**Transparent Partition Limitations**

Parallel calculation with transparent partitions has the following limitations:

- You cannot use parallel calculation across transparent partitions unless the calculation occurs at the target.
- You must set CALCTASKDIMS or SET CALCTASKDIMS to 1 so that there is only one task dimension.
- You must increase the calculator cache so that multiple bitmaps can be used. You can identify the calculator cache mode that controls the bitmap options by checking the application log at the start of each calculation pass for an entry similar to the following:

```
Multiple bitmap mode calculator cache memory usage has a limit of [50000] bitmaps.
```

See “Sizing the Calculator Cache” on page 828.

**Restructuring Limitation**

Do not use parallel calculation if you have selected incremental restructuring. Parallel calculation does not support incremental restructuring.

**Commit Threshold Adjustments**

Essbase checks the commit threshold specified by the database setting “Number of blocks before internal commit.” If the setting requires that less than 10 MB of data be written before an internal commit, then Essbase automatically increases the commit threshold for the duration of the calculation pass to 10 MB. If the setting is greater than 10 MB, Essbase uses the setting value.

Essbase writes a message to the application log noting the temporary increase if it occurs.

If you can allocate more than 10 MB extra disk space for calculation, consider increasing the commit threshold value; that is, the number of blocks before a commit, to a very large number for better performance.

The default value, if unspecified, is 3000, and may adjust dynamically during a calculation.

If Essbase Server runs on Oracle Exalytics In-Memory machine, then for calculations and data load requests, the commit happens at the end of the request, and the default frequency of 3000 (or any other value specified by the setting) is ignored.
To view the current threshold, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Data Integrity Options</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display database dbs_name</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETDBINFO: Number of blocks modified before internal commit</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

To modify the commit threshold, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Data Integrity Options</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database dbs_name set implicit_commit after n blocks</td>
<td>Oracle Essbase Technical Reference, list of MaxL statements</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM 21</td>
<td>&quot;Example of Specifying Isolation Level Settings with ESSCMD&quot; on page 785</td>
</tr>
</tbody>
</table>

See “Uncommitted Access” on page 781.

**Isolation Level Limitation**

You must use uncommitted mode for parallel calculation.

To set the isolation level to uncommitted mode, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Data Integrity Options</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database dbs_name disable committed_mode</td>
<td>Oracle Essbase Technical Reference, list of MaxL statements</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM 18</td>
<td>&quot;Example of Specifying Isolation Level Settings with ESSCMD&quot; on page 785</td>
</tr>
</tbody>
</table>

See “Uncommitted Access” on page 781.

**Checking Current CALCPARALLEL Settings**

You can check either the server configuration file or the calculation script that you plan to use to see if parallel calculation is enabled.
To check whether parallel calculation has been enabled in the server configuration file:

1. **Open the server essbase.cfg file with a text editor.**
2. **Search for the parameter CALCPARALLEL, and check its specified value.**

   The number of threads that can simultaneously perform tasks to complete a calculation is specified by a value between 1 and 128. Block storage databases running on 32-bit platforms support up to 64 threads. Block storage databases running on 64-bit platforms and aggregate storage databases (whether running on 32-bit or 64-bit platforms) support up to 128 threads. See the *Oracle Essbase Technical Reference.*

To check whether a calculation script sets parallel calculation, look for the SET CALCPARALLEL command. Review the script carefully, because the script may enable or disable parallel calculation more than once. Alternately, a script can use FIXPARALLEL command blocks for parallel calculation.

**Enabling CALCPARALLEL Parallel Calculation**

To use CALCPARALLEL parallel calculation, enable it at the server level, application level, or database level using either of these methods:

- Add or edit the appropriate configuration settings to the `essbase.cfg` file.
  
  See CALCPARALLEL and CALCTASKDIMS in the *Oracle Essbase Technical Reference.*

- Add the appropriate calculation commands to a calculation script.
  
  See SET CALCPARALLEL and SET CALCTASKDIMS in the *Oracle Essbase Technical Reference.*

Parallel calculation settings use standard precedence rules:

- The database setting takes precedence over the application setting
- The application setting takes precedence over the server setting

Setting parallel calculation at the server level enables it for all calculations performed on all applications and databases on the server. You can disable parallel calculation for individual applications or databases by setting parallel calculation at the server level in the configuration file and then adding application-specific or database-specific entries in a calculation script.

**Caution!** Read this entire chapter before attempting to enable parallel calculation.

To enable parallel calculation:

1. If you plan to enable parallel calculation in the configuration file, check the current status to see whether an entry exists.
   
   Use the process described in “Checking Current CALCPARALLEL Settings” on page 506.
2 Add or modify CALCPARALLEL in the essbase.cfg file on the server, or add SET CALCPARALLEL to a calculation script.

3 If needed, enable Essbase to use more than the one sparse dimension to identify tasks for parallel calculation.

   Use the process described in “Identifying Additional Tasks for Parallel Calculation” on page 508 and “Tuning CALCPARALLEL with Log Messages” on page 509.

4 If you added entries to the configuration file, restart the server.

5 Run the calculation.

Oracle recommends that you set the value of CALCPARALLEL to be one less than the number of processors available for calculation. This extra processor can then be used by either the operating system or by the Essbase process responsible for writing out dirty blocks from the cache.

Tip: You can combine the use of CALCPARALLEL and SET CALCPARALLEL if the site requires it. For example, you can set CALCPARALLEL as off at the server level, and use a calculation script to enable and disable parallel calculation as needed.

Identifying Additional Tasks for Parallel Calculation

By default, Essbase uses an iterative technique to select the optimal number of task dimensions to use for CALCPARALLEL parallel calculation.

If necessary, you can enable Essbase to use a specific number, \( n \), of task dimensions. For example, if you have a FIX statement on a member of the last sparse dimension, you can include the next-to-last sparse dimension from the outline as well. Because each unique member combination of these two dimensions is identified as a potential task, more and smaller tasks are created, increasing the opportunities for parallel processing and improving load balancing.

To specify the number of task dimensions for parallel calculation:

1 If you are not sure, verify whether parallel calculation is enabled.

   See “Checking Current CALCPARALLEL Settings” on page 506. Without CALCPARALLEL (or SET CALCPARALLEL in a calculation script), CALCTASKDIMS has no effect.

2 Optional: Essbase selects a default number, \( n \), of task dimensions to use for parallel calculation and this number is printed in the application log file as an informational message; for example: Parallelizing using [2] task dimensions. To override the default \( n \) setting, add or modify CALCTASKDIMS in the essbase.cfg file on the server, or use the calculation script command SET CALCTASKDIMS at the top of the script.

3 If you add or modify CALCTASKDIMS in the essbase.cfg file on the server, restart Essbase.

4 If you are using a calculation script, run the script.

Note: In some cases, Essbase uses fewer dimensions to identify tasks than is specified by CALCTASKDIMS or SET CALCTASKDIMS. See the Oracle Essbase Technical Reference.
Tuning CALCPARALLEL with Log Messages

If you are using CALCPARALLEL parallel calculation, you may encounter the following log messages:

Current selection of task dimensions \([n]\) will generate insufficient number of tasks \([n]\) for parallel calculation. See whether calculation time can be improved by increasing the number of task dimensions by one (see SET CALCTASKDIMS topic in the Technical Reference). Also, consider using FIXPARALLEL to make custom task selections that are different from CALCPARALLEL.

If this message is encountered, it means that during a parallel calculation, Essbase refrained from increasing the number of task dimensions, in case that would have resulted in tasks becoming too small. When tasks become too small, calculation scheduling overhead could overtake the benefits of parallelism. However, when tasks are too large, there might not be enough tasks for parallel calculation threads to work on.

If the next potential task dimension is not the first sparse dimension, consider increasing the number of task dimensions by one using SET CALCTASKDIMS, and observe whether that improves the speed of the calculation. Also, consider using FIXPARALLEL to make custom task selections that are different from CALCPARALLEL (see “Using FIXPARALLEL Parallel Calculation” on page 511).

Current number of task dimensions \([n]\) for parallel calculation might have caused too many tasks \([n]\) to be generated. See whether calculation time can be improved by decreasing the number of task dimensions by one (see SET CALCTASKDIMS topic in the Technical Reference). Also, consider using FIXPARALLEL to make custom task selections that are different from CALCPARALLEL.

For parallel calculation, having a sufficient number of tasks helps to reduce the effects of data skew. However, too many tasks (even for appropriately sized tasks) can cause the scheduling overhead to outweigh the benefits. Essbase targets an optimal range. If you see the above message, it means that Essbase tried to meet the recommended minimum number of tasks by adding one more task dimension; in doing so, it is possible that the upper boundary for task count may have been crossed.

If the last task dimension selected by Essbase is not the only task dimension, consider decreasing task dimensions by one using SET CALCTASKDIMS, and observe whether that improves the speed of the calculation. Also, consider using FIXPARALLEL to make custom task selections that are different from CALCPARALLEL (see “Using FIXPARALLEL Parallel Calculation” on page 511).

Monitoring CALCPARALLEL Parallel Calculation

You can view events related to parallel calculation in the application log.
To view the application log:

See “Viewing Logs” in the Oracle Essbase Administration Services Online Help.

For each calculation pass, Essbase writes several types of information to the application log to support parallel calculation:

- If you have enabled parallel calculation and Essbase has determined that parallel calculation can be performed, Essbase writes a message in the application log:

  Calculating in parallel with \( n \) threads

  \( n \) represents the number of concurrent tasks specified in CALCPARALLEL or SETCALCPARALLEL.

- For each formula that prevents parallel calculation (forces serial calculation), Essbase writes a message to the application log:

  Formula on ((or backward dependence from) mbr memberName prevents calculation from running in parallel.

  \( memberName \) represents the name of the member where the relevant formula exists. You can look in the application log for such messages and consider removing the formula or, if possible, tagging the relevant member or members as Dynamic Calc so they do not feature in the calculation pass.

- Essbase writes a message to the application log specifying the number of tasks that can be executed concurrently (based on the data, not the value of CALCPARALLEL or SETCALCPARALLEL):

  Calculation task schedule [576, 35, 14, 3, 2, 1]

  The example message indicates that 576 tasks can be executed concurrently. After the 576 tasks complete, 35 more can be performed concurrently, and so on.

  The benefit of parallel calculation is greatest in the first few steps and diminishes as fewer concurrent tasks are performed.

  The degree of parallelism depends on the number of tasks in the task schedule. The greater the number, the more tasks that can run in parallel, and the greater the performance gains.

- Essbase writes a message to the application log file indicating how many tasks are empty (contain no calculations):

  [Tue Jun 27 12:30:44 2007] Local/CCDemo/Finance/essexer/Info(1012681) Empty tasks [291, 1, 0, 0, 0, 0]

  In the example, Essbase indicates that 291 of the tasks at level 0 were empty.

  If the ratio of empty tasks to the tasks specified in the calculation task schedule is greater than 50% (for example, 291 / 576), parallelism may not be giving you improved performance because of the high sparsity in the data model.

  You can change dense-sparse assignments to reduce the number of empty tasks and increase the performance gains from parallel calculation.
Using FIXPARALLEL Parallel Calculation

Although parallel calculation can be performed using the CALCPARALLEL configuration setting, in certain cases it might be beneficial to use the FIXPARALLEL command block method.

In a FIXPARALLEL command block, you input some commands to be executed, along with a number of threads \((\text{numThreads})\) and a member list \((\text{mbrList})\) specifying the database regions (slices) to be calculated. Essbase creates a list of tasks from the combinations in the member list, and divides the tasks across the threads.

The FIXPARALLEL method can be advantageous in the following cases:

- If you need to use temporary variables during parallel calculation.
- If you need to use the DATACOPY, DATAEXPORT, or CLEARBLOCK calculation commands.
- In conjunction with the @XREF or @XWRITE functions.
- If you need to export regions of the database in parallel.
- In cases where CALCPARALLEL is not meeting performance requirements, and your outline generates many empty tasks, or contains many task groupings with fewer tasks than threads made available to the calculation.

For detailed information about FIXPARALLEL and related commands, see the Oracle Essbase Technical Reference.
Understanding Custom-Defined Macros

With custom-defined macros, you can combine multiple calculation functions into a single function.

When developing and testing custom-defined macros, create and test new macros locally within a test application. Register custom-defined macros globally only after you have tested them in a test application and are ready to use them in a production environment.

To create and manage custom-defined macros, you must have a security level of Database Manager or higher.

Naming Custom-Defined Macros

Follow these guidelines when naming custom-defined macros:

- Start the macro name with the “@” symbol; for example, @MYMACRO. The rest of a name can contain letters, numbers, and the following symbols: @, #, $, and _. Macro names must not contain spaces.
- For macros that are called only by other macros, start the macro name with “@_”, to distinguish it from general-use macros and functions.
Give macros unique names. Additionally, a macro name must be different from the names of custom-defined functions and from the names of existing calculation functions.

**Note:** If an application contains a local macro that has the same name as a global macro, the local macro takes precedence and is used for calculation.

- For local macros, you must prepend the application name to the macro name, separating the application name from the macro name with a period:

  AppName.@MacroName

  For example:

  Sample.@MYMACRO

- Because global macros are available to any application running on the Essbase Server where the macro was created, you do not assign an application name to it.

## Creating Custom-Defined Macros

When you create a custom-defined macro, Essbase records the macro definition and stores it in a catalog of macros. You can then use the macro in formulas and calculation scripts until the macro is removed from the catalog.

You can register a custom-defined macro in the following ways:

- As local, in which the macro is available only in the Essbase application in which it was created
- As global, in which the macro is available to all Essbase applications running on the Essbase Server where the macro was created

➤ To create a custom-defined macro, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Custom-Defined Macros</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create macro</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

The following MaxL statement creates a local macro named `@COUNTRANGE` for use in the Sample application:

```maxl
create macro Sample.'@COUNTRANGE'(Any) AS
'@COUNT(SKIPMISSING, @RANGE(@@S))'
spec '@COUNTRANGE(MemberRange)'
comment 'counts all non-missing values';
```

The following MaxL statement creates a global macro named `@COUNTRANGE`:

```maxl
create macro '@COUNTRANGE'(Any) AS
'@COUNT(SKIPMISSING, @RANGE(@@S))'
spec '@COUNTRANGE(MemberRange)'
comment 'counts all non-missing values';
```
Using Custom-Defined Macros

You can use custom-defined macros like native calculation commands in calculation scripts or formulas.

To use a custom-defined macro:

1 Create or open an existing calculation script or formula.
   - If it was registered locally, you must use a calculation script or formula within the application in which the macro was created.
   - If it was registered globally, you can use any calculation script or formula within any application on the Essbase Server.

2 Add the custom-defined macro to the calculation script or formula.
   For example, to use the @COUNTRANGE custom-defined macro shown earlier in this chapter, create the following calculation script:
   
   \[ \text{CountMbr} = \text{@COUNTRANGE}(\text{Sales, Jan:Dec}); \]

   Use this calculation script with the Sample.Basic database, or replace “Sales, Jan:Dec” with a range of members in a test database.

3 Save the calculation script or formula, and then run it as usual.

Viewing Custom-Defined Macros

View a custom-defined macro to determine whether it has been successfully created, or whether it is local or global.

To view a custom-defined macro, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Viewing Custom-Defined Macros</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display macro</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Updating Custom-Defined Macros

To update a custom-defined macro:

1 Determine whether the macro is registered locally or globally.
   See “Viewing Custom-Defined Macros” on page 515.

2 To update the macro definition; use a tool:
The following MaxL statement changes the local macro @COUNTRANGE, which is used only in the Sample application:

```maxl
create or replace macro Sample.'@COUNTRANGE'(Any)
as '@COUNT(SKIPMISSING, @RANGE(@@S))';
```

The following MaxL statement changes the global macro @COUNTRANGE:

```maxl
create or replace macro '@COUNTRANGE'(Any)
as '@COUNT(SKIPMISSING, @RANGE(@@S))';
```

### Copying Custom-Defined Macros

You can copy custom-defined macros to any Essbase Server and application to which you have appropriate access.

➤ To copy a custom-defined macro, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Custom-Defined Macros</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create macro</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

### Removing Custom-Defined Macros

The procedure for removing global custom-defined macros, which is more complex than that for removing local custom-defined macros, should be performed only by DBAs.

➤ To remove a custom-defined macro:

1. **Determine whether the macro is registered locally or globally.**
   
   See “Viewing Custom-Defined Macros” on page 515.

2. **Verify that no calculation scripts or formulas are using the custom-defined macro.**

3. **To remove the macro from the catalog of macros; use a tool:**

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Deleting Custom-Defined Macros</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>drop macro</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
4 Restart all applications associated with the macro.

See "Refreshing the Catalog of Custom-Defined Macros" on page 517.

The following MaxL statement removes the local macro @COUNTRANGE, which is used only in the Sample application:

```
drop macro Sample.'@COUNTRANGE';
```

The following MaxL statement removes the global macro @COUNTRANGE:

```
drop macro '@COUNTRANGE';
```

**Refreshing the Catalog of Custom-Defined Macros**

Refresh the catalog of custom-defined macros when you add, update, or remove macros.

To refresh the catalog of custom-defined macros for all applications on a server, restart the server.

To refresh the catalog of custom-defined macros for one application, use the `refresh custom definitions` MaxL statement.

The following MaxL statement refreshes the catalog of custom-defined macros for the Sample application:

```
refresh custom definition on application sample;
```
Developing Custom-Defined Calculation Functions

In This Chapter

Process for Creating Custom-Defined Functions ...................................................... 519
Custom-Defined Function Requirements .............................................................. 520
Creating and Compiling a Java Class ................................................................. 521
Installing Java Classes on Essbase Server ....................................................... 522
Registering Custom-Defined Functions ............................................................. 523
Using Registered Custom-Defined Functions .................................................. 524
Updating Custom-Defined Functions ................................................................. 524
Viewing Custom-Defined Functions ................................................................. 525
Removing Custom-Defined Functions ............................................................... 526
Copying Custom-Defined Functions ................................................................. 526
Performance Considerations for Custom-Defined Functions ......................... 527
Memory Considerations for Custom-Defined Functions ................................. 527

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases. Also see Chapter 60, “Comparison of Aggregate and Block Storage.”

Process for Creating Custom-Defined Functions

To enhance the calculation functions provided with Essbase, you can create custom-defined functions for use in calculation scripts. Essbase does not provide sample custom-defined functions.

Custom-defined calculation functions are written in Java. Essbase does not provide tools for creating Java classes and archives; you must have a supported version of the JDK.

For examples of custom-defined functions, see the Oracle Essbase Technical Reference.

To create a custom-defined function:

1. Review the requirements for custom-defined functions.
   See “Custom-Defined Function Requirements” on page 520.

2. Write a public Java class that contains at least one public, static method to be used as a custom-defined function.
   See “Creating and Compiling a Java Class” on page 521.
3 Install the Java class.
   See “Installing Java Classes on Essbase Server” on page 522.

4 Register the custom-defined function as a local or global function.
   See “Registering Custom-Defined Functions” on page 523.

Custom-Defined Function Requirements

You can create multiple methods in a class for use as a custom-defined function. Typically, Oracle recommends that you create the methods that you plan to use across all applications on an Essbase Server as custom-defined functions in a single class. If, however, you plan to add custom-defined functions that will be used in selective applications on the Essbase Server, create these custom-defined functions in a separate class and add them to Essbase Server in a separate .jar file.

When creating multiple Java classes that contain methods for use as custom-defined functions, verify that each class name is unique. Duplicate class names cause methods in the duplicate class not to be recognized, and you cannot register those methods as custom-defined functions.

Using test programs in Java, test the Java classes and methods. When you are satisfied with the output of the methods, install them on Essbase Server and register them in a single test application. Do not register functions globally for testing; doing so makes updating them more difficult if you encounter problems.

Methods in custom-defined functions can have any combination of the following supported data types as input parameters:

- boolean
- byte
- char
- com.hyperion.essbase.calculator.CalcBoolean
- float, double
- java.lang.String
- short, int, long
- arrays of any of these types

CalcBoolean is an Essbase-specific data type that can include three values—TRUE, FALSE, and #MISSING. For information about the other listed data types, see the JDK documentation.

The method return data type can be void or any of the preceding data types. Returned data types are converted to Essbase-specific data types. Strings are mapped to a string type. Boolean values are mapped to the CalcBoolean data type. All other values are mapped to a double type.
Note: Essbase does not support double variables returned with infinite or Not-a-Number values. If these values are returned from a Java program, they may not be recorded or displayed correctly in Essbase. Double variables should be checked for infinite or Not-a-Number values and set to finite values before being returned to Essbase. See the entry for the class, Double, in the JDK documentation.

For creating, deleting, and managing custom-defined functions, Essbase requires these security permissions:

- Local, application-wide, custom-defined functions: Application Manager or higher
- Global, server-wide, custom-defined functions: Administrator

When you register a custom-defined function in Essbase, you give the function a name, which is used in calculation scripts and formulas and is distinct from the Java class and method name used by the function.

Follow these requirements for naming custom-defined functions:

- Start the name with the @ symbol. The rest of a function name can contain letters, numbers, and the following symbols: @, #, $, and _. Function names cannot contain spaces.
  
  For example: @MYFUNCTION

- Start the names of custom-defined functions that are called only by custom-defined macros with “@_”, to distinguish them from general-use functions and macros.
  
  For example: @_MYFUNCTION

- Custom-defined functions must have unique names. Function names must be different from each other, from the names of custom-defined macros, and from the names of existing calculation functions.

- If an Essbase application contains a local function that has the same name as a global function, the local function is used for calculation.

Creating and Compiling a Java Class

To create and compile a Java class, use a text editor and the JDK javac tool.

1. In a text editor, create a Java class.

For example:

```java
public class CalcFunc {
    public static double sum (double[] data) {
        int i, n = data.length;
        double sum = 0.0d;
        for (i=0; i<n; i++) {
            double d = data [i];
            sum = sum + d;
        }
    }
```

521
    return sum;
    }
    }
2 Save the file with a .java extension.
    For example:
    CalcFunc.java
3 Navigate to the directory where the .java file resides; at a command prompt, enter this command:
    javac java_filename
    For example:
    javac CalcFunc.java
4 Resolve any compiling errors until the compiler creates a new file with a .class extension.
    For example:
    CalcFunc.class

Installing Java Classes on Essbase Server

Java classes must be compiled in a JAR file, using the JDK jar tool.

➢ To create a .jar file and install it on an Essbase Server:

1 Navigate to the directory where the .class file resides; at a command prompt, enter this command:
    jar cf jar_filename class_filename
    For example:
    jar cf CalcFunc.jar CalcFunc.class
2 On the computer running Essbase Server, copy the .jar file to one of the following directories (if the directory does not exist, create it):
    ● For .jar files containing global custom-defined functions:
        ARBORPATH/java/udf/
    ● For .jar files to be used only with specific applications:
        ARBORPATH/app/appName/udf/

        where appName is the name of the application where the local custom-defined function will be used.

        If the .jar file is subsequently placed in another location, you must modify the CLASSPATH variable to include the full path and filename for the .jar file.
3 If the functions will be used only by specific applications, restart those applications in Essbase. Otherwise, restart Essbase Server.
Registering Custom-Defined Functions

After you have compiled the Java classes for custom-defined functions into .jar files and installed the .jar files on Essbase Server, you must register the custom-defined functions before you can use them in calculation scripts and formulas. See “Custom-Defined Function Requirements” on page 520.

When you register a global custom-defined function, all Essbase applications on the Essbase Server can use it. Test custom-defined functions in a single application (and register them only in that application) before making them global functions.

Use the same process for updating the catalog of functions as for updating the catalog of macros. See “Refreshing the Catalog of Custom-Defined Macros” on page 517.

Caution! Do not register global functions for testing; doing so makes changing them more difficult if you encounter problems.

To register a custom-defined function, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Custom-Defined Functions</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create function</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

To register a custom-defined function with local scope, include the application name as a prefix. For example, the following MaxL statement registers the custom-defined function, @JSUM, in the CalcFunc class as a local function for use within the Sample application:

```maxl
create function Sample.'@JSUM'
as 'CalcFunc.sum'
spec '@JSUM(memberRange)'
comment 'adds list of input members';
```

To register a custom-defined function with global scope, do not include the application name as a prefix. For example, the following MaxL statement registers the custom-defined function, @JSUM, in the CalcFunc class as a global function for use in any application on Essbase Server:

```maxl
create function '@JSUM'
as 'CalcFunc.sum'
spec '@JSUM(memberRange)'
comment 'adds list of input members';
```

Note: Specifying input parameters for the Java method is optional. If you do not specify input parameters, Essbase reads them from the method definition in the Java code. If, however, you are registering multiple custom-defined functions with the same method name but with different parameter sets, you must register each version of the function separately, specifying the parameters for each version of the function.
Using Registered Custom-Defined Functions

You can use registered custom-defined functions like native Essbase calculation commands.

To use a registered custom-defined function:

1. Create or open an existing calculation script or formula.
   - If the custom-defined function was registered locally—within a specific application—you must use a calculation script or formula within that application.
   - If the custom-defined function was registered globally, you can use any calculation script or formula on Essbase Server.

2. Add the custom-defined function to the calculation script or formula.
   For example, to use JSUM, use this calculation script:
   
   "New York" = @JSUM(@LIST(2.3, 4.5, 6.6, 1000.34));

   Use this calculation script with the Sample.Basic sample database, or replace “New York” with the name of a member in a test database.

3. Save the calculation script or formula, and then run it as usual.

Updating Custom-Defined Functions

The procedure for updating custom-defined functions depends on these conditions:

- Whether the function is registered locally or globally
- Whether the signature of the custom-defined function—class name, method name, or input parameters—has been changed in the Java code for the custom-defined function

Typically, to update a custom-defined function, you must replace the .jar file that contains the code for the function, and then re-register the function. If, however, the signature of the custom-defined function has not changed, and the function has only one set of input parameters (it is not an overloaded method), you can replace the .jar file that contains the function.

Note: Only DBAs should update global custom-defined functions.

To update a custom-defined function:

1. Determine whether the function is local or global.
   See “Viewing Custom-Defined Functions” on page 525.

2. Make the changes to the Java class for the custom-defined function and use Java test programs to test its output.

3. Compile the Java classes and archive them in a new .jar file, using the same name as the previous .jar file.
Include any other classes and methods for custom-defined functions that were included in the previous .jar file.

4 Perform an action, depending on whether you are updating a local or global custom-defined function:
   a. Local: Shut down any Essbase applications that use the functions in the .jar file.
   b. Global: Shut down all Essbase applications

   If you are unsure which Essbase applications use which functions in the .jar file, shut down all Essbase applications.

5 Copy the new .jar file to Essbase Server, replacing the existing .jar file with the same name.

6 If the signature of the custom-defined function has not changed, skip to step 8.

7 To replace the custom-defined function, use a tool:
   - Administration Services: See “Editing Custom-Defined Functions” in the Oracle Essbase Administration Services Online Help.
   - MaxL: Use the create or replace function statement. For example:
     - Local:
       ```
       create or replace function sample.'@JSUM'
       as 'CalcFunc.sum';
       ```
     - Global:
       ```
       create or replace function '@JSUM'
       as 'CalcFunc.sum';
       ```

8 Restart the applications that you shut down, which updates the catalog.

### Viewing Custom-Defined Functions

You can view custom-defined functions to determine whether a function has been registered successfully and whether it is registered locally or globally. Custom-defined functions are not displayed until they have been created and registered.

To view a custom-defined function, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Viewing Custom-Defined Functions</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display function</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

For example, use the following MaxL statement to view the custom-defined functions in the Sample application and any registered global functions:

```maxl
display function Sample;
```

The `display function` statement lists global functions without an application name to indicate that they are global. If the application contains a function with the same name as a global function, only the local function is listed.
Removing Custom-Defined Functions

The following permissions are required to remove a custom-defined function:

- Local: Application Manager permission for the application, or any wider permission
- Global: Administrator permission

Before removing custom-defined functions, you should verify that no calculation scripts or formulas are using them. Global custom-defined functions can be used in calculation scripts and formulas across Essbase Server, so you must verify that no calculation scripts or formulas on Essbase Server are using a global custom-defined function before removing it.

**Caution!** Remove global custom-defined functions only when users are not accessing Essbase databases and calculation routines are not being performed.

To remove a custom-defined function:

1. **Determine whether the function is local or global.**
   
   See “Viewing Custom-Defined Functions” on page 525.
2. **Perform an action, depending on whether you are removing a local or global custom-defined function:**
   a. Local: Shut down any Essbase applications that use the functions in the .jar file.
   b. Global: Shut down all Essbase applications.
3. **To remove the custom-defined function, use a tool:**
   a. Administration Services: See “Deleting Custom-Defined Functions” in the Oracle Essbase Administration Services Online Help
   b. MaxL: Use the `drop function` MaxL statement. For example:
      - Local:
        
        ```
        drop function Sample.'@JSUM';
        ```
      - Global:
        
        ```
        drop function '@JSUM';
        ```
4. **Restart the applications that you shut down, which updates the catalog.**

Copying Custom-Defined Functions

You can copy custom-defined functions to any Essbase Server and application to which you have appropriate access.

To copy a custom-defined function, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Custom-Defined Functions</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
</tbody>
</table>
Performance Considerations for Custom-Defined Functions

Because custom-defined functions are implemented as an extension of the Essbase calculator framework, you can expect custom-defined functions to operate less efficiently than functions native to the Essbase calculator framework.

To optimize performance, limit the use of custom-defined functions to calculations that you cannot perform with native Essbase calculation commands, particularly in applications where calculation speed is critical.

Memory Considerations for Custom-Defined Functions

Use of the JVM API and Java API for XML Parsing has an initial effect on the memory required to run Essbase. The memory required to run these additional components is documented in the memory requirements for Essbase. See the Oracle Enterprise Performance Management System Installation and Configuration Guide.

Beyond these startup memory requirements, the Java programs you develop for custom-defined functions sometimes require additional memory. When started, the JVM for Win32 operating systems immediately allocates 2 MB of memory for programs. This allocation is increased according to the requirements of the programs that are then run by the JVM. The default upper limit of memory allocation for the JVM on Win32 operating systems is 64 MB. If the execution of a Java program exceeds the default upper limit of memory allocation for the JVM, the JVM generates an error. For more information about JVM memory management and memory allocation details for other operating systems, see JDK documentation.

Considering the default memory requirements of the JVM and the limitations of the hardware on which you run servers, carefully monitor your use of memory. In particular, developers of custom-defined functions should be careful not to exceed memory limits of the JVM when creating large artifacts within custom-defined functions.
In Retrieving Data:

- Understanding Report Script Basics
- Developing Report Scripts
- Writing MDX Queries
- Copying Data Subsets and Exporting Data
- Retrieving Relational Data
All report script examples in this chapter are based on the Sample.Basic database.

**Working With a Simple Report Script**

When you combine report commands that include page, row, and column dimension declarations with selected members, you have all the elements of a simple report script.

The following step-by-step example of the report script process includes a sample script that specifies these elements, dimensions, and member selection commands. It includes comments, which document the behavior of the script, and the ! output command. This script is based on the Sample.Basic database.

1. Create a report script.
   
   See “Creating Scripts” in the *Oracle Essbase Administration Services Online Help*.

2. Type the following information in the report script.

   // This is a simple report script example
   // Define the dimensions to list on the current page, as below
   <PAGE (Market, Measures)

   // Define the dimensions to list across the page, as below
   <COLUMN (Year, Scenario)

   // Define the dimensions to list down the page, as below
   <ROW (Product)
// Select the members to include in the report
Sales
<ICHDREN Market
Qtr1 Qtr2
Actual Budget Variance
<ICHDREN Product

// Finish with a bang
!

3. Save the report script.

See “Saving Scripts” in the Oracle Essbase Administration Services Online Help.

4. Execute the report script.

See “Executing Report Scripts” in the Oracle Essbase Administration Services Online Help.

When you execute the example script against the Sample.Basic database, it produces the following report:

**East Sales**

<table>
<thead>
<tr>
<th></th>
<th>Qtr1</th>
<th>Variance</th>
<th>Qtr2</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>9,211</td>
<td>6,500</td>
<td>2,711</td>
<td>10,069</td>
</tr>
<tr>
<td>200</td>
<td>6,542</td>
<td>3,700</td>
<td>2,842</td>
<td>6,977</td>
</tr>
<tr>
<td>300</td>
<td>6,483</td>
<td>4,500</td>
<td>1,983</td>
<td>6,956</td>
</tr>
<tr>
<td>400</td>
<td>4,725</td>
<td>2,800</td>
<td>1,925</td>
<td>4,956</td>
</tr>
<tr>
<td>Product</td>
<td>26,961</td>
<td>17,500</td>
<td>9,461</td>
<td>28,678</td>
</tr>
</tbody>
</table>

**West Sales**

<table>
<thead>
<tr>
<th></th>
<th>Qtr1</th>
<th>Variance</th>
<th>Qtr2</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>7,660</td>
<td>5,900</td>
<td>1,760</td>
<td>7,942</td>
</tr>
<tr>
<td>200</td>
<td>8,278</td>
<td>6,100</td>
<td>2,178</td>
<td>8,524</td>
</tr>
<tr>
<td>300</td>
<td>8,599</td>
<td>6,800</td>
<td>1,799</td>
<td>9,583</td>
</tr>
<tr>
<td>400</td>
<td>8,403</td>
<td>5,200</td>
<td>3,203</td>
<td>8,888</td>
</tr>
<tr>
<td>Product</td>
<td>32,940</td>
<td>24,000</td>
<td>8,940</td>
<td>34,937</td>
</tr>
</tbody>
</table>

**South Sales**

<table>
<thead>
<tr>
<th></th>
<th>Qtr1</th>
<th>Variance</th>
<th>Qtr2</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>5,940</td>
<td>4,100</td>
<td>1,840</td>
<td>6,294</td>
</tr>
<tr>
<td>200</td>
<td>5,354</td>
<td>3,400</td>
<td>1,954</td>
<td>5,535</td>
</tr>
<tr>
<td>300</td>
<td>4,639</td>
<td>4,000</td>
<td>639</td>
<td>4,570</td>
</tr>
<tr>
<td>400</td>
<td>4,639</td>
<td>4,000</td>
<td>639</td>
<td>4,570</td>
</tr>
<tr>
<td>Product</td>
<td>15,933</td>
<td>11,500</td>
<td>4,433</td>
<td>16,399</td>
</tr>
</tbody>
</table>

**Central Sales**

<table>
<thead>
<tr>
<th></th>
<th>Qtr1</th>
<th>Qtr2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Understanding How Report Writer Works

Report Writer comprises three main components:

- Report Script Editor is a text editor that you use to write report scripts. Report commands define formatted reports, export data subsets from a database, and produce free-form reports. Execute the saved script to generate a report. Saved report scripts have the file extension .rep.

- Report Extractor retrieves data information from the Essbase database when you run a report script.

- Report Viewer displays the complete report. Saved reports have the file extension .rpt.
The Report Extractor processes the report script and retrieves data, performing the following actions:

1. Composes the member list, based on all possible member combinations. For example, `<IDESCENDANTS East` retrieves member East and all of its descendants.

2. Applies member restrictions. For example, `<LINK` refines the member selection.

3. Orders the member output. For example, `<SORT` determines the order in which members are sorted.

4. Extracts data from the following areas:
   - Local regions
   - Partitioned regions
   - Dynamically calculated data

5. Restricts data. For example, the following command suppresses the display of all rows that contain only missing values:
   ```
   {SUPMISSINGROWS}
   ```

6. Sorts data. For example, `<TOP` returns rows with the greatest values of a specified data column.

7. Formats output. For example, `{SKIP}` skips one or more lines in the final output report.

The order in which Report Extractor retrieves data affects the execution of complex extraction and formatting commands. For example, because the Report Extractor restricts data (step 5) before sorting data (step 6), if you place conditional retrieval commands in the wrong order,
report output results can be unexpected. Be aware of the data retrieval process when designing report scripts.

Parts of a Report

Understanding the parts of a report is essential as you plan and design your own reports.

Figure 139   Elements of a Typical Report

A typical report is composed of the following parts:

- **Page Headings** list dimensions represented on the current page. All data values on the page have the dimensions in the page heading as a common property.
  
  `<PAGE (Market, Measures)`

- **Column Headings** list members across a page. You can define columns that report on data from multiple dimensions, which results in nested column headings.
  
  `<COLUMN (Year, Scenario)`

- **Row Headings** list members down a page. You can define a member list that includes rows from multiple levels within a dimension or from multiple dimensions. The rows are indented below the dimension name.
  
  `<ROW (Product)`

- **Titles** contain user-defined text, date and time stamp, the user name of the person running the report, page numbers, the name of the source database, or any other descriptive information. Titles are user-generated and optional. Page, column, and row headings are automatically generated, because they are necessary to clearly describe the data on the report page.

  `{ STARTHEADING
  TEXT  1 "Prepared by:"
  14 "*USERNAME"`
Data values are the values contained in the database cells; they are the lookup results of member combinations or the results of calculations when the report is run through the Report Extractor. Each data value is the combination of the members in the page heading, column heading, and row name.

All data values in a row share the properties of the row names of that row. A report can have zero or more row name dimensions, each of which produces column of row names, with the innermost row name column cycling the fastest.

### Parts of a Report Script

A report script comprises a series of Report Writer commands, terminated by the bang (!) report output command.

You can enter one or more report scripts in a report script file, which is a text file that you create with Report Script Editor or any text editor.

To build a report script, enter or select commands that define the layout, member selection, and format in Report Script Editor. The different elements of a script are color-coded to aid readability. You can enable syntax autocompletion to help build scripts quickly.

The commands in Report Writer perform two functions, data extraction and formatting:

- Extraction commands deal with the selection, orientation, grouping, and ordering of raw data extracted from the database. These commands begin with less-than signs (<).
- Formatting commands allow customization of the report format and appearance, the creation of new columns, and calculation of columns and rows. These commands are generally contained within braces ({ }), although some begin with less-than signs (<).
- The bang character (!) terminates a series of commands and requests information from the database. You can place one or more report scripts, each terminated by its own ! command, in the same report file.

For information about report commands, see the Oracle Essbase Technical Reference.

### Planning Reports

Report design is important to presenting information. Include the proper elements and arrange information in an attractive, easy-to-read layout.

1. Consider the reporting needs and the time required to generate the report.
2. Roughly sketch the report. Include the following items:
• Layout
• Number of columns
• Members
• Titles, if applicable
• Format of data values

3 Review the sketch; it is often apparent at this stage if additional data or formatting is needed.

4 Determine ways to optimize the report runtime.

   See Chapter 58, “Optimizing Reports and Other Types of Retrieval” for a comprehensive discussion of how to optimize a report script.

   Note: As you plan the report, minimize use of numeric row names; instead, to avoid ambiguity, give rows descriptive names.

### Considering Security and Multiple-User Issues

You must use Administration Services to use Report Script Editor to create or modify a report script. You can also use any text editor to create script files. If you use Report Script Editor, it enables you to create and modify report scripts stored on your desktop machine, as well as the Essbase Server. To modify report scripts stored on the server, you must have Application Manager or Database Manager access.

Essbase supports concurrent, multiple-user database access. As in most multiple-user environments, Essbase protects critical data with a security system. Users can read or update data only with the correct permissions.

When you execute a report script, Essbase security verifies that you have read or higher access level to all data members specified in the report. In a filtering process identical to that for retrieving members into a spreadsheet, Essbase filters any member from the output for which you have insufficient permissions.

To users who are only reporting data, locks placed by other users are transparent. Even if a user has locked and is updating part of the data required by the report, the lock does not interfere with the report in any way. The data in the report reflects the data in the database at the time you run the report. Running the same report later reflects any changes made after the last report ran.


### Reviewing the Process for Creating Report Scripts

This section describes the process for creating a report script.

1. Create the report script.

   See “Creating Report Scripts” on page 538.
2. Check the report script syntax.
   See “Checking Script Syntax” in the Oracle Essbase Administration Services Online Help.

3. Save the report script.
   See “Saving Report Scripts” on page 538.

4. Run the report script.
   See “Executing Report Scripts” on page 539.

5. If desired, save the report.
   See “Saving Reports” in the Oracle Essbase Administration Services Online Help.

Creating Report Scripts

You can report on the data in a database using the following methods:

- **Report Script Editor.** Use Report Script Editor to create large-scale reports comprising many pages of multidimensional data. Reports of this scale often can exceed the capabilities of even the most robust spreadsheet. Report Writer commands let you define formatted reports, export data subsets from an Essbase database, and produce free-form reports. See “Creating Scripts” in the Oracle Essbase Administration Services Online Help.
- **A text editor.**
- **Through a spreadsheet.** Use report commands in a spreadsheet in free-form mode or template-retrieval mode.
- **Essbase APIs.** See “Generating Reports Using the C, Visual Basic, and Grid APIs” on page 576 and see the Oracle Essbase API Reference.
- **Third-party reporting tools.**

For information about creating and editing report scripts in Administration Services, see “About Report Script Editor” in the Oracle Essbase Administration Services Online Help.

Saving Report Scripts

You can save a report script in the following locations:

- **As a file on a client machine or network.**
- **As an artifact on Essbase Server.** To allow other users access to the report script, save it on Essbase Server. You can associate the script artifact with the following artifacts:
  - An application and all the databases within the application, which lets you run the script against any database in the application.
  - A database, which lets you run the script against the specified database.

Report scripts have a .rep extension by default. If you run a report script from Administration Services, the script must have a .rep extension.
To save a report script using Report Script Editor:
See “Saving Report Scripts” in the *Oracle Essbase Administration Services Online Help*.

### Executing Report Scripts

When you execute a report script using Administration Services, you can send the results to the Report Viewer window, to a printer, and/or to a file. From the Report Viewer window, you can print, save, and copy the report.

Using Administration Services, you can execute a report in the background so that you can continue working as the report processes. You can then check the status of the background process to see when the report has completed.

See “Executing Report Scripts” in the *Oracle Essbase Administration Services Online Help*.

### Copying Report Scripts

You can copy report scripts to applications and databases on any Essbase Server, according to your permissions. You can also copy scripts across servers as part of application migration.

To copy a report script, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Scripts</td>
<td><em>Oracle Essbase Administration Services Online Help</em></td>
</tr>
<tr>
<td>MaxL</td>
<td>alter object</td>
<td><em>Oracle Essbase Technical Reference</em></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>COPYOBJECT</td>
<td><em>Oracle Essbase Technical Reference</em></td>
</tr>
</tbody>
</table>

### Developing Free-Form Reports

Free-form reports are often easier to create than structured reports. The free-form reporting style is ideal for ad hoc reporting in the Report Script Editor window.

A free-form report does not include PAGE, COLUMN, or ROW commands and instead gathers this information from a series of internal rules that are applied to the report script by the Report Extractor when you run the report.

The following example script and report illustrate free-form reporting:

Sales Colas
Jan Feb Mar
Actual Budget
Illinois
Ohio
Wisconsin
Missouri
Iowa
You can use formatting commands to add specific formats to a free-form report. When PAGE, COLUMN, and ROW commands are omitted, Essbase formats free-form reports according to the following rules:

1. The Report Extractor finds the last member or members of a single dimension defined in the report specification (before the report output operator !). This dimension becomes the ROW dimension for the report. All remaining selections become PAGE or COLUMN dimensions, as defined by rules 2 and 3.

2. The Report Extractor searches for any single-member selections. If a single member is found that does not satisfy rule 1, that dimension becomes a PAGE dimension.

3. The Report Extractor searches for all remaining dimension members that do not satisfy rules 1 or 2. If any remaining members are found, those dimensions become COLUMN dimensions. COLUMN dimensions are nested in the order of selection in the free-form script.

4. The Report Extractor searches the database outline for any dimensions not specified in the report specification. If unspecified dimensions are found, they become PAGE dimensions (the default for single-member selections, as defined in rule 2).

5. A subsequent selection of one or more consecutive members from a given dimension overrides any previous selection for that dimension.

For example, the following report recognizes California, Oregon, Washington, Utah, Nevada, and West as members of Market.

Sales
Jan Feb Mar
Actual Budget
Apr May Jun
California
Oregon
Washington
Utah
Nevada
Report Extractor applies free-form formatting rules to this report:

1. Because California, Oregon, Washington, Utah, Nevada, and West are listed last, the Report Extractor treats them as if ROW (Market) had been specified (rule 1).

2. Sales is a single-member selection from dimension Measures. The Report Extractor treats this member as if PAGE (Measures) had been specified (rule 2).

3. After searching the remaining members, the Report Extractor finds members of dimensions Year and Scenario, which it treats as COLUMN (Year, Scenario) (rule 3).

4. The Report Extractor searches the database outline and finds that dimension Product is not specified in the report specification. Because Product is a single-member selection, the Report Extractor treats this member as if PAGE (Product) had been specified (rule 4).

5. Finally, the Report Extractor finds that Apr May Jun is from the same dimension as Jan Feb Mar and is displayed on a subsequent line of the script. The Report Extractor discards the first specification (Jan Feb Mar) and uses the second (Apr May Jun).

Resulting report:

<table>
<thead>
<tr>
<th>Product Sales</th>
<th>Actual</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apr</td>
<td>May</td>
</tr>
<tr>
<td></td>
<td>======</td>
<td>======</td>
</tr>
<tr>
<td>California</td>
<td>3,814</td>
<td>4,031</td>
</tr>
<tr>
<td>Oregon</td>
<td>1,736</td>
<td>1,688</td>
</tr>
<tr>
<td>Washington</td>
<td>1,868</td>
<td>1,908</td>
</tr>
<tr>
<td>Utah</td>
<td>1,449</td>
<td>1,416</td>
</tr>
<tr>
<td>Nevada</td>
<td>2,442</td>
<td>2,541</td>
</tr>
<tr>
<td>West</td>
<td>11,309</td>
<td>11,584</td>
</tr>
</tbody>
</table>

**Note:** You cannot use substitution variables in free-form mode.
In This Chapter

- Understanding Extraction Commands .......................................................... 543
- Understanding Formatting Commands .......................................................... 544
- Understanding Report Script Syntax ............................................................ 544
- Designing the Page Layout ......................................................................... 545
- Formatting .................................................................................................. 549
- Selecting and Sorting Members ................................................................... 560
- Restricting and Ordering Data Values ......................................................... 571
- Converting Data to a Different Currency ..................................................... 575
- Generating Reports Using the C, Visual Basic, and Grid APIs ....................... 576

All report script examples in this chapter are based on the Sample.Basic database.

Also see:

- Chapter 34, “Understanding Report Script Basics”
- Oracle Essbase Technical Reference, for report command syntax and an extensive set of report script examples

Understanding Extraction Commands

You create a report using extraction commands, which specify member combinations for pages, columns, and rows.

Extraction commands determine the selection, orientation, grouping, and ordering of raw data records extracted from the database. These commands are based on either dimension or member names, or keywords, and their names begin with the greater-than symbol (>).

Extraction commands apply to the report from the line on which they occur until the end of the report. If another extraction command occurs on a subsequent line of the report, it overrides the previous command.
Understanding Formatting Commands

You use formatting commands to determine the visual design of the report and to control the display of the data values. Formatted data values are displayed in the report when you run the script, based on the combined extraction and report commands.

Formatting commands enable you to customize the format and appearance of a report and create report-time calculations. Formatting commands are generally enclosed in braces ({}), although several formatting commands begin with the less-than (<) character.

Formatting commands are either applied globally within the report script or are specific to a member.

Understanding Report Script Syntax

To build a report, you enter commands that define the layout, member selection, and format you want in Report Script Editor. The different elements of a script are color-coded to aid readability. You can enable autocompletion to help build scripts interactively as you type. See “About Report Script Editor” in the Oracle Essbase Administration Services Online Help.

When you write a report script, follow these guidelines:

- Separate commands with at least one space, tab, or new line for readability. Report processing is unaffected by extra blank lines, spaces, or tabs.
- Enter commands in uppercase or lowercase. Commands are not case-sensitive. If the database outline is case-sensitive, the members in the report script must match the outline.
- To start report processing, enter the bang (!) report output command or one or more consecutive numeric values. You can place one or more report scripts, each terminated by its own ! command, in the same report file.
- You can group multiple format commands within one set of braces. For example, these formats are synonymous:
  
  \[
  \text{(UDATA SKIP)}
  \]
  
  \[
  \text{(UDATA) (SKIP)}
  \]

- Enclose member names in quotation marks in the following cases:
  
  - Names beginning with an ampersand (for example, “&Product”).
  - Names containing spaces (for example, “Cost of Goods Sold”).
  - Names containing the word Default (for example, “Default Value”).
  - Duplicate member names, which must be entered as qualified member names (for example, “[2006].[Qtr1]”)
  - Names containing one or more numerals at the beginning of the name (for example, “100-Blue”)
  - Names containing any of the characters listed in Table 90:
Table 90  Characters that Require Member Name Enclosures

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>asterisks</td>
</tr>
<tr>
<td>@</td>
<td>at signs</td>
</tr>
<tr>
<td>{}</td>
<td>braces</td>
</tr>
<tr>
<td>[]</td>
<td>brackets</td>
</tr>
<tr>
<td>,</td>
<td>commas</td>
</tr>
<tr>
<td>:</td>
<td>colons</td>
</tr>
<tr>
<td>-</td>
<td>dashes, hyphens, or minus signs</td>
</tr>
<tr>
<td>&lt;</td>
<td>less-than signs</td>
</tr>
<tr>
<td>()</td>
<td>parentheses</td>
</tr>
<tr>
<td>+</td>
<td>plus signs</td>
</tr>
<tr>
<td>;</td>
<td>semicolons</td>
</tr>
<tr>
<td>/</td>
<td>slashes</td>
</tr>
</tbody>
</table>

- If a formatting command is preceded by three or more underscore, equal sign, or hyphen characters, respectively, the Report Extractor assumes that the characters are extraneous underline characters and ignores them. For example, ==={SKIP 1}.

- Use // (double slash) to indicate a comment. Everything on the line following a comment is ignored by the Report Writer. Each line of a comment must start with a double slash, so you can include multiline comments.

- Exercise caution in abbreviating command names. Many names begin with the same letters, and the results may be unexpected unless you use a completely unambiguous abbreviation.

Designing the Page Layout

Reports are two-dimensional views of multidimensional data. You can use page layout commands to incorporate additional dimensions that are defined as nested groups of columns or rows on a page, or additional pages in the report.

The page layout is composed of headings that make up the columns and rows of a page. You define the basic layout of a report using page, row, and column data extraction commands combined with specific member selections.

Each component of page layout has a different formatting command:

`<PAGE`
`<COLUMN`
`<ROW`
In addition, the <ASYM and <SYM commands override the default method of interpreting the column dimension member lists, and produce either an asymmetric or symmetric report format.

See “Formatting Page, Column, and Row Headings” on page 550.

Creating Page, Column, and Row Headings

To define report headings:

1  Enter <PAGE(dimensionName, dimensionName)

   where dimensionName lists dimensions represented on the current page. All data values on the page have the dimensions in the page heading as a common property. Example:
   <PAGE (Measures, Market)

2  Press Enter.

3  Enter <COLUMN(dimensionName)

   where dimensionName equals the name of each dimension to display across the page. For example:
   <COLUMN (Year)

   Adding dimension names creates nested column headings.

4  Press Enter.

5  Enter <ROW(dimensionName)

   where dimensionName equals the name of each dimension to display down the page. For example:
   <ROW (Market)

6  Press Enter.

   Note: You can select additional members to associate with the heading commands. Using a member name as a parameter for the PAGE, COLUMN, or ROW commands causes Report Extractor to associate the member with the appropriate dimension.

Example report script:

<PAGE (Product, Measures)
<COLUMN (Scenario, Year)
Actual
<ICHILDREN Qtr1
<ROW (Market)
<IDESCENDANTS East
!

Resulting report:

<table>
<thead>
<tr>
<th>Product</th>
<th>Measures</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>Feb</td>
<td>Mar</td>
</tr>
<tr>
<td>========</td>
<td>========</td>
<td>=======</td>
</tr>
</tbody>
</table>

546
New York  512  601  543  1,656
Massachusetts  519  498  515  1,532
Florida  336  361  373  1,070
Connecticut  321  309  290  920
New Hampshire  44  74  84  202
East  1,732  1,843  1,805  5,380

You can create page, column, and row headings with members of attribute dimensions.

Example report script:

```plaintext
<PAGE (Measures,Caffeinated)
Profit
<COLUMN (Year,Ounces)
Apr  May
"12"
<ROW (Market,"Pkg Type")
Can
<ICHOILDREN East
!

Resulting report:

<table>
<thead>
<tr>
<th>Profit</th>
<th>Caffeinated</th>
<th>12 Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apr</td>
<td>May</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>New York</td>
<td>Can</td>
<td>276</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>Can</td>
<td>397</td>
</tr>
<tr>
<td>Florida</td>
<td>Can</td>
<td>202</td>
</tr>
<tr>
<td>Connecticut</td>
<td>Can</td>
<td>107</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>Can</td>
<td>27</td>
</tr>
<tr>
<td>East</td>
<td>Can</td>
<td>1,009</td>
</tr>
</tbody>
</table>
```

Modifying Headings

You can perform the following modifications to headings in the report using the commands listed in Table 91:

### Table 91  Report Writer Commands: Headings

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STARTHEADING</strong></td>
<td>Create a custom page heading in place of the default heading, which is displayed at the top of each page in the report or immediately following a HEADING command. Use the ENDHEADING command to specify the end of the custom heading.</td>
</tr>
<tr>
<td><strong>HEADING</strong></td>
<td>Display the page heading, either the default heading or the heading as defined with the STARTHEADING and ENDHEADING commands. Use this command to re-enable the page heading display if the SUPHEADING command has been used.</td>
</tr>
<tr>
<td><strong>IMMHEADING</strong></td>
<td>Force the immediate display of the heading without waiting for the next unsuppressed data row, when heading suppression commands are in use.</td>
</tr>
<tr>
<td><strong>COLHEADING</strong></td>
<td>Automatically turn on the display of the column header.</td>
</tr>
<tr>
<td><strong>PAGEHEADING</strong></td>
<td>Display the page heading before the next data output row.</td>
</tr>
</tbody>
</table>
Creating Symmetric and Asymmetric Reports

Essbase reports can contain symmetric or asymmetric column groups. Essbase determines the symmetry of column groups automatically, based on the members you select.

A symmetric report, shown below, is characterized by repeating, identical groups of members.

<table>
<thead>
<tr>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget</td>
<td>Actual</td>
</tr>
<tr>
<td>Q1</td>
<td>Q2</td>
</tr>
</tbody>
</table>

An asymmetric report, shown below, is characterized by groups of nested members that differ by at least one member in the nested group. There can be a difference in the number of members or the names of members.

<table>
<thead>
<tr>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget</td>
<td>Actual</td>
</tr>
<tr>
<td>Q1</td>
<td>Q2</td>
</tr>
</tbody>
</table>

By default, Essbase creates a symmetric report unless you select the same number of members for all column dimensions.


The Essbase evaluation of symmetry versus asymmetry takes place before any ordering, restriction on columns, or application of the effects of calculated columns.

Overriding Default Column Groupings

You can override the default column grouping that Essbase selects for reports with the <SYM and <ASYM commands. <SYM and <ASYM affect the member selection commands that follow them in a report.

1. Use the <SYM command when the selection of column members meets the requirements of the rule for asymmetry, but you want to produce a symmetric report. The <SYM command always produces a symmetric report, creating all combinations of each column dimension.

2. Turn off the symmetric format and restore the rules for asymmetric reports with the <ASYM command.

Changing Column Headings

If you need to change only the column headings rather than the symmetry of the report, the <PYRAMIDHEADERS and <BLOCKHEADERS formatting commands are useful.

- Use the <BLOCKHEADERS formatting command to change the pyramid-style headers used in symmetric reports to block-style headers such as those used in asymmetric reports. A symmetric report uses the <PYRAMIDHEADERS mode of column layout by default.
Use the <PYRAMIDHEADERS formatting command to change the block-style headers used in asymmetric reports to pyramid-style headers such as those used in symmetric reports. An asymmetric report uses the <BLOCKHEADERS mode of column layout.

### Formatting

Formatting commands, usually enclosed in braces ({}), define the format of data and labels in the final report and can be either global or member-specific.

- Global commands are executed when they occur in the report script file and stay in effect until the end of the report file or until another global command replaces them.
  
  For example, the {SUPMISSINGROWS} command suppresses all rows in the report script file that contain only missing values.

- Member-specific commands are executed as they are encountered in the report script, usually the next member in the report script, and affect only that member. A format attached to a member is executed before that member is processed.

  For example, the {SKIP} command skips the specified number of rows between row dimensions in a report script. If you want additional rows to skip lines, you must use the SKIP command again.

### Formatting Report Pages

You can use several formatting commands to design the look of the final report pages. See:

- “Setting Page Length, Width, and Centering” on page 549
- “Inserting Page Breaks” on page 550

See the Oracle Essbase Technical Reference for examples.

### Setting Page Length, Width, and Centering

You can set the following page specifications in the report script using the commands listed in Table 92:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIDTH</td>
<td>Specify the column widths.</td>
</tr>
<tr>
<td>LMARGIN</td>
<td>Set the left margin.</td>
</tr>
<tr>
<td>SETCENTER</td>
<td>Set the center of the page.</td>
</tr>
</tbody>
</table>
**Inserting Page Breaks**

You can set the following types of page breaks in the report script using the commands listed in Table 93:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAGELENGTH</td>
<td>Set the number of lines for each page.</td>
</tr>
<tr>
<td>NEWPAGE</td>
<td>Force a page break regardless of how many lines have been generated for the current page.</td>
</tr>
<tr>
<td>PAGEONDIMENSION</td>
<td>Insert a page break whenever a member from the same dimension as the member in the command changes from one line in the report to the next. Use the NOPAGEONDIMENSION command to turn off this function.</td>
</tr>
<tr>
<td>FEEDON</td>
<td>Enable page breaks in a report when the number of lines on a page is greater than the current PAGELENGTH setting.</td>
</tr>
</tbody>
</table>

**Formatting Page, Column, and Row Headings**

Column and row formatting commands make up a special type of format setting commands.

**Specifying Column Formats**

Specifications for column formatting commands can precede or follow the columns to which they apply, depending on the desired format.

For example, in the following script, based on the Sample.Basic database, the first \{DECIMAL\} command is processed after two columns are set up, Actual and Budget. The \{DECIMAL\} command, however, refers to a column three, which does not yet exist. Essbase responds to this command by dynamically expanding the report to three columns. When the report specification expands to six columns, the \{DECIMAL\} formatting applies to columns three and six (and all multiples of three).

Essbase performs this pattern extension on the assumption that when another dimension is added, causing repetitions of previous column dimension groups, the formatting should repeat as well. The second \{DECIMAL\} formatting command is then applied to columns 1 and 4 only, as it occurs after the creation of six columns.

Example report script:

```plaintext
<PAGE (Measures, Market)
Texas Sales
  <COLUMN (Scenario, Year)
    Actual Budget
{DECIMAL 2 3 }
    Jan Feb Mar
{DECIMAL 1 1 4 }
  <ROW (Product)
  <DESCENDANTS "100"
!```

Resulting report:
The following scripts demonstrate two approaches to column formatting that produce identical results. In the first script, the first two \{DECIMAL\} commands are positioned to format every first and third column by distributing the formats when Jan Feb displays after processing the \{DECIMAL\} command.

Example report script: Format columns by distributing the formats

\begin{verbatim}
California Sales
<COLUMN (Scenario, Year)
  Actual Budget Variance
{DECIMAL 1 1 }
{DECIMAL 2 3 }
Jan Feb
// {DECIMAL 1 1 4 } These lines are commented; the
// {DECIMAL 2 3 6 } Report Extractor ignores them.
<ROW (Product)
<DESCENDANTS "100"
!
\end{verbatim}

The two \{DECIMAL\} commands are positioned to format the individual columns 1, 3, 4, and 6.

Example report script: Format columns by direct assignment

\begin{verbatim}
<PAGE (Measures, Market)
California Sales
<COLUMN (Scenario, Year)
  Actual Budget Variance
  // {DECIMAL 1 1 } These lines are commented; the
  // {DECIMAL 2 3 } Report Extractor ignores them.
Jan Feb
{DECIMAL 1 1 4 7 }
{DECIMAL 2 3 6 9 }
<ROW (Product)
<DESCENDANTS "100"
!
\end{verbatim}

Resulting report for both scripts:

Sales California

\begin{verbatim}
  Actual                  Budget                  Variance
  Jan  Feb  Jan  Feb  Jan   Feb
  =====  ====  =====  ====  =====  ====
100-10  678.0  645  840.00  800.0 (162) (155.00)
100-20  118.0  122  140.00  150.0  (22)  (28.00)
100-30  145.0  132  180.00  160.0 (35) (28.00)
\end{verbatim}
**Note:** By default, attribute calculation dimension members (for example, SUM, AVG) are displayed as columns. To display them in rows, you must include them in the ROW command.

### Accommodating Long Column Names and Row Names

Member names too long to fit into columns are automatically truncated; the tilde character (~) signifies that part of the name is missing. Long member names are common when using aliases.

You can modify columns to display the entire member name using the commands listed in Table 94 on page 552:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAMEWIDTH</td>
<td>Define the column width for all row members in the column.</td>
</tr>
<tr>
<td>NAMESCOL</td>
<td>Change where the row member column is displayed and shift the remaining columns left or right to allow long member names.</td>
</tr>
</tbody>
</table>

### Suppressing Page, Column, and Row Formatting

You can suppress the display of page heading, columns, and rows in a report by using the commands listed in Table 95:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPCOLHEADING</td>
<td>The default column heading in the report.</td>
</tr>
<tr>
<td>SUPEMPTYROWS</td>
<td>Rows that have only zero or missing values.</td>
</tr>
<tr>
<td>SUPMISSINGROWS</td>
<td>All rows that contain missing values. Use INCMISSINGROWS, INCZEROROWS, or INCEMPTYROWS to display rows that are empty or have missing data or zeros.</td>
</tr>
<tr>
<td>SUPPAGEHEADING</td>
<td>The page member heading whenever a heading is generated.</td>
</tr>
<tr>
<td>SUPALL</td>
<td>The page and column headings, all member names, page breaks, commas, and brackets in the final report. To turn on the display of columns of row member names, use the NAMESON command. To turn on the use of commas and brackets, use the COMMAS and BRACKETS commands.</td>
</tr>
<tr>
<td>SUPHEADING</td>
<td>The default heading (page header and column headers) or custom header, if defined, at the top of each page.</td>
</tr>
<tr>
<td>SUPNAMES</td>
<td>Row member names in the final report. Use the NAMESON command to include row member names in the report.</td>
</tr>
<tr>
<td>SUPOUTPUT</td>
<td>All output while continuing to process all operations, such as calculations and format settings. Use the OUTPUT command to reverse the actions of SUPOUTPUT.</td>
</tr>
<tr>
<td>SUPCURHEADING</td>
<td>Currency information when you use the CURRENCY command to convert data values in a report to a specified currency.</td>
</tr>
</tbody>
</table>
Repeating Row Names

To repeat the row member names on every line of the report, use the `<ROWREPEAT` command. Use the `<NOROWREPEAT` command to prevent row member names from being repeated on each line of the report if the row member name does not change on the next line. NOROWREPEAT is enabled by default.

Using Tab Delimiters

You can use tabs rather than spaces between columns in report scripts; for example, when you want to export report output into another form.

To replace spaces with tab delimiters, type `{TABDELIMIT}` anywhere in the report script.

Adding Totals and Subtotals

Column and row calculations let you create additional calculations that are not defined as part of the database outline. For example, you can use column and row calculations to create extra columns or rows in a report, based upon selected data members, and perform calculations on these or existing columns and rows.

For examples of report scripts that contain column and row calculations, see “Sample 14, Calculating Columns” on the “Example of Report Scripts” page of the Oracle Essbase Technical Reference.

Totaling Columns

The CALCULATE COLUMN command lets you create a report column, perform on-the-fly calculations, and display the calculation results in the newly created column.

Table 96 lists column calculation commands:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCULATE COLUMN</td>
<td>Create a report column, perform dynamic calculations, and display the calculation results in the newly created column. Use the OFFCOLCALCS command to temporarily disable column calculations in the report, and ONCOLCALCS to re-enable calculations.</td>
</tr>
<tr>
<td>REMOVECOLCALCS</td>
<td>Remove all column calculation definitions from the report.</td>
</tr>
</tbody>
</table>

CALCULATE COLUMN adds up to 499 ad hoc column calculations to a report. Each new calculated column is appended to the right of the existing columns in the order in which it is created and is given the next available column number. These columns calculate the sum of data across a range of columns or an arithmetic expression composed of simple mathematical operators.

The CALCULATE COLUMN command supports standard mathematical operations.
If you use the same name for multiple columns, Essbase creates only the last column specified in the CALCULATE COLUMN command. Use a leading space with the second name (and two leading spaces with the third name, and so on) to create a unique column name.

Alternately, you can add descriptive text far enough to the right that it is truncated to the column width. You can, for example, use the names Q1 Actual and Q1 Budget to distinguish similar column names without affecting the appearance of the report. Column names are printed with right justification until the column header space is filled. Excess characters are then truncated to the right.

Divide lengthy column name labels into multiple lines. The maximum number of lines across which you can divide a label is equal to the number of column dimensions designated in the report specification. To break a column name, insert a tilde (~) in the name at the point where you want the break. You must also specify at least two members for each column dimension to use the maximum number of lines.

Example report script:

(CALCULATE COLUMN "Year to Date~Actual Total" = 1 : 2)
(CALCULATE COLUMN "Year to Date~Budget Total" = 3 : 4)

Resulting report:

<table>
<thead>
<tr>
<th>Sales East</th>
<th>Actual Year to Date</th>
<th>Budget Year to Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan</td>
<td>Feb</td>
</tr>
<tr>
<td></td>
<td>=====</td>
<td>=====</td>
</tr>
<tr>
<td>400-10</td>
<td>562</td>
<td>560</td>
</tr>
<tr>
<td>400-20</td>
<td>219</td>
<td>243</td>
</tr>
<tr>
<td>400-30</td>
<td>432</td>
<td>469</td>
</tr>
</tbody>
</table>

As a rule, in symmetric reports, if a calculated column name has fewer levels than the number of column dimensions, the previous member (to the left) of each of the column dimensions, above the top level supplied in the calculated column name, is attributed to the calculated column. If normal PYRAMIDHEADERS mode is in use, the centering of those higher-level column members shifts to the right to include the calculated column or columns. Column header members on the same level as calculated column names are not applied to the new calculated column or columns, and their centering does not shift.

If BLOCKHEADERS mode is in use; that is, if every member applying to a column is repeated above that column, the same rules apply, except that instead of shifting column header member centering, they are repeated in the appropriate higher levels of the calculated column name.

Asymmetric reports do not have groups of columns that share a member property. These reports still allow multiple-level column names up to the number of column levels defined, but member properties from preceding columns are not automatically shared and used for those levels that are undefined.

If there are fewer column header dimensions than the number of levels that you want, you can create multiline column labels. In this case, use TEXT, STARTHEADING, ENDHEADING, and other formatting commands to create a custom heading.
Numbering Columns

If the number of regular (not calculated) columns varies in the report because multiple sections in the report have different numbers of columns, the column numbers used to identify the calculated columns shift accordingly, as illustrated:

- If the first section of a report has 12 columns (including row name columns), and three calculated columns are declared, column numbers 0–11 are the regular columns, and columns 12–14 are the calculated columns.
- If a second section of the report reduces the number of regular columns to six, then the regular columns are columns 0–5, and the same calculated columns are columns 6–8.
- Similarly, if the number of regular columns is increased, the numbering of the calculated columns starts at a higher number.

In the example, CC1, CC2, and CC3 represent the names of three calculated column names. The column numbering for a report with two different sections with varying numbers of regular columns:

```
<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>22</td>
<td>55</td>
<td>26</td>
</tr>
<tr>
<td>Expense</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>23</td>
<td>65</td>
<td>33</td>
</tr>
</tbody>
</table>
```

```
<table>
<thead>
<tr>
<th></th>
<th>Qtr1</th>
<th>YTD</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>2</td>
<td>9</td>
<td>22</td>
<td>57</td>
<td>36</td>
</tr>
<tr>
<td>Expense</td>
<td>4</td>
<td>8</td>
<td>56</td>
<td>45</td>
<td>33</td>
</tr>
</tbody>
</table>
```

If you do not want the calculated columns in the second section, or if you need a different set of column calculation, use the command REMOVECOLCALCS to clear the old ones out. You can then define new column calculations.

This example assumes that all three column calculations had no references to regular columns other than columns 1 and 2. If CC3’s calculation were = 1 + 3 + 6, when the second section of the report starts, an error occurs stating that the column calculation referred to a nonexistent column (6).

Totaling Rows

Row calculations create summary rows in a report. You can use summary rows to calculate the sum of data across a range of rows or to calculate an arithmetic expression composed of simple mathematical operators.

Table 97 lists row calculation commands:
### Table 97  Report Writer Commands: Row Calculations

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCULATE ROW</td>
<td>Create a row and associate it with a row name or label. This process is similar to declaring a variable. You can also perform simple calculations with CALCULATE ROW. For more complex calculations, use SETROWOP. See also OFFROWCALCS and ONROWCALCS.</td>
</tr>
<tr>
<td>OFFROWCALCS</td>
<td>Temporarily disable row calculations in the report. See also CALCULATE ROW and ONROWCALCS.</td>
</tr>
<tr>
<td>ONROWCALCS</td>
<td>Re-enable calculations after using OFFROWCALCS. See also CALCULATE ROW and OFFROWCALCS.</td>
</tr>
<tr>
<td>SETROWOP</td>
<td>Define complex calculations for the row specified in CALCULATE ROW. SETROWOP defines a calculation operator to be applied to all subsequent output data rows. You can display the calculation results in the newly created row with the PRINTROW command.</td>
</tr>
<tr>
<td>PRINTROW</td>
<td>Immediately display the row specified in CALCULATE ROW to the report.</td>
</tr>
<tr>
<td>CLEARROWCALC</td>
<td>Reset the value of the calculated row to #MISSING. See also CLEARALLROWCALC.</td>
</tr>
<tr>
<td>CLEARALLROWCALC</td>
<td>Reset the value of all calculated rows after using the CLEARROWCALC command.</td>
</tr>
<tr>
<td>SAVEROW</td>
<td>Create a calculated row with captured data. See also SAVEANDOUTPUT.</td>
</tr>
<tr>
<td>SAVEANDOUTPUT</td>
<td>Capture data and output the result after using the SAVEROW command.</td>
</tr>
</tbody>
</table>

Commands that designate columns must use valid data column numbers, as determined by the original order of the columns.

- Precede and follow all operators in an expression with a single space.
- Essbase does not support nested (parenthetical) expressions.
- Essbase supports integer and floating-point constants in expressions as single entries or members of an array.

The CALCULATE ROW command can specify an operation (+, -, *, /, or OFF) as an equation consisting of constants, other calculated rows, and operators. Equations are evaluated at the time of declaration. Member names are not supported in expressions with the CALCULATE ROW command.

If you specify an operator, the operator applies to subsequent output rows and stores the result in the calculated row. Specifying an operator is useful for aggregating a series of rows to obtain a subtotal or total. To reset the operator, use SETROWOP. If the CALCULATE ROW command does not specify either an equation or an operator, the + operator is assumed.

The CALCULATE ROW command supports the standard mathematical operations.

Example report script:

```plaintext
{ CALC ROW "Total Sales" = "Sales..Group1" + "Sales..Group2" }
```

The example creates “Total Sales” based on two other calculated rows.
Changing How Data Is Displayed

Formatting commands customize how data displays in the final report:

Underlining

Use underlining as a visual aid to break up blocks of information in a report, using the commands listed in Table 98 on page 557:

Table 98  Report Writer Commands: Underline

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNDERLINECHAR</td>
<td>Set the default underline character to display in the report.</td>
</tr>
<tr>
<td>UCHARACTERS</td>
<td>Underline all characters that are not blank in the preceding row.</td>
</tr>
<tr>
<td>UCOLUMNS</td>
<td>Underline all the columns in the preceding row.</td>
</tr>
<tr>
<td>UDATA</td>
<td>Underline all the data columns for a row, while not underlining the row name columns.</td>
</tr>
<tr>
<td>UNAME</td>
<td>Underline all the row name columns in the preceding row while not underlining the data columns.</td>
</tr>
<tr>
<td>UNAMEONDIMENSION</td>
<td>Underline the row member names in a row whenever a member from the same dimension as the member in the command changes. Use the NOUNAMEONDIM command to turn off underlining for new rows.</td>
</tr>
</tbody>
</table>

Suppressing Data Formatting

You can suppress data that you do not want to be displayed in the final report by using the SUPPRESS commands listed in Table 99:

Table 99  Report Writer Commands: Suppress Data Formatting

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPBRACKETS</td>
<td>Brackets around negative numbers. Use the BRACKETS command to re-enable brackets.</td>
</tr>
<tr>
<td>SUPCOMMAS</td>
<td>Commas in numbers greater than 999. Use the COMMAS command to re-enable commas.</td>
</tr>
<tr>
<td>SUPZEROROWS</td>
<td>Rows that have only zero data values. Use INCZEROROWS or INCEMPTYROWS to re-enable the display.</td>
</tr>
<tr>
<td>SUPEUROPEAN</td>
<td>The European method for displaying numbers (2,000,01 whereas the non-European equivalent is 2,000.01). Use the EUROPEAN command to re-enable European number display.</td>
</tr>
<tr>
<td>SUPFEED</td>
<td>The automatic insertion of a page break whenever the number of lines on a page exceeds the current PAGELENGTH setting.</td>
</tr>
<tr>
<td>SUPFORMATS</td>
<td>Formats that produce output such as underlines and skips. Use INCFORMATS to re-enable the display.</td>
</tr>
<tr>
<td>SUPMASK</td>
<td>Text masks that were defined in the report using the MASK command. Use INCMASK to re-enable the display.</td>
</tr>
</tbody>
</table>

See “Suppressing Page, Column, and Row Formatting” on page 552 for descriptions of the SUPPRESS commands used to suppress formats.
**Indenting**

Use indenting to provide visual clues to row levels of the script. Table 100 on page 558 lists the indenting commands:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDENT</td>
<td>Shift the first-row names column in column output order by a specified number of characters.</td>
</tr>
<tr>
<td>INDENTGEN</td>
<td>Indent subsequent row members in the row names column based on the generation in the database outline. Use the NOINDENTGEN command to left-justify row member names based on generation name.</td>
</tr>
</tbody>
</table>

**Inserting Custom Titles**

Titles are user-generated and optional, in contrast to the automatically generated page and column headings and row names, which describe the data on the report page.

Titles repeat at the top of each report page and provide the following information about a report:

- A date and time stamp
- The user name of the person running the report
- Page numbers
- The name of the source database
- Any other descriptive information

To add a title to the report, use the TEXT command, combined with any of the following:

- Any predefined keywords that automatically display information in the report
- A text string that you define

**Note**: You can also use the TEXT command at the bottom of the report to provide summary information.

**Replacing Missing Text or Zeros with Labels**

When you run a report, there are often many empty data cells where no data was applicable to the retrieval, or cells where the value is zero.

The report displays the default #MISSING label in the data cell when no data values are found.

To replace the #MISSING label with a text label, at the point in the script where you want to replace the #MISSING label with a text label, type:

```
{MISSINGTEXT "text"}
```

where text is the text string that to be displayed in the data cells.

You can place the MISSINGTEXT command at any point in the report script; the command applies throughout the script.
Note: You can also suppress #MISSING labels from appearing in the report. See “Suppressing Data Formatting” on page 557 for descriptions of SUPPRESS commands used to suppress labels.

To replace zeros with a text label, at the point in the script where you want to replace zeros with a text label, type:

\{(ZEROTEXT \["text"]\)\}

where text is the text string to be displayed in the data cells.

Note: If a value is equal to #MISSING, any string inserted after that value using the AFTER command does not print. AFTER strings also do not print if you replace #MISSING with some other value (such as 0).

### Adding Blank Spaces

Adding blank spaces in a report draws the reader to key information, such as totals. Table 101 lists the commands for adding blank space:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKIP</td>
<td>Add one or more blank lines in the final report.</td>
</tr>
<tr>
<td>SKIPONDIMENSION</td>
<td>Add a blank line when a member from the same dimension as the specified member in the command changes on the next line in the report. Use the NOSKIPONDIMENSION command to turn off insertion of a new line.</td>
</tr>
</tbody>
</table>

### Changing How Data Values Display

You can change how data values display in the final report by using the commands listed in Table 102:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMAS</td>
<td>Turn on the display of commas for numbers greater than 999 after commas have been suppressed with either a SUPCOMMAS or SUPALL command.</td>
</tr>
<tr>
<td>BRACKETS</td>
<td>Turn on the display of brackets around negative numbers instead of negative signs, after using the SUPBRACKETS command earlier in the script.</td>
</tr>
<tr>
<td>AFTER</td>
<td>Include a percentage sign or other character after the data values.</td>
</tr>
<tr>
<td>BEFORE</td>
<td>Include a dollar sign or other character before the data values.</td>
</tr>
<tr>
<td>Report Command</td>
<td>Description</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>EUROPEAN</td>
<td>Use the European method for displaying numbers where decimal points are used as the thousands separator character and commas separate the decimal portion of the number from the integer portion (2,000,01; the non-European equivalent is 2,000.01).</td>
</tr>
<tr>
<td>MASK</td>
<td>Overwrite text in each output row with a specified characters and position.</td>
</tr>
</tbody>
</table>

## Selecting and Sorting Members

The data that is displayed in the final report is based upon the members that you select and the order in which you display them. In addition, you can use conditional retrievals to further refine selecting and sorting members.

## Selecting Members

Member selection commands are extraction commands that select ranges of members based on database outline relationships, such as sibling, generation, and level. Using member selection commands ensures that any changes to the outline are automatically reflected in the report, unless you change the member name on which the member selection command is based. Attribute dimensions can be included in member selection commands.

Table 103 lists the member selection commands:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALLINSAMEDIM</td>
<td>Select members from the same dimension as the dimension member.</td>
</tr>
<tr>
<td>ALLSIBLINGS</td>
<td>Include siblings of the specified member.</td>
</tr>
<tr>
<td>ANCESTORS</td>
<td>Include ancestors of the specified member.</td>
</tr>
<tr>
<td>ATTRIBUTE</td>
<td>Select a base dimension member based on its attributes.</td>
</tr>
<tr>
<td>CHILDREN</td>
<td>Select members in the level immediately below the specified member.</td>
</tr>
<tr>
<td>DESCENDANTS</td>
<td>Include descendants of the specified member to the report, excluding the dimension top.</td>
</tr>
<tr>
<td>DIMBOTTOM</td>
<td>Select all level 0 members for the dimension to which a given member belongs.</td>
</tr>
<tr>
<td>DIMTOP</td>
<td>Include the top member of the dimension.</td>
</tr>
<tr>
<td>IANCESTORS</td>
<td>Include a member and its ancestors.</td>
</tr>
<tr>
<td>ICHILDREN</td>
<td>Select the specified member and members in the level immediately below it.</td>
</tr>
<tr>
<td>IDESCENDANTS</td>
<td>Include the specified member and its descendants.</td>
</tr>
<tr>
<td>IPARENT</td>
<td>Include the specified member and its parent.</td>
</tr>
<tr>
<td>Report Command</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>OFSAMEGEN</td>
<td>Include members from the same dimension and generation as the specified member.</td>
</tr>
<tr>
<td>ONSAMELEVELAS</td>
<td>Include members from the same dimension and on the same level as the specified member.</td>
</tr>
<tr>
<td>PARENT</td>
<td>Include the parent of the specified member to the report.</td>
</tr>
<tr>
<td>TODATE</td>
<td>Extract data for a specified date or for a time period before or after a specific date.</td>
</tr>
<tr>
<td>WITHATR</td>
<td>Include base dimension members associated with the specified attribute dimension.</td>
</tr>
</tbody>
</table>

**Selecting Members by Using Generation and Level Names**

*Generation* and *level name* selection commands identify a specific level or generation of members based on either of the following items:

- The default generation or level name in the outline
- The user-defined generation or level name in the outline

When you use generation and level names, changes to the outline are automatically reflected in the report. You can define your own generation and level names or use the default names provided by Essbase. See “Generations and Levels” on page 63.

Using generation or level names whenever possible makes the report easier to maintain. Because you do not have to specify a member name in the report, you need not change the report if the member name is changed or deleted from the database outline.

**Note:** Generation and level names are standalone commands. You cannot use them in place of member names in report extraction or formatting commands such as `<DESCENDANTS` or `<CHILDREN`.

To use default level names, at the point in the script where you want to select a member by the default level name, use the format:

\[ Lev_n, dimensionName \]

where \( n \) is the level number.

*dimensionName* is the name of the dimension from which you want to select the members.

**Note:** Do not insert a space after the comma.

For example, \( Lev1, Year \) selects all the level 1 members of the Year dimension.

To use default generation names, at the point in the script where you want to select a member by the default generation name, use the format:

\[ Gen_n, dimensionName \]

For example, \( Gen1, Year \) selects all the generation 1 members of the Year dimension.
where \( n \) is the generation number.

dimensionName is the name of the dimension from which you want to select the members.

**Note:** Do *not* insert a space after the comma.

For example, Gen2,Year selects all the generation 2 members of the Year dimension.

**Note:** These default generation and level names are not displayed in Outline Editor.

The following example report script uses the default generation name Gen2,Year to generate a report that includes the members Qtr1, Qtr2, Qtr3, and Qtr4 from the Year dimension:

```
<PAGE(Product)
<COLUMN(Year)
<ROW (Measures)
{OUTALTNAMES}
Cola
Gen2,Year
Sales Profit
!
```

Resulting report:

```
Cola Market Scenario
Qtr1   Qtr2   Qtr3   Qtr4
======== ======== ======== ========
Sales      14,585   16,048   17,298   14,893
Profit    5,096    5,892    6,583    5,206
```

**Selecting Duplicate Members**

You can select duplicate member name outlines by using the commands listed in Table 104:

**Table 104**  Report Writer Commands: Select Duplicate Members

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>REPQUALMBR</td>
<td>Displays member names for any unique member names and a qualified name for any duplicate member names.</td>
</tr>
<tr>
<td>REPMBR</td>
<td>Displays member names only for members of the dimension specified.</td>
</tr>
<tr>
<td>REPMBRALIAS</td>
<td>Displays member names followed by aliases.</td>
</tr>
<tr>
<td>REPALIAS</td>
<td>Displays alias names followed by member names for members in the report output.</td>
</tr>
<tr>
<td>REPALIASMBR</td>
<td>Displays aliases followed by member names for members of the dimension specified.</td>
</tr>
<tr>
<td>OUTPUTMEMBERKEY</td>
<td>Displays a member identifier for duplicate member names.</td>
</tr>
</tbody>
</table>
Selecting Dynamic Time Series Members

You create and identify dynamic members in the database outline; they are members calculated only during user retrieval requests, such as generating a report script. The time dimension has a special Dynamic Time Series option. The Dynamic Time Series option has reserved the following generation names that you can define in the outline alias table, as listed in Table 105:

<table>
<thead>
<tr>
<th>Generation Name</th>
<th>Reserved Names</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>H-T-D</td>
<td>History-to-Date</td>
</tr>
<tr>
<td>Year</td>
<td>Y-T-D</td>
<td>Year-to-Date</td>
</tr>
<tr>
<td>Season</td>
<td>S-T-D</td>
<td>Season-to-Date</td>
</tr>
<tr>
<td>Period</td>
<td>P-T-D</td>
<td>Period-to-Date</td>
</tr>
<tr>
<td>Quarter</td>
<td>Q-T-D</td>
<td>Quarter-to-Date</td>
</tr>
<tr>
<td>Month</td>
<td>M-T-D</td>
<td>Month-to-Date</td>
</tr>
<tr>
<td>Week</td>
<td>W-T-D</td>
<td>Week-to-Date</td>
</tr>
<tr>
<td>Day</td>
<td>D-T-D</td>
<td>Day-to-Date</td>
</tr>
</tbody>
</table>

See “Applying Predefined Generation Names to Dynamic Time Series Members” on page 452.

Note: The database header message for the outline identifies the number of dynamic members that are enabled in the current outline.

To select a Dynamic Time Series member, at the point in the script where you want to select a Dynamic Time Series member, use either:

- `<LATEST memberName`
  
  where `memberName` is the name of the member in the time dimension.

  The `<LATEST` command, a global command, is applied to the entire report script and is an aggregation based on the lowest level member within the dimension.

- `reservedName(memberName)`
  
  where `reservedName` is the reserved Dynamic Time Series generation name and the `memberName` is the name of the member in the time dimension.

  If you use this syntax to specify a Dynamic Time Series, the time series name is associated only to the member listed in the argument.

When you run the report script, the members are dynamically updated and the information is incorporated into the final report.
Note: You must enter the Dynamic Time Series string exactly as it is displayed in the database outline; you cannot create a string and incorporate it into the final report. You can create an alias table for the Dynamic Time Series members in the database outline and use the aliases instead of the predefined generation names.

Selecting Members by Using Boolean Operators

Boolean operators enable you to specify precise member combinations within a report—useful when dealing with large outlines. Use the AND, OR, and NOT Boolean operators, combined with extraction commands, to refine member selections within the report script.

- AND, when all conditions must be met.
- OR, when one condition of several must be met.
- NOT, to choose the inverse of the selected condition.

To create a Boolean expression using operators, at the point in the script where you want to use linking, enter the format:

```<LINK (extractionCommand [operator extractionCommand])>
```

where `extractionCommand` is the member selection command to retrieve data from, and `operator` is either the AND or OR operator.

Note: Select members from the same dimension. All extraction command arguments must be enclosed in parentheses, as in the example above. NOT can be associated only with an extraction command and does not apply to the entire expression.

You can use Boolean operators with member selection commands, such as UDA and wildcards. For a list of all valid extraction commands that can be used with the LINK command, see the Oracle Essbase Technical Reference.

Examples:

The following example selects sweet products from the “100” subtree, plus all products on the same level as “100-10”:

```<LINK ((<IDESCENDANTS("100") AND <UDA(Product,Sweet)) OR ONSAMELEVELAS "100"-10")>
```

The following example selects products that are not sweet from the “100” subtree, plus all products on the same level as “100-10”.

```<LINK ((<IDESCENDANTS("100") AND NOT <UDA (Product,Sweet)) OR ONSAMELEVELAS "100"-10")>
```

For additional examples of narrowing member selection criteria, see the Oracle Essbase Technical Reference.
Selecting Members by Using Substitution Variables

Substitution variables act as global placeholders for information that changes regularly; you set the substitution variables on the server through Administration Services, MaxL, or ESSCMD, and assign a value to each variable. You can then change the value anytime, reducing manual changes to a report script. You must have the role of at least Database Manager to set substitution variables.

For example, many reports are dependent on reporting periods; if you generate a report based on the current month, you must manually update the report script every month. With a substitution variable set on the server, such as CurMnth, you can change the assigned value each month to the appropriate time period. Essbase dynamically updates the information when you run the final report.

See “Using Substitution Variables” on page 120 for a comprehensive discussion about creating and changing substitution variables in the database outline. For information about the leading & character, see the Oracle Essbase Technical Reference.

You can set substitution variables at the following levels:

- Server, providing access to the variable from all applications and databases on the server
- Application, providing access to the variable from all databases within the application
- Database, providing access to the specified database

To use a substitution variable, at the point in the script where you want to use the variable, use the format:

```
&variableName
```

where `variableName` is the same as the substitution variable set on the server.

For example,

```<ICHILDREN &CurQtr```

becomes

```<ICHILDREN Qtr1```

**Note:** The substitution variable must be accessible from the application and database against which you are running the report. Also, the variable name can be an alphanumeric combination (for variable name size limit, see Appendix A, “Limits”). You cannot use spaces or punctuation in the variable name.

When you run the report script, Essbase replaces the variable name with the substitution value, and that information is incorporated into the final report.

Selecting Members by Using Attributes

Using attributes, you can select and report on data based on one or more characteristics of base members. You can group and analyze members of base dimensions according to their attributes.
You can also perform crosstab reporting based on multiple attributes. Using the `<ATTRIBUTE` command, you can select all the base dimension members associated with an attribute. For example, you can query the Sample.Basic database on how many 12-ounce units of grape and orange juice were sold in New York during the first quarter.

To select a member based on a specific attribute, at the point in the script where you want to select members based on a specific attribute, use the format:

```plaintext`
<ATTRIBUTE memberName
```

where `memberName` is the name of an attribute-dimension member; for example:

```plaintext`
<ATTRIBUTE Bottle
```

returns all products packaged in bottles.

Attribute dimensions have members with the same name. For example, the attribute dimension Ounces and the attribute dimension Age each can have a member named 24. To ensure that a query returns correct results, specify the full attribute-dimension member name. The following format returns all products that are packaged in 24 oz. units:

```plaintext`
<ATTRIBUTE Ounces_24
```

Attribute types can be text, numeric, date, and Boolean. See “Understanding Attribute Types” on page 166.

For a sample report, see “Sample 20: Using Attributes in Member Selection” in the Oracle Essbase Technical Reference.

Selecting Members by Attribute Association

You can select all base dimension members associated with one or more attributes using the `WITHATTR` command. For example, you can display all products associated with a member of the Pkg Type attribute dimension. At the point in the script where you want to select the members, enter the following syntax:

```plaintext`
<WITHATTR (attributeDimensionName, "Operator", Value)
```

The following command returns all base dimension members that are associated with the attribute Small from the Population attribute dimension.

```plaintext`
<WITHATTR (Population, "IN", Small)
```

The following command returns all base dimension members that are associated with the attribute 32 from the Ounces attribute dimension.

```plaintext`
<WITHATTR (Ounces, ",<", 32)
```

**Note:** The `<WITHATTR` command can be used within the `LINK` command to refine member selections, as illustrated in the following example: `<LINK ((<WITHATTR (Ounces, ",<", 32) AND <WITHATTR ("Pkg Type", ",=", Can))

For a sample report, see “Sample 21: Using the WITHATTR Command in Member Selection” in the Oracle Essbase Technical Reference.
Selecting Members by Date

You can extract attributes data for a specific date, for a period before a specific date, or for a period after a specific date using the <TODATE command. For example, you can extract information on all products that were introduced on December 10, 1996, before December 10, 1996, or after December 10, 1996. The <TODATE command must be used within the <WITHATTR command. For example, the following format returns data on all products that were introduced on December 10, 1996.

<WITHATTR ("Intro Date", ",=", <TODATE ("mm-dd-yyyy", "12-10-1996")

The following format returns data on all products that were introduced before December 10, 1996.

<WITHATTR ("Intro Date", ",<", <TODATE ("mm-dd-yyyy", "12-10-1996")

The following format returns data on all products that were introduced after December 10, 1996.

<WITHATTR ("Intro Date", ",>", <TODATE ("mm-dd-yyyy", "12-10-1996")

Note: The types of date format supported are mm-dd-yyyy or dd-mm-yyyy. The date must be between January 1, 1970 and January 1, 2038 (inclusive).

Selecting Members by Using UDAs

UDAs enable you to select and report on data based on a common characteristic. UDAs are useful when performing member selections from an outline with an unbalanced hierarchy (in which the members of a dimension do not have identical member levels). You can set UDAs on the server for characteristics such as color, size, gender, flavor, or any other common member characteristics. You must have Database Manager permissions to set UDAs on the server.

UDAs are different from attributes. UDAs are member labels that you create to extract data based on a particular characteristic, but you cannot use UDAs to group data, to perform crosstab reporting, or to retrieve data selectively. For data analysis, UDAs are not as powerful as attributes.

You can use the UDA command with Boolean operators to refine report queries. See “Selecting Members by Using Boolean Operators” on page 564 for examples.

Also see “Creating UDAs” on page 158.

To select members based on a UDA, at the point in the script where you want to select members based on the UDA, use the format:

<UDA (dimensionName, "UDAstring")

where dimensionName is the dimension of the member that you select, and UDAstring is the UDA that is set on the server. The following example selects members of the Product dimension with the Sweet attribute.

<UDA (product, "Sweet")

When you run the report script, Essbase incorporates the UDA members into the final report.
Selecting Members by Using Wildcards

You can use wildcards to select members, generation, or level names in a report script. If you use member names, Essbase searches the member and all descendants of that member. If you specify a generation or level name, Essbase searches only members of that generation or level.

Using wildcards reduces the member information needed for a script and simplifies script maintenance.

The following two types of wildcards are supported in Report Writer:

- Trailing asterisks (*) at the end of the string to search for common member properties
- Pattern-matching question marks (?) anywhere in the string to represent any single-character member property

To select members using a trailing wildcard, at the point in the script where you want to select members using a trailing wildcard, use the format:

```<MATCH (memberName,"character*")>```

where `memberName` is the name of the member that you select, and `character` is the beginning character in the following member. The following report script:

```<MATCH (Year,"J*")>```

returns Jan, Jun, and Jul.

To select members using a pattern-matching wildcard, at the point in the script where you want to select members using a pattern-matching wildcard, use the format:

```<MATCH (memberName,"??characters")>```

where `memberName` is the name of the member to select, and `characters` are the characters in the following member. The following report script:

```<MATCH (Product,"???-10")>```

returns 100-10, 200-10, 300-10, and 400-10.

**Note:** In the Sample.Basic database example, three question marks represent the variable three characters in the string. If two question marks were used in the example, no matches were found. You can place question mark wildcards anywhere in the match string.

Suppressing Shared Members

In conjunction with the following items, you can suppress the display of later instances of shared members when you extract data for a report:

- Generation names
Suppress shared members to eliminate unnecessary data duplication within the report.

To suppress shared members, at the point in the script from which you want to suppress a shared member, use:

```
<SUPSHARE
```

`<SUPSHARE` suppresses the display of shared members for the duration of the report script. Use `<SUPSHAREOFF` to reset the display of shared members.

## Selecting How Member Names are Displayed

Aliases make reports easier to read and help the reader focus on the data values rather than the meanings of member names. You can display members in a report by their aliases. For example, you can display page, column, and row names, such as Diet Cola or Caffeine Free Cola, rather than the corresponding member names 100-20 and 100-30.

Qualified member names help identify specific members in duplicate member databases. You can display the qualified member name when duplicate member names are encountered; for example, `[State].[New York]` and `[City].[New York]` uniquely identify the member name New York. For information about duplicate member names, see Chapter 8, “Creating and Working With Duplicate Member Outlines”.

Table 106 lists the commands for displaying member names:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;REPALIAS</code></td>
<td>Display alias names for members of the specified dimension</td>
</tr>
<tr>
<td><code>&lt;REPALIASMBR</code></td>
<td>Display alias names followed by member names</td>
</tr>
<tr>
<td><code>&lt;REPMBRALIAS</code></td>
<td>Display member names followed by alias names</td>
</tr>
<tr>
<td><code>&lt;REPMBR</code></td>
<td>Display member names only for members of the dimension specified</td>
</tr>
<tr>
<td><code>&lt;REPOQUALMBR</code></td>
<td>Display member names for unique member names and display qualified names for duplicate member names</td>
</tr>
<tr>
<td><code>&lt;OUTPUTMEMBERKEY</code></td>
<td>Display member identifiers for duplicate member names, and member and alias names.</td>
</tr>
</tbody>
</table>

`<REPALIAS`, `<REPALIASMBR`, `<REPMBRALIAS`, `<REPMBR`, and `<REPOQUALMBR` are format commands that can be applied to specific dimensions. They override one another. For example, when Report Writer encounters `<REPALIASMBR Product`, it displays the alias name in front of the member name. If `<REPMBRALIAS Product` is found later in the script, Report Writer then displays the member name in front of the alias name. For duplicate member outlines, the `<OUTPUTMEMBERKEY` command can be combined with any of the other commands in
the table. The member identifier, and the member name, alias name, or both, are included in the report output.

**Example Displaying a Member Name and Alias**

You can display members in a report as a combination of the member name and its alias. Combining the member name and alias enables you to display more descriptive page, column, and row names, such as Diet Cola 100-20 or 100-30 Caffeine Free Cola.

To display member names and aliases, use the `<REPALIASMBR` command or `<REPMBRALIAS` command in a report script.

This example uses `<REPALIASMBR` to display the alias name ahead of the member name:

```
<PAGE (Product, Measures)
<COLUMN (Scenario, Year)
Actual
<ICHILDREN Qtr1
<ROW (Market)
<DESCENDANTS "300"
<REPALIASMBR Product
!
```

Resulting report:

```
<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Cream 300-10</td>
<td>800</td>
<td>864</td>
<td>880</td>
<td>2,544</td>
</tr>
<tr>
<td>Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanilla Cream 300-20</td>
<td>220</td>
<td>231</td>
<td>239</td>
<td>690</td>
</tr>
<tr>
<td>Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet Cream 300-30</td>
<td>897</td>
<td>902</td>
<td>896</td>
<td>2,695</td>
</tr>
<tr>
<td>Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cream Soda 300</td>
<td>1,917</td>
<td>1,997</td>
<td>2,015</td>
<td>5,929</td>
</tr>
<tr>
<td>Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

**Sorting Members**

When you sort the members you include in a report, be aware that sorting commands affect members differently, depending on whether they are referenced by member selection commands or by static member definitions. Report Writer commands sort members by member name or data values.

*Member selection commands* such as `<CHILDREN` and `<DESCENDANTS`, select members in the order specified by the database outline. By default, a report that includes member selection
commands displays members in their hierarchical database outline order. You can override this default by specifying a sort order with a sort command.

Because sort commands affect the order of the members selected by the member selection commands, they must precede any member selection commands to which they apply. If you specify a sort command, the sort order is preserved until another sort command overrides it.

Sort commands modify member selection commands, such as `<CHILDREN` and `<DESCENDANTS`. Sort commands do not perform final sorting of rows during formatting. Be careful when you place a sort command in the report script that you do not start the sort too soon, and that you override it to turn it off, if necessary, before the next selection command.

Sort commands have no effect on static member definitions.

Table 107 lists the member sort commands:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SORTALTNAMES</td>
<td>Sort members alphabetically by the alias name of the member, if aliases are used in the report script.</td>
</tr>
<tr>
<td>SORTASC</td>
<td>Sort following members in ascending order starting with the lowest generation and moving toward the highest generation.</td>
</tr>
<tr>
<td>SORTDESC</td>
<td>Sort following members in descending order starting with the highest generation and moving toward the lowest generation.</td>
</tr>
<tr>
<td>SORTGEN</td>
<td>Sort following members according to the generation of the member in the database outline.</td>
</tr>
<tr>
<td>SORTLEVEL</td>
<td>Sort following members according to the level of the member in the database outline.</td>
</tr>
<tr>
<td>SORTMBRNAMES</td>
<td>Sort members alphabetically by member name.</td>
</tr>
<tr>
<td>SORTNONE</td>
<td>Disable all previous sorting commands so that members added to the report follow the normal hierarchical order based on the database outline.</td>
</tr>
</tbody>
</table>

**Restricting and Ordering Data Values**

You can perform conditional retrieval and data sorting in reports by using the commands listed in Table 108:

<table>
<thead>
<tr>
<th>Report Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOP</td>
<td>Specify the number of rows to return. These rows must contain the top values of a specific data column.</td>
</tr>
<tr>
<td>BOTTOM</td>
<td>Specify the number of rows to return. These rows must contain the lowest values of a specific data column.</td>
</tr>
<tr>
<td>RESTRICT</td>
<td>Specify the conditions the columns of a data row must satisfy before the row is returned.</td>
</tr>
<tr>
<td>ORDERBY</td>
<td>Specify the ordering of the rows of a report, based on the data values of data columns.</td>
</tr>
</tbody>
</table>
Configurable variables are used during conditional retrievals. See “Changing Buffer Size” on page 889.

Understanding the Order of Operation

<RESTRICT, <ORDERBY, <TOP, and <BOTTOM can be displayed anywhere in the report script and in any order. When using these commands, place all global script formatting commands before a Page member or a Column member, or before a <PAGE command or <COLUMN command that expands into Page or Column members (for example, IDESCENDANTS, or ICHILDREN).

Essbase extracts data and applies restrictions and ordering in the following order:

1. Applies RESTRICT and any existing restrictive option such as SUPPMISSING, SUPZEROS, and SUPEMPTYROWS.
2. Applies TOP or BOTTOM, or both.
3. Applies ORDERBY.

Essbase then returns rows and displays output.

Using TOP, BOTTOM, and ORDERBY with Sorting Commands

<TOP, <BOTTOM, and <ORDERBY commands sort the output of a report by its data values. Essbase applies <TOP and <BOTTOM first, followed by <ORDERBY. If the report contains a sort command, such as <SORTMBR NAMES, which sorts members and not data, Essbase applies the sort command first, followed by <TOP and <BOTTOM, and then <ORDERBY. <ORDERBY is the final sort.

Using RESTRICT

The arguments of the <RESTRICT command let you specify qualifications for selecting rows. Essbase includes only qualified rows in the resulting report output.

<RESTRICT works only on the range of rows that you specify in a row member selection.

Essbase processes the restrictions from left to right, and does not allow grouping with parentheses in the list of arguments.

For example, the following example is not a valid syntax:

RESTRICT (... (@DATACOLUMN(1) > 300 AND @DATACOLUMN(2) < 600) ...)

Use only one <RESTRICT per report, as terminated by the ! command. If a report script contains multiple reports, each <RESTRICT overwrites the one in the previous report. For example:

RESTRICT (@DATACOLUMN(1) > @DATACOLUMN(2) AND 800 < @DATACOLUMN(3) OR @DATACOLUMN(4) <> #MISSING)

This <RESTRICT command is equivalent in operation to the following syntax:
Using ORDERBY

The `<ORDERBY` command orders the output rows according to the data values in the specified columns. Using an optional direction argument to the ORDERBY command, you can specify either an ascending order using the ASC flag, or descending order using the DESC flag. You can specify different sorting directions in different columns of the same report. If no direction argument is used, ascending (ASC) is the default order.

To determine the set of rows to be ordered, specify the row grouping dimension in the command. The default row grouping is the innermost row dimension.

Only one `<ORDERBY` is allowed per report, as terminated by the `!` command. If a report script contains multiple reports, each `<ORDERBY` overwrites the one in the previous report.

Using ORDERBY with Formatting Commands

`<ORDERBY` command guidelines:

- Avoid using row formatting commands when you are using `<ORDERBY` in a report. Formatting commands scheduled for a given point in the report may show up unexpectedly because `<ORDERBY` shifted the row that contained the member with formatting.
- In general, avoid using row formatting commands, and place overall script formatting before column members or commands that expand the column members (such as “ICHILDREN column dimension, `<column ...`, column member”).

Using TOP and BOTTOM

The `<TOP` and `<BOTTOM` commands specify the qualified number of rows with the highest or lowest column values, respectively, within a row group to be returned in a report. If the row group member is not specified, the innermost row group dimension is the default row group.

You can use `<TOP` and `<BOTTOM` together in the same report, but only one `<TOP` and one `<BOTTOM` is allowed per report. In this case, the two commands should have the same data column as their argument in order to prevent confusion. The result of the `<TOP` and `<BOTTOM` command is sorted by the value of the data column specified in the command in descending order.

`<TOP` and `<BOTTOM` work only on the range of rows specified in row member selection.

**Note:** If `<TOP` or `<BOTTOM` occurs with `<ORDERBY`, the ordering column of the `<ORDERBY` does not have to be the same as the data column of the `<TOP` or the `<BOTTOM`.  

573
If any combination of the `<ORDERBY`, `<TOP`, or `<BOTTOM` commands exist together in a report script, the row group member (`<rowGroupMember>`) should be the same. This restriction removes any confusion about the sorting and ordering of rows within a row group.

**Caution!** Essbase discards rows that contain #MISSING values in their sorting column from the set of extracted data rows before the applying the TOP or BOTTOM sort.

For example, this command returns two rows with the highest data values in col2 (Actual, Qtr2) per row group:

```
1- TOP (2, @DATACOLUMN(2))
```

When you run this command against the Sample.Basic database, the row grouping is Product, which implies that for Florida, the report returns 100-10 and 100-30 product rows, and for Maine, the report returns 100-10, 100-40 product rows, and so on:

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th></th>
<th></th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qtr1</td>
<td>Qtr2</td>
<td>Qtr1</td>
<td>Qtr2</td>
</tr>
<tr>
<td>Florida</td>
<td>100-10</td>
<td>570</td>
<td>670</td>
<td>570</td>
</tr>
<tr>
<td></td>
<td>100-20</td>
<td>235</td>
<td>345</td>
<td>321</td>
</tr>
<tr>
<td></td>
<td>100-30</td>
<td>655</td>
<td>555</td>
<td>455</td>
</tr>
<tr>
<td></td>
<td>100-40</td>
<td>342</td>
<td>342</td>
<td>432</td>
</tr>
<tr>
<td>Maine</td>
<td>100-10</td>
<td>600</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>100-20</td>
<td>734</td>
<td>334</td>
<td>734</td>
</tr>
<tr>
<td></td>
<td>100-30</td>
<td>324</td>
<td>321</td>
<td>235</td>
</tr>
<tr>
<td></td>
<td>100-40</td>
<td>432</td>
<td>342</td>
<td>289</td>
</tr>
<tr>
<td>New York</td>
<td>100-10</td>
<td>1010</td>
<td>1210</td>
<td>1110</td>
</tr>
<tr>
<td></td>
<td>100-20</td>
<td>960</td>
<td>760</td>
<td>650</td>
</tr>
<tr>
<td></td>
<td>100-30</td>
<td>324</td>
<td>550</td>
<td>432</td>
</tr>
<tr>
<td></td>
<td>100-40</td>
<td>880</td>
<td>980</td>
<td>880</td>
</tr>
<tr>
<td></td>
<td>100-50</td>
<td>#MI</td>
<td>#MI</td>
<td>#MI</td>
</tr>
</tbody>
</table>

This example returns rows with the highest data values in col2 (Actual, Qtr2) per report, because the row grouping is the “market.”

```
2- TOP ("market", 3, @DATACOLUMN(2))
```

Resulting rows:

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th></th>
<th></th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qtr1</td>
<td>Qtr2</td>
<td>Qtr1</td>
<td>Qtr2</td>
</tr>
<tr>
<td>New York</td>
<td>100-10</td>
<td>1010</td>
<td>1210</td>
<td>1110</td>
</tr>
<tr>
<td></td>
<td>100-40</td>
<td>880</td>
<td>980</td>
<td>880</td>
</tr>
<tr>
<td>Maine</td>
<td>100-10</td>
<td>600</td>
<td>800</td>
<td>800</td>
</tr>
</tbody>
</table>

This example returns two rows with the lowest data values in col2 (Actual, Qtr2) per row group.

```
3- BOTTOM ("market", 2, @DATACOLUMN(2))
```

Resulting rows:

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th></th>
<th></th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qtr1</td>
<td>Qtr2</td>
<td>Qtr1</td>
<td>Qtr2</td>
</tr>
<tr>
<td>Maine</td>
<td>100-20</td>
<td>734</td>
<td>334</td>
<td>734</td>
</tr>
<tr>
<td></td>
<td>100-30</td>
<td>324</td>
<td>321</td>
<td>235</td>
</tr>
</tbody>
</table>

**Note:** `<TOP` and `<BOTTOM` put an upper limit on the number of (qualified) rows returned after all restrictions are applied. This upper limit equals the number of rows in the `<TOP` plus the number of rows in the `<BOTTOM` commands.
Understanding How Other Report Configurations Affect TOP and BOTTOM

When using the <TOP and <BOTTOM commands, be aware that some other commands affect their operation. In particular, Essbase treats the <SUPPMISSING, <SUPZEROS, and <SUPEMPTYROWS options as restrictions and applies them to the extracted rows along with the <RESTRICT command restrictions. Essbase applies these optional restrictions to the data rows before processing the <TOP or <BOTTOM commands, and before applying an <ORDERBY command.

Using TOP and BOTTOM with Formatting Commands

Whenever a formatting command occurs in a report, it is appended to the member that follows it. For example, in this sequence, {UCOLUMNS}, the underline columns command is appended internally to the member that comes next. In Script 1, it is appended to the row member that can be described as “first child of market, assuming Florida.”

```
SCRIPT 1
....
< ROW Market {UCOLUMNS}
{UCOLUMNS }
<ICHILDREN Market < TOP ....
SCRIPT 2
....
{UCOLUMNS}
< Florida (row member)
< BOTTOM ....
```

Script 2, appends {UCOLUMNS} to the row member Florida. Essbase executes {UCOLUMNS} whenever it encounters a row that has row member Florida. If the TOP or BOTTOM command returns a row that does not contain Florida, the formatting commands appended to the rows are never executed.

Therefore, it is a good idea to place all general formatting commands before a <COLUMN command, or a command that expands into column members to guarantee that the formatting is executed. However, do not use formatting commands that work on rows, because these rows may never be picked up by the <TOP or <BOTTOM command. Also avoid using <SAVEROW and <CALCULATE ROW with the <TOP and <BOTTOM commands.

Converting Data to a Different Currency

If the database has a currency partition, you can calculate currency conversions in report scripts. Use the <CURRENCY command to set the output currency and currency type. Use the <CURHEADING command to display the currency conversion heading.

**Note:** Currency conversion is not supported across transparent partitions.

For information about creating a currency conversion application, see “Building Currency Conversion Applications and Performing Conversions” on page 211.
Generating Reports Using the C, Visual Basic, and Grid APIs

You can generate reports using the C, Visual Basic, and C Grid APIs, as listed in Table 108:

Table 109  Report APIs

<table>
<thead>
<tr>
<th>Task</th>
<th>C API Function</th>
<th>Visual Basic API Function</th>
<th>C Grid API Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start sending a report specification to the active database.</td>
<td>ESSBEGINREPORT</td>
<td>ESBBEGINREPORT</td>
<td>ESSGBEGINREPORT</td>
</tr>
<tr>
<td>Mark the end of a report specification being sent to the active database.</td>
<td>ESSENDREPORT</td>
<td>ESBENDREPORT</td>
<td>N/A</td>
</tr>
<tr>
<td>Send a report specification to the active database as a single string.</td>
<td>ESSREPORT</td>
<td>ESBREPORT</td>
<td>N/A</td>
</tr>
<tr>
<td>Send a report specification to the active database from a file.</td>
<td>ESSREPORTFILE</td>
<td>ESBREPORTFILE</td>
<td>ESSREPORTFILE</td>
</tr>
</tbody>
</table>

See the Oracle Essbase API Reference for descriptions and syntax.
Introduction

MDX, the data manipulation language for Essbase, is a query language for multidimensional databases that can be used to execute grid retrievals. MDX expressions can also be used to define formulas on Essbase aggregate storage databases, to query metadata, to qualify member names, and to describe data or outline subsets for conditional triggers and other Essbase functionality.

This chapter provides an introduction to MDX with a series of practice exercises.

To complete the exercises, which are based on the Sample.Basic database, use the MaxL Shell. Before continuing, start Essbase and log on to MaxL Shell. Additionally, be prepared to use a text editor to create the sample queries as presented in this chapter.

Note: You can use the MDX Script Editor in Administration Services Console instead of the MaxL Shell. However, the instructions in this chapter use the MaxL Shell.

Understanding Elements of a Query

In this section you will create a template to use as a basis for developing simple queries.

Most queries can be built upon the following grammatical framework:
SELECT
{}  
ON COLUMNS  
FROM Sample.Basic

SELECT in line 1 is the keyword that begins the main body of all MDX statements.
The braces { } in line 2 are a placeholder for a set. In the above query, the set is empty, but the braces remain as a placeholder.

To create a query template:
1. Create a folder to store sample queries that can be run against the Sample.Basic database.
   For example, create a folder called “queries” under the ARBORPATH/app/Sample/Basic directory of the Essbase installation.
2. Using a text editor, type the following code into a blank file:
   SELECT
   {}
   ON COLUMNS  
   FROM Sample.Basic
3. Save the file as qry_blank.txt to the queries folder.

Note: If you are using the MDX Script Editor in Administration Services, instead of a text editor, save the query as qry_blank.MDX from MDX Script Editor.

Introduction to Sets and Tuples

A set is an ordered collection of one or more tuples that have the same dimensionality (see “Rules for Specifying Sets” on page 580 for an explanation of dimensionality).

A tuple is a way to refer to a member or a member combination from any number of dimensions. For example, in the Sample.Basic database, Jan is a tuple, as is (Jan, Sales), as is ([Jan],[Sales],[Cola],[Utah],[Actual]).

The member name can be specified in these ways:

- By specifying the actual name or the alias; for example:
  - Cola
  - Actual
  - COGS
  - [100]

If the member name starts with number or contains spaces, it should be within brackets; for example, [100]. Brackets are recommended for all member names, for clarity and code readability.

If the member name starts with an ampersand (&), it should be within quotation marks; for example, ["&xyz"]. This is because the leading ampersand is reserved for substitution.
variables (see “Using Substitution Variables in MDX Queries” on page 597). You can also specify it as \texttt{StrToMbr("&100")}.

For attribute members, the long name (qualified to uniquely identify the member) should be used; for example, \texttt{[Ounces\_12]} instead of \texttt{[12]}.

- By specifying dimension name or any one of the ancestor member names as a prefix to the member name; for example, \texttt{[Product].[100-10]} and \texttt{[Diet].[100-10]}. This practice is recommended for all member names, as it eliminates ambiguity and enables you to refer accurately to shared members.

\textbf{Note:} Do not use multiple ancestors in the member name qualification. Essbase returns an error if multiple ancestors are included. For example, \texttt{[Market].[New York]} and \texttt{[East].[New York]} are valid names for New York; however, \texttt{[Market].[East].[New York]} returns an error.

- By specifying the name of a calculated member defined in the WITH section.

