Hierarchy Developer's Guide for Oracle Self-Service E-Billing

Version 6.2

October 2013

ORACLE

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 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.

Contents

1 What's New in This Release

What's New in Hierarchy Developer's Guide for Oracle Self-Service E-Billing, Version 6.2

No new features have been added to this guide for this release. This guide has been updated to reflect only product name changes.

2 Hierarchy Manager Overview

This chapter covers the tasks for customizing the Oracle Self-Service E-Billing Hierarchy Manager functionality. It includes the following topics:

Key Features of Hierarchy Manager

Hierarchy Manager provides an organizational console for mapping the department and personnel structures of a business customer's entire enterprise. The Web browser interface minimizes training and maximizes productivity. Hierarchy Manager enables authorized users within a business-to-business (B2B) organization to quickly model personnel and departments and grant appropriate access at each level of the structure. Hierarchy Manager saves organizational data and structures in an extremely efficient format for rapid searches and queries across a hierarchy.

Hierarchy Manager provides user access control. It also provides a mechanism to glue together data into a tree structure. When you define a hierarchy structure, you can navigate and run reports based on that structure.

Key features of Hierarchy Manager include:

- Robust and generic organizational modeling
- Unlimited levels in a hierarchy
- Hierarchy-based Access Control (HBAC)
- Works with Object Management Framework (OMF) to allow any type of business object being linked into Hierarchy Manager
- Multiple hierarchies with associated type value
- Versioned hierarchy structure changes
- Advanced searching and filtering on multiple criteria
- Importing and exporting of data and hierarchy structures
- Supports analytic reporting
- Works with Extract Transform Loading (ETL) Process
- Public APIs to allow additional customization
- Provides an extension framework to support custom behaviors
- Support for configurable hierarchy type with rules
- Provides a framework for OLTP and OLAP data synchronization

- Provides flexible transaction management under the Spring framework
- Provides a default Hierarchy Manager UI
- Object Management Framework (OMF) Features and Services
- OMF provides a set of generic interfaces and functions for handling business object creation, registration, lookup and resolution of universal resource identification for any kind of business objects. OMF also provides a reusable catalog of business objects that are used by Hierarchy Manager. The generic OMF interfaces allows Hierarchy Manager to link, remove, find and search objects linked into Hierarchy Manager in a uniform way, without having to know the specific type of business objects.

Preconfigured Hierarchy Manager Business Objects

The following set of business objects are preconfigured with Oracle Self-Service E-Billing Hierarchy Manager:

- Billing Account
- Company
- Service Agreement
- Charge Type
- Service Charge Type
- Service Plan

3 Hierarchy Manager Concepts

This chapter describes the basic concepts of Oracle Self-Service E-Billing Hierarchy Manager functionality. It includes the following topics:

Elements of Hierarchy Manager

The basic elements of a hierarchy include:

- **Hierarchy.** A system organized in the shape of a pyramid, with each row of objects called nodes, linked to objects directly beneath it. A hierarchy contains a root directory at the top of the pyramid and subdirectories below it.
- **Hierarchy Nodes.** A representation of linked business objects and are organized into parent-child relationships in the hierarchy.
- **Element or Business Object.** A generic term for elements represented within hierarchy structures. Business objects include items such as folderbusiness objects and object types. Each type of object will have different properties and actions associated with it. To be linked into a hierarchy, you must implement certain interfaces in the business object, for example:
  - **Billing Account.** An account from the billing system that generates an invoice or statements.
  - **Service Agreement (Contract).** Could be the leaf node of the hierarchy, or a node that has a parent node. A credit card, MTN, or a Mobile Subscriber Integrated Services Digital Network-Number (MSISDN) are examples of a service agreement or contract.

Hierarchy Manager Business Objects

Business objects must implement the Object Management Framework (OMF) object interface:

- **Link Target.** Business objects that are linked into one or more hierarchies. A given link target can only be linked once within one hierarchy, but can be linked to multiple different hierarchies at the same time. To link your business object through a hierarchy, you must implement the link target interface for your OMF object. By default, a user is a special element that is NOT a link target.
- **Group or Folder.** A specific link target maintained within the hierarchy that can have business objects as children, such as MSISDNs and MTN, and users, along with additional folders.
- **Service Provide.** Company that provides services that a customer has signed contracts for.
- **Customer.** A Customer of the Service Provider.
- **User.** An enrolled user that has a unique login name, password, and individually assigned and managed permissions that are assigned to a node in the hierarchy.
- **Role.** A role is a customer-defined set of default permissions that can be assigned to a user. The roles are permission sets that are customized by the client based on business requirements. The permissions mapped to roles are outside the scope of Hierarchy Manager.
- **Permission.** Permission allows a user to view or take action on information they have access to, based on the nodes they are assigned to in the hierarchy. Permissions include view summary, view detail, pay, report, manage hierarchy, assign users, assign permissions, and so on.

Hierarchy and Role Access Control

Hierarchy Manager supports both access control based on hierarchy and role.

- **Hierarchy-Based Access Control.** A user is assigned or associated with one of the nodes inside Hierarchy Manager. Once a node is assigned, the user has granted access to all the nodes under the assigned node, as shown Figure 1.

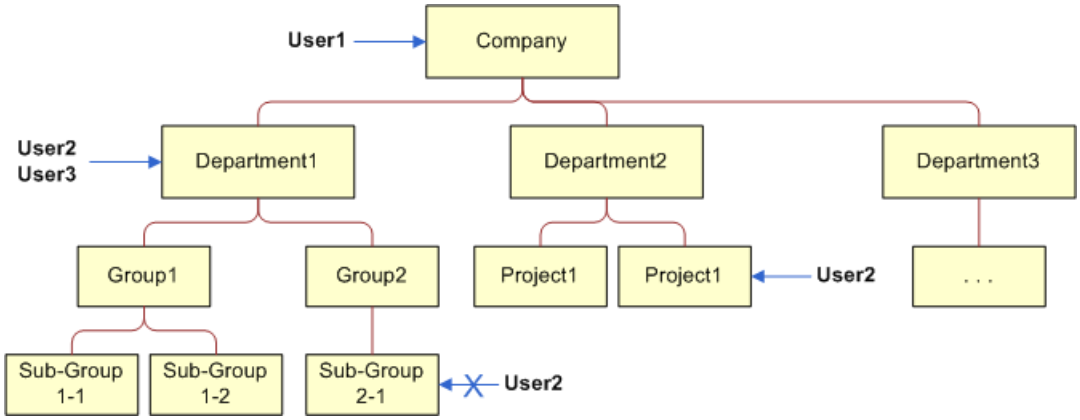

Figure 1. Example of Hierarchy-Based Access Control

A user can be assigned to one or multiple nodes in the same hierarchy as long as these nodes are not on the same path to the root node.

- **Hierarchy Role-Based Access Control.** Hierarchy Manager supports the following roles:
  - **Subscriber.** Users with the Subscriber role can view assigned hierarchies, including all nodes from the assigned node down. Subscribers can view assigned hierarchies only, and cannot edit or make assignments. Subscribers must be assigned or associated with a node in order to access the hierarchy.
  - **Manager.** User with the Manager role can view assigned hierarchies, including all nodes from the assigned node down. Managers can create, view, edit, and delete hierarchies, and assign or un-assign other Managers and Subscribers to and from subtrees. Managers must be assigned or associated with a node in order to access the hierarchy.
  - **System Administrator.** Users with the System Administrator role can view hierarchies within their company, including all nodes in the hierarchy. System Administrators can create, view, edit, and delete hierarchies and assign Managers and Subscribers. System Administrators do not need to be assigned or associated with any hierarchy tree node in order to see the hierarchy.
  - **Customer Service Representative (CSR).** Customer Service Representatives can view all hierarchies across companies, starting from the root node, and can create and delete hierarchies. By default, the Hierarchy Manager UI does not support the Customer Service Representative role, however, an API allows you custom implementation.

Hierarchy Type

Each hierarchy is associated with a hierarchy type. Multiple hierarchies can share the same type and you can have multiple hierarchy types. Hierarchy types are configurable during deployment.

Oracle Self-Service E-Billing Hierarchy Manager provides the following hierarchy types:

- **Billing Hierarchy.** Based on the inherent structures contained within the invoice data stream. billing hierarchies are created automatically at billing data load time. The structure of the billing hierarchy cannot be modified by the end user. A simple billing hierarchy could work as shown in Figure 2.
- **Business Hierarchy.** Also referred as organizational hierarchy. Business hierarchies are user-defined structures that represent the business' groups and cost centers, they can contain service line usage and charges taken from multiple accounts.

Figure 2 shows a simple billing hierarchy structure.

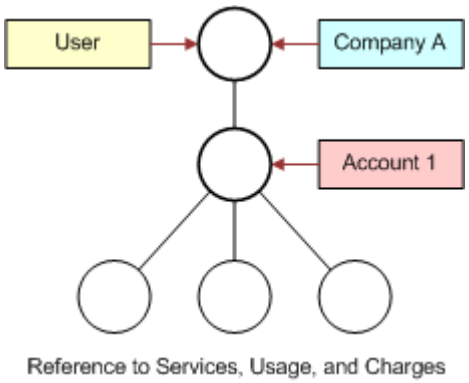

Figure 2. Simple Billing Hierarchy Structure

Reporting Periods and Versioning

Hierarchy Manager versions changes made across reporting periods.

Reporting Periods

A hierarchy reporting period defines a time range with a start and end date. The reporting period start and end dates do not have to match the billing periods defined in external billing system. The reporting period is the smallest time interval for hierarchy versioning. Only the changes made across different hierarchy periods are versioned. Changes made to hierarchies within a reporting period are not tracked or versioned. Figure 3 illustrates the relationship between hierarchy reporting periods and billing periods.

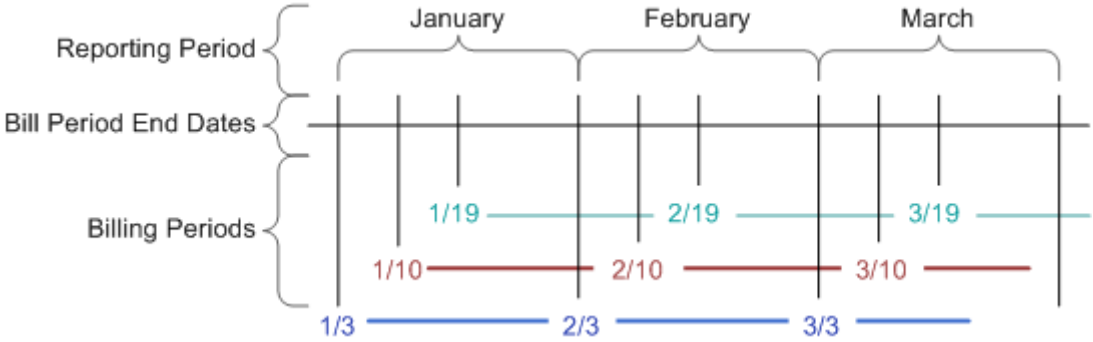

Figure 3. Reporting Periods

Hierarchy Versioning

Changes made to the hierarchy structure and the relationship across different reporting periods are versioned. Changes made to user assignments and link target attributes are not versioned. Structure changes are versioned. Figure 4 shows an example of hierarchy versioning.

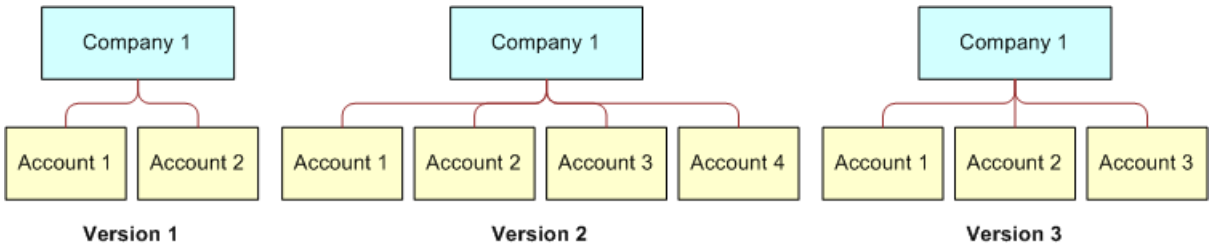

Figure 4. Versioning Example

Attributes of a link target are not versioned. As shown in Figure 5, if the owner of Phone1 changes from Joe to Susan, the information that Joe has owned Phone1 in the past will be lost.

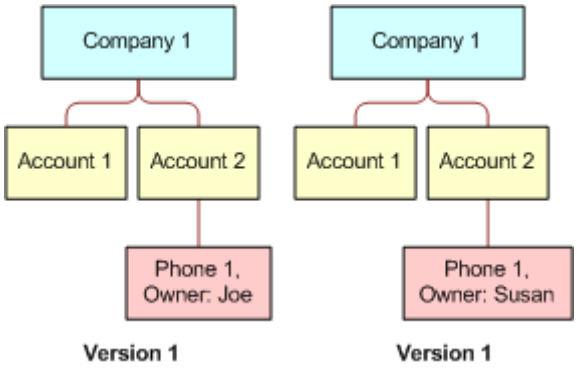

Figure 5. Link Target Attributes

Hierarchy Life Cycle States

Once you create a hierarchy, it goes through the following states before being completely removed from the Oracle Self-Service E-Billing database:

- **Unpublished.** When a hierarchy is first created, it is in an unpublished state. Unpublished hierarchies can only be available or accessed by its creator and system administrators. Changes made to the hierarchy are not versioned. Reporting is not available on an unpublished hierarchy.
- **Published.** Once a hierarchy is published, structural changes made to the hierarchy will be versioned. A published hierarchy cannot be unpublished. A published hierarchy is available for public to use, and accessibility is controlled based on user's role and association with hierarchy. You can run reports on published hierarchies.
- **Expired.** A published hierarchy can be expired by an administrator or a manager user. Once a hierarchy is expired from a given period, hierarchy information from the following period and onwards is removed. However, data for periods prior that expiring period, inclusive, is still available for editing and reporting.
- **Deleted.** A user can delete a hierarchy, which marks the hierarchy as deleted in the database. Deleted hierarchies are not available for the user to access for any periods. Run a housekeeping batch job to physically remove all marked as deleted hierarchies from the database.

Figure 6 illustrates the state transition of a hierarchy.

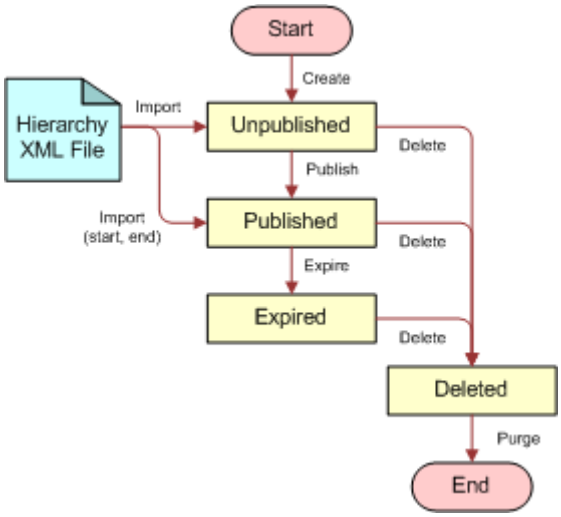

Figure 6. State Transition of a Hierarchy

Data Replication

Once a hierarchy is published, changes made to that hierarchy will be versioned across reporting periods. When a new period starts, a backend scheduled job is run to replicate the latest hierarchy structure to the current period. Only the references to the relationship are replicated for each period.

Assigned and Unassigned Objects

Hierarchy Manager defines the following assigned and unassigned objects:

- **Assigned Link Targets or OMF Objects.** Link targets or business objects that have been linked into the current hierarchy or into the sub-tree from the current node down.
- **Un-Assigned Link Targets or OMF Objects.** Link targets or business objects that the current user has been granted access to, but that have not yet been linked into the current hierarchy, or into the sub-tree from the current node down.
- **Assigned Users.** Users of the current company, who have been associated at least once to a node from current node down, or current hierarchy.
- **Unassigned Users.** Users of the current company, who can be associated to the current node, or the root node of the hierarchy.
- **Authorized Users.** Users who have permission to access the current node, which includes users associated with the current node, and those with any ancestor nodes.
- **Unauthorized Users.** Users of the current company that do not have access to the current node.

Consider the following points when using Hierarchy Manager in your application:

- Hierarchy Manager's tree structure does not support multiple parents.
- Only one unique link target for each hierarchy is supported.
- Each hierarchy is unique by domain ID or company ID, and name.
- Each company or domain can only have one billing hierarchy.

Hierarchy Example

There are two types of hierarchies:

- Billing system hierarchies
- Organizational structure hierarchies

Most billing systems cannot accurately model the business structure of an organization, because the two hierarchy structures are usually very different. The following diagram shows how a telecommunication company could model one of their customers in their billing system. In the example, there are two accounts, and each account has several mobile phones. Each account number has an invoice produced for it, and the accounts can be on different billing cycles. In the example shown in Figure 7, account number 1234 is billed on the first of each month, and account number 2345 is billed on the 15th of each month. The billing system might not know that these two accounts belong to the same company.

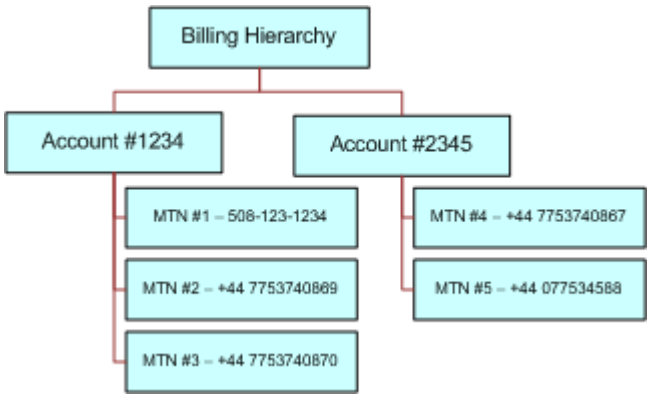

Figure 7. Billing Hierarchy Example

Most companies have more complex business structures than the preceding example, which they would like to map to the contracts they have with the Service Provider. The example in Figure 8 shows how the two accounts can be modeled from a business structure point of view.

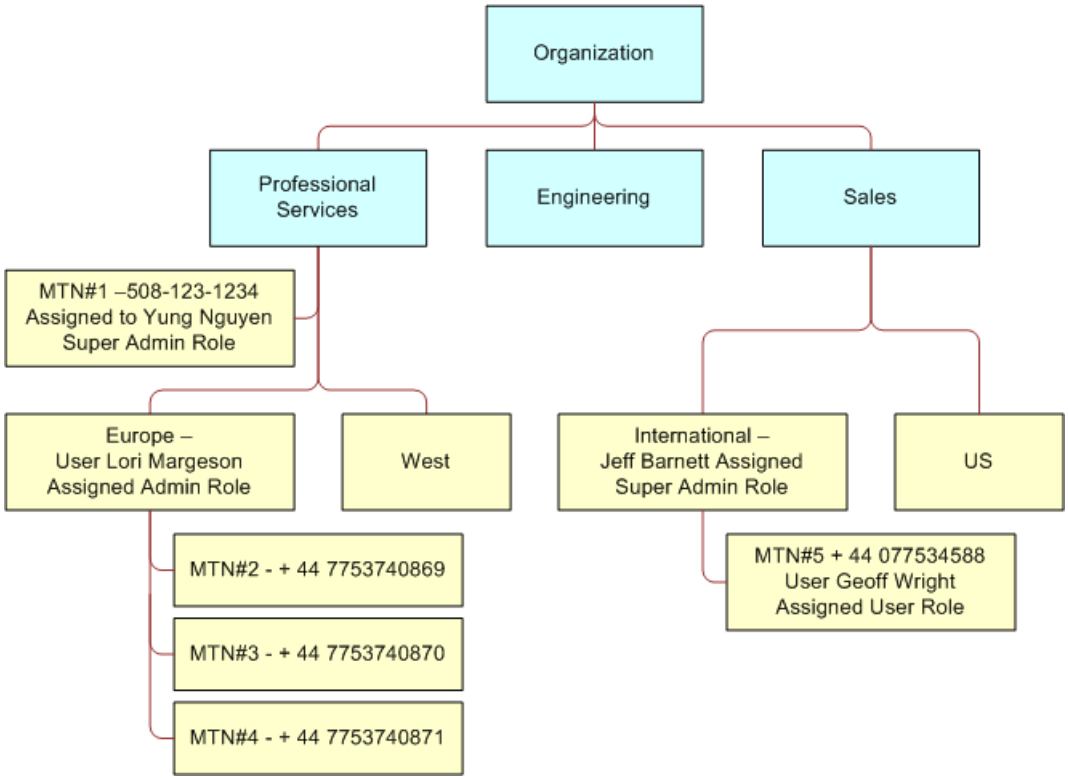

Figure 8. Business Hierarchy Example

The business structure in this example provides much better interaction between the service provider and customer in an online customer self service offering. In this example, both contracts and users are assigned to a business structure. However, in many organizations, one business structure is not sufficient. Month to month, organizations can require a project structure that is very different from the original business structure. Figure 9 illustrates how the same billing hierarchy used in the first business structure can be arranged into a completely different business structure.

