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Repository Guide

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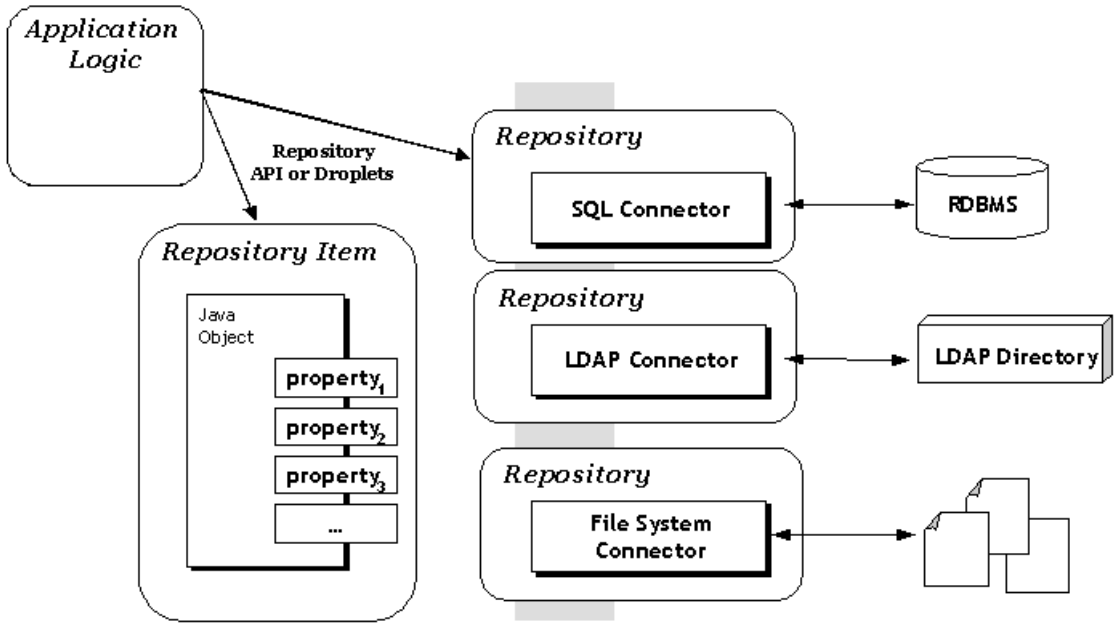
1 Introduction

Data access is a large part of most Internet applications. Oracle ATG Web Commerce Data Anywhere Architecture™ provides a unified view of content and data across a business for organizations and their customers. The core of the Oracle ATG Web Commerce Data Anywhere Architecture is the Repository API. Through the Repository API, you can employ a single approach to accessing disparate data types, including SQL databases, LDAP directories, content management systems, and file systems.

With the Oracle ATG Web Commerce Data Anywhere, the application logic created by developers uses the same approach to interact with data regardless of the source of that data. One of the most powerful aspects of this architecture is that the source of the data is hidden behind the Oracle ATG Web Commerce Repository abstraction. It is easy to change from a relational data source to an LDAP directory as none of the application logic needs to change. After data is retrieved from a data source, it is transformed into an object-oriented representation. Manipulation of the data can be done using simple `getPropertyValue` and `setPropertyValue` methods. The Repository API ties in closely with Oracle ATG Web Commerce's targeting APIs, so you can retrieve items from the repository based on a variety of targeting rules, as well as retrieving specific identified items.

The figure below provides a high-level overview of the Oracle ATG Web Commerce Data Anywhere Architecture.



Oracle ATG Web Commerce Data Anywhere Architecture offers several advantages over the standard data access methods such as Java Data Objects (JDO), Enterprise JavaBeans (EJB), and Java Database Connectivity (JDBC). Among the differences:

Data source independence

Oracle ATG Web Commerce Data Anywhere Architecture provides access to relational database management systems, LDAP directories, and file systems using the same interfaces. This insulates application developers from schema changes and also storage mechanism. Data can even move from a relational database to an LDAP directory without requiring recoding. Java Data Objects support data source independence, but it is up to vendors to provide an LDAP implementation.

Fewer lines of Java code

Less code leads to faster time-to-market and reduced maintenance cost. Persistent data types created with Oracle ATG Web Commerce Data Anywhere are described in an XML file, with no Java code required.

Unified view of all customer interactions

A unified view of customer data (gathered by web applications, call center applications, and ERP systems) can be provided without copying data into a central data source. This unified view of customer data leads to a coherent and consistent customer experience.

Maximum performance

Intelligent caching of data objects ensures excellent performance and timely, accurate results. The JDO and EJB standards rely on a vendor implementation of caching that might not be available.

Simplified transactional control

The key to overall system performance is minimizing the impact of transactions while maintaining the integrity of your data. In addition to full Java Transaction API (JTA) support, Oracle ATG Web Commerce Data Anywhere lets both page developers and software engineers control the scope of transactions with the same transactional modes—required, supports, never—used by EJB deployment engineers.

Fine-grained access control

You can control who has access to which data at the data type, data object, even down to the individual property with Access Control Lists (ACLs).

Integration with ATG product suites

Oracle ATG Web Commerce personalization, scenarios, commerce, portal, and content administration applications all make use of repositories for data access. A development team is free to use EJBs along side of Oracle ATG Web Commerce technology, but the easiest way to leverage investment in Oracle ATG Web Commerce technology is to follow the example set by the solution sets. The Oracle ATG Web Commerce solution sets satisfy all their data access needs with repositories.

2 Repository API

The Oracle ATG Web Commerce Repository API (`atg.repository.*`) is the foundation of persistent object storage, user profiling, and content targeting in Oracle ATG Web Commerce products. A repository is a data access layer that defines a generic representation of a data store. Application developers use this generic representation to access data by using only interfaces such as `Repository` and `RepositoryItem`. Repositories access the underlying data storage device through a connector, which translates the request into whatever calls are needed to access that particular data store. Connectors for relational databases and LDAP directories are provided out-of-the-box. Connectors use an open, published interface, so additional custom connectors can be added if necessary.

Developers use repositories to create, query, modify, and remove repository items. A repository item is like a JavaBean, but its properties are determined dynamically at runtime. From the developer's perspective, the available properties in a particular repository item depend on the type of item they are working with. One item might represent the user profile (name, address, phone number), while another might represent the meta-data associated with a news article (author, keywords, synopsis).

The purpose of the Repository interface system is to provide a unified perspective for data access. For example, developers can use targeting rules with the same syntax to find people or content.

Applications that use only the Repository interfaces to access data can interface to any number of back-end data stores solely through configuration. Developers do not need to write a single interface or Java class to add a new persistent data type to an application

Each repository connects to a single data store, but multiple repositories can coexist within Oracle ATG Web Commerce products, where various applications and subsystems use different repositories or share the same repository. Applications that use only the Repository API to access data can interface to any number of back-end data stores solely through configuration. For example, the security system can be directed to maintain its list of usernames and passwords in an SQL database by pointing the security system at an SQL repository. Later, the security system can be changed to use an LDAP directory by reconfiguring it to point to an LDAP repository. Which repositories you use depends on the data access needs of your application, including the possible requirement to access data in a legacy data store.

The Oracle ATG Web Commerce platform includes the following models for repositories:

- SQL repositories use Oracle ATG Web Commerce's Generic SQL Adapter (GSA) connector to map between Oracle ATG Web Commerce and the data in an SQL database. You can use an SQL repository to access content, user profiles, application security information, and more.
- SQL profile repository, included in the Oracle ATG Web Commerce Personalization module, uses the Generic SQL Adapter connector to map user data that is contained in an SQL database. See the *Personalization Programming Guide*.
- *LDAP Repositories* (page 319) use the Oracle ATG Web Commerce LDAP connector to access user data in an LDAP directory. See the *LDAP Repositories* (page 319) chapter.
- *Composite Repositories* (page 279) let you use multiple data stores as sources for a single repository.

- Versioned repositories extend the SQL repositories and are used in Oracle ATG Web Commerce Content Administration. See the *Content Administration Programming Guide*.

When you store a document in a repository, in addition to the document meta-information, you need access to the physical content and path information that tells you where the document is stored. Content-specific repository extensions handle this. These are located in the `atg.repository.content` package, described later in the *SQL Content Repositories* (page 213) chapter.

Repository Architecture

A data store can contain many types of objects. The repository is not the data store itself; rather, it is composed of JavaBeans whose properties can be found and stored in the data store. The repository provides a mechanism to retrieve the data elements, and creates a run-time representation of the available metadata for each object. This goal is achieved through three main conceptual parts of the Repository API:

- Repository Items (page 4)
- Item Descriptors (page 5)
- *Repository Queries* (page 13)

For example, a repository might track elements of an organization. Each employee has a corresponding repository item, as does each department. An employee item descriptor specifies all properties that an employee repository item can possess; a department item descriptor specifies all the possible properties of a department. An application can build queries that return the appropriate employee or department repository items as they are needed by the application.

Repository Items

A repository is a collection of repository items. A repository item is a JavaBean component that implements `atg.repository.RepositoryItem` or one of its sub-interfaces, and corresponds to the smallest uniquely identifiable entity in the underlying data store. In the SQL repository, for example, a repository item often corresponds roughly to a row in a table. In the SQL profile repository, each user profile is a repository item.

Properties

Each repository item is composed of named properties that store the item's data—for example, `id`, `firstName`, and `lastName`. In the SQL repository, these properties generally correspond to table columns. Repository item properties are defined in its item descriptor.

Repository item properties can be single-or multi-valued. In some repository implementations such as the SQL repository, a property's value can refer to one or more other repository items, either in the same or another repository. This enables a repository item to use properties that are complex data structures..

Repository IDs

Each repository item must have an identifier, which is called a repository ID. The repository ID must uniquely differentiate the repository item from all other repository items of the same type. The repository is typically configured to find the repository ID from some elements of the underlying data. In the SQL repository, for instance, each item descriptor must specify the columns that act as the repository ID, usually the same as the

table's primary key. Depending on the repository's configuration, the repository ID might not be exposed as a property of the repository item.

The combination of item descriptors, properties, identifiers, and items allows a repository to read application data from the underlying data store and write application data back to it. If desired, a repository can be defined to expose certain properties, item descriptors, or the entire repository as read-only. Properties can also act as translators between the underlying data source and the Java application. For example, you might want your Oracle ATG Web Commerce application to display last names in upper case. You can define a repository property named `lastNameUpperCase` that takes the last name value from the database and returns it in upper case. The Repository API provides this and other options without requiring you to modify any application code.

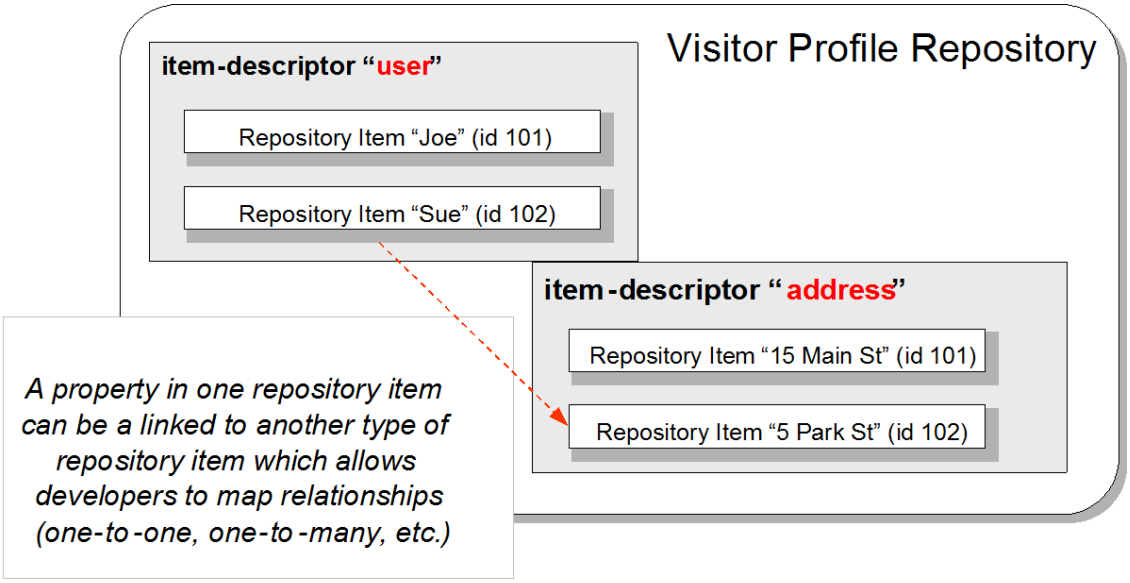
Item Descriptors

Each repository item belongs to an item type that is defined by a Repository item descriptor. An item descriptor implements the `atg.repository.RepositoryItemDescriptor` interface and can subclass `atg.repository.ItemDescriptorImpl`. An item descriptor provides the following information:

- The item type's name
- Item type properties
- The class of the Java object used to represent the item type—for example, Integer or String

Repository item descriptors depend on a combination of the underlying data store and the configuration of the repository. In the SQL repository, for example, an item descriptor might correspond to a single database table, or encompass multiple tables.

Item descriptors are defined in an XML repository definition file. A repository can support multiple item descriptors. For example, the figure below shows two item descriptors that are defined in a Visitor Profile repository that stores customer data: `user` and `address`. Each item descriptor is typically implemented by multiple items. The example below shows how item descriptors user and address are implemented by multiple items:



As shown in this figure, you can model relationships between item types. In this example, item type `user` has an `address` property. The value of the `address` property is a repository item of type `address`.

The ItemDescriptor mechanism is built upon Oracle ATG Web Commerce Dynamic Beans (`atg.beans.*`) system (described in the *Nucleus: Organizing JavaBean Components* chapter of the *Platform Programming Guide*), which lets you describe properties for Java objects without defining the `getX` and `setX` methods for each property as required by the JavaBean specification. This interface is used to describe a set of dynamic properties that occur together and have consistent behavior and semantics. An item descriptor essentially acts like a `BeanInfo` where one can get access to the PropertyDescriptors that compose the repository item. (For information about BeanInfos and PropertyDescriptors, see the JSDK 2 API documentation for `java.beans.BeanInfo` and `java.beans.PropertyDescriptor`.)

Most repositories support simple property types such as Strings and Integers. Oracle ATG Web Commerce repositories can also use the Java Collections Framework to model complex relationships between items using familiar object-oriented concepts. Thus, an item property can store as its value:

- A list of multiple values as a Set, List, Map, or array.
- Another repository item or multiple repository items.

For example, a repository might have item descriptors `Person` and `Address`. The `Person` item descriptor might have an `addresses` property that exposes a list of addresses. This property might be of type `RepositoryItem[]`, and the repository items in that array use the `Address` item descriptor. This allows repositories to represent one-to-one, one-to-many, or many-to-many relationships.

The information stored in ItemDescriptor components is usually not needed to develop Oracle ATG Web Commerce applications. This property metadata is available for applications that provide a user interface for exploring and navigating a repository. For example, the ATG Control Center uses repository ItemDescriptors to limit the selections available to its users.

MutableRepository

The base interfaces of a repository define an immutable data store. It provides a read-only version of the elements contained in the repository. Extensions of the Repository interfaces provide facilities to create, update, and remove items from a repository. See atg.repository.MutableRepository (page 8). The design goal for updates was to allow transactional integrity across a set of changes in a high performance manner. When an item needs to be updated, a clone of the object is returned and changes are made to the cloned object. The repository carries out those changes only when the object is submitted for an update action.

Generally, repositories use caches to improve performance. Items retrieved out of a repository either through a query process or directly by ID from the repository are cached. Typically, cache policies are based on least recently used (LRU) design patterns or time-based expiration. For more information, see the chapter *SQL Repository Caching* (page 103).

Core Repository API Elements

This section describes the core Repository API for users who wish to extend it. Extensions can include specific form handlers to update user information or specialized queries to search for documents. The following interfaces and classes are described:

- atg.repository.Repository (page 7)
- atg.repository.RepositoryView (page 7)
- atg.repository.RepositoryItem (page 8)
- atg.repository.MutableRepository (page 8)
- atg.repository.PropertiesChangedEvent (page 10)

atg.repository.Repository

The base definition of any repository implementation, this interface provides methods to access RepositoryItems, RepositoryViews and ItemDescriptors.

Given a unique ID or set of IDs, you can retrieve repository items with the following methods:

```
RepositoryItem getItem(String pId, String pDescriptorName)
RepositoryItem[] getItems(String[] pIds, String pDescriptorName)
```

Depending on the repository implementation, item IDs can take different forms. In SQL repositories, a repository item ID by default is numeric and is auto-generated through the `IdGenerator` service, which is described the *Core Dynamo Services* chapter of the *Platform Programming Guide*. The SQL repository also supports composite repository item IDs. In that case, you can retrieve items from the repository with these methods:

```
RepositoryItem getItem(CompositeKey pId, String pDescriptorName)
RepositoryItem [] getItems(CompositeKey [] pIds, String pDescriptorName)
```

In other cases, an item ID might be the path of the document, as in some of the file-system based repositories.

The Repository API includes the `RepositoryItemDescriptor` interface, a subinterface of `atg.beans.DynamicBeanInfo` (see the *Platform Programming Guide* chapter *Nucleus: Organizing JavaBean Components*). This lets you access the "dynamic bean info" of the available repository items, such as the property descriptors and property names, with this method:

```
RepositoryItemDescriptor getItemDescriptor(String pName)
```

You can also get a list of all available ItemDescriptors from the `itemDescriptorNames` property.

atg.repository.RepositoryView

If you do not have an exact repository ID, you can search for items in the repository through a `RepositoryView`. Item descriptors and `RepositoryViews` often have a one-to-one relationship and often have the same name. You can find out what views are available through the `viewNames` property of the Repository component. This is useful if you need to build a system to navigate and view the entire contents of a repository. The IDs for items in different item types might not overlap. There might be no view that can return all items in the repository, but if there is, it is the default view. If you need to use the default view, you can use the view named by the `defaultViewName` property. Alternatively, you can create properties for your own services that allow you to explicitly name the view your code is interested in using. After you have a name, you can retrieve that view through the `RepositoryView getView(String pName)` method. From this returned object you can build and execute a query.

The `RepositoryView` can also implement `atg.repository.RepositoryViewContainer` if the repository needs to express a hierarchy of `RepositoryViews`. For example, a document management system might have a root view for all "documents." From that you might have sub-document types such as white papers, promo blurbs, images, and so on. Further, the sub-view images might also have a refinement for specific

image types like JPEG and GIF. You can see what attributes are available for building queries by accessing the `itemDescriptor` property of the `RepositoryView`. This describes all the property information about all the items that can be returned by this view.

Sets of repository items can be gathered by queries, which you can build with the `atg.repository.QueryBuilder` interface. This `QueryBuilder` object can be retrieved from the view's `queryBuilder` property. After a query is built, each `RepositoryView` implementation translates the internalized data structure into its native query language, for example SQL, and return an array of repository items that match the supplied query criteria. This is the mechanism by which the targeting engine understands how to translate the rule syntax into the appropriate method calls of the `QueryBuilder`.

After a query is built from the `QueryBuilder`, it is executed via by one of several `executeQuery` methods defined in the `RepositoryView` interface. For example:

```
RepositoryItem[] executeQuery(Query pQuery)
```

`executeQuery` methods allow range queries and sorting criteria to be added to the execution of the query. The methods return one of the following:

- An array of RepositoryItems, for elements that match the query's `WHERE` clauses.
- Null, if no elements can be found.

atg.repository.RepositoryItem

The `atg.repository.RepositoryItem` interface is the immutable interface that represents an element from a repository. Each `RepositoryItem` is uniquely identified through its `repositoryId` property. The ItemDescriptor that describes the dynamic bean info about the item is available through the `itemDescriptor` property. Given the repository item, you can also know what repository it came from with the `repository` property. To retrieve the attributes of the `RepositoryItem`, use the `getPropertyValue(String pPropertyName)` method. You can retrieve subproperties with the `DynamicBeans.getSubPropertyValue` method, which takes a hierarchy property name of the form `propertyName1.subPropertyName2.subSubPropertyName3`.

A Dynamic Bean property mapper is registered for the `RepositoryItem` interface. This lets you reference the names of these properties as though they were JavaBean properties in the Oracle ATG Web Commerce Servlet Bean syntax. See the *Nucleus: Organizing JavaBean Components* chapter of the *Platform Programming Guide*.

atg.repository.MutableRepository

Some repository services implement `MutableRepository`, a subclass of `Repository`. The SQL repository implements this interface. The `MutableRepository` interface defines these methods:

- `createItem()`
- `addItem()`
- `removeItem()`
- `updateItem()`

createItem() method

There are two `createItem` methods:

```
createItem(String pDescriptorName)
createItem(String pId, String pDescriptorName)
```

Each of these requires a `DescriptorName` parameter, which is the name of the `RepositoryView` or ItemDescriptor that describes the repository item to create. Each repository has a default ItemDescriptor, which might allow your code to use the `defaultViewName` property of the repository to supply this value. One of the `createItem` methods takes a potential unique ID to use for the `MutableRepositoryItem` to create. If you do not supply an ID, one is automatically generated and guaranteed to be unique.

In the SQL profile repository, for example, the `createItem` methods return a transient instance of a `MutableRepositoryItem`. At this point, the profile does not exist persistently in a data store. The item exists only as the object reference you are returned. You can try to refetch the object (if the user's session is not expired or the server did not restart) through the `getItem(String pId, String pDescriptorName)` method of the Repository (unless the `GSARepository.storeTransientItems` property is set to `false`). Maintaining profile RepositoryItems in RAM rather than in the profile database allows anonymous users to be represented in the same Repository API, but does not hamper performance for handling requests for large sites. It becomes untenable to try to create anonymous user database records for web sites that have a large volume of users.

addItem() method

After you create an item, you can turn it into a persistent repository item with the `addItem` method. This takes in the repository item that you want to add persistently:

```
RepositoryItem addItem(MutableRepositoryItem pItem)
```

removeItem() method

Removing an item from the repository is very easy. Pass the ID and ItemDescriptor name of the item you want to remove persistently to the `removeItem` method. The item's property values are deleted and are no longer accessible from the repository:

```
removeItem(String pId, String pDescriptorName)
```

updateItem() method

The `MutableRepository` updates a repository item in a transactionally aware manner. It differs from a standard JavaBean in order to ensure that the update operation in the backend data store (such as a relational database) is efficient. Thus, updating an item requires three steps:

1. Fetch a mutable version of the repository item through the `getItemForUpdate` and `getItemsForUpdate` methods. These methods return instances of `MutableRepositoryItem`. This interface extends `RepositoryItem` and adds one method:

   ```
   setPropertyValue(String pPropertyName, Object pPropertyValue)
   ```

2. Use the `setPropertyValue` method of `MutableRepositoryItem` to change as many properties as you wish. These changes are not reflected in the repository until the final `updateItem` operation is invoked.

3. Save the changes with the `updateItem` method. This method extracts all the changes required for the item and updates the item in the data store. Depending on how you have configured transactional behavior, the update can be committed immediately, or it can happen automatically when the associated transaction commits. See Repositories and Transactions (page 29) in the *SQL Repository Architecture* (page 29) chapter. If there was any type of error, a `RepositoryException` is thrown.

For example:

```
try {
   RepositoryItem user = ... // get a reference to the user you want to update
   MutableRepository mutableRepository = (MutableRepository)user.getRepository();
   MutableRepositoryItem mutableUser =
```

```
      mutableRepository.getItemForUpdate(user.getRepositoryId(),
                        user.getItemDescriptor().getItemDescriptorName());
   mutableUser.setPropertyValue("name", "bob");
   mutableUser.setPropertyValue("age", new Integer(26));
   mutableRepository.updateItem(mutableUser);
}
catch (RepositoryException exc) {
 // deal with exception
}
```

This same methodology should be applied for RAM-based RepositoryItems that you have created through the `createItem` method. No database transaction is performed, but the values are updated in the repository.

The Dynamo Application Framework (DAF) includes three classes that provide useful methods for dealing with repository items:

- `atg.repository.servlet.RepositoryFormHandler`
- `atg.userprofiling.ProfileForm`
- `atg.userprofiling.ProfileFormHandler`

See the *User Profile Forms* chapter in the *Page Developer's Guide* and the source code for the `ProfileForm` and `ProfileFormHandler` classes, included in the Oracle ATG Web Commerce Personalization module distribution in the `<ATG11dir>/DPS/src/Java/atg/userprofiling` directory.

atg.repository.PropertiesChangedEvent

When a repository item is modified, its item descriptor broadcasts locally a `PropertiesChangedEvent`. This event can be one of the following types:

Event Type	Description
DELETE	the item was removed in this transaction
UPDATE	properties of an item changed in this transaction
INSERT	the item was newly added to the database
CACHE_INVALIDATE	some application code called the `removeItemFromCache` method

In addition to its type, a `PropertiesChangedEvent` contains the following:

Property	Description
`item`	The item that is changed. This is set to null if the item that was modified is not currently in the cache. In that case, look at the `repositoryId` property for the identity of the item that was changed.
`repositoryId`	The repository ID of the item that is changed.

Property	Description
itemDescriptorName	The item descriptor of the item that is changed.
properties	A Map where the keys are RepositoryPropertyDescriptors and the values are the new property values. If all properties have changed (or might have changed), a null value is returned for the properties map. Returned only for UPDATE events.