\textbf{Exercise: Running Your First Query}

Recall that the braces \{ \} in line 2 of your query template are a placeholder for a set. In this exercise, we will add a set to the query and run it.

\begin{itemize}
  \item \textbf{To run the query:}
  \begin{enumerate}
    \item Open \texttt{qry\_blank.txt}.
    \item Because a set can be as simple as one tuple, add \texttt{Jan} as a set to the query template. Retain the braces (required for all set specifications except for sets that are produced by a function call).
    \begin{verbatim}
    SELECT
      \{Jan\}
    ON COLUMNS
    FROM Sample.Basic
    \end{verbatim}
    
    Type \texttt{Jan} inside the braces in line 2:
    \begin{verbatim}
    SELECT
      \{Jan\}
    ON COLUMNS
    FROM Sample.Basic
    \end{verbatim}
    
    \item Save the query as \texttt{qry\_first.txt}.
    \item Ensure that Essbase is started (the \texttt{essbase.exe} process is running).
    \item In order for Essbase to receive MDX statements, pass the statements to Essbase using either the MaxL Shell or MDX Script Editor in Administration Services. The examples in this chapter use the MaxL Shell.
    \begin{itemize}
      \item Start the MaxL Shell and log on with a valid user name and password. For example, \texttt{essmsh -l admin passwd}
    \end{itemize}
    
    \item Copy and paste the entire \texttt{SELECT} query into the MaxL Shell, but do not press \textbf{Enter} yet.
    \item Enter a semicolon at the end, anywhere after Basic but before pressing \textbf{Enter}. The semicolon is not part of MDX syntax requirements, but it is required by MaxL Shell to indicate the end of a statement that is ready to execute.
  \end{enumerate}
\end{itemize}
Rules for Specifying Sets

As described previously, a set is an ordered collection of one or more tuples.

For example, in the following query, \{[100-10]\} is a set consisting of one tuple.

```
SELECT
  \{[100-10]\}
ON COLUMNS
FROM Sample.Basic
```

In the following query, \{([100-10], [Actual])\} is also a set consisting of one tuple, though in this case, the tuple is not one member name. Rather, \{([100-10], [Actual])\} represents a tuple consisting of members from two dimensions, Product and Scenario.

```
SELECT
  \{([100-10], [Actual])\}
ON COLUMNS
FROM Sample.Basic
```

When a set has multiple tuples, the following rule applies: In each tuple of the set, members must represent the same dimensions as do the members of other tuples of the set. Additionally, the dimensions must be represented in the same order. In other words, each tuple of the set must have the same dimensionality. For example:

- The following set consists of two tuples of the same dimensionality:
  \{([West, Feb], [East, Mar])\}

- The following set breaks the dimensionality rule, because Feb and Sales are from different dimensions:
  \{([West, Feb], [East, Sales])\}

- The following set breaks the dimensionality rule, because although the two tuples contain the same dimensions, the order of dimensions is reversed in the second tuple:
  \{([West, Feb], [Mar, East])\}

- A set can also be a collection of sets, or it can be empty (containing no tuples).
- A set must be enclosed in braces {}, except in cases where the set is represented by an MDX function that returns a set.

**Note:** If an MDX query contains references to members that do not exist in the outline, the unresolved member names can be skipped so that the query can continue without error. In the *Oracle Essbase Technical Reference*, see MDX Member Specification.
Introduction to Axis Specifications

An axis is a specification determining the layout of query results from a database. Axes fit into MDX queries as follows:

```
SELECT <axis>, [ <axis>... ]
FROM <database>
```

At least one axis must be specified in any MDX query.

Up to 64 axes may be specified, beginning with AXIS(0) and continuing with AXIS(1)...AXIS(63). Using more than three axes is uncommon. The order of axes is not important; however, when a set of axes 0 through n are specified, no axis between 0 and n should be skipped. Additionally, a dimension cannot appear on multiple axes.

The first five axes have keyword aliases, as listed in Table 110:

<table>
<thead>
<tr>
<th>Axes Keyword Alias</th>
<th>Axes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON COLUMNS</td>
<td>Can be used in place of AXIS(0)</td>
</tr>
<tr>
<td>ON ROWS</td>
<td>May replace AXIS(1)</td>
</tr>
<tr>
<td>ON PAGES</td>
<td>May replace AXIS(2)</td>
</tr>
<tr>
<td>ON CHAPTERS</td>
<td>May replace AXIS(3)</td>
</tr>
<tr>
<td>ON SECTIONS</td>
<td>May replace AXIS(4)</td>
</tr>
</tbody>
</table>

For example, in the following query, the axis specification is (Jan)ON COLUMNS:

```
SELECT (Jan) ON COLUMNS
FROM Sample.Basic
```

Exercise: Running A Two-Axis Query

1. Open `qry_blank.txt`.
2. Add a comma after ON COLUMNS; then add a placeholder for a second axis by adding ON ROWS:
   ```
   SELECT {}
   ON COLUMNS,
   {}
   ON ROWS
   FROM Sample.Basic
   ```
3. Save the new query template as `qry_blank_2ax.txt`.
4. As the set specification for the column axis, enter the Product members 100-10 and 100-20. For example:
SELECT
  {([100-10],[100-20])}
ON COLUMNS,
  {}
ON ROWS
FROM Sample.Basic

Because these member names contain special characters, you must use brackets. The
convention used here, to enclose all member names in brackets even if they do not contain
special characters, is recommended.

5  As the set specification for the row axis, enter the Year members Qtr1 through Qtr4.

SELECT
  {([100-10],[100-20])}
ON COLUMNS,
  {[Qtr1],[Qtr2],[Qtr3],[Qtr4]}
ON ROWS
FROM Sample.Basic

6  Save the query as qry_2ax.txt.

7  Paste the query into the MaxL Shell and run it, as described in Exercise: Running Your First Query.

Results of the query are shown in Table 111:

<table>
<thead>
<tr>
<th></th>
<th>100-10</th>
<th>100-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qtr1</td>
<td>5096</td>
<td>1359</td>
</tr>
<tr>
<td>Qtr2</td>
<td>5892</td>
<td>1534</td>
</tr>
<tr>
<td>Qtr3</td>
<td>6583</td>
<td>1528</td>
</tr>
<tr>
<td>Qtr4</td>
<td>5206</td>
<td>1287</td>
</tr>
</tbody>
</table>

Exercise: Querying Multiple Dimensions on a Single Axis

To query multiple dimensions on a single axis:

1  Open qry_blank_2ax.txt.

2  On the column axis, specify two tuples, each of which is a member combination rather than a single
   member. Enclose each tuple in parentheses, because multiple members are represented in each tuple.

SELECT
  {([100-10],[East]), ([100-20],[East])}
ON COLUMNS,
  {}
ON ROWS
FROM Sample.Basic

3  On the row axis, specify four two-member tuples, nesting each Quarter with Profit:

SELECT
  {([100-10],[East]), ([100-20],[East])}

ON COLUMNS,
{
    ([Qtr1],[Profit]), ([Qtr2],[Profit]),
    ([Qtr3],[Profit]), ([Qtr4],[Profit])
}
ON ROWS
FROM Sample.Basic

4 Save the query as qry_lax.txt.
5 Paste the query into the MaxL Shell and run it, as described in Exercise: Running Your First Query.

Results of the query are shown in Table 112:

<table>
<thead>
<tr>
<th></th>
<th>100-10</th>
<th>100-20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>East</td>
<td>East</td>
</tr>
<tr>
<td>Qtr1</td>
<td>Profit</td>
<td>2461</td>
</tr>
<tr>
<td>Qtr2</td>
<td>Profit</td>
<td>2490</td>
</tr>
<tr>
<td>Qtr3</td>
<td>Profit</td>
<td>3298</td>
</tr>
<tr>
<td>Qtr4</td>
<td>Profit</td>
<td>2430</td>
</tr>
</tbody>
</table>

Cube Specification

A cube specification is the part of the query that determines which database is being queried. The cube specification fits into an MDX query as follows:

SELECT <axis> [, <axis>...] FROM <database>

The <database> section follows the FROM keyword and should consist of delimited or nondelimited identifiers that specify first an application name and a then database name; for example, the following specifications are valid:

- FROM Sample.Basic
- FROM [Sample.Basic]
- FROM [Sample].[Basic]
- FROM 'Sample'.'Basic'

Using Functions to Build Sets

Rather than creating sets member-by-member or tuple-by-tuple, you can use a function that returns a set. MDX includes several functions that return sets and several functions that return other values. For a complete reference of MDX functions supported by Essbase, see the MaxL section of the online Oracle Essbase Technical Reference.
Exercise: Using the MemberRange Function

The MemberRange function returns a range of members inclusive of and between two specified members of the same generation. Its syntax is as follows:

\[
\text{MemberRange}(\text{member1, member2, [, layertype]})
\]

where the first argument you provide is the member that begins the range, and the second argument is the member that ends the range. The \text{layertype} argument is optional. See the \textit{Oracle Essbase Technical Reference}.

\textbf{Note:} An alternate syntax for MemberRange is to use a colon between the two members, instead of using the function name: \textit{member1 : member2}.

\begin{itemize}
  \item To use the MemberRange function:
  \begin{enumerate}
    \item Open \textit{qry_blank.txt}.
    \item Delete the braces \{\}, which are unnecessary when you are using a function to return the set.
    \item Use the colon operator to select a member range of Qtr1 through Qtr4:
      \begin{verbatim}
      SELECT [Qtr1]:[Qtr4]
      ON COLUMNS
      FROM Sample.Basic
      \end{verbatim}
    \item Paste the query into the MaxL Shell and run it, as described in \textit{Exercise: Running Your First Query}. Qtr1, Qtr2, Qtr3, and Qtr4 are returned.
    \item Use the MemberRange function to select the same member range, Qtr1 through Qtr4.
      \begin{verbatim}
      SELECT MemberRange([Qtr1],[Qtr4])
      ON COLUMNS
      FROM Sample.Basic
      \end{verbatim}
    \item Save the query as \textit{gry_member_range_func.txt}.
    \item Paste the query into the MaxL Shell and run it, as described in \textit{Exercise: Running Your First Query}.
  \end{enumerate}
\end{itemize}

Results: The same results should be returned when running the queries listed in step 3 and step 5.

Exercise: Using the CrossJoin Function

The CrossJoin function returns the cross product of two sets from different dimensions. Its syntax is as follows:

\[
\text{CrossJoin(set, set)}
\]

The CrossJoin function takes two sets from different dimensions as input and creates a set that is a cross product of the two input sets, useful for creating symmetric reports.
To use the CrossJoin function:

1. Open `qry_blank_2ax.txt`.

2. Replace the braces `{}` from the columns axis with `CrossJoin()`. 

   ```sql
   SELECT
       CrossJoin ()
   ON COLUMNS,
       {}
   ON ROWS
   FROM Sample.Basic
   ```

3. Add two comma-separated pairs of braces as placeholders for the two set arguments you will provide to the CrossJoin function:

   ```sql
   SELECT
       CrossJoin ({}, { })
   ON COLUMNS,
       {}
   ON ROWS
   FROM Sample.Basic
   ```

4. In the first set, specify the Product member `[100-10]`. In the second set, specify the Market members `[East]`, `[West]`, `[South]`, and `[Central].`

   ```sql
   SELECT
       CrossJoin ({{[100-10]},{[East],[West],[South],[Central]}})
   ON COLUMNS,
       {}
   ON ROWS
   FROM Sample.Basic
   ```

5. On the row axis, use CrossJoin to cross a set of Measures members with a set containing `Qtr1`:

   ```sql
   SELECT
       CrossJoin ({{[100-10]},{[East],[West],[South],[Central]}})
   ON COLUMNS,
       CrossJoin ({{[Sales],[COGS],[Margin %],[Profit %]},{[Qtr1]}})
   ON ROWS
   FROM Sample.Basic
   ```

6. Save the query as `qry_crossjoin_func.txt`.

7. Paste the query into the MaxL Shell and run it, as described in Exercise: Running Your First Query.

When using CrossJoin, the order of arguments affects the order of tuples in the output.

**Note:** Consider using CrossJoinAttribute if the input sets are a base dimension and its attribute dimension. For more information, see Oracle Essbase Technical Reference.

Results of the query are shown in Table 113:
Table 113  Results: Using the CrossJoin Function

<table>
<thead>
<tr>
<th></th>
<th>100-10</th>
<th>100-10</th>
<th>100-10</th>
<th>100-10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>East</td>
<td>West</td>
<td>South</td>
<td>Central</td>
</tr>
<tr>
<td>Sales</td>
<td>Qtr1</td>
<td>5731</td>
<td>3493</td>
<td>2296</td>
</tr>
<tr>
<td>COGS</td>
<td>Qtr1</td>
<td>1783</td>
<td>1428</td>
<td>1010</td>
</tr>
<tr>
<td>Margin %</td>
<td>Qtr1</td>
<td>66.803</td>
<td>59.118</td>
<td>56.01</td>
</tr>
<tr>
<td>Profit %</td>
<td>Qtr1</td>
<td>45.82</td>
<td>29.974</td>
<td>32.448</td>
</tr>
</tbody>
</table>

**Exercise: Using the Children Function**

The Children function returns a set of all child members of the given member. Use this syntax:

Children (member)

**Note:** An alternate syntax for Children is to use it as an operator on the input member, as follows: member.Children. We will use the operator syntax in this exercise.

- To use the Children function to introduce a shortcut in the first axis specification:
  1. Open qry_crossjoin_func.txt.
  2. In the second set of the column axis specification, replace [East],[West],[South],[Central] with [Market].Children.

```mdx
SELECT
  CrossJoin ({[100-10]}, {[Market].Children})
ON COLUMNS,
  CrossJoin ({{Sales],[COGS],[Margin %],[Profit %]}, {[Qtr1]})
ON ROWS
FROM Sample.Basic
```

3. Save the query as gry_children_func.txt.

4. Paste the query into the MaxL Shell and run it, as described in Exercise: Running Your First Query.

Results: You should see the same results as those shown in returned for Table 113 on page 586.

**Working with Levels and Generations**

In MDX, layer refers to generations and levels in an Essbase hierarchy.

In Essbase, generation numbers begin counting with 1 at the dimension name; higher generation numbers are those closest to leaf members in a hierarchy.
Level numbers begin with 0 at the leaf-most part of the hierarchy, and the highest level number is a dimension name.

A number of MDX functions take a layer you specify as an input argument and perform set operations based on the generation or level represented in the layer argument.

You can specify a layer argument in the following ways:

- Generation or level name; for example, States or Regions.
- The dimension name along with the generation or level name; for example, Market.Regions and [Market].[States].
- The Levels function with a dimension and a level number as input. For example, [Year].Levels(0).
- The Level function with a member as input. For example, [Qtr1].Level returns the level of quarters in Sample.Basic, which is level 1 of the Market dimension.
- The Generations function with a dimension and a generation number as input. For example, [Year].Generations(3).
- The Generation function with a member as input. For example, [Qtr1].Generation returns the generation of quarters in Sample.Basic, which is generation 2 of the Market dimension.

Note: In the Sample.Basic database, Qtr1 and Qtr4 are in the same layer. This means that Qtr1 and Qtr4 are also in the same generation. However, in a different database with a ragged hierarchy, Qtr1 and Qtr4 might not necessarily be in the same level, although they are in the same generation. For example, if the hierarchy of Qtr1 drills down to weeks, and the hierarchy of Qtr4 stops at months, Qtr1 is one level higher than Qtr4, but they are still in the same layer.

Exercise: Using the Members Function

The Members function can be used to return all members of a specified generation or level. Its syntax when used with a layer argument:

```
Members (layer)
```

where the `layer` argument you provide indicates the generation or level of members you want returned.

Note: An alternate syntax for Members is `layer.Members`.

To use the Members function:

1. Open `qry_blank.txt`.
2. Delete the braces `{}`.
3. Use the Members function and the Levels function to select all level 0 members in the Market dimension of Sample.Basic:
Save the query as `qry_members_func.txt`.

Paste the query into the MaxL Shell and run it, as described in Exercise: Running Your First Query.

Results: All states in the Market dimension are returned.

### Using a Slicer Axis to Set Query Point-of-View

A **slicer** axis is a way to limit a query to apply only a specific area of the database. The optional slicer, if used, must be in the WHERE section of an MDX query. Furthermore, the WHERE section must be the last component of the query, following the cube specification (the FROM section):

```mdx
SELECT {set}
ON axes
FROM database
WHERE slicer
```

Use the slicer axis to set the context of the query; it is usually the default context for all the other axes.

For example, for a query to select only Actual Sales in the Sample.Basic database, excluding budgeted sales, the WHERE clause might look like the following:

```mdx
WHERE ([Actual], [Sales])
```

Because (Actual, Sales) is specified in the slicer axis, you need not include them in the ON AXIS(n) set specifications.

**Note:** The same dimension cannot appear on other axes and the slicer axis. To filter an axis using criteria from its own dimension, you can use a sub select. For more information, see MDX Sub Select in *Oracle Essbase Technical Reference*.

### Exercise: Limiting the Results with a Slicer Axis

To use the slicer axis to limit results:

1. Open `gry_crossjoin_func.txt`.
2. Paste the query into the MaxL Shell and run it, as described in Exercise: Running Your First Query.

    Note the results in one of the data cells; for example, notice that the first tuple, ([100-10], [East], [Sales], [Qtr1]), has a value of 5731.
3. Add a slicer axis to limit the data returned to budgeted values only.

```
SELECT
   CrossJoin ([100-10]), ([East],[West],[South],[Central])
```
ON COLUMNS,
CrossJoin (  
   {
    [Sales],[COGS],[Margin %],[Profit %]
   },
   {
    [Qtr1]
   }
)

ON ROWS
FROM Sample.Basic
WHERE (Budget)

4 Paste the query into the MaxL Shell and run it.
5 Save the query as qry_slicer_axis.txt.

Results: You should see different results for the queries listed in step 1 and step 3.

Common Relationship Functions

Table 114 lists the relationship functions that return sets based on member relationships in the database outline:

Table 114  List of Relationship Functions That Return Sets

<table>
<thead>
<tr>
<th>Relationship Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>Returns the children of the input member.</td>
</tr>
<tr>
<td>Siblings</td>
<td>Returns the siblings of the input member.</td>
</tr>
<tr>
<td>Descendants</td>
<td>Returns the descendants of a member, with varying options.</td>
</tr>
</tbody>
</table>

Table 115 on page 589 lists the relationship functions that return a single member rather than a set:

Table 115  List of Relationship Functions That Return a Single Member

<table>
<thead>
<tr>
<th>Relationship Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ancestor</td>
<td>Returns an ancestor at the specified layer.</td>
</tr>
<tr>
<td>Cousin</td>
<td>Returns a child member at the same position as a member from another ancestor.</td>
</tr>
<tr>
<td>Parent</td>
<td>Returns the parent of the input member.</td>
</tr>
<tr>
<td>FirstChild</td>
<td>Returns the first child of the input member.</td>
</tr>
<tr>
<td>LastChild</td>
<td>Returns the last child of the input member.</td>
</tr>
<tr>
<td>FirstSibling</td>
<td>Returns the first child of the input member’s parent.</td>
</tr>
<tr>
<td>LastSibling</td>
<td>Returns the last child of the input member’s parent.</td>
</tr>
</tbody>
</table>

For examples using relationship functions, see the MDX examples in the MaxL section of the Oracle Essbase Technical Reference.
Performing Set Operations

Table 116 lists the set functions that operate on input sets without deriving further information from a database:

<table>
<thead>
<tr>
<th>Pure Set Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrossJoin, CrossJoinAttribute</td>
<td>Returns a cross-section of two sets from different dimensions.</td>
</tr>
<tr>
<td>Distinct</td>
<td>Deletes duplicate tuples from a set.</td>
</tr>
<tr>
<td>Except</td>
<td>Returns a subset containing the differences between two sets.</td>
</tr>
<tr>
<td>Generate</td>
<td>An iterative function. For each tuple in set1, returns set2.</td>
</tr>
<tr>
<td>Head</td>
<td>Returns the first ( n ) members or tuples present in a set.</td>
</tr>
<tr>
<td>Intersect</td>
<td>Returns the intersection of two input sets.</td>
</tr>
<tr>
<td>Subset</td>
<td>Returns a subset from a set, in which the subset is a numerically specified range of tuples.</td>
</tr>
<tr>
<td>Tail</td>
<td>Returns the last ( n ) members or tuples present in a set.</td>
</tr>
<tr>
<td>Union</td>
<td>Returns the union of two input sets.</td>
</tr>
</tbody>
</table>

**Exercise: Using the Intersect Function**

The Intersect function returns the intersection two input sets, optionally retaining duplicates.

**Syntax:**

Intersect \((set, set [,ALL])\)

Use the Intersect function to compare sets by finding tuples that are present in both sets.

To use the Intersect function:

1. Open `qry_blank.txt`.
2. Delete the braces \( {} \) from the axis, and replace them with Intersect(). For example:

   ```sql
   SELECT Intersect ()
   ON COLUMNS FROM Sample.Basic
   ```

3. Add two comma-separated pairs of braces to use as placeholders for the two set arguments you will provide to the Intersect function. For example:

   ```sql
   SELECT Intersect ( ( ), ( ) )
   ```
ON COLUMNS FROM Sample.Basic

4 Specify children of East as the first set argument. For example:

    SELECT Intersect {
        [East].children },
    {} ON COLUMNS FROM Sample.Basic

5 For the second set argument, specify all members of the Market dimension that have a UDA of "Major Market." For example:

    SELECT Intersect {
        [East].children },
        UDA([Market], "Major Market")
    } ON COLUMNS FROM Sample.Basic

6 Save the query as qry_intersect_func.txt.

7 Paste the query into the MaxL Shell and run it, as described in “Exercise: Running Your First Query” on page 579.

Results: All children of East that have a UDA of “Major Market” are returned. For example:

New York  Massachusetts  Florida
8202       6172          5029

Exercise: Using the Union Function

The Union function joins two input sets, optionally retaining duplicates. Syntax:

    Union (set, set [,ALL])

Use the Union function to lump two sets together into one set.

To use the Union function:

1 Open qry_intersect_func.txt.
2 Replace Intersect with Union.
3 Save the query as qry_union_func.txt.
4 Paste the query into the MaxL Shell and run it.

Results: A comparison of theses query results with the results using the Intersect function (see “Exercise: Using the Intersect Function” on page 590) shows that while Intersect returns a set
containing only those children of East that have a UDA of “Major Market,” Union returns \{all children of east\} + \{all Market Members that have a UDA of “Major Market”\).

For more examples using pure set-operative functions, see the *Oracle Essbase Technical Reference*.

**Creating and Using Named Sets and Calculated Members**

Calculated members and named sets are logical entities in query that can be used multiple times during the life of the query. Calculated members and named sets can save time in lines of code written as well as in execution time. The optional WITH section at the beginning of an MDX query is where you define the calculated members and/or named sets.

**Calculated Members**

A calculated member is a hypothetical member that exists for the duration of the query execution. Calculated members enable complex analysis without necessitating adding new members to the database outline. Calculated members are a storage place for calculation results performed on actual members.

Use the following guidelines for calculated member names:

- Associate the calculated member with a dimension; for example, to associate the member MyCalc with the Measures dimension, name it `[Measures].[MyCalc]`.
- Do not use actual member names to name calculated members; for example, do not name a calculated member `[Measures].[Sales]`, because Sales already exists in the Measures dimension.

Setting the solve order for each calculated member is recommended when you use multiple calculated members to create ratios or custom totals. For more information about solve order, see the MDX section of the *Oracle Essbase Technical Reference*.

**Exercise: Creating a Calculated Member**

This exercise includes the Max function, a common function for calculations. The Max function returns the maximum of values found in the tuples of a set. Its syntax is as follows: 

Max \( (set, numeric\_value) \)

- To create a calculated member:
  1. **Open** qry_blank_2ax.txt.
  2. **On** the row axis set, specify the children of Product. For example:
     ```
     SELECT {}
     ON COLUMNS,
     ```
3 At the beginning of the query, add a placeholder for the calculated member specification. For example:

```plaintext
WITH MEMBER [{}.{}] AS ''
SELECT {} ON COLUMNS,
{{[Product].children}} ON ROWS
FROM Sample.Basic
```

4 To associate the calculated member with the Measures dimension and name it Max Qtr2 Sales, add this information to the calculated member specification. For example:

```plaintext
WITH MEMBER [Measures].[Max Qtr2 Sales] AS ''
SELECT {} ON COLUMNS,
{{[Product].children}} ON ROWS
FROM Sample.Basic
```

5 After the AS keyword and inside the single quotation marks, define the logic for the calculated member named Max Qtr2 Sales.

Use the Max function with the set to evaluate (Qtr2) as the first argument, and the measure to evaluate (Sales) as the second argument. For example:

```plaintext
WITH MEMBER [Measures].[Max Qtr2 Sales] AS '
  Max (
    {{[Year].[Qtr2]},
    [Measures].[Sales]
  )
'
SELECT {} ON COLUMNS,
{{[Product].children}} ON ROWS
FROM Sample.Basic
```

6 The calculated member Max Qtr2 Sales is defined in the WITH section. To use it in a query, include it on one of the axes in the SELECT portion of the query. Select the predefined calculated member on the columns axis. For example:

```plaintext
WITH MEMBER [Measures].[Max Qtr2 Sales] AS ' 
  Max ( 
    {{[Year].[Qtr2]},
    [Measures].[Sales]
  ) 
' 
SELECT {{Measures].[Max Qtr2 Sales]} 
ON COLUMNS, 
{{[Product].children}}
```
ON ROWS
FROM Sample.Basic

7 Save the query as gry_calc_member.txt.

8 Paste the query into the MaxL Shell and run it, as described in “Exercise: Running Your First Query” on page 579.

Results of the query are shown in Table 117:

Table 117 Results: Creating a Calculated Member

<table>
<thead>
<tr>
<th>Max Qtr2 Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>400</td>
</tr>
<tr>
<td>Diet</td>
</tr>
</tbody>
</table>

Named Sets

You define named sets in the WITH section of the query. Doing so is useful because you can reference the set by name when building the SELECT section of the query.

For example, the named set Best5Prods identifies a set of the five top-selling products in December:

WITH SET [Best5Prods] AS
'Topcount {
[Product].members,
5,
([Measures].[Sales], [Scenario].[Actual], [Year].[Dec])
}',
SELECT [Best5Prods] ON AXIS(0),
([Year].[Dec]) ON AXIS(1)
FROM Sample.Basic

Using Iterative Functions

Table 118 lists the functions that loop through sets of data, and perform search conditions and results that you specify:
Table 118   List of Iterative Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter</td>
<td>Returns the subset of tuples in set for which the value of the search condition is TRUE.</td>
</tr>
<tr>
<td>IIF</td>
<td>Performs a conditional test and returns an appropriate numeric expression or set depending on whether the test evaluates to TRUE or FALSE.</td>
</tr>
<tr>
<td>Case</td>
<td>Performs conditional tests and returns the results you specify.</td>
</tr>
<tr>
<td>Generate</td>
<td>An iterative function. For each tuple in set1, returns set2.</td>
</tr>
</tbody>
</table>

Filter Function Example

The following query returns all Market dimension members for which the expression IsChild([Market].CurrentMember,[East]) returns TRUE; the query returns all children of East.

```
SELECT Filter([Market].Members,
    IsChild([Market].CurrentMember,[East])
) ON COLUMNS
FROM Sample.Basic
```

The Filter function in MDX is comparable to the RESTRICT command in Report Writer.

For more examples of Filter and other iterative functions, see the Oracle Essbase Technical Reference.

Working with Missing Data

When you are querying on a database, you can use the NON EMPTY keywords at the beginning of an axis specification to prevent cells containing no value from being included the result of the query.

The axis specification syntax including NON EMPTY:

```
<axis_specification> ::= 
    [NON EMPTY] <set> ON 
    COLUMNS | ROWS | PAGES | CHAPTERS | SECTIONS | AXIS <unsigned_integer>
```

Including the optional keywords NON EMPTY before the set specification in an axis causes suppression of slices in that axis that would contain entirely #MISSING values.

For any given tuple on an axis (such as (Qtr1, Actual)), a slice consists of the cells arising from combining this tuple with all tuples of all other axes. If all of these cell values are #MISSING, the NON EMPTY keyword causes elimination of the tuple.

For example, if even one value in a row is not empty, the entire row is returned. Including NON EMPTY at the beginning of the row axis specification would eliminate the following row slice from the set returned by a query:
In addition to suppressing missing values with NON EMPTY, you can use the following MDX functions to handle #MISSING results:

- CoalesceEmpty, which searches numeric value expressions for non #MISSING values
- IsEmpty, which returns TRUE if the value of an input numeric-value-expression evaluates to #MISSING
- Avg, which omits missing values from averages unless you use the optional IncludeEmpty flag

The NonEmptyCount MDX function returns the count of the number of tuples in a set that evaluate to non-#Missing values. Each tuple is evaluated and included in the count returned by this function. If the numeric value expression is specified, it is evaluated in the context of every tuple, and the count of non-#Missing values is returned.

On aggregate storage databases only, the NonEmptyCount MDX function is optimized so that the calculation of the distinct count for all cells can be performed by scanning the database only once. Without this optimization, the database is scanned as many times as the number of cells corresponding to the distinct count. The NonEmptyCount optimization is triggered when an outline member formula has the following syntax:

```
NONEMPTYCOUNT(set, measure, exclude_missing)
```

The exclude_missing parameter supports the NonEmptyCount optimization on aggregate databases by improving the performance of a query that queries metrics that perform a distinct count calculation.

The NONEMPTYMEMBER and NONEMPTYTUPLE properties enable MDX in Essbase to query on large sets of members or tuples while skipping formula execution on non-contributing values that contain only #MISSING data.

- Use a single NONEMPTYMEMBER property clause at the beginning of a calculated member or formula expression to indicate to Essbase that the value of the formula or calculated member is empty when any of the members specified in nonempty_member_list are empty.
- Use a single NONEMPTYTUPLE property clause at the beginning of a calculated member or formula expression to indicate to Essbase that the value of the formula or calculated member is empty when the cell value at the tuple given in nonempty_member_list is empty.

Given an input set, the NonEmptySubset MDX function returns a subset of that input set in which all tuples evaluate to nonempty. An optional value expression may be specified for the nonempty check. This function can help optimize queries that are based on a large set for which the set of nonempty combinations is known to be small. NonEmptySubset reduces the size of the set in the presence of a metric; for example, you might request the nonempty subset of descendants for specific Units.

For more information and examples, see the MDX section of the Oracle Essbase Technical Reference.
Using Substitution Variables in MDX Queries

Substitution variables act as global placeholders for information that changes regularly; you set the substitution variables on the server through Administration Services, MaxL, or ESSCMD and assign a value to each variable. You can change the value anytime. You must have the role of at least Database Manager to set substitution variables. See "Using Substitution Variables" on page 120.

To use a substitution variable in an MDX expression, consider:

- The substitution variable must be accessible from the application and database you are querying.
- A substitution variable has two components: the name and the value.
- The variable name can be an alphanumeric combination whose maximum size is specified in Appendix A, "Limits." Do not use spaces, punctuation, or brackets ([ ]) in substitution variable names used in MDX.
- At the point in the expression where you want to use the variable, show the variable name preceded by an ampersand (&); for example, where CurMonth is the name of the substitution variable set on the server, include &CurMonth in the MDX expression.
- When you perform the retrieval, Essbase replaces the variable name with the substitution value, and that value is used by the MDX expression.

For example, the expression is written showing the variable name CurQtr preceded with the &:

```sql
SELECT
  ([&CurQtr])
ON COLUMNS
FROM Sample.Basic
```

When the expression is executed, the current value (Qtr1) is substituted for the variable name, and the expression that is executed is:

```sql
SELECT
  ([Qtr1])
ON COLUMNS
FROM Sample.Basic
```

Querying for Properties

In MDX, properties describe certain characteristics of data and metadata. MDX enables you to write queries that use properties to retrieve and analyze data. Properties can be intrinsic or custom.

Intrinsic properties are defined for members in all dimensions. The intrinsic member properties defined for all members in an Essbase database outline are MEMBER_NAME, MEMBER_ALIAS, LEVEL_NUMBER, and GEN_NUMBER.

MDX in Essbase supports two types of custom properties: attribute properties and UDA properties. Attribute properties are defined by the attribute dimensions in an outline. In the Sample.Basic database, the Pkg Type attribute dimension describes the packaging characteristics
of members in the Product dimension. This information can be queried in MDX using the property name [Pkg Type].

Attribute properties are defined only for specific dimensions and only for a specific level in each dimension. For example, in the Sample.Basic outline, [Ounces] is an attribute property defined only for members in the Product dimension, and this property has valid values only for the level 0 members of the Product dimension. The [Ounces] property does not exist for other dimensions, such as Market. The [Ounces] property for a non level 0 member in the Product dimension is a NULL value. The attribute properties in an outline are identified by the names of attribute dimensions in that outline.

The custom properties also include UDAs. For example, [Major Market] is a UDA property defined on Market dimension members. It returns a TRUE value if [Major Market] UDA is defined for a member, and FALSE otherwise.

### Querying for Member Properties

Properties can be used inside an MDX query in two ways.

- You can list the dimension and property combinations for each axis set. When a query is executed, the specified property is evaluated for all members from the specified dimension and included in the result set.

  For example, on the column axis, the following query returns the GEN_NUMBER information for every Market dimension member. On the row axis, the query returns MEMBER_ALIAS information for every Product dimension member.

  ```mdx
  SELECT [Market].Members
  DIMENSION PROPERTIES [Market].[GEN_NUMBER] on columns,
  Filter ([Product].Members, Sales > 5000)
  DIMENSION PROPERTIES [Product].[MEMBER_ALIAS] on rows
  FROM Sample.Basic
  ```

  When querying for member properties using the DIMENSION PROPERTIES section of an axis, a property can be identified by the dimension name and the name of the property, or by using the property name itself. When a property name is used by itself, that property information is returned for all members from all dimensions on that axis, for which that property applies. In the following query, the MEMBER_ALIAS property is evaluated on the row axis for Year and Product dimensions.

  ```mdx
  SELECT [Market].Members
  DIMENSION PROPERTIES [Market].[GEN_NUMBER] on columns,
  CrossJoin([Product].Children, Year.Children)
  DIMENSION PROPERTIES [MEMBER_ALIAS] on rows
  FROM Sample.Basic
  ```

- Properties can be used inside value expressions in an MDX query. For example, you can filter a set based on a value expression that uses properties of members in the input set.

  The following query returns all caffeinated products that are packaged in cans.

  ```mdx
  SELECT Filter([Product].levels(0).members,
  ```
The following query calculates the value [BudgetedExpenses] based on whether the current Market is a major market, using the UDA [Major Market].

\[
\text{WITH} \\
\quad \text{MEMBER [Measures].[BudgetedExpenses] AS} \\
\quad \quad \text{"IIF([Market].CurrentMember.[Major Market],} \\
\quad \quad \quad \text{[Marketing] * 1.2, [Marketing]}\text{')} \\
\quad \text{SELECT \{[Measures].[BudgetedExpenses]\} ON COLUMNS,} \\
\quad \quad \quad \text{[Market].Members ON ROWS} \\
\quad \text{FROM Sample.Basic} \\
\text{WHERE ([Budget])}
\]

The Value Type of Properties

The value of an MDX property in Essbase can be a numeric, Boolean, or string type. MEMBER_NAME and MEMBER_ALIAS properties return string values. LEVEL_NUMBER, and GEN_NUMBER properties return numeric values.

The attribute properties return numeric, Boolean, or string values based on the attribute dimension type. For example, in Sample.Basic, the [Ounces] attribute property is a numeric property. The [Pkg Type] attribute property is a string property. The [Caffeinated] attribute property is a Boolean property.

Essbase allows attribute dimensions with date types. The date type properties are treated as numeric properties in MDX. When comparing these property values with dates, use the TODATE function to convert date strings to numeric before comparison.

The following query returns all Product dimension members that have been introduced on date 03/25/2007. Because the property [Intro Date] is a date type, the TODATE function must be used to convert the date string “03-25-2007” to a number before comparing it.

\[
\text{SELECT} \\
\quad \text{Filter ([Product].Members,} \\
\quad \quad \text{[Product].CurrentMember.[Intro Date] =} \\
\quad \quad \quad \text{TODATE("mm-dd-yyyy","03-25-2007")} \text{) ON COLUMNS} \\
\quad \text{FROM Sample.Basic}
\]

When a property is used in a value expression, you must use it appropriately based on its value type: string, numeric, or Boolean.

You can also query attribute dimensions with numeric ranges.

The following query retrieves Sales data for Small, Medium, and Large population ranges.

\[
\text{SELECT} \\
\quad \{\text{Sales}\} \text{ ON COLUMNS,} \\
\quad \{\text{Small, Medium, Large}\} \text{ ON ROWS} \\
\text{FROM Sample.Basic}
\]
When attributes are used as properties in a value expression, you can use range members to check whether a member’s property value falls within a given range, using the IN operator.

For example, the following query returns all Market dimension members with the population range in Medium:

```
SELECT Filter(
    IN "Medium"
) 
ON AXIS(0) 
FROM Sample.Basic
```

### NULL Property Values

Not all members may have valid values for a given property name. For example, the MEMBER_ALIAS property returns an alternate name for a given member as defined in the outline; however, not all members may have aliases defined. In these cases a NULL value is be returned for those members that do not have aliases.

In the following query,

```
SELECT [Year].Members 
DIMENSION PROPERTIES [MEMBER_ALIAS] 
ON COLUMNS 
FROM Sample.Basic
```

none of the members in the Year dimension have aliases defined for them. Therefore, the query returns NULL values for the MEMBER_ALIAS property for members in the Year dimension.

The attribute properties are defined for members of a specific dimension and a specific level in that dimension. In the Sample.Basic database, the [Ounces] property is defined only for level 0 members of the Product dimension.

Therefore, if you query for the [Ounces] property of a member from the Market dimension, as shown in the following query, you will get a syntax error:

```
SELECT Filter([Market].members, 
    [Market].CurrentMember.[Ounces] = 32) ON COLUMNS 
FROM Sample.Basic
```

Additionally, if you query for the [Ounces] property of a non level 0 member of the dimension, you will get a NULL value.

When using property values in value expressions, you can use the function IsValid() to check for NULL values. The following query returns all Product dimension members with an [Ounces] property value of 12, after eliminating members with NULL values.

```
SELECT Filter([Product].Members, 
    IsValid([Product].CurrentMember.[Ounces]) AND 
    [Product].CurrentMember.[Ounces] = 12)
```
ON COLUMNS
FROM Sample.Basic
Copying Data Subsets and Exporting Data

In This Chapter

- Process for Creating a Database Subset .............................................................. 603
- Exporting Data............................................................................................ 607

Process for Creating a Database Subset

You can move data between Essbase databases or to other programs by extracting an output file of the data that you want to move. To meet the import format specifications of most other programs, create a text file using a report script or a calculation script.

This section describes the process for copying a database subset from one Essbase Server (Essbase Server 1) to another (Essbase Server 2).

1. On Essbase Server 2, create an application and database to contain the database subset.
   
   See “Create an Application and Database” on page 604.

2. Copy the outline file (for example, source_dbname.otl) from the source database on Essbase Server 1 to the new database on Essbase Server 2.

   You may need to rename the outline file to match the name of the database Essbase Server 2 (for example, target_dbname.otl), overwriting the existing target database outline file.

   See “Copy the Outline File from the Source Database” on page 604.

3. Create an output file (for example, a plain text file) containing the required data subset.

   See “Create an Output File Containing the Required Data Subset” on page 605.

4. Load the output file into the new database that you have created.

   See “Load the Output File into the New Database” on page 606.

If required, repeat steps 3 and 4 to create an output file from the database on Essbase Server 2 and load the data back into the main Essbase database on a different computer.

The example in the following sections is based on the Sample.Basic database. The data subset in the example is the Actual, Measures data for the West market. The example copies the data subset to Essbase Server 2 and the West Westmkts database.
Create an Application and Database

Create an application and database on Essbase Server 2. You will copy the required subset of data into this new database. You can give this application and database any name.

To create the application and database:

See “Creating Applications” and “Creating Databases” in the Oracle Essbase Administration Services Online Help.

Ensure that the new, empty database is not running.

To stop a database:

See “Stopping Databases” in the Oracle Essbase Administration Services Online Help.

Copy the Outline File from the Source Database

Copy the outline file (.otl) of the source database to the new database that you have created. In this example, you copy the basic.otl outline file from the Sample.Basic database and rename it wesmkts.otl on Essbase Server 2.

How you copy the outline file depends on whether you can connect to the source Essbase database from the Essbase Server 2 computer.

- If you can connect, use any of the following methods to copy the outline:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>COPYDB</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

- If you can not connect, use the operating system to copy the outline file.

1. Use the operating system to copy the source outline file; for example, copy basic.otl to westmkts.otl.

2. Give the copied outline exactly the same name as the new database.

3. Save the outline file in the ARBORPATH/app/appname/dbname directory on the Essbase Server 2 computer, where ARBORPATH is the directory in which you installed Essbase, and appname and dbname are the new application and database that you have created.

For example, copy basic.otl to a disk, renaming it to westmkts.otl. Then copy westmkts.otl from the disk to the following directory on Essbase Server 2:

Oracle/Middleware/EPMSys11R1/products/Essbase/EssbaseServer/app/west/westmkts/westmkts.otl

It is safe to overwrite the existing, empty westmkts.otl file.
4. Stop and restart the new database.

See “Starting Databases” and “Stopping Databases” in the Oracle Essbase Administration Services Online Help.

You now have a copy of the database outline on Essbase Server 2.

Create an Output File Containing the Required Data Subset

Create an output file that contains the required data subset. The output file can be a text file or a spreadsheet file. Use either of the following methods to create a data subset.

The following example uses Report Writer to create a subset of the Westmkts database. You can also use a report script to export a subset of data.

To create a text file that contains the required data subset:

1. Select the source database. For example, select West Westmkts.

   See “Navigating and Selecting Objects” in the Oracle Essbase Administration Services Online Help.

   • If you can connect to the Essbase Server 1 database from the Essbase Server 2 computer, you can select the source database from Essbase Server 2.
   • If you cannot connect, use a different computer from the Essbase Server 2 computer to select the source database.

2. Create a report.

   See “Creating Scripts” in the Oracle Essbase Administration Services Online Help.

3. Write a report script that selects the required data subset. For information about writing report scripts, see Chapter 34, “Understanding Report Script Basics.”

   For example, the following report script selects the Actual, Measures data for the West market from Sample.Basic:

   ```
   {TABDELIMT}
   QUOTEMBRNAMES
   Actual
   <IDESC West
   <IDESC Measures
   ```

   • Use TABDELIMIT to place tab stops between data, instead of spaces, to ensure that no member names or data values are truncated.
   • Use QUOTEMBRNAMES to place quotation marks (" ") around member names that contain blank spaces. Essbase then recognizes the member names when it loads the data.

4. Execute the report script.

   See “Executing Report Scripts” in the Oracle Essbase Administration Services Online Help.
Save the report script with a .txt extension; for example, westout.txt.

To load the data, the output file must be in the ARBORPATH/app/appname/dbname directory on Essbase Server 2, where appname and dbname are the new application and database directories that you have created.

If you are using the Essbase Server 2 computer, you can save the output file directly into the ARBORPATH/app/appname/dbname directory; for example:

Oracle/Middleware/EPMSystem11R1/products/Essbase/EssbaseServer/app/west/westmkts/westout.txt

If you are not using the Essbase Server 2 computer, save the output file anywhere on the current computer. By default, Essbase saves the file on the Essbase client computer and not on the server. When you run the report, use the operating system to copy the file to the ARBORPATH/app/appname/dbname directory on Essbase Server 2. For example, use a disk to copy the file.

If you are not using the Essbase Server 2 computer, download and copy the file from the Essbase client directory to the ARBORPATH/app/appname/dbname directory on Essbase Server 2. For example, copy the output file to:

Oracle/Middleware/EPMSystem11R1/products/Essbase/EssbaseServer/app/west/westmkts/westout.txt

You are now ready to load the text file into the new database.

**Load the Output File into the New Database**

Load the output file into the new database on Essbase Server 2.

To load a file into a database:

See “Performing a Data Load or Dimension Build” in the *Oracle Essbase Administration Services Online Help*.

The following example illustrates how to load data into the Westmkts database:

1. Select the new database. For example, select Westmkts.
2. Start the data load using the text file you have just created, for example, westout.

   **Note:** If westout is not displayed, check that you gave it a .txt extension and placed it in the ARBORPATH/app/West/Westmkts directory. See “Create an Output File Containing the Required Data Subset” on page 605.

See Chapter 20, “Performing and Debugging Data Loads or Dimension Builds.”

You can now view the data on the Essbase Server 2 computer. You might need to recalculate the database subset. Because you are viewing a subset of the database, a percentage of data values will be #MISSING.
If required, you can copy report scripts and other artifact files to the Essbase Server 2 computer to use with the database subset that you have created.

# Exporting Data

To export data from a database to move data between Essbase databases or to a format that can be read by programs other than Essbase, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart View</td>
<td>“Working with Query Designer”</td>
<td>Oracle Smart View for Office User's Guide</td>
</tr>
<tr>
<td>MaxL</td>
<td>export data</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>Calculation scripts</td>
<td>“Exporting Data Using the DATAEXPORT Command” on page 477</td>
<td>Oracle Essbase Database Administrator's Guide</td>
</tr>
</tbody>
</table>

**Note:** When you use MaxL, calculation scripts, or Administration Services Console to export text data, and the end fields of the last record have no values, those fields will not contain the missing value marker (such as #MI). To improve overall processing time, the fields are left blank in the last output record.

Export files from databases in Unicode-mode applications are in UTF-8 encoding. If Essbase finds insufficient disk space for the export file, no data is exported.

If you plan to import Essbase data into a program that requires special delimiters, use the Report Writer MASK command or the delimiter parameter of the DATAEXPORT calculation command to specify the delimiter.

For more information about exporting data for backup purposes, see the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.

You can use report scripts or calculation scripts to export Essbase data in text format. Both tools enable you to create text files that meet the import format specifications of most other programs.

## Exporting Data Using MaxL

You can export data from an Essbase database using the `export data` MaxL statement. Data can be export serially or in parallel. If the data for a thread exceeds 2 GB, Essbase may divide the export data into multiple files with numbers appended to the file names.

- Block storage databases: You can export all data, level-0 data, or input-level data, which does not include calculated values.

To export data in parallel, specify a comma-separated list of export files, up to a maximum of 1024 file names. The number of file names determines the number of export threads. The
number of available block-address ranges limits the number of export threads that Essbase actually uses. Essbase divides the number of actual data blocks by the specified number of file names (export threads). If there are fewer actual data blocks than the specified number of export threads, the number of export threads that are created is based on the number of actual data blocks. This approach results in a more even distribution of data blocks between export threads.

**Note:** In specifying the number of export files, it is important to consider the number of available CPU cores and I/O bandwidth on the computer on which Essbase Server runs. Specifying too large a number can result in poor performance.

**Note:** Parallel export operations on block storage databases do not dynamically create threads, but instead use a set number of threads from a pre-created pool of threads. You can customize the size of the thread pool. For more information, see the WORKERTHREADS configuration setting topic in the *Oracle Essbase Technical Reference*.

- Aggregate storage databases: You can export only level-0 data, which does not include calculated values. (Level-0 data is the same as input data in aggregate storage databases.) You cannot perform upper-level data export or columnar export on an aggregate storage database.

To export data in parallel, specify a comma-separated list of export files, from 1 to 8 file names. The number of threads Essbase uses typically depends on the number of file names you specify. However, on a very small aggregate storage database with a small number of data blocks, it is possible that only a single file will be created (in effect, performing serial export), even though parallel export to multiple files is requested.

Export files are stored in the `ARBORPATH/app` directory on the server unless an absolute path is specified.

### Exporting Text Data Using Calculation Scripts

You can use the following calculation commands to select and format a text import file: DATAEXPORT, DATAEXPORTCOND, SET DATAEXPORTOPTIONS, FIX...ENDFIX, and EXCLUDE...ENDEXCLUDE. For general information about creating and running a calculation script, see Chapter 29, “Developing Calculation Scripts for Block Storage Databases.”

Calculation script-based data export works with stored and dynamically calculated members only and provides fewer formatting options than report scripts. However, calculation script-based data exports provide decimal- and precision-based formatting options and can be faster than report scripts. The DATAEXPORT calculation command also enables export directly to relational databases, eliminating the usual intermediate import step.

The following calculation script example produces a text file that contains a subset of the database.

```
SET DATAEXPORTOPTIONS
{   DATAEXPORTLEVEL "ALL";
```
These commands specify inclusion of all levels of data and indicate that data is to be repeated in columns, with the Scenario dimension set as the dense dimension column header for the output. The FIX command defines the data slice, and then the data is exported to a text file at C:\exports\actual.txt. Commas are used as delimiters, and missing data values are indicated by consecutive delimiters. Running this script against Sample.Basic generates the following data:

"Actual"
"100-10","New York","Sales","Qtr1",1998
"100-10","New York","COGS","Qtr1",799
"100-10","New York","Margin","Qtr1",1199
"100-10","New York","Marketing","Qtr1",278
"100-10","New York","Payroll","Qtr1",153
"100-10","New York","Misc","Qtr1",2
"100-10","New York","Total Expenses","Qtr1",433
"100-10","New York","Profit","Qtr1",766
"100-10","New York","Opening Inventory","Qtr1",2101
"100-10","New York","Additions","Qtr1",2005
"100-10","New York","Ending Inventory","Qtr1",2108
"100-10","New York","Margin %","Qtr1",60.01001001001001
"100-10","New York","Profit %","Qtr1",38.33833833833834
"100-10","New York","Profit per Ounce","Qtr1",63.83333333333334

For information about DATAEXPORT calculation commands, see the Oracle Essbase Technical Reference.

Exporting Text Data Using Report Scripts

Report Writer provides extensive flexibility in selecting output data and formatting it to meet the needs of other programs. Report scripts work with all member types (for example: stored members, Dynamic Calc members, attributes, label-only members, shared members, and aliases.) However, report scripts generally are slower because they use query-based data extraction, which probes data blocks that are not materialized in the database. See “Executing Report Scripts” in the Oracle Essbase Administration Services Online Help and “Executing Report Scripts” on page 539. Report script-based export provides more flexibility in formatting the data and is ideal for generating professional-looking reports.

When you export data to a program that uses a two-dimensional, fixed-field format, you need not specify page or column dimensions. To create a two-dimensional report, you can specify every dimension as a row dimension. Use the ROWREPEAT command to add the name of each member specified to each row (rather than the default, nested style). The following script example and report illustrate this situation for a five-dimensional database:

<ROW (Year, Measures, Product, Market, Scenario)
(ROWREPEAT)
<ICHILDREN Year

609
Sales
<ICHILDREN "400"
East
Budget
!!!

Resulting report:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Sales</th>
<th>100-10</th>
<th>100-20</th>
<th>100-30</th>
<th>100</th>
<th>100-20</th>
<th>100-30</th>
<th>100-20</th>
<th>100-30</th>
<th>100-20</th>
<th>100-30</th>
<th>100-20</th>
<th>100-30</th>
<th>100-20</th>
<th>100-30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qtr1</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Qtr1</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Qtr1</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Qtr2</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Qtr2</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Qtr3</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Qtr3</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Qtr4</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Qtr4</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Year</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Year</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Year</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
<tr>
<td>Year</td>
<td>Sales</td>
<td>400-10</td>
<td>400-20</td>
<td>400-30</td>
<td>400</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
<td>400-20</td>
<td>400-30</td>
</tr>
</tbody>
</table>

To create a two-dimensional report that contains only bottom-level (level 0) data, use CHILDREN or DIMBOTTOM to select level 0 members.

- To list only level 0 data for specific members, use the CHILDREN command with the level 1 member as a parameter above the data that you want to print.
- To list all level 0 data for the dimension to which a given member belongs, use the DIMBOTTOM command with any member in the dimension that contains the data that you want to print.

For example, the following script uses the CHILDREN command to select the children of Qtr1, which is a level 1 member, and the DIMBOTTOM command to select all level 0 data in the Product dimension.

```plaintext
<ROW (Year, Measures, Product, Market, Scenario)
{ROWREPEAT}
{DECIMAL 2}
<CHILDREN Qtr1
Sales
<DIMBOTTOM Product
East
Budget
!!!
```

Resulting report:

<table>
<thead>
<tr>
<th>Month</th>
<th>Sales</th>
<th>100-10</th>
<th>100-20</th>
<th>100-30</th>
<th>100-20</th>
<th>100-30</th>
<th>100-20</th>
<th>100-30</th>
<th>100-20</th>
<th>100-30</th>
<th>100-20</th>
<th>100-30</th>
<th>100-20</th>
<th>100-30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>100-10</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>100-10</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>100-10</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>100-10</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
<td>100-20</td>
<td>100-30</td>
</tr>
</tbody>
</table>

610
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>200-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>200-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>200-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>200-40</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>300-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>300-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>300-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>400-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>400-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Jan</td>
<td>Sales</td>
<td>400-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>100-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>100-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>100-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>200-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>200-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>200-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>200-40</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>300-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>300-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>300-40</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>400-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>400-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Feb</td>
<td>Sales</td>
<td>400-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>100-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>100-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>100-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>200-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>200-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>200-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>200-40</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>300-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>300-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>300-30</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>400-10</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>400-20</td>
<td>East</td>
<td>Budget</td>
</tr>
<tr>
<td>Mar</td>
<td>Sales</td>
<td>400-30</td>
<td>East</td>
<td>Budget</td>
</tr>
</tbody>
</table>

For another example of formatting for data export, see “Sample 12 on the Examples of Report Scripts” page in the “Report Writer Commands” section of the Oracle Essbase Technical Reference.
The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

**Integrating Relational Databases with Essbase**

Because relational databases can store several terabytes of data, they offer nearly unlimited scalability. Multidimensional databases, generally smaller than relational databases, offer sophisticated analytic capabilities. By integrating a relational database with an Essbase database, you leverage the scalability of the relational database with the conceptual power of the multidimensional database.

A source relational database can be integrated with an Essbase database by using XOLAP (extended online analytic processing). This a variation on the role of OLAP in business intelligence. Specifically, XOLAP is an Essbase multidimensional database that stores only the outline metadata and retrieves data from a relational database at query time. XOLAP thus integrates with an Essbase database, leveraging the scalability of the relational database with the more sophisticated analytic capabilities of a multidimensional database. Your business needs determine whether OLAP or XOLAP is best suited to your environment.

**XOLAP Overview**

XOLAP (extended online analytic processing) is a variation on the role of OLAP in business intelligence. Specifically, XOLAP is an Essbase multidimensional database that stores only the outline metadata and retrieves data from a relational database at query time. XOLAP thus integrates a source relational database with an Essbase database, leveraging the scalability of the relational database with the more sophisticated analytic capabilities of a multidimensional
database. Your business needs determine whether OLAP or XOLAP is best suited to your environment.

OLAP and XOLAP store the metadata outline and the underlying data in different locations:
- In OLAP, the metadata is located in the Essbase database, and the underlying data is also located in the Essbase database.
- In XOLAP, the metadata is located in the Essbase database while the underlying data remains in your source relational database.

The differences in the locations of the metadata and data are key to understanding how XOLAP can be of benefit because these differences affect the functionality of OLAP and XOLAP.

OLAP lends itself to traditional relational data storage and data analysis. XOLAP lends itself to operations supported in mixed or "hybrid" environments.

For information on guidelines and restrictions in using XOLAP and how to designate models for XOLAP, see the *Oracle Essbase Studio User’s Guide*.

**XOLAP Workflow**

The workflow of data retrieval in an XOLAP environment is much like that of a non-XOLAP environment:

1. The model is designated as XOLAP-enabled in Essbase Studio.
2. The cube is deployed in Essbase Studio; however, no data is loaded at that time.
3. The Essbase database is queried using Smart View or other reporting tools that can access Essbase databases.
4. Essbase dynamically generates the required SQL to retrieve the data from the source relational database.

**Guidelines for Using XOLAP**

**Subtopics**
- Restrictions for XOLAP
- Usages Not Supported in XOLAP

XOLAP has several restrictions. There are also several usages not supported in XOLAP.

**Restrictions for XOLAP**

XOLAP has the following restrictions:
- No editing of an XOLAP cube is allowed. If you wish to modify an outline, you must, instead, create a new outline in Essbase Studio. XOLAP operations will not automatically incorporate
any changes in the structures and the contents of the dimension tables after an outline is created.

- When derived text measures are used in cube schemas to build an Essbase model, XOLAP is not available for the model.
- XOLAP can be used only with aggregate storage. The database is automatically duplicate-member enabled.
- XOLAP supports dimensions that do not have a corresponding schema-mapping in the catalog; however, in such dimensions, only one member can be a stored member.
- XOLAP is supported for these data sources only:
  - IBM DB2
  - Netezza
  - Teradata

**Usages Not Supported in XOLAP**

XOLAP does not support use of the following

- Flat files
- Ragged hierarchies
- Alternate hierarchies
- Recursive hierarchies
- Calendar hierarchies
- Filters
- Typed measures
- User defined members at the leaf level
- Multiple relational data sources

**Optimizing XOLAP**

Use the following Essbase configuration settings to optimize XOLAP performance:

- SSOPTIMIZEDGRIDPROCESSING: Specifies whether optimized grid processing, which cuts the input grid into symmetric grids to create fewer symmetric queries, is enabled for spreadsheet operations.
- SSBULKGRIDPROCESSING: Optimizes asymmetric Grid API queries for XOLAP.
Part VI

Designing and Managing a Security System

In Designing and Managing a Security System:

- User Management and Security in EPM System Security Mode
- Managing the Essbase Security File (essbase.sec)
- Controlling Access to Database Cells Using Security Filters
Using Essbase in EPM System Security Mode

Essbase is deployed in EPM System security mode. EPM System security uses Oracle Hyperion Shared Services to provide user management, user provisioning, and external authentication definition. Provisioning refers to the process of assigning roles and access permissions to users for Essbase applications.

EPM System security requires access to a Shared Services server running Shared Services client and server software, and to a database dedicated to Shared Services.

Essbase no longer supports Essbase native security mode. You must migrate Essbase deployments that are in Essbase native security mode to EPM System security mode. See “Migrating Essbase from Native Security to EPM System Security” on page 629 for information about migrating any Essbase Server applications and any existing Essbase users and groups to Shared Services.
Security for Users and Groups in EPM System Security

Subtopics

- EPM System Security Migration and Upgrade Considerations
- User Security Considerations after EPM System Security Migration and Upgrade

In EPM System security mode, Essbase obtains user and group details (including user and group information and provisioning to Essbase applications) from Shared Services. Essbase no longer stores all users and groups in the Essbase security file (essbase.sec); therefore, an Essbase Administrator does not need to explicitly synchronize security between Essbase and Shared Services.

When a user logs on to Essbase, Essbase queries Shared Services for that user’s information. The privileges with which a user starts a session are preserved throughout the session, regardless of whether the user’s privileges are changed in Shared Services during the session.

A user or group is stored in the Essbase security file only under the following circumstances:

- The user or group was not successfully migrated to Shared Services.
- The user or group is assigned database calculation or filter access.
- The user or group is specified in the query governor exclude list.
- The user is the creator of an application or database.
- The user has locked a database-related artifact.
- The PERSISTUSERATLOGIN configuration setting is set to TRUE.

When a user logs on to Essbase, PERSISTUSERATLOGIN specifies whether to add the user to the essbase.sec file, if the user does not already exist in the file.

To remove users or groups from the Essbase security file without de-provisioning them from Shared Services, use the drop user or drop group MaxL statements with the from security_file grammar. Calculation and filter associations also are removed.

Note: The drop user and drop group MaxL statements are deprecated, except when using the from security_file grammar. Oracle recommends using Shared Services Console, Java API, or Lifecycle Management to remove users and groups instead of using MaxL or C API.

For display operations, Essbase queries Shared Services.

EPM System Security Migration and Upgrade Considerations

When migrating Essbase from Essbase native security to EPM System security, users that do not successfully migrate are retained in the Essbase security file.
If a user’s database permissions changed during migration to Shared Services, information is written to a text file named `AccessModifiedUsers_n.txt`, where `n` represents the sequence ID for the instance of Essbase that is registered with Shared Services. (The sequence ID is incremented each time Essbase is externalized.) This file, which is located in the `ARBORPATH/bin` directory, contains the following information:

- The user’s name
- Applications and databases to which the user has access
- The user’s access level for a specific database before migration to Shared Services
- The user’s access level after migration to Shared Services, including access acquired through groups and other means
- The user’s filter assignments

In Shared Services, if an Essbase application contains multiple databases, the databases must have the same user security access levels (however, users can have different calculation script and database filters assigned for databases within the same application). During migration to Shared Services, if a user has different access levels for two databases in the same application, the user is given the more restrictive access level for both databases.

When migrating Shared Services users with the option to have user passwords automatically generated, those user names and passwords are written to a text file named `MigratedUsersPassword.txt`, which is located in the `ARBORPATH/bin` directory. If the Administrator designated a specific password for the migrated users, the password is not listed in the file. This file is created when performing an upgrade or migration.

User Security Considerations after EPM System Security Migration and Upgrade

The following security issues must be addressed after migrating users to Shared Services or upgrading Essbase:

- To log on to Essbase and access the Essbase agent, a user no longer must have the Server Access role on the global Essbase Server application. A user with any role (whether directly or indirectly provisioned) on an Essbase application can log on to Essbase and access the Essbase agent.

  To prevent users who do not have a role on the global Essbase Server application from accessing the Essbase agent, you must manually modify users’ roles. Be sure to evaluate the roles that a user inherits from a group.

- When a user logs on to Essbase, Essbase queries Shared Services for the user’s roles. The more roles that a user has, the longer it takes to complete the login process. To improve login performance, users should not be assigned unneeded roles.

  Essbase no longer assigns the Application Manager role, which is unnecessary, to an Essbase Administrator when he creates an Essbase application. If, in your Essbase deployment, the Application Manager role is assigned to Essbase Administrators, you must manually remove the Application Manager role from the Essbase Administrators.
Also, an Essbase Administrator who has an Administrator role on the global Essbase Server application might be assigned application roles that are not needed. Essbase provides a migration utility that can remove the application roles for Essbase Administrators only.

The migration utility (which runs on 32-bit Windows only), identifies the users who are affected by both security issues. Additionally, if specified, the utility can correct the issue of Essbase Administrators having application roles.

To run the migration.bat file:

1. Navigate to the ESSBASEPATH/utilities directory.
2. Unzip the migration.zip file, which creates a MigrationTools subdirectory.
3. In the MigrationTools subdirectory, edit the migration.properties file with the following information:
   - AdminUserName—Name of the Essbase Administrator who runs the migration utility
   - AdminUserPassword—The Essbase Administrator’s password
   - HSSServer—Hostname of the Shared Services Server
   - HSSPort—Port number of the Shared Services Server
   - EssbaseProjectName—The project name for the Essbase Server on which you want to run the migration utility
   - SavedToFile—When set to TRUE, specifies that the results of the migration script should be written to the following text files, which are located in the MigrationTools subdirectory:
     - EntitiesWithCubeRolesOnly.txt—Lists the users and groups that have application roles but do not have a role on the global Essbase Server application
     - EssbaseAdminsWithCubeRoles.txt—Lists the Essbase Administrators who have application roles

   When set to FALSE (the default), the results are written to the screen.

   Sample versions of these files are located in the MigrationTools subdirectory.

   - FixAdminUser—When set to TRUE, removes application roles from Essbase Administrators. When set to FALSE (the default), writes the names of Essbase Administrators, and the application roles assigned to them, to the screen.

   For example:

   AdminUserName = admin
   AdminUserPassword = password
   HSSServer = pant5
   HSSPort = 58080
   EssbaseProjectName = Analytic Servers:ALNG3:1
   SavedToFile true
   FixAdminUser false
Note: When running the utility for the first time against an Essbase Server, Oracle recommends setting SavedToFile to TRUE and FixAdminUser to FALSE so that you can view and verify the results. Then, you can set FixAdminUser to TRUE and run the utility again to remove application roles from Essbase Administrators.

4 Run the migration.bat file.
5 Make any necessary manual changes.

**Essbase User Roles for Shared Services**

Roles, which determine the tasks that users can perform, can be grouped in the following ways:

- **Product-specific roles**
  
  Examples of Essbase roles are Administrator and Database Manager. All Essbase roles are specific to a Shared Services application (the permissions granted to the user by the role apply only to the specific application for which the role is assigned, and not to all applications).

- **Shared Services roles**
  
  Examples of Shared Services roles are Project Manager or Provisioning Manager. Most Shared Services roles are global (the role applies to all Shared Services applications). An exception is the Provisioning Manager role, which is specific to an application.

  See the *Oracle Enterprise Performance Management System User Security Administration Guide*.

The following Essbase roles provide different levels of authority to perform tasks in Essbase.

You can provision a user with the following roles for an Essbase Server:

- Administrator
- Create/Delete Application
- Server Access

You can provision a user with the following roles for an application:

- Application Manager
- Database Manager
- Calc
- Write
- Read
- Filter
- Start/Stop Application

In Shared Services Console, roles belonging to Essbase are grouped under the Essbase node; roles belonging to Essbase applications are grouped under the application nodes.
Note: There is no concept of provisioning an Administration Services Administrator user role through Shared Services. When migrated, an Administration Services Administrator is assigned no roles in Shared Services.

Table 119 lists the user roles that are specific to Essbase and the Shared Services role of Provisioning Manager, which is application-specific. The table shows the corresponding tasks that each user can perform.

Table 119 Essbase and Shared Services User Roles and Tasks

<table>
<thead>
<tr>
<th>User Role</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager</td>
<td>(A Shared Services role) Creates and manages projects within Shared Services.</td>
</tr>
<tr>
<td>Administrator (previously Supervisor)</td>
<td>Full access to administer the server, applications, and databases.</td>
</tr>
<tr>
<td>Note: The Provisioning Manager role, which is a Shared Services application-specific role, is automatically assigned when you migrate Essbase Administrators (previously known as Supervisors). However, when you create an Essbase Administrator in Shared Services Console, you must manually assign the Provisioning Manager role. Users with the Provisioning Manager role can provision users and groups with roles for applications.</td>
<td></td>
</tr>
<tr>
<td>Create/Delete Application</td>
<td>Ability to create and delete applications and databases within applications. Includes Application Manager and Database Manager permissions for the applications and databases created by this user.</td>
</tr>
<tr>
<td>Server Access</td>
<td>Ability to access any application or database that has a minimum access permission other than none.</td>
</tr>
<tr>
<td>Application Manager (previously Application Designer)</td>
<td>Ability to create, delete, and modify databases and application settings within the particular application. Includes Database Manager permissions for databases within the application. An Application Manager can delete only those applications and databases that he created.</td>
</tr>
<tr>
<td>Note: The Provisioning Manager role is automatically assigned when you migrate Essbase Application Managers. However, when you create an Essbase Application Manager in Shared Services Console, you must manually assign the Provisioning Manager role.</td>
<td></td>
</tr>
<tr>
<td>Database Manager (previously Database Designer)</td>
<td>Ability to manage databases (for example, to change the database properties or cache settings), database artifacts, locks, and sessions within the assigned application.</td>
</tr>
<tr>
<td>Calc</td>
<td>Ability to calculate, update, and read data values based on the assigned scope, using any assigned calculations and filter.</td>
</tr>
<tr>
<td>Write</td>
<td>Ability to update and read data values based on the assigned scope, using any assigned filter.</td>
</tr>
<tr>
<td>Read</td>
<td>Ability to read data values.</td>
</tr>
<tr>
<td>Filter</td>
<td>Ability to access specific data and metadata according to the restrictions of a filter.</td>
</tr>
<tr>
<td>Start/Stop Application</td>
<td>Ability to start and stop an application or database.</td>
</tr>
</tbody>
</table>

Essbase Projects, Applications, and Databases in Shared Services

Shared Services artifacts include projects, applications, user roles, users, and groups. When you assign access to a user or group in Shared Services, you provision the user or group with a role.
for an application. See the Oracle Enterprise Performance Management System User Security Administration Guide.

Shared Services and Essbase both use the term “application.” Essbase uses “application” to refer to a container for databases. Shared Services uses “application” to refer to an artifact for which you provision users. In this topic, “application” refers to a Shared Services application, unless an Essbase application is specifically stated. In most cases, an Essbase application maps to a Shared Services application, so the distinction is unnecessary.

For Essbase, migration is done at the Essbase Server level. When you migrate an Essbase Server to Shared Services, a Shared Services project is created for the Essbase Server. The project is named `Essbase:machineName:EssbaseServer#`, where `machineName` is the Essbase Server computer name and `EssbaseServer#` is the sequence number. The sequence number for the first Essbase Server that is migrated is 1. When migrating multiple Essbase Servers on the same computer, the sequence number is incremented by 1. Also, if you delete the security file and remigrate an Essbase Server, each successful migration creates a new server project with a new sequence number. You can delete unwanted projects in Shared Services Console.

Essbase automatically creates the following applications within the project and automatically registers the applications with Shared Services:

- An application named `Essbase:machineName:EssbaseServer#`, which is the same name as the Shared Services project. This application, which allows you to specify security at the Essbase Server level, is known as the global Essbase Server application. After migration, you can change the name of the global application and application project in Shared Services by using the `alter system MaxL` statement with the `rename global registration name` grammar. See the Oracle Essbase Technical Reference.

- A Shared Services application for each Essbase application on the Essbase Server. In Shared Services, if an Essbase application contains multiple databases, the databases must have the same user security access levels. (However, users can have different calculation script and database filters assigned for databases within the same application. See “Assigning Database Calculation and Filter Access in Shared Services” on page 628.)

In the following illustration, the first instance of `Essbase:JWARD:1` is the Shared Services project for the first Essbase Server migrated on JWARD. The second instance of `Essbase:JWARD:1` is the global Essbase Server application.

```
Projects
   Essbase:JWARD:1
      ASOsamp
      DMDemo
      Demo
      Essbase Servers:JWARD:1
      Sampeast
      Sample
      Sample_U
      Samppart
```

After you have migrated to Shared Services, when you create an application and database in Essbase, a corresponding Shared Services application is created within the Essbase Server project, and the application is automatically registered with Shared Services.
**Essbase Users and Groups in Shared Services**

When you migrate to Shared Services, all native Essbase users and groups that do not already exist in an external authentication directory are converted to native Shared Services users and groups in the native Shared Services user directory and are given equivalent roles. Externally authenticated users are registered with Shared Services but are still stored in their original authentication directory. See “User and Group Migration” on page 631.

After you have migrated to Shared Services, you must create and manage users and groups in Shared Services Console, or through the external user directory. See the *Oracle Enterprise Performance Management System User Security Administration Guide*.

When users and groups are stored in an external authentication directory from any supported authentication provider, a user and group can have the same name on the same provider; however, two users or two groups cannot have the same name on the same provider.

Shared Services supports aggregated groups, in which a parent group contains one or more subgroups. The subgroups inherit the roles of their parent group. For example, if a parent group is provisioned with the Essbase Administrator role, any subgroups (and users in the groups) inherit the Essbase Administrator role.

**Note:** In Essbase, when you copy an application or database and the target Essbase Server is in EPM System security mode, user and group security is not copied with the application. Use the copy provisioning functionality in Shared Services Console to copy security for an application.

**Assigning Access to Users in Shared Services**

**Subtopics**

- Launching and Logging In to Shared Services Console
- Assigning Server Access in Shared Services
- Assigning Application Access in Shared Services
- Assigning Database Calculation and Filter Access in Shared Services
- Assigning Application Access Type in Shared Services

Shared Services Console provides a centralized UI where you can perform user management tasks for EPM System products. The Shared Services Console launches Essbase screens, which allow you to assign security access to database filters and calculation scripts. In EPM System security mode, you use Shared Services Console, MaxL, or the API to manage security.

**Note:** Some restrictions exist when managing security using MaxL or the C API. It is recommended to use Shared Services Console, Java API, or Oracle Hyperion Enterprise Performance Management System Lifecycle Management for user and group management tasks, instead of using MaxL or C API. For specific restrictions on MaxL, see the MaxL section of *Oracle Essbase Technical Reference*.

In Administration Services Console, you can only view security information.
For information on assigning access to users and groups and viewing a report of users, groups, and provisioned roles for each application, see the Oracle Enterprise Performance Management System User Security Administration Guide.

**Launching and Logging In to Shared Services Console**

To manage Essbase users in Shared Services Console, you must log on to the console as a user who is provisioned with the following Shared Services roles:

- Provisioning Manager role for the appropriate Essbase Server or applications
- Directory Manager role for the appropriate authentication directory

When you launch Shared Services Console, you log on as whichever user is appropriate. For example, you must log on as a Shared Services Administrator to provision an Essbase Administrator with the Directory Manager role, so that he or she can create and delete users.

**Assigning Server Access in Shared Services**

To specify security at the Essbase Server level in EPM System security mode (for example, provisioning a user with the Provisioning Manager role for all Essbase applications on an Essbase Server), provision the user with the appropriate role for the global Essbase Server application; that is, the Shared Services application that represents the Essbase Server. See “Essbase Projects, Applications, and Databases in Shared Services” on page 624.

Figure 140 shows the roles that are available for the Essbase Server named DTRIPATH-PC1 and the Demo application.

**Figure 140  Shared Services Console Provisioning Panel**
Note: When you provision a user with the Essbase Administrator role, you must also manually provision the user with the Provisioning Manager role for the Essbase Server and for each Essbase application on the server. (When you migrate an Essbase Administrator, the Provisioning Manager role is automatically assigned.)

Assigning Application Access in Shared Services

To specify security at the Essbase application level in EPM System security mode (for example, provisioning a user with the Database Manager role for the Sample application), provision the user with the appropriate role for the application.

Note: When you provision a user with the Application Manager role, you must also manually provision the user with the Provisioning Manager role for the appropriate application. (When you migrate an Essbase Application Manager, the Provisioning Manager role is automatically assigned.)

You can set minimum permissions for an application, for example, if you want all users to have at least write access to all databases in an application. The default setting is None, meaning that no minimum permission is set; all users can access the application according to their roles.

To set the minimum permission for an application:

See “Setting Minimum Permissions for Applications” in the Oracle Essbase Administration Services Online Help.

Assigning Database Calculation and Filter Access in Shared Services

After provisioning users for Essbase applications in Shared Services Console, you can assign more granular access permissions to users and groups for a specific Essbase application and database. For example, after assigning a user access to an application and assigning the user’s role for the application, you can assign an Essbase filter to the user, or assign the user access to a specific calculation script.

You must create the filters and calculation scripts in Essbase. See Chapter 41, “Controlling Access to Database Cells Using Security Filters.”

When you select an Essbase application from Shared Services Console, you see a list of the users and groups provisioned to that application. You can select the users and groups to which you want to assign additional permissions. You then select the database to which a user or group needs access, and assign filter and calculation script access to selected users and groups. See the Shared Services Console online documentation.
To specify access permissions in Shared Services, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Assigning Database Calculation and Filter Access</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>grant</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

When you assign database calculation and filter access, you automatically log on to Administration Services and Essbase as the Shared Services Console logged-in user. This user must be an Essbase Administrator, Application Manager, or Database Manager. The user must have the Provisioning Manager role for the appropriate applications.

You cannot assign database calculation or filter access to an Essbase Administrator or Application Manager.

**Assigning Application Access Type in Shared Services**

Essbase and Planning have the concept of an *application access type* for Essbase and Planning users. For example, when an Essbase user is created using any Essbase administration tool, the user is automatically assigned the “Essbase” application access type; when a Planning user is created using the Planning interface, the user is automatically assigned the “Planning” application access type. A user’s application access type specifies whether the user has access to Essbase applications only, to Oracle Hyperion Planning applications only, or to both.

In Shared Services Console, you can select a global Essbase Server application to see the list of users and groups provisioned to that application. See the *Oracle Enterprise Performance Management System User Security Administration Guide*.

When you assign database calculation and filter access, you automatically log on to Administration Services and Essbase as the Shared Services Console logged-in user. This user must be a valid Essbase Administrator and must have the Provisioning Manager role for the appropriate applications.

To refresh Essbase with application access type information for newly provisioned users, click **Refresh**.

**Migrating Essbase from Native Security to EPM System Security**

**Subtopics**

- Application and Database Migration
- User and Group Migration

If Essbase and Administration Services use Essbase native security mode, you must migrate each deployment to EPM System security mode. For Essbase, migration is done at the Essbase Server.
level. After you have converted to EPM System security mode, you cannot convert back to Essbase native security mode. Essbase native security mode is no longer supported.

You must be an Essbase Administrator to run a migration.

➢ To migrate Essbase Server, Essbase Administration Server, and users and groups to EPM System security, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Converting Essbase Server and Migrating Users to Shared Services</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter system</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

For Essbase Administration Server, if you ran Oracle Hyperion Enterprise Performance Management System Configurator after installation and specified a Shared Services server and login, at that point, Essbase Administration Server is converted to EPM System security mode. You can view the Shared Services configuration information in the Essbase Administration Server properties window (Configuration tab). You can then migrate Administration Services users to Shared Services.

You must be an Administration Services Administrator to migrate Administration Services users.

➢ To migrate Administration Services users or to remigrate any Essbase users and groups that failed migration, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Migrating Users to Shared Services</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter group, alter user, display group, display user</td>
<td>Oracle Enterprise Performance Management System User Security Administration Guide</td>
</tr>
</tbody>
</table>

**Note:** Before migrating users, groups, and applications to Shared Services, ensure that the NETDELAY and NETRETRYCOUNT configuration settings are high enough to allow the migration to complete. Set NETDELAY to at least 3 hours, possibly more, depending on the size of the security file. Return the settings to their original values after the migration is complete. Specify these settings in the client essbase.cfg file, which you place in the ARBORPATH/bin folder of the client computer from which you launch the migration. For example, if you use Administration Services Console to launch the migration, the client essbase.cfg file must be in the ARBORPATH/bin folder on the computer on which Essbase Administration Server is installed.
Essbase automatically creates a backup of the security file before and after migration (essbase.bak_preUPM and essbase.bak_postUPM). Oracle suggests that you manually back up these files to a safe location.

The Administration Services Essbase Server Properties window displays information on whether the server is in EPM System security mode.

### Application and Database Migration

After you have migrated to Shared Services, a project is created for each Essbase Server that you migrate. The project contains a Shared Services application for each Essbase application on the migrated server. See “Essbase Projects, Applications, and Databases in Shared Services” on page 624.

### User and Group Migration

When you migrate to Shared Services, all native Essbase users and groups that do not already exist in an external authentication directory are converted to native Shared Services users and groups in the native Shared Services user directory and are given equivalent roles. For example, a native Essbase Administrator (previously known as Supervisor) becomes a Shared Services user with the Essbase Administrator and the Provisioning Manager roles assigned, and a native Essbase user with Calc privileges on a database becomes a Shared Services user with the Calc role assigned on the application that contains the database. During migration, Administrators and Application Managers are automatically given the Provisioning Manager role for the appropriate applications.

**Note:** When Essbase runs in EPM System security mode, the Essbase create/delete user privilege becomes obsolete. You must be an Essbase administrator to create/delete Essbase users and, additionally, you must be a Shared Services administrator to create/delete users in Shared Services.

Any externally authenticated users are registered with Shared Services but remain stored in their original authentication directory. If a user directory is not running, the entire migration fails.

Any disabled Essbase users or groups do not migrate.

An Essbase user name cannot exist as a group name in Shared Services. If it does, the Essbase user does not migrate.

In Shared Services, if an Essbase application contains multiple databases, the databases must have the same user security access levels. During migration, if a user has different access levels for two databases in the same application, the user is given the more restrictive access level for both databases. In such cases, a warning is sent to the Administrator who ran the migration and the information is logged in the AccessModifiedUsers_n.txt file, which is located in the ARBORPATH/bin directory.

Users and groups are migrated in the following order:
1. Applications that are registered with Shared Services
2. Groups
3. Users

If a migration fails, the status of the migration depends on the point at which it fails. For example, if the migration fails at step 1, then the total migration fails. If a migration fails at step 2, the result depends on the reason for failure. If a migration fails at step 3, when one or more users fails to migrate, then applications and groups may have been migrated.

Users and groups that fail migration are listed in the `essbase.sec` file, which is located in the `ARBORPATH/bin` directory.

When you use Administration Services Externalize Users Wizard to migrate Administration Services users or to remigrate Essbase users that previously failed to be migrated, migration errors are logged in the file that you specify in the wizard, as well as in the Essbase Server log (`EPM_ORACLE_HOME/logs/essbase/essbase.log`).

If a group fails migration, all users in the group fail migration; you must repair and migrate the group in order for the users to migrate successfully.

If a group exists in both Essbase and Shared Services, the following conditions apply:

- Shared Services cannot contain two groups at different levels in the same hierarchy (an ancestor-child relationship) when the groups exist in Essbase (see Example 2). If it does, the entire migration process fails.
- The Shared Services group cannot contain a user that does not exist in the Essbase group of the same name. If it does, the Essbase group, and all users in the group, do not migrate.
- The Essbase group cannot contain a user that exists in Shared Services, unless the Shared Services user belongs to the Shared Services group of the same name. If it does, the Essbase group, and all users in the group, do not migrate.

The following examples highlight group migration considerations:

**Example 1:** The groups in this example migrate successfully from Essbase to Shared Services.

Essbase has groups named group 1 and group 2:

```
group 1, group 2
```

Shared Services has two identical groups and also has a group 3, which contains group 1 and group 2:

```
group 3
  | group 1, group 2
```

The groups migrate successfully because group 1 and group 2 are at the same level as each other in Shared Services and because Essbase does not have a group 3.

**Note:** If group 3 has Administrator (previously known as Supervisor) access to the Essbase Server instance and Essbase group 1 and group 2 have user access, the resulting group 1 and group 2 in Shared Services will have Administrator access.
Example 2: The migration in this example fails because Shared Services contains group 1 and group 2 at different levels.

Essbase has groups named group 1 and group 2:

```
group 1, group 2
```

Shared Services has group 1 and group 2, but group 1 contains group 2:

```
group 1
| group 2
```

Example 3: The migration in this example fails because Essbase contains group 1, group 2, and group 3 and Shared Services contains group 3 at a different level from group 1 and group 2.

Essbase has groups named group 1, group 2, and group 3:

```
group 1, group 2, group 3
```

Shared Services has group 1 and group 2, but has a group 3, which contains group 1 and group 2:

```
group 3
| group 1, group 2
```

**User and Group Identities**

In EPM System security mode, Essbase enables user and group names to be non-unique, if you specify the user or group’s provider directory or unique identity attribute.

In MaxL, user and group names can be specified as `name@provider` or as a unique identity attribute.

The provider is the name of a user directory, such as LDAP or Active Directory, where the external user or group is hosted. The unique identity attribute, or "identity," is a unique string assigned to every user and group. The identity enables Essbase to distinguish between users and groups with the same name across providers.

For more information, see the MaxL topics for USER-NAME and GROUP-NAME in the *Oracle Essbase Technical Reference*.

**Note:** If a user or group name includes the @ character, you must specify the provider as well, or else Shared Services considers the @ character as a delimiter indicating a provider name. For example, if you want to log in user admin@msad, who is on a Native Directory provider, you must specify 'admin@msad@Native Directory'.
Security Information Recovery in EPM System Security Mode

Subtopics

- User and Group Information
- Application Information

If a discrepancy occurs between the security information in Shared Services and the security information in the Essbase security file, the type of discrepancy determines whether Shared Services information or the Essbase security file information takes precedence.

User and Group Information

Shared Services takes precedence for user and group information. User and group information can be restored using Shared Services and external user directory backup and recovery procedures. See the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.

Note: When recovering user and group information, any associations to filters, calculation scripts, and application access type are lost if the Shared Services backup does not have that information. If the Essbase security backup file does not have that information, the filters and calc scripts themselves are lost (not just the associations to the users or groups).

Application Information

Essbase takes precedence for application and database information. If an application is deleted from Shared Services, the application is still available in Essbase. You must reregister the application with Shared Services. If an application is deleted in Essbase, it is automatically deleted from Shared Services.

To reregister an application with Shared Services, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Reregistering Applications with Shared Services</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Managing the Essbase Security File (essbase.sec)

About the Essbase Security File

In EPM System security mode, some Essbase security information is stored by Shared Services and external user directories, and some security information is stored in the Essbase security file (essbase.sec), located in the ARBORPATH/bin directory.

The following information is stored by Shared Services or by the external user directories:

- Users
- Groups
- Passwords
- User and group role information for applications

The following information is stored in essbase.sec:

- Calculation script access
- Filter access
- Application access type
- Application and database properties, including substitution variables and DISKVOLUMES settings (block storage databases only)

The content of essbase.sec is encrypted; however, the contents can be exported to a readable, text file format, which is useful for review purposes. When exporting the essbase.sec file, follow your company’s security procedures to ensure the integrity of the data. See “Exporting the Essbase Security File to a Readable Format” on page 640.
Managing Essbase Security Backup Files

Each time you start Essbase Server, Essbase creates a temporary file, named tempessbase.sec, that is used to validate the Essbase security file (essbase.sec). When Essbase Server successfully starts using essbase.sec, tempessbase.sec is deleted and Essbase creates a security backup file, named essbase_timestamp.bak.

You can manage the number of security backup files that Essbase maintains; the interval at which the security backup files are created; and whether to switch to the latest, valid security backup file on startup if the essbase.sec file is invalid.

- **NUMBEROFSECFILEBACKUPS** configuration setting: Specifies the maximum number (2 to 10) of security backup files that Essbase creates and maintains. When the limit is exceeded, Essbase deletes the security backup file with the oldest timestamp and creates the latest backup file.

  By default, Essbase maintains a minimum of two versions of essbase_timestamp.bak.

- **SECFILEBACKUPINTERVAL** configuration setting: Specifies the amount of time Essbase waits before creating a security backup file.

  By default, Essbase creates a new security backup file every 300 seconds (which is five minutes).

- **ENABLESWITCHTOBACKUPFILE** configuration setting: Specifies whether Essbase automatically loads a valid security backup file at startup if the essbase.sec file is invalid.

  By default, Essbase does not load a security backup file at startup if the security file is invalid.

  Also see “Reconciling the Essbase Security File to the State of Essbase on an External Disk” on page 639.

The content of essbase_timestamp.bak is encrypted.

To update the essbase_timestamp.bak file, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Updating the Security Backup File</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter system sync security backup</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>essbase.cfg</td>
<td>NUMBEROFSECFILEBACKUPS SECFILEBACKUPINTERVAL ENABLESWITCHTOBACKUPFILE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Note:** Essbase automatically creates a backup of the security file before and after migration (essbase.bak_preUPM and essbase.bak_postUPM). See “Migrating Essbase from Native Security to EPM System Security” on page 629.
Restoring the Essbase Security File

The Essbase security file (essbase.sec) would need to be restored if the file was missing or invalid (or corrupted), and if all back up files are invalid.

If you attempt to start Essbase Server and cannot get a password prompt or your password is rejected, no backup files are created. You can restore essbase.sec from the latest, valid security backup file by copying essbase_timestamp.bak to essbase.sec. Both files are in the ARBORPATH/bin directory.

Because Essbase uses EPM System security, you must also restore the latest backups from Shared Services and any external user directories that you are using.

If the essbase.sec file is missing (for example, the Essbase Server bin directory is moved and then a patch is applied), Essbase creates a new security file at startup but Essbase may start in Essbase native security mode instead of in EPM System security mode. Messages similar to the following ones are logged in the essbase.log file:

[Mon Oct 08 16:10:30 2012]Local/ESSBASE0///2636/Error(1051430)
Failed to create Essbase project [EssbaseCluster-1] at Shared Services with Error [Application group already exist.]

[Mon Oct 08 16:10:30 2012]Local/ESSBASE0///2636/Warning(1056822)
Failed to migrate Essbase to HSS security mode during startup. Check SharedServices_Security_client.log. May need to remove essbase.sec and any of the newly migrated Essbase applications from HSS, then rerun configuration tool.

To start Essbase in EPM System security mode, remove the Essbase project (for example, EssbaseCluster-1) from Shared Services and then restart Essbase.

If the essbase.sec file is invalid, messages similar to the following ones are logged in the essbase.log file:

[Mon Oct 08 15:35:19 2012]Local/ESSBASE0///2600/Warning(1056801)
Validation of security file [C:\Oracle\Middleware\user_projects\epmsystem1\EssbaseServer \essbaseserver1\BIN\ESSBASE.SEC] failed

[Mon Oct 08 15:35:19 2012]Local/ESSBASE0///2600/Warning(1056801)
Validation of security file [C:\Oracle\Middleware\user_projects\epmsystem1\EssbaseServer \essbaseserver1\bin\ESSBASE_1349731009.BAK] failed

If the ENABLESWITCHTOBACKUPFILE configuration setting is set to TRUE in the essbase.cfg file, Essbase automatically loads a valid security backup file at startup. Messages similar to the following ones are logged in the essbase.log file:

[Mon Oct 08 15:35:19 2012]Local/ESSBASE0///2600/Warning(1056802)
ESSBASE will use the file [C:\Oracle\Middleware\user_projects\epmsystem1\EssbaseServer \essbaseserver1\bin\ESSBASE_1349720690.BAK] as the security file

[Mon Oct 08 15:35:19 2012]Local/ESSBASE0///2600/Info(1056797)
Incremental security backup started by SYSTEM. The file created is [C:\Oracle\Middleware\user_projects\epmsystem1\EssbaseServer\essbaseserver1\bin \ESSBASETS_1349735719.BAK]

[Mon Oct 08 15:35:20 2012]Local/ESSBASE0///2600/Info(1051134)
External Authentication Module: [Single Sign-On] enabled
If all security backup files are invalid, messages similar to the following ones are logged in the essbase.log file:

...  
rtype = 50630 rlen = 50116 rindex = 49602
Read Error: Part of security file is missing
Read Error: Invalid security file
rtype = 12849 rlen = 13363 rindex = 32513
Read Error: Part of security file is missing
Read Error: Invalid security file

Fatal Error: The security file is not valid and there are no valid back up files to use. Restart Essbase after deleting the security file, a new security file will be created.

Again, remove the Essbase project (for example, EssbaseCluster-1) from Shared Services and then restart Essbase.

For information on backup procedures for Shared Services and Essbase, see the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide and the documentation for the appropriate external user directories.

**Caution!** Back up the Essbase security file and Shared Services simultaneously.

### Changing Essbase Security Backup File Comparison Frequency

Essbase updates the latest, valid security backup file (essbase_timestamp.bak) if Essbase determines that the security file (essbase.sec) has changed since the latest security backup file (essbase_timestamp.bak) was created. By default, Essbase performs this check at specified intervals instead of only when Essbase Server starts.

Consider the following facts before changing the interval value:

- In Administration Services, the same check box manages how often the security backup file is checked against the security file and how often user inactivity is checked.
- The default value is five minutes, the recommended setting to ensure that the security backup file is checked frequently enough to capture security changes. Five minutes is also the recommended value for the inactivity check.
- If you set the value to zero, the inactivity check is disabled, and the essbase_timestamp.bak file is compared to essbase.sec every five minutes (and updated if necessary).
- Enter a larger value if your security file does not need to be updated frequently. Enter a smaller value if performance is not an issue.

You can also update the security backup file anytime, not only at specified intervals.
To manually update the security backup file or change the frequency of backup file comparisons, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Updating the Security Backup File</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter system sync security_backup</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Reconciling the Essbase Security File to the State of Essbase on an External Disk

When Essbase is started using the latest, valid security backup file (essbase_timestamp.bak) instead of essbase.sec, you can use the alter system MaxL statement to reconcile the security file to match the state of Essbase applications and databases on an external disk.

The alter system reconcile grammar logs messages in essbase.log when:

- An application or database folder is on the disk but not in the security file
- An application or database is in the security file but not on the disk. In this scenario, using the alter system reconcile force grammar removes the application or database from the security file.

Managing Essbase Security File Fragmentation

Subtopics

- Displaying the Essbase Security File Fragmentation Status
- Compacting the Essbase Security File While the Agent is Running

Changing or deleting Essbase security entities, such as filters, users, groups, applications, databases, substitution variables, disk volumes, passwords, and other Essbase artifacts, can cause fragmentation in the security file (essbase.sec). Too much fragmentation in files can slow down security-related performance.

Essbase compacts the security file automatically each time the Agent is stopped. You can check the fragmentation status of the security file and you can compact the security file without stopping the Agent.

Displaying the Essbase Security File Fragmentation Status

The fragmentation status of the security file is displayed as a percent.

To display the fragmentation status of the security file, use the display system MaxL statement with the security file fragmentation_percent grammar.
Compacting the Essbase Security File While the Agent is Running

Besides manually compacting the security file, you can use the SECURITYFILECOMPACTIONPERCENT configuration setting to define a percentage of fragmentation that triggers compaction automatically.

➢ To compact the security file without stopping the Agent, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
<td>COMPACT</td>
<td>Enter the Agent command at the command prompt in the Essbase Server window</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter system compact security file</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>essbase.cfg</td>
<td>SECURITYFILECOMPACTIONPERCENT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Note: Compacting the security file while the Agent is running slows down Agent activity until the operation is completed, which could take a few minutes.

Exporting the Essbase Security File to a Readable Format

An Essbase Administrator can export the contents of the essbase.sec file for an Essbase Server instance to a readable text file format, which is useful for review purposes.

Caution! When exporting essbase.sec, follow your company’s security procedures to ensure the integrity of the data.

The export security file command, which can be run from Administration Services Console or as a MaxL statement, is run against the Essbase Server session for which you are currently logged in. The Essbase Server session can be run as a service.

➢ To export essbase.sec, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Exporting the Security File</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>export security_file</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Note: The DUMP agent command is similar to the export security file command, except that the DUMP command cannot be executed against an Essbase Server running as a service. See Table 128 on page 691.
About Security Filters

When security levels defined for applications, databases, users, and groups are insufficient, Essbase security filters give you more specific control. Filters enable you to control access to individual data within a database by defining what kind of access is allowed to which parts of the database, and to whom these settings apply.

If you have Administrator permissions, you can define and assign any filters to any users or groups. Filters do not affect you.

If you have Create/Delete Applications permissions, you can assign and define filters for applications that you created.

If you have Application Manager or Database Manager permissions, you can define and assign filters within your applications or databases.

Defining Permissions Using Security Filters

Filters control security access to data values, or cells. You create filters to accommodate security needs for specific parts of a database. When you define a filter, you designate restrictions on particular database cells. When you save the filter, you give it a unique name to distinguish it from other filters, and the server stores it in the essbase.sec security file. You can then assign the filters to any users or groups on Essbase Server.

For example, a manager designs a filter named RED and associates it with a database to limit access to cells containing profit information. The filter is assigned to a visiting group called REVIEWERS, so that they can read, but cannot alter, most of the database; they have no access to Profit data values.
Filters comprise one or more access settings for database members. You can specify the following access levels and apply them to data ranging from a list of members to one cell:

- **None**: No data can be retrieved or updated for the specified member list.
- **Read**: Data can be retrieved but not updated for the specified member list.
- **Write**: Data can be retrieved and updated for the specified member list.
- **Metaread**: Metadata (dimension and member names) can be retrieved and updated for the corresponding member specification.

**Note:** The metaread access level overrides all other access levels. If additional filters for data are defined, they are enforced within any defined metaread filters. If you have assigned a metaread filter on a substitution variable and then try to retrieve the substitution variable, an unknown member error occurs, but the value of the substitution variable is displayed. This behavior is expected. Metadata security cannot be completely turned off in partitions. Therefore, do not set metadata security at the source database; otherwise, incorrect data may result at the target partition. When drilling up or retrieving on a member that has metadata security turned on and has shared members in the children, an unknown member error occurs because the original members of the shared members have been filtered. To avoid this error, give the original members of the shared members metadata security access.

Any cells that are not specified in the filter definition inherit the database access level. Filters can, however, add or remove access assigned at the database level, because the filter definition, being more data-specific, indicates a greater level of detail than the more general database access level.

Data values not covered by filter definitions default to the access levels defined for users.

Calculation access is controlled by permissions granted to users and groups. Users who have calculate access to the database are not blocked by filters—they can affect all data elements that the execution of their calculations would update.

**Note:** During the calculation of MDX calculated members, cells to which a user does not have access are treated as #MISSING cells.
Creating Filters

Subtopics

- Filtering Members Versus Filtering Member Combinations
- Filtering Using Substitution Variables
- Filtering with Attribute Functions
- Metadata Filtering

You can create a filter for each set of access restrictions you need to place on database values. You need not create separate filters for users with the same access needs. After you have created a filter, you can assign it to multiple users or groups of users. However, only one filter per database can be assigned to a user or group.

**Note:** If you use a calculation function that returns a set of members, such as children or descendants, and it evaluates to an empty set, the security filter is not created. An error is written to the application log stating that the region definition evaluated to an empty set.

Before creating a filter, perform the following actions:

- Connect to the server and select the database associated with the filter.
- Check the naming rules for filters in Appendix A, “Limits.”

To create a filter, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating or Editing Filters</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create filter</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Filtering Members Versus Filtering Member Combinations

*Figure 141* illustrates different ways to control access to database cells. Data can be protected by filtering entire members or by filtering member combinations.

- Filtering members separately affects whole regions of data for those members.
- Filtering member combinations affects data at the member intersections.
Filtering Members Separately

To filter all the data for one or more members, define access for each member on its own row in Filter Editor. Filter definitions on separate rows of a filter are treated with an OR relationship.

For example, to block access to Sales or Jan, assume that user KSmith is assigned the following filter:

- Access: None. Member specification: Sales.
- Access: None. Member specification: Jan.

The next time user KSmith connects to Sample.Basic, her spreadsheet view of the profit margin for Qtr1 (Figure 142) shows that she has no access to data values for the member Sales or the member Jan, which are marked with #NOACCESS. All data for Sales is blocked from view, as well as all data for January, inside and outside of the Sales member. Data for COGS (Cost of Goods Sold), a sibling of Sales and a child of Margin, is available, with the exception of COGS for January.
Filtering Member Combinations

To filter data for member combinations, define the access for each member combination using a row in Filter Editor. In filter definitions, two member sets separated by a comma are treated as union of those two member sets (an AND relationship).

For example, assume that user RChinn is assigned the following filter: Access: None. Member specification: Sales, Jan.

The next time user RChinn connects to Sample.Basic, her spreadsheet view of the profit margin for Qtr1 (Figure 143) shows that she has no access to the data value at the intersection of members Sales and Jan, which is marked with #NoAccess. Sales data for January is blocked from view. However, Sales data for other months is available, and non-Sales data for January is available.

Filtering Using Substitution Variables

Substitution variables enable you to more easily manage information that changes regularly. Each substitution variable has an assigned name and value. The Database Manager can change the value anytime. Where a substitution variable is specified in a filter, the substitution variable value at that time is used.

For example, if you want a group of users to see data only for the current month, you can set up a substitution variable named CurMonth and define a filter (MonthlyAccess) wherein you specify access, using &CurMonth for the member name. Using an ampersand (&) at the beginning of a specification identifies it as a substitution variable instead of a member name to Essbase. Assign the MonthlyAccess filter to the appropriate users.

Each month, you need to change only the value of the CurMonth substitution variable to the member name for the current month, such as Jan, Feb, and so on. The new value will apply to all assigned users.

See “Using Substitution Variables” on page 120.
Filtering with Attribute Functions

You can use filters to restrict access to data for base members sharing a particular attribute. To filter data for members with particular attributes defined in an attribute dimension, use the attribute member in combination with the @ATTRIBUTE function or the @WITHATTR function.

**Note:** @ATTRIBUTE and @WITHATTR are member set functions. Most member set functions can be used in filter definitions.

For example, assume that user PJones is assigned this filter: Access: None. Member specification: @ATTRIBUTE("Caffeinated_False").

The next time user PJones connects to Sample.Basic, his spreadsheet view of first-quarter cola sales in California (Figure 144) shows that he has no access to the data values for any base dimension members associated with Caffeinated_False. Sales data for Caffeine Free Cola is blocked from view. Note that Caffeine Free Cola is a base member, and Caffeinated_False is an associated member of the attribute dimension Caffeinated (not shown in the above spreadsheet view).

![Figure 144 Results of Filter Blocking Access to Caffeine-free Products](image)

<table>
<thead>
<tr>
<th>Sales</th>
<th>California</th>
<th>Qtr1</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cola</td>
<td>1998</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet Cola</td>
<td>367</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caffeine Free Cola</td>
<td>#Miss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colas</td>
<td>2757</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Metadata Filtering

Metadata filtering provides data filtering and an additional layer of security. With metadata filtering, an administrator can remove outline members from a user’s view, providing access only to those members that are of interest to the user.

When a filter is used to apply MetaRead permission on a member:

1. Data for all ancestors of that member are hidden from the filter user’s view.
2. Data and metadata (member names) for all siblings of that member are hidden from the filter user’s view.
Managing Filters

Subtopics

- Viewing Filters
- Editing Filters
- Copying Filters
- Renaming Filters
- Deleting Filters

Viewing Filters

➤ To view a list of filters, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating or Editing Filters</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display filter</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LISTFILTERS</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Editing Filters

➤ To edit a filter, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating or Editing Filters</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create filter</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Copying Filters

You can copy filters to applications and databases on any Essbase Server, according to your permissions. You can also copy filters across servers as part of application migration.

➤ To copy a filter, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Filters</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create filter</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>COPYFILTER</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
**Renaming Filters**

➢ To rename a filter, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Renaming Filters</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create filter</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>RENAMEFILTER</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Deleting Filters**

➢ To delete a filter, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Deleting Filters</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>drop filter</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Assigning Filters**

Subtopics

- Assigning Filters in EPM System Security Mode
- Overlapping Filter Definitions
- Overlapping Metadata Filter Definitions
- Overlapping Access Definitions

After you define filters, you can assign them to users or groups, which lets you manage multiple users who require the same filter settings. Modifications to the definition of a filter are automatically inherited by users of that filter.

Filters do not affect users who have the Administrator role. Only one filter per database can be assigned to a user or group.

**Assigning Filters in EPM System Security Mode**

In EPM System security mode, you assign filters through Oracle Hyperion Shared Services Console.

To assign a filter to a user or group, see “Assigning Database Calculation and Filter Access in Shared Services” on page 628.
Overlapping Filter Definitions

If a filter contains rows that have overlapping member specifications, the inherited access is set by the following rules, listed in order of precedence:

1. A filter that defines a more detailed dimension combination list takes precedence over a filter with less detail.
2. If the preceding rule does not resolve the overlap conflict, the highest access level among overlapping filter rows is applied.

For example, this filter contains overlap conflicts:

- Access: None. Member specification: Actual.
- Access: Read. Member specification: Actual, @DESCENDANTS("New York").

The third specification defines security at a greater level of detail than the other two. Therefore, read access is granted to all Actual data for members in the New York branch.

Because write access is a higher access level than none, the remaining data values in Actual are granted write access.

All other cells, such as Budget, are accessible according to the minimum database permissions.

If you have write access, you also have read access.

Note: Changes to members in the database outline are not reflected automatically in filters. You must manually update member references that change.

Overlapping Metadata Filter Definitions

You should define a MetaRead filter using multiple rows only when the affected member set in any given row (the metaread members and their ancestors) has no overlap with MetaRead members in other rows. It is recommended that you specify one dimension per row in filters that contain MetaRead on multiple rows. However, as long as there is no overlap between the ancestors and MetaRead members, it is still valid to specify different member sets of one dimension into multiple MetaRead rows.

For example, in Sample Basic, the following filter definition has overlap conflicts:

- Access: MetaRead. Member specification: California.

In the first row, applying MetaRead to California has the effect of allowing access to California but blocking access to its ancestors. Therefore, the MetaRead access to West is ignored; users who are assigned this filter will have no access to West.

If you wish to assign MetaRead access to West, as well as California, the appropriate method is to combine them into one row: Access: MetaRead. Member specification: California, West.
Overlapping Access Definitions

When the access rights of user and group definitions overlap, the following rules, listed in order of precedence, apply:

1. An access level that defines a more detailed dimension combination list takes precedence over a level with less detail.
2. If the preceding rule does not resolve the overlap conflict, the highest access level is applied.

Example 1:
User Fred is defined with the following database access:

<table>
<thead>
<tr>
<th>FINPLAN</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPPLAN</td>
<td>R</td>
</tr>
<tr>
<td>PRODPLAN</td>
<td>N</td>
</tr>
</tbody>
</table>

He is assigned to Group Marketing, which has the following database access:

<table>
<thead>
<tr>
<th>FINPLAN</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPPLAN</td>
<td>N</td>
</tr>
<tr>
<td>PRODPLAN</td>
<td>W</td>
</tr>
</tbody>
</table>

His effective rights are set as:

<table>
<thead>
<tr>
<th>FINPLAN</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPPLAN</td>
<td>W</td>
</tr>
<tr>
<td>PRODPLAN</td>
<td>W</td>
</tr>
</tbody>
</table>

Example 2:
User Mary is defined with the following database access:

<table>
<thead>
<tr>
<th>FINPLAN</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODPLAN</td>
<td>N</td>
</tr>
</tbody>
</table>

She is assigned to Group Marketing, which has the following database access:

<table>
<thead>
<tr>
<th>FINPLAN</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODPLAN</td>
<td>W</td>
</tr>
</tbody>
</table>

Her effective rights are set as:

<table>
<thead>
<tr>
<th>FINPLAN</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODPLAN</td>
<td>W</td>
</tr>
</tbody>
</table>

In addition, Mary uses the filter artifact RED (for the database FINPLAN). The filter has two filter rows:

- Access: Write. Member specification: Budget, @IDESCENDANTS(“New York”).

The Group Marketing also uses a filter artifact BLUE (for the database FINPLAN). The filter has two filter rows:

- Access: Read. Member specification: Actual, Sales.
Mary’s effective rights from the overlapping filters, and the permissions assigned to her and her group:

- R: Entire FINPLAN database.
- W: For all Budget data in the New York branch.
- W: For data values that relate to Budget and Sales.
In Enabling Multi-Language Applications Through Unicode:

- Understanding the Essbase Unicode Implementation
- Administering Unicode-Mode Applications
Understanding the Essbase Unicode Implementation

In This Chapter

About Unicode ........................................................................................... 655
When to Use Unicode-Mode Applications ............................................................. 656
Locales and the ESSLANG Variable .................................................................... 657
Unicode and Non-Unicode Application Modes ....................................................... 657
Unicode and Non-Unicode Essbase Server Modes ............................................... 658
Increased Name Lengths ................................................................................ 658
Compatibility Between Different Versions of Client Programs and Essbase Applications ......... 658
Unicode-Enabled C API.................................................................................. 659
Identification of Text Encoding and Locale ............................................................ 659
Unicode-Enabled Administration Tools ............................................................... 659
Retrieval Tools ............................................................................................. 660
SQL Interface ............................................................................................. 660
Sample_U.Basic ......................................................................................... 661

The information in this chapter applies to block storage and aggregate storage databases.

About Unicode

Sharing data across national and language boundaries is a challenge for multinational businesses. Traditionally, each computer stores and renders text based on its locale specification. A locale identifies the local language and cultural conventions, such as currency and date format, data sort order, and character-set encoding. Encoding refers to the bit combinations used to store the character text as data, as defined by a code page or an encoding format. In Essbase, code pages map characters to bit combinations for non-Unicode encodings.

Because different encodings can map the same bit combination to different characters, a file created on one computer can be misinterpreted by another computer with a different locale.

The Unicode Standard enables computers with different locales to share character data. Unicode provides encoding forms with thousands of bit combinations, enough to support the character sets of multiple languages simultaneously. By combining all character mappings into one encoding form, Unicode enables users to correctly view character data created on computers with different locale settings.
Essbase conforms to version 2.1 of the Unicode Standard and uses UTF-8 encoding. See www.unicode.org.

Through its Unicode implementation, Essbase enables employees of global businesses to view, in their own languages, company information stored in Essbase databases. For example, using alias tables in their respective languages, users in Taiwan can view database reports in Chinese characters, and users in France can view the same reports in French characters.

The following topics describe the characteristics of the Essbase implementation of Unicode.

Note: In Essbase, user-defined character sets (UDC) are not supported.

### When to Use Unicode-Mode Applications

Consider working with Unicode-mode applications only in the following situations:

- You need to enable users with different languages to view, in their own languages and character sets, information from a common database.
  
  For example, using alias tables in Japanese and German, users in Japan and Germany can view information about a common product set in their own languages.

- You need to handle artifact names longer than non-Unicode-mode applications support.
  
  For example, application and database names need to include more than eight characters, or you are working with a multibyte character set, and you need to handle more characters in artifact names.

  See Appendix A, “Limits.”

- For a translated, multibyte Essbase implementation, you have experienced a “round-trip” problem, where two different bit values can map to the same character, which can occur in communications between multibyte operating systems and application programs.
  
  As Java applications, Administration Services and Provider Services always work in Unicode; therefore, no round-trip conversion errors occur.

When deciding whether to use Unicode-mode applications, consider the following points:

- Using non-Unicode text files with Unicode-mode applications requires an understanding of locales and care in managing them. Oracle recommends using UTF-8 encoded files to prevent errors that can cause database corruption.
  
  See “Managing File Encoding” on page 668.

- To work with Unicode-mode applications, custom client programs that were written to support non-Unicode-mode applications must be built to use the longer strings used by Unicode-mode applications. This task may be a simple rebuild or may involve reprogramming, depending on the design of the applications. Depending on how modified programs are coded, more memory may be required.

  See the Oracle Essbase API Reference.
Locales and the ESSLANG Variable

Essbase uses the ESSLANG variable to define the locale of a computer. For example, to support American English, you can set ESSLANG to `English_UnitedStates.Latin1@Binary`.

For each Essbase Server installation, you must specify the ESSLANG variable, which should be set to the locale that is defined for the computer's operating system.

For client computers, specifying the ESSLANG variable is optional. If ESSLANG is defined, Essbase uses the ESSLANG value as the computer locale. If ESSLANG is not specified, the operating system locale is used.

The ESSLANG variable is set when you install Essbase. See the *Oracle Enterprise Performance Management System Installation and Configuration Guide*.

For non-Unicode-mode clients and applications, the client and Essbase Server locale values must be the same. For Unicode-mode applications, client and Essbase Server locale values can be different.

Unicode and Non-Unicode Application Modes

Applications are designated as Unicode-mode applications or non-Unicode-mode applications.

**Unicode-mode applications** support multiple character sets. When Essbase works with Unicode-mode applications, it uses the UTF-8 encoding form to interpret and store character text. Character-based artifacts in Unicode-mode applications, such as member and alias names, can include characters from different languages.

Because Unicode-mode applications accept input files in non-Unicode-encoding and UTF-8, Essbase relies on locale indicators and user prompting to read or write non-Unicode-encoded files.

Clients working with Unicode-mode applications can have locales different from that of Essbase Server. For example, client computers with Japanese locales and client computers with German locales can work with the same Unicode-mode application on an instance of Essbase Server that has a Spanish locale.

For Unicode-mode applications, the limits of most artifact names are longer than the limits in non-Unicode-mode applications, and the limits are calculated based on characters rather than bytes. See “Increased Name Lengths” on page 658.

**Non-Unicode-mode applications** support one character set that is defined by a locale value that must be the same for Essbase Server and all non-Unicode clients that work with non-Unicode-mode applications. By default, Essbase creates applications in non-Unicode mode.

You can define an application as Unicode-mode when you create the application (see “Creating Unicode-Mode Applications” on page 665), or you can migrate a non-Unicode-mode application to Unicode mode in a separate step (see “Migrating Applications to Unicode Mode” on page 665).

**Note:** You cannot convert a Unicode-mode application to non-Unicode mode.
Unicode-mode and non-Unicode-mode applications can reside on the same Essbase Server.

**Unicode and Non-Unicode Essbase Server Modes**

Essbase Server is in Unicode mode when it has permission to create Unicode-mode applications and to migrate existing applications to Unicode mode. See “Setting Essbase Server to Unicode Mode” on page 664.

Whether Essbase Server is in Unicode mode affects only the creation and migration of applications. Regardless of the Essbase Server Unicode setting, you can work with both Unicode mode and non-Unicode-mode applications.

**Increased Name Lengths**

For Unicode-mode applications, the maximum number of characters allowed in strings, such as application, database, and member names, is greater than the maximum allowed for non-Unicode-mode applications.

The maximum length of Unicode artifact names is based on the number of characters, regardless of how many bytes each character requires. The maximum length of non-Unicode artifact names is calculated in bytes.

Not limiting by bytes is advantageous for applications using multibyte character sets, such as Chinese and Japanese. For example, the limit for member names in Unicode-mode applications is 1024 characters, even if they are multibyte characters, whereas the limit for member names in non-Unicode applications is 1024 bytes. See Appendix A, “Limits.”

**Note:** The increased size limits may affect the size of the outline and user-written client programs.

To take advantage of longer name sizes, users may decide to work with Unicode-mode applications, even if all users work in the same locale (see “When to Use Unicode-Mode Applications” on page 656).

**Compatibility Between Different Versions of Client Programs and Essbase Applications**

Essbase supports Unicode-mode and non-Unicode-mode client programs.

*Non-Unicode-mode client programs* (for example, MaxL Shell):

- Communicate with Essbase API in short strings
- Cannot make changes to Unicode-mode outlines
- Cannot perform outline synchronization of Unicode-mode outlines
Unicode-mode client programs (for example, Administration Services Console and Smart View):

- Communicate with Essbase API in Unicode encoding, using long strings
- Cannot synchronize non-Unicode-mode outlines with multibyte characters

**Note:** If you use Administration Services Console or another tool to create a MaxL script and save it in UTF-8 and then execute the script in MaxL Shell, MaxL Shell assumes the role of a Unicode-mode client. You can use this approach, for example, to update outlines through dimension builds. When you create the script, remember to include the UTF-8 signature. See “Encoding Indicators” on page 669.

### Unicode-Enabled C API

Custom-written client programs used with pre-7.0 Essbase releases cannot be used with Unicode-mode applications because these custom programs use short strings and short buffers.

To provide restricted access to Unicode-mode applications, these older custom client programs, depending on how they are written, can be recompiled in a Unicode-enabled release of Essbase. When recompiled, the programs work with long buffers but short strings.

For complete access to Unicode-mode and non-Unicode-mode applications, existing custom applications must be modified using the Essbase API functions for Unicode. Rewritten and compiled clients work with long buffers and long strings for full Unicode support. See the Oracle Essbase API Reference.

### Identification of Text Encoding and Locale

Essbase supports use of non-Unicode-encoded files, such as report and calculation scripts, with Unicode-mode applications. To identify a file's encoding type, Essbase looks for encoding indicators (UTF-8 signature or locale indicator). If a file does not contain either encoding indicator, and the file is not on Essbase Server, Administration Services prompts the user for the locale of the file. See “Encoding Indicators” on page 669.