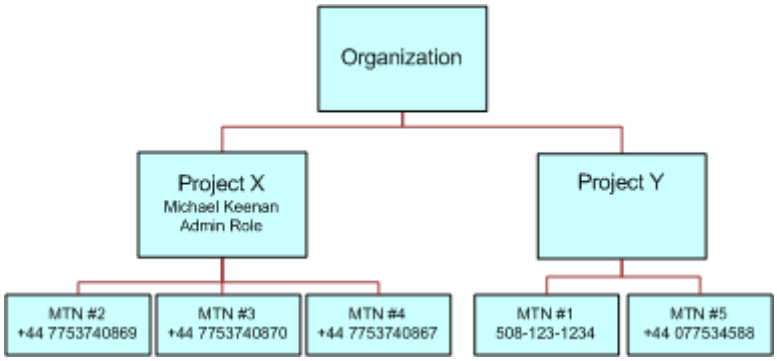

Figure 9. Rearranged Business Structure Example

Each of these example of business structures models how a customer could design a hierarchy to support the functions provided in a Billing and Payment application. Payment, electronic bill viewing, order management, service management, and reporting all use the business structures. Business structures provide the scope for the other components to act on. User and business objects can be assigned to each of the business structures. Hierarchy Manager provides only the business structures and captures user access control. The ability to use this structure to perform analytics, make payments, or other features are the responsibility of the other modules.

Additionally, the user management and role-based access control features are components separate from Hierarchy Manager. The assignment and role of a user at a level of hierarchy is performed using Hierarchy Manager, but management of the user and access control is separate.

ETL Processing

During ETL processing, accounts, service agreements (such as MTNs or MSISDNs) and other business object dimension data and fact data are loaded into the OLAP database. In addition, the ETL exchange table EDX_RPT_ETL_XCHANGE, which captures information about accounts, service agreements, companies and billing hierarchies, is populated and used to load corresponding production tables in OLTP database.

OLTPProductionLoader is one of steps in the ETL process, which loads different business objects from OLAP database tables, including Hierarchy Manager, into OLTP database production tables.

Figure 10 illustrates ETL processing.

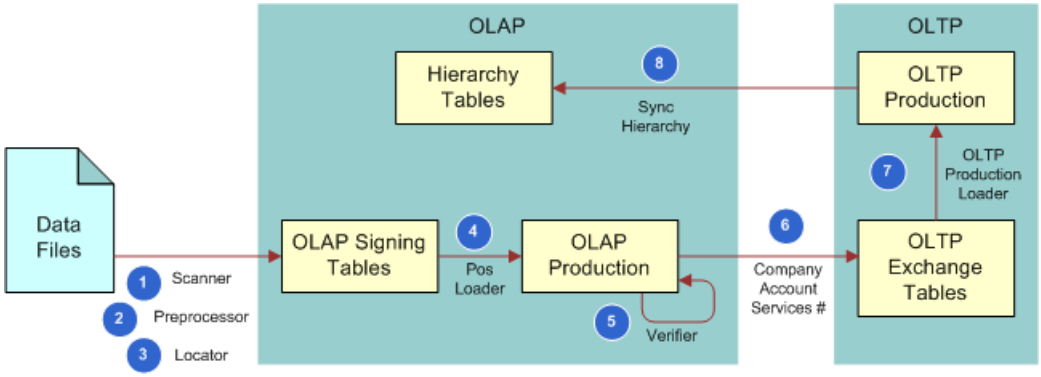

Figure 10. ETL Processing

Among account and service loaders, which populate account and service agreement tables to OLTP production (step 7 in the diagram), Hierarchy Manager ETL loader reads hierarchy information from the EDX_RPT_ETL_XCHANGE table and populates Hierarchy Manager tables. While the changes are made to Hierarchy Manager in OLTP tables, the same changes are pushed into OLAP hierarchy tables as well. For additional information about setting up and using the ETL process, see *Implementation Guide for Oracle Self-Service E-Billing* and *Administration Guide for Oracle Self-Service E-Billing*.

4 Hierarchy Manager and OMF Architecture

This chapter describes the Oracle Self-Service E-Billing Hierarchy Manager and Object Management Framework (OMF) architecture. It includes the following topics:

Hierarchy Manager Purpose and Components

Hierarchy Manager provides a set of APIs and services to allow applications to model arbitrary hierarchical relationships among any kinds of business objects. The core module design and extension framework make Hierarchy Manager well-suited in tightly coupled systems or in a federated database. Figure 11 shows the Hierarchy Manager components.

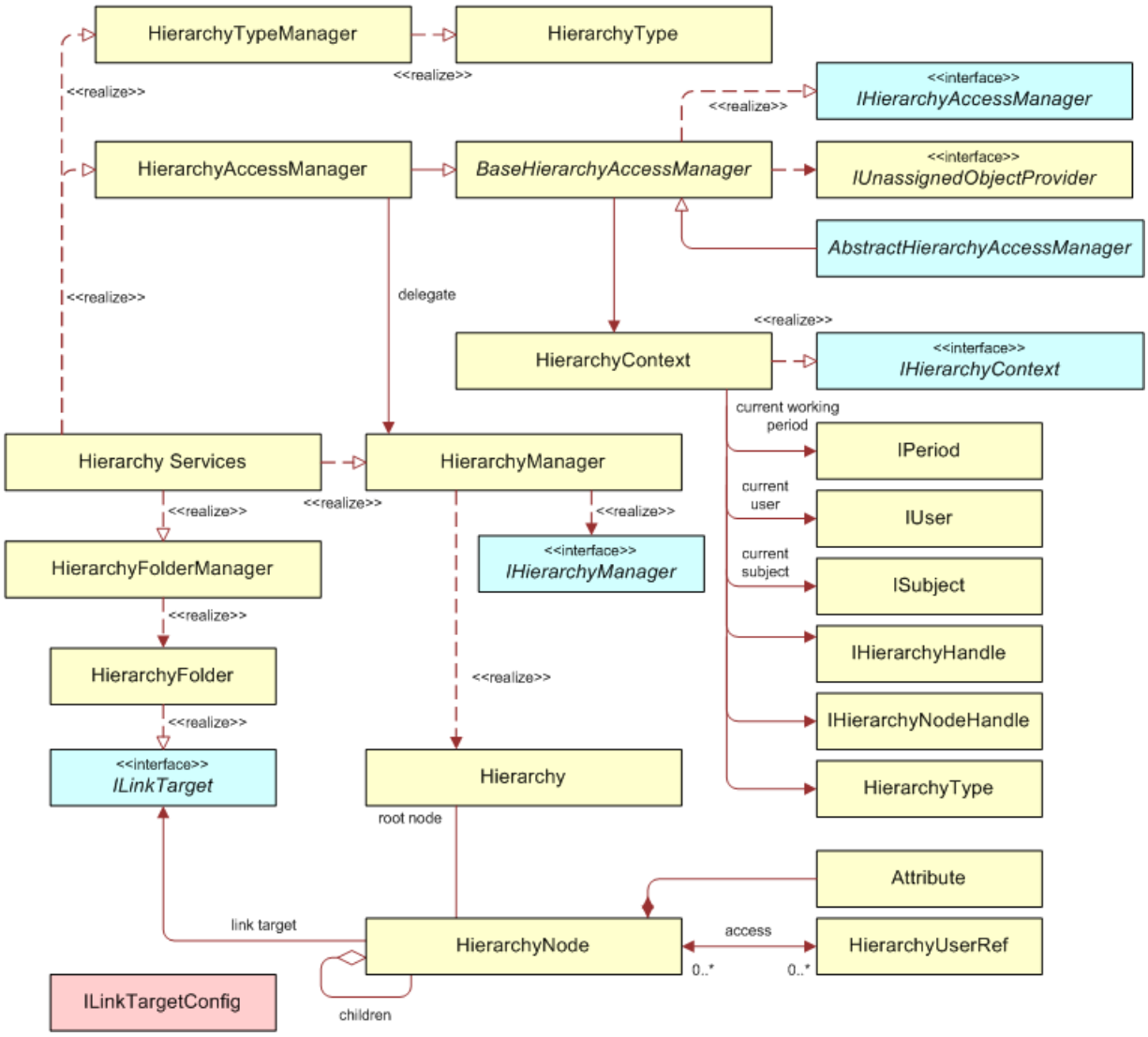

Figure 11. Hierarchy Components

Figure 12 shows a typical activity flow in Hierarchy Manager.

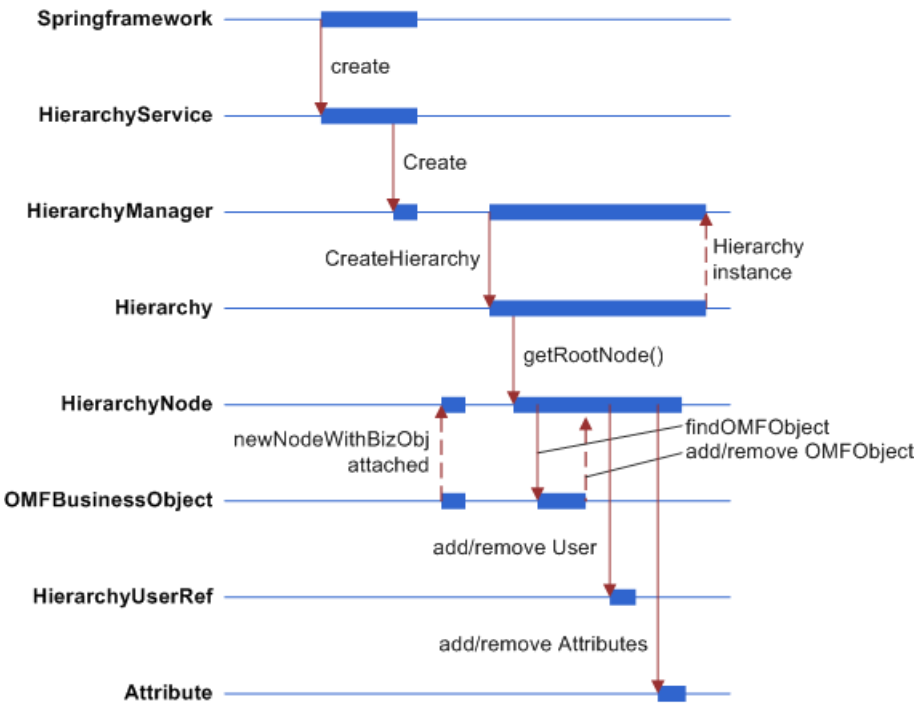

Figure 12. Hierarchy Manager Activity Flow

Figure 13 shows the key interfaces from the OMF component.

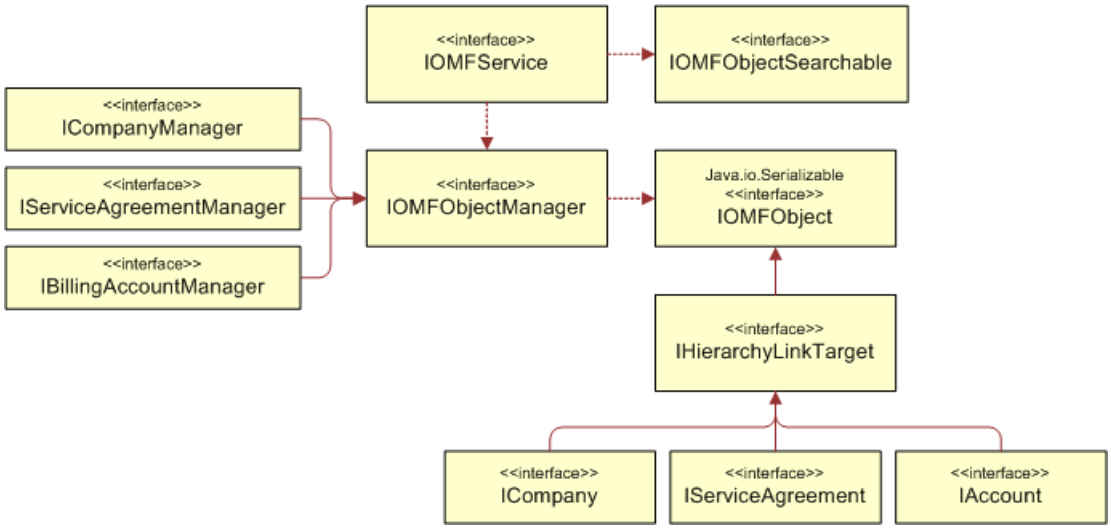

Figure 13. Key OMF Interfaces

System Collaborations

Figure 14 shows the collaboration of systems in Hierarchy Manager.

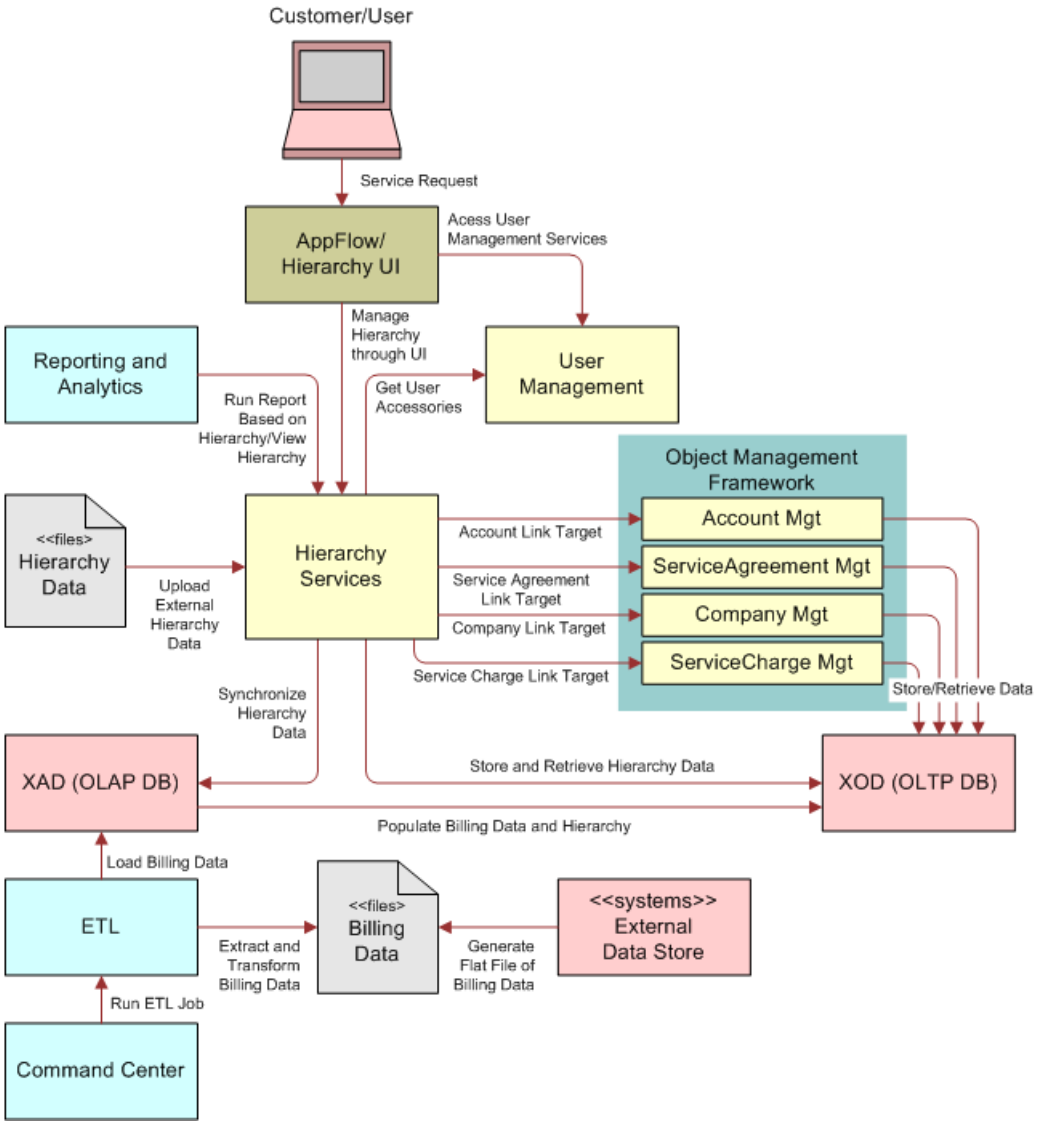

Figure 14. System Collaborations in Hierarchy Manager

Working with Reporting

To run reports for hierarchy structures, changes made to hierarchies must be synchronized to the OLAP database. In addition to hierarchy tree structure, each OMF object linked into hierarchy must be synchronized. Each OMF object has implemented an OLAP handler to handle their specific synchronization logic for being linked into a hierarchy.

Changes made to the OLTP hierarchies are categorized into different types of events. An event handler is called directly by the hierarchy API code to process the corresponding event. As a result, the same changes are then be propagated into the OLAP side of the hierarchy tables. The changes made in OLTP and OLAP are bounded into a single transaction to guarantee the data integrity between the OLTP and OLAP databases, using distributed database transaction management.

For each OMF object that must be linked into Hierarchy Manager, you must implement the ILinkTargetEventHandler interface defined in the com.edocs.common.api.hierarchy.connector package. Figure 15 shows the database synchronization of hierarchy changes.

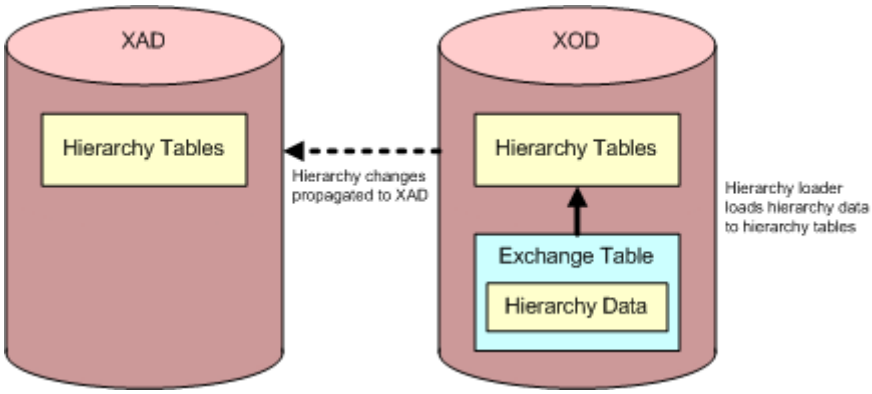

Figure 15. Database Synchronization of Changes to Hierarchies

5 Basic Hierarchy Manager Use Cases

This chapter describes some basic Oracle Self-Service E-Billing Hierarchy Manager use cases. It includes the following topics:

Configuring Hierarchy Types

Hierarchy Manager supports configurable hierarchy types. You can change the properties of preconfigured hierarchy types and add additional hierarchy types when necessary. Each hierarchy type can have name, code, description and allowable link targets for that type. Code in a hierarchy type uniquely identifies the type object. You can use the IHierarchyTypeManager interface to find all hierarchy types and the valid link targets for each type.