If you have a component that you want to be notified when repository item properties change, it can implement the atg.repository.PropertiesChangedListener interface. You can add your PropertiesChangedListener implementation to the atg.repository.ItemDescriptorImpl returned by the repository.getItemDescriptor() method, with the method ItemDescriptorImpl.addPropertiesChangedListener.

Cloning Repository Items

The atg.repository.RepositoryUtils class includes a method you can use to clone a repository item. This creates a copy of a repository item in a repository without adding the item to the repository. A copy can be a deep copy or a shallow copy. Furthermore, you can specify a list of properties to exclude from the copy.

The full signature of the cloneItem method is:

```
public static MutableRepositoryItem cloneItem(RepositoryItem pItem,
                                               boolean pDeepCopy,
                                               Map pPropExceptions,
                                               Map pExcludedProperties,
                                               MutableRepository pDestRepository,
                                               String pId)
                                        throws RepositoryException,
                                               DuplicateIdException
```

The cloneItem method's parameters are as follows:

Parameter	Description
pItem	Item to copy.
pDeepCopy	Boolean, specifies the mode of the copy: true: The method creates a deep copy of the item and its properties. false: The method creates a shallow copy, only getting references of child RepositoryItems. Shallow copying only works if the source and destination repositories are the same.

Parameter	Description
`pPropExceptions` (optional)	Hierarchical map of property name exceptions to the above mode. Keys are property names, while values are null or, if the property is another repository item, another Map. For example, if you clone a `product` item using `pDeepCopy=true`, you can add the key `parentCategory` with a null value into `pPropExceptions`. This results in a shallow copy of the `product.parentCategory`. Alternatively, you can add the key `parentCategory` but set the value to another map of exceptions that included the key/value pair `keywords=null`. This results in a deep copy of `product.parentCategory` but a shallow copy of the `product.parentCategory.keywords`.
`pExcludedProperties` (optional)	Properties to exclude from the clone. Keys are item descriptor names and the values are collections of property names to exclude..
`pDestRepository` (optional)	Repository to copy the new item into. If the source and destination repositories are the same, properties that are items are cloned to the repository of the source item-property. If this parameter is omitted, the new item is copied to source repository.
`pId` (optional)	Repository ID to use in the copy of the item. If this parameter is omitted, a unique ID is automatically generated.

3 Repository Queries

A repository query defines a request to find all items of a specified item type that fit a set of criteria. Those criteria are specified in terms of the item type's properties—for example:

find all `Person` items where `age` property > 30

The Repository API can express a wide variety of queries, including queries that match patterns in text, query through collections, or even query through complex values. Queries can also specify the order in which to return results, and can specify which results from a large result set to return. For example, a query can return a subset of Person items as follows:

- `lastName` starts with `A`.
- `interests` includes `biking`.
- `addresses` property contains an `Address` item with `zipCode` set to `02139`.
- Sorts results on `lastName`.
- Returns only items `10-20`.

Queries can be built and executed with the Repository API. In cases where the query is complex or cannot use the Repository API directly, queries can be represented in the Repository Query Language (page 18) (RQL). In most cases, however, repository queries can be constructed easily with targeting UI components in the ATG Control Center.

Repository Query API

This section describes the basic elements of queries in the Repository API:

- atg.repository.QueryBuilder (page 13)
- atg.repository.QueryOptions (page 14)

atg.repository.QueryBuilder

The `atg.repository.QueryBuilder` interface defines the available query operations that repositories support. The `QueryBuilder` interface enables you to build `Query` objects that can be passed to the repository.

A Query is constructed from QueryExpressions. Each Query relates one or more QueryExpressions and a query operation. Queries can use standard logical query operations such as AND, OR, NOT, EQUALS, GREATER THAN, LESS THAN OR EQUALS, and more complicated query operations such as collection inclusion, and pattern matching.

The QueryBuilder implementation is not required to support all query operations—it depends on what query features the data store supports. For unsupported query operations, the method should throw a RepositoryException. You can use the atg.repository.QueryOptions (page 14) class to limit the size of a query's result set or otherwise modify the query.

Query Creation Example

The following example creates a query that returns all repository items whose gender property is female:

1. Given a RepositoryView, initialize a QueryBuilder for it:

```
QueryBuilder b = view.getQueryBuilder();
```

2. Create a QueryExpression for the gender property and a QueryExpression for the constant female:

```
QueryExpression gender = b.createPropertyQueryExpression("gender");
QueryExpression female = b.createConstantQueryExpression("female");
```

3. Create a ComparisonQuery that incorporates the gender and female QueryExpressions:

```
Query femaleQuery = b.createComparisonQuery(gender, female,
QueryBuilder.EQUALS);
```

4. Pass the resulting Query to the RepositoryView for execution:

```
items = view.executeQuery(femaleQuery);
```

atg.repository.QueryOptions

You can use the atg.repository.QueryOptions class to specify ways that a query can be modified. You can set the QueryOptions properties, and pass the QueryOptions bean to the following executeQuery method:

```
RepositoryItem[] executeQuery(Query pQuery, QueryOptions pQueryOptions);
```

The QueryOptions properties let you limit the size of the result set, direct how the result set should be sorted, and pre-cache specified properties:

Property Name	Description
startingIndex	The index of the first element of a query result set that should actually be returned. By setting startingIndex and endingIndex, you can limit the size of the query's result set.
endingIndex	The items beginning with the endingIndex element of the query result set are not returned. In other words, the total number of items returned is endingIndex - startIndex. A value of -1 indicates that there is no limit to the number of items returned.

Property Name	Description
`sortDirectives`	Specifies the sort order of a query's result set.
`precachedPropertyNames`	A list of properties that should be pre-cached for each item in a query's result set at the time the query is run. Use `addPrecachedPropertyName(`*`propertyName`*`)` to add a property hint to a query built with QueryBuilder.

The following example contains the following steps:

1. Creates an unconstrained query against the Profile Repository.
2. Creates a `SortDirectives` that contains a `SortDirective`, sorting the result set in ascending order by the login property. A `SortDirective` can be ascending or descending and case-sensitive or case-insensitive (although not all data stores support case-insensitive sorting).
3. Creates a `QueryOptions` with a `startingIndex` of 0 and an `endingIndex` of 5. This limits the number of profiles returned to at most 5. The `QueryOptions` incorporates the `SortDirectives`.
4. Executes the query with the `QueryOptions`.
5. Outputs the results, displaying the `login` property.

```
// Creates an unconstrained query against the profile repository.
// It returns at most the first 5 profiles.
// Hints are used to precache login and password properties.
// Results are sorted by the login property.
Repository repository = (Repository)request.resolveName(
  "/atg/userprofiling/ProfileAdapterRepository");
RepositoryView view = repository.getView("user");
Query query = view.getQueryBuilder().createUnconstrainedQuery();
String [] precachedPropertyNames = {"login", "password"};
SortDirectives sortDirectives = new SortDirectives();
sortDirectives.addDirective(new SortDirective(
  "login",SortDirective.DIR_ASCENDING));
RepositoryItem [] items = view.executeQuery(
  query, new QueryOptions(0, 5, sortDirectives, precachedPropertyNames));

for (int i = 0; i < items.length; i++)
  out.print("<li>" + items[i].getPropertyValue("login"));
```

Repository Query Examples

The examples in this section demonstrate how to perform some simple repository queries. In the Repository API, all queries are performed with `Query` or `QueryExpression` objects. A `QueryExpression` is a building block you can use to create simple or complex queries. A `Query` is a repository query that can be executed. A `Query` can also be used as a building block to create queries that are more complicated.

The following example assumes an item descriptor named `user` with an integer property named `userType`. The query finds users whose `userType` property is set to 2:

```
import atg.repository.*;

MutableRepository pRepository =
  (MutableRepository)ServletUtil.getCurrentRequest().resolveName
  ("/atg/userprofiling/ProfileAdapterRepository");

    // Queries are created using QueryBuilders and executed by
    // RepositoryViews. A Query is defined in the context of a
    // specific item descriptor and thus must be built and executed with
    // the right QueryBuilder and RepositoryView.

    RepositoryItemDescriptor userDesc = pRepository.getItemDescriptor("user");
    RepositoryView userView = userDesc.getRepositoryView();
    QueryBuilder userBuilder = userView.getQueryBuilder();

    // create a QueryExpression that represents the property userType
    QueryExpression userType =
      userBuilder.createPropertyQueryExpression("userType");

    // create a QueryExpression that represents the constant 2
    QueryExpression two =
      userBuilder.createConstantQueryExpression(new Integer(2));

    // now we build our query: userType = 2
    Query userTypeIsTwo =
      userBuilder.createComparisonQuery(userType, two, QueryBuilder.EQUALS);

    // finally, execute the query and get the results
    RepositoryItem[] answer = userView.executeQuery(userTypeIsTwo);

    System.out.println("running query: userType = 2");
    if (answer == null)
      {
        System.out.println("no items were found");
      }
    else
      {
        for (int i=0; i<answer.length; i++)
          System.out.println("id: " + answer[i].getRepositoryId());
      }
```

The preceding example can be expanded to include multiple selection criteria:

```
userType < 2 AND login STARTS WITH "j"
```

```
import atg.repository.*;

MutableRepository pRepository =
  (MutableRepository)ServletUtil.getCurrentRequest().resolveName
  ("/atg/userprofiling/ProfileAdapterRepository");

    // reuse the building blocks we have to create
    // the "userType < 2" query
    Query userTypeLTTwo =
      userBuilder.createComparisonQuery(userType, two, QueryBuilder.LESS_THAN);
```

```
// create the "login STARTS WITH j" query
QueryExpression login =
  userBuilder.createPropertyQueryExpression("login");

QueryExpression j =
  userBuilder.createConstantQueryExpression("j");

//Note that we could make this query case-insensitive by adding another
//parameter to the createPatternMatchQuery, with a value of true
Query startsWithJ =
  userBuilder.createPatternMatchQuery(login, j, QueryBuilder.STARTS_WITH);

// now AND the two pieces together. You can AND together as many
// Query pieces as you like: we only have two in our example
Query[] pieces = { userTypeLTTwo, startsWithJ };
Query andQuery = userBuilder.createAndQuery(pieces);

// execute the query and get the results
answer = userView.executeQuery(andQuery);

System.out.println("running query: userType < 2 AND login STARTS WITH j");
if (answer == null) {
    System.out.println("no items were found");
}
else {
   for (int i=0; i<answer.length; i++)
      {
       RepositoryItem item = answer[i];
       String id = item.getRepositoryId();
       String l = (String)item.getPropertyValue("login");
       Integer a = (Integer)item.getPropertyValue("userType");
       System.out.println("item: " + id + ", login=" + l + ", userType=" + a);
   }
}
```

Repository Queries in the ATG Control Center

The ATG Control Center includes UI components for creating repositories queries. For example, the People and Organizations > Profile Repository window displays an expression editor for composing queries on the Profile repository like this:

```
List Items of type User whose Gender is female
```

Note: ATG Control Center limits the number of items that can be returned by such queries. This limit is configurable and is set in the `maxQueryCount` property of `/atg/devtools/RepositoryAgent`. The default value is `1000`.

Repository Query Language

Oracle ATG Web Commerce's Repository Query Language, or RQL, is a generic language for formulating queries that map to any repository implementation, such as SQL or LDAP. The repository connectors translate those queries into a syntax that the underlying data store understands.

You can use RQL in several different ways:

- Use RQL servlet beans in a JSP to perform repository queries: `RQLQueryForEach` and `RQLQueryRange`. For detailed information about these servlet beans, see the *Page Developer's Guide*.
- Define an RQL filter that is implicitly applied to all queries performed by the repository. See Repository Filtering (page 81) in the *SQL Repository Queries* (page 81) chapter.
- Include RQL queries in `<query-items>` tags in the XML repository definition file. This is mainly useful for unit testing queries; it can also be used to preload repository caches. See Querying Items (page 151) in the *Developing and Testing an SQL Repository* (page 147) chapter and Preloading Caches (page 130) in the *SQL Repository Caching* (page 103) chapter.
- Use RQL directly by creating an `atg.repository.rql.RqlStatement` object. You can get an `RqlQuery` object from the `RqlStatement` object, then get an `atg.repository.Query` object from the `RqlQuery` object. This approach can be simpler than using a `QueryBuilder` implementation to create a `Query` object.

This section describes the details of RQL syntax and structure.

RQL Overview

RQL is a textual query syntax that is similar to SQL. It describes the set of conditions that must be matched by items of a particular item descriptor. The following is a simple RQL query that matches all items whose `age` property is greater than 30.

```
age > 30
```

Note: This RQL query omits the name of the item descriptor, which is usually implied by the context of the query's use.

RQL supports all standard comparison operators and logical operators such as `AND`, `OR`, and `NOT`. For example:

```
age > 30 AND (lastName = "jones" OR paymentOverdue = true)
```

RQL keywords are case-insensitive—for example, keywords `NOT` and `not` are equivalent.

Constants such as `30`, `true`, or `jones` can represent numbers, boolean, or String values. String values are represented with Java syntax. They must be enclosed by quotes, and escape sequences for special characters or UNICODE characters must use Java escape syntax.

Properties such as `age` or `lastName` must be property names as they are defined in the repository. For example, a database might have a column named `phone` that is mapped to the repository property `primaryPhoneNumber`. An RQL query must use the repository's property name `primaryPhoneNumber`.

```
age > 30 and (lastName = "jones" or paymentOverdue = true)
```

RQL statements specify the conditions that an item must meet in order to be included in the result set. An RQL statement can also specify other directives to apply to the result set, such as ordering results and returning a portion of the result set.

Comparison Queries

Comparison queries are the simplest RQL queries, where a property's value is compared against another property value, or against a constant. For example:

```
age > 30
```

All standard comparison operators can be used:

=	!=
<	<=
>	>=

These operators can be applied to String properties and arguments, where case ordering is determined by lexical order of the Strings.

In general, these operators can only be used on properties that are scalar values. They should not be used on multi-valued properties.

Text Comparison Queries

Text comparison queries can be applied to String properties to determine if a portion or all of a property's value matches a given comparison value. For example:

```
firstName STARTS WITH "h"
lastName ENDS WITH "son"
phoneNumber CONTAINS "33"
state EQUALS "Utah"
```

Be sure to enclose the comparison value in double quotes; otherwise, the RQL parser assumes the operand refers to a property name rather than a value.

By default, text comparison queries are case-sensitive. To perform a case-insensitive comparison, use the IGNORECASE directive. For example:

```
sports CONTAINS IGNORECASE "ball"
```

You can also make a negative text comparison query:

```
NOT firstName STARTS WITH IGNORECASE "j"
```

Note: Negated pattern match queries can cause performance problems. Consider the queries you want to use and plan your database indexes accordingly to avoid table scans. STARTS WITH and EQUALS queries can be

optimized easily with database indexes, while other pattern match queries generally cannot be. Case-insensitive pattern matching can also affect the ability of the database to optimize the query.

Date and Timestamp Queries

You can query on Date and Timestamp Properties (page 63) by using RQL's `date` and `timestamp` functions. These functions create date literals, which let you create RQL queries that compare a date or timestamp string to date or timestamp property values. These functions use the following formats:

```
date("yyyy-MM-dd")
datetime("yyyy-MM-dd HH:mm:ss zzz")
```

For example:

```
submittedDate > date("2009-10-22")
submittedDate > datetime("2009-10-22 16:08:45 EDT")
```

Property of Property Queries

The queries shown earlier, as well as those described in the Full Text Search Queries (page 22) section, can be applied to scalar properties. Some repositories support the use of properties that are themselves an item from another (or the same) item descriptor. For example, the `address` property might point to another item descriptor which itself has properties like `city`, `state`, and `zip`.

Queries can drill down through these properties with a dot notation. For example:

```
address.zip = "48322"
```

RQL allows for multiple levels of "property-of-property" expressions. For example:

`department.manager.address.state`.

Logical Operators

Query expressions can be combined with AND, OR, and NOT operators. Parentheses can be used to affect grouping. NOT has the highest precedence, AND the next highest precedence, and OR has the lowest precedence. For example, this expression:

```
name = "joe" OR NOT phone ENDS WITH "7" AND age > 30
```

is grouped as follows:

```
(name = "joe" OR ((NOT phone ENDS WITH "7") AND age > 30))
```

Multi-Valued Property Queries

Logical operators and the MATCH and MATCHES operators (described in the later section Full Text Search Queries (page 22)) should only be applied to scalar properties. Another set of queries can be applied to arrays or collections of scalar values—for example, properties of type `int[]`, or Set of Strings. You can query multi-valued properties with the following operators:

- `INCLUDES`

- `INCLUDES ANY`
- `INCLUDES ALL` (not valid for GSARepository queries)

The INCLUDES query matches items where the specified property includes the specified value. For example:

```
interests INCLUDES "biking"
```

The INCLUDES query can also match one of a set of items by including the ANY or ALL keyword, followed by a comma-separated set of items that are enclosed in braces. For example:

```
interests INCLUDES ANY { "biking", "swimming" }
```

This is equivalent to:

```
(interests INCLUDES "biking") OR (interests INCLUDES "swimming")
```

While this:

```
interests INCLUDES ALL { "biking", "swimming" }
```

is equivalent to:

```
(interests INCLUDES "biking") AND (interests INCLUDES "swimming")
```

INCLUDES ITEM

Some repositories support properties that point to multiple items of another (or the same) item descriptor. For example, the `addresses` property might point to an array of items, which themselves have address-related properties.

In this case, RQL allows for a subquery to be defined on these properties. For example:

```
addresses INCLUDES ITEM (zip = "48322" AND state = "MI")
```

This query means “find all people whose list of addresses includes at least one address whose zip code is 48322 and whose state is MI”.

IS NULL

An IS NULL query can determine whether an expression evaluates to null. For example:

```
phoneNumber IS NULL
```

This expression evaluates to true if the `phoneNumber` is null.

COUNT

The COUNT operator can be used to query on the size of a multi-valued property. For example:

```
COUNT (addresses) > 3
```

This finds all people whose addresses property contains 4 or more elements.

ALL

An RQL query of ALL returns all items in a particular item descriptor. Use this query with care, because the result set can be very large. Usually this is combined with an ORDER BY or RANGE directive (described below). The RQL query is simply:

```
ALL
```

PROPERTY HINT

An RQL query can use PROPERTY HINT to view hints within a particular query. When a property is specified with a PROPERTY HINT, the property is loaded with the initial query, which prevents return calls back to the database to retrieve the property value later. For example, the query would look like this:

```
brand = "BrandX" AND nonreturnable = false PROPERTY HINTS description,
displayName, template
```

This returns all items with the brand BrandX that are returnable. It also loads the `description`, `displayName` and `template` properties in the query. Because the `template` property is in an auxiliary table, it is loaded with a JOIN as of the next release.

If you were using this query to display information on a page, all of the information that you require is obtained from a single database query.

Full Text Search Queries

Some content repositories support the ability to perform full text searches. The formats of the text strings and other search directives vary from repository to repository. However, the basic query looks like this:

```
MATCH "mars"
```

This returns those items whose content matches `mars` in a full text search. (Content repositories allow parts of the item's data to be designated as "content" for the purposes of display and searching).

Another form of the query allows the full text search to proceed over a particular property:

```
firstName MATCHES "abr"
```

Note that MATCH and MATCHES queries apply only to scalar properties.

Both forms of the query allow a special USING directive to pass special instructions to the underlying search engine. The format of this directive depends on the repository and whatever search engine it uses.

For example, to use the Oracle ConText full text search engine, the query looks like this:

```
firstName MATCHES "abr" USING "ORACLE_CONTEXT"
```

ID-based Queries

RQL can query items based on their repository IDs. This ability should be used with care, because repository IDs are not portable across repository implementations.

The first query searches for items that match a set of IDs. For example:

```
ID IN { "0002421", "0002219", "0003244" }
```

The next ID-based query applies only to content repositories, where items are organized into folders. This query restricts the search to only those items in the specified folders. The folders must be specified by ID:

```
IN FOLDERS { "10224", "10923", "12332" }
```

Note that passing in an empty or null set of IDs results in an exception.

Composite IDs can be specified in RQL queries with the following format for integers:

```
[value1, value2 ... valueN]
```

String IDs use the format:

```
["value1", "value2" ... "valueN"]
```

So a simple comparison query of a composite ID property might look like:

```
ID IN ["dept2", "emp345"]
```

Such a query returns an item with a composite repository ID of `dept2:emp345`. A query like this returns items with any of the IDs `dept2:emp345`, `dept2:emp346`, or `dept2:emp347`:

```
ID IN { ["dept2", "emp345"], ["dept2", "emp346"], ["dept2", "emp347"] }
```

ORDER BY

After a query is defined with the aforementioned query elements, the result is a set of items. The ORDER BY directive orders the results by item properties. For example:

```
age > 30 ORDER BY firstName
```

This query returns a result set where items are ordered by the `firstName` property in ascending order—the default. Results can also be ordered in descending order by adding SORT DESC to the end of the directive:

```
age > 30 ORDER BY firstName SORT DESC
```

Results can be ordered by multiple properties. For example:

```
age > 30 ORDER BY lastName, firstName SORT DESC
```

This orders results by `lastName`. If multiple results have the same `lastName`, within their group they are ordered by `firstName` in descending order.

A further directive, CASE IGNORECASE, can specify case-insensitive sorting:

```
age > 30 ORDER BY firstName SORT DESC CASE IGNORECASE
```

Note that you can omit the tokens SORT and CASE, unless you use parameters for the ASC/DESC or USECASE/IGNORECASE tokens.

RANGE

Many queries have the potential for returning large result sets. Most applications do not want to display the entire result set –they might want to display just the first 10 results. Or they might want to page through the results, showing results 0-9, then results 10-19, and so on.

The RANGE directive is used to specify this in the RQL query. The RANGE directive must come after the ORDER BY directive (if any). It has three forms. The first is the most common:

```
age > 30 RANGE +10
```

This causes only the first 10 results to be returned. If the result set is already less than 10, all results are returned.

The next form of the RANGE directive allows the results to start at a specified index:

```
age > 30 RANGE 10+
```

This causes the first 10 results to be skipped, and the remaining results to be returned.

The final form of the RANGE directive combines the above two forms, and is often used for paging:

```
age > 30 RANGE 40+10
```

This skips the first 40 results, then returns up to the next 10 results.

Parameters in Queries

In all of the previous examples, the queries contain hard-coded constants, such as `30` or `joe`. Most typically, the actual values used in the query are unknown when the RQL statement is written. In this case, the values can be substituted with parameter expressions. For example:

```
age > ?0 AND firstName CONTAINS ?1 RANGE ?2+10
```

Every `?{number}` represents a parameterized value that is supplied on query execution. How those values are supplied depends on the application performing the query. In the case of entity EJBs, where RQL queries are used to represent finder methods, the parameters are filled in from the arguments of the finder methods. For example, `?0` is substituted with the value of the first argument, `?1` with the second, and so on.

Parameter expressions can generally be used wherever constant values are used, including in RANGE expressions. However, parameter expressions cannot be used in array expressions, such as ID IN or IN FOLDERS queries. Also, parameter expressions cannot be used as substitutes for property names; all property names must be hard-coded into the RQL query when it is written.

Parameterized Field Queries

When a parameterized query is used, each numbered placeholder is substituted with the value of an entire object at runtime. However, it is sometimes more useful to substitute in the value of one of the object's fields, rather than the entire value of the object. A parameterized field query specifies this with the syntax `?{number}.{fieldName}`. For example:

```
name = ?0.name AND age = ?0.age
```

In this example, only one object is passed into the query at runtime. However, this object is expected to have two public member variables called `name` and `age`. The query extracts the values of these member variables from the object and substitute those values for the `?0.name` and `?0.age` parameters. Note that the fields must be public member variables of the object that is passed in, not JavaBean properties. For example, the following object can be passed in to the query:

```
public class QuerySpecifier {
public String name;
public int age;
```

```
}
```

Parameterized Field Queries are used most often for entity EJBs, which allow primary key classes to contain multiple fields. In this case, only one object is passed to the query (the primary key), but if the primary key spans multiple database fields, the primary key object contains the values of those fields in its public member variables.

RQL Examples

The following example shows how you might use a parameter expression in Java code. It creates an `RqlStatement` and uses it in executing a query to find `person` repository items where the value of the `age` property is greater than 23.

```
RepositoryView view = repository.getView("person");
RqlStatement statement = RqlStatement.parseRqlStatement("age > ?0");

Object params[] = new Object[1];
params[0] = new Integer(23);

RepositoryItem [] items =statement.executeQuery (view, params);
```

Here is another example that demonstrates a text comparison query:

```
RqlStatement statement=RqlStatement.parseRqlStatement("lastName STARTS WITH ?0");
Object params[] ={new String("m")};
    items = statement.executeQuery (view, params);
```

Note how in the text comparison queries the comparison value `"m"` is enclosed in double quotes; otherwise, the RQL parser assumes the comparison term refers to a property name rather than a property value.

RQL Grammar

The following is a formal definition of the RQL grammar:

```
RQLStatement:: Query OrderByClause RangeClause

Query:: OR | AND | NOT | Comparison | ID IN | IN FOLDERS | ALL |
TextSearch | PropertyTextSearch | INCLUDES ITEM | IS NULL | (Query)
```

The precedence order of the queries from highest to lowest is as follows:

- (Query)
- Comparison, ID IN, IN FOLDERS, ALL, TextSearch, PropertyTextSearch, INCLUDES ITEM, IS NULL
- NOT
- AND
- OR
- OR:: *Query* OR *Query* ...