The Essbase Unicode File Utility includes options to insert a UTF-8 signature or locale indicator in text files. Or you can use a text editor or other means to insert them. See “Essbase Unicode File Utility” on page 673.

### Unicode-Enabled Administration Tools

To administer Unicode-mode applications, you can use Administration Services and MaxL Shell (ESSCMD is not supported). With Administration Services Console, which is a Unicode-mode client, you can administer Unicode-mode and non-Unicode-mode applications.

Unicode-related administration activities include changing the Unicode-related mode of Essbase Server to enable or disable the following abilities:

- Creation of Unicode-mode applications
Migration of non-Unicode-mode applications to Unicode mode

Viewing of Unicode-related status of Essbase Server and applications

See Chapter 43, “Administering Unicode-Mode Applications”.

Retrieval Tools

Essbase provides several methods for retrieving data from Unicode-mode and non-Unicode-mode applications.

Report Script

Report script output files are encoded to the encoding of the application. For example, if a report script is run against a database in a Unicode-mode application, the report script output is encoded in UTF-8; if run against a database in a non-Unicode-mode application, the output is encoded in the encoding of the application.

Spreadsheet

With Smart View, you can view data in Unicode-mode and non-Unicode-mode applications.

To run Smart View, you connect to Provider Services. To install these programs, see the Oracle Enterprise Performance Management System Installation and Configuration Guide.

For information about working with Smart View, see the Oracle Smart View for Office User’s Guide.

SQL Interface

With SQL Interface, you can load data from a Unicode-mode relational database to a Unicode-mode Essbase application. Table 120 shows supported encodings for Unicode-mode and non-Unicode-mode applications:

<table>
<thead>
<tr>
<th>Application mode</th>
<th>Relational Database Encoding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Unicode</td>
<td>A supported non-Unicode encoding</td>
</tr>
<tr>
<td>Unicode</td>
<td>A supported non-Unicode encoding</td>
</tr>
<tr>
<td>Unicode</td>
<td>UTF-8</td>
</tr>
</tbody>
</table>

SQL Interface accepts user authentication (user name and password) and application information in UTF-8 encoding.

See “Supported Locales” on page 671.
Sample_U.Basic

To learn more about Unicode-mode applications, use the Sample_U.Basic application. Member names in Sample_U.Basic are in English.

Table 121 lists the non-English alias tables and their import files included in the Sample_U.Basic database:

<table>
<thead>
<tr>
<th>Language</th>
<th>Non-English Alias Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>nameschn.alt</td>
</tr>
<tr>
<td>German</td>
<td>namesger.alt</td>
</tr>
<tr>
<td>Japanese</td>
<td>namesjpn.alt</td>
</tr>
<tr>
<td>Russian</td>
<td>namesrsn.alt</td>
</tr>
</tbody>
</table>
The information in this chapter applies to block storage and aggregate storage databases.

**Setting Up a Computer for Unicode Support**

Install the following tools (provided by third-party vendors) for working with UTF-8 encoded text on computers that manage Unicode-mode applications:

- UTF-8 fonts: For viewing UTF-8 encoded text that contains non-ASCII characters
- (Optional) Unicode editor (which includes the UTF-8 signature): For manual editing of data sources or other text files

Essbase provides the Essbase Unicode File Utility, which converts text files to UTF-8 encoding. See “Essbase Unicode File Utility” on page 673.

**Defining Password Security**

Essbase security is defined at the Essbase Server level. To create passwords, use characters encoded according to the code page specified in the ESSLANG variable on the Essbase Server computer.

In a multibyte character set environment, passwords cannot contain multibyte characters. Consider using the characters in the standard ASCII character set, in the range from 0 through
127, which includes the uppercase and lowercase letters in the standard English alphabet and the numerals 0 through 9. These characters are common to all code pages and to UTF-8.

**Naming Applications and Databases**

When you name applications and databases, you must use characters that are supported by the character set that is specified by the ESSLANG variable. On the computer where Essbase Server is installed, the ESSLANG variable must be set to the locale that is defined for the computer's operating system.

**Managing Unicode-Mode Essbase Servers**

The topics in this section discuss processes for managing Unicode-mode Essbase Servers.

**Setting Essbase Server to Unicode Mode**

By setting Essbase Server to Unicode mode, you grant permission for creating Unicode-mode applications and for migrating applications to Unicode mode.

➤ To set Essbase Server to Unicode mode, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Managing Essbase Server Permissions to Create Unicode-Mode Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter system</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Note:** The UNICODEENABLE setting, when added to `essbase.cfg`, enables you to create Unicode-mode applications without needing to set the Essbase Server to Unicode mode. You can also work with Unicode-mode applications without Essbase Server being set to Unicode mode.

**Viewing the Unicode-Related Mode of Essbase Server**

The Unicode-related mode of Essbase Server indicates whether Essbase Server has permission to create Unicode-mode applications and to migrate applications to Unicode mode.

In Administration Services Console, the Unicode-related mode is shown as a server property.

In MaxL Shell, the Unicode-related mode is displayed as the configuration, with the following values:

- 2, for non-Unicode-mode applications
- 3, for Unicode-mode applications
To see whether Essbase Server is set to Unicode mode, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Managing the Essbase Server Permission to Create Unicode-Mode Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display system</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Managing Unicode-Mode Applications
The topics in this section discuss processes for managing Unicode-mode applications.

Creating Unicode-Mode Applications
When you create an application, you can specify the application to be Unicode-mode-enabled.

To create a Unicode-mode-enabled application, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Unicode-Mode Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Migrating Applications to Unicode Mode
When Essbase Server migrates a non-Unicode-mode application to Unicode mode, the character encoding in the application files is converted to UTF-8 encoding.

Before migrating application files to Unicode mode, perform the following tasks:

- Back up all application and database files in the application.
  See the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.
- If needed, apply the outline change files and then remove them.
  If present, outline change files reside in each database directory, with the database name as the file name and a .chg extension; for example, /sample/basic/basic.chg.
- To avoid mixing Unicode encoding and non-Unicode encoding in log files, back up log files and then clear or remove them.
  Log files end with any of the following extensions: .log, .xcp, and .olg.
- Grant Essbase Server permission to migrate applications to Unicode mode. See “Setting Essbase Server to Unicode Mode” on page 664.

665
To migrate an application from non-Unicode mode to Unicode mode, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Migrating Applications to Unicode Mode</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Text files, such as calculation scripts, report scripts, and data sources, are not converted to UTF-8 encoding. For Unicode-mode applications, text files can be encoded in UTF-8 or in non-Unicode locales. You can use Essbase Unicode File Utility to convert non-Unicode-encoded files to UTF-8. See “Essbase Unicode File Utility” on page 673.

**Note:** If you choose to work with non-Unicode text files in your Unicode-mode application, ensure that you understand how Essbase determines the locales of non-Unicode text files. See “Managing File Encoding” on page 668.

### Backing Up and Restoring Databases Between Unicode and Non-Unicode Applications

When working with Unicode and non-Unicode applications, Essbase does not allow a backed up database from a Unicode application to be restored to a non-Unicode application.

For a list of supported combinations of restoring backed up databases between Unicode and non-Unicode applications, see the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.

### Viewing the Unicode-Related Mode of an Application

In Administration Services, the Unicode-related mode of an application is shown as an application property. In MaxL, it is displayed as the application type, with the following values:

- 2, for non-Unicode-mode applications
- 3, for Unicode-mode applications

To see whether an application is a Unicode-mode application, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Monitoring Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Using Control Characters in Report Scripts

When working with reports for non-Unicode-mode applications, Report Writer uses language-specific codes that enable columnar data to line up precisely. Because Unicode does not contain language-specific formatting codes within its encoding, report columns may not line up precisely.

Non-Unicode-mode applications that use single-byte code pages support the following Hexadecimal control characters in report scripts:

\( x20, x09, x0A, x0D, xB3, xC3, xC4, xC2, xC0, x0C, xB1 \)

Unicode-mode applications and non-Unicode-mode applications that use multibyte code pages support the following Hexadecimal control characters in report scripts:

\( x20, x09, x0A, x0C, x0D \)

Working with Partitions

Consider the following situations when designing and working with partitions:

- Partitions cannot connect non-Unicode-mode databases to Unicode-mode databases.
- For transparent and replicated (but not linked) partitions, the application mode of both ends of the partitions must be the same—either Unicode mode or non-Unicode mode.
- All databases in a partition must be in the same encoding.
- Partitions across Unicode-mode databases can be administered by Unicode-mode clients; for example, Administration Services or MaxL scripts executed in Administration Services Console.
- Non-Unicode-mode outlines containing multibyte characters cannot be synchronized by Unicode-mode clients, such as Administration Services and MaxL scripts. You can, however, use a client that is not Unicode-enabled or a non-Unicode mode client, such as MaxL Shell (`essmsh`).

Working with Logs

By default, the Essbase agent log file is encoded to the locale specified by the ESSLANG variable defined for Essbase Server. You can use the UNICODEAGENTLOG configuration setting to write the agent log file in UTF-8 encoding. With a UTF-8 font, all characters in the log file should be readable. See the Oracle Essbase Technical Reference.

Application and outline change log files for databases in Unicode-mode applications are UTF-8 encoded. To view:

- Application logs, use Log Viewer or Log Analyzer in Administration Services, or a UTF-8 editor
- Outline change logs, use a UTF-8 editor
You cannot change the encoding of log files related to Unicode-mode applications to non-Unicode encoding.

Managing File Encoding

Essbase supports many non-Unicode encodings (see “Supported Locales” on page 671). In addition, UTF-8 encoding is supported for Unicode-mode applications.

Because a bit combination can map to different characters in different encodings, you must understand how Essbase works with file encodings, particularly if you intend to use non-Unicode-encoded files with Unicode-mode applications.

Note: Oracle recommends using UTF-8-encoded files for Unicode-mode applications shared across multiple locales. Using UTF-8 encoding is simpler, because you need not keep track of locales and encoding, and it can be more efficient, because Essbase Administration Server uses Unicode encoding internally, and no internal conversion between formats is needed.

The following topics describe how Essbase determines the encoding of files and how you manage files with different encoding.

How the Encoding of a File Is Determined

With non-Unicode-mode applications, Essbase and Administration Services assume that character text is encoded to the locale specified by the ESSLANG value defined for Essbase Server.

When Essbase works with Unicode-mode applications, it encodes character text in UTF-8 encoding internally and stores character text in UTF-8. Export files also are encoded in UTF-8. When Essbase works with Unicode-mode applications, it can also handle non-Unicode-encoded input files (such as script files, rules files, and data sources), converting them internally to UTF-8.

Note: For Unicode-mode applications, Essbase requires that dbname.cfg query log settings file be encoded in UTF-8.

Essbase and Administration Services use file-encoding indicators (UTF-8 signature or locale indicator) to know whether a file is encoded in UTF-8 or in a supported non-Unicode encoding.

A locale indicator is optional for a non-Unicode input file whose encoding matches the locale of Essbase Server. If, however, the encoding does not match, you must provide a locale indicator. See “Encoding Indicators” on page 669.

UTF-8-encoded text files must include the UTF-8 signature.

Administration Services uses the following process to determine the encoding of a non-Unicode-encoded file:

1. If a locale indicator is present in the file, Administration Services uses the specified encoding.
2. If a locale indicator is not present, and the file is located within an application, Administration Services uses the encoding specified in the Essbase Server locale.

3. If a locale indicator is not present, and the file is not located within an application, Administration Services determines the encoding based on the type of file:
   - Text files: Administration Services prompts for the encoding.
   - Outline and rules files: Administration Services uses the encoding specified in the Essbase Server locale.

When Essbase performs a dimension build or data load, the rules file and data file can have different encodings. For example, the text in a rules file can be in UTF-8 encoding, and the data source can be encoded to a non-Unicode computer locale.

**Note:** When you use Administration Services Console to create script files or data sources, the appropriate encoding indicator is automatically included in the file. If you use any other tool to create Unicode-encoded text files, you must ensure that the UTF-8 signature is included. Non-Unicode-encoded text files require a locale indicator if the encoding is different from the Essbase Server locale.

The following Essbase system text files are encoded to the locale specified by the ESSLANG value defined for Essbase Server:

- `essbase.cfg`
- ESSCMD scripts

## Encoding Indicators

To properly interpret text, such as member names, Essbase must know how it is encoded. Many files contain an encoding indicator, but occasionally you may be prompted to specify the encoding; for example, in the following cases:

- Administration Services creates a file and stores it in a different location than the Essbase Server
- Administration Services reads a file created by a non-Unicode, pre-7.0 release of Essbase

The type of encoding indicator depends on the type of file:

- Files that are internal to applications and databases and that users cannot directly edit are primarily binary files and do not contain encoding indicators.
  
  Character text in these files is encoded based on the application mode:
  
  - Text in Unicode-mode application files is UTF-8 encoded.
  - Text in non-Unicode-mode application files is encoded to the locale specified in the ESSLANG variable of the Essbase Server where the application was created.

- Binary files that you can edit (such as outline and rules files)
As needed, Essbase keeps track internally of whether the character text is in UTF-8 encoding. If not UTF-8, Essbase uses an internal locale indicator to identify the locale used for character text encoding.

- The following text files that you can edit use a UTF-8 signature or a locale indicator to indicate their encoding:
  - Calculation scripts
  - Report scripts
  - MaxL scripts
  - Data sources for dimension builds and data loads
  - Alias table import files (Administration Services requires alias table import files to be UTF-8 encoded)

**Caution!** Do not use non-Unicode-encoded files containing locale indicators with pre-7.0 release Essbase Server installations, which are not Unicode enabled. To remove the locale indicators, use Essbase Unicode File Utility. See “Essbase Unicode File Utility” on page 673.

---

**UTF-8 Signature**

UTF-8-encoded text files must contain the UTF-8 signature, which is a mark at the beginning of a text file. This signature is visible in some third-party UTF-8 text editors.

Many UTF-8 text editors can create the UTF-8 signature, or you can use the Essbase Unicode File Utility to insert the UTF-8 signature into a file (see “Essbase Unicode File Utility” on page 673).

When you create a file using Administration Services Console, a UTF-8 signature is automatically inserted in the file.

---

**Locale Indicator (Locale Header Record)**

The locale indicator is a *locale header record*, which is an additional text record that identifies the encoding of a non-Unicode text file. You can insert the locale header record as the first record in a non-Unicode-encoded text file when you create the file, or you can use Essbase Unicode File Utility to add the header.

**Caution!** Do not insert a locale header record in a UTF-8 encoded file. If a text file contains both types of encoding indicators, the locale header is read as the first data record.

The locale header record has the following format:

```
//ESS_LOCALE locale-name
```

*locale-name* is a supported Global C locale in the format that is used for the ESSLANG variable:

```
language_territory.code_page_name@sortsequence
```
The following example displays a locale header record for a specific Russian code page:

//ESS_LOCALE Russian_Russia.ISO-8859-5@Default

**Note:** Essbase consults only the code page name portion of the record. The sortsequence specification does not affect sort sequences in report scripts.

The following rules also apply:

- After locale-name, use a blank, tab or <end of line> to end the header.
- You can include blanks or tabs in the following locations:
  - Before the keyword “//ESS_LOCALE”
  - Between “//ESS_LOCALE” and locale-name
  - After the locale specification

For compatibility, Administration Services Console saves calculation scripts on a pre-7.0 release Essbase Server installation in a different format. Instead of prefixing the locale with //, Administration Services Console inserts the locale header between calculation script comment indicators:

/* */

**Supported Locales**

The following supported locales can be used in locale header records, in Essbase Unicode File Utility, and as ESSLANG variable values:

- Arabic_SaudiArabia.ISO-8859-6@Default
- Arabic_SaudiArabia.MS1256@Default
- Croatian_Croatia.ISO-8859-2@Croatian
- Croatian_Croatia.MS1250@Croatian
- CyrillicSerbian_Yugoslavia.ISO-8859-5@Default
- CyrillicSerbian_Yugoslavia.MS1251@Default
- Czech_CzechRepublic.ISO-8859-2@Czech
- Czech_CzechRepublic.MS1250@Czech
- Danish_Denmark.ISO-8859-15@Danish
- Danish_Denmark.IBM500@Danish
- Danish_Denmark.Latin1@Danish
- Danish_Denmark.MS1252@Danish
- Dutch_Netherlands.IBM037@Default
- Dutch_Netherlands.IBM500@Default
- Dutch_Netherlands.ISO-8859-15@Default
- Dutch_Netherlands.Latin1@Default
- Dutch_Netherlands.MS1252@Default
- English_UnitedStates.IBM037@Binary
- English_UnitedStates.IBM285@Binary
- English_UnitedStates.IBM500@Binary
- English_UnitedStates.MS1252@Binary
- English_UnitedStates.Latin1@Binary
- English_UnitedStates.US-ASCII@Binary
- Finnish_Finland.IBM500@Finnish
Essbase Unicode File Utility

You can use Essbase Unicode File Utility to convert non-Unicode-encoded text files to UTF-8 encoding, or to add or delete encoding indicators. This program supports the following operations:

- Converting non-Unicode-encoded text files to UTF-8 encoding, including the UTF-8 signature.
- Adding UTF-8 signatures to UTF-8-encoded text files.
- Inserting a locale header record at the beginning of non-Unicode-encoded text files.
- Adding a locale indicator to outline files (.otl) or rules files (.rul).
- Removing locale indicators from files (the utility cannot remove UTF-8 signatures).

Located in the $ESSBASEPATH/bin directory, Essbase Unicode File Utility is called essutf8.exe (in Windows) or ESSUTF8 (in UNIX). You can use the utility program with the following files:

- Calculation scripts
- Report scripts
- MaxL scripts
- Text data sources for dimension builds and data loads
- Alias table import files
- Outline files
- Rules files

For information about this utility and its command syntax, see the Oracle Essbase Technical Reference.
In Maintaining Essbase:

- Managing Essbase Using OPMN
- Running Essbase Servers, Applications, and Databases
- Managing Applications and Databases
- Monitoring Data, Applications, and Databases
- Managing Database Settings
- Allocating Storage and Compressing Data
- Ensuring Data Integrity
- Using MaxL Data Definition Language
About OPMN

Oracle Process Manager and Notification server (OPMN) enables you to monitor and control the Essbase Agent process. You add Essbase Agent information to the `opmn.xml` file to enable Oracle Process Manager and Notification Server to start, stop, and restart the agent using the OPMN command line interface. OPMN can automatically restart the Essbase Agent when it becomes unresponsive, terminates unexpectedly, or becomes unreachable as determined by ping and notification operations. OPMN is installed in `EPM_HOME`.

Figure 145 shows how Essbase integrates with OPMN.

**Note:** In the `opmn.xml` file, the `essbase-port-range`, `agent-port`, and `agent-secure-port` parameters take precedence over similar configuration settings in the `essbase.cfg` file.

About OPMN Failover Functionality

You can use the failover functionality available in OPMN to provide high availability of Essbase clusters (see “Understanding Essbase Failover Clusters” on page 680).
Oracle Process Manager Modules (PM Modules) communicate with the Essbase Agent for process administration and health monitoring. As a managed component, the Essbase Agent and OPMN communicate using Oracle Notification Server (ONS), which is the transport mechanism for notifications between components.

When you start Essbase using the OPMN command line interface (see “Starting and Stopping Essbase Server” on page 692), OPMN spawns the agent process and sets the status to initialized (a message is logged in the opmn.log file). Whether this state transitions to alive depends on whether OPMN receives a response (a reverse ping) from the agent, which implies that the agent is active.

After Essbase is up and running, OPMN periodically sends a TCP-based forward ping to the agent. If a ping attempt fails, OPMN retries up to three times to contact the agent. If all ping attempts fail, OPMN stops the agent. OPMN attempts to restart the agent for these scenarios:

- **restart-on-death** (in opmn.xml) is set to TRUE.

  In a production environment, restart-on-death should always be set to TRUE. Oracle recommends trying to restart a process on the local node first, before attempting failover. When **restart-on-death** is set to TRUE, OPMN first attempts to restart Essbase on the local node for the number of restarts that are configured in opmn.xml (the first start and the number of restarts). If all restart attempts fail, then failover to the standby node occurs.

  In development and test environments, you can set **restart-on-death** to FALSE to test failover.

In non-failover mode, which is the default mode, the default setting for **restart-on-death** is FALSE.
• Failover mode is on, which supersedes the restart-on-death value. If restart-on-death is FALSE and failover mode is on, OPMN may bring up Essbase on the active or passive node.

When you stop Essbase using the OPMN command line interface, OPMN shuts down the agent, thereby releasing all resources held by the agent. Essbase Servers shut down when they detect that the parent agent process has shut down.

**Starting and Stopping Essbase Using OPMN**

Components that are managed by OPMN should never be started or stopped manually. Use the opmnctl command line utility to start and stop system components.

**Note:** If you attempt to use MaxL to shut down an Essbase instance that was started using OPMN, you are warned to use OPMN to shut down Essbase.

In a Windows environment, before you launch Essbase, change the OPMN service (Oracle Process Manager (instanceName)) to start as a named user so that the shared network files are accessible.

Use these commands to start, stop, and monitor Essbase from OPMN:

• opmnctl startall
• opmnctl stopall
• opmnctl status

   Enables you to determine the status of system component processes.

• opmnctl startproc ias-component=EssbaseInstanceName

   Starts the system component named EssbaseInstanceName.

• opmnctl restartproc ias-component=EssbaseInstanceName

   Restarts the system component named EssbaseInstanceName.

• opmnctl stopproc ias-component=EssbaseInstanceName

   Stops the system component named EssbaseInstanceName.

where EssbaseInstanceName is one of the following:

• If you did not implement failover clustering, EssbaseInstanceName is the name of the Essbase instance that you entered when you configured Essbase Server.

• If you implemented failover clustering, EssbaseInstanceName is the name of the Essbase cluster that you entered when you set up the Essbase cluster.

Note that the Essbase Server start and stop scripts redirect to OPMN. See the Oracle Enterprise Performance Management System Installation and Configuration Guide.
For more information on OPMN commands, see the Oracle Process Manager and Notification Server Administrator’s Guide.

For troubleshooting and logging information, see Oracle Enterprise Performance Management System Installation and Configuration Troubleshooting Guide.

Logging In to Essbase Using Logical Names

Essbase clients can use a URL to connect to an Essbase cluster, in the form:

http(s)://host:port/aps/Essbase?ClusterName=clusterName&SecureMode=yesOrno

To simplify login, Essbase clients should use the logical cluster name directly, in the form 
<name>:<secure>, instead of the URL. If you want to enable client login using the cluster name, you must first specify a property to configure Provider Services. The cluster name is resolved by the Provider Services servers specified in configuration files:

- APSRESOLVER in essbase.cfg—Server-to-server communication; for example, when defining Essbase servers for partitions, XRefs, and XWrites
  See the Oracle Essbase Technical Reference.
- aps.resolver.urls in essbase.properties—Client-to-server communication; for example, when connecting to Essbase from Smart View
  See the Oracle Hyperion Provider Services Administration Guide.

The Login API adheres to this precedence order when resolving the server name:

1. Look up the server name in the internal cache (maintained in the API layer).
2. If the server name is not found in the cache, contact each Provider Services server listed in essbase.cfg and attempt to resolve the server name.
3. If the server name is not found, treat the server name as a physical server name.

Understanding Essbase Failover Clusters

An active-passive Essbase cluster consists of two Essbase instances, one on each node that share a common storage for configuration and data. Storage is shared across two computers (for example, using a SAN), which removes the need for the administrator to synchronize storage, as well as the constraint of read-only support (as is the case with Essbase active-active clusters in Provider Services). Essbase uses database tables to ensure that only one agent and its associated servers are active to avoid data corruptions on writes. During installation and configuration, a table is created to hold information on configuration and application data existing in the cluster. Active-passive Essbase clusters do not use any file-system locking (that is, essbase.lck files).

We use the Service Failover functionality available in OPMN to cluster Essbase servers to provide active-passive service failover with write-back capability and API support. Clustering Essbase servers provides the capability to switch over automatically to a passive server when the active server fails, thus ensuring that the Essbase Agent is highly available.
Essbase Failover Clusters and Lease Management

Subtopics

- Why Leases?
- How Leases Work
- How Leases are Implemented
- Logging

The topics in this section explain the concept of leases.
Why Leases?

Essbase failover uses a leasing mechanism to solve the problem of split-brain. A split-brain situation can develop when both instances in an active-passive clustered environment think they are “active” and are unaware of each other, which violates the basic premise of active-passive clustering. Situations where split-brain can occur include network outages or partitions.

How Leases Work

An Essbase process acquires a lease on a specified shared resource or set of resources upon startup; it renews the lease periodically and surrenders the lease upon termination.

This lease establishes the process as the primary service provider and grants the right to update the specified set of shared resources, service client requests, and spawn processes.

Essbase servers can acquire leases if and only if its authorizing agent has a current lease.

How Leases are Implemented

Essbase failover implements a leasing mechanism using a centralized relational database to store, update, and retrieve information about the following:

- Shared resources
- Lease ownership
- Lease validity

The set of tables used for this purpose is created during Essbase installation and configuration. These tables reside in the same database and schema as the Shared Services Registry.

On startup, Essbase Agent and servers inspect the database table to see if any other process currently owns the lease for its shared resource. If yes, the agent and servers wait until the lease expires and retries. If not, the agent and servers take ownership of the shared resource; that is, they get a lease.

The agent and servers acquire a lease on startup and surrender the lease on termination. The agent and servers periodically renew the lease to indicate its health. If the lease cannot be renewed, the agent and servers self-terminate.

Lease ownership grants exclusive right to update a set of shared resources residing on a shared disk. The lease owner (Essbase Agent or Essbase Server) attempts to renew the lease within a preconfigured interval of time. See the AGENTLEASERENEWALTIME and SERVERLEASERENEWALTIME configuration settings in the Oracle Essbase Technical Reference.

Logging

Diagnostic messages specific to lease management are logged in Lease Manager logs. See the Oracle Enterprise Performance Management System Installation and Configuration Troubleshooting Guide.
Fine-Tuning Failover Detection

The tunable parameters shown in Table 122, Table 123, and Table 124 control failover detection. By default, these parameters are set so that failover occurs in less than one minute. You may need to fine tune these parameters based on your business requirements.

Table 122  Tunable Agent Parameters (in essbase.cfg)

<table>
<thead>
<tr>
<th>Agent Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent Lease Expiry Time</td>
<td>20 seconds</td>
</tr>
<tr>
<td>Agent Lease Renewal Interval</td>
<td>10 seconds</td>
</tr>
<tr>
<td>Agent Lease Acquire Max Retry</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 123  Tunable Server Parameters (in essbase.cfg)

<table>
<thead>
<tr>
<th>Server Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server Lease Expiry Time</td>
<td>20 seconds</td>
</tr>
<tr>
<td>Server Lease Renewal Interval</td>
<td>10 seconds</td>
</tr>
<tr>
<td>Server Lease Acquire Max Retry</td>
<td>5</td>
</tr>
</tbody>
</table>

The time delay between each lease acquire failed attempt until maximum retry is calculated based on how much time is left for the lease to expire. If the lease is available and acquire fails, then the delay could be one second. See the Oracle Essbase Technical Reference.

Table 124  Tunable OPMN Parameters (in opmn.xml)

<table>
<thead>
<tr>
<th>OPMN Parameter</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>restart-on-death</td>
<td>FALSE. If FAILOVERMODE is set to TRUE (in essbase.cfg), you must change this value to TRUE so that OPMN restarts Essbase Agent if it terminates abnormally.</td>
</tr>
<tr>
<td>shutdown-force-enabled</td>
<td>FALSE. You must set this to TRUE if you enabled Essbase failover clustering. Setting this to TRUE enables you to forcibly kill Essbase if graceful shutdown by OPMN fails.</td>
</tr>
<tr>
<td>OPMN Forward Ping Interval</td>
<td>20 seconds</td>
</tr>
<tr>
<td>OPMN PROC_READY (reverse ping) Interval</td>
<td>20 seconds</td>
</tr>
<tr>
<td>Agent Start or Restart Retries</td>
<td>2</td>
</tr>
<tr>
<td>OPMN Agent Start Timeout</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

This means that OPMN tolerates two failures to start or restart the agent before marking this instance as nonfunctional for this service, which is when the agent service failover begins in failover mode; otherwise it will throw an error.
<table>
<thead>
<tr>
<th>OPMN Parameter</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPMN Agent Restart Timeout</td>
<td>10 minutes</td>
</tr>
<tr>
<td>OPMN Agent Stop Timeout</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

See the *Oracle Process Manager and Notification Server Administrator’s Guide*.

## Conditions for Agent and Server Terminations

Table 125 lists the failure conditions that cause Essbase Agent and Essbase Server to terminate, the affected components, OPMN reactions, and Essbase client responses.

### Table 125 Essbase Agent and Server Termination Scenarios

<table>
<thead>
<tr>
<th>Failure Condition</th>
<th>Assumed Working</th>
<th>Failover Functionality</th>
<th>Expected Service Level Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essbase Server death:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Software bug</td>
<td>Network</td>
<td>OPMN is not involved.</td>
<td>Client gets a “request failed” error (while request is bound to the server).</td>
</tr>
<tr>
<td>● Lease expired</td>
<td>Shared disk</td>
<td>Essbase Agent restarts an Essbase Server on getting a new request; there may be a slight delay in server startup while waiting for lease availability.</td>
<td>Client must reissue the request.</td>
</tr>
<tr>
<td>● Abnormal error condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Essbase Agent death:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Software bug</td>
<td>Network</td>
<td>OPMN ping of Essbase Agent fails.</td>
<td>Client gets a network disconnect error (when attempting to contact Essbase Agent using SessionID).</td>
</tr>
<tr>
<td>● Lease expired</td>
<td>Shared disk</td>
<td>OPMN attempts to restart Essbase Agent on same node.</td>
<td>Servers become orphaned and the following events occur:</td>
</tr>
<tr>
<td>● Abnormal error condition</td>
<td></td>
<td>If Essbase Agent does not restart on the same node, OPMN initiates failover on the passive node.</td>
<td>1. Servers stop renewing their lease and terminate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Essbase Agent restarts servers on getting application requests.</td>
<td>2. Servers detect pipe break and terminate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Either (1) or (2) occurs, whichever comes earlier, and servers terminate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Client must re-login to Essbase (after the agent restarts).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Client must resubmit request.</td>
</tr>
<tr>
<td>Failure Condition</td>
<td>Assumed Working</td>
<td>Failover Functionality</td>
<td>Expected Service Level Agreement</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Network outage (network partition, that is, primary IP [eth0] down on active node)</td>
<td>Essbase Agent (on current active node)</td>
<td>OPMN “forward ping” of Essbase Agent fails. OPMN attempts to restart Essbase Agent on local node, which fails (eth0 is down); Essbase Agent terminates. Servers detect Essbase Agent death and terminate. Network heartbeat between ONS peers in active and passive node fails (that is, a network partition). OPMN in passive node becomes new active node. OPMN brings up the Essbase Agent on the new active node; there might be a slight delay for the Essbase Agent lease to become available. Essbase Agent brings up Essbase Servers as requests are received.</td>
<td>Client gets “error” while trying to reuse Session or “hangs” until network outage detected. Essbase Agent and servers becomes unreachable. Client musty re-login to the Essbase Agent after it comes up on passive node; and then it needs to resubmit requests.</td>
</tr>
<tr>
<td>Essbase.lck file exists after Agent death</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Essbase.lck file is corrupt after Essbase Agent death</td>
<td>Not applicable</td>
<td>Not applicable for Essbase failover. Essbase Agent does not start until the administrator restores good essbase.sec from backup.</td>
<td>Service unavailable without Administrator. After Essbase Agent comes back up, clients must re-login.</td>
</tr>
<tr>
<td>Disk outage (Shared disk down)</td>
<td>Not applicable</td>
<td>Not applicable for Essbase failover. Customer needs to eliminate single point of failure in shared disk. This can be addressed by running the shared disk with a mirroring setup, like in a SAN with disk redundancy (RAID 1-0 configuration).</td>
<td>Both active and passive nodes fail. Service is not available.</td>
</tr>
<tr>
<td>Lease database outage</td>
<td>Not applicable</td>
<td>Essbase Agent unable to renew lease and terminates. Servers unable to renew lease and terminate. You need to eliminate single point of failure for lease database. Oracle recommends that you run the lease database (which is relational) in cold failover cluster (CFC) (active-passive) mode or RAC mode (active-active).</td>
<td>Service unavailable. Both active and passive nodes are unable to run Essbase.</td>
</tr>
<tr>
<td>Failure Condition</td>
<td>Assumed Working</td>
<td>Failover Functionality</td>
<td>Expected Service Level Agreement</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-----------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Node failure (catastrophic hardware failure)</td>
<td>Network</td>
<td>Network heartbeat between ONS peers on active and passive nodes fails (current active node has crashed).&lt;br&gt;OPMN on the passive node becomes the new active node.&lt;br&gt;OPMN brings up Essbase Agent on the new active node; there might be a slight delay for the Essbase Agent lease to become available.&lt;br&gt;Essbase Agent brings up Essbase Servers as requests come in.</td>
<td>Client gets &quot;error&quot; while trying to reuse Session; Agents and Servers have died.&lt;br&gt;Client must re-login to Essbase Agent after it comes up on standby node; then, it needs to resubmit requests.</td>
</tr>
<tr>
<td>Shared Services Java web application outage</td>
<td>Network</td>
<td>Not applicable to Essbase failover.&lt;br&gt;As long as the LDAP provider is up (OpenLDAP, Oracle LDAP/External Directory), Essbase Agent can authenticate users (there is no runtime dependency on Shared Services).</td>
<td>Certain user operations will fail; for example, create and delete application fails (which updates Shared Services Registry using the Shared Services Web server).&lt;br&gt;Existing clients continue to work.</td>
</tr>
<tr>
<td>Essbase Agent and server hang (application bug)</td>
<td>Network</td>
<td>Essbase Agent and server hangs are not explicitly handled, but the overall robustness of the agent and servers improves when using failover clusters.</td>
<td>As long as Essbase Agent and server are able to renew their leases, there is no change to the existing behavior.</td>
</tr>
</tbody>
</table>

**Universal/Uniform Naming Convention (UNC) Paths**

When working with Essbase clusters to achieve high availability of servers, it is customary to use network file systems for sharing the Essbase application files across systems.

On Windows, you can use Universal/Uniform Naming Convention (UNC) to describe the location of a network resource, such as a shared directory. Syntax:

\ComputerName\SharedFolder\Resource

For Essbase running on Windows, UNC paths are supported to specify network shared paths for the following Essbase Server application artifacts:

- **ARBORPATH**
- Tablespace paths for aggregate storage applications
- Disk volume paths for block storage applications

UNC paths are not supported for all other file paths, including client side paths for data load and dimension build.

For full documentation of UNC syntax, see MSDN.
Configuration for SSL Encrypted Communication with Provider Services

To configure Essbase for encrypted (SSL) communication with Provider Services, you must perform a configuration task to enable the Essbase libcurl library to set up a secure channel to Provider Services. This is required to enable secure connections to be made between Essbase and Provider Services using logical Essbase cluster names.

Use the following configuration options to either disable peer verification, or provide the location of the certificate authority (CA) certificates.

To complete this configuration, set the following environment variables, using the operating system command line:

API_DISABLE_PEER_VERIFICATION=1

Set this variable if the connection goes through SSL, but does not need a certificate. Essbase provides data encryption, but not authentication.

If API_DISABLE_PEER_VERIFICATION is not set, or is set to 0, you must set up a certificate. To establish a secure connection with Provider Services, Essbase requires a CA signing of a Provider Services certificate, to provide authentication for the Provider Services server. You can specify either a file or a directory which includes the certificate. Choose one of the following options:

API_CAINFO=CA certificate file path

or

API_CAPATH=directory path containing CA certificates

The environment variables described are only applied when logging with a Provider Services URL that starts with https. Logins with the http URL are directed through TCP/IP.
Running Essbase Servers, Applications, and Databases

In This Chapter

Essbase Executable Files ........................................................................................................ 689
Understanding the Agent ........................................................................................................... 690
Starting and Stopping Essbase Server ..................................................................................... 692
Starting and Stopping Applications ......................................................................................... 694
Starting and Stopping Databases ............................................................................................. 696
Managing Ports ....................................................................................................................... 698
Communicating with Essbase Using SSL ................................................................................ 700
Controlling Query Size and Duration ..................................................................................... 701
Increasing Agent Connections to Essbase Server ................................................................. 701
Limiting the Number of User Sessions ..................................................................................... 702

Essbase Executable Files

Table 126 lists the Essbase server and client executable files:

Table 126  Main Essbase Executable Files

<table>
<thead>
<tr>
<th>Executable File</th>
<th>Description</th>
<th>Location</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>essbase.exe</td>
<td>Essbase Server Agent process</td>
<td>ESSBASEPATH/bin</td>
<td>&quot;Understanding the Agent&quot; on page 690</td>
</tr>
<tr>
<td>esssvr.exe</td>
<td>Application process</td>
<td>ESSBASEPATH/bin</td>
<td>&quot;Starting and Stopping Applications&quot; on page 694</td>
</tr>
<tr>
<td>essmsh.exe</td>
<td>MaxL Shell</td>
<td>ESSBASEPATH/bin</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>esscmd.exe</td>
<td>ESSCMD command-line client interface</td>
<td>ESSBASEPATH/bin</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>adminsrv.exe or startEAS.exe</td>
<td>Essbase Administration Server executable</td>
<td>EPM_ORACLE_HOME/products/Essbase/eas/server/bin</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>admincon.bat</td>
<td>Administration Services Console application</td>
<td>EPM_ORACLE_HOME/products/Essbase/eas/server/bin</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
</tbody>
</table>

1On UNIX, executable files do not have an .exe extension.
Understand the Agent

The Essbase Agent manages Essbase Server. The Agent process starts and stops all applications and acts as the traffic coordinator for Essbase Server. OPMN manages the Essbase Agent.

Essbase Server start and stop scripts redirect to OPMN. By default, OPMN starts Essbase as a background service.


The agent log is called the Essbase Server log. See “Viewing the Essbase Server and Application Logs” on page 739.

Multithreading

essbase.exe and esssvr.exe (ESSBASE and ESSVR on UNIX) are multithreading and symmetric multiprocessing (SMP) applications. Multithreading ensures high performance in a client-server environment. SMP provides scalability when a single server computer hosts multiple Essbase applications. Essbase Server uses POSIX kernel threads, which are included in UNIX operating systems.

By default, the number of threads is based on the number of ports, as shown in Table 127. The number of ports represents the number of concurrent connections that Essbase supports. Essbase provides one reserve port for the system administrator, which is used to log off users when all other ports are in use.

Table 127  Ports and Multithreading

<table>
<thead>
<tr>
<th>Number of Ports</th>
<th>Default Number of Threads</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 ports</td>
<td>5</td>
</tr>
<tr>
<td>6-10 ports</td>
<td>10</td>
</tr>
<tr>
<td>11+ ports</td>
<td>20</td>
</tr>
</tbody>
</table>

You can set the number of threads for the Agent or Essbase Server in the essbase.cfg file using the AGENTTHREADS, AGTSVRCONNECTIONS, and SERVERTHREADS configuration settings. See the Oracle Essbase Technical Reference.

List of Agent Commands and Equivalents

Agent commands can be entered in the OPMN command line interface. Table 128 describes each Agent command, and the MaxL, ESSCMD, or Administration Services equivalents:
Table 128  Agent Commands and MaxL, ESSCMD, or Administration Services Equivalents

<table>
<thead>
<tr>
<th>Agent Command</th>
<th>Function</th>
<th>MaxL, ESSCMD, or Administration Services Equivalent</th>
</tr>
</thead>
</table>
| START appname | Starts the specified application. | - MaxL: `alter system load application appname;`
- ESSCMD: LOADAPP
- Administration Services: Start, then Application on the application node in Enterprise View |
| STOP appname  | Stops the specified application. | - MaxL: `alter system unload application appname;`
- ESSCMD: UNLOADAPP
- Administration Services: Stop, then Application on application node in Enterprise View |
| USERS         | Displays a list of users connected to the Essbase Server. The following information is displayed: | - MaxL: `display user;`
- (lists all users and shows which users are logged on)
- ESSCMD: LISTUSERS
- (lists all users)
- Administration Services: Edit, then Sessions on the server node in Enterprise View |
| PORTS         | Displays the number of ports installed on the Essbase Server and the number of ports in use. | - MaxL: `display system;`
- (to display available unused ports)
- ESSCMD: N/A
- Administration Services: Edit, then Properties (Essbase Server Properties window, Statistics tab) on the server node in Enterprise View |
| LOGOUTUSER user | Disconnects a user from the Essbase Server and frees a port. This command requires the Essbase system password. | - MaxL: `alter system logout session by user username;`
- ESSCMD: LOGOUTUSER
- Administration Services: Edit, then Sessions on the server node in Enterprise View |
| PASSWORD      | Changes the system password that is required to start the Essbase Server. This command requires the Essbase system password. | - MaxL: `alter user system_administrator set password password;`
- ESSCMD: SETPASSWORD
- Administration Services: N/A |
| COMPACT       | Enables compaction of the security file when the Agent is running. See “Managing Essbase Security File Fragmentation” on page 639. **Note:** Essbase compacts the security file automatically each time the Agent is stopped. | - MaxL: `alter system compact security file;`
- ESSCMD: N/A
- Administration Services: Compact security file on the server's security node in Enterprise View |

691
<table>
<thead>
<tr>
<th>Agent Command</th>
<th>Function</th>
<th>MaxL, ESSCMD, or Administration Services Equivalent</th>
</tr>
</thead>
</table>
| DUMP filename | Dumps information from the Essbase security file  
\((\text{essbase.sec})\) to a specified file in text (ASCII) format. If you do not supply a path with the filename, the file is saved to the  
\(\text{ARBORPATH/bin}\) directory. This command requires the Essbase system password.  
\textbf{Note:} You cannot use the DUMP command against an Essbase Server that is run as a service. If the server is running as a service, use the \textbf{Export Security File} command in Administration Services or the \texttt{export security_file} MaxL statement. |  
\textbullet MaxL: \texttt{export security_file};  
\textbullet ESSCMD: N/A  
\textbullet Administration Services: \textbf{Export Security File} on the server's security node in Enterprise View  
See “Exporting the Essbase Security File to a Readable Format” on page 640.  
\textbf{Note:} You can use the export security file command against an Essbase Server that is run as a service. |
| VERSION       | Displays the Essbase Server software version number. |  
\textbullet MaxL: \texttt{display system};  
\textbullet ESSCMD: GETVERSION  
\textbullet Administration Services: \texttt{Edit, then Properties} (Essbase Server Properties window, License tab) on the server node in Enterprise View |
| HELP          | Lists all valid Agent commands and their respective functions. Same as pressing Enter. | N/A |
| QUIT and EXIT | Shuts down all open applications and stops Essbase Server. |  
\textbullet MaxL: \texttt{alter system shutdown};  
\textbullet ESSCMD: SHUTDOWNSERVER  
\textbullet Administration Services: \texttt{Stop} on the server node in Enterprise View |

---

**Starting and Stopping Essbase Server**

**Subtopics**

\- Starting Essbase on Ports Qualified by Host Names
\- Hiding Essbase Server Passwords on HP-UX and Solaris
\- Changing the Essbase Server System Password

To start Essbase Server, you must have Administrator permissions.

Components that are managed by OPMN should never be started or stopped manually. Use the `opmnctl` command line utility to start and stop system components.

Navigate to \texttt{EPM\_ORACLE\_INSTANCE/bin} and use the following commands to start and stop Essbase Server:

\- `opmnctl startall`
\- `opmnctl stopall`
For additional methods for starting and stopping Essbase Server, see the *Oracle Enterprise Performance Management System Installation and Configuration Guide*. Note that the Essbase Server start and stop scripts redirect to OPMN.

**Note:** You cannot start Essbase Server from ESSCMD or MaxL. If you attempt to use MaxL to shut down an Essbase instance that was started using OPMN, you are warned to use OPMN to shut down Essbase.

In a Windows environment, before you launch Essbase, change the OPMN service (Oracle Process Manager (`instanceName`)) to start as a named user so that the shared network files are accessible.

### Starting Essbase on Ports Qualified by Host Names

You can specify the host name to which Essbase binds by using the `ESSBASESERVERHOSTNAME` configuration setting in `essbase.cfg`. If no host name is specified, Essbase uses a system API to get the host name. Using host names enables you to partition network traffic on all the network interfaces of a computer. This is useful on computers with single network cards and those with multiple NIC cards.

### Hiding Essbase Server Passwords on HP-UX and Solaris

On HP-UX and Solaris, the `ps -ef` utility creates a process listing that includes the system password.

**Note:** On IBM AIX, the Essbase Server system password is hidden automatically.

1. To hide the Essbase Server system password:

   1. Create a shell script, named `essbase.secure`, that contains these commands:

   ```bash
   #!/bin/sh
   PASS=$1
   ESSBASE -b -secure << EOF &
   $\{PASS\}
   EOF
   ```

   2. To launch the Agent, use this command:

   ```bash
essbase.secure password
   ```

   - To have the script to return to a command prompt without manually entering a carriage return or to imbed the script within a larger script, execute the script with this command:

   ```bash
   essbase.secure &
   ```

   - (Optional) To redirect the standard output to a file named `nohup.out`, which is useful when running the script in a nonactive terminal session, use this command:

   ```bash
   nohup essbase.secure &
   ```
Changing the Essbase Server System Password

You can change the password that is required to start Essbase Server.

**Note:** Changing the system password does not change the connection password for the Essbase system Administrator.

To change the Essbase Server system password, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
<td>password</td>
<td>Enter the Agent command in the OPMN command line interface. Enter the current system password. Enter the new system password; then re-enter it.</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter user system_administrator set password password</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETPASSWORD</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Essbase verifies that the system password has been updated.

Starting and Stopping Applications

When an application is started, Essbase loads the application and all associated databases into memory on the Essbase Server computer. All client requests for data, such as data loads, calculations, reports, and spreadsheet lock and sends, are then handled through the application process (ESSSVR). The application process is always started by the Agent process (ESSBASE).

Multiple application processes can run on Essbase Server concurrently. On Windows, a separate window opens for each application process that is running. If an application contains multiple running databases, all databases are managed by the one application process.

When you stop an application, Essbase unloads all information and databases from memory on the Essbase Server computer and closes the application process.

Starting an Application

When you start an application, the following actions can happen:

- Users can connect to the application.
- The application can respond to commands from the Agent.
- Users can change the settings of the application.
- Data and user security are enabled.
- Each database in the application can start.
To start an application, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
<td>START appname</td>
<td>Enter the Agent command in the OPMN command line interface.</td>
</tr>
<tr>
<td>Administration Services</td>
<td>Starting Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter system load application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LOADAPP or SELECT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

The application starts and, if you are running on Windows, opens the application server window on the Essbase Server computer.

You can also start an application by completing any of these actions:

- Starting a database within an application. See “Starting a Database” on page 697.
- Saving an outline to Essbase Server. (Opening an outline does not start an application.)

You can set options that control how applications start:

- startup (Allow user to start application): If an application is stopped, and a user attempts to retrieve data from any databases within that application, the application starts on the Essbase Server computer automatically.
- autostartup (Start application when Essbase starts): Users may experience better initial performance when they make requests of databases in that application, because the application and databases are already loaded into memory on the Essbase Server computer.

To control how applications are started, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Configuring Applications to Start Automatically</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter application enable startup</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter application enable autostartup</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Stopping an Application**

Stop applications properly to prevent the databases within them from becoming corrupt. When you stop an application, transactions may be running. If you stop an application using any of the proper methods (see the following table), the application does not stop if a calculation or data load is in progress. Instead, Essbase displays a message in the Agent window.

If you stop the Agent by closing the window or by pressing Ctrl+C, the application stops, and the next time you start the application, Essbase rolls back any transactions that were in progress. See “Rollback with Committed Access” on page 781 or “Rollback with Uncommitted Access” on page 782.
To properly stop applications, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
<td>stop appname</td>
<td>Enter the Agent command in the OPMN command line interface.</td>
</tr>
<tr>
<td>Administration Services</td>
<td>Stopping Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>Maxl.</td>
<td>alter system unload application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>UNLOADAPP</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Stopping an Application Improperly**

Sometimes, stopping the application server process improperly, by closing the application server window, is necessary; for example, if the application server is corrupted and is not processing client requests.

To stop the application improperly, use a method for the operating system on which Essbase Server runs

1. **For UNIX platforms, kill the ESSSVR process.**
   
   You can use the ps output to identify individual applications. If an application freezes, you can stop the application by using this command:
   
   ```bash
   kill -9 <pid>
   ```

2. **For Windows, choose a method:**
   
   a. Perform a Windows operating system End Task.
      
      Windows does not display process IDs for individual Essbase applications—all of the running Essbase applications are displayed as undifferentiated ESSSVR processes, preventing you from stopping a single application in the event that the application freezes.
   
   b. Click the **Close** button in the application server window.
   
   c. Taskkill the process ID.
      
      You can find the process ID for individual application servers in the `EPM_ORACLE_HOME/logs/essbase/essbase.log` file. When the server starts, a line like the following is displayed in the Essbase Server log:
      
      ```
      Application [Sample] started with process id [225]
      ```

**Starting and Stopping Databases**

Starting a database loads the database into memory on the Essbase Server computer. Stopping a database unloads all database information from memory.
Starting a Database

When Essbase starts a database and loads it to memory, the entire index cache for that database is allocated in memory automatically. The data cache and data file cache are allocated as blocks requested from Essbase clients.

When you start an application, Essbase loads the application and its databases into memory on the Essbase Server computer. When you start a database from an application that is not started, the application is loaded into memory along with all its related databases.

To start a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
<td>START appname</td>
<td>Enter the Agent command in the OPMN command line interface.</td>
</tr>
<tr>
<td>Administration Services</td>
<td>Starting Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter application load database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LOADDB or SELECT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

To configure a database to start automatically when its parent application starts, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Configuring Databases to Start Automatically</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database enable autostartup</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Stopping a Database

Stopping a database unloads all data from memory and commits any updated data to disk. If a database is stopped and a user attempts to retrieve data from it, the database starts on Essbase Server automatically, without any explicit commands issued.

When you stop a database, transactions may be currently running. If you stop a database using any of the proper methods (see the following table), the database does not stop if a calculation or data load is in progress. Instead, Essbase displays a message in the Essbase Server window.

If you stop the Agent by closing the Essbase Server window or by pressing Ctrl+C, the database stops, and the next time you start the database, Essbase rolls back any transactions that were in progress. See “Rollback with Committed Access” on page 781 or “Rollback with Uncommitted Access” on page 782.
To stop a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
<td>STOP appname</td>
<td>Enter the Agent command in the OPMN command line interface.</td>
</tr>
<tr>
<td>Administration Services</td>
<td>Stopping Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter application unload database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>UNLOADDB</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Managing Ports

Subtopics

- Viewing a List of Users and Available Ports
- Specifying Nondefault Port Values
- Changing Port Default Values
- Viewing Port Statistics
- Managing Essbase Administration Server Communication Ports

The Agent enables you to manage ports on Essbase Server.

Viewing a List of Users and Available Ports

You can view a list of users that are connected to Essbase Server at any given time, the number of ports available, and the number of connections.

To view a list of users connected to Essbase Server, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
<td>USERS</td>
<td>Enter the Agent command in the Oracle Process Manager and Notification Server command line interface.</td>
</tr>
<tr>
<td>Administration Services</td>
<td>Viewing Essbase Server Users and Groups</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display user</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LISTUSERS</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
To view the number of ports installed on Essbase Server, as well as the number of ports in use, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent</td>
<td>PORTS</td>
<td>Enter the Agent command in the command line interface.</td>
</tr>
<tr>
<td>Administration Services</td>
<td>Checking Available Ports</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td></td>
<td>Also see About Essbase Connections and Ports</td>
<td></td>
</tr>
<tr>
<td>MaxL</td>
<td>display user</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LISTUSERS</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

### Specifying Nondefault Port Values

To change the default port values used by the Agent, you must set one or more of these configuration settings:

- **AGENTPORT** specifies the port that the Agent uses.
- **SERVERPORTBEGIN** specifies the first port number the Agent on a computer tries to use for its first server process.
- **SERVERPORTEND** specifies the highest value the Agent tries to use for a port when it tries to start a server process. If the value is unavailable, the server process fails.
- **PORTINC** specifies the value of the increment in between port numbers used by the Agent.

You may want to change the default value. Two possible reasons:

- The default value specifies a port number already in use.
- You may want to install a second instance of Essbase Server on a computer to facilitate testing. You can use Oracle Hyperion Enterprise Performance Management System Configurator to assign the second Essbase Server instance to a different port than the first. See the Oracle Enterprise Performance Management System Deployment Options Guide

### Changing Port Default Values

If you need to change one or more of the default values associated with Agent and server ports, or to expand port ranges using MaxL, see the Oracle Essbase Technical Reference.

### Viewing Port Statistics

You can enable Essbase to log, at a specified interval, the number of ports being used. By analyzing the information in the log, you can monitor port utilization and identify a need for more ports before users are unable to connect.

To enable Essbase Server to check port use statistics and write those statistics to the Essbase Server log, use the PORTUSAGELOGINTERVAL configuration setting:
PORTUSAGELOGINTERVAL \( n \)

where \( n \) represents the number of minutes between each check of the number of ports in use. The value of \( n \) can be any whole number from 1 to 60, with 5 being the recommended minimum and default value. Essbase ignores any portion of a nonwhole number. For example, Essbase evaluates 2.5 as 2 minutes. Statistics are written to the Essbase Server log immediately after each check. The log file will resemble the following output:

[Mon Apr 22 00:48:50 2003]Local/ESSBASE0///Info(1056214)

See the *Oracle Essbase Technical Reference*.

### Managing Essbase Administration Server Communication Ports

Essbase Administration Server has several configurable communication ports, which are different from Essbase Server ports. See “About Essbase Administration Server” on page 110.

### Communicating with Essbase Using SSL

Essbase supports the Secure Socket Layer (SSL) protocol for all client-to-server and server-to-server communication. SSL allows Essbase to communicate unilaterally across a network with Essbase clients, including Provider Services, Administration Services, and Essbase Studio, while preventing eavesdropping and tampering. End-point authentication and communications occur confidentiality over the Internet using CipherSuite cryptography.

These configuration settings supply parameters that enable SSL communication:

- \texttt{AGENTSECUREPORT}
- \texttt{CLIENTPREFERREDMODE}
- \texttt{ENABLECLEARMODE}
- \texttt{ENABLESECUREMODE}
- \texttt{NETSSLHANDSHAKETIMEOUT}
- \texttt{SSLCIPHERSUITES}
- \texttt{WALLETPATH}

The following considerations apply when partitioning in secure (SSL) mode:

- The partition source and target must have the same security protocol; for example, both or neither use SSL.
- To enable Essbase to use SSL connectivity, you must set \texttt{ENABLESECUREMODE} to TRUE.
- Consider setting \texttt{CLIENTPREFERREDMODE} to SECURE.
If CLIENTPREFERREDMODE is not set, or is set to FALSE, but ENABLESECUREMODE is set to TRUE, you can securely create and refresh partitions in MaxL by adding :secure to the HOST-NAME string. For example,

`login esbuser esbpassword on “localhost:6423:secure”;`

The following considerations apply when using location aliases in secure (SSL) mode:

- To enable Essbase to use SSL connectivity, you must set ENABLESECUREMODE to TRUE.
- If the location alias is being set up to a secure port, you must append :secure to the server name specification. For example, using MaxL,
  
  `create location alias EasternDB from Sample.Basic to East.Sales at Easthost: 6423:secure as User1 identified by password1;`

To configure Essbase for encrypted (SSL) communication with Provider Services, you must perform a configuration task to enable the Essbase libcurl library to set up a secure channel to Provider Services. See “Configuration for SSL Encrypted Communication with Provider Services” on page 687.

For more information on using SSL with Essbase, see the Oracle Enterprise Performance Management System User Security Administration Guide.

**Controlling Query Size and Duration**

Users may unintentionally request information that is so large or so complex to retrieve that the query will slow performance or fail to complete properly. Use the QRYGOVEXECTIME and QRYGOVEXECBLK configuration settings, referred to as query governors, to control query size or duration:

- **QRYGOVEXECTIME [appname [dbname]] n**
  
  Limits the time Essbase Server allows a query to run before terminating the query.

- **QRYGOVEXECBLK [appname [dbname]] n**
  
  Limits the number of blocks a query can access before terminating the query.

You can apply these settings to all the applications and databases on Essbase Server, to all the databases on a single application, or to one database. See the Oracle Essbase Technical Reference.

**Increasing Agent Connections to Essbase Server**

Increasing the maximum possible threads between Essbase Server and the Agent allows multiple users to log on and connect to an application and database simultaneously.

Use the AGENTTHREADS and AGTSVRCONNECTIONS configuration settings to control the maximum number of threads created to perform the initial connection to Essbase Server:
- **AGENTTHREADS** `maximum_number_of_threads`

- **AGTSVRCONNECTIONS** `maximum_number_of_threads`

  Keep the `maximum_number_of_threads` value for AGTSVRCONNECTIONS equal to or less than the value for AGENTTHREADS to avoid wasting resources. Each connection requires one thread each from the server and Agent, so there is no need for higher values for AGTSVRCONNECTIONS. See the *Oracle Essbase Technical Reference*.

**Note:** All requests for information after initial connection and before disconnection are handled by a different set of server threads, whose maximum number is controlled by the SERVERTHREADS configuration parameter.

**Limiting the Number of User Sessions**

Use the MAXLOGIN configuration setting to limit the maximum number of simultaneous user session connections to Essbase Server. This number includes multiple instances of the same user. For example, one user with five open Excel worksheets connected to the same Essbase Server uses one port but five sessions.

You can adjust the value of MAXLOGIN to match computer resources or to more closely manage concurrent ports and user sessions. A concurrent port is used for each unique combination of client computer, Essbase Server, and login name. See the *Oracle Essbase Technical Reference*.

**Note:** User sessions use the threads whose maximum is controlled by the SERVERTHREADS configuration setting and are not related to the threads whose maximum is controlled by AGENTTHREADS and AGTSVRCONNECTIONS.
Managing Applications and Databases

In This Chapter

- Understanding Applications and Databases .......................................................... 703
- Understanding How Essbase Files Are Stored......................................................... 704
- Managing Applications, Databases, and Database Artifacts ........................................ 708
- Migrating Applications Using Administration Services................................................ 715
- Porting Applications Across Platforms ........................................................................ 715

Also see the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.

Understanding Applications and Databases

An application is a management structure that contains one or more Essbase databases and related files. Essbase applications and databases usually reside on the Essbase Server. The server computer can store multiple applications.

An Essbase database is a data repository that contains a multidimensional data storage array. A multidimensional database supports multiple views of data so that users can analyze the data and make meaningful business decisions.

Files that are related to Essbase databases are called artifacts or objects. Database artifacts perform actions against one or more Essbase databases, such as defining calculations or reporting against data. By default, artifacts are stored in their associated database folder on the server. Some artifacts also can be saved to a client computer or to other available network directories. See “Understanding How Essbase Files Are Stored” on page 704.

The common types of database artifacts in Essbase:

- A database outline (a storage structure definition)
- Data sources
- Rules for loading data and building dimensions dynamically (rules files)
- Scripts that define how to calculate data (calculation scripts)
- Scripts that generate reports on data (report scripts)
- Security definitions
- Security filters
For a complete description of each database artifact, see “Understanding Database Artifacts” on page 116.

Understanding How Essbase Files Are Stored

Essbase installation files and files that are created when using Essbase are stored in the following locations:

- **MIDDLEWARE_HOME**—Oracle WebLogic Server home, and, optionally, one or more Oracle homes, including EPM Oracle home.
  
  In a default installation, **MIDDLEWARE_HOME** is:
  
  Oracle/Middleware

- **EPM_ORACLE_HOME**—Directory under which all EPM System products are installed.
  
  In a default installation, **EPM_ORACLE_HOME** is:
  
  MIDDLEWARE_HOME/EPMSystem11R1
  
  For example:
  
  Oracle/Middleware/EPMSystem11R1

- **EPM_ORACLE_INSTANCE**—Deployed product location (includes data and applications, deployed Java web applications, and log files).
  
  In a default installation, **EPM_ORACLE_INSTANCE** is:
  
  Oracle/Middleware/user_projects/epmsystem1

- **ESSBASEPATH**—The Essbase installation directory.
  
  In a default installation, the **ESSBASEPATH** directories are:
  
  - For Essbase Server:
    
    EPM_ORACLE_HOME/products/Essbase/EssbaseServer
  
  - For Essbase Client:
    
    EPM_ORACLE_HOME/products/Essbase/EssbaseClient

  For a list of directories that are created under **ESSBASEPATH**, see the *Oracle Enterprise Performance Management System Installation and Configuration Guide*.

- **ARBORPATH**:
  
  - The app directory location where Essbase application files (as they are created) and sample applications and databases (provided with Essbase) are stored.
The bin directory location where Essbase configuration setting (essbase.cfg) and security (essbase.sec and essbase_timestamp.bak) files (as they are created) are stored.

In a default installation, ARBORPATH is:

```
EPM_ORACLE_INSTANCE/EssbaseServer/essbaseserver1
```

- `EPM_ORACLE_INSTANCE/common`—Directory where common internal and third-party components are stored.
- `EPM_ORACLE_INSTANCE/diagnostics/logs`—Directory where log files are stored.

For more information about `MIDDLEWARE_HOME`, `EPM_ORACLE_HOME`, and `ESSBASE_ORACLE_INSTANCE`, see the *Oracle Enterprise Performance Management System Installation and Configuration Guide*.

### Server Software File Types

Table 129 lists the types of Essbase Server files:

<table>
<thead>
<tr>
<th>File Extension</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bak</td>
<td>ARBORPATH/bin</td>
<td>Backup of security file</td>
</tr>
<tr>
<td>bnd</td>
<td>ESSBASEPATH/bin</td>
<td>Microsoft ODBC file for SQL Interface installation using a DB2 database</td>
</tr>
<tr>
<td>cfg</td>
<td>ARBORPATH/bin</td>
<td>Essbase Server configuration file</td>
</tr>
<tr>
<td>cnt</td>
<td>ESSBASEPATH/bin</td>
<td>Online help contents file</td>
</tr>
<tr>
<td>cpl</td>
<td>ESSBASEPATH/bin</td>
<td>Microsoft ODBC driver for Windows platforms</td>
</tr>
<tr>
<td>dll</td>
<td>ESSBASEPATH/bin</td>
<td>Microsoft Windows Dynamic Link Library</td>
</tr>
<tr>
<td>eqd</td>
<td>ESSBASEPATH/bin</td>
<td>Query Designer files</td>
</tr>
<tr>
<td>exe</td>
<td>ESSBASEPATH/bin</td>
<td>Executable file</td>
</tr>
<tr>
<td>hlp</td>
<td>ESSBASEPATH/bin</td>
<td>Online help file</td>
</tr>
<tr>
<td>lck</td>
<td>ESSBASEPATH/bin</td>
<td>Lock file</td>
</tr>
<tr>
<td>lic</td>
<td>ESSBASEPATH/bin</td>
<td>License information file for ODBC</td>
</tr>
<tr>
<td>pl</td>
<td>ESSBASEPATH/bin</td>
<td>Sample Perl script</td>
</tr>
<tr>
<td>pm</td>
<td>ESSBASEPATH/bin</td>
<td>Perl Module</td>
</tr>
<tr>
<td>mdb</td>
<td>ESSBASEPATH/bin</td>
<td>Message database file</td>
</tr>
<tr>
<td>sec</td>
<td>ARBORPATH/bin</td>
<td>Security file</td>
</tr>
</tbody>
</table>
### Application and Database File Types

Table 130 lists the file types that Essbase uses to store applications, databases, and their related artifacts.

<table>
<thead>
<tr>
<th>File Extension</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>alg</td>
<td></td>
<td>Spreadsheet audit historical information</td>
</tr>
<tr>
<td>apb</td>
<td></td>
<td>Backup of application file</td>
</tr>
<tr>
<td>app</td>
<td></td>
<td>Application file, defining the name and location of the application and other application settings</td>
</tr>
<tr>
<td>arc</td>
<td></td>
<td>Archive file</td>
</tr>
<tr>
<td>atx</td>
<td></td>
<td>Spreadsheet audit transaction</td>
</tr>
<tr>
<td>chg</td>
<td></td>
<td>Outline synchronization change file</td>
</tr>
<tr>
<td>csc</td>
<td></td>
<td>Essbase calculation script</td>
</tr>
<tr>
<td>db</td>
<td></td>
<td>Database file, defining the name, location, and other database settings</td>
</tr>
<tr>
<td>dbb</td>
<td></td>
<td>Backup of database file</td>
</tr>
<tr>
<td>ddb</td>
<td></td>
<td>Partitioning definition file</td>
</tr>
<tr>
<td>ddm</td>
<td></td>
<td>Temporary partitioning file</td>
</tr>
<tr>
<td>ddn</td>
<td></td>
<td>Temporary partitioning file</td>
</tr>
<tr>
<td>esm</td>
<td></td>
<td>Essbase kernel file that manages pointers to data blocks and contains control information used for database recovery</td>
</tr>
<tr>
<td>esr</td>
<td></td>
<td>Temporary database root file</td>
</tr>
<tr>
<td>esn</td>
<td></td>
<td>Temporary Essbase kernel file</td>
</tr>
<tr>
<td>ind</td>
<td></td>
<td>Essbase index file</td>
</tr>
<tr>
<td>inn</td>
<td></td>
<td>Temporary Essbase index file</td>
</tr>
<tr>
<td>log</td>
<td></td>
<td>Server or application log</td>
</tr>
<tr>
<td>lro</td>
<td></td>
<td>LRO file linked to a data cell</td>
</tr>
<tr>
<td>lst</td>
<td></td>
<td>Cascade table of contents or list of files to back up</td>
</tr>
<tr>
<td>mxl</td>
<td></td>
<td>MaxL script file (saved in Administration Services)</td>
</tr>
<tr>
<td>File Extension</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>ocl</td>
<td>Database change log</td>
<td></td>
</tr>
<tr>
<td>ocn</td>
<td>Incremental restructuring file</td>
<td></td>
</tr>
<tr>
<td>oco</td>
<td>Incremental restructuring file</td>
<td></td>
</tr>
<tr>
<td>olb</td>
<td>Backup of outline change log</td>
<td></td>
</tr>
<tr>
<td>olg</td>
<td>Outline change log</td>
<td></td>
</tr>
<tr>
<td>otl</td>
<td>Essbase outline file</td>
<td></td>
</tr>
<tr>
<td>otm</td>
<td>Temporary Essbase outline file</td>
<td></td>
</tr>
<tr>
<td>otn</td>
<td>Temporary Essbase outline file</td>
<td></td>
</tr>
<tr>
<td>oto</td>
<td>Temporary Essbase outline file</td>
<td></td>
</tr>
<tr>
<td>pag</td>
<td>Essbase database data (page) file</td>
<td></td>
</tr>
<tr>
<td>pan</td>
<td>Temporary Essbase database data (page) file</td>
<td></td>
</tr>
<tr>
<td>rep</td>
<td>Essbase report script</td>
<td></td>
</tr>
<tr>
<td>rul</td>
<td>Essbase rules file</td>
<td></td>
</tr>
<tr>
<td>scr</td>
<td>Essbase ESSCMD script</td>
<td></td>
</tr>
<tr>
<td>sel</td>
<td>Saved member select file</td>
<td></td>
</tr>
<tr>
<td>tct</td>
<td>Essbase database transaction control file that manages all commits of data and follows and maintains all transactions</td>
<td></td>
</tr>
<tr>
<td>tcu</td>
<td>Temporary database transaction control file</td>
<td></td>
</tr>
<tr>
<td>trg</td>
<td>Trigger definition file. XML (Extensible Markup Language) format</td>
<td></td>
</tr>
<tr>
<td>txt</td>
<td>Text file, such as a data file to load or a text document to link as a LRO</td>
<td></td>
</tr>
<tr>
<td>xcp</td>
<td>Exception error log</td>
<td></td>
</tr>
<tr>
<td>xls</td>
<td>Microsoft Excel file</td>
<td></td>
</tr>
</tbody>
</table>

**API File Types**

Table 131 lists the types of Essbase files stored in the ESSBASEPATH/api subdirectories:

<table>
<thead>
<tr>
<th>File Extension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>UNIX static library file</td>
</tr>
<tr>
<td>bas</td>
<td>Microsoft Visual Basic program source file, containing header definitions for the Essbase API</td>
</tr>
<tr>
<td>File Extension</td>
<td>Description</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>h</td>
<td>C or C++ header file, containing header definitions for the Essbase API</td>
</tr>
<tr>
<td>lib</td>
<td>C or C++ program library</td>
</tr>
<tr>
<td>np</td>
<td>Named Pipes network library</td>
</tr>
<tr>
<td>tcp</td>
<td>TCP/IP network library</td>
</tr>
</tbody>
</table>

**Managing Applications, Databases, and Database Artifacts**

**Subtopics**

- Strategies for Backing Up and Recovering Databases
- Using the File System to Manage Applications and Databases During Backup
- Monitoring Applications
- Using Essbase to Manage Applications and Databases
- Using Essbase to Manage Artifacts

For a description of Essbase applications, databases, and database artifacts, see “Understanding Applications and Databases” on page 116 and “Understanding Database Artifacts” on page 116.

**Strategies for Backing Up and Recovering Databases**

Regular Essbase backups, which should be integrated into production server maintenance, are key to database maintenance. Backup frequency should be determined by the volatility of the database and server environment and the need for rapid database restoration (should a server interruption occur).

To back up and restore block storage databases, you can use either of the following methods:

- Automated database backup and restore and transaction logging and replay

  Backup and restore provides the equivalent functionality of manually backing up and restoring a database. When a backed-up database is restored, transactions that occurred after the backup procedure are not recovered. However, with transaction logging and replay, post-backup transactions are captured and can be replayed. Thus, a backed-up database can be recovered to the most-recent state before the interruption occurred.

  The use of the database backup and restore and transaction logging and replay features eliminates the need for various manual steps and, therefore, enables administrators to back up and recover databases more efficiently. Oracle recommends incorporating these features in your backup and recovery strategy.

- Manual backup and restore
Essbase customers who have designed a backup and restore strategy that uses manual procedures and who do not need the functionality of transaction logging and replay can continue using their manual strategy.

To back up and restore aggregate storage applications, you must use manual procedures. See the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.

**Using the File System to Manage Applications and Databases During Backup**

You should not use the platform file system to copy, move, rename, or delete applications and databases. When an application or database is altered through the file system, the Essbase security file is unable to recognize the changes. This situation creates a mismatch between what actually exists on the hard drive and what exists according to Essbase.

Caution! Do not move, copy, modify, or delete any of these files: essn.ind, essn.pag, dbname.ind, dbname.esm, or dbname.tct. Doing so may result in data corruption.

Certain application and database files can be managed successfully through the file system:

- Rules files for dimension builds and data loads (.rul)
- Data load or dimension build files
- Calculation scripts (.csc)
- Report scripts (.rep)
- MaxL scripts (.mxl or any extension)

To copy or move an outline file (.otl), you must use Administration Services. See “Copying Outlines” in the Oracle Essbase Administration Services Online Help.

The only time the file system should be used to manage applications and databases is during backup, when the entire directory for an application or database is copied and stored elsewhere. See the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.

**Monitoring Applications**

Each application that is loaded is an open task or process in the operating system. On Windows platforms, the application is displayed in a command-line window. On UNIX platforms, the application server is a child process of ESSBASE. When the application starts, ESSBASE starts the esssvr process. See “Starting an Application” on page 694.
On Windows platforms, when an application starts, a new icon is displayed in the taskbar. Double-click the icon to view the server window.

Essbase Server records application-level activities in an application log. See “Using Essbase Logs” on page 726.

To view application activities as they occur, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Windows platforms, use the application-process window</td>
<td>Select the command-line window that bears the name of the application.</td>
</tr>
<tr>
<td>UNIX</td>
<td><code>tail -f logfile</code></td>
</tr>
</tbody>
</table>

**Using Essbase to Manage Applications and Databases**

This section describes managing applications and databases.

**Viewing Applications and Databases**

When you start Administration Services Console, the Enterprise View tree is displayed in the navigation panel. Enterprise View is a graphical tree view of the Essbase environment. It displays the Administration Servers and Essbase Servers that you select. Your view of the Essbase environment may look different from that of other administrators.

Applications and databases, and their associated artifacts, are represented as nodes beneath the Essbase Server node. Artifacts are grouped into container nodes. For example, individual applications are contained in the Applications node, and databases are contained in the Databases container node. If sample applications and databases are installed with Essbase Server, they appear in Enterprise View along with your organization’s applications and databases.

See “About Enterprise View” in the *Oracle Essbase Administration Services Online Help*.

➢ To create an application:

See “Creating Applications” in the *Oracle Essbase Administration Services Online Help*.

**Copying or Migrating Applications**

You can copy an application to any Essbase Server to which you have appropriate access. You can copy (migrate) an entire application to another Essbase Server, or you can copy an application on the same Essbase Server. For example, you may need to migrate an entire application from a development server to a production server. Or, you may want to copy an application on the same server for testing or for backup purposes.

Essbase copies applications differently, depending on whether you are copying to the same Essbase Server or to a different Essbase Server. When you migrate applications, you can select the artifacts to migrate, such as calculation scripts, report scripts, rules files, custom-defined macros and functions, substitution variables, and filters. You can also specify how user and group security is migrated.
Administration Services provides a Migration Wizard that helps you migrate applications. See “Migration Wizard” in Oracle Essbase Administration Services Online Help.

To copy an application, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create application as</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>COPYAPP</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Renaming Applications

When you rename an application, the application and its associated directory (ARBORPATH/app/appname) are renamed. All artifacts within the application (for example, databases or calculation scripts) with the same name as the application are not renamed. Before you rename an application, see “Naming Conventions for Applications and Databases” on page 1093.

To rename an application, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Renaming Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>RENAMEAPP</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Deleting Applications

When you delete an application, all artifacts within the application also are deleted. The ARBORPATH/app/appname directory and all files in the directory are deleted.

To delete an application, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Deleting Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>drop application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>DELETEAPP</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Copying Databases

You can copy a database in an application to any Essbase Server and application to which you have appropriate access. You can copy (migrate) an entire database to another Essbase Server,
or you can copy a database on the same Essbase Server. For example, you may need to migrate an entire database from a development server to a production server. Or, you may want to copy a database on the same server for testing or for backup purposes. Essbase copies databases differently depending on whether you are copying to the same Essbase Server or to a different Essbase Server. See “Copying Databases” in Oracle Essbase Administration Services Online Help.

Administration Services provides a Migration Wizard that helps you migrate applications and databases. See “Migration Wizard” in Oracle Essbase Administration Services Online Help.

When you copy a database, all files associated with the database, except data files (.pag and .ind), are copied to the destination application. Before copying, make sure you have enough disk space to contain a full copy of the database and its related files.

To copy a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Copying Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>create database as</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>COPYDB</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Note:** Essbase allows copying a non-Unicode database to a Unicode application; however, copying a Unicode database to a non-Unicode application is not allowed.

Before you copy an aggregate storage application, you must merge all incremental data slices into the main database slice. Data in unmerged incremental data slices is not copied. See “Manually Merging Incremental Data Slices” on page 691.

### Renaming Databases

When you rename a database, the database and its associated directory (ARBORPATH/app/appname/dbname), and the outline file (.otl) are renamed. All other artifacts in the database (for example, calculation scripts) with the same name as the database are not renamed.

To rename a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Renaming Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>RENAMEDB</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Deleting Databases

When you delete a database, all artifacts within it are also deleted. The `ARBORPATH/app/appname/dbname` directory and all files located in the directory are deleted.

To delete a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Deleting Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>drop database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>DELETEDB</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Using Essbase to Manage Artifacts

This section describes copying, renaming, and deleting artifacts, such as outlines, calculation scripts, report scripts, rules files, and data sources. See “Understanding Database Artifacts” on page 116.

Caution! The only time the file system should be used to manage applications is during backup, when the entire directory for an application or database is copied and stored elsewhere.

Copying Artifacts

You can copy any database artifact, except an outline, to another application, database, server, or client location. For instructions on copying outlines, see “Creating and Editing Outlines” on page 128.

To copy an artifact, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Topics on copying the specific artifact; for example, Copying Rules Files</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter object</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>COPYOBJECT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Renaming Artifacts

You can rename any artifact except an outline. An outline always has the same name as the database, so you must rename the database to rename the outline.
To rename an artifact, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Topics on renaming the specific artifact; for example, Renaming a Rules File</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter object</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>RENAMEOBJECT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Deleting Artifacts**

You can delete any artifact except an outline. An outline is a required part of a database, so you must delete the database to delete the outline.

To delete an artifact, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Topics on deleting the specific artifact; for example, Deleting Rules Files</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>drop object</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>DELETE command for the artifact to delete</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Locking and Unlocking Artifacts**

Essbase uses a checkout facility for database artifacts to ensure that only one user modifies an artifact simultaneously. This section describes how to lock and unlock artifacts, with the exception of outlines. See “Locking and Unlocking Outlines” on page 129.

**Note:** Locking artifacts is not the same as locking data blocks. The Essbase kernel handles locking for data blocks but not for artifacts. See “Data Locks” on page 778.

By default, whenever you open a database artifact, Essbase prompts you to lock the artifact. You can change this default behavior for some artifacts; see “Setting Essbase Default Options” in Oracle Essbase Administration Services Online Help.

When an artifact is locked, Essbase does not allow other users to save over, rename, or delete the artifact. You can open a locked artifact and edit it, but you cannot save over the existing artifact. To save changes made to a locked artifact, save the modified artifact to a different location. You can execute and copy locked artifacts.

**Unlocking Artifacts**

You can unlock artifacts according to your permissions. In Administration Services, you can view all artifact locks for an Essbase Server, application, or database.
To unlock an artifact, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Locking and Unlocking Objects</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter object</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>UNLOCKOBJECT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

### Migrating Applications Using Administration Services

Using Administration Services, you can migrate applications to any Essbase Server to which you have appropriate access, regardless of platform. For example, you may need to migrate an application from a development server to a production server. When you migrate applications, you can select the artifacts to migrate, such as calculation scripts, report scripts, rules files, custom-defined macros and functions, substitution variables, and filters. You can also specify how user and group security is migrated.

To migrate an application:

See “Copying Applications” in *Oracle Essbase Administration Services Online Help*.

### Porting Applications Across Platforms

Essbase runs on multiple platforms, including Windows and UNIX.

After you create an application, you may want to port the application to a server that runs a different operating system. This section describes how to port an application to another Essbase computer.

Porting Essbase applications across servers involves these steps:

1. “Identifying Compatible Files” on page 715
2. “Checking File Names” on page 716
3. “Transferring Compatible Files” on page 717
4. “Reloading the Database” on page 719

### Identifying Compatible Files

If you are porting an Essbase application to a server that uses a different operating system, you must identify which Essbase files are compatible with the new operating system.

The following file types are compatible between operating systems:

- Text files. The Essbase text files are calculation scripts (.csc) and report scripts (.rep), and any MaxL or ESSCMD scripts you have developed. Also, data files can be text files.
Rules files. These files are binary files, but they are compatible between operating systems. Rules files have the extension .rul.

Outline files. These files are binary files, but they are compatible between operating systems. Outline files have the extension .otl.

The following file types are incompatible between operating systems and must be redefined or reloaded on the new server:

- Database files with the extensions .db and .dbb
- Data files with the extension .pag
- Index files with the extension .ind
- Security files with the extension .sec
- Application files with the extensions .app and .apb
- Essbase Kernel files with the extension .esm

Note: If you are using the Linked Reporting Objects feature, you must relink any files or cell notes on the new server. For a comprehensive discussion of how LROs are used, see Chapter 11, “Linking Objects to Essbase Data.”

Checking File Names

When transferring files to a UNIX system, be aware of the case-sensitivity of file names. UNIX is a case-sensitive operating system, and files are recognized only if file names are in the correct case. For example, in certain MaxL and ESSCMD operations, you must specify a file name, and the file name must be entered in the correct case.

The Essbase system files use the following naming conventions on UNIX systems:

- Executable files have no extension and are uppercase (for example, ESSBASE, ESSCMD).
- Static library files have the file extension .a and are in lowercase (for example, libessnet.a).
- Shared library files have the file extension .sl on HP-UX, .so on Solaris, and .a on AIX. These file names are in lowercase (for example, libesscur.sl).
- Security files have the file extension .sec and are in lowercase (for example, essbase.sec).
- Message database files have the file extension .mdb and are in lowercase (for example, essbase.mdb).
- Online help files have the file extension .hlp and are in lowercase (for example, esscmd.hlp).

Essbase files on UNIX systems are capitalized with proper case—the first letter is uppercase, and the remaining letters are lowercase. Table 132 gives examples of names for different file types:
Table 132  File Naming Examples for UNIX

<table>
<thead>
<tr>
<th>File Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database files</td>
<td>Mydb.db</td>
</tr>
<tr>
<td>Data files</td>
<td>Mydb.pag</td>
</tr>
<tr>
<td>Index files</td>
<td>Mydb.ind</td>
</tr>
<tr>
<td>Outline files</td>
<td>Mydb.otl</td>
</tr>
<tr>
<td>Rules files</td>
<td>Atlanta.rul</td>
</tr>
<tr>
<td>Data files to load</td>
<td>Atlanta.txt</td>
</tr>
<tr>
<td>Calculation scripts</td>
<td>Mycalc.csc</td>
</tr>
<tr>
<td>Report scripts</td>
<td>Myrepo.rep</td>
</tr>
<tr>
<td>Archive files</td>
<td>Mydb.arc</td>
</tr>
<tr>
<td>Application logs</td>
<td>Myapp.log</td>
</tr>
</tbody>
</table>

Note: The application name is an exception to the above rule. The application name can be in lowercase.

Table 133 lists several examples of valid and invalid file names on UNIX systems:

Table 133  Valid and Invalid File Names on UNIX

<table>
<thead>
<tr>
<th>Valid File Names</th>
<th>Invalid File Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model.csc</td>
<td>MODEL.CSC</td>
</tr>
<tr>
<td>Monthly.rep</td>
<td>Monthly.Rep</td>
</tr>
<tr>
<td>Forecast.otl</td>
<td>forecast.otl</td>
</tr>
<tr>
<td>Actuals.rul</td>
<td>ActuAls.rUl</td>
</tr>
<tr>
<td>My_File.txt</td>
<td>My_File.Txt</td>
</tr>
</tbody>
</table>

Note: Essbase does not allow long file names for applications, databases, calculation scripts, reports, and other database files. All file names for artifacts you create must conform to the Windows 8.3 convention.

Transferring Compatible Files

If two servers are connected, you can create the application and database directories on the new server and use either FTP (File Transfer Protocol) or Administration Services to transfer the
compatible application files. If the servers are not connected, you must redefine server information on the new server before reloading the database.

**Using FTP to Transfer Files**

Using FTP, you can transfer files directly between operating systems. You should transfer only the files that are compatible between operating systems, and you should transfer the files in binary mode.

If you have files with the wrong case on a UNIX server, Administration Services can see them but cannot open them. After you use FTP to transfer files, rename the files on the server to ensure that they are capitalized in the proper case. Alternatively, you can use FTP to rename the file when you transfer the file. For example:

```
ftp>put oldfile Newfile
```

**Using Administration Services to Transfer Files**

Using Administration Services, you can transfer files from the client computer to the server in the following ways:

- As part of an application migration. See “Migration Wizard” in *Oracle Essbase Administration Services Online Help*.
- As part of a database migration. See “Copying Databases” in *Oracle Essbase Administration Services Online Help*.
- One artifact at a time. See the topic for the individual artifact; for example, “Copying Rules Files,” in *Oracle Essbase Administration Services Online Help*.

**Redefining Server Information**

If the server you are porting to is not connected to the existing server, you must redefine some information on the new server.

To redefine server information:

1. To create users and specify their permissions, use Administration Services on the new server.
2. To create the applications and databases that you want to port, use Administration Services on the new server.
   
   See Chapter 6, “Creating Applications and Databases.”
3. Copy the outline files (.*otl) for the databases that you want to port from the old server to the same directory location on the new server. Ensure that the application is not running while you copy these files.
   
   See “Creating and Editing Outlines” on page 128.
4. Copy compatible files from the old server to the new server.
   
   See “Identifying Compatible Files” on page 715.
5  **Reload the database.**
   
   See “**Reloading the Database**” on page 719.

---

**Reloading the Database**

Database files, such as `.db`, `.pag`, `.esm`, and `.ind`, are not included when copying an application or database between servers and are not compatible between operating systems. If you copy an application or database between servers or port an application to a server on a different operating system, you must repopulate the database by reloading the data from a data file and a rules file (if applicable). One way you can reload is to export the data to a text file, transfer the text file to the new server, and then use the text file to load data. After the load is complete, calculate the new database.
Monitoring Data, Applications, and Databases

In This Chapter

- Monitoring Data Changes Using Triggers .............................................................. 721
- Using Essbase Logs.............................................................................................. 726

Monitoring Data Changes Using Triggers

Subtopics

- Administering Triggers
- Effect of Triggers on Performance and Memory Usage
- Trigger Examples

The triggers feature provided by Essbase enables efficient monitoring of data changes in a database.

If data breaks rules specified in a trigger, Essbase can log relevant information in a file or, for some triggers, can send an e-mail alert (to a user or system administrator); for example, to notify the sales manager if, in the Western region, sales for a month fall below sales for the equivalent month in the previous year.

There are two types of triggers. On-update triggers are activated during the update process, when the block containing the data referenced by the trigger is brought into memory. After-update triggers are activated after the update transaction is complete.

Note: On-update triggers are supported only on block storage databases.

Administering Triggers

Subtopics

- Creating On-Update Triggers
- Creating After-Update Triggers

To administer triggers, a user must have Database Manager security privilege. Essbase monitors and potentially activates triggers during the following activities:

- Data load
Calculation

Lock and send from Oracle Essbase Spreadsheet Add-in (available only for on-update triggers on block storage databases)

Essbase does not activate triggers during a database restructure.

To create, change, display, and delete triggers, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Triggers</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td></td>
<td>Editing Triggers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Viewing Triggers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enabling and Disabling Triggers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Viewing Trigger Spool Files</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deleting Triggers</td>
<td></td>
</tr>
<tr>
<td>MaxL</td>
<td><code>create trigger</code></td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td><code>create or replace trigger</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>alter trigger</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>display trigger</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>drop trigger</code></td>
<td></td>
</tr>
</tbody>
</table>

You can see information on enabled and disabled triggers in the application log file when you start Essbase Server.

Creating On-Update Triggers

When creating on-update triggers, consider the following information:

- You must use a symmetric WHERE clause when defining the area specification for a trigger. See the MDX documentation in the MaxL section of the Oracle Essbase Technical Reference.
- To enable Essbase to send e-mail alerts, you must have JVM installed on your system.
  
  **Note:** E-mails related to Unicode-mode applications are encoded in UTF-8 and require a UTF-8-capable e-mail reader.
- You cannot define a trigger that requires data from the following Essbase features:
  - Dynamic Calc
  - Partitioning
- You can specify whether all trigger data values are stored in the spool file or whether only the most current values are stored (for example, use the `log_value` parameter on the MaxL `create trigger` statement or `create and replace trigger` statement). If the `log_value` parameter is set to ON, both the new value and old value are logged to the spool file. If the `log_value`
parameter is set to OFF, values are not logged to the spool file. The log_value parameter is active only for data load and lock-and-send activities.

Consider data security when sending e-mail alerts. When Essbase activates a trigger and sends an e-mail, it cannot check whether the e-mail recipient is authorized to see the data referenced by the trigger condition.

Avoid referencing a sparse dimension member in a trigger condition. When Essbase executes a trigger on one data block, it must read another data block that may or may not be updated. Depending on the state of the second block, Essbase may activate the trigger in error.

The following example is based on the Sample.Basic database. Assume that East and West are sparse dimensions and that the following statement defines the trigger condition:

```mdx
FIX (East, West, Sales, Jan, Actual, Cola)
IF ((Sales -> East + Sales -> West) > 20)
EMAIL sales@.com
```

Assume that the following Sales data values are stored for East and West:

- Sales -> East = 5
- Sales -> West = 6

Now assume that a user does a lock-and-send request to update the data values:

- Sales -> East = 15
- Sales -> West = 3

When Sales->East is updated to 15, temporarily, the database contains the following values:

- Sales -> East = 15
- Sales -> West = 6

So Essbase activates the trigger because 15 plus 6 is greater than 20. Subsequently, Essbase updates Sales -> West to 3. Now the data does not meet the trigger condition, because 15 + 3 < 20. However, Essbase has already activated the trigger.

When a data load is followed by a calculation, if both the loaded data and the calculated data meet the trigger condition, Essbase activates the trigger twice, once on the data load and once on the calculation.

**Creating After-Update Triggers**

When creating after-update triggers, consider the following information:

- You must use a symmetric WHERE clause when defining the area specification for a trigger. See the MDX documentation in the MaxL section of the *Oracle Essbase Technical Reference*.
- Spreadsheet lock-and-send operations do not activate after-update triggers.
Effect of Triggers on Performance and Memory Usage

Depending on the number of enabled triggers in a database, there may be a small decrease in performance of calculation and data load. You can control the maximum amount of memory used by the triggers feature by specifying the TRIGMAXMEMSIZE configuration setting in the essbase.cfg file. By default, TRIGMAXMEMSIZE is set to 4096 bytes. Choosing to write information to a file, rather than sending e-mail, may improve calculation and data load performance by reducing network traffic.

Trigger Examples

Subtopics

- Example 1: Tracking Sales for January
- Example 2: Tracking Sales for Quarter 1
- Example 3: Tracking Inventory Level

The following examples are based on the Sample.Basic database.

Note: You cannot define an on-update trigger that requires data from Dynamic Calc members or from members from another partition.

Example 1: Tracking Sales for January

Example 1 tracks the Actual, Sales value for the following month, product, and region:

- January (Year dimension member Jan)
- Colas (Product dimension member 100)
- Eastern region (Market dimension member East)

When the member being calculated is Jan, and when the Actual, Sales value of Colas for January exceeds 20, the example sends an e-mail to two e-mail accounts.

```plaintext
create trigger Sample.Basic.Trigger_Jan_20
where "(Jan,Sales,[100],East,Actual)"
when Jan > 20 and is(Year.currentmember,Jan) then
mail ([Docs.Company.com],[trgsales@company.com],
    [inventory@company.com],
    [Mail sent by trigger_Jan_20])
end;
```

Example 2: Tracking Sales for Quarter 1

Example 2 tracks the Actual, Sales value for the following months, product, and region:

- January, February, and March (the children of Year dimension member Qtr1)
- Colas (Product dimension member 100)
- Eastern region (Market dimension member East)

When the member being calculated is Jan, Feb, or Mar, and when the Actual, Sales value of Colas for the month January, February, or March exceeds 20, the example logs an entry in the file Trigger_Jan_Sales_20, Trigger_Feb_Sales_20, or Trigger_Mar_Sales_20. On subsequent trigger activations, both old and new log values are retained in the log files.

```sql
create or replace trigger Sample.Basic.Trigger_Qtr1_Sales
log_value on
Where "(crossjoin(Qtr1.children, {{Measures.Sales, [100],
    East, Scenario.Actual}}))"*
When Year.Jan > 20 and is(Year.currentmember, Jan) then
    spool Trigger_Jan_Sales_20
When Year.Feb > 20 and is(Year.currentmember, Feb) then
    spool Trigger_Feb_Sales_20
When Year.Mar > 20 and is(Year.currentmember, Mar) then
    spool Trigger_Mar_Sales_20
end;
```

**Example 3: Tracking Inventory Level**

Example 3 tracks the inventory level for the following product, region, and months:

- Colas (product 100)
- Eastern region (market East)
- January, February, and March (the children of Qtr1)

The trigger is activated after the update action is complete. If the inventory of Colas in the eastern region falls below 500,000, the example logs an entry in the file Inventory_East.

```sql
create after update trigger Sample.Basic.Inventory_east
where "(crossjoin ({{children([Qtr1])},
    {{[Market].[East], [Product].[100],
      [Inventory].[Ending Inventory]}}))"
when [Ending Inventory] < 500000 then
    spool Inventory_East
end;
```
Using Essbase Logs

Subtopics

- Essbase Server and Application Logs
- Contents of the Essbase Server Log
- Essbase Server Log Example
- Contents of the Application Log
- Example of an Application Log
- Essbase Server and Application Log Message Categories
- Using Essbase Server and Application Logs
- Implementing Query Logs
- Understanding and Using the Outline Change Log
- Understanding and Using Exception Logs
- Understanding and Using Dimension Build and Data Load Error Logs

This topic describes the logs that Essbase Server creates to record information about server, application, and database activities. Table 134 briefly describes each log.

Essbase also uses the Oracle Diagnostic Logging framework (ODL) for logging purposes. For information on the Essbase implementation of ODL, see the Oracle Hyperion Enterprise Performance Management System Installation and Configuration Troubleshooting Guide.

Table 134 Summary of Logs

<table>
<thead>
<tr>
<th>Log Type</th>
<th>Log Location</th>
<th>Information Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essbase Server log</td>
<td>$EPM_ORACLE_INSTANCE/diagnostics/logs/essbase/essbase_0/ESSBASE.LOG</td>
<td>Server activities and errors</td>
</tr>
<tr>
<td>Application log</td>
<td>$EPM_ORACLE_INSTANCE/diagnostics/logs/essbase/essbase_0/app/appname/appname.LOG</td>
<td>Application activities and errors</td>
</tr>
<tr>
<td>Query log</td>
<td>$EPM_ORACLE_INSTANCE/diagnostics/logs/essbase/essbase_0/app/appname/dbname00001.qlg</td>
<td>Query patterns of Essbase database retrievals</td>
</tr>
<tr>
<td>Outline change log</td>
<td>$EPM_ORACLE_INSTANCE/diagnostics/logs/essbase/essbase_0/app/appname/dbname.dbname.olg</td>
<td>Changes to the outline</td>
</tr>
<tr>
<td>Exception log</td>
<td>One of these locations: $ARBORPATH/log00001.xcp $EPM_ORACLE_INSTANCE/diagnostics/logs/essbase/essbase_0/app/log00001.xcp $EPM_ORACLE_INSTANCE/diagnostics/logs/essbase/essbase_0/app/appname/log00001.xcp $EPM_ORACLE_INSTANCE/diagnostics/logs/essbase/essbase_0/app/appname/dbname/log00001.xcp</td>
<td>Errors that result when Essbase Server stops abnormally</td>
</tr>
</tbody>
</table>
The following topics describe the information written to a log and explains how you can use that information to maintain, tune, or troubleshoot Essbase Server.

For information about Administration Services logs, see “About the Administration Server Log” in Oracle Essbase Administration Services Online Help.

### Contents of the Essbase Server Log

The information in the ESSBASE.LOG file can help you assess:

- Who performed an operation
- When an operation was performed
- Errors that occurred when an operation was performed or attempted

Table 135 lists the types of actions logged and the information included in the log message. For information about specific error messages, see the Oracle Essbase Error Message Reference.
<table>
<thead>
<tr>
<th>Type of Action</th>
<th>Information Included</th>
</tr>
</thead>
</table>
| Actions performed at the Essbase Server level, such as logging on Essbase Server or setting security | - User name  
- Date and time  
- If changing permissions—User and group information and IP address of user  
- If logging on—Time and date the user last logged on  
- If logging off—Length of time the user was logged on  
- If creating or changing an application or database—Request to create or open the artifact; load, connect, and start the application or database to be created; and lock of the artifact to be created or changed  
- If creating, changing, or viewing an application or database—Requests to list applications and databases and requests to retrieve access information  
- Shutdown or startup requests  
- Requests to retrieve and delete the Essbase Server log |
| Actions performed at the application level, such as viewing application settings or viewing and changing custom-defined macros, custom-defined functions, and substitution variables | - User name  
- Date and time  
- Requests to retrieve operating system resources, license information, and system-wide configuration  
- Retrieving and setting global values  
- If altering substitution variables—Request to list and set substitution variables  
- If altering custom-defined macros—Request to list and delete custom-defined macros  
- Requests to retrieve and delete the application log |
| Actions performed at the database level, such as creating rules files, outlines, reports, or calculation scripts | - User name  
- Date and time  
- Requests to retrieve client settings, user, and group information  
- Requests to list applications and databases  
- Requests to retrieve access information  
- Requests to lock artifacts  
- Returning artifacts |

**Essbase Server Log Example**

The following `essbase.log` example shows entries written when Essbase Server starts. First, the Sample application and the Basic database are loaded. The log file includes information about the time the application and database are loaded, the process ID assigned to the application by the operating system, and the startup of the security authentication module.

**Note:** You can use the process ID to stop the application improperly if you are unable to perform a normal shutdown. See “Stopping an Application Improperly” on page 696.

```
[Tue Nov 06 07:54:16 2001]Local/ESSBASE0///Info(1054014)
Database Basic loaded
```
The following log shows a single error. The admin user tried to rename an application using a name that already exists on Essbase Server. The log file includes information about the user name, the time of the error, and the operation that failed and caused the error.

```
[Tue Nov 06 08:00:04 2001]Local/ESSBASE0///Info(1051001)
Received client request: Rename Application (from user admin)

[Tue Nov 06 08:00:04 2001]Local/ESSBASE0///Error(1051031)
Application Testing already exists

[Tue Nov 06 08:00:04 2001]Local/ESSBASE0///Warning(1051003)
Error 1051031 processing request [Rename Application] - disconnecting
```

The next log shows a shutdown. The log file includes information about the name of the application shutdown and the time of the shutdown.

```
[Tue Nov 06 08:00:46 2001]Local/ESSBASE0///Info(1054005)
Shutting down application Sample

[Tue Nov 06 08:00:52 2001]Local/ESSBASE0///Info(1051052)
Essbase Server - finished
```

**Contents of the Application Log**

The information in the `appname.log` file can help you assess:

- Who performed a specific operation
- When an operation was performed
- Errors that occurred when an operation was performed or attempted
- Information about dimensions and members to aid in optimization
- The name of an artifact used to execute an operation (such as a calc script or load file used to perform a calculation or a data load) if the artifact resides on an instance of Essbase

Table 136 lists the types of actions logged and the information included in the log message.
Table 136  Contents of the Application Log

<table>
<thead>
<tr>
<th>Type of Action</th>
<th>Information Included</th>
</tr>
</thead>
</table>
| Actions performed at the database level, such as loading data, clearing data, or calculating data | ● User name  
● Date and time  
● Application and database name and time  
● If starting application—Loading Java modules, and reading and writing database and application information  
● If loading databases—Information about dimension sizes, dynamic calculation members, blocks, cache sizes, index page size, and I/O information  
● If starting databases—Application and database setup information, including reading free space information, writing database parameters, retrieving state information, writing application and database definition information, retrieving database volumes, and writing database mapping  
● If loading—Load command, parallel data load information, cells updated, elapsed load time, and the name of the rules file and data file  
  **Note:** Essbase supplies the load rule name only if the client making the request (for example, Administration Services) is at the same release level as Essbase; for example, Release 7.0.  
● If calculating—the name of the calculation script used to perform the calculation  
● If reporting—the name of the report script |
| Actions performed at the outline level, such as restructuring | ● User name  
● Date and time  
● Information about dimension sizes, dynamic calculation members, blocks, cache sizes, index page size, I/O information, and restructure elapsed time |
| Actions performed at the spreadsheet level, such as lock and send | ● User name  
● Date and time  
● Action performed |

**Example of an Application Log**

**Subtopics**

- Example 1: Startup Messages in the Application Log
- Example 2: Errors in the Application Log
- Example 3: Shutdown Messages in the Application Log
- Example 4: Query Elapsed Time in the Application Log

**Example 1: Startup Messages in the Application Log**

The following log example shows all the entries written to `appname.log` when Essbase Server starts. The log file includes information such as the time the application starts, when application and database information is read and written, when the application is ready for login requests, and when the database is loaded.

[Tue Nov 06 08:47:14 2001]Local/Sample///Info(1002035)  
Starting Essbase Server - Application [Sample]
After Essbase Server starts, it writes information about the dimensions and members in the outline, such as the dimension sizes and dynamic calculation information, to the application log, as shown in the following example:

```plaintext
[Tue Nov 06 08:47:15 2001]Local/Sample///Info(1019012)
Declared Dimension Sizes = [20 17 23 25 5 3 5 3 15 8 6 ]

[Tue Nov 06 08:47:15 2001]Local/Sample///Info(1007043)
Actual Dimension Sizes = [20 14 20 25 4 3 5 3 15 8 5 ]

[Tue Nov 06 08:47:15 2001]Local/Sample///Info(1007125)
The number of Dynamic Calc Non-Store Members = [8 6 0 0 2 ]

[Tue Nov 06 08:47:15 2001]Local/Sample///Info(1007126)
The number of Dynamic Calc Store Members = [0 0 0 0 0 ]
```

Next, Essbase Server writes information about the blocks in the database, including the block size, the number of declared and possible blocks, and the number of blocks needed to perform calculations (you can use this information to estimate the retrieval performance for members of sparse dimensions tagged as Dynamic Calc) to the application log:
The logical block size is [1120]

Maximum Declared Blocks is [575] with data block size of [1700]

Maximum Actual Possible Blocks is [500] with data block size of [192]

Formula for member [Opening Inventory] will be executed in [CELL] mode

Essbase needs to retrieve [1] Essbase Kernel blocks in order to calculate the top dynamically calculated block.

Next, Essbase Server writes information about the caches set for each database to the application log:


The Dyn.Calc.Cache for database [Basic], when full, will result in [allocation from non-Dyn.Calc.Cache memory].

Writing Parameters For Database [Basic]

Reading Parameters For Database [Basic]


Index page size ==> [8192] bytes.

Using buffered I/O for the index and data files.

Using waited I/O for the index and data files.

Data cache size ==> [3145728] bytes, [2048] data pages

Data file cache size ==> [0] bytes, [0] data file pages

The final messages logged at startup refer to general database information:
Example 2: Errors in the Application Log

The following example shows a single error. An unknown member was found in the data load file; the presence of an unknown member caused the load to fail. First, you see the request for the data load, then the error message, and, finally, information messages describing the data values changed by the data load and the data load elapsed time.

User [admin] set active on database [Basic]


Unknown Item [500-10] in Data Load, [0] Records Completed
No data values modified by load of this data file

Data Load Elapsed Time : [0.11] seconds
Example 3: Shutdown Messages in the Application Log

The following messages are logged when Essbase Server performs a normal shutdown. First, information about the database is retrieved. Then the database is unloaded, free space information is written, and the server shuts down.

[Tue Nov 06 08:50:26 2001]Local/Sample///Info(1013214)
Clear Active on User [admin] Instance [1]

[Tue Nov 06 08:50:34 2001]Local/Sample///Info(1013205)
Received Command [Get Database Info]

[Tue Nov 06 08:50:34 2001]Local/Sample///Info(1013205)
Received Command [Get Database State]

[Tue Nov 06 08:50:34 2001]Local/Sample///Info(1013205)
Received Command [Get Database Volumes]

[Tue Nov 06 08:50:34 2001]Local/Sample///Info(1013205)
Received Command [Get Database State]

[Tue Nov 06 08:50:34 2001]Local/Sample///Info(1013205)
Received Command [Get Database Volumes]

[Tue Nov 06 08:50:34 2001]Local/Sample///Info(1013205)
Received Command [Unload Database]

[Tue Nov 06 08:50:34 2001]Local/Sample///Info(1019018)
Writing Parameters For Database [Basic]

[Tue Nov 06 08:50:34 2001]Local/Sample///Info(1019020)
Writing Free Space Information For Database [Basic]

[Tue Nov 06 08:50:34 2001]Local/Sample///Info(1013207)
RECEIVED SHUTDOWN COMMAND - SERVER TERMINATING

Example 4: Query Elapsed Time in the Application Log

The following message is logged when Smart View queries an Essbase database. The elapsed time of 0.121 seconds is the amount of time that the application process (ESSSVR) takes to execute the request; not the actual roundtrip retrieval time of the query.

[Tue Apr 22 10:23:20 2014]Local/ASOsamp/Sample/admin@NativeDirectory/7476/Info(1260039)
MaxL DML Execution Elapsed Time: [0.121] seconds

Essbase Server and Application Log Message Categories

Table 137 provides error message categories for each error number range that is shown in the first column. When you receive an error message, use this table to identify the Essbase component to which the error is related. See Oracle Essbase Error Message Reference.
<table>
<thead>
<tr>
<th>Error Message Number Range</th>
<th>Component That Generated the Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001000-1001999</td>
<td>Report Writer</td>
</tr>
<tr>
<td>1002000-1002999</td>
<td>General server</td>
</tr>
<tr>
<td>1003000-1003999</td>
<td>Data load</td>
</tr>
<tr>
<td>1004000-1004999</td>
<td>General server</td>
</tr>
<tr>
<td>1005000-1005999</td>
<td>Backup, export, or validate</td>
</tr>
<tr>
<td>1006000-1006999</td>
<td>Data cache</td>
</tr>
<tr>
<td>1007000-1007999</td>
<td>Outline restructure</td>
</tr>
<tr>
<td>1008000-1008999</td>
<td>System calls, portable layer, ASD, or Agent</td>
</tr>
<tr>
<td>1009000-1009999</td>
<td>Restoring ASCII data</td>
</tr>
<tr>
<td>1010000-1010999</td>
<td>Internal (block numbering)</td>
</tr>
<tr>
<td>1011000-1011999</td>
<td>Internal (utilities)</td>
</tr>
<tr>
<td>1012000-1012999</td>
<td>Calculator</td>
</tr>
<tr>
<td>1013000-1013999</td>
<td>Requestor</td>
</tr>
<tr>
<td>1014000-1014999</td>
<td>Lock manager</td>
</tr>
<tr>
<td>1015000-1015999</td>
<td>Alias table</td>
</tr>
<tr>
<td>1016000-1016999</td>
<td>Report Writer</td>
</tr>
<tr>
<td>1017000-1017999</td>
<td>Currency</td>
</tr>
<tr>
<td>1018000-1018999</td>
<td>Not currently used</td>
</tr>
<tr>
<td>1019000-1019999</td>
<td>Database artifacts</td>
</tr>
<tr>
<td>1020000-1029999</td>
<td>Spreadsheet extractor</td>
</tr>
<tr>
<td>1021000-1021999</td>
<td>Oracle Essbase SQL Interface</td>
</tr>
<tr>
<td>1022000-1022999</td>
<td>Security</td>
</tr>
<tr>
<td>1023000-1023999</td>
<td>Partitioning</td>
</tr>
<tr>
<td>1024000-1024999</td>
<td>Query Extractor</td>
</tr>
<tr>
<td>1030000-1030999</td>
<td>API</td>
</tr>
<tr>
<td>1040000-1040999</td>
<td>General network</td>
</tr>
<tr>
<td>1041000-1041999</td>
<td>Network—Named Pipes</td>
</tr>
<tr>
<td>1042000-1042999</td>
<td>Network—TCP</td>
</tr>
<tr>
<td>Error Message Number Range</td>
<td>Component That Generated the Error</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>1043000-1049999</td>
<td>Not currently used</td>
</tr>
<tr>
<td>1050000-1055999</td>
<td>Agent</td>
</tr>
<tr>
<td>1056000-1059999</td>
<td>Not currently used</td>
</tr>
<tr>
<td>1060000-1060999</td>
<td>Outline API</td>
</tr>
<tr>
<td>106100-1069999</td>
<td>Not currently used</td>
</tr>
<tr>
<td>1070000-1070999</td>
<td>Index manager</td>
</tr>
<tr>
<td>1071000-1079999</td>
<td>Not currently used</td>
</tr>
<tr>
<td>1080000-1080099</td>
<td>Transaction manager</td>
</tr>
<tr>
<td>1081000-1089999</td>
<td>Not currently used</td>
</tr>
<tr>
<td>1090000-1099999</td>
<td>Rules file processing</td>
</tr>
<tr>
<td>1010000-1019999</td>
<td>Not currently used</td>
</tr>
<tr>
<td>1100000-1100999</td>
<td>Not currently used</td>
</tr>
<tr>
<td>1110000-1119999</td>
<td>Oracle Hyperion Web Analysis</td>
</tr>
<tr>
<td>1120000-1129999</td>
<td>Grid API</td>
</tr>
<tr>
<td>1130000-1139999</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>1140000-1149999</td>
<td>Linked Reporting Objects (LRO)</td>
</tr>
<tr>
<td>1150000-1159999</td>
<td>Outline synchronization</td>
</tr>
<tr>
<td>1160000-1169999</td>
<td>Outline change records</td>
</tr>
<tr>
<td>1170000-1179999</td>
<td>Attributes</td>
</tr>
<tr>
<td>1180000-1189999</td>
<td>Showcase</td>
</tr>
<tr>
<td>1190000-1199999</td>
<td>Not currently used</td>
</tr>
<tr>
<td>1200000-1200999</td>
<td>Calculator framework</td>
</tr>
</tbody>
</table>

**Using Essbase Server and Application Logs**

The following topics describe the actions you can perform on server and application logs.

For a comprehensive discussion of server and application logs, see “Essbase Server and Application Logs” on page 727. For information about specific error messages, see *Oracle Essbase Error Message Reference*.

You can also view logs using Administration Services. See “About Log Viewer” in *Oracle Essbase Administration Services Online Help*. 

736
Setting the Maximum Log File Size for Essbase Server and Application Logs

You can specify the maximum log file sizes for Essbase Server (Agent) and application log files in the `essbase.cfg` file using these settings:

- AGTMAXLOGFILESIZE
- APPMAXLOGFILESIZE

The default maximum log file size is 2 GB.

See Oracle Essbase Technical Reference.

Setting the Type of Essbase Server MessagesLogged or Displayed in the Essbase Server Window

You can specify whether to have Essbase Server messages written to the Essbase Server log (`EPM_ORACLE_INSTANCE/diagnostics/logs/essbase/essbase_0/essbase.log`), the Essbase Server window, or both.

Log levels:

- Information messages, such as notification of a user action or information about an application or database

  In the following example, the admin user logged out.

  `[Sun Oct 21 16:00:55 2001]Local/ESSBASE0///Info(1051037)`
  Logging out user admin, active for 144 minutes

- Warning messages, such as a notification that an operation was not completed

  Warnings often follow errors. In the following example, the rename operation did not complete because of a previous error in the log.

  `[Fri Nov 02 13:38:14 2001]Local/ESSBASE0///Warning(1051003)`
  Error 1051031 processing request [Rename Application] - disconnecting

- Error messages, such as trying to perform an action that Essbase Server cannot perform

  In the following example, the rename operation failed because the application name already existed.

  `[Fri Nov 02 13:38:14 2001]Local/ESSBASE0///Error(1051031)`
  Application Testing already exists

- Debug messages, such as OPMN ping messages.

Table 138 lists the configuration settings that you specify in the `essbase.cfg` file to determine what types of messages Essbase Server writes to the Essbase Server log or displays to the Essbase Server window. If you change an `essbase.cfg` setting, restart Essbase Server to apply the change.
Table 138  List of Essbase Server Message Configuration Settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGENTLOGMESSAGELEVEL</td>
<td>An essbase.cfg setting that determines the level of messages to be written to the Essbase Server log.</td>
</tr>
<tr>
<td>AGENTDISPLAYMESSAGELEVEL</td>
<td>An essbase.cfg setting that determines the level of messages to be written to the Essbase Server window.</td>
</tr>
<tr>
<td>PORTUSAGELOGINTERVAL</td>
<td>An essbase.cfg setting that specifies how often to check the number of ports in use.</td>
</tr>
</tbody>
</table>

**Setting the Type of Application Messages Logged**

By default, the application log lists the following types of messages:

- Information messages that detail routine actions that Essbase Server performs

  In the following example, Essbase Server writes the time elapsed during a data load to the application log:
  
  [Fri Nov 02 13:04:15 2001]
  Local/Sample/Basic/admin/Info(1003024)
  Data Load Elapsed Time : [3.014] seconds

- Warning messages that list conditions that are not deemed serious by Essbase Server

  In the following example, Essbase Server writes a statement that no data values were changed during a data load to the application log:
  
  [Fri Nov 02 12:43:44 2001]
  Local/Sample/Basic/admin/Warning(1003035)
  No data values modified by load of this data file

- Error messages that describe errors that occurred while performing the task

  Error messages can range from serious, such as a file not loading correctly, to very serious, such as a disk space error that causes Essbase Server to crash. In the following example, Essbase Server writes a statement to the application log file indicating that a data value was encountered before all dimensions in the outline were specified:
  
  [Fri Nov 02 12:53:32 2001]
  Local/Sample/Basic/admin/Error(1003007)

Table 139 lists settings that you specify in the essbase.cfg file and a command that you can use in a calculation script to determine what types of messages Essbase Server writes to the application log. If you change an essbase.cfg setting, restart Essbase Server to apply the change.

Table 139  List of Application Log Message Configuration Settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOGMESSAGELEVEL</td>
<td>An essbase.cfg setting that determines whether Essbase Server writes all messages, warning messages, or error messages to the application log</td>
</tr>
<tr>
<td>Setting</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>TIMINGMESSAGES</td>
<td>An essbase.cfg setting that determines whether Essbase Server writes the duration of each spreadsheet and report query to the application log</td>
</tr>
<tr>
<td>SSLUNKNOWN</td>
<td>An essbase.cfg setting that determines whether Essbase Server writes error messages when it encounters an unknown member name during a spreadsheet operation to the application log</td>
</tr>
</tbody>
</table>
| SET MSG      | A calculation script setting that determines whether Essbase Server writes the following items to the application log during the duration of the calculation script:  
|               | • A summary of calculation statistics  
|               | • Detailed calculation statistics  
|               | • All messages, error messages, or no messages |

### Viewing the Essbase Server and Application Logs

When you view a log, you are viewing a snapshot. To view an updated version of a log, close and reopen the log. You can view a log from a specific date to the present or to view the entire log.

You must have Administrator permissions to view Essbase Server logs, and you must have at least Application Manager permissions to view application logs.

► To view a server or application log, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Viewing Logs</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>Any text editor</td>
<td></td>
<td>(See the documentation for the text editor.)</td>
</tr>
</tbody>
</table>

### Changing Essbase Server and Application Log Levels in Administration Services

You can change Essbase log levels at the server and application level in Administration Services Console. See “Changing Log Levels” in the Oracle Essbase Administration Services Online Help.