The following aspects of hierarchy type are configurable:

- Number of hierarchy types supported
- Name of each hierarchy type
- Valid link target types each hierarchy type allows
- Valid children types for each link target allowed in a hierarchy type
- Some special behavior for hierarchy importer and exporter

By default, Hierarchy Manager supports business and billing hierarchy types. The configuration for these default types is shown in the following file:

- **UNIX.** `EDX_HOME/xma/config/modules/hierarchy/Hierarchy.cfg.xma.xml`
- **Windows.** `EDX_HOME\xma\config\modules\hierarchy\Hierarchy.cfg.xma.xml`

The configuration file, Hierarchy.cfg.xma.xml, contains the bean entries that define the two hierarchy types to support: BusinessHierarchyType and BillingHierarchyType. You can add more types as new beans in the types property, shown in Figure 16.

```
<bean id="HierarchyConfig" class="com.edocs.common.hierarchy.core.HierarchyConfig" singleton="true">
        <property name="types">
            <list>
                <ref bean="BusinessHierarchyType"/>
                <ref bean="BillingHierarchyType"/>
            </list>
        </property>
</bean>
```

Figure 16. Configuration of Additional Hierarchy Types

Figure 17 shows the business hierarchy type preconfigured in the hierarchy.cfg.xma.xml file.

```
<bean id="BillingHierarchyType" class="com.edocs.common.hierarchy.core.HierarchyTypeConfig">
    <property name="name"><value>hierarchytype.Billing</value></property>
    <property name="code"><value>BILLING</value></property>
    <property name="description"><value>Billing hierarchy</value></property>
    <property name="validLinkTargets">
        <list>
            <ref bean="HierarchyFolderConfig"/>
            <ref bean="AccountConfig"/>
            <ref bean="CompanyConfig"/>
            <ref bean="ServiceAgreementConfig"/>
        </list>
    </property>
    <property name="linkTargetRelationship">
        <list>
            <!-- if any of the link target doesn't defined below , then by default it can have any type of valid -->
            <!-- link target defined above as it children -->
            <!-- Account can only have service as it children -->
            <bean class="com.edocs.common.hierarchy.core.LinkTargetRelationship">
                <property name="parent"><ref bean="AccountConfig"/></property>
                <property name="validChildren">
                    <list>
                        <ref bean="ServiceAgreementConfig"/>
                    </list>
                </property>
            </bean>
            <!-- Service agreement is a leaf node -->
            <bean class="com.edocs.common.hierarchy.core.LinkTargetRelationship">
                <property name="parent"><ref bean="ServiceAgreementConfig"/></property>
            </bean>
            <!-- Company can have folder , and account as it children -->
            <bean class="com.edocs.common.hierarchy.core.LinkTargetRelationship">
                <property name="parent"><ref bean="CompanyConfig"/></property>
                <property name="validChildren">
                    <list>
                        <ref bean="HierarchyFolderConfig"/>
                        <ref bean="AccountConfig"/>
                    </list>
                </property>
            </bean>
        </list>
    </property>
    <property name="hierarchyExchangeConfiguration">
        <bean class="com.edocs.common.hierarchy.connector.exchange.HierarchyExchangeConfiguration">
            <property name="updateHierarchyIdentity"><value>FALSE</value></property>
            <property name="ignoreUserAccess"><value>FALSE</value></property>
        </bean>
    </property>
</bean>
```

Figure 17. Business Hierarchy Type Configuration

Table 1 describes the hierarchy configuration properties as shown in Figure 17.

Table 1. Business Hierarchy Configuration Properties

Call Out	Property	Description
1	name	Specifies the resource bundle key for displaying the name of this hierarchy type.
2	code	A unique string value to identify business hierarchy type. It is recommended that you do not change this value.
3	validLinkTarget	You can link a list of valid link target objects into this type of hierarchy.
4	linkTargetRelationship	Specifies the rule by which a link target can be linked in as a child node. The list includes all link targets that can restrict their list of link targets when they link into hierarchies.
5	parent, with ServiceAgreementConfig bean	Indicates that for Service Agreement objects in a business hierarchy, no valid link target can be linked in as its child. Service Agreement must be the leaf node of a business hierarchy.
6	parent, with CompanyConfig bean	Indicates that in a business hierarchy, company objects can have folders as a child node.
7	hierarchyExchange Configuration	Specifies certain behaviors that you can override for hierarchy import and export.

Figure 18 shows the default billing hierarchy type preconfigured in the hierarchy.cfg.xma.xml file.

```
<bean id="BillingHierarchyType" class="com.edocs.common.hierarchy.core.HierarchyTypeConfig">
    <property name="name"><value>hierarchytype.Billing</value></property>
    <property name="code"><value>BILLING</value></property>
    <property name="description"><value>Billing hierarchy</value></property>
    <property name="validLinkTargets">
        <list>
            <ref bean="HierarchyFolderConfig"/>
            <ref bean="AccountConfig"/>
            <ref bean="CompanyConfig"/>
            <ref bean="ServiceAgreementConfig"/>
        </list>
    </property>
    <property name="linkTargetRelationship">
        <list>
            <!-- if any of the link target doesn't defined below , then by default it can have any type of valid -->
            <!-- link target defined above as it children -->
            <!-- Account can only have service as it children -->
            <bean class="com.edocs.common.hierarchy.core.LinkTargetRelationship">
                <property name="parent"><ref bean="AccountConfig"/></property>
                <property name="validChildren">
                    <list>
                        <ref bean="ServiceAgreementConfig"/>
                    </list>
                </property>
            </bean>
            <!-- Service agreement is a leaf node -->
            <bean class="com.edocs.common.hierarchy.core.LinkTargetRelationship">
                <property name="parent"><ref bean="ServiceAgreementConfig"/></property>
            </bean>
            <!-- Company can have folder , and account as it children -->
            <bean class="com.edocs.common.hierarchy.core.LinkTargetRelationship">
                <property name="parent"><ref bean="CompanyConfig"/></property>
                <property name="validChildren">
                    <list>
                        <ref bean="HierarchyFolderConfig"/>
                        <ref bean="AccountConfig"/>
                    </list>
                </property>
            </bean>
        </list>
    </property>
    <property name="hierarchyExchangeConfiguration">
        <bean class="com.edocs.common.hierarchy.connector.exchange.HierarchyExchangeConfiguration">
            <property name="updateHierarchyIdentity"><value>FALSE</value></property>
            <property name="ignoreUserAccess"><value>FALSE</value></property>
        </bean>
    </property>
</bean>
```

Figure 18. Billing Hierarchy Type Configuration

Creating and Modifying Hierarchies, Using APIs

This topic describes how to use APIs to create and manage hierarchies.

Creating New Hierarchies

You can create a new hierarchy or create a hierarchy from an existing one, as shown in the following examples.

Code Example: Creating a New Hierarchy

The following code shows an example of a new hierarchy:

```
LookupService lookup = LookupServiceFactory.getInstance();
IHierarchyService hierarchyServices =
(IHierarchyService)lookup.getModule("hierarchy");
IHierarchyManager hm = hierarchyServices.createHierarchyManager(hierarchy_creator);
IHierarchy hierarchy =
  hm.createHierarchy(companyid, hierarchyname, hierarchy_type);
…..
```

Code Example: Creating a Hierarchy from an Existing Hierarchy

The following code shows an example of a new hierarchy created from an existing hierarchy:

```
Hm.createHiearchyFromNode(companyIdStr, hierarchyNameStr,

                                  hierarchyType,

                                  fromNode, preserveUserAccess);
```

Adding or Removing Entities to or from a Hierarchy

Any Object Management Framework (OMF) business objects that implement IHierarchyLinkTarget can be added into Hierarchy Manager:

```
public interface IOMFObject   {

     public String getDisplayName();

     public String getExternalKey();

     public String getOMFObjectType();

     public String getURI();

}
```

```
public interface IHierarchyLinkTarget extends IOMFObject {

  public String getLinkTargetId();

public String getLinkTargetName();

public boolean isEditable();

public boolean isEditable();

}
```

Code Example: Adding a Link Target

The following code shows an example of a new link target:

```
IServiceAgreementManager samgr =
IOMFService.findOMFObjectManagerByName(“edx:omf:serviceAgreement”);

IHierarchyLinkTarget linkSrv =

(IHierarchyLinkTarget)samgr.find(“5088002000”, “ACCT001”);

IHierarchyNode hNode = hierarchy.getRoot();

IHierarchyNode srvNode = hNode.addLinkTarget(linkSrv);
```

Code Example: Adding a Folder

The following code shows an example of a new folder:

```
IHiearchyFolderManager fMgr = hierarchyService.createHierarchyFolderManager();

IHierarchyFolder hFolder = fMgr.create(“HR", "Human Resource", “This is HR folder“);

hFolder.addAttribute(hierarchyService.createAttribute(“Phone: ”, “508-123-8700”));

IHierarchyNode fNode = rootNode.addLinkTarget(hFolder);

}
```

Code Example: Removing a Business Object from Hierarchy Manager

The following code shows an example of a removed business object:

```
srvNode.remove();
```

Code Example: Moving a Business Object from One Node to Another Parent Node

The following code shows an example of a business object moved from one node to another parent node:

```
IHierarchyNode newParentNode = ….
```

```
srvNode.move(newParentNode);
```

Adding and Removing Users from Hierarchy Manager Access Control (HBAC)

You can add or remove users from Hierarchy Management Access Control (HBAC), as shown in the following examples.

Code Example: Adding or Removing User Access

The following code shows an example of adding and removing user access:

```
IHierarchyNode.addUserAccess(String userId)

IHierarchy.addUserAccess(IOMFObject linkTarget, String userId)

IHierarchyNode.removeUserAccess(String userId)
```

Code Example: Retrieving Authorized Users

The following code shows an example of retrieving authorized users:

```
IHierarchyNode.getUsers()

IHierarchyNode.getAllAuthorizedUsers()
```

Searching and Filtering Hierarchies

Hierarchy Manager service provides a search API, which supports finding hierarchies and entries within a hierarchy or on single or multiple attributes of link targets.

Searching and Filter Hierarchies Using IHierarchyManager

You can search and filter hierarchies using IHierarchyManager, as shown in the following examples.

Code Example: Retrieving Hierarchies for a User, and by Hierarchy Type

The following code shows an example of retrieving hierarchies for a user, and by hierarchy type:

```
IHierarchy[] getHierarchies(IUser user)

IHierarchy[] getHierarchies(IUser user, IHierarchyType hierType)

IHierarchy[] getHierarchiesForUser(String userId)
```

```
IHierarchy[] getHierarchiesForUser(String userId, IHierarchyType type)
```

Code Example: Retrieving Hierarchies by Company, and by Hierarchy Type

The following code shows an example of retrieving hierarchies by company, and by hierarchy:

```
IHierarchy[] getHierarchiesForDomain(String domainId)

IHierarchy[] getHierarchiesForDomain(String domainId,

HierarchyType hierType)
```

Code Example: Locating a Hierarchy

The following code shows an example of locating a hierarchy:

```
IHierarchy findHierarchy(String hName, String domainId)
```

Code Example: Finding the Containing Hierarchy for an Object

The following code shows an example of finding the containing hierarchy for an object:

```
IHierarchy[] findHierarchyForLinkTargetURI(IHierarchyType type, String
linkTargetURI)
```

Searching Nodes within a Hierarchy

You can search for hierarchy nodes across all hierarchies to which you have access, within a single hierarchy, or within a subtree of a hierarchy. Based on the type of search, you can use methods defined in `IHierarchyManager`, `IHierarchy`, or `IHierarchyNode` to conduct your search.

Code Example: Finding a Root Node for User within a Hierarchy

The following code shows an example of finding a root node for a user within a hierarchy:

```
IHierarchyNode[] IHierarchy.findRootNodeForUser(IUser)

IHierarchyNode[] IHierarchy.findRootNodeForUser(String uid)

IHierarchyNode[] IHierarchy.findRootNodeForUser2(String userID)

IHierarchyNode[] IHierarchy.findRootNodes2(IUser user) throws DataStoreException
```

Code Example: Find Node within a Hierarchy, or a Section of Hierarchy

The following code shows an example of finding a node within a hierarchy, or a section of hierarchy

- By Link Target URI:

  ```
  IHierarchyNode[ ] findNodeByLinkTargetURI(String linkTargetURI)
  ```

```
IHierarchyNode[ ] findNodeByLinkTargetURI(String URI, IPeriod period)
```

- By Link Target Type:

  ```
  findNodeByLinkTargetType(String linkTargetType)
  ```

- By Link Target Id:

  ```
  findNodeByLinkTargetId(string linkTargetId)
  ```

Navigating a Hierarchy

The code examples in this topic show how to navigate a hierarchy.

Code Example: Get Root Node for a Hierarchy

The following code shows an example of getting a root node for a hierarchy:

```
IHierarchy.getRoot()
```

Code Example: For a Node, Getting its Parent or Children

The following code shows an example of getting a parent or children for a node:

```
IHierarchyNode.getParent()
```

or

```
IHierarchyNode.getChildren()
```

Searching for Link Target Attributes within Hierarchy Manager

To search on an attribute of a link target within Hierarchy Manager, search capability must be configured in the XML configuration files, and the link target object must implement `IOMFSearchable` interface. Once the attributes are set for search, you can use the following methods to find objects based on their attribute values.

```
IServiceAgreementManager saManager =

IOFMService.getOMFManagerByName(ServiceAgreementManager.getClassName());

ISearchCriteria criteria = saManager.getSearchCriteria();
criteria.add(criteria.equals("subscriberName", "John Willson" )).add(
criteria.isNull( "extAttr1"));
IHierarchyNode  foundNodes =
rootNode.findNodeByLinkTargetTypeAndCriteria(saManager.getType(),criteria);
```

Taking the User's Role into Consideration

In addition to the APIs that provide a variety of methods that retrieve information based on your requirements, Hierarchy Manager also provides a set of classes that takes the user's role and permissions into consideration.

Creating Hierarchies

The following code shows an example of creating hierarchies:

```
IHierarchyContext hierarchyContext = new HierarchyContext();

//hierarchyContext can be set through web appflow layer


hierarchyContext.setUser(user);

hierarchyContext.setSubject(subject);

…

LookupService lookup = LookupServiceFactory.getInstance();

IHierarchyService hierarchyServices =
(IHierarchyService)lookup.getModule("hierarchy");

IHierarchyAccessManager haMgr =
hierarchyServices.createHierarchyAccessManager(hierarchyContext);

IHierarchy hierarchy =

haMgr.createHierarchy (hierarchyname, hierarchy_type, hierarchyDesc);

…..
```

Use IHierarchyAccessManager to create a hierarchy, based on the current user or subject information stored in the HierarchyContext. Note that the method acts differently depending on the user role:

- **User is a Subscriber.** HierarchyAccessException is thrown, because the subscriber is not allowed to create a hierarchy.
- **User is a Manager.** A new hierarchy is created with a domain ID of the user's company ID, and the user is assigned to the root node of the tree.
- **User is a System Administrator.** A new hierarchy is created with a domain ID of the user's company ID.

Finding a List of Hierarchies That a User Can Access

The following code retrieves a list of hierarchies based on the user type:

```
IHierarchy[ ] hierarchies = haMgr.getHierarchies(hierarchyType);
```

Depending on the user role set in the current context, the method returns the following if the user is:

- **Subscriber or Manager.** A list of hierarchies that the subscriber has been given access explicitly to some nodes in the tree.
- **System Administrator.** All hierarchies that belong to the company of the user.

Finding Top Level Nodes That a User Can Access for a Hierarchy

The following code retrieves a list of the top level nodes for the specified user type:

```
IHierarchyNode[] rootNOdes = haMgr.getRootNodes(hierarchy, period);

or

IHierarchyNode[] rootNOdes = haMgr.getRootNodes();
```

Since hierarchy structure is versioned for each period, the root node can vary depending on which period you are currently looking at. When the hierarchy and period are not passed in as parameters, the current hierarchy and current period stored in hierarchyContext are used. Again, depending on the user role set in the current context, the method returns the following:

- **Subscriber or Manager.** One or more hierarchy nodes that the current user has been given access explicitly. For example, the nodes that the current user is assigned to.
- **System Administrator.** The root node of the hierarchy.

Finding Assigned Link Targets or OMF Objects

The following code shows an example of finding assigned link targets or OMF objects:

```
IHierarchyNodeObjWrapper[] linkTargetNodes =
haMgr.findAssignedLinkTargets(hierarchy,linkTargetType, searchCriteria);

Or

IHierarchyNodeObjWrapper[] linkTargetNodes =
haMgr.findAssignedLinkTargets(hierNode,linkTargetType, searchCriteria);
```

This method finds link targets of a given type within the hierarchy. The searchCriteria is used as a filter to apply on link target objects themselves. The returned IHierarchyNodeObjWrapper is a wrapper class, which contains the handle to the HierarchyNode object and the link target object itself. The returned list returns information about all the objects you need, as well as the corresponding hierarchy node that the object is linked with.

The search takes the user's role into consideration, and only returns objects that qualify the search criteria and are accessible to the current user.

```
IOMFObject[] omfObjects =

                haMgr.findAssignedOMFs(hierarchy,omfType, searchCriteria);

or

IOMFObject[] omfObjects =

                haMgr.findAssignedOMFs(hierNode,omfType, searchCriteria);
```

This method finds OMF objects of the given type within the hierarchy. The searchCriteria is used as a filter to apply to the OMF objects. The method returns a list of business objects without node information. The search takes user's role into consideration as well, and returns objects that qualify the search criteria and are accessible to the current user.

To improve performance for assigned search, you can choose to implement the IAssignedObjectProvider search interface and write specific query with cross table join between Hierarchy Manager tables and OMF object table to improve performance. The default behavior for assigned search is to use the methods above, which is slower since multiple queries will be executed and the result are again filter in memory.

Finding Unassigned Link Targets or OMF Objects

The following code shows finding unassigned link targets or OMF objects:

```
IOMFObject[] unassignedOMF =
       findUnassignedOMFObjects(hierarchy, omfType, searchCriteria);
```

This method returns a list of OMF objects that: qualify the search criteria, the current user has access to, and have not been linked into the current hierarchy yet.

To determine the list of objects that the current user has access to typically involves interaction with other hierarchies, or even to another data rule set in Hierarchy Manager to determine what objects are available for current user to access.

Hierarchy Manager is used as a master access control hierarchy. When searching for an unassigned account or unassigned service agreement, Hierarchy Manager can return a list of accounts or service agreements that are granted access to the current user but have not been assigned to the current hierarchy.

The IUnAssignedObjectProvider interface can implement specific rules for retrieving unassigned objects based on the application business logic. It could be necessary to communicate with an external system for the access information.

Assigned and Unassigned Search Provider

The Hierarchy Manager search functionalities are assigned and unassigned search. Assigned search is searching for business objects that linked into the current hierarchy. Assigned search returns only business objects the current user have access to in the hierarchy for a given period.

Unassigned search is searching for business objects the users was given access to in the master hierarchy and not assigned into the current hierarchy for a given period.

By default assigned and unassigned search are provided for all OMF objects where the OMF object managers implement the IOMFObjectSearchable interface. This method of search is very flexible and work very well with OMF objects where there are not a lot of objects. For search where the result could be a big set, implementing a search provider extending two interfaces IAssignedObjectProvider for assigned search and IUnassignedObjectProvider for unassigned search.

The search provider was created to search for unassigned objects where the user accessibility to a business object is not managed by Hierarchy Manager. This concept of the provider is equivalent to the user access managed in the master hierarchy.

To be able to plug-in the search provider into the hierarchy search framework, you must implement a class that implements the interfaces IAssignedObjectProvider and IUnassignedObjectProvider. Then edit the configuration file, hierarchy.cfg.xma.xml, for the link target that this search provider supports.

The interface IAssignedObjectProvider has two methods:

- **public HierarchySearchResult getAssignedLinkTargets(IHierarchy hierarchy, SearchProperties searchProp);.** Searches the entire hierarchy for specific link target type for user.
- **public HierarchySearchResult getAssignedLinkTargets(IHierarchyNode selectedNode, SearchProperties searchProp);.** Searches for a specific link target type at the specified node and all of its descendants.

The interface IUnassignedObjectProvider has one method:

```
public HierarchySearchResult getUnassignedLinkTargets(IHierarchy targetHierarchy,
SearchProperties searchProp) throws HierarchyException;
```

This method searches the unassigned link targets of the specified type and period and filter the result of the specified object attributes.

The following code is an example of a provider to support the ServiceAgreement business object:

```
<bean id="ServiceAgreementConfig"
class="com.edocs.common.hierarchy.core.LinkTargetConfig" singleton="true">

  <property name="targetType">

     <value>edx:omf:serviceagreement:</value>

  </property>

  <property name="targetTypeName">

     <value>hierarchy.element.class.ServiceAgreement</value>
```

```
  </property>
  <property name="displayName">
     <value>getLinkTargetName</value>
  </property>
  <property name="xmlTag">
     <value>ServiceAgreement</value>
  </property>
  <property name="storedHierXRef">
     <value>false</value>
  </property>
  <property name="xmlExchangeHandler">
     <bean
class="com.edocs.common.omf.serviceagreement.ServiceAgreementXMLExchangeHandler"/>
  </property>
  <property name="linkTargetEventHandlers">
     <list>
     <bean
class="com.edocs.common.hierarchy.connector.olap.OLAPServiceAgreementHandler"/>
     </list>
  </property>
  <property name="assignedObjectProvider">
     <bean class="com.edocs.common.xma.api.LookupBeanFactoryBean">
        <property name="beanUri">
  <value>edx:platform://modules/omf?id=ServiceAgreementSearchProvider</value>
        </property>
     </bean>
  </property>
  <property name="unassignedObjectProvider">
     <bean class="com.edocs.common.xma.api.LookupBeanFactoryBean">
```

```
        <property name="beanUri"> <value>edx:platform://modules/
omf?id=ServiceAgreementSearchProvider</value>

</property>

</bean>

</property>

</bean>
```

Managing Business Objects

The Object Management Framework has adopted a set of patterns for object creation, modification, and retrieval. Within the catalog of business objects provided by default, each type of business object has its own Manager class, Object class, and DAO (Data Access Object) class. The manager class deals with a business object's lifecycle, the object class is the data object and can contain business logic, and DAO class deals with database persistence.