- AND:: *Query* AND *Query* ...
- NOT:: NOT *Query*
- Comparison:: Expression ComparisonOperator Expression
- ComparisonOperator:: = | != | < | <= | > | >= | INCLUDES ANY | INCLUDES ALL | INCLUDES | STARTS WITH [IGNORECASE] | ENDS WITH [IGNORECASE] | CONTAINS [IGNORECASE]
- IdIn:: ID IN *StringArray*
- InFolders:: IN FOLDERS *StringArray*
- All:: ALL
- TextSearch:: MATCH *StringLiteral* [USING *StringLiteral*]
- PropertyTextSearch:: ObjectExpression MATCHES StringLiteral [USING StringLiteral]
- IncludesItem:: *Expression* INCLUDES ITEM (*Query*)
- Expression:: CountExpression | ObjectExpression | ParameterExpression | ConstantExpression
- CountExpression:: COUNT (ObjectExpression | ParameterExpression | ConstantExpression)
- ObjectExpression:: PropertyName | ObjectExpression.PropertyName | ObjectExpression[Expression]
- PropertyName:: <Java identifier>
- ParameterExpression:: ?<Parameter number>[.<Field name>]
- ConstantExpression:: StringLiteral | IntegerLiteral | DoubleLiteral | BooleanLiteral | ArrayLiteral
- StringLiteral:: "<Java string literal>"

  The string literal uses the Java format, including escape characters (including octal and Unicode), and must be enclosed in double quotes.

  - IntegerLiteral:: <Java integer literal>
  - DoubleLiteral:: <Java double literal>
  - BooleanLiteral:: true | false
  - ArrayLiteral:: { *ConstantExpression*, ... }
  - StringArray:: { *StringLiteral*, ... }
  - OrderByClause:: ORDER BY *PropertyName* [[SORT] [ASC | DESC]] [CASE [IGNORECASE | USECASE]]

    The SORT ASC/DESC directives are optional and default to SORT ASC. The CASE IGNORECASE/USECASE directives are optional and default to CASE USECASE.

  - RangeClause:: RANGE <Starting Index> + <Count>

4 SQL Repository Overview

The Oracle ATG Web Commerce SQL repository can be used to connect Oracle ATG Web Commerce applications to an SQL database. An SQL database provides fast, scalable storage and retrieval of persistent information. The SQL repository works with an SQL database to store objects and make those objects visible inside an Oracle ATG Web Commerce application as Dynamic Beans. The uses of an SQL repository can be as varied as the uses of a relational database.

The Oracle ATG Web Commerce platform includes SQL repositories that store:

- User profiles (the Personalization module's SQL Profile Repository). See the *SQL Profile Repositories* chapter in the *Personalization Programming Guide*.
- Web site content (the SQL content repository). See this chapter and the *SQL Content Repositories* (page 213) chapter.
- Security profiles used by the Administrative Security system. See the *Managing Access Control* chapter of the *Platform Programming Guide*.

In addition, an ATG Commerce site uses repositories that store:

- Store catalog
- In-process orders
- Inventory
- Gift lists and wish lists
- Pricing and promotions

Refer to the *Commerce Programming Guide* for information about these repositories.

The Oracle ATG Web Commerce platform includes a component at `/atg/registry/ContentRepositories` that instantiates the class `atg.repository.nucleus.RepositoryRegistryService`, which maintains a list of all registered SQL content repositories.

Repository setup steps

You set up an SQL repository on the Oracle ATG Web Commerce platform in the following steps:

1. Create the repository definition file to be used by the SQL repository.

   This template is an XML file that defines repository item descriptors and their attributes, and describes the relationship of your SQL repository to the SQL database. While the SQL repository can represent a variety of data models, it cannot easily represent any arbitrary data model. Thus, it is usually a good idea to design the SQL repository schema before you design your SQL database schema.

The *SQL Repository Data Models* (page 35) and *SQL Repository Item Properties* (page 59) chapters describe how to design item descriptors and other SQL repository elements. See also the SQL Repository Definition Tag Reference (page 161) for details about the XML tags used to create the SQL repository definition file.

2. Configure an SQL Repository component.

   This component's `definitionFiles` property points to the repository definition file. For detailed information, see Configuring the SQL Repository Component (page 203).

3. Create the SQL database schema on your SQL database server.

   You can use the startSQLRepository (page 151) script with the `-outputSQL` option to generate a preliminary form of the SQL needed to create the database schema, then edit the output to optimize the database schema.

5 SQL Repository Architecture

The SQL repository is a generalized and flexible implementation of the Oracle ATG Web Commerce Repository API that an application can use to access data stored in an SQL database. See the *Repository API* (page 3) chapter for more information. The SQL repository is implemented through the `atg.adapter.gsa` package (GSA stands for Generic SQL Adapter).

The main Oracle ATG Web Commerce component in the SQL repository is an instance of the `atg.adapter.gsa.GSARepository` class, which extends the class `atg.repository.RepositoryImpl` and implements two interfaces:

- `atg.repository.MutableRepository`
- `atg.repository.content.ContentRepository`

You create an SQL repository instance by instantiating the `atg.adapter.gsa.GSARepository` class. This class is not documented in the *ATG Platform API Reference*, and it is not intended that you access this class directly from Java code. Normally, you access all Repository functionality with the interfaces `atg.repository.Repository` and `atg.repository.MutableRepository`. This enables your classes to work with any repository implementation for the greatest flexibility. Some methods like those for cache invalidation are defined on the class `atg.repository.RepositoryImpl`. It is anticipated that future repositories will extend that class, so you can make your code more reusable and maintainable by accessing those methods on this base class rather than the implementation class of `atg.adapter.gsa.GSARepository`.

The SQL repository uses an XML repository definition file to describe the item descriptors that compose a repository. The repository definition file also describes the relationships between repository definitions—item descriptors, repository items, and repository item properties, and the corresponding elements of an SQL database—its tables, rows, and columns, respectively. The XML tags of the repository definition file are described in detail in the *SQL Repository Reference* (page 161) chapter. The XML tags are also introduced in examples in this chapter and in the *SQL Repository Item Properties* (page 59) chapter.

Repositories and Transactions

All SQL repository operations are performed with the current JTA transaction, if one exists. For example, when an application calls the Repository `updateItem()` methods, for example, changes are immediately visible only to subsequent `getItem()` calls that are made in that transaction. When the JTA transaction is committed, the repository item changes are committed to the database.

If you do not have a JTA transaction in place, each SQL repository operation that affects the state of a repository item creates and commits a transaction around the operation. Thus, a `setPropertyValue` call by itself with no JTA transaction in place is committed to the database when the call returns.

Here are two examples:

If no transaction exists:

1. Begin JTA transaction.
2. Call `setPropertyValue`.
3. Commit JTA transaction. At this point, SQL is issued and the changes are committed.

Using the `updateItem` method:

1. Begin JTA transaction.
2. Call `setPropertyValue`.
3. Call `updateItem`. At this point, SQL is issued.
4. Commit JTA transaction. Changes are committed.

Generally, you want to call `updateItem` explicitly. This ensures that if you perform any queries between the change made in the `setPropertyValue` call and the commitment of the transaction, those queries have the new property value available to them.

Distributed cache invalidation

You can configure the Oracle ATG Web Commerce platform to send repository item cache invalidation messages to other remote Oracle ATG Web Commerce servers. If you set an item descriptor to one of several Distributed Caching Modes (page 114), a cache invalidation message is sent to other Oracle ATG Web Commerce servers. You can also set an item descriptor to Locked Caching (page 106) mode; when a server gives up ownership of the lock, it also invalidates the cache. For more information see the *SQL Repository Caching* (page 103) chapter.

Transaction isolation

The SQL repository implements transaction isolation. The first time an item is accessed in a transaction—through `getItem()`, or the first attempt to call `getPropertyValue()` on an item that was retrieved in a different transaction—it is guaranteed to be up to date at that time. If another transaction changes the item while this transaction is in progress, those changes are visible only to a new transaction.

Managing Transactions

By default, a transaction is created and committed for each method call. This is generally not the most efficient way to handle repository item updates. It is generally more efficient if all method calls that create or update a repository item are performed in a single transaction.

The Oracle ATG Web Commerce platform provides several transaction demarcation techniques for grouping repository method calls into a single transaction.

Use the Transaction servlet bean

This servlet bean, described in the *Page Developer's Guide*, explicitly creates a transaction on a page. For example, the following uses the current transaction, if any exists. If there is no current transaction, one is created before calling the `output` open parameter, and committed at the end of the droplet:

```
<droplet bean="/atg/dynamo/transaction/droplet/Transaction">
```

```
  <param name="transAttribute" value="required">
  <oparam name="output">

    ... do repository item work ...

  </oparam>
</droplet>
```

Use JTA

JTA (Java Transaction API) lets you explicitly manage the transaction. For example, you might explicitly create a transaction around a repository item creation or update like this:

```
TransactionManager tm = ...
TransactionDemarcation td = new TransactionDemarcation ();
try {
  try {
    td.begin (tm);

    ... do repository item work ...
  }
  finally {
    td.end ();
  }
}
catch (TransactionDemarcationException exc) {
  ... handle the exception ...
}
```

Use a FormHandler

If you are writing a FormHandler component, you can simply extend the class `atg.droplet.TransactionalFormHandler`. This FormHandler automatically wraps a transaction around all property `get` method calls called from a page and another transaction around all property `set` or `handle` method calls made from a page. See the *Working with Forms and Form Handlers* chapter of the *Platform Programming Guide* for more information.

For detailed information about managing transactions, see the *Transaction Management* chapter in the *Platform Programming Guide*.

Repository Definition Files

Each repository can be defined with one or more XML repository definition files. The repository definition files used by a repository are specified by the `definitionFiles` property of the Repository component. The value of the `definitionFiles` property is the absolute name of an XML file in the application's configuration path.

If more than one XML file is defined with the same path in different configuration path directories, they are combined using the XML combination rules described in the *Nucleus: Organizing JavaBean Components* chapter of the *Platform Programming Guide*. This lets you modify one XML file by adding or removing item descriptors, properties, and tables in another layer of the configuration path.

XML file combination matches the `item-descriptor`, `table`, and `property` tags by name, operating from the outside tag inward. The changes that you make must exactly match the item descriptor, table, and property that you want to modify.

The following example file modifies the repository definition for the Profile repository, located at `/atg/userprofiling/userProfile.xml`:

```
<gsa-template>
  <item-descriptor name="user" cache-mode="locked" item-cache-size="500">
    <table name="dps_user">
      <property name="userType" data-type="enumerated">
        <option value="investor" code="1">
        <option value="broker" code="2">
        <option value="guest" code="3">
      </property>
    </table>
  </item-descriptor>
</gsa-template>
```

This modifies the standard repository definition as follows:

- Sets the `user` item descriptor's `cache-mode` to `locked`.
- Changes the `data-type` attribute of the `userType` property from `int` to `enumerated`, and sets several options for its value.
- Sets the `item-cache-size` to 500 (the default setting is 1000).

Default Values and XML File Combination

If a repository's DTD provides a default setting for an XML element, that default setting applies to all XML files that do not explicitly set the element. For example, the SQL Repository DTD sets the `property` element's `expert` attribute to `false`:

```
expert%flag;"false"
```

If a base SQL repository definition file sets a property's `expert` attribute to true, and supplemental SQL repository definition files—that is, files that are later in the configuration path—modify that property, the supplemental files must also set the `expert` attribute to true; otherwise, the attribute's value reverts to the DTD's default setting of `false`.

SQL Repository Items

Repository items are Dynamic Beans that implement the `RepositoryItem` interface. Because they are registered as Dynamic Beans, RepositoryItems do not need to define `setX` and `getX` methods for each property. The properties of RepositoryItems are defined at application startup when the XML file that defines the repository template is parsed.

Each repository item has a unique repository ID. The Oracle ATG Web Commerce IdGenerator generates unique repository IDs and should be used instead of sequences generated directly by the database system. See the *Core Dynamo Services* chapter of the *Platform Programming Guide*.

A repository organizes repository items into types that have the same set of properties. Each item type is defined by an item descriptor.

SQL Repository Item Descriptors

An SQL repository can define multiple named item types. Each item type is defined by an item descriptor. You can define different kinds of objects with different item descriptors, and Oracle ATG Web Commerce manages them in a single repository. Each named type corresponds to an item descriptor, and each item descriptor corresponds to a `RepositoryView` of the same name.

For example, a simple database might have two kinds of entities, `book` and `author`, where a book has one author, and an author has zero or more books. This is depicted in the figure below.

DAF lets you represent this in a single repository using two independent types named `book` and `author`, each type defined by its own item descriptor. These item types are independent in that they do not share any properties in their item descriptors. They might both have properties such as name or weight, but these properties are independently defined. Another way to look at it is that they each have their own item descriptor.

The SQL repository also supports a simplified form of inheritance for item descriptors. See Item Descriptor Inheritance (page 46) in the *SQL Repository Data Models* (page 35) chapter.

6 SQL Repository Data Models

Repository items correspond to business objects, like customers, and elements of business objects, like a customer's shipping address. An item descriptor in an SQL repository defines a repository item type. It specifies repository item properties and the database tables and columns that store the data of those properties. This chapter describes how to define item descriptors and how to represent the relationships between item descriptors in an SQL repository definition.

Note that an SQL repository cannot necessarily work with any arbitrary SQL database model. The basic data model patterns are described in the Sample SQL Repository Definition Files (page 192) section of the *SQL Repository Reference* chapter.

Primary and Auxiliary Tables

Each item descriptor must specify one primary table. The primary table is specified with the `type="primary"` XML attribute in a `<table>` tag. The `<table>` tag for the primary table sets its `id-column-names` attribute to the columns that store the repository ID. For example:

```
<table name="user" type="primary" id-column-names="id">
properties...
</table>
```

id Property

In order to obtain the data of a repository item from a datastore, you must supply the primary table's ID. The repository item descriptor can map to the table's ID column implicitly through the `<table>` tag attribute `id-column-names`; or it can explicitly map to the ID column through a `<property>` tag that is set as follows:

```
<property name="id" column-name="table-id-column"/>
```

For example:

```
<item-descriptor name="user">
  <table name="user" type="primary" id-column-names="emp_id">
     <property name="id" column-name="emp_id"/>
  </table>
```

```
</item-descriptor>
```

If the item descriptor does not explicitly define an `id` property, its data type cannot be explicitly set; and it uses the default `string` data type. In this case, the following constraints apply:

- You cannot query against repository item IDs.
- You cannot access the item's ID by calling `getPropertyValue()`; it is, however, accessible through `getRepositoryId()`.

However, if you explicitly define the `id` property in the item descriptor with a `<property>` tag, you can query repository items by their ID and you can explicitly set the `id` property's data type. The columns specified by the `id-column-names` attribute are not required to use the same data type; a composite repository ID can be composed of strings, integers, and longs.

Note: You cannot change a repository item's ID after it is saved to the database.

Constraints

Do not use the following special characters in repository IDs:

Characters Used In:	Examples
URLs	+ (plus) / (forward slash) ? (question mark) % (percent sign) # (hash) & (ampersand)
XML	< (left angle bracket) > (right angle bracket) " (double quote) ' (single quote) & (ampersand)

Compound Repository IDs

A repository ID can span multiple database columns, where the data type of each column corresponds to the Java type `String`, `Integer`, or `Long`. An item descriptor can define one property that combines the data from all database ID columns, or define a property for each database ID column. The two examples that follow show how two database ID columns, `folder_id` and `doc_id`, can be specified by one item descriptor property, and by two properties.

Here, the `ID` property combines the data from the two database ID columns:

```
<table name="doc" type="primary" id-column-names="folder_id,doc_id">
  <property name="ID" column-names="folder_id,doc_id"
        data-types="string,int"/>
</table>
```

Here, two properties, `folder` and `document`, are defined to represent both database ID columns:

```
<table name="doc" type="primary" id-column-names="folder_id,doc_id">
  <property name="folder" column-names="folder_id" data-type="string"/>
  <property name="document" column-names="doc_id" data-type="int"/>
</table>
```

Concatenation of Multi-Column IDs

By default, a multi-column ID is encoded as a String that concatenates ID elements in the order specified by the item descriptor's `id-column-names` attribute. Each element is separated by a separator character—by default, colon (`:`).

The item descriptor's `id-separator` attribute can specify a different separator character. For example, an item descriptor might define its ID separator character as an asterisk (*):

```
<item-descriptor name="employee" id-separator="*">
  <table name="user" type="primary" id-column-names="dept_id,emp_id">
    properties...
  </table>
</item-descriptor>
```

In this case, the repository ID for a `user` item might look like this:

```
sales*bbanzai
```

The following constraints apply to multi-column ID separator characters:

- Do not use brackets or comma as separator character. These characters are used by RQL and the SQL repository when specifying lists of IDs.
- Repository IDs in both columns must exclude the ID separator—by default, colon (:).

Accessing Items with Compound Repository IDs

In order to retrieve or remove an item that uses a compound repository ID, you can supply the concatenated string ID as a parameter to `atg.adapter.gsa.GSARepository` methods such as `getItems()`.

For example, given the following item descriptor:

```
<item-descriptor name="employees">
  <table name="employee_table" type="primary" id-column-names="dept_id,emp_id">
    <property name="id" column-names="dept_id,emp_id" data-types="string,int"/>
  </table>
</item-descriptor>
```

You might obtain an employee repository item as follows:

```
RepositoryItem employee = rep.getItems("IS:100002", "employee");
```

IdSpaces and the id Property

IDs for repository items are requested from the appropriate `IdSpace` for the repository item. The `id-space-names` attribute in the primary table of an item descriptor specifies which `IdSpaces` supply repository IDs for items of that item type. For item types with single-column IDs, the default name for the `IdSpace` is the item

descriptor name. For item types with multi-column IDs, the default name for the `IdSpace` is derived from the primary table name and ID column:

```
primary-table-name.id-column-names
```

For example, in an item descriptor defined like this:

```
<item-descriptor name="user">
  <table name="users" type="primary" id-column-names="id">
    properties...
  </table>
</item-descriptor>
```

the default `IdSpace` is named `user`. In an item descriptor with a composite repository ID defined like this:

```
<table name="user" type="primary" id-column-names="dept_id,emp_id">
    properties...
</table>
```

the default `IdSpaces` is named `user.dept_id` and `user.emp_id`. In any case, you can override the default `IdSpace` names with the `id-space-names` attribute in the item descriptor definition:

```
<table name="user" type="primary" id-column-names="dept_id,emp_id"
       id-space-names="DepartmentId,EmployeeId">
    properties...
</table>
```

See the *Core Dynamo Services* chapter in the *Platform Programming Guide* for more information about ID space names and how they affect the IDs of newly generated items.

Database Sequences and Repository IDs

Tables in a relational database must have a primary key. When designing a database, the primary key can often be chosen from intrinsic data. For example, a person's social security number or the hardware address of a network interface card are unique identifiers that can be good choices for a repository ID.

Sometimes, there is no natural ID and you must generate one to serve as the primary key. Typically an integer counter is used for this. The major relational database management system vendors have facilities to automatically generate IDs internally. These IDs (called sequences in some systems) differ from each other in how they are generated and retrieved. Database-generated sequences are not supported as repository IDs in the Oracle ATG Web Commerce platform. Instead, use an ID generated by the `IdGenerator`, as described above and in the *Core Dynamo Services* chapter of the *Platform Programming Guide*.

Auxiliary Tables

You can handle some data relationships with auxiliary attribute tables. For example, you can store users and their addresses in two related database tables, as described in the following piece of an XML repository definition:

```
<item-descriptor name="user">
  <table name="dps_user" type="primary" id-column-names="id">
    <property name="login" data-type="string"/>
  </table>
  <table name="dps_address" type="auxiliary" id-column-names="id">
    <property name="address1"/>
    <property name="city"/>
    <property name="state"/>
    <property name="zip"/>
  </table>
</item-descriptor>
```

Each user has a single address. For the purposes of this example, the user information is stored in a separate table from the user's address information.

Note that if you use auxiliary tables, each table definition, whether primary or not, must define an `id-column-names` attribute. This attribute defines the column names in the table that represent the repository ID. This indicates how to join auxiliary tables to the primary table. The columns in the `id-column-names` attribute must be listed in the same order as they are in the `id-column-names` attribute of the primary table.

References Constraints

In general, auxiliary and multi tables should not have REFERENCES constraints that point to each other. Instead, each of these tables can have a REFERENCES constraint that points to the primary table for the repository item. This limitation exists because the SQL repository processes insert and delete statements for auxiliary and multi tables in the same order. As a result, if you specify REFERENCES constraints between an auxiliary and a multi table or vice versa, a constraint error results on the insert or the delete.

Properties and Database Columns

All repository item properties are described in the XML repository definition with `<property>` tags. You can explicitly map an item property to a database column name through the `column-names` attribute; otherwise, the property name and database column name are assumed to be the same. For example, you can map the `login` property to the `login_name` property as follows:

```
<property name="login" column-names="login_name" data-types="string"/>
```

The `column-names` attribute of a property specifies the database column that stores the property. Each property must also define its data type with the `data-types` attribute. In the case of a multi-column `id` property, the `data-types` attribute is a comma-separated list of data types, where each entry corresponds to an entry in the `column-names` attribute. Each column can have a different data type. If no data type is specified, the string data type is used by default. The valid data type names and their Java and SQL representations are listed in the Data Type Mappings: Java and SQL (page 172) section in the *SQL Repository Reference* (page 161) chapter.

One-to-Many Relationships: Multi-Valued Properties

The SQL repository supports one-to-many relationships between two tables, and does not interpret the results according to any specific paradigm. This allows your application to apply whatever meaning you want to one-to-many relationships.

The SQL repository implements one-to-many relationships as multi-valued properties. To implement a multi-valued property, define the property with several <table> and <property> attributes:

<table> attributes

The `<table>` tag for a multi-valued property must set the following attributes:

Attribute	Set To:

`type`	`multi`
	
	For example:
	
	`<table name="..." type="multi" ...`

`multi-column-name`	The appropriate table column name. For example: `<table name="..." type="multi" multi-column-name="idx" ...` The `multi-column-name` attribute ensures that the ordering of the multi-values are maintained. The column specified by the `multi-column-name` attribute is used for multi-valued properties of data type array, map, and list and is not used for sets (which are unordered). For map type properties, the values in the column specifiedy by the `multi-column-name` attribute must be a string. For list or array type properties, these values should be an integer or numeric type, and must be sequential.
`id-column-names`	The appropriate table column names. As with auxiliary tables, the ordering of the ID column names is important. The columns specified by This attribute must list table columns in the same order as the `id-column-names` attribute of the primary table.

<property> attributes

The `<property>` tag for a multi-valued property sets the following attributes:

Attribute	Set To:

`data-type`	One of the following:
	
	`array`
	`set`
	`map`
	`list`
	
	For example:
	
	`<property ... data-type="array" ...`

`component-data-type`	A primitive data type such as `int` and `string`, or the name of a user-defined property type (see User-Defined Property Types (page 73)). For example: `<property name="interests" column-name="interest" data-type="array" component-data-type="string"/>` Note that the SQL repository does not support references to binary types.
`component-item-type`	The item descriptor name of the referenced repository items. For example: `<property name="..." column-name="designers" data-type="array" component-item-type="user"/>`

Note: You cannot establish a default value for multi-valued properties.

The following example shows how the XML repository definition might specify the multi-valued property `interests`:

```
<item-descriptor name="user">
  <table name="dps_user" id-column-names="id" type="primary">
    <property name="login" data-type="string"/>
  </table>
  <table name="dps_interest" type="multi" id-column-names="id"
         multi-column-name="idx">
    <property name="interests" column-name="interest" data-type="array"
              component-data-type="string"/>
    </table>
</item-descriptor>
```

See also the Sample SQL Repository Definition Files (page 192) section in the *SQL Repository Reference* (page 161) chapter for more examples of one-to-many relationships in repository definitions.

Allow null values

By default, null values are not allowed in multi-valued properties. You can specify to allow null values at two levels:

- Enable all multi-valued properties in a repository to accept null values by setting the repository property `allowNullValues` to `true`.
- Allow null values for an individual property by setting its `<property>` tag attribute `allowNullValues` to `true`.

Operating on Multi-Valued Properties

When you operate on the returned value from a `List`, `Set`, or `Map` property, do not rely on the concrete implementation of this class. You should not serialize this value, or use it directly in the `setPropertyValue` call for another `List`, `Set`, or `Map` property. Instead, you can copy these values into another List that you create and use that value. For example:

```
List ls = (List) item.getPropertyValue("someListProperty");
ArrayList toUseElsewhere = new ArrayList();
toUseElsewhere.addAll(ls);
```

Now you can use `toUseElsewhere` in a `writeObject` call or in another `setPropertyValue` call.

Many-to-Many Relationships

You can represent many-to-many data relationships in an SQL repository. For example, an author may have written multiple books, and a book may have multiple authors. Representing this kind of relationship depends on the `type="multi"` attribute in a `<table>` tag. You can represent a many-to-many relationship with two one-to-many relationships that point to the same intermediate table. The following example represents a many-to-many relationship between the authors of a book and the books written by an author:

```
<item-descriptor name="author">
 <table type="primary" name="author">
 ...
 </table
 <table type="multi"
        name="author_book"
        id-column-names="author_id"/>
   <property name="booksWritten" column-name="book_id"
             data-type="set" component-item-type="book"/>

 </table>
</item-descriptor>

<item-descriptor name="book">
 <table type="primary" name="book">
 ...
 </table
 <table type="multi"
        name="author_book"
        id-column-names="book_id"/>
   <property name="authors" column-name="author_id"
             data-type="set" component-item-type="author"/>
 </table>
</item-descriptor>
```

This example uses three tables:

- `author` items use the primary database table `author`.
- `book` items use the primary database table `book`.