### Viewing System and Application Message Levels

You can view current system-wide and application message levels with MaxL statements that use the message_level grammar. The output is a table with two columns: component and message_level.

► To view system message levels, use the following MaxL statement:

```maxl
display system message_level;
```

Output:

```
component          message_level
+------------------+------------------
```

---

739
To view the message level for an application, use the following MaxL statement:

```
display application appname message_level;
```

For example, assume the application is Sample. Output:

```
component   message_level
+------------------+------------------
Sample       info
lease_manager error
```

### Clearing the Essbase Server and Application Logs Immediately

The server and application logs use disk space on the server. Occasionally, you may need to clear entries from a log before it grows too large. Clearing the server log removes all entries in the log but does not remove the server log. Clearing the application log removes all the entries in the application log and deletes the application log. Back up each log before you clear it.

You must have Administrator permissions to clear server and application logs.

To clear a server or application log immediately, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Deleting Logs</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>To clear the Essbase Server log:</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>alter system clear logfile;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To clear the application log:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>alter application appname clear logfile;</td>
<td></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>To clear the server log:</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>DELETELOG &quot;&quot;;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To delete the application log:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DELETELOG &quot;appname&quot;;</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** To clear a server or application log each time the server or application restarts, see “Clearing the Essbase Server and Application Logs Upon Restart” on page 740. To conserve space by limiting the items logged in the Essbase Server log or application log, see “Setting the Type of Essbase Server Messages Logged or Displayed in the Essbase Server Window” on page 737 or “Setting the Type of Application Messages Logged” on page 738.

### Clearing the Essbase Server and Application Logs Upon Restart

By default, Essbase Server appends messages to the end of the server and application logs. Using the CLEARLOGFILE configuration setting, you can set Essbase Server to clear the Essbase Server
log each time the server is restarted or the application log each time the application is restarted. If you change the essbase.cfg file, restart Essbase Server to apply the change.

**Note:** To clear a server or application log without restarting the server or application, see “Clearing the Essbase Server and Application Logs Immediately” on page 740. To conserve space by limiting the items logged in the Essbase Server log or application log, see “Setting the Type of Essbase Server Messages Logged or Displayed in the Essbase Server Window” on page 737 or “Setting the Type of Application Messages Logged” on page 738.

**Setting Delimiters in the Essbase Server and Application Logs**

You can change the symbol used to delimit log entries for server and application logs. Changing the delimiter also affects messages logged in the Essbase Server window. By default, Essbase Server uses spaces to delimit fields in a log, as in the following example:

```
[Thu May 10 20:14:46 2001]Local/ESSBASE0///Info(1051051)
Essbase Server - started
```

You can also use tildes, carets, colons, ampersands, or asterisks to delimit the entries in the server and application logs. If possible, choose a delimiter that does not occur frequently in the data, application, or database. The following example shows a log entry delimited by tildes (~):

```
Thu~May~10~20:16:13~2005~Local~ESSBASE0~~~Info~(1051051)~Oracle Essbase Server - started
```

**Note:** If you set delimiters to anything other than spaces, you can no longer sort the log entries by date in Log Viewer.

Table 140 on page 741 lists settings that you specify in the essbase.cfg file to determine the delimiters that Essbase Server uses in the server and application logs. If you change an essbase.cfg setting, restart Essbase Server to apply the change.

**Table 140  List of Log Message Delimiter Configuration Settings**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DELIMITEDMSG</td>
<td>An essbase.cfg setting that, when set to TRUE, adds a tilde (~) between each field in the server and application logs. To specify a different delimiter, use the DELIMITER setting.</td>
</tr>
<tr>
<td>DELIMITER</td>
<td>An essbase.cfg setting that specifies the delimiter used between each field in the server and application logs. Essbase Server enables you to use the following characters as log delimiters: tilde (~), the default delimiter; caret (^); colon (:); ampersand (&amp;); and asterisk (*). The DELIMITER setting works only when DELIMITEDMSG is set to TRUE.</td>
</tr>
</tbody>
</table>
Analyzing Logs with Log Analyzer

You can use Log Analyzer to filter, search, and analyze Essbase Server logs and application logs. Based on filters you choose or create, you can view robust graphical charts for a log. An autorefresh option enables you to monitor log file information dynamically.

To use Log Analyzer:

See “About Log Analyzer” in Oracle Essbase Administration Services Online Help.

Implementing Query Logs

Query logging enables Essbase administrators to track query patterns of an Essbase database. The query log file tracks all queries performed against the database, regardless of whether the query originated from Spreadsheet Add-in or Report Writer. Query logging can track members, generation or level numbers of members belonging to specific generations or levels. Query logging also offers the flexibility to exclude logging of certain dimensions and members belonging to generations or levels. Because the query log file output is an XML document, you can import the log file to any XML-enabled tool to view the log. For information about the query log file structure, refer to querylog.dtd in the ESSBASEPATH/bin directory.

Query logging is available for both block storage and aggregate storage databases.

To enable query logging, create a query configuration file (distinct from the essbase.cfg file) and add to the file the configuration settings that control how query logging is performed.

In the ARBORPATH/app/appname/dbname directory, create a query log configuration file. The configuration file must be named dbname.cfg, where dbname matches the name of the database. For example, the query log configuration file for Sample.Basic is basic.cfg. The output query log file is located, by default, at ARBORPATH/app/appname/dbname00001.qlg.

See the Oracle Essbase Technical Reference.

Understanding and Using the Outline Change Log

You can set Essbase Server to create an outline change log, a text file named dbname.olg, that saves outline modification information to a text file. You can review the outline change log anytime to see the changes that have been made to an outline since the log was created. This information helps you to roll back an outline to a previous version.

The outline change log is located in the following directory:

EPM_ORACLE_INSTANCE/diagnostics/logs/essbase/essbase_0/app/appname/dbname

The following topics describe the outline change log and the actions that you can perform on it.

Understanding the Contents of the Outline Change Log

Table 141 lists the types of actions written to the outline change log and the information included in the log message.
Table 141 Outline Change Log Contents

<table>
<thead>
<tr>
<th>Type of Change</th>
<th>Information Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add a dimension</td>
<td>• Name of dimension</td>
</tr>
<tr>
<td></td>
<td>• Type of dimension (dense or sparse)</td>
</tr>
<tr>
<td></td>
<td>• Dimension tag (if any)</td>
</tr>
<tr>
<td></td>
<td>• Name of left sibling of dimension (if any)</td>
</tr>
<tr>
<td></td>
<td>• Level number of dimension</td>
</tr>
<tr>
<td></td>
<td>• Generation number of dimension</td>
</tr>
<tr>
<td>Delete a dimension</td>
<td>Name of dimension</td>
</tr>
<tr>
<td>Update a dimension</td>
<td>• Name of dimension</td>
</tr>
<tr>
<td></td>
<td>• Dimension tag</td>
</tr>
<tr>
<td></td>
<td>• Type of dimension (dense or sparse)</td>
</tr>
<tr>
<td></td>
<td>• Level name changes (if applicable)</td>
</tr>
<tr>
<td></td>
<td>• Generation name changes (if applicable)</td>
</tr>
<tr>
<td>Rename a dimension</td>
<td>• Old name of dimension</td>
</tr>
<tr>
<td></td>
<td>• New name of dimension</td>
</tr>
<tr>
<td>Move a dimension to a new position</td>
<td>• Name of dimension</td>
</tr>
<tr>
<td></td>
<td>• Old location, including left sibling of dimension</td>
</tr>
<tr>
<td></td>
<td>• New location, including left sibling of dimension</td>
</tr>
<tr>
<td>Add a member to a dimension</td>
<td>• Name of new member or members</td>
</tr>
<tr>
<td></td>
<td>• Unary calculation symbol for member</td>
</tr>
<tr>
<td></td>
<td>• Level number of member</td>
</tr>
<tr>
<td></td>
<td>• Generation number of member</td>
</tr>
<tr>
<td></td>
<td>• Status of member (Store, Share)</td>
</tr>
<tr>
<td></td>
<td>• Member alias (if applicable)</td>
</tr>
<tr>
<td></td>
<td>• Account type of member (if applicable)</td>
</tr>
<tr>
<td></td>
<td>• UDAs of member (if applicable)</td>
</tr>
<tr>
<td></td>
<td>• Calculation formula for member (if applicable)</td>
</tr>
<tr>
<td>Update a member of a dimension</td>
<td>• Name of member updated</td>
</tr>
<tr>
<td></td>
<td>• Member properties that were updated</td>
</tr>
<tr>
<td>Rename a member of a dimension</td>
<td>• Old name of member</td>
</tr>
<tr>
<td></td>
<td>• New name of member</td>
</tr>
<tr>
<td>Move a member of a dimension to a new position</td>
<td>• Name of member moved</td>
</tr>
<tr>
<td></td>
<td>• New location</td>
</tr>
<tr>
<td></td>
<td>• Names of parent and left sibling in new location</td>
</tr>
</tbody>
</table>

The outline change log program reads outline information from left to right. If you are looking at an outline, the left sibling is the sibling directly above (to the left of) the newly added dimension or member. This rule does not apply if the immediately preceding dimension or member is a
If a newly added (or moved) member is the first child of its parent, or if the member is the first dimension in the outline, the outline change log identifies the old location of the dimension or member as None.

**Reviewing an Example of an Outline Change Log**

When a user makes and saves changes to an outline, Essbase writes the change information into the outline change log as a group of entries. Each group of entries begins and ends with identifying information so that you can easily identify each revision, from newest to oldest.

The following change log shows one record, indicating that since the outline change log was started, the outline was modified once. First, the outline change log lists the beginning of the change, including the application and database changed; the time of the change; and the user making the change. Next, the outline change log lists the change—a member named 100-50 was added to 100 member of the Product dimension. Finally, the outline log lists the end of the change, including the application and database changed; the time of the change; and the user making the change.

```
[Begin Outline Change for Sample/Basic, Sat Nov 03 12:49:31 2001, By admin]
Number of member changes for dimension "Product" : 1
Added new member "100-50" to "100" :
Left sibling - "100-40"
Status - Store Data
Added alias "Cherry Cola" to alias table "Default"
Unary calc symbol - Add
Level Number - 0
Generation Number - 3
[End Outline Change for Sample/Basic, Sat Nov 03 12:49:32 2001, By admin]
```

**Creating Outline Change Logs**

By default, Essbase Server does not create an outline change log. To create one, use the OUTLINECHANGELOG TRUE configuration setting in *essbase.cfg*. See the *Oracle Essbase Technical Reference*.

**Note:** During a restructure, Essbase holds outline change information in memory until all updates have been made to the outline change log. Turning on the outline change log may, therefore, affect restructure performance. See “Conditions Affecting Database Restructuring” on page 841.

**Viewing Outline Change Logs**

You can view the outline change log by opening the log file in a text editor.
Setting the Size of the Outline Change Log

The default size for the outline change log (dbname.olg) is 64,000 bytes. To change the maximum size, use the OUTLINECHANGELOGFILESIZE configuration setting in the essbase.cfg file. See the Oracle Essbase Technical Reference.

When the outline change log reaches the maximum size, Essbase copies the contents of the .olg file to a new file, changing the extension to .olb. For example, when basic.olg reaches the maximum size, the contents are copied to basic.olb.

After the copy operation, the .olg file is cleared and Essbase writes new log entries to it.

Each time the .olg files reaches its maximum file size, Essbase overwrites the existing .olb file with the current contents of the .olg. Therefore, be sure to retrieve information from the .olb file before it is overwritten.

The default, minimum, and maximum file sizes for the .olg file are also automatically applied to the .olb file. For example, if you change the maximum size of the outline change log to 2 MB, the .olb file is automatically set to the same maximum size.

Understanding and Using Exception Logs

When an Essbase Server, an application, or a database shuts down abnormally, Essbase Server sometimes creates an exception log as a text file named log0000n.xcp. The following topics describe the server, application, and database exception logs and the actions that you can perform on them.

Understanding the Contents of Exception Logs

If an Essbase Server, an application, or a database shuts down abnormally and cannot restart, Essbase Server generates an exception log to help troubleshoot the problem. The location of the exception log depends on which component shut down abnormally and the amount of information that Essbase Server had available at the time. Table 143 on page 750 describes the location of the exception log for each type of abnormal shutdown.

Table 142 lists the sections of the exception log and the information included in each section. If Essbase Server could not retrieve all the information before the shutdown finished, some of the later sections may be blank.

<table>
<thead>
<tr>
<th>Section of Log</th>
<th>Information Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information</td>
<td>• Date and time</td>
</tr>
<tr>
<td></td>
<td>• Application and database name</td>
</tr>
<tr>
<td></td>
<td>• Location of exception log</td>
</tr>
<tr>
<td></td>
<td>• Process type</td>
</tr>
<tr>
<td></td>
<td>Use this information to determine which component shut down abnormally and when it shut down.</td>
</tr>
<tr>
<td>Section of Log</td>
<td>Information Included</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Machine registers and stack info</td>
<td>General registers</td>
</tr>
<tr>
<td></td>
<td>Floating point registers</td>
</tr>
<tr>
<td></td>
<td>Hex registers</td>
</tr>
<tr>
<td></td>
<td>Stack trace</td>
</tr>
<tr>
<td></td>
<td>Stack dump</td>
</tr>
<tr>
<td></td>
<td>Oracle Support can examine this section of the log to help determine why an abnormal shutdown may have occurred.</td>
</tr>
<tr>
<td>Application-wide configuration</td>
<td>Server and application name</td>
</tr>
<tr>
<td></td>
<td>Elapsed application time; that is, how long the application was running</td>
</tr>
<tr>
<td></td>
<td>List of modules</td>
</tr>
<tr>
<td></td>
<td>Use this information to determine whether the application shut down quickly and that all modules are correct. More information about modules is in the system-wide configuration section of the exception log.</td>
</tr>
<tr>
<td>Operating system resources</td>
<td>System date and time</td>
</tr>
<tr>
<td></td>
<td>Elapsed operating system time; that is, how long the operating system was running</td>
</tr>
<tr>
<td></td>
<td>Resource information, including CPU type, memory information, swap information, and drive information</td>
</tr>
<tr>
<td></td>
<td>Use this information to see if it is an operating system problem, such as a lack of memory.</td>
</tr>
<tr>
<td>System-wide configuration</td>
<td>Elapsed Essbase time; that is, how long Essbase was running</td>
</tr>
<tr>
<td></td>
<td>Essbase release information</td>
</tr>
<tr>
<td></td>
<td>Network information</td>
</tr>
<tr>
<td></td>
<td>Environment variables</td>
</tr>
<tr>
<td></td>
<td>Module information, including module name and release</td>
</tr>
<tr>
<td></td>
<td>Use this information to ensure that the release is the same for Essbase and each module, and that environment variables are set correctly.</td>
</tr>
<tr>
<td>essbase.cfg values</td>
<td>Values of all settings in the essbase.cfg file.</td>
</tr>
<tr>
<td></td>
<td>Use this information to make sure that Essbase Server is configured correctly.</td>
</tr>
<tr>
<td>License information</td>
<td>Serial number and license expiration date</td>
</tr>
<tr>
<td></td>
<td>Number of ports purchased and ports in use</td>
</tr>
<tr>
<td></td>
<td>Essbase options enabled</td>
</tr>
<tr>
<td></td>
<td>Other Oracle Hyperion products enabled</td>
</tr>
<tr>
<td></td>
<td>Use this information to ensure that the correct options of Essbase are installed and that you have purchased enough ports.</td>
</tr>
</tbody>
</table>
### Section of Log | Information Included
--- | ---
Client request activity | - Server name  
- Application name  
- Thread information, including the number of threads  
- Request information  
- Detailed information about each thread, including the action it is performing, the database, user name, start time, and end time  
Use this information to determine how heavy the load on the server was, based on client requests.

File information | - Page file size  
- Index file size  
Use this information to determine whether the page file or the index is too large.

Database information | Use this information to ensure that the database is set up correctly.

Database statistics | Use this information to view dimension information and to see characteristics of data blocks in the database.

### Reviewing an Example of an Exception Log

The following example is of an exception log. The first section of the log lists general information about the application and database. In this example, the Essbase Server shut down:

----- Exception Error Log Begin -----  
Current Date & Time: Sat Nov 24 13:25:13 2001  
Process Type: Server  
Application Name: Sample  
Database Name: Basic  
Exception Log File: C:\HYPERION\ESSBASE\log00001.xcp  
Current Thread Id: 1116  
Exception Code: 0xC0000005=Access Violation  
Exception Flags: 0x00000000=Continuable  
Exception Address: 0x002D2249  
Exception Parameters: 2  
Exception Parameter 0: 0x00000000=Read Violation  
Exception Parameter 1: 0x002D2249 (Virtual Address)

The next section of the log lists register and stack trace information. Oracle Support can examine this section of the log to assist in determining why an abnormal shutdown occurred.

----- Machine Registers -----  
General Registers:  
EAX=0x00000000  EBX=0x01358008  ECX=0x00002200  
Control Registers:  
CS =0x0000001B  EIP=0x002D2249  Flg=0x00010202  
Segment Registers:  
DS =0x00000023  ES =0x00000023  FS =0x00000038
Floating Point Registers:
   CWD=0xFFFF027F   SWD=0xFFFF0000   TWD=0xFFFFF000

Register Area (Hex):
   00 00 00 00 00 00 00 00 00 00
...continued hexadecimal listings...

Debug Registers:
   DR0=0x2F75C73B   DR1=0x75E07D39   DR2=0x1475FF16
   DR3=0x00000000   DR6=0x0000E00B   DR7=0x00000000

----- Stack -----

Stack Trace:
   0: 0x0002D2249
   1: 0x0002D2249
...continued stack trace listings...

Stack Dump (Hex):
   (Stack dump truncated from 1397 to 1024 bytes.)
   0x0012EA2C:  00000000 01358008 01358008 FFFFFFFF
   0x0012EA3C:  00002200 002D728C 0012EC6C 002D202D
...continued stack dump listings...

The following section of the log lists application information:

----- Application-Wide Configuration -----  

Server Name:           ASPEN
Application Name:      Sample
Elapsed App Time:      00:00:01:28
Module Count:          6
Module  0:             0x00241000 = C:\HYPERION\ESSBASE\BIN\ESSSEC.DLL
Module  1:             0x002C1000 = C:\HYPERION\ESSBASE\BIN\ESSNET.DLL
...continued module listings...

The following section of the log lists operating system information. You can determine how much memory is available, how much swap space is used, and how much memory is available on each drive:

----- Operating System Resources -----  

System Date & Time:    Sat Nov 24 13:25:13 2001
Elapsed OS Time:       02:03:03:10
OS Name & Version:     Windows NT 5.00
CPU Count:             1
CPU Type:              Pentium
Total Physical Memory: 327024 KB (334872576)
Free Physical Memory:  155760 KB (159498240)
Used Physical Memory:  171264 KB (175374336)
Swap Flags:
   Enabled:            Y
   Disabled:           N
   File Found:         Y
   Denied:             N
Swap file(s):          C:\pagefile.sys
Total Swap Space:      467192 KB (478404608)
Free Swap Space: 421528 KB (431644672)
Used Swap Space: 45664 KB (46759936)
Total Drives: 5
Current Drive: 3
Drive 1:
  Drive Name: C
  Volume Label:
  Drive Type: Fixed
  File System: NTFS
  Total Drive Space: 11778448 KB
  Free Drive Space: 8592548 KB
  Used Drive Space: 3185900 KB
...continued drive listings...

The following section of the log lists system configuration information, such as paths or essbase.cfg settings:

----- System-Wide Configuration -----  
Elapsed Essbase Time: 00:00:01:33
Essbase Version: 6.2.0
Essbase Description: Ess62P0B128
Network Type: Windows Sockets
Environment Variable: ARBORPATH = C:\HYPERION\ESSBASE
Environment Variable: ARBORMSGPATH = C:\HYPERION\ESSBASE\bin
Module Count: 13
Module 0:
  Module Name: C:\HYPERION\ESSBASE\BIN\ESSUTL.DLL
  Module Version: 6.2.0.1
  Module Description: Ess62P0B128.1
  Module Use Count: 5
...continued module listings...

----- ESSBASE.CFG Configuration Values ----- 
Configuration Value: JvmModuleLocation = C:\Hyperion\Essbase\java\jre13\bin\hotspot\jvm.dll
Configuration Value: AuthenticationModule = LDAP essldap.dll x
Configuration Value: OUTLINECHANGELOG = TRUE

The following section of the log lists license information (such as a serial number), Essbase options (such as ports purchased) and Oracle Hyperion products purchased:

----- License Information ----- 
Serial Number: xxx
License Expiry Date:
Port Count: 10
Ports In Use Count: 0
Limited Use Version: N
Read-Only SS: N
...continued Essbase options and Hyperion product listings...

The following section of the log lists client activity, such as using Administration Services to view databases:
----- Client Request Activity -----  

Server Name: ASPEN  
Application Name: Sample  
Total Request Threads: 5  
Avail Request Threads: 6  
Total Requests: 56  
Average Requests: 48.000000  
Weighted Average: 7.440000  
Statistics Per Minute:  
  Current Requests: 48  
  Minimum Requests: 48.000000  
  Maximum Requests: 48.000000  
Thread Count: 5  
Thread Id 1444:  
  Request Name: List Objects  
  Database Name: Basic  
  User Name: admin  
...continued thread listings...

----- Exception Error Log End -----  

Viewing Exception Logs  
You can view the exception change log by opening it in any text editor. The location of the exception log depends on which component shut down abnormally and the amount of information that Essbase Server had available at the time.  
Table 143 describes the location of the exception log.  

<table>
<thead>
<tr>
<th>Component That Shut Down</th>
<th>Location of the Exception Log</th>
</tr>
</thead>
</table>
| Essbase Server           | The log is in the ARBOPATH directory; for example:  
                           | EPM_ORACLE_INSTANCE/EssbaseServer/log00001.xcp |
| Application              | If the application name is unknown, the log is in the ARBOPATH/app directory. For example:  
                           | EPM_ORACLE_INSTANCE/EssbaseServer/essbaseserver1/app/log00001.xcp  
                           | If the application name is known, the log is in the application directory. For example, if the Sample application shut down abnormally:  
                           | EPM_ORACLE_INSTANCE/EssbaseServer/essbaseserver1/app/Sample/log00001.xcp |

---

750
<table>
<thead>
<tr>
<th>Component That Shut Down</th>
<th>Location of the Exception Log</th>
</tr>
</thead>
</table>
| Database                 | If the database name is unknown, the log is in the application directory; for example, if the Basic database shut down abnormally: 
  
  `EPM_ORACLE_INSTANCE/EssbaseServer/essbaseserver1/app/sample/log00001.xcp`

  | If the database name is known, the log is in the database directory; for example, if the Basic database shut down abnormally: 
  
  `EPM_ORACLE_INSTANCE/EssbaseServer/essbaseserver1/app/sample/basic/log00001.xcp` |

**Overwriting or Retaining Existing Logs**

By default, Essbase Server creates one or more exception logs each time the server shuts down abnormally. Subsequent exception logs are numbered sequentially; for example, if `log00001.xcp` exists, the next log is named `log00002.xcp`.

While you can use the EXCEPTIONLOGOVERWRITE TRUE configuration setting in `essbase.cfg` to overwrite the existing exception log file instead of creating a new log file, Oracle recommends that you use the default setting of FALSE. An abnormal shutdown may create multiple exception log files, and the first log file created during the shutdown is often the most descriptive. See *Oracle Essbase Technical Reference*.

**Understanding and Using Dimension Build and Data Load Error Logs**

**Subtopics**

- Understanding and Viewing Dimension Build and Data Load Error Logs
- Reviewing an Example of a Dimension Build and Data Load Error Log
- Setting the Maximum Number of Errors
- Loading Dimension Build and Data Load Error Logs

Essbase Server writes errors that occur during a dimension build or data load in error logs. The log that Essbase Server chooses for errors depends on the operation that you perform, such as a dimension build or a data load, and how you perform it, such as using Administration Services, or MaxL. The following topics describe the location of dimension build and data load errors and the actions that you can perform on dimension build and data load error logs.

**Understanding and Viewing Dimension Build and Data Load Error Logs**

The `dataload.err` log contains errors that occurred during a dimension build or a data load. The logs also contain the records that failed to load. After you fix the errors, you can reload the logs. See “Loading Dimension Build and Data Load Error Logs” on page 753.
Essbase Server writes errors that occur during a dimension build or data load to the following error logs:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Location of Error Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension build</td>
<td>EAS_HOME/client/dataload.err</td>
</tr>
<tr>
<td>Data load with a rules file</td>
<td>EAS_HOME/client/dataload.err</td>
</tr>
<tr>
<td>Data load without a rules file</td>
<td>ARBORPATH/app/appname/appname.log</td>
</tr>
</tbody>
</table>

**Note:** If the data load or dimension build fails and there is no error log, see “Checking Error Logs” on page 312 for a description of possible causes.

To set the location and file name of dimension build and data load error logs, see “Performing a Data Load or Dimension Build” in *Oracle Essbase Administration Services Online Help*.

To view the dimension build and data load error logs, open them in any text editor.

### Reviewing an Example of a Dimension Build and Data Load Error Log

The following data log entry indicates that because the 500 member did not exist in the outline, no data was loaded to it.

```
\ Member 500 Not Found In Database
500   500-10   500-10-10
```

To resolve this problem, you can perform either of the following actions and restart the load:

- Perform a dimension build to create the missing member. See “Performing Data Loads or Dimension Builds” on page 305.
- Add the missing member in Outline Editor. See “Adding Dimensions and Members to an Outline” on page 129.

The following dimension build log entry indicates that the 600-20 member is not the parent of the 600 member. Ensure that you use the correct rules file with the correct text file. The record looks like it is for a level (bottom-up) build, but the error message indicates that Essbase Server is trying to perform a generation (top-down) build. After you correct the problem, restart the dimension build.

```
\Record #2 - Incorrect Parent [600-20] For Member [600] (3307)
600-20-10   600-20   600
```

### Setting the Maximum Number of Errors

The default size of the data ERR files is 1,000 records. When the log reaches this size, Essbase Server no longer writes errors to the log. The dimension build or data load, however, continues.
Using the DATAERRORLIMIT configuration setting, you can specify the number of records (1 to 65,000) that are logged in the `dataload.err` log files. If you change the `essbase.cfg` file, restart Essbase Server to apply the change.

**Loading Dimension Build and Data Load Error Logs**

If the dimension build or data load fails, you must determine whether the Isolation Level transaction setting is Committed or Uncommitted. If the transaction setting is Committed, you must restart the data load from the beginning. If it is Uncommitted, you can load only the records that failed by loading the error log. Reloading only the failed records is much faster than reloading every record.

To reload the error log:

1. If you load from the server, change the file extension from `.err` to `.txt`. For example, change the `dataload.err` file to `dataload.txt`. If you load from the client, you can leave the `.err` extension.

2. Fix the problem that caused the dimension build or data load to fail. Fixing the problem might involve changing the outline, the text in the error log, or the rules file.

   Check whether the following conditions are true:
   
   - Can you validate the rules file?
     
     See “Setting Dimension Build Operational Instructions” on page 288.
   
   - Is the data source available?
     
     See “Verifying that the Data Source Is Available” on page 311.
   
   - Is the server available?
     
     See “Verifying that Essbase Server Is Available” on page 311.

3. Load the error log using the appropriate rules file.

   See Chapter 17, “Understanding Data Loading and Dimension Building.”
Understanding the Essbase Server Kernel

Subtopics

- Understanding Buffered I/O and Direct I/O
- Viewing the I/O Access Mode
- Setting the I/O Access Mode

The kernel provides the foundation for a variety of functions of Essbase Server, including data loading, calculations, spreadsheet lock and send, partitioning, and restructuring. The kernel reads, caches, and writes data; manages transactions; and enforces transaction semantics to ensure data consistency and data integrity.

The kernel has the following functions:

- Handles disk storage and caching of Essbase files
- Handles data retrieval
- Handles data updates
- Controls input/output functions related to Essbase
- Consolidates free space for reuse
- Manages concurrent operations
- Recovers databases after a server crash
- Issues locks
- Manages transactions
Understanding Buffered I/O and Direct I/O

Direct I/O and buffered I/O are access modes that you can set at the database level. The Essbase Kernel uses buffered I/O (input/output) by default, but direct I/O is available on the operating systems and file systems that Essbase supports, with the exception of Linux.

Buffered I/O uses the file system buffer cache.

Direct I/O bypasses the file system buffer cache and is able to perform asynchronous, overlapped I/Os. The following benefits are provided:

- Faster response time. A user waits less time for Essbase to return data.
- Scalability and predictability. Essbase lets you customize the optimal cache sizes for its databases.

If you set a database to use direct I/O, Essbase attempts to use direct I/O the next time the database is started. If direct I/O is not available on your platform when the database is started, Essbase uses buffered I/O, which is the default. However, Essbase will store the I/O access mode selection in the security file and attempts to use that I/O access mode each time the database is started.

Note: Cache memory locking can only be used if direct I/O is used. You also must use direct I/O if you want to use an operating system’s no-wait (asynchronous) I/O.

Viewing the I/O Access Mode

Buffered I/O is the default for all databases.

To view which I/O access mode a database is currently using or is currently set to, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Selecting an I/O Access Mode</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETDBINFO</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Setting the I/O Access Mode

To use direct I/O instead of the default buffered I/O for any database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Selecting an I/O Access Mode</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
</tbody>
</table>
Understanding Kernel Components

The kernel contains components that control all aspects of retrieving and storing data:

- The Index Manager finds and tracks the location of requested data. See “Index Manager” on page 757.
- The Allocation Manager, part of the Index Manager, allocates space and manages some file operations. See “Allocation Manager” on page 758.
- The Data Block Manager retrieves the data pointed to by the index and stores the data. See “Data Block Manager” on page 759.
- The LRO Manager handles retrieval and storage of LROs. See “LRO Manager” on page 759.
- The Lock Manager handles the locking of data blocks to regulate concurrent data access. See “Lock Manager” on page 759.
- The Transaction Manager tracks transactions and handles internal commit and abort operations. See “Transaction Manager” on page 760.

Index Manager

Index Manager manages the database index and provides a fast way to look up Essbase data blocks. Index Manager determines which portions of the database index to cache in the index cache, and manages the index cache.

Table 145 lists the components that Index Manager controls:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>The method that Essbase uses to locate and retrieve data. The term index also refers to the index file.</td>
</tr>
<tr>
<td>Index file</td>
<td>File that Essbase uses to store data retrieval information. It resides on disk and contains index pages. Essbase names index files incrementally on each disk volume, using the naming convention essxxxxx.ind, where xxxx is a number. The first index file on each disk volume is named ess00001.ind.</td>
</tr>
<tr>
<td>Index page</td>
<td>A subdivision of an index file that contains index entries that point to data blocks.</td>
</tr>
<tr>
<td>Index entry</td>
<td>A pointer to a data block. An index entry exists for every intersection of sparse dimensions.</td>
</tr>
<tr>
<td>Index cache</td>
<td>A buffer in memory that holds index pages.</td>
</tr>
</tbody>
</table>
The term index refers to all index files for a single database. The index can span multiple volumes, and multiple index files can reside on a single volume. Use the disk volumes setting to specify disk spanning parameters. For information on setting the index cache size, see “Sizing the Index Cache” on page 825. For information about allocating storage space with the disk volumes setting, see “Specifying Disk Volumes” on page 766.

**Allocation Manager**

Allocation Manager, part of the Index Manager, performs these tasks:

- Creation and extension of index and data files on disk
- File open and close operations
- Designation of which volume to use for a new file
- Sequence of volume use

When one of these tasks must be performed, the Allocation Manager uses this process to allocate space:

1. It attempts to use free space in an existing file.
2. If not enough free space is available, it attempts to expand an existing file.
3. If not enough free space is available in existing files, it creates a file on the current volume.
4. If it cannot expand a file or create a file on the specified volume, it attempts to use the next specified volume.
5. If all specified volumes are full, an error message is displayed, and the transaction is aborted.

The Allocation Manager allocates space for index and data files based on the database settings for storage.

To check current values and set new values, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Database Properties</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM 23</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

See “Specifying Disk Volumes” on page 766.

For information on how Essbase stores data, see “Storage Allocation” on page 765.
**Data Block Manager**

The Data Block Manager brings data blocks into memory, writes them out to data files, handles data compression, and writes data files to disk. The Data Block Manager controls four components. The following table describes each component:

Table 146 lists the components that Data Block Manager controls:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data file</td>
<td>A file that contains data blocks. Essbase generates the file upon data load and stores it on disk. Essbase names data files incrementally—essxxxxx.pag, where xxxx is a number, starting with 00001.</td>
</tr>
<tr>
<td>Data block</td>
<td>The primary storage unit within Essbase. A data block is a multidimensional array that represents cells of the dense dimensions for a given intersection of sparse dimensions.</td>
</tr>
<tr>
<td>Data cache</td>
<td>A buffer in memory that holds uncompressed data blocks.</td>
</tr>
<tr>
<td>Data file cache</td>
<td>A buffer in memory that holds compressed data files (.pag).</td>
</tr>
</tbody>
</table>

The size of the data file cache determines how much of the data within the data files can fit into memory simultaneously. The data cache size and the data block size determine how many data blocks can fit into memory simultaneously. Data files for a single database can span multiple volumes; multiple databases can reside on the same volume. See “Sizing the Data File Cache” on page 826 and “Sizing the Data Cache” on page 827. Also see “Specifying Disk Volumes” on page 766.

**LRO Manager**

LROs enable you to associate objects, such as flat files, with data cells. Using Smart View, users can create and store LRO files, with an .lro extension.

LRO files are stored in the database directory (ARBORPATH/app/appname/dbname; for example, app/Sample/Basic).

Essbase stores information about LROs in an LRO catalog. Each catalog resides in its own Essbase index page and coexists in an index file with other, non-LRO Essbase index pages.

See Chapter 11, “Linking Objects to Essbase Data” and the Oracle Smart View for Office User’s Guide.

**Lock Manager**

The Lock Manager issues locks on data blocks, which in turn controls concurrent access to data.

The committed access and uncommitted access isolation levels use different locking schemes. For more information on isolation levels and locking, see Chapter 50, “Ensuring Data Integrity.”
**Transaction Manager**

The Transaction Manager controls transactions and commit operations and manages database recovery.

Essbase commits data automatically. Commits are triggered by transactions that modify data—data loading, calculating, restructuring, and spreadsheet lock and send operations.

How Essbase commits data depends on whether the transaction isolation level is set to committed or uncommitted access (the default). See “Committed Access” on page 778 and “Uncommitted Access” on page 781.

The Transaction Manager maintains a transaction control table, dbname.tct, to track transactions.

For information about commit operations and recovery, see “Recovering from a Crashed Database” on page 787.

**Understanding Kernel Startup**

The sequence of events during kernel startup:

1. After the Essbase Server starts, a user connects to it from a client.
2. The user starts a database.
3. Essbase loads the database.
4. The Essbase Agent passes database settings to the server.
5. The kernel begins its initialization process.
6. The kernel starts its components—the Index Manager, Lock Manager, LRO Manager, Data Block Manager, and Transaction Manager.

If it encounters an error during start up, the Essbase Kernel shuts itself down.

**Understanding the Precedence of Database Settings**

Essbase provides default values for some database storage settings in the essbase.cfg file. You can leave the default settings or change their values in two places:

- You can define storage settings for all databases on the Essbase Server by changing values in the essbase.cfg file.
- You can define storage settings for a single database by using any of the methods specified in “Specifying and Changing Database Settings” on page 762.

Changes made for an individual database permanently override essbase.cfg settings and Essbase defaults for the relevant database until they are changed or withdrawn.

If you use MaxL or Administration Services Console to change settings at the database level, the changes become effective at different times, as shown in Table 147:
Table 147  Database Setting Precedence

<table>
<thead>
<tr>
<th>Setting</th>
<th>When setting becomes effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Index cache</td>
<td>After you stop and restart a database</td>
</tr>
<tr>
<td>• Data file cache</td>
<td></td>
</tr>
<tr>
<td>• Data cache</td>
<td></td>
</tr>
<tr>
<td>• Cache memory locking</td>
<td></td>
</tr>
<tr>
<td>• Disk volume</td>
<td></td>
</tr>
<tr>
<td>Isolation level parameters, concurrency parameters</td>
<td>The first time after setting these values that there are no active transactions</td>
</tr>
<tr>
<td>All other settings</td>
<td>Immediately</td>
</tr>
</tbody>
</table>

If you manually change these database settings in essbase.cfg, you must stop and restart the relevant application to make them effective.

**Note:** The size of index pages is fixed at 8 KB to reduce input-output overhead, as well as to simplify database migration.

**Understanding How Essbase Reads Settings**

Essbase reads essbase.cfg when you start Essbase Server and applies settings to the databases that you created using the methods described in “Specifying and Changing Database Settings” on page 762.

Database settings that you specify using Administration Services, ESSCMD, or MaxL always override essbase.cfg settings, even if you change a setting in essbase.cfg after you have applied a setting for a database. Only removing a setting triggers Essbase to use essbase.cfg, and then only after Essbase Server is restarted.

**Viewing Most-Recently Entered Settings**

To view the most-recently entered settings, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Database Properties</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETDBSTATE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>GETDBINFO</td>
<td></td>
</tr>
</tbody>
</table>
Customizing Database Settings

You can customize settings for each database on Essbase Server. The information in this section helps you understand what each setting controls, how to specify settings, and lists examples. For a table of performance-related settings, see Chapter 53, “Improving Essbase Performance.”

**Note:** Configure settings that are applied to an entire Essbase Server in `essbase.cfg`. For more information, see the Oracle Essbase Technical Reference.

Table 148 lists the major database settings that you can customize:

<table>
<thead>
<tr>
<th>Setting</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index cache size</td>
<td>“Sizing the Index Cache” on page 825</td>
</tr>
<tr>
<td>Data file cache size</td>
<td>“Sizing the Data File Cache” on page 826</td>
</tr>
<tr>
<td>Data cache size</td>
<td>“Sizing the Data Cache” on page 827</td>
</tr>
<tr>
<td>Cache memory locking</td>
<td>“Deciding Whether to Use Cache Memory Locking” on page 824</td>
</tr>
<tr>
<td>Disk volumes</td>
<td>“Storage Allocation” on page 765</td>
</tr>
<tr>
<td>Data compression</td>
<td>“Data Compression” on page 770</td>
</tr>
<tr>
<td>Isolation level</td>
<td>“Understanding Isolation Levels” on page 777</td>
</tr>
</tbody>
</table>

The following sections describe how to change kernel settings and list examples.

**Specifying and Changing Database Settings**

Before you change database settings, review information about precedence of the settings as changed in different parts of Essbase, and how Essbase reads those settings:

- “Understanding Kernel Startup” on page 760
- “Understanding How Essbase Reads Settings” on page 761

To specify most database settings, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Database Properties</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>SETDBSTATE</td>
<td></td>
</tr>
</tbody>
</table>
These methods provide different ways to change the same database settings. In rare cases, you may want to use `essbase.cfg` to specify settings.

**Caution!** In previous versions of Essbase, you can specify many database settings in the `essbase.cfg` file on Essbase Server. In Version 5.x and later, Essbase overrides most of the `.cfg` settings. For an explanation of how newer versions of Essbase handle settings, see “Understanding the Precedence of Database Settings” on page 760 and “Understanding How Essbase Reads Settings” on page 761.

### Using alter database in MaxL

Issue a separate `alter database` statement for each database setting you want to change. For example, the following MaxL script logs on to Essbase, changes three database settings, and logs off:

```maxl
login admin identified by secretword;
alter database sample.basic enable committed_mode;
alter database sample.basic set lock_timeout immediate;
alter database sample.basic disable create_blocks;
logout;
```

**Note:** Terminate each MaxL statement with a semicolon when issuing them using the MaxL Shell; however, if MaxL statements are embedded in Perl scripts, do *not* use the semicolon statement terminator.

You can use MaxL to write batch scripts that automate database setting changes. See the *MaxL Language Reference*, located in the *Oracle Essbase Technical Reference*.

### Using SETDBSTATEITEM in ESSCMD

For simple items, specify the command, item number representing the parameter, application, database, and value for the parameter:

```maxl
SETDBSTATEITEM 2 "SAMPLE" "BASIC" "Y";
```

For parameters that require multiple values, such as Isolation Level (item 18), specify multiple values; in this case, all the values after “BASIC”:

```maxl
SETDBSTATEITEM 18 "SAMPLE" "BASIC" "1" "Y" "-1";
```

If you do not know the parameter number, omit it, and Essbase lists all parameters and their corresponding numbers. Essbase also prompts you for a database and an application name.

Use a separate SETDBSTATEITEM command for each parameter; you cannot string parameter numbers together on the same line.

See the *Oracle Essbase Technical Reference* for information about the parameters for the SETDBSTATE and SETDBSTATEITEM commands.
Note: SETDBSTATEITEM or SETDBSTATE affects only the specified database.

You can include SETDBSTATEITEM (or SETDBSTATE) in batch scripts. For a comprehensive discussion of batch processing, see “Using Script and Batch Files for Batch Processing” on page 1086. For information on specific ESSCMD syntax, see the Oracle Essbase Technical Reference.
In This Chapter

Storage Allocation ....................................................................................... 765
Data Compression ....................................................................................... 770

Storage Allocation

Essbase uses a data file to store data blocks. By default, a data file is located in its associated database folder. Data files follow the naming convention `essn.pag`, where `n` is greater than or equal to one and less than or equal to 65,535.

Essbase uses an index file to store the index for a database. By default, an index file is located in its associated database folder. Index files follow the naming convention `essn.ind`, where `n` is greater than or equal to 1 and less than or equal to 65,535.

Essbase automatically allocates storage for data and index files. You can use disk volumes to control how storage is allocated for these files.

1. Verify how much space Essbase uses to store index and data files. See “Checking Index and Data File Sizes” on page 765 for information about how to check sizes.

2. Choose a technique to control storage:
   - Specify which volumes (drives) Essbase uses to store these files. See “Specifying Disk Volumes” on page 766.
   - Install Essbase on one volume and store files on another.

Checking Index and Data File Sizes

1. To view index file (`.ind` file) and data file (`.pag` file) names, counts, sizes, and totals, and to determine whether each file is open in Essbase, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Checking Index and Data File Sizes</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>LISTFILES</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Note: The file size information that is provided by Windows for index and data files that reside on NTFS volumes may not be accurate. The file size information provided by Administration Services and by LISTFILES is accurate.

**Specifying Disk Volumes**

Use disk volumes to specify where you want to store Essbase index files (essn.ind) and data files (essn.pag).

Files are written to the disk volume in the following directory structure:

```plaintext
.../app/app_name/db_name
```

If you do not use the disk volumes setting, Essbase stores data only on the volume where the ARBORPATH directory resides. If the ARBORPATH variable is not set, Essbase stores data only on the volume where the server was started.

For new files, changes to the disk volumes setting take effect when you next start the database. Existing files and volumes are not affected.

Note: For information about how to check the size of the index and data files, see “Checking Index and Data File Sizes” on page 765.

You can specify disk volumes using Administration Services, MaxL, or ESSCMD. When you use disk volumes, Essbase provides the following options for each disk volume:

- Volume name
- Maximum space to use on the volume (called Partition Size in Administration Services and Volume Size in ESSCMD)
- File type
  
  You can specify index files, data files, or both. The default is index and data files on the same volume.
- Maximum file size
  
  The default and recommended value is 2,097,152 KB (2 GB). When Essbase reaches the maximum file size, it creates a file and names it incrementally. For example, when ess00001.ind is filled to maximum size, Essbase creates ess00002.ind.

Caution! If you specify a volume name but not a volume size, Essbase uses all available space on the volume.

Essbase creates data files and index files in these situations:

- If the total sizes of all files reach the maximum size that you specified in the disk volumes setting
By default, the total is the sum of all index and data file sizes. If you specify Index as the file type, the total refers to the sum of all index files on a volume. If you specify Data as the file type, the total refers to the sum of all data files on a volume.

For example, suppose you want to use up to 12 GB for Essbase files on volume E, 16 GB on volume F, and 16 GB on volume G. Essbase creates a file on volume F when, on volume E, the sizes of the index and data files reach 12 GB and more data needs to be written to disk.

- If the size of an individual index or data file on any volume reaches 2 GB

Using the previous example (12 GB for volume E; 16 GB for volume F; and 16 GB for volume G), suppose volumes E and F have reached their capacities and Essbase is using volume G. On volume G, Essbase creates ess00001.ind, filling it to the default limit of 2 GB, and creates ess00001.pag, filling it to 1 GB. 3 GB of the 16 GB on volume G have been used. Because ess00001.ind has reached the maximum file size of 2 GB, the next time Essbase needs storage space when writing index files to disk, it creates ess00002.ind. When ess00002.ind reaches the 2 GB limit, Essbase creates ess00003.ind. Essbase follows the same procedures for data files.

Essbase names files consecutively, starting with ess00001.xxx, where xxx is ind for an index file and pag for a data file, and continuing up to ess65535.xxx. This naming convention applies to each volume, so in the above example, volumes E, F, and G each have files named ess00001.pag and ess00001.ind.

Keep in mind the following guidelines when specifying disk volumes:

- Specify the disk volumes in the order in which you want the volumes to be used. You do not need to specify the volume on which Essbase is installed as one of the volumes; you can install on one volume and store data on other volumes.
- If a volume reaches capacity, Essbase moves to the next volume.
- If all specified volumes reach capacity, Essbase stops ongoing database operations, issues an error message, and performs fatal error handling. See “Understanding Fatal Error Handling” on page 1049. If these events occur, shut down the database, allocate more disk space, and restart the database.
- You can tell Essbase to stop storing files on a volume. Essbase can still access the volume as needed, but it no longer stores additional index and data information on the volume. To stop storing information on a volume, select the volume definition that you want to remove and click Delete.
- You set disk volumes on a per-database basis. Multiple databases can use space on the same volume, so allocate space carefully. For example, if you specify 7 GB on Volume A for Database 1 and 7 GB on Volume A for Database 2, you have allocated 14 GB for Essbase files on Volume A.

On Windows, you can use Universal/Uniform Naming Convention (UNC) to specify a disk volume as the location of a network resource, such as a shared directory. Syntax:

\\ComputerName\SharedFolder\Resource

767
Specifying Disk Volumes with Administration Services

To specify disk volumes with Administration Services:

See “Setting Disk Volumes” in Oracle Essbase Administration Services Online Help.

Specifying Disk Volumes with MaxL

To allocate a new volume, delete a volume, or modify volume settings, see the topic for alter database (disk volumes) in the Oracle Essbase Technical Reference.

Specifying Disk Volumes with ESSCMD

To allocate a new volume, see the ESSCMD SETDBSTATEITEM 23 in the Oracle Essbase Technical Reference.

ESSCMD prompts you for the number of new disk volumes you want to add, unless you supply the number on the command line.

Then, for each new volume, ESSCMD prompts you for the following values, unless you supply them on the command line.

- Volume name (for each volume)
- Volume size (maximum space to use on the volume)
  
  The default value is Unlimited; the minimum setting is 8 MB.

When you use ESSCMD, you can specify volume size in bytes (B), kilobytes (K), megabytes (M), gigabytes (G), or terabytes (T). ESSCMD displays minimum, maximum, and current values and 0 for unlimited.

- File type
  
  You can specify index files, data files, or both. The default is 3 - Index + Data (index and data files on the same volume).

- File size (maximum size for each file specified in file type before Essbase creates a new file)
  
  The default value is 2 GB; the minimum setting is 8 MB.

The following example allocates up to 10 GB on Volume E, sets a maximum file size of 2 GB, and specifies that data files should be stored only on E:

```
SETDBSTATEITEM 23 "SAMPLE" "BASIC" "1" "E" "10G" "2" "2G"
```

To change the settings on an allocated volume, enter SETDBSTATEITEM 24 in ESSCMD and either follow the prompts or supply the required values on the command line.

ESSCMD prompts you for the following values, unless you supply them on the command line:

- Volume number
  
  Use the GETDBSTATE command in ESSCMD to see a list of the currently defined disk volumes and to see the number assigned to each volume.
Volume name
Volume size
File type
File size

The following example allocates up to 20 GB on Volume C and sets a maximum file size of 2 GB:

```
SETDBSTATEITEM 24 "SAMPLE" "BASIC" "1" "C" "20G" "3" "2G"
```

To stop Essbase from storing additional files on a volume, enter SETDBSTATEITEM 25 in ESSCMD and either follow the prompts or supply the required values on the command line. Essbase continues accessing files on the deallocated volume but does not write new files to it.

ESSCMD prompts you for the following value, unless you supply it on the command line—Delete which volume definition. Use the GETDBSTATE command in ESSCMD to see a list of the currently defined disk volumes and to see the number assigned to each volume.

The following example deallocates the volume that is specified as fourth:

```
SETDBSTATEITEM 25 "SAMPLE" "BASIC" "4"
```

**Note:** If you delete an application or database, Essbase does not remove the directory containing the application or database on a disk volume. The computer’s operating system still shows the folder and file labels on the disk. However, you can reuse the same name of the application or database that you had removed on the disk volume.

For more syntax information, see the Oracle Essbase Technical Reference.

On UNIX, `volume_name` is a mounted UNIX file system. You must enter a fully qualified pathname to the Essbase installation directory (`ESSBASEPATH`). Essbase automatically appends the `app` directory to the path; you do not specify the `app` directory.

Consider the following example:

```
/vol2/EssbaseServer 10M
```

Volume size is the maximum space, in KB, allocated to the volume. The default value is unlimited—Essbase uses all available space on that volume.

### Reviewing an Example of Specifying Volumes to Control Storage

Assume you want to use up to 20 GB for Essbase files on Volume E, 25 GB on Volume F, and 25 GB on Volume G. You are using the default file size limit of 2 GB. When you load data, Essbase stores up to 20 GB on Volume E; if the database is larger than 20 GB, Essbase stores the next 25 GB on Volume F, and so on.

Table 149 shows and example of information about each disk volume.
Data Compression

Essbase allows you to choose whether data blocks that are stored on disk are compressed, as well as which compression scheme to use. When data compression is enabled, Essbase compresses data blocks when it writes them out to disk. Essbase fully expands the compressed data blocks, including empty cells, when the blocks are swapped into the data cache.

Generally, data compression optimizes storage use. You can check compression efficiency by checking the compression ratio statistic. See “Checking the Compression Ratio” on page 775.

Essbase provides several options for data compression:

- Bitmap compression, the default
  Essbase stores only nonmissing values and uses a bitmapping scheme.

- Run-length encoding (RLE)
  Essbase compresses repetitive, consecutive values, including zeros and #MISSING values.

- zlib compression
  Essbase builds a data dictionary based on the actual data being compressed.

- Index Value Pair compression
  Essbase applies this compression if the block density is less than 3%.

- No compression
  Essbase does not compress data blocks when they are written to disk.

Because Essbase compresses data blocks as they are written to disk, it is possible for bitmap, RLE, and uncompressed data blocks to coexist in the same data file. Keep in mind the following rules:

- When a compressed data block is brought into the data cache, Essbase expands the block to its full size, regardless of the scheme that was used to compress it.

- When Essbase stores a block on disk, Essbase treats the block the same whether it was compressed or uncompressed when it was brought into the data cache. In either case, Essbase compresses the block according to the specified compression type (including not compressing it if no compression is specified).

- If compression is not enabled, Essbase writes out the fully expanded block to disk.
You may want to disable data compression if blocks have very high density (90% or greater) and have few consecutive, repeating data values. Under these conditions, enabling compression consumes resources unnecessarily.

**Bitmap Data Compression**

When a data block is not compressed, Essbase uses 8 bytes to store every nonmissing cell (cells with data values). Essbase also uses a 72-byte block header for each block, whether or not the block is compressed.

With bitmap compression, Essbase uses a bitmap to represent data cells and stores only the bitmap, the block header, and the other control information. A bitmap uses one bit (represented as “1” or “0”) for each cell in the data block, whether the cell value is missing (“0”) or nonmissing (“1”). Therefore, the bitmap scheme provides a fixed overhead for data compression.

When using bitmap compression, Essbase stores only nonmissing values and does not compress repetitive values or zeros (contrast with RLE compression, described in “RLE Data Compression” on page 771). When Essbase places a data block into the data cache, it fully expands the data block, using the bitmap to recreate the missing values.

The following is a representation of a portion of an uncompressed data block, with eight cells (cells 1–4 in the first row and cells 5–8 in the second row). In the first row, the data values are: 25, #MISSING, #MISSING, and #MISSING. In the second row, the data values are: #MISSING, 16, 7, and #MISSING.

Uncompressed data block

<table>
<thead>
<tr>
<th></th>
<th>25</th>
<th>#MISSING</th>
<th>#MISSING</th>
<th>#MISSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>#MISSING</td>
<td>16</td>
<td>7</td>
<td>#MISSING</td>
</tr>
</tbody>
</table>

When the data block is fully expanded in memory, Essbase uses 64 bytes (8 bytes * 8 cells). When the data is stored uncompressed on disk, Essbase uses 24 bytes (8 bytes * 3 cells with data—cells 1, 6, 7).

When the data is stored compressed on disk, Essbase uses 1 byte (1 bit * 8 cells; 8 bits = 1 byte) to store the bitmap. The following is a representation of the bitmap of the uncompressed data block described above:

Bitmap of compressed data block

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

In most cases, bitmap compression conserves disk space more efficiently. However, much depends on the configuration of the data.

**RLE Data Compression**

When using the run-length encoding (RLE) compression scheme, Essbase compresses consecutive, repetitive values—any value, including zero, that repeats three or more times
consecutively. Essbase tracks each repeating value and the number of times it repeats consecutively.

With RLE compression, Essbase uses 8 bytes, plus a 16-byte repetition factor, for a total of 24 bytes for the set of three or more consecutive, repetitive cells. For values that are not repeated or are repeated only twice, Essbase uses 8 bytes for each value.

In the following representation of a data block, Essbase considers the three consecutive #MISSING values in the first row (cells 2, 3, and 4) and the left-most #MISSING value in the second row (cell 5) as repeating values. The right-most #MISSING value in the second row (cell 8) is not a repeating value because it is separated from the cell 5 #MISSING value by cells 6 and 7, which have data values (16 and 7, respectively).

Data values in data block

25 #MISSING #MISSING #MISSING
#MISSING 16 7 #MISSING

When the data block is fully expanded in memory, Essbase uses 64 bytes (8 bytes * 8 cells). When the data is stored uncompressed on disk, Essbase uses 24 bytes (8 bytes * 3 cells with data—cells 1, 6, 7).

When the data is stored compressed on disk, Essbase uses 56 bytes:

- Cell 1—8 bytes
- Cells 2-5—24 bytes (8 bytes + 16 bytes)
- Cell 6—8 bytes
- Cell 7—8 bytes
- Cell 8—8 bytes

Essbase also uses a 72-byte block header for each block, whether or not the block is compressed.

**zlib Compression**

This method is used in packages such as PNG, Zip, and gzip. Calculation and data loading are faster with direct I/O and zlib compression than with buffered I/O and zlib compression. If data storage is your greatest limiting factor, use zlib, but be aware that, under some circumstances, data loads may be up to 10% slower than bitmap compression. The size of the database, however, is generally significantly smaller when you use zlib compression.

In contrast to bitmap compression, which uses an algorithm to track which values are missing and does not interact with any other type of data, zlib compression builds a data dictionary based on the actual data being compressed (including any missing values). Therefore, zlib compression should provide greater compression ratios over bitmap compression, given extremely dense data. However, because the effectiveness of the zlib algorithm is dependent (at the bit level) on the actual data being compressed, general guidelines about when zlib compression provides greater compression than bitmap compression based solely on density are not available. Unlike other compression methods, the storage space saved has little or no relationship to the number of missing cells or the number of contiguous cells of equal value. Generally, the more dense or
heterogeneous the data is, the better zlib will compress it in comparison to bitmap or RLE compression. However, under some circumstances, it is possible that zlib will not yield better results than using bitmap or RLE compression. It is best to test with a representative data sample.

To estimate the storage savings you may obtain with zlib, create a small database using your usual compression technique (bitmap or RLE) with a small sampling of real data and shut down Essbase Server. Note the size of the created data files. Then clear the data in the sample database, change the compression setting to zlib, reload the same sample data, and shut down Essbase Server again. Now note the difference in the storage used. You can also use the small sample database to estimate any changes in calculation or data loading speed.

Index Value Pair Compression

Index Value Pair addresses compression on databases with larger block sizes, where the blocks are highly sparse. This compression algorithm is not selectable but is automatically used whenever appropriate by the database. The user must still choose between the compression types None, bitmap, RLE, and zlib through Administration Services.

Table 150 lists the available compression types the user can choose and the compression types that Essbase evaluates and then applies.

<table>
<thead>
<tr>
<th>Chosen Compression Type</th>
<th>Evaluated Compression Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Bitmap</td>
<td>Bitmap, Index Value Pair</td>
</tr>
<tr>
<td>RLE</td>
<td>RLE, Bitmap, Index Value Pair</td>
</tr>
<tr>
<td>zlib</td>
<td>zlib</td>
</tr>
</tbody>
</table>

For example, if the user selects RLE, Essbase reviews each block and evaluates the following compression types for highest compression: RLE, bitmap, or Index Value Pair. If the user chooses zlib, zlib is the only compression type applied.

Deciding Which Compression Type to Use

You can choose from four compression settings: bitmap (the default), RLE, zlib, or None.

In most cases, you need not worry about choosing a setting. Bitmap compression almost always provides the best combination of fast performance and small data files. However, much depends on the configuration of the data.

Data compression is CPU-intensive. Consider the trade-offs of computation costs versus I/O costs and disk space costs when choosing a compression setting.

In general, a database compresses better using the RLE setting than the bitmap setting if a large number of repeated nonmissing data cells for a given block have the same value. Using RLE compression is computationally more expensive than using bitmap compression. If your
database shrinks significantly using RLE compression, however, you may see a performance improvement due to decreased I/O costs.

Databases usually shrink when using zlib compression, but not always. Using zlib compression significantly increases CPU processing. For most databases, this extra processing outweighs the benefits of the decreased block size. But if your database shrinks significantly using zlib compression, you may see a performance improvement due to decreased I/O costs.

The None compression setting does not reduce the disk usage of a database compared to bitmap compression. In fact, no compression may make no difference to improve the performance of the database, because bitmap compression is extremely fast.

Remember that each database is unique, and the previous statements are general characteristics of compression types. Although the default bitmap compression works well for most databases, the best way to determine the best compression setting for your database is to try each one.

### Changing Data Compression Settings

Changes to the data compression setting take effect immediately as Essbase writes data blocks to disk. For blocks already on disk, Essbase does not change compression schemes or enable or disable compression. When you change the data compression settings of blocks already on disk, Essbase uses the new compression scheme the next time Essbase accesses, updates, and stores the blocks.

➢ To view or change the current settings, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Selecting a Data Compression Method</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>To enable or disable data compression: SETDBSTATE or: SETDBSTATEITEM 14 To set the data compression type: SETDBSTATEITEM 15</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

#### Example of Using SETDBSTATEITEM

To enable or disable data compression, enter SETDBSTATEITEM 14 in ESSCMD and either follow the prompts or supply the required values on the command line.

ESSCMD prompts you for the following values, unless you supply them on the command line:

- Data Compression on Disk? Enter Y (Yes, the default) or N (No).
- Data Compression Type. Enter 1 (run-length encoding) or 2 (bitmap, the default).

To specify the data compression type, enter SETDBSTATEITEM 15 in ESSCMD and either follow the prompts or supply the required values on the command line. ESSCMD prompts you for a value of “1” (run length encoding) or “2” (bitmap, the default).  

774
The following example enables Bitmap compression:

```
SETDBSTATEITEM 14 "SAMPLE" "BASIC" "Y" "2"
```

For more syntax information, see the *Oracle Essbase Technical Reference*.

## Checking the Compression Ratio

The compression ratio represents the ratio of the compressed block size (including overhead) to the uncompressed block size, regardless of the compression type in effect. Overhead is the space required by mechanisms that manage compression/expansion.

To check the compression ratio, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Checking the Compression Ratio</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETDBSTATS</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Note:** The larger the number, the more compression. The compression ratio can vary widely from block to block.

## Data Block Size

Data block size is determined by the amount of data in a particular combination of dense dimensions. For example, when you change the dense or sparse configuration of one or more dimensions in the database, the data block size changes. Data block size is $8n$ bytes, where $n$ is the number of cells that exist for that combination of dense dimensions.

**Note:** The optimum size range is 8 KB to 100 KB.

For information about determining the size of a data block, see “Size of Expanded Data Block” on page 1057.

To view the block size for a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Checking Data Block Statistics</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETDBSTATS</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Ensuring Data Integrity

In This Chapter

- Understanding Transactions ................................................................. 777
- Understanding Isolation Levels ................................................................. 777
- Understanding How Essbase Handles Transactions ............................... 783
- Specifying Data Integrity Settings .............................................................. 784
- Accommodating Data Redundancy ............................................................ 785
- Checking Structural and Data Integrity ...................................................... 786
- Using VALIDATE to Check Integrity ......................................................... 786
- Recovering from a Crashed Database ......................................................... 787

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases. Also see Chapter 60, “Comparison of Aggregate and Block Storage.”

Understanding Transactions

When a database is in read/write mode, Essbase considers every update request to the server (such as a data load, a calculation, or a statement in a calculation script) as a transaction. Essbase tracks information about transactions in a transaction control file (dbname.tct).

The transaction control file contains an entry for each transaction and tracks the current state of each transaction (Active, Committed, or Aborted).

See “Understanding How Essbase Handles Transactions” on page 783.

Understanding Isolation Levels

Isolation levels determine how Essbase commits data to disk. When data is committed, it is taken from server memory and written to the database on disk. Essbase automatically commits data to disk. There are no explicit commands that users perform to commit data blocks. However, setting the isolation level for a database defines how Essbase automatically commits data blocks.

Essbase offers two isolation levels for transactions—committed access and uncommitted access (the default). You can optimize data integrity by using committed access.

For an explanation of access types, see “Committed Access” on page 778 and “Uncommitted Access” on page 781.
**Note:** Setting the isolation level to committed access may increase memory and time requirements for database restructure.

**Note:** The Grid API is always in Committed Access Mode.

## Data Locks

Essbase issues write (exclusive) locks for blocks that are created, updated, or deleted, and issues read (shared) locks for blocks that should be accessed but not modified. By issuing the appropriate locks, Essbase ensures that data changed by one operation cannot be corrupted by a concurrent update.

This section discusses locks on data blocks, not locks on database artifacts. For information about locking and unlocking outlines and other artifacts, see “Locking and Unlocking Artifacts” on page 714.

Table 151 explains the lock types:

<table>
<thead>
<tr>
<th>Lock</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write (exclusive) lock</td>
<td>Prevents any other transaction from accessing the locked data block. Used for all data block updates, including spreadsheet lock and send operations.</td>
</tr>
<tr>
<td>Read (shared) lock</td>
<td>Allows other transactions read-only access to the data block but prevents other transactions from modifying the data block.</td>
</tr>
</tbody>
</table>

Table 152 shows the locks that Essbase issues for various types of operations.

<table>
<thead>
<tr>
<th>Type of Operation</th>
<th>Lock Issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spreadsheet retrieve</td>
<td>Read (shared) lock on each data block.</td>
</tr>
<tr>
<td>Retrieve and lock</td>
<td>Write (exclusive) lock on all affected blocks. A subsequent send command commits the data.</td>
</tr>
<tr>
<td>Calculate derived block</td>
<td>Write lock on the block being calculated.</td>
</tr>
<tr>
<td></td>
<td>As a block is calculated, all blocks containing the block’s children acquire read locks.</td>
</tr>
<tr>
<td>Data load</td>
<td>Write lock</td>
</tr>
<tr>
<td>Restructure</td>
<td>Write lock</td>
</tr>
</tbody>
</table>

How Essbase handles locking depends on whether committed or uncommitted access is enabled.

## Committed Access

Committed access provides a high level of data consistency because only one transaction at a time can update data blocks. Under committed access, Essbase allows transactions to hold read/
write locks on all data blocks involved with the transaction until the transaction completes and commits. However, you can still allow read-only access to the last committed data values.

Essbase provides options that determine when locks are issued on data blocks:

- Pre-image access (enabled by default). Pre-image access provides users read-only access to data blocks that are locked for the duration of a concurrent transaction. Users see the last committed data values for the locked data blocks.

- Wait, or timeout:
  - Indefinite wait (the default). The transaction waits to acquire a lock on the required locked block.
  - Immediate access, or no wait. If a required block is locked by another transaction, Essbase displays a lock timeout message, and the transaction aborts.
  - A number of seconds that you specify. The transaction waits that number of seconds to acquire a lock on the required locked blocks. If the specified time runs out before the transaction acquires a lock, Essbase displays a lock timeout message, and the transaction aborts.

When pre-image access is enabled, you are not limited to read-only access to data blocks; if you need write access to locked blocks, the transaction waits for write access or times out, depending on the wait or timeout setting. The transaction gets immediate write access to data blocks that are not locked by another transaction.

If pre-image access is not enabled, and if you need read or write access to locked blocks, the transaction waits for write access or times out, depending on the wait or timeout setting.

**Memory Considerations with Committed Access**

Under committed access, note the following memory considerations:

- Essbase retains redundant data until a transaction commits. Allow disk space for double the size of the database to accommodate redundant data.

- Models with a large number of blocks may experience memory problems under committed access. Each lock (one lock per block) uses approximately 80 bytes of memory per calculation, and each lock is held in memory until the transaction is complete. There is a limit to the addressable memory space per process, and eventually models with a large number of blocks may hit this limit, causing the transaction to terminate. In such cases, consider using Uncommitted Access.

**Note:** Setting the isolation level to committed access may increase memory and time requirements during database restructure.

**Locking Under Committed Access**

Under committed access, Essbase locks blocks for read and write access:
For read access, the lock remains until another transaction requests it, whether or not the transaction is complete. Other transactions can read the locked block, but none can alter it.

For write access, a transaction locks and holds the lock on each block that it modifies until the transaction completes.

Table 153 illustrates locking behavior under committed access when multiple transactions are contending for a lock on the same data. In this example, transaction Tx1 is running and transaction Tx2 is requesting access to the same data. (Note that access to locked blocks depends on what options are enabled. For a discussion of options, see “Committed Access” on page 778.)

Table 153  Locking Behavior Under Committed Access

<table>
<thead>
<tr>
<th>Pre-image access enabled</th>
<th>Tx1 holds read lock; Tx2 requests read lock</th>
<th>Tx1 holds read lock; Tx2 requests write lock</th>
<th>Tx1 holds write lock; Tx2 requests read lock</th>
<th>Tx1 holds write lock; Tx2 requests write lock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wait (timeout) period specified (indefinite wait or a number of seconds wait)</td>
<td>Tx2 gets read lock.</td>
<td>Tx2 waits for Tx1 to release read lock.</td>
<td>Tx2 gets pre-image access.</td>
<td>Tx2 waits for Tx1 to release write lock.</td>
</tr>
<tr>
<td>No wait (timeout) period specified (immediate timeout)</td>
<td>Tx2 gets read lock.</td>
<td>Essbase issues timeout message and aborts the transaction.</td>
<td>Tx2 gets pre-image access.</td>
<td>Essbase issues timeout message and aborts the Tx2 transaction.</td>
</tr>
<tr>
<td>No pre-image access</td>
<td>Wait (timeout) period specified (indefinite wait or a number of seconds wait)</td>
<td>Tx2 gets read lock.</td>
<td>Tx2 waits for Tx1 to release read lock.</td>
<td>Tx2 waits for Tx1 to release write lock.</td>
</tr>
<tr>
<td>No wait (timeout) period specified (immediate timeout)</td>
<td>Tx2 gets read lock.</td>
<td>Essbase issues time-out message and aborts the Tx2 transaction.</td>
<td>Essbase issues timeout message and aborts the Tx2 transaction.</td>
<td>Essbase issues timeout message and aborts the Tx2 transaction.</td>
</tr>
</tbody>
</table>

For information on setting concurrency parameters, see “Specifying Data Integrity Settings” on page 784.

Concurrency with Committed Access

Occasionally, under committed access, a deadlock results when two transactions are locking or waiting for access to the same blocks, and neither transaction can complete under these conditions.

For example, if transaction Tx1 needs to update first data block B1 and then data block B2, it first locks B1 and then attempts to lock B2. Meanwhile, if transaction Tx2 needs to update first data block B2 and then block B1, Tx2 first locks B2 and then attempts to lock B1. Tx1 locked B1 and is waiting for B2, and Tx2 locked B2 and is waiting for B1.

Essbase transactions periodically perform deadlock detection while waiting to acquire a lock. If detected, Essbase issues an error message, and the transaction fails.
If you try to update a block that is locked by another user, Essbase behaves in these ways:

- If wait is set to indefinite, the transaction waits to acquire the needed locks.
- If wait is set to 0 (immediate), and if the required blocks are not immediately available, Essbase displays an error message, and the transaction fails.
- If wait is set to a user-specified number of seconds, and the time has expired, Essbase displays an error message and aborts the transaction.
- If the request times out, try the operation again.

For information about how to set concurrency options, see “Specifying Data Integrity Settings” on page 784.

**Rollback with Committed Access**

Under committed access, if the server crashes, Essbase rolls back all database updates by transactions that were in progress when the server stopped, ensuring that changes made by the aborted transactions are undone.

If a transaction is aborted because of a nonfatal error, all changes made by the transaction are rolled back.

See “Recovering from a Crashed Database” on page 787.

**Uncommitted Access**

With uncommitted access (enabled by default), the Essbase kernel allows transactions to hold read/write locks on a block-by-block basis; Essbase releases a block after it is updated but does not commit blocks until the transaction completes or until a specified limit (a “synchronization point”) has been reached. You can set this limit, as described below.

Concurrent users accessing the same data blocks might experience unexpected results under uncommitted access, because Essbase allows read-only access to data at its last commit point.

With uncommitted access, you can control when Essbase performs an explicit commit operation by specifying synchronization point parameters:

- **Commit Blocks** (number of blocks modified before a synchronization point occurs). The default is 3,000.
  
  If you set Commit Blocks to 0, the synchronization point occurs at the end of the transaction.

- **Commit Rows** (number of rows to data load before a synchronization point occurs). The default is 0, which means that the synchronization point occurs at the end of the data load.

- If either Commit Blocks or Commit Rows has a nonzero value, a synchronization point occurs when the first threshold is reached. For example, if Commit Blocks is 10 but Commit Rows is 0 and you load data, a synchronization point occurs after 10 blocks are updated. If Commit Blocks is 5 and Commit Rows is 5 and you load data, a synchronization point occurs after 5 rows are loaded or 5 blocks are updated, whichever happens first.
If a user-defined threshold is exceeded during an operation, Essbase issues a synchronization point to commit the data processed to that point. Essbase performs as many synchronization points as are necessary to complete the operation.

**Note:** Essbase analyzes the value of Commit Blocks and Commit Rows during its analysis of feasibility for parallel calculation use. If Essbase finds the values set too low, it automatically increases them.

For information about how to specify synchronization point parameters, see “Specifying Data Integrity Settings” on page 784.

---

**Caution!** Essbase retains redundant data to enforce transactional semantics. Allow disk space for double the size of the database to accommodate redundant data, particularly if both Commit Blocks and Commit Rows are set to 0.

---

### Memory Considerations with Uncommitted Access

If your data cache is too small to hold the number of blocks specified in your Commit Blocks and Commit Rows settings, the blocks will be written to disk as soon as the caches become full, which will be before the transaction is committed.

### Locking Under Uncommitted Access

Under uncommitted access, Essbase locks blocks for write access until Essbase finishes updating the block. Under committed access, Essbase holds locks until a transaction completes.

Table 154 illustrates locking behavior under uncommitted access when many transactions contend for a lock on the same data. In this example, transaction Tx1 is running and transaction Tx2 is requesting access to the same data.

**Table 154  Locking Behavior with Uncommitted Access**

<table>
<thead>
<tr>
<th>Status when Tx2 Makes a Request</th>
<th>If Tx1 holds read lock</th>
<th>If Tx1 holds write lock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read lock</td>
<td>Tx2 gets read lock</td>
<td>Tx2 gets read lock</td>
</tr>
<tr>
<td>Write lock</td>
<td>Tx2 gets write lock</td>
<td>Tx2 waits for Tx1 to release the lock</td>
</tr>
</tbody>
</table>

### Concurrency with Uncommitted Access

With uncommitted access, blocks are released more frequently than with committed access, when all blocks are locked until the end of the transaction.

### Rollback with Uncommitted Access

Under uncommitted access, if the server crashes, Essbase rolls back all database updates from the point of the last successful commit. Some updates from an aborted transaction may have
committed. Whether transactions committed their updates the way users expected depends on the order in which overlapping transactions updated and committed data.

If a transaction is aborted because of a nonfatal error, Essbase commits only the data that the transaction finished processing before the abort of the transaction.

See “Recovering from a Crashed Database” on page 787.

Parallel Calculation and Uncommitted Access

If Essbase is using parallel calculation, Essbase checks the commit threshold.

Committed Versus Uncommitted Access

Consider the following issues when choosing an isolation level:

- **Database performance.**
  Uncommitted access always yields better database performance than committed access. When using uncommitted access, Essbase does not create locks that are held for the duration of a transaction but commits data based on short-term write locks.

- **Data consistency.**
  Committed access provides a higher level of data consistency than uncommitted access. Retrievals from a database are more consistent. Also, only one transaction at a time can update data blocks when the isolation level is set to committed access. This factor is important in databases where multiple transactions attempt to update the database simultaneously.

- **Data concurrency.**
  Uncommitted access provides better data concurrency than committed access. Blocks are released more frequently than during committed access. With committed access, deadlocks can occur.

- **Database rollbacks.**
  If a server crash or other server interruption occurs during active transactions, the Essbase kernel rolls back the transactions when the server is restarted. With committed access, rollbacks return the database to its state before transactions began. With uncommitted access, rollbacks may result in some data being committed and some data not being committed.

  See “What to Expect if a Server Interruption Occurs” on page 789.

Understanding How Essbase Handles Transactions

Essbase tracks transactions from start to finish, swapping data blocks in and out of memory as needed and committing data blocks when a transaction completes. The following list describes how Essbase handles a transaction: all list items apply to committed and uncommitted access (see “Understanding Isolation Levels” on page 777).
1. A user or batch program begins an operation.
2. The OLAP engine notifies the Essbase kernel that a transaction is to begin.
3. The Essbase kernel begins the transaction.
4. The OLAP engine requests data from the Essbase kernel.
5. The Essbase kernel locates the requested data. It passes the data, and some associated control information, to the OLAP engine. If you are using a spreadsheet, this data is displayed on the sheet.
6. If you are using a spreadsheet, when you modify data, you submit the data.
7. The Essbase kernel associates the transaction with an entry in its transaction control table.
8. After the operation is complete on the OLAP engine side, the OLAP engine notifies the Essbase kernel about the update, and the Essbase kernel updates internal data structures accordingly.
9. Steps 4–8 repeat as often as necessary to complete the operation.
10. The transaction ends. If Essbase encounters an error during transaction processing, it aborts the transaction. If no errors are encountered, Essbase commits the transaction. For differences in commit behavior under committed and uncommitted access, see “Understanding Isolation Levels” on page 777.
11. Essbase issues a message to notify the client that the transaction is complete; for example, “TOTAL CALC ELAPSED TIME...”

Under uncommitted access, it is possible to access uncommitted data when multiple transactions are active and are accessing the same data. Transaction results are unpredictable under uncommitted access.

Under uncommitted access, if you have defined a commit threshold, Essbase may need to break down one database operation into multiple synchronization points. See “Uncommitted Access” on page 781 for information on commit thresholds.

### Specifying Data Integrity Settings

You can specify isolation level, synchronization point parameters, and concurrency parameters using Administration Services, MaxL, or ESSCMD. Changes to isolation level settings take effect the next time there are no active transactions. For information about deciding which settings to choose, see “Committed Access” on page 778 and “Uncommitted Access” on page 781.

To specify data integrity settings, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Data Integrity Options</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM 18</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Example of Specifying Isolation Level Settings with ESSCMD

To specify isolation level settings using ESSCMD, enter SETDBSTATEITEM 18 in ESSCMD and either follow the prompts or supply the required values on the command line.

Choose 1 (committed access) or 2 (uncommitted access, the default). Depending on which you specify, ESSCMD prompts you for other parameters (or you can supply the values on the command line).

If you choose 1 (committed access), ESSCMD prompts for the following information:

- Pre-image access; Y (Yes) or N (No, the default). Pre-image access provides users read-only access to data blocks that are locked for the duration of a transaction. Users see the last committed data values for the locked data blocks.

- Wait (in the Database Settings dialog box) or timeout (in ESSCMD): -1, 0, or \( n \).
  - -1 is indefinite wait.
  - 0 is immediate access, or no wait.
  - \( n \) is the number of seconds that you specify.

If you choose 2 (uncommitted access), ESSCMD prompts for the following values. See “Uncommitted Access” on page 781 for explanations of these options.

- Number of blocks modified before internal commit
- Number of rows to data load before internal commit

You can also specify isolation level parameters (pre-image access and so on) by specifying parameters 19–22 on SETDBSTATEITEM. Enter SETDBSTATEITEM with no parameters; ESSCMD displays a list that includes each parameter by number, with a description.

Here is an example of using SETDBSTATEITEM to set an isolation level. This example enables committed access and pre-image access and specifies indefinite wait time.

```
SETDBSTATEITEM 18 "SAMPLE" "BASIC" "1" "Y" "-1"
```

See the Oracle Essbase Technical Reference.

Example of Specifying Isolation Level Settings with MaxL

To specify isolation level settings, use this MaxL statement:

```
alter database appname.dbname enable committed_mode
```

See the Oracle Essbase Technical Reference.

Accommodating Data Redundancy

To ensure data integrity, the Essbase kernel temporarily retains redundant (duplicate) information. To accommodate redundant information, allow disk space for double the size of the database.
Essbase maintains a file called `dbname.esm`, in which it stores crucial control information.

**Caution!** The `dbname.tct` file, `dbname.esm` file, the index files, and the data files contain information crucial for data recovery. Never alter or delete these files.

## Checking Structural and Data Integrity

To validate database integrity and to check for database corruption, perform an action:

- Perform a dense restructure. Because a dense restructure recreates all blocks within a database, this method verifies index nodes and cells for each block.

- Export all levels of data from the database. Exporting an entire database accesses blocks and all data values across the entire database.

- Use the ESSCMD VALIDATE command to check structural and data integrity. See “Using VALIDATE to Check Integrity” on page 786.

If errors occur during any of these checks, restore the database from backups. See the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.

## Using VALIDATE to Check Integrity

The VALIDATE command performs many structural and data integrity checks:

- Verifies the structural integrity of free space information in the index.

- Compares the data block key in the index page with the data block key in the corresponding data block.

- The Essbase index contains an entry for every data block. For every read operation, VALIDATE automatically compares the index key in the index page with the index key in the corresponding data block and checks other header information in the block. If it encounters a mismatch, VALIDATE displays an error message and continues processing until it checks the entire database.

- Restructures data blocks whose restructure was deferred with incremental restructuring.

- Checks every block in the database to make sure each value is a valid floating point number.

- Verifies the structural integrity of the LROs catalog.

**Note:** When you issue the VALIDATE command, we recommend placing the database in read-only mode.

As Essbase encounters mismatches, it records error messages in the VALIDATE error log. You can specify a file name for error logging; Essbase prompts you for this information if you do not provide it. The VALIDATE utility runs until it has checked the entire database.

You can use the VALIDATE command in ESSCMD to perform these structural integrity checks.
During index free space validation, the VALIDATE command verifies the structural integrity of free space information in the index. If integrity errors exist, Essbase records them in the VALIDATE log. The file that you specified on the VALIDATE command holds the error log.

If VALIDATE detects integrity errors regarding the index free space information, the database must be rebuilt. You can rebuild in three ways:

- Restore the database from a recent system backup
- Restore the data by exporting data from the database; creating an empty database; and loading the exported data into the new database.
- Restructure the database


Even if you do not use VALIDATE, Essbase automatically performs certain validity checking whenever a read operation is performed, to ensure that the index is synchronized with the data.

For every read operation, Essbase compares the data block key in the index page with the data block key in the corresponding data block and checks other header information in the block.

If Essbase encounters a mismatch, it displays an “Invalid block header” error message.

**Recovering from a Crashed Database**

After a server interruption such as a crash, Essbase recovers a database, rolling back all transactions that were active when the interruption occurred. Recovery time depends on the index size. The larger the index, the longer it takes.

Essbase also recovers and consolidates free fragments (unused addressable units in the data blocks). However, free space recovery is the most time-consuming aspect of database recovery, so it is delayed by default. You must trigger free space recovery explicitly unless you have changed the default setting. See “Free Space Recovery” on page 788 for the advantages and disadvantages of delaying free space recovery.

Essbase recovers data as soon as the server is started after a server interruption. Recovery phases:

1. Transaction recovery rolls back all transactions that were active when the interruption occurred.
2. Index file recovery truncates files to their previously committed sizes.
3. Data free space recovery rebuilds the data free space tables. The size of the index determines the duration of this phase.

**Note:** Free space recovery is delayed until you trigger it, unless you have changed the default setting.
A media failure (faulty disk, disk failure, or head crash) requires that you restore data from backups. See the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.

**Caution!** Do not move, copy, modify, or delete the following files: essxxxxx.ind, essxxxxx.pag, dbname.ind, dbname.esm, dbname.tct. Doing so can result in data corruption.

The Essbase kernel uses fatal error handling to display appropriate messages and to shut down the server, depending on the error encountered. For an explanation of how fatal error handling works, see “Understanding Fatal Error Handling” on page 1049.

For information about how transactions are rolled back after a crash, see “Committed Versus Uncommitted Access” on page 783.

**Free Space Recovery**

Database recovery occurs when you load an application that has just crashed or terminated abnormally. Essbase does not perform free space recovery automatically, because it is the most expensive part of database recovery. You must either trigger free space recovery explicitly or change the default setting so that Essbase will recover free space automatically.

All database functions run normally whether you recover free space or not. When you recover free space, you can reuse disk space marked as free in the data files. Keep in mind that free space recovery is time-consuming, so you might delay it until a better time.

You should, however, perform free space recovery as soon as possible to take advantage of the free space in the data files and to ensure that the database has not been corrupted. Also, if a database crashes repeatedly, and you do not run free space recovery, data files can become unnecessarily large.

To trigger free space recovery, use the MaxL alter database command. For example:

```
alter database DBS-NAME recover freespace
```

See the Technical Reference.

To change the default behavior for free space recovery, change the DELAYEDRECOVERY configuration setting to FALSE. See the “Configuration Settings” section of the Technical Reference.

To get information about free space recovery, use the GETDBSTATS command. GETDBSTATS provides the following information about free space recovery:

```
Free Space is Recoverable : true/false
Estimated Bytes of Recoverable Free Space : nnn
```

**Note:** If free space is recoverable, the block counters are estimates and do not necessarily match the number of existing blocks.
What to Expect if a Server Interruption Occurs

Table 155 lists types of Essbase Server interruptions and their results:

<table>
<thead>
<tr>
<th>Interruption</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power loss on server</td>
<td>Essbase Server stops. When you restart the server, Essbase recovers the database.</td>
</tr>
<tr>
<td>Operating system crash</td>
<td></td>
</tr>
<tr>
<td>Server stopped with Ctrl+C keys</td>
<td></td>
</tr>
<tr>
<td>Operation cannot complete because of system limitations</td>
<td>Essbase performs fatal error handling. You may need to allocate more memory or disk space and restart the server.</td>
</tr>
<tr>
<td>Memory shortage</td>
<td></td>
</tr>
<tr>
<td>Out of disk space</td>
<td></td>
</tr>
<tr>
<td>Application stopped with Ctrl+C keys</td>
<td></td>
</tr>
<tr>
<td>Server crash</td>
<td>Essbase Exception Manager creates an error log of type .xcp. Server stops. When you restart the server, Essbase recovers the database.</td>
</tr>
</tbody>
</table>

Table 156 shows what you must do if a server interruption occurs during a transaction. How Essbase recovers from an interruption depends on the transaction isolation level setting (committed or uncommitted access)—see “Rollback with Committed Access” on page 781 and “Rollback with Uncommitted Access” on page 782.

Table 156 Recovery Procedures for Server Requests

<table>
<thead>
<tr>
<th>Type of Request</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock</td>
<td>Issue the lock command again.</td>
</tr>
<tr>
<td>(for spreadsheet update)</td>
<td></td>
</tr>
<tr>
<td>Send</td>
<td>If Essbase issues an error, repeat the last send operation.</td>
</tr>
<tr>
<td>(spreadsheet update)</td>
<td>If the spreadsheet has been lost or does not exist, and if you are using SSAUDIT spreadsheet logging, reload the dbname.atx file. See “How to Use Spreadsheet Update Logging” on page 790.</td>
</tr>
<tr>
<td>Calculation</td>
<td>Check the server and application logs to see where the calculation left off. See “Viewing the Essbase Server and Application Logs” on page 739. Decide whether to start the calculation over. Repeat the last calculation.</td>
</tr>
<tr>
<td>Data load</td>
<td>Perform an action:</td>
</tr>
<tr>
<td></td>
<td>- Repeat the last data load. See Chapter 20, “Performing and Debugging Data Loads or Dimension Builds.”</td>
</tr>
<tr>
<td></td>
<td>- Load the error log. See “Loading Dimension Build and Data Load Error Logs” on page 753.</td>
</tr>
<tr>
<td>Arithmetic data load</td>
<td>If the database is set to committed access, reload the data. (The transaction has been rolled back.)</td>
</tr>
<tr>
<td>(adding to or subtracting from values in the database)</td>
<td>If the database is set to uncommitted access, some of the data loaded, so if you reload all of the data, you receive incorrect results for the data values that loaded twice. Therefore, perform the following actions:</td>
</tr>
<tr>
<td></td>
<td>- Clear the database.</td>
</tr>
<tr>
<td></td>
<td>- Restore the database to its preload state.</td>
</tr>
<tr>
<td></td>
<td>- Rerun the load.</td>
</tr>
<tr>
<td>Type of Request</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| Restructure     | The restructure is not complete. Delete the temporary restructure files:  
|                 | .esn  
|                 | .inn  
|                 | .otn  
|                 | .pan  
|                 | .tcu  
|                 | Repeat the last operation that caused a restructure. |

**Note:** If the UPDATECALC parameter is set to FALSE, Essbase recalculates the entire database if an interruption occurs during a calculation. (The default value of the parameter is TRUE.)

### How to Use Spreadsheet Update Logging

For extra protection against data loss and for spreadsheet audit information, Essbase provides spreadsheet update logging, which you enable by using the SSAUDIT or SSAUDITR parameter in the essbase.cfg file on the server. You can specify SSAUDIT for all databases on the server or for individual databases. See the *Oracle Essbase Technical Reference*.

Essbase handles recovery under normal situations. However, sometimes you may want to load the spreadsheet update log manually. For example, if you have restored from a recent backup and do not want to lose changes made since the backup or you experience a media failure, you can recover transactions from the update log. To do so, use the Essbase command-line facility, ESSCMD, from the Essbase Server window.

The following ESSCMD command sequence loads the update log:

```
LOGIN hostnode username password
SELECT appname dbname
LOADDATA 3 filepath:appname.ATX
EXIT
```

To simplify loading the update log, prepare a batch file as described in “Using Script and Batch Files for Batch Processing” on page 1086.

When SSAUDIT or SSAUDITR is specified, Essbase logs spreadsheet update transactions chronologically. Essbase uses two files:

- `{dbname}.atx` stores spreadsheet update transactions as a unit that can be used as the input source for data loads.
- `{dbname}.alg` contains historical information for each transaction, such as user name, date, and timestamp, and the number of transaction rows from the `.atx` file.

Both files are stored on the server.

The spreadsheet update log can get quite large, even if you are using SSAUDITR, Essbase clears the log only after you back up data. If spreadsheet updates are frequent, consider periodically deleting the log manually.
When a database is started after a shutdown, if spreadsheet logging is enabled, Essbase writes the following message to the database log:

Starting Spreadsheet Log
volumename\app\appname\dbname\dbname.atx for database dbname

An example of the message is:

Starting Spreadsheet Log Hyperion\products\Essbase\EssbaseServer\app\appl\sample \sample.atx for database Sample

To ensure successful spreadsheet update logging, stop and restart the application after either of the following:

- Any operation that causes a restructure. See Chapter 55, “Optimizing Database Restructuring.”
- Running any of the following ESSCMD commands:
  - CREATEAPP
  - CREATEDB
  - COPYDB
  - RENAMEDB

Essbase ensures that if you enable spreadsheet logging, updates cannot take place without being logged. If for any reason Essbase cannot write to the update log, Essbase stops the transaction and issues an error message.

SSAUDIT and SSAUDITR are available only from the essbase.cfg file.
Using MaxL Data Definition Language

In This Chapter

The MaxL DDL Language ................................................................. 793
The MaxL Shell .............................................................................. 799
The MaxL Perl Module ................................................................. 804

Also see the MaxL DDL section of the Oracle Essbase Technical Reference.

The MaxL DDL Language

The MaxL data definition language is an interface for making administrative requests to Essbase using statements rather than a series of commands with complicated arguments.

Using MaxL, you can automate administrative operations on Essbase databases. You can write MaxL scripts with variables to make them customizable and reusable.

For Essbase to receive and parse MaxL statements, you must “pass” them to the Essbase Server using either the MaxL Shell (essmsh), Administration Services, or a customized Perl program that uses the MaxL Perl Module, which enables you to embed its statements in Perl programs.

Overview of Statements

All MaxL DDL scripts and interactive sessions comprise a login and a sequence of statements, each terminated by a semicolon and consisting of grammatical sequences of keywords and variables. Statements are similar to English sentences; for example,

create or replace user user-name identified by password;

MaxL statements begin with a verb, such as create or alter, which indicates the type of operation to perform. Then you specify an artifact, such as database or user, which indicates the Essbase elements you are working with. The rest of the statement provides details about the action to perform, using a grammatically correct sequence of statement parts, or tokens.

For an overall picture of grammar requirements and the verb-artifact structure of MaxL statements, see the MaxL DDL section of the Oracle Essbase Technical Reference.
Components of Statements

The MaxL parser recognizes and requires an ordered presentation of tokens, which are the components of statements. A token is a space-delimited sequence of valid characters that is recognized by MaxL as a single readable unit. Tokens can be any of the following:

- Keywords
- Names
- Strings
- Numbers

Keywords

**Keywords** are the reserved words that make up the MaxL vocabulary. These include verbs, artifacts, and other words needed to construct statements. Keywords in MaxL are independent of your data; conversely, you must define all other MaxL tokens (names, for example).

The MaxL parser expects to see MaxL keywords and other tokens in their correct grammatical order, as diagrammed in MaxL topics in the Oracle Essbase Technical Reference.

Figure 147 shows a sample syntax diagram from the Oracle Essbase Technical Reference. Only the lowercase words in the diagram represent keywords. The other elements are placeholders for names or values that you provide.

Figure 147 Example of MaxL Syntax Diagram: Alter Filter

![Diagram of Alter Filter]

**Note:** Keywords are not case-sensitive; the use of lowercase for keywords is a documentation convention. See “How to Read MaxL Railroad Diagrams” in the Oracle Essbase Technical Reference.

Names

**Names** in MaxL are used to uniquely identify databases and database artifacts, such as users, applications, or filters.

Rules for Names

Unless you enclose a MaxL name within single quotation marks, a MaxL name is a string that must begin with an alphabetic character or the underscore. Names that are not enclosed in quotation marks may contain only alphabetic characters, numbers, and the underscore.
When enclosed in single quotation marks, a name may contain white space and any of the following special characters:

. , ; % $ * + - = < > [ ] { } ( ) ? ! / \ ~ # & @ ^

**Note:** Any name that is also a MaxL keyword must be enclosed in single quotation marks. For a list of keywords, see the *Oracle Essbase Technical Reference*.

**Examples:**

The following application names *do not* require single quotation marks:

Orange
Orange22
_Orange

The following application names *do* require single quotation marks:

Orange County (because the name contains a space)
22Orange (because the name begins with a number)
variable (because the name is a MaxL keyword)
**Types of Names**

Some Essbase artifacts have single names, and some require compound names known as *doubles* and *triples*, which express the nesting of namespaces.

A *singleton name* can be meaningful in a system-wide context—the artifact to which it refers may be global to Essbase—or it needs no specified application or database context. For example, an application has a singleton name because it need not be considered in the context of another application or database.

A *double* is two names connected by a period, and a *triple* is three names connected by two periods. Doubles and triples show the inherited namespace of the named entity. For example, a database usually is identified using two names. The first identifies the application in which the database resides, and the second is the database name; for example:

**Sample.Basic**

Database artifacts, such as filters, usually are identified using triple names: the first two names identify the application and database, and the third is the artifact name. Therefore, a filter name could look like this:

**sample.basic.filter3**

**Table 157** shows the type of name required for the most common artifacts and provides an example of the name used in a statement.

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td>singleton</td>
<td>create user Fiona identified by 'password';</td>
</tr>
<tr>
<td>Group</td>
<td>singleton</td>
<td>alter user Fiona add to group Managers;</td>
</tr>
<tr>
<td>Host</td>
<td>singleton</td>
<td>drop replicated partition Samppart.Company from Sampeast.East at EastHost;</td>
</tr>
<tr>
<td>Application</td>
<td>singleton</td>
<td>create application '&amp;New App';</td>
</tr>
<tr>
<td>Database</td>
<td>double</td>
<td>display database '&amp;New App'.testdb;</td>
</tr>
<tr>
<td>Calculation</td>
<td>triple</td>
<td>drop calculation Sample.basic.'alloc.csc';</td>
</tr>
<tr>
<td>Filter</td>
<td>triple</td>
<td>display filter row sample.basic.filter1;</td>
</tr>
<tr>
<td>Function (local)</td>
<td>double</td>
<td>drop function sample.'@COVARIANCE';</td>
</tr>
<tr>
<td>Function (global)</td>
<td>singleton</td>
<td>create function '@JSUM' as 'CalcFnc.sum';</td>
</tr>
<tr>
<td>Location alias</td>
<td>triple</td>
<td>drop location alias Main.Sales.EasternDB;</td>
</tr>
<tr>
<td>Role</td>
<td>singleton</td>
<td>grant designer on database Sample.basic to Fiona;</td>
</tr>
<tr>
<td>Substitution variable</td>
<td>singleton</td>
<td>alter system add variable Current_month; alter system set variable Current_month July;</td>
</tr>
</tbody>
</table>
Strings

Strings are used in MaxL statements to represent the text of comments, member expressions, calculation scripts, and file references. Strings can begin with any valid character. As with names, strings containing white space or special characters must be enclosed in single quotation marks.

See “Rules for Names” on page 794 for a list of valid special characters.

Table 158 shows examples of statement elements that are strings:

Table 158  Examples of String in MaxL Statements

<table>
<thead>
<tr>
<th>Type of String</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Password</td>
<td>create user Fiona identified by sunflower;</td>
</tr>
<tr>
<td>Comment</td>
<td>alter group Financial comment 'Reports due July 31';</td>
</tr>
<tr>
<td>Member expression</td>
<td>create filter sample.basic.filt1 read on 'Sales,@ATTRIBUTE(Bottle)'; create or replace replicated partition sampeast.east area '@IDESC(East), @IDESC(Qtr1)' to samppart.company mapped globally '(&quot;Eastern Region&quot;)' to '(East)';</td>
</tr>
<tr>
<td>Body of a calculation</td>
<td>execute calculation '&quot;Variance&quot;=@VAR(Actual, Budget); &quot;Variance %&quot;=@VARPER(Actual, Budget);' on Sample.basic;</td>
</tr>
<tr>
<td>File reference</td>
<td>spool on to '/homes/fiona/out.txt';</td>
</tr>
</tbody>
</table>

Numbers

You use numbers in MaxL statements to change certain database settings in Essbase. For example, you can change cache and buffer sizes or set system-wide intervals such as the number of days elapsing before users are required to change their passwords. To change numeric settings, you can use positive integers, positive real numbers, and zero. Decimals and scientific notation are permitted.

Examples:

1000
2.2
645e-2

For size settings, units must follow the number. Spaces between numbers and units are optional. Units are case-insensitive and may include the following: B/b (bytes), KB/kb (kilobytes), MB/
mb (megabytes), GB/gb (gigabytes), and TB/tb (terabytes). If no units are given, bytes are assumed.

Examples:
1000 b
5.5GB
645e-2 mb
145 KB
2,000e-3TB

Analysis of Statements

Subtopics
- Altering a Database
- Granting a Permission
- Creating a Calculation

This section helps you review what you have learned about statements by illustrating MaxL statements and their components, in template form. In the diagrams, lowercase words are keywords, and uppercase words are intended to be replaced with the appropriate values, as shown in the example following each illustration.

Altering a Database

Figure 148 MaxL statement to change data file cache size

```
alter database DBS-NAME set data_file_cache_size SIZE-STRING
```

Keywords (2)  Name (double)  Keywords (2)  Positive number plus units

Example:
alter database Sample.Basic set data_file_cache_size 32768KB;

Granting a Permission

Figure 149 MaxL statement to grant application permissions to a user

```
grant APP-SYSTEM-ROLE on application APP-NAME to USER-NAME
```

Keywords  Choose app-level security role  Keywords (2)  Name (singleton)

798
Example:
grant designer on application Sample to Fiona;

Creating a Calculation

Figure 150 MaxL statement to create a stored calculation

```
create calculation CALC-NAME CALC-STRING

Keywords (2) Name (triple) Body of the calculation
```

Example:
create calculation sample.basic.varcalc
'"Variance"=@VAR(Actual, Budget);
"Variance %"=@VARPER(Actual, Budget);'
;

The MaxL Shell

Subtopics

- Starting the MaxL Shell
- Logging In to Essbase
- Command Shell Features
- Stopping the MaxL Shell

This section shows you how to get started using most of the features of the MaxL Shell. Also see the Oracle Essbase Technical Reference.

This section does not discuss using the Administration Services MaxL Script Editor. See the Oracle Essbase Administration Services Online Help.

Starting the MaxL Shell

The MaxL Shell can be invoked to take input in these ways:

- Interactively, from the keyboard
- From a MaxL script file (statements are read from the file specified on the command line)
- From standard input that is piped to the MaxL Shell from the output of another program

The MaxL Shell also accepts command-line arguments at invocation time. These can be used with positional parameters to represent any name, or a password.
Starting the Shell for Interactive Input

To enter MaxL statements interactively at the command line, invoke the shell at your operating-system prompt.

For example:

```
  essmsh
```

To enter MaxL statements interactively after logging in at invocation time, use the `-l` flag.

For example:

```
  essmsh -l Admin password
  ...
  49 - User logged in: [Admin].
```

To enter MaxL statements interactively and supply command-line arguments to represent variables that you will use in your interactive session, use the `-a` flag.

For example:

```
  essmsh -a Admin password Sample.Basic
  ...
  login $1 $2;
  49 - User logged in: [admin].
  alter database $3.$4 enable aggregate_missing;
  72 - Database altered: ['sample'. 'basic'].
```

In the above example, `$1`, `$2`, `$3`, and `$4` are positional parameter variables representing arguments entered after `essmsh` at invocation time, in the order in which they were entered.

Starting the Shell for File Input

To invoke the MaxL Shell to take input from a MaxL script file, type `essmsh` followed by the name of a MaxL script in the current directory, or, the full path and file name of a MaxL script in another directory.

If you provide only a file name, the MaxL Shell assumes that the file is in the current directory (the directory the operating-system command prompt was in when `essmsh` was invoked). In the following invocation example, the file `maxlscript.msh` must be in `C:`.

```
  C:\> essmsh maxlscript.msh
```

If the MaxL script is not in the current directory, provide a path to the MaxL script. You can use absolute paths or relative paths.

For example:

```
  $ essmsh ..\Oracle\Middleware\EPMSys11R1\products\Essbase\EssbaseServer\test.msh
```

Note: MaxL scripts do not require a particular—or any—file extension. This document uses `.msh`.
In UNIX shells, place single quotation marks around the path to avoid file-reading errors.

In a Windows command prompt, if the path to the script contains a space, you may have to use double quotation marks around the entire path and file name to avoid file-reading errors.

### Starting the Shell for Programmatic Input

To invoke the MaxL Shell to take input from the standard output of another program or process, use the \texttt{-i} flag.

For example:

```bash
program.sh | essmsh -i
```

The shell script \texttt{program.sh} may generate MaxL statements as output. The shell script output is piped to \texttt{essmsh -i}, which uses that output as its input. This allows for efficient co-execution of scripts.

### Windows Example Using \texttt{-i} Invocation

The following Windows batch script generates a login statement and a MaxL display statement as its output. The \texttt{-i} flag enables that output to be used by \texttt{essmsh}, the MaxL Shell, as input.

```cmd
echo login admin password on localhost; display privilege user;|essmsh -i
```

User Admin is logged in, all user privileges are displayed, and the MaxL session is terminated.

### UNIX Example Using \texttt{-i} Invocation

The following portion of a shell script ensures that there are no applications on the system by testing whether the \texttt{display application} statement returns zero applications.

```bash
if [ $(echo "display application;" | essmsh -l admin password -i 2>&1 | awk '/Records returned/ {print $7}' ) != "[0]." ]
then
    print "This test requires that there be no applications."
    print "Quitting."
    exit 2
fi
```

Explanation:

1. MaxL grammar is piped to a MaxL Shell invocation and login, as the output of the UNIX \texttt{echo} command.
2. The results of the MaxL session are tested by \texttt{awk} for pattern-matching with the MaxL status message you would get if you entered \texttt{display application} on an empty system: \texttt{Records returned: [0]}.
3. \texttt{Awk} matches the string \texttt{'Records returned: '}, and then checks to see if that is equal to \texttt{'[0].'}. 

801
4. If $7$ (a variable representing the fifth token awk finds in the status string) is equal to '
[0].', there are no applications on the system; otherwise, $7$ would equal '
[1].' or whatever number of applications exist on the system.

For more information and examples on invocation options, see the Oracle Essbase Technical
Reference. Invocation information is also contained in the essmsh “man page”. To view the man
page, enter essmsh -h | more at the operating-system command prompt.

Logging In to Essbase

The MaxL language interpreter requires a connection to an Essbase session before it can begin
parsing MaxL statements. Use the MaxL Shell to establish the connection to Essbase.

To log on to Essbase after the command shell has been started, use the shell login grammar.

For example:

```
  essmsh

  MAXL>login Fiona identified by sunflower on hostname;
```

If a host name is not specified, localhost is assumed.

To log on when you invoke the shell, use the -l option. To log on to a server besides
localhost at invocation time, use the -s option. To set a message level, use -m.

For example:

```
  essmsh -l fiona sunflower -s myHost -m error
```

Note: You can log out and change users without quitting the shell.

When a user logs in to Essbase through a MaxL Shell session and Essbase is restarted while
the user is still logged in, the next login through the same MaxL Shell session is delayed
by four seconds.

For more information about MaxL Shell invocation options, see the Oracle Essbase Technical
Reference.

Command Shell Features

The MaxL Shell includes command-line argument processing, environment variable processing,
nesting of MaxL scripts, and shell escapes. These features offer the flexibility needed to create a
highly automated Essbase production environment.

See the Oracle Essbase Technical Reference.
Nesting MaxL Scripts

As a DBA, you may want to save your separate automated tasks in several MaxL scripts, rather than executing many operations from a single script. Putting the pieces together is simple if you know how to reference one MaxL script from another.

To reference or include other MaxL scripts within the current MaxL session, use the following MaxL Shell syntax:

\[ \text{msh <scriptfile>;} \]

**Note:** Because `msh` is a shell command, it is limited to the originating session. Therefore, you should not reference MaxL scripts that contain new login statements.

Spooling Output to a File

You can create a log file of all or part of a MaxL session and its associated messages by spooling output to a file.

➢ To record a MaxL session:

1. log on to Essbase. For example, `login fiona sunflower;`
2. Begin spooling output, using `spool on to <filename>`. For example: `spool on to 'C:\output\display.txt';`
3. Enter as many MaxL statements as you want recorded.
4. Stop spooling output, using `spool off;`.

MaxL statements and their output are logged to the output file when you issue the spool command, either in an interactive session or in a script. However, MaxL Shell commands and output are logged only if you spool during an interactive session. MaxL Shell commands and output are ignored in log files created from script sessions. Additionally, output from any operating-system commands you may have included is ignored in the log files of both interactive and script sessions.

Including Operating-System Commands

You can issue operating-system commands directly from a MaxL session. The operating-system output becomes part of the MaxL Shell output. When the operating system finishes executing commands, it returns control to `essmsh`.

To escape to the operating system from within a MaxL session, use `shell`.

For example, to run the UNIX `date` command from a MaxL script:

`shell date;`

To escape to ESSCMD from within a MaxL session, use single quotation marks:

For example:
Using Variables to Customize MaxL Scripts

In the MaxL Shell, you can use variables as placeholders for data that is subject to change or that you refer to often; for example, the name of a computer, user names, or passwords. You can use variables in MaxL scripts and during interactive sessions. Using variables in MaxL scripts eliminates the need to create customized scripts for each user, database, or host. Variables can be environment variables (for example, \$ESSBASEPATH, which references the Essbase installation directory), positional parameters (for example, \$1, \$2, and so on), and locally defined shell variables. A variable always begins with a \$ (dollar sign) when you reference it.

For more information about using variables in the MaxL Shell, see the Oracle Essbase Technical Reference.

Stopping the MaxL Shell

You can log out of a MaxL session or log on as another user without quitting the shell. You should include a logout statement at the end of MaxL scripts. You need not exit at the end of MaxL script files, or after a session using stream-oriented input from another program’s output.

To log out without exiting the MaxL Shell, enter:

```
logout;
```

To exit from the MaxL Shell after using interactive mode, enter:

```
exit;
```

The MaxL Perl Module

With the MaxL Perl Module (Essbase.pm), you can embed the MaxL language within Perl programs, offering more programmatic control than is available in the shell.

Essbase.pm, in the Perlmod directory, enables Perl programmers to wrap MaxL statements in Perl scripts. Database administration with MaxL becomes as efficient and flexible as your Perl programs.

While you administer Essbase databases, Perl with MaxL enables you to take advantage of these and other programmatic features:

- Conditional testing
- Interprocess communication
- Message handling
- E-mail notification
- Web scripting

Essbase.pm contains methods that enable passing MaxL statements by means of Perl:
connect () establishes a connection to Essbase

do () tells Perl to execute the enclosed MaxL statement

pop_msg () navigates through the stack of returned MaxL messages

fetch_col (), fetch_desc (), and fetch_row () retrieve information from MaxL display output tables

disconnect () terminates the connection to Essbase

To make the Perl methods available to Essbase, include a reference to Essbase.pm in the Perl program. Place the following line at the top of each Perl script:

use Essbase;

Perl is not difficult to learn, especially if you have knowledge of UNIX shells or other programming languages. To download Perl and learn more about it, visit the Comprehensive Perl Archive Network Web site at http://www.cpan.org/.

See the MaxL DDL section of the Oracle Essbase Technical Reference and the Readme file in the PERLMOD directory of your Essbase installation.
In Optimizing Essbase:

- Monitoring Performance
- Improving Essbase Performance
- Optimizing Essbase Caches
- Optimizing Database Restructuring
- Optimizing Data Loads
- Optimizing Calculations
- Optimizing Reports and Other Types of Retrieval
- Running Essbase on Oracle Exalytics In-Memory Machine
Finding Diagnostic Information

Essbase provides performance information dialog boxes at the Essbase Server, application, and database level. View performance information before performing these tasks:

- Preparing to migrate data
- Adding users
- Analyzing performance problems
- Performing other administrative tasks

Essbase displays information on a snapshot basis; to see the latest information, click Refresh. If the Refresh button is displayed in a window or dialog box, it updates every tab in the window or dialog box.

For a comprehensive discussion of Essbase Server, application, and outline logs, see “Essbase Server and Application Logs” on page 727.

The following sections provide procedures for accessing information about Essbase Servers, applications, and databases that are commonly used to diagnose performance or other issues.
Viewing Essbase Server Information

You can view information about the Essbase Server license, configuration, operating system, disk drives, and applications for Essbase Server.

➢ To view Essbase Server information, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Monitoring Essbase Servers</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETAPPSTATE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Viewing Application Information

You can view application information to identify which databases are running in the application and to check access, security, and startup information.

➢ To view application information, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Monitoring Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETAPPSTATE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Viewing Database Information

You can view information about database storage, database statistics, and lock contention. This information may help you identify activities or operations that affect performance.

➢ To view database information, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Instructions</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Monitoring Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>display database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
### Monitoring the Status of Applications and Databases

You can view the start and stop status of applications and databases that you are authorized to use.

- To view application/database status, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Instructions</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Viewing Application/Database Status</td>
<td><a href="#">Oracle Essbase Administration Services Online Help</a></td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETAPPINFO</td>
<td><a href="#">Oracle Essbase Technical Reference</a></td>
</tr>
<tr>
<td></td>
<td>GETDBINFO</td>
<td></td>
</tr>
</tbody>
</table>

### Monitoring User Sessions and Requests

You can monitor active user sessions for an Essbase Server, application, or database. If you have Administrator or Application Manager permissions, you can disconnect a user session or terminate a request made during a session.

- To monitor user sessions and requests, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Instructions</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Viewing Active User Sessions</td>
<td><a href="#">Oracle Essbase Administration Services Online Help</a></td>
</tr>
<tr>
<td>MaxL</td>
<td>display session alter system</td>
<td><a href="#">Oracle Essbase Technical Reference</a></td>
</tr>
</tbody>
</table>

### Monitoring Applications from the Operating System

Each application that is loaded is an open task or process in the operating system. You can use the operating system to view application tasks or processes:

- On Windows platforms, the application is displayed in an application server window, where you can view application activities as they occur. When the Agent starts an application, a
new icon is displayed in the taskbar. Double-click the icon to view the application server window.

- On UNIX platforms, the application server is often a background process. When the application starts, the ESSBASE command starts the ESSSVR process. To see activities, you can route all messages to a file with the `tail -f log` command, where `log` is the name of a file that you specify.

- You can also view a snapshot of the Essbase Server or application log using Administration Services. For information about viewing, filtering, searching, and analyzing logs, see *Oracle Essbase Administration Services Online Help*. For information on server and application logs, see “Essbase Server and Application Logs” on page 727.
In This Chapter

Recognizing Basic Design Issues That Affect Optimization .......................... 813
Resetting Databases to Improve Performance ........................................ 813
Using Database Settings to Customize for Maximum Performance ............. 814
Fragmentation and its Implications ................................................................. 818
Enabling Windows 4 GB Tuning (4GT) ...................................................... 819
Implementing 64-bit Essbase ................................................................. 819
Configuring the JVM Heap Size for Essbase Running on Solaris 64-bit .......... 820
About the CLASSPATH Environment Variable ........................................... 820
Finding Additional Optimization Information ............................................. 820

Recognizing Basic Design Issues That Affect Optimization

Use the following list to identify basic design issues that affect optimization outside this volume:

- For an introduction to basic concepts and how they relate to optimized performance, see Chapter 3, “Understanding Multidimensional Databases.”
- For a discussion of how to analyze a database design while it is still on paper and of how this analysis can aid optimization, see “Analyzing and Planning” on page 79.
- To understand how basic database outline issues affect performance, see “Designing an Outline to Optimize Performance” on page 93.

Resetting Databases to Improve Performance

You can periodically reset a database and then reload it. Even if you reload a database very often, the main database (.pag) files can grow unless you reset the database.

To reset a database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>MaxL</td>
<td>alter database appname.dbname reset</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Using Database Settings to Customize for Maximum Performance

Subtopics

- Database Cache Settings
- Database Disk Volumes Settings
- Database Transaction Control Settings
- Miscellaneous Database Settings

You can customize Essbase for maximum performance, using database settings at the database level in Administration Services, ESSCMD, or MaxL.

Note: If you are migrating a database, see the Oracle Enterprise Performance Management System Installation and Configuration Guide for information about the default settings after migration.

The following sections list performance settings and describe how to adjust them.

Database Cache Settings

Table 159 describes database cache settings and lists the location of the settings in Administration Services, MaxL, and ESSCMD:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index cache size</td>
<td>“Sizing the Index Cache” on page 825</td>
<td>Administration Services: Database Properties window, Caches tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>alter database appname.dbname set index_cache_size n</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSCMD: SETDBSTATEITEM 12</td>
</tr>
<tr>
<td>Data file cache size</td>
<td>“Sizing the Data File Cache” on page 826</td>
<td>Administration Services: Database Properties window, Caches tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>alter database appname.dbname set data_file_cache_size n</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSCMD: SETDBSTATEITEM 27</td>
</tr>
<tr>
<td>Setting</td>
<td>Topic</td>
<td>Location</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Data cache size</td>
<td>“Sizing the Data Cache” on page 827</td>
<td>- Administration Services: Database Properties window, Caches tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>alter database appname.dbname set data_cache_size n</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSCMD: SETDBSTATEITEM 5</td>
</tr>
<tr>
<td>Index page size</td>
<td>Fixed size</td>
<td>N/A</td>
</tr>
<tr>
<td>Cache memory locking</td>
<td>“Deciding Whether to Use Cache Memory Locking” on page 824</td>
<td>- Administration Services: Database Properties window, Caches tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>alter database appname.dbname enable cache_pinning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSCMD: SETDBSTATEITEM 26</td>
</tr>
</tbody>
</table>

See “Setting Database Properties” in *Oracle Essbase Administration Services Online Help*.