As the standard product offering from OMF, the following business objects and their services are provided: Billing Account, Company, Service Agreement, Charge Type, Service Charge Type, and Service Plan.

When using the OMF framework, the following terms are heavily used:

- **Business Object Type.** A string uniquely identifies the type of business object.
- **Business Object URI.** A string uniquely identifies the business object instance. The URI consists of the type and the ID of that object within the type.

Exchanging Hierarchy Data Using XML

Hierarchy Manager supports both XML import and XML export. Since objects linked into a hierarchy can be of any type, it is important for the Importer and Exporter to support flexible XML formatting. Using XML allows you to specify information that you would like to get processed through the XML importer and exporter. Both the XML importer and exporter share the same XML format.

XML Schema

The hierarchy importer is flexible enough to import hierarchy relationships as well as link target content. You can decide whether the importer and exporter will deal with only relationships or will also deal with link target content.

To meet these requirements, Hierarchy Manager provides two XML schema definition files:

- **`Common-hierarchy-interchange-1.0.xsd`**. Specifies the format that is core to Hierarchy Manager. It is recommended you use the file as is. The file is located in the following directory:
  - **UNIX.** `EDX_HOME/config/xml`

- **Windows.** `EDX_HOME\config\xml`

For additional information about this schema, see Appendix A, "Hierarchy Manager XML Exchange Schema."

`Instance-hierarchy-interchange-1.0.xsd`. Is used to customize the hierarchy structure. You can add one or more sections that describe application-specific business objects, or link targets, in the import or export XML file. This file is referenced by the common-hierarchy-interchange-1.0.xsd schema file. So you only need to reference the common-hierarchy-interchange-1.0.xsd file in the XML import or export files. Both the XML importer and exporter share the same XML schema. For additional information about this schema, see Appendix B, "Hierarchy XML File Example."

Importing Hierarchies

To import the hierarchy XML, you can use the following method through `IHierarchyAccessManager`:

```
HierarchyExchangeResult importXML(hierarchyInputStream, startPeriod, endPeriod);
```

A hierarchy XML file can contain one or multiple hierarchy structures. The XML file only specifies the structure relationship of the hierarchy and user association, but does not specify any time period information. The period information is provided as additional parameters passed in from higher layer application code. When importing for multiple periods, the hierarchy structure will be replicated for each period. If the hierarchy has changes between different periods, it either must be imported separately with one for each period, or it must be modified for the period once they are imported.

You can import a hierarchy either in a published or unpublished state. If the hierarchy already exists in a published state, then any subsequent imported structures must be imported in a published state.

When calling the preceding method where startPeriod and endPeriod are provided, the hierarchy will be imported and published for the periods within the specified range. If the periods are null, the hierarchy will be in an unpublished state.

If a hierarchy exists for a given period, the hierarchy structure will be overwritten. If the hierarchy does not exist, the hierarchy structure will be created.

Exporting Hierarchies

To export a hierarchy to an XML file, use the following method of IHierarchyAccessManager:

```
InputStream exportXMLAsInputStream(hierarchy, newHierarchyNameStr);
```

When exporting a hierarchy, the period specified in the HierarchyContext is used to get the correct version of the hierarchy to export. Also, based on the current user's role, only the content that is available to view for the current user is exported, which might not be the complete hierarchy stored in the database.

6 Extending Advanced Hierarchy Manager Use Cases

This chapter describes the various extension frameworks and shows how to extend the preconfigured Hierarchy Manager capabilities for client solutions. It includes the following topics:

Creating New Types of Business Objects to Work with Hierarchy Manager

Hierarchy Manager allows any kind of business object to be linked through it, as long as that business object implements a set of interfaces, and registers with Hierarchy Manager properly. In addition to the set of business objects provided with the Oracle Self-Service E-Billing, you can extend the application by creating their own business objects and linking the new types of business objects into Hierarchy Manager.

This topic describes the steps on how to create a new business object and make it work with Hierarchy Manager.

Creating New Business Objects

To create a new type of business object, write your business object java classes and manage your business logic and persistent store, potentially using hibernate. It is recommended that you have a manager class, business object class and Data Access Object class for your new type of business object.

To create a new business object

1. Create a new or extend an existing business object by implementing `IOMFObject.java`.
2. Create a new object manager by implement `IOMFObjectManager.java`.
3. Configure hibernate-mappings for your new business object.

Registering Objects with the OMF Module

To use the Object Management Framework (OMF) service, you must register your business objects with the OMF framework. Once you register your business object with OMFService, you can do something similar for your business object instance.

To register business objects with the OMF framework

1. Edit the omf.xma.xml file, located in the following directory:
   - **UNIX.** xma/config/omf
   - **Windows.** xma/config/omf
2. Add a new OMFObjectManagerConfig bean in the OMFService bean section of the omf.xma.xml file, specifying the following properties:
   - **Name**. The name of the manager, which can be any string you choose.
   - **Type**. A unique string that identifies the type of business object. This value must be the same as the one returned from IOMFObject.getOMFObjectType() and IOMFObjectManager.getType().
   - **Implementation**. The full class name of your object manager class, which is typically a singleton class.

   The OMFService bean in the omf.xma.xml file is shown as follows:

```
<bean id="OMFService" class="com.edocs.common.omf.OMFService" singleton="true">
        <property name="registeredOMFanagers">
            <list>
               <bean class="com.edocs.common.omf.OMFObjectManagerConfig">
                    <property name="name"><value>chargeTypeManager</value></
property>
                    <property name="type"><value>edx:omf:chargetype:</value></
property>
                    <property name="implementation">
            <bean class="com.edocs.common.omf.chargetype.ChargeTypeManager"
singleton="true"/>
       </property>
                 </bean>

                 <bean class="com.edocs.common.omf.OMFObjectManagerConfig">
                   <property name="name"><value>companyManager</value></property>
                 <property name="type"><value>edx:omf:company:</value></property>
                    <property name="implementation"><ref bean="companyManager"/
></property>
                 </bean>

                 <bean class="com.edocs.common.omf.OMFObjectManagerConfig">
                   <property name="name"><value>accountManager</value></property>
                 <property name="type"><value>edx:amf:account:</value></property>
                    <property name="implementation">
          <bean
class="com.edocs.domain.telco.amf.defaultimpl.BillingAccountManager"
```

```
singleton="true"/>
       </property>
                 </bean>

                 <bean class="com.edocs.common.omf.OMFObjectManagerConfig">
                   <property name="name"><value>serviceAgreementManager</value></
property>
                     <property name="type"><value>edx:omf:serviceagreement:</
value></property>
                     <property name="implementation">
       <bean
class="com.edocs.common.omf.serviceagreement.ServiceAgreementManager"
singleton="true"/>
       </property>
                 </bean>

                 <bean class="com.edocs.common.omf.OMFObjectManagerConfig">
                     <property name="name"><value>serviceChargeManager</value></
property>
                    <property name="type"><value>edx:omf:servicecharge:</value></
property>
                     <property name="implementation">
                     <bean
class="com.edocs.common.omf.servicecharge.ServiceChargeManager"
singleton="true"/>
          </property>
                 </bean>
            </list>
        </property>
        <property name="defaultBillerId"><value>1</value></property>
    </bean>
```

Code Example: Finding Your Business Object Manager Class

The following code shows an example of finding your business object manager class:

```
IServiceAgreementManager saMgr =
IOMFService.findOMFObjectManagerByType("edx:omf:serviceAgreement:");
```

Or

```
IServiceAgreementManager saMgr =
IOMFService.findOMFObjectManagerByName(serviceAgreementManager);
```

Code Example: Finding the Corresponding Business Object Instance for an Object URI

The following code shows an example of finding the corresponding business object instance for an object URI:

```
IServiceCharge sc = IOMFService.findOMFObjectByURI(scURIString);
```

Making Business Objects Transactional Aware

To ensure that your OMF object supports flexible transaction management, each object's DAO layer is wrapped in either the Spring framework's transaction proxy, or it is managed through the spring hibernate transaction interceptor. Here are some examples:

```
<bean id="ServiceAgreementDimDaoTarget"
   class="com.edocs.common.omf.serviceagreement.olap.ServiceAgreementDimDao"
  singleton="true">
  <property name="sessionFactory">
  <ref bean="OLAPSessionFactory"/></property>
  </bean>
  <bean id="ServiceAgreementDaoTarget"
      class="com.edocs.common.omf.serviceagreement.ServiceAgreementDao"
     singleton="true">
  <property name="sessionFactory"><ref
     bean="OMFSessionFactory"/></property>
     <property name="enableOLAPSync"><value>true</value></property>
     <property name="serviceDimDao"><ref
     bean="ServiceAgreementDimDaoTarget"/>
     </property>
  </bean>
  <bean id="ServiceAgreementDao"
class="org.springframework.transaction.interceptor.TransactionProxyFactoryBean"
singleton="true">
     <property name="proxyTargetClass"><value>true</value></property>
     <property name="transactionManager"><ref bean="TransactionManager"/></
property>
     <property name="target"><ref bean="ServiceAgreementDaoTarget"/></property>
     <property name="transactionAttributes">
        <props>
           <prop key="find*">PROPAGATION_REQUIRED,readOnly</prop>
           <prop key="get*">PROPAGATION_REQUIRED,readOnly</prop>
           <prop key="*">PROPAGATION_REQUIRED,-HierarchyException,-
DataStoreException</prop>
        </props>
     </property>
  </bean>
```

The OMFSessionFactory and TransactionManager beans are defined in the omf.xma.xml file for OMF module objects as follows. Add your new hbm.xml file into the <list> section:

```
<bean id="OMFSessionFactory"
class="org.springframework.orm.hibernate.LocalSessionFactoryBean">
<property name="dataSource"><ref bean="myDataSource"/></property>
<property name="mappingResources">
  <list>
  <value>com/edocs/common/omf/chargetype/chargetype.hbm.xml</value>
  <value>com/edocs/common/omf/company/company.hbm.xml</value>
  <value>com/edocs/common/omf/company/companyprofile.hbm.xml</value>
  <value>com/edocs/common/omf/costcenter/costcenter.hbm.xml</value>
  <value>com/edocs/common/omf/period/period.hbm.xml</value>
  <value>com/edocs/common/omf/flexfieldmap/extfielddef.hbm.xml</value>
  <value>com/edocs/common/omf/service/service.hbm.xml</value>
```

```
   <value>com/edocs/common/omf/serviceagreement/serviceagreement.hbm.xml</value>
   <value>com/edocs/common/omf/servicecharge/servicecharge.hbm.xml</value>
  <value>com/edocs/common/omf/plan/plan.hbm.xml</value>
  </list>
</property>
<property name="hibernateProperties"><ref bean="defaultHibernateProps"/></
property>
</bean>
```

Code Example: Using the JTA Transaction Manager

Specify the TransactionManager using JtaTransactionManager. For example:

```
<!-- Use JTA Transaction Manager for multiple data sources)-->
<bean id="TransactionManager"
class="org.springframework.transaction.jta.JtaTransactionManager">
<property name="transactionManagerName">
<value>javax.transaction.TransactionManager</value>
        </property>
    <property
name="userTransactionName"><value>javax.transaction.UserTransaction</value>
        </property>
    </bean>
```

Code Example: Using the Hibernate Transaction Manager

Specify the TransactionManager using HibernateTransactionManager. For example:

```
<!-- Use Hibernate manage transaction manager for single data source -->

<bean id="TransactionManager"
class="org.springframework.orm.hibernate.HibernateTransactionManager"
singleton="true" lazy-init="default" autowire="default" dependency-check="default">
  <property name="sessionFactory"><ref bean="OMFSessionFactory"/></property>
</bean>
```

Use one transaction manager for all your modules, because Oracle Self-Service E-Billing works with the OLAP database using the JTA transaction manager, and the JTA transaction manager is used by all modules and components. Use the hibernate transaction manager to unit test your code.

Making OMF Objects Work with Hierarchy Manager

Hierarchy Manager allows any kind of business object to be linked through a hierarchy, as long as that business object implements a set of interfaces and registers with hierarchy properly.

For the standard product, the following types of business objects are ready to be used as hierarchy link targets: Account, Company, Service, ServiceAgreement, ChargeType, ServiceCharge, CostCenter, and Folder.

In addition to linking the business object to the hierarchy, the new types of business objects can participate in various hierarchy related processes, such as ETL loader, hierarchy XML exchange, and OLTP to OLAP synchronization through a framework.

Once you have created your business object, to link your object through hierarchy, implement a list of hierarchy related interfaces, and then tell the hierarchy module where to find these implementations by configuring them the in the `hierarchy/hierarchy.cfg.xma.xml` file.

Implementing Hierarchy Manager Interfaces

This topic describes the Hierarchy Manager interfaces.

IHierarchyLinkTarget Hierarchy Interface

To link your business object through hierarchy, first implement the IHierarchyLinkTarget interface.

```
public interface IHierarchyLinkTarget extends IOMFObject
{
    /**
     * This is the link target identifier. This id is decided by the actually link
target implementation.
     * For example, the link target id for IAccount is account number, for IService
is account number
    * and service number. Note, this id only unique identify this object in a special
domain. For example,
    * the account number is guaranteed unique only for the accounts for a particular
billing system.
     * @return link target id string
     */
    public String getLinkTargetId();

    /**
     * This is the link target name. This sometimes can be the same as the link
target Id.
     * But usually this is a short, descriptive name that can stand for the link
target id,
     * but looks nicer on the UI.
     * @return link target name.
     */
    public String getLinkTargetName();
    /**
     * Returns true if this object has one or more properties that are modifiable.
     *
     * @return true if this object is modifiable through hierarchy.
     */
    public boolean isEditable();
    /**
     * Returns true if the specified property is modifiable through hierarchy.
     * @param propertyName - the name of a property.
     * @return true if property is modifiable.
```

```
     */
    public boolean isEditable(String propertyName);
}
```

The values returned from the getLinkTargetId() and getLinkTargetName() methods will be persisted with the hierarchy tree node, and be used to display and quickly search the object inside the tree. The IsEditable() method indicates whether your object can be edited through the hierarchy tree. Method isEditable(String) specifies which attributes of the object can be edited if the object is editable.

IHierarchyXMLExchangeHandler Hierarchy Interface

Based on the schema provided by each application, Hierarchy Manager allows you to provide their own handlers to handle both import and export of the business objects. providing flexibility in deciding how the Hierarchy Manager importer is used in an application.

If you would like to interchange (import or export) your hierarchy data structure with another part of the application or with an external system through XML, you must implement this interface.

```
package com.edocs.common.api.hierarchy.connector;

public interface IHierarchyXMLExchangeHandler
{
  /**
   * Processes the information passed through a domObject to see if
 * it can be added to the Hierarchy.
   * @param domObject XML DOM representation of the OMF object
   * @param period that will be used to validate link target
   * @return An Instance of {@link ImportLinkTargetValidationStatus} to indicate
   * what action should be taken by the XMLContentHandler
   */
  public ILinkTargetImportResult validateLinkTarget(Document domObject,
IPeriod period);
  /**
   * Processes the information passed through a domObject.  Either find
   * the specified link target object or create a new link target with
   * the supplied information.
   * @param domObject XML DOM representation of the OMF object
   * @return created or found link target (OMF object)
   */
  public IHierarchyLinkTarget importLinkTarget(Document domObject)
throws HierarchyException;
    /**
     * Used for delta hierarchy import processing
     * @param domObject object representing the link target.
    * @param isNew boolean indicating whether the hierarhcy to be imported is a new.
     * @return a converted link target object.
     * @throws HierarchyException
     */
   public IHierarchyLinkTarget importDeltaLinkTarget(Document domObject,
boolean isNew) throws HierarchyException;
  /**
   * Converts the link target (OMF object) into XML.
```

```
     *
     * @param linkTarget the link target object to be exported.
     * @return XML representation of the OMF object.
     */
    public String exportLinkTarget(IHierarchyLinkTarget linkTarget)
  throws HierarchyException;
    /**
     * Initializes this exchange handler with the XmlTag to use.
     * @param xmlTag the tag string for given type of link target class.
     */
    public void initialise(String xmlTag);
  }
```

By implementing this interface, you can decide the rule for valid objects, which determines whether the given business object must be created by the hierarchy importer, if the object does not already exist.

ILinkTargetEventHandler Hierarchy Interface

If you need to run reports against your link target through Hierarchy Manager, and your link target data are stored in OLAP, then you must implement this handler. When the hierarchy is changed on the OLTP side, the hierarchy OLAP synchronizer invokes your handler to synchronize hierarchy and the relationship with your link target on the OLAP side.

```
package com.edocs.common.api.hierarchy.connector;

public interface ILinkTargetEventHandler
{
    /**
     * Hook that is called when adding a new link target.
     * @param event the event object
     * @throws DataStoreException thrown if database errors occurred.
     */
    public void processAddEvent(IEvent event) throws DataStoreException;

    /**
     * Hook that is called when adding a node to a period.
     * @param event the event object
     */
    public void processNodePeriodAddEvent(IEvent event);

    /**
     * Hook called when removing a link target from hierarchy tree.
     * @param event the event object that contains information about the event.
     * @throws DataStoreException thrown if database errors occurred.
     */
    public void processRemoveEvent(IEvent event) throws DataStoreException;

    /**
     * Hook called when removing a hierarchy.
     * @param event the event object that contains information about the event.
     */
    public void processRemoveHierarchyEvent(IEvent event);
```

```
    /**
     * Hook called when a node is removed from a period.
     * @param event the event object that contains information about the event.
     */
    public void processNodePeriodRemoveEvent(IEvent event);

    /**
     * Hook called for moving a node to a different node.
     * @param event the event object that contains information about the event.
     */
    public void processMoveEvent(IEvent event);

    /**
     * Hook called when publishing hierarchy. Implementing class needs to override
     this method
     * to deal with any link target related operation.
     * @param event the event object that contains information about the event.
     */
    public void processPublishEvent(IEvent event);

    /**
     * Hook called when expiring a hierarchy.
     * @param event the event object that contains information about the event.
     */
    public void processExpireHierarchy(IEvent event);
}
```

Configuring Link Targets

Register link targets for new business objects with Hierarchy Manager by adding LinkTargetConfig beans to the hierarchy.cfg.xma.xml file.

Hierarchy Manager provides a framework that handles a variety of hierarchy-related operations, including object definition, creation, lookup, resolving a linkage, XML exchange, and OLTP to OLAP synchronization. Link targets are highly configurable so that application-specific business objects can provide their own implementations as needed.

Not all handlers are required for all business objects. You can decide which handlers to implement based on application requirements. Here are some examples in the hierarchy.cfg.xma.xml file:

```
<bean id="ServiceAgreementConfig"
class="com.edocs.common.hierarchy.core.LinkTargetConfig" singleton="true">
  <property name="targetType"><value>edx:omf:serviceagreement:</value></property>
  <property name="targetTypeName"><value>Service Agreement</value></property>
  <property name="displayName"><value>getLinkTargetName</value></property>
  <property name="xmlTag"><value>ServiceAgreement</value></property>
  <property name="storedHierXRef"><value>false</value></property>
  <property name="xmlExchangeHandler">

<beanclass="com.edocs.common.omf.serviceagreement.ServiceAgreementXMLExchangeHandl
er"/>
  </property>
  <property name="linkTargetEventHandlers">
```

```
            <list>
                    <bean
class="com.edocs.common.hierarchy.connector.olap.OLAPServiceAgreementHandler"/>
                </list>
  </property>
</bean>
```

Table 2 describes the link target properties in the hierarchy.cfg.xma.xml file.