- `author` and `book` items both use the intermediate multi table `author_book` to handle the relationship between authors and books.

The data type of the properties in the intermediate multi table must be Set, not array, map or list.

Tables can have columns other than the ones referenced in the repository definition file, provided two conditions are true:

- The columns allow null values.
- There is no design requirement that the repository recognize the existence of such columns.

Default Item Descriptor

You can identify a repository's default item descriptor, by setting its `<item-descriptor>` `default` attribute to `true`. Each repository can have a single default item descriptor. If a repository has only one item descriptor definition, it is the default. If no default item descriptor is explicitly identified, the first item descriptor in the XML file is the default.

When you use Repository methods such as `getItem`, `createItem` without specifying an item descriptor, you use the default item descriptor. These methods are not recommended for most applications, unless there is only one item type in the repository.

Cascading Data Relationships

The SQL repository uses the `cascade` attribute in a `<property>` tag to better handle hierarchical properties—that is, properties that have the attribute `item-type` or `component-item-type`. The `cascade` attribute can be set to one or more of these values:

```
insert
update
delete
```

For example:

```
<property name="scenarios" item-type="scenario" cascade="update,delete"/>
```

Cascade Insert

When you create a repository item that contains a property with the `item-type` attribute and the property's `cascade` attribute is set to `insert`, the following actions occur:

- An item of the type declared by the `item-type` attribute is also created.
- The property is set to point to the other item created.

`insert` is typically used together with `update` and `delete`, so the referenced item is automatically created, updated, and deleted with the parent item.

Note: `insert` is ignored for properties that use the attribute `component-item-type`.

Cascade Update

If a repository item property references other items and the property's `cascade` attribute is set to `update`, the following actions occur:

- When you call `addItem()`, any new (transient) items referenced by this property are added automatically to the repository.
- When you call `updateItem()`, any modified referenced items are automatically updated. Any referenced items that are new (transient) items are added.

Cascade Delete

If a repository item property references other items and the property's `cascade` attribute is set to `delete`, removal of the repository item triggers removal of the referenced items. Also, when you remove a reference to this item, the item is automatically removed.

You should exercise caution when using cascading deletion in one-to-many relationships. Specifically, never set `cascade` to `delete` in properties on the "many" side of the relationship where those properties refer to items on the "one" side of the relationship. The item on the "one" side of the relationship cannot be deleted safely, because multiple items may be referring to it.

For example, an item descriptor `company` has an `employee` property that references many repository items defined by an `employee` item descriptor. The `employee` item descriptor itself defines a `company` property. In this one-to-many relationship, the `employee` property in the `company` item descriptor can set `cascade` to `delete`. However, the `company` property in the `employee` item descriptor must not set its own `cascade` attribute to `delete`; otherwise, the removal of one `employee` item would also entail removal of the `company` item that references all other `employee` items.

Removing null references

It sometimes happens that an item property references other items and one of those items is removed without explicitly removing the reference to it. This can occur when the database has no references constraint on the pertinent columns, so the referenced item can be removed without updating the referencing item's property. It can also occur in a case where the referenced item might actually exist, but is currently filtered out by an RQL filter so it appears not to exist.

A repository item ignores references to missing items rather than returning an error if the referencing property sets its `removeNullValues` attribute to `true`. In this case, the missing item is returned as null to a scalar reference, and is omitted from the items that are returned for multi-valued references.

For example, a user profile might have a multi-valued property that is a list of favorite articles. Any given article might be deleted or become out of date. You can remove references to articles that are no longer available with the `removeNullValues` attribute like this:

```
<property name="favoriteArticles" data-type="list"
          component-item-type="articles">
  <attribute name="removeNullValues" value="true"/>
</property>
```

Order of deletion

Depending on how the database schema defines reference constraints, you might need to control whether a cascading deletion occurs before or after deletion of the referencing item. You can specify the desired behavior in an item descriptor by setting the `cascadeDeleteOrder` attribute:

```
<item-descriptor name="biographies" ...>
  <attribute name="cascadeDeleteOrder" value="last"/>
  <table name="...>
    <property name="publisher" item-type="publisher" cascade="delete"/>
    <property name="...>
</item-descriptor>
```

You can set `cascadeDeleteOrder` to one of these values:

Value	Description
`afterAuxiliaryBeforePrimary`	The default setting: cascading deletion is performed after deleting auxiliary multi-table rows, but before deleting the primary table row. This is the default behavior.
`first`	Cascading deletion is performed before any deletions in tables of this item.
`last`	Cascading deletion is performed after all deletions in tables of this item.

Cascade Example

The following item descriptors define two item types: `author` and `address`. The `author` item type references the address item type as follows:

- `author` defines an `address` property, which sets the attribute `item-type` to `address`.
- The `address` property sets its `cascade` attribute to `insert`, `update` and `delete`.

```
<!-- The "author" item type -->
<item-descriptor name="author">
  <table name="author" id-column-names="author_id" type="primary">
    <property name="name"/>
    <property name="address" item-type="address" cascade="insert,update,delete"/>
  </table>
</item-descriptor>

<!-- The "address" item type -->
<item-descriptor name="address">
  <table name="address" id-column-names="address_id" type="primary">
    <property name="streetAddress"/>
    <property name="city"/>
    <property name="state"/>
    <property name="zip"/>
  </table>
```

```
</item-descriptor>
```

Given these definitions, whenever an `author` type repository item is created, added, updated, or deleted, the same actions apply to the corresponding `address` repository item.

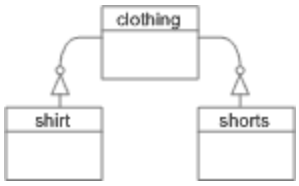
Item Descriptor Inheritance

The SQL repository supports a simplified form of inheritance that uses an optional one-to-one relationship between the primary table and an auxiliary table. The same repository can define one item descriptor that inherits properties from another.

For example, a clothing store catalog might offer shirts and shorts. Because the two items are likely to have common properties, you might use inheritance as follows:

- Define a base item descriptor class `clothing` which defines the properties common to shirts and shorts.
- Define item descriptors `shirt` and `shorts` as sub-types of `clothing`, so they inherit the properties defined in `clothing` .

The data model for the clothing catalog can be represented as follows:



This approach has several advantages

- Avoids duplicated database columns and code.
- Facilitates queries across multiple sub-types, such as `shirt` and `shorts`. For example:

```
find all clothing items where description contains "shorts"
```

The XML repository definition (with inheritance-related tags in bold face) looks like this:

```
<!-- The "clothing" item type, a base type -->
<item-descriptor name="clothing" sub-type-property="type">

  <!-- This is the primary table that holds clothing data -->
  <table name="clothing" type="primary" id-column-names="id">
    <property name="type" data-type="enumerated">
      <option value="shirt"/>
      <option value="shorts"/>
    </property>
    <property name="name"/>
    <property name="description"/>
    <property name="color"/>
    <property name="size"/>
    <property name="shippingWeight"/>
```

```
  </table>
</item-descriptor>

<!-- The "shirt" item type is a subclass of "clothing" -->
<item-descriptor name="shirt" super-type="clothing" sub-type-value="shirt">
  <table name="shirt" type="auxiliary" id-column-names="id">
    <property name="season"/>
  </table>
</item-descriptor>

<!-- The "shorts" item type, now a subclass of "clothing" -->
<item-descriptor name="shorts" super-type="clothing" sub-type-value="shorts">
  <table name="shorts" type="auxiliary" id-column-names="id">
    <property name="pleated" data-type="boolean"/>
  </table>
</item-descriptor>
```

These definitions utilize inheritance as follows:

- The parent item descriptor `clothing` defines properties that are common to its sub-types `shirt` and `shorts`—for example, `color` and `size`. This item descriptor's `sub-type-property` attribute points to the enumerated property `type`, which specifies this item descriptor's sub-types.
- The item descriptors `shirt` and `shorts` define themselves as sub-types of the `clothing` item descriptor through the attributes `super-type` (set to `clothing`) and `sub-type-value` (set to `shirt` and `shorts`, respectively).

Note: Instances of objects are associated with their superclasses by ID. So, in this example, a shirt ID always has a matching clothing ID.

A sub-type item descriptor must never set `sub-type-value` to `NULL`. Given the previous example: some clothing items might be neither shirts nor shorts. In this case, the `clothing` item descriptor should set its `sub-type-value` attribute to `clothing` and add `clothing` as an option to its `sub-type-property`:

```
<!-- The "clothing" item type, a base type -->
<item-descriptor name="clothing" sub-type-property="type"
                                 sub-type-value="clothing">
  <!-- This is the primary table that holds clothing data -->
  <table name="clothing" type="primary" id-column-names="id">
    <property name="type" data-type="enumerated">
      <option value="clothing"/>
      <option value="shirt"/>
      <option value="shorts"/>
    <property/>
   ...
```

From the Repository API point of view, each ItemDescriptor maps to a single `RepositoryView`. When an SQL repository uses item type inheritance, each parent item type results in a `RepositoryViewContainer` that contains its subtype views as children.

Benefits of Item Descriptor Inheritance

The built-in inheritance capability of SQL repositories lets you easily query across a complex hierarchy of sub-types, and helps optimize performance. For example, given the previous model, the following query can return both shirt and shorts items:

```
get all clothing items with a shipping weight > 2 pounds
```

The code for this query looks like this:

```
// get hold of the repository
Repository gsa = ...;

// get the view to use for querying "clothing" type items
RepositoryView clothingView = gsa.getView("clothing");

// get a query builder
QueryBuilder qb = clothingView.getQueryBuilder();

// build the query
QueryExpression weightLimit = qb.createConstantQueryExpression(new Integer(2));
QueryExpression itemWeight = qb.createPropertyQueryExpression("shippingWeight");
Query q = qb.createComparisonQuery(itemWeight,
                                   weightLimit,
                                   QueryBuilder.GREATER_THAN);

// run the query
RepositoryItem[] items = clothingView.executeQuery(q);

// separate the shirts and shorts and do whatever with them
for (int i=0; i<items.length; i++) {
    RepositoryItem item = items[i];

    // all clothing items have a name and a description
    logDebug("clothing: " + item.getPropertyValue("name") +
             ' ' + item.getPropertyValue("description"));

    // the ItemDescriptor defines the "type" of an item
    RepositoryItemDescriptor desc = item.getItemDescriptor();

    // now we do different things, depending on the
    // type of clothing item we have
    if (desc.getItemDescriptorName().equals("shirt") {
        // shirts have a property called "season"
        logDebug("\tshirt, season = " + item.getPropertyValue("season"));

        // do shirt-related things
        myShirtProcessor(item);
    }
    else {
        // shorts have a property called "pleated"
        logDebug("\tshirt, season = " + item.getPropertyValue("pleated"));

        // do shorts-related things
        myShortsProcessor(item);
    }
}
```

This example uses the name of the item descriptor to determine the item type. You can also look at the value of the `type` property declared in your template. In the example, the enumerated properties are defined with the `useCodeForValue` attribute set to `true`. As result, the query looks like this:

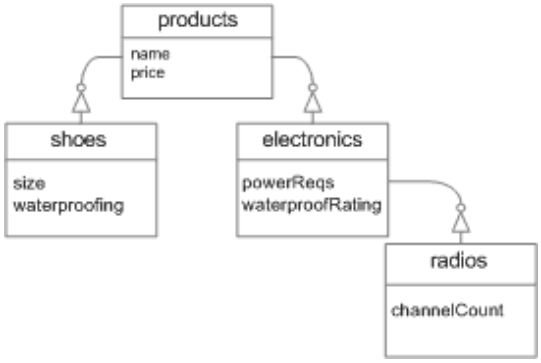
```
...
RepositoryItem item = items[i];
```

```
Integer itemTypeCode = (Integer)item.getPropertyValue("type");
if (itemTypeCode.intValue() == 0)
  {
    ... shirts ...
  }
else
  {
    ... shorts ...
  }
```

Choice of one approach over another is largely a matter of style. The item descriptor approach uses the actual name like `shirt` or `shorts`. The type attribute approach uses the type code stored in the clothing table: typically something like `0` or `1`, as in this case.

Queries and Item Descriptor Inheritance

The SQL repository query system lets you create a query against a parent item descriptor that returns items of a child item descriptor. For example, a repository might define the following item descriptors and properties:



Given these inheritance relationships, you can create the following queries against items of type `products`, although `products` does not contain the queried properties—`waterproofRating`, `size`, and `channelCount`:

```
products whose waterproofRating is 'JIS-4'
products whose channelCount = 7
products whose waterproofRating is 'JIS-4' OR whose size > 7
```

Item Descriptor Inheritance with the copy-from Attribute

You may want to make a copy of an item descriptor without doing any dynamic typing of that item descriptor. If so, you can use the `copy-from` attribute. This creates a copy of the specified item descriptor, to which you can add additional properties. This is a way to share property definitions between different item descriptors, or perhaps to add additional properties to an existing item descriptor definition. Because these item descriptors share the same tables (and thus the same data), it might be unwise to use both old and new item descriptors. Instead, it might be better to use the `super-type` attribute and `sub-type-property` attribute if you want to use both.

Limitations of SQL Repository Inheritance

The SQL repository's inheritance support has the following constraints:

- A type can only inherit from one parent.
- A class hierarchy can only have one `sub-type-property` value. You can define a second level of sub-classing —for example, you might define an item descriptor named `bermuda-shorts` that has `shorts` as its super-type-- but you cannot have another different `sub-type-property`.

All parent item descriptors (item descriptors that are used in `super-type` or `copy-from` attributes) must be fully defined by the time they are referenced in the XML repository definition file. They can be defined in front of the new XML file in the same file, or specified in an XML file that is parsed before this XML file.

You should avoid using too many levels of inheritance. Queries against items whose properties span multiple sub-types may require joins of all tables in the hierarchy. If you use these kinds of queries, keep in mind that performance decreases as the number of tables joined increases.

Derived Properties

An SQL repository can define derived properties, where one repository item derives property values from another repository item or from another property in the same item. Derived properties are important to data models that use a tree structure, where certain property values are passed down from other properties.

Note: Using derived properties can affect performance: the more complex the derivation, the greater the likely impact.

Derivation Syntax

An item descriptor defines a derived property value through <derivation> (page 173) and <expression> (page 176)tags, as follows:

```
<property name=target-property [attributes]...>
   <derivation  [attributes]...>
       <expression> source-property </expression>
       ...
   </derivation>
</property>
```

The `<derivation>` tag encloses one or more <expression> (page 176) tags. Each `<expression>` tag encloses a repository item property name, which provides one potential source of the derived value. `<derivation>` tag attributes specify how the expressions are parsed to provide a value.

For example, an organization might be a hierarchy of divisions, departments, and employees. A repository represents this hierarchy with the item descriptors `division`, `department`, and `employee`, respectively. Each item descriptor defines a `spendingLimit` property. A business rule might specify that an employee's spending limit, unless explicitly set for that employee, is derived from the employee's department. If no department spending limit is set, it is derived from the department's division.

This derived property relationship is represented in a repository definition file as follows:

```
<item-descriptor name="employee">
   ...
```

```
   <property name="department" item-type="department"/>
   <property name="empSpendingLimit" data-type="int"/>
   <property name="spendingLimit" writable="false">
     <derivation>
       <expression>empSpendingLimit</expression>
       <expression>department.spendingLimit</expression>
     </derivation>
   </property>
 </item-descriptor>

<item-descriptor name="department">
   ...
   <property name="division" item-type="division"/>
   <property name="deptSpendingLimit" data-type="int"/>
   <property name="spendingLimit" writable="false">
     <derivation>
       <expression>deptSpendingLimit</expression>
       <expression>division.divSpendingLimit</expression>
     </derivation>
   </property>
 </item-descriptor>

<item-descriptor name="division">
   ...
   <property name="divSpendingLimit" data-type="int"/>
</item-descriptor>
```

Recursive Properties Notation

A derived property expression can specify multiple levels of subproperties. For example, an employee's spending limit might be derived as follows:

```
<item-descriptor name="employee">
  <property name="department" item-type="department"/>
  <property name="spendingLimit" data-type="int" writable="false">
    <derivation>
      <expression>department.employeeDefaultInfo.spendingLimit</expression>
    </derivation>
  </property>
</item-descriptor>

<item-descriptor name="department">
   <property name="employeeDefaultInfo" item-type="employeeInfo"/>
   <property name="deptSpendingLimit" data-type="int"/>
 </item-descriptor>

<item-descriptor name="employeeInfo">
  <property name="spendingLimit" data-type="int" writable="false"/>
  <property name="officeLocation" data-type="string"/>
</item-descriptor>
```

Writable and Non-writable Derivations

The firstNonNull (page 53) derivation method must be non-writable, unless you set a writable override property for the derived property. You can set a property to be not writable like this:

```
<property name="spendingLimit" data-type="int" writable="false"/>
```

The derivation methods firstWithAttribute (page 54) and firstWithLocale (page 54) can be writable, even if the property does not define a writable override property. See Override Properties (page 52) in this section for more information.

Override Properties

You can explicitly set a property value rather than have the property derivation logic supply one, by specifying an `override-property` attribute in the `<derivation>` tag:

```
<item-descriptor name="employee">
  <property name="department" item-type="department"/>
  <property name="empSpendingLimit" data-type="int"/>
  <property name="spendingLimit">
    <derivation override-property="empSpendingLimit">
      <expression>department.spendingLimit</expression>
    </derivation>
  </property>
</item-descriptor>
```

The `derivation` tag here specifies that if the `empSpendingLimit` property is not null, it is used as the value of the `spendingLimit` property, otherwise the `spendingLimit` property is derived as before. The `override-property` attribute lets you edit in a Repository Editor a property that is otherwise derived from another property.

Properties Derived from the Same Item

Properties do not have to derive from subproperties. They can also derive from properties in the same item. For example, suppose a `user` item descriptor defines a home address and a shipping address. The ship-to address can inherit its value from the home address, like this:

```
<item-descriptor name="user">
    <property name="shipToAddress" writable="false" item-type="address">
      <derivation>
        <expression>shippingAddress</expression>
        <expression>homeAddress</expression>
      </derivation>
    </property>
    <table name="user" >
      <property name="shippingAddress" item-type="address">
      <property name="homeAddress" item-type="address">
    </table>
</item-descriptor>
```

Complex Derivations

The previous examples show properties that derive their value from a simple hierarchy. Property derivation expressions can also specify various unrelated properties. In the following example, a shipping address is derived from one of the following sources:

- Shipping address

- Billing address
- Home address
- Company address

```
/* item descriptors address and company previously defined */

<item-descriptor name="user">
  <property name="shipToAddress" writable="false" item-type="address">
    <derivation>
      <expression>shippingAddress</expression>
      <expression>billingAddress</expression>
      <expression>homeAddress</expression>
      <expression>company.address</expression>
    </derivation>
  </property>
  <table name="user" >
    <property name="shippingAddress" item-type="address"/>
    <property name="billingAddress" item-type="address"/>
    <property name="homeAddress" item-type="address"/>
    <property name="company" item-type="company"/>
  </table>
</item-descriptor>
```

To determine the value of the user's `shipToAddress` for a user, the expressions specified in the derivation are searched in order. Any expression may also refer to properties that are themselves derived.

Derivation Methods

A derived property definition can specify one of several different derivation methods to determine the appropriate property value. The SQL repository traverses in order each of the expressions in the `<derivation>` tag, applying the specified derivation method. There are six derivation methods included in the Oracle ATG Web Commerce platform:

- firstNonNull (page 53)
- firstWithAttribute (page 54)
- firstWithLocale (page 54)
- alias (page 55)
- union (page 55)
- collectiveUnion (page 56)

firstNonNull

By default, the SQL repository derives a property by traversing the expressions in order, starting with the property itself. The first non-null value found is used as the property value. This is the `firstNonNull` derivation method.

The `firstNonNull` method is the default derivation method, and so it is not necessary to specify it in the XML. However, the derivation method can be specified in the `method` attribute of a `<derivation>` tag in the SQL repository definition file, as in this example:

```
<item-descriptor name="employee">
   <property name="department" item-type="department"/>
   <property name="empSpendingLimit" data-type="int"/>
   <property name="spendingLimit" writable="false">
     <derivation method="firstNonNull">
       <expression>empSpendingLimit</expression>
       <expression>department.spendingLimit</expression>
     </derivation>
   </property>
 </item-descriptor>
```

firstWithAttribute

The `firstWithAttribute` method requires you to specify an attribute named `derivationAttribute`. The code iterates through the expressions in order, and uses the first property with an attribute that matches the value of the `derivationAttribute`. If the value with the real key is null, the value of the `defaultKey` is used.

For example:

```
<item-desciptor name="myItem">
  <property name="name">
    <derivation method="firstWithAttribute">
       <expression>englishName</expression>
       <expression>icelandicName</expression>
      <expression>shonaName</expression>
    </derivation>
    <attribute name="derivationAttribute" value="language"/>
    <attribute name="defaultKey" value="en"/>
  </property>

  <property name="englishName">
    <attribute name="language" value="en"/>
  </property>
  <property name="icelandicName">
    <attribute name="language" value="is"/>
  </property>
  <property name="shonaName">
    <attribute name="language" value="sn"/>
  </property>
</item-descriptor>
```

If `getKey` returns `sn` (the user is in Zimbabwe, for example) `myItem.name` returns the same value as `myItem.shonaName`.

firstWithLocale

The `firstWithLocale` method is a subclass of `firstWithAttribute`. It performs the following actions:

1. Gets the user's current locale as the key from the Nucleus component defined by a `keyService` attribute.
2. Compares this locale to each expression's `locale` value.
3. Returns the first property whose attribute matches.

The locale is searched in a locale-specific way. For example, if `locale=fr_FR_EURO`, it first looks for a property where the locale attribute is `fr_FR_EURO`, then looks for `fr_FR`, and finally looks for `fr`.

There is also a defaultKey, which the keyService uses if the value with the real key is null. In other words, if the real key is de_DE and you are looking for displayName, but displayName_de is null, displayName_en is returned instead (assuming its locale is en and the defaultKey is en or en_US).

Using a defaultKey can slow performance. If no default key is defined, it is not used. If the default key is the same as the current key, there are no performance implications. In all other cases, there is an extra clause on all search terms, which can result in a slower search.

The following example of a derived property definition uses the firstWithLocale derivation method:

```
<property name="displayName data-type="string">
  <derivation method="firstWithLocale">
    <expression>displayName_en</expression>
    <expression>displayName_de</expression>
  </derivation>
    <attribute name="derivationAttribute" value="locale"/>
    <attribute name="keyService" value="/atg/userprofiling/LocaleService"/>
    <attribute name="defaultKey" value="en"/>
</property>
```

alias

The Alias derivation method lets you define an alternate name for a repository item property and use either name to access the property. This can be useful in a situation where different application modules use the same property, but want to use different names for the property. A single alternate name can be defined in an <expression> element within a <derivation> element.

For example, suppose an item descriptor defines a property named firstName. You want some application code to refer to this property as name1. You can use the Alias derivation method to define name1 to be the equivalent of firstName, as follows:

```
<item-descriptor name="user" ...>
  <table name="USER" ...>
    <property name="firstName" ...>
    ....
  </table>
    <property name="name1">
    <derivation method="alias">
        <expression>firstName</expression>
    </derivation>
  </property>
```

In this example, when the name1 property is accessed, the firstName property of the item is returned.

union

The Union derivation method enables the combination of several properties of a repository item into a single property. The class takes two or more set or list type properties, and combines the values of those properties in the current repository item to create the new derived property. The members of the set or list can be of any data type supported by the Repository API. For example, suppose you have set type properties named brothers and sisters. You can use the Union derivation method to create a derived property named siblings that combines the values of the brothers and sisters properties into a single property.

```
<property name="siblings">
```

```
   <derivation method="union">
      <expression>brothers</expression>
      <expression>sisters</expression>
   </derivation>
</property>
```

The `siblings` property represents a union of values in the sets `brothers` and `sisters`. The data type of the values in the collections defined in all the expressions of the derived property must be the same.

If two or more of the properties to be combined in the Union derived property include the same element, the Union derived property has duplicate elements if the property is of type `list`, but has unique elements if the property is of type `set`.

collectiveUnion

The CollectiveUnion derivation method enables a property to be derived from a union of subproperties. The `expression` element is a property in the item descriptor that represents a collection of values. The derived property returns a union of the properties indicated by the value of the `collectionProperty` attribute.

For example, suppose you have an item descriptor named `sku`. Each `sku` type item has a `parentProducts` property, which is a collection of `product` type repository items. The following defines a `catalogs` property that is derived from a union of the `catalogs` properties of the items that make up the `parentProducts` property.

```
<item-descriptor name="sku" ...>
  <property name="catalogs">
    <derivation method="collectiveUnion">
       <expression>parentProducts</expression>
    </derivation>
    <attribute name="collectionProperty" value="catalogs"/>
  </property>
  <table name="sku_prod" ... >
    <property name="parentProducts"
              data-type="set" component-item-type="product">
    ...
  </table>
</item-descriptor>
<item-descriptor name="product" ...>
  <table name="prod_com" ... >
    <property name="catalogs" ... />
    ...
  </table>
</item-descriptor>
```

In this example, the union of `product.catalogs` is returned for each product in the `parentProducts` property of the `sku` item. The derived property is accessible through the `sku` item's `catalogs` property.