**Database Disk Volumes Settings**

Table 160 describes database disk volume settings and lists the location of the settings in Administration Services, MaxL, and ESSCMD:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume name</td>
<td>“Specifying Disk Volumes” on page 766</td>
<td>- Administration Services: Database Properties window, Storage tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>alter database appname.dbname set disk volume</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSCMD: SETDBSTATEITEM 23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SETDBSTATEITEM 24</td>
</tr>
<tr>
<td>Partition size</td>
<td>“Specifying Disk Volumes” on page 766</td>
<td>- Administration Services: Database Properties window, Storage tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>alter database appname.dbname set disk volume</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSCMD: SETDBSTATEITEM 23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SETDBSTATEITEM 24</td>
</tr>
<tr>
<td>File type</td>
<td>“Specifying Disk Volumes” on page 766</td>
<td>- Administration Services: Database Properties window, Storage tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>alter database appname.dbname set disk volume</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESSCMD: SETDBSTATEITEM 23</td>
</tr>
</tbody>
</table>
### Database Transaction Control Settings

Table 161 describes database transaction control settings and lists the location of the settings in Administration Services, MaxL, and ESSCMD:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
</table>
| Maximum file size                | “Specifying Disk Volumes” on page 766           | • Administration Services: Database Properties window, Storage tab<br>• MaxL:<br>  
  ```sql
  alter database appname.dbname set disk volume
  ```  
  • ESSCMD: SETDBSTATEITEM 23 |

See “Setting Disk Volumes” in Oracle Essbase Administration Services Online Help.

### Table 161  Database Transaction Control Settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
</table>
| Isolation level              | “Understanding Isolation Levels” on page 777 | • Administration Services: Database Properties window, Transactions tab<br>• MaxL:<br>  
  ```sql
  alter database appname.dbname enable committed_mode
  ```  
  • ESSCMD: SETDBSTATEITEM 18 |

| Commit Blocks                | “Understanding Isolation Levels” on page 777   | • Administration Services: Database Properties window, Transactions tab<br>• MaxL:<br>  
  ```sql
  alter database appname.dbname enable committed_mode
  ```  
  and  
  ```sql
  alter database appname.dbname set implicit_commit after n blocks
  ```  
  • ESSCMD: SETDBSTATEITEM 21 |

| Commit Rows                  | “Understanding Isolation Levels” on page 777   | • Administration Services: Database Properties window, Transactions tab<br>• MaxL:<br>  
  ```sql
  alter database appname.dbname enable committed_mode
  ```  
  and  
  ```sql
  alter database appname.dbname set implicit_commit after n rows
  ```  
  • ESSCMD: SETDBSTATEITEM 22 |

| Wait for write access to locked data block | “Understanding Isolation Levels” on page 777 | • Administration Services: Database Properties window, Transactions tab<br>• MaxL:<br>  
  ```sql
  alter database appname.dbname set lock_timeout
  ```  
  • ESSCMD: SETDBSTATEITEM 20 |
<table>
<thead>
<tr>
<th>Setting</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-image access</td>
<td>&quot;Understanding Isolation Levels&quot; on page 777</td>
<td>- Administration Services: Database Properties window, Transactions tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>alter database appname.dbname enable pre_image_access</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ESSCMD: SETDBSTATEITEM 19</td>
</tr>
</tbody>
</table>

See “Setting Data Integrity Options” in Oracle Essbase Administration Services Online Help.

## Miscellaneous Database Settings

Table 162 describes miscellaneous database settings and lists the location of the settings in Administration Services, MaxL, and ESSCMD:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retrieval buffer size</td>
<td>“Setting the Retrieval Buffer Size” on page 889</td>
<td>- Administration Services: Database Properties window, General tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>alter database appname.dbname set retrieve_buffer_size n</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ESSCMD: SETDBSTATEITEM 16</td>
</tr>
<tr>
<td>Retrieval sort buffer size</td>
<td>“Setting the Retrieval Sort Buffer Size” on page 890</td>
<td>- Administration Services: Database Properties window, General tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>alter database appname.dbname set retrieve_sort_buffer_size n</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ESSCMD: SETDBSTATEITEM 17</td>
</tr>
<tr>
<td>Data compression</td>
<td>“Data Compression” on page 770</td>
<td>- Administration Services: Database Properties window, Storage tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>alter database appname.dbname enable compression</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>alter database appname.dbname set compression type</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ESSCMD:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SETDBSTATEITEM 14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SETDBSTATEITEM 15</td>
</tr>
<tr>
<td>Maximum memory for trigger definitions</td>
<td>“Understanding Triggers Definitions” on page 119</td>
<td>MaxL:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>create or replace trigger, alter trigger display trigger, and drop trigger</code></td>
</tr>
</tbody>
</table>

See “Setting Database Properties” in Oracle Essbase Administration Services Online Help.
Fragmentation and its Implications

Subtopics

- Factors Influencing Fragmentation
- Removing Fragmentation

Fragmentation refers to free space within an Essbase database. There are two implications of fragmentation. One is related to performance, and the other is related to size of the data files.

Historically, fragmentation has been perceived as degrading performance. However, with advances in hardware, memory, and disk architectures, the correlation between fragmentation and performance is no longer significant. Furthermore, several enhancements have been made to algorithms within Essbase, making the older statistics pertaining to fragmentation less relevant. Oracle recommends the use of the latest efficient storage systems to store Essbase data files, such as Storage Area Network (SAN) or flash.

The second implication of fragmentation is related to increase in the size of data files. Oracle recommends regular monitoring of the number of blocks and the data file size. If the size of the data files increases even though the number of data blocks remains the same, and available disk space is diminishing, consider taking steps to reduce fragmentation.

Factors Influencing Fragmentation

The following factors may influence fragmentation:

- The database is under intensive update activity, such as heavy data loads and calculations
- The database uses parallel update operations, such as parallel calculation and parallel restructuring
- The NUMBLOCKSTOEXTEND configuration setting is greater than 1 (the default is 2048)
- Data load records are not sorted. Optimize data loads by sorting load records based on sparse dimension members. For a comprehensive discussion of optimizing data load by grouping sparse members, see “Grouping Sparse Member Combinations” on page 852.

Removing Fragmentation

You can remove fragmentation and compact an Essbase database using either of the following methods:

- Perform an export of the database, delete all data in the database with CLEARDATA, and reload the export file. See the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide.
- Run the MaxL statement alter database force restructure.
Enabling Windows 4 GB Tuning (4GT)

Essbase supports Microsoft 4 GB Tuning (4GT). 4GT enables users with extremely large databases to take advantage of a larger address space to improve performance.

Enabling the Windows 4GT feature may benefit users if the Essbase installation has the following characteristics:

- Essbase is configured to use direct I/O. Enabling 4GT on Essbase installations configured for buffered I/O is not recommended.
- The index and data caches are sized correctly, and Essbase performance is consistently improved by increasing the data file cache, but further increases are bounded by the previous 2 GB addressability limitation. For information about setting cache values, see Chapter 54, “Optimizing Essbase Caches.”

For additional information about the Microsoft Windows 4GT feature, see http://www.microsoft.com.

Implementing 64-bit Essbase

Because processes on 64-bit have greatly increased memory addressability over 32-bit processes, the 64-bit edition of Essbase can handle larger outlines and cache sizes than 32-bit Essbase. In computing environments that support it, implementing 64-bit Essbase can improve the performance of existing applications and can sustain much larger applications.

On 64-bit Essbase, you can set cache sizes larger than the existing 32-bit limits. In Essbase clients, the maximum values you can set for the data cache, data file cache, and index cache is 4 GB. You can enable larger values for the data cache and data file cache using the MEMSCALINGFACTOR configuration setting. See the Oracle Essbase Technical Reference.

The maximum thread settings are higher for 64-bit Essbase than for 32-bit Essbase. Table 163 lists the maximum thread settings for each. For information about changing thread settings, see the Oracle Essbase Technical Reference. For information about multi-threading, see “Multithreading” on page 690.

<table>
<thead>
<tr>
<th>Setting</th>
<th>32-bit Maximum</th>
<th>64-bit Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGENTTHREADS</td>
<td>500</td>
<td>1024</td>
</tr>
<tr>
<td>SERVERTHREADS</td>
<td>500</td>
<td>1024</td>
</tr>
<tr>
<td>DLTHREADS_PREPARE</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>DLTHREADS_WRITE</td>
<td>16</td>
<td>32</td>
</tr>
</tbody>
</table>

Default retrieval buffer settings for 64-bit Essbase are higher than for 32-bit Essbase. Table 164 lists the default retrieval buffer settings for each. See “Changing Buffer Size” on page 889.
Table 164  Default Retrieval Buffer Settings for 32-bit and 64-bit Essbase

<table>
<thead>
<tr>
<th>Setting</th>
<th>32-bit Default</th>
<th>64-bit Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retrieval Buffer</td>
<td>10 KB</td>
<td>20 KB</td>
</tr>
<tr>
<td>Retrieval Sort Buffer</td>
<td>10 KB</td>
<td>20 KB</td>
</tr>
</tbody>
</table>

**Note:** Because of internal data structure size changes, 64-bit Essbase requires a larger retrieval sort buffer size than 32-bit Essbase. If you encounter the error, “Sort buffer limit of [x] rows have been exceeded” (where x is the current maximum number of rows allowed for the current buffer size), increase the retrieval sort buffer size by a factor of two.

**Configuring the JVM Heap Size for Essbase Running on Solaris 64-bit**

By default, Essbase sets the JVM heap size to 512 MB when the JVM is initialized. To set a different heap size, specify an ESS_JVM_OPTION environment variable.

**Syntax:**

```plaintext
ESS_JVM_OPTIONn -XX:HeapBaseMinAddress
```

This information applies only to Essbase running on Solaris 64-bit.

**About the CLASSPATH Environment Variable**

For diagnostic and informational purposes, Essbase prints the value of the CLASSPATH environment variable to the Agent console during JVM initialization.

**Finding Additional Optimization Information**

“Using Database Settings to Customize for Maximum Performance” on page 814 provides general-purpose information and does not account for the wide variety of configuration possibilities. For more information about performance and server, application, or other settings, see these chapters:

- For information on optimizing performance for a particular function, see these chapters:
  - Chapter 56, “Optimizing Data Loads”
  - Chapter 57, “Optimizing Calculations”
  - Chapter 26, “Understanding Intelligent Calculation”
  - Chapter 58, “Optimizing Reports and Other Types of Retrieval”
- For information on the Essbase Kernel, see the following chapters:
- Chapter 48, “Managing Database Settings”
- Chapter 49, “Allocating Storage and Compressing Data”
- Chapter 50, “Ensuring Data Integrity”
- Chapter 54, “Optimizing Essbase Caches”
- Appendix D, “Estimating Disk and Memory Requirements”
Optimizing Essbase Caches

In This Chapter

Understanding Essbase Caches ................................................................. 823
Deciding Whether to Use Cache Memory Locking ........................................ 824
Sizing Caches ...................................................................................... 824
Fine-Tuning Cache Settings ..................................................................... 836

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases. Also see Chapter 60, “Comparison of Aggregate and Block Storage.”

Understanding Essbase Caches

Essbase uses five memory caches to coordinate memory usage:

<table>
<thead>
<tr>
<th>Cache</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index cache</td>
<td>A buffer in memory that holds index pages. How many index pages are in memory simultaneously depends upon the amount of memory allocated to the cache.</td>
</tr>
<tr>
<td>Data file cache</td>
<td>A buffer in memory that holds compressed data files (.pag files). Essbase allocates memory to the data file cache during data load, calculation, and retrieval operations, as needed. The data file cache is used only when direct I/O is in effect.</td>
</tr>
<tr>
<td>Data cache</td>
<td>A buffer in memory that holds uncompressed data blocks. Essbase allocates memory to the data cache during data load, calculation, and retrieval operations, as needed.</td>
</tr>
<tr>
<td>Calculator cache</td>
<td>A buffer in memory that Essbase uses to create and track data blocks during calculation operations.</td>
</tr>
<tr>
<td>Dynamic calculator cache</td>
<td>A buffer in memory that Essbase uses to store all of the blocks needed for a calculation of a Dynamic Calc member in a dense dimension (for example, for a query).</td>
</tr>
</tbody>
</table>

Essbase provides default size settings for each cache; you can adjust the sizes as needed for each database. Appropriate cache size is affected by many factors, including database size, block size, index size, and available server memory. Cache size settings can significantly affect database and general server performance.

The following topics provide information about sizing caches for performance.
Deciding Whether to Use Cache Memory Locking

Before setting cache sizes, you must enable cache memory locking or leave cache memory locking disabled (the default).

The setting for cache memory locking controls whether the memory used for the index cache, data file cache, and data cache are locked into physical memory, giving the Essbase kernel priority use of system RAM.

To use cache memory locking, you must be using direct I/O (buffered I/O is the default I/O access mode), and direct I/O requires a larger index cache size than buffered I/O. See Chapter 48, “Managing Database Settings.”

Locking improves performance for an Essbase database because the system memory manager need not swap the memory used by the caches when swapping the memory used by Essbase Server. By default, cache memory locking is turned off.

Enabling cache memory locking gives the Essbase Kernel priority use of system RAM. If you enable cache memory locking, leave at least one-third of the system RAM available for non-Essbase Kernel use. If you do not want to give the Essbase Kernel priority usage of system RAM, do not enable cache memory locking.

If you are running Essbase on Solaris, run the Bourne shell script, root.sh, before starting Essbase and enabling cache memory locking. This script sets the server to run in Superuser mode so that it can lock memory. See the Oracle Enterprise Performance Management System Installation and Configuration Guide.

To enable cache memory locking, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Enabling Cache Memory Locking</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database enable cache_pinning</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM 26</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Sizing Caches

The settings that you should use for each of the caches that you can configure depend on data distribution and the dense/sparse configuration of the database. The maximum combined total size of the caches should equal the amount of available memory after the memory required by Essbase is taken into account.

The needs for each site, even for a particular database, can vary. Depending on the complexity and type of each operation, Essbase allocates as much memory for the data file cache and the data cache as needed. Use the recommended values in this section to estimate enough memory for optimal performance.
If you are using Essbase for the first time, cache sizes are set automatically to the default values discussed in the following sections. Use these topics to find and understand recommendations for each cache size.

**Note:** Changes made to cache sizes take effect the next time you start the database.

### Sizing the Index Cache

The index is stored in index files on disk. When a database is active, the most recently accessed index pages are held in the index cache. How much of the index can be held in memory simultaneously depends on the amount of memory that you allocate to the index cache.

**Note:** The size of index pages is fixed at 8 K to reduce input-output overhead, as well as to simplify database migration.

The effectiveness of the index cache size depends on the nature of the calculation. For example, if you were reloading and recalculating an entire database (such as a database that is refreshed each month), a high index cache size is not helpful, because Essbase is creating blocks rather than searching the index cache for existing blocks during calculation.

**Table 166** shows default and recommended settings for the index cache:

**Table 166  Index Cache Size Settings**

<table>
<thead>
<tr>
<th>Minimum Value</th>
<th>Maximum Values</th>
<th>Default Values</th>
<th>Recommended Value</th>
</tr>
</thead>
</table>
| 1 MB (1,048,576 bytes) | 32-bit Essbase: 4 GB  
64-bit Essbase: 256 TB | Buffered I/O: 1 MB (1,048,576 bytes) 
Direct I/O: 10 MB | Combined size of all `essn.ind` files, if possible; otherwise, as large as possible. Do not set this cache size higher than the total index size, because no performance improvement results. To determine the total index size, see “Index Files” on page 1062. |

For information about changing the I/O access mode for a database, or about changing the default for all newly created databases, see “Understanding Buffered I/O and Direct I/O” on page 756.

In general, if you are using direct I/O, make the index cache as large as system resources allow.

If you are using buffered I/O, make the index cache as small as possible.

For information on testing and fine-tuning cache settings, see “Fine-Tuning Cache Settings” on page 836.
Changing the Index Cache Size

To set the size of the index cache, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Cache Sizes</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database set index_cache_size</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM 12 SETDBSTATE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Sizing the Data File Cache

The data file cache holds data files (.pag files) in memory if you are using direct I/O. If you are not using direct I/O, the data file cache is not used. How much of the data within data files can fit into memory simultaneously depends on the amount of memory you allocate to the data file cache.

In general, if you must choose whether to allocate memory to the data cache or to the data file cache, choose the data file cache if you are using direct I/O.

Table 167 shows default and recommended settings for the data file cache:

<table>
<thead>
<tr>
<th>Minimum Value</th>
<th>Default Value</th>
<th>Recommended Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct I/O: 10,240 KB (10,485,760 bytes)</td>
<td>Direct I/O: 32,768 KB (33,554,432 bytes)</td>
<td>Combined size of all essn.pag files, if possible; otherwise, as large as possible. This cache setting not used if Essbase is set to use buffered I/O.</td>
</tr>
</tbody>
</table>

In general, if you are using direct I/O, make the data file cache as large as system resources allow. If you are using buffered I/O, the data file cache is not used.

For information on testing and fine-tuning cache settings, see “Fine-Tuning Cache Settings” on page 836.

Changing the Data File Cache Size

To set the size of the data file cache, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Cache Sizes</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database set data_file_cache_size</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Sizing the Data Cache

Data blocks reside on physical disk and in memory. The number of blocks that can be held in the data cache simultaneously depends on how much memory you allocate to the data cache.

When a block is requested, Essbase searches the data cache for the block. If Essbase finds the block in the cache, it is accessed immediately. If the block is not found in the cache, Essbase searches the index for the appropriate block number and then uses the index entry of the block to retrieve it from the appropriate data file on disk. Retrieving a requested block from the data cache is faster and therefore improves performance.

In general, if you must choose whether to allocate memory to the data cache or to the data file cache, choose the data file cache if you are using direct I/O.

Table 168 shows default and recommended settings for the data cache:

<table>
<thead>
<tr>
<th>Minimum Value</th>
<th>Default Value</th>
<th>Recommended Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3072 KB</td>
<td>3072 KB (3,145,728 bytes)</td>
<td>0.125 * the value of data file cache size. Increase value if any of these conditions exist:</td>
</tr>
<tr>
<td>(3145728 bytes)</td>
<td></td>
<td>● Many concurrent users are accessing different data blocks.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Calculation scripts contain functions on sparse ranges, and the functions require all members of a range to be in memory (for example, when using @RANK and @RANGE).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● For data load, the number of threads specified by the DLTHREADSWRITE setting is high and the expanded block size is large.</td>
</tr>
</tbody>
</table>

In certain cases, you might need to increase the data cache when running concurrent calculations; for example, when concurrent calculations do not share any common blocks and the sparse member with the largest number of children has all its children blocks populated in the database.

To calculate the data cache for concurrent calculations, use the following formula:

\[(\text{Size of big block in bytes}) \times \max(\text{Number of children for a Sparse member}) \times \left(\text{Number of concurrent batch calc processes}\right) \times 2\]

If other concurrent operations (such as data loads and queries) take place when running concurrent calculations, increase the data cache even more to accommodate these requests.

Make the data cache as small as possible whether you are using buffered I/O or direct I/O.

For information on testing and fine-tuning cache settings, see “Fine-Tuning Cache Settings” on page 836.

Note: When running Essbase on 64-bit platforms, optimal data cache and data file cache settings may be larger than 4 GB. Although you cannot specify settings larger than 4 GB in Essbase clients, you can enable larger settings using the MEMSCALINGFACTOR configuration setting. See the Oracle Essbase Technical Reference.
Changing the Data Cache Size

To set the size of the data cache, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting Cache Sizes</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database set data_cache_size</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM 5</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>SETDBSTATE</td>
<td></td>
</tr>
</tbody>
</table>

Sizing the Calculator Cache

Essbase can create a bitmap, whose size is controlled by the size of the calculator cache, to record and track data blocks during a calculation. Determining which blocks exist using the bitmap is faster than accessing the disk to obtain the information, particularly if calculating a database for the first time or calculating a database when the data is sparse.

Essbase uses the calculator cache bitmap if the database has at least two sparse dimensions and either of these conditions is also met:

- You calculate at least one full sparse dimension.
- You specify the SET CACHE ALL command in a calculation script.

The best size for the calculator cache depends on the number and density of the sparse dimensions in your outline. Use the following topics to understand the calculator cache bitmap, size the calculator cache, and change the size of the calculator cache (and therefore the largest possible size for the bitmap), if required:

Understanding the Calculator Cache Bitmap

For the calculator cache, Essbase separates sparse dimensions in the database into two groups:

- Bitmap dimensions: The sparse dimensions from the database outline that Essbase fits into the bitmap until the bitmap is full. Each member combination of the sparse dimensions placed in the bitmap occupies 1 bit of memory, and there must be enough space in the bitmap for every member combination of a sparse dimension for it to be placed in the bitmap.
- Anchoring dimensions: The remaining one or more sparse dimensions in the database outline that do not fit into the bitmap.

Essbase starts with the first sparse dimension in the database outline and fits as many sparse dimensions as possible into the bitmap. The dimensions that fit are the bitmap dimensions. Essbase stops the process when it cannot fit another complete sparse dimension into the bitmap. Because the calculator cache controls the size of the bitmap, the number of sparse dimensions...
that can fit in the bitmap depends on the size of the calculator cache (and the number and size of the sparse dimensions).

The remaining sparse dimensions are the anchoring dimensions. For anchoring dimensions, Essbase cannot use the bitmap to determine whether blocks exist.

To see which dimensions are anchoring dimensions and which are bitmap dimensions, use the SET MSG DETAIL calculation command to display bitmap information in the application log.

Carefully order the sparse dimensions in your outline so that as many dimensions as possible can be placed into the bitmap. Start with the dimension that contains the fewest members and continue until the dimension with the most members is last. This order allows more dimensions to fit into the bitmap and results in improved calculation performance.

**Note:** The order of sparse dimensions in the outline also affects query performance. See “Optimizing Query Performance” on page 93.

Essbase uses a single bitmap if there are multiple anchoring dimensions or if the calculator cache is not large enough to support multiple bitmaps, and uses multiple bitmaps if there is one anchoring dimension.

A single bitmap has these properties:
- A single bitmap is used to track child blocks.
- A single bitmap uses the least memory but is less efficient than multiple bitmaps.

Multiple bitmaps have these properties:
- Multiple bitmaps are used, one to track child blocks and one to track parent blocks.
- Multiple bitmaps use more memory but are faster than using a single bitmap. The performance improvement is particularly high when you are calculating the database for the first time.
- The number of bitmaps used is determined by the maximum number of dependent parents for any members in the anchoring dimension. A member has one dependent parent, unless it has a shared member. For example, consider the Product dimension of the Sample.Basic database. The member Cola (100-10) has one parent, Colas (100). However, Diet Cola (100-20) has two parents, Diet Drinks (Diet) and Colas (100). No members of Product have more than two dependent parents. Therefore, if Product is the anchoring dimension, the maximum dependent parents is two.

Essbase chooses one of three options, as shown in **Table 169**, for the calculation:

<table>
<thead>
<tr>
<th>Option</th>
<th>Method</th>
<th>Performance Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Single anchoring dimension, multiple bitmaps</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Single anchoring dimension, single bitmap</td>
<td>2</td>
</tr>
</tbody>
</table>
Option | Method | Performance Rating
--- | --- | ---
3 | Multiple anchoring dimensions, single bitmap | 3

Essbase chooses the optimal performance method for a database calculation, based on the size of the calculator cache. If the calculator cache size is too small for any of the above options, Essbase does not use a calculator cache. Calculation performance may be significantly impaired.

Enabling parallel calculation may change which calculator cache option is used. See "Relationship Between CALCPARALLEL Parallel Calculation and Other Essbase Features" on page 503.

**Caution!** If you are calculating the database for the first time, the size of the calculator cache is particularly significant for calculation performance. If possible, ensure that the calculator cache is large enough for Essbase to use the optimal calculator cache option.

### Calculating the Calculator Cache Size

The optimum size of the calculator cache depends on the memory that the system has available and on the nature and configuration of the database.

Using the following formula, you can calculate the calculator cache size required for Essbase to choose each of the three options in Table 169 on page 829:

\[
\text{Calculator cache} = \text{Bitmap size in bytes} \times \text{Number of bitmaps}
\]

where

\[
\text{Bitmap size in bytes} = \max\left(\left(\frac{\text{member combinations on the bitmap dimensions}}{8}\right), 4\right)
\]

and where

\[
\text{Number of bitmaps} = \max(\text{Maximum number of dependent parents in the anchoring dimension} + 2, \text{constant bitmaps})
\]

**Note:** The minimum bitmap size is 4 bytes. If \((\text{member combinations on the bitmap dimensions}/8)\) is less than 4 bytes, Essbase uses a bitmap size of 4 bytes.

Consider a sample database with five sparse dimensions (S1 to S5), as shown in Table 170:

<table>
<thead>
<tr>
<th>Sparse Dimension</th>
<th>Number of Members</th>
<th>Dependent Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>20</td>
<td>Not applicable</td>
</tr>
<tr>
<td>S2</td>
<td>20</td>
<td>Not applicable</td>
</tr>
<tr>
<td>S3</td>
<td>50</td>
<td>Not applicable</td>
</tr>
<tr>
<td>S4</td>
<td>50</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
Use this sample database for the following sample calculations:

- “Option 1: Single Anchoring Dimension, Multiple Bitmaps” on page 831
- “Option 2: Single Anchoring Dimension, Single Bitmap” on page 831
- “Option 3: Multiple Anchoring Dimensions, Single Bitmap” on page 832

### Option 1: Single Anchoring Dimension, Multiple Bitmaps

For this sample calculation, assume the following facts about a database (from Table 169 on page 829):

- Bitmap dimensions: S1, S2, S3, S4
- Anchoring dimension: S5
- Dependent parents in anchoring dimension: 3

Perform this calculation:

\[
\text{Bitmap size in bytes} = \frac{S1 \times S2 \times S3 \times S4}{8} = \frac{20 \times 20 \times 50 \times 50}{8} = 125,000 \text{ bytes}
\]

\[\text{Number of bitmaps} = \text{Maximum number of dependent parents in the anchoring dimension} = +\]
\[= 2 \text{ constant bitmaps} + 3 = 5\]

\[\text{Calculator cache} = \text{Bitmap size} \times \text{Number of bitmaps} = 125,000 \times 5 = 625,000 \text{ bytes}\]

For Essbase to use multiple bitmaps for this database with one anchoring dimension, the calculator cache must be 625,000 bytes.

### Option 2: Single Anchoring Dimension, Single Bitmap

For this sample calculation, assume the following facts about a database (from Table 169 on page 829):

- Bitmap dimensions: S1, S2, S3, S4
- Anchoring dimension: S5
- Dependent parents in anchoring dimension: Not applicable

Perform this calculation:

\[
\text{Bitmap size in bytes} = \frac{S1 \times S2 \times S3 \times S4}{8} = \frac{20 \times 20 \times 50 \times 50}{8}
\]
Number of bitmaps = Single bitmap
= 1

Calculator cache = Bitmap size * Number of bitmaps
= 125,000 * 1
= 125,000 bytes

For Essbase to use a single bitmap for this database with one anchoring dimension, the calculator cache must be 125,000 bytes.

**Option 3: Multiple Anchoring Dimensions, Single Bitmap**

For this sample calculation, assume the following facts about a database (from Table 169 on page 829):

- Bitmap dimensions: S1, S2, S3
- Anchoring dimensions: S4, S5
- Dependent parents in anchoring dimensions: Not applicable

Perform this calculation:

\[
\text{Bitmap size in bytes} = \frac{S1 \times S2 \times S3}{8} \\
= \frac{20 \times 20 \times 50}{8} \\
= 2,500 \text{ bytes}
\]

Number of bitmaps = Single bitmap
= 1

Calculator cache = Bitmap size * Number of bitmaps
= 2,500 * 1
= 2,500 bytes

For Essbase to use a single bitmap for this database with multiple anchoring dimensions, the calculator cache must be 2,500 bytes.

**Choosing a Calculator Cache Size for a Database**

Table 171 shows which calculator cache option Essbase uses, depending on the calculator cache size specified:

<table>
<thead>
<tr>
<th>Minimum Size Specified</th>
<th>Option Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>625,000 bytes</td>
<td>Option 1 (provides optimal performance)</td>
</tr>
<tr>
<td>125,000 bytes</td>
<td>Option 2</td>
</tr>
</tbody>
</table>
If you specify a calculator cache size of less than 2,500 bytes, Essbase does not use a calculator cache during the calculation. Calculation performance may be significantly impaired.

You can check which calculator cache option Essbase is able to use on a database by using the SET MSG SUMMARY command in a calculation script. Run the following calculation script on the empty database:

```
SET MSG SUMMARY;
CALC ALL;
```

Essbase displays the calculator cache setting in the ESSCMD window or in the application log. See “SET MSG SUMMARY and SET MSG DETAIL” on page 862.

The maximum calculator cache size that you can specify is 200,000,000 bytes. The default is 200,000 bytes. The calculator cache size that you choose depends on available memory and the configuration of the database.

**Note:** The sizes of the calculator, index, data file, and data caches usually have a greater effect on performance if the database calculation is based more on aggregations and less on formula calculations.

### Sizing the Calculator Cache to Calculate the Database for the First Time

If you are calculating the database for the first time, the size of the calculator cache is particularly significant. If possible, ensure that the calculator cache is large enough for Essbase to use the optimal calculator cache option. See “Calculating the Calculator Cache Size” on page 830.

### Changing the Calculator Cache with Calculation Scripts

You can use the default calculator cache size, or you can set the size of the calculator cache within a calculation script. If you set the size from a calculation script, the setting is used only for the duration of the calculation script. See the calculation script SET CACHE command and CALCCACHE configuration setting in the *Oracle Essbase Technical Reference*.

### Sizing Dynamic Calculator Caches

Essbase uses a separate dynamic calculator cache for each open database. The DYNCALCCACHEMAXSIZE setting in the essbase.cfg file specifies the maximum size of each dynamic calculator cache on the server. By default, the size is set to 20 MB. Essbase allocates area in a dynamic calculator cache for data blocks until the maximum memory area specified by the DYNCALCCACHEMAXSIZE setting is allocated. For the maximum limit, see the *Oracle Essbase Technical Reference*. Also see “Changing the Dynamic Calculator Cache Size” on page 834.
Reviewing Dynamic Calculator Cache Usage

For each database, Essbase writes two messages to the application log for each data retrieval:

[Thu Oct 17 11:37:17 2007] Local/Sample///Info(1007125)
The number of Dynamic Calc Non-Store Members = [7 6 0 0 2 ]

[Thu Oct 17 11:37:17 2007] Local/Sample///Info(1007126)
The number of Dynamic Calc Store Members = [0 0 0 0 0 ]

The first message describes the total time required for the retrieval. If a dynamic calculator cache is used, the second message displays the number of blocks calculated within the data calculator cache (DCC = n) and the number of blocks calculated in general memory (non-DCC = n).

Changing the Dynamic Calculator Cache Size

There are five configuration settings that are relevant to dynamic calculator caches. The optimum values for these dynamic calculator cache settings depend on the memory on the server machine, the configuration of all databases on the server machine, and the nature of user queries.

The following description of each configuration setting includes recommendations for how to determine values for your system. To match your site’s unique requirements, you may need to test and adjust the settings.

- **DYNCALCCACHEMAXSIZE**: This setting specifies the maximum size Essbase can allocate to each dynamic calculator cache on the server.

  Recommended setting value = C * S * U.

  - C is the value of the appropriate CALCLOCKBLOCK setting in the essbase.cfg file. (The SET LOCKBLOCK command specifies which CALCLOCKBLOCK setting to use.)
  - S is the size of the largest expanded block across all databases on the machine. To calculate the expanded block size, multiply the number of members (including Dynamic Calc members and dynamic time series members) in each dense dimension together for the number of cells in the block, and multiply the number of cells by the size of each member cell, 8 bytes.

  For example, consider the member count in dense dimensions in Sample.Basic (Label Only members are not counted):

  - 19 (Year, with 12 stored members and 7 Dynamic Calc members, including HTD and QTD)
  - 14 (Measures, with 8 stored members and 6 Dynamic Calc members)
  - 4 (Scenario, with 2 stored members and 2 Dynamic Calc members)

  \[ S = 19 \times 14 \times 4 \text{ cells} \times 8 \text{ bytes} / \text{cell} = 8512 \text{ bytes per block} \]

  This number is shown in the application log as the logical block size.

  - U is the maximum number of expected concurrent users on the database that has the largest number of concurrent users.
Assigning the value 0 (zero) to `DYNCALCACHEMAXSIZE` tells Essbase not to use dynamic calculator caches.

By default, the size for this value is 20 MB (20,971,520 bytes). For the maximum limit, see the Oracle Essbase Technical Reference.

- `DYNCALCACHEWAITFORBLK`: If Essbase uses all of the area allocated for a dynamic calculator cache, this setting tells Essbase whether to wait until space becomes available in the cache or to immediately write and calculate the blocks in memory outside the dynamic calculator cache. If the dynamic calculator cache is too small, it is possible for multiple threads to be in queue, each thread waiting to calculate its data blocks.

  Recommended setting value = FALSE (default value).

  Before setting to TRUE, try these alternatives:
  - Add physical memory to the server machine
  - Increase the value of `DYNCALCACHEMAXSIZE`, test, and repeat until you verify that you cannot use any more memory for the dynamic calculator cache.

- `DYNCALCACHEBLKTIMEOUT`: If Essbase is to wait for available space in the dynamic calculator cache, this setting defines how long it waits.

  Recommended setting value = WT / B.

  - WT is the maximum tolerable wait time for a query; for example, 5 seconds.
  - B is the total number of logical blocks accessed in the largest query.

  To determine the value of B, check the messages in the application log for the largest number of Dyn.Calc.Cache “Big Block Allocs” for a query, as discussed in “Reviewing Dynamic Calculator Cache Usage” on page 440.

- `DYNCALCACHEBLKRELEASE`: If Essbase has waited the specified time and space still is not available in the dynamic calculator cache, this setting tells Essbase whether to write and calculate the blocks immediately outside the dynamic calculator cache or to create space in the dynamic calculator cache by swapping out blocks and temporarily compressing the swapped blocks in a dynamic calculator cache compressed-block buffer.

  Recommended setting value = FALSE (default value).

  Set to TRUE only if you are experiencing severe memory shortage problems.

- `DYNCALCACHECOMPRBLKBUFSIZE`: If Essbase has waited the specified wait time and the `DYNCALCACHEBLKRELEASE` setting is TRUE, this setting is the size of the dynamic calculator cache compressed-block buffer.

  Recommended setting value = \( \frac{C \times S}{2} \).

  - C is the value of the current CALCLOCKBLOCK setting in the `essbase.cfg` file. The SET LOCKBLOCK command specifies which CALCLOCKBLOCK configuration setting is current.
  - S is the size of the largest expanded block across all databases on the machine. Calculate S as described for the `DYNCALCACHEMAXSIZE` setting.
Fine-Tuning Cache Settings

After using a database at your site with typical data, user access, and standard environment (including servers, network, etc.), observe how Essbase performs. It is difficult to predict optimal cache sizes without testing. You may need to adjust your cache settings.

Understanding Cache Settings

The sizes of the index cache and the data file cache (when direct I/O is used) are the most critical Essbase cache settings. In general, the larger these caches, the less swapping activity occurs; however, setting larger cache sizes does not always improve performance. Read this entire section to understand cache size considerations.

Index Cache

The advantages of a large index cache plateau at some point. When the index cache size equals or exceeds the index size (including all index files on all volumes), performance does not improve. However, to account for future growth of the index, you can set the index cache size larger than the current index size. Because the index cache is filled with index pages, for optimum use of storage, set the size of the index cache to be a multiple of the size of the index page (8 KB). See “Index Files” on page 1062 for an example of estimating index size.

Data File Cache

If possible, set the data file cache to equal the size of the stored data, which is the combined size of all ess*.pag files. Otherwise, the data file cache should be as large as possible. If you want to account for future growth of stored data, you can set the data file cache size larger than the current size of stored data.

Note:  The data file cache is used only if you are using direct I/O.

Data Cache

The data cache should be about 0.125 times the data file cache. However, certain calculations require a larger data cache size. If many concurrent users are accessing different data blocks, this cache should be larger.
In general, if you must choose between allocating memory to the data file cache or allocating it to the data cache, choose the data file cache if you are using direct I/O. If upgrading from a previous version of Essbase, see the *Oracle Enterprise Performance Management System Installation and Configuration Guide* Enabling Windows 4 GB Tuning (4GT).

### Checking Cache Hit Ratios

Every cache has a “hit ratio”: the percentage of time that a requested piece of information is available in it. You can check the hit ratio of the index cache, the data cache, and the data file cache to determine whether to increase the cache size.

- **To check cache hit ratios:**
  
  See “Checking Cache Hit Ratios” in *Oracle Essbase Administration Services Online Help*.

- The cache hit ratio indicates the percentage of time that a requested piece of information is already in the cache. A higher hit ratio indicates that the data is in the cache more often. This improves performance, because the requested data need not be retrieved from disk for the next process. A hit ratio of 1.0 indicates that every time data is requested, it is found in the cache. This is the maximum performance possible from a cache setting.

- The Hit Ratio on Index Cache setting indicates the Essbase kernel success rate in locating index information in the index cache without having to retrieve another index page from disk.

- The Hit Ratio on Data File Cache setting indicates the Essbase kernel success rate in locating data file pages in the data file cache without having to retrieve the data file from disk.

- The Hit Ratio on Data Cache setting indicates the Essbase success rate in locating data blocks in the data cache without having to retrieve the block from the data file cache.

- Check memory allocation. Add smaller amounts of memory at a time, if needed, because a smaller increment may have the same benefit as a large one. Large, incremental allocations of memory usually result in very little gain in the hit ratio.

### Checking Performance

You can check cache statistics for a database by using the `query database` MaxL statement with the `performance statistics` grammar. See Chapter 52, “Monitoring Performance.”

### Running Test Calculations

Because calculations are the most processor-intensive operations on a Essbase database, you should run test calculations and examine how various cache sizes affect memory use on Essbase Server.
In This Chapter

- Database Restructuring ................................................................. 839
- Optimization of Restructure Operations ..................................... 843
- Actions That Improve Performance ........................................... 843
- Outline Change Quick Reference ............................................... 846

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:
- Chapter 60, “Comparison of Aggregate and Block Storage”
- “Designing an Outline to Optimize Performance” on page 93
- “Positioning Dimensions and Members” on page 130
- “Using Alternative Design Approaches” on page 171
- “Optimizing Outline Performance” on page 172
- “Optimizing Calculation and Retrieval Performance” on page 180

Database Restructuring

As your business changes, you change the Essbase database outline to capture new product lines, provide information on new scenarios, reflect new time periods, and so on. Some changes to a database outline affect the data storage arrangement, forcing Essbase to restructure the database.

Because changes that require restructuring the database are time-consuming (unless you discard the data before restructuring), consider deciding on such changes based on how they affect performance. This section provides the information necessary to understand how restructuring affects performance and describes tasks you can perform related to database restructuring:

**Note:** For information about clearing data and thus avoiding some restructuring, see CLEARDATA and CLEARBLOCK in the *Oracle Essbase Technical Reference* or Clearing Data in the *Oracle Essbase Administration Services Online Help*. 
Types of Database Restructuring

Subtopics
- Implicit Restructures
- Explicit Restructures

This section describes the ways that a database restructure is triggered.

Implicit Restructures

Essbase initiates an implicit restructure of the database files after an outline is changed using Outline Editor or Dimension Build. The type of restructure that is performed depends on the type of changes made to the outline:

- **Dense restructure**: If a member of a dense dimension is moved, deleted, or added, Essbase restructures the blocks in the data files and creates new data files. When Essbase restructures the data blocks, it regenerates the index automatically so that index entries point to the new data blocks. Empty blocks are not removed. Essbase marks all restructured blocks as dirty, so after a dense restructure you must recalculate the database. Dense restructuring, the most time-consuming of the restructures, can take a long time to complete for large databases.

- **Sparse restructure**: If a member of a sparse dimension is moved, deleted, or added, Essbase restructures the index and creates new index files. Restructuring the index is relatively fast; the time required depends on the index size.

- **Outline-only restructure**: If a change affects only the database outline, Essbase does not restructure the index or data files. Member name changes, creation of aliases, and dynamic calculation formula changes are examples of changes that affect only the database outline.

If you use incremental restructuring, Essbase defers dense restructuring. If you change a database outline frequently, consider enabling incremental restructuring. See “Incremental Restructuring and Performance” on page 844 for a comprehensive discussion of incremental restructuring.

**Note:** How a database outline is changed (by using Outline Editor or using dimension build) does not influence restructuring. Only the type of information change influences what type of restructuring, if any, takes place. For information about outline changes and the type of restructures they cause, see “Outline Change Quick Reference” on page 846.

Explicit Restructures

When you manually initiate a database restructure, you perform an explicit restructure. An explicit restructure forces a full restructure of the database. A full restructure comprises a dense restructure plus removal of empty blocks.
To initiate an full restructure, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Restructuring Databases Manually</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

## Conditions Affecting Database Restructuring

Intelligent Calculation, name changes, and formula changes affect database restructuring:

- If you use Intelligent Calculation in the database, all restructured blocks are marked as dirty whenever data blocks are restructured. Marking the blocks as dirty forces the next default Intelligent Calculation to be a full calculation.
- If you change a name or a formula, Essbase does not mark the affected blocks as dirty. Therefore, you must use a method other than full calculation to recalculate the member or the database.

Use Table 172 for information about restructuring:

**Table 172  Topics Related To Database Restructuring**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Related Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligent Calculation</td>
<td>“Restructuring Databases” on page 426</td>
</tr>
</tbody>
</table>
| Sparse and dense dimensions   | • “Sparse and Dense Dimensions” on page 64, “Selection of Dense and Sparse Dimensions” on page 65  
|                               | • “Dense and Sparse Selection Scenarios” on page 67       |
| Attribute dimensions          | “Designing Attribute Dimensions” on page 171              |
| Dimension building            | Chapter 17, “Understanding Data Loading and Dimension Building” |
| Outline Editor                | Chapter 7, “Creating and Changing Database Outlines”     |

## Temporary Files Used During Restructuring

When Essbase restructures both the data blocks and the index, it uses the files described in Table 173:

**Table 173  Files Used During Database Restructuring**

<table>
<thead>
<tr>
<th>File</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>essxxxxx.pag</td>
<td>Essbase data file</td>
</tr>
<tr>
<td>essxxxxx.ind</td>
<td>Essbase index file</td>
</tr>
</tbody>
</table>
### File Description

<table>
<thead>
<tr>
<th>File</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dbname.esm</td>
<td>Essbase kernel file that contains control information used for database recovery</td>
</tr>
<tr>
<td>dbname.tct</td>
<td>Transaction control table</td>
</tr>
<tr>
<td>dbname.ind</td>
<td>Free fragment file for data and index free fragments</td>
</tr>
<tr>
<td>dbname.ctl</td>
<td>Outline file in which is defined all metadata for a database and how data is stored.</td>
</tr>
</tbody>
</table>

### Restructuring Requires a Temporary Increase in the Index Cache Size

Restructuring an Essbase database results in a temporary increase (double at most) of the index cache size. When the restructure is completed, the index cache size returns to the size before the restructure was performed.

### Dense Restructures

- To perform a dense restructure, Essbase does the following:
  1. **Creates temporary files that are copies of the following files**:
     - essxxxxx.ind
     - essxxxxx.pag
     - dbname.otl
     - dbname.esm
     - dbname.tct

     Each temporary file substitutes either n or u for the last character of the file extension. Temporary file names are:
     - essxxxxx.inn
     - essxxxxx.pan
     - dbname.otn
     - dbname.esn
     - dbname.tcu

     2. Reads the blocks from the database files copied in step 1, restructures the blocks in memory, and stores them in the new temporary files. This step takes the most time.

     3. Removes the database files that were copied in step 1

     4. Renames the temporary files created in step 1 to the correct file names.

### Sparse Restructures

When Essbase does a sparse restructure (restructures only the index), it uses the following files:

- essxxxxx.ind
- dbname.otl
To perform a sparse restructure, Essbase does the following:

1. Renames the `dbname.esm` file to `dbname.esr`.
2. Renames the `essxxxxx.ind` files to `essxxxxx.inm`.
3. Creates index files (`essxxxxx.ind`) to store index information that is changed by the restructuring operation.
4. Removes `dbname.esr` and `essxxxxx.inm` created in step 1.

**Optimization of Restructure Operations**

If a database outline changes frequently, analyze the outline and the types of changes that you are making. Changes to sparse dimensions or attribute dimensions are relatively fast, because only the index changes. Changes to dense dimensions are relatively slow, because data blocks are rebuilt.

These types of restructure operations are listed from fastest to slowest:
- Outline only (no index or data files)
- Sparse (only index files)
- Dense (index files and data files) as a result of adding, deleting, or moving members and other operations. See “Outline Change Quick Reference” on page 846
- Dense (index and data files) as a result of changing a dense dimension to sparse or changing a sparse dimension to dense

**Actions That Improve Performance**

**Subtopics**
- Incremental Restructuring and Performance
- Parallel Restructuring
- Options for Saving a Modified Outline
- Outline Change Log
- Essbase Partitioning Option

Several actions improve performance related to database restructuring:
- If you change a dimension frequently, make it sparse.
- Use incremental restructuring to control when Essbase performs a required database restructuring.
- Consider using parallel restructuring on multiprocessor systems.
- Select options when you save a modified outline that reduce the amount of restructuring required.
**Note:** Setting the isolation level to committed access may increase memory and time requirements for database restructure. Consider setting the isolation level to uncommitted access before a database restructure. For information on isolation level settings, see Chapter 50, “Ensuring Data Integrity.”

**Incremental Restructuring and Performance**

If you make frequent changes to a database outline, consider enabling incremental restructuring. With it enabled, Essbase defers restructuring so that a change to the database outline or to a dimension does not cause structural change. Essbase restructures the index and, if necessary, the affected block the next time the block is accessed.

**Understanding Incremental Restructuring**

When incremental restructuring is enabled, the changes to index files (\texttt{essxxxxx.ind}) and data files (\texttt{essxxxxx.pag}) are deferred until they must subsequently be accessed for certain outline operations. In a database with a large amount of data, this deferral can result in significant time savings. For a list of outline operations for which Essbase can apply incremental restructuring, see “Outline Change Quick Reference” on page 846.

The following changes override incremental restructuring; that is, they result in immediate restructuring, even if incremental restructuring is enabled:

- Adding or deleting a nonattribute dimension.
- Deleting a stored member of a sparse dimension.
- Changing a dimension definition from sparse to dense or from dense to sparse.
- If you are using LROs in a database, incremental restructuring is automatically disabled on that database. Disabling incremental restructuring does not affect other databases on the server.
- Certain member additions and certain changes to sparse dimensions can also trigger immediate restructuring. See “Outline Change Quick Reference” on page 846.

Whether or not incremental restructuring is enabled, if an outline has already been incrementally restructured (a dense restructure is pending), adding shared members causes Essbase to perform a dense restructure.

**Note:** Recalculate the database after any type of restructure operation.

**Using Incremental Restructuring**

You can enable incremental restructuring for any of the following databases:

- One database in an application
- All databases in an application
- All databases in all applications
To enable incremental restructuring, use the INCRESTRUC configuration setting in the essbase.cfg file. See the Oracle Essbase Technical Reference.

Essbase logs outline changes in an internal file, dbname.ocl. Essbase clears the file when it does a dense restructure or when you clear or reset the database. The file dbname.ocl can grow quite large. To clear this file, issue VALIDATE in ESSCMD, which causes Essbase to restructure any blocks whose restructure was deferred. When you issue VALIDATE, ensure that the database is not in read-only mode (which is used for backing up a database). See “Using VALIDATE to Check Integrity” on page 786.

Parallel Restructuring

By default, block storage restructuring is performed sequentially. Blocks are renumbered and reshaped from first to last, a time-intensive process. Parallel restructuring can reduce restructuring time by dividing block restructuring work across multiple concurrent threads to use available processor cores. Because calculation is performed separately from restructuring, each block can be restructured independently of other blocks.

Blocks are divided into \( n \) groups, where \( n \) is the number of restructuring threads. This division is performed by traversing the breadth of the index BTree until the number of keys at a level is equal to or greater than \( n \). If there is no level with more than \( n \) keys, the number of restructuring threads is reduced accordingly.

The number of restructuring threads to use is defined in essbase.cfg using the RESTRUCTURETHREADS configuration setting. If RESTRUCTURETHREADS is not defined, the default is one thread. For details, see the Oracle Essbase Technical Reference.

Note: Parallel restructuring operations do not dynamically create threads, but instead use a set number of threads from a pre-created pool of threads. You can customize the size of the thread pool. For more information, see the WORKERTHREADS configuration setting topic in the Oracle Essbase Technical Reference.

Options for Saving a Modified Outline

Essbase displays a dialog box when you save outline changes that trigger database restructuring (using Outline Editor). In the Restructure Database dialog box, you define how data values are handled during restructure; for example, you can preserve all data, preserve only level 0 or input data, or discard all data during restructure. See “Saving Outlines” in Oracle Essbase Administration Services Online Help.

If the database contains data, you need enough free disk space on the server to create a backup copy of the database. Backup ensures that any abnormal termination during the restructure process does not corrupt the database.

Essbase may display a “Restructuring not required” message yet still perform an index-only restructure. This event most likely will occur if you make changes to a sparse dimension. If you try to cancel a restructure operation, Essbase may issue a “Can’t cancel” message. If such a message is displayed, Essbase is performing final cleanup, and it is too late to cancel.
Outline Change Log

If you activate the outline change log, Essbase records all activity that affects the outline (member name changes, member moves, and so on). The more changes you make to the outline, the more updates Essbase must make to the log, slowing performance.

By default, Essbase does not log outline changes. To see whether outline logging is slowing performance, look for OUTLINECHANGELOG TRUE in the essbase.cfg file. See “Understanding and Using the Outline Change Log” on page 742.

Essbase Partitioning Option

When you use Partitioning, Essbase tracks outline changes so that you can synchronize the database outlines across partitions. Tracking outline changes slows restructuring, particularly when there are many structural changes.

If Essbase restructures data when you are using partitioning, perform the following steps to make sure that data is synchronized across partitions:

1. Validate the partitions.
   See “Validating Partitions” on page 253.

   Note: To validate a partition, you must have Database Manager permissions or higher.

2. Synchronize the outlines of the partitions.
   See “Synchronizing Outlines” on page 255.

Outline Change Quick Reference

The tables in this section show all outline changes that affect calculation and restructuring, including incremental restructuring.

Note: If you are using Partitioning, restructuring affects only the database to which you are connected.

| Table 174   Actions: Delete, Add, or Move Member |
|-------------|-----------------------------------------------|
| Action                  | Calculation and Standard Restructure Effects                                                                 |
|                         | Incremental Restructuring Applies? (If Enabled)                                                           |
| Delete member of sparse dimension | Data must be recalculated to reflect changes to relationships. Essbase deletes from the index file all pointers to blocks represented by the deleted member. Because the blocks are no longer pointed to, they become free space. No restructure. | For regular members, no. Essbase restructures the index, overriding incremental restructure. For label-only members, yes, restructuring is deferred. |
| Delete member of attribute dimension | None | No |
### Table 175  Actions: Other Member-Related Changes

<table>
<thead>
<tr>
<th>Action</th>
<th>Calculation and Standard Restructure Effects</th>
<th>Incremental Restructuring Applies? (If Enabled)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delete member of dense dimension</td>
<td>Data must be recalculated to reflect changes to relationships. Essbase restructures the data files to reflect a changed block size.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Delete shared member in sparse or dense dimension</td>
<td>Data must be recalculated. The data remains associated with the original member name, but, because the parent of the shared member may have depended on child data, recalculation is needed. No restructure.</td>
<td>No</td>
</tr>
<tr>
<td>Add member to sparse dimension</td>
<td>Data for the new member must be loaded or calculated to derive new values. Essbase restructures the index.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Add member to dense dimension</td>
<td>Data for the new member must be loaded or calculated to derive new values. Data must be recalculated. Essbase restructures the data files to reflect a changed block size. Essbase restructures the index.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Add member to attribute dimension</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Add shared member to sparse or dense dimension</td>
<td>Data must be recalculated. The new shared member affects the consolidation to its parent. No restructure.</td>
<td>No</td>
</tr>
<tr>
<td>Move regular member within a sparse dimension</td>
<td>Data must be recalculated to reflect changes in consolidation. Essbase restructures the index file.</td>
<td>No. Essbase restructures the index file, overriding incremental restructure.</td>
</tr>
<tr>
<td>Move regular member within a dense dimension</td>
<td>Data must be recalculated to reflect changes in consolidation. Essbase restructures index and data files.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Move an attribute dimension member</td>
<td>None</td>
<td>No</td>
</tr>
</tbody>
</table>

---

847
<table>
<thead>
<tr>
<th>Action</th>
<th>Calculation and Standard Restructure Effects</th>
<th>Incremental Restructuring Applies? (If Enabled)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define Dynamic Calc member as Dynamic Calc and Store</td>
<td>For dense dimension members: Essbase restructures both index and data files. For sparse dimension members: no restructure.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Define Dynamic Calc and Store member as Dynamic Calc</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Define regular dense dimension member as Dynamic Calc and Store</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Define regular dense dimension member as Dynamic Calc</td>
<td>Essbase restructures both index and data files.</td>
<td>Restructure deferred.</td>
</tr>
<tr>
<td>Define sparse dimension Dynamic Calc and Store member or Dynamic Calc member as regular member</td>
<td>No restructure</td>
<td>No</td>
</tr>
<tr>
<td>Define sparse dimension regular member as Dynamic Calc or Dynamic Calc and Store</td>
<td>Essbase restructures index and data files.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Define dense dimension Dynamic Calc and Store member as regular member</td>
<td>No restructure</td>
<td>No</td>
</tr>
<tr>
<td>Define dense dimension Dynamic Calc member as regular member</td>
<td>Essbase restructures index and data files.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Define dense dimension regular member as Dynamic Calc member</td>
<td>Essbase restructures index and data files.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Add, delete, or move sparse dimension Dynamic Calc member</td>
<td>Essbase restructures index files.</td>
<td>For member add or delete, changes to data and index files are deferred. For member move, Essbase restructures index files, overriding incremental restructure.</td>
</tr>
<tr>
<td>Add, delete, or move sparse dimension Dynamic Calc and Store member</td>
<td>Essbase restructures index files.</td>
<td>For member add, changes to data and index files are deferred. For member move or delete, Essbase restructures index files (overrides incremental restructure).</td>
</tr>
<tr>
<td>Add, delete, or move dense dimension Dynamic Calc and Store member</td>
<td>Essbase restructures index and data files.</td>
<td>No</td>
</tr>
<tr>
<td>Add, delete, or move dense dimension Dynamic Calc member</td>
<td>No restructure.</td>
<td>No</td>
</tr>
<tr>
<td>Action</td>
<td>Calculation and Standard Restructure Effects</td>
<td>Incremental Restructuring Applies? (If Enabled)</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Change dense-sparse property</td>
<td>Data must be recalculated.</td>
<td>Essbase restructures index and data files.</td>
</tr>
<tr>
<td></td>
<td>Essbase restructures both index and data files.</td>
<td></td>
</tr>
<tr>
<td>Change label only property</td>
<td>Data must be recalculated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Essbase restructures index and data files.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Change shared member property</td>
<td>Data must be recalculated to reflect the changed data value of the child.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Essbase restructures both index and data files.</td>
<td>Yes. Changes to data and index files are deferred.</td>
</tr>
<tr>
<td>Change properties other than dense-sparse, label, or shared</td>
<td>Data may need to be recalculated to reflect changed consolidation properties, such as changing time balance from first to last.</td>
<td>No</td>
</tr>
<tr>
<td>Change the order of two sparse dimensions</td>
<td>No calculation or data load impact.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Essbase restructures the index.</td>
<td>Essbase restructures the index, overriding incremental restructure.</td>
</tr>
<tr>
<td>Change the order of dimensions</td>
<td>Data must be recalculated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Essbase restructures both index and data files.</td>
<td>Essbase restructures index and data files (overrides incremental restructure).</td>
</tr>
<tr>
<td>Change the order of attribute dimensions</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Create, delete, clear, rename, or copy an alias table</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Import an alias table or set a member alias</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Change the case-sensitive setting</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Name a level and generation</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Create, change, or delete a UDA</td>
<td>None</td>
<td>No</td>
</tr>
</tbody>
</table>
Optimizing Data Loads

In This Chapter

- Understanding Data Loads ................................................................. 851
- Grouping Sparse Member Combinations ............................................. 852
- Making the Data Source as Small as Possible .................................... 854
- Making Source Fields as Small as Possible ........................................ 855
- Positioning Data in the Same Order as the Outline ............................. 855
- Loading from Essbase Server .............................................................. 855
- Using Parallel Data Load ................................................................... 856

Some information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases. Also see Chapter 60, “Comparison of Aggregate and Block Storage.”

Understanding Data Loads

This section does not apply to aggregate storage databases.

Loading a large data source into an Essbase database can take hours. You can shorten the data loading process by minimizing the time spent on these actions:

- Reading and parsing the data source
- Reading and writing to the database

To optimize data load performance, think in terms of database structure. Essbase loads data block by block. For each unique combination of sparse dimension members, one data block contains the data for all the dense dimension combinations, assuming that at least one cell contains data. For faster access to block locations, Essbase uses an index. Each entry in the index corresponds to one data block. See “Sparse and Dense Dimensions” on page 64, “Selection of Dense and Sparse Dimensions” on page 65, and “Dense and Sparse Selection Scenarios” on page 67.

When Essbase loads a data source, Essbase processes the data in five stages of a pipeline.

For free form data load, the stages are:

1. **Input**—Essbase collects input from file or SQL connection
2. **Tokenize**—Essbase separates input fields from records, creating tokens
3. **Convert**—Essbase converts tokens into member items
4. **Preparation**—Essbase arranges the data in preparation for putting it into blocks
5. **Write**—Essbase puts the data into blocks in memory and then writes the blocks to disk, finding the correct block on the disk by using the index, which is composed of pointers based on sparse intersections

For rules-file based data load, the stages are:

1. **Input**—Essbase collects input from file or SQL connection
2. **Pre-Rule**—Essbase reads data load records
3. **Rule**—Essbase applies rules, embedded in rules file, to data load records
4. **Preparation**—Essbase arranges the data in preparation for putting it into blocks
5. **Write**—Essbase puts the data into blocks in memory and then writes the blocks to disk, finding the correct block on the disk by using the index, which is composed of pointers based on sparse intersections

**Note:** On aggregate storage databases, the fifth stage does not apply.

This process is repeated until all data is loaded. By using one or more processing threads in each stage, Essbase can perform some processes in parallel. See “Using Parallel Data Load” on page 856.

Examples in this chapter assume that you are familiar with the information in this topic: “Data Sources” on page 266.

**Grouping Sparse Member Combinations**

This section does not apply to aggregate storage databases.

The most effective strategy to improve performance is to minimize the number of disk I/Os that Essbase must perform while reading or writing to the database. Because Essbase loads data block by block, organizing the source data to correspond to the physical block organization reduces the number of physical disk I/Os that Essbase must perform.

Arrange the data source so that records with the same unique combination of sparse dimensions are grouped together. This arrangement corresponds to blocks in the database.

The examples in this chapter illustrate ways that you can organize the data following this strategy. These examples use a subset of the Sample.Basic database, as shown in Table 178:

<table>
<thead>
<tr>
<th>Sparse, Nonattribute Dimensions</th>
<th>Dense Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario (Budget, Actual)</td>
<td>Measures (Sales, Margin, COG, Profit)</td>
</tr>
<tr>
<td>Product (Cola, Root Beer)</td>
<td>Year (Jan, Feb)</td>
</tr>
</tbody>
</table>

852
**Sparse, Nonattribute Dimensions** | **Dense Dimensions**
---|---
Market (Florida, Ohio) |  

**Note:** Because you do not load data into attribute dimensions, they are not relevant to this discussion although they are sparse.

Consider the following data source. Because it is not grouped by sparse-dimension member combinations, this data has not been sorted for optimization. As Essbase reads each record, it must deal with different members of the sparse dimensions.

<table>
<thead>
<tr>
<th>Jan</th>
<th>Actual</th>
<th>Cola</th>
<th>Ohio</th>
<th>Sales</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Budget</td>
<td>&quot;Root Beer&quot;</td>
<td>Florida</td>
<td>Sales</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Actual</td>
<td>&quot;Root Beer&quot;</td>
<td>Ohio</td>
<td>Sales</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Budget</td>
<td>Cola</td>
<td>Florida</td>
<td>Sales</td>
<td>30</td>
</tr>
</tbody>
</table>

This data loads slowly because Essbase accesses four blocks instead of one.

An optimally organized data source for the same Sample.Basic database shows different records sorted by a unique combination of sparse-dimension members: Actual -> Cola -> Ohio. Essbase accesses only one block to load these records.

<table>
<thead>
<tr>
<th>Actual</th>
<th>Cola</th>
<th>Ohio</th>
<th>Jan</th>
<th>Sales</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>Cola</td>
<td>Ohio</td>
<td>Jan</td>
<td>Margin</td>
<td>18</td>
</tr>
<tr>
<td>Actual</td>
<td>Cola</td>
<td>Ohio</td>
<td>Jan</td>
<td>COGS</td>
<td>20</td>
</tr>
<tr>
<td>Actual</td>
<td>Cola</td>
<td>Ohio</td>
<td>Jan</td>
<td>Profit</td>
<td>5</td>
</tr>
</tbody>
</table>

You can use a data source that loads many cells per record. Ensure that records are grouped together by unique sparse-dimension member combinations. Then order the records so that the dimension in the record for which you provide multiple values is a dense dimension.

The next data source example uses a header record to identify the members of the Measures dimension, which is dense. The data is sorted first by members of the dense dimension Year and grouped hierarchically by members of the other dimensions. Multiple values for the Measures dimension are provided on each record.

<table>
<thead>
<tr>
<th>Jan Actual</th>
<th>Cola</th>
<th>Ohio</th>
<th>Sales</th>
<th>Margin</th>
<th>COG</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan Actual</td>
<td>Cola</td>
<td>Florida</td>
<td>30</td>
<td>19</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Jan Actual</td>
<td>&quot;Root Beer&quot;</td>
<td>Ohio</td>
<td>18</td>
<td>12</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Jan Actual</td>
<td>&quot;Root Beer&quot;</td>
<td>Florida</td>
<td>28</td>
<td>18</td>
<td>20</td>
<td>8</td>
</tr>
</tbody>
</table>

Notice that the heading and first data line that requires two lines in this example; the previous example needs four lines for the same data.

For information about arranging data in source files before loading, see “Data Sources that Do Not Need a Rules File” on page 273.
Making the Data Source as Small as Possible

Make the data source as small as possible. The fewer fields that Essbase reads in the data source, the less time is needed to read and load the data.

Group the data into ranges. Eliminating redundancy in the data source reduces the number of fields that Essbase must read before loading data values.

The following example data source is not organized in ranges. It includes unneeded repetition of fields. All values are Profit values. Profit must be included only at the beginning of the group of data applicable to it. This example contains 33 fields that Essbase must read to load the data values properly.

<table>
<thead>
<tr>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>&quot;New York&quot;</td>
</tr>
<tr>
<td>Cola</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>&quot;New York&quot;</td>
</tr>
<tr>
<td>&quot;Diet Cola&quot;</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>Ohio</td>
</tr>
<tr>
<td>Cola</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>Ohio</td>
</tr>
<tr>
<td>&quot;Diet Cola&quot;</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>Feb</td>
</tr>
<tr>
<td>&quot;New York&quot;</td>
</tr>
<tr>
<td>Cola</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>Feb</td>
</tr>
<tr>
<td>&quot;New York&quot;</td>
</tr>
<tr>
<td>&quot;Diet Cola&quot;</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>Feb</td>
</tr>
<tr>
<td>Ohio</td>
</tr>
<tr>
<td>Cola</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>Feb</td>
</tr>
<tr>
<td>Ohio</td>
</tr>
<tr>
<td>&quot;Diet Cola&quot;</td>
</tr>
<tr>
<td>9</td>
</tr>
</tbody>
</table>

The next example provides the same data optimized by grouping members in ranges. By eliminating redundancy, this example contains only 23 fields that Essbase must read in order to load the data values properly.

<table>
<thead>
<tr>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>&quot;New York&quot;</td>
</tr>
<tr>
<td>Cola</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>&quot;Diet Cola&quot;</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>Ohio</td>
</tr>
<tr>
<td>Cola</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>&quot;Diet Cola&quot;</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>Feb</td>
</tr>
<tr>
<td>&quot;New York&quot;</td>
</tr>
<tr>
<td>Cola</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>&quot;Diet Cola&quot;</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>Ohio</td>
</tr>
<tr>
<td>Cola</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>&quot;Diet Cola&quot;</td>
</tr>
<tr>
<td>9</td>
</tr>
</tbody>
</table>

Essbase assigns the first value, 4, to Jan->New York->Cola; it assigns the next value, 3, to Jan->New York->Diet Cola and so on.

Although sorted efficiently, the data source sorted and grouped by dense dimensions shows a lot of repetition that can slow down the load process. You can further optimize this data by grouping the data into ranges. The optimized data source below eliminates the redundant fields, reducing processing time.

<table>
<thead>
<tr>
<th>Sales</th>
<th>Margin</th>
<th>COG</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>Actual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>Ohio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>18</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Florida</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>19</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>&quot;Root Beer&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ohio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>12</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Florida</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>18</td>
<td>20</td>
<td>8</td>
</tr>
</tbody>
</table>

See “Formatting Ranges of Member Fields” on page 274.
Making Source Fields as Small as Possible

Making fields in a data source smaller enables Essbase to read and load faster. Make the fields in the data source as small as possible by performing the following tasks:

- Remove excess white space in the data source. For example, use tabs instead of blank spaces.
- Round computer-generated numbers to the precision you need. For example, if the data value has nine decimal points and you care about two, round the number to two decimal points.
- Use #MI instead of #MISSING.

Positioning Data in the Same Order as the Outline

This section does not apply to aggregate storage databases.

The index is organized in the same order as the sparse dimensions in the outline. To further optimize the data source, with the sparse data combinations in the data source grouped together, arrange the data so that sparse dimensions are in the same order as the outline.

Essbase pages portions of the index in and out of memory as requested by the data load or other operations. Arranging the source data to match the order of entries in the index speeds the data load because it requires less paging of the index. Less paging results in fewer I/O operations.

Essbase uses the index cache size to determine how much of the index can be paged into memory. Adjusting the size of the index cache may also improve data load performance.

**Note:** If the index cache size is large enough to hold the entire index in memory, positioning data in the same order as the outline does not affect the speed of data loads.

See “Sizing the Index Cache” on page 825.

Loading from Essbase Server

Loading the data source from Essbase Server is faster than loading from a client computer. To load a data source from the server, move the data source to the server and start the load.

Loading data from the server improves performance because the data need not be transported over the network from the client computer to the server computer.
Using Parallel Data Load

Subtopics

- Understanding Parallel Data Load
- Enabling Parallel Data Load With Multiple Files
- Optimizing Parallel Data Load

The following topics discuss parallel data load and how it might improve performance for your site.

Understanding Parallel Data Load

One aspect of parallel data load describes the pipeline optimization you can achieve by using the `essbase.cfg` settings `DLTHREADSPREPARE` and `DLTHREADSWRITE`. While the minimum and default number of threads allocated for a data load is 5 (one thread per stage of the pipeline), these settings enable you to add threads to selected stages in the pipeline. For example, with the following configuration, you can increase the threads used in the Prepare and Write stages from 1 each to 4 each:

```
DLSTANDARDTHREADPERSTAGE Sample Basic FALSE
DLTHREADSPREPARE Sample Basic 4
DLTHREADSWRITE Sample Basic 4
```

With the above configuration, the data load is set to run with 11 threads.

**Note:** Parallel data load operations do not dynamically create threads, but instead use a set number of threads from a pre-created pool of threads. You can customize the size of the thread pool. For more information, see the `WORKERTHREADS` configuration setting topic in the `Oracle Essbase Technical Reference`.

Another aspect of parallel data load refers to the concurrent loading of multiple data files into an Essbase database. When working with large data sets (for example, a set of ten 2 GB files), loading the data sources concurrently enables you to fully utilize the CPU resources and I/O channels of modern servers with multiple processors and high-performance storage subsystems.

You can also adjust the number of threads used in multiple-file data loads. For example, specifying the above configuration while also specifying two data files results in the creation of two data load pipelines, each having 11 threads.
Enabling Parallel Data Load With Multiple Files

To enable parallel data load,

1. Specify multiple files as the data source, by using a wildcard character (* and/or ?) to match all data sources files you intend to use. In the Oracle Essbase Technical Reference, see the MaxL import data statement.

2. If necessary, control the number of threads spawned by the parallel data load.
   
   See “Optimizing Parallel Data Load” on page 857.

Optimizing Parallel Data Load

Parallel data load includes a “throttle” to limit the number of client threads or server pipelines that are used. A throttle control is important because if the data-file specification matches several hundred files, you should avoid spawning that many threads or pipelines. To control the number of threads or pipelines spawned by a data load request, set the limit using the max_threads grammar in the import data MaxL statement. You can also adjust the number of threads available in the thread pool, using the WORKERTHREADS configuration setting.

In general, avoid using more pipelines than you have CPU cores. Additionally, monitor the system I/O bandwidth utilization to help determine how many data loads your I/O subsystem can handle in parallel. See “Monitoring Processor and I/O Activity” on page 857.

If you are executing a large number of parallel data loads, performance will likely be improved by setting DLSINGLETHREADPERSTAGE to TRUE in the essbase.cfg file.

Monitoring Processor and I/O Activity

When loading data, you can view processor and I/O activity. Different operating systems provide different tools for viewing system performance. For example, the Task Manager in Windows enables you to view processor and memory usage and processes.

For more details on:

- Windows XP, use Control Panel, then Administrative Tools, and then Performance
- Windows Server 2008, use Control Panel, then Administrative Tools, and then Reliability and Performance Monitor
- Windows 7, use Control Panel, then Administrative Tools, then Performance Monitor, and then Resource Monitor

Among the tools available on UNIX are top and vmstat; iostat is the most commonly used utility to monitor I/O activity. You can also use third-party tools to view and analyze system use.

Implications in Sizing the Data Cache

For block storage databases, Essbase Server allocates the data cache memory area to hold uncompressed data blocks. If you are using the DLTHREADSWRITE configuration setting, each
thread specified by that setting uses an area in the data cache equal to the size of an expanded block.

Depending on the size of the block, the number of threads, and how much data cache is used by other concurrent operations during a data load, it may be possible to need more data cache than is available. In such circumstances, decrease the number of threads or increase the size of the data cache.

See “Changing the Data Cache Size” on page 828.
In This Chapter

Designing for Calculation Performance .......................................................... 859
Monitoring and Tracing Calculations ............................................................. 861
Using Simulated Calculations to Estimate Calculation Time ....................... 862
Estimating Calculation Effects on Database Size .......................................... 866
Using Formulas .......................................................................................... 866
Using Bottom-Up Calculation ..................................................................... 871
Hybrid Aggregation Mode in Block Storage Databases ............................... 873
Managing Caches to Improve Performance .................................................. 873
Working with the Block Locking System ....................................................... 874
Using Two-Pass Calculation ....................................................................... 876
Choosing Between Member Set Functions and Performance ....................... 883
Consolidating #MISSING Values ................................................................. 884
Removing #MISSING Blocks ..................................................................... 886
Identifying Additional Calculation Optimization Issues ............................... 886

The information in this chapter applies only to block storage databases and is not relevant to aggregate storage databases.

Also see:

- Chapter 60, “Comparison of Aggregate and Block Storage”
- Chapter 15, “Designing Partitioned Applications”
- Chapter 27, “Dynamically Calculating Data Values”
- Chapter 29, “Developing Calculation Scripts for Block Storage Databases”
- Chapter 26, “Understanding Intelligent Calculation”

Designing for Calculation Performance

You can configure a database to optimize calculation performance.

The best configuration for the site depends on the nature and size of the database. Use the information in the following topics as guidelines only.
Block Size and Block Density

A data block size of 8 Kb to 100 Kb provides optimal performance in most cases.

If data blocks are much smaller than 8 KB, the index is usually very large, forcing Essbase to write to and retrieve the index from disk. This process slows calculation.

If data blocks are much larger than 100 KB, Intelligent Calculation does not work effectively. See Chapter 26, “Understanding Intelligent Calculation.”

To optimize calculation performance and data storage, balance data block density and data block size by rearranging the dense and sparse dimension configuration of the database. Keep these suggestions in mind:

- Keep data block size between 8 KB and 100 KB with as high a block density as possible.
- Run test calculations of the most promising configurations of a database that contains representative data. Check results to determine the configuration that produces the best calculation performance.

You can view information about a database, including the potential and actual number of data blocks and the data block size.

To view data block information, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Checking Data Block Statistics</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETDBINFO</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Order of Sparse Dimensions

You may improve calculation performance by changing the order of standard (not attribute) sparse dimensions in the database outline. Order standard sparse dimensions by the number of members they contain, placing the dimension that contains the fewest members first. This arrangement provides many possible improvements, depending on the site:

- The calculator cache functions more effectively, providing approximately a 10% performance improvement if you have a database outline with a large dimension (for example, one containing 1000 members).
- Parallel calculation, if enabled, more likely will be used if the standard sparse dimension with the most members is the last standard sparse dimension in the outline.

Incremental Data Loading

Many companies load data incrementally. For example, a company may load data each month for that month.
To optimize calculation performance when you load data incrementally, make the dimension tagged as time a sparse dimension. If the time dimension is sparse, the database contains a data block for each time period. When you load data by time period, Essbase accesses fewer data blocks because fewer blocks contain the relevant time period. Thus, if you have Intelligent Calculation enabled, only the data blocks marked as dirty are recalculated. For example, if you load data for March, only the data blocks for March and the dependent parents of March are updated.

However, making the time dimension sparse when it is naturally dense may significantly increase the size of the index, creating possibly slower performance due to more physical I/O activity to accommodate the large index.

If the dimension tagged as time is dense, you still receive some benefit from Intelligent Calculation when you do a partial data load for a sparse dimension. For example, if Product is sparse and you load data for one product, Essbase recalculates only the blocks affected by the partial load, although time is dense and Intelligent Calculation is enabled.

For information on incremental loads, see “Loading Data into Aggregate Storage Databases” on page 954.

Database Outlines with Multiple Flat Dimensions

Calculation performance may be affected if a database outline has multiple flat dimensions. A flat dimension has very few parents, and each parent has many thousands of children; in other words, flat dimensions have many members and few levels.

You can improve performance for outlines with multiple flat dimensions by adding intermediate levels to the database outline.

Formulas and Calculation Scripts

You may achieve significant improvements in calculation performance by carefully grouping formulas and dimensions in a calculation script. In this way, you can ensure that Essbase cycles through the data blocks in the database as few times as possible during a calculation.

Order commands in calculation scripts to make the database calculation as simple as possible. Consider applying all formulas to the database outline and using a default calculation (CALC ALL). This method may improve calculation performance.

See Chapter 29, “Developing Calculation Scripts for Block Storage Databases” and “Calculation Passes” on page 408.

Monitoring and Tracing Calculations

You can display information in the application log about how Essbase is calculating the database by using the following commands in a calculation script.
**SET MSG SUMMARY and SET MSG DETAIL**

You can use the SET MSG SUMMARY and SET MSG DETAIL calculation commands in a calculation script to do the following:

- Display calculation settings, for example, whether completion notice messages are enabled
- Provide statistics on the number of data blocks created, read, and written
- Provide statistics on the number of data cells calculated

SET MSG DETAIL also provides an information message every time Essbase calculates a data block. SET MSG DETAIL is useful for reviewing the calculation order of data blocks and for testing intelligent recalculations.

---

**Caution!** Because SET MSG DETAIL causes a high processing overhead, use it only during test calculations.

SET MSG SUMMARY causes a processing overhead of approximately 1% to 5%, depending on database size, and is therefore appropriate for all calculations.

---

**SET NOTICE**

You can use the SET NOTICE calculation command in a calculation script to display calculation completion notices that tell you what percentage of the database has been calculated. You can use the SET MSG SUMMARY command with the SET NOTICE command to show calculation progress between completion notices. Completion notices do not significantly reduce calculation performance, except when used with a very small database.

---

**Using Simulated Calculations to Estimate Calculation Time**

You can simulate a calculation using SET MSG ONLY in a calculation script. A simulated calculation produces results that help you analyze the performance of a real calculation that is based on the same data and outline.

By running a simulated calculation with a command such as SET NOTICE HIGH, you can mark the relative amount of time each sparse dimension takes to complete. Then, by performing a real calculation on one or more dimensions, you can estimate how long the full calculation will take, because the time a simulated calculation takes to run is proportional to the time that the actual calculation takes to run.

For example, if the calculation starts at 9:50:00 AM, and the first notice is time-stamped at 09:50:10 AM and the second is time-stamped at 09:50:20 AM, you know that each part of the calculation took 10 seconds. If you then run a real calculation on only the first portion and note that it took 30 seconds to run, you know that the other portion also will take 30 seconds. If there
were two messages total, then you would know that the real calculation will take approximately 60 seconds \((20 / 10 * 30 = 60 \text{ seconds})\).

Use the following topics to learn how to perform a simulated calculation and how to use a simulated calculation to estimate calculation time.

**Performing a Simulated Calculation**

Before you can estimate calculation time, you must perform a simulated calculation on a data model that is based on your actual database.

1. **To perform a simulated calculation:**
   1. Create a data model that uses all dimensions and all levels of detail about which you want information.
   2. Load all data. This procedure calculates only data loaded in the database.
   3. Create a calculation script with these entries:
      ```
      SET MSG ONLY;
      SET NOTICE HIGH;
      CALC ALL;
      ```
      If you are using dynamic calculations on dense dimensions, substitute the `CALC ALL` command with the specific dimensions that you need to calculate; for example, `CALC DIM EAST`.

      **Note:** If you try to validate the script, Essbase reports an error. Disregard the error.
   4. Run the script.
   5. Find the first sparse calculation message in the application log and note the time in the message.
   6. Note the time for each subsequent message.
   7. Calculate the dense dimensions of the model that are not being dynamically calculated:
      ```
      CALC DIM (DENSE_DIM1, DENSE_DIM2, ...);
      ```
   8. Calculate the sparse dimensions of the model:
      ```
      CALC DIM (SPARSE_DIM1, SPARSE_DIM2, ...);
      ```
   9. Project the intervals at which notices will occur, and then verify against sparse calculation results. You can then estimate calculation time.

**Estimating Calculation Time**

When you perform a simulated calculation, you record the results and use them to estimate actual calculation time.

1. **To estimate total calculation time:**
   1. Note the times of all the intervals between application log messages generated by `SET NOTICE HIGH`. See Table 179.
2. Use the following calculation to estimate the time for a real calculation:

Total time required for simulated calculation, divided by the first simulated calculation notice interval, multiplied by the first real calculation time interval.

Table 179 Sample Intervals Between Log Messages

<table>
<thead>
<tr>
<th>Calculation Notice Number</th>
<th>Simulated Calculation Time Interval (in seconds)</th>
<th>Sparse Dimension Calculation Interval (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Total calculation time</td>
<td>43</td>
<td></td>
</tr>
</tbody>
</table>

In this example, \( \frac{43}{7} \times 45 = 276.4 \) seconds, so the real calculation should take 276.4 seconds.

Factors Affecting Estimate Accuracy

The simulated calculation should return a time accurate to about 5%, excluding the following issues:

- “Variations Due to a Chain of Influences” on page 864
- “Variations Due to Outline Structure” on page 865

When these factors are present, this estimating technique more closely predicts calculation time when Essbase reaches 30%–40% of the simulated calculations (30%–40% of the messages generated by SET NOTICE HIGH). See the Oracle Essbase Technical Reference.

Variations Due to a Chain of Influences

Using SET MSG ONLY as a calculation-time estimating technique should be validated against later CALCNOTICE intervals. The results of this estimating technique vary because of the following chain of influences:

1. Blocks differ in block density through the real consolidation process, therefore
2. The rate at which Essbase writes blocks to the disk differs, therefore
3. The rate at which blocks are processed in the cache differs, therefore
4. Actual results may differ from the predicted calculation time.

**Variations Due to Outline Structure**

Another factor that can make actual results diverge significantly from predicted is the outline structure. Calculations based on CALCNOTICE intervals assume evenly balanced processing time throughout the outline. Factors that can skew this balance include the following situations:

- The model contains one or two sparse dimensions that are large in relation to the other sparse dimensions.
- Larger dimensions have member configurations that result in multiple shared roll-ups.

**Changing the Outline Based on Results**

After you have estimated and analyzed a simulated calculation, you can make changes in the outline to improve performance.

From top to bottom in the outline, order sparse dimensions to create the fewest percentage increases in upper blocks:

- Level 0 blocks following full model load 100,000
- Upper level blocks after consolidating only sparse dimension 1: 1,000,000
- Upper level blocks after consolidating only sparse dimension 2: 3,000,000
- Upper level blocks after consolidating only sparse dimension 3: 10,000,000
- Upper level blocks after consolidating only sparse dimension 4: 300,000
- Upper level blocks after consolidating only sparse dimension 5: 5,700,000

For example:

- #4 (members = 10,000, 4 levels)
- #1 (members = 500, 2 levels)
- #2 (members = 100, 4 levels)
- #5 (members = 10,000, 4 levels)
- #3 (members = 20, flat)

Use the simulated calculation to generate the upper block count. These numbers may be accurate despite actual dimension sizes as noted next to the items above.

**Caution!** The largest count of members is not always a good predictor.
Estimating Calculation Effects on Database Size

Given the current number of blocks in a database, you can estimate the number of blocks that a CALC ALL will produce.

To estimate the database size resulting from a calculation using interactive mode:

1. Load data and issue a CALC ALL command and note the average block size.
2. Start the MaxL shell, log on to Essbase, and start an application and database. For example:
   ```
   essmsh
   login username password;
   alter system load application appname;
   alter application appname load database dbname;
   ```
3. Providing the application and database name, enter the following MaxL statement and note the value that is returned for the number of blocks:
   ```
   query database appname.dbname get estimated size;
   ```
4. Multiply the number of blocks by the average size of the blocks in the database.

Results are accurate to ±10%.

Be aware of the following conditions when you query Essbase for an estimate of the full size of a database:

- You must perform this query after a CALC ALL. Any other calculation will not produce accurate results.
- You can obtain accurate results with formulas only if they are on sparse dimensions.
- You cannot obtain accurate results with top-down calculations on any member in combination with a lock on data (committed access).
- If you need to estimate partitions, you must query Essbase for a database size estimate on every partition and add the results. If you query for the size of only the source database, the estimate includes only the data on the source database server.

Using Formulas

You may achieve significant improvements in calculation performance by carefully using formulas in the database outline. For example, you may achieve improved calculation performance by placing formulas on members in the database outline instead of placing the formulas in a calculation script. See Chapter 23, “Developing Formulas for Block Storage Databases.”

The following sections discuss how to handle formula issues that affect performance.

Consolidating

Using the database outline to roll up values is more efficient than using a formula to calculate values. For example, the consolidation of members 100-10, 100-20, and 100-30 into member
100, as shown in Figure 151, is more efficient than applying the following formula to member 100:

\[100 - 10 + 100 - 20 + 100 - 30\]

Figure 151 Consolidation Example

100 (+) (Alias: Cola)
100-10 (+) (Alias: Cola)
100-20 (+) (Alias: Diet Cola)
100-30 (+) (Alias: Caffeine Free Cola)

Using Simple Formulas

If you use a simple formula, and block size is not unusually large, you can place the formula on a member of either a sparse or a dense dimension without significantly affecting calculation performance. The bigger the block size, the more impact simple formulas have on calculation performance. For a discussion of the relationship between block size and calculation performance, see “Block Size and Block Density” on page 860.

A simple formula is, for example, a ratio or a percentage and meets the following requirements:

- Does not reference values from a different dimension (sparse or dense). For example, a simple formula cannot reference Product -> Jan.
- Does not use range functions. For example, a simple formula cannot use @AVGRANGE, @MAXRANGE, @MINRANGE, or @SUMRANGE.
- Does not use relationship or financial functions. For example, a simple formula cannot use @ANCESTVAL, @NEXT, @PARENTVAL, @SHIFT, @ACCUM, or @GROWTH. For a complete list of relationship and financial functions, see the Oracle Essbase Technical Reference.

For information on how formulas affect calculation performance, see “Bottom-Up and Top-Down Calculation” on page 872.

Using Complex Formulas

If you use a complex formula, you can improve performance by applying the following guidelines:

- If possible, apply the formula to a member in a dense dimension.
- Use the FIX command in a calculation script to calculate only required data blocks. See “Using the FIX Command” on page 475.
- Increase the density of the database (ratio of existing data blocks to possible data blocks).
  
  See “Block Size and Block Density” on page 860.

A complex formula is one that meets any of the following requirements:
References a member or members in a different dimension (sparse or dense); for example, Product -> Jan.

Uses one or more range functions, for example, @AVGRANGE, @MAXRANGE, @MINRANGE, or @SUMRANGE.

Uses relationship or financial functions; for example, @ANCESTVAL, @NEXT, @PARENTVAL, @SHIFT, @ACCUM, or @GROWTH. For a complete list of relationship and financial functions, see the Oracle Essbase Technical Reference.

When applied to sparse dimension members, complex formulas create more calculation overhead and therefore slow performance. This problem occurs because the presence of complex formulas requires Essbase to perform calculations on all possible as well as all existing data blocks related to the member with the complex formula. The presence of a relationship or financial function on a sparse dimension member causes Essbase to perform calculations on all blocks, possible as well as existing, increasing the overhead even more.

Thus, a complex formula that includes a relationship or financial function creates a greater overhead increase than does a complex formula that does not include a relationship or financial function.

For a discussion about how complex formulas affect calculation performance, see “Bottom-Up and Top-Down Calculation” on page 872.

Two examples illustrate complex formula overhead:

- If a database has 90 existing data blocks and 100 potential data blocks, the overhead for complex formulas is not large, not more than 10 extra blocks to read and possibly write values to.
- If a database has 10 existing data blocks and 100 potential data blocks, the overhead is as much as ten times what it would be without the complex formula (depending on the outline structure and other factors), as many as 90 extra blocks to read and possibly write to.

In all cases, the lower the ratio of existing data blocks to possible data blocks, the higher the calculation performance overhead and the slower the performance.

### Optimizing Formulas on Sparse Dimensions in Large Database Outlines

You can use the SET FRMLBOTTOMUP calculation command to optimize the calculation of formulas in sparse dimensions in large database outlines. With this command, you can force a bottom-up calculation on sparse member formulas that otherwise would be calculated top-down. See “Forcing a Bottom-Up Calculation” on page 873.

Forcing a bottom-up calculation on a top-down formula enables efficient use of the CALC ALL and CALC DIM commands. Review the discussions of the SET FRMLBOTTOMUP calculation command and the CALCOPTFRMLBOTTOMUP configuration setting in the Oracle Essbase Technical Reference.
**Constant Values Assigned to Members in a Sparse Dimension**

If you assign a constant to a member in a sparse dimension, Essbase automatically creates a data block for every combination of sparse dimension members that contains the member.

For example, assume that a member or a calculation script formula contains the following expression:

```
California = 120;
```

In this formula, California is a member in a sparse dimension and 120 is a constant value. Essbase automatically creates all possible data blocks for California and assigns the value 120 to all data cells. Many thousands of data blocks may be created. To improve performance, create a formula that does not create unnecessary values.

To assign constants in a sparse dimension to only those intersections that require a value, use FIX in a manner similar to the following example:

```
FIX(Colas,Misc,Actual)
    California = 120;
ENDFIX
```

In this example, Colas is a member of the sparse dimension, Product; Actual is a member of the dense dimension, Scenario; and Misc is a member of the dense dimension, Measures. The value 120 is assigned to any intersection of California (in the Market dimension), Actual (in the Scenario dimension), Misc (in the Measures dimension), Colas (in the Product dimension), and any member in the Year dimension, because a specific member of Year is not specified in the script.

Because Sample.Basic includes only two sparse dimensions, this example affects only one block. If more sparse dimensions existed, Essbase would ensure data blocks for all combinations of the sparse dimensions with California and Colas, creating blocks if necessary. Within the new blocks, Essbase sets Measures and Scenario values (other than those assigned the value 120) to #MISSING.

**Nonconstant Values Assigned to Members in a Sparse Dimension**

If you assign nonconstant values to members of a sparse dimension, blocks are created based on the Create Blocks on Equations setting. The Create Blocks on Equations setting is defined at the database level, as a database property. (See “Nonconstant Values” on page 365.)

Within calculation scripts, you can temporarily override the Create Blocks on Equations setting. Consider the effects of the following calculation when West does not have a value and Create Blocks on Equations is enabled:

```
West = California + 120;
```

Unneeded blocks may be created for all sparse-member intersections with West, even if the corresponding block value is #MISSING for all of the children of West. Especially in a large database, creation and processing of unneeded blocks requires additional processing time.
To control creation of blocks when you assign nonconstant values to members of a sparse dimension, use the SET CREATEBLOCKONEQ ON | OFF calculation command, as shown in the following script:

```plaintext
FIX (Colas);
  SET CREATEBLOCKONEQ OFF
  West = California + 120;
  SET CREATEBLOCKONEQ ON
  East = "New York" + 100;
ENDFIX
```

Because the Create Block on Equation setting is disabled at the beginning of the script, West blocks are created only when values exist for the children of West. Later, because the Create Block on Equation setting is enabled, all blocks for East are created.

**Note:** Using SET CREATEBLOCKONEQ affects only creation of blocks during the execution of the calculation script that contains this command. This command does not change the overall database setting for Create Blocks on Equations.

### Using Cross-Dimensional Operators

Use caution when using a cross-dimensional operator ( -> ) in the following situations:

- “On the Left of an Equation” on page 870
- “In Equations in a Dense Dimension” on page 871

#### On the Left of an Equation

For faster calculation script performance, use FIX in the calculation script to qualify the use of a formula rather than a formula that includes a cross-dimensional operator on the left of an equation.

For example, assume that you want to increase the Jan -> Sales values in Sample.Basic by 5%. To improve performance by calculating only the relevant combinations of members, use the FIX command:

```plaintext
FIX(Jan)
  Sales = Sales * .05;
ENDFIX
```

With the FIX command, Essbase calculates the formula only for specified member combinations, in this example, for combinations that include Jan.

Compare this technique to using the slower cross-dimensional operator approach. For the previous example, you place the following formula on the Sales member in the database outline:

```plaintext
Sales(Sales -> Jan = Sales -> Jan * .05;)
```

As Essbase cycles through the database, it calculates the formula for every member combination that includes a member from the dimension tagged as time (Jan, Feb, Mar, and so on), although only January combinations need to be calculated.
In Equations in a Dense Dimension

When you use a cross-dimensional operator in an equation in a dense dimension, Essbase does not automatically create the required blocks if both of these conditions apply:

- Resultant values are from a dense dimension.
- The operand or operands are from a sparse dimension.

You can use the following techniques to create the blocks and avoid the performance issue.

- Ensure that the results members are from a sparse dimension, not from a dense dimension. In this example, the results member Budget is from a sparse dimension:

  ```
  FIX(Sales)
  Budget = Actual * 1.1;
  ENDFIX
  FIX(Expenses)
  Budget = Actual * .95;
  ENDFIX
  ```

- Use the DATACOPY calculation command to create and then calculate the required blocks. See “Using DATACOPY to Copy Existing Blocks” on page 481.

- Use a member formula that contains the dense member equations:

  ```
  FIX(Sales, Expenses)
  Budget (Sales = Sales -> Actual * 1.1;
  Expenses = Expenses -> Actual * .95;)
  ENDFIX
  ```

Managing Formula Execution Levels

Formulas in a block storage outline can have dependencies on one another such that they cause a nested execution of formulas within one or more blocks. Such formulas are called recursive formulas. Sometimes recursive formulas result in large or unending loops that result in abnormal termination of the server.

To avoid abnormal termination, you can use the CALCLIMITEFORMULARECURSION configuration setting to stop a formula execution that reaches 31 execution levels. See the Oracle Essbase Technical Reference

Using Bottom-Up Calculation

A top-down calculation is less efficient than a bottom-up calculation, because more blocks are calculated than is necessary. Although a top-down calculation is less efficient than a bottom-up calculation, top-down calculations are necessary in some cases to ensure that calculation results are correct.

The following topics describe which calculation to use in different situations:
Bottom-Up and Top-Down Calculation

Essbase uses one of two calculation methods to do a full calculation of a database outline—bottom-up calculation or top-down calculation. By default, Essbase does a bottom-up calculation.

For a bottom-up calculation, Essbase determines which data blocks must be calculated before it calculates the database. Essbase then calculates only the blocks that must be calculated. The calculation begins with the existing block with the lowest block number and works up through each block in number order until the existing block with the highest block number is reached. See “Block Calculation Order” on page 400.

If the database outline contains a complex member formula, Essbase performs a top-down calculation for the relevant member.

Use the following information to learn more about simple and complex formula interactions with bottom-up and top-down calculation:

Bottom-Up Calculations and Simple Formulas

For simple formulas, Essbase does a bottom-up calculation to determine which blocks must be calculated before running the full calculation. For example, for a simple formula on a member (such as $A = B + C$), $A$ is calculated only if $B$ or $C$ exists in the database. That is, the dependency of the formula on $B$ and $C$ is known before the calculation is started.

Top-Down Calculations and Complex Formulas

Before starting a calculation, Essbase searches the database outline and marks complex formulas that require top-down calculation; for example, a member formula that contains a cross-dimensional reference. When Essbase reaches a member with a top-down formula, it does a top-down calculation for the member.

When a formula on a member is complex, all possible blocks for the member must be examined to see if an existing block must be changed or a new block created; it is difficult to determine the dependency that blocks have on other blocks before the start of the calculation. The top-down method slows calculation performance because Essbase must search for appropriate blocks to calculate to execute the formula.

When a formula is compiled, if the formula is to be calculated top-down, Essbase logs a message in the application log file.

Consider the following complex formula:

$$A = B \rightarrow D + C \rightarrow D$$

To calculate the formula, Essbase must examine every combination of $A$ to see whether $B \rightarrow D$ or $C \rightarrow D$ exists.

See “Using Complex Formulas” on page 867.
Forcing a Bottom-Up Calculation

If it is appropriate for the site, you can force a bottom-up calculation on a top-down formula.

To force a bottom-up calculation, use a tool:

<table>
<thead>
<tr>
<th>Method</th>
<th>Topic Where Discussed</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculation function</td>
<td>@CALCMODE in a formula</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>Calculation script command</td>
<td>SET FRMLBOTTOMUP</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>essbase.cfg file setting</td>
<td>CALCOPTFRMLBOTTOMUP or CALCMODE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Forcing a bottom-up calculation on a formula usually increases performance time. If the formula contains complex functions (for example, range functions) or if the formula's dependencies are not straightforward, a bottom-up calculation may produce results different from those of a top-down calculation.

Caution! Before changing the setting CALCOPTFRMLBOTTOMUP or using the calculation script command SET FRMLBOTTOMUP in a production environment, check the validity of calculation results by comparing, relative to the same data, the results of a bottom-up calculation and the results of a top-down calculation.

Hybrid Aggregation Mode in Block Storage Databases

Hybrid aggregation mode is available for block storage databases. Hybrid aggregation for block storage databases means that wherever possible, block storage data calculation executes with efficiency similar to that of aggregate storage databases. For more information, see “Hybrid Aggregation” on page 905. See also the help topic for the configuration setting ASODYNAMICAGGINBSO, in the Oracle Essbase Technical Reference.

Managing Caches to Improve Performance

The following section describes the caches that are used with block storage databases. For information about the aggregate storage cache, see “Managing the Aggregate Storage Cache” on page 1025.

When calculating a database, Essbase uses approximately 30 bytes of memory per member in the database outline. So if the database has 5,000 members, Essbase needs approximately 150 KB of memory to calculate the database.
You can avoid excess memory use by combining calculation scripts. You can obtain good performance by using parallel calculation with a single calculation script. See Chapter 31, “Using Parallel Calculation.”.

Essbase uses memory to optimize calculation performance, especially for large calculations. The amount of memory used is not controllable, except by altering the size of the database outline. However, you can ensure that the memory cache sizes enable Essbase to optimize the calculation. Essbase uses memory caches to coordinate memory usage:

- Calculator cache. Ensure that the calculator cache is large enough to optimize calculation performance.
- Dynamic calculator cache.
- Index cache. If the database is large, the default index cache is not large enough to provide optimum calculation performance.
- Data cache.
- Data file cache.
- Application cache. If hybrid aggregation mode is used in block storage databases, the application cache can help you manage memory usage for retrievals. The application cache is similar to the aggregate storage cache; for more information, see “Managing the Aggregate Storage Cache” on page 1025.

When you first calculate a database, the size of the calculator cache is significant for calculation performance. If possible, ensure that the calculator cache is large enough for Essbase to use the optimal calculator cache option.

See “Sizing Caches” on page 824. Read the entire topic before making changes.

**Working with the Block Locking System**

When a block is calculated, Essbase locks the block and all blocks that contain the children of the block. Essbase calculates the block and then releases the block and the blocks containing the children.

By default, Essbase locks up to 100 blocks concurrently when calculating a block. This number of block locks is sufficient for most database calculations. If you are calculating a formula in a sparse dimension, Essbase works most efficiently if it can lock all required child blocks concurrently. Therefore, when calculating a formula in a sparse dimension, you may want to set a lock number higher than 100 if you are consolidating very large numbers of children (for example, more than 100). By increasing the number, you ensure that Essbase can lock all required blocks, and performance is not impaired.

Essbase locking behavior depends on the isolation level setting. See “Locking Under Committed Access” on page 779 and “Locking Under Uncommitted Access” on page 782.
Note: For consolidations in a sparse dimension, block locking is not a consideration, because Essbase does not need to lock all blocks containing children concurrently.

Using SET LOCKBLOCK and CALCLOCKBLOCK

You can use the SET LOCKBLOCK command in a calculation script along with the CALCLOCKBLOCK setting in the `essbase.cfg` file to specify the maximum number of blocks that Essbase can lock concurrently when calculating a block. If you do not modify the default setting, and the default 100 blocks is not sufficient during calculation, the calculation may require more time than expected.

Managing Concurrent Access for Users

Essbase uses the block locking system to manage concurrent access to users. This system ensures that only one user at a time can update or calculate a particular data block. How Essbase handles locking blocks and committing data depends on the isolation level setting.

When Essbase calculates a data block, it creates an exclusive lock; other users cannot update or calculate it, but they can have read-only access. When Essbase finishes the calculation, it releases the block. Other users can then update the block if they have the appropriate security access.

When a user is updating a data block, the block is locked. If a database calculation requires a data block that is being updated by another user, the calculation waits for one of the following conditions:

- For the data block to be released if the isolation level setting is Uncommitted Access.
- For the calculation to complete if the isolation level setting is Committed Access.

Essbase does not provide a message to say that the calculation is waiting for the data block to be released.

You can prevent calculation delays caused by waiting for locked blocks by using Essbase security options to do either of the following:

- Deny access to other users
- Disconnect users from Essbase

For information on how Essbase handles locks and transactions, see “Understanding How Essbase Handles Transactions” on page 783 and “Data Locks” on page 778.

Note: When Essbase locks a block for calculation, it does not put an exclusive lock on the dependent child blocks, so another user can update values in the child blocks. If necessary, you can use the above security options to prevent such updates.
Using Two-Pass Calculation

You can improve performance significantly by tagging an accounts dimension member as two-pass in the database outline, if it is appropriate for the application. The combination of data and calculation needs may require the use of a calculation script to calculate a formula twice, instead of two-pass tagging, to preserve accuracy.

Use these sections to understand more about two-pass calculation. Decide whether you can tag an accounts dimension member as two-pass to improve performance, or whether you must use a calculation script to calculate a formula twice. This section also provides information about how to enable two-pass calculation or create a calculation script for two-pass calculation.

For information about the interaction of two-pass calculation and attribute members, see Table 18 on page 167.

Understanding Two-Pass Calculation

You can use a two-pass calculation on member formulas that must be calculated twice to produce the correct value.

Whenever possible, Essbase calculates two-pass formulas at the data block level, calculating the two-pass formulas simultaneously as the main calculation. Thus, Essbase need not do an extra calculation pass through the database. However, in some situations, Essbase needs an extra calculation pass through the database.

How Essbase calculates the two-pass formulas depends on whether there is a dimension tagged as time as well as a dimension tagged as accounts and on the dense-sparse configuration of the time and account dimensions.

Reviewing a Two-Pass Calculation Example

Consider this calculation required for Profit%:

Profit % = Profit % Sales

Assume that Table 180 shows a subset of a data block with Measures and Year as dense dimensions. Measures is tagged as accounts, and Year is tagged as time. The AGGMISSG configuration setting is turned off (the default).

Data values have been loaded into the input cells. Essbase calculates the cells in which the numbers 1 through 7 appear, in that order. For example, Profit % -> Jan is calculated first; Profit % -> Qtr1 has multiple consolidation paths.

<table>
<thead>
<tr>
<th>Measures -&gt; Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit</td>
<td>75</td>
<td>50</td>
<td>120</td>
<td>5</td>
</tr>
<tr>
<td>Sales</td>
<td>150</td>
<td>200</td>
<td>240</td>
<td>6</td>
</tr>
</tbody>
</table>
Essbase uses this calculation order:

1. Essbase calculates the formula Profit % Sales for Profit % -> Jan, Profit % -> Feb, Profit % -> Mar, and Profit % -> Qtr1 (1, 2, 3, 4 above).
2. Essbase calculates Profit -> Qtr1 and Sales -> Qtr1 by adding the values for Jan, Feb, and Mar (5, 6 above).
3. Essbase calculates Profit % -> Qtr1 by adding the values for Profit % -> Jan, Profit % -> Feb, and Profit % -> Mar (7 above). This addition of percentages produces the value 125%, which is not the correct result.

### Table 181  Two-Pass Calculation Example: Incorrect Results

<table>
<thead>
<tr>
<th>Measures/Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit</td>
<td>75</td>
<td>50</td>
<td>120</td>
<td>245</td>
</tr>
<tr>
<td>Sales</td>
<td>150</td>
<td>200</td>
<td>240</td>
<td>590</td>
</tr>
<tr>
<td>Profit%</td>
<td>50% (1)</td>
<td>25% (2)</td>
<td>50% (3)</td>
<td>125% (7)</td>
</tr>
</tbody>
</table>

4. If you tag Profit% as two-pass in the database outline, Essbase uses the Profit % Sales formula to recalculate the Profit% values and produce the correct results.

### Table 182  Two-Pass Calculation Example: Correct Results

<table>
<thead>
<tr>
<th>Measures/Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Qtr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit</td>
<td>75</td>
<td>50</td>
<td>120</td>
<td>245</td>
</tr>
<tr>
<td>Sales</td>
<td>150</td>
<td>200</td>
<td>240</td>
<td>590</td>
</tr>
<tr>
<td>Profit%</td>
<td>50% (1)</td>
<td>25% (2)</td>
<td>50% (3)</td>
<td>0% (4) 125% (7) 42% (8)</td>
</tr>
</tbody>
</table>

For information about multiple calculation passes, see “Calculation Passes” on page 408.
Understanding the Interaction of Two-Pass Calculation and Intelligent Calculation

Two scenarios are described in detail in the following sections. If you are using Intelligent Calculation, use the scenario that matches the configuration of the database; each scenario tells you how to ensure that Essbase accurately calculates two-pass formulas.

These scenarios require that you understand the concepts of Intelligent Calculation. See Chapter 26, “Understanding Intelligent Calculation.”

Scenario A

In this scenario, you place formulas in the outline and, as appropriate, tag specific formulas as two-pass for best performance.

No Extra Calculation Pass for Two-Pass Formulas

Because Essbase calculates the two-pass formulas while it is calculating the data block, Essbase need not do an extra calculation pass through the database.

All Data Blocks Marked As Clean

After the calculation, all data blocks are marked as clean for the purposes of Intelligent Calculation.

When you tag a member formula as two-pass in the outline, Essbase does the two-pass calculation while each data block is being calculated. However, when you repeat a formula in a calculation script, Essbase must read the data blocks and write them to memory to recalculate the formula.

Scenario B

In this scenario, you create a calculation script to perform the formula calculation for best performance.

Extra Calculation Pass for Two-Pass Formulas

Essbase calculates the database and then does an extra calculation pass to calculate the two-pass formulas. Even though all data blocks are marked as clean after the first database calculation, Essbase ignores the clean status on the blocks that are relevant to the two-pass formula and recalculates these blocks.

Data Blocks for Two-pass Formulas Not Marked As Clean

After the first calculation, Essbase has marked all data blocks as clean for the purposes of Intelligent Calculation. In a second calculation pass through the database, Essbase recalculates the required data blocks for the two-pass formulas. However, because the second calculation is a partial calculation of the database, Essbase does not mark the recalculated blocks as clean.
When you recalculate the database with Intelligent Calculation turned on, these data blocks may be recalculated unnecessarily.

If the database configuration allows Essbase to use Scenario B, consider using a calculation script to perform two-pass formula calculations. If you use a calculation script, Essbase still does an extra calculation pass through the database; however, you can ensure that Essbase has marked all the data blocks as clean after the calculation. See “Creating Calculation Scripts for Two-Pass and Intelligent Calculation” on page 880.

### Choosing Two-Pass Calculation Tag or Calculation Script

Although tagging an accounts member as two-pass may bring performance benefits, some applications cannot use this method. Check these qualifications to see whether you should apply a two-pass tag or create a calculation script that performs a calculation twice for best performance and accuracy:

- You can tag a member as two-pass if it is in a dimension tagged as accounts. When you perform a default calculation on the database, Essbase automatically recalculates any formulas tagged as two-pass if they are in the dimension tagged as accounts in the database outline.

- You can tag a member as two-pass if it is a Dynamic Calc or Dynamic Calc and Store member of any dimension. See Chapter 27, “Dynamically Calculating Data Values.”

- You may need to use a calculation script to calculate a two-pass formula to obtain accurate results, even if the two-pass tag would provide performance benefits. See “Creating Calculation Scripts for Two-Pass and Intelligent Calculation” on page 880.

- Use a calculation script instead of the two-pass tag to ensure efficient use of Intelligent Calculation. See “Understanding the Interaction of Two-Pass Calculation and Intelligent Calculation” on page 878.

- You must use a calculation script to calculate a formula twice if the database configuration means that Essbase uses Scenario A, as described in “Scenario A” on page 878, and if the formula references values from another data block.

- You may want to use a calculation script to calculate two-pass formulas if the database configuration means that Essbase uses Scenario B, as described in “Scenario B” on page 878.

### Enabling Two-Pass on Default Calculations

A database setting enables two-pass calculation in default calculations. When you perform a default calculation on a database with two-pass calculation enabled (the default setting), Essbase automatically attempts to calculate formulas tagged as two-pass in the dimension tagged as accounts in the database outline. This is true even if you have customized the default calculation script.
To perform a default calculation, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Calculating Block Storage Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>execute calculation</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>CALCDEFAULT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

To enable two-pass calculation, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Using Two-Pass on a Default Calculation</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATE</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Creating Calculation Scripts for Two-Pass and Intelligent Calculation

Use these methods to create calculation scripts to perform two-pass calculations with Intelligent Calculation, so that the calculation is accurate and as fast as possible:

- Before the calculation script command that recalculates a two-pass formula, add the SET UPDATECALC OFF command to disable Intelligent Calculation. If you have Intelligent Calculation enabled (the default), Essbase calculates only the data blocks that are not marked as clean, but when you perform a default calculation of the database with Intelligent Calculation enabled, all data blocks are marked as clean, so Essbase does not perform the two-pass formula recalculation.

- When you use a calculation script, Essbase does not automatically recalculate two-pass formulas. Use the CALC TWOPASS command.

- If you have changed the default calculation of CALC ALL, and Intelligent Calculation is enabled, the data blocks may not be marked as clean after the first calculation. See Chapter 26, “Understanding Intelligent Calculation.” Also see “Setting Default Calculations” in the Oracle Essbase Administration Services Online Help.

To obtain the performance benefits of Intelligent Calculation when performing the first, full calculation of the database, use one of these methods, depending on the calculation needs and outline structure:

- “Intelligent Calculation with a Large Index” on page 881
- “Intelligent Calculation with a Small Index” on page 882
- “Intelligent Calculation Turned Off for a Two-Pass Formula” on page 883

These three options use the following example situation:
The outline has a dimension tagged as accounts, and it is a dense dimension. You want to calculate sales for each product as a percentage of sales for all products. Assume this formula should calculate the dimension:

\[ \text{Sales} \% \text{Sales} \rightarrow \text{Product} \]

When Essbase calculates the data block for each product, it has not yet calculated the value \( \text{Sales} \rightarrow \text{Product} \), so the results for the sales of each product as a percentage of total sales are incorrect.

**Intelligent Calculation with a Large Index**

If the index is large, and you want to use Intelligent Calculation, you can use any of the following options for the best performance. All three options perform the same tasks.

1. Enable Intelligent Calculation.
2. Calculate the full database and marks the data blocks as clean.
3. Disable Intelligent Calculation.
4. Mark the recalculated blocks as clean, even though this calculation is a partial calculation of the database. If you do not use the command `SET CLEARUPDATESTATUS AFTER`, Essbase marks data blocks as clean only after a full calculation of the database.
5. Essbase cycles through the database, calculating only the formula for the relevant member (Share of Sales in our example), or calculating all formulas tagged as two-pass in the database outline.

**Use a Calculation Script**

Use this model to create a calculation script that performs a full calculation of the database with Intelligent Calculation enabled:

```
SET UPDATECALC ON;
CALC ALL;
SET UPDATECALC OFF;
SET CLEARUPDATESTATUS AFTER;
"Share of Sales" = Sales \% Sales -> Product;
```

**Use a Calculation Script and the Two-Pass Tag**

- To tag a member as two-pass, and use a calculation script to calculate first the full database, then the two-pass member:
  1. Place a formula in the database outline and tag it as two-pass.
  2. Place the formula on the appropriate member in the dimension tagged as accounts, in our example, Share of Sales.
  3. Create a calculation script that performs a full database calculation and then a two-pass calculation:

```
SET UPDATECALC ON;
CALC ALL;
SET UPDATECALC OFF;
```
Use a Client and a Calculation Script

To perform a default calculation from a client and then use a calculation script to perform the formula calculation:

1. Enable Intelligent Calculation, if this default has been changed.
2. Perform a full calculation, using any of the tools listed in Table 183 on page 882.
3. Use a calculation script similar to this example to disable Intelligent Calculation and calculate the formula:

   ```
   SET UPDATECALC OFF;
   SET CLEARUPDATESTATUS AFTER;
   "Share of Sales" = Sales % Sales -> Product;
   ``

   or:

   ```
   SET UPDATECALC OFF;
   SET CLEARUPDATESTATUS AFTER;
   CALC TWOPASS;
   ```

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Calculating Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>execute calculation</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>CALCDEFAULT</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>


Intelligent Calculation with a Small Index

To use Intelligent Calculation when the index is small:

1. Create a calculation script to calculate the database, but tell Essbase not to mark the calculated data blocks as clean.
2. Mark all data blocks as clean and do not recalculate the data blocks.

   ```
   SET CLEARUPDATESTATUS OFF;
   CALC ALL;
   CALC TWOPASS;
   SET CLEARUPDATESTATUS ONLY;
   CALC ALL;
   ``

3. Essbase performs these tasks:
a. The SET CLEARUPDATESTATUS OFF command tells Essbase not to mark the calculated data blocks as clean.

b. The first CALC ALL command causes Essbase to cycle through the database, calculating all dirty data blocks. Essbase does not mark the calculated data blocks as clean. Essbase does not automatically recalculate the formulas tagged as two-pass in the database outline.

c. The CALC TWOPASS command causes Essbase to cycle through the database, recalculating the formulas that are tagged as two-pass in the dimension tagged as accounts in the database outline. Essbase recalculates the formulas because the required data blocks are not marked as clean by the previous CALC ALL. Essbase does not mark the recalculated data blocks as clean.

d. The SET CLEARUPDATESTATUS ONLY command tells Essbase to mark the data blocks as clean but not to calculate the data blocks. This command disables calculation.

e. The last CALC ALL command causes Essbase to cycle through the database and mark all the data blocks as clean. Essbase searches the index and marks the data blocks as clean. It does not calculate the data blocks.

**Intelligent Calculation Turned Off for a Two-Pass Formula**

To turn Intelligent Calculation off for a Two-Pass formula, create a calculation script that performs these tasks:

- Disables Intelligent Calculation.
- Performs a full calculation.
- Repeats the following two-pass formula:

```
SET UPDATECALC OFF;
CALC ALL;
"Share of Sales" = Sales / Sales -> Product;
```

**Choosing Between Member Set Functions and Performance**

Queries and calculations that reference a member that has been tagged as Dynamic Calc or Dynamic Calc and Store may be significantly slower than queries and calculations involving the same members, if the member has formulas involving any of these functions:

- @CURRMBR
- @PARENT
- @SPARENTVAL
- @ANCEST
- @SANCESTVAL
If you are experiencing slow performance, consider either removing the dynamic calculation tag or removing these functions from the attached formula.

## Consolidating #MISSING Values

If no data value exists for a combination of dimension members, Essbase gives the combination a value of #MISSING. Essbase treats #MISSING values and zero (0) values differently.