Table 2. Link Target Properties

Property	Description
targetType	A type string that uniquely identifies the type of the business object. This value must be the same value as IOMFManager.getOMFObjectType() and IOMFService.getTypeByURI().
targetTypeName	The displayable string representing the type of object, such as Service Agreement for serviceAgreement objects
displayName	When the object is linked into a hierarchy, which method to call on the object to display the object's name. If this value is specified, the specified method is called. If this value is not specified, then getLinkTargetName() is used.
xmlTag	Tag name used in the XML exchange for the import and export file. For more information on xmltTag, see "IHierarchyXMLExchangeHandler Hierarchy Interface" on page 53
xmlExchangeHandler	The implementation class of IHierarchyXMLExchangeHandler to use for XML import and export.
linkTargetEventHandler	The implementation class of ILinkTargetEventHandler to use for object-specific OLTP to OLAP synchronization. This class can support a list of handlers to synchronize to multiple destinations.

The following code from the hierarchy.cfg.xma.xml file shows an example of the linkTargetEventHandler:

```
<bean id="ChargeTypeConfig"
class="com.edocs.common.hierarchy.core.LinkTargetConfig" singleton="true">
    <property name="targetType"><value>edx:omf:chargetype:</value></property>
    <property name="targetTypeName"><value>Charge</value></property>
    <property name="displayName"><value>getLinkTargetName</value></property>
    <!-- my list of customize handlers to handle charge type. -->
    <property name="linkTargetAddEventHandlers">
        <list>

lass="com.edocs.common.hierarchy.connector.olap.OLAPChargeTypeHandler"/>
</list>
    </property>
</bean>
```

```
<bean id="HierarchyFolderConfig"
class="com.edocs.common.hierarchy.core.LinkTargetConfig" singleton="true">
    <property name="targetType"><value>edx:hierarchy:folder:</value></property>
    <property name="targetTypeName"><value>Hierarchy Folder</value></property>
    <property name="displayName"><value>getLinkTargetName</value></property>
    <property name="xmlTag"><value>Folder</value></property>
    <property name="xmlExchangeHandler">
        <bean

<bean
cclass="com.edocs.common.hierarchy.connector.exchange.FolderXMLExchangeHandler"/>
    </property>
</bean>

ean id="CompanyConfig" class="com.edocs.common.hierarchy.core.LinkTargetConfig"
singleton="true">
<property name="targetType"><value>edx:omf:company:</value></property>
<property name="targetTypeName"><value>Company</value></property>
<property name="displayName"><value>getLinkTargetName</value></property>
<property name="xmlTag"><value>Company</value></property>
     <property name="xmlExchangeHandler">
        <bean class="com.edocs.common.omf.company.CompanyXMLExchangeHandler">
           <constructor-arg index="0">
              <bean class="com.edocs.common.xma.api.LookupBeanFactoryBean">
                 <property name="beanUri">
                     <value>edx:platform://modules/omf?id=companyManager</value>
                 </property>
              </bean>
           </constructor-arg>
</bean>
     </property>
</bean>

<bean id="AccountConfig" class="com.edocs.common.hierarchy.core.LinkTargetConfig"
singleton="true">
     <property name="targetType"><value>edx:amf:billingaccount:</value></property>
     <property name="targetTypeName"><value>hierarchy.element.class.Account</
value></property>
     <property name="displayName"><value>getLinkTargetName</value></property>
     <property name="xmlTag"><value>Account</value></property>
     <property name="xmlExchangeHandler">
        <bean
class="com.edocs.domain.telco.amf.defaultimpl.BillingAccountXMLExchangeHandler">
           <constructor-arg index="0">
              <bean
class="com.edocs.domain.telco.amf.defaultimpl.BillingAccountManager"
singleton="true"/>
           </constructor-arg>
        </bean>
     </property>
     <property name="linkTargetEventHandlers">
        <list>
           <bean
class="com.edocs.common.hierarchy.connector.olap.OLAPAccountHandler"/>
```

```
      </list>
    </property>
  </bean>


   <bean id="ServiceChargeConfig"
class="com.edocs.common.hierarchy.core.LinkTargetConfig" singleton="true">
    <property name="targetType"><value>edx:omf:servicecharge:</value></property>
    <property
name="targetTypeName"><value>hierarchy.element.class.ServiceCharge</value></
property>
    <property name="displayName"><value>getLinkTargetName</value></property>
    <property name="xmlTag"><value>ServiceCharge</value></property>
    <property name="xmlExchangeHandler">
      <bean
class="com.edocs.common.omf.servicecharge.ServiceChargeXMLExchangeHandler"/>
    </property>
    <!-- my list of customize handlers to handle charge type. -->
    <property name="linkTargetEventHandlers">
      <list>
        <bean
class="com.edocs.common.hierarchy.connector.olap.OLAPServiceChargeHandler"/>
      </list>
    </property>
  </bean>
```

Configuring the Link Target into a Hierarchy Type

Add the new config bean for the new link target to the hierarchy type config where the business object must be linked. See the following example code in the hierarchy.cfg.xma.xml file:

```
<bean id="BusinessHierarchyType"
class="com.edocs.common.hierarchy.core.HierarchyTypeConfig">
  <property name="name"><value>hierarchy.type.Business</value></property>
  <property name="code"><value>BUSINESS</value></property>
  <property name="description"><value>Business hierarchy</value></property>
  <property name="validLinkTargets">
    <list>
      <ref bean="HierarchyFolderConfig"/>
      <ref bean="CompanyConfig"/>
      <ref bean="ServiceAgreementConfig"/>
      <ref bean="ServiceChargeConfig"/>
    </list>
  </property>
      <property name="linkTargetRelationship">
           <list>
              <!-- if any of the link target is not defined below, then by default
it can have any type of valid -->
              <!-- link target defined above as it children -->
              <!-- Service agreement is a leaf node -->
            <bean class="com.edocs.common.hierarchy.core.LinkTargetRelationship">
                 <property name="parent"><ref bean="ServiceAgreementConfig"/></
property>
              </bean>
```

```
            <!-- Company can have folder, and account as it children -->
          <bean class="com.edocs.common.hierarchy.core.LinkTargetRelationship">
                <property name="parent"><ref bean="CompanyConfig"/></property>
                <property name="validChildren">
                    <list><ref bean="HierarchyFolderConfig"/></list>
                </property>
            </bean>
        </list>
    </property>
</bean>
```

Making New OMF Objects Searchable in Hierarchy Manager

Using XML configuration you can specify which attributes to use as part of search criteria for a given business object. Based on those attributes, you can construct flexible search criteria to conduct different searches. If the related information is spread out among several java classes, the searchable attributes can be specified through object references. For a predefined business object, you can add or remove searchable attributes through XML configuration as well.

The following topics list the steps required to support search capability for your OMF object.

Defining Search Criteria

First, define where the search starts when you search for an attribute. Typically, the search starts at a top-level class, for example, search service number on service agreement object. The following code shows an example of how to enable support search criteria for a service agreement object:

```
<bean id="serviceAgreementSearchCriteria"
      class="com.edocs.common.omf.search.SearchCriteriaSupport"
      singleton="false">
   <property name="searchMetaData">
   <ref local="serviceAgreementSearchMeta"/>
   </property>
</bean>
```

When a class is subordinate, the search for the specified bean class is always done through its parent class. For example, if you would like to search for a user's address, which is stored in the UserProfile class, the search criteria support is specified on the User class, not on the UserProfile class.

Configuring Searchable Properties

Three types of property are available for search: simple property, references to other objects, and extended attribute of the business object. Through object reference, your search can be conducted across multiple objects. You can specify your own search configuration in one or multiple files.

Specify the search Meta data bean to specify which attributes can be searched by. In the ServiceAgreement class, use the SimpleProperty bean class to indicate that the simple property name and description can be searched. See the following example configuration:

```
<bean id="serviceAgreementSearchMeta"
    class="com.edocs.common.omf.search.SearchMetaDataSupport" singleton="true">

    <property name="beanClassName">
        <value>com.edocs.common.omf.serviceagreement.ServiceAgreement</value>
    </property>
    <property name="propertyList">
        <list>
            <bean class="com.edocs.common.omf.search.SimpleProperty">
                <property name="name">
                    <value>name</value>
                </property>
            </bean>
            <bean class="com.edocs.common.omf.search.SimpleProperty">
                <property name="name">
                    <value> subscriberName</value>
                </property>
            </bean>
            <bean class="com.edocs.common.omf.search.SimpleProperty">
                <property name="name">
                    <value> extAttr1</value>
                </property>
            </bean>
        </list>
    </property>
</bean>
```

In the ServiceCharge class, use the EntityProperty bean class to indicate that serviceAgreementId is an object reference to serviceAgreement. Through the reference of serviceAgreementId, the searchable attributes on ServiceAgreement are available for search on ServiceCharge class.

```
<bean id="serviceChargeSearchMeta"
          class="com.edocs.common.omf.search.SearchMetaDataSupport"
          singleton="true">

        <property name="beanClassName">
            <value>com.edocs.common.omf.servicecharge.ServiceCharge</value>
        </property>

        <property name="propertyList">
            <list>
                <bean class="com.edocs.common.omf.search.EntityProperty">
                <property name="name"><value>serviceAgreementId</value> </property>
                    <property name="searchMetaData"><ref
local="serviceAgreementSearchMeta"/></property>
                </bean>
                <bean class="com.edocs.common.omf.search.EntityProperty">
                    <property name="name"><value>chargeTypeId</value></property>
                 <property name="searchMetaData"><ref local="chargeTypeSearchMeta"/
></property>
                </bean>
            </list>
        </property>
    </bean>
```

In the BillingAccount class, MapProperty indicates that attr1 and attr2 are extended attributes that can be used in search criteria.

```
        <bean id="accountSearchMeta"
           class="com.edocs.common.omf.search.SearchMetaDataSupport" singleton="true">

            <property name="beanClassName">
   <value>com.edocs.domain.telco.amf.defaultimpl.BillingAccount</value>
            </property>
     <property name="propertyList">
     <list>
     <bean class="com.edocs.common.omf.search.SimpleProperty">
          <property name="name"><value>Name</value></property>
     </bean>
        <bean class="com.edocs.common.omf.search.SimpleProperty">
           <property name="name"><value>Description</value></property>
        </bean>
        <bean class="com.edocs.common.omf.search.SimpleProperty">
           <property name="name"><value>companyName</value></property>
        </bean>
        <bean class="com.edocs.common.omf.search.SimpleProperty">
           <property name="name"><value>contactName</value></property>
        </bean>
                    <bean class="com.edocs.common.omf.search.MapProperty">
                      <property name="name"><value>attributes</value></property>
                        <property name="key"><value>attr1</value></property>
                    </bean>
                    <bean class="com.edocs.common.omf.search.MapProperty">
                        <property name="name"><value>attributes</value></property>
                        <property name="key"><value>attr2</value></property>
                    </bean>
     </list>
   </property>
       </bean>
```

Implementing Search Interfaces

Implement IOMFObjectSearchable to tell which attributes are available for search. The search component reads the preceding configuration file to get a list of attributes that can be used as searchable attributes.

```
   public interface IOMFObjectSearchable
   {

       /**
        * Finds IOMFObjects that match the provided attribute value.
        * A "%" character is interpreted as the like wildcard.
        * So for instance, "foo%" will match all strings that
        * start with "foo".  If there is no "%" character present
        * in the value then an equals match is performed.
        *
        * @param  criteria - the search criteria
        * @return list of IOMFObject objects
```

```
     */
    public List findLike(String attributeName, String value);


    /**
     * Finds IOMFObjects that satisfy the specified search criteria.
     *
     * @param  criteria - the search criteria
     * @return list of IOMFObject objects
     */
    public List find(ISearchCriteria criteria);

    /**
     * Returns a new ISearchCriteria object.
     *
     * @return ISearchCriteria object.
     */
    public ISearchCriteria getSearchCriteria();

    /**
     * Gets a list of IPropertyInfo - one for each searchable property.
  *The IPropertyInfo
     * object specifies the name and display name of a searchable property.
     *
     * @return List of IPropertyInfo objects.
     */
    public List getPropertyInfo();
}
```

Constructing Search Criteria

Use ISearchCritieria and IPredicate to build search criteria. ISearchCritieria.toQueryString() converts the search criteria to a Hibernate SQL string, calls the hibernate API to do the final query, and returns the result set, for example:

```
IServiceAgreementManager saManager =

IOFMService.getOMFManagerByName(ServiceAgreementManager.getClassName());

ISearchCriteria criteria = saManager.getSearchCriteria();
criteria.add(criteria.equals("subscriberName", "John Willson" )).add(
criteria.isNull( "extAttr1"));
IHierarchyNode  foundNodes =
rootNode.findNodeByLinkTargetTypeAndCriteria(saManager.getType(),criteria);
```

Providing Support for Reporting on the New Business Object

You must implement an event handler to run reports against your business objects through the hierarchy link target, because the link target data is stored in OLAP. When hierarchy is changed in OLTP, either through the UI or a batch job, an event handler can be called directly by the hierarchy API to process these events. Changes can be categorized by event type.

The same mechanism can be used to propagate to the reporting (OLAP) database. The changes made to OLTP and OLAP are bound in a single transaction to guarantee data integrity between OLTP and OLAP databases, using distributed database transaction management.

Example of Writing Your Own Synchronization Handler

If you create a new business object and register it as a link target with hierarchy, you also want to write your own OLAP handler, so that when your business object is linked into hierarchy, the same relationship can be propagated to the OLAP reporting table.

The way you construct the relationship between business object and hierarchy cross reference table determines how much control you have over the relationship. The general pattern is that each hierarchy node has a corresponding entry in the edx_rpt_hierarchy_xref_dim table.

The node and concrete link target type relationship is modeled through the hierarchy and link target workspace table. You can choose whether each link target has a node entry in the edx_rpt_hierarchy_xref_dim table. The alternative is to build a workspace table with just the link targets that are parent nodes of your object.

If you do not want to add a node entry to your link target object, make sure that you return isStoredFlat() = true in your link target event handler. Then, the node entry is not added to the link target edx_rpt_hierarchy_xref_dim table, and your objects and parent objects are stored flat in the workspace table, and can speed up the query.

To write your own OLAP link target handler, implement interface ILinkTargetEventHandler.

Once you finished your OLAP handler, you must register it with Hierarchy Manager, using the hierarchy link target configuration in the hierarchy.cfg.xma.xml file.

```
<bean id="ServiceAgreementConfig"
class="com.edocs.common.hierarchy.core.LinkTargetConfig" singleton="true">
  <property name="targetType"><value>edx:omf:serviceagreement:</value></property>
  <property name="targetTypeName"><value>Service Agreement</value></property>
  <property name="displayName"><value>getLinkTargetName</value></property>
  <property name="xmlTag"><value>ServiceAgreement</value></property>
  <property name="storedHierXRef"><value>false</value></property>
  <property name="xmlExchangeHandler">

<beanclass="com.edocs.common.omf.serviceagreement.ServiceAgreementXMLExchangeHandl
er"/>
  </property>
  <property name="linkTargetEventHandlers">
            <list>
                      <bean
class="com.edocs.common.hierarchy.connector.olap.OLAPServiceAgreementHandler"/>
```

```
                </list>
  </property>
</bean>
```

Supporting XML Exchange

The following topics describe how to configure XML exchanges in Hierarchy Manager.

Configuring XML Schema for Your Business Object

The Hierarchy Manager importer is flexible enough to import hierarchy relationships as well as link target content. You can decide whether the importer and exporter handles only relationships or also handles link target content.

To meet these requirements, Hierarchy Manager provides two XML schema definition files:

- **Common-hierarchy-interchange-1.0.xsd.** Specifies the format that is core to Hierarchy Manager. Do not change this file. Use the file as is.
- **Instance-hierarchy-interchange-1.0.xsd.** Customizes the hierarchy structure. You can add one or more sections to describe application-specific business objects, or link targets, in the import or export XML file.

The Instance-hierarchy-interchange-1.0.xsd file is referenced in the common-hierarchy-interchange-1.0.xsd schema file. So in preparing an XML data file, you only need to reference the common-hierarchy-interchange-1.0.xsd file as shown in the following example:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<ListOfHierarchies xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="common-hierarchy-interchange-1.0.xsd">
```

Link target can be defined in the instance-hierarchy-interchange.1.0.xsd file, such as:

```
<xs:element name="CostCenter">
<xs:complexType>
<xs:attribute name="name" type="xs:string"/>
  <xs:attribute name="fiscalCode" type="xs:string"/>
  <xs:attribute name="manager" type="xs:string"/>
  </xs:complexType>
</xs:element>
```

In the XML data file, a node that represents a cost object can be expressed as the following example:

```
 <Node>
  <BusinessObject>
       <CostCenter name=”PS”,  fiscalCode="10001" manager="Joe Smith"/>
    </BusinessObject>
    <CanBeAccessedBy>
       <userId>jsmith</userId>
       <userId>jane</userId>
```

```
    </CanBeAccessedBy>
  </Node>
```

Example of Writing Your Own Link Target Exchange Handler

The following example shows how to define your own link target exchange handler:

```
package com.edocs.common.api.hierarchy.connector;

public interface IHierarchyXMLExchangeHandler
{
  /**
   * Processes the information passed through a domObject to see if
 * it can be added to the Hierarchy.
   * @param domObject XML DOM representation of the OMF object
   * @param period that will be used to validate link target
   * @return An Instance of {@link ImportLinkTargetValidationStatus} to indicate
   * what action should be taken by the XMLContentHandler
   */
  public ILinkTargetImportResult validateLinkTarget(Document domObject,
IPeriod period);
  /**
   * Processes the information passed through a domObject.  Either find
   * the specified link target object or create a new link target with
   * the supplied information.
   * @param domObject XML DOM representation of the OMF object
   * @return created or found link target (OMF object)
   */
  public IHierarchyLinkTarget importLinkTarget(Document domObject)
throws HierarchyException;
    /**
     * Used for delta hierarchy import processing
     * @param domObject object representing the link target.
    * @param isNew boolean indicating whether the hierarhcy to be imported is a new.
     * @return a converted link target object.
     * @throws HierarchyException
     */
   public IHierarchyLinkTarget importDeltaLinkTarget(Document domObject,
boolean isNew) throws HierarchyException;
  /**
   * Converts the link target (OMF object) into XML.
   *
   * @param linkTarget the link target object to be exported.
   * @return XML representation of the OMF object.
   */
  public String exportLinkTarget(IHierarchyLinkTarget linkTarget)
throws HierarchyException;
  /**
   * Initializes this exchange handler with the XmlTag to use.
   * @param xmlTag the tag string for given type of link target class.
```

```
     */
    public void initialise(String xmlTag);
}
```

By implementing this interface, you can decide the rule for valid objects; whether the business object must be created by the Hierarchy Manager importer when the object does not already exist.

The ValidateLinkTarget() method is the first one called on your XMLExchangeHandler during the process of importing. You can put your own logic in the validation. For example, if the object you are handling does not exist when the hierarchy is imported, you can decide whether to stop the importer from continuing, or just skip over the object and continue to import the rest of the hierarchy.

ILinkTargetImportResult returns validation results and other context information for each link target being imported:

```
package com.edocs.common.api.hierarchy.connector.exchange;

public interface ILinkTargetImportResult
{
    /**
     * Returns the link target element tag.
     * @return the link target element tag.
     */
  public String getTag();

    /**
     * Returns the status of import.
     * @return the status of import.
     */
  public ImportLinkTargetValidationStatus getStatus();

    /**
     * Returns a list of attribute errors, if any.
     * @return a list of attribute errors, if any.
     */
  public List getAttributeErrors();

    /**
     * Returns the identifier.
     * @return the identifier.
     */
  String getIdentifier();
}
```

ImportLinkTargetValidationStatus contains the result of link target validation with the following possible values:

- **PASS.** Indicates that validation passed.
- **WARN_SKIP.** Indicates that there is a warning message. The link target to be imported must be skipped. For example, will not be linked into the hierarchy.
- **WARN_INCLUDE.** Indicates that there is a warning message. However, the link target to be imported will be included in the hierarchy tree.

- **FAIL_END**. Indicates that there is an error. However, the importer process can continue with a failure message at the end.
- **FAIL_NOW.** Indicates that there is a fatal error and the importer process must end immediately.

By returning different status code, your validation method can tell the importer what to do next.

Transactions in Hierarchy Manager Importer

Operations that create data using the importer are bounded into a single database transaction. Changes made to the database are not committed until the importer commits the changes. You can configure the commit size and approach. Modify the HierarchyImporter.xma.xml file:

```
<bean id="HierarchyXMLContentHandler"
class="com.edocs.common.hierarchy.connector.exchange.HierarchyXMLContentHandler"
singleton="false">
     <constructor-arg index="0">
        <ref bean="IHierarchyManager"/>
     </constructor-arg>
     <constructor-arg index="1">
        <ref bean="IHierarchyTypeManager"/>
     </constructor-arg>
     <constructor-arg index="2">
        <ref bean="TransactionManager"/>
     </constructor-arg>
     <constructor-arg index="3">
        <ref bean="IHierarchyPeriodValidationManager"/>
     </constructor-arg>
     <constructor-arg index="4">
        <bean class="com.edocs.common.xma.api.LookupBeanFactoryBean">
           <property name="beanUri">
               <value>edx:platform://modules/omf?id=periodManager</value>
           </property>
        </bean>
     </constructor-arg>

     <property name="commitedBatchSize"><value>200</value><!-- 200 records --></
property>
     <property name="batchCommitEnable"><value>true</value></property>
     <property name="transactionHoldingTime"><value>5</value><!-- holding the
transaction for 5 minutes max --></property>
</bean>
```

Working with an External SSO System

In some client systems, data for accessing billing information is stored in an external single sign-on (SSO) system. While replicating information into Oracle Self-Service E-Billing is possible for some deployments, for others Oracle Self-Service E-Billing must work with an external access control system to provide hierarchical reporting functionality. For additional information about using an external SSO system, see *Implementation Guide for Oracle Self-Service E-Billing*.

Figure 19 shows the set of interfaces and base classes that are provided as part of the set of extension points.

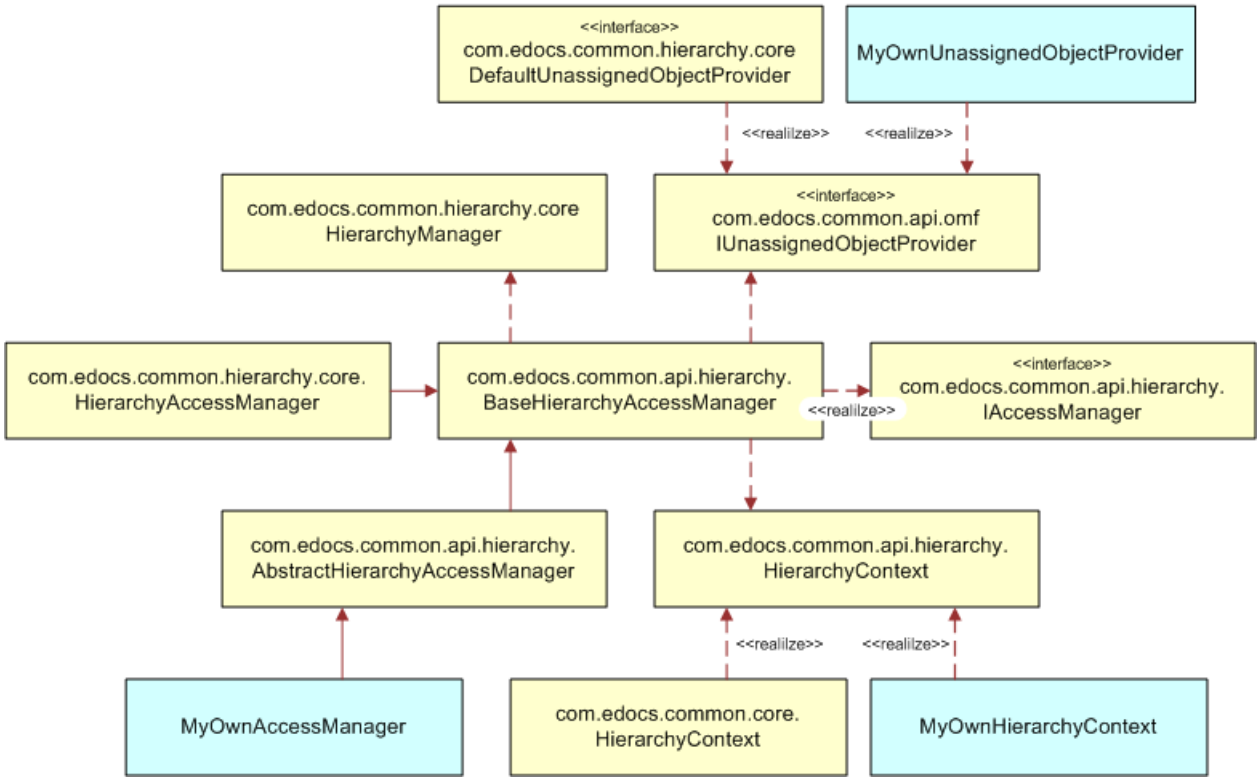

Figure 19. SSO Extension Point Interfaces and Classes

In Figure 19, class myOwnHierarchyContext, myOwnAccessManager, and myOwnUnassignedObjectProvider are places where you can add custom logic for access control related integration.

In the myOwnHierarchyContext class, you can store any information you gathered from external systems: http session and/or internal tables.

The myOwnAccessManager class is based on the information you stored to determine what level of access control to give, which delegates to IHierarchyManager to actually do the hierarchy related work.

The myOwnUnassignedObjectProvider class can be any class you create, as long as it provides the correct list of unassigned objects for a given user and hierarchy position. The class can include code that queries an external system, or uses PL/SQL to retrieve a list of objects based on your business rules.

Figure 20 shows a possible interaction sequence.

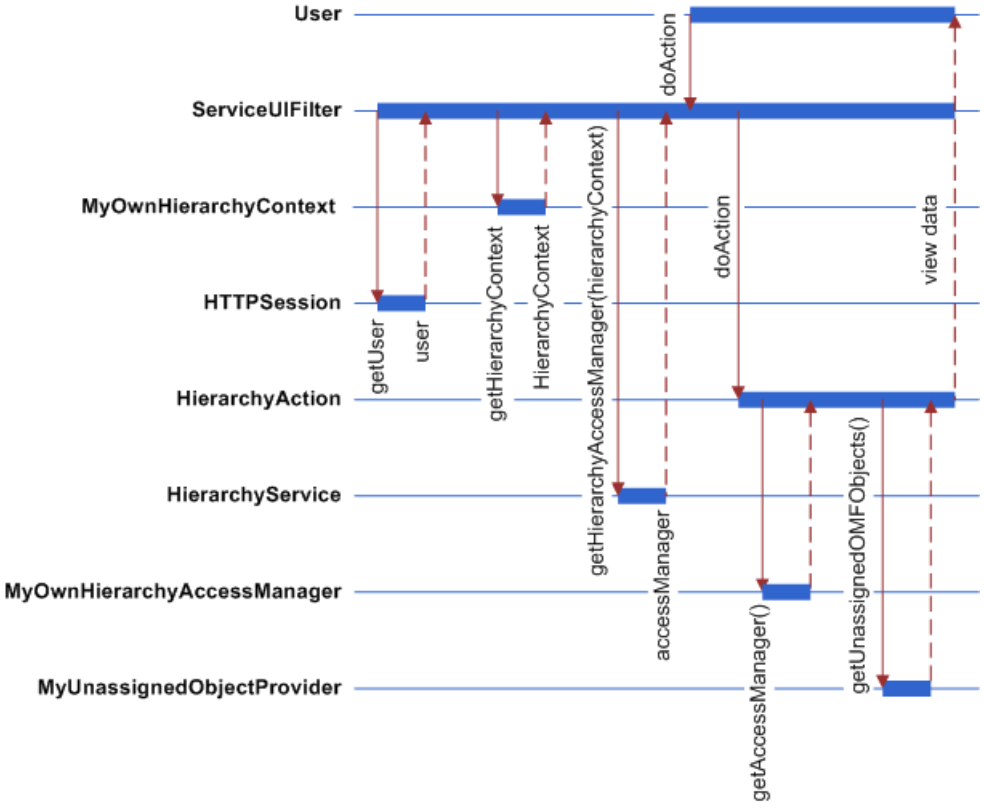

Figure 20. Example SSO Interaction Sequence

Working with Extended Attributes on Service Agreement Object

As one of the preconfigured features, the ServiceAgreement object provides five flexible string attributes for your use. These attributes can represent any properties. The label of these extended attributes can be different for each company. For example, in company A, the extendedAttribute1 field keeps the License Number attribute, which is related to the serviceAgreement. In company B, the same extendedAttribute1 fields for different service Agreement objects can keep service agreement owner's nick-name. Oracle Self-Service E-Billing internally maintains a list of attribute name mappings for each company to support extended attribute label mapping. The map can be used to render extended attribute names in the UI.

IExtFieldDefManager is responsible for managing and finding the mapped entries. Details about using this feature can be found in java doc for the com.edocs.common.api.omf.flexfieldmap package.

7 APIs for Customizing Oracle Self-Service E-Billing Hierarchy Manager

This chapter describes the APIs provided for customizing the Oracle Self-Service E-Billing Hierarchy Manager. It includes the following topics:

For more information about customizing and implementing your software, see *Implementation Guide for Oracle Self-Service E-Billing*.

IAttribute Interface

The IAttribute interface represents an attribute of a hierarchy node. Each attribute is essentially a name-value pair. A node can have a list of attributes associated with it. Each attribute is identified by its name and value. It is possible to have multiple nodes that have the same name but different values, for example: {"fruit", "apple"}, {"fruit", "orange"}, and {"fruit", "pear}. Table 3 describes the methods available for the IAttribute API.

Table 3. IAttribute Methods

Method	Description
String getName()	Retrieves the name of the attribute
java.lang.Object getValue()	Retrieves the value of the attribute.
void setName(java.lang.String name)	Sets the name of the attribute.
void setValue(java.lang.Object value)	Sets the value of the attribute.

IExpression Interface

The IExpression interface represents different filter operations you can have on a query, especially for searching name-value pairs such as hierarchy node attributes. Use IHierarchyService.createExpression() to get an instance of this object. Table 4 describes the methods available for the IExpression API.

Table 4. IExpression Methods

Method	Description
IFilter and(IFilter c1, IFilter c2)	Creates a filter which performs the AND logic operation on the two passed-in filters.
IFilter between(java.lang.String propertyName, java.lang.Object lo, java.lang.Object hi)	Creates a filter which performs the BETWEEN operation.
IFilter eq(java.lang.String propertyName, java.lang.Object value)	Creates a filter which performs the EQUAL logic operation.
IFilter ge(java.lang.String propertyName, java.lang.Object value)	Creates a filter which performs the GREATER THAN OR EQUAL (>=) operation.
IFilter gt(java.lang.String propertyName, java.lang.Object value)	Creates a filter which performs the GREATER THAN (>) operation.
IFilter in(java.lang.String propertyName, java.util.Collection values)	Creates a filter which performs the IN operation.
IFilter isNotNull(java.lang.String propertyName)	Creates a filter which performs the IS NOT NULL operation.

Table 4. IExpression Methods

Method	Description
IFilter isNull(java.lang.String propertyName)	Creates a filter which performs the IS NULL operation.
Filter le(java.lang.String propertyName, java.lang.Object value)	Creates a filter which performs the LESS THAN OR EQUAL (<=) operation.
IFilter like(java.lang.String propertyName, java.lang.Object value)	Creates a filter which performs the SQL LIKE operation.
IFilter lt(java.lang.String propertyName, java.lang.Object value)	Creates a filter which performs the LESS THAN (<) operation.
IFilter not(IFilter expression)	Creates a filter which performs the NOT operation on the passed in filter.
IFilter or(IFilter c1, IFilter c2)	Creates a filter which performs the OR logic operation on the two passed-in filters.
IFilter sql(java.lang.String sql)	Creates a filter using the passed in SQL expression.

IFilter Interface

The IFilter interface represents a query filter, which can be used as a filter to the query result. Table 5 describes the methods available for the IFilter API.

Table 5. IFilter Methods

Method	Description
java.lang.String toSQLString()	The string representation of the filter.

IFilteredQuery Interface

The IFilteredQuery interface provides methods to access a query which, when executed, returns a list of objects that can be filtered to match the specified filter class. Table 6 describes the methods available for the IFilteredQuery API.

Table 6. IFilteredQuery Methods

Method	Description
`IFilteredQuery add(IFilter filter)`	Adds the filter to be apply when execute the list().
`java.lang.Class getFilteredClass()`	Returns the filtered class.
`java.util.List getFilters()`	Returns a list of filter inserted by the add().

Table 6. IFilteredQuery Methods

Method	Description
`java.util.List list()`	Executes the query and return a list of java object for class set by setFilteredClass()
`void setFilteredClass(java.lang.Class class)`	Sets the class for filtering.

IHierarchy Interface

The IHierarchy interface represents a contract of a hierarchy. Use this API to remove, update, and publish a hierarchy, or access and modify the attributes or tree nodes of a hierarchy. Each hierarchy has a root node and include many levels of child nodes. A hierarchy only maintains the parent-child relationship among nodes. The nodes themselves are not business objects; they have no business meaning. The business meaning is expressed through the link target of each node.

A hierarchy can have one of three states:

- **Unpublished.** When a hierarchy is first created, it is in unpublished state. Unpublished hierarchies can only be available to or accessed by its creator and system administrators. Changes made to an unpublished hierarchy are not versioned. When an unpublished hierarchy is removed by an end user, the hierarchy is physically removed from the Oracle Self-Service E-Billing database.
- **Published.** Once a hierarchy is published, any changes made to the hierarchy structure is versioned based on the periods defined. A published hierarchy cannot be unpublished again.
- **Expired.** Once a hierarchy is expired, it becomes not available for periods that are later than the expiration period. However, the hierarchy is still available for the periods prior to the expiration period, and the user can still edit the hierarchy for the older version.

Each hierarchy also has a list of associated attributes, or properties, described in Table 7.

Table 7. IHierarchy Attributes

Attribute	Description
Id	Internal unique ID to identify the hierarchy.
version	Version of the hierarchy.
hierarchy type	The type of the hierarchy.
company id	The ID of the company to which the hierarchy belongs.
name	The name of the hierarchy, which is unique within the specific company.
display name	A more descriptive name for the hierarchy
description	The description of the hierarchy.
created date	The date when the hierarchy is created.

Table 7. IHierarchy Attributes

Attribute	Description
created by	The ID of the user who creates the hierarchy.
modified date	The date when the hierarchy is last modified.
modified by	The ID of the user who last modified the hierarchy.
deleted date	The date when the hierarchy is marked as deleted.
publish date	The date when the hierarchy is published.
expire date	The date when the hierarchy is expired.
expire period	The period staring which the hierarchy becomes expired. Get an instance of IHierarchy through IHierarchyManager.

Table 8 describes the methods available for the IHierarchy API.

Table 8. IHierarchy Methods

Method	Description
void addUserAccess(IOMFObject omfObject, java.lang.String userId)	Gives user access to a targeted node.
void expire()	Expires the hierarchy starting from the current working period.
IHierarchyNode[] findAllNodeForUserOfType(java.lang.String userId, java.lang.String omfObjectType)	Returns all nodes which the user has access to and whose link target types are of the specified type.
IHierarchyNode[] findFolderNode(java.lang.String folderName)	Deprecated.
IHierarchyNode findFolderNodeByLinkTargetId(java.lang.String linkTargetId)	Deprecated.
IHierarchyNode[] findNodeByLinkTargetId(java.lang.String linkTargetId)	Finds all nodes from a specific hierarchy that match a link target ID.
IHierarchyNode[] findNodeByLinkTargetType(java.lang.String linkTargetType)	Finds all nodes in this hierarchy whose link target types match the one specified by linkTargetType.
IHierarchyNode[] findNodeByLinkTargetTypeAndDisplayName(java.lang.String linkTargetType, java.lang.String linkTargetDisplayName)	Finds all nodes in this hierarchy whose link target types are the specified linkTargetType and whose link target names are the specified linkTargetDisplayName.

Table 8. IHierarchy Methods

Method	Description
IHierarchyNode findNodeByLinkTargetTypeAndLinkTargetId(java.lang.String linkTargetType, java.lang.String linkTargetId)	Finds all nodes in this hierarchy that match a link target type and link target Id.
IHierarchyNode findNodeByLinkTargetURI(java.lang.String linkTargetURI)	Finds a node in a hierarchy whose link target URL matches the specified linkTargetURI.
IHierarchyNode[] findNodeByLinkTargetURI(java.lang.String[] linkTargetURIs)	Finds an array of nodes in the hierarchy whose link target URIs match one of the URIs specified by linkTargetURIs.
IHierarchyNode[] findRootNodeForUser(java.lang.String userID)	Finds a list of root hierarchy nodes which the user has access to.
IHierarchyNode[] findRootNodeForUser2(java.lang.String userID)	Finds the nodes a user has access to; if the user has multiple access points in this hierarchy, the node is virtual. You can use this API if you have the userID.
IHierarchyNode[] findRootNodes(IUser user)	Finds a list of top level node for the user based on user's role.
IHierarchyNode[] findRootNodes2(IUser user)throws DataStoreException	Finds the nodes a user has access to; if the user has multiple access points in this hierarchy, the node is virtual. You can use this API if you have a user object.
java.util.List findUsers(java.lang.String userId, HierSearchType searchType, IAttribute[] attributes)	Deprecated.
java.util.List findUsers(java.lang.String userId, HierSearchType searchType, java.lang.String attrName, java.lang.Object attrValue)	Finds user objects (Assigned, Unassigned, Authorized or Unauthorized as specified in HierSearchType) that match the specified attribute value within the hierarchy.
IUser getActor()	Returns the user who is currently operating on the hierarchy.
java.util.List getAvailablePeriods()	Retrieves a list of periods that this hierarchy exists in.
java.util.List getAvailablePeriods(java.lang.String userId)	Retrieves all periods within which that specified user can have access to the hierarchy.
java.lang.String getCompanyID()	Retrieves the unique IDof the company which this hierarchy belongs to.
java.util.Date getCreatedAt()	Deprecated. Retrieves the date when the hierarchy was created.

Table 8. IHierarchy Methods

Method	Description
java.util.Date getCreatedate()	Retrieves the hierarchy creation date.
java.lang.String getCreatedBy()	Retrieves user ID who created the hierarchy.
java.util.Date getDeletedAt()	Deprecated. Returns the date when the hierarchy was marked as deleted.
java.lang.String getDescription()	Retrieves the description of the hierarchy.
java.lang.String getDisplayName()	Retrieves the display name of the hierarchy.
java.util.Date getExpiredate()	Retrieves the hierarchy expiration date.
IPeriod getExpiredPeriod()	Retrieves the period when the hierarchy is expired, or good through.
IHierarchyHandle getHandle()	Retrieves the hierarchy handle for this hierarchy. You can serialize this handle into a persistent store and then use it to restore the hierarchy.
java.lang.Long getID()	Retrieves the internal ID used to identify this hierarchy.
java.util.List getLinkTargetTypes()	Retrieves all valid link targets type string.
java.util.Date getModifiedAt()	Deprecated. Retrieves the date when the hierarchy was modified last time.
java.lang.String getModifiedBy()	Retrieves the login name of user who modified the hierarchy last time.
java.util.Date getModifydate()	Retrieves the hierarchy last modified date.
java.lang.String getName()	Retrieves the name of the hierarchy
java.util.Date getPublishdate()	Retrieves hierarchy publish date.
IHierarchyNode getRoot()	Returns the root node of this hierarchy.
IHierarchyType getType()	Retrieves the type of the hierarchy.
java.lang.Long getVersion()	Retrieves the versioning number of this object stored in the database.
IPeriod getWorkingPeriod()	Retrieves the current working period.
boolean isActivated()	The opposite of the isDeleted().
boolean isDeleted()	Checks whether this hierarchy has been marked as deleted.
boolean isPublished()	Checks whether the hierarchy has been published.
void publish()	Publishes the hierarchy for the current period.

Table 8. IHierarchy Methods

Method	Description
void publish(IPeriod startPeriod, IPeriod endPeriod)	Publishes the hierarchy from startPeriod to endPeriod, inclusive.
void purge()	Removes the hierarchy from the Oracle Self-Service E-Billing database.
void remove()	Removes the hierarchy.
void removeAccessForUser(java.lang.String userId)	Removes a users access to this hierarchy, which actually means all the nodes in this hierarchy.
void removeUserAccess(IHierarchyLinkTarget linkTarget, java.lang.String userId)	Removes user's access to the node whose link target is parameter linkTarget.
void replicateData(IPeriod startPeriod, IPeriod endPeriod)	Replicates current hierarchy structure for new periods specified between starting and end periods, inclusive.
void setActor(IUser user)	Sets the actor.
void setDescription(java.lang.String description)	Sets the description of the hierarchy.
void setDisplayName(java.lang.String displayName)	Sets the display name of the hierarchy.
void setName(java.lang.String name)	Sets the name of the hierarchy.
void setToLastestAvailablePeriod()	Sets the working period to the latest available period.
void setWorkingPeriod(IPeriod workingPeriod)	Sets a new working period.
void update()	Updates this hierarchy with the new attributes and or properties.

IHierarchyFolder Interface

The IHierarchyFolder interface provides a protocol to access, update, or add attributes to a hierarchy folder. Table 9 describes the methods available for the IHierarchyFolder API.

Table 9. IHierarchyFolder Methods

Method	Description
void addAttribute(IAttribute attribute)	Adds additional IAttribute object to the folder.
java.util.Set getAttributes()	Retrieves a set of attributes added through addAttribute() method.
java.lang.String getDescription()	Retrieves description of the folder.

Table 9. IHierarchyFolder Methods

Method	Description
java.lang.String getDisplayName()	Returns display name of the folder.
java.lang.String getLinkTargetName()	Retrieves link target name.
java.lang.String getName()	Deprecated. Use getDisplayName().
void setDescription(java.lang.String description)	Sets description.
void setDisplayName(java.lang.String displayName)	Sets display name.
void setLinkTargetName(java.lang.String name)	Sets folder name.
void setName(java.lang.String name)	Deprecated. Use setDisplayName()
void update()	Updates the folder object into database

IHierarchyFolderManager Interface

The IHierarchyFolderManager interface provides a protocol to access the hierarchy folder manager. Table 10 describes the methods available for the IHierarchyFolderManager API.

Table 10. IHierarchyFolderManager Methods

Method	Description
IHierarchyFolder createFolder(java.lang.String folderName, java.lang.String description)	Creates a new folder object by passing in the name and description.
IHierarchyFolder createFolder(java.lang.String folderExternalKey, java.lang.String folderName, java.lang.String description)	Creates a new folder object by passing in unique string key, name and description

IHierarchyHandle Interface

Like an EJBHandler for EJB object, the IHierarchyHandle interface provides a handler to a hierarchy object, serializes the handler to a secondary storage, and then uses it to restore the hierarchy object. Table 11 describes the methods available for the IHierarchyHandle API.

Table 11. IHierarchyHandle Methods

Method	Description
java.lang.String getDisplayName()	The display name for the hierarchy, which can be used to display a human-readable description of the hierarchy.
IHierarchy getHierarchy()	Retrieves the hierarchy corresponding to this handle.
java.lang.String getHierarchyId()	Returns a string identifier for the hierarchy. The value returned is usually a long value, but can change depending on the implementation.
java.lang.Long getVersion()	The version number of the hierarchy represented by this handle. The value is the database version number and is not related to versioned hierarchies.

IHierarchyLinkTarget Interface

The IHierarchyLinkTarget interface represents an IOMFObject, which resolves to a link target. Any object that wishes to be linked into hierarchy must implement this interface. Table 12 describes the methods available for the IHierarchyLinkTarget API.

Table 12. IHierarchyLinkTarget Methods

Method	Description
java.lang.String getLinkTargetId()	The link target identifier.
java.lang.String getLinkTargetName()	The link target name.
boolean isEditable()	Returns true if this object has one or more properties that are modifiable.
boolean isEditable(java.lang.String propertyName)	Returns true if the specified property is modifiable.

IHierarchyManager Interface

The IHierarchyManager interface provides a contract for managing hierarchy-related operations like create, update, delete, or search. Obtain an instance of IHierarchyManager through IHierarchyService:

- LookupService lookup: LookupServiceFactory.getInstance()
- IHierarchyService hierarchyService: (IHierarchyService) lookup.getModule("hierarchy")
- IHierarchyManager hierarchyManager: hierarchyService.createHierarchyManager(anIUser)

Table 13 describes the methods available for the IHierarchyManager API.

Table 13. IHierarchyManager Methods

Method	Description
void addUserAccess(IOMFObject omfObject, java.lang.String userId)	Allows a user to access nodes whose link targets are the same as the given object in all hierarchies.
void addUserAccess(java.lang.String userId, IHierarchyNode[] nodes)	Associates a user to multiple nodes.
IHierarchy createHiearchyFromNode(java.lang.String companyId, java.lang.String hierarchyName, IHierarchyType hierarchyType, IHierarchyNode nodeToCopy, boolean preserveUserAccess)	Creates a hierarchy with a new copy of a tree base on the passed in node.
IHierarchy createHiearchyFromNode(java.lang.String companyId, java.lang.String hierarchyName, IHierarchyType hierarchyType, java.util.Set nodesToCopy, boolean preserveUserAccess)	Creates a hierarchy with a new copy of a tree base on the passed in node.
HierarchyExchangeResult exportXML(IHierarchy hierarchy, java.lang.String newHierarchyName)	Deprecated. Exports to XML file a specified hierarchy from the point of view of the currently logged in user.
java.io.InputStream exportXMLAsInputStream(IHierarchy hierarchy, java.lang.String newHierarchyName)	Exports to XML file a specified hierarchy from the point of view of the currently logged in user.
IHierarchy findHierarchy(java.lang.String companyID, java.lang.String hierName)	Finds the hierarchy with corresponding company ID and hierarchy name.
IHierarchy[] findHierarchyForLinkTargetURI(IHierarchyType hierarchytype, java.lang.String linkTargetURI)	Finds the hierarchies with the specific hierarchy type and containing the specific link target.

Table 13. IHierarchyManager Methods

Method	Description