Repository Items and Session Backup

Serialized JavaBeans can be saved on a session backup server. If the Oracle ATG Web Commerce server originally handling a session becomes unavailable, important elements of a user's session can be recreated from these

serialized beans. A property's `serialize` attribute tag lets you customize how to handle that property when a repository item is serialized.

If you serialize a transient item, its properties are serialized along with it. You can exclude individual properties from serialization as follows:

```
<property ...>
<attribute name="serialize" value="false"/>
</property>
```

If you serialize a persistent item, only transient properties (those not in a table tag) are serialized unless their `serialize` attribute is set as follows:

```
<property ...>
<attribute name="serialize" value="true"/>
</property>
```

If the item is persistent, its persistent properties are written to the database and can be retrieved if the session needs to be restored.

7 SQL Repository Item Properties

An item descriptor in an SQL repository can define special types of properties. The following sections describe some of these special property types, as well as other useful repository property attributes:

- Enumerated Properties (page 59)
- Required Properties (page 62)
- Unique Properties (page 63)
- Date and Timestamp Properties (page 63)
- Null Properties (page 64)
- Property Validation with a Property Editor Class (page 65)
- Maintaining Item Concurrency with the Version Property (page 66)
- Repository Items as Properties (page 67)
- Transient Properties (page 70)
- Assigning FeatureDescriptorValues with the <attribute> Tag (page 70)
- Linking between Repositories (page 72)
- SQL Types and Repository Data Types (page 72)
- User-Defined Property Types (page 73)
- Property Fetching (page 79)
- Handling Large Database Columns (page 80)

Enumerated Properties

Enumerated item properties are string properties that are constrained to a predefined list of valid values. Generally, an enumerated item property should provide access to a small list of valid values. A `TaggedPropertyEditor` is registered for enumerated properties so components like user interfaces can access the list of valid values.

Oracle ATG Web Commerce supports two enumerated data types:

- enumerated (page 60): Stores integer codes to the database.
- enumerated String (page 61): Stores string codes to the database.

enumerated

The following item descriptor definition creates an enumerated property named `transactionType`. The definition provides a list of valid String values; the SQL repository generates the corresponding integer codes when the template is initialized:

```
<!-- The "transaction" item type -->
<item-descriptor name="transaction">
  <table name="transaction" id-column-names="xact_id">
    <property name="amount" data-type="int"/>
    <property name="transactionType" data-type="enumerated">
      <option value="credit"/>
      <option value="debit"/>
      <option value="purchase"/>
    </property>
  </table>
</item-descriptor>
```

Setting Integer Codes

You can explicitly specify the integer codes with the `<option>` tag's `code` attribute:

```
<property name="transactionType" data-type="enumerated">
  <option value="credit" code="200"/>
  <option value="debit" code="201"/>
  <option value="purchase" code="202"/>
</property>
```

Reserved Enumerated Property Integer Codes

Avoid assigning integer codes to enumerated properties that collide with integer codes that are used or reserved for future use by Oracle ATG Web Commerce products. In general, it is safe to assign enumerated properties integer codes within the range of 101-999 (some older Oracle ATG Web Commerce versions use integer code values between 0-100). You can also safely use negative integers.

The following option codes are reserved for use by Oracle ATG Web Commerce modules and products:

Module/Product	Reserved Option Code Values
DAF	1000 - 1999
DPS	2000 - 2999
DSS	3000 - 3999
Oracle ATG Web Commerce	4000 - 4999

Module/Product	Reserved Option Code Values
Oracle ATG Web Commerce B2B	5000 - 5999
ATG Portal	6000 - 6999
Oracle ATG Web Commerce Content Administration	8000 - 8999
ATG Ticketing	9000 - 9999
Oracle ATG Web Commerce Service Center	11000 - 11999
Oracle ATG Web Commerce	12000 - 12999
Agent	14000 - 14999
future Oracle ATG Web Commerce use	16000 +

Converting Integer Codes to Strings

By default, an enumerated property returns its value as an integer code. You can configure an enumerated property so the repository converts the integer code into a string value by setting the `useCodeForValue` attribute to `false`. For example, you might modify the previous definition as follows:

```
<property name="transactionType" data-type="enumerated">
  <attribute name="useCodeForValue" value="false"/>
  <option value="credit" code="200"/>
  <option value="debit" code="201"/>
  <option value="purchase" code="202"/>
</property>
```

Given this definition, the string value `credit`, `debit`, or `purchase` is returned when you get the `transactionType` property.

Conversely, if `useCodeForValue` is set to `true` (the default), the integer code is returned. If an enumerated property returns an integer code, you can get the property editor for an enumerated property and use it to create a property editor that can convert between string and integer codes. See the JavaBeans specification for a description of `PropertyEditors`.

enumerated String

By defining a property as an `enumerated String` instead of an `enumerated` data type, the following options are available to you:

- Save enumerated codes as String values in the database.
- Save one or more strings from a list of multiple choice strings.

You provide the property with the values by adding the following attribute:

`<attribute name="stringEnumProvider" value="`*`string-enum-provider-value`*`"/>`

where *string-enum-provider-value* is an implementation of `atg.adapter.gsa.StringEnumProvider`. The Oracle ATG Web Commerce installation provides two implementations for this interface, which are referenced by two properties in the site repository:

- `/atg/multisite/SiteTypesProvider`: Specified by `siteConfiguration.siteTypes`, obtains a list of site types from the SiteManager.
- `/atg/multisite/ShareableTypeStringEnumProvider`: Specified by `siteGroup.shareableTypes` properties, obtains a list of shareable types from the SiteGroupManager.

For example, the site repository's item descriptor `siteConfiguration` defines its `siteTypes` property as a collection of `enumerated String` values as follows:

```
<item-descriptor name="siteConfiguration" ... >
...
 <property name="siteTypes"
   column-names="site_type"
   data-type="set"
   component-data-type="enumerated string"
   category-resource="categoryBasics"
   display-name-resource="siteTypes">
   <attribute name="stringEnumProvider" value="/atg/multisite/SiteTypesProvider"/>
   <attribute name="propertySortPriority" value="100"/>
 </property>
...
</item-descriptor>
```

Required Properties

You can require that a repository item property is always set to a non-null value as follows:

- Set property tag's `required` attribute. For example:

  ```
  <property name="lastName" data-type="string" required="true" />
  ```

- Set the repository component's `enforceRequiredProperties` property component to `true` (the default value). This ensures that the repository checks that all required properties are present when adding repository items, and forbids the setting of a required property to null.

The repository definition must conform to its database schema; if the schema defines a property as `NOT NULL`, the repository definition must set the property's `required` attribute to `true`.

Constraints

The following constraints apply to usage of the `required` attribute:

- If a property references an item that is defined in the database as NOT NULL but you cannot mark the property as required, indicate this by adding the `references` attribute tag and set its value to `true` and its data type to `boolean`. For example:

  ```
  <property name="myProperty">
  ```

```
  <attribute name="references" value="true" data-type="boolean"/>
  </property>
```

- The `required` attribute is not supported for items that reference collections—that is, item descriptor definitions where `data-type="set"`.

Unique Properties

Some repository item properties require unique values—for example, a user profile's login property should not be shared by other user profiles. You mark a property as unique as follows:

```
<property name="login" data-type="string" required="true">
  <attribute name="unique" value="true"/>
</property>
```

Repository editors in the Oracle ATG Web Commerce Control Center enforce the requirement that the value be unique.

Date and Timestamp Properties

A repository item can have properties that are set to the current date or time, using the `java.util.Date`, `java.sql.Date`, or `java.sql.Timestamp` classes. You can have a property whose value is set to the current time or date by setting the feature attribute `useNowForDefault` to `true`. For example:

```
<property name="creationDate" data-type="timestamp">
  <attribute name="useNowForDefault" value="true"/>
</property>
```

You can query on date and timestamp properties by using the RQL functions date and timestamp. For more information, see Date and Timestamp Queries (page 20) in the Repository Query Language (page 18) chapter.

For more information about this technique, see the Assigning FeatureDescriptorValues with the <attribute> Tag (page 70) section in this chapter.

Last-Modified Properties

In some applications, it is useful to know when a repository item was most recently modified. The following item descriptor contains a last-modified property:

```
<item-descriptor name="article" last-modified-property="lastActivity">
  <attribute name="updateLastModified" value="true"/>
<table name=ARTICLES type="primary" ...>
```

```
  <property name="lastActivity" data-type="timestamp"/>
...
</table>
</item-descriptor>
```

Three requirements apply:

- The item descriptor contains a date or timestamp property that stores the last-modified value. This property must be persistent and single-valued:

  ```
  <property name="lastActivity" data-type="timestamp"/>
  ```

- The item descriptor sets the `last-modified-property` attribute to the name of the last-modified property:

  ```
  <item-descriptor name="article" last-modified-property="lastActivity">
  ```

- The item descriptor sets the `updateLastModified` `<attribute>` element to `true`:

  ```
  <attribute name="updateLastModified" value="true"/>
  ```

Given this example, an `article` item's `lastActivity` property is updated with the current time when the item is added or updated.

Null Properties

A property is set to null if its definition does not set a default value. For example:

```
<property name="favoriteColor" data-type="string"/>
```

You can also explicitly set a property's default value to null as follows:

```
<property name="favoriteColor" data-type="string" default="__NULL__"/>
```

This technique is useful if, for example, you combine two or more repository definition files into a single template and need to override a non-null value and restore the default to null.

Grouping and Sorting Properties

In order to group similar properties in a Repository user interface, include the `category` attribute in their respective `<property>` tags and set the attribute to the same value. For example, the `<property>` tags that define login and password properties each set their `category` attribute to `Login`; thus, the login name and password are listed together under the heading Login.

By default, properties with the same `category` setting are listed in ascending alphabetical order of their `display-name` settings. You can explicitly control the display order of grouped properties by setting their `propertySortPriority` attributes to the desired integer values; in that case, the properties are displayed in ascending numeric order. The default `propertySortPriority` setting is 0.

For example, Oracle ATG Web Commerce user profile definitions set three name properties (first, middle, last) as follows:

```
<property category="Basics" name="firstName" data-type="string"
          display-name="First name">
   <attribute name="propertySortPriority" value="-3"/>
</property>

<property category="Basics" name="middleName" data-type="string"
          display-name="Middle name">
   <attribute name="propertySortPriority" value="-2"/>
</property>

<property category="Basics" name="lastName" data-type="string"
          display-name="Last name">
   <attribute name="propertySortPriority" value="-1"/>
</property>
```

Given these settings, the Basics category for a user profile the ATG Control Center displays name properties in the following order:

- First name
- Middle name
- Last name

Category Ordering in the ACC

The ACC lists categories in the following order:

1. All named categories that contain required properties (properties with the attribute `required="true"`).
2. All named categories that do not contain required properties.
3. A special "anonymous" category containing properties that are not assigned to any category.
4. A special "Groups" category containing boolean properties that correspond to content or profile groups.

Within each of these four sets, categories are listed in alphabetical order.

Property Validation with a Property Editor Class

You can specify a property editor class to use with a property, using the `editor-class` attribute. For example, the following tag associates a special property editor with the password property:

```
<property name="password" data-type="string" required="true"
editor-class="atg.beans.PasswordPropertyEditor"/>
```

A property editor can be used to validate a property value. Note, however, that a property editor does not have access to the repository item, only the property. Therefore, you cannot use a property editor to make comparisons with other properties.

You can also limit a property's values to a list of valid choices with an enumerated property. See the Enumerated Properties (page 59) section.

Maintaining Item Concurrency with the Version Property

The SQL repository can use a system of optimistic locking to maintain consistent versions of repository items. This optimistic locking system can be used in combination with any repository caching mode: disabled, simple, locked, and distributed.

To use the optimistic locking system for an item descriptor, add a version property to the item descriptor and a corresponding version column to the primary database table for the item descriptor. This version property must use `data-type="int"` or `data-type="long"` and the database column must be of a type that is compatible with the repository `int` or `long` type. The version property is identified in the item-descriptor tag with an attribute named `version-property`, the value of which is the name of the version property. For example:

```
<item-descriptor name="news" version-property="version">
  <table name="business_news" id-column-names="id"/>
    <property name="version" data-type="int"/>
    ...
  </table>
</item-descriptor>
```

The value of the version property is incremented every time the item is updated. Its value starts as 0 when the item is created, is set to 1 when the item is added, and is incremented in each subsequent update.

The version number for a particular item is read and associated with that transaction the first time that item is referenced in a transaction. If you try to update the item from a transaction whose version does not match the current version number in the database, a `ConcurrentUpdateException` is thrown to abort that update. This exception is a subclass of `RepositoryException`.

Here is a sample scenario that shows how the SQL repository uses the version property to implement optimistic locking:

1. Dynamo1 reads a repository item for update. It obtains the item's version property, which has a value of 2.

2. Dynamo2 reads the same repository item for update. Because Dynamo1 has not yet committed any changes to the item, Dynamo2 gets the same value for the item's version property, 2.

3. Dynamo1 updates the repository item. In the course of the update, the value for the version property in the repository item is checked to see whether it is the same as what is found in the corresponding database column. In this case, both values are still 2. The update to the repository item is committed, with the version property incremented by 1, so the value of the version property is now 3.

4. Dynamo2 tries to update the repository item. When the value for the version property in the repository item is checked to see whether it is the same as what is found in the corresponding database column, the values do not match. Dynamo2 is holding a value of 2, while the value of the version property in the database is now 3. Dynamo2 throws a `ConcurrentUpdateException` and does not apply the changes in the update.

This can be very useful for simple and distributed caching modes where there is a possibility of overwriting another Dynamo's changes.

You can take advantage of optimistic locking in pages that include forms. Often in a form, you read the data in one transaction and update the data in another transaction. There is a possibility that another process might try to update an item in an intermediate transaction. To handle this case, you can place the version property value as a hidden field in your form. Then, you can either check that it is still the same yourself after you start the transaction which updates the item, or you just set the version property (along with the other properties in the item) and deal with the `ConcurrentUpdateException` when it occurs. For example, you can include in a page a hidden input tag like this:

```
<input type="hidden" bean="FormHandler.value.version">
```

You can also use a `RepositoryFormHandler`, which can set a version property just like it sets any other property of a repository item.

Repository Items as Properties

The value of a property of a repository item can be another repository item. Both multi-valued properties and single-valued properties can have repository items as property values. This is a powerful feature, and allows you much greater flexibility in defining a database schema that your application accesses as a repository.

Consider as a simple example a repository that contains books and authors. You can represent both books and authors as repository items, which enables you to do things like this:

```
Repository gsa = ...;
String myBookId = ...;

// get my book from the db
RepositoryItem book = gsa.getItem(myBookId,descriptorName);

// get the author of my book (it's a dynamic bean too!)
RepositoryItem author = (RepositoryItem)book.getPropertyValue("author");
```

Without support for objects as properties, the application must get an `authorId` from the book and perform another lookup to get the actual author.

You can specify that a repository item property is another repository item, rather than a primitive, with the `item-type` attribute instead of the `data-type` attribute. The following example shows a portion of a template that defines two item descriptors, `book` and `author`:

- Repository items of the `book` item descriptor have an `author` property whose value is another repository item, an author.
- Repository items of the `author` item descriptor have a `book` property whose value is another repository item, a book.

```
<!-- The "book" item type -->
<item-descriptor name="book" default="true">
  <table name="book" type="primary" id-column-names="book_id">
    <property name="title"/>
    <property name="author" column-name="author_id"
              item-type="author"/>
```

```
  </table>
</item-descriptor>

<!-- The "author" item type -->
<item-descriptor name="author">
  <table name="author" id-column-names="author_id" type="primary">
    <property name="lastName"/>
    <property name="firstName"/>
  </table>
  <table name="book" id-column-names="author_id" type="auxiliary">
    <property name="book" item-type="book" column-name="book_id"/>
  </table>
</item-descriptor>
```

Multiple Item Properties

You can also specify that a repository item property references other repository items. In the previous example, an author may have written more than one book. Instead of the `book` property in the preceding example, this next example uses a `books_written` property whose value is a `Set` of `book` repository items. The `<property>` tag for the `books_written` property uses the following attributes:

- `data-type="set"`
  Specifies that the property value is a `Set` of items
- `component-item-type="book"`
  Specifies that the items making up the set are items of the `book` item descriptor
- `column-name="book_id"`
  Specifies that the database column is named `book_id`, rather than `books_written`.

```
<!-- The "book" item type -->
<item-descriptor name="book" default="true">
  <table name="book" type="primary" id-column-names="book_id">
    <property name="title"/>
    <property name="author" item-type="author" column-name="author_id"/>
  </table>
</item-descriptor>

<!-- The "author" item type -->
<item-descriptor name="author">
  <table name="author" id-column-names="author_id" type="primary">
    <property name="lastName"/>
    <property name="city"/>
    <property name="state"/>
    <property name="zip"/>
  </table>
  <table name="book" id-column-names="author_id" type="multi">
    <property name="books_written" data-type="set"
          component-item-type="book"
          column-name="book_id"/>
  </table>
</item-descriptor>
```

In this example, the repository definition XML defines the `book` table twice: in the `book` item descriptor and in the `author` item descriptor. In the `author` item descriptor, the `<table>` tag for the `book` table includes the

attribute `type="multi"`, indicating that each `author` item can have more than one row with the `id` column. In a multi-table, all defined attributes are multi-valued types. To define `Array`, `List` and `Map` types, you also must specify a `multi-column-name` attribute on the table tag. This specifies which column to use as the sorting value in order to determine the order of the `List` and the key for the `Map`.

Now the properties `author` and `books_written` are actually real beans (in this case RepositoryItems) instead of just simple Java primitives. In the `author` item descriptor, the `books_written` property is a `Set` of RepositoryItems that correspond to books. The other types supported are `List`, `Map`, and `Array`.

Adding an Item to a Multi-Item Property

How you add a repository item to a `Set`, `List`, `Map`, or `Array` partly depends on how you use the `cascade` attribute. For example, the previous definition of the `books_written` property might be modified to set `cascade` to `update`:

```
<property name="books_written" data-type="set"
component-item-type="book"
column-name="book_id"
cascade="update"/>
```

This setting makes it easier for you to keep the book repository items synchronized with the author repository items that refer to them. See the Cascading Data Relationships (page 43) section. You can add a `book` item to a set of items in the `books_written property` like this:

```
Repository gsa = ...;
RepositoryItem newBook = getRepository().createItem("book");
Set books_written = (Set) author.getPropertyValue("books_written");
books_written.add(newBook);
```

If the `books_written` property does not have `cascade="update"`, you must add the item with the `addItem()` method (thus inserting the row in the database) before you add it to the list:

```
Repository gsa = ...;
RepositoryItem newBook = getRepository().createItem("book");
getProfileRepository().addItem(newBook);
Set books_written = (Set) author.getPropertyValue("books_written");
books_written.add(newBook);
```

Remember that in each of these cases, it is most efficient to ensure that all method calls are performed in a single transaction. See Repositories and Transactions (page 29) in the *SQL Repository Architecture* section.

Prohibiting Duplicate Values

You can prohibit duplicate values in multi-item properties of type List and Array by setting the repository component property `prohibitCollectionDuplicates` to `true`. By default, this property is set to `false`. The repository definition of individual properties can override the repository-level setting. For example:

```
<property name="color"
               column-names="color" data-type="list"
               component-data-type="string">
   <attribute name="prohibitDuplicates" value="true"/>
```

```
</property>
```

Querying Subproperties

The SQL repository allows applications to query repository items based on attributes of their attributes, sometimes referred to as subproperties.

Continuing the book example, subproperty querying means that you can write repository queries like:

```
Get me all the books that were written by authors living in NY
```

This query can be represented using RQL in a `<query-items>` tag, as follows:

```
<query-items item-descriptor="book">author.state="NY"</query-items>
```

Transient Properties

The SQL repository lets you define properties of a repository item that are transient. Transient properties are never stored or read from the persistent data store. They are readable and writable, but not queryable. Transient properties provide applications a hook for custom objects that are not persisted by the repository.

You can specify a transient property by defining a `<property>` tag that is not associated with any database table, but which is instead a direct child of an `<item-descriptor>` tag. For example, in the following example, the `user` item descriptor has a transient property that specifies whether the user is logged in at that time:

```
<item-descriptor name="user" sub-type-property="userType">
    <property name="loggedIn" data-type="boolean">
    <table name="user" type="primary" id-column-names="id">
      <property name="userType" data-type="enumerated"
                column-name="user_type">
...
```

You can also define an entire item descriptor to be transient. Such an item descriptor has no `<table>` tags and no properties that are direct children of a `<table>` tag. The properties of transient item descriptor are queryable by default, unlike a transient property of an item descriptor with other properties that are persistent properties. In the case of a transient item descriptor, no indexing is used, so queries against large repositories are slow. Using transient repositories is sometimes a useful testing tool during application development.

Assigning FeatureDescriptorValues with the <attribute> Tag

You can use the `<attribute>` tag as a child tag in a `<property>` or `<item-descriptor>` tag to associate arbitrary name/string value pairs with the property. These named values correspond to those specified in `java.beans.FeatureDescriptor`, which `RepositoryPropertyDescriptor` implements.

This is simply a way of letting applications associate more metadata with individual properties. The SQL repository does not do anything with the data expressed in the <attribute> tag; it remembers the values defined in the template and allows one to read them at runtime. This is the same mechanism that the @beaninfo JavaDoc tag system uses.

Here is an example, which assigns to the author property the name/value pair of maxLength="30":

```
<!-- The "book" item type -->
<item-descriptor name="book">
  <table name="book" id-column-names="book_id" type="primary">
    <property name="title"/>
    <property name="author">
      <attribute name="maxLength" value="30"/>
    </property>
  </table>
</item-descriptor>
```

It is also useful to refer to values of Nucleus components as attributes. You can do this with the bean attribute of the <attribute> tag. For example:

```
<attribute name="documentRootPath"
bean="/atg/demo/QuincyFunds/repositories/
FeaturesDataStore.relativePathPrefix" />
```

If you use a relative Nucleus address for the bean attribute, it refers to a component relative to the Repository component.

You can access property attributes programmatically with the RepositoryPropertyDescriptor.getValue method. For example:

```
RepositoryPropertyDescriptor.getValue("maxLength");
```

Attributes Used in the ACC

Oracle ATG Web Commerce defines a set of feature descriptor attributes that modify how a repository item property is treated in the ATG Control Center. These attributes are defined by an <attribute> tag within a <property> tag. For example:

```
<property name="author">
<attribute name="uiqueryable" value="false"/>
</property>
```

The default value for each of these attributes is true:

Attribute	Description
uiqueryable	If this attribute is set to false, the property is not available to a targeting UI element or an Oracle ATG Web Commerce expression editor in the ACC.
uiwritable	If this attribute is set to false, the property cannot be modified or set in the ACC. Unless the property tag also has the writable=false attribute, the property can still be modified or set programmatically or through a form.

Linking between Repositories

A property value can refer not just to another type of repository item, but also to a repository item in another repository. When you define a property that refers to an item in a different repository, use the `repository` attribute as part of the property tag. For example, if you had a `workAddress` item type in an LDAP repository, you might refer to it in an SQL repository like this:

```
<table name="employees" id-column-names="id">
   ...
  <property name="work_address"
            item-type="workAddress"
            repository="/atg/userprofiling/LDAPRepository"/>
</table>
```

The `repository` attribute can be used with the attribute `item-type` or the `component-item-type` to indicate that this item is in a different repository, not the current repository. The value of the linked property in the database is the repository ID of the item in the other repository.

The `repository` attribute specifies a Nucleus component name relative to the location of the current repository. This enables you to create a composite repository that combines the item descriptors from more than one repository. Note, however, that a single repository query cannot span repositories with different data sources.

When you use composite repositories, make sure that your affiliated repositories do not use the same item descriptor names. In this way, your application can go to the composite repository, get an item descriptor named `products`, and not have to know that it is dealing with a separate repository.

SQL Types and Repository Data Types

At application startup, the SQL repository accesses the database to determine the JDBC type of each property in the repository template. This enables the SQL repository to use the appropriate JDBC type in creating SQL queries. For large database schemas, however, getting the JDBC type of every column in your schema can take an unacceptably long time. If this is a problem, you can solve it in several ways:

Set the sql-type attribute for All Repository Item Properties

You can explicitly set the `sql-type` or `sql-types` attribute for every non-transient property in your repository template. These attributes are attributes of the `<property>` element. For example:

```
<property name="winning_number" data-type="long" sql-type="numeric" />
```

If you set the `sql-type` or `sql-types` attribute for every non-transient property in your repository template, the SQL repository does not try to check the JDBC type of your properties.

One drawback of this approach is that the `sql-type` can vary depending on your database software vendor. If you set the `sql-type` attribute explicitly, you must review and update the value if you move your repository implementation to a different vendor's database software.

Set the safeSQLTypes Property in the GSARepository Component

The `GSARepository` class includes a property named `safeSQLTypes`. This property can be set to a comma-separated list of SQL types for which the repository always uses the default type. You can set this property

to string values of SQL types like `varchar`, or to the corresponding integer values specified in the class `java.sql.Types` (for example, -4). The default value of this property is empty.