### Understanding #MISSING Calculation

Table 184 shows how Essbase calculates #MISSING values. In this table, X represents any number:

<table>
<thead>
<tr>
<th>Calculation/Operation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>X + #MISSING</td>
<td>X</td>
</tr>
<tr>
<td>X - #MISSING</td>
<td>X</td>
</tr>
<tr>
<td>#MISSING - X</td>
<td>-X</td>
</tr>
<tr>
<td>X * #MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>X / #MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>#MISSING / X</td>
<td>#MISSING</td>
</tr>
<tr>
<td>X / 0</td>
<td>#MISSING</td>
</tr>
<tr>
<td>X % #MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>#MISSING % X</td>
<td>#MISSING</td>
</tr>
<tr>
<td>X % 0</td>
<td>#MISSING</td>
</tr>
<tr>
<td>X == #MISSING</td>
<td>FALSE, unless X is #MISSING</td>
</tr>
<tr>
<td>X != #MISSING</td>
<td>TRUE, unless X is #MISSING</td>
</tr>
<tr>
<td>X &lt; &gt; #MISSING</td>
<td>TRUE, unless X is #MISSING</td>
</tr>
<tr>
<td>X &lt;= #MISSING</td>
<td>(X &lt;= 0)</td>
</tr>
<tr>
<td>X &gt;= #MISSING</td>
<td>(X &gt;= 0) or (X == #MISSING)</td>
</tr>
<tr>
<td>X &gt; #MISSING</td>
<td>(X &gt; 0)</td>
</tr>
<tr>
<td>X &lt; #MISSING</td>
<td>(X &lt; 0)</td>
</tr>
<tr>
<td>X AND #MISSING:</td>
<td>#MISSING</td>
</tr>
<tr>
<td>Y AND #MISSING, where Y represents any nonzero value</td>
<td>0</td>
</tr>
<tr>
<td>0 AND #MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>#MISSING AND #MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>Calculation/Operation</td>
<td>Result</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------</td>
</tr>
<tr>
<td>X OR #MISSING:</td>
<td>Y</td>
</tr>
<tr>
<td>Y OR #MISSING, where Y represents any nonzero value</td>
<td>#MISSING</td>
</tr>
<tr>
<td>0 OR #MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>#MISSING OR #MISSING</td>
<td></td>
</tr>
<tr>
<td>IF (#MISSING)</td>
<td>IF (0)</td>
</tr>
<tr>
<td>$f$ (#MISSING)</td>
<td>#MISSING for any Essbase function of one variable</td>
</tr>
<tr>
<td>$f$ (X)</td>
<td>#MISSING for any X not in the domain of $f$ and any Essbase function of multiple variables (except where specifically noted)</td>
</tr>
</tbody>
</table>

By default, Essbase does not roll up #MISSING values. However, if you always load data at level 0 and never at parent levels, you should enable the setting for consolidating #MISSING values. This setting provides a calculation performance improvement of 1%–30%. The performance improvement varies, depending on database size and configuration.

**Caution!** The default, not consolidating #MISSING values, must be in effect if you load data at parent, rather than child, levels, if any child member combinations have #MISSING values. If all child member combinations have any other values, including zero (0), Essbase rolls up the child values and overwrites the parent values correctly, so you can safely change the default.

## Changing Consolidation for Performance

To consolidate, enable the setting for consolidating #MISSING values by using one of the methods described above. The degree of performance improvement you achieve depends on the ratio between upper-level blocks and input blocks in the database.

To change how Essbase consolidates #MISSING values, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Aggregating Missing Values During Calculation</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>Calculation script</td>
<td>SET AGGMISSG</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Note:** If you enable the setting for consolidating #MISSING values, the cell calculation order within a data block changes. See “Cell Calculation Order” on page 402.

When the setting for consolidating #MISSING values is disabled, note that the performance overhead is particularly high in the following situations:
When the ratio of calculated data blocks to input data blocks is low

When you load many data values at parent levels on sparse dimensions; for example, in the Sample.Basic database, if you load many data values into East in a sparse Market dimension

In these situations, the performance overhead is 10%–30%. If calculation performance is critical, you may want to reconsider the database configuration or how you load data.

For information on how Essbase calculates #MISSING values, see “Consolidating #MISSING Values” on page 884.

**Removing #MISSING Blocks**

You can use the CLEARDATA command to change the value of cells in a block to #MISSING. It does not remove the data blocks. These extra blocks can slow retrieval and calculation performance.

If the #MISSING blocks are slowing performance, perform either action:

- Use the CLEARBLOCK command to remove the data blocks.
- Export the data and re-import it (see the Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide).

**Note:** Removing empty blocks improves performance when data values already have been loaded. However, data load process time increases if new values require that blocks be created.

**Identifying Additional Calculation Optimization Issues**

The relationship between calculation and performance is also described in the following chapters:

- In Chapter 27, “Dynamically Calculating Data Values,” see the following topics:
  - “Benefitting from Dynamic Calculation” on page 429
  - “Choosing Between Dynamic Calc and Dynamic Calc and Store” on page 433
  - “Reducing the Impact on Retrieval Time” on page 438
  - “Dynamically Calculating Data in Partitions” on page 443

- In Chapter 29, “Developing Calculation Scripts for Block Storage Databases,” see the following topics:
  - “Specifying Global Settings for a Database Calculation” on page 463
  - “Writing Calculation Scripts for Partitions” on page 482

For the relationship of two-pass calculation and the SET CLEARUPDATESTATUS command, see the Oracle Essbase Technical Reference.
When you convert currencies using the CCONV command, the resulting data blocks are marked as \textit{dirty} for the purposes of Intelligent Calculation. This means that Essbase recalculates all the converted blocks when you recalculate the database. See Chapter 26, “Understanding Intelligent Calculation.”
### Changing Buffer Size

The time required to generate a report varies depending upon factors such as the size of the database you are reporting from, the number of queries included in the script, and the size of the report buffer.

Configurable variables specify the size of the buffers used for storing and sorting data extracted by retrievals. The buffer should be large enough to prevent unnecessary read and write activities. See “Report Extractor” on page 534.

The following report variables are used in the conditional retrieval and data sorting commands.

### Setting the Retrieval Buffer Size

The database retrieval buffer is a server buffer, per database, that holds extracted row data cells before they are evaluated. Retrieval tools such as the Essbase Retrieval Wizard and the Report Writer use this buffer.

When the retrieval buffer is full, the rows are processed and the buffer is reused. If this buffer is too small, frequent reuse of the area can increase retrieval times. If this buffer is too large, too much memory may be used when concurrent users perform queries, also increasing retrieval times.

The following sections describe ways you can manage retrieval buffer sizes.
Manually Setting the Retrieval Buffer Size

Each database has a retrieval buffer setting, in kilobytes, that you can change. The default buffer size is 10 KB for 32-bit platforms and 20 KB for 64-bit platforms. If you are increasing the size of the buffer, Oracle recommends that you do not exceed 100 KB, although the size limit is set at 100,000 KB.

To manually set the retrieval buffer size, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting the Size of Retrieval Buffers</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Setting the Retrieval Sort Buffer Size

The retrieval sort buffer size setting specifies the size, in kilobytes, of the server buffer that holds the data to be sorted during a Report Writer retrieval. If the sort buffer is full, Essbase posts an error message.

Essbase requires a larger retrieval sort buffer size on 64-bit platforms than on 32-bit platforms. If you encounter an error indicating that the retrieval sort buffer limit has been exceeded, increase the setting by a factor of two.

You can adjust the buffer size on a per-database basis. The default buffer size is set to 10 KB on 32-bit platforms and to 20 KB on 64-bit platforms.

To set the retrieval sort buffer size, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting the Size of Retrieval Buffers</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>SETDBSTATEITEM</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Setting Numeric Precision

The NUMERICPRECISION configuration setting, used by the RESTRICT command, defines the number of precision digits the internal numerical comparison considers in the Report Extractor. If a precision setting is greater than necessary for the data, retrieval is slower than it could be. Identify the correct precision level and adjust NUMERICPRECISION accordingly. See the Oracle Essbase Technical Reference.

If you change an essbase.cfg setting, restart Essbase Server to apply the change.
Generating Symmetric Reports

When using Report Writer, if report processing time is of primary importance, consider making all reports symmetric. Symmetric reports provide better processing performance than asymmetric reports.

With a symmetric report, the Report Extractor uses one pass to compose the member list based on all possible member combinations. In the following example, the data values (Actual Jan and Feb, and Budget Jan and Feb) are retrieved in one pass.

**Symmetric Report Member Combinations Supporting One Pass**

<table>
<thead>
<tr>
<th>Sales South</th>
<th>Actual</th>
<th></th>
<th>Budget</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan</td>
<td>Feb</td>
<td>Jan</td>
<td>Feb</td>
</tr>
<tr>
<td></td>
<td>========</td>
<td>========</td>
<td>========</td>
<td>========</td>
</tr>
<tr>
<td>100–10</td>
<td>757</td>
<td>773</td>
<td>930</td>
<td>950</td>
</tr>
<tr>
<td>100–20</td>
<td>450</td>
<td>487</td>
<td>550</td>
<td>590</td>
</tr>
<tr>
<td>100–30</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>100</td>
<td>1,207</td>
<td>1,260</td>
<td>1,480</td>
<td>1,540</td>
</tr>
</tbody>
</table>

With an asymmetric report, the Report Extractor must retrieve and process each block of possible member combinations separately. In the following example, the data values (Actual Jan and Budget Jan) are retrieved in two passes.

**Asymmetric Report Member Combinations Requiring Multiple Passes**

<table>
<thead>
<tr>
<th>Sales South</th>
<th>Actual</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan</td>
<td>Jan</td>
</tr>
<tr>
<td></td>
<td>========</td>
<td>========</td>
</tr>
<tr>
<td>100–10</td>
<td>757</td>
<td>950</td>
</tr>
<tr>
<td>100–20</td>
<td>450</td>
<td>590</td>
</tr>
<tr>
<td>100–30</td>
<td>#MISSING</td>
<td>#MISSING</td>
</tr>
<tr>
<td>100</td>
<td>1,207</td>
<td>1,540</td>
</tr>
</tbody>
</table>

See “Report Extractor” on page 534.

Improving Retrieval Performance on Large Dimensions

Queries on large dimensions often have large resource requirements. However, these queries typically are sparse, meaning that the number of nonempty values returned is small compared to the size of the input query. For these large but sparse queries, we suggest using the following special MDX and Report Writer functions to help Essbase more efficiently use memory and processor resources. These functions optimize retrieval performance by attempting to handle only nonempty combinations.

- Leaves() MDX function
- NonEmptySubset() MDX function
- MDX optimization properties: NONEMPTYMEMBER and NONEMPTYTUPLE
Organizing Members to Optimize Data Extraction

Report Extractor extracts data in a certain order for Report Writer. If you do not require a formatted report and you are using Report Writer, you can reduce the time required to generate the report by using either of these strategies:

- Creating the report script in the same order as Report Extractor extracts data
- Grouping dense dimensions in columns and sparse dimensions in rows

These strategies save the most time if used to create large production reports.

Report Extractor looks at data from bottom to top and right to left, starting from the bottom column member to the top column member and proceeding from the innermost row member (right) to the outermost row member (left).

In the following example, the column members come from dense dimensions and the row members from sparse dimensions. The sequence in which the report is read is represented by the numbers 1–3, which are in parentheses; for example, (1):

```
Sales South

       (3) Actual    Budget (2)
       Jan       Jan (1)
               ========   ========
100–10       757       950
100–20       450       590
100–30   #MISSING  #MISSING
100       1,207     1,540
```

To reduce the time to extract data, group dense dimensions first, then group sparse dimensions in the sequence in which they are displayed in the outline.

When dense dimensions are nested in the report columns, Report Extractor examines each data block only once, improving performance time.

Because attributes are sparse dimensions and are dynamically calculated, Essbase cannot use the sparse data extraction method when a report contains attribute dimensions.

Understanding Reports for Outlines That Contain Dynamic or Transparent Members

If you generate a report that accesses a database outline that contains Dynamic Calc and Store members, the first time that you generate the report takes longer than subsequent retrievals that access the same data block.
If you generate a report that accesses a database outline that contains Dynamic Calc or Dynamic Time Series members, Essbase calculates the member every time a report is generated, increasing the reporting time.

See Chapter 27, “Dynamically Calculating Data Values.”

If you run a report that contains transparent members, the report takes longer to generate, because it must access multiple servers to retrieve the required data.

**Limiting LRO File Sizes**

You can limit the size of files that users can link to a database. Limiting the size prevents users from taking up too much of the server resources by storing extremely large objects. See “Limiting LRO File Sizes for Storage Conservation” on page 190.
Running Essbase on Oracle Exalytics In-Memory Machine

In This Chapter

- About Running Essbase on Oracle Exalytics In-Memory Machine ........................................ 895
- Virtual Memory and Swap Space Considerations ........................................................................ 895
- Increase in Page File Size when Essbase Runs on Oracle Exalytics In-Memory Machine .... 895

The information in this chapter applies only to Essbase running on an Oracle Exalytics In-Memory machine.

About Running Essbase on Oracle Exalytics In-Memory Machine

When running Essbase on an Oracle Exalytics In-Memory machine, you must set the ORACLEHARDWAREACCELERATION configuration setting to TRUE. See the Oracle Essbase Technical Reference.

Caution! This setting must only be used when Essbase is deployed on the Exalytics In-Memory machine. ORACLEHARDWAREACCELERATION is not supported and should never be set to TRUE on deployments of Essbase on non-Exalytics In-Memory machines.

Virtual Memory and Swap Space Considerations

When Essbase Server runs on Oracle Exalytics In-Memory Machine, an accompanying increase in virtual memory usage is normal and expected. Virtual memory usage is increased by the size of page files. For best performance, configure swap space on the system to be greater than the sum of the expected sizes of dynamic calculator caches, for all databases on the system.

Increase in Page File Size when Essbase Runs on Oracle Exalytics In-Memory Machine

When Essbase runs operations that create new blocks (for example, data loads and calculations), these operations cause a page file to grow in size as the blocks get written to the disk. On Oracle
Exalytics In-Memory machine, when blocks are created for the first time, Essbase adds a margin to the compressed block size to account for future growth in the block as more dense data is added. Therefore, the initial page file size on Exalytics will be slightly higher; however, this extra allocation helps reduce fragmentation and the frequent need for restructuring.
Part X

Creating, Calculating, and Managing Aggregate Storage Databases

In Creating, Calculating, and Managing Aggregate Storage Databases:

- Comparison of Aggregate and Block Storage
- Aggregate Storage Applications, Databases, and Outlines
- Aggregate Storage Time-Based Analysis
- Loading, Calculating, and Retrieving Aggregate Storage Data
- Performing Custom Calculations and Allocations on Aggregate Storage Databases
- Managing Aggregate Storage Applications and Databases
Introduction

Essbase provides an aggregate storage kernel as a persistence mechanism for multidimensional databases. Aggregate storage databases enable dramatic improvements in both database aggregation time and dimensional scalability. The aggregate storage kernel is an alternative to the block storage kernel. Aggregate storage databases typically address read-only, “rack and stack” applications that have large dimensionality, such as the following applications:

- Customer analysis. Data is analyzed from any dimension, and there are potentially millions of customers.
- Procurement analysis. Many products are tracked across many vendors.
- Logistics analysis. Near real-time updates of product shipments are provided.

A sample application (ASOsamp), a data file, and a rules file are provided to demonstrate aggregate storage functionality.

Aggregate storage applications, which differ from block storage applications in concept and design, have limitations that do not apply to block storage applications. The following sections describe the differences.

See also “Hybrid Aggregation” on page 905.
# Inherent Differences

**Table 185  Inherent Differences Between Aggregate Storage and Block Storage**

<table>
<thead>
<tr>
<th>Inherent Differences</th>
<th>Aggregate Storage</th>
<th>Block Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage kernel</td>
<td>Architecture that supports rapid aggregation, optimized to support high dimensionality and sparse data.</td>
<td>Multiple blocks defined by dense and sparse dimensions and their members, optimized for financial applications.</td>
</tr>
<tr>
<td>Physical storage</td>
<td>Through the Application Properties window, Tablespaces tab in Administration Services.</td>
<td>Through the Database Properties window, Storage tab in Administration Services.</td>
</tr>
<tr>
<td>definition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create database</td>
<td>Migrate a block storage outline or define after application creation.</td>
<td>Define after application creation.</td>
</tr>
<tr>
<td><strong>Note:</strong></td>
<td>Do not use the file system to copy a block storage outline into an aggregate storage application. Use the migration wizard in Administration Services to migrate the outline.</td>
<td></td>
</tr>
<tr>
<td>Copy database</td>
<td>Not supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Databases supported</td>
<td>One</td>
<td>Several (one recommended)</td>
</tr>
<tr>
<td>per application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application and</td>
<td>See &quot;Naming Conventions for Applications and Databases&quot; on page 1093. Names reserved for tablespaces, cannot be used as application or database names:</td>
<td>See &quot;Naming Conventions for Applications and Databases&quot; on page 1093.</td>
</tr>
</tbody>
</table>
| database names       | ● default  
● log 
● metadata  
● temp |
|                     |                                                                                                            |                                                                                                         |
| Application and      | Displayed in the Application Properties window and the Database Properties window in Administration Services. | Displayed in the Application Properties window and the Database Properties window in Administration Services |
| database information  | Information not supported by or relevant to aggregate storage applications is not shown. For a description of aggregate storage-specific information, see the Oracle Essbase Administration Services Online Help for the Application Properties window and Database Properties window. |                                                                                                         |
| display              |                                                                                                            |                                                                                                         |
| Configuration settings | For a list of the settings that apply to aggregate storage databases, see the Oracle Essbase Technical Reference. | For a list of the settings that do not apply to block storage databases, see the Oracle Essbase Technical Reference. |
| (essbase.cfg)         |                                                                                                            |                                                                                                         |

# Outline Differences

**Table 186  Outline Differences Between Aggregate Storage and Block Storage**

<table>
<thead>
<tr>
<th>Outline Functionality</th>
<th>Aggregate Storage</th>
<th>Block Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dense or sparse</td>
<td>Not relevant</td>
<td>Relevant</td>
</tr>
<tr>
<td>dimension designation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outline Functionality</td>
<td>Aggregate Storage</td>
<td>Block Storage</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Multiple hierarchies enabled, dynamic hierarchy, or stored hierarchy designation</td>
<td>Relevant</td>
<td>Irrelevant</td>
</tr>
</tbody>
</table>
| Accounts dimensions and members on dynamic hierarchies | Support with the following exceptions:  
  - No two-pass calculation (however, for information on specifying the calculation order, see “Calculation Order” on page 971)  
  - No association of attribute dimensions with the dimension tagged Accounts  
  - Additional restrictions for shared members. See “Alternate Hierarchies” on page 912. | Full support |
| Members on stored hierarchies                    | Support with the following exceptions:  
  - Support for the ~ (no consolidation) operator (undemeath label-only members only) and the + (addition) operator  
  - Cannot have formulas  
  - Restrictions on label only members (See Member storage types.)  
  - No Dynamic Time Series members  
  - Stored hierarchy dimensions cannot have shared members. Stored hierarchies within a multiple hierarchies dimension can have shared members. See “Stored Hierarchies” on page 910. | Full support |
| Member storage types                             | Support with the following exceptions:  
  - Dynamic Calc and Store not relevant  
  - On stored hierarchies, two limitations if a member is label only:  
    - All dimension members at the same level as the member must be label only  
    - The parents of the member must be label only.  
  Note: On dynamic hierarchies, ability to tag any member as label only  
  Note: On conversion from a block storage database, attribute dimension members are tagged as Dynamic Calc. On standard dimension members Dynamic Calc tags are converted and tagged as stored members, which changes the Members Stored value on the Dimensions tab of the Database Properties window in Administration Services. | Support for all member storage types in all types of dimensions except attribute dimensions |
| Ragged hierarchies and hierarchies with more than 10 levels | Support, with possible performance impact | Support |
| Outline validation                               | When database is started  
  - When outline is saved  
  - When block storage outline is converted to aggregate storage outline  
  - When user requests | When outline is saved  
  - When user requests |
| Outline paging                                   | Support | No support |
### Calculation Differences

**Table 187** Calculation Differences Between Aggregate Storage and Block Storage

<table>
<thead>
<tr>
<th>Calculation Functionality</th>
<th>Aggregate Storage</th>
<th>Block Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database calculation</td>
<td>Aggregation of the database, which can be predefined by defining aggregate views</td>
<td>Calculation script or outline consolidation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hybrid aggregation is also available. Hybrid aggregation for block storage databases means that wherever possible, block storage data calculation executes with efficiency similar to that of aggregate storage databases. In the Oracle Essbase Technical Reference, see the configuration setting ASODYNAMICAGGINBSO.</td>
</tr>
<tr>
<td>Formulas</td>
<td>Allowed with the following restrictions:</td>
<td>Support for Essbase calculation functions</td>
</tr>
<tr>
<td></td>
<td>• Must be valid numeric value expressions written in MDX; cannot contain the % operator—replace with expression: (value1 / value2) * 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No support for Essbase calculation functions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• On dynamic hierarchy members, formulas are allowed without further restrictions</td>
<td></td>
</tr>
<tr>
<td>Calculation scripts</td>
<td>Not supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Attribute calculations</td>
<td>Support for Sum</td>
<td>Support for Sum, Count, Min, Max, and Average</td>
</tr>
<tr>
<td>dimension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculation order</td>
<td>Member formula calculation order can be defined by the user using the solve order member property</td>
<td>Defined by the user in the outline consolidation order or in a calculation script</td>
</tr>
</tbody>
</table>

### Partitioning Differences

**Table 188** Partitioning Differences Between Aggregate Storage and Block Storage

<table>
<thead>
<tr>
<th>Partitioning Functionality</th>
<th>Aggregate Storage</th>
<th>Block Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partitioning</td>
<td>Support with the following restrictions:</td>
<td>Fully supported</td>
</tr>
<tr>
<td></td>
<td>No outline synchronization</td>
<td></td>
</tr>
</tbody>
</table>
## Data Load Differences

Table 189  Data Load Differences Between Aggregate Storage and Block Storage

<table>
<thead>
<tr>
<th>Data Load Functionality</th>
<th>Aggregate Storage</th>
<th>Block Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cells loaded through data loads</td>
<td>Only level 0 cells whose values do not depend on formulas in the outline are loaded</td>
<td>Cells at all levels can be loaded (except Dynamic Calc members)</td>
</tr>
<tr>
<td>Update of database values</td>
<td>At the end of a data load, if an aggregation exists, the values in the aggregation are recalculated</td>
<td>No automatic update of values. To update data values, you must execute all necessary calculation scripts.</td>
</tr>
<tr>
<td>Data load buffers</td>
<td>The loading of multiple data sources into aggregate storage databases is managed through temporary data load buffers</td>
<td>Not supported</td>
</tr>
<tr>
<td>Atomic replacement of the contents of a database</td>
<td>When loading data into an aggregate storage database, you can replace the contents of the database or the contents of all incremental data slices in the database</td>
<td>Not supported</td>
</tr>
<tr>
<td>Data slices</td>
<td>Aggregate storage databases can contain multiple slices of data. Data slices can be merged</td>
<td>Not supported</td>
</tr>
<tr>
<td>Dimension build for shared members</td>
<td>Full support for parent-child build method. Duplicate generation (DUPGEN) build method limited to building alternate hierarchies up to generation 2 (DUPGEN2).</td>
<td>Support for all build methods</td>
</tr>
<tr>
<td>Loading data mapped to dates</td>
<td>In a date-time dimension, you can load data into level 0 members using supported date-format strings instead of member names</td>
<td>Date-time dimension type is not supported</td>
</tr>
</tbody>
</table>

## Query Differences

Table 190  Query Differences Between Aggregate Storage and Block Storage

<table>
<thead>
<tr>
<th>Query Functionality</th>
<th>Aggregate Storage</th>
<th>Block Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Writer</td>
<td>Supported, except for commands related to sparsity and density of data</td>
<td>Fully supported</td>
</tr>
<tr>
<td>Smart View</td>
<td>Supported, with limited ability to change data (write-back)</td>
<td>Fully supported</td>
</tr>
<tr>
<td>API</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Export</td>
<td>Support with the following restrictions:</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>● Export of level 0 data only (no upper-level export)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● No columnar export</td>
<td></td>
</tr>
<tr>
<td>MDX queries</td>
<td>Supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>
### Query Functionality

<table>
<thead>
<tr>
<th></th>
<th>Aggregate Storage</th>
<th>Block Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queries on attribute members that are associated with non-level 0 members</td>
<td>Returns values for descendants of the non-level 0 member. See also &quot;Design Considerations for Attribute Queries&quot; on page 915.</td>
<td>Returns #MISSING for descendants of the non-level 0 member.</td>
</tr>
<tr>
<td>Queries on attribute members and shared members</td>
<td>A shared member automatically shares the attribute associations of its nonshared member</td>
<td>A shared member does not share the attribute associations of its nonshared member</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Query logging</th>
<th>Not supported</th>
<th>Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Query performance</td>
<td>Considerations when querying data from a dimension that has multiple hierarchies. See “Query Design Considerations for Aggregate Storage” on page 916.</td>
<td>Hierarchies not relevant</td>
</tr>
</tbody>
</table>

### Feature Differences

#### Table 191 Feature Differences Between Aggregate and Block Storage

<table>
<thead>
<tr>
<th>Features</th>
<th>Aggregate Storage</th>
<th>Block Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aliases</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Currency conversion</td>
<td>Not supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Incremental data load</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>LROs</td>
<td>Not supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>
| Time balance reporting                        | Support with the following restrictions:  
  - Skip Zeros is not supported  
  - Time dimension must contain only stored hierarchies  
  - Shared members must be at level zero | Supported         |
| Triggers                                      | After-update triggers supported | On-update triggers and after-update triggers supported |
| Unicode                                       | Supported         | Supported     |
| Variance reporting                            | Not supported     | Supported     |
| Date-time dimension type and linked attribute dimensions | Supported | Not supported |
| User ability to change data (write-back)      | Supported with the following restriction: Write back to an aggregate storage database must be to level 0 members. | Supported |
Hybrid Aggregation

Essbase hybrid aggregation combines block storage functionality with aggregate storage performance. In hybrid aggregation mode, you retain the use of block storage elements while enabling the use of more (and larger) sparse dimensions, while also reducing the database footprint and improving performance.

In block storage databases, large, sparse dimensions must be stored: making them dynamic would result in too much block I/O at query time, affecting performance. Very large stored sparse dimensions can lead to lengthy batch aggregation times, as well as large database sizes that grow in relation to the number and size of the sparse dimensions. Even with such drawbacks, block storage is widely used for its powerful functionality.

Aggregate storage is designed specifically to enable large databases with more and larger dimensions. Unlike block storage, it does not require large sparse dimensions to be pre-aggregated to achieve good query performance. The key lies in the aggregate storage query processor, and in a bitmap index associated with every stored, level-0 cell. The bitmap index has the information required for very fast retrievals and aggregations.

For all the benefits that aggregate storage offers, however, there are many applications that are simply better suited to block storage. In such cases, hybrid aggregation might be the solution. Hybrid aggregation is a combination of the best features of block storage and aggregate storage:

- It enables the full block storage functionality of a block storage outline, utilizing calculation order and calculation scripts.
- It stores data in block storage data and index files.
- It uses the aggregate storage query processor whenever possible. When there is a query that the aggregate storage query processor cannot handle, the block storage query processor takes over and accomplishes the task.

**Note:** The aggregate storage query processor does not interface directly with the block storage data and index files; rather, it brings the data into an aggregate storage temporary tablespace. Just as with aggregate storage mode, the temporary tablespace resides within the aggregate storage cache to the largest extent possible, overflowing to the file system only as needed. Aggregate storage-level performance is achieved whenever the aggregate storage query processor is used. In some cases, hybrid aggregation query performance may be even greater than the equivalent aggregate storage performance.

To get started with hybrid aggregation, follow these guidelines:

- Read all content related to hybrid aggregation, in the Essbase documentation and Readme files. Particularly, see the topic for the configuration setting ASODYNAMICAGGINBSO, in the Oracle Essbase Technical Reference.
- Set up a development environment, and migrate existing block storage applications to it.
- Where possible, make larger sparse dimensions dynamic.
- Enable hybrid aggregation mode using the ASODYNAMICAGGINBSO configuration setting.
Run test queries and examine the log, both before and after enabling hybrid aggregation. This activity can reveal the extent to which the aggregate storage query processor was used, and the benefits of hybrid mode that were gained.

If needed, optimize the application so that a greater percentage of queries can use the aggregate storage query processor. For more information, see the section entitled “Functions Supported in Hybrid Aggregation Mode,” in the Oracle Essbase Technical Reference.
Introduction

Aggregate storage applications and databases and block storage applications and databases differ in concept and design. Some block storage outline features do not apply to aggregate storage. For example, the concept of dense and sparse dimensions does not apply. See Chapter 60, “Comparison of Aggregate and Block Storage”.

A new sample application (ASOsamp), a data file, and a rules file are provided to demonstrate aggregate storage functionality.

Process for Creating Aggregate Storage Applications

This topic provides a high-level process for creating an aggregate storage application.

1. Create an aggregate storage application, database, and outline.

   See “Creating Aggregate Storage Applications, Databases, and Outlines” on page 908.
2. Use tablespaces to optimize data storage and retrieval.
   See “Managing Storage for Aggregate Storage Applications” on page 1024.

3. Specify the maximum size of the aggregate storage cache.
   See “Managing the Aggregate Storage Cache” on page 1025.

4. Load data into the aggregate storage database. A data load can be combined with a dimension build.
   See “Preparing Aggregate Storage Databases” on page 949. You can preview a subset of the data in Administration Services. See “Previewing Data” in the Oracle Essbase Administration Services Online Help.

5. Precalculate chosen aggregations to optimize retrieval time.
   See “Calculating Aggregate Storage Databases” on page 969.

   See “Viewing Aggregate Storage Statistics” in the Oracle Essbase Administration Services Online Help.

7. Write back to an aggregate storage database must be to level 0 members.
   In some scenarios, you might want to use a transparent partition for write-back. See “Using a Transparent Partition for Write-Back to Aggregate Storage Databases” on page 931.

8. View data using Oracle tools (for example, Smart View) or third-party tools.

Creating Aggregate Storage Applications, Databases, and Outlines

You must create an aggregate storage application to contain an aggregate storage database. An aggregate storage application can contain only one database. You can create an aggregate storage application, database, and outline in the following ways:

- Convert a block storage outline to an aggregate storage outline, and then create an aggregate storage application to contain the converted database and outline.

  Essbase supports the following scenarios for converting block storage outlines to aggregate storage outlines:
  - Non-Unicode block storage outline to non-Unicode aggregate storage outline
  - Non-Unicode block storage outline to Unicode aggregate storage outline
  - Unicode block storage outline to Unicode aggregate storage outline

  The following conversion scenarios are not supported:
  - Unicode block storage outline to non-Unicode aggregate storage outline
  - Aggregate storage outline to a block storage outline

- Create an aggregate storage application and database. The aggregate storage outline is created automatically when you create the database.
For information on loading dimensions and members into an aggregate storage outline, see “Building Dimensions in Aggregate Storage Databases” on page 949 and “Loading Data into Aggregate Storage Databases” on page 954.

Aggregate storage application and database information differs from block storage information, and specific naming restrictions apply to aggregate storage applications and databases. See Table 185.

To convert a block storage outline to an aggregate storage outline, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Converting Block Storage Outlines to Aggregate Storage</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td></td>
<td>Aggregate Storage Outline Conversion Wizard</td>
<td></td>
</tr>
<tr>
<td>MaxL</td>
<td>create outline</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Note:** Do not use the file system to copy a block storage outline into an aggregate storage application. Use the Aggregate Storage Outline Conversion Wizard in Administration Services to convert the outline.

To create an aggregate storage application or database, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Applications</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td></td>
<td>Creating Databases</td>
<td></td>
</tr>
<tr>
<td>MaxL</td>
<td>create application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>create database</td>
<td></td>
</tr>
</tbody>
</table>

When creating aggregate storage applications, databases, and outlines, consider the differences between aggregate storage and block storage and issues specific to aggregate storage. See the following sections, and also see Chapter 62, “Aggregate Storage Time-Based Analysis.”

**Hierarchies**

In aggregate storage outlines and block storage outlines, dimensions are structured to contain one or more hierarchies of related levels and members within the levels. For example, the Time dimension in the ASOsamp.Sample database includes the hierarchies MTD, QTD, and YTD, as shown in Figure 152.
In an aggregate storage database, you can create two types of hierarchies:

- Stored
- Dynamic

The two types of hierarchies have different advantages and restrictions. A dimension may contain both types of hierarchies. To use multiple hierarchies in a dimension (even if they are all stored hierarchies), you must enable multiple hierarchies for that dimension.

To enable multiple hierarchies for a dimension, tag the dimension member as multiple hierarchies enabled using a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Defining Hierarchies in Aggregate Storage Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>import database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

When you tag a dimension member as multiple hierarchies enabled, it is automatically tagged label only.

If you do not tag the dimension as multiple hierarchies enabled, Essbase automatically tags the dimension as a stored hierarchy (except the dimension tagged as Accounts, which is automatically tagged as a dynamic hierarchy).

**Note:** The first hierarchy in a multiple hierarchies enabled dimension must be a stored hierarchy.

**Stored Hierarchies**

Members of stored hierarchies are aggregated according to the outline structure. Because aggregate storage databases are optimized for aggregation, the aggregation of data values for stored hierarchies is very fast. To allow this fast aggregation, members of stored hierarchies have the following restrictions:

- Stored hierarchies can have the no-consolidation (~) operator (only underneath label only members) or the addition (+) operator.
Stored hierarchies cannot have formulas.

Stored hierarchies have restrictions on label only members. See Table 186 on page 900.

In Figure 153 on page 913, the All Merchandise hierarchy and the High End Merchandise hierarchy are stored hierarchies. The All Merchandise member and the High End Merchandise member are the tops of the hierarchies and are both tagged as top of a stored hierarchy.

To specify a stored hierarchy, tag the top member of the hierarchy as top of a stored hierarchy using a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Defining Hierarchies in Aggregate Storage Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>import database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

The following members can be tagged as top of a stored hierarchy:

- **A dimension member** (generation 1). If a dimension member is tagged as top of a stored hierarchy, the entire dimension is considered a single stored hierarchy, and no other member in the dimension can be tagged as top of a stored hierarchy or top of a dynamic hierarchy.

- **The children of the dimension member** (generation 2). If a generation 2 member is tagged as top of a stored hierarchy, all generation 2 members in the dimension also must be tagged as either top of a stored hierarchy or top of a dynamic hierarchy. The first hierarchy in the dimension must be a stored hierarchy.

The dimension tagged as accounts is automatically considered a dynamic hierarchy. You cannot specify the accounts dimension as a stored hierarchy.

### Dynamic Hierarchies

To evaluate a dynamic hierarchy, Essbase calculates, rather than aggregates, the members and formulas. The order in which members and formulas are evaluated is defined by the solve order property. See “Calculation Order” on page 971.

At the time of retrieval, Essbase calculates the required member combinations and calculates any required outline member formulas. Because dynamic hierarchies are calculated, the data retrieval time may be longer than for data retrieved from stored hierarchies. However, when you design your database, dynamic hierarchies provide the following advantages:

- They can contain any consolidation operator.
- They can have formulas.
To specify a dynamic hierarchy, tag the top member of the hierarchy as top of a dynamic hierarchy using a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Defining Hierarchies in Aggregate Storage Outlines</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>import database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

The following members can be tagged as top of a dynamic hierarchy:

- A **dimension member** (generation 1). If a dimension member is tagged as top of a dynamic hierarchy, the entire dimension is considered a single dynamic hierarchy, and no other member in the dimension can be tagged as top of a dynamic hierarchy or top of a stored hierarchy.

- The **children of the dimension member** (generation 2). If a generation 2 member is tagged as top of a dynamic hierarchy, all generation 2 members in the dimension must also be tagged as either top of a dynamic hierarchy or top of a stored hierarchy. The first hierarchy in the dimension must be a stored hierarchy.

**Note:** If a member has the no-consolidation operator (~) on all its children, the member must be tagged label only.

The dimension tagged accounts is automatically considered a dynamic hierarchy. You cannot specify the accounts dimension as a stored hierarchy.

Essbase cannot select dynamic hierarchy members for an aggregate view. See “Aggregating an Aggregate Storage Database” on page 974.

### Alternate Hierarchies

An alternate hierarchy may be modeled in either of the following ways:

- As an attribute dimension, which uses attributes to classify members logically within the dimension (for example, a Product dimension can have attributes such as Size and Flavor). See Chapter 10, “Working with Attributes.”

**Note:** If you use an attribute dimension to create an alternate hierarchy, you can create a crosstab report query of members in the attribute dimension with members in the base dimension. For example, a crosstab report of product sales information could show size attributes (such as small and large) as column headings and products as row headings. If you use shared members to create an alternate hierarchy, you cannot create an equivalent crosstab report query of the shared members with the nonshared members in the primary hierarchy.

- As a hierarchy of shared members. The alternate hierarchy has shared members that refer to nonshared members of previous hierarchies in the outline. The shared members roll up according to a different hierarchy from the nonshared members to which they refer. Shared
members on dynamic hierarchies can have formulas. See “Understanding Shared Members” on page 149. Table 192 shows the hierarchies for the ASOsamp.Sample database. The Products dimension is shown in Figure 153 on page 913.

<table>
<thead>
<tr>
<th>Product</th>
<th>Hierarchy</th>
<th>Alternate Hierarchy (containing shared members)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat Panel</td>
<td>Products, All Merchandise, Personal Electronics, Home Entertainment, Televisions</td>
<td>Products, High End Merchandise</td>
</tr>
<tr>
<td>HDTV</td>
<td>Products, All Merchandise, Personal Electronics, Home Entertainment, Televisions</td>
<td>Products, High End Merchandise</td>
</tr>
</tbody>
</table>

Figure 153  Aggregate Storage Outline Displaying the Alternate Hierarchy High End Merchandise on the Product Dimension

The following restrictions apply when creating alternate hierarchies in aggregate storage outlines:

- The nonshared instance of the member must occur in the outline before any shared instances of the member. For example, in Figure 153, the member HDTV occurs in the All Merchandise hierarchy before it occurs as a shared member in the alternate hierarchy of High End Merchandise.
- The first hierarchy in a dimension where multiple hierarchies are enabled cannot contain a shared member.
- Stored hierarchy dimensions cannot have shared members. Stored hierarchies within a multiple hierarchies dimension can have shared members.
- To ensure that values are not double-counted, a stored hierarchy cannot contain multiple copies of the same shared member. For example, a stored hierarchy cannot contain a shared member and any of its ancestors. In Figure 153 on page 913, you cannot add the shared member “Televisions” as a child of “High End Merchandise,” because doing so would make “Televisions” a sibling of its children, shared members “Flat Panel” and “HDTV,” causing the values of “Flat Panel” and “HDTV” to be added twice.
Nonshared instances of a member must be in the same dimension as the shared member (same for block storage outlines).

A stored hierarchy cannot contain a nonshared instance and a shared instance of the same member.

A stored hierarchy can contain a shared instance of a dynamic hierarchy member only if the dynamic hierarchy member is a level 0 member without a formula.

**Note:** In an aggregate storage database, a shared member automatically shares any attributes that are associated with its nonshared member. This also applies to an implied shared member (for example, a member that has only one child). See “Understanding Implied Sharing” on page 152. You can prevent implied sharing by setting the Never Share property; see “Determining How Members Store Data Values” on page 147. This behavior of shared members and attributes in aggregate storage databases is different from the behavior in block storage databases.

### Attribute Dimensions

This topic provides information on the differences between aggregate storage and block storage databases with regard to attribute dimensions. To use the information in this topic, you should be familiar with attribute dimension concepts for block storage databases. See Chapter 10, “Working with Attributes.”

The following information applies to attribute dimensions when used on aggregate storage databases:

- Only the addition (+) consolidation operator is available for attribute dimensions.

- For a given attribute dimension, all associations must be with one level of the base dimension. For example, in the ASOsamp.Sample database, associations for the Store Manager attribute dimension are with level 0 of the Stores dimension. The following restrictions apply to attribute associations:
  - Level 0: You can associate attributes with any level 0 member of a dynamic or stored hierarchy that does not have a formula.
  - Non-level 0: You can associate attributes only to upper level members in the primary stored hierarchy.

Attribute dimensions do not have hierarchy types. You cannot specify an attribute dimension as a dynamic or stored hierarchy. Essbase treats attribute dimensions as stored alternate hierarchies of the base dimension. For example, in the ASOsamp.Sample database, Essbase treats the Store Manager attribute dimension as if the Store Manager dimension were a stored alternate hierarchy of the Stores dimension.

When using query tracking, Essbase considers queries on attribute dimension data and may include attribute dimension members in aggregate view selections. See “Selecting Views Based on Usage” on page 980 and “Calculating Aggregate Storage Databases” on page 969.
Note: Queries on attribute members that are associated with non-level 0 members return values for descendants of the non-level 0 member. This behavior of queries on attribute members in aggregate storage databases is different from the behavior in block storage databases.

Design Considerations for Attribute Queries

When selecting and building views based on attribute query data, some queries on attribute data are always dynamically calculated at the time of retrieval, which may affect query performance.

Every query involving attribute dimension members must also include at least one member from the base dimension. If the query involves a single attribute dimension and a sum-of-all dimension member, Essbase aggregates the query data, potentially improving query performance. In other cases, Essbase must calculate the query at the time of retrieval.

Table 193 describes attribute query types and how Essbase calculates the query:

<table>
<thead>
<tr>
<th>Attribute Query Type</th>
<th>Query Calculation Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Query involves a sum-of-all base dimension member and members from one attribute dimension.</td>
<td>Essbase can aggregate query data, potentially improving query performance.</td>
</tr>
<tr>
<td>Query involves any member of the base dimension and members from multiple attribute dimensions.</td>
<td>Essbase calculates the query at the time of retrieval based on the level 0 input data.</td>
</tr>
<tr>
<td>Query involves any child member of the base dimension member (or dimension member that is tagged as label-only) and members from one attribute dimension.</td>
<td>Essbase calculates the query at the time of retrieval based on the level 0 input data, or on data from aggregations on the base dimension.</td>
</tr>
</tbody>
</table>

In the outline displayed in Figure 154 on page 916, RealDimension is the sum of all its descendents (it is not tagged as label-only). If a query involves one or more members from a single attribute dimension (for example, AttributeDimension1), crossed with the base dimension member (RealDimension), Essbase can build aggregate cells for the data, potentially improving query performance.

The following queries, however, are always calculated at the time of retrieval:

- Any query requesting data for members from an attribute dimension (for example AttributeDimension1) and any of the children of RealDimension is calculated dynamically at retrieval time based on the level 0 input data or on data from aggregations.
- Any query requesting data from multiple attribute dimensions (for example AttributeDimension1 and AttributeDimension2) and a base member dimension (for example RealDimension) is calculated dynamically at retrieval time based on level 0 input data.
Design Considerations for Aggregate Storage Outlines

This topic lists the key design considerations when you create aggregate storage database outlines. For an example of implementing these design considerations, see the ASOsamp.Sample database. Consider the following information when designing an aggregate storage outline:

- Use stored hierarchies (rather than dynamic hierarchies) as much as possible.
- Use alternate hierarchies (shared members) only when necessary.
- Minimize the number of hierarchies. (For example, each additional stored hierarchy slows down view selection and potentially increases the size of the aggregated data).
- If a hierarchy is a small subset of the first hierarchy, consider making the small hierarchy a dynamic hierarchy. Considerations include how often the hierarchy data is queried and the query performance impact when it is dynamically queried at the time of retrieval.
- The performance of attributes is the same as for members on a stored hierarchy.
- The higher the association level of an attribute to the base member, the faster the retrieval query. (See also, “Design Considerations for Attribute Queries” on page 915).

Query Design Considerations for Aggregate Storage

When querying data from a dimension that has multiple hierarchies, query performance may improve if you query the data in the following way:

1. Select the hierarchy that you want to query.
2. Navigate to find the detailed data (for example, by zooming in on the hierarchy in Oracle Hyperion Essbase Spreadsheet Toolkit).

Including dynamic hierarchy members and stored hierarchy members in the same query may require a large internal memory cache, which decreases query performance.

64-bit Dimension Size Limit for Aggregate Storage Database Outline

An aggregate storage database outline cannot exceed 64-bits per dimension.

The number of bits needed by a dimension is the maximum number of bits used by any level 0 child, including the level 0 children in alternate hierarchies and associated attribute dimensions.
For the purposes of member numbering, attribute dimensions are treated as alternate hierarchies of their base dimensions.

In general, the formula to determine the number of bits required for any member in a dimension can be expressed as:

\[ \text{#_bits\_member’s\_parent} + \log(x) \]

where \( x \) is the number of children of the parent.

For example, if the member’s parent is member A, which requires 5 bits, and A has 10 children, the number of bits required by each child is:

\[ 5 + \log(10) = 9 \text{ bits} \]

The top member of a dimension or hierarchy usually uses 0 bits. However, when one or more top generations consist of label-only members, the label-only members do not receive member numbers (because they are not considered stored members). Therefore, if there are \( x \) members in the first non-label-only generation, those members use \( \log(x) \) bits. The rest of the children below them are numbered normally.

Similarly, if a dimension or hierarchy is dynamic, only the level 0 members that are stored or shared receive member numbers. The number of bits required for those members is \( \log(x) \), where \( x \) is the number of level 0 members that are stored or shared (that is, the number of level 0 members that are not formula members).

If, however, any alternate hierarchies have stored (non-shared) level 0 members, each member of every hierarchy in the dimension (including associated attribute dimensions) uses an extra \( \log(x) \) bit, where \( x \) is the total number of hierarchies and associated attribute dimensions for this base dimension.

The following example uses the Products dimension in the ASOsamp.Sample database:

The Products dimension has two hierarchies: All Merchandise and High End Merchandise, which is an alternate hierarchy. High End Merchandise has one stored level 0 member: Stored Member. The Products dimension does not have any associated attribute dimensions.

Members All Merchandise and High End Merchandise use \( \log(2) = 1 \) bit.
Note: If the alternate hierarchy High End Merchandise did not have any stored level 0 members, the top members of each hierarchy (and associated attribute dimensions) would each use 0 bits.

The calculation of the number of bits required by each level 0 children:

All Merchandise = 1 bit

Personal Electronics, Home Entertainment, Other = 1 + \log(3) = 3 bits

Digital Cameras/Camcorders, Handhelds/PDAs, Portable Audio = 3 + \log(3) = 5

Children of Digital Cameras/Camcorders = 5 + \log(3) = 7

Children of Handhelds/PDAs = 5 + \log(3) = 7

Children of Portable Audio = 5 + \log(2) = 6

Televisions, Home Audio/Video = 3 + \log(2) = 4

Children of Televisions = 4 + \log(5) = 7

Children of Home Audio/Video = 4 + \log(4) = 6

Computers and Peripherals = 3 + \log(1) = 3 **

Systems, Displays, CD/DVD drives = 3 + \log(3) = 5

Children of Systems = 5 + \log(2) = 6

High End Merchandise = 1 bit

Flat Panel, HDTV, Stored Member = 1 + \log(3) = 3 bits

Member Computers and Peripherals has the same number of bits (3) as its parent Other.

The maximum bits used by any level 0 children in the Products dimension is 7 (Children of Digital Cameras and Children of Televisions). Therefore, Products uses 7 bits, which is less than the dimension size limit of 64 bits.

If the dimension size exceeds 64 bits:

- Essbase generates the following error when saving the outline:
  
  Hierarchy [DimensionName] is too complex. It exceeds the maximum member number width of 64 bits. See application log for details.

- Essbase logs messages similar to the following messages in the application log:
  
  Member number for member [level0member] requires [65] bits to encode
  Member [level0member] contributes [5] bits to member number
  Member [level1parent] contributes [20] bits to member number
  Member [level2parent] contributes [20] bits to member number
  Member [level3parent] contributes [20] bits to member number

To fix the error, use one of these recommendations:

- If possible, delete some siblings of any of the members referenced in the messages. Reducing the number of siblings by a power of two saves one bit. For instance, assume that level0member, which contributes 5 bits to the member number, has 18 siblings, including itself. Reducing the number of siblings to 16 or fewer saves one bit because \log(16) = 4. Similarly, reducing the number of siblings to 8 or fewer saves two bits.

- Reclassify some siblings of members referenced in the messages. For example, move half of level0member’s 18 siblings to another parent that doesn’t have as many children. Alternately, create a new parent as a sibling of level1parent and move half of level1parent’s children under the new member. This approach saves one bit.
Combine some intermediate levels. For instance, move level0member, and all of its siblings, to be children of level2parent and then remove level1parent. This approach is more involved but it can save many bits.

In Administration Services Console, to see the number of bits a dimension requires:

1. From the Enterprise view or a custom view, select a database.
2. Right-click, and select Edit and then Properties.
3. In the Database Properties dialog box, select the Statistics tab.
   In the Aggregate Storage Statistics area, the number of levels and bits used in each dimension is displayed.

Understanding the Compression Dimension for Aggregate Storage Databases

By default, the compression dimension in an aggregate storage database is the Accounts dimension. Changing the compression dimension triggers a full restructure of the database. Essbase requires the compression dimension to be a single dynamic hierarchy. If the dimension has a different hierarchy setting, such as multiple hierarchies, it will be set to single dynamic hierarchy automatically. The original hierarchy setting is lost (setting a different dimension as compression does not return the original hierarchy setting). Attribute dimensions cannot be compression dimensions, nor can dimensions with attributes associated to them.

The choice of compression dimension can significantly affect performance. A good candidate for a compression dimension is one that optimizes data compression while maintaining retrieval performance. This topic provides information about choosing an optimal compression dimension.

Note: The information in this topic applies to loaded databases. See “Loading Data into Aggregate Storage Databases” on page 954.

Maintaining Retrieval Performance

Because compression dimensions are dynamically calculated, you must take into account design considerations for dynamically calculated dimensions when choosing a compression dimension. Dynamic dimensions are calculated at the time of retrieval, so the data retrieval time is longer than for stored hierarchies.

If a dimension with a large number of level 0 members is tagged as compression, upper-level queries take longer because they require many level 0 members to be retrieved. If users will be doing many upper-level retrievals on a large dimension, it is not a good candidate for a compression dimension.
Managing Database Compression While Maintaining Retrieval Performance

Another consideration when choosing a compression dimension is how well it is expected to compress the database. The size of the compressed database changes depending on which dimension you tag as compression.

In Administration Services, you can view compression estimates and then choose a compression dimension in the same dialog box. Selecting a new compression dimension in Administration Services restructures the outline automatically.

➢ To view the expected level 0 size of the database for each dimension when hypothetically tagged as compression, and to choose a compression dimension:

See “Selecting a Compression Dimension for Aggregate Storage” in the Oracle Essbase Administration Services Online Help.

Viewing Compression Estimation Statistics

Subtopics

- Stored level 0 members
- Average bundle fill
- Average value length
- Expected level 0 size

In Administration Services and in MaxL, you can view detailed compression and query statistics. You can view the number of stored level 0 members, which affects retrieval performance; the average bundle fill and average value length, which affect compression; and the level 0 size.

➢ To view detailed query and compression statistics, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Database Properties Window</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>Query Database (Aggregate Storage)</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

The following sections describe each of the compression and query related statistics.

Stored level 0 members

Dimensions with a large number of stored level 0 members do not perform well if tagged Compression. As with any dynamically calculated dimension, upper-level retrievals from compression dimensions generally are slow. See “Maintaining Retrieval Performance” on page 919.
Average bundle fill

Compression is more effective if values are grouped together in consecutive members on
dimensions or hierarchies rather than spread throughout the outline with lots of #MISSING data
between values. Essbase saves memory by storing information about the location and contents
of the groups rather than storing it separately for each of the members. The average bundle fill
is the average number of values stored in the groups. It can vary between 1 and 16, with 16 being
the best. Choosing a compression dimension that has a higher average bundle fill means that
the database compresses better.

In some outlines, you can improve compression by ordering the numbers in the compression
dimension so that members that are frequently populated are grouped together. When
populated members are grouped together, more values fit into each bundle, increasing the
average bundle fill and improving compression.

Average value length

The average value length is the average storage size, in bytes, required for the stored values in
the cells. It can vary between 2 bytes and 8 bytes with 2 bytes being the best. Without compression,
it takes 8 bytes to store a value in a cell. With compression, it can take fewer bytes, depending
on the value length. For example, 10.050001 might take 8 bytes to store even when compressed,
but 10.05 may only take 2 bytes (4 bytes to store when compressed). Dimensions with a smaller
average value length compress the database better.

Rounding the data values to no more that two digits after the decimal point can reduce the
average value length, improving compression.

Expected level 0 size

This field indicates the estimated size of the compressed database. A smaller expected level 0 size
indicates that choosing this dimension is expected to enable better compression.

Verifying Outlines

Aggregate storage outline files have the same file extension (otl) as block storage database
outline files and are stored in an equivalent directory structure. When you save an outline,
Essbase verifies it for errors. You can also verify the accuracy of an outline before you save it.
Some block storage database features do not apply to aggregate storage databases, and the
verification process considers the rules for aggregate storage databases. See Chapter 60,
“Comparison of Aggregate and Block Storage.”

To verify an aggregate storage outline:

See “Verifying Outlines” in the Oracle Essbase Administration Services Online Help.
Outline Paging

Aggregate storage database outlines are pageable. This feature may significantly reduce memory usage for very large database outlines. For aggregate storage databases, Essbase preloads part of the database outline into memory. Then, during data retrieval, Essbase pages other parts of the outline into memory as required.

When you create an aggregate storage database, the outline is created in a pageable format. When you use the Aggregate Storage Outline Conversion Wizard to convert an existing block storage outline to aggregate storage, the outline is automatically converted to a pageable format.

Paging an outline into memory enables Essbase to handle very large outlines (for example, 10 million or more members) but potentially increases data retrieval time.

Note: Aggregate storage databases that have pageable outlines contain memory pages, and therefore their outline files may be larger than binary block storage database outline files.

Outline Paging Limits

The maximum size of a buildable outline (the number of members) depends on several factors:

- The available memory for Essbase
- The amount of memory in Essbase allocated for other uses
- The amount of memory required for each member (and aliases for each member)

Table 194 shows the amount of addressable memory available for Essbase on supported 32-bit operating systems:

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Addressable Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows 2003 Server</td>
<td>3 GB</td>
</tr>
<tr>
<td></td>
<td>Requires a setting in the boot.ini file</td>
</tr>
<tr>
<td>AIX</td>
<td>3.25 GB</td>
</tr>
<tr>
<td></td>
<td>Up to 13 (256 MB) segments. Requires setting the LDR_CNTRL environment variable to:</td>
</tr>
<tr>
<td></td>
<td>0xDD0000000000000000D0A</td>
</tr>
<tr>
<td>HP-UX</td>
<td>2.9 GB</td>
</tr>
<tr>
<td></td>
<td>Requires using the following command to set the addressable memory for the Essbase server process, ESSSVR:</td>
</tr>
<tr>
<td></td>
<td>chatr +q3p enable ESSSVR</td>
</tr>
<tr>
<td>Redhat Linux</td>
<td>3.9 GB available by default</td>
</tr>
<tr>
<td>Solaris</td>
<td>3.9 GB available by default</td>
</tr>
</tbody>
</table>

Essbase uses about 40 MB of memory on startup. In addition, the various caches require the following memory allocations:
Outline paging cache: 8 MB
Aggregate storage data cache: 32 MB
Aggregate storage aggregation cache: 10 MB

Therefore, the initial memory footprint for Essbase is about 90 MB. In addition, memory must be allocated to process incoming query requests. Typical memory to reserve for this purpose is about 300 MB. The total memory allocated for Essbase is therefore 390 MB.

On a Windows system with 1.85 GB of addressable memory, the amount available to build and load the outline is about 1.46 GB (1.85 GB - 390 MB = 1.46 GB).

The maximum outline size depends on whether it is built using a dimension build or from an outline already loaded into Essbase.

**Dimension Build Limit**

To build the outline by using a dimension build, Essbase allocates about 100 bytes per member, plus the size of the member name, plus the size of all alias names for the member (up to 10 aliases are allowed).

For a sample outline (using a single byte codepage) where the average member name is 15 characters and there is one alias (of 20 characters) per member, the memory requirement for each member that is added:

\[
100 + 15 + 20 \text{ bytes} = 135 \text{ bytes}
\]

The total number of members that can be added in a dimension build is the available memory (1.46 GB, or 153,092,060 bytes) divided by the number of bytes per member (135), approximately 11 million members.

On systems with more than 2 GB of addressable memory, the outline can be larger in proportion to the extra memory that is available.

When the dimension build is complete, a dbname.otn file is saved in the database directory. The .otn file is used as input for the outline restructuring process, which replaces the old outline with the new one. During restructuring, two copies of the outline are loaded into memory, the old one (potentially empty), and the new one, so the maximum size of an outline that can be restructured depends on the size of the old outline.

In a dimension build, which starts with an empty outline, only one outline is loaded into memory.

**Loaded Outline Limit**

The memory requirement for an outline loaded into Essbase at runtime or during restructuring is different from the memory requirements for a dimension build. Essbase allocates about 60 bytes per member, plus the size of the member name plus 5 bytes, plus the size of all alias names for the member (up to 10 aliases are allowed) plus 5 bytes. For a sample outline where the average member name is 15 characters and there is one alias (of 20 characters) per member, the memory requirement for each member that is added:

\[
60 + 15 + 5 + 20 + 5 \text{ bytes} = 105 \text{ bytes per member}
\]
Assuming 1.46 GB of available memory, the maximum size of an outline that can be loaded is one with 14 million members (1.46 GB / 105 bytes).

The 14 million members are the sum of two outlines that are loaded during restructuring. For example, if an existing outline has 5 million members, the new outline can have a maximum of 9 million members. In an incremental dimension build, it is recommended to build the smaller dimensions first and the larger ones last to allow for a maximum outline size.

**Compacting the Aggregate Storage Outline File**

The outline file (.otl) for an aggregated storage outline increases in size as the outline changes; for example, when members are added or deleted. You can decrease the outline file size by compacting it. After the outline file is compacted, the file continues to grow as before, when members are added or deleted.

Compacting the outline file causes Essbase to restructure the outline and can take place only when no other users or processes are actively using the database. Compacting the outline does not cause Essbase to clear the data.

*Note:* When a member is deleted from the outline, the corresponding record of that member in the outline file is marked as deleted but the record remains in the outline file. Compacting the outline file does not remove the records of deleted members.

To compact an outline file, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Compacting Aggregate Storage Outline Files</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Developing Formulas on Aggregate Storage Outlines**

Formulas calculate relationships between members in a database outline. If you are familiar with using formulas on block storage outlines, consider the following differences when using formulas on aggregate storage outlines:

- Essbase provides a native calculation language (the Calc language, or Calc) to write formulas on block storage outlines. To write formulas for aggregate storage outlines, the MDX (Multidimensional Expressions) language is required.
- Apply formulas directly to members in the database outline. For block storage databases, formulas can be placed in a calculation script. For aggregate storage databases, you cannot place formulas in a calculation script.

The current chapter concentrates on using MDX to write formulas on aggregate storage databases. For information about using MDX to write queries, see Chapter 36, “Writing MDX Queries.” For information about writing formulas for block storage outlines, see Chapter 23,
“Developing Formulas for Block Storage Databases.” Also see the MDX section of the Oracle Essbase Technical Reference.

**Using MDX Formulas**

An MDX formula must always be an MDX numeric value expression. In MDX, a numeric value expression is any combination of functions, operators, and member names that does one of the following actions:

- Calculates a value
- Tests for a condition
- Performs a mathematical operation

A numeric value expression is different from a set expression. A set expression is used on query axes and describes members and member combinations. A numeric value expression specifies a value.

A numeric value expression is used in queries to build calculated members, which are logical members created for analytical purposes in the WITH section of the query, but which do not exist in the outline.

The following query defines a calculated member and uses a numeric value expression to provide a value for it:

```mdx
WITH MEMBER
[Measures].[Prod Count]
AS
'Count (Crossjoin ({{[Units]},
{{[Products].children}
}),')', SOLVE_ORDER=1
SELECT
{{[Geography].children}
ON COLUMNS,
{
Crossjoin ({{[Units]},
{{[Products].children}
}),
{{[Measures].[Prod Count]}, [Products]})
}
ON ROWS
FROM
ASOsamp.Sample
```

In the sample query, the WITH clause defines a calculated member, Product Count, in the Measures dimension, as follows:

```mdx
WITH MEMBER
[Measures].[Prod Count]
```
The numeric value expression follows the WITH clause and is enclosed in single quotation marks. In the sample query, the numeric value expression is specified as follows:

```sql
'Count (Crossjoin (
  {[Units]},
  {[Products].children})
)',
```

The SOLVE_ORDER property specifies the order in which members and formulas are evaluated. See “Calculation Order” on page 971.

**Note:** For an explanation of the syntax rules used to build the numeric value expression in the example, see the documentation in the *Oracle Essbase Technical Reference* for the Count, CrossJoin, and Children functions.

A numeric value expression also can be used as an MDX formula to calculate the value of an existing outline member. Therefore, rather than creating the example query, you can create an outline member on the Measures dimension called Prod Count that is calculated in the outline in the same way that the hypothetical Prod Count was calculated in the sample query.

1. To create a calculated member with a formula:
   - **Create a member.**
   - **Attach an MDX formula to the member.**
     Assuming that you created the example Prod Count member, you would use the following formula, which is the equivalent of the numeric value expression used to create the calculated member in the example query:
     ```mdx
     Count(Crossjoin ( {[Units]}, {[Products].children}))
     ```
   - **Verify the formula by verifying the outline.**
     When you retrieve data from the aggregate storage database, the formula is used to calculate the member value.

     You can use substitution variables within formulas. For example, you could define a substitution variable named “EstimatedPercent” and provide different percentages as substitution variable values. See “Using Substitution Variables” on page 120.

Before applying formulas to members in the outline, you can write MDX queries that contain calculated members. When you can write an MDX query that returns the calculated member results that you want, you are ready to apply the logic of the numeric value expression to an outline member and validate and test the expression. See Chapter 36, “Writing MDX Queries.” For syntax information about MDX, see the *Oracle Essbase Technical Reference.*
Formula Calculation for Aggregate Storage Databases

Essbase calculates formulas in aggregate storage outlines only when data is retrieved. Calculation order may affect calculation results. Whenever you use MDX formulas on multiple dimensions in an aggregate storage outline, it is good practice to set the solve order for each member or dimension. See “Calculation Order” on page 971.

Note: When designing an aggregate storage database calculation, consider that aggregate storage database members with MDX formulas are dynamically calculated. The dynamically calculated members have a value of #MISSING until they are queried.

Formula Syntax for Aggregate Storage Databases

When you create member formulas for aggregate storage outlines, observe the following rules:

- Enclose member names in brackets ([ ]) if they meet any of the following conditions:
  - Start with a number or contains spaces; for example, [100]. Brackets are recommended for all member names, for clarity and code readability.
  - Are the same as an operator or function name. See the Oracle Essbase Technical Reference for a list of operators and functions.
  - Include a nonalphanumeric character; for example, a hyphen (-), an asterisk (*), or a slash (/).

  Note: In formulas, member names starting with $ or & must be enclosed in quotation marks as well as brackets. For example, $testmember would be expressed in the formula as "$testmember"/100

- Use the IIF function to write conditional tests with a single else condition. The syntax for the IIF function does not require an ELSEIF keyword to identify the else condition nor an ENDIF keyword to terminate the statement. You can nest IIF functions to create a more complex formula.

- Use the CASE, WHEN, THEN construct to write conditional tests with multiple conditions.

- Be certain that tuples are specified correctly. A tuple is a collection of members with the restriction that no two members can be from the same dimension. Enclose tuples in parentheses; for example, (Actual, Sales).

- Be certain that sets are specified correctly. A set is an ordered collection of one or more tuples. When a set has multiple tuples, the following rule applies: In each tuple of the set, members must represent the same dimensions as do the members of other tuples of the set. Additionally, the dimensions must be represented in the same order. In other words, all tuples of the set must have the same dimensionality.

  See “Rules for Specifying Sets” on page 580.

Enclose sets in braces, for example:

{ [Year].[Qtr1], [Year].[Qtr2], [Year].[Qtr3], [Year].[Qtr4] }
Creating Formulas on Aggregate Storage Outlines

Subtopics

- Checking Formula Syntax
- Displaying Formulas

You use Formula Editor to create formulas. Formula Editor is a tab in the Member Properties dialog box in Outline Editor. Formulas are plain text. You can type the formulas directly into the formula text area, use a predefined formula template, or you can create a formula in the text editor of your choice and paste it into Formula Editor.

You can also include formulas in a dimension build data source. See “Setting Field Type Information” on page 285.

To create a formula:

See “Creating Formulas for Aggregate Storage Databases” in the Oracle Essbase Administration Services Online Help.

Checking Formula Syntax

Essbase includes MDX-based syntax checking that tells you about syntax errors in formulas. For example, Essbase tells you if you have mistyped a function name or specified a nonexistent member. Unknown names can be validated against a list of function names. If you are not connected to Essbase Server or to the application associated with the outline, Essbase may connect you to validate unknown names.

Syntax checking occurs when you save a formula. Errors are displayed in the Messages panel. If an error occurs, you choose to save or not save the formula. If you save a formula with errors, you are warned when you verify or save the outline. When you calculate a formula with errors, the formula is ignored and the member is given a value of $MISSING.

A syntax checker cannot warn you of semantic errors in a formula. Semantic errors occur when a formula does not work as you expect. One way to find semantic errors in a formula is to place the numeric value expression that defines the formula into a query and run the query to verify that the results are as you expect. See “Using MDX Formulas” on page 925 to see how to place a formula into a query.

You can use MDX Script Editor to create a query. MDX Script editor provides features such as color coding and autocompletion of MDX syntax. See “About MDX Script Editor” in the Oracle Essbase Administration Services Online Help.
Displaying Formulas

To display a formula, use tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Creating Formulas for Aggregate Storage Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>query database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>GETMBRCALC</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Composing Formulas on Aggregate Storage Outlines

Subtopics

- Basic Equations for Aggregate Storage Outlines
- Members Across Dimensions in Aggregate Storage Outlines
- Conditional Tests in Formulas for Aggregate Storage Outlines
- Specifying UDAs in Formulas in Aggregate Storage Outlines

The following sections discuss and give examples of how to write a variety of formulas for members in aggregate storage outlines.

Basic Equations for Aggregate Storage Outlines

You can apply a mathematical operation to a formula to create a basic equation. For example, the following formula is applied to the Avg Units/Transaction member in the ASOsamp.Sample database:

\[
\frac{[\text{Units}]}{[\text{Transactions}]}\]

The formula in Avg Units/Transaction divides the number of units by the number of transactions to arrive at the average number of units per transaction.

In aggregate storage outlines, members cannot be tagged as expense items. Therefore, functions in Calc, such as @VAR and @VARPER, which determine the difference between two members by considering expense tags, are not relevant in aggregate storage outlines.

The MDX subtraction operator can be used to calculate the difference between two members. For example, the following formula can be applied to a new member, called Price Diff, in ASOsamp.Sample, to calculate the difference between the price paid and the original price:

\[
[\text{Price Paid}] - [\text{Original Price}]\]

Members Across Dimensions in Aggregate Storage Outlines

ASOsamp.Sample provides a formula on a member called % of Total. This member formula identifies the percentage of the Measures total that is produced by Transactions. The formula for % of Total:
The formula specifies a member (Transactions) divided by a tuple (Transactions, Years, ...). The formula lists a top member from every dimension to account for all Transaction data in the cube; that is, not Transaction data for the Curr Year member but Transaction data for all members of the Years dimension, not Transaction data for months in the first two quarters but Transaction for all months, and so on. In this way, the value of % of Total represents the percentage of the Measures total that are produced by Transactions.

**Conditional Tests in Formulas for Aggregate Storage Outlines**

You can define a formula that uses a conditional test or a series of conditional tests to determine the value for a member. Use the IIF function to perform a test with one else condition. You can nest IIF functions to create a more complex query.

The example specifies a formula for a member that represents the price the company must pay for credit card transactions, which includes a 5% charge. The following example assumes that the Credit Price member has been added to the Measures dimension of the ASOsamp.Sample database. Credit Price has the following formula, which adds 5% to Price Paid when the payment type is a credit card.

```
IIF (
    [Payment Type].CurrentMember=[Credit Card],
    [Price Paid] * 1.05, [Price Paid]
)
```

Use the CASE, WHEN, THEN construct to create formulas with multiple tests and else conditions.

The Filter function returns the tuples of the input set that meet the criteria of the specified search condition. For example, to establish a baseline (100) for all products, you can add a Baseline member and create a formula for it, as follows:

```
Count(Filter(Descendants([PersonalElectronics],
    [Products].Levels(0)), [Qtr1] > 100.00))
```

**Specifying UDAs in Formulas in Aggregate Storage Outlines**

UDAs are words or phrases that you create for a member. For example, in Sample.Basic, top-level members of the Market dimension have the UDA Small Market or the UDA Major Market.

The Major Market example used in this topic shows how to create a formula for a member that shows the sum of sales for all major market members. The example assumes that a new member (Major Market Total) has been added to Sample.Basic.

1. MDX provides a Boolean function, IsUDA, which Returns TRUE if a member has the associated UDA tag. The following syntax returns TRUE if the current member of the Market dimension has the UDA “Major Market”:

   ```
   IsUda([Market].CurrentMember, "Major Market")
   ```
2. A Filter function, when used with IsUDA (as shown in the following syntax), cycles through each member of the Market dimension and returns a value for each member that has the Major Market UDA:

\[
\text{Filter([Market].Members, IsUda([Market].CurrentMember, "Major Market")})
\]

3. The Sum function adds the values returned by the Filter function; for the Major Market example, the following formula is produced:

\[
\text{Sum (Filter([Market].Members, IsUda([Market].CurrentMember, "Major Market")}})
\]

This formula is attached to the Major Market Total member.

Using a Transparent Partition for Write-Back to Aggregate Storage Databases

**Note:** Using a transparent partition is not required to write-back to an aggregate storage database; however, this method is supported.

With a write-back partition, you can update data on-the-fly in the target block storage database while the data in the source aggregate storage database remains unchanged. Creating a write-back partition potentially decreases calculation time and reduces database size.

When creating write-back partitions, follow these guidelines:

- Create the block storage database in a separate application from the one in which the aggregate storage database is located.
  
  Typically, the block storage database contains a subset of the dimensions in the aggregate storage database.

- Create a transparent partition based on where you want the data to be stored. Make the block storage database the target and the aggregate storage database the source.

  See Chapter 15, “Designing Partitioned Applications.”

**Note:** You may want to partition on the time dimension if data for some time periods is stored in the aggregate storage database and data for other time periods is stored in the block storage database. For example, if you have actual data for January through March, which is stored in an aggregate storage database, and you want to budget for the last nine months of the year using write-back members in a block storage database.

Users query and write-back to the block storage database. Queries are processed by the block storage database or transparently by the aggregate storage database.
To create an aggregate storage and block storage write-back partition use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Aggregate Storage Partition Wizard</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td></td>
<td>Creating Partitions</td>
<td></td>
</tr>
<tr>
<td>MaxL</td>
<td>create database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>create partition</td>
<td></td>
</tr>
</tbody>
</table>

You need Database Manager permissions to create a partitioned application.

**Figure 155** illustrates using a transparent partition for analyzing the variance between forecast and actual data:

![Figure 155](image)

The following procedure is based on the aggregate storage sample database (ASOsamp.Sample), and uses the Administration Services Aggregate Storage Partition Wizard (see the *Oracle Essbase Administration Services Online Help*).

To create a write-back partition:

1. Select the ASOsamp.Sample database, which contains the actual data for the current year and for previous years.

   See **Figure 156**.
Create a block storage database containing the following subset of dimensions from ASOsamp.Sample: Measures, Years, Time, Products, Stores, and Geography.

Edit the Years dimension to add the following members to the block storage database outline:

- A member called Next Year, which will contain the forecast data.
- A member called Forecast Variance. Add a formula to this member to calculate the variance between actual and forecast data.

Delete the following member formulas:

- Measures dimension member formulas on Avg Units/Transaction and % of Total
- Years dimension member formulas on Variance and Variance%
- Time dimension member formulas under QTD and YTD

These formulas are expressions written in MDX that are copied from the aggregate storage database. MDX formula expressions cannot be interpreted in block storage databases.

Link the databases with a transparent partition on the Years dimension, with the block storage database (forecast data) as the target and the aggregate storage database (actual data) as the source.

Do not include the write-back members (Forecast and Variance) in the partitioned area.
Note: When using the Administration Services Aggregate Storage Partition wizard, this step is automatic. The databases are automatically partitioned on the Years dimension because you selected the Years dimension in step 3. The write-back members are not included in the partitioned area.

You input forecast values into the block storage database write-back members. Because the added members are outside the partitioned area, you can write to them and then calculate data and generate reports based on updated data. The transparent partition provides a seamless view of both databases.
Aggregate Storage Time-Based Analysis

In This Chapter

Introduction ............................................................................................... 935
Understanding Date-Time Dimensions ................................................................. 936
Understanding Linked Attributes ....................................................................... 937
Designing and Creating an Outline for Date-Time Analysis ........................... 939
Modifying or Deleting Date-Time Dimensions ................................................. 942
Loading Data Mapped to Dates ........................................................................ 943
Analyzing Time-Based Data ............................................................................. 944

The information in this chapter applies only to aggregate storage databases and is not relevant to block storage databases. Also see Chapter 60, “Comparison of Aggregate and Block Storage.”

Introduction

Most data analysis includes a time (history) perspective. Aggregate storage applications provide built-in time-based functionality through time dimensions and date-time dimensions.

Aggregate storage time dimensions are similar to block storage time dimensions. They enable tagging the accounts dimension for such time balance calculations as first, last, average, and to-date values. Time dimensions are easily modifiable.

Aggregate storage date-time dimensions enable the first, last, and average time balance support. In addition, Administration Services provides the powerful Create Date-Time Dimension wizard for quick date-time dimension setup based on special calendars, plus linked attribute dimension setup enabling crosstab reporting of time-related data. Date-time dimensions have a rigid structure and are not easily modified after they are created.

The remainder of this chapter discusses date-time dimensions and the linked attribute dimensions that can be associated with them. For information about time balance calculations in aggregate storage outlines, see “Performing Time Balance and Flow Metrics Calculations in Aggregate Storage Accounts Dimensions” on page 985.
Understanding Date-Time Dimensions

Date-time dimensions contain a date hierarchy based on the selection of one of several standard corporate calendars. Dimension and member properties contain text strings that Essbase Server uses to manage the hierarchy, as shown in Figure 158.

Figure 158  Sample Date-Time Hierarchy

```
/* Date-time Dimension Date Time Hierarchy */
  + Quarter 1 of Gregorian Year 2008 (Never Share) /* TI-MBR,TSPAN[1-1-2008,3-31-2008] */
  Month 1 of Gregorian Year 2008 (Never Share) /* TI-MBR,TSPAN[1-1-2008,1-31-2008] */
  Month 2 of Gregorian Year 2008 (Never Share) /* TI-MBR,TSPAN[2-1-2008,2-29-2008] */
  Month 3 of Gregorian Year 2008 (Never Share) /* TI-MBR,TSPAN[3-1-2008,3-31-2008] */
  + Quarter 2 of Gregorian Year 2008 (Never Share) /* TI-MBR,TSPAN[4-1-2008,6-30-2008] */
  + Quarter 3 of Gregorian Year 2008 (Never Share) /* TI-MBR,TSPAN[7-1-2008,9-30-2008] */
  + Quarter 4 of Gregorian Year 2008 (Never Share) /* TI-MBR,TSPAN[10-1-2008,12-31-2008] */
  + Quarter 1 of Gregorian Year 2009 (Never Share) /* TI-MBR,TSPAN[1-1-2009,3-31-2009] */
  + Quarter 2 of Gregorian Year 2009 (Never Share) /* TI-MBR,TSPAN[4-1-2009,6-30-2009] */
    Month 10 of Gregorian Year 2009 (Never Share) /* TI-MBR,TSPAN[10-1-2009,10-31-2009] */
```

The dimension member at the top of the hierarchy shows the comment:

```
```

The TI-MBR,TSPAN[\[date1, date2\]] information enclosed between exclamation points (!) defines the time range covered by the dimension: in this case two years, Jan. 1, 2008–Dec. 31, 2009. Positioned in front of the time span, the array TI-HIER,TP[3,1,4,5] describes the hierarchy. The first number in the array, 3, indicates that the hierarchy contains three time periods. The remaining numbers in the array indicate what time periods are included, based on the following possible levels:

- 1—Year
- 2—Semester
- 3—Trimester
- 4—Quarter
- 5—Month
- 6—Period
- 7—Week
- 8—Day

Array TI-HIER,TP[3,1,4,5] indicates that the array contains three time periods: year, quarter, and month.

Using the same time span TI-MBR,TSPAN syntax, each member comments field defines the time range that it covers; for example, member “Quarter 1 of Gregorian Year 2008” covers Jan.
Understanding Linked Attributes

Analyzing data in terms of relative position within time periods can be useful; for example, knowing that some costs increase in the last week of each quarter can help you balance expenditures. Linked attributes enable data analysis based on relative time periods such as the first month of a quarter, or the fourth week of a month.

Linked attribute dimensions can be associated only with the date-time dimension. Defining linked attribute dimensions is part of the Create Date-Time Dimensions wizard. The linked attribute dimensions that you create are based on the time depths you select when you define the calendar for the date-time dimension. For example, as shown in Figure 159, if you select year, quarter, and month time depths and create linked attributes, the wizard creates three linked attribute dimensions (default dimension names): “Quarter by Year,” “Month by Year,” and “Month by Quarter.” Each attribute dimension contains members with sequential numeric names, indicating a relative position that will be used in analyzing the members associated with that attribute.
Figure 159  Sample Date-Time Dimension with Linked Attributes

Linked attributes enable you to compare sales of the first month of a quarter against sales of the second and third months of a quarter in a simple crosstab analysis, as shown:

<table>
<thead>
<tr>
<th></th>
<th>100-10</th>
<th>100-10</th>
<th>100-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month by Quarter 1</td>
<td>11326.72</td>
<td>13544.89</td>
<td>24693.33</td>
</tr>
<tr>
<td>Month by Quarter 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month by Quarter 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Gregorian Year 2007

Gregorian Year 2008

Note: Linked attributes cannot be assigned to year time-depth members.

Linked attribute dimensions reflect two time components, which are easier to understand if we use the default names; for example, “Quarter by Year.” Members of the “Quarter by Year” dimension are associated with quarter time-depth members such as “Quarter 1 of Gregorian Year 2008” in Figure 159 on page 938. The first time component, “Quarter,” is called the association level, because it indicates the date-time dimension members to which the attributes are associated.
The second time component in this example, “Year,” is called the attachment level. The attachment level indicates a member level in the associated date-time dimension. Each member of the linked attribute dimension contains a number that indicates a relationship between the association level and the attachment level. “Quarter by Year: 1” is the first attribute member “Quarter by Year: 2” is the second member, and so on.

The date-time dimension members associated with linked attribute “Quarter by Year: 1” are the first quarters of their respective years. All date-time dimension members with the attribute “Month by Quarter: 1” are the first months of their respective quarters. Thus linked attributes enable analysis of information based on a common periodic relationship such as first, second, and third.

Designing and Creating an Outline for Date-Time Analysis

The Administration Services Create Date-Time Dimension wizard uses your option selections to design a time-analysis structure including date-time dimension through calendar templates. You choose a calendar type, customize it to your business requirements, and select other options to fit your time-analysis needs. The wizard creates the following outline components:

- The date-time dimension.
  See “Understanding Date-Time Dimensions” on page 936.
- (Optional) Linked attribute dimensions and member associations.
  See “Understanding Linked Attributes” on page 937.
- (Optional) Attribute dimensions associated with day-level members. These are standard Boolean or text attributes based on specific dates or days of the week. You can use these attributes to include or exclude day-level information. For example, the wizard enables defining the following types of situations:
  - Assigning a Boolean attribute dimension such as “Weekend” to selected days of the week, resulting in every day of the week having a [Weekend].[True] or [Weekend].[False] attribute.
  - Assigning attributes for special days or holidays that you designate.
  - Assigning text attributes such as “Monday” and “Tuesday” to appropriate weekdays.

The Administration Services Create Date-Time Dimension wizard builds all members for the calendars and time ranges specified.

Preparing for Creating Date-Time Dimensionality

Before running the Create Date-Time Dimension wizard, consider the following points:

- What time period must the database model? You must provide the start and end dates.
- What type of calendar fits your business use?
What time-period granularity should the database reflect in its outline? Does business analysis drill down to the week level, or can weeks be omitted because reporting is by month or a higher level? Are any business measures analyzed and reported down to the day level? Are semester or trimester breakdowns required?

Would analysis of data within time relationships be valuable? For example, within a business calendar containing quarters, would the ability to see trends for each closing quarter be useful, such as whether sales increase toward the close of each?

The Create Date-Time Dimension wizard is a powerful tool with many options. Consider some practice runs to better understand the dimensions it builds. See also the topics for each page of this wizard in Oracle Essbase Administration Services Online Help.

Understanding Date-Time Calendars

The Create Date-Time Dimension wizard calendar templates determine the hierarchical structure of members in the date-time type of dimension. For all calendars, you must select a date-time dimension name, the calendar type, the first day of the week, and the beginning and ending dates for which you want to build date-time dimension members. You also must select time depths, which determine the calendar member hierarchy. The year time depth is required for all calendars. The availability of other time depths depends on the calendar type and other time depths selected. For example, semester and trimester time depths are mutually exclusive.

If a time depth is selected, the wizard creates, within each year, a member for each instance of that time depth. For example, if the month time depth is selected, 12 month members are created in the hierarchy under each year. A naming rule indicates a naming pattern for each member, which includes a number for the relative position within its year ancestor. For example, in the Gregorian calendar shown in Figure 159 on page 938, the month members follow a default naming pattern that includes the month number such as “Month 4 of Gregorian Year 2008.”

Note: When selecting naming rules for time dimensions, it is possible to create duplicate members. This can cause the create date-time dimension procedure to fail unless the outline is set to allow duplicate member names. If the outline is not set to allow duplicate member names, you must avoid duplicates.

Depending on the calendar template and chosen time depths, you may need to define year, month, or period characteristics (semantic rules) such as period starting or ending dates, week count, or how months or weeks are grouped within their parent members. These characteristics affect the rules by which members are built and named. For some calendars, availability of year, period, or month semantic rules is dependent on other year, period, or month options selected. See “Create Date-Time Dimension Wizard—Select Calendar Hierarchy Panel” in Oracle Essbase Administration Services Online Help.

The Create Date-Time Dimension wizard provides templates for the following calendar types:
**Gregorian**

The Gregorian calendar is the standard 12-month calendar, January 1–December 31. Time depths are year, semester, trimester, quarter, month, week, and day.

**Fiscal**

Fiscal calendar definitions are based on company financial reporting requirements and can start on any date. Weeks In fiscal calendars have seven days. The 12-month reporting period includes two months of four weeks and one month of five weeks, in a repeated three-month quarterly pattern, (4-4-5, 4-5-4, or 5-4-4 weeks). If the year has 53 weeks, one month can have an extra week.

The week definition determines how to divide the calendar year into weeks. You can adjust the week definition to make a 52 week or 53 week year. Time depths are year, semester, trimester, quarter, month, week, and day.

**Retail**

The retail calendar, from the National Retail Federation, is modeled to analyze week-over-week data across years. It has a 4-5-4 quarter pattern with leap weeks every five to six years. The starting date differs from year to year but always falls in early February. When comparing year over year, standard practice is to omit the first week of a 53-week year to normalize for the extra week while the years keep the same holidays. Available time depths are year, semester, quarter, month, week, and day.

**Manufacturing**

The manufacturing calendar defines a 13-period year, made up of seven-day weeks. Manufacturing periods are divided into three quarters of three periods each and one quarter of four periods. All periods have four weeks, except for 53-week years, in which one period has five weeks.

When you define the 13 periods, you specify which quarter has the extra period. If the year has 53 weeks, you must specify which period will have the extra week. If you specify that the year starts on a specific date, you must indicate whether the year has 52 weeks or 53. If the year has 52 weeks, you may need to specify both 52-week and 53-week options, to pare the weeks first down to 53, then pare them down to 52. Available time depths are year, semester, quarter, period, week, and day.

**ISO 8601**

The ISO 8601 calendar contains seven-day weeks. The year can start before or after January 1 and is modeled to start on a day such that the first week of the ISO calendar contains the first Thursday of January. The first day of the week is Monday. Year, week, and day time depths are required for the ISO calendar, with no additional time-depth options.
Modifying or Deleting Date-Time Dimensions

The only way to modify a date-time dimension is manually. Because of its tight structure, modifying a date-time dimension can be risky. In most cases, it is better to delete the dimension and use the Create Date-Time Dimension wizard to recreate it with the changes built in by the wizard, particularly if changes involve adding or removing members.

Even for minor changes, you must be aware of the comments structure described in “Understanding Date-Time Dimensions” on page 936. The TI-HIER and TI-MBR,TSPAN sections must be at the beginning of the comments field. You can add comments after the last ! mark, such as:

TI-MBR,TSPAN[1-1-2006,1-31-2006]! This is the First Month

Note: If you edit the TI-HIER and TI-MBR,TSPAN sections in member comments, you must ensure that the correct members exist throughout the hierarchy, and you must edit dependent ranges for ancestors or descendants. For example, if you change the span of a given month, you must also change the span of the quarter.

If you delete a date-time dimension, also delete all associated attribute dimensions. Linked attributes have meaning only when they are whole; that is, all members exist and be associated in the correct sequence. An outline is invalid if you disassociate a linked attribute from only a few members.

Be aware of the verification rules summarized in the following sections.

Verification Rules for Date-Time Dimensions

- The dimension is tagged as “Date-Time”.
- The dimension is a single-hierarchy, stored dimension.
- The hierarchy is balanced; all level 0 members are of the same generation.
- Members are all tagged with the addition (+) consolidator.
- Member comment fields for each member contain the following information in the left-most part of the comment. (Details are described in “Understanding Date-Time Dimensions” on page 936.)
  - The member comment field for the top dimension member includes contains the TI-HIER, TP[ ] specification that contains an array that describes the hierarchy structure.
  - The member comment field for each member including the top dimension member contains the TI-MBR, TSPAN[ ] specification that includes the date range for the member, with starting date preceding ending date.
- Along a generation, date ranges should be contiguous and should increase in ascending order. For example, along the month generation, the date range for each month member must have a starting date that logically follows from the ending date of the previous period. There must be no time gaps, and the span of the parent member must equal the total time span of its children.
Verification Rules for Linked Attribute Dimensions

- Linked attribute dimensions are tagged as “Linked Attribute.”
- Linked attribute dimensions are associated with the date-time dimension.
- Each linked attribute dimension has two levels only, the parent level and the children attribute members.
- Linked attribute member names are sequential numbers, starting with 1.
- If attribute dimensions exist, all combinations of attachment and association levels for the date-time dimension must exist. For example, if the date-time dimension includes year, semester, and month time depths, if you create linked attribute dimensions you must create “Month by Year,” “Month by Semester,” and “Semester by Year.”

Loading Data Mapped to Dates

You can load data into the level 0 members of date-time dimensions using date strings instead of member names. Even if the date hierarchy does not span to the day granularity level, the data source can be specified by individual dates. The load process aggregates the values and stores them at the appropriate level.

Loading data based on date provides the following advantages:

- Data can be loaded from any day-level load file, as long as the data file date format is supported.
- If you set the data load to “Add to existing cells,” data can be loaded from a day-level load file to a less granular level in the hierarchy; for example to week or month level 0 cells.

Table 195 lists the date format strings you can use when you define the date field in the data load rules file:

<table>
<thead>
<tr>
<th>Date Format String</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>mon dd yyyy</td>
<td>Jan 15 2006</td>
</tr>
<tr>
<td>Mon dd yyyy</td>
<td>January 15 2006</td>
</tr>
<tr>
<td>mm/dd/yy</td>
<td>01/15/06</td>
</tr>
<tr>
<td>mm/dd/yyyy</td>
<td>01/15/2006</td>
</tr>
<tr>
<td>yy.mm.dd</td>
<td>06.01.06</td>
</tr>
<tr>
<td>dd/mm/yy</td>
<td>15/01/06</td>
</tr>
<tr>
<td>dd.mm.yy</td>
<td>15.01.06</td>
</tr>
<tr>
<td>dd-mm-yy</td>
<td>15-01-06</td>
</tr>
<tr>
<td>dd Mon yy</td>
<td>15 January 06</td>
</tr>
<tr>
<td>Date Format String</td>
<td>Example</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>dd mon yy</td>
<td>15 Jan 06</td>
</tr>
<tr>
<td>Mon dd yy</td>
<td>January 15 06</td>
</tr>
<tr>
<td>mon dd yy</td>
<td>Jan 15 06</td>
</tr>
<tr>
<td>mm-dd-yy</td>
<td>01-15-06</td>
</tr>
<tr>
<td>yy/mm/dd</td>
<td>06/01/15</td>
</tr>
<tr>
<td>yymmdd</td>
<td>060115</td>
</tr>
<tr>
<td>dd Mon yyyy</td>
<td>15 January 2006</td>
</tr>
<tr>
<td>dd mon yyyy</td>
<td>15 Jan 2006</td>
</tr>
<tr>
<td>yyyy-mm-dd</td>
<td>2006-01-15</td>
</tr>
<tr>
<td>yyyy/mm/dd</td>
<td>2006/01/15</td>
</tr>
<tr>
<td>Long Name</td>
<td>Sunday, January 15, 2006</td>
</tr>
<tr>
<td>Short Name</td>
<td>1/8/06 (m/d/yy)</td>
</tr>
</tbody>
</table>

**Note:** Using extra white space not included in the internal format strings returns an error. Trailing characters after the date format has been satisfied are ignored. If you erroneously use a date string of 06/20/2006 with date format mm/dd/yy, the trailing 06 is ignored and the date is interpreted as June 20, 2020. Long Name format is not verified for a day-of-week match to the given date.

**Analyzing Time-Based Data**

The MDX and Smart View interfaces can take advantage of linked attributes for analyzing periodic relationships within data.

**Using Smart View to Analyze Time-Related Data**

Smart View provides use of linked attributes in several different ways:

- Working on the free-form grid. With a date-time member on the grid selected, using Member Selection shows Date-Time as a dimension type and lists the members of that dimension. The Period and Range filters enable you to select and display information using linked attributes.

- Using Query Designer.
  - Selecting Date-Time dimension on the Query Designer Toolbar includes linked attributes in the attributes list.
Using the POV toolbar, you can select a linked attribute, drag it to the free-form grid,
and execute the query.

For additional information, see Oracle Smart View for Office User’s Guide.

Analyzing Time-Based Metrics with MDX

Table 196 lists the MDX functions that are provided for analysis of date hierarchies. For a complete description of these functions, see the Oracle Essbase Technical Reference.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DateDiff</td>
<td>Returns the difference between two input dates.</td>
</tr>
<tr>
<td>DatePart</td>
<td>Returns the date part (Year/Quarter/Month/Day/DayOfYear/Weekday) as a number.</td>
</tr>
<tr>
<td>DateRoll</td>
<td>To the given date, rolls (adds or subtracts) a number of specific time intervals, returning another date.</td>
</tr>
<tr>
<td>DateToMember</td>
<td>Returns the date-hierarchy member specified by the input date.</td>
</tr>
<tr>
<td>FormatDate</td>
<td>Returns a formatted date-string.</td>
</tr>
<tr>
<td>GetFirstDate</td>
<td>Returns the start date for a date-hierarchy member.</td>
</tr>
<tr>
<td>GetLastDate</td>
<td>Returns the end date for a date-hierarchy member.</td>
</tr>
<tr>
<td>Today</td>
<td>Returns a number representing the current date on the Essbase computer.</td>
</tr>
<tr>
<td>ToDateEx</td>
<td>Converts any date string to a date that can be used in calculations.</td>
</tr>
</tbody>
</table>
Loading, Calculating, and Retrieving Aggregate Storage Data

In This Chapter

Introduction ............................................................................................... 947
Preparing Aggregate Storage Databases ......................................................... 949
Calculating Aggregate Storage Databases ....................................................... 969
Retrieving Aggregate Storage Data .............................................................. 989

The information in this chapter applies only to aggregate storage databases and is not relevant to block storage databases. Also see Chapter 60, “Comparison of Aggregate and Block Storage.”

Introduction

The most common processes for working with database information include maintaining the outline, loading data values to the database, calculating values, and retrieving database information. Performing these tasks with aggregate storage databases is different from performing them with block storage databases.

Examples in this chapter refer to the outline in Figure 160.
The simplified aggregate storage outline in Figure 160 is not completely expanded. A plus sign (+) node at the left of a member name indicates that the member has children that are not displayed.
Preparing Aggregate Storage Databases

Subtopics

- Building Dimensions in Aggregate Storage Databases
- Understanding Exclusive Operations on Aggregate Storage Databases
- Loading Data into Aggregate Storage Databases
- Clearing Data from an Aggregate Storage Database
- Copying an Aggregate Storage Application
- Combining Data Loads and Dimension Builds

The topics in this section describe dimension build and data load process differences between aggregate storage and block storage databases. You should be familiar with data load, dimension build, and rules file concepts and procedures.

For information about using data sources to change outlines and to load data values, see Chapter 17, “Understanding Data Loading and Dimension Building” and Chapter 20, “Performing and Debugging Data Loads or Dimension Builds.”

For information on the maximum size of a buildable aggregate storage outline, see “Outline Paging Limits” on page 922.

Building Dimensions in Aggregate Storage Databases

Subtopics

- Rules File Differences for Aggregate Storage Dimension Builds
- Data Source Differences for Aggregate Storage Dimension Builds
- Building Alternate Hierarchies in Aggregate Storage Databases

Aggregate storage dimension build changes to the outline can result in all aggregate views or all data values being cleared from the database when the dimension build is finished. “Aggregate Storage Database Restructuring” on page 1027 describes the results of outline changes.

If you use multiple data sources to build dimensions, you can save processing time by performing an incremental dimension build. Incremental dimension builds enable you to defer restructuring until all data sources have been processed. For information about incremental dimension build, see “Performing Deferred-Restructure Dimension Builds” on page 307.

Differences between outline characteristics of block storage outlines and aggregate storage outlines affect data sources and rules files. For example, defining a dimension as sparse or dense is not relevant to aggregate storage outlines.
Rules File Differences for Aggregate Storage Dimension Builds

Subtopics

- Field Type Differences for Aggregate Storage Dimension Builds
- Data Prep Editor Dialog Boxes for Aggregate Storage

Rules files for building aggregate storage outlines must define only outline properties and field types that apply to aggregate storage outlines. See Table 186, “Outline Differences Between Aggregate Storage and Block Storage,” on page 900.

After converting a block storage outline to aggregate storage, update the rules files by associating them to the aggregate storage version of the outline. See “Associating an Outline with an Editor” in the Oracle Essbase Administration Services Online Help.

Field Type Differences for Aggregate Storage Dimension Builds

The solve order field type is available only on aggregate storage databases.

The field contains a number (0–127) that specifies the order in which the member is evaluated in the outline. Values less than 0 or greater than 127 are reset to 0 and 127, respectively. No warning message is displayed. For information on the solve order property, see “Calculation Order” on page 971.

Valid build methods for solve order:

- Generation
- Level
- Parent-child references

➤ To set field information:

See “Setting Field Types” in the Oracle Essbase Administration Services Online Help.

Data Prep Editor Dialog Boxes for Aggregate Storage

As you edit rules files for aggregate storage databases, some dimension build rules file options that apply only to block storage databases are displayed in Data Prep Editor dialog boxes. Table 197 lists block storage rules file settings that do not apply to aggregate storage outlines. Entries in rules files for these options are ignored when the rules file is processed.

Table 197 Aggregate Storage Dimension Build Rules File Differences

<table>
<thead>
<tr>
<th>Rules File Location in the Administration Services Interface</th>
<th>Dimension Build Rules File Options That Do Not Apply to Aggregate Storage Databases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension Build Settings dialog box, Global Settings tab</td>
<td>Data configuration options</td>
</tr>
</tbody>
</table>
Rules File Location in the Administration Services Interface | Dimension Build Rules File Options That Do Not Apply to Aggregate Storage Databases
---|---
Dimension Properties dialog box, Dimension Properties tab | Dimension types option: Country
Two-Pass calculation option
Data storage options:
- Dynamic Calc and Store
- Dynamic Calc
All configuration options

Dimension Properties dialog box, Accounts Dimension tab | None of the options on this tab apply.

Field Properties dialog box, Dimension Build Properties tab | Field type options:
- Currency name
- Currency category

Currency functionality does not apply to aggregate storage databases.

See the *Oracle Essbase Administration Services Online Help*.

**Data Source Differences for Aggregate Storage Dimension Builds**

Data sources for modifying aggregate storage outlines should not include field values that apply only to block storage outlines. Table 198 lists the member codes that are recognized in dimension build data sources as properties for members of aggregate storage database outlines. Any other consolidation code is ignored and + (Add) is assumed. See “Using the Data Source to Work with Member Properties” on page 283.

**Table 198  Consolidation Codes for Members of Aggregate Storage Outlines**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>Express as a percentage of the current total in a consolidation (applies only to members of a dynamic hierarchy)</td>
</tr>
<tr>
<td>*</td>
<td>Multiply by the current total in a consolidation (applies only to members of a dynamic hierarchy)</td>
</tr>
<tr>
<td>+</td>
<td>Add to the current total in a consolidation (applies only to members of a dynamic hierarchy)</td>
</tr>
<tr>
<td>-</td>
<td>Subtract from the current total in a consolidation (applies only to members of a dynamic hierarchy)</td>
</tr>
<tr>
<td>/</td>
<td>Divide by the current total in a consolidation (applies only to members of a dynamic hierarchy)</td>
</tr>
<tr>
<td>~</td>
<td>Exclude from the consolidation (applies only to members of a dynamic hierarchy or members beneath Label Only members in a stored hierarchy)</td>
</tr>
<tr>
<td>^</td>
<td>Essbase does not use the value of the member in any consolidation in any dimension except attribute dimensions</td>
</tr>
<tr>
<td>O</td>
<td>Tag as label only</td>
</tr>
<tr>
<td>N</td>
<td>Never allow data sharing</td>
</tr>
</tbody>
</table>
Currency name and currency category field types are not supported for aggregate storage outlines.

In aggregate storage outlines, formulas must be specified in the same format as MDX numeric value expressions. See “Developing Formulas on Aggregate Storage Outlines” on page 924.

### Building Alternate Hierarchies in Aggregate Storage Databases

To build shared members in an aggregate storage outline, select the **autoconfigure** setting in the Dimension Build Settings dialog box in Administration Services, and then make sure that Essbase is set up to allow sharing (clear **Do Not Share** in the Dimension Build Settings dialog box in Administration Services or omit the **Never allow Data Sharing** property in the rules file). When autoconfigure is selected and sharing is enabled, Essbase automatically creates duplicate members under a new parent as shared members. See “Building Shared Members by Using a Rules File” on page 339.

**Note:** There are restrictions on using the duplicate generation (DUPGEN) method to build alternate hierarchies in aggregate storage outlines. See Table 189, “Data Load Differences Between Aggregate Storage and Block Storage,” on page 903.

**Caution!** In alternate hierarchies in aggregate storage databases, you can associate attributes only with level-0 members.

### Understanding Exclusive Operations on Aggregate Storage Databases

On aggregate storage databases, multiple exclusive operations cannot be performed simultaneously on the same database. If one exclusive operation is running and a second exclusive operation is attempted simultaneously, the second operation is rejected with a message indicating that the operation cannot proceed while the first operation is in progress. For example, when performing a partial data clear on an aggregate storage database, a second partial data clear cannot run concurrently on the database, even if the operations are clearing different regions in the database. While most exclusive operations are mutually exclusive, there are some exceptions.

Exclusive operations and exceptions:

- **Export**

  Multiple export operations can run at the same time because export is a read-only operation. Export operations can run at the same time as build aggregations and backup, both of which
are exclusive operations; however, export is not compatible with any other exclusive operation.

- Build aggregations
- Backup (putting the database in read-only archive mode)
- Data load (committing the contents of a load buffer to the database)

Creating an aggregate storage load buffer and loading data into the load buffer are not exclusive operations. These operations can run concurrently with any other operations. However, committing the data in the load buffer to the database is an exclusive operation.

- Spreadsheet send operations (for example, updating cells)

If a send operation is running while another exclusive operation is attempted, the new operation waits for the send operation to finish before proceeding. Even though not compatible with the send operation, the new operation does not error out because send operations are always assumed to be small and fast (<5 seconds). This means it is possible for many users to perform spreadsheet send operations at the same time without those operations being rejected because they are incompatible with each other.

Note: In the case where multiple exclusive operations are attempted while a send operation is running, the order in which the new exclusive operations execute after the send operation completes is random; the order is not based on the sequence in which the new exclusive operations were attempted. For example, if a send operation is running and an exclusive operation of a different type is attempted, the new exclusive operation waits for the send operation to finish before proceeding. If, in the meantime, more send operations are attempted by other users, those send operations might be executed before the other exclusive operation, even though they were attempted afterward. Therefore, the exclusive operation might wait indefinitely as long as there is at least one send operation waiting to be executed.

- Merge slices
- Data clear operations (full, aggregates only, and partial)

Queries are allowed to run concurrently with all exclusive operations. However, if an operation adds, changes, or removes any data in the database, the following sequence takes place at the end of the operation, when the changes are made visible to queries:

1. Any new queries are temporarily blocked from starting (the queries wait).
2. Existing queries finish running.
3. Data changes from the exclusive operation are committed to the database.
4. Queries that are waiting proceed.

Queries are never rejected or canceled because of an operation that changes data on an aggregate storage cube.
Loading Data into Aggregate Storage Databases

Subtopics

- Incrementally Loading Data Using a Data Load Buffer
- Controlling Data Load Buffer Resource Usage
- Setting Data Load Buffer Properties
- Resolving Cell Conflicts
- Performing Multiple Data Loads in Parallel
- Listing Data Load Buffers for an Aggregate Storage Database
- Creating a Data Slice
- Merging Incremental Data Slices
- Replacing Database or Incremental Data Slice Contents
- Viewing Incremental Data Slices Statistics
- Managing Disk Space For Incremental Data Loads
- Using Smart View
- Data Source Differences for Aggregate Storage Data Loads
- Rules File Differences for Aggregate Storage Data Loads

For general information about loading data, see Chapter 20, “Performing and Debugging Data Loads or Dimension Builds.”

Aggregate storage databases facilitate analysis of very large dimensions containing up to a million or more members. To efficiently support loading data values into such large databases, Essbase:

- Allows the processing of multiple data sources through temporary aggregate storage data load buffers
- Allows you to control the percentage of resources a data load buffer uses
- Allows an aggregate storage database to contain multiple slices of data (a query to the database accesses each slice, collecting all of the data cells)
- Provides an incremental data load process that completes in a length of time that is proportional to the size of the incremental data

To load values to an aggregate storage databases, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Performing a Data Load or Dimension Build for Aggregate Storage Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database import data</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td>ESSCMD</td>
<td>IMPORT LOADDB</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Note: If values have been calculated and stored through an aggregation, Essbase automatically updates higher-level stored values when data values are changed. No additional calculation step is necessary. The existence and size of an aggregation can affect the time it takes to perform a data load. See “Aggregations” on page 976.

You cannot export data when loading data into a database.

**Incrementally Loading Data Using a Data Load Buffer**

Using the import database data MaxL statement to load data values from a single data source does not involve the aggregate storage data load buffer.

If you use multiple import database data MaxL statements to load data values to aggregate storage databases, you can significantly improve performance by loading values to a temporary data load buffer first, with a final write to storage after all data sources have been read.

In the aggregate storage data load buffer, Essbase sorts and commits the values after all data sources have been read. If multiple (or duplicate) records are encountered for any specific data cell, the values are accumulated (see “Resolving Cell Conflicts” on page 958). Essbase then stores the accumulated values—replacing, adding to, or subtracting from existing data values in the database. Using the aggregate storage data load buffer can significantly improve overall data load performance.

Note: When using the aggregate storage data load buffer, the choice for replacing, adding, or subtracting values is specified for the entire set of data sources when loading the data buffer contents to the database.

While the data load buffer exists in memory, you cannot build aggregations or merge slices, because these operations are resource-intensive. You can, however, load data to other data load buffers, and perform queries and other operations on the database. There might be a brief wait for queries, until the full data set is committed to the database and aggregations are created.

The data load buffer exists in memory until the buffer contents are committed to the database or the application is restarted, at which time the buffer is destroyed. Even if the commit operation fails, the buffer is destroyed and the data is not loaded into the database. (You can manually destroy a data load buffer by using the alter database MaxL statement. See the Oracle Essbase Technical Reference.)

Note: Stopping the application before committing the buffer contents destroys the buffer. In this situation, after restarting the application, you must initialize a new buffer and load the data to it.

To use the data load buffer for aggregate storage databases:

1. Prepare the data load buffer, where data values are sorted and accumulated by using the alter database MaxL statement to initialize an aggregate storage data load buffer. For example:

```
alter database ASOSamp.Sample
    initialize load_buffer with buffer_id 1;
```
2 Load data from your data sources into the data load buffer using the \texttt{import database} MaxL statement. Use multiple statements to load data from multiple data sources. You can include any combination of data sources, such as \texttt{.xls} files, text files, and SQL relational sources. Specify a rules file if the data source requires one.

The following example loads three data sources, one of which uses a rules file, into the same data load buffer:

```maxl
import database ASOsamp.Sample data
  from server data_file 'file_1.txt'
  to load_buffer with buffer_id 1
  on error abort;
import database ASOsamp.Sample data
  from server data_file 'file_2'
  using server rules_file 'rule'
  to load_buffer with buffer_id 1;
  on error abort;
import database ASOsamp.Sample data
  from server excel data_file 'file_3.xls'
  to load_buffer with buffer_id 1
  on error abort;
```

To load data into multiple load buffers simultaneously, see “Performing Multiple Data Loads in Parallel” on page 958.

3 Use the \texttt{import database} MaxL statement to commit the data load buffer contents to the database. For example:

```maxl
import database ASOsamp.Sample data
  from load_buffer with buffer_id 1;
```

To commit the contents of multiple data load buffers into the database with one MaxL statement, see “Performing Multiple Data Loads in Parallel” on page 958.

The following incremental data load example provides optimal performance when new data values do not intersect with existing values:

1. Create a single data load buffer using the \texttt{ignore_missing_values} and \texttt{ignore_zero_values} properties. For example:

```sql
alter database ASOsamp.Sample
  initialize load_buffer with buffer_id 1
  property ignore_missing_values, ignore_zero_values;
```

If the database must be available for send data requests while the database is being updated, initialize the data load buffer with the \texttt{resource_usage} grammar set for 80%. For example:

```sql
alter database ASOsamp.Sample
  initialize load_buffer with buffer_id 1
  resource_usage 0.8 property
  ignore_missing_values, ignore_zero_values;
```

2. Load the data into the buffer. For example:

```maxl
import database ASOsamp.Sample data
  from server data_file 'file_1.txt'
  to load_buffer with buffer_id 1
  on error abort;
```
import database ASOsamp.Sample data
from server data_file 'file_2'
to load_buffer with buffer_id 1;
on error abort;

3. Commit the contents of the data load buffer to the database by creating a slice and adding values. For example:

   import database ASOsamp.Sample data
   from load_buffer with buffer_id 1
   add values create slice;

**Controlling Data Load Buffer Resource Usage**

When performing an incremental data load, Essbase uses the aggregate storage cache for sorting data. You can control the amount of the cache a data load buffer can use by specifying the percentage. The percentage is a number between .01 and 1.0 inclusive; only two digits after the decimal point are significant—for example, 0.029 is interpreted as 0.02. By default, the resource usage of a data load buffer is set to 1.0, and the total resource usage of all data load buffers created on a database cannot exceed 1.0. For example, if a buffer of size 0.9 exists, you cannot create another buffer of a size greater than 0.1.

**Note:** Send operations internally create load buffers of size 0.2; therefore, a load buffer of the default size of 1.0 will cause send operations to fail because of insufficient data load buffer resources.

To set the amount of resources the buffer is allowed to use, use the `alter database MaxL` statement with the `resource_usage` grammar.

For example, to set the resource_usage to 50% of the total cache, use this statement:

   alter database ASOsamp.Sample
   initialize load_buffer with buffer_id 1
   resource_usage .5;

If you plan to run concurrent send operations, use the ASOLOADBUFFERWAIT configuration setting and the `alter database MaxL` statement with the `wait_for_resources` grammar. ASOLOADBUFFERWAIT applies to the creation of aggregate storage data load buffers with the `wait_for_resources` option, and applies to allocations, custom calculations, and lock and send operations.

**Setting Data Load Buffer Properties**

When loading data incrementally, you can specify how missing and zero values in the source data are treated when loading the data into the data load buffer.

For resolving cell conflicts for duplicate cells, you can specify whether to use the last cell loaded into the load buffer.

The data load buffer properties:

- `ignore_missing_values`: Ignores #MI values in the incoming data stream
- **ignore_zero_values**: Ignores zeros in the incoming data stream
- **aggregate_use_last**: Combines duplicate cells by using the value of the cell that was loaded last into the load buffer

**Note**: When loading text and date values into an aggregate storage database, use the aggregate_use_last option to help eliminate invalid aggregations. For other guidelines, see “Loading, Clearing, and Exporting Text and Date Measures” on page 195.

If you use multiple properties in the command and any conflict, the last property listed takes precedence.

To set data load buffer properties, use the `alter database MaxL` statement with the `property` grammar.

For example:
```
alter database ASOsamp.Sample
  initialize load_buffer with buffer_id 1
  property ignore_missing_values, ignore_zero_values;
```

In Administration Services Console, you can set options to ignore missing values and zero values, and to aggregate duplicate cells by using the value of the last cell loaded, on the Data Load dialog box. See “Data Load Dialog Box” in the *Oracle Essbase Administration Services Online Help*.

### Resolving Cell Conflicts

By default, when cells with identical keys are loaded into the same data load buffer, Essbase resolves the cell conflict by adding the values together.

To create a data load buffer that combines duplicate cells by accepting the value of the cell that was loaded last into the load buffer, use the `alter database MaxL` statement with the `aggregate_use_last` grammar.

For example:
```
alter database ASOsamp.Sample
  initialize load_buffer with buffer_id 1
  property aggregate_use_last;
```

**Note**: When using data load buffers with the `aggregate_use_last` grammar, data loads are significantly slower, even if there are not any duplicate keys.

### Performing Multiple Data Loads in Parallel

Multiple data load buffers can exist on an aggregate storage database. To save time, you can load data into multiple data load buffers simultaneously.

Although only one data load commit operation on a database can be active at any time, you can commit multiple data load buffers in the same commit operation, which is faster than committing buffers individually.
**Note:** When using Administration Services Console to load data into an aggregate storage database, only a single data load buffer is used.

To load data into multiple data load buffers simultaneously, use separate MaxL Shell sessions. For example, in one MaxL Shell session, load data into a buffer with an ID of 1:

```
alter database ASOsamp.Sample
    initialize load_buffer with buffer_id 1 resource_usage 0.5;
import database ASOsamp.Sample data
    from data_file "dataload1.txt"
    to load_buffer with buffer_id 1
    on error abort;
```

Simultaneously, in another MaxL Shell session, load data into a buffer with an ID of 2:

```
alter database ASOsamp.Sample
    initialize load_buffer with buffer_id 2 resource_usage 0.5;
import database ASOsamp.Sample data
    from data_file "dataload2.txt"
    to load_buffer with buffer_id 2
    on error abort;
```

When the data is fully loaded into the data load buffers, use one MaxL statement to commit the contents of both buffers into the database by using a comma-separated list of buffer IDs:

For example, this statement loads the contents of buffers 1 and 2:

```
import database ASOsamp.Sample data
    from load_buffer with buffer_id 1, 2;
```

**Note:** When loading SQL data into aggregate storage databases, you can use up to eight rules files to load data in parallel. This functionality is different than the process described above. When preforming multiple SQL data loads in parallel, you use one `import database` MaxL statement with the `using multiple rules_file` grammar. Essbase initializes multiple temporary aggregate storage data load buffers (one for each rules file) and commits the contents of all buffers into the database in one operation. See the Oracle Essbase SQL Interface Guide.

### Listing Data Load Buffers for an Aggregate Storage Database

Multiple data load buffers can exist on an aggregate storage database. For a list and description of the data load buffers that exist on an aggregate storage database, use the `query database` MaxL statement with the `list load_buffers` grammar:

```
query database appname.dbname list loadBuffers;
```

This statement returns the following information about each existing data load buffer:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>buffer_id</td>
<td>ID of a data load buffer (a number between 1 and 4,294,967,296).</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>internal</td>
<td>A Boolean that specifies whether the data load buffer was created internally by Essbase (TRUE) or by a user (FALSE).</td>
</tr>
<tr>
<td>active</td>
<td>A Boolean that specifies whether the data load buffer is currently in use by a data load operation.</td>
</tr>
<tr>
<td>resource_usage</td>
<td>The percentage (a number between .01 and 1.0 inclusive) of the aggregate storage cache that the data load buffer is allowed to use.</td>
</tr>
<tr>
<td>aggregation_method</td>
<td>One of the methods used to combine multiple values for the same cell within the buffer:</td>
</tr>
<tr>
<td></td>
<td>- AGGREGATE_SUM: Add values when the buffer contains multiple values for the same cell.</td>
</tr>
<tr>
<td></td>
<td>- AGGREGATE_USE_LAST: Combine duplicate cells by using the value of the cell that was loaded last into the load buffer.</td>
</tr>
<tr>
<td>ignore_missings</td>
<td>A Boolean that specifies whether to ignore #MI values in the incoming data stream.</td>
</tr>
<tr>
<td>ignore_zeros</td>
<td>A Boolean that specifies whether to ignore zeros in the incoming data stream.</td>
</tr>
</tbody>
</table>

**Creating a Data Slice**

You can incrementally commit the data load buffer to an aggregate storage database to create a slice. After loading the new slice into the database, Essbase creates all necessary views on the slice (such as aggregate views) before the new data is visible to queries.

Creating a data slice is useful because it improves the performance of incremental data loads. The amount of time an incremental data load takes is proportional to the amount of new data; the size of the database is not a factor.

To create a data slice, use the `import database` MaxL statement with the `create slice` grammar.

For example, to create a slice by overriding values (the default), use this statement:

```plaintext
import database ASOsamp.Sample data
   from load_buffer with buffer_id 1
   override values create slice;
```

**Note:** If you use override values when creating a slice, #MISSING values are replaced with zeros. Using this option is significantly slower than using the add values or subtract values options.

In Administration Services Console, you can set an option to create a slice on the Data Load dialog box. See “Data Load Dialog Box” in the Oracle Essbase Administration Services Online Help.
Merging Incremental Data Slices

Subtopics

- Automatically Merging Incremental Data Slices During a Data Load to an Aggregate Storage Database
- Manually Merging Incremental Data Slices

Automatically Merging Incremental Data Slices During a Data Load to an Aggregate Storage Database

Using the AUTOMERGE and AUTOMERGEMAXSLICENUMBER configuration settings, you can specify whether Essbase automatically merges incremental data slices during a data load to an aggregate storage database.