IHierarchy[] findHierarchyForLinkTargetURI(IHierarchyType hierarchytype, java.lang.String linkTargetURI, IPeriod period)	Finds the hierarchies with the given hierarchy type and containing the given link target for the given period.
IHierarchyNode[] findNodeByLinkTargetId(java.lang.String linkTargetId)	Finds all nodes in all hierarchies that match a link target ID.
IHierarchyNode[] findNodeByLinkTargetId(java.lang.String linkTargetId, IPeriod period)	Finds all nodes in all hierarchies that match a link target ID in specific period.
IHierarchyNode[] findNodeByLinkTargetType(java.lang.String linkTargetType)	Finds all nodes in all hierarchies that match a link target type.
IHierarchyNode[] findNodeByLinkTargetType(java.lang.String linkTargetType, IPeriod period)	Finds all nodes in all hierarchies that match a link target type in specific period.
IHierarchyNode[] findNodeByLinkTargetTypeAndDisplayName(java.lang.String linkTargetType, java.lang.String linkTargetDisplayName)	Finds all nodes in all hierarchies that match a link target type and link target display name.
IHierarchyNode[] findNodeByLinkTargetTypeAndDisplayName(java.lang.String linkTargetType, java.lang.String linkTargetDisplayName, IPeriod period)	Finds all nodes in all hierarchies in the specific period that match the given link target type and link target display name.
IHierarchyNode[] findNodeByLinkTargetTypeAndLinkTargetId(java.lang.String linkTargetType, java.lang.String linkTargetId)	Finds all nodes in all hierarchies that match a link target type and link target ID.
IHierarchyNode[] findNodeByLinkTargetTypeAndLinkTargetId(java.lang.String linkTargetType, java.lang.String linkTargetId, IPeriod period)	Finds all nodes in all hierarchies that match a link target type and link target ID in the specified period.
IHierarchyNode[] findNodeByLinkTargetURI(java.lang.String uri)	Finds all nodes that have the matched URI from all hierarchies.
IHierarchyNode[] findNodeByLinkTargetURI(java.lang.String uri, IPeriod period)	Finds all nodes with link targets having matched URI from all hierarchies for the given period.
IHierarchyNode[] findRootNodeForUser(java.lang.String userId)	Finds all top level nodes the user has access to across all hierarchies.

Table 13. IHierarchyManager Methods

Method	Description
IHierarchyNode[] findRootNodeForUser(java.lang.String userId, IPeriod period)	Finds all top level nodes the user has access to across all hierarchies for a given period.
IUser getActor()	Retrieves the current user who is managing this hierarchy.
IHierarchy[] getDeletedHierarchies()	Retrieves all hierarchies marked as deleted.
IHierarchy[] getExpirableHierarchyCreatedBy(IHierarchyType hierarchyType, java.lang.String userId)	Finds all hierarchies of specific type that can be expired by the given user.
IHierarchy[] getExpirableHierarchyForCompany(IHierarchyType hierarchyType, java.lang.String domainId)	Finds all hierarchies of specific type that can be expired for the current domain(company).
IHierarchy[] getHierarchies()	Retrieves all hierarchies currently existed in the database.
IHierarchy[] getHierarchies(IHierarchyType hierarchyType)	Retrieves all hierarchies for a given hierarchy type.
IHierarchy[] getHierarchies(IUser user, IHierarchyType type)	Retrieves all hierarchies of a certain type the specified user has access to.
IHierarchy[] getHierarchiesCreateByUserOfType(java.lang.String userId, IHierarchyType hierarchyType)	Finds all hierarchies of specific type that are created by the given user.
IHierarchy[] getHierarchiesForDomain(java.lang.String domainName)	Returns all the hierarchies for a company.
IHierarchy[] getHierarchiesForDomain(java.lang.String domainName, IHierarchyType hiearchyType)	Retrieves all hierarchies for a company with specified hierarchy type.
IHierarchy[] getHierarchiesForUser(java.lang.String userId)	Retrieves all hierarchies the user have access to.
IHierarchy[] getHierarchiesForUser(java.lang.String userId, IHierarchyType hierarchyType)	Retrieves all hierarchies of given type for a given user.
IHierarchy getHierarchy(java.lang.Long hierarchyID)	Returns a hierarchy with an internal ID that is useful on the UI, where hierarchy is saved in the session instead of in the hierarchy object.
IHierarchyNode getHierarchyNode(java.lang.Long hierarchyNodeId)	Returns a hierarchy node with an internal ID, the database key.

Table 13. IHierarchyManager Methods

Method	Description
HierarchyExchangeResult importXML(java.io.InputStream hierarchyFile)	Imports a hierarchy from an XML file.
void purgeHierarchy(IHierarchy hierarchy)	Permanently deletes the hierarchy from the Oracle Self-Service E-Billing database.
void purgeHierarchy(java.lang.String hierarchyDomain, java.lang.String hierarchyName)	Permanently deletes the inactive hierarchy from persistent storage.
void removeAllAccessForUser(java.lang.String userExternalID)	Removes this user's access from all hierarchies.
void removeAllHierarchyForCompany(java.lang.String companyId)	Removes all the hierarchies for a company.
void setActor(IUser actor)	Sets the current user who is managing this hierarchy.
void validateXML(java.io.InputStream hierarchyFile)	Validates hierarchy XML file based on XML schema provided in common-hierarchy-interchange-1.0.xsd and instance-hierarchy-interchange-1.0.xsd

IHierarchyNode Interface

The IHierarchyNode interface provides a contract for a hierarchy node. This API expresses the parent-child relationship of a hierarchy, and has no direct business meaning. A node only has business meaning after it is linked to a business object. The list of business objects include IAccount, IService, ICharge. Objects can have the properties described in Table 14.

Table 14. IHierarchyNode Object Properties

Attribute	Description
id	The internal ID used to identify this hierarchy node.
alias	The alias given to this node.
isContainer	Indicates whether this node is a container. Only container nodes can have children.
createdAt	The date when the node was created.
createdBy	The user ID who created this node.
deletedAt	The date when this node was marked as deleted.
description	The description of the node.

Table 14. IHierarchyNode Object Properties

Attribute	Description
linkTargetId	The ID of the link target of the node. For example, account number for IAccount.
linkTargetName	The name of the link target of the node.
linkTargetType	The type of the link target of the node.
linkTargetURI	The URI of the link target of the node.

Table 15 describes the methods available for the IHierarchyNode API.

Table 15. IHierarchyNode Methods

Method	Description
void addAttribute(IAttribute attribute)	Adds an attribute to the attribute list of the node.
void addAttributes(java.util.Collection attributes)	Adds a collection of attributes to the attribute list of the node.
IHierarchyNode addLinkTarget(IHierarchyLinkTarget child)	Creates a new node whose link target is as specified and add that node as the child node of this node object.
void addUserAccess(java.lang.String userId)	Gives a user access to this node.
IHierarchyNode[] findByOMFTypeAndAttributes(java.lang.String omfType, IAttribute[] attributes)	Deprecated. Use #findNodeByLinkTargetTypeAndCriteria(String ,com.edocs.common.api.omf.search.ISearchCriteria) instead. Finds all nodes that are the descendants of this node whose link target types match the specified OMF object type and node attributes match the ones in the specified attributes.
IHierarchyNode[] findNodeByLinkTargetId(java.lang.String linkTargetId)	Finds all nodes that match the specified link target ID, beginning at this node and searching recursively to the child nodes.
IHierarchyNode[] findNodeByLinkTargetType(java.lang.String linkTargetType)	Finds all nodes that are the descendants of this node whose link target types match the specified link target type.
IHierarchyNode[] findNodeByLinkTargetTypeAndCriteria(java.lang.String linkTargetType, ISearchCriteria criteria)	Finds all nodes that are the descendants of this node whose link target type match the specified link target type and link target object match the specified criteria.

Table 15. IHierarchyNode Methods

Method	Description
IHierarchyNode[] findNodeByLinkTargetTypeAndDisplayName(java.lang.String linkTargetType, java.lang.String linkTargetDisplayName)	Finds all nodes that are the descendants of this node whose link target types match the specified link target type and link target display names match the specified link target display name.
IHierarchyNode findNodeByLinkTargetURI(java.lang.String linkTargetURI)	Finds a node that matches the specified link target URI, beginning at this node and searching recursively to the child nodes.
IOMFObject[] findOMFObject(java.lang.String userId, java.lang.String elementType, HierSearchType status, IAttribute[] attributes)	Deprecated. Use IHierarchyAccessManager#findAssignedOMFObjects(com.edocs.common.api.hierarchy.IHierarchyNode, String, com.edocs.common.api.omf.search.ISearchCriteria) or IHierarchyAccessManager#findUnassignedOMFObjects(com.edocs.common.api.hierarchy.IHierarchy, String, com.edocs.common.api.omf.search.ISearchCriteria)
IHierarchyNodeObjWrapper[] findOMFObject(java.lang.String userId, java.lang.String elementType, HierSearchType status, java.lang.String attrName, java.lang.Object attrValue)	Deprecated. Use IHierarchyAccessManager#findAssignedOMFObjects(com.edocs.common.api.hierarchy.IHierarchyNode, String, com.edocs.common.api.omf.search.ISearchCriteria) or IHierarchyAccessManager#findUnassignedOMFObjects(com.edocs.common.api.hierarchy.IHierarchy, String, com.edocs.common.api.omf.search.ISearchCriteria)
java.util.List findUsers(HierSearchType status, IAttribute[] attributes)	Deprecated.
java.util.List findUsers(HierSearchType searchType, java.lang.String attrName, java.lang.Object attrValue)	Finds users (Assigned, Unassigned, Authorized or Unauthorized as specified in HierSearchType) that match the specified attribute name and value within the sub tree starting from the current node.
java.lang.String getAlias()	Each node can be given an alias.
java.util.Set getAllAuthorizedUsers()	Retrieves all the users who have access to this node.
java.util.Collection getAllUsers()	Returns a collection of users having access to this node and its parent nodes.

Table 15. IHierarchyNode Methods

Method	Description
java.lang.Object getAttribute(java.lang.String attributeName)	Retrieves the value of the attribute for a given name.
java.util.Set getAttributes()	Retrieves all the attributes for this node.
java.util.Set getAttributes(java.lang.String attributeName)	Retrieves all attributes of the node whose names match the specified attribute name.
java.util.Set getAuthorizedUsers()	Retrieves all the users who are directly assigned to access this node.
java.util.Set getChildren()	Retrieves all the immediate children nodes of this node.
java.util.Set getChildren(boolean initializeHasChildren)	Retrieves all the immediate children nodes of this node.
java.util.Set getChildren(boolean initializeHasChildren, IHierarchyNode startFromNode, int fetchSize)	Returns a list of IHierarchyNode objects that represent as child nodes of the current node.
java.util.Set getChildren(boolean initializeHasChildren, int startPosition, int fetchSize)	Returns a list of IHierarchyNode objects that represent as child nodes of the current node.
java.util.Set getChildrenOfType(java.lang.String omfObjectType)	Returns a set of immediate children whose link target types match the specified type.
java.util.Set getChildrenOfType(java.lang.String omfObjectType, java.util.Collection attributes)	Returns a set of immediate children whose link target types match the specified type and whose node attributes match those specified.
java.util.Date getCreatedAt()	Retrieves the date when the node was created.
java.lang.String getCreatedBy()	Retrieves the ID of the user who created the node.
java.util.Date getDeletedAt()	Retrieves the date when the node was marked as deleted.
java.lang.String getDescription()	Retrieves the description property of this node.
java.util.Date getExpiredate()	Retrieves the date when the node is removed
IHierarchyNodeHandle getHandle()	Retrieves the hierarchy node handle that can be serialized and passed across the net.
IHierarchy getHierarchy()	Retrieves the current hierarchy object which this node belongs to.
java.lang.String getHierarchyName()	Retrieves the name of the hierarchy this node is associated with.
java.lang.Long getID()	Returns the internal node ID.

Table 15. IHierarchyNode Methods

Method	Description
`IHierarchyLinkTarget getLinkTarget()`	Retrieves the link target object of this nodes.
`java.lang.String getLinkTargetExtKey()`	Retrieves link target external key.
`java.lang.String getLinkTargetID()`	Retrieves the ID of the link target of this node.
java.lang.String getLinkTargetName()	Retrieves the name of the link target of this node.
java.lang.String getLinkTargetType()	Retrieves the type of the link target for this node.
java.lang.String getLinkTargetURI()	Retrieves the URI of the link target of this node.
java.lang.String getOmfObjectType()	Deprecated. use {#getLinkTargetType} instead.
java.lang.String getOmfObjectURI()	Retrieves the URI of the link target of this node.
IHierarchyNode getParent()	Retrieves the parent node of this node.
java.lang.String getPath()	This is the absolute path from the root node to this node.
int getScrollPosition()	Retrieves the position and focus of current child nodes.
java.util.Collection getUsers()	Returns a collection of IUser objects assigned to this node.
java.util.List getUsersAssignedToNodeOrAnyAncestor()	Retrieves all the users who have access to this node or any of its ancestor nodes.
java.util.List getUsersAssignedToNodeOrAnyDescendent()	Retrieves all the users who have access to this node or any of its descendant, or child, nodes.
boolean hasChildren()	Use this method to check whether the node has any children without loading all the children nodes.
boolean hasUser()	Indicates whether the node has any users associated with.
boolean isDeleted()	Deprecated. With versioning, it does not make sense to have a deleted node. Checks whether this node has been marked as deleted.
boolean isFolder()	Checks whether this node is a folder.
boolean isRoot()	Checks whether this node is a root node.

Table 15. IHierarchyNode Methods

Method	Description
void move(IHierarchyNode destination)	Moves this node to a different parent in the same hierarchy or between two different hierarchy.
void moveUser(IHierarchyNode destination, java.lang.String userid)	Re-associates the given user from current node to the destination node.
void remove()	Marks this hierarchy node and its children as deleted.
void removeAllAttributes()	Removes all attributes for this node.
IAttribute removeAttribute(java.lang.String name, java.lang.String value)	Removes the attribute with specified name and value from this node.
void removeAttributes(java.lang.String name)	Removes all attributes whose names are the same as the specified name.
void removeUserAccess(java.lang.String userId)	Removes user access from the node.
void setAlias(java.lang.String alias)	Gives this node an alias.
void setDescription(java.lang.String description)	Sets the description property of this node.
void setLinkTargetName(java.lang.String name)	Sets the name of the link target of this node.
void update()	Persists any changes made to the node.
void update(IHierarchyLinkTarget linkTarget)	Updates the current node value using the information from the given link target.

IHierarchyNodeHandle Interface

The IHierarchyNodeHandle interface provides a protocol to access a hierarchy node. IHierarchyNodeHandle is a light version of a hierarchy node. This protocol can be used to retrieve IHierarchyNode when full information about the node is required. The handle class has been used by higher layer, such as UI service layer to build UI element of the tree. Table 16 describes the methods available for the IHierarchyNodeHandle API.

Table 16. IHierarchyNodeHandle Methods

Method	Description
IHierarchyNode getHierarchyNode()	Retrieves the hierarchy node corresponding to this handle.
java.lang.String getLinkTargetName()	Retrieves link target name for displaying hierarchy node.

Table 16. IHierarchyNodeHandle Methods

Method	Description
java.lang.String getNodeId()	Returns string identifier for the hierarchy node. The value returned is usually a long value, but can change depending on the implementation.
java.lang.Long getParentId()	Retrieves unique identifier of the parent node.
java.lang.String getParentLinkTargetName()	Retrieves the link target name for parent node.
java.lang.String getPath()	Retrieves the path this node holds in the hierarchy.
java.lang.Long getVersion()	The version number of hierarchy node represented by this handle. The value is the database version number and is not related to versioned hierarchies.

IHierarchyService Interface

The IHierarchyService interface provides a contract for creating a hierarchy service that provides an entry-point to the hierarchy module. Implement this interface to create important Hierarchy components such as IHierarchyManager.

To use XMA to obtain an instance of IHierarchyService:

1. LookupService lookup: LookupServiceFactory.getInstance();
2. IHierarchyService hierarchyService: (IHierarchyService) lookup.getModule("hierarchy");
3. Use the IHierarchyService interface to create hierarchy managers and filter queries on hierarchies.

Table 17 describes the methods available for the IHierarchyService API.

Table 17. IHierarchyService Methods

Method	Description
IAttribute createAttribute(java.lang.String name, java.lang.Object value)	Creates an instance of IAttribute, which represents a Hierarchy node attribute.
IExpression createExpression()	Creates an instance of IExpression.
IFilteredQuery createFilteredQueryForIHierarchy()	Creates an instance of IFilteredQuery to manage hierarchy query-related operations.
IFilteredQuery createFilteredQueryForIHierarchyNode()	Creates an instance of IFilteredQuery to manage hierarchy node query-related operations.

Table 17. IHierarchyService Methods

Method	Description
IHierarchyAccessManager createHierarchyAccessManager(IHierarchyContext hierarchyContext)	Returns a singleton of the IHierarchyAccessManager to manage hierarchy access.
IHierarchyFolderManager createHierarchyFolderManager()	Creates an instance of IHierarchyFolderManager to manage hierarchy folder-related operations.
IHierarchyManager createHierarchyManager(IUser user)	Creates an instance of IHiearchyManager to manage hierarchy-related operations.
IHierarchyTypeManager createHierarchyTypeManager()	Creates an instance of IHierarchyTypeManager to manage hierarchy type-related operations.
java.util.List getObjectSearchTypes(OMFTypeProperty otp)	Returns a list of HierSearchType objects for the specified OMFTypeProperty
java.util.List getObjectSearchTypes(OMFTypeProperty omfType, IHierarchyType hierType)	Returns a list of hierarchy search types for specified OMF type within given type of hierarchy.

IHierarchyType Interface

The IHierarchyType interface represents the type of hierarchy. Note, this object is persistent. Table 18 describes the methods available for the IHierarchyType API.

Table 18. IHierarchyType Methods

Method	Description
java.lang.String getCode()	A unique code to identify this hierarchy type.
java.lang.String getDescription()	Retrieves the description of the hierarchy type
java.lang.Long getID()	Retrieves the internal ID used to identify this hierarchy type.
java.lang.String getName()	Retrieves the name of the hierarchy type.

IHierarchyTypeManager Interface

The IHierarchyTypeManager object is used to manage hierarchy types. You can get an instance of this object through IHierarchyService. Table 19 describes the methods available for the IHierarchyTypeManager API.

Table 19. IHierarchyTypeManager Methods

Method	Description
boolean canContain(IHierarchyType hierarchyType, OMFTypeProperty parentType, OMFTypeProperty childType)	Returns true if the given type of parent and child can form a valid relationship in the specified type of hierarchy.
IHierarchyType getHierarchyType(java.lang.String code)	Retrieves an instance of IHierarchy by its unique code
java.util.List getHierarchyTypes()	Retrieves all the supported hierarchy types.
java.lang.String getOMFObjectTypeName(java.lang.String omfType)	Retrieves the name of the link target with the specified object type .
java.util.List getOMFObjectTypes(IHierarchyType hierarchyType)	Each hierarchy type allows a list of link target objects to be linked to it.
java.util.List getOMFTypePropertyList(IHierarchyType hierarchyType)	A function that calls the getOMFObjectTypes(IHierarchyType hierarchyType) internally, and return OMF type and the type name pairs in a list.

IHierarchyUserRef Interface

The IHierarchyUserRef interface represents a user being assigned to a hierarchy node. Table 20 describes the methods available for the IHierarchyUserRef API.

Table 20. IHierarchyUserRef Methods

Method	Description
java.lang.String getExternalID()	Retrieves the user ID.

ILinkTargetConfig Interface

The ILinkTargetConfig interface provides a contract for accessing the link target configuration. The link target provides business meaning to a hierarchy node. Table 21 describes the methods available for the ILinkTargetConfig API.

Table 21. ILinkTargetConfig Methods

Method	Description
java.lang.String getDescription()	Retrieves the method name which will be used to retrieve description string.
java.lang.String getDisplayName()	Retrieves the method name for displaying display name.
java.lang.String getExternalKey()	Returns the method name to be used as display external key properties.
java.util.List getLinkTargetEventHandlers()	Returns a list of event handler class names.
java.lang.String getTargetType()	Returns target type string for the link target.
java.lang.String getTargetTypeName()	Retrieves name string assigned for given target class.
IUnassignedObjectProvider getUnassignedObjectProvider()	Retrieves the name of class for retrieving unassigned objects.
IHierarchyXMLExchangeHandler getXmlExchangeHandler()	Returns full class name of XML exchange handler for handle this type of element in the XML import process.
java.lang.String getXmlTag()	Returns XML element tag name used for this type of link target.
boolean isStoredHierXRef()	Returns a Boolean indicating whether this type of link target, when handled in the OLAP side, is flatten out outside the hierarchy node table.

A Hierarchy Manager XML Exchange Schema

This appendix contains information about the Hierarchy Manager XML Exchange Schema. It includes the following topics:

Location of the XML Exchange Schema

The Hierarchy Manager XML Exchange Schema is found in the following location:

- **UNIX.** `EDX_HOME/config/xml/common-hierarchy-interchange-1.0.xsd`
- **Windows.** `EDX_HOME\config\xml\common-hierarchy-interchange-1.0.xsd`

XML Exchange Schema file Contents

The contents of the XML Exchange Schema file are:

```
<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" version="1.0">
  <xs:annotation>
    <xs:documentation>
          This file contains the XML schema definition that edocs hierarchy module
          uses for interchanging hierarchical business structures.
          Do not modify this file for deployment specific requirements.
          Any deployment specific information should be made in the
          instance-hierarchy-interchange-1.0.xsd schema definition file.
    </xs:documentation>
  </xs:annotation>
  <xs:include schemaLocation="instance-hierarchy-interchange-1.0.xsd">
    <xs:annotation>
      <xs:documentation>
```

```
        Includes the document containing instance/deployment specific schema
details.
     </xs:documentation>
     </xs:annotation>
  </xs:include>
  <xs:element name="ListOfHierarchies">
     <xs:complexType>
        <xs:sequence>
           <xs:element name="DeltaHierarchy" minOccurs="0">
              <xs:complexType>
                 <xs:sequence>
                    <xs:element name="Move" maxOccurs="unbounded" minOccurs="0">
                       <xs:complexType>
                          <xs:all>
                             <xs:element name="SrcHierarchy" type="HierarchyDef"/>
                             <xs:element name="SrcNode" type="DeltaNodeDef"/>
                             <xs:element name="DestHierarchy" type="HierarchyDef"/>
                             <xs:element name="DestNode" type="DeltaNodeDef"/>
                          </xs:all>
                       </xs:complexType>
                    </xs:element>
                    <xs:element name="Add" maxOccurs="unbounded" minOccurs="0">
                       <xs:complexType>
                          <xs:all>
                             <xs:element name="SrcNode" type="DeltaNodeDef"/>
                             <xs:element name="DestHierarchy" type="HierarchyDef"/>
                             <xs:element name="DestNode" type="DeltaNodeDef"/>
                          </xs:all>
                       </xs:complexType>
                    </xs:element>
```

```
                <xs:element name="Delete" maxOccurs="unbounded" minOccurs="0">
                   <xs:complexType>
                      <xs:all>
                         <xs:element name="SrcNode" type="DeltaNodeDef"/>
                         <xs:element name="DestHierarchy" type="HierarchyDef"/>
                      </xs:all>
                   </xs:complexType>
                </xs:element>
             </xs:sequence>
          </xs:complexType>
       </xs:element>
       <xs:element name="CompleteHierarchy" type="Hierarchy" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:complexType name="DeltaNodeDef">
  <xs:sequence>
    <xs:element name="BusinessObject" type="BusinessObjectType"/>
  </xs:sequence>
</xs:complexType>
<xs:complexType name="Hierarchy">
  <xs:annotation>
    <xs:documentation>
            Always the hierarchy will be created using the user given name,
            and the name in the XML file will be ignored.
        </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="AcceptableBusinessObjectTypes"
type="AcceptableBusinessObject" minOccurs="0"/>
```

```
      <xs:element name="RootNode" type="HierarchyNode"/>
    </xs:sequence>
    <xs:attributeGroup ref="HierarchyAttrs"/>
  </xs:complexType>
  <xs:complexType name="AcceptableBusinessObject">
    <xs:annotation>
      <xs:documentation>
                A list of xml tag names of acceptable business object types to be
                  considered when importing a hierarchy.
               If there were any tags which were not specified here in the XML file,
                  then those and their child nodes will be ignored.
                When overriding an existing hierarchy, any nodes with any other
               type than specified here will be unaltered by the import process.
                If this section is not present then the content of the whole XML
file will be imported.
          </xs:documentation>
    </xs:annotation>
    <xs:sequence maxOccurs="unbounded">
      <xs:element name="tagName" type="xs:string"/>
    </xs:sequence>
  </xs:complexType>
  <xs:attributeGroup name="HierarchyAttrs">
    <xs:attribute name="domainID" type="xs:string" use="optional">
      <xs:annotation>
        <xs:documentation>
        When the domain ID is not available, user's domain ID will be used.
       </xs:documentation>
      </xs:annotation>
    </xs:attribute>
    <xs:attribute name="type" type="HierarchyType" use="optional">
```

```
        <xs:annotation>
          <xs:documentation>
          When the hierarchy type is not available, user's default hierarchy type
will be used
          which be set by the importer/exporter hooks.
         </xs:documentation>
        </xs:annotation>
      </xs:attribute>
      <xs:attribute name="name" type="xs:string" use="required"/>
      <xs:attribute name="displayName" type="xs:string" use="optional">
        <xs:annotation>
          <xs:documentation>
          When the display name is not available, name will be used.
         </xs:documentation>
        </xs:annotation>
      </xs:attribute>
      <xs:attribute name="period" type="xs:date" use="optional">
        <xs:annotation>
          <xs:documentation>
          Period is optional and will be ignored for the first release.
         </xs:documentation>
        </xs:annotation>
      </xs:attribute>
    </xs:attributeGroup>
    <xs:complexType name="NodeList">
      <xs:sequence maxOccurs="unbounded">
        <xs:element name="Node" type="HierarchyNode"/>
      </xs:sequence>
    </xs:complexType>
    <xs:complexType name="AccessDef">
```

```
   <xs:sequence>
      <xs:element name="userId" type="xs:string" maxOccurs="unbounded"/>
   </xs:sequence>
</xs:complexType>
<xs:complexType name="HierarchyNode">
   <xs:sequence>
      <xs:element name="BusinessObject" type="BusinessObjectType"/>
      <xs:element name="CanBeAccessedBy" type="AccessDef" minOccurs="0"/>
      <xs:element name="ChildNodeList" type="NodeList" minOccurs="0"/>
   </xs:sequence>
</xs:complexType>
<xs:complexType name="FolderDef">
   <xs:annotation>
      <xs:documentation>
             Folder is the default business object type.
      </xs:documentation>
   </xs:annotation>
   <xs:all>
      <xs:element name="Description" type="xs:string" minOccurs="0"/>
      <xs:element name="AttributeList" minOccurs="0">
         <xs:complexType>
            <xs:sequence>
               <xs:element name="Attribute" minOccurs="0" maxOccurs="unbounded">
                  <xs:complexType>
                     <xs:attribute name="name" type="xs:string"/>
                     <xs:attribute name="value" type="xs:string"/>
                  </xs:complexType>
               </xs:element>
            </xs:sequence>
         </xs:complexType>
```

```
      </xs:element>
   </xs:all>
   <xs:attribute name="name" type="xs:string"/>
   <xs:attribute name="externalID" type="xs:string"/>
</xs:complexType>
<xs:complexType name="ServiceAgreementDef">
   <xs:sequence>
      <xs:element name="ExtAttr1" type="xs:string" minOccurs="0"/>
      <xs:element name="ExtAttr2" type="xs:string" minOccurs="0"/>
      <xs:element name="ExtAttr3" type="xs:string" minOccurs="0"/>
      <xs:element name="ExtAttr4" type="xs:string" minOccurs="0"/>
      <xs:element name="ExtAttr5" type="xs:string" minOccurs="0"/>
   </xs:sequence>
   <xs:attribute name="serviceNo" use="required">
      <xs:simpleType>
         <xs:restriction base="xs:string">
            <xs:minLength value="1"/>
            <xs:maxLength value="255"/>
         </xs:restriction>
      </xs:simpleType>
   </xs:attribute>
   <xs:attribute name="accountNo" use="optional">
      <xs:simpleType>
         <xs:restriction base="xs:string">
            <xs:minLength value="1"/>
            <xs:maxLength value="255"/>
         </xs:restriction>
      </xs:simpleType>
   </xs:attribute>
   <xs:attribute name="billerId" use="optional">
```

```
      <xs:simpleType>
         <xs:restriction base="xs:string">
            <xs:minLength value="1"/>
            <xs:maxLength value="255"/>
         </xs:restriction>
      </xs:simpleType>
   </xs:attribute>
</xs:complexType>
<xs:complexType name="ServiceChargeDef">
   <xs:attribute name="serviceNo" use="required">
      <xs:simpleType>
         <xs:restriction base="xs:string">
            <xs:minLength value="1"/>
            <xs:maxLength value="255"/>
         </xs:restriction>
      </xs:simpleType>
   </xs:attribute>
   <xs:attribute name="accountNo" type="xs:string"/>
   <xs:attribute name="billerId" type="xs:string"/>
   <xs:attribute name="chargeType" use="required">
      <xs:simpleType>
         <xs:restriction base="xs:string">
            <xs:minLength value="1"/>
            <xs:maxLength value="32"/>
         </xs:restriction>
      </xs:simpleType>
   </xs:attribute>
</xs:complexType>
<xs:complexType name="CompanyDef">
   <xs:attribute name="fiscalCode" type="xs:string"/>
```

```
   <xs:attribute name="companyTitle" type="xs:string"/>
</xs:complexType>
<xs:complexType name="HierarchyDef">
   <xs:attributeGroup ref="HierarchyAttrs"/>
</xs:complexType>
<xs:complexType name="AccountDef">
   <xs:attribute name="accountNo" use="required">
      <xs:simpleType>
         <xs:restriction base="xs:string"><xs:minLength value="1"/>
            <xs:maxLength value="255"/>
         </xs:restriction>
      </xs:simpleType>
   </xs:attribute>
   <xs:attribute name="billerId" use="optional">
      <xs:simpleType>
         <xs:restriction base="xs:string">
            <xs:minLength value="1"/>
            <xs:maxLength value="255"/>
         </xs:restriction>
      </xs:simpleType>
   </xs:attribute>
</xs:complexType>
<xs:complexType name="BusinessObjectType">
   <xs:choice>
      <xs:group ref="DeploymentSpecificBusinessObjectType"/>
      <xs:element name="Folder" type="FolderDef"/>
      <xs:element name="ServiceAgreement" type="ServiceAgreementDef"/>
      <xs:element name="ServiceCharge" type="ServiceChargeDef"/>
      <xs:element name="Company" type="CompanyDef"/>
      <xs:element name="Account" type="AccountDef"/>
```

```
      </xs:choice>
    </xs:complexType>
  </xs:schema>
```

B Hierarchy XML File Example

This appendix contains an example of a Hierarchy XML file. It includes the following topic:

Example of a Hierarchy XML File on page 105

Example of a Hierarchy XML File

The following text shows an example of Hierarchy XML file content:

```
<?xml version="1.0" encoding="ISO-8859-1"?>

<ListOfHierarchies xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="common-hierarchy-interchange-1.0.xsd">

  <CompleteHierarchy name="Jul_AmericanHighTech" domainID="American HighTech1"
type="BILLING" displayName="Jul_AmericanHighTech">

     <RootNode>

        <BusinessObject>

           <Company fiscalCode="American HighTech1" companyTitle="American
HighTech1"/>

        </BusinessObject>

        <ChildNodeList>

           <Node>

              <BusinessObject>

                 <Account accountNo="1|29006120" billerId="1"/>

              </BusinessObject>

              <ChildNodeList>

                 <Node>

                    <BusinessObject>

                       <ServiceAgreement serviceNo="5458039028"

                                 accountNo="29006120" billerId="1"/>

                    </BusinessObject>

                 </Node>
```

```
   </ChildNodeList>
</Node>
<Node>
   <BusinessObject>
      <Account accountNo="1|31569801" billerId="1"/>
   </BusinessObject>
   <ChildNodeList>
      <Node>
         <BusinessObject>
            <ServiceAgreement serviceNo="4943929463"
                    accountNo="31569801" billerId="1"/>
         </BusinessObject>
      </Node>
      <Node>
         <BusinessObject>
            <ServiceAgreement serviceNo="4943942893"
                        accountNo="31569801" billerId="1"/>
         </BusinessObject>
      </Node>
   </ChildNodeList>
</Node>
<Node>
   <BusinessObject>
      <Account accountNo="1|41251761" billerId="1"/>
   </BusinessObject>
   <ChildNodeList>
      <Node>
         <BusinessObject>
            <ServiceAgreement serviceNo="7379289372"
                  accountNo="41251761" billerId="1"/>
```

```
                  </BusinessObject>
               </Node>
               <Node>
                  <BusinessObject>
                     <ServiceAgreement serviceNo="7379830382"
                           accountNo="41251761" billerId="1"/>
                  </BusinessObject>
               </Node>
            </ChildNodeList>
         </Node>
         <Node>
            <BusinessObject>
               <Account accountNo="1|5128140" billerId="1"/>
            </BusinessObject>
            <ChildNodeList>
               <Node>
                  <BusinessObject>
                     <ServiceAgreement serviceNo="4513783743" accountNo="5128140"
billerId="1"/>
                  </BusinessObject>
               </Node>
               <Node>
                  <BusinessObject>
                     <ServiceAgreement serviceNo="4514724956" accountNo="5128140"
billerId="1"/>
                  </BusinessObject>
               </Node>
               <Node>
                  <BusinessObject>
                     <ServiceAgreement serviceNo="4519382734" accountNo="5128140"
billerId="1"/>
```

```
            </BusinessObject>
         </Node>
      </ChildNodeList>
   </Node>
   <Node>
      <BusinessObject>
         <Account accountNo="1|61362310" billerId="1"/>
      </BusinessObject>
      <ChildNodeList>
         <Node>
            <BusinessObject>
               <ServiceAgreement serviceNo="3184732174"
                  accountNo="61362310" billerId="1"/>
            </BusinessObject>
         </Node>
      </ChildNodeList>
   </Node>
   <Node>
      <BusinessObject>
         <Account accountNo="1|71385461" billerId="1"/>
      </BusinessObject>
      <ChildNodeList>
         <Node>
            <BusinessObject>
               <ServiceAgreement serviceNo="7634076300"
                        accountNo="71385461" billerId="1"/>
            </BusinessObject>
         </Node>
      </ChildNodeList>
   </Node>
```

```
            <Node>
               <BusinessObject>
                  <Account accountNo="1|80011008" billerId="1"/>
               </BusinessObject>
               <ChildNodeList>
                  <Node>
                     <BusinessObject>
                        <ServiceAgreement serviceNo="4070620806"
                                accountNo="80011008" billerId="1"/>
                     </BusinessObject>
                  </Node>
                  <Node>
                     <BusinessObject>
                        <ServiceAgreement serviceNo="4071135451"
                                   accountNo="80011008" billerId="1"/>
                     </BusinessObject>
                  </Node>
               </ChildNodeList>
            </Node>
         </ChildNodeList>
      </RootNode>
   </CompleteHierarchy>
</ListOfHierarchies>
```

Index

No index available for this guide.