The SQL repository does not try to determine the JDBC types for properties in a database table if every property has its `sql-type` attribute set explicitly, or is of a type included in the `safeSQLTypes` property for that repository.

Cache the Schema Information

You can configure the SQL repository to cache information about your repository database schemas. Do this by setting the `updateSchemaInfoCache` property in the `GSARepository` component to `true`. The default value for this property is `false`. If you set this property to `true`, after you reassemble, redeploy, and restart your application, the server creates the directory `{atg.dynamo.home}/data/schemaInfoCache/`. This directory contains a series of files with names like *`repositoryName`*`.properties`, one file for each repository in your application. Each file in the `/data/schemaInfoCache` directory specifies the SQL type of each column in that repository's schema, in the following format:

```
tablename.colname=SQLtype
```

The SQL type in this case is the integer type code specified in the class `java.sql.Types`. For example, setting the `updateSchemaInfoCache` to true in the `ProfileAdapterRepository` component might generate a file that begins like this:

```
## SchemaInfoCache - auto generated
#Tue May 13 17:32:25 EDT 2003
dps_user_scenario.scenarioInstances=12
paf_usr_pgfld.creationDate=93
dps_email_address.emailAddresses=12
```

These files can be generated against one database and copied to another as long as the schemas are compatible. If you change the schema and this property is enabled, you must remove the `/data/schemaInfoCache` directory so it is regenerated. The `/data/schemaInfoCache` directory does get regenerated automatically if you add a property that refers to a new column or a new table. If those files exist, they are used even if the `updateSchemaInfoCache` property is set to `false`. This enables a live server to use the schema info cache generated by a different staging server. This can be useful if one server in a cluster is unable to generate the schema information.

User-Defined Property Types

In addition to the standard data types of repository item properties, described in Data Type Mappings: Java and SQL (page 172), the SQL repository lets you add your own types of properties. The new property types can implement both `getX` and `setX` functionality in one of two ways, depending on your requirements:

- If the property is transient, extend:

  `atg.repository.RepositoryPropertyDescriptor`

- If the property is to be stored in the database and needs to appear inside a `<table>` tag, modify the SQL repository's default property implementation and extend:

```
atg.adapter.gsa.GSAPropertyDescriptor
```

In either case, you can add additional configuration information to the XML file unique to your type. Also, the `PropertyDescriptor` `get` and `set` methods can set and get other property values in the same item.

Identifying a User-Defined Property Type

You can identify your property type in one of two ways:

- Directly: Use the name of your Java class.
- Indirectly: Specify a type name of your type and register it with this method:

```
atg.repository.RepositoryPropertyDescriptor.
registerPropertyDescriptorClass(String typeName,
Class pPropertyDescriptorClass)
```

If you use the indirect method, set the `userPropertyDescriptors` property of the `GSARepository` component to include your type (or, in the alternative, call the `registerPropertyDescriptorClass()` method at some point before the XML repository definition file is loaded).

Most users find the direct Java class approach simpler. In either case, you set the `<property>` tag attribute `property-type` to the user-defined property type.

Using the property-type Attribute

The `property-type` attribute specifies the `PropertyDescriptor` class that defines your property type, as in this example:

```
<property name="contentFile"
          property-type="atg.repository.FilePropertyDescriptor">
  <attribute name="pathNameProperty" value="contentFileName"/>
</property>
```

Generally, if you specify a type with the `property-type` attribute, you do not need to use the `data-type` or `item-type` attribute to specify the type. However, in some cases, you might create user-defined properties that can represent more than one data type. In such cases, you can use the `data-type` attribute to further constrain the property.

Implementing a User-Defined Property Type

As the SQL repository parses the XML repository definition file, it creates an instance of your `RepositoryPropertyDescriptor` class and stores it directly in the SQL repository's list of property descriptors for each item descriptor. The SQL repository calls `setItemDescriptor()` to associate your property with its item descriptor. The SQL repository then calls one or more methods corresponding to the property's type:

- `RepositoryPropertyDescriptor.setPropertyType()`
- `GSAPropertyDescriptor.setComponentPropertyType()`

- `RepositoryPropertyDescriptor.setPropertyItemDescriptor()`

If the property refers to another item's type, this method:

`RepositoryPropertyDescriptor.setComponentItemDescriptor()`

sets the item descriptor for that type, depending on which attributes are set in the <property> tag: `data-type`, `item-type`, `component-data-type`, or `component-item-type`. They define the property's Java class, the component's property class (if the property is a multi-valued property), the `RepositoryItemDescriptor` for a scalar or a multi-valued property that refers to other item types.

If your property type can accept any of these values, you do not need to override these methods. If your property is constrained in what data types it supports (which is generally the case), you should put error checking logic into these methods to throw errors if an invalid type is specified. Your property descriptor should throw the unchecked `IllegalArgumentException` to provide details about what type is required. If your property type is very restrictive, you can implement these methods to return the appropriate values:

- `RepositoryPropertyDescriptor.getPropertyType()`
- `GSAPropertyDescriptor.getComponentPropertyType()`
- `RepositoryPropertyDescriptor.getPropertyItemDescriptor()`
- `RepositoryPropertyDescriptor.getComponentItemDescriptor()`

This prevents developers of repository definitions from having to set the `data-type`, `component-data-type`, `item-type`, and `component-item-type` attributes. You may still want to put error checking in these methods to signal errors if they do provide invalid values.

Caution: When an application calls the repository item method to retrieve or set a user-defined property, it calls the repository item's own `getPropertyValue()` and `setPropertyValue()` methods, which, in turn, call the `getPropertyValue()` and `setPropertyValue()` methods that you implemented for that property. The second set of get and set methods should avoid calling the first set; otherwise, an infinite loop can occur.

The `getPropertyValue` method receives an extra `Object pValue` argument. This is set to any value found in the cache for this property name, if any, or null if no value is in the cache. The call to `setPropertyValue` can embed a call to `setPropertyValueInCache(this, yourvalue)` in order to cache this property value for subsequent method calls.

If your property is not set, you may choose to return the value of the `getDefault()` method on the `RepositoryPropertyDescriptor`. This allows the user to set the default value for this property with the `default` attribute in the XML tag. This method calls `setDefaultValueString`, which converts the default value based on the class returned by `getPropertyType`, which calls `setDefaultValue`. You may choose to modify this behavior by overriding these methods though typically this functionality is sufficient.

Note that user defined properties must be serializable. The `getPropertyValue` and `setPropertyValue` methods do not need to work on an unserialized version, but the `getPropertyType`, `getComponentType`, `getPropertyItemDescriptor`, and `getComponentItemDescriptor` methods in particular do need to work. This is important so that the ATG Control Center can understand the type of property it is editing.

To make your user-defined property queryable, it should represent a database column. Unless your user-defined property extends `GSAPropertyDescriptor`, the property is not queryable and you should implement the method `isQueryable` to return `false`. If you want a user-defined property to be queryable, make sure it extends `GSAPropertyDescriptor`. You may also override the methods `isWritable` and `isReadable` to turn off write access or read access to your property respectively. Other methods such as `isHidden`, `isExpert` can also be overridden if you want to set additional Bean attributes. The method `setValue(String pName, Object pValue)` is called if any feature descriptor attributes are supplied with this property.

Property Conversion Methods

User-defined properties that correspond directly to a column in an SQL table must extend the class `atg.adapter.gsa.GSAPropertyDescriptor`. These classes must implement three additional methods:

- rawToReal (page 76)
- realToRaw (page 76)
- createDBPropertyEditor (page 76)

rawToReal

This method converts from the database version of the property value to the property value as it is returned by `RepositoryItem.getPropertyValue`. For example, for you might convert the ID of an item into the item itself. You do not need to implement this method if the default behavior of the SQL repository is what you want.

realToRaw

This does the opposite of `rawToReal`. It converts from the version of the value given to `setPropertyValue` into the value given to the `setObject` call in JDBC. For example, if you have a property that specifies a reference to another item, you convert from the `RepositoryItem` to its ID.

For examples of these methods, see the source code for the `atg.adapter.gsa.EnumPropertyDescriptor` class at:

```
<ATG11dir>/DAS/src/Java/atg/adapter/gsa/EnumPropertyDescriptor
```

createDBPropertyEditor

This method is used by some reporting UIs or other tools which need to get the database value directly from SQL, but want to convert that value to or from a String representation. For example, you might perform a query against the Profile Repository, and receive the code value for an enumerated property. You can use the `createDBPropertyEditor` to convert the code value to its String representation for display in a UI, for instance. This method is like the method `createPropertyEditor`, but the property editor returned from `createDBPropertyEditor` should operate on the raw value (the value returned from the JDBC `getObject` call), not the real value (as returned by the `RepositoryItem.getPropertyValue` call).

Null Values in User-Defined Property Types

When the `getPropertyValue(Item, pValue)` method gets called for a user-defined property descriptor, it is given the currently cached value in the variable `pValue`. If you have previously stored a value for this property in the cache, it is given to you here. Your implementation may just choose to return that value.

Two different representations of a null value can be returned:

- `pValue = null` indicates there is no value in the cache for this property.
- `pValue = RepositoryItemImpl.NULL_OBJECT` indicates that an explicit null value was already cached for this item.

User-Defined Properties and the ACC

In order to property display a user-defined properly in the ATG Control Center, make sure that its Java class is available to the ACC. Package any user-defined property Java classes as part of an Oracle ATG Web Commerce

application so the ACC can pull the classes across the RMI interface. Otherwise, a remote ACC throws an "unknown block data" error.

User-Defined Property Type Examples

Here's an example that defines a user defined property type in an XML repository definition file:

```
<item-descriptor name="images">
  <table name="book" id-column-names="book_id" type="primary">
    <property name="title"/>
    <property name="author"/>
    <property name="lastModifiedTime"/>
    <property name="contentFileName" data-type="string"/>
  </table>
  <property name="contentFile"
            property-type="atg.repository.FilePropertyDescriptor">
    <attribute name="pathNameProperty" value="contentFileName"/>
  </property>

</item-descriptor>
```

For the user defined property implementation used in this example, see the source code in:

```
<ATG11dir>/Das/src/Java/atg/repository/FilePropertyDescriptor.java
```

If you extend the `GSAPropertyDescriptor` class, you have two additional methods that you can override. These methods convert data between the type that is stored in the database and the type that is stored in the cache. These methods are called only when the data is loaded from or stored to the database. If a cached value is found, it is returned without calling these methods. Thus it is slightly more efficient to do conversion here than in the `getPropertyValue` or `setPropertyValue` methods.

```
//-------------------------------------
/**
 * Translate a raw property value to a real value. The real value is what
 * applications use. The raw value is what is stored in the DB.
 * @param pRawValue for a property
 * @return real value to use in applications for the property
 **/
public Object rawToReal(Object pRawValue)

//-------------------------------------
/**
 * Translate a property value to a raw value. The real value is what
 * applications use. The raw value is what is stored in the DB.
 * @param pRealValue for a property
 * @return raw value for storing this property in the DB
 **/
public Object realToRaw(Object pRealValue)
```

The following example, from the `productCatalog.xml` file in ATG Commerce defines two property descriptors:

- The `data` property returns a `java.io.File` object when you call `getPropertyValue("data")` on one of the `media-external` items. The path name for this `File` object is computed by concatenating the value of

the `url` property of the `media-external` item with the value of the `pathPrefix` attribute below, `./docs`. Thus the path is of the form:

```
./docs/<value of the url property>
```

- The `mimeType` property computes a MIME type from the `url` property. It returns a MIME type string such as `"text/html"` from the value of the `url` property. It uses a `MimeTyper` component to convert the suffix to a MIME type.

```
<!-- Media, which is stored on the external file system -->
<item-descriptor name="media-external" display-name="Media - External"
                 super-type="media" sub-type-value="external"
                 item-cache-size="1000" query-cache-size="1000"
                 version-property="version" id-space-name="media"
                 content-property="data">
    <table name="dcs_media_ext" type="auxiliary" id-column-names="media_id">
       <property name="url" data-type="string" column-name="url"
                 required="true"/>
    </table>
    <property name="data" property-type="atg.repository.FilePropertyDescriptor"
              writable="false" queryable="false">
      <attribute name="pathNameProperty" value="url"/>
      <attribute name="pathPrefix" value="./docs"/>
    </property>
    <property name="mimeType"
              property-type="atg.repository.MimeTyperPropertyDescriptor"
              data-type="String" writable="false" queryable="false">
        <attribute name="identifier" value="url"/>
    </property>
</item-descriptor>
```

A new property type is defined by implementing a sub-class of the `atg.repository.RepositoryPropertyDescriptor` class. In this class, you can define values for the readable, writable, and queryable properties. They also have the following additional methods that are typically overridden by a user-defined property type:

```
//-------------------------------------
 // Ability to retrieve/save values to the repository item
 //-------------------------------------

 //-------------------------------------
 /**
  * This method is called to retrieve a read-only value for this property.
  *
  * Once a repository has computed the value it would like to return for
  * this property, this property descriptor gets a chance to modify it
  * based on how the property is defined.  For example, if null is to
  * be returned, we return the default value.
  */
 public Object getPropertyValue(RepositoryItemImpl pItem, Object pValue);

 //-------------------------------------
 /**
  * Sets the property of this type for the item descriptor provided.
  */
 public void setPropertyValue(RepositoryItemImpl pItem, Object pValue);
```

You can register user defined property types in a static registry so they can be defined with a simple name, like tag converters. List your user defined properties in the `userPropertyDescriptors` property of the `GSARepository` component.

Property Fetching

Normally, when a repository item is loaded from the database, properties in each table are loaded at the same time. By default, all primary table properties of a repository item are loaded when `getItem` is called for the first time on the item.

You might need to modify this default property fetching behavior. For some applications, the database activity required to load all primary table properties can adversely affect performance unnecessarily. For example, an application may want the SQL repository to load a large GIF property only if it is specifically asked for. This is known as *lazy evaluation*. On the other end of the spectrum, you might need to load properties from different tables immediately. For example, an application may want to always load a user's last name whenever a profile is read from the database. This is known as *prefetching*. Finally, some applications want to group properties so when one value is requested, all values in this group are loaded—for example, loading a zip code and state code whenever a street address is loaded.

You can achieve a finer level of control over property loading by using cache groups in your repository definition. By default, the cache group of a property is the same name as the table that the property is defined in. You can set the cache group of a property with the `group` attribute in the property's definition in the repository definition file. All properties with the same `group` attribute are fetched whenever any member of the group is fetched. Only those properties that are in the same cache group as the repository ID (or, if there is no ID property, all the properties in the primary table) are loaded when `getItem` is called for the first time on an item. While generally you define a cache group with the `group` attribute in the property's definition in the repository definition file, you can also define a cache group with the `setGroup` method of `atg.adapter.gsa.GSAPropertyDescriptor`.

For example, an address might be composed of several properties, like this:

```
<property name="address1" group="address"/>
<property name="city" group="address"/>
<property name="state" group="address"/>
<property name="zip" group="address"/>
```

The `group="address"` attribute ensures that the whole address is loaded whenever one element of the address is accessed, even if the properties are stored on different database tables. So, if you call `getPropertyValue` for the `city` property, the `address1`, `state`, and `zip` properties are also loaded.

If you want to assure that only the repository ID is returned and none of the repository item's other properties, you can isolate the repository ID in its own cache group:

```
<item-descriptor name="user" default="true">
    <table name="usr_tbl" type="primary" id-column-names="id">
      <property name="id" data-type="string" group="id"/>
      <property name="name" data-type="string" group="info"/>
      <property name="age" data-type="int" group="info"/>
    </table>
</item-descriptor>
```

Handling Large Database Columns

If your SQL repository definition includes properties that might correspond to large objects in the database, you might need to set some properties in the SQL Repository component to handle them.

Property	Description
`useSetBinaryStream`	If `useSetBinaryStream` is set to `true`, the SQL repository always uses `setBinaryStream()` instead of `setBytes()` in prepared statements. The `setBinaryStream()` is required for large byte arrays in some JDBC drivers.
`useSetUnicodeStream`	If `useSetUnicodeStream` is set to true, the SQL repository always uses `setUnicodeStream()` instead of `setString()` in prepared statements. The `setUnicodeStream()` method is required for large Strings in some JDBC drivers. Setting `useSetUnicodeStream="true"` is recommended if you use Oracle with internationalized content, but is not recommended if you do not have internationalized content in your database. Note that if you use MS SQL Server, you must set `useSetUnicodeStream` to false.
`useSetAsciiStream`	If `useSetAsciiStream` is set to `true`, the SQL repository always uses `setAsciiStream()` instead of `setString()` in prepared statements. You can `useSetAsciiStream` instead of `useSetUnicodeStream`, but you lose the ability to handle internationalized values in the database.
`useSetObject`	If `useSetObject` is set to `true`, the SQL repository always uses `setObject()` instead of `setInt()`, `setFloat()`, `setDouble()`, or `setString()` in prepared statements.

8 SQL Repository Queries

The SQL repository adds a number of features to the basic query architecture of the Repository API described in the *Repository Queries* (page 13) chapter. This chapter discusses the following topics:

- Repository Filtering (page 81)
- Overriding RQL-Generated SQL (page 83)
- Parameterized Queries (page 84)
- Named Queries (page 87)
- Text Search Queries (page 92)
- Wildcards in Queries (page 94)
- Not Queries and Null Values (page 95)
- Outer Joins (page 95)
- Table Ownership Issues (page 96)
- Unsupported Queries in the SQL Repository (page 97)

Repository Filtering

The SQL repository lets you filter database read operations. For example, you might want a database lookup always to return only items whose `activeFlag` property is `true`. You can filter the repository by defining a repository query that specifies the filter criteria you want and associating it with the appropriate item descriptor. The filter is automatically applied to all of the following operations:

- `Repository.getItem()`
- `Repository.getItems()`
- `MutableRepository.getItemForUpdate()`
- `MutableRepository.getItemsForUpdate()`
- `RepositoryView.executeQuery()`
- `RepositoryView.executeCountQuery()`

You can define a repository filter in three ways:

- Use the `<rql-filter>` tag in the definition file for an item descriptor.
- Set the `filterQuery` property of the item descriptor to a Query object.
- Set the `rqlFilterString` property of the item descriptor to an RQL string, which is compiled into the Query object that defines the filter.

In most cases, the first method, using the `<rql-filter>` tag, is easiest and preferable.

<rql-filter>

You can create a repository filter with the `<rql-filter>` tag in the definition file for an item descriptor. The `<rql-filter>` tag encloses an RQL statement, as in the following example:

```
<item-descriptor name="article">
  <rql-filter>
    <rql>name starts with "n"</rql>
  </rql-filter>
  <table name="article" id-column-names="article_id">
    <property name="name"/>
    <property name="date"/>
  </table>
</item-descriptor>
```

This setting causes queries and item lookups for this item descriptor to return only items whose `name` property starts with `n`. The SQL repository issues SQL in the form of an extra WHERE clause condition to implement filtering so any given query or item lookup should be no slower with a reasonable filter tacked on.

You can also use RQL substitution parameters in your filter query. For example:

```
<item-descriptor name="article">
  <rql-filter>
    <rql>name starts with ?0 or availabilityDate &lt; ?1</rql>
    <param value="n"></param>
    <param bean="/myApp.IssueDate"></param>
  </rql-filter>
  <table name="article" id-column-names="article_id">
    <property name="name"/>
    <property name="availabilityDate" data-type="timestamp"/>
  </table>
</item-descriptor>
```

In this example, the RQL parameters are substituted into the query:

- The first parameter is a simple constant value. Typically it is not necessarily to substitute constant values as they can be inlined in the RQL query string.
- The second parameter is a Nucleus component. If an object of type `atg.service.util.CurrentDate` is used as a parameter (as in this example), the filtering logic calls `getTimeAsTimeStamp()` on that object and uses that as the value of the parameter. This lets you have a `CurrentDate` service used in a filter. Also note, as in this example, that the "less than" symbol (<) is a markup character and must be escaped in your XML file as `&lt`.

For information about RQL, see the Repository Query Language (page 18) section in the *Repository Queries* (page 13) chapter.

filterQuery and rqlFilterString Properties

In the great majority of cases, it is easiest to set a filter query with the <rql-filter> tag. However, there are two other ways of defining the filter used by an item descriptor. You might want to use one of these techniques if you need to set the filter query at runtime:

- Set the filterQuery property of the item descriptor to a Query created by the same repository. Do this by creating a Query object and calling GSAItemDescriptor.setFilterQuery() on it.
- Set the item descriptor's rqlFilterString to an RQL string that expresses the query. If the filterQuery property of the item descriptor is null, the SQL repository tries to use the rqlFilterString and compile it into the filter query. If both properties are null, filtering is disabled.

Note: For best performance, two constraints apply:

- filterQuery or rqlFilterString should refer only to properties in the primary table for the item descriptor. Otherwise, joins are required for every item access, which can dramatically degrade repository performance.
- Do not change the filter too often—more than once or twice a day. Each query executed by the SQL repository is attached using AND to the filter query before being executed (or looked up in the cache). Too frequent changes to the filter or the RQL filter parameters diminish effectiveness of the query cache.

Overriding RQL-Generated SQL

The SQL created through RQL may in some cases not be optimized for your needs. Should such a situation arise, you can use the atg.adapter.gsa.query.SqlPassthroughQuery class. A SqlPassthroughQuery is used with the QueryBuilder to specify the SQL statement to pass directly to the database. Note that the SQL repository cannot use the results of arbitrary queries to generate repository items. The query must return the ID column or columns in their declared order from the item descriptor's id-column-names attribute.

Here is an example of how a SqlPassthroughQuery might be used in a page. Note that the SQL statement is sent to the database "as is."

```
import atg.adapter.gsa.query.*;

GSARepository repo =
   (GSARepository)request.resolveName("/examples/TestRepository");
RepositoryView view = repo.getView("canard");
Object params[] = new Object[4];
  params[0] = new Integer (25);
  params[1] = new Integer (75);
  params[2] = "french";
  params[3] = "greek";
Builder builder = (Builder)view.getQueryBuilder();
String str = "SELECT * FROM usr_tbl WHERE (age_col > 0 AND age_col < 1
AND EXISTS (SELECT * from subjects_tbl where id = usr_tbl.id AND subject
IN (2, 3)))";

RepositoryItem[] items =
    view.executeQuery (builder.createSqlPassthroughQuery(str, params));

if (items == null)
   out.println(" Is null.");
```

```
else{
   out.println(" Is not null: " + items.length + "<p>");
   for (int i = 0; i < items.length; i++){
     out.println(items[i].toString() + "<br>");
     }
 }
```

Parameterized Queries

A parameterized query is a Repository `Query` that is incomplete (that is, missing some data) when it is created, and is supplied with that data when the query is executed. This is very similar to a PreparedStatement in JDBC. Parameterized queries are supported only in the SQL repository. You can substitute a parameter only for constant values, and not column specifications in a Repository `Query`. The use of parameters in a `Query` enables developers to reuse a single instance of that `Query` over and over again, supplying different parameter values at execution time. For example, if your goal is to create a `Query` like this:

```
select id from dps_user where first_name = 'keith'
```

only the value `'keith'` can be parameterized; the column name `first_name` cannot. Sorting and range information also cannot be parameterized, so only constraints can use parameters. Furthermore, parameterized queries are used only in queries against the database; you cannot use parameterized queries against transient properties or in cases where the SQL Repository component's `useDatabaseQueries` property is set to `false`.

Parameterized Query API

The use of parameters in a `Query` is implemented by a basic interface, `atg.repository.ParameterSupportView`, which extends `atg.repository.RepositoryView`. The `ParameterSupportView` interface provides additional method signatures to the `executeQuery()` methods provided in `RepositoryView`. This means that for every `executeQuery()` method, there is a similar one with an optional `Object[]` argument representing parameter values for any parameters in the Query that is passed in. For example:

```
public RepositoryItem[] executeQuery(Query pQuery,
Object[] pParameterValues)
```

Each element in the `pParameterValues` array corresponds to a parameter in the given `Query`. `pParameterValues[0]` corresponds to the first parameter in the `Query`, `pParameterValues[1]` corresponds to the second parameter in the `Query`, and so on. When you create a Query, you must remember the number of parameters and their order, especially in the case of compound queries that use AND and OR operators. You can use the `Query.getQueryRepresentation()` method to obtain a string of the query representation including all parameter locations.

Also, the `atg.repository.QueryBuilder` interface is extended by an interface named `atg.repository.ParameterSupportQueryBuilder`. This interface adds a single method to create a parameter `QueryExpression` that can be used in queries created by the `ParameterSupportQueryBuilder`:

```
public QueryExpression createParameterQueryExpression()
throws RepositoryException
```

The `atg.adapter.gsa.GSAView` class used by the SQL repository implements the `atg.repository.ParameterSupportView` interface, and the `atg.adapter.gsa.query.Builder` class

implements the `atg.repository.ParameterSupportQueryBuilder` interface. This makes parameterized queries available in the SQL repository.

Query Types that Support Parameters

Not every query type in the SQL repository can have parameters in every argument. The following `QueryBuilder` methods support parameters, with the specified limitations:

Method	Parameter Locations
`createComparisonQuery`	Either expression or both expressions can be a parameter.
`createPatternMatchQuery`	Only the `pattern` argument can be a parameter.
`createTextSearchQuery`	Only the `searchstring` argument can be a parameter.
`createIncludesQuery`	Only the `collection` argument (the first argument) can be a parameter, and it must be multi-valued.
`createIncludesAnyQuery`	Either expression or both expressions can be a parameter (and they must be multi-valued in all cases).