AUTOMERGE configuration setting options:

- ALWAYS—Specifies to automatically merge incremental data slices during a data load to an aggregate storage database. By default, merges are executed once for every four consecutive incremental data slices. If, however, the AUTOMERGEMAXSLICENUMBER configuration setting is used, the auto-merge process is activated when the AUTOMERGEMAXSLICENUMBER value is exceeded. The size of the incremental data slices is not a factor in selecting which ones are merged.
  
  The default value is ALWAYS.

- NEVER—Specifies to never automatically merge incremental data slices during a data load to an aggregate storage database. To manually merge incremental data slices, use the alter database MaxL statement with the merge grammar. See “Manually Merging Incremental Data Slices” on page 961.

- SELECTIVE—Specifies to activate the incremental data slice auto-merge process when the number of incremental data slices specified in the AUTOMERGEMAXSLICENUMBER configuration setting is exceeded. If the number of incremental data slices in the data load does not exceed the value of AUTOMERGEMAXSLICENUMBER, the auto-merge process is not activated.

Manually Merging Incremental Data Slices

You can merge all incremental data slices into the main database slice or merge all incremental data slices into a single data slice while leaving the main database slice unchanged. To merge slices, you must have the same privileges as for loading data (Administrator or Database Manager permissions).

After the new input view is written to the database, Essbase creates the aggregate views for the slice. The views created for the new slice are a subset of the views that exist on the main database slice.

Note: You cannot export data when performing a merge.
If you cleared data from a region using the logical clear region operation, which results in a value of zero for the cells you cleared, you can elect to remove zero value cells during the merge operation. See “Clearing Data from Specific Regions of Aggregate Storage Databases” on page 965.

To perform merging operations, use the alter database MaxL statement with the merge grammar. For example, to merge all incremental data slices into the main database slice, use this statement:

```
alter database ASOsamp.Sample
    merge all data;
```

To merge all incremental data slices into the main database slice and remove zero value cells, use this statement:

```
alter database ASOsamp.Sample
    merge all data remove_zero_cells;
```

To merge all incremental data slices into a single data slice, use this statement:

```
alter database ASOsamp.Sample
    merge incremental data;
```

In Administration Services Console, you can merge data slices. See “Merging Incremental Data Slices (Aggregate Storage Databases)” in the Oracle Essbase Administration Services Online Help.

**Note:** Before you copy an aggregate storage application, you must merge all incremental data slices into the main database slice. Data in unmerged incremental data slices is not copied. See “Manually Merging Incremental Data Slices” on page 961.

### Replacing Database or Incremental Data Slice Contents

For data sets that are small enough to reload completely while maintaining low data latency, Essbase can remove the current contents of a database and replace the database with the contents of a specified data load buffer. The atomic replacement functionality transitions querying the old contents of the database to the new contents without interrupting service. The newly loaded data set is aggregated to create the same set of views that existed for the replaced data set.

Essbase also allows for atomically replacing the contents of all incremental data slices in a database. Consider a situation in which data can be separated into a relatively large, static data set that is never updated and a relatively small, volatile data set for which the individual updates are difficult to identify but are confined to the volatile data set. For example, the large, static data set consists of historical transaction data for the last three years; however, for the transaction data for the past two months, users can change a characteristic of a transaction in the source database. Tracking these changes can be prohibitively complex. You can load the static data set as the main slice in a database and the volatile data set as one or more incremental slices.

Essbase removes the current contents of all incremental data slices and creates a new slice (using the add values grammar) with the contents of a specified data load buffer. The newly loaded data set is augmented with aggregated views based on the set of views that exist on the main slice.
Note: To use the **override** grammar, create a data load buffer with the ignore_missing_values property for optimal performance. Additionally, you must ensure that there are not any conflicts between the static and volatile data sets (for example, there should not be a value in each data set for the same cell).

To replace the contents of a database or the incremental data slices in a database, use the **import database** **MaxL** statement with the **override** grammar.

For example, to replace the contents of a database, use this statement:

```
import database ASOsamp.Sample data
  from load_buffer with buffer_id 1
  override all data;
```

To replace the contents of all incremental data slices with a new slice, use this statement:

```
import database ASOsamp.Sample data
  from load_buffer with buffer_id 1
  override incremental data;
```

Note: If the override replacement fails, Essbase continues to serve the old data set.

In Administration Services Console, you can set the option to replace the contents of the database or data slices in the Data Load dialog box. See “Replacing Database or Data Slice Contents (Aggregate Storage Database)” in the *Oracle Essbase Administration Services Online Help*.

**Viewing Incremental Data Slices Statistics**

Essbase provides statistics on the size and number of incremental data slices, and the cost of querying the incremental data slices.

The time it takes for a query to access all of the incremental data slices is expressed as a percentage (between .01 and 1.0 inclusive). If a database has a main slice and multiple incremental data slices, a query statistic of 0.66 means that two-thirds of the query time was spent querying the incremental data slices and one-third was spent querying the main data slice. If the cost of querying the incremental data slices is too high, you can merge the slices.

To view the incremental data slice statistics, see “Viewing Aggregate Storage Statistics” in the *Oracle Essbase Administration Services Online Help*.

**Managing Disk Space For Incremental Data Loads**

Incremental data loads on aggregate storage databases may use disk space up to two times the size of your current data files. Using the **execute aggregate process** **MaxL** statement with the **stopping when total_size exceeds** grammar, you can specify the maximum disk space of the resulting data files, as a ratio of the current database size. See the *Oracle Essbase Technical Reference*. 
In cases where databases are larger than 2 GB, you can reduce disk space utilization by setting the maximum file size of the default tablespace to no more than 2 GB. See “Working with Tablespaces” on page 1024.

To set the maximum file size of the default tablespace, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Managing Tablespaces</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter tablespace</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Using Smart View**

In Smart View, the submit command is equivalent to using the incremental data load functionality with the `override` grammar.

While performing a send operation, new requests for lock, unlock, and retrieve and lock will wait until the send operation is completed.

See the *Oracle Smart View for Office User’s Guide*.

**Data Source Differences for Aggregate Storage Data Loads**

While processing data source records for loading values into aggregate storage databases, Essbase processes source data records only for the level 0 dimension intersections where the member does not have a formula.

The following example shows a data source with records for only level 0 intersections. The last field contains data values; the other fields are level 0 members of their respective dimensions.

Jan, Curr Year, Digital Cameras, CO, Original Price, 10784
Jan, Prev Year, Camcorders, CO, Original Price, 13573

Essbase ignores records that specify upper-level members and, at the end of the data load, displays the number of skipped records.

For example, the following record would be skipped because member Mid West is a level 1 member:

Jan, Curr Year, Digital Cameras, Mid West, Original Price, 121301

Sorting data sources is unnecessary because Essbase Server reads and sorts records internally before committing values to the database.

**Rules File Differences for Aggregate Storage Data Loads**

Rules file specifications for loading values to aggregate storage databases reflect the aggregate storage data load process.
For block storage data loads, through the rules file, you choose for each data source whether to overwrite existing values, add values in the data source to existing values, or subtract them from existing values.

For aggregate storage data loads using the aggregate storage data load buffer, you make this choice for all data load sources that are gathered into the data load buffer before they are loaded to the database.

To use a rules file that was defined for a block storage outline with an aggregate storage outline, first associate the rules file with the aggregate storage outline. See “Associating an Outline with an Editor” in the Oracle Essbase Administration Services Online Help.

### Clearing Data from an Aggregate Storage Database

**Subtopics**

- Clearing Data from Specific Regions of Aggregate Storage Databases
- Clearing All Data from an Aggregate Storage Database

You can selectively clear data or clear all data from an aggregate storage database.

Also see “Clearing Aggregations” on page 984.

### Clearing Data from Specific Regions of Aggregate Storage Databases

You can clear data from a specified region in an aggregate storage database and retain the data located in other regions. This feature is useful when you want to delete volatile data (such as data corresponding to the last month) but retain historical data. You must have Database Manager or Administrator permission to clear data.

Methods for clearing data from a region:

- **Physical**

  The input cells in the specified region are physically removed from the aggregate storage database, as illustrated in Figure 161.

![Figure 161 Physically Clearing a Region of Data](image)
If there are multiple data slices in the database, the physical clear region operation automatically merges all data slices into the main data slice. After data for the specified region is cleared, Essbase materializes all aggregate views that were present in the main data slice before the clear region operation took place.

The process for physically clearing data completes in a length of time proportional to the size of the input data, not to the size of the data being cleared. Therefore, you might use this method only when removing large slices of data.

To physically clear data, use the `alter database MaxL` statement with the `clear data in region` grammar and the `physical` keyword:

```
alter database appname.dbname clear data in region 'MDX set expression' physical;
```

- **Logical**

The input cells in the specified region are written to a new data slice with negative, compensating values that result in a value of zero for the cells you want to clear, as illustrated in Figure 162.

![Figure 162 Logically Clearing a Region of Data](image)

The logical clear region operation automatically merges only the data slice with zero values into the main data slice; other data slices in the database are not merged. After data for the specified region is cleared, Essbase materializes aggregate views only in the new data slice.

The process for logically clearing data completes in a length of time that is proportional to the size of the data being cleared. Because compensating cells are created, this option increases the size of the database.

To logically clear data, use the `alter database MaxL` statement with the `clear data in region` grammar but without the `physical` keyword:

```
alter database appname.dbname clear data in region 'MDX set expression';
```

Queries to the logically cleared region return zero values instead of #MISSING values. You may need to update formulas that rely on #MISSING values for empty cells.

To remove cells with a value of zero, use the `alter database MaxL` statement with the `merge` grammar and the `remove_zero_cells` keyword. See the *Oracle Essbase Technical Reference*. 

966
Note: Oracle does not recommend performing a second logical clear region operation on the same region, because the second operation does not clear the compensating cells created in the first operation and does not create new compensating cells.

In specifying the region to be cleared, follow these guidelines:

- The region must be symmetrical.
  - \{(Jan, Budget)\} is a valid symmetrical region that clears all Budget data for Jan.
  - \{(Jan, Forecast1),(Feb, Forecast2)\} is an invalid region because it consists of two asymmetrical regions (Jan, Forecast1 and Feb, Forecast2).
- Individual members in any dimension in the region specification must be stored members.
- Members in the region cannot be:
  - Dynamic members (members with implicit or explicit MDX formulas)
  - From attribute dimensions
    - If you need to clear cells by an attribute, use the Attribute MDX function.
- Members in the region can be upper-level members in stored hierarchies, which is a convenient way to specify multiple level 0 members.

For example, you can specify Qrt1, which is the same as specifying Jan, Feb, and Mar (the level 0 children of Qrt1):

The following two MaxL statements produce the same results:

```
alter database appname.dbname clear data in region '{Qtr1}';
alter database appname.dbname clear data in region '{Jan, Feb, Mar}';
```

- (Physically clearing data only) Members in the region can be upper-level members in alternate hierarchies.

For example, you can specify High End Merchandise, which is the same as specifying Flat Panel, HDTV, Digital Recorders, and Notebooks (the shared, level 0 children of High End Merchandise):
The following two MaxL statements produce the same results:

```
alter database appname.dbname clear data in region '{High End Merchandise}';
alter database appname.dbname clear data in region '{[Flat Panel], [HDTV], [Digital
Recorders], [Notebooks]}';
```

To specify members in alternate hierarchies when logically clearing data, use the Descendants MDX function.

**Note:** When the region contains upper-level members from alternate hierarchies, you may experience a decrease in performance. In this case, consider using only level 0 members.

- The MDX set expression must be enclosed with single quotation marks.

For example, to clear all January data for Forecast1 and Forecast2 scenarios, use this statement:

```
alter database ASOSamp.Sample clear data in region 'CrossJoin({Jan},{Forecast1,
Forecast2})';
```

During the clear region operation, you cannot perform operations that update the database (such as loading data, merging data slices, or clearing data from another region), nor export data. You can query the database; however, the query results are based on the data set before the clear region operation.

The `clear data in region` grammar cannot clear data from the entire database. See “Clearing All Data from an Aggregate Storage Database” on page 968.

### Clearing All Data from an Aggregate Storage Database

Clearing all data from an aggregate storage database is the same as for a block storage database. To clear the entire database, either use:

- The `alter database` MaxL statement with the `reset` grammar:
  
  ```
  alter database appname.dbname reset;
  ```

- Administration Services Console
  
  See “Clearing Data” in the *Oracle Essbase Administration Services Online Help*. 
Copying an Aggregate Storage Application

To copy all of the data in an aggregate storage application, you must merge all incremental data slices into the main database slice. Data in unmerged incremental data slices is not copied.

See “Manually Merging Incremental Data Slices” on page 961.

Combining Data Loads and Dimension Builds

When using the aggregate storage data load buffer, you can combine data sources and rules files to add members to the outline and to load data values to the level 0 cells. Regardless of the order in which you specify the files, Essbase makes the outline changes and then loads the data values.

**Note:** Although dimension builds and data loads for aggregate storage databases can be combined into one operation in Administration Services, Oracle recommends that you separate dimension build operations from data load operations, because some dimension builds clear data, which could lead to data loss. See “Building Dimensions in Aggregate Storage Databases” on page 949.

Calculating Aggregate Storage Databases

Subtopics

- Outline Factors Affecting Data Values
- Block Storage Calculation Features That Do Not Apply to Aggregate Storage Databases
- Calculation Order
- Aggregating an Aggregate Storage Database
- Performing Time Balance and Flow Metrics Calculations in Aggregate Storage Accounts Dimensions

Aggregate storage database values are calculated through the outline structure and MDX formulas. When a data load is complete, all the information needed to calculate an aggregate storage database is available. When a retrieval request is made, Essbase Server calculates the needed values by consolidating the values loaded for level 0 members and calculating formulas. Values calculated for retrievals are not stored.

To improve retrieval performance, Essbase can aggregate values and store them ahead of time. However, aggregating and storing all values can be a lengthy process that requires disk space for storage. Essbase provides an intelligent aggregation process that balances time and storage resources. See “Aggregating an Aggregate Storage Database” on page 974.

To prepare an aggregate storage database for retrieval, you create the outline and load the level 0 values. Then you calculate the database by aggregating, and storing additional values, with the remaining values to be calculated when retrieved.

**Note:** If a database needs calculation scripts to handle special calculations and data dependencies, consider altering the database design or making it a block storage database.
Outline Factors Affecting Data Values

The hierarchical structure of an aggregate storage outline determines how values are rolled up. Level 0 member values roll up to level 1 member values, level 1 member values roll up to level 2 member values, and so on.

Consolidation operators assigned to members of dynamic hierarchies define the operations used in the roll-up: add (+), subtract (-), multiply (*), divide (/), percent (%), no operation (~), and (^) never consolidate. See Table 198 on page 951.

Note: Members of stored hierarchies can have only the addition (+) or the no-consolidation (~) operator.

For more complex operations, you can provide MDX formulas on members of dynamic hierarchies. MDX formulas are written in the same format as MDX numeric value expressions. See “Developing Formulas on Aggregate Storage Outlines” on page 924.

Block Storage Calculation Features That Do Not Apply to Aggregate Storage Databases

The following characteristics of calculating block storage databases do not apply to aggregate storage databases:

- Calculation script calculations
- Dynamic Calc and Dynamic Calc and Store member storage properties
- Block storage formula syntax and predefined Essbase functions in formulas
- Custom-defined calculation functions and custom-defined calculation macros
- Formulas on members of dimensions other than members of aggregate storage dynamic hierarchies
- Preloaded values for member intersections above level 0
- Two-pass calculations tags
- Block storage performance features such as Intelligent Calculation
Calculation Order

Subtopics

- Solve Order Property
- Example Using the Solve Order Property

Aggregate storage calculation order and block storage calculation order differ. For aggregate storage databases, Essbase calculates data in the following order:

1. **Aggregates members of stored hierarchies and attribute dimensions.** The order in which members and dimensions are aggregated is optimized internally and changes according to the nature of the database outline and the existing aggregations. Because the aggregation is additive, the order in which Essbase aggregates the dimensions and members does not affect the results.

   Because the internal aggregation order for an aggregate storage database is not predictable, any inherent rounding errors are also not predictable. These rounding errors are expected behavior in computer calculation and are extremely small in relation to the data values concerned.

2. **Calculates dynamic hierarchy dimension members and formulas.** The order in which members and formulas are evaluated is defined by the solve order property, which you can set for each member or dimension. Calculation order may affect calculation results.

**Solve Order Property**

The concept of solve order applies to query execution. When a cell is evaluated in a multidimensional query, the order in which the calculations should be resolved may be ambiguous. To remove ambiguity, you can use the solve order property to specify the required calculation priority.

**Note:** It is good practice to specify the solve order for each member by setting the solve order property at the member level or at the dimension level. Members without formulas that do not have a specified solve order inherit the solve order of their dimension. Members with formulas that do not have a specified solve order have a solve order of zero.

To specify the solve order for a member or a dimension, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Specifying the Calculation Order for Members and Dimensions in Aggregate Storage Databases</td>
<td><a href="https://docs.oracle.com/en/essbase/oracle-essbase/8-2/administration-services-help.html">Oracle Essbase Administration Services Online Help</a></td>
</tr>
</tbody>
</table>

The value of the solve order property determines the priority with which Essbase calculates the formulas. The formulas on the members that have a specified solve order are calculated in order
from the lowest solve order to the highest. (See “Example Using the Solve Order Property” on page 972). You can specify a solve order between 0 and 127. The default is 0.

You can specify the solve order at the member level or at the dimension level. Essbase uses the following information to define calculation precedence:

1. Member solve order

2. Dimension solve order (members without formulas for which you do not specify a member solve order inherit the solve order of their dimension. Members with formulas for which you do not specify a member solve order have a solve order of zero.)

If multiple members have the same solve order, the members are evaluated in the reverse order in which their dimensions occur in the database outline. The member that occurs later in the outline takes precedence.

The tie situation calculation order is different for calculated members defined in an MDX query for block storage databases. See the Oracle Essbase Technical Reference.

**Note:** When a member formula is dependant on the value of another member, the member with the formula must have a higher solve order than the member or members on which it depends. For example, in the ASOsamp.Sample database outline in Figure 164 on page 973, Avg Units/Transaction depends on the value of Units and of Transactions. Avg Units/Transaction must have a higher solve order than Units and Transactions.

**Example Using the Solve Order Property**

The following example is based on the ASOsamp.Sample database. To remove ambiguity in query results, the example uses the solve order property to specify the required calculation priority.

The spreadsheet query in Figure 163 on page 972 retrieves data for the number of units sold and the number of transactions for January of the current year and for January of the previous year. The Variance member shows the difference between the current year and the previous year. The Avg Units/Transaction member shows a ratio of the number of units sold per transaction.

**Figure 163  Results from Spreadsheet Query of ASOsamp.Sample database Showing the Variance Between Two Ratios (C12)**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Jan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cur Year</td>
<td>Units</td>
<td>42228</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Transactions</td>
<td>44930</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Avg Units/Transaction</td>
<td>0.56409302</td>
</tr>
<tr>
<td>7</td>
<td>Prev Year</td>
<td>Units</td>
<td>31643</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Transactions</td>
<td>30160</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Avg Units/Transaction</td>
<td>0.956430111</td>
</tr>
<tr>
<td>10</td>
<td>Variance</td>
<td>Units</td>
<td>10596</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Transactions</td>
<td>11540</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Avg Units/Transaction</td>
<td>-0.023000291</td>
</tr>
<tr>
<td>13</td>
<td>Variance %</td>
<td>Units</td>
<td>35.4519425</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Transactions</td>
<td>34.5978271</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Avg Units/Transaction</td>
<td>-0.556277601</td>
</tr>
</tbody>
</table>

972
Figure 164 shows the database outline for these members and the formulas applied to the Variance and Avg Units/Transaction members.

When calculating the variance of the average units per transaction (cell C12 in Figure 163 on page 972), the result could be the variance between the two ratios, or the result could be the ratio of the two variances. The result depends on whether Essbase gives precedence to the formula on Variance or the formula on Avg Units/Transaction.

The value of the solve order property, which is attached to the members in the database outline, determines the priority with which Essbase evaluates the formulas. The formula on the member that has the higher solve order takes precedence.

In the example, if the Variance member has a higher solve order than the Avg Units/Transaction member, then the formula on the Variance member takes precedence and the result is the variance between two ratios. This is the case in the ASOsamp.Sample database, because the solve order of the Variance member is 20 and the solve order of the Avg Units/Transaction member is 10. The formula on Variance takes precedence, because the Variance member has the higher solve order. The result for cell C12 of the query in Figure 163 is the variance between the two ratios, as shown in Table 200:

<table>
<thead>
<tr>
<th>Table 200</th>
<th>Using the Solve Order Property to Specify the Variance Between Two Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Member</td>
<td>Solve Order</td>
</tr>
<tr>
<td>Variance</td>
<td>20</td>
</tr>
<tr>
<td>Avg Units/</td>
<td>10</td>
</tr>
<tr>
<td>Transaction</td>
<td></td>
</tr>
</tbody>
</table>

Alternatively, if you change the ASOsamp.Sample database, and you give the Avg Units/Transaction member a higher solve order than the Variance member, then the formula on the Avg Units/Transaction member takes precedence, and the result is the ratio of two variances, as shown in Table 201 and in Figure 165:
Table 201  Using the Solve Order Property to Specify the Ratio of Two Variances

<table>
<thead>
<tr>
<th>Member</th>
<th>Solve Order</th>
<th>Formula</th>
<th>Result of Intersection of Variance and Avg Units/Transaction (cell C12 in Figure 165)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variance</td>
<td>10</td>
<td>Curr Year - Prev Year</td>
<td>Variance (current year to previous year) of units / variance of transactions</td>
</tr>
<tr>
<td>Avg Units/Transaction</td>
<td>20</td>
<td>Units/Transactions</td>
<td>10585 (cell C10) / 11340 (cell C11) = 0.933421517 (cell C12)</td>
</tr>
</tbody>
</table>

Figure 165  Results from Spreadsheet Query of ASOSamp.Sample Database Showing the Ratio of Two Variances (C12)

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>Jan</td>
</tr>
<tr>
<td>4</td>
<td>Curr Year</td>
<td>Units</td>
<td>452236</td>
</tr>
<tr>
<td>5</td>
<td>Transactions</td>
<td></td>
<td>44900</td>
</tr>
<tr>
<td>6</td>
<td>Avg Units/Transaction</td>
<td></td>
<td>0.934221111</td>
</tr>
<tr>
<td>7</td>
<td>Prev Year</td>
<td>Units</td>
<td>31643</td>
</tr>
<tr>
<td>8</td>
<td>Transactions</td>
<td></td>
<td>31100</td>
</tr>
<tr>
<td>9</td>
<td>Avg Units/Transaction</td>
<td></td>
<td>0.934221111</td>
</tr>
<tr>
<td>10</td>
<td>Variance</td>
<td>Units</td>
<td>10585</td>
</tr>
<tr>
<td>11</td>
<td>Transactions</td>
<td></td>
<td>11340</td>
</tr>
<tr>
<td>12</td>
<td>Avg Units/Transaction</td>
<td></td>
<td>0.933421517</td>
</tr>
<tr>
<td>13</td>
<td>Variance %</td>
<td>Units</td>
<td>33.4519625</td>
</tr>
<tr>
<td>14</td>
<td>Transactions</td>
<td></td>
<td>34.19756971</td>
</tr>
<tr>
<td>15</td>
<td>Avg Units/Transaction</td>
<td></td>
<td>0.933421517</td>
</tr>
</tbody>
</table>

Aggregating an Aggregate Storage Database

Subtopics

- Understanding Aggregation-Related Terms
- Performing Database Aggregations
- Fine-Tuning Aggregate View Selection
- Selecting Views Based on Usage
- Understanding User-Defined View Selection
- Query Hints
- Working with Aggregation Scripts
- Optimizing Aggregation Performance
- Clearing Aggregations
- Replacing Aggregations

Aggregate storage databases require no separate calculation step after data values are loaded into the level 0 cells of the outline. From any point in the database, users can retrieve and view values that are aggregated dynamically, for the current retrieval only. Aggregate storage databases are smaller than block storage databases, enabling quick retrieval of data values.

As databases grow, retrievals must process more data values to satisfy the calculation needs of the queries. For faster retrieval, Essbase enables you to precalculate data values and store those values in aggregations. If a database size nears one million aggregate cells, you should strongly consider performing an aggregation. Depending on database usage and the usage environment, you can achieve performance benefits by precalculating smaller databases as well. You can use either Administration Services Console or MaxL to calculate an aggregate storage database.
Understanding Aggregation-Related Terms

Subtopics

- Aggregate Cells
- Aggregate Views
- Aggregations
- Aggregation Scripts

The following topics describe terms that are integral to an explanation of aggregate storage database calculation.

**Aggregate Cells**

Cells for level 0 intersections across dimensions, without formulas, are called input cells. Data values can be loaded to them. Higher-level cells involving members of the accounts dimension or dynamic hierarchies are always calculated at retrieval. All other higher-level intersections across dimensions are aggregate cells. For example, for the outline in Figure 160 on page 948, Price Paid > Curr Year > 1st Half > Portable Audio > CO is an aggregate cell; Original Price > Curr Year > Jan > Camcorders > CO is another aggregate cell. Values for aggregate cells must be rolled up from lower-level values.

Aggregate cell values are calculated for each request, or they can be precalculated and stored on disk.

**Aggregate Views**

When Essbase defines which aggregate cells to precalculate and store, it works with aggregate views. An aggregate view is a collection of aggregate cells. The collection is based on the levels of the members within each dimension.

For example, consider one aggregate view for the outline in Figure 160 on page 948. This aggregate view includes aggregate cells for the following dimension levels:

- Measures dimension, level 0
- Years dimension, level 0
- Time dimension, level 1 of hierarchy 0
- Product dimension, level 2 of hierarchy 0
- Geography dimensions, level 0

The example aggregate view is shown as 0, 0, 1/0, 2/0, 0.

Each dimension is shown, left to right, in its sequence in the outline. If a dimension contains hierarchies, the notation specifies the member level within its hierarchy. Hierarchies within a dimension are numbered top-down, starting with hierarchy 0.

The 0, 0, 1/0, 2/0, 0 aggregate view contains aggregate cells that include the following member intersections:
Aggregations

Aggregations are consolidations, based on outline hierarchy, of level 0 data values. An aggregation contains one or more aggregate views. Essbase provides an intelligent aggregation process that selects aggregate views to be rolled up, aggregates them, and then stores the values for the cells in the selected views. If an aggregation includes aggregate cells dependent on level 0 values that are changed through a data load, the higher-level values are automatically updated at the end of the data load process.

The term aggregation is used for the aggregation process and the set of values stored as a result of the process.

Aggregation Scripts

Each aggregation script is a file that defines a particular selection of aggregate views to be materialized. The Administration Services Aggregation Design Wizard enables you to create aggregation scripts and store them in the database directory as text files with the .csc extension. See “Working with Aggregation Scripts” on page 982.

Performing Database Aggregations

You can use either Administration Services Aggregation Design Wizard or MaxL statements to perform an aggregation. The aggregation process has two phases:

- Aggregate view selection.
- Calculation and storage of values for the selected aggregate views. This phase is also called the materialization of the aggregation.
During the aggregate view selection phase, Essbase analyzes how calculating and storing various combinations of aggregate views might affect average query response time. As input to the analysis, you can define physical storage and performance requirements. You can also track data usage and provide the information to the analysis process. See “Selecting Views Based on Usage” on page 980.

Based on their usefulness and resource requirements, Essbase creates a list of aggregate views. Included with each view in the list is storage and performance information that applies when that aggregate view plus all other aggregate views listed above it are stored. You can choose to aggregate the listed views, select and aggregate a subset of the listed views, or rerun the selection process with different input criteria. You can also add to an aggregation the materialization of new views that are based on new selection criteria. See “Fine-Tuning Aggregate View Selection” on page 978.

Whether or not you materialize the selection, you can save the selection of aggregate views as an aggregation script. Aggregation scripts provide flexibility and can save time because they enable you to bypass the selection process if the same selection is needed again. See “Working with Aggregation Scripts” on page 982.

After the selection process is finished, the selected aggregate views are calculated when you materialize the selected aggregate views into an aggregation.

The following process is recommended for defining and materializing aggregations:

1. After the outline is created or changed, load data values.
2. Perform the default aggregation.
   Optional: Specify a storage stopping point.
3. Materialize the suggested aggregate views and save the default selection in an aggregation script.
4. Run the types of queries for which the aggregation is designed.
5. If query time or aggregation time is too long, consider fine-tuning the aggregation. See “Fine-Tuning Aggregate View Selection” on page 978.
6. Optional: Save the aggregation selection as an aggregation script.
   See “Working with Aggregation Scripts” on page 982.

To perform a database aggregation selection or materialization, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Calculating Aggregations to Improve Retrievals</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>execute aggregate process</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>execute aggregate selection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>execute aggregate build</td>
<td></td>
</tr>
</tbody>
</table>
**Fine-Tuning Aggregate View Selection**

The default selection of aggregate views proposed by Essbase provides excellent performance. However, accepting all aggregate views in the selection list does not guarantee optimum performance. For the default selection, Essbase analyzes stored hierarchies and assumes an equal chance that any aggregate cell will be retrieved. Essbase cannot account for external factors such as the amount of available memory at the time of a query. Available memory can be affected by such factors as the cache memory definition at retrieval time, or the memory other concurrent processes require.

You may want to track which data is most queried and include the results and alternate views in the aggregate view selection process. See “Selecting Views Based on Usage” on page 980.

As you tune and test aggregations, consider the following points:

- Improving retrieval performance can increase disk storage costs and the time it takes to materialize the aggregation.

- Tracking queries may result in a set of proposed aggregate views that provide better performance for some queries than for others. Selecting proposed aggregate views can considerably improve performance time of some queries with others experiencing little improvement—but never worse—as long as query type and frequency are close to the type and frequency of queries performed during the tracking period.

- Optimizing aggregations may require an iterative, fine-tuning process.

To estimate the size of aggregate views, you can use the ASOSAMPLESIZEPERCENT configuration setting in `essbase.cfg` to specify the number of sample cells Essbase uses. The sample size is specified as a percentage of input-level data. The default, and minimum, sample size is 1 million (1,000,000) cells. See the Oracle Essbase Technical Reference.

Essbase provides information to help you select and store the right balance of aggregate views for your database. Weigh this information against what you know about your database retrieval requirements and environment. Use the following information to help you select aggregate views for an aggregation:

- **The maximum storage requirement**
  
  You can specify a storage limit for selecting aggregate views in two ways:

  - When the aggregation selection is initiated, you specify a maximum storage stopping value. Aggregate views are selected until the specified storage limit is reached or there are no more views to select.
In Administration Services, the number you specify is the amount of storage in MB; in MaxL, the number is a factor times the size of the level 0 stored values. See the Oracle Essbase Administration Services Online Help and the Oracle Essbase Technical Reference.

- After each analysis of the database, Essbase displays information about the level 0 input cell view followed by a list of suggested aggregate views. Displayed by each aggregate view is a storage number that includes that aggregate view and all other aggregate views it depends on. You can consider this storage number as you select the aggregate views to be included in the aggregation.

- The relative “Query Cost” performance improvement

The Query Cost number that is displayed by each aggregate view in the list projects an average retrieval time for retrieving values from the associated aggregate view. The default view selection estimates the cost as the average of all possible queries. When using query tracking, the estimated cost is the average for all tracked queries. The cost number for a specific aggregate view can be different in different selection lists; for example, aggregate view 0, 0, 1/0, 2/0, 0 can show a different query cost in the default selection list than it would show in a selection that includes tracked queries in the analysis.

To compute the percentage improvement, divide the query cost value for the aggregate view into the query cost value shown for storing only level 0 input cells.

- Tracked usage

Before running an aggregate view selection, you can turn on query tracking to determine which data is retrieved most often. After some period of database activity, you can have Essbase include the usage statistics in the aggregation analysis process. See “Selecting Views Based on Usage” on page 980.

- Aggregation time

The time it takes to perform an aggregation after the selection process completes increases for each aggregate view materialized. To determine actual aggregation time, you must perform the aggregation.

The following process is recommended for fine-tuning aggregations:

1. Perform the default aggregations described in “Performing Database Aggregations” on page 976.
2. Save the default selection in an aggregation script. See “Working with Aggregation Scripts” on page 982.
3. Turn on query tracking. See “Selecting Views Based on Usage” on page 980.
4. Have users perform their usual queries against the database or perform the batch query operations for which the aggregation is being designed. Queries from all query tools are tracked.
5. After sufficient time to capture data retrieval requirements, perform another aggregation including tracked data.
6. Analyze the proposed list of aggregate views to be stored, and select the aggregate views that you determine provide the best balance of system resources and retrieval performance.
7. Materialize the selected aggregate views and, if desired, save the selection in an aggregation script.

8. Working with aggregation scripts and various selection criteria, repeat the process until you think you have the optimum selection of aggregate views for your situation.

**Note:** To optimize aggregations for different database retrieval situations, such as for generating reports or user queries, you may need to repeat the tuning process, creating an aggregation script for each situation. See “Working with Aggregation Scripts” on page 982.

### Selecting Views Based on Usage

Essbase enables you to capture retrieval statistics against a database. You can then use these statistics to build aggregations tailored to retrieval patterns in your company. Also, Essbase includes alternate hierarchies in its analysis of the database when usage information is used in the aggregate view selection process.

Database usage for periodic reporting may be different than for ongoing user retrievals. To optimize different retrieval situations, consider tracking situational usage patterns and creating aggregation scripts for each situation.

Before you begin the aggregation selection process, ensure that query tracking is on and that it has been on long enough to capture representative usage.

➢ To track data query patterns, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Tracking Query Data for Aggregation View Selection</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Query tracking holds query usage information in memory. Performing any of the following operations clears query usage information.

- Loading or clearing data
- Materializing or clearing an aggregation
- Turning off query tracking

Query tracking remains on until you turn it off, stop the application, or change the outline.

### Understanding User-Defined View Selection

By default, Essbase uses internal mechanisms to decide how to create aggregations. User-defined view selection provides a way for you to influence default view selection and view selection based on query data. See “Selecting Views Based on Usage” on page 980.

Administrators may apply view selection properties to stored hierarchies to restrict Essbase from choosing certain levels for aggregation.
Note: Secondary hierarchies are either shared or attribute hierarchies.

<table>
<thead>
<tr>
<th>Property</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>On primary hierarchies, Essbase considers all levels. It does not aggregate on secondary hierarchies unless alternative roll-ups are enabled.</td>
</tr>
<tr>
<td>Consider all levels</td>
<td>Considers all levels of the hierarchy as potential candidates for aggregation. This is the default for primary hierarchies, but not for secondary hierarchies.</td>
</tr>
<tr>
<td>Do not aggregate</td>
<td>Does not aggregate along this hierarchy. All views selected by Essbase are at the input level.</td>
</tr>
<tr>
<td>Consider bottom level only</td>
<td>Applies only to secondary hierarchies. Essbase considers only the bottom level of this hierarchy for aggregation.</td>
</tr>
<tr>
<td>Consider top level only</td>
<td>Applies only to primary hierarchies. Considers only top level of this hierarchy for aggregation.</td>
</tr>
<tr>
<td>Never aggregate to intermediate levels</td>
<td>Applies to primary hierarchies. Selects top and bottom levels only.</td>
</tr>
</tbody>
</table>

Note: The bottom level of an attribute dimension consists of the zero-level attribute members. When a secondary hierarchy is formed using shared members, the bottom level comprises the immediate parents of the shared members.

Essbase considers only views that satisfy the selected view selection properties.

You should be familiar with the dominant query patterns of databases before changing default properties; preventing selection of certain views will make queries to those views slower while improving the speed of other queries. Similarly, enabling Consider All Levels on a secondary hierarchy may speed queries to that hierarchy while making other queries slower.

To define view selection properties, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Setting View Selection Properties</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>execute aggregate process and execute aggregate selection</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

Query Hints

Query hints tell Essbase what types of queries likely will occur. For example, to indicate queries at the bottom level of the time dimension, you can specify one member at the bottom level of time, such as January. This tells Essbase that any member at the bottom level of time likely will be queried. Essbase gives members indicated in query hints priority when selecting views, optimizing common queries.

If no member is specified for a dimension, it means that any member of that dimension may be used in a query. For example, using a query hint of (Sales, 100, East) on Sample.Basic means
that profit margin measures for level 1 products at level 1 markets is a common type of query, regardless of Year and Scenario dimensions, which were omitted.

Usage-based view selection overrides query hints. See “Selecting Views Based on Usage” on page 980. User-defined view selection overrides query hints if there is a conflict between the two. See “Understanding User-Defined View Selection” on page 980.

Asterisks (*) indicate that no member is selected for a dimension.

<table>
<thead>
<tr>
<th>Hint</th>
<th>Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Jan, *, *, *, *,)</td>
<td>Frequent queries to the bottom level of time.</td>
</tr>
<tr>
<td>(Qtr1, *, *, *, Cola)</td>
<td>Queries often include members both at the bottom level of product and the quarterly level of time.</td>
</tr>
<tr>
<td>(Jan, *, *, NY, *) (Qtr1, *, *, NY, *)</td>
<td>Analysis at the state level of Market tends to stay at the Quarterly level or below.</td>
</tr>
</tbody>
</table>

Numerous hints can exist in the same outline. Any view that fits at least one hint is given more weight than views that fit none.

Query Hints cannot contain dynamic, label-only, or shared members.

To apply query hints, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Query Hints</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
</tbody>
</table>

**Working with Aggregation Scripts**

**Subtopics**

- Creating Aggregation Scripts
- Executing Aggregation Scripts

Each aggregation script represents a specific aggregate view selection against a database.

Aggregation scripts can save you time. For example, after loading new data values you need not perform another aggregate view selection. You can speed the aggregation process by using the selection stored in an aggregation script to materialize the aggregation.

Aggregation scripts also give you flexibility. You can use them to save aggregate view selections optimized for different retrieval situations; for example, you can use one script to optimize retrievals in month-end reporting and another for daily retrieval requirements.

Aggregation scripts for a database become invalid when the selection it contains is invalid for the database. Create aggregation scripts when you create aggregations. Do not manually modify aggregation script files, which may cause unpredictable results. For information about when you must create aggregations and aggregation scripts, see “Replacing Aggregations” on page 984.
Creating Aggregation Scripts

Saved aggregation scripts enable you to split up the total aggregation process. You can materialize an aggregation at a different time than when the aggregate views for the aggregation are selected. The aggregation script contains information derived during the aggregate view selection phase.

To create an aggregation script, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
</table>
| Administration Services | Calculating Aggregations to Improve Retrievals  
Aggregation Design Wizard                               | Oracle Essbase Administration Services Online Help |
| MaxL                  | query database  
execute aggregate selection                                    | Oracle Essbase Technical Reference |

Aggregation scripts are stored in the database directory as text files with the .csc extension and are valid as long as the dimension level structure in the outline has not changed. For information about when aggregation selections are invalid, see “Replacing Aggregations” on page 984. To avoid the potential clutter of invalid aggregation script files, use the Aggregation Design Wizard or manually delete aggregation scripts when they are no longer useful.

Executing Aggregation Scripts

Executing an aggregation script materializes the aggregate views specified within it. Although you can create multiple aggregation scripts, only one aggregation can be materialized at a time.

To execute an aggregation script, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
</table>
| Administration Services | Calculating Aggregations to Improve Retrievals  
Aggregation Design Wizard                               | Oracle Essbase Administration Services Online Help |
| MaxL                  | execute aggregate build                                    | Oracle Essbase Technical Reference |

Note: When Aggregation Design Wizard displays the list of existing aggregation scripts, it lists all files with the .csc extension in the database directory. Only valid aggregation script files can be executed.

Optimizing Aggregation Performance

To possibly improve aggregation performance time, you can use the CALCPARALLEL configuration setting to increase the number of threads. Because each thread handles a task of building an aggregate view, the number of threads you define establishes how many aggregate views can be built concurrently. Even on single-CPU computers, increasing the CALCPARALLEL configuration setting may improve performance where building aggregates is
I/O-bound, such as for databases too large to fit in memory. Because threads must share aggregate storage cache, the cache size must be sufficiently large to support the number of threads defined. Otherwise, increasing the number of threads could degrade aggregation performance time.

**Note:** For small databases, the performance of building aggregate views in Essbase 9.3.1 and later versions may be slower than Essbase versions earlier than 9.3.1. However, Essbase 9.3.1 should perform better for databases larger than a few hundred million cells, especially on computers with more than two processors and where the CALCPARALLEL configuration setting has been chosen appropriately.

See the *Oracle Essbase Technical Reference*.

### Clearing Aggregations

At times you might want to manually clear aggregations from the disk; for example, to make the disk space available for disk-intensive operations. Clearing aggregations clears all data, except level 0 values, from the database, releasing the disk area for other use. After aggregations are cleared, queries calculate retrieved values dynamically from level 0 values.

For information about when Essbase Server automatically clears aggregated data, see “Database restructure” in Table 186, “Outline Differences Between Aggregate Storage and Block Storage,” on page 900.

To clear aggregations, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Clearing Data from Aggregate Storage Databases</td>
<td><em>Oracle Essbase Administration Services Online Help</em></td>
</tr>
<tr>
<td>MaxL</td>
<td>alter database</td>
<td><em>Oracle Essbase Technical Reference</em></td>
</tr>
</tbody>
</table>

### Replacing Aggregations

You can replace an aggregation by clearing the existing aggregation and materializing a different selection of aggregate views. You can perform a new aggregate view selection and materialization process, or you can run an aggregation script. Consider replacing the aggregation in the following situations:

- To fine-tune the selection of aggregate views to improve performance. See “Fine-Tuning Aggregate View Selection” on page 978.
- To create aggregations optimized for different database retrieval situations, such as for generating reports or user queries.
- To optimize an aggregation after significant growth in database size. Gradually, as the size of a database increases, an aggregation can become less efficient. Consider replacing an
aggregation when performance degradation is noticeable or when the database size increases to about 150% of its original size.

- To optimize aggregations for new or different operational environments, such as memory and disk resource availability changes.

You must replace an aggregation and associated aggregation scripts after the number of levels in a dimension has been changed or one or more dimensions have been added or removed from the outline. See “Performing Database Aggregations” on page 976 and “Working with Aggregation Scripts” on page 982.

**Performing Time Balance and Flow Metrics Calculations in Aggregate Storage Accounts Dimensions**

**Subtopics**

- Using Time Balance Tags in Aggregate Storage Accounts Dimensions
- Using Flow Tags in Aggregate Storage Accounts Dimensions
- Restrictions on Alternate Hierarchies
- Aggregating Time-Balance Tagged Measures
- Effect of Attribute Calculations on Time Balance Measures in Aggregate Storage Databases

The topics in this section explain how to perform time balance and flow metrics calculations on aggregate storage databases.

**Using Time Balance Tags in Aggregate Storage Accounts Dimensions**

You can set Time Balance properties on aggregate storage Accounts dimensions to provide built-in calculations along the Time dimension. This saves time and performance overhead of using member formulas to achieve time-balance functionality.

The following time-balance properties are supported on stored or formula-bearing Accounts dimension members:

- TB First, TB Last, TB Average
- SKIP NONE, SKIP MISSING

Consider a stored measure such as Headcount in a human-resources application. Within a Year-Quarter-Months hierarchy, Headcount data is loaded at the month level.
The desired yearly or quarterly Headcount value is not the sum of its months; rather, it should be the last recorded value within a time period.

Tagging Headcount as TB Last with SKIPMISSING means that, for Year 2005, its value is the last nonempty value of the headcount for its months. If Dec has a nonmissing Headcount value, then that value will be returned; otherwise, the Nov value will be checked and returned if nonmissing.

If a formula-bearing member has a time balance tag, the formula is executed only for level 0 Time members, and the Time dimension is aggregated according to the time balance tag.

The time balance tags provide a built-in calculation along the Time dimension. To perform other time-based calculations using formulas, such as period-to-date and rolling averages, you can create a dimension called TimeView and write all time-based formulas on that dimension. Doing so enables you to use Time Balance calculation functionality without losing the ability to perform other time-based calculations.

**Using Flow Tags in Aggregate Storage Accounts Dimensions**

A Flow tag can be assigned to Accounts dimension members bearing formulas.

The following example describes the problem to be solved with flow metrics. Assume you have Sales and Additions figures for all 12 months. You want to perform an aggregation to populate each month’s beginning inventory.

<p>| Table 202  Inventory Calculation |</p>
<table>
<thead>
<tr>
<th>Sales</th>
<th>Additions</th>
<th>Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Feb</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Mar</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Apr</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
You would use an MDX formula on the Beginning Inventory member in order to calculate its value. Without flow metrics, to obtain each month’s beginning inventory, the calculator engine would have to reiterate the MDX formula exponentially.

\[
\text{Inventory} = \text{SUM(MemberRange(Jan:Time.CurrentMember), (Additions - Sales))} + \text{Beg\_Inventory}
\]

To optimize the illustrated example, assign the Inventory member the formula \((\text{Addition} - \text{Sales})\), and tag the member as Flow.

**Restrictions on Alternate Hierarchies**

If alternate hierarchies are used in the aggregate storage time dimension, the following restrictions apply when using Flow and TB tags on the Accounts dimension:

1. The shared level among alternate time hierarchies must be level 0.
2. The order of members at shared level among alternate time hierarchies must be the same in all alternate hierarchies.
3. The number of shares for a stored member must not exceed that of its previous sibling. Previous sibling means the prior stored member in the outline, found at the same generation.

For example, consider the following Year dimension. The alternate hierarchies are not valid, because the number of shares for April (3) is greater than the number of shares for March (1).
Aggregating Time-Balance Tagged Measures

The MDX Aggregate function can be used to aggregate measures tagged with time balance tags. See the Oracle Essbase Technical Reference.

Effect of Attribute Calculations on Time Balance Measures in Aggregate Storage Databases

The following calculation logic applies if

1. The aggregate storage outline contains a time dimension or date-time dimension with one or more attribute or linked-attribute dimensions.
2. You perform queries on time balance tagged measures.

If the above cases are both true, MDX Aggregate() semantics are used to evaluate the cells. For example, consider a scenario in which:
Year is a time-date dimension with a day level hierarchy.

Holiday is an attribute dimension on Year, with each date tagged with Holiday_TRUE or Holiday_FALSE.

Opening Inventory is tagged as TBFirst.

The value of (Year, Holiday_TRUE, [Opening Inventory]) is evaluated according to the following MDX logic:

\[
\text{Aggregate( \{ \text{Set of dates that are holidays in Year} \}, [\text{Opening Inventory}] )}
\]

### Retrieving Aggregate Storage Data

#### Subtopics

- Attribute Calculation Retrievals
- Retrieval Tools Supporting Aggregate Storage Databases

The topics in this section describe how Essbase retrieves data from aggregate storage databases. Also see Table 190, “Query Differences Between Aggregate Storage and Block Storage,” on page 903.

### Attribute Calculation Retrievals

Aggregate storage applications support only the Sum member of the Attribute Calculations dimension. If you specify any other member name from the Attribute Calculations dimension, such as Min or Avg, an error is returned. See “Understanding the Attribute Calculations Dimension” on page 177.

### Retrieval Tools Supporting Aggregate Storage Databases

Essbase provides the following programs and tools that enable data retrieval from aggregate storage databases:

- MDX Queries
- Report Writer which is run through Administration Services Console or the export data using report_file MaxL statement

**Note:** Commands that support block-storage-only features (for example, the <SPARSE Report Writer command) cannot be used with aggregate storage databases. MDX queries fully support aggregate storage features.
The information in this chapter applies only to aggregate storage databases.

For information about performing custom calculations on block storage databases, see:

- Chapter 29, “Developing Calculation Scripts for Block Storage Databases”
- Chapter 30, “Reviewing Examples of Calculation Scripts for Block Storage Databases”

For information about performing allocations on block storage databases, see:

- “Allocating Values” on page 382
- “Allocating Costs Across Products” on page 491
- “Allocating Values within a Dimension” on page 492
- “Allocating Values Across Multiple Dimensions” on page 494

For more information about APIs and configuration settings discussed in this chapter, see the Oracle Essbase API Reference and the Oracle Essbase Technical Reference, respectively.

**Performing Custom Calculations and Allocations on Aggregate Storage Databases**

Essbase provides separate API functions and structures for performing custom calculations (see “Custom Calculations on Aggregate Storage Databases” on page 992) and allocations (see “Allocations on Aggregate Storage Databases” on page 997) on aggregate storage databases. However, both features share the following common functionality:

- Aggregate storage data load buffers
Custom calculations extend the analytical capabilities of Essbase by enabling the execution of recurring calculations on aggregate storage databases.

You can write custom calculations for aggregate storage databases that update target level 0 cells. Custom calculation scripts are expressed in MDX.

Using custom calculations, you can do basic math on account balances in a general ledger and write the results to targeted level 0 members of an Essbase aggregate storage database. You can perform calculations on account balances or on fixed amounts and can be scheduled to repeat every accounting period.

Custom calculations on aggregate storage databases can be useful when the database is used for general ledger reporting, where double-entry accounting is in effect. Debit items, such as assets and expenses, must balance with credit items, such as equity and revenue.

Use the following workflow to create and execute custom calculations:

- Create a calculation script expressed in MDX.
  See “Writing Custom Calculations” on page 994.
- Select an area of the database where the calculation will be executed. You provide the area at execution time using the target and POV (point of view) parameters.
- If you use debit and credit processing, select the debit and credit members in the outline to write the positive and negative values. You provide these parameters at execution time.
If you use offsetting entries, select the area where offsetting entries should be made. You provide this parameter at execution time using an MDX tuple. If an offset is not specified or is empty, the offset calculation is not performed.

**Note:** In general ledger bookkeeping, an offsetting entry is a counterbalancing measure on the opposite side of the ledger; for example, a $100 credit in January may have a $100 offset added to the debit side of the ledger, so the ledger can be balanced in preparation for an upcoming expense of that amount.

See “Understanding Offset Handling for Custom Calculations and Allocations” on page 1021.

- Execute the custom calculation script using the Essbase API.
  
  See “Executing Custom Calculations” on page 994.

### List of Custom Calculations Criteria

Custom calculation functionality depends on a variety of specified criteria. Table 203 provides a brief description of the criteria used to define custom calculations. Review these terms before continuing.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POV</strong></td>
<td>A symmetric region in the database that describes the context in which custom calculations are performed. Attribute members cannot be used for this argument.</td>
</tr>
<tr>
<td><strong>Calculation script</strong></td>
<td>A calculation script expressed in MDX. Attribute members cannot be used in the left side of the equation.</td>
</tr>
<tr>
<td><strong>Target</strong></td>
<td>A tuple argument expressed in MDX that defines the region in the database where calculation results are written. This argument is combined with left side of each formula and the offset to determine where the results and offset values are written. Attribute members cannot be used for this argument.</td>
</tr>
<tr>
<td><strong>(Optional) Offset</strong></td>
<td>The location in the database where an offsetting value for each source amount is written. Attribute members cannot be used for this argument.</td>
</tr>
<tr>
<td><strong>(Optional) Credit and debit members</strong></td>
<td>In double-entry accounting, balancing journal entries for one transaction. Both are MDX member expressions. The debit member indicates a member to which positive result values are written, and the credit member indicates a member to which negative result values are written. Attribute members cannot be used for this argument.</td>
</tr>
<tr>
<td><strong>Source region</strong></td>
<td>An MDX set expression specifying the region of the cube referred to by the formulas in the script.</td>
</tr>
</tbody>
</table>
Writing Custom Calculations

A custom calculation script is a file that you create and store with a .csc extension. Create the custom calculation script with one or a series of tuple-expression pairs in MDX, terminated by semicolons. The syntax:

tuple := numeric_value_expression;

The tuple is an MDX specification of one or more members where no two members can be from the same dimension. The tuple must be on the left side of the equation and is the primary factor in determining where results of the custom calculation are written.

Only member names are allowed in the tuple expression. The use of member functions is not supported for custom calculation scripts.

Note: The secondary factor determining the target for results is the target parameter, and the third factor is the POV parameter. You specify the second and third parameters at calculation execution time, rather than as part of the calculation script.

The numeric_value_expression is a simple MDX numeric value expression, such as a number or an arithmetic operation. The expression must be on the right side of the equation. Only arithmetic operators are permitted. An error is returned if non arithmetic operators (such as AND, OR, or IF statements) are used.

Member names can be used in the numeric value expression, but the use of member functions is not supported for custom calculation scripts.

Attribute members cannot be used on the left side of the equation in a custom calculation script.

You must also define the source region, which serves as a performance hint for Essbase. Essbase pre-fetches the data specified in the source region, and uses that to perform the calculation specified in the script.

For an example of a custom calculation script, and more information about defining the source region, see “Sample Use Case for Custom Calculations” on page 995.

Executing Custom Calculations

You can execute custom calculations using the MaxL execute calculation statement (aggregate storage version).

You can execute custom calculation scripts using the Essbase API. Use EssPerformCustomCalcASO to perform or verify a custom calculation on an aggregate storage database. Provide the information for the custom calculation in the ESS_PERF_CUSTCALC_T structure.

You can also use Oracle Hyperion Calculation Manager to design a custom calculation and deploy it for execution to Enterprise Scheduling Services.
Sample Use Case for Custom Calculations

Consider an outline with the following dimensions:

- **Company**, containing CompanyA, CompanyB, and other children.
- **Department**, containing numbered departments such as 101, 102, 103.
- **Account**, in which Account 5740 is a rent expense account and SQFT is a statistical account used to record square footage for each department.
- **Scenario**, in which the Actual member is where data is posted, and the Allocation member is where allocations and custom calculations are stored. The Scenario member is a parent that aggregates the child members Actual and Allocation.
- **Year**, a time dimension organized by months and quarters.
- **Geography**, a dimension organized by states and cities.
- **AmountType**, in which Debit is the target, and Credit is the offset.
- **Project**, a dimension containing projects such as Proj1, Proj2.

The **POV** is an MDX set expression indicating where the custom calculation should be executed. It is specified as follows:

```mdx
CrossJoin( { ( [Company], [101], [Jan], [Scenario] ) }, Descendants( Geography, Geography.Levels(0)) )
```

The **DebitMember** is an MDX member expression indicating a debit member to which positive result values should be written. It is specified as `[BeginningBalance_Debit]`.

The **CreditMember** is an MDX member expression indicating a credit member to which negative and offsetting result values should be written. It is specified as `[BeginningBalance_Credit]`.

**Note:** The offset is written to the debit member in the case that the sum of all result values is negative.

The offset is an MDX tuple expression indicating where offsetting entries should be made. It is specified as `([Account_NA], [Project_NA])`.

The offset expression is combined with Target and POV to determine the location where offsetting entries are made. If dimensions overlap, the order for resolving the offset location is the offset, the target, and the POV, in that order.

The **target** is an MDX tuple expression indicating where to write the results of the custom calculation. It is specified as (Allocation).

The target expression is combined with POV, and the left side of each line in the custom calculation script, to determine the location where results are written. If dimensions overlap, the order for resolving the target location is the left side of the equations, the target, and the POV, in that order. In this example, results are written to the Allocation member, because the target overrides the Scenario member specified in the POV.
The following is an example of a custom calculation script:

(AccountA, Proj1) := 100;
([AccountB], [Proj1]) := ([AccountB], [Proj1]) * 1.1;
(AccountC, Proj1) :=
    ((AccountB, Proj1, 2007) + (AccountB, Proj1)) / 2;
(AccountA, Proj2) :=
    ((AccountD, Proj1) +
     (AccountB, Proj2)) / 2;

For each combination in the POV,

- The calculation script is executed in the context of the current POV combination.
- One offset value is written to the target location.

**Note:** Each formula (line in the calculation script) is executed simultaneously, rather than sequentially. Therefore, you cannot use the result of one formula in a subsequent formula.

To define the source region, examine the custom calculation script and determine which members are referenced on the right sides of equations. At a minimum, the source region should include all members from the right sides of the assignment statements in the custom calculation script.

Define the source region as a single MDX set. If the members on the right sides of the equations are from more than one dimension, you can use CrossJoin to create the set from two sets. CrossJoin only accepts two sets, so you may have to use nested CrossJoins.

The source region for the above custom calculation script is:

Crossjoin(
    {[AccountB], [AccountD]},
    Crossjoin(  
        {[Proj1], [Proj2]}, {[2007]}  
    )
)

It is not necessary to include any members in the source region that are not assigned in the script. For example, if you added to the source region an [AccountC], which is not used in the script, then it would be ignored, and could cause a slight detriment to performance.

It is not necessary to account for numbers in the source region. For example, the following assignment in a custom calculation script requires nothing to be added to source region:

([Buď Var]) := 10.
Allocations are used in the budgeting process to distribute revenues or costs.

The allocations feature allows you to allocate a given source amount to a target range of cells in an aggregate storage database. The source amount can be allocated to the target proportionately, based on a given basis, or the source amount can be spread evenly to the target.

You can perform aggregate storage allocations using the MaxL `execute allocation` statement.

You can also perform aggregate storage allocations by using the EssPerformAllocationAso API function and providing the information about the allocation in the ESS_PERF_ALLOC_T API structure.

A single allocation, which corresponds to a single call to the EssPerformAllocationAso API, has its own POV (point of view), range, amount, basis, target, and, optionally, offset. To perform allocations with different sets of values for these parameters, you must make a sequence of individual API calls.

Allocations are performed in the allocation engine and then written back to the aggregate storage database using temporary data load buffers that Essbase creates. For general information about data load buffers, see “Loading Data into Aggregate Storage Databases” on page 954. For information specific to allocations and custom calculations, see “Understanding Data Load Buffers for Custom Calculations and Allocations” on page 1020.

### List of Allocation Criteria

Allocations are based on a variety of specified criteria. Table 204 provides a brief description of the criteria used to define allocations. Review these terms before continuing.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>POV</td>
<td>A symmetric region in the database that describes the context in which allocations are performed</td>
<td>“Setting the POV” on page 1000</td>
</tr>
<tr>
<td>Range</td>
<td>A symmetric region in the database in which allocated values are calculated and written</td>
<td>“Setting the Range” on page 1001</td>
</tr>
<tr>
<td>(Optional) Excluded range</td>
<td>Locations in the range where you do not want allocation values written</td>
<td>“Setting the Range” on page 1001</td>
</tr>
<tr>
<td>Amount</td>
<td>The amount to be allocated</td>
<td>“Setting the Amount” on page 1002</td>
</tr>
<tr>
<td>(Optional) Amount context</td>
<td>Additional context, or specificity, for the amount</td>
<td>“Setting the Amount” on page 1002</td>
</tr>
<tr>
<td>(Optional) Amount time span</td>
<td>One or more time periods to be considered for the amount</td>
<td>“Setting the Amount” on page 1002</td>
</tr>
<tr>
<td>(Optional) Zero amount options</td>
<td>Treatment of zero or #MISSING amount values</td>
<td>“Setting the Amount” on page 1002</td>
</tr>
<tr>
<td>Basis</td>
<td>When combined with the range, defines the location of basis values that determine how the amount is allocated</td>
<td>“Setting the Basis” on page 1004</td>
</tr>
<tr>
<td>(Optional) Basis time span</td>
<td>One or more time periods to be considered for the basis</td>
<td>“Setting the Basis” on page 1004</td>
</tr>
<tr>
<td>(Required if basis time span is set) Basis time span option</td>
<td>Method for calculating the basis across the basis time span:</td>
<td>“Setting the Basis” on page 1004</td>
</tr>
<tr>
<td></td>
<td>● Combine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Split</td>
<td></td>
</tr>
<tr>
<td>Zero basis options</td>
<td>Treatment of zero basis values</td>
<td>“Setting the Basis” on page 1004</td>
</tr>
<tr>
<td>(Optional) Negative basis options</td>
<td>Treatment of negative basis values</td>
<td>“Setting the Basis” on page 1004</td>
</tr>
<tr>
<td>Target</td>
<td>When combined with the range, defines the region in the database where allocation values are written</td>
<td>“Setting the Target” on page 1005</td>
</tr>
<tr>
<td>(Optional) Target time span</td>
<td>One or more time periods to be considered for the target</td>
<td>“Setting the Target” on page 1005</td>
</tr>
<tr>
<td>(Required if target time span is set) Target time span option</td>
<td>Method for allocating values across the target time span:</td>
<td>“Setting the Target” on page 1005</td>
</tr>
<tr>
<td></td>
<td>● Divide the amount</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Repeat the amount</td>
<td></td>
</tr>
<tr>
<td>Allocation method</td>
<td>Method for allocating the amount:</td>
<td>“Setting the Allocation Method” on page 1005</td>
</tr>
<tr>
<td></td>
<td>● Share: Allocates the amount proportionately to the basis values</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Spread: Allocates the amount evenly</td>
<td></td>
</tr>
</tbody>
</table>
Understanding Regions

Essbase uses various regions in the database when performing allocations. Each region consists of at least one member from each dimension defined in the region.

<table>
<thead>
<tr>
<th>Region Name</th>
<th>Region Definition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>(POV X amount [X amount context] X [amount time span])</td>
<td>The region containing the amount values that are to be allocated. The source region and target region cannot overlap.</td>
</tr>
<tr>
<td>Target</td>
<td>(POV X target X debit member/credit member X range X [target time span])</td>
<td>The region containing the locations to which allocated values are written. The source region and target region cannot overlap. The target region need not need be empty before performing an allocation. Essbase overwrites non-empty cells either with allocation data or with zeros. For cells with #MISSING, the cells remain #MISSING unless Essbase writes allocation data to those cells.</td>
</tr>
</tbody>
</table>
**Region Name** | **Region Definition** | **Description**
---|---|---
Basis | \((POV X basis X range X [basis time span])\) | The region containing the basis values that are used to determine how the source amount is allocated. Basis might override part of the POV.
Offset | \((POV X offset X debitMember/creditMember)\) | The region containing the locations to which offset values are written.

### Specifying Allocation Criteria

Allocation parameter values can be expressed in the following ways:

- MDX member expression
- MDX set expression
- MDX tuple expression (where no two members can be from the same dimension)
- Constant

For more information about how to express allocation parameter values, see the *Oracle Essbase API Reference*.

### Using Shared Members

When shared members are specified in allocation parameters, Essbase maps the shared members to their original members before performing the allocation.

### Using Duplicate Members

When duplicate members are specified in allocation parameters, either because a member name is repeated or because a member and its shared member are both specified, Essbase removes the duplicate members and issues a warning.

### Setting the POV

*POV* specifies a symmetric region in the database that describes the context in which allocations are performed. The POV can consist of only level 0 members. The dimensions defined in the POV cannot be used in other parameters, except for the basis and the basis time span.

The allocation is repeated for every combination of members in the POV set. The number of POV combinations is the product of the number of members from dimensions with multiple members. (Dimensions with only one member are not used to calculate the number of combinations.)

For example, assume that the POV consists of two dimensions (CostCenter and Project), and allocations are to be made to two cost centers (CostCenter1 and CostCenter2) and three projects (Project1, Project2, and Project3). The number of POV combinations is six:
The allocation is repeated six times by successively setting the allocation context to each combination.

Values considered as the basis for the allocation are dependent on the POV combination. See “Setting the Basis” on page 1004.

**Note:** If time periods are specified in the POV, you cannot use the amount time span and the target time span options. See “Setting the Amount” on page 1002 and “Setting the Target” on page 1005, respectively.

### Setting the Range

*Range* specifies a symmetric region in the database in which allocated values are calculated and written.

If you do not want allocation values written to certain cells within the range, use the *excluded range* parameter to express a symmetrical subset of the range. Even when excluding a subset of the range, Essbase uses all cells in the range to calculate allocated values.

When you exclude cells from the range, the sum of allocated values might be less than the value of the amount.

The following examples assume that the range consists of six member combinations, the amount is 6, and the allocation method is spread, in which Essbase evenly allocates the amount across the range. The allocation spread amount is 1 (6/6 = 1).

As illustrated in Table 206, Essbase writes 1 in each cell in the range.

<table>
<thead>
<tr>
<th></th>
<th>CostCtr1</th>
<th>CostCtr2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Project2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Project3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

As illustrated in Table 207, if the excluded range is set to the member combination of (Project2,CostCtr2), Essbase does not write the allocation spread amount to that cell. Therefore, the sum of allocated values (5) is less than the amount (6). The value of the excluded cell after the allocation process is either #MISSING or zero.
**Table 207  Example: Allocating the Amount to Only Some Members in the Range**

<table>
<thead>
<tr>
<th>Project</th>
<th>CostCtr1</th>
<th>CostCtr2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Project2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Project3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

The range and excluded range can consist of only level 0 members.

**Setting the Amount**

*Amount* specifies the source of the allocation. The amount value is allocated to cells in the target region. The amount, which can consist of upper-level or level 0 members, can be expressed as a numeric value expression, a tuple, or a constant.

How you express the amount determines certain requirements:

- **Numeric value expression:**
  - All members in the expression must be from the same dimension.
  - Tuples cannot be used in the expression.
  - Only arithmetic expressions (+, -, /, and *) can be used in the expression.
  - MDX functions (such as Avg and Parent) are not allowed.

  For example:
  
  \[(\text{Acc}_1000 + \text{Acc}_2000)/2\]
  
  \[\text{AccA} + \text{AcctB}\]
  
  \[\text{Balance} \times 1.1\]

- **Tuple:**
  - The tuple must use one member from every dimension that is not specified in the POV.
  - The amount context must be empty.

  For example:
  
  \[(\text{Balance}, \text{Cost}_\text{Center}_00, \text{Project}_00)\]
  
  \[(\text{Balance}, \text{Cost}_\text{Center}_00, \text{Actual})\]

- **Constant:**
  - The amount context must be empty.
  - The amount time span must be empty.

  For example:
  
  100
You can use these parameters to further define the amount:

- **(Optional) Amount context** provides additional context, or specificity, for the amount. The amount context, which can consist of upper-level or level 0 members, can be expressed as a tuple. By specifying the amount context, you can include a member from a dimension that is not specified in the POV.

  When using amount context, these requirements apply to the amount and the amount context:
  
  - The parameters cannot refer to members in the same dimensions.
  - Together, the parameters must use members from every dimension not specified in the POV.

- **(Optional) Amount time span** specifies one or more time periods to be considered for the amount. The amount value is aggregated over the specified time periods, and the aggregated amount value is allocated. Time periods must be level 0 members in a Time dimension.

  When amount is specified using an arithmetic expression, and amount time span is used, amount time span takes precedence over any formulas in the amount or any formula members used in the amount. For example, assume that the amount is specified as Dept_A/Dept_B and amount time span is set to Jan, Feb, Mar, and Apr for each department, as shown in Table 208. The amount to be allocated for the POV is calculated by dividing the amount time span value for Dept_A (10) by the amount time span value for Dept_B (20), which is 0.5.

<table>
<thead>
<tr>
<th>Members in Amount Time Span</th>
<th>Dept_A</th>
<th>Dept_B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Feb</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Mar</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Apr</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>

- **(Optional) Zero amount options** specifies how to treat the amount if the value is zero or #MISSING. You can choose to allocate zero values (the default), skip to the next nonzero or non-#MISSING amount value, or cancel the entire allocation operation.

You can use amount context and amount time span to achieve the same result, as shown in following example. The amount is the value of Dept_A, but amount time span is used to focus only on the months of Jan, Feb, Mar, and Apr for Dept_A. As shown in Table 209, the aggregated value of the members included in the amount time span (10) is the amount value that is allocated across the cells in the range.
Table 209  Example: Amount Time Span

<table>
<thead>
<tr>
<th>Members in Amount Time Span</th>
<th>Dept_A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1</td>
</tr>
<tr>
<td>Feb</td>
<td>2</td>
</tr>
<tr>
<td>Mar</td>
<td>3</td>
</tr>
<tr>
<td>Apr</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
</tr>
</tbody>
</table>

You can achieve the same amount value by specifying amount as an arithmetic expression of Jan + Feb + Mar + Apr and setting the amount context as Dept_A, as shown in Table 210:

Table 210  Example: Amount Context

<table>
<thead>
<tr>
<th>Amount Context</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept_A</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

Setting the Basis

(Optional) Basis, when combined with the range, defines the location of basis values that determine how the amount is allocated. The basis can consist of upper-level or level 0 members.

You can use these parameters to further define the basis:

- (Optional) Basis time span specifies one or more time periods to be considered for the basis. Time periods must be level 0 members in a Time dimension.
- (Required if basis time span is set) Basis time span option specifies how the basis is calculated across the time periods specified by the basis time span. You can choose to use the basis value for each time period individually (split) or use the sum of the basis values across the time periods specified by the basis time span (combine).
  - If basis time span specifies multiple time periods and the target time span specifies one time period or is empty, you must set the basis time span option to combine. Essbase ignores the target time span option.
  - If basis time span and target time span specifies multiple time periods, and you set the basis time span option to split, the periods specified by basis time span and target time span must be identical. Essbase ignores the target time span option.

See “Understanding Settings for Basis and Target Time Span” on page 1009.

- Zero basis options specifies how to treat a zero basis value. You can choose to skip to the next nonzero or non-#MISSING amount value or cancel the entire allocation operation. Essbase processes the zero basis options setting based on the allocation method. See “Setting the Allocation Method” on page 1005.
(Optional) **Negative basis options** specifies how to treat a negative basis value. The options available for the negative basis options depend on the allocation method used. See “Setting the Allocation Method” on page 1005.

**Note:** The basis is ignored when using the spread allocation method and you have not set any spread skip options.

### Setting the Target

*Target*, when combined with the range, defines the region in the database where allocation values are written. The target can consist of only level 0 members.

You can use these parameters to further define target:

- (Optional) **Target time span** specifies one or more time periods to be considered for the target. Time periods must be level 0 members in a Time dimension.

- (Required if target time span is set) **Target time span option** specifies the method for allocating values across the time periods specified in target time span. You can choose to divide the amount value or repeat the amount value across the specified time periods.
  - If basis time span specifies multiple time periods, and the target time span specifies one time period or is empty, you must set the basis time span option to combine. Essbase ignores the target time span option.
  - If basis time span and target time span specifies multiple time periods, and you set the basis time span option to split, the periods specified by the basis time span and target time span must be identical. Essbase ignores the target time span option.

See “Understanding Settings for Basis and Target Time Span” on page 1009.

### Setting the Allocation Method

**Allocation method** specifies whether to allocate the amount evenly or proportionally.

- The **share** method allocates a percentage of the amount (`alloc_share_amt`) by dividing the basis value for the current member in the range (`basis_mbr_value`) by the sum of the basis across the range (`basis_range_sum`). The allocated amounts are based on the number of valid basis values in the range. The algorithm for calculating the allocation share amount:
  
  \[
  \text{alloc\_share\_amt} = \frac{\text{basis\_mbr\_value}}{\text{basis\_range\_sum}} \times \text{amount}
  \]

  Basis values and Essbase action:
  - Zero, Essbase writes a zero to the corresponding target cell.
    - If the sum of all basis values is zero (which would result in a division-by-zero error), Essbase uses the zero basis options setting. See “Setting the Basis” on page 1004.
  - #MISSING, Essbase either leaves the target cell as #MISSING, or, if the target cell already has a value, overwrites the existing value with zero.
A negative number, Essbase uses the negative basis options setting. You can choose to use the negative basis value (the default), skip to the next amount value (no data is allocated for the current amount value, and Essbase skips to the next POV combination), or cancel the entire operation.

The following examples illustrate the share allocation method. In both examples, the amount to allocate is 10.

In Table 211, assume that the amount (10) represents the rent expense for a building, and the basis represents the head count of each department in the range. Essbase uses the basis values for departments with non-#MISSING head count (Dept_A through Dept_D) to calculate the allocation share amounts, which is the rent allocation.

The rent allocation for Dept_A is the basis value of Dept_A (3), divided by the sum of valid basis values across the range (3 + 2 = 5), multiplied by the amount (10): 3/5 * 10 = 6. For Dept_D, the rent allocation is 2/5 * 10 = 4. The total of the target cells in the range equals 10.

<table>
<thead>
<tr>
<th>Members in Range</th>
<th>Basis (Head Count)</th>
<th>Target (Rent Allocation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept_A</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Dept_B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dept_C</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dept_D</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

In Table 212, assume that all basis values are to be considered in calculating the share allocation amounts. The allocation for Mbr1 is the basis value of Mbr1 (3), divided by the sum of valid basis values across the range (3 + -1 + 2 = 4), multiplied by the amount (10): 3/4 * 10 = 7.5. For Mbr3, the allocation is -1/4 * 10 = -2.5; for Mbr4, the allocation is 2/4 * 10 = 5. The total of the target cells in the range equals 10.

<table>
<thead>
<tr>
<th>Members in Range</th>
<th>Basis</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mbr1</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>Mbr2</td>
<td>#MISSING</td>
<td></td>
</tr>
<tr>
<td>Mbr3</td>
<td>-1</td>
<td>-2.5</td>
</tr>
<tr>
<td>Mbr4</td>
<td>2</td>
<td>5.0</td>
</tr>
</tbody>
</table>

The spread method allocates the amount evenly across the range (alloc_spread_amt). The number used to divide the amount and, therefore, the number of target cells where the allocation spread amount is to be written, is based on the number of valid basis values in the range (#_valid_basis_values). The algorithm for calculating the allocation spread amount:
The allocation amount is calculated as:

\[ \text{alloc\_spread\_amt} = \frac{\text{amount}}{\#\text{\_valid\_basis\_values}} \]

When using the spread allocation method, you can use the optional *spread skip options* parameter to skip all basis values in the range that are zero, #MISSING, or negative. You can specify multiple options.

### Basis values and Essbase action:
- **Zero**, Essbase writes a zero to the corresponding target cell.
  - If spread skip options is set to skip zero, no data is allocated.
- **#MISSING**, Essbase either leaves the target cell as #MISSING; or, if the target cell already has a value, Essbase overwrites the existing value with zeros.
  - If spread skip options is set to skip #MISSING, no data is allocated.
- **A negative number**, Essbase uses the negative basis options setting (which takes precedence over the spread skip options setting of skip negative). You can choose one of the following actions:
  - Use the negative basis value (the default)
  - Skip to the next amount value (no data is allocated for the current amount value)
  - Use the absolute value of the negative number
  - Treat the negative number as $MISSING (no value is allocated to the target cell)
  - Treat the negative number as a zero (zero is allocated to the target cell)
  - Cancel the entire operation

If all basis values have been skipped (which would make the denominator in the allocation zero), Essbase uses the zero basis options setting. See “Setting the Basis” on page 1004.

The following examples illustrate the spread allocation method. In both examples, the amount to allocate is 10.

In **Table 213**, assume that the spread skip options parameter is not specified. Therefore, Essbase considers all four basis members in the range. Essbase divides the amount (10), by the number of valid basis members in the range (4), and spreads that value (2.5) to each target cell in the range: \(10/4 = 2.5\).

**Table 213  Spread Allocation Method Example: Do Not Skip Basis Values**

<table>
<thead>
<tr>
<th>Members in Range</th>
<th>Basis</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mbr1</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>Mbr2</td>
<td>#MISSING</td>
<td>2.5</td>
</tr>
<tr>
<td>Mbr3</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Mbr4</td>
<td>-6</td>
<td>2.5</td>
</tr>
</tbody>
</table>

In **Table 214**, assume that the spread skip options parameter is set to ignore #MISSING and negative numbers. Therefore, Essbase considers only the two basis members with positive values (Mbr1 and Mbr3). Essbase divides the amount (10), by the number of valid basis members in the range (2), and spreads that value (5) to each target cell in the range: \(10/2 = 5\).
members in the range (2), and spreads that value (5) to the Mbr1 and Mbr3 target cells: $\frac{10}{2} = 5$.

<table>
<thead>
<tr>
<th>Members in Range</th>
<th>Basis</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mbr1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Mbr2</td>
<td>#MISSING</td>
<td></td>
</tr>
<tr>
<td>Mbr3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Mbr4</td>
<td>-6</td>
<td></td>
</tr>
</tbody>
</table>

**Setting the Rounding Method**

The *rounding method* specifies whether to round allocated values (the default is not to round).

If you choose to round values, the rounding method specifies how to handle rounding errors. You can choose to discard rounding errors, or to round all allocated values and add the total rounding error to the highest allocated value, the lowest allocated value, or to a specific cell. If you choose to add the rounding error to the highest or lowest allocated value, and there are multiple highest or lowest allocated values, Essbase chooses one of the highest or lowest values to which to add the rounding error.

If you choose to round allocation values, you can use these parameters to further define the rounding method:

- *(Required if rounding allocated values)* *Round digits* specifies the number of decimal places to which allocated values are rounded. You can choose to round to the nearest integer (the default), to a specified number of decimal places, or to a power of 10.

  Round digits must be a number from -100 to 100 and can be expressed as an integer, an MDX numeric value expression, or a tuple.

  Using an MDX numeric value expression is helpful when the setting for round digits is based on the currency of the allocated value. For example, assume that the database contains a dimension named Currency, which is part of the POV, and an associated attribute dimension named NumCurrencyDigits, which specifies how to round allocated values based on the currency of the allocated values. You can express round digits as:

  \[
  \text{Currency.currentMember.NumCurrencyDigits}
  \]

  **Note:** If, for the rounding method, you choose not to round allocated values, the round digits parameter must be empty.

- *(Required if rounding method is set to a specific location)* *Round to location* specifies a cell to which to add the total rounding error. Expressed as a tuple, the cell must be in the range and have the same dimensionality as the range. Round to location can consist of only level 0 members.
Setting the Offset

(Optional) Offset specifies the location in the database where an offsetting value for each source amount is written.

Offset works the same for allocations and custom calculations. See “Understanding Offset Handling for Custom Calculations and Allocations” on page 1021.

Balancing Allocations

(Optional) debitMember and creditMember can consist only of level 0 members.

The debit member and the credit member must be two different members from the same dimension.

debitMember and creditMember work the same for allocations and custom calculations. See “Understanding Credit and Debit Processing for Custom Calculations and Allocations” on page 1022.

Understanding Settings for Basis and Target Time Span

Subtopics

- Example 1: Basis and Target Time Span—Empty or Single Member
- Example 2: Basis Time Span—Empty or Single Member; Target Time Span—Multiple Members
- Example 3: Basis Time Span—Multiple Members; Target Time Span—Empty or Single Member
- Example 4: Basis and Target Time Span—Multiple Members; Basis Time Span Option—Split
- Example 5: Basis and Target Time Span—Multiple Members; Basis Time Span Option—Combine

The number of members that are specified for the basis time span and target time span affect how Essbase treats the basis time span option and target time span option, respectively, as summarized in Table 215. In situations where the basis or target time span is empty or set to a single time period, Essbase ignores any setting that you might have set for the respective basis or target time span option. In situations where one or both of the basis or target time spans are set to multiple time periods, Essbase requires a particular setting for the respective basis or target time span option.
**Table 215** Summary: Basis and Target Time Span, and Basis and Time Span Option

<table>
<thead>
<tr>
<th>Basis Time Span</th>
<th>Target Time Span</th>
<th>Basis Time Span Option</th>
<th>Target Time Span Option</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty or single member</td>
<td>Empty or single member</td>
<td>Ignored</td>
<td>Ignored</td>
<td>“Example 1: Basis and Target Time Span—Empty or Single Member” on page 1010</td>
</tr>
<tr>
<td>Empty or single member</td>
<td>Multiple members</td>
<td>Ignored</td>
<td>Divide or repeat</td>
<td>“Example 2: Basis Time Span—Empty or Single Member; Target Time Span—Multiple Members” on page 1010</td>
</tr>
<tr>
<td>Multiple members</td>
<td>Empty or single member</td>
<td>Combine</td>
<td>Ignored</td>
<td>“Example 3: Basis Time Span—Multiple Members; Target Time Span—Empty or Single Member” on page 1012</td>
</tr>
<tr>
<td>Multiple members</td>
<td>Multiple members</td>
<td>Split</td>
<td>Ignored</td>
<td>“Example 4: Basis and Target Time Span—Multiple Members; Basis Time Span Option—Split” on page 1013</td>
</tr>
<tr>
<td>Multiple members</td>
<td>Multiple members</td>
<td>Combine</td>
<td>Divide or repeat</td>
<td>“Example 5: Basis and Target Time Span—Multiple Members; Basis Time Span Option—Combine” on page 1014</td>
</tr>
</tbody>
</table>

**Example 1: Basis and Target Time Span—Empty or Single Member**

In this example, the basis time span and target time span are not set or are set for only one time period. Essbase ignores any setting you might have chosen for the basis time span option or target time span option.

**Example 2: Basis Time Span—Empty or Single Member; Target Time Span—Multiple Members**

In this example, the basis time span is not set, and multiple time periods are specified for the target time span. The basis time span option is ignored. For the target time span option, you can select either divide or repeat.

Assume the amount is 1000. **Table 216** shows that the basis for each department (Dept_1 = 1) and the total basis for the range (21):

**Table 216** Example 2: Basis Values

<table>
<thead>
<tr>
<th>Range</th>
<th>Dept_1</th>
<th>Dept_2</th>
<th>Dept_3</th>
<th>Dept_4</th>
<th>Dept_5</th>
<th>Dept_6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis</td>
<td>$1$&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>$21$&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup>Basis for the member  
<sup>2</sup>Total basis for the range

The setting for target time span option determines how the allocation is calculated.

- Repeat the allocated amount across the specified target time span periods:
In this scenario, Essbase performs the allocation for a single period and copies the allocated amount value to all members in the target time span.

The algorithm Essbase uses:

\[
\text{alloc\_amt} = \left( \frac{\text{basis\_mbr\_value}}{\text{basis\_total\_range}} \right) \times \text{amount}
\]

As shown in Table 217, for Dec 07, Dept_1, the member basis value (1) is divided by the total basis across the range (21), and the result (0.04762) is multiplied by amount (1000): \((1/21) \times 1000 = 47.62\). Essbase copies 47.62 into the cells for Jan 08, Feb 08, Mar 08, and Apr 08. Essbase continues to perform allocations for Dec 07 for each department. For each target time span, the sum of the allocated values across the range equals the amount (1000).

**Table 217**  
Example 2: Allocation Using Target Time Span Option Set to Repeat

<table>
<thead>
<tr>
<th>Members in Target Time Span</th>
<th>Range</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dept_1</td>
<td>Dept_2</td>
</tr>
<tr>
<td>Dec 07</td>
<td>47.62</td>
<td>95.24</td>
</tr>
<tr>
<td>Jan 08</td>
<td>47.62</td>
<td>95.24</td>
</tr>
<tr>
<td>Feb 08</td>
<td>47.62</td>
<td>95.24</td>
</tr>
<tr>
<td>Mar 08</td>
<td>47.62</td>
<td>95.24</td>
</tr>
<tr>
<td>Apr 08</td>
<td>47.62</td>
<td>95.24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\text{Total allocated values}\)

The total allocated amount is the original amount value (1000) multiplied by the number of target time span members (5): \(1000 \times 5 = 5000\).

- Divide the allocated amount across the specified target time span periods

In this scenario, Essbase performs the allocation for one period and evenly divides the allocated amount across all members in the target time span.

The algorithm Essbase uses:

\[
\text{alloc\_amt} = \left( \frac{\text{basis\_mbr\_value}}{\text{basis\_total\_range}} \right) \times \text{amount}/\#\_\text{target\_time\_span\_periods}
\]

As shown in Table 218, for Dec 07, Dept_1, Essbase performs the same calculation as described for the repeat target time span option scenario to arrive at 47.62. However, this amount is evenly divided across all five target time span periods for Dept_1; therefore, 9.52 is written in each target cell: \(47.62/5 = 9.52\). Essbase continues to perform allocations for each department. For each target time span, the sum of the allocated values across the range equals (200).
Table 218  Example 2: Allocation Using Target Time Span Option Set to Divide

<table>
<thead>
<tr>
<th>Members in Target Time Span</th>
<th>Range</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 07</td>
<td>Dept_1</td>
<td>9.52</td>
<td>19.05</td>
<td>28.57</td>
<td>38.10</td>
</tr>
<tr>
<td>Jan 08</td>
<td>Dept_1</td>
<td>9.52</td>
<td>19.05</td>
<td>28.57</td>
<td>38.10</td>
</tr>
<tr>
<td>Feb 08</td>
<td>Dept_1</td>
<td>9.52</td>
<td>19.05</td>
<td>28.57</td>
<td>38.10</td>
</tr>
<tr>
<td>Mar 08</td>
<td>Dept_1</td>
<td>9.52</td>
<td>19.05</td>
<td>28.57</td>
<td>38.10</td>
</tr>
<tr>
<td>Apr 08</td>
<td>Dept_1</td>
<td>9.52</td>
<td>19.05</td>
<td>28.57</td>
<td>38.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Total allocated values

The total allocated values across the range is the original amount value (1000): 200 * 5 = 1000.

Example 3: Basis Time Span—Multiple Members; Target Time Span—Empty or Single Member

In this example, multiple time periods are specified for the basis time span, but the target time span is not set. The target time span option is ignored. The only valid choice for the basis time span option is combine.

Assume the amount is 1000. As shown in Table 219, the basis to be used for each department is the sum of the basis values for the basis time span (Dept_1 = 15); the total basis for the range is the sum of all department basis values (147):

Table 219  Example 3: Basis Values

<table>
<thead>
<tr>
<th>Members in Basis Time Span</th>
<th>Range</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 07</td>
<td>Dept_1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Jan 08</td>
<td>Dept_1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Feb 08</td>
<td>Dept_1</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Mar 08</td>
<td>Dept_1</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Apr 08</td>
<td>Dept_1</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>151</td>
<td>20</td>
<td>25</td>
<td>12</td>
</tr>
</tbody>
</table>

1 Basis for each range member summed across the basis time span periods
2 Total basis for the range

The allocation is calculated using the basis time span setting of combine, which uses the sum of the basis values across the basis time span periods.
The algorithm Essbase uses for each range member:
\[
\text{alloc}_\text{amt} = \left( \frac{\text{sum across basis time span}}{\text{basis total range}} \right) \times \text{amount}
\]

As shown in Table 220, the allocated value for each department is written to one target location, because the target time span is not set to multiple periods. For the allocated amount for Dept_1, the sum of the basis time span (15) is divided by the total basis for the range (147), and the result (0.10204) is multiplied by amount (1000): \((15/147) \times 1000 = 102.04\). Essbase continues to perform allocations for each department in the range.

**Table 220  Example 3: Allocation Using Basis Time Span Set to Combine**

<table>
<thead>
<tr>
<th>Range</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept_1</td>
<td>102.04</td>
</tr>
<tr>
<td>Dept_2</td>
<td>136.05</td>
</tr>
<tr>
<td>Dept_3</td>
<td>170.07</td>
</tr>
<tr>
<td>Dept_4</td>
<td>81.63</td>
</tr>
<tr>
<td>Dept_5</td>
<td>238.10</td>
</tr>
<tr>
<td>Dept_6</td>
<td>272.11</td>
</tr>
<tr>
<td><strong>Target</strong></td>
<td><strong>1000(^1)</strong></td>
</tr>
</tbody>
</table>

\(^1\)Total allocated values

The total allocated values across the range is the original amount value (1000).

**Example 4: Basis and Target Time Span—Multiple Members; Basis Time Span Option—Split**

In this example, multiple time periods are specified for the basis time span and the target time span, and the basis time span option is set to *split*. When using the split basis time span option, the periods specified by the basis time span and target time span must be identical. (For an example of setting the basis time span option to *combine*, see “Example 5: Basis and Target Time Span—Multiple Members; Basis Time Span Option—Combine” on page 1014.)

Assume the amount is 1000. As shown in Table 221, the total basis for the range is the sum of all department basis values (165):

**Table 221  Example 4: Basis Values**

<table>
<thead>
<tr>
<th>Members in Basis Time Span</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dept_1</strong></td>
<td><strong>Dept_2</strong></td>
</tr>
<tr>
<td>Dec 07</td>
<td>1</td>
</tr>
<tr>
<td>Jan 08</td>
<td>2</td>
</tr>
<tr>
<td>Feb 08</td>
<td>3</td>
</tr>
<tr>
<td>Mar 08</td>
<td>4</td>
</tr>
<tr>
<td>Apr 08</td>
<td>5</td>
</tr>
</tbody>
</table>

\(^1\)Total basis for each basis time span period
\(^2\)Total basis for the range

The allocation is calculated using the basis time span setting of split, which uses the basis value for each time period individually.
The algorithm Essbase uses:

\[ alloc\_amt = \left( \frac{\text{basis\_mbr\_value}}{\text{basis\_total\_range}} \right) \times \text{amount} \]

As shown in Table 222, for Dec 07, Dept_1, the member basis value (1) is divided by the total basis for the range (165), and the result (0.00606) is multiplied by amount (1000): \(\frac{1}{165} \times 1000 = 6.06\). Essbase continues to perform allocations for each time period for each department.

**Table 222 Example 4: Allocation Using Basis Time Span Set to Split**

<table>
<thead>
<tr>
<th>Members in Target Time Span</th>
<th>Dept_1</th>
<th>Dept_2</th>
<th>Dept_3</th>
<th>Dept_4</th>
<th>Dept_5</th>
<th>Dept_6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 07</td>
<td>6.06</td>
<td>12.12</td>
<td>18.18</td>
<td>24.24</td>
<td>30.30</td>
<td>36.36</td>
<td>127.27</td>
</tr>
<tr>
<td>Jan 08</td>
<td>12.12</td>
<td>18.18</td>
<td>24.24</td>
<td>30.30</td>
<td>36.36</td>
<td>42.42</td>
<td>163.64</td>
</tr>
<tr>
<td>Feb 08</td>
<td>18.18</td>
<td>24.24</td>
<td>30.30</td>
<td>36.36</td>
<td>42.42</td>
<td>48.48</td>
<td>200.00</td>
</tr>
<tr>
<td>Mar 08</td>
<td>24.24</td>
<td>30.30</td>
<td>36.36</td>
<td>42.42</td>
<td>48.48</td>
<td>54.55</td>
<td>236.36</td>
</tr>
<tr>
<td>Apr 08</td>
<td>30.30</td>
<td>36.36</td>
<td>42.42</td>
<td>48.48</td>
<td>54.55</td>
<td>60.61</td>
<td>272.73</td>
</tr>
</tbody>
</table>

\(^1\text{Total allocated values}\)

The total allocated values across the range is the original amount value (1000).

**Example 5: Basis and Target Time Span—Multiple Members; Basis Time Span Option—Combine**

In this example, multiple time periods are specified for the basis and target time spans; however, because the basis time span option is set to *combine*, the basis and target time spans need not contain the same member set. (For an example of setting the basis time span option to *split*, see “Example 4: Basis and Target Time Span—Multiple Members; Basis Time Span Option—Split” on page 1013.)

Assume the amount is 1000. As shown in Table 223, the basis to be used for each department is the sum of the basis values across the basis time span (Dept_1 = 10); the basis for the range is the sum of all department basis values (113):

**Table 223 Example 5: Basis Values**

<table>
<thead>
<tr>
<th>Members in Basis Time Span</th>
<th>Dept_1</th>
<th>Dept_2</th>
<th>Dept_3</th>
<th>Dept_4</th>
<th>Dept_5</th>
<th>Dept_6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 07</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Jan 08</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Feb 08</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

1014
The setting for target time span option determines how the allocation is calculated.

- **Repeat the allocated amount across the specified target time periods:**

  In this scenario, Essbase performs the allocation for a single period and copies the allocated amount value to all members in the target time span.

  The algorithm Essbase uses for each range member:
  
  $$\text{alloc\_amt} = \left(\frac{\text{sum\_across\_basis\_time\_span}}{\text{basis\_total\_range}}\right) \times \text{amount}$$

  As shown in Table 224, for Dec 07, Dept_1, the basis for Dept_1 (10) is divided by the total basis for the range (113), and the result (0.0885) is multiplied by amount (1000): (10/113) * 1000 = 88.50. Essbase copies 88.50 into the cells for Jan 08, Feb 08, Mar 08, and Apr 08. Essbase continues to perform allocations for Dec 07 for each department. For each target time span, the sum of the allocated values across the range equals the amount (1000).

  **Table 224  Example 5: Allocation Using Target Time Span Option Set to Repeat**

<table>
<thead>
<tr>
<th>Members in Target Time Span</th>
<th>Dept_1</th>
<th>Dept_2</th>
<th>Dept_3</th>
<th>Dept_4</th>
<th>Dept_5</th>
<th>Dept_6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 07</td>
<td>88.50</td>
<td>123.89</td>
<td>159.29</td>
<td>132.74</td>
<td>230.09</td>
<td>265.49</td>
<td>1000</td>
</tr>
<tr>
<td>Jan 08</td>
<td>88.50</td>
<td>123.89</td>
<td>159.29</td>
<td>132.74</td>
<td>230.09</td>
<td>265.49</td>
<td>1000</td>
</tr>
<tr>
<td>Feb 08</td>
<td>88.50</td>
<td>123.89</td>
<td>159.29</td>
<td>132.74</td>
<td>230.09</td>
<td>265.49</td>
<td>1000</td>
</tr>
<tr>
<td>Mar 08</td>
<td>88.50</td>
<td>123.89</td>
<td>159.29</td>
<td>132.74</td>
<td>230.09</td>
<td>265.49</td>
<td>1000</td>
</tr>
<tr>
<td>Apr 08</td>
<td>88.50</td>
<td>123.89</td>
<td>159.29</td>
<td>132.74</td>
<td>230.09</td>
<td>265.49</td>
<td>1000</td>
</tr>
</tbody>
</table>

  **Total allocated values**

  The total allocated values is the original amount value (1000) multiplied by the number of target time span members (5): 1000 * 5 = 5000.

- **Divide the allocated amount across the specified target time periods:**

  In this scenario, Essbase performs the allocation for a single period and evenly divides the allocated amount across all members in the target time span.

  The algorithm Essbase uses:
  
  $$\text{alloc\_amt} = \left(\frac{\text{basis\_time\_span}}{\text{basis\_total\_range}}\right) \times \text{amount}\div\#\_target\_time\_span\_periods$$
As shown in Table 225, Essbase performs the same calculation as described for the repeat target time span option scenario to arrive at 88.50. However, this amount is evenly divided across all five target time span periods for Dept_1; therefore, 17.70 is written in each target cell: \(88.50/5 = 17.70\). Essbase continues to perform allocations for each department. For each target time span, the sum of the allocated values across the range equals (200).

### Table 225  Example 5: Allocation Using Target Time Span Option Set to Divide

<table>
<thead>
<tr>
<th>Members in Target Time Span</th>
<th>Range</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dept_1</td>
<td>Dept_2</td>
</tr>
<tr>
<td>Dec 07</td>
<td>17.70</td>
<td>24.78</td>
</tr>
<tr>
<td>Jan 08</td>
<td>17.70</td>
<td>24.78</td>
</tr>
<tr>
<td>Feb 08</td>
<td>17.70</td>
<td>24.78</td>
</tr>
<tr>
<td>Mar 08</td>
<td>17.70</td>
<td>24.78</td>
</tr>
<tr>
<td>Apr 08</td>
<td>17.70</td>
<td>24.78</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\text{Total allocated values}\)

The total allocated values across the range is the original amount value (1000): \(200 \times 5 = 1000\).

### Examples of Aggregate Storage Allocations

The following example illustrates how changing the POV combination affects the values considered as the basis for the allocation. The example, which uses the share allocation method, allocates the total rent from the previous year to all cost centers in the current year, based on each cost center's head count. Assume that the aggregate storage database has four dimensions—Departments, Time, CostCenter, and Measures—and the allocation criteria is specified as shown in Table 226:

### Table 226  POV Example: Allocation Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>POV</td>
<td>Dept_A, Dept_B</td>
</tr>
<tr>
<td>Amount</td>
<td>2007, CCNA, TotalRent</td>
</tr>
<tr>
<td></td>
<td>Assume that the amount values are:</td>
</tr>
<tr>
<td></td>
<td>• Dept_A = 1000</td>
</tr>
<tr>
<td></td>
<td>• Dept_B = 2000</td>
</tr>
<tr>
<td>Basis</td>
<td>Jan 2008, Head count</td>
</tr>
<tr>
<td>Target</td>
<td>Jan 2008, RentalAllocation</td>
</tr>
</tbody>
</table>
Criteria | Definition
--- | ---
Range | Level 0 descendants of CostCenter
Assume that the range evaluates to the following cost centers:
- CostCenter1
- CostCenter2
- CostCenter3
- CostCenter4

The allocation is performed for each of the POV combinations:
- Dept_A
- Dept_B

Each POV combination has its own set of basis values that are used in calculating the allocation: the head count for each cost center in the range and the total Jan 2008 head count, as shown in Table 227:

<table>
<thead>
<tr>
<th>POV</th>
<th>CostCenter1</th>
<th>CostCenter2</th>
<th>CostCenter3</th>
<th>CostCenter4</th>
<th>2008 Head Count Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept_A</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Dept_B</td>
<td>5</td>
<td>0</td>
<td>10</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

For each POV, Essbase divides the head count of each cost center (the basis value of each member) by the total head count of the range (the basis value of the range), and then multiplies that value by the total rental amount for each department (amount). For example, for Dept_A,CostCenter1, the member basis value (1) is divided by the basis of the range (11), and the result (0.09090909) is multiplied by amount (1000): (1/11) * 1000 = 90.90909. For Dept_B,CostCenter1, the allocated amount is 666.6667: (5/15) * 2000 = 666.6667. Table 228 shows the allocated share amount for each cost center:

<table>
<thead>
<tr>
<th>POV</th>
<th>CostCenter1</th>
<th>CostCenter2</th>
<th>CostCenter3</th>
<th>CostCenter4</th>
<th>Rental Allocation Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept_A</td>
<td>90.90909</td>
<td>181.8182</td>
<td>272.7273</td>
<td>454.5455</td>
<td>1000</td>
</tr>
<tr>
<td>Dept_B</td>
<td>666.6667</td>
<td>0</td>
<td>1333.333</td>
<td></td>
<td>2000</td>
</tr>
</tbody>
</table>

Table 227  POV Example: Basis Values for Each POV Combination

Table 228  POV Example: Target Values for Each POV Combination
Sample Use Case for Aggregate Storage Allocations

Subtopics

- Scenario 1: Aggregate Storage Allocations
- Scenario 2: Aggregate Storage Allocations

The objective of this sample use case is to use the share allocation method to proportionally redistribute the total monthly rent expense across departments, based on the square footage each department occupies.

Consider an outline with the following dimensions:

- **Company**: Contains multiple ledgers. The rent expense allocations take place in the Vision US ledger.
- **Department**: Contains the following members:
  - 100, which stores the total monthly rent expense, of $100,000, for Vision US. This amount is proportionally allocated to the children of department 999.
  - 999, which is the parent of the following departments:
    - 101, which receives 45% of the rent allocation
    - 102, which receives 30% of the rent allocation
    - 103, which receives 25% of the rent allocation
- **Account**: Contains the following members:
  - 5740, which is a rent expense account
  - SQFT, which is a statistical account used to record square footage for each department
- **AmountType**: Contains PeriodActivity, which is the parent of the following members:
  - PeriodActivityDebit, which is the target location
  - PeriodActivityCredit, which is the offset location

You can accomplish the rent expense allocation in several ways, each with the same result. Two scenarios are presented. For each scenario, assume that the following parameters are defined as follows:

- **Allocation method**: Share
- **Range**: The descendents of department 999:
  - 101
  - 102
  - 103

  No cells in the range are excluded.
- **Basis**: The square footage of each range member for the period of activity (which is monthly).

SQFT, PeriodActivity
- **Zero amount option**: (Default) Allocate zero amount values.
- **Zero basis option**: If the basis value is zero, cancel the allocation operation.
- **Basis time span option**: (Default) Split, use the basis value for each time period individually.
- **Rounding method**: Round allocation values to the nearest 1,000 and add the total rounding error to department 101.
- **Debit member**: If the sum is positive, write the value to PeriodActivityDebit.
- **Credit member**: Write the value to PeriodActivityCredit.

**Scenario 1: Aggregate Storage Allocations**

For scenario 1, assume the following parameters are defined as follows:

- **POV**: Consists of one member, Vision US, from the Company dimension.
  
  Because only one member from one dimension is specified, the POV does not change and, therefore, the allocation is performed only once.

- **Amount**: The source value of the allocation is from the following cross-dimensional member:
  
  5740,100,Beginning Balance

- **Target**: Write allocated values to account 5740 for each department.

- **Offset**: Write the offsetting entry to member 5740,100.

**Scenario 2: Aggregate Storage Allocations**

For scenario 2, assume the following parameters are defined as follows:

- **POV**: Consists of one member each from two dimensions:
  
  - Vision US, from the Company dimension
  - 5740, from the Amount dimension
  
  In this scenario, account 5740 is a part of the POV. In the basis, account 5740 is overridden with member SQFT.

  Because only one member from each dimension is specified, the POV does not change and, therefore, the allocation is performed only once.

- **Amount**: The source value of the allocation is from the following cross-dimensional member:
  
  100,Beginning Balance

- **Target**: Not set. Because the combination of POV, target, debit member/credit member, and range uses members from all dimensions, the target can be empty.

- **Offset**: Write the offset entry to department 100.
Avoiding Data Inconsistency When Using Formulas

Formula members can be used in the amount and the basis but not in the target. However, because aggregate storage databases do not support transaction semantics, you might experience data inconsistency issues when using formula members in the amount or the basis.

In the following example, User 1 posts revenue values for a set of departments and User 2 performs an allocation of bonus money, for which the year-to-date revenue for each department is basis of the allocation. The order in which these operations are performed affects the result:

- **Scenario 1**: User 1 posts revenue before User 2 runs the allocation.
  The allocation results are based on the updated revenue values.

- **Scenario 2**: User 2 runs the allocation before User 1 posts revenue.
  The allocation results are based on prior revenue values, not on the updated revenue values.

- **Scenario 3**: User 1 posts revenue and User 2 runs the allocation concurrently.
  The allocation results are based on the updated or prior revenue values, depending on which user operation started first.
  Oracle does not recommend running these operations concurrently when using formula members in the amount or the basis.

Also, assume that an MDX formula is used to calculate the year-to-date revenue for the allocation. The complexity of the formula can affect the result:

- **Scenario 4**: The year-to-date revenue formula involves members from one dimension and uses only the following arithmetic expressions: +, -, /, and *.
  The allocation results are based entirely on either the updated or prior revenue values.
  Oracle recommends using simple MDX formulas, as described in scenario 4.

- **Scenario 5**: The year-to-date revenue formula is more complicated than the formula in scenario 4.
  It is possible that some of the allocation results are based on the updated revenue values and some are based on the prior revenue values.

Understanding Data Load Buffers for Custom Calculations and Allocations

When performing allocations or custom calculations on an aggregate storage database, Essbase uses temporary data load buffers. If there are insufficient resources in the aggregate storage cache to create the data load buffers, Essbase waits until resources are available.

Multiple data load buffers can exist on a single aggregate storage database. The data load buffers that Essbase creates for allocations and custom calculations are not configurable. You can, however, configure the data load buffers that you create for data loads and postings.
If you want to perform allocations and custom calculations concurrently with data loads and postings, set the resource usage for the data load buffers that you create for data loads and postings to a maximum of 0.8 (80%). The lower you set the resource usage setting, the greater the number of allocations and custom calculations that can run concurrently with data loads and postings. You can also configure the amount of time Essbase waits for resources to become available in order to process load buffer operations.

To configure data load buffers, use the `alter database` MaxL statement with the `initialize load_buffer grammar` and `ASOLOADBUFFERWAIT configuration setting`.

### Understanding Offset Handling for Custom Calculations and Allocations

In general ledger bookkeeping, an offsetting entry is a counterbalancing measure on the opposite side of the ledger from a transaction of equal value. In this document, an offsetting entry is referred to as an offset.

Specification of an offset is optional. An offset might be needed in case the sum of credits and the sum of debits are not equal. If the sum of credits and debits are not equal, the ledger is unbalanced. In such a case, an offset would serve to balance the ledger.

For example, a $100 credit in January may need a $100 offset added to the debit side of the ledger, so that the ledger can be balanced in preparation for a known upcoming expense of that amount.

An offset is a location you specify in the form of a tuple, to which Essbase writes a value offsetting the result of the custom calculation script.

In the following examples, assume the POV is Prod1, Prod2, AcctA, AcctB, Jan.

The following custom calculation script has a sum of 13.

```plaintext
mbr1 := 7;
mbr2 := -4;
mbr3 := 0;
mbr4 := 10;
```

Therefore, if an offset is required, it must also be 13. Assume that an offset is written to a member called “Offset_Member.”

<table>
<thead>
<tr>
<th>Debit</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>mbr1</td>
<td>7</td>
</tr>
<tr>
<td>mbr2</td>
<td>4</td>
</tr>
<tr>
<td>mbr3</td>
<td>0</td>
</tr>
<tr>
<td>mbr4</td>
<td>10</td>
</tr>
<tr>
<td>mbr_offset</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
</tr>
</tbody>
</table>

When an offset is used, credit and debit processing is reversed. The following calculation sequence occurs when an offset is used with credit and debit processing:

1. For the given POV, get the sum of results written by the calculation script (in this case, 13).
2. If the sum is positive, write it to the credit member in the target database.
3. If the sum is negative, change it to a positive and write it to the debit member in the target database.

**Understanding Credit and Debit Processing for Custom Calculations and Allocations**

Oracle General Ledger uses double-entry accounting, in which every transaction has two journal entries: a debit entry and a credit entry.

Thus, for every transaction, there are two accounts, represented as columns. The two accounts must balance; in other words, the sum of debit column must equal the sum of the credit column.

A debit member can be specified, to which the custom calculation writes positive result values, and a credit member can be specified, to which the custom calculation writes negative and offsetting result values. The debit member and the credit member must be two different members from the same dimension. For example, a dimension called “AmountType” may have two level 0 children named “Credit” and “Debit.”

Whenever the calculation would result in writing a positive number to a level 0 cell in the target database, the positive value is written to the debit member.

Whenever the calculation would result in writing a negative number to a level 0 cell in the target database, the sign is changed to a positive and is written to the credit member.
Managing Aggregate Storage Applications and Databases

In This Chapter

- Aggregate Storage Security ................................................................. 1023
- Managing Storage for Aggregate Storage Applications................................. 1024
- Managing the Aggregate Storage Cache ...................................................... 1025
- Improving Performance When Building Aggregate Views on Aggregate Storage Databases .... 1026
- Aggregate Storage Database Restructuring ................................................ 1027
- Exporting Aggregate Storage Databases .................................................... 1033
- Calculating the Number of Stored Dimension Levels in an Aggregate Storage Outline .......... 1034

The information in this chapter applies only to aggregate storage databases and is not relevant to block storage databases.

Also see:

- Chapter 60, “Comparison of Aggregate and Block Storage”
- Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide for information on backing up an aggregate storage application

Aggregate Storage Security

Defining and executing aggregations requires Calculation (Administration Services) or Execute (MaxL) permission or higher. Dimension builds that clear database values require Write permission.

See these security-related topics:

- “Managing User/Group Permissions for Applications and Databases”
  in the Oracle Essbase Administration Services Online Help
- “Privileges and Roles” in the Oracle Essbase Technical Reference
Managing Storage for Aggregate Storage Applications

Subtopics

- Working with Tablespaces
- Defining Tablespaces

For aggregate storage applications, Tablespace Manager controls data retrieval and storage, using tablespace definitions to manage data storage and work areas on the disk.

Working with Tablespaces

Tablespaces help optimize data file and work file storage and retrieval. Tablespaces define location definitions that map data artifacts, such as aggregate views and aggregations, to files. Each application directory contains directories for four tablespaces:

- **default**—Contains database data structure and database values (After data is loaded, the tablespace location cannot be changed.)
- **log**—Contains a binary transactional log of default tablespace updates
- **metadata**—Contains information about file locations, files, and objects contained in the database
- **temp**—Provides a temporary workspace to be used during operations such as data loads, aggregations, and retrievals

Tablespace names are case-sensitive, regardless of operating system. You cannot change the location or size of metadata and log. For default and temp you can specify multiple locations and sizes, and you can define tablespace properties:

- Directory path locations
- Maximum disk space to be used at each location
- Maximum file size allowed within each location

**Note:** You can modify or delete file locations used to store information within a tablespace if the locations are empty.

Because Tablespace Manager allocates disk space in fixed-size increments, specifying the maximum disk space for a tablespace location specifies an end point but does not reserve the specified space.

When space is needed, Essbase checks file locations (in numerical order) and, when space is found, starts writing. When all locations are used, no space is available, and an error is returned. When database values are cleared, tablespace files shrink, releasing disk space. Work files that are no longer needed are deleted, making space available for other programs.
Based on the maximum size specified for files, Essbase writes multiple files; for example, ess00001.dat, ess00002.dat, and so on. If you back up database files to other media, do not set a maximum tablespace file size greater than the size that the media can handle.

**Defining Tablespaces**

You define tablespace definitions for each aggregate storage application.

To define tablespaces, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Managing Tablespaces</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>alter tablespace</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>

**Managing the Aggregate Storage Cache**

Aggregate storage cache facilitates memory usage during data loads, aggregations, and retrievals. The cache memory locking feature is used only with block storage applications.

When an aggregate storage outline is started, a small area in memory is allocated as the aggregate storage cache for the relevant application. As additional cache area is needed, the cache size incrementally increases until the maximum cache size is used or the operating system denies additional allocations.

**Note:** Denial of aggregate cache memory allocations does not deny increased use of existing memory.

You can view the current aggregate cache memory allocation and the maximum aggregate cache size setting. Changing the setting may optimize memory use. The default maximum cache size, 32 MB, is the minimum setting size. You can use the size of input-level data to determine when to increase the maximum size for the cache. Administration Services and MaxL display the size of input-level data as the aggregate storage database property: Size of level 0 values.

A 32 MB cache setting supports a database with approximately 2 GB of input-level data. If the input-level data size is greater than 2 GB by some factor, the aggregate storage cache can be increased by the square root of the factor. For example, if the input-level data size is 3 GB (2 GB * 1.5), multiply the aggregate storage cache size of 32 MB by the square root of 1.5, and set the aggregate cache size to the result: 39.04 MB.

For aggregation materialization performance, consider the number of threads set for parallel calculation. The aggregation materialization process uses multiple threads that divide the aggregate storage cache. Increasing the number of threads specified in the CALCPARALLEL configuration setting for aggregate storage applications or databases may require an increase in aggregate storage cache size. See the CALCPARALLEL configuration setting in the Oracle Essbase Technical Reference.
Note: Setting the number of threads higher than the number of processors may improve aggregate storage application performance.

Do not increase the maximum size of the aggregate storage cache beyond what is needed.

➢ To set aggregate storage cache size, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Sizing the Aggregate Storage Cache</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>query application</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
<tr>
<td></td>
<td>alter application</td>
<td></td>
</tr>
</tbody>
</table>

Note: A changed aggregate storage cache setting becomes effective when the application is restarted.

**Improving Performance When Building Aggregate Views on Aggregate Storage Databases**

You might encounter the following message while building aggregate views on an aggregate storage database:

*For better performance, increase the size of aggregate storage cache*

This message sometimes occurs when an aggregate storage database is larger than a few hundred million input cells.

To improve the performance of building aggregates, take the following steps.

1. Increase the size of the aggregate storage cache to at least 512 MB or 20% of the input data size, whichever is smaller. (If the cache setting is already greater than this amount, proceed to the next step.) You can use Administration Services Console or the following MaxL command:

   ```
   alter application appname set cache_size xMB
   ```

   This setting takes effect after you restart the application.

2. If you still see the message when building aggregate views after increasing the aggregate storage cache, use the ASOSAMPLESIZEPERCENT configuration setting. Syntax:

   ```
   ASOSAMPLESIZEPERCENT [appname [dbname]] n
   ```

   Gradually increase the \( n \) value until the message disappears and optimal aggregation performance is reached. For a database that contains:
   - 20 million input cells, start with 5%
   - 100 million cells, start with 1%
   - More than 1 billion cells, start with 0.1%
Clear the aggregate views; then reselect and rebuild them. If the message still appears, increase the setting and try again.

Performance of building aggregate views may not improve until the message no longer occurs. When the message no longer occurs and performance no longer improves, stop increasing the setting.

**Note:** If you increase the ASOSAMPLESIZEPERCENT setting too high, performance will start to degrade again. The optimal setting for a database larger than 1 billion cells will probably be less than 3%. For more information on ASOSAMPLESIZEPERCENT, see the *Oracle Essbase Technical Reference*.

### Aggregate Storage Database Restructuring

**Subtopics**

- Levels of Aggregate Storage Database Restructuring
- Outline-Change Examples

Database restructures may be forced by some aggregate storage database outline changes, including changes to hierarchies. A hierarchy comprises a top member and its descendants.

- A dynamic hierarchy includes only one stored level. The Accounts dimension is a dynamic hierarchy.
- An attribute dimension is one hierarchy. The generation 1 member is the top member of the hierarchy.
- If a standard dimension is not tagged as multiple hierarchies enabled, it is one hierarchy.
- If a standard dimension is tagged as multiple hierarchies enabled, it contains multiple hierarchies. The generation 2 members are the top members of the hierarchies. For example, the Products dimension in ASO Samp.Sample contains two hierarchies. The top members are the generation 2 members All Merchandise and High End Merchandise.

![Diagram of Products hierarchy]

What outlines changes affect:

- Whether data must be cleared from the database before restructuring
- The time and storage required to restructure the outline
Levels of Aggregate Storage Database Restructuring

To minimize the time and storage needed for database restructures, if a database outline changes frequently, analyze the outline and the types of outline changes.

Levels of restructuring for aggregate storage databases, listed from most to least expensive (in regard to time, storage, and data):

Table 229 Aggregate Storage Restructuring Levels

<table>
<thead>
<tr>
<th>User-Outline Changes</th>
<th>Essbase-Restructure Level</th>
<th>Performance Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add, delete, or move a standard dimension</td>
<td>Clears data and aggregate views, and performs full outline restructure</td>
<td>Very high</td>
</tr>
<tr>
<td>Add, delete, or move a hierarchy.</td>
<td></td>
<td>Storage requirement is up to three times the size of the database file (dat file).</td>
</tr>
<tr>
<td>Change the number of stored levels in a hierarchy.</td>
<td></td>
<td>User must select the aggregate views and rerun the database aggregation.</td>
</tr>
<tr>
<td>See:</td>
<td>Clear aggregate views, and performs full outline restructure</td>
<td></td>
</tr>
<tr>
<td>Example: No Change in the Number of Stored Levels in a Hierarchy on page 1030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example: Change in the Number of Stored Levels in a Hierarchy on page 1031</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change the top member of a stored hierarchy from label-only to stored or from stored to label-only.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change a dynamic hierarchy to a stored hierarchy or a stored hierarchy to a dynamic hierarchy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change a primary or an alternate hierarchy so that it matches or no longer matches its primary or alternate hierarchy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All level 0 members of a primary hierarchy must be represented directly or indirectly (for example, a parent that is a sum of its children may represent its children) in all alternate hierarchies. The top level of the primary hierarchy must equate to the top level of each alternate hierarchy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>See &quot;Example: Changes in Alternate Hierarchies&quot; on page 1031.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform a change that is not included in other categories; for example, delete or move a member, or add a member that is not the last of its siblings</td>
<td>Performs full outline restructure</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage requirement is up to three times the size of the database file (dat file).</td>
</tr>
</tbody>
</table>

1028
<table>
<thead>
<tr>
<th>User-Outline Changes</th>
<th>Essbase-Restructure Level</th>
<th>Performance Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform a light restructure change (described below) to an alternate hierarchy or an attribute dimension</td>
<td>Rebuilds all aggregate views that are based on attribute dimensions or alternate hierarchies</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage requirement is up to three times the size of the affected views. Such aggregate views normally exist only if you used query tracking to select views based on usage. See “Selecting Views Based on Usage” on page 980.</td>
</tr>
<tr>
<td>On nonattribute dimensions without stored level 0 members (for example, all level 0 members are shared or have formulas), add a child or child branch without changing the number of levels in the hierarchy and without crossing a power of 2 boundary.</td>
<td>Performs light outline restructure.</td>
<td>Very low</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> If the number of levels in the hierarchy changes, Essbase clears all aggregate views and performs a full outline restructure. Performance impact is Very High.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If the number of levels in the hierarchy does not change, but adding a child or child branch crosses a power of 2 boundary, Essbase performs a full outline restructure. Performance impact is High.</td>
<td></td>
</tr>
<tr>
<td>On nonattribute dimensions with stored level 0 members:</td>
<td>Performs light outline restructure.</td>
<td>Very low</td>
</tr>
<tr>
<td>● Add a child as the last child of a parent without crossing a power of 2 boundary (1, 2, 4, 8, 16, and so on). For example, if a parent member has three children, you may add a fourth child as the last child of the parent.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Add a child branch as the last child branch of an existing parent without crossing a power of 2 boundary and without changing the number of levels in the hierarchy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examples:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Renames a member</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Changes a formula</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Changes an alias</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Changes a dynamic hierarchy consolidation operator (for example, from + to -)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
User-Outline Changes

<table>
<thead>
<tr>
<th>Essbase-Restructure Level</th>
<th>Performance Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clears aggregate views, and performs full outline restructure</td>
<td>Very high</td>
</tr>
</tbody>
</table>

On nonattribute dimensions with stored level 0 members:

- Add a child that crosses a power of 2 boundary as the last child of a parent. For example, if a parent member has three children and you add a fourth and fifth child, the fifth child crosses the power of 2 boundary. See “Example: Addition of Child Members” on page 1032.
- For scenarios in which adding a child branch as the last child branch of an existing parent that crosses a power of 2 boundary or changing the number of levels in the hierarchy, which triggers a full outline restructure, see “Example: Addition of Child Branches” on page 1032.

Outline-Change Examples

Subtopics

- Example: No Change in the Number of Stored Levels in a Hierarchy
- Example: Change in the Number of Stored Levels in a Hierarchy
- Example: Changes in Alternate Hierarchies
- Example: Addition of Child Members
- Example: Addition of Child Branches

This sections contains examples of the more complicated outline changes described in Table 229, “Aggregate Storage Restructuring Levels,” on page 1028.

Example: No Change in the Number of Stored Levels in a Hierarchy

In ASOsamp.Sample, the Measures dimension is tagged as accounts. Therefore, as a dynamic hierarchy, Measures includes only one stored level.

Adding the child member All to Ratios does not change the number of stored levels in the Measures dimension. Saving the outline triggers a light restructure.

In ASOsamp.Sample, Income Level is a stored hierarchy dimension.
Adding a child member does not change the number of levels (two) in the hierarchy. Adding a seventh or eighth child member at the end is allowed; however, adding a ninth child member crosses the power of 2 boundary (see “Example: Addition of Child Members” on page 1032), requiring a full outline restructure.

Example: Change in the Number of Stored Levels in a Hierarchy

In the Product dimension in ASOsamp.Sample, renaming Photo Printers to Printers and adding child members increases the number of levels in the All Merchandise hierarchy from four to five. When the outline is saved, Essbase clears all aggregate views and performs a full outline restructure.

Example: Changes in Alternate Hierarchies

If you delete the shared member Orange under Drinks by Category and do not delete its nonshared member under Drinks, the alternate hierarchy Drinks by Category is no longer a replica of the Drinks hierarchy. When the outline is saved, Essbase clears all aggregate views and performs a full outline restructure.

If you delete the shared and nonshared Orange members, the alternate hierarchy Drinks by Category remains a replica of the Drinks hierarchy. When the outline is saved, Essbase performs a full outline restructure but does not clear aggregate views.
Example: Addition of Child Members

In ASOsamp.Sample, adding a child member under Systems in the All Merchandise hierarchy increases the number of children under Systems to three, crossing the power of 2 boundary. When the outline is saved, Essbase performs a full outline restructure.

However, adding a child member under Computers and Peripherals increases the number of children under Computers and Peripherals from three to four. Adding a fourth child, which must be added after the existing members, does not cross the boundary of 2 or 4. The child must be added after existing members. When the outline is saved, Essbase performs a light restructure.

Example: Addition of Child Branches

In ASOsamp.Sample, adding a child branch under Computers and Peripherals in the All Merchandise hierarchy increases the number of children to four. Adding this child, which must be added after the existing members, does not cross the power of 2 boundary. The new member, called Other Peripherals, has two children. Systems (which is a sibling of Other Peripherals) has two children. Adding the child branch stays within the power of 2 boundary for children of sibling members at the same level. When the outline is saved, Essbase performs a light restructure.
Adding a child branch with three child members crosses the power of 2 boundary and may require that Essbase perform a full outline restructure. However, if Systems already had three members, the power of 2 boundary would be four and, at most, four children can be added to Other Peripherals without triggering a full outline restructure.

**Exporting Aggregate Storage Databases**

If you have read permission for an aggregate storage database, you can export level 0 data from the database to a specified text file. The export file contains only uncompressed data, not control, outline, or security information. During data export, users can connect to Essbase Server and perform read-only operations on the database.

Exported data can be reloaded without a rules file if there are no outline changes. Consider exporting data for the following reasons:

- To transfer data across platforms
- To create an exported file in text, rather than binary, format
- To create backups

The default location for export files is `ARBORPATH/app/`. You can specify an alternate location; see the *Oracle Essbase Administration Services Online Help* or the *Oracle Essbase Technical Reference*.

Aggregate storage database exports have limits:

- You can export only level 0 data (input data).
- You cannot perform columnar exports. In a columnar export, the output file displays a member name from each dimension in every row (and names can be repeated from row to row).

To avoid creating export files larger than 2 GB, Essbase may create multiple export files that include a number suffix in the name, as follows: _1, _2, and so on. For example, if the first file name is `/home/exportfile.txt`, the next file is `/home/exportfile_1.txt`.

To improve performance, you can export data in parallel.

To export data, use a tool:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Topic</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration Services</td>
<td>Exporting Databases</td>
<td>Oracle Essbase Administration Services Online Help</td>
</tr>
<tr>
<td>MaxL</td>
<td>export data</td>
<td>Oracle Essbase Technical Reference</td>
</tr>
</tbody>
</table>
Calculating the Number of Stored Dimension Levels in an Aggregate Storage Outline

To calculate the number of stored dimension levels in an outline:

1. Determine the stored-level factor for each dimension.
2. Multiply the dimension factors together; for example, \(a \times b \times c \times d\), and so on.

To determine the factor for each dimension, use the following guidelines:

- For dynamic dimensions, the factor is 1.
- For stored dimensions, for an initial dimension factor, count the non-label-only levels.
  - If a stored dimension has attribute dimensions, count the levels in each attribute dimension, and add that number to the dimension factor. Then, if all level 0 members of the dimension have an attribute from a specific attribute dimension, subtract 1 for each attribute dimension in which this occurs.
  - If a stored dimension has additional stored hierarchies, count the number of non-label-only levels in each stored hierarchy, and add the count to the dimension factor. Do not count a level if it comprises only shared members.
  - Dynamic hierarchies in a stored dimension do not affect the dimension factor.

For example, multiplying the factors for the 11 dimensions in ASO Samp.

\[1 \times 1 \times 4 \times 2 \times 2 \times 2 \times 3 \times 2 \times 6 \times 7 \times 7\] equals 56,448.

To view dimension level factors, choose a method:

- In Administration Services Console, right-click a database, select Edit, and then Properties.
  On the Statistics tab, under Aggregate storage statistics, each non-attribute dimension in the outline is listed, showing the number of stored levels (which is the dimension level factor) in each dimension. For example:
  
  Dimension [Products] has [6] levels, bits used 7

- Use this MaxL command:

  ```
  query database appName.dbName list aggregate_storage runtime_info;
  ```
In Appendixes:

- Limits
- Setting Up Sample Applications
- Troubleshooting Essbase Errors
- Estimating Disk and Memory Requirements
- Using ESSCMD
- Naming Conventions for Essbase
- Differences in Security-Related Operations in Different Security Models
- Essbase 32-Bit and 64-Bit Compatibility
- Essbase Features No Longer Supported or Deprecated in Previous Releases
In this appendix, the term non-Unicode applications refers to non-Unicode-mode applications and applications on Essbase Servers that are not Unicode-enabled. See Chapter 42, “Understanding the Essbase Unicode Implementation.”

### Name and Related Artifact Limits

Table 230 lists limits for names and related artifacts.

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alias name</td>
<td>● Non-Unicode application limit: 80 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 80 characters</td>
</tr>
<tr>
<td>Alias table name</td>
<td>● Non-Unicode application limit: 30 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 30 characters</td>
</tr>
<tr>
<td>Application name</td>
<td>● Non-Unicode application limit: 8 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 30 characters</td>
</tr>
<tr>
<td>Application description</td>
<td>● Non-Unicode application limit: 79 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 80 characters</td>
</tr>
<tr>
<td>Artifact</td>
<td>Limits</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>• Custom-defined function name</td>
<td>• Non-Unicode application limit: 127 bytes. MaxL and the API truncate characters after 127 bytes.</td>
</tr>
<tr>
<td>• Custom-defined macro name</td>
<td>• Unicode-mode application limit: 128 characters. MaxL and the API truncate characters after 128 characters.</td>
</tr>
<tr>
<td>• Custom-defined function specification</td>
<td></td>
</tr>
<tr>
<td>• Custom-defined macro specification</td>
<td></td>
</tr>
<tr>
<td>In either case, no truncation on server. No error is displayed if truncation occurs.</td>
<td></td>
</tr>
<tr>
<td>Custom-defined function and macro comment</td>
<td>• Non-Unicode application limit: 255 bytes. MaxL and the API truncate characters after 255 bytes.</td>
</tr>
<tr>
<td></td>
<td>• Unicode-mode application limit: 256 characters. MaxL and the API truncate characters after 256 characters.</td>
</tr>
<tr>
<td>Database name</td>
<td>• Non-Unicode application limit: 8 bytes</td>
</tr>
<tr>
<td></td>
<td>• Unicode-mode application limit: 30 characters</td>
</tr>
<tr>
<td>Database description</td>
<td>• Non-Unicode application limit: 79 bytes</td>
</tr>
<tr>
<td></td>
<td>• Unicode-mode application limit: 80 characters</td>
</tr>
<tr>
<td>Dimension name</td>
<td>• Non-Unicode application limit: 80 bytes</td>
</tr>
<tr>
<td></td>
<td>• Unicode-mode application limit: 80 characters</td>
</tr>
<tr>
<td>Directory path</td>
<td>• Non-Unicode application limit: 255 characters</td>
</tr>
<tr>
<td>For example:</td>
<td>• Unicode-mode application limit: 1024 characters</td>
</tr>
<tr>
<td>$EPM_ORACLE_HOME/products/Essbase/EssbaseServer/bin</td>
<td></td>
</tr>
<tr>
<td>Environment variable name</td>
<td>• Non-Unicode application limit: 320 bytes</td>
</tr>
<tr>
<td></td>
<td>• Unicode-mode application limit: 320 characters</td>
</tr>
<tr>
<td>Environment variable value</td>
<td>• Non-Unicode application limit: 256 bytes</td>
</tr>
<tr>
<td></td>
<td>• Unicode-mode application limit: 256 characters</td>
</tr>
<tr>
<td>Essbase Server name</td>
<td>• Non-Unicode application limit: 1024 bytes</td>
</tr>
<tr>
<td></td>
<td>• Unicode-mode application limit: 1024 characters</td>
</tr>
<tr>
<td>Filename for calculation scripts, report scripts, and rules files</td>
<td>• Non-Unicode application limit: 8 bytes</td>
</tr>
<tr>
<td></td>
<td>• Unicode-mode application limit: 1024 bytes, as in some MaxL statements, 1024 bytes.</td>
</tr>
<tr>
<td>File name for text and Excel files</td>
<td>Non-Unicode application limit: 8 bytes</td>
</tr>
</tbody>
</table>

For example:
$EPM_ORACLE_HOME/products/Essbase/EssbaseServer/bin
<table>
<thead>
<tr>
<th>Artifact</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter name</td>
<td>● Non-Unicode application limit: 256 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 256 characters</td>
</tr>
<tr>
<td>Group name</td>
<td>● Non-Unicode application limit: 256 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 256 characters</td>
</tr>
<tr>
<td>LRO cell note</td>
<td>● Non-Unicode application limit: 600 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 600 characters</td>
</tr>
<tr>
<td>LRO URL</td>
<td>512 characters (always single-byte characters)</td>
</tr>
<tr>
<td>LRO description for URLs and files</td>
<td>● Non-Unicode application limit: 80 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 80 characters</td>
</tr>
<tr>
<td>Member comment field</td>
<td>● Non-Unicode application limit: 255 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 256 characters</td>
</tr>
<tr>
<td>Member name</td>
<td>● Non-Unicode application limit: 80 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 80 characters</td>
</tr>
<tr>
<td>Qualified member name limit: the number of</td>
<td>20 levels</td>
</tr>
<tr>
<td>levels that can be specified in a qualified</td>
<td></td>
</tr>
<tr>
<td>member name</td>
<td></td>
</tr>
<tr>
<td>Password</td>
<td>● Non-Unicode application limit: 100 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 100 characters</td>
</tr>
<tr>
<td>Runtime substitution variable name</td>
<td>320 bytes</td>
</tr>
<tr>
<td>Runtime substitution variable value</td>
<td>256 bytes</td>
</tr>
<tr>
<td>Substitution variable name</td>
<td>320 bytes</td>
</tr>
<tr>
<td>Substitution variable value</td>
<td>256 bytes</td>
</tr>
<tr>
<td>Maximum number of text values in a text list</td>
<td>1024</td>
</tr>
<tr>
<td>object</td>
<td></td>
</tr>
<tr>
<td>Maximum length of the name of a text value</td>
<td>80</td>
</tr>
<tr>
<td>Range of numbers for the ID of a text value</td>
<td>-32768 to 32767</td>
</tr>
<tr>
<td>Trigger name</td>
<td>● Non-Unicode application limit: 30 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 30 characters</td>
</tr>
<tr>
<td>UDA</td>
<td>● Non-Unicode application limit: 1024 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 1024 characters</td>
</tr>
<tr>
<td>User name</td>
<td>● Non-Unicode application limit: 256 bytes</td>
</tr>
<tr>
<td></td>
<td>● Unicode-mode application limit: 256 characters</td>
</tr>
</tbody>
</table>
Data Load and Dimension Build Limits

Table 231 lists limits related to data loading and dimension building.

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection and rejection criteria</td>
<td>Number of characters that describe selection and rejection criteria: combination of all criteria limited to 32 KB</td>
</tr>
<tr>
<td>Number of error messages written to a data load or dimension build error log (DATAERRORLIMIT in essbase.cfg)</td>
<td>Default 1000, minimum 1, maximum 65000</td>
</tr>
<tr>
<td>Maximum number of generations allowed when building a duplicate member dimension</td>
<td>20</td>
</tr>
<tr>
<td>Maximum number of source files for incremental dimension build</td>
<td>64</td>
</tr>
</tbody>
</table>

Aggregate Storage Database Limits

Table 232 lists limits related to aggregate storage databases.

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of hierarchies in a single dimension of an aggregate storage database</td>
<td>65535 (including all stored hierarchies, dynamic hierarchies, and any attribute dimensions based on the dimension)</td>
</tr>
<tr>
<td>Number of members in an aggregate storage outline</td>
<td>10,000,000 to 20,000,000 members, depending on available memory and other memory requirements</td>
</tr>
<tr>
<td>Maximum file location size in an aggregate storage database</td>
<td>4,294,967,295 MB</td>
</tr>
</tbody>
</table>
| Number of cells that can be queried in an aggregate storage database that has a very sparse data set | $2^{64}$  
The limit is based on the number of cells that Essbase processes in the query, which is the product of the member count across all dimensions, not on the number of cells contained in the output report.  
You might encounter this limit when using a client interface (such as Oracle Hyperion Financial Reporting) that suppresses missing data in order to generate a relatively small report compared to the size of the query. |
| Number of alias tables                                                  | 32                                                                    |
| Number of parallel export threads                                       | 8                                                                     |

For information about how Essbase uses export threads, see the data export MaxL command for block storage database and the EXPORTTHREADS configuration setting in the Oracle Essbase Technical Reference.
<table>
<thead>
<tr>
<th>Artifact</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of dimensions in an aggregate storage outline</td>
<td>255</td>
</tr>
<tr>
<td>When working with an aggregation storage database outline, dimensions that you delete count toward the total number of dimensions because Essbase does not reclaim the ID of deleted dimensions. Therefore, if you create and then delete dimensions, the maximum number of dimensions is reduced by the number of deleted dimensions.</td>
<td></td>
</tr>
</tbody>
</table>

## Block Storage Database Limits

Table 233 lists limits related to block storage databases.

**Table 233**  Block Storage Database Limits

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of members in a block storage outline</td>
<td>Approximately 1,000,000 explicitly defined members in an Essbase outline. Longer member names, which can occur if using multibyte characters, decrease the number of members that are allowed.</td>
</tr>
<tr>
<td>Number of possible cells per block in a block storage database</td>
<td>32-bit and 64-bit: $2^{28} - 1$ (268,435,455)</td>
</tr>
<tr>
<td>Number of possible sparse blocks in a block storage database</td>
<td>The product of the stored member count of sparse dimensions cannot exceed the following values: 32-bit and 64-bit: $2^{104}$ For instructions on how to calculate the number of possible sparse blocks in a block storage database, see “Potential Number of Data Blocks” on page 1055.</td>
</tr>
<tr>
<td>Number of Linked Reporting Objects in a block storage database</td>
<td>32-bit and 64-bit: $2^{104}$ <strong>Note:</strong> When viewing or editing Linked Reporting Objects attached to cells, you may encounter a limitation prior to $2^{104}$, if the outline has non-stored members. If this occurs, the following error is displayed: <em>Error 1140013 Invalid Cell Address Entered</em> You can work around the limit by reordering the dimensions in the outline.</td>
</tr>
<tr>
<td>Number of alias tables</td>
<td>32</td>
</tr>
<tr>
<td>Number of parallel export threads</td>
<td>1024</td>
</tr>
<tr>
<td>For information about how Essbase uses export threads, see the data export MaxL command for aggregate storage database and the EXPORTTHREADS configuration setting in the <em>Oracle Essbase Technical Reference</em>.</td>
<td></td>
</tr>
<tr>
<td>Number of dimensions in a block storage outline</td>
<td>255</td>
</tr>
</tbody>
</table>

## Drill-through to Oracle Applications Limits

Table 234 lists limits related to drill-through URLs.
Table 234  Drill-through to Oracle Applications Limits

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of drill-through URLs per database</td>
<td>255</td>
</tr>
<tr>
<td>Number of drillable regions in a drill-through URL</td>
<td>256</td>
</tr>
<tr>
<td>Number of characters per drillable region</td>
<td>65536</td>
</tr>
</tbody>
</table>

Other Size or Quantity Limits

Table 235 lists other size and quantity limits.

Table 235  Other Size or Quantity Limits

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula size</td>
<td>65534 bytes</td>
</tr>
<tr>
<td>Number of security filters</td>
<td>Per Essbase Server: 65535&lt;br&gt;Per Essbase database: 32290</td>
</tr>
<tr>
<td>Number of users and groups (combined)</td>
<td>30,000&lt;br&gt;Exceeding this limit results in an error.</td>
</tr>
<tr>
<td>Rules file maximum record size</td>
<td>64 KB</td>
</tr>
<tr>
<td>Rules file SQL query maximum size</td>
<td>64 KB</td>
</tr>
<tr>
<td>MDX maximum query limits and set sizes</td>
<td>See the “MDX Query Limits” topic in the Oracle Essbase Technical Reference.</td>
</tr>
<tr>
<td>Maximum size for variable arrays in calculation scripts and formulas, Arrays temporarily store arguments to calculation functions, including MEMBERS, NUMBERS, and STRINGS, or values associated with them.</td>
<td>Maximum integer value of 2,147,483,647</td>
</tr>
<tr>
<td>MaxL maximum statement length</td>
<td>81,920 characters or bytes</td>
</tr>
</tbody>
</table>
## Introduction

The Essbase Server installation includes sample applications that are designed to familiarize you with Essbase features. Each application contains one or more databases and each database has an associated data load file, as described in Table 236:

<table>
<thead>
<tr>
<th>Application</th>
<th>Database</th>
<th>Data Load File</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>Basic</td>
<td>Calcdat.txt</td>
</tr>
<tr>
<td></td>
<td>Interntl</td>
<td>Currcalc.txt</td>
</tr>
<tr>
<td></td>
<td>Xchgrate</td>
<td>Rates.txt</td>
</tr>
<tr>
<td>Sample Interntl and Xchgrate databases demonstrate Essbase Currency Conversion features.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demo</td>
<td>Basic</td>
<td>Data.txt</td>
</tr>
<tr>
<td>Samppart</td>
<td>Company</td>
<td>Calccomp.txt</td>
</tr>
<tr>
<td>Demonstrates Essbase Partitioning features. See Chapter 15, “Designing Partitioned Applications.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampeast</td>
<td>East</td>
<td>Calceast.txt</td>
</tr>
<tr>
<td>Demonstrates Essbase Partitioning features. See Chapter 15, “Designing Partitioned Applications.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample_U</td>
<td>Basic</td>
<td>Calcdat.txt</td>
</tr>
<tr>
<td>Contains a Unicode-mode version of the Basic database in the Sample application, which includes alias tables in English and four other character sets. Characters in this application are encoded in UTF-8.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASOsamp</td>
<td>Sample</td>
<td>dataload.txt1</td>
</tr>
<tr>
<td>Demonstrates aggregate storage features.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1The ASOsamp.Sample database must be loaded using the dataload.rul rules file. The other samples do not require a rules file.
Loading Data into Sample Databases

Before you can use a sample application, you must load data into it.

**Note:** Before loading data into the Partitioning sample databases, first create a partition user or other user name. See “Creating the Partition User” on page 1046.

To load data into a sample database:

1. **Open the Administration Services Console.**
2. **From Enterprise View or a custom view, navigate to the appropriate Essbase Server, application, and database.**
3. **Right-click the database and select Load data.**
4. **Set the Data Load options.**
   - For Data Source Type, select **Data file**.
   - For Mode, choose one of the following options:
     - **Load only**: Performs a data load.
     - **Build only**: Performs a dimension build.
     - **Both**: Performs both a data load and a dimension build.
   - For Data Source, click **Find Data File**. In the Essbase Server tab, navigate to the correct data source. For **Files of Type**, ensure that **Data files (*.txt)** is selected.
   - For Rules File, if the data source requires a rules file, click **Find Rule File**. In the Essbase Server tab, navigate to the rule file. For **Files of Type**, ensure that **Rules file (*.rul)** is selected.

**Note:** The ASOsamp database must be loaded using the `dataload.rul` file. The other samples do not require a rules file.

When the data load is completed, a dialog box appears with information about the files that loaded and whether there were errors.

Providing User Access to Sample Applications

Essbase provides a comprehensive security system for a secure multiple-user environment. By default, the sample applications are created with a security access level of None, which means that no user can connect to the sample databases unless the user is defined as an administrator.

The system administrator, defined when installing Essbase, automatically holds administrator privileges. Therefore, the system administrator can make the sample applications available to other users.
To provide all users with Write access to a sample application:

1. Log on to Administration Services Console using the system administrator account.
2. From Enterprise View, find the appropriate Essbase Server and application.
3. Right-click the application and select Edit properties.
4. In Application Properties, select the General tab.
5. For Minimum access level, select Write.
   
   For example, if you want all users to have at least Write access to all databases in the application (meaning that all users can update data values), select Write.
6. From the Minimum Database Access group, select Write.
7. Click Apply.
8. Repeat this procedure for each database.

The selected application is ready for use. If you want to provide access to another application, repeat the procedure.

Preparing the Aggregate Storage Sample Application

To prepare the sample aggregate storage application for use:

1. Load data using the following data and rules files:

   ARBORPATH/app/ASOsamp/Sample/dataload.txt
   ARBORPATH/app/ASOsamp/Sample/dataload.rul

   For instructions on loading data to aggregate storage databases, see the Oracle Essbase Administration Services Online Help.

2. Precalculate aggregations on the database to improve retrieval times, using one of these methods:
   - Aggregation Design Wizard in Administration Services.
     See the Oracle Essbase Administration Services Online Help.
   - execute aggregate process MaxL statement.
     See the Oracle Essbase Technical Reference.

3. Make sure that the essbase.jar file is in the ESSBASEPATH/java directory.

Preparing the Partitioning Sample Applications

Setting the Environment

Essbase includes two sample applications and databases that demonstrate the features of Partitioning:
The Partitioning applications and databases include partition definitions stored in .ddb files. The .ddb files define the map between member combinations in the target database, Company, and the source database, East.

For the Partitioning applications to work in your environment, you may need to create a user named partitionuser (see “Creating the Partition User” on page 1046), or change the embedded user names in the .ddb files (see “Changing Embedded User Names in Sample Partition Definitions” on page 1046).

**Note:** Do not make changes to user name information directly in the .ddb files.

### Creating the Partition User

Before you work with the Samppart and Sampeast applications, you may need to create a user named partitionuser, which must have Application Manager access to both applications.

► To create partitionuser:

1. Log on to Administration Services Console using the system administrator account.
2. In Enterprise View, navigate to the Administration Server’s node and select the appropriate Essbase Administration Server name.
3. Right-click the User node and select Create user.
4. For Create user on Essbase Administration Server, enter partitionuser for User name.
5. For Password, type a password.
6. For Confirm Password, type the password again.
7. For Administrator privileges, select true.
8. Click OK.

### Changing Embedded User Names in Sample Partition Definitions

If you choose not to create partitionuser, you can change the embedded user name in the partition definition files (.ddb) to the user name of your choice, as long as that user has administrator privileges. The .ddb files shipped with Samppart and Sampeast are based on the server name “localhost.”

► To change the user name in the Samppart.Company and Sampeast.East .ddb files:

1. Open Administration Services Console.
2. In Enterprise View, expand the Applications node and select the Samppart application.
3 Expand the Databases node and select the Company database.

4 Expand the Partitions node, select Source Databases, and then double-click:
   servername:Sampeast:East  [transparent]

5 For Data Source and Data Target, select a user name from User list.

6 Enter the password.

7 Click Repair to save your changes.

Note: If, in the Repair Partition dialog box, you changed the user name for the Data Source and the Data Target groups, you do not need to repeat this process to change the user name in the Sampeast.East .ddb file.
Troubleshooting Essbase Errors

In This Appendix

Understanding Fatal Error Handling ................................................................. 1049
Recovering from Dense Restructure Failures ....................................................... 1050
Recovering from Sparse Restructure Failure ....................................................... 1050
Synchronizing Member Names in Report Scripts and Database Outlines .......... 1050
Handling Essbase Server Problems When Running Multiple Reports ............... 1051
References ........................................................................................................ 1051

Understanding Fatal Error Handling

The Essbase Server Kernel considers the following errors fatal:

- One or more control fields have unexpected or inconsistent values.
- The kernel detects data corruption.
- The kernel cannot perform an operation that is necessary to ensure data integrity (for example, disk space is insufficient).
- The kernel encounters a condition that can lead to data corruption.

When the kernel encounters a fatal error, it shuts down and restarts, attempting to reinitialize itself and proceed with database recovery. When recovery begins, Essbase displays an error message similar to this one:

1080022 Reinitializing the Essbase Kernel for database dbname due to a fatal error...

This message is followed by other informational messages related to database recovery, such as this one:

1080028 Performing transaction recovery for database dbname during fatal error processing.

When you see such messages, the kernel has shut down and is attempting to restart. Check the Essbase Server log and determine whether Essbase issued a fatal error message just before it generated the reinitialization messages. See “Using Essbase Server and Application Logs” on page 736.

If the kernel did encounter a fatal error, you must usually restart any operation that was active at the time of the fatal error. If the operation was a calculation or a data load, you may be able to continue where the operation left off; check the Essbase Server log to see how far Essbase
processed the operation. When in doubt, restart the operation. See “What to Expect if a Server Interruption Occurs” on page 789.

If the kernel did not encounter a fatal error, contact your software provider’s technical support to determine what caused the kernel to shut down and restart.

See “Contents of the Essbase Server Log” on page 727 for descriptions of the contents of the Essbase Server log. See “Essbase Server and Application Log Message Categories” on page 734 for information about identifying the component where the error occurred.

Recovering from Dense Restructure Failures

If an error or system failure occurs while Essbase is restructuring, it probably will occur during step 2 in the procedure “Dense Restructures” on page 842.

To recover from a failure during step 2 of “Dense Restructures” on page 842:
1. Delete the temporary files, to free disk space and to avoid conflicts during the next database restructure.
2. Restart the database.

To recover from a failure during step 1, step 3, or step 4 of “Dense Restructures” on page 842:
1. Review the disk directory and determine how far restructuring has progressed.
2. If all but step 4 is complete, rename the temporary files to the correct file names.

Recovering from Sparse Restructure Failure

If a system failure occurs during any step of a sparse restructure, you can recover by restarting the database.

Synchronizing Member Names in Report Scripts and Database Outlines

When you run a report, ensure that the member names in the report script match the member names in the database outline. An error displays whenever the Report Extractor cannot find a matching member name; you must correct the name in the report script before the report continues processing.
Handling Essbase Server Problems When Running Multiple Reports

Your server computer may freeze if you try to run more reports in parallel than you have assigned server thread resources.

If you are running multiple report scripts and your server freezes, check the value of the configuration file setting SERVERTHREADS in the `essbase.cfg` file on the server. At least one thread should exist for each report running. For example, if you are running 22 reports, the value for SERVERTHREADS should be at least 22.

References

Chapters related to partitions, currency conversion, and data load have basic troubleshooting information in the relevant chapters.

For information about restoring from backups, see the *Oracle Hyperion Enterprise Performance Management System Backup and Recovery Guide*.

For information about specific error messages, see *Oracle Essbase Error Message Reference*.

For information about error and exception logs, see “Using Essbase Logs” on page 726.
Estimating Disk and Memory Requirements

In This Appendix

Introduction ............................................................................................. 1053
Understanding How Essbase Stores Data ........................................................... 1053
Determining Disk Space Requirements .............................................................. 1054
Determining Memory Requirements .............................................................. 1067

Introduction

This appendix uses a worksheet approach to help you keep track of the many components that you calculate. If you are using a printed version of this book, you can photocopy the worksheets. Otherwise, you can simulate the worksheets on your own paper. Labels, such as DA and MA, help you keep track of the various calculated disk and memory component values.

Understanding How Essbase Stores Data

To size a database, you must understand the units of storage that Essbase uses. This discussion assumes that you are familiar with the following basic concepts:

- How Essbase stores data, as described in Chapter 3, “Understanding Multidimensional Databases”
- How Essbase Kernel components manage Essbase data, as described in Chapter 48, “Managing Database Settings”

An Essbase database comprises many components. In addition to an outline file and data file, Essbase uses several types of files and memory structures to manage data storage, calculation, and retrieval operations.

Table 237 describes the major components to consider when you estimate the disk and memory requirements of a database. “Yes” means the type of storage indicated is relevant, “No” means that it is not.

<table>
<thead>
<tr>
<th>Storage Unit</th>
<th>Description</th>
<th>Disk</th>
<th>Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outline</td>
<td>A structure that defines all elements of a database. The number of members in an outline determines the outline size.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## Storage Unit

<table>
<thead>
<tr>
<th>Storage Unit</th>
<th>Description</th>
<th>Disk</th>
<th>Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data files</td>
<td>Files in which Essbase stores data values in data blocks in data files. Named \textit{ess}xxxxx.pag, where xxxxx is a number. Essbase increments the number, starting with \textit{ess00001}.pag, on each disk volume. Memory is also affected, because Essbase copies the files into memory.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Data blocks</td>
<td>Subdivisions of a data file. Each block is a multidimensional array that represents all cells of all dense dimensions relative to a particular intersection of sparse dimensions.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Index files</td>
<td>Files that Essbase uses to retrieve data blocks from data files. Named \textit{ess}xxxxx.ind, where xxxxx is a number. Essbase increments the number, starting with \textit{ess00001}.ind, on each disk volume.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Index pages</td>
<td>Subdivisions of an index file. Contain index entries that point to data blocks. The size of index pages is fixed at 8 KB.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Index cache</td>
<td>A buffer in memory that holds index pages. Essbase allocates memory to the index cache at startup of the database.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Data file cache</td>
<td>A buffer in memory that holds data files. When direct I/O is used, Essbase allocates memory to the data file cache during data load, calculation, and retrieval operations, as needed. Not used with buffered I/O.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Data cache</td>
<td>A buffer in memory that holds data blocks. Essbase allocates memory to the data cache during data load, calculation, and retrieval operations, as needed.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Calculator cache</td>
<td>A buffer in memory that Essbase uses to create and track data blocks during calculation operations.</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

## Determining Disk Space Requirements

Essbase uses disk space for its server software and for each database. Before estimating disk storage requirements for a database, you must know how many dimensions the database includes, the sparsity and density of the dimensions, the number of members in each dimension, and how many of the members are stored members.

To calculate the disk space required for a database:

1. Calculate the factors identified in “Calculating the Factors to Be Used in Sizing Disk Requirements” on page 1055.
2. Calculate the disk space required for a single database.
   - See “Estimating Disk Space Requirements for One Database” on page 1059.
3. Calculate the total disk space required for Essbase Server.

**Note:** The database sizing calculations in this chapter assume an ideal scenario with an optimum database design and unlimited disk space. The space required is difficult to determine precisely because most multidimensional applications are sparse.
Calculating the Factors to Be Used in Sizing Disk Requirements

Before estimating disk space requirements for a database, you must calculate the factors to be used in calculating the estimate. Later in the chapter, you use these values to calculate the components of a database. For each database, you add together the sizes of its components.

Table 238 lists the sections that provide instructions to calculate these factors. Go to the section indicated, perform the calculation, and then write the calculated value in the Value column.

Table 238  Worksheet: List of Factors That Affect Disk Space Requirements of a Database

<table>
<thead>
<tr>
<th>Database Sizing Factor</th>
<th>Label</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Potential Number of Data Blocks” on page 1055</td>
<td>DA</td>
<td></td>
</tr>
<tr>
<td>&quot;Number of Existing Data Blocks&quot; on page 1056</td>
<td>DB</td>
<td></td>
</tr>
<tr>
<td>&quot;Size of Expanded Data Block” on page 1057</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>&quot;Size of Compressed Data Block” on page 1058</td>
<td>DD</td>
<td></td>
</tr>
</tbody>
</table>

Potential Number of Data Blocks

The potential number of data blocks is the maximum number of data blocks possible in the database.

If the database is already loaded, you can see the potential number of blocks on the Statistics tab of the Database Properties dialog box of Administration Services.

If the database is not already loaded, you must calculate the value.

➢ To determine the potential number of data blocks, assume that data values exist for all combinations of stored members.

1 Using Table 239 as a worksheet, list each sparse dimension and its number of stored members. If more than seven sparse dimensions exist, list the dimensions elsewhere and include all sparse dimensions in the calculation.

The following types of members are not stored members:

- Members from attribute dimensions
- Shared members
- Label Only members
- Dynamic Calc members (Dynamic Calc And Store members are stored members)

Table 239  Worksheet: List of Sparse Dimensions with Number of Stored Members

<table>
<thead>
<tr>
<th>Sparse Dimension Names</th>
<th>Enter Number of Stored Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
</tr>
</tbody>
</table>
2 Multiply the number of stored members of the first sparse dimension (line a.) by the number of stored members of the second sparse dimension (line b.) by the number of stored members of the third sparse dimension (line c.), and so on:

\[ a \times b \times c \times d \times e \times f \times g \ (\text{and so on}) \]

= potential number of blocks

Write the resulting value to the cell labeled DA in Table 238 on page 1055.

Example

The Sample.Basic database contains the following sparse dimensions:

- Product (19 stored members)
- Market (25 stored members)

Therefore, there are \(19 \times 25 = 475\) potential data blocks.

Number of Existing Data Blocks

As compared with the potential number of blocks, existing blocks refers to those data blocks that Essbase actually creates. For Essbase to create a block, at least one value must exist for a combination of stored members from sparse dimensions. Because many combinations can be missing, the number of existing data blocks is usually much less than the potential number of data blocks.

To see the number of existing blocks for a database that is already loaded, look for the number of existing blocks on the Statistics tab of the Database Properties dialog box of Administration Services. Write the value in the cell labeled DB in Table 238 on page 1055.

If the database is not already loaded, you must estimate a value.

To estimate the number of existing data blocks:

1. Estimate a database density factor that represents the percentage of sparse dimension stored-member combinations that have values.

2. Multiply this percentage against the potential number of data blocks:
number of existing blocks
= estimated density
* potential number of blocks

Write the number of actual blocks to the cell labeled DB in Table 238 on page 1055.

Example
The following three examples show different levels of sparsity and assume 100,000,000 potential data blocks:

- Extremely sparse: 5 percent of potential data cells exist.

  \[ \text{.05 (estimated density)} \times 100,000,000 \text{ (potential blocks)} = 5,000,000 \text{ existing blocks} \]

- Sparse: 15 percent of potential data cells exist.

  \[ \text{.15 (estimated density)} \times 100,000,000 \text{ (potential blocks)} = 15,000,000 \text{ existing blocks} \]

- Dense: 50 percent of potential data cells exist.

  \[ \text{.50 (estimated density)} \times 100,000,000 \text{ (potential blocks)} = 50,000,000 \text{ existing blocks} \]

Size of Expanded Data Block
The potential, expanded (uncompressed) size of each data block is based on the number of cells in a block and the number of bytes used for each cell. The number of cells is based on the number of stored members in the dense dimensions. Essbase uses eight bytes to store each intersecting value in a block.

To see the number of existing blocks for a database that is loaded, look for the size of an expanded data block on the Statistics tab of the Database Properties dialog box of Administration Services. If the database is not loaded, you must estimate the value.

- To determine the size of an expanded data block:
  1. Using Table 240 on page 1058 as a worksheet, enter each dense dimension and its number of stored members. If more than seven dense dimensions exist, list the dimensions elsewhere, and include all dense dimensions in the calculation.

     The following types of members are not stored members:
     - Members from attribute dimensions
     - Shared members
     - Label Only members
     - Dynamic Calc members (Dynamic Calc and Store members are stored members)
Table 240  Worksheet: List of Dense Dimensions with Number of Stored Members

<table>
<thead>
<tr>
<th>Dense Dimension Names</th>
<th>Number of Stored Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td></td>
</tr>
<tr>
<td>g.</td>
<td></td>
</tr>
</tbody>
</table>

2  Multiply the number of stored members of the first dense dimension (line a) by the number of stored members of the second dense dimension (line b) by the number of stored members of the third dense dimension (line c), and so on, to determine the total number of cells in a block:

\[ a \times b \times c \times d \times e \times f \times g \text{ (and so on)} \]

= the total number of cells

3  Multiply the resulting number of cells by 8 bytes to determine the expanded block size:

\[ \text{(Total number of cells)} \times 8 \text{ bytes per cell} \]

= expanded block size

Write the resulting value to the cell labeled DC in Table 238 on page 1055.

Example

The Sample.Basic database contains the following dense dimensions:

- Year (12 stored members)
- Measures (8 stored members)
- Scenario (2 stored members)

Perform the following calculations to determine the potential size of a data block in Sample.Basic:

\[ 12 \times 8 \times 2 = 192 \text{ data cells} \]

192 data cells

* 8 bytes

= 1,536 bytes (potential data block size)

Size of Compressed Data Block

Compression affects the actual disk space used by a data file. The four types of compression (bitmap, run-length encoding (RLE), zlib, and index-value) affect disk space differently. For a discussion of data compression unrelated to estimating size requirements, see “Data Compression” on page 770.
If you are not using compression, or if you have enabled RLE compression, skip this calculation and proceed to “Stored Data Files” on page 1060.

**Note:** Due to sparsity also existing in the block, actual (compressed) block density varies widely from block to block. The calculations in this discussion are only for estimation purposes.

To calculate an average compressed block size when bitmap compression is enabled:

1. **Determine an average block density value.**
   - If the database is loaded, you can see the size of an expanded data block on the Statistics tab of the Database Properties dialog box of Administration Services. Use the value that is displayed for Block Density.
   - If you want to estimate block density prior to loading data, estimate the ratio of existing data values to potential data values.

2. **To determine the compressed block size, perform the following calculation:**
   
   \[
   \text{expanded block size} \times \text{block density} = \text{compressed block size}
   \]

   Write the resulting block size to the cell labeled DD in Table 238 on page 1055.

**Example**

Assume an expanded block size of 1,536 bytes and a block density of 25% (.25):

\[
1,536 \text{ bytes} \times .25 = 384 \text{ bytes (compressed block size)}
\]

**Estimating Disk Space Requirements for One Database**

To estimate the disk-space requirement for a database, make a copy of Table 241 or use a separate sheet of paper as a worksheet for one database. If multiple databases are on a server, repeat this process for each database. Write the name of the database on the worksheet.

Each row of this worksheet refers to a section that describes how to size that component. Perform each calculation and write the results in the appropriate cell in the Size column. The calculations use the factors that you wrote in Table 238 on page 1055.

<table>
<thead>
<tr>
<th>Database Name:</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Database Component</strong></td>
<td><strong>Size</strong></td>
</tr>
<tr>
<td>“Stored Data Files” on page 1060</td>
<td>DE</td>
</tr>
<tr>
<td>“Index Files” on page 1062</td>
<td>DF</td>
</tr>
<tr>
<td>“Fragmentation Allowance” on page 1062</td>
<td>DG</td>
</tr>
</tbody>
</table>
### Database Components

<table>
<thead>
<tr>
<th>Database Component</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Outline&quot; on page 1063</td>
<td>DH</td>
</tr>
<tr>
<td>&quot;Work Areas&quot; on page 1064:</td>
<td>DI</td>
</tr>
<tr>
<td>DE + DF + DG + DH</td>
<td></td>
</tr>
<tr>
<td>&quot;Linked Reporting Objects Considerations&quot; on page 1065, if needed</td>
<td>DJ</td>
</tr>
</tbody>
</table>

Total disk space required for the database:

\[ \text{DI} + \text{DJ} \]

Write the name of this database and the total disk space required in Table 242 on page 1066, which is a worksheet for determining the disk space requirement for all databases on the server (there are placeholders for seven databases—“a” through “g”).

Repeat this exercise for each database on the server. After estimating disk space for all databases on the server, proceed to “Estimating the Total Essbase Server Disk Space Requirement” on page 1066.

### Stored Data Files

The size of the stored database depends on whether the database is compressed and the compression method chosen for the database. Essbase provides five compression-method options: bitmap, run-length encoding (RLE), zlib, index-value, and none.

Calculating the size of a compressed database is complex for a number of reasons including the following:

- The compression method used can vary by block.
- In some situations Essbase chooses what it considers the best method at the block level.

For a comprehensive discussion of data compression unrelated to estimating size requirements, see “Data Compression” on page 770. The calculations in this discussion are for estimation purposes only.

The calculation for the space required to store the compressed data files (\textit{essxxxxx.pag}) uses the following factors:

- Number of existing blocks (value DB from Table 238 on page 1055)
- Fixed-size overhead (72 bytes per block)
- Size of expanded data block (value DC from Table 238 on page 1055)
- Database density: the percentage of sparse dimension stored-member combinations that have values. (To calculate, see "Number of Existing Data Blocks” on page 1056.)

### Calculations for No Compression

To calculate database size when the compression option is none, use the formula:
Calculations for Compressed Databases

Because the compression method used can vary per block, the following calculation formulas are general estimates of the database size. Actual implementation could result in numbers larger or smaller than the calculations.

**Bitmap Compression**

To estimate database size when the compression option is bitmap, use the formula:

\[
\text{Number of blocks} \times (72 \text{ bytes} + \text{average size in bytes of an expanded data block} \times (1/64 + \text{proportion of cells that are not #MISSING}))
\]

For example, if there are 1000 blocks, the average expanded block size is 2000 bytes, and 30% of cells are #MISSING, the result is:

\[
1000 \times (72 + 2000 \times (1/64 + 0.7)) = 1000 \times 1503 = 1,503,000 \text{ bytes (approximately)}
\]

Write the result in cell labeled DE in Table 241 on page 1059. Proceed to “Index Files” on page 1062.

**Index-Value Compression**

To estimate database size when the compression option is Index-value, use the formula:

\[
\text{Number of blocks} \times (72 \text{ bytes} + 1.5 \times \text{database density} \times \text{expanded data block size})
\]

Write the result in cell labeled DE in Table 241 on page 1059. Proceed to “Index Files” on page 1062.

**RLE Compression**

To estimate database size when the compression option is RLE, use the formula for calculating Bitmap Compression.

When the compression method is RLE, Essbase automatically uses the bitmap or Index-value method for a block if it determines that better compression can be gained. Estimating using the bitmap calculation estimates the maximum size.

Write the result in cell labeled DE in Table 241 on page 1059. Proceed to “Index Files” on page 1062.
**zlib Compression**

To estimate database size when the compression option is zlib, use the formula for calculating **Bitmap Compression**.

Determining the size of a data block when zlib compression is used is difficult. Individual blocks could be larger or smaller than if compressed using other compression types. Calculating using the bitmap compression formula at least provides an approximation to use for this exercise.

Write the result in cell labeled DE in Table 241 on page 1059. Proceed to “Index Files” on page 1062.

**Index Files**

The calculation for the space required to store the index files (essxxxxx.ind) uses the following factors:

- Number of existing blocks (value DB from Table 238 on page 1055)
- 112 bytes—the size of an index entry

The minimum size for the index is 8,216,576 bytes (8 MB). To calculate the size of a database index, including all index files, perform the following calculation:

\[
\text{number of existing blocks} \times 112 \text{ bytes} = \text{the size of database index}
\]

In the cell labeled DF in Table 241 on page 1059, write whichever is the larger number: the results of the calculation or 8,216,576.

**Example**

Assume a database with 15,000,000 blocks.

\[
15,000,000 \text{ blocks} \\
\times 112 \\
= 1,680,000,000 \text{ bytes}
\]

**Note:** If the database is already loaded, select the Storage tab on the Database Properties window to see the size.

**Fragmentation Allowance**

If you are using bitmap or RLE compression, some fragmentation occurs, the amount of which is based on individual database and operating system configurations and cannot be precisely predicted.

As a rough estimate, calculate 20% of the compressed database size (value DE from Table 241 on page 1059) and write the result to the cell labeled DG in the same table.

**Example**

Calculating fragmentation allowance assuming a compressed database size of 5,769,000,000 bytes:
The space required by an outline can have two components.

- The main area of the outline is a component of both disk and memory space requirements and is calculated using the following factors:
  - The number of members in the outline
  - The length, in characters, of member names and aliases

- The attribute association area of an outline is a component only of disk space and is calculated using the following factors:
  - The number of members in each base dimension
  - The number of members in each attribute dimension

To estimate the size of the outline file:

1. **Estimate the main area of the outline by multiplying the number of members by a name-length factor between 350 and 450 bytes.**

   If the database includes few aliases or very short aliases and short member names, use a smaller number within this range. If you know that the member names or aliases are very long, use a larger number within this range.

   Because the name-length factor is an estimated average, the following formula provides only a rough estimate of the main area of the outline:

   \[
   \text{number of members} \times \text{name-length factor} = \text{size of main area of outline}
   \]

   **Note:** See Appendix A, “Limits,” for the maximum sizes for member names and aliases.

   For memory space requirements calculated later in this chapter, use the size of the main area of the outline.

2. **For disk space requirements, if the outline includes attribute dimensions, calculate the size of the attribute association area for the database.** Calculate the size of this area for each base dimension. Multiply the number of members of the base dimension by the sum of the count of members of all attribute dimensions associated with the base dimension, and then divide by 8:

   \[
   \frac{\text{number of base-dimension members} \times \text{sum of count of attribute-dimension members}}{8} = \text{size of attribute association area for a base dimension}
   \]

   **Note:** Within the count of members, do not include Label Only members and shared members.

3. **Sum the attribute association areas of each dimension to determine the total attribute association area for the outline.**
For the total disk space required for the outline, add together the main outline area and the attribute association area:

main area of outline + total attribute association area

Write the result of this calculation to the cell labeled DH in Table 241 on page 1059.

Example

Assume the outline has the following characteristics:

- 26,000 members
- A name-length factor of 400 bytes
- A base dimension Product (23,000 members—excluding Label Only members and shared members) with two attribute dimensions associated with it—Ounces (20 members) and Pkg Type (50 members)
- A base dimension Market (2,500 members—excluding Label Only members and shared members) with one associated attribute dimension, Population (12 members)

Perform the following calculations:

1. Calculate the main area of the outline:
   \[ \text{name-length factor of 400 bytes} \times 26,000 \text{ members} = 10,400,000 \text{ bytes} \]

2. Calculate the attribute association areas:
   - For the base dimension Product:
     \[ \frac{(23,000 \times (20 + 50)) \text{ bits}}{8 \text{ bits per byte}} = 201,250 \text{ bytes} \]
   - For the base dimension Market:
     \[ \frac{(2,500 \times 12) \text{ bits}}{8 \text{ bits per byte}} = 3,750 \text{ bytes} \]

3. Sum these areas for the total attribute association area for the database:
   \[ 201,250 \text{ bytes} + 3,750 \text{ bytes} = 205,000 \text{ bytes} \]

4. For a total estimate of outline disk space, add the main area of the outline and the total attribute association area:
   \[ 10,400,000 \text{ bytes} + 205,000 \text{ bytes} = 10,605,000 \text{ bytes (outline disk space requirement)} \]

Note: Do not use this procedure to calculate outline memory space requirements. Use the process described in “Outline Size Used in Memory” on page 1070.

Work Areas

Three processes create temporary work areas on the disk:

- For recovery purposes, Essbase maintains a data recovery area on the disk. The size of this area increases until the database is restructured.
- During restructuring, Essbase uses a restructuring work area on the disk.
During upgrade from prior releases of Essbase, for recovery purposes, Essbase creates a copy of the database in a migration work area.

To create these temporary work areas, Essbase may require disk space equal to the size of the entire database. Restructuring and migration need additional work space the size of the outline. Because none of these activities occur simultaneously, a single allocation can represent all three requirements.

To calculate the size of a work area used for restructuring, migration, and recovery, calculate the sum of the sizes of the following database components from Table 241 on page 1059:

- Compressed data files (value DE)
- Index files (value DF)
- Fragmentation allowance (value DG)
- Outline (value DH)

Use the following formula to calculate the size of the work area:

\[
\text{work area} = \text{size of compressed data files} + \text{size of index files} + \text{fragmentation allowance} + \text{outline size}
\]

Write the result of this calculation to the cell labeled DI in Table 241 on page 1059.

Linked Reporting Objects Considerations

You can use the Linked Reporting Objects (LROs) feature to associate objects (also called artifacts) with data cells. The objects can be flat files, HTML files, graphics files, and cell notes. See Chapter 11, “Linking Objects to Essbase Data.”

Two aspects of LROs affect disk space:

- The size of the object. Because Essbase copies files used as LROs to the server, you must know the combined size of all files you are using as LROs.

  **Note:** You can set a limit on the size of a linked object, if the linked object is a file (as opposed to a cell note). See “Limiting LRO File Sizes” on page 893.

- The size of the LRO catalog, where the Essbase Kernel stores information about LROs. Cell notes and URLs are also stored in the catalog. A catalog entry is stored as an index page. For every catalog entry, Essbase uses 8 KB.

To estimate the disk space requirements for LROs:

1. Estimate the size of the objects. If a limit is set, multiply the number of LROs by that limit. Otherwise, sum the size of all anticipated LROs.

2. Size the LRO catalog. Multiply the total number of LROs by 8,192 bytes.

3. Add together the two areas and write the result of this calculation to the cell labeled DJ in Table 241 on page 1059.
Example

Assume the database uses 1,500 LROs, which comprise the following:

- 1,000 URLs, at a maximum of 512 bytes each
- 500 cell notes

Perform the following calculations:

1. Multiply 1,000 * 512 bytes for 512,000 bytes maximum required for the stored URLs.
2. Calculate the size of the LRO catalog. Multiply 1,500 total LROs * 8,192 bytes = 12,288,000 bytes.
3. Add together the two areas; for example:
   \[
   \begin{align*}
   & 512,000 \text{ bytes} \\
   & + 12,288,000 \text{ bytes} \\
   &= 12,800,000 \text{ bytes total LRO disk space requirement}
   \end{align*}
   \]

See also “Block Storage Database Limits” on page 1041 for Linked Reporting Objects considerations.

Estimating the Total Essbase Server Disk Space Requirement

The earlier calculations in this chapter estimate the data storage requirement for a single database. Often, multiple databases resides on the server.

In addition to the data storage required for each database, the total Essbase data storage requirement on a server includes Essbase software. Allow approximately 200 MB (209,715,200 bytes) for the base installation of Essbase software and sample applications. The allowance varies by platform and file system.

To estimate the total server disk space requirement:

1. In the worksheet in Table 242, list the names and disk space requirements that you calculated for each database.
2. Sum the database requirements and write the total in bytes in the cell labeled DL.
3. In the cell labeled DM, write the disk space requirement for the software installed on the server; for example, 209,715,200 bytes.
4. For the total server disk space requirement in bytes, sum the values in cells DL and DM. Write this value in the cell labeled DN.
5. Convert the total in cell DN to MB by dividing the value by 1,048,576 bytes. Write this value in the cell labeled DO.

Table 242 Worksheet: Estimate of Total Server Disk Space Requirement

<table>
<thead>
<tr>
<th>List of Databases ¹</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
</tr>
</tbody>
</table>

¹ List of databases includes the names and disk space requirements calculated for each database.
### List of Databases

<table>
<thead>
<tr>
<th>Database</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>b.</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td></td>
</tr>
<tr>
<td>g.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sum of database disk sizes:</th>
<th>DL:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a + b + c + d + e + f + g)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size in bytes for Essbase server software</th>
<th>DM:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Essbase Server disk requirement in bytes:</th>
<th>DN:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DL + DM)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Essbase Server disk requirement in megabytes (MB):</th>
<th>DO:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DN / 1,048,576 \text{ bytes})</td>
<td></td>
</tr>
</tbody>
</table>

1See Table 241 on page 1059

---

### Determining Memory Requirements

The minimum memory requirement for running Essbase is 64 MB. On UNIX systems, the minimum requirement is 128 MB. Based on the number of applications and databases and the database operations on the server, the memory you require may be greater.

To calculate the memory required for a database:

1. **Calculate the factors identified in “Factors to Be Used in Sizing Memory Requirements” on page 1068.**

2. **Calculate application memory requirements.**
   - See “Estimating Startup Memory Requirements for Applications” on page 1069.

3. **Calculate the memory required for a single database.**
   - See “Estimating Startup Memory Requirements for Databases” on page 1069.
   - If Essbase Server contains multiple databases, perform these calculations for each database.

4. **Calculate the total memory requirement for Essbase Server.**
Factors to Be Used in Sizing Memory Requirements

Before you start the estimate, calculate factors to be used in calculating the estimate.

Table 243 lists sizing factors with references to sections in this chapter and other chapters that provide information to determine these sizes. Go to the section indicated, perform the calculation, and return to Table 243. Write the size, in bytes, in the Value column this worksheet.

Later in this chapter, you can refer to Table 243 for values to use in various calculations.

<table>
<thead>
<tr>
<th>Database Sizing Factor</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number of cells in a logical block</td>
<td>MI:</td>
</tr>
<tr>
<td>See “The Number of Cells in a Logical Block” on page 1071.</td>
<td></td>
</tr>
<tr>
<td>The number of threads allocated through the SERVERTHREADS ESSCMD</td>
<td>MJ:</td>
</tr>
<tr>
<td>See the Oracle Essbase Technical Reference.</td>
<td></td>
</tr>
<tr>
<td>Potential stored-block size</td>
<td>MK:</td>
</tr>
<tr>
<td>See “Size of Expanded Data Block” on page 1057.</td>
<td></td>
</tr>
</tbody>
</table>

The calculations in this chapter do not account for the following factors that have complex implications on how much memory is used and are not included in the discussion:

- Cache memory locking. Whether cache memory locking is enabled affects how the operating system and Essbase manage memory. See “Deciding Whether to Use Cache Memory Locking” on page 824.
- Different operation types and their associated cache allocations. Data load, data retrieval, and calculation operations set aside memory for the data file, data, and calculation caches, plus some overhead associated with the caches.
- The sizes of the retrieval buffer and the retrieval sort buffer. See “Changing Buffer Size” on page 889 for a discussion of the significance of the size of the retrieval buffer and the retrieval sort buffer.
- Database workload; for example, the complexity of a calculation script or the number and complexity of data queries.
- The number of data blocks defined using the CALCLOCKBLOCK setting in the essbase.cfg file in combination with the SET LOCKBLOCK setting, which specifies which CALCLOCKBLOCK setting to use.
- The number of Dynamic Calc members in the outline, including members of attribute dimensions.
- The isolation level settings
- Synchronization points
- Use of triggers
- MDX implications
Estimating Startup Memory Requirements for Applications

You must calculate overall memory used at application startup plus the memory requirements for each database.

Each open application has the following memory requirements at startup:

- Essbase code and static data (10 MB). This number may vary, depending on the operating system.
- (Optional) JVM (2 to 4 MB), which is used for custom-defined functions. This value depends on the operating system.

Multiply the number of applications that will be running simultaneously on the server by the startup requirement and write the resulting value in the cell labeled ML in Table 246 on page 1078.

Estimating Startup Memory Requirements for Databases

Calculate memory requirements for each database on Essbase Server.

For each database, make a copy of Table 244 or use a separate sheet of paper as a worksheet for one database. If multiple databases are on Essbase Server, repeat this process for each database. Write the database name on the worksheet.

Each row links to information that describes how to size that component. Perform each calculation and note the results in the appropriate cell in the Size (MB) column. Some calculations use the factors that you wrote in Table 243 on page 1068. After filling in all the sizes in the Size column, total them to determine the memory requirement for that database.

<table>
<thead>
<tr>
<th>Database Name:</th>
<th>Size (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Memory Requirements:</strong></td>
<td></td>
</tr>
<tr>
<td>Startup requirements per database:</td>
<td></td>
</tr>
<tr>
<td>Database outline</td>
<td>MA:</td>
</tr>
<tr>
<td>See “Outline Size Used in Memory” on page 1070.</td>
<td></td>
</tr>
<tr>
<td>Index cache</td>
<td>MB:</td>
</tr>
<tr>
<td>See “Sizing Caches” on page 824.</td>
<td></td>
</tr>
<tr>
<td>Cache-related overhead</td>
<td>MC:</td>
</tr>
<tr>
<td>See “Cache-Related Overhead” on page 1071.</td>
<td></td>
</tr>
<tr>
<td>Area for data structures</td>
<td>MD:</td>
</tr>
<tr>
<td>See “Memory Area for Data Structures” on page 1072.</td>
<td></td>
</tr>
</tbody>
</table>
**Database Name:**

<table>
<thead>
<tr>
<th>Memory used for data retrievals</th>
<th>Size (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>See &quot;Estimating Additional Memory Requirements for Data Retrievals&quot; on page 1073.</td>
<td>ME:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Memory used for calculations</th>
<th>Size (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>See &quot;Estimating Additional Memory Requirements for Calculations&quot; on page 1077.</td>
<td>MF:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total memory required for the database:</th>
<th>Size (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA + MB + MC + MD + ME + MF</td>
<td>MG:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total database memory requirement in megabytes (MB):</th>
<th>Size (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MG / 1,048,576 bytes</td>
<td>MH:</td>
</tr>
</tbody>
</table>

Write the name of this database and the total memory required in Table 246 on page 1078, which is a worksheet for determining the memory requirement for all databases on the server (there are placeholders for seven databases—“a” through “g”).

Repeat this exercise for each database on the server. After estimating the memory required for all databases on the server, proceed to “Estimating the Total Essbase Server Disk Space Requirement” on page 1066.

**Outline Size Used in Memory**

The attribute association area included in disk space calculations is not a sizing factor for memory. Calculate only the main area of the outline.

For memory size requirements, outline size is calculated using the following factors:

- The number of members in the outline
- The length, in characters, of member names and aliases

To calculate the outline memory requirement, multiply the number of members by a name-length factor of 300 bytes-400 bytes and write the result in the cell labeled MA in Table 244 on page 1069.

If the database includes few aliases or very short aliases and short member names, use a smaller number in the 300 byte-400 byte range. If you know that the names or aliases are very long, use a larger number within this range.

Because the name-length factor is an estimated average, the following formula provides only a rough estimate of the main area of the outline:

\[
\text{memory size of outline} = \text{number of members} \times \text{name-length factor}
\]

**Note:** See Appendix A, “Limits,” for the maximum sizes for member names and aliases.
Example

Assuming that the outline has 26,000 members and a median name-length, use the following calculation to estimate the outline size used in memory:

\[
26,000 \text{ members} \\
\times \text{ 350 bytes per member} \\
= 9,100,000 \text{ bytes}
\]

Index Cache

At startup, Essbase sets aside memory for the index cache, the size of which can be user-specified. To determine the size of the index cache, see “Sizing Caches” on page 824 and write the size in the cell labeled MB in Table 244 on page 1069.

Cache-Related Overhead

Essbase uses additional memory while it works with the caches. The calculation for this cache-related overhead uses the following factors:

- Index cache (value MB from Table 244 on page 1069)
- The number of server threads (value MJ from Table 243 on page 1068)

To calculate the cache-related overhead at startup:

1. Calculate half the index cache size, in bytes.
   
   \[
   \text{index cache size} \\
   \times .5 \\
  = \text{index cache-related overhead}
   \]

2. Calculate additional cache overhead in bytes using the following formula:
   
   \[
   \left( \left( \text{# of server threads allocated to the Essbase Server process} \times 3 \right) \times 256 \right) \\
  + 5242880 \text{ bytes} \\
  = \text{additional cache overhead}
   \]

3. Sum the index cache overhead plus the additional cache overhead.
   
   \[
   \text{cache-related overhead} \\
  = \text{index cache-related overhead} \\
  + \text{additional cache overhead}
   \]

Write the result to the cell labeled MC in Table 244 on page 1069.

The Number of Cells in a Logical Block

The term logical block refers to an expanded block in memory.
To determine the cell count of a logical block, multiply all members of each dense dimension (including Dynamic Calc and Dynamic Calc and Store members but excluding Label Only and shared members):

1. Using Table 245 as a worksheet, enter each dense dimension and its number of members, excluding Label Only and shared members. If there are more than seven dense dimensions, list the dimensions elsewhere and include all dense dimensions in the calculation.

<table>
<thead>
<tr>
<th>Dense Dimension Names</th>
<th>Number of Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td></td>
</tr>
<tr>
<td>g.</td>
<td></td>
</tr>
</tbody>
</table>

2. Multiply the number of members of the first dense dimension (line a.) by the number of members of the second dense dimension (line b.) by the number of members of the third dense dimension (line c.), and so on, to determine the total number of cells in a logical block:

\[ a \times b \times c \times d \times e \times f \times g = \text{total number of cells} \]

Write the result to the cell labeled MI in Table 243 on page 1068.

Example

Excluding Label Only and shared members, the dense dimensions in Sample.Basic contain 17 (Year), 14 (Measures), and 4 (Scenario) members. The calculation for the cell count of a logical block in Sample.Basic:

\[ 17 \times 14 \times 4 = 952 \text{ cells} \]

Memory Area for Data Structures

At application startup, Essbase sets aside an area of memory based on the following factors:

- The number of members in the outline
- The number of cells in a logical block (value MI in Table 243 on page 1068)
- The number of threads on the server (value MJ in Table 243 on page 1068)

To calculate the data structure area in memory:

1. Use the following formula to calculate the size in bytes:
Number of threads
* ((Number of members in the outline * 26 bytes)
  + (Logical block cell count * 36 bytes))

2 Write the result in the cell labeled MD in Table 244 on page 1069.

Example

Assuming 20 threads for the Sample.Basic database, the startup area in memory required for data structures is calculated:

20 threads
* ((79 members * 26 bytes) + (952 cells * 36 bytes))
= 726,520 bytes
726,520 bytes
/ 1,048,576 bytes = .7 MB

Estimating Additional Memory Requirements for Database Operations

In addition to startup memory requirements, operations such as queries and calculations require additional memory. Because of many variables, the only way to estimate memory requirements of operations is to run sample operations and monitor the memory used during them. The following sections provide guidelines.

Estimating Additional Memory Requirements for Data Retrievals

Essbase processes requests for database information (queries) from many sources. For example, Essbase processes queries from Oracle Essbase Spreadsheet Add-in and Report Writer. Essbase uses additional memory when it retrieves the data for these queries, especially when Essbase must perform dynamic calculations to retrieve the data. This section describes Essbase memory requirements for query processing.

Essbase is a multi-threaded application in which queries get assigned to threads. Threads are automatically created when Essbase is started. In general, a thread exists until you shut down Essbase Server. See “Multithreading” on page 690.

As Essbase processes queries, it cycles through available threads. For example, assume that 20 threads are available at startup. As each query is processed, Essbase assigns each succeeding query to the next sequential thread. After it has assigned the 20th thread, Essbase cycles back to the beginning, assigning the 21st query to the first thread.

While processing a query, a thread allocates some memory, and then releases most of it when the query is completed. Some memory is released to the operating system, and some is released to the dynamic calculator cache for the database being used. However, the thread holds on to a portion of the memory for possible use in processing subsequent queries. As a result, after a thread has processed its first query, the memory held by the thread is greater than it was when Essbase first started.

Essbase uses the maximum memory for query processing when both conditions are true:

- The maximum simultaneous queries that will occur are being processed.
All threads have been assigned to at least one query by Essbase.

In the example where 20 threads are available at startup, the maximum amount of memory is used for queries when at least 20 queries have been processed and the maximum number of simultaneous queries are in process.

Calculating the Maximum Additional Memory Required

To estimate query memory requirements by observing actual queries:

1. Observe memory use during queries.
2. Calculate the maximum possible use of memory for query processing by totaling the memory used by queries that will be run simultaneously, and add the memory acquired by threads that are now waiting for queries.

Use the following variables when you calculate the formula in Estimating the Maximum Memory Usage for a Query Before and After Processing:

- Total number of threads (Total#Threads)
- Maximum memory usage for any query during processing (MAXAdditionalMemDuringP)
- Maximum number of possible concurrent queries (Max#ConcQueries)
- Maximum memory usage for any query after processing (MAXAdditionalMemAfterP)

Determining the Total Number of Threads

The potential number of threads available is based on the number of licensed ports that are purchased. The actual number of threads available depends on settings that you define for the Agent or the server. Use the number of threads on the system as the value for Total#Threads in later calculations.

Estimating the Maximum Number of Concurrent Queries

Determine the maximum number of concurrent queries and use this value for Max#ConcQueries in later calculations. This value cannot exceed the value for Total#Threads.

Estimating the Maximum Memory Usage for a Query Before and After Processing

The memory usage of individual queries depends on the size of each query and the number of data blocks that Essbase needs to access to process each query. To estimate the memory usage, calculate the additional memory Essbase uses during processing and after processing each query. Choose several queries that you expect to use the most memory. Consider queries that must process large numbers of members; for example, queries that perform range or rank processing.

To estimate the memory usage of a query:

1. Turn the dynamic calculator cache off by setting the essbase.cfg setting DYNCALCACHEMAXSIZE to 0 (zero). Turning off the dynamic calculator cache enables measurement of memory still held by a
thread by ensuring that, after the query is complete, the memory used for blocks during dynamic
calculations is released by the ESSVR process to the operating system.

2 Start the Essbase application.

3 Using memory monitoring tools for the operating system, note the memory used by Essbase Server before
processing the query. Use the value associated with the ESSVR process.

    Use this value for MemBeforeP.

4 Run the query.

5 Using memory monitoring tools for the operating system, note the peak memory usage of Essbase Server
while the query is processed. This value is associated with the ESSVR process.

    Use this value for MemDuringP.

6 Using memory monitoring tools for the operating system, after the query is completed, note the memory
usage of Essbase. This value is associated with the ESSVR process.

    Use this value for MemAfterP.

7 Calculate the following two values:

   ● Additional memory used while Essbase processes the query
     (AdditionalMemDuringP):
     \[
     \text{AdditionalMemDuringP} = \text{MemDuringP} - \text{MemBeforeP}
     \]

   ● Additional memory used after Essbase has finished processing the query
     (AdditionalMemAfterP):
     \[
     \text{AdditionalMemAfterP} = \text{MemAfterP} - \text{MemBeforeP}
     \]

8 When you have completed the above calculations for all the relevant queries, compare all results to
determine the following two values:

   ● The maximum AdditionalMemDuringP used by a query:
     (MAXAdditionalMemDuringP)

   ● The maximum AdditionalMemAfterP used by a query:
     (MAXAdditionalMemAfterP)

9 Insert the two values from step 7 into the formula in the following statement.

The additional memory required for data retrievals will not exceed the following:
\[
\text{Max#ConcQueries} \times \text{MAXAdditionalMemDuringP} + (\text{Total#Threads} - \text{Max#ConcQueries}) \times \text{MAXAdditionalMemAfterP}
\]

    Write the result of this calculation, in bytes, to the cell labeled ME in Table 244 on page 1069.

Because this calculation method assumes that all of the concurrent queries are maximum-sized
queries, the result may exceed your actual requirement. It is difficult to estimate the actual types
of queries that will be run concurrently.
To adjust the memory used during queries, you can set values for the retrieval buffer and the retrieval sort buffer. See “Setting the Retrieval Buffer Size” on page 889 and “Setting the Retrieval Sort Buffer Size” on page 890.

**Estimating Additional Memory Requirements Without Monitoring Actual Queries**

If you cannot perform this test with actual queries, you can calculate a rough estimate for operational query requirements. Requirements for each retrieval vary considerably. Generally, this estimate uses the following fixed factors:

- The size of the retrieval buffer (10,240 bytes)
- If sorting is involved in the query, the size of the retrieval sort buffer (20,480 bytes)
- The size of the buffer that holds formatting information (140 KB, which rounds up to 144,000 bytes)
- Report Writer factors:
  - 40 bytes per selected member in the retrieval
  - 8 bytes per member of the largest dimension

This estimate also uses the following variables:

- The memory used for dynamically calculated values, which is based on the following numbers:
  - The number of blocks specified by the SET LOCKBLOCK command.
  - The number of cells in a logical block, which includes Dynamic Calc members. See value MH in Table 244 on page 1069.
- The size of the data cache. See “Sizing the Data Cache” on page 827.
- If direct I/O is used, the size of the data file cache. See “Sizing the Data File Cache” on page 826.
- Report Writer factors the number of:
  - Selected members in an average retrieval.
  - Members in the largest dimension to calculate

You can then use the following two calculations for the memory needed for retrievals:

- **Buffer and work area used in each retrieval:**
  
  retrieval buffer (10,240 bytes)  
  + retrieval sort buffer (20,480 bytes)  
  + formatting buffer (144,000 bytes)  
  + each selected member in the retrieval (40 bytes)  
  + each member of the largest dimension (8 bytes)  
  + dynamic calc area  
  + data cache size  
  + data file cache size

- **Memory needed for estimated number of concurrent retrievals:**
Member storage area for the largest dimension
+ (number of retrievals
* sum of buffer and work areas used in each retrieval)

Summarize the calculations and write the result, in bytes, to the cell labeled ME in Table 244 on
page 1069.

Example
To estimate the maximum memory needed for concurrent queries, assume the following values
for this example:

- The area required by the largest dimension:
  23,000 members * 8 bytes/member = 184,000 bytes
- The buffer and work area values apply for each retrieval:
  - Retrieval buffer: 10,240 bytes
  - Retrieval sort buffer: 20,480 bytes
  - Formatting buffer: 144,000 bytes
  - Dynamic calc area: 761,600 bytes

  With SET LOCKBLOCK set as 100 blocks, the calculation:
  100 blocks * 7616-byte block size = 761,600 bytes
- Data cache size: 3072 KB, which equals 3,145,728 bytes
- Data file cache size: zero. Direct I/O is not used in the example.
- The largest dimension has 23,000 members.
- The maximum number of concurrent queries is 20.
- The number of selected members is generalized across all queries to be 10,000 members.

  The approximate memory requirement equals the following:
  10000 members * 40 bytes/member = 400,000 bytes

Estimated memory for retrievals:
184,000 bytes + (20 concurrent inquiries
* (10,240 bytes + 20,480 bytes + 144,000 bytes
+ 761,600 bytes + 3,145,728 bytes + 400,000 bytes))
= 75,824,960 bytes

**Estimating Additional Memory Requirements for Calculations**

For existing calculation scripts, you can use the memory monitoring tools provided for the
operating system on the server to observe memory usage. Run the most complex calculation
and notice the memory use before and while running the calculation. Calculate the difference
and use that figure as the additional memory requirement for the calculation script.

For a comprehensive discussion of calculation performance, see Chapter 57, “Optimizing
Calculations.”
If you cannot perform a test with a calculation script, you can calculate a very rough estimate for the operational requirement of a calculation by adding the following values:

- The size of the calculator cache.
  
  See “Sizing the Calculator Cache” on page 828.

- The size of the data cache.
  
  See “Sizing the Data Cache” on page 827.

- The size of the outline. For calculations, Essbase uses approximately 30 additional bytes of memory per member of the database outline. For information about concurrent calculations, see “Managing Caches to Improve Performance” on page 873.

- The size of the memory area used by the blocks set aside by the SET LOCKBLOCK command.
  - To calculate the memory requirement in bytes, multiply the specified number of data blocks by the logical size of the data blocks.
  
  - For the logical block size, multiply the number of cells (value MI in Table 243 on page 1068) by 8 bytes per cell.

For the total calculation requirement, summarize the memory needed for all calculations that will be run simultaneously and write that total to the cell labeled MF in Table 244 on page 1069.

**Note:** The size and complexity of the calculation scripts affect the memory required. The effects are difficult to estimate.

### Estimating Total Essbase Memory Requirements

You can use Table 246 as a worksheet on which to calculate an estimate of the total memory required on the server.

**Table 246  Worksheet: Total Server Memory Requirement**

<table>
<thead>
<tr>
<th>Component</th>
<th>Memory Required (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum of application startup memory requirements</td>
<td>ML:</td>
</tr>
<tr>
<td>See “Estimating Startup Memory Requirements for Applications” on page 1069.</td>
<td></td>
</tr>
</tbody>
</table>

In rows a–g, list concurrent databases (from copies of Table 244 on page 1069) and enter their respective memory requirements (MH) in the column to the right.

- a. MH:  
- b. MH:  
- c. MH:  
- d. MH:  
- e. MH:
To estimate the total Essbase memory requirement on a server:

1. In the cell labeled ML, record the total startup memory requirement for applications, as described in “Estimating Startup Memory Requirements for Applications” on page 1069.

2. List the largest set of databases that will run concurrently on the server. In the Memory Required column, for the MH value for each database, note the memory requirement estimated in the database requirements worksheet, Table 244 on page 1069.

3. Determine the operating system memory requirement, and write the value in megabytes to the cell labeled MN in Table 246.

4. Total all values and write the result in the cell labeled MO.

5. Compare the value in MN with the total available random-access memory (RAM) on the server.

**Note:** In addition, consider memory requirements for client software, such as Administration Services, that may be installed on the Essbase Server computer. See the Oracle Enterprise Performance Management System Installation and Configuration Guide.

If cache memory locking is enabled, the total memory requirement should not exceed two-thirds of available RAM; otherwise, system performance can be severely degraded. If cache memory locking is disabled, the total memory requirement should not exceed available RAM.

If insufficient memory is available, you can redefine the cache settings and recalculate the memory requirements. This process can be iterative. See “Fine-Tuning Cache Settings” on page 836. In some cases, you may need to purchase additional RAM.
In This Appendix

Understanding ESSCMD ................................................................. 1081
Preparing to Start ESSCMD ............................................................ 1084
Starting and Quitting ESSCMD ...................................................... 1084
Using Interactive Mode ................................................................. 1084
Using Script and Batch Files for Batch Processing ....................... 1086

Also see:

- Oracle Essbase Technical Reference for ESSCMD syntax and usage
- Oracle Essbase Administration Services Online Help for information about MaxL Script Editor

Understanding ESSCMD

With ESSCMD, you can execute Essbase Server operations at the command line, in either interactive or batch mode.

*Interactive mode* means entering commands at the ESSCMD command line and receiving prompts where necessary. Interactive mode is convenient for short operations that require few commands, checking for information on the fly, and error checking.

*Batch processing mode* is used for automating routine Essbase Server maintenance and diagnostic tasks. You can write a script or batch file and run it from the command line. Batch processing mode is convenient if you frequently use a particular series of commands, or if a task requires many commands.

Understanding Syntax Guidelines

In general, use the same syntax for entering ESSCMD commands that you do for other calculation commands. However, differences exist between the ESSCMD interactive and batch processing modes in the requirements for quotation marks and the semicolon statement terminator. Use the guidelines in this section when creating script or batch files.
Quotation Marks

Quotation marks (" ") enclose character parameters and responses to commands.

- In interactive ESSCMD, using quotes is optional. Use quotes when a parameter has an embedded space; for example:
  
  `CALC "Calc All;"`

- In an ESSCMD script file, always enclose all character parameters and responses to commands in quotation marks; for example:

  `LOGIN "Localhost" "user1" "Password";`

- Numeric parameters and responses do not require quotation marks.

- Do not enclose quotation marks within quotation marks.

Semicolon Statement Terminator

The ; (semicolon) statement terminator signals the end of a command; for example:

```
SELECT "SAMPLE" "BASIC";
```

- In interactive ESSCMD, pressing the Enter key signals ESSCMD that the command is complete. The statement terminator is optional.

- In an ESSCMD script file, you should use the terminator, even though it is optional, if a command has many parameters. Doing so is especially important to signal the end of the parameter list if some parameters are optional.

If you omit some optional parameters and do not use a semicolon to end the list, ESSCMD looks for the remaining values in the next command in the file, leading to unpredictable results.

The SETAPPSTATE and SETDBSTATE commands, defined in the Oracle Essbase Technical Reference, are examples of commands that you should terminate with a semicolon to prevent confusion in processing.

Note: All syntax examples in this chapter use quotation marks and semicolon terminators.

Canceling ESSCMD Operations

When running ESSCMD, you can cancel an asynchronous operation, such as a calculation, export, or restructure operation, by pressing and holding the Esc key until ESSCMD responds.

Referencing Files

Some commands require that you precede artifact or file names with a numeric parameter, from 1 to 4, that tells Essbase where to look for the artifact or file. The parameter directs ESSCMD to look for files in other applications, databases, or systems.
Table 247 lists each value for the numeric parameter (Number), the file location to which it applies, and the information that ESSCMD requests when you use each parameter setting. appname is the application name and dbname is the database name.

<table>
<thead>
<tr>
<th>Number</th>
<th>File</th>
<th>Essbase prompts user for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Local or client-based file</td>
<td>● Windows: Files in the ARBORPATH/client/appname/dbname directory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● UNIX: Files in the ARBORPATH/client/appname/dbname directory</td>
</tr>
<tr>
<td>2</td>
<td>Remote or server-based file</td>
<td>● Windows: Files in the ARBORPATH/app/appname/dbname directory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● UNIX: Files in the ARBORPATH/app/appname/dbname directory</td>
</tr>
<tr>
<td>3</td>
<td>File</td>
<td>Fully qualified path to the file, unless file is in the current ESSCMD directory</td>
</tr>
<tr>
<td>4</td>
<td>SQL table</td>
<td>Full network and database information for the SQL table</td>
</tr>
</tbody>
</table>

For example, the LOADDATA command can load a data file that resides on the client or Essbase Server. The command requires the numeric parameter to tell Essbase where to look for the data file. This example causes ESSCMD to prompt for the fully qualified path name of the file to load:

```
LOADDATA 3
```

File extensions are usually optional in interactive and batch processing modes, except when using commands that require a numeric parameter that indicates the location of files:

- If you use file option 3 (File), you must enter the file extension in both interactive and batch processing modes.
- If the artifact is in the directory from which you started ESSCMD, you need not enter a path.

## Accessing Multiple Databases

Because ESSCMD supports multiple login instances on Essbase Server, you can access multiple databases in a single session. Even when you log on to multiple databases, you use only one port on your server license.

## Considering Case-Sensitivity

The Essbase Server creates application and database names exactly as the user specifies. Case is not changed for any platform.

For backward compatibility, the Essbase Server searches for existing application and database names using the exact case first. However, if it cannot find the file, Essbase Server searches all possible case combinations to find the existing application and database names.

Essbase does not allow you to create application and database names that differ only in case. For example, Essbase displays an error message if application mYdATA exists and you try to create an application MyData.

You can choose to make member names case-sensitive.
To make a member case-sensitive:

See “Making Members Case-Sensitive” in the Oracle Essbase Administration Services Online Help.

**Getting Help**

For descriptions and syntax for individual ESSCMD commands, see the Oracle Essbase Technical Reference.

**Preparing to Start ESSCMD**

Before you start ESSCMD, ensure that the following items are installed and running:

- Essbase
- Communications protocol (TCP/IP) on Essbase

**Starting and Quitting ESSCMD**

ESSCMD comprises two files: `esscmd.exe` and `esscmd.hlp` (esscmd and esscmd.hlp on UNIX platforms) on Essbase Server and Essbase Administration Server.

To start ESSCMD, enter ESSCMD at the operating system command prompt.

When ESSCMD starts, a command prompt is displayed:

```
::: [n] ->
```

where `n` is the value of the active login instance. Each subsequent, successful login increments this value by one. When ESSCMD starts, the instance number is zero (0).

**Note:** Use the SETLOGIN command to toggle between active login instances. Use the LISTLOGINS command to view active login instances.

To quit ESSCMD, enter EXIT at the prompt and press Enter.

ESSCMD disconnects from the application server and terminates the session.

**Using Interactive Mode**

In interactive mode, you enter commands and respond to prompts, which is useful when you are performing simple tasks that require few commands. If you are performing more complex tasks that require many commands, consider creating a script file or batch file. See “Using Script and Batch Files for Batch Processing” on page 1086.

For syntax conventions when working in interactive mode, see “Understanding Syntax Guidelines” on page 1081.
Logging on to Essbase Server

After starting ESSCMD, you must connect to Essbase Server so that you can enter commands.

To log on to Essbase Server:

1. At the ESSCMD prompt, log on to the server with the LOGIN command.
   See the Oracle Essbase Technical Reference.

2. Enter the server name.
   When you connect from the Essbase Server window, the server name depends on your network setup. For example, the name could be aspen.

3. Enter your user name.

4. Enter your password.

The ESSCMD prompt is displayed:

```
aspen:::userName[1]->
```

`userName` is your login name.

You can enter any valid ESSCMD command. For a complete listing of commands, see the Oracle Essbase Technical Reference.

Note: To load an application into memory and select a database on the Essbase server, use the SELECT command to select a database from an application that resides on the server.

The ESSCMD prompt is displayed:

```
aspen: appname: dbname: userName[1]->
```

`appname` is the name of the application. `dbname` is the name of the database to which you are connected.

Entering Commands

Choose either of the following methods to enter commands in interactive mode:

- Enter the command and press Enter.
  
  ESSCMD prompts you for each of the command parameters. For example, the SELECT command has two parameters, as shown in the command syntax:
  
  ```
  SELECT "appname" "dbname";
  ```
  
  If you enter only SELECT and press Enter, ESSCMD prompts you for the first parameter, the application name (`appname`). After you enter the application name and press Enter, ESSCMD prompts you for the database name (`dbname`).

- Type the commands and all parameters, and press Enter.
Using SELECT as the example, you would enter:

SELECT "Sample" "Basic";

Whichever method you use, the interactive prompt now reflects the application and database names. For example, the following prompt tells you that the Sample application and Basic database are selected:

aspen:Sample:Basic:User[1]->

In this case, you can enter other commands without the application or database name parameters that it normally requires.

**Canceling Operations**

While ESSCMD is running, you can cancel an asynchronous operation, such as a calculation, export, or restructure operation, by pressing and holding the Esc key until ESSCMD responds.

**Caution!**

Do not pause or suspend your system while Essbase is processing a command. Pausing the system may prevent Essbase from correctly completing the command.

**Using Script and Batch Files for Batch Processing**

If you use a series of commands frequently or you must enter many commands to complete a task, consider automating the task with a script or batch file. These files are useful for batch data loads and complex calculations.

See “Understanding Syntax Guidelines” on page 1081.

- A **script file** contains ESSCMD commands. You can run a script file from the operating system command line or from within an operating system batch file, and the script file is processed by ESSCMD. By default, an ESSCMD script file has a `.scr` file extension. You can use a different extension.

- A **batch file** is an operating system file that calls multiple ESSCMD scripts and can also include operating system commands. You can use a batch file to run multiple sessions of ESSCMD. You can run a batch file on Essbase Server from the operating system prompt; the file is processed by the operating system. On Windows, batch files have `.bat` file extensions.

**Note:** On UNIX, a batch or script file is written as a shell script. A shell script usually has the file extension `.sh` (Bourne or Korn shell) or `.csh` (C shell).

When you run a script or batch file, ESSCMD executes the commands in sequence until it reaches the end of the file.

Some commands may be changed in new releases of Essbase. Changes might affect existing scripts. To ensure that your scripts work correctly in the current release, see the *Oracle Essbase*
New Features and the Essbase Readme for information about changed or deleted commands and change your scripts if needed.

Writing Script Files

ESSCMD script files automate an often-used or lengthy series of commands. Each script file must be a complete ESSCMD session, with login, application and database selection, logout, and termination commands.

To define a script file:

1. Enter ESSCMD commands in any editor that saves data in ASCII text.
2. Save the file with the .scr ESSCMD script file extension.

For example, the following script file, test.scr, was created in Notepad:

```
LOGIN "localhost" "User1" "password";
SELECT "Sample" "Basic";
GETDBSTATE
EXIT;
```

When run from the operating system command line, this script logs User1 into the Essbase localhost server, selects the Sample application and Basic database, gets database statistics, and quits the ESSCMD session.

Running Script Files

To run script files in ESSCMD:

1. Enter the following command at the operating system prompt:
   
   ESSCMD scriptFileName.scr

2. Replace scriptFileName with the name of the script file.
   
   For example, enter the following if the script file is in the current directory:
   
   ESSCMD TEST.SCR

3. If the script file is not in the current directory, include the path.
   
   For example:
   
   ESSCMD C:\WORK\SCRIPTS\TEST.SCR (an absolute path on Windows)
   
   or
   
   ESSCMD ..\SCRIPTS\TEST.SCR (a relative path on Windows)
Handling Command Errors in Script Files

ESSCMD error-handling features provide error checking and handling for your script files. You can write error-handling commands into your script file to check for errors and, if necessary, branch to an appropriate error-handling response.

After each ESSCMD command is executed, a number is stored in an internal buffer. If the command executes successfully, 0 is returned to the buffer. If the command is unsuccessful, the error number is stored in the buffer; a state called nonzero status.

For error checking within an ESSCMD script file, ESSCMD provides the following error-handling commands:

- **IFERROR** checks the previously executed command for a nonzero return status (failure to execute). If the status is not zero, processing skips all subsequent commands and jumps to a user-specified point in the file, where it resumes. The script file can branch to an error-handling routine or the end of the file.
- **RESETSTATUS** reverts all saved status values to 0 (zero) in preparation for more status checking.
- **GOTO** forces unconditional branching to a user-specified point in the file, whether or not an error occurred.

In this load.scr example file, if the LOADDATA command does not execute successfully, ESSCMD branches to the end of the file to avoid attempting to calculate and run a report script on the empty database:

```
LOGIN "localhost" "User1" "password" "Sample" "Basic";
LOADDATA 2 "calcdat";
IFERROR "Error";
CALC "Calc All;"
IFERROR "Error";
RUNREPT 2 "Myreport";
IFERROR "Error";
[possible other commands]
EXIT;

:Error
```

**Note:** You can use the OUTPUT command to log errors to a text file.

For the syntax and usage of ESSCMD error commands, see the Oracle Essbase Technical Reference.

Reviewing Sample Script Files

Essbase provides sample script files, based on the Sample.Basic database, that demonstrate common batch operations. The sample script files reside in the following directory:

ARBORPATH/app/Sample/Basic
**Sample Script: Importing and Calculating Data**

The *sample1.src* file executes the following actions:

- Logs on to Essbase Server
- Selects an application and database
- Prevents other users from logging on and making changes to the database
- Imports data from a text file
- Calculates the database
- Reenables logins
- Exits ESSCMD

```
LOGIN "Poplar" "TomT" "Password";
SELECT "Sample" "Basic";
DISABLELOGIN;
IMPORT 2 "ACTUALS" 4 "Y" 2 "ACTUAL" "N";
CALCDEFAULT;
ENABLELOGIN;
EXIT;
```

**Sample Script: Building Dimensions and Importing and Calculating Data from a SQL Source**

The *sample2.scr* file executes the following actions:

- Logs on to Essbase Server
- Selects an application and database
- Prevents other users from logging on and making changes to the database
- Updates the outline from an SQL data source
- Imports data from SQL
- Calculates the database
- Reenables logins
- Exits ESSCMD

```
LOGIN "Poplar" "TomT" "Password";
SELECT "Sample" "Basic";
DISABLELOGIN;
BUILDDIM 2 "PRODRUL" 4 "PRODTBL" 4 "PROD.ERR";
IMPORT 4 "TOMT" "PASSWORD" 2 "ACTUAL" "N";
CALCDEFAULT;
EXIT;
```

**Sample Script: Scheduling Report Printing**

The *sample3.scr* file executes the following actions:

- Logs on to Essbase Server
Selects an application and database
- Assigns reports that output to files for later printing
- Exits ESSCMD

LOGIN "Poplar" "TomT" "Password";
SELECT "Sample" "Basic";
RUNREPT 2 "REP1" "REP1.OUT";
RUNREPT 2 "REP2" "REP2.OUT";
RUNREPT 2 "REP3" "REP3.OUT";
EXIT;

**Writing Batch Files**

You can write a batch file that runs one or more ESSCMD scripts and includes operating system commands. See your operating system instructions to learn the syntax for writing batch files.

**Handling Command Errors in Batch Files**

For the operating system batch file, you can use ESSCMD command return values to control the flow of scripts that the batch file executes.

An ESSCMD program returns an integer value upon exiting. This value represents the status of the last executed command, usually whether the command succeeded or failed. You can set up your batch file to test for this value, and if the test fails, branch to an error-handling response. This process is similar to creating a script file. See “Handling Command Errors in Script Files” on page 1088.

For example, a batch file could contain three scripts: an ESSCMD batch file that loads data, a calculation script that performs calculations on the data, and a report script that reports on the results of the calculation. If the load batch file fails, the calculations and reporting also fail. In this case, it would be best to stop the batch file after the failure of the load file and correct the error that caused the failure before continuing. If your batch file tests for the return value of the load process, and this return value indicates failure, the batch file can jump to the end of the file and stop or execute some other error-handling procedure, rather than attempting to calculate data that did not load.

The following example shows a Windows operating system batch file and the contents of one of the ESSCMD scripts it runs, load.scr. Because error-checking requirements vary, the syntax in this example may not correspond to that of your operating system. See your operating system documentation for error checking in batch files.

An operating system batch file could contain commands like this:

```
ESSCMD LOAD.SCR
If not %errorlevel%==0 goto Error
ESSCMD CALC.SCR
If not %errorlevel%==0 goto Error
ESSCMD REPORT.SCR
If not %errorlevel%==0 goto Error
Echo All operations completed successfully
EXIT
```
:Error
Echo There was a problem running the script
Naming Conventions for Applications and Databases

When naming applications and databases, follow these rules:

- Use no more than 8 bytes when naming non-Unicode-mode applications and databases.
- Use no more than 30 characters when naming Unicode-mode applications and databases.
- Do not use spaces in the name.
- Do not use the characters listed in Table 248 in the name:

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>asterisk</td>
</tr>
<tr>
<td>[ ]</td>
<td>brackets</td>
</tr>
<tr>
<td>:</td>
<td>colon</td>
</tr>
<tr>
<td>;</td>
<td>semicolon</td>
</tr>
<tr>
<td>,</td>
<td>comma</td>
</tr>
<tr>
<td>=</td>
<td>equal sign</td>
</tr>
<tr>
<td>&gt;</td>
<td>greater-than sign</td>
</tr>
<tr>
<td>&lt;</td>
<td>less-than sign</td>
</tr>
<tr>
<td>Character</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------</td>
</tr>
<tr>
<td>.</td>
<td>period</td>
</tr>
<tr>
<td>+</td>
<td>plus sign</td>
</tr>
<tr>
<td>?</td>
<td>question mark</td>
</tr>
<tr>
<td>&quot;</td>
<td>double quotation mark</td>
</tr>
<tr>
<td>'</td>
<td>single quotation mark</td>
</tr>
<tr>
<td>/</td>
<td>forward slash</td>
</tr>
<tr>
<td>\</td>
<td>backslash</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>l</td>
<td>tabs</td>
</tr>
</tbody>
</table>

- For database names, do not use the:
  - String drxxxxxx (not case-sensitive)
  - Reserved word Replay

- For aggregate storage databases, do not use the following words as application or database names:
  - DEFAULT
  - LOG
  - METADATA
  - REPLAY
  - TEMP

Application and database names are not case-sensitive. However, on case-sensitive file systems, the application or database name is created exactly as you enter it. Therefore, when creating, renaming, or copying applications and databases on case-sensitive file systems, Essbase ensures that the same application or database name but with different case usage cannot be used. For example, if you create an application name with all uppercase letters (NEWAPP), you cannot then create an application with the same name but with mixed-case letters (Newapp). Also, when manually copying application and database files from one computer to another and then creating an application or database, you must use the same case for the application and database directory names on both computers.

**Naming Conventions for Dimensions, Members, and Aliases**

When naming dimensions, members, and aliases in the database outline, follow these rules:

- Use no more than 80 bytes when naming non-Unicode-mode dimensions, members, or aliases.
- Use no more than 80 characters when naming Unicode-mode dimensions, members, or aliases.
- Names are not case-sensitive unless case-sensitivity is enabled.
  See “Setting Outline Properties” in the Oracle Essbase Administration Services Online Help.
- Even when case-sensitivity is enabled, in an aggregate storage outline for which duplicate member names is enabled, do not use matching names with only case differences for a dimension name. For example, do not name two dimensions “Product” and “product.”
- Do not use quotation marks (“ ”), brackets ([ ]), or tabs in dimension, member, or alias names.
- At the beginning of dimension or member names, do not use the characters listed in Table 249:

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@</td>
<td>at sign</td>
</tr>
<tr>
<td>\</td>
<td>backslash</td>
</tr>
<tr>
<td>{ }</td>
<td>brace</td>
</tr>
<tr>
<td>,</td>
<td>comma</td>
</tr>
<tr>
<td>-</td>
<td>dash, hyphen, or minus</td>
</tr>
<tr>
<td>=</td>
<td>equal sign</td>
</tr>
<tr>
<td>&lt;</td>
<td>less than sign</td>
</tr>
<tr>
<td>()</td>
<td>parentheses</td>
</tr>
<tr>
<td>.</td>
<td>period</td>
</tr>
<tr>
<td>+</td>
<td>plus sign</td>
</tr>
<tr>
<td>'</td>
<td>single quotation mark</td>
</tr>
<tr>
<td>_</td>
<td>underscore</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Do not place spaces at the beginning or end of names. Essbase ignores such spaces.
- Do not use these words as dimension, member, or alias names:
  - Calculation script commands, operators, and keywords
  - Report Writer commands
  - Function names and function arguments.
  - Names of other dimensions and members (unless the member is shared), and generation names, level names, and aliases in the database
Any of these words:

ALL
AND
ASSIGN
AVERAGE
CALC
CALCMBR
COPYFORWARD
CROSSDIM
CURMBRNAME
DIM
DIMNAME
DIV
DYNAMIC
EMPTYPARAM
EQ
EQOP
EXCEPT
EXP
EXPPERROR
FLOAT
FUNCTION
GE
GEN
GENRANGE
GROUP
GT
ID
IDERROR
INTEGER
LE
LEVELRANGE
LOOPBLOCK
LOOPPARMS
LT
MBR
MBRNAME
MBRONLY
MINUS
MISSING
MUL
MULOP
NE
NON
NONINPUT
NOT
OR
PAREN
PARENPARAM
PERCENT
PLUS
RELOP
SET
SKIPBOTH
SKIPMISSING
SKIPNONE
SKIPZERO
Naming Conventions for Dynamic Time Series Members

If you enable Dynamic Time Series members, do not use the following associated generation names:

- History
- Year
- Season
- Period
- Quarter
- Month
- Week
- Day

Naming Conventions for Attribute Calculations Dimension Member Names

In unique member outlines that contain an attribute dimension (and, therefore, an Attribute Calculations dimension), do not use the following names unless you change the default names in the Attribute Calculations dimension:

- Sum
- Count
- Min
- Max
- Avg

If the outline is tagged as a duplicate member outline, you can use the default names to name other base or attribute members.

See “Changing the Member Names of the Attribute Calculations Dimension” on page 176.
Naming Conventions in Calculation Scripts, Report Scripts, Formulas, Filters, and Substitution and Environment Variable Values

In substitution variable values, environment variable values, calculation scripts, report scripts, filter definitions, partition definitions, or formulas, you must enclose member names in brackets ([ ]) when used within MDX statements, and otherwise in quotation marks (" "), in these situations:

- Name starts with one or more numerals (for example, 100).
- Name contains spaces or any characters listed in Table 250:

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&amp;</td>
<td>ampersand</td>
</tr>
<tr>
<td>*</td>
<td>asterisk</td>
</tr>
<tr>
<td>@</td>
<td>at sign</td>
</tr>
<tr>
<td>\</td>
<td>backslash</td>
</tr>
<tr>
<td>{ }</td>
<td>braces</td>
</tr>
<tr>
<td>:</td>
<td>colon</td>
</tr>
<tr>
<td>,</td>
<td>comma</td>
</tr>
<tr>
<td>-</td>
<td>dash, hyphen, or minus</td>
</tr>
<tr>
<td>!</td>
<td>exclamation point</td>
</tr>
<tr>
<td>=</td>
<td>equal sign</td>
</tr>
<tr>
<td>&gt;</td>
<td>greater than sign</td>
</tr>
<tr>
<td>&lt;</td>
<td>less than sign</td>
</tr>
<tr>
<td>()</td>
<td>parentheses</td>
</tr>
<tr>
<td>%</td>
<td>percent sign</td>
</tr>
<tr>
<td>.</td>
<td>period</td>
</tr>
<tr>
<td>+</td>
<td>plus sign</td>
</tr>
<tr>
<td>;</td>
<td>semicolon</td>
</tr>
<tr>
<td>/</td>
<td>slash</td>
</tr>
<tr>
<td>~</td>
<td>tilde</td>
</tr>
</tbody>
</table>
In calculation scripts and formulas, you must enclose these member names, which are also Essbase keywords, in quotation marks (" ") for block storage databases, and in brackets ([ ]) for aggregate storage databases:

BEGIN
DOUBLE
ELSE
END
FUNCTION
GLOBAL
IF
MACRO
MEMBER
RANGE
RETURN
STRING
THEN

List of Essbase System-Defined Dimension and Member Names

When using attribute dimensions, Essbase creates the following dimension and members names:

Member names in attribute dimensions:

- True
- False

Dimension name: Attribute Calculations

Member names in the Attribute Calculations dimension:

- Sum
- Count
- Min
- Max
- Avg

See “Naming Conventions for Attribute Calculations Dimension Member Names” on page 1097.

List of MaxL DDL Reserved Words

See “Reserved Words List” in the Oracle Essbase Technical Reference.
Differences in Security-Related Operations in Different Security Models

There are different security models for Essbase:

- **EPM System security mode**: Most of the security responsibilities are moved from Essbase to Shared Services. Security information stored in the Shared Services native directory include: users and groups information, roles assignment for users and groups, application information, and more. User authentication for users in external providers (such as LDAP, MSAD, and OID) is done through the providers. Security information in the `essbase.sec` file is kept to a minimum.

- **Fusion security mode**: Fusion JPS security is responsible for user and group management, as well as role management for users and groups. User authentication for users in external providers (such as LDAP, MSAD, and OID) is done through the providers. There is no security information stored in `essbase.sec`. Application and database information is still stored in `essbase.sec`.

Table 251 explains how security-related operations are handled in each security mode.

<table>
<thead>
<tr>
<th>Request</th>
<th>Oracle Enterprise Performance Management System Security</th>
<th>Fusion Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create user</td>
<td>Create Shared Services native user in the Shared Services native directory</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Create group</td>
<td>Create Shared Services native group in the Shared Services native directory</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Delete user</td>
<td>Delete Shared Services native user in the Shared Services native directory</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Delete group</td>
<td>Delete Shared Services native group in the Shared Services native directory</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Rename user</td>
<td>Rename Shared Services native user in the Shared Services native directory</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Rename group</td>
<td>Rename Shared Services native group in the Shared Services native directory</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Add user to group</td>
<td>Add user to group in the Shared Services native directory</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Request</td>
<td>Oracle Enterprise Performance Management System Security</td>
<td>Fusion Security</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>Add group to group</td>
<td>Add group to group in the Shared Services native directory</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Set password</td>
<td>Set the Shared Services native user password</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Migrate to Shared Services mode</td>
<td>Disabled (Essbase is already migrated)</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Migrate user to Shared Services mode</td>
<td>Migrate failed user to Shared Services mode</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Migrate group to Shared Services mode</td>
<td>Migrate failed group to Shared Services mode</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>List users that failed to migrate</td>
<td>List users that failed to migrate</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>List groups that failed to migrate</td>
<td>List groups that failed to migrate</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Create application</td>
<td>Create application in the <code>essbase.sec</code> file and register the application in the Shared Services native directory</td>
<td>Create application in the <code>essbase.sec</code> file</td>
</tr>
<tr>
<td>Create database</td>
<td>Create database in the <code>essbase.sec</code> file (Essbase databases are not registered in the Shared Services native directory)</td>
<td>Create database the <code>essbase.sec</code> file</td>
</tr>
<tr>
<td>Reregister application</td>
<td>Reregister application in the Shared Services native directory</td>
<td>Disabled (applies to Shared Services mode only)</td>
</tr>
<tr>
<td>Delete application</td>
<td>Delete application in the <code>essbase.sec</code> file and deregister the application in the Shared Services native directory</td>
<td>Delete application in the <code>essbase.sec</code> file</td>
</tr>
<tr>
<td>Delete database</td>
<td>Delete database in the <code>essbase.sec</code> file (Essbase databases are not registered in the Shared Services native directory)</td>
<td>Delete database in the <code>essbase.sec</code> file</td>
</tr>
<tr>
<td>Set user</td>
<td>Set security information for the user</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Set external user</td>
<td>Set security information for the external provider user</td>
<td>Disabled (an error message is returned)</td>
</tr>
<tr>
<td>Grant access to user</td>
<td>Grant access to system/application/database to user (stored in the Shared Services native directory)</td>
<td>Disabled (an error message is returned from Shared Services CSS API)</td>
</tr>
<tr>
<td>Grant access to group</td>
<td>Grant access to system/application/database to group (stored in the Shared Services native directory)</td>
<td>Disabled (an error message is returned from Shared Services CSS API)</td>
</tr>
<tr>
<td>Display user/group</td>
<td>Display users/groups that are provisioned to Essbase from Shared Services</td>
<td>Display users/groups that are stored in the <code>essbase.sec</code> file (filter assigned)</td>
</tr>
<tr>
<td>Grant filter to user</td>
<td>Grant filter to user (stored in the <code>essbase.sec</code> file)</td>
<td>Grant filter to user (stored in the <code>essbase.sec</code> file)</td>
</tr>
<tr>
<td>Grant filter to group</td>
<td>Grant filter to group (stored in the <code>essbase.sec</code> file)</td>
<td>Grant filter to group (stored in the <code>essbase.sec</code> file)</td>
</tr>
<tr>
<td>Request</td>
<td>Oracle Enterprise Performance Management System Security</td>
<td>Fusion Security</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Display filter</td>
<td>Display filters that are stored in the <code>essbase.sec</code> file</td>
<td>Display filters that are stored in the <code>essbase.sec</code> file</td>
</tr>
</tbody>
</table>
Essbase 32-Bit and 64-Bit Client and Server Compatibility

The following table summarizes the compatibility of 32-bit and 64-bit clients and servers with Essbase Server:

<table>
<thead>
<tr>
<th>Client</th>
<th>Server</th>
<th>Essbase Server: Platform to Which Client Can Connect</th>
</tr>
</thead>
<tbody>
<tr>
<td>32-bit Administration Services Console</td>
<td>32-bit Administration Services Server</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>32-bit Administration Services Console</td>
<td>64-bit Administration Services Server</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>64-bit Administration Services Console</td>
<td>64-bit Administration Services Server</td>
<td>64-bit</td>
</tr>
<tr>
<td>32-bit Essbase Studio Console</td>
<td>32-bit Essbase Studio Server</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>32-bit Essbase Studio Console</td>
<td>64-bit Essbase Studio Server</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>64-bit Essbase Studio Console</td>
<td>64-bit Oracle Essbase Studio Server</td>
<td>64-bit</td>
</tr>
<tr>
<td>32-bit Smart View</td>
<td>32-bit Provider Services</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>32-bit Oracle Smart View for Office</td>
<td>64-bit Provider Services</td>
<td>64-bit</td>
</tr>
<tr>
<td>32-bit Administration Services Console</td>
<td>32-bit Provider Services</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>64-bit Oracle Essbase Administration Services Console</td>
<td>64-bit Provider Services</td>
<td>64-bit</td>
</tr>
<tr>
<td>32-bit Java API or XMLA client application</td>
<td>32-bit Provider Services</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>64-bit Java API or XMLA client application</td>
<td>64-bit Provider Services</td>
<td>64-bit</td>
</tr>
</tbody>
</table>
Essbase API Compatibility on 32-Bit and 64-Bit Platforms

Essbase provides APIs for 32-bit and 64-bit platforms, which you can use to write and compile client programs that interface with Essbase Server.

- Client programs developed for 32-bit platforms using the Essbase C API or Visual Basic API can run on 32-bit platforms and connect to either 32-bit or 64-bit Essbase Server.
- Precompiled client programs developed using the 32-bit Essbase Visual Basic API can run on 64-bit Windows platforms connecting to 64-bit Essbase Server, as long as the 32-bit runtime environment is set up as according to the documented instructions.
- Client programs developed for 64-bit platforms using the Essbase C API:
  - Can run on 64-bit platforms and connect to 32-bit or 64-bit Essbase Servers
  - Cannot run on 32-bit platforms

**Caution!** Client programs developed for 64-bit platforms do not require the `#pragma` directive to set the byte alignment.

- You cannot develop a client program for 64-bit Windows using the Essbase Visual Basic API.

The following table summarizes the compatibility of client programs developed with Essbase APIs:

<table>
<thead>
<tr>
<th>Client Development: Platform with API Version</th>
<th>Platform on which Client Can Run</th>
<th>Essbase Server: Platforms to Which Client Can Connect</th>
</tr>
</thead>
<tbody>
<tr>
<td>32-bit C API / Runtime Client</td>
<td>32-bit</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>32-bit VB API / Runtime Client</td>
<td>32-bit Windows</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td></td>
<td>64-bit Windows</td>
<td>64-bit</td>
</tr>
<tr>
<td>32-bit Java (API or XMLA client application)</td>
<td>32-bit Provider Services server</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>32-bit embedded Java (API client application)</td>
<td></td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>64-bit C API / Runtime Client</td>
<td>64-bit</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>64-bit Java (API or XMLA client application)</td>
<td>64-bit Oracle Hyperion Provider Services server</td>
<td>64-bit</td>
</tr>
<tr>
<td>64-bit embedded Java (API client application)</td>
<td></td>
<td>64-bit</td>
</tr>
</tbody>
</table>
Essbase introduces behavior changes in addition to new features. Changes in behavior include not supported and deprecated features, components, configuration settings, options, and syntax.

**Terminology:**
- **Not supported**—In the release in which a feature is not supported, the functionality is either completely removed from the product or, if not completely removed, is no longer supported.
- **Deprecated**—In the release in which a feature is deprecated, the feature is still fully functional (unless limitations are specified) and supported. Typically, a deprecated feature will no longer be supported in the next release.

**Caution!** Oracle strongly recommends not implementing deprecated features.

This topic lists the Essbase features, by release, that were no longer supported or deprecated.

**Essbase 11.1.2.4**

For information about features that are no longer supported or are deprecated in this release, see the 11.1.2.4 Oracle Essbase Readme.
Essbase 11.1.2.3.503

Not supported calculation command: SET FORCEPARALLELCALC.
Consider using FIXPARALLEL instead.

Essbase 11.1.2.3.500

Not supported configuration settings:
- VLBREPORT
- XOLAPENABLEHEURISTICS

Essbase 11.1.2.3

Not supported features:
- Oracle Essbase Spreadsheet Add-in
- Data Mining

Deprecated configuration settings:
- PRELOADALIASNAMESPACE
- PRELOADMEMBERNAMESPACE

Essbase 11.1.2.2.100

Not supported functionality:
- Starting Essbase Server in the foreground
- Windows Authentication for SQL Server

Not supported configuration setting: MEMSCALINGFACTOR

Essbase 11.1.2.2.000

Not supported configuration settings:
- HSSREGNAME
- INSTANCENAME
- NODENAME is completely replaced by ESSBASESERVERHOSTNAME, which serves all the purposes of NODENAME, as well as specifies the host name to which Essbase binds.
- SHARDEDSERVICESLOCATION is no longer a valid setting. The necessary information is now centralized in the Oracle Hyperion Shared Services Registry.
Deprecated configuration setting: MEMSCALINGFACTOR

**Essbase 11.1.2.1**

Deprecated configuration settings:

- HSSREGNAME
- INSTANCENAME
- NODENAME is completely replaced by ESSBASESERVERHOSTNAME, which serves all the purposes of NODENAME, as well as specifies the host name to which Essbase binds.
- SHAREDSERVICESLOCATION is no longer a valid setting. The necessary information is now centralized in the Oracle Hyperion Shared Services Registry.

**Essbase 11.1.1.4**

Not supported feature: Reference cubes

Not supported Visual Basic API functions:

- EsbPartitionOpenDefFile
- EsbPartitionReadDefFile
- EsbPartitionWriteDefFile

Not supported configuration settings:

- CssSyncLevel
- CssRefreshLevel
- SharedServicesRefreshInterval

Not supported MaxL grammar:

- For the **alter application** MaxL statement:
  - sync user
  - sync group
  - sync all_users_groups
- For the **alter group** MaxL statement: all sync with all application
- For the **alter system** MaxL statement: resync sss
- For the **alter user** MaxL statement:
  - set type external with protocol MODULE-STRING identified by AUTH-PARAMETERS
  - sync security with all application
• For the **create user** MaxL statement: with protocol MODULE-STRING identified by AUTH-PARAMETERS

• For the **display user system** MaxL statement:
  1. all shared_services_native with auto_password
  2. all migr_modified_access

Not supported C main API functions:

• EssGetMigrModifiedAccessUsers
• EssGetNewSSNativeEssbaseUsers
• EssReassignIdentity
• EssResyncSSSecurity
• EssSyncGroupWithApp
• EssSyncUser
• EssSyncUserWithApp
• EssSyncUsersandGroupsWithApps

### Essbase 9.3.3

Not supported functionality:

• Security Synchronization between Oracle Essbase and Shared Services
• Custom authentication using non Oracle Hyperion Shared Services-based LDAP or MSAD modules

Deprecated configuration settings:

• CssSyncLevel
• CssRefreshLevel
• SharedServicesRefreshInterval

Deprecated MaxL grammar:

• For the **alter application** MaxL statement:
  1. sync user
  2. sync group
  3. sync all_users_groups

• For the **alter group** MaxL statement: all sync with all application

• For the **alter system** MaxL statement: resync sss

• For the **alter user** MaxL statement:
- set type external with protocol MODULE-STRING identified by AUTH-PARAMETERS
- sync security with all application

- For the create user MaxL statement: with protocol MODULE-STRING identified by AUTH-PARAMETERS

- For the display user system MaxL statement:
  - all shared_services_native with auto_password
  - all migr_modified_access

Deprecated C main API functions:
- EssGetMigrModifiedAccessUsers
- EssGetNewSSNativeEssbaseUsers
- EssReassignIdentity
- EssResyncSSSecurity
- EssSyncGroupWithApp
- EssSyncUser
- EssSyncUserWithApp
- EssSyncUsersandGroupsWithApps