QueryCache and Parameterized Queries

When a query is cached, any parameter values entered at execution time are included in the `QueryCacheEntryKey`, and queries with dissimilar values are cached separately. For example, if the same query is executed twice, each time with different parameter values, two entries are created in the `QueryCache`. If the query is executed again with parameters that were already used, the query should be found in cache.

Parameterized Query Example

The following is an example of how you might use a parameterized query. Note that error handling is not dealt with in these examples.

Suppose you wanted to create a query like this:

```
firstName = 'Jerry'
```

Then, you want to change that to

```
firstName = 'Phil'
```

Query Example without Parameters

The first example shows how to do this without the use of parameters:

```
// Get the repository through our made up getRepository( ) call
Repository rep = getRepository();
RepositoryItemDescriptor desc = rep.getItemDescriptor("user");
RepositoryView view = desc.getRepositoryView();
```

```
QueryBuilder qb = view.getQueryBuilder();

// Build our first Query
// firstName = 'Jerry'
QueryExpression firstNameProp = qb.createPropertyQueryExpression("firstName");
QueryExpression jerryValue = qb.createConstantQueryExpression
(new String("Jerry"));
Query firstNameQuery = qb.createComparisonQuery(firstNameProp, jerryValue,
 QueryBuilder.EQUALS);

// Execute our first Query
RepositoryItem[] jerryItems = view.executeQuery(firstNameQuery);

// Set up our second Query now
QueryExpression philValue = qb.createConstantQueryExpression(new String("Phil"));
firstNameQuery = qb.createComparisonQuery(firstNameProp, philValue,
QueryBuilder.EQUALS);

// Execute our second Query
RepositoryItem[] philItems = view.executeQuery(firstNameQuery);
```

Query Example with Parameters

With the use of parameters in your queries, you can create a reusable Query as in the example that follows. Note that the view used is a `ParameterSupportView` instead of a `RepositoryView`:

```
// Get the repository through our made up getRepository( ) call
Repository rep = getRepository();
RepositoryItemDescriptor desc = rep.getItemDescriptor("user");
// Our RepositoryView is a ParameterSupportView this time, so we know it supports
// parameters in Queries
// Note – this assumes we have advanced knowledge that this view is an instance of
// a ParameterSupportView
ParameterSupportView view = (ParameterSupportView)desc.getRepositoryView();
ParameterSupportQueryBuilder qb = view.getQueryBuilder();

// Builder our first Query up
// firstName = 'Jerry'
QueryExpression firstNameProp = qb.createPropertyQueryExpression("firstName");
QueryExpression parameterValue = qb.createParameterQueryExpression();
Query firstNameQuery = qb.createComparisonQuery
            (firstNameProp, parameterValue, QueryBuilder.EQUALS);

// Execute our first Query
Object[] args = new Object[1];
args[0] = new String("Jerry");
RepositoryItem[] jerryItems = view.executeQuery(firstNameQuery, args);

// Set up our second Query now
args[0] = new String("Phil");
RepositoryItem[] philItems = view.executeQuery(firstNameQuery, args);
```

The first example creates a new constant `QueryExpression` in order to change the name from `Jerry` to `Phil`. This also requires a new instance of a comparison `Query` to use the new `QueryExpression`. The second example increases efficiency by creating just one `Query` object, and changing the value of the desired name in an `Object` array that is passed to the `executeQuery` method. This also lets you cache a `Query` in your internal application (above the query cache layer), and pass in varying parameter values at execution time.

Named Queries

A named query is a Repository `Query` or SQL statement that can be invoked by name. With named queries, you can reuse the same query object as often as needed. You can define named queries in an item descriptor; you can also create them in Java code through repository APIs.

Note: Named queries are supported only in SQL and Integration repositories.

Named Queries and Item Inheritance

Item descriptor subtypes inherit the named queries defined for their parent item types. For example, a financial application might define a `user` item type with `investor` and `broker` subtypes. If the `user` item descriptor defines a named query `getUsersByLogin`, the `investor` and `broker` subtypes also have access to the same named query.

Named Queries in an SQL Repository Definition File

You can define a named query in an `<item-descriptor>` element in an SQL repository definition file. A named query is defined in a `<named-query>` element. For example, given the following RQL query:

```
lastName ENDS WITH "son"
```

you can define a named query as follows:

```
<item-descriptor name=...>
...
  <named-query>
     <rql-query>
       <query-name>myQuery</query-name>
       <rql>lastName ENDS WITH "son"</rql>
     </rql-query>
  </named-query>
</item-descriptor>
```

An item descriptor can define named queries in three ways:

- RQL Named Queries (page 87)
- SQL Named Queries (page 88)
- Stored Procedures (page 89)

RQL Named Queries

An RQL named query can use all syntactical options that available to the Repository Query Language (page 18), including parameters and fields in parameters.

The RQL statement is defined in an `<rql-query>` element. For example:

```
<item-descriptor name=...>
...
```

```
  <named-query>
     <rql-query>
       <query-name>myQuery</query-name>
       <rql>name = ?0.name AND age = ?1.age</rql>
     </rql-query>
  </named-query>
</item-descriptor>
```

SQL Named Queries

An SQL named query defines a query's SQL statement in an `<sql-query>` element. SQL named queries can include database-specific keywords.

For example:

```
<item-descriptor name=...>
...
<named-query>
  <sql-query>
    <query-name>myQuery</query-name>
    <sql>
      select id,first_name,last_name from dps_user WHERE login=?
    </sql>
    <returns>id,firstName,lastName</returns>
    <input-parameter-types>java.lang.String</input-parameter-types>
    <dependencies>login</dependencies>
  </sql-query>
</named-query>
...
</item-descriptor>
```

The following table describes the child elements that are valid within an `<sql-query>` element:

Element	Description
`<sql>`	Contains the SQL column and table names (not the property names defined by the repository). The `<sql>` element must also include the ID from the primary table in the item descriptor. If the ID for an item descriptor is defined as a composite ID (using two or more columns), all columns in the composite ID must be selected. **Caution**: Named queries must be read-only. The SQL statement must not include actions that update the datastore—for example, `INSERT` or `DELETE`. Doing so can yield unpredictable results.
`<returns>`	A comma-separated list of Repository property names returned by this query. These property names let you know the type of the column when reading values from the returned `ResultSet`.
`<dependencies>`	Indicates which properties this query depends on. If any properties in the `<dependencies>` element change, remove this query from the query cache. These properties are typically those referenced in the SQL statement's `WHERE` clause.

Element	Description
<input-parameter-types>	A comma-separated list of classes that must be instantiated for query parameters. There must be one value for each parameter. For example, given three query String parameters, the <input-parameter-types> element must be set as follows: <input-parameter-types> java.lang.String, java.lang.String, java.lang.String </input-parameter-types> This tag serves two purposes. - Enables type checking during query execution . - Specifies the number of required query parameters.

The properties that are used in the <returns> element must be:

- Defined as readable in the repository.
- Persistent properties defined in a table tag and not transient properties.
- Single-valued (multi-valued properties are valid only if they are composite IDs).

The property columns are returned in the same order as specified in the <returns> tag. Because users do not need to define an explicit RepositoryPropertyDescriptor for the ID property, the ID property can be omitted from the <returns> element, but it must exist in the SQL statement as the first column(s) selected.

The <returns> element is optional: select statements can return only the ID property. The <returns> element should specify the ID property only if the item descriptor explicitly defines it with the <property> element. Otherwise, the value in the id-column-name attribute of the <table> tag is used as the name of the ID column.

Stored Procedures

An SQL named query can reference a stored procedure by qualifying the <sql> element with the attribute setting stored-procedure=true. In this case, the <returns> and <dependencies> tags must conform to the stored procedure's returns and constraints. For example:

```
<item-descriptor name=...>
...
  <named-query>
    <sql-query>
      <query-name>myQuery</query-name>
      <sql stored-procedure="true">
         { call myStoredProcedure (?, ?) }
      </sql>
      <returns>id,firstName,lastName<returns>
      <input-parameter-types>java.lang.String,java.lang.String
      </input-parameter-types>
      <dependencies>login</dependencies>
    </sql-query>
  </named-query>
</item-descriptor>
```

The body of the <sql> tag for a stored procedure must use the syntax required by java.sql.CallableStatement. The following requirements apply:

- Curly braces must enclose the `CallableStatement`.
- A `CallableStatement` typically has two formats: for procedures, which do not have an explicit return value, and one for functions, which do. Non-Oracle stored procedures in the SQL repository must use `procedure` syntax, as in the previous example.
- Question (?) marks indicate parameters. In stored procedures, parameters can be one of the following:
  - `IN`: Values go in the database.
  - `OUT`: Values come out of the database.
  - INOUT: Values can go in and come out.

  The SQL repository supports only `IN` parameters. `OUT` and `INOUT` parameters are valid only for Oracle stored procedures.

A stored procedure must return a java.sql.ResultSet. Most JDBC drivers do so by default, but there are exceptions. Oracle, for example, requires some special tuning, as described in the next section.

Caution: The stored procedure must be read-only; it must not include actions that update the datastore—for example, `INSERT` or `DELETE`. Doing so can yield unpredictable results.

Using Stored Procedures with Oracle Databases

An Oracle stored procedure returns a `ResultSet` only if it is defined to do so (see Returning a JDBC result set from an Oracle stored procedure). The body of the <sql> element must reference the stored procedure with the `function` syntax,. For example:

```
{ ? = call myOracleProcedure (?, ?) }
```

You indicate the returned value through this notation:

```
? =
```

Note: You should consider wrapping existing stored procedures with procedures so the results are formatted to conform with Oracle ATG Web Commerce SQL repository requirements.

Java Code Access to Named Queries

The following Java code can access and execute any parameterized SQL named query:

```
import atg.repository.*;
...

// somehow get item descriptor
RepositoryView view = itemDesc.getRepositoryView();
...

try {
  if(!(view instanceof NamedQueryView))
    throw new ServletException
      ("view " + view.getViewName() + " is not a NamedQueryView");
  NamedQueryView nView = (NamedQueryView)view;
  Query namedQuery = nView.getNamedQuery(queryName);
```

```
  ...

  if(!(view instanceof ParameterSupportView))
    throw new ServletException
      ("view " + view.getViewName() + " is not a ParameterSupportView");
  return ((ParameterSupportView)view).executeQuery(namedQuery, args);
}

catch (RepositoryException re) {
  if (pServlet.isLoggingError())
    pServlet.logError("unable to execute query due to RepositoryException",re);
  throw re;
}
```

Any repository that extends `atg.repository.RepositoryViewImpl` can access the base `NamedQuery` feature.

The following sections describe the named query API:

- NamedQueryView Interface (page 91)
- QueryDescriptor (page 92)

NamedQueryView Interface

Interface `atg.repository.NamedQueryView` provides methods to create and access named queries. This interface extends `atg.repository.RepositoryView`. Oracle ATG Web Commerce provides an implementation: the class `atg.repository.RepositoryViewImpl`, which supports the use of named queries.

The `NamedQueryView` interface includes the methods described in the following table:

Method	Description
`createNamedQuery`	`public void createNamedQuery(String pQueryName, Query pQuery)` Creates an association in the `RepositoryView` between a name and a `Query` object. After this association is created, you can call `getNamedQuery` to get the `Query` object to be used for execution. If this method is called with a `pQueryName` that is already assigned a `Query`, the existing `Query` is overwritten with the new `Query`
`getNamedQuery`	`public Query getNamedQuery(String pQueryName)` Gets the `Query` object associated with the given name. If no such entry was created for the given String, null is returned.
`getNamedQueryNames`	`public String[] getNamedQueryNames()` Returns the names of all Named Queries that this `RepositoryView` knows about, or null if there are none.
`getQueryDescriptor`	`public QueryDescriptor getQueryDescriptor(String pQueryName)` Returns a `QueryDescriptor` object that describes aspects of the requested `NamedQuery`. If there is no named query by the given name, null is returned.

Method	Description
getQueryName	public String getQueryName(Query pQuery) Returns the name of the given Query, if any exists. Otherwise, null is returned.

QueryDescriptor

Interface atg.repository.QueryDescriptor defines methods for an object that describes a Repository Query and associates a Repository Query object with a user-defined String. It defines the following methods:

```
public Query getQuery()
public String getQueryName()
```

The atg.repository.query.QueryDescriptorImpl class is the base implementation of the QueryDescriptor interface and the atg.adapter.gsa.query.GSAQueryDescriptor class is the SQL repository's subclass of QueryDescriptorImpl.

Text Search Queries

The SQL repository supports full text searches via the QueryBuilder.createTextSearchQuery() method. In order for full text search queries to work, you must have a supported full text search engine installed and configured.

The following example demonstrates use of the full-text query feature. This class can be found in:

<ATG11dir>/DAS/src/Java/atg/adapter/gsa/sample/FullTextQuery.java

It must be run from DYNAMO_HOME. It also requires a repository definition file named gsa-template.xml to be in the current directory.

```
package atg.adapter.gsa.sample;

import atg.repository.*;

public class FullTextQuery
extends Harness
{
  //-------------------------------------
  /** Class version string */
  public static final String CLASS_VERSION =
  "$Id: FullTextQuery.java,v 1.1 2000/03/20 19:39:31 mstewart Exp $";

  //-------------------------------------
  /**
   * Run our sample.
   * @param pRepository repository to use
   * @exception RepositoryException if there is repository trouble
   **/
  public void go(Repository pRepository)
    throws RepositoryException
  {
```

```
// print header
pln("### Running Sample Full-Text Query ###");
pln(CLASS_VERSION);
pln("");

/*
** This example demonstrates how do perform some simple full-text repository
** queries. In the repository API all queries are performed using Query
** or QueryExpression objects. A QueryExpression is a building block you
** can use to create simple or complex queries. A Query is a repository
** query that can be executed. A Query can also be used as a building
** block to create more complicated queries. Here we perform a simple
** query to find user repository items whose story property
** includes text in which the word 'dog' appears within 10 words of the
** word 'cat'.
*/

// queries are created using QueryBuilders and executed by
// RepositoryViews. A Query is defined in the context of a specific item
// descriptor and thus must be built and executed with the right
// QueryBuilder and RepositoryView.
RepositoryItemDescriptor userDesc = pRepository.getItemDescriptor("user");
RepositoryView userView = userDesc.getRepositoryView();
QueryBuilder userBuilder = userView.getQueryBuilder();

// create a QueryExpression that represents the property, story
QueryExpression comment =
  userBuilder.createPropertyQueryExpression("story");

// create a QueryExpression that represents a search expression
// using the NEAR operator.
QueryExpression dogNearCat =
  userBuilder.createConstantQueryExpression("NEAR((dog, cat), 10)");

        // define the format being used by the search expression
        // appropriate to the database being used. This assumes an Oracle
        // database with the interMedia/Context full-text search option
        // installed.
        QueryExpression format =
              userBuilder.createConstantQueryExpression("ORACLE_CONTEXT");

        // pick a minimum required score that the results must meet or exceed
        // in order to be returned by the full-text search engine.
// See your search engine vendor's docs for more information on the meaning
// and use of the score value.
QueryExpression minScore =
  userBuilder.createConstantQueryExpression(new Integer(1));


// now we build our query: comment contains 'dog' within 10 words of 'cat'
Query dogTenWordsNearCat =
  userBuilder.createTextSearchQuery(comment, dogNearCat, format, minScore);

// finally, execute the query and get the results
RepositoryItem[] answer = userView.executeQuery(dogTenWordsNearCat);

pln("running query: story contains 'dog' within 10 words of 'cat' ");
if (answer == null)
  {
    pln("no items were found");
```

```
      }
    else
      {
        for (int i=0; i<answer.length; i++)
          pln("id: " + answer[i].getRepositoryId());
      }

   }

  //-------------------------------------
  /**
   * Main routine. This example uses no command line arguments
   **/
  public static void main(String[] pArgs)
    throws Exception
  {
    runParser(FullTextQuery.class.getName(), pArgs);
  }

} // end of class FullTextQuery
```

You can specify what properties a text search query should search, with the `text-search-properties` attribute in the `<item-descriptor>` tag that defines an item type. For example, the following value indicates that a text search should examine the `keywords` and `content` properties for matches:

```
<item-descriptor name="newsItems
text-search-properties="keywords,content">
...
```

Simulating Text Search Queries

As a convenience feature, the SQL repository can simulate full text searches with the SQL LIKE operator. If full text searching is not available for your database, you can substitute pattern matching queries for text search queries by setting the following property in the `GSARepository` component:

```
simulateTextSearchQueries=true
```

The SQL repository converts text search queries into CONTAINS pattern match queries, which are implemented with the SQL LIKE operator.

Simulated text search queries are useful for demos and standalone development when one wants to put in place the `createTextSearchQuery()` API calls without having to set up a text search engine. However, simulated text queries are extremely inefficient and are not supported for production systems. A simulated text search query with LIKE typically causes a table scan, so avoid simulated queries in production.

Wildcards in Queries

Databases often treat % and _ as wildcard characters. Pattern-match queries in the SQL repository (such as CONTAINS, STARTS WITH, or ENDS WITH), assume that a query that includes % or _ is intended as a literal search including those characters and is not intended to include wildcard characters. The query generated therefore uses an escape character in front of the characters % and _ in pattern-match queries. One exception applies:

a pattern-match query can be used to simulate a text search query; in that case wildcards should be passed through.

You can disable this behavior by setting the `escapeWildcards` property of the SQL Repository component to `false`.

The escape character is \ (backslash) by default. You can set a different escape character through the `wildcardEscapeCharacter` property of the SQL repository component.

Not Queries and Null Values

Comparison and pattern-match repository queries do not return items where the property queried is null. The following queries are the operators of the comparison or pattern-match queries that exhibit this behavior:

```
=, !=, <, <=, >, >=, CONTAINS, STARTS_WITH, ENDS_WITH
```

For example, if your query is `balance = 101` or `balance < 101`, the query does not return an item whose `balance` property is null. However, if your query is `balance != 101`, the query still does not return an item whose `balance` property is null.

If you wish your query to return items whose queried property is null, you may use an IS NULL query, or an IS NULL clause as part of an OR query, for example:

```
(balance != 101) OR (balance IS NULL)
```

Outer Joins

By default, the SQL repository uses outer joins in queries that involve auxiliary tables. Different database vendors use different syntax to create outer joins. The Oracle ATG Web Commerce platform automatically sets the `outerJoinSupport` property of the `GSARepository` component to specify the appropriate type of outer join to be used by the SQL repository. You can also configure this property manually, using the following values:

Value	Database Vendor	Description
sql92		Use `FROM tablex x LEFT OUTER JOIN tabley y ON x.id = y.id`
jdbc		Similar to `sql92` but uses JDBC escape syntax `{oj ... }` to tell the JDBC driver to convert to native join syntax.
plus-equals	Oracle	`x += y`
star-equals	Microsoft	`x =* y`
informix	Informix	`FROM OUTER tablex`

Value	Database Vendor	Description
none		Use inner joins rather than outer joins.

Table Ownership Issues

If the user does not own the database tables used by the SQL repository, you must configure the repository so when the repository is initialized, it can determine the column types in the tables. If you have not configured the table ownership correctly, you may get an "unknown JDBC types for property" error.

The `<table>` tag supports several attributes that let you configure table ownership:

- metaDataSchemaPattern (page 96)
- metaDataCatalogName (page 96)
- tablePrefix (page 96)
- metaDataSynonymTableName (page 96)

metaDataSchemaPattern

Specifies the name of the database account used to create the tables that underlie the repository.

metaDataCatalogName

Specifies a catalog name. If the user does not own the table to be used by the repository, this attribute can be used once during repository initialization in a call to determine the column types.

tablePrefix

If the user does not own the table used by the repository, the `tablePrefix` lets you construct a qualified table name. This attribute is not used during the initial metadata query, but if present is prepended to the table name when inserts or updates are made. For example:

```
<attribute name="tablePrefix" value="myPrefix."/>
```

For instance, the following snippet sets `dps_user` to use `testing2` as the schema name for the metadata call. The string `testing2.` prepended to the table name for all other queries.

```
<gsa-template>
 ...
  <table name="dps_user" type="primary" id-column-name="id">
    <attribute name="tablePrefix" value="testing2."/>
    <attribute name="metaDataSchemaPattern" value="testing2"/>
 ...
```

metaDataSynonymTableName

If a database schema uses a synonym to reference a table in another schema, and the synonym and table names are different, the `<table>` tag must set the `metaDataSynonymTableName` attribute to the source table's name.

On startup, a repository uses this attribute to identify the source table so it can obtain the database metadata and validate the table definition.

Constraints

In using these attributes, be sure use the same case (upper, lower, mixed) that your database uses to store object identifiers. For example, Oracle stores its identifiers in uppercase. So, you set `metaDataSchemaPattern` to `DYNAMO` instead of `Dynamo`. See the JavaDoc for `java.sql.DatabaseMetaData.getColumns()` for more information. See also the *Logging and Data Collection* chapter of the *Platform Programming Guide* for more information about these attributes.

Setting Ownership at the Repository Level

You can specify ownership for all repository tables by setting the SQL repository component properties `metaDataSchemaPattern`, `metaDataCatalogName`, and `tablePrefix`. These settings can be overridden by individual tables that set the corresponding attributes.

Unsupported Queries in the SQL Repository

The SQL repository does not support queries of the following types:

```
includesAll
elementAt
indexOf
```

9 Localizing SQL Repository Definitions

You can use Java resource bundles to make it easier to localize an SQL repository definition. By using resources for repository item properties used in the ATG Control Center's Repository Editors, you can display labels and values suitable for the Repository Editor user's locale.

The SQL repository localization feature enables you to use resource files to localize:

- The values of the `display-name` and `description` of both item descriptors and properties
- The `category` of properties
- The strings used for representing values of enumerated property types

Defining a Resource Bundle

To localize these values, first you must associate a resource bundle using an `<attribute name="resourceBundle"... />` tag like:

```
<attribute name="resourceBundle" value="resourceBundleName"/>
```

You can use the `<attribute>` tag to set the resource bundle at the property, table, or item descriptor level. A property uses its own `resourceBundle` attribute if it is set. If not, it looks for a `resourceBundle` attribute set in its `<table>` tag, then for a `resourceBundle` attribute set in its `<item-descriptor>` tag. For example:

```
<item-descriptor name="user" ....>
  <attribute name="resourceBundle" value="atg.userprofiling.ProfileResources"/>
...
```

If you use `xml-combine="append"` to add properties to an item descriptor defined in a different configuration layer, do not set the `resourceBundle` attribute in the item descriptor, as it overwrites the setting of `resourceBundle` in the other configuration level. Set the `resourceBundle` at the table or property level instead.

Localizing Properties

To localize labels used in a Repository Editor, use the localizable attributes, as follows:

Standard Label Attribute	Localizable Label Attribute
display-name	display-name-resource
description	description-resource
category	category-resource

For example, to localize the `display-name`, use the `display-name-resource` attribute instead of the `display-name` attribute:

```
<item-descriptor name="user" ...
                 display-name-resource="itemDescriptorUser">
    <attribute name="resourceBundle"
               value="atg.userprofiling.UserProfileTemplateResources"/>
```

Then, for each locale you want to support, create resource bundle properties files for each repository definition. Each resource bundle consists of a list of keys defined in the resource label attributes, with the localized value.

The `UserProfileTemplateResources.properties` resource bundle referred to in the preceding example contains this entry:

```
itemDescriptorUser=User
```

Localizing Enumerated Properties

You can also localize the string values that correspond to each option value in an enumerated property, with the `resource` attribute in the `<option>` tag. As with label attributes, a localized enumerated property needs to have a resource bundle defined for it at the property, table, or item descriptor level. Then, you can specify the resource key that holds the localized string value with the `resource` attribute, as in this example:

```
<property name="emailStatus" ... data-type="enumerated" ...>
    <option resource="emailStatusUnknown" code="0"/>
    ...
```

When you specify a default, use the resource name as the value, such as:

```
<property name="emailStatus" ... data-type="enumerated"
          default="emailStatusUnknown" ... >
     <attribute name="useCodeForValue" value="false"/>
```

```
     <option resource="emailStatusUnknown" code="0"/>
     <option resource="emailStatusValid" code="1"/>
     <option resource="emailStatusInvalid" code="2"/>
</property>
```

Use caution when localizing the strings used for enumerated types. If you have `useCodeForValue` set to `true`, calling `getPropertyValue` does not return the localized property value. To display the localized value on a page, include the localized string in your page, using a `Switch` servlet bean to choose the proper value.

For more information about resource bundles and localization, see the *Internationalizing a Dynamo Web Site* chapter in the *Platform Programming Guide*.

10 SQL Repository Caching

Efficient database access is important to many Oracle ATG Web Commerce applications. You should design an application so it requires minimal access to the database and ensures data integrity. An intelligent caching strategy is central to achieving these goals. The following sections describe how to use SQL repository caches:

- Item and Query Caches (page 103)
- Caching Modes (page 104)
- Simple Caching (page 106)
- Locked Caching (page 106)
- Distributed Caching Modes (page 114)
- Distributed TCP Caching (page 115)
- Distributed JMS Caching (page 118)
- Distributed Hybrid Caching (page 119)
- Cache Configuration (page 124)
- Monitoring Cache Usage (page 127)
- Caching by Repository IDs (page 129)
- Restoring Item Caches (page 129)
- Preloading Caches (page 130)
- Enabling Lazy Loading (page 131)
- Cache Flushing (page 134)

Item and Query Caches

For each item descriptor, an SQL repository generally maintains two caches:

- Item Caches (page 104)
- Query Caches (page 104)

Note: Item descriptors within an inheritance tree share the same item cache. For more information, see Cache Configuration (page 124).

Item Caches

Item caches hold the values of repository items, indexed by repository IDs. Item caching can be explicitly enabled for each item descriptor. Even if caching is explicitly disabled, item caching occurs within the scope of each transaction (see Disabling Caching (page 105)).

An item cache entry is invalidated when that item is updated. The scope of an entry's invalidation depends on its caching mode. For example, when an item is changed under simple caching mode, only the local cache entry is invalidated; other Oracle ATG Web Commerce instances are not notified. Oracle ATG Web Commerce provides several different Distributed Caching Modes (page 114) to invalidate items across multiple instances.

Query Caches

Query caches hold the repository IDs of items that match given queries. When a query returns repository items whose item descriptor enables query caching, the result set is cached as follows:

- The query cache stores the repository IDs.
- The item cache stores the corresponding repository items.

Subsequent iterations of this query use the query cache's result set and cached items. Any items that are missing from the item cache are fetched again from the database.

Query caching is turned off by default. If items in your repository are updated frequently, or if repeated queries are rare, the benefits of query caching might not justify the overhead that is incurred by maintaining the cache.

A query cache entry can be invalidated for two reasons:

- A cached item property that was specified in the original query is modified.
- Items of a queried item type are added to or removed from the repository.

Note: Queries that include derived item properties are never cached.

Caching Modes

The SQL repository supports the following caching modes:

- Simple Caching (page 106) handles caches in each server locally; no attempt is made to synchronize updates across multiple server instances.
- Locked Caching (page 106) uses read and write locks to synchronize access to items stored by multiple caches.
- Distributed TCP Caching (page 115) uses TCP to broadcast cache invalidation events to all servers in a cluster.
- Distributed JMS Caching (page 118) uses JMS to broadcast cache invalidation events to all servers in a cluster.
- Distributed Hybrid Caching (page 119) uses TCP to send cache invalidation events only to those servers that are known to cache the target items.

- Distributed External Caching (page 124) stores cached data in an external distributed caching application.

Setting Caching Mode

Caching modes are set at the item descriptor level, through the `<item-descriptor>` tag's `cache-mode` attribute. The default caching mode is Simple Caching (page 106). To set a different caching mode on an item descriptor, set `cache-mode` to one of the following values:

- `simple`
- `locked`
- `distributed`
- `distributedJMS`
- `distributedHybrid`

Disabling Caching

When caching is disabled for an item, its property values are cached only during the current transaction, and only if the transaction requires one or more of that item's properties. This ensures a consistent view of item data while the transaction is in progress. Thus, multiple calls to `getPropertyValue()` for the same property within the same transaction require only one database query. Cached item properties are reloaded from the datastore for each transaction.

Caching should generally be disabled for application data that is exposed to changes by non-Oracle ATG Web Commerce repository applications—for example, online banking data, where caching might need to be disabled in order to ensure display of up-to-date user account balances. In some circumstances, you might configure integration so the repository cache is invalidated when data is modified by an external application.

You can disable caching for items of a specified type, or for specific item properties:

- To set an item type's caching mode, set its `<item-descriptor>` tag's `cache-mode` attribute to `disabled`.
- To disable caching for an individual property within an item descriptor, set the `<property>` tag's `cache-mode` attribute to `disabled`. Each property's definition overrides the caching mode set for its item descriptor. For example:

```
<item-descriptor name="user" cache-mode="simple">
<table name="dps_user">
<property name="password" cache-mode="disabled">
...
</table>
...
```

Caution: If caching is disabled for an item type or individual item properties, any code that retrieves that item requires access to the database, which can noticeably degrade application performance.

Global disabling

You can globally set item and query cache sizes to 0 for the entire repository, which effectively disables caching; this is typically done for debugging purposes only. In order to set cache sizes to 0 on application startup, set two SQL Repository component properties to true:

- `disableItemCachesAtStartup` disables all item caches by setting their size to 0.

- `disableQueryCachesAtStartup` disables all query caches by setting their size to 0.

Inherited Caching Modes

You can set a property to inherit the default caching mode by setting its `cache-mode` attribute to `inherit`. This setting can be useful when a property's caching mode is set to disabled at one point in the configuration path and you want to reset the property to the default caching mode at a later point.

Simple Caching

When caching mode is set to simple, each server maintains its own cache in memory. A server obtains changes to an item's persistent state only after the cached entry for that item is invalidated. This mode is suitable for read-only repositories such as product catalogs, where changes are confined to a staging server, and for architectures where only one server handles a given repository item type.

You can ensure that an item's cached data is regularly refreshed by setting its item descriptor's `item-cache-timeout` attribute. This approach can prevent stale data from accumulating in the item cache, and avoids the overhead of other caching modes. For many multi-server sites, setting this attribute to a low threshold, such as one minute, incurs only a low-risk delay in caching the latest data. See Cache Timeout (page 126) for more information.

Locked Caching

A multi-server application might require locked caching, where only one Oracle ATG Web Commerce instance at a time has write access to the cached data of a given item type. You can use locked caching to prevent multiple servers from trying to update the same item simultaneously—for example, Commerce order items, which can be updated by customers on an external-facing server and by customer service agents on an internal-facing server. By restricting write access, locked caching ensures a consistent view of cached data among all Oracle ATG Web Commerce instances.

Prerequisites

Locked caching has the following prerequisites:

- Item descriptors that specify locked caching must disable query caching by setting their `query-cache-size` attribute to 0.
- A repository with item descriptors that use locked caching must be configured to use a ClientLockManager Component (page 107); otherwise, caching is disabled for those item descriptors. The repository's `lockManager` property is set to a component of type `atg.service.lockmanager.ClientLockManager`.
- At least one `ClientLockManager` on each Oracle ATG Web Commerce instance where repositories participate in locked caching must be configured to use a `ServerLockManager`.
- A ServerLockManager Component (page 107) must be configured to manage the locks among participating Oracle ATG Web Commerce instances.

ClientLockManager Component

If an SQL repository contains item descriptors that use locked caching, set the Repository component's `lockManager` property to a component of type `atg.service.lockmanager.ClientLockManager`. Oracle ATG Web Commerce provides a default `ClientLockManager` component:

```
/atg/dynamo/service/ClientLockManager
```

Thus, you can set an SQL Repository's `lockManager` property as follows:

```
lockManager=/atg/dynamo/service/ClientLockManager
```

ClientLockManager Properties

A `ClientLockManager` component must be configured as follows:

Property	Setting
`useLockServer`	`true` enables this component to connect to a `ServerLockManager`
`lockServerAddress`	Host address of the `ServerLockManager` and, if set, the backup `ServerLockManager`
`lockServerPort`	The ports used on the `ServerLockManager` hosts, listed in the same order as in `lockServerAddress`

For example, given two `ServerLockManagers` on hosts `tartini.acme-widgets.com` and `corelli.acme-widgets.com`, where both use port 9010, the `ClientLockManager` is configured as follows:

```
$class=atg.service.lockmanager.ClientLockManager
lockServerAddress=tartini.acme-widgets.com,corelli.acme-widgets.com
lockServerPort=9010,9010
useLockServer=true
```

Note: The `liveconfig` configuration layer always sets `useLockServer` to true.

ServerLockManager Component

The `ServerLockManager` synchronizes locking among various Oracle ATG Web Commerce servers, so only one at a time can modify the same item. At least one Oracle ATG Web Commerce server must be configured to start the `/atg/dynamo/service/ServerLockManager` component on application startup.

To do this, add the `ServerLockManager` to the `initialServices` property of `/atg/dynamo/service/Initial` in the `ServerLockManager` server's configuration layer. For example:

```
<ATG11dir>/home/localconfig/atg/dynamo/service/Initial.properties
```

This properties file sets the `initialServices` property as follows:

```
#/home/localconfig/atg/dynamo/service/Initial.properties:
```

```
initialServices+=ServerLockManager
```

ServerLockManager Failover

You can configure two ServerLockManagers, where one acts as the primary lock server and the other serves as backup. The primary ServerLockManager is determined by a string comparison of two lock server property settings, lockServerAddress and lockServerPort, where the server with the lower string value is designated as the primary ServerLockManager.

On detecting failure of the primary ServerLockManager, the backup ServerLockManager takes over and clients redirect lock requests to it. If both ServerLockManagers fail, caching is disabled and all data is accessed directly from the database. Caching resumes when the one of the ServerLockManagers restarts.

ServerLockManager Properties

A ServerLockManager component is configured with the following properties:

Property	Description
port	This server's port
otherLockServerAddress	The other ServerLockManager address
otherLockServerPort	The port of the ServerLockManager specified in otherLockServerAddress
otherServerPollInterval	The interval in milliseconds that this server waits before polling the server specified in otherLockServerAddress
waitTimeBeforeSwitchingFromBackup	The time in milliseconds that this server waits after detecting that the primary ServerLockManager has failed, before taking over as the primary ServerLockManager

For example, given ServerLockManagers tartini.acme-widgets.com and corelli.acme-widgets.com running on port 9010, their respective configurations might look like this:

```
# tartini:9010
$class=atg.service.lockmanager.ServerLockManager
port=9010
otherLockServerAddress=corelli.acme-widgets.com
otherLockServerPort=9010
otherServerPollInterval=2000
waitTimeBeforeSwitchingFromBackup=10000
```

```
# corelli:9010
$class=atg.service.lockmanager.ServerLockManager
port=9010
otherLockServerAddress=tartini.acme-widgets.com
```

```
otherLockServerPort=9010
otherServerPollInterval=2000
waitTimeBeforeSwitchingFromBackup=10000
```

Running ServerLockManager and Page Servers

A `ServerLockManager` should not run in the same Oracle ATG Web Commerce instance as a page server that handles user sessions. By running the `ServerLockManager` in a separate Oracle ATG Web Commerce instance, the overhead of managing locks has no impact on user sessions; and the page server can restart independently of the `ServerLockManager`.

Processing Lock Requests

When an item type's caching mode is set to locked, the repository must obtain read or write locks to items before it can make them accessible to an application. Items that use locked caching mode can have one writer or multiple readers at a time.

Write Lock Request

When an application updates an item, the item's repository requests a write lock from its `ClientLockManager`. If another transaction on the same Oracle ATG Web Commerce instance owns a write lock on the same item, the `ClientLockManager` can transfer the write lock, when available, to the pending request. Otherwise, it relays the request to its `ServerLockManager`, which determines whether it has any lock entries for the item. The ServerLockManager then processes the lock request as follows:

Existing Lock Entry	ServerLockManager Action
None	Grants write lock request, creates write lock entry for the item.
Read	Asks `ClientLockManagers` to release their read locks on the item. When all read locks are released, grants the write lock request and creates a write lock entry for the item.
Write	Denies write lock request and adds the request to the queue of other pending requests for the item. Grants the request when the item becomes available. **Note:** A write lock request always has precedence over pending read lock requests.

Read Lock Request

When an application looks up an item, the item's repository requests a read lock from its `ClientLockManager`. The `ClientLockManager` relays this request to its `ServerLockManager`, which determines whether it already has any lock entries for the item. It then processes the lock request as follows:

Existing Lock Entry	ServerLockManager Action
None	Grants read lock, creates read lock entry for the item.

Existing Lock Entry	ServerLockManager Action
Read	Grants read lock, adds this `ClientLockManager` to list of read locks for the item.
Write	Denies read lock and adds the read lock request to the queue of other pending read requests for the item. Grants the request when the item becomes available.

Processing Competing Lock Requests

When a transaction releases a write lock and multiple lock requests are pending for the locked item, the requests are processed in the following order:

1. If any write lock requests are pending on the local Oracle ATG Web Commerce instance for the item, the `ClientLockManager` transfers the write lock to one of them.
2. If no write lock requests are pending locally for the item, the `ClientLockManager` checks whether any lock requests are pending on other Oracle ATG Web Commerce instances; if so, it releases the lock to the ServerLockManager so it can grant one of those requests.
3. If no remote lock requests are pending, the `ClientLockManager` checks whether any local read lock requests are pending; if so, it releases the write lock and grants one of those requests.

Lock Lifespan

Lock ownership information is cached on the `ClientLockManager` as long as the item itself remains in the item cache. The lock can be passed among different transactions or threads on the Oracle ATG Web Commerce instance without informing the `ServerLockManager`.

A read lock remains valid until one of the following events occurs:

- The item is removed from the item cache.
- The `ServerLockManager` requests that the lock be released—for example, in response to a write lock request.

Isolation Levels

When an item type's `cache-mode` is set to `locked`, Oracle ATG Web Commerce uses read and write locks to control which threads can access and change items of that type. The exact behavior depends on how you set the isolation level for the item descriptor.

To minimize deadlocks when you use locked caching, configure item descriptors to use one of the following repository isolation levels:

Isolation Level	Description
`readCommitted` (default)	Oracle ATG Web Commerce obtains a read lock on an item when a transaction calls `getItem` or `getPropertyValue`. If the transaction tries to update the item, Oracle ATG Web Commerce releases the read lock and tries to acquire a write lock.

Isolation Level	Description
`repeatableRead`	Oracle ATG Web Commerce obtains a read lock on an item when a transaction first calls `getItem` or `getPropertyValue`. If the transaction tries to update the item, Oracle ATG Web Commerce tries to convert the read lock into a write lock. Unlike `readCommitted`, the `repeatableRead` isolation level prevents another transaction from obtaining a write lock on the item.
`serializable`	Prevents different transactions from reading an item at the same time, whether from the same server, or from different servers.

You set an item type's isolation level in its `<item-descriptor>` tag as in the following example:

```
<item-descriptor name="myItem" cache-mode="locked">
    <attribute name="isolationLevel" value="readCommitted"/>
...
</item-descriptor>
```

Locking Exceptions

Attempts to obtain an item lock can yield one of the following exceptions:

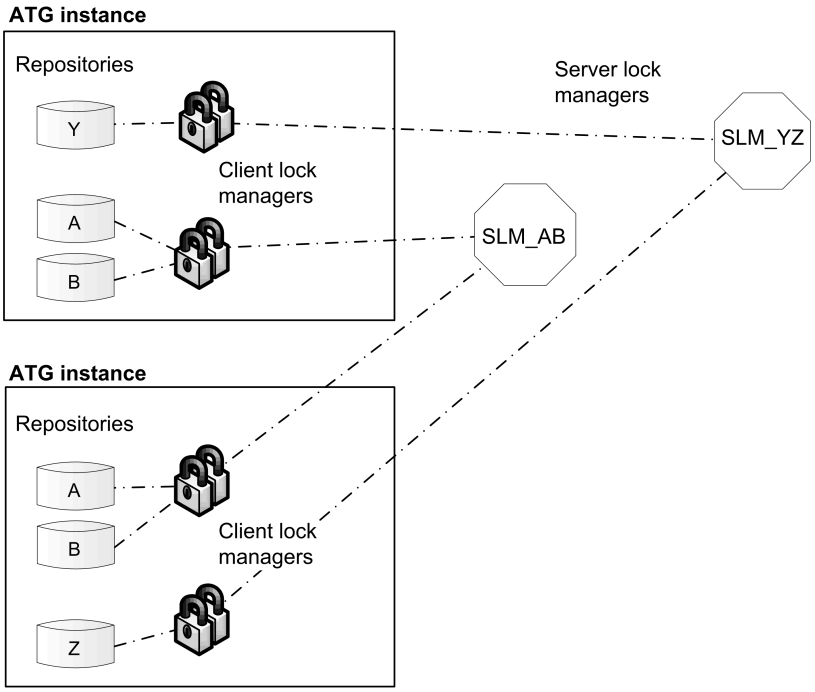
Exception	Cause
`RepositoryException`	Deadlock occurs on calls to `getItem` or `getItemForUpdate`. This exception is a wrapper for `DeadlockException`.
`ConcurrentUpdateException`	The isolation level is set to `repeatableRead` and the transaction cannot convert a read lock to a write lock—typically because another transaction is trying to obtain a write lock at the same time, or is also trying to convert a read lock to a write lock.
`IllegalArgumentException`	A transaction calls a method such as `setPropertyValue` that does not throw a `RepositoryException`. This exception is a wrapper for `RepositoryException`, which wraps the pertinent exception.

Resolving Lock Contention

If excessive lock contention causes the lock server to become a bottleneck, you can distribute the load by instantiating multiple server lock managers to handle competing lock requests. For example, the following diagram shows a site with the following setup:

- Repositories A, B, Y, and Z, where A and B each have two instances on different Oracle ATG Web Commerce instances
- Four client lock managers, where the client lock managers for repositories A and B reference server lock manager SLM_AB, and client lock managers for repositories Y and Z reference server lock manager SLM_YZ

- Two server lock managers that handle different sets of lock requests: SLM_AB and SLM_YZ



In a distributed application where the same repository—for example, the ProfileAdapterRepository–runs on multiple Oracle ATG Web Commerce instances, all repository instances must use the same ServerLockManager component. In the previous diagram, two instances of repository A run on separate Oracle ATG Web Commerce instances. Thus, their client lock managers must be set up to use the same server lock manager.

Monitoring Lock Managers

The Dynamo Administration Interface pages for ClientLockManager and ServerLockManager components display the state of the internal tables for each lock entry. To view this information, click Display Lock Table under Service Info.

ClientLockManager lock table

The ClientLockManager lock table contains these columns:

Column Heading	Value
Key	A string that identifies the locked item with this format: *repository-component-path*:*item-descriptor-name*:*item-id*
Read owned	Set to true or false, indicates whether this client lock manager has a read lock on this item. Multiple client lock managers can simultaneously have the same read lock. One read lock on an item prevents other processes from obtaining a write lock.

Column Heading	Value
Write owned	Set to true or false, indicates whether this client lock manager has a write lock on the item.
Read requested Write requested	Set to true or false, indicates whether a request is pending from another client to obtain a read/write lock. The ServerLockManager forwards client requests to all ClientLockManagers that own locks on the desired item. This field is set to true only when the Read owned or Write owned field is set to true and the lock request conflicts with active lock owners—for example, a write lock is requested for an item by another client when this client has a thread with active read ownership on that item.
Globally owned	Set to true if an active read or write lock exists that was acquired from the ServerLockManager. If the ServerLockManager is unavailable, a client can distribute locks but sets this field to false, indicating that the lock is valid only for this client.
Write owner	The thread that owns this lock in this client.
Read owners	One or more threads that own this lock in this client.
Read waiters Write waiters	The threads that are waiting for this lock.

ServerLockManager Lock Table

The ServerLockManager lock table contains these columns:

Column Heading	Value
Key	A string that identifies the locked item with this format: *`repository-component-path`*`:`*`item-descriptor-name`*`:`*`item-id`*
Write owner	The client that owns this lock.
Read owners	One or more clients that own this lock.
Read waiters Write waiters	The client IDs that are waiting for this lock.

Locking Scenarios and Workflows

A site that runs multiple Oracle ATG Web Commerce applications and uses Oracle ATG Web Commerce scenarios or workflows should enable locked caching for item descriptors that pertain to scenarios and workflows, as described in the *Personalization Programming Guide*. This setting is enabled when you use the `liveconfig` configuration layer for the DSS and Publishing modules.

Distributed Caching Modes

Oracle ATG Web Commerce provides three caching modes that synchronize item caches across multiple Oracle ATG Web Commerce instances:

- Distributed TCP Caching (page 115)
- Distributed JMS Caching (page 118)
- Distributed Hybrid Caching (page 119)

Simple versus Distributed Caching

Simple caching mode is generally sufficient if site users do not require immediate access to recent item changes. You can use item descriptor attributes `item-expire-timeout` and `query-expire-timeout` to specify how long items can stay in the item and query caches, respectively, before they are invalidated. For many multi-server sites, setting this attribute to a low threshold provides a reasonable response time to item changes, while avoiding the network overhead incurred by distributed caching modes—especially Distributed TCP Caching (page 115) and Distributed JMS Caching (page 118). See Cache Timeout (page 126) for more information.

Distributed Caching Mode Options

Sites that require timely or reliable access to the latest data should use one of the distributed caching modes that Oracle ATG Web Commerce provides. The choice of a distributed caching mode depends on a number of requirements.

Distributed TCP

The following requirements apply:

- Real-time access to item changes
- Infrequent updates to cached items
- Modest number of item caches to monitor

Distributed JMS

The following requirements apply:

- Reliable delivery of invalidation messages
- Infrequent updates to cached items
- Large number of item caches to monitor

Distributed hybrid

The following requirements apply:

- Real-time access to item changes

- Large number of cached items to monitor across many clients
- Infrequent updates to cached items

A site that uses distributed hybrid caching must provide enough server memory to support a large GSACacheServerManager. For more information, see Optimizing Performance (page 123) later in this chapter.

Distributed TCP Caching

If an application modifies an item whose item descriptor specifies distributed TCP caching mode, a cache invalidation event is broadcast from that Oracle ATG Web Commerce instance to all other Oracle ATG Web Commerce instances that use distributed TCP caching. The event message supplies the nature of the change, the changed item's type, and repository ID. Receiving repositories respond by invalidating that cached item.

Distributed TCP caching is suitable for sites where the following conditions are true:

- Items of a type that specifies distributed TCP caching are likely to be cached across most Oracle ATG Web Commerce instances in the application.
- Items are subject to frequent reads.
- Items are rarely changed, added or deleted.

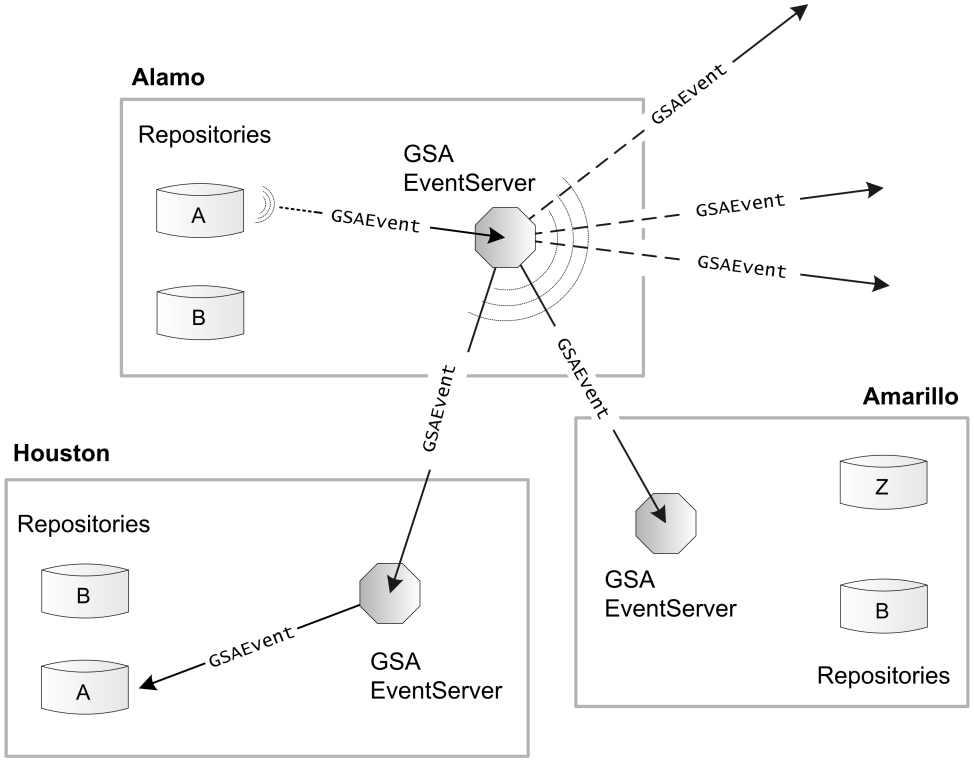
An item that changes frequently—say, more than 50 or 100 times per second —is not suitable for distributed TCP caching mode, because the extra network activity incurred by cache invalidation messages outweighs caching benefits. Cache invalidation events are broadcast to all Oracle ATG Web Commerce instances that enable distributed caching, even if they do not cache the invalidated item; as the number of these Oracle ATG Web Commerce instances increases, so too increases the network activity associated with each cache invalidation event.

Implementation

Distributed TCP caching is implemented by the following elements:

- Cache invalidation events of class `atg.adapter.gsa.event.GSAEvent` convey cache changes to other Oracle ATG Web Commerce instances, identifying the event type, item descriptor name, and repository ID.
- Event server components of class `atg.adapter.gsa.event.GSAEventServer` send and receive cache invalidation events over TCP among participating Oracle ATG Web Commerce instances. All repositories in an Oracle ATG Web Commerce instance reference the same event server. When instantiated, the event server opens up a server socket on the specified port or, if unspecified, on one that is randomly assigned.
- `das_gsa_subscriber` is a database table that maintains routing information for each item descriptor that uses distributed TCP caching. This table provides the address and port of each event server that provides access to a given item descriptor. When a change occurs on one Oracle ATG Web Commerce instance to an item that uses distributed TCP caching, its repository uses `das_gsa_subscriber` to look up the same item descriptors on other Oracle ATG Web Commerce instances. It then generates a cache invalidation event with their routing information.

The following graphic shows how updates to a cached repository item on Oracle ATG Web Commerce server Alamo trigger an invalidation event that is broadcast to other Oracle ATG Web Commerce servers, whose GSAEventServers relay it to the corresponding repositories:



Distributed TCP Caching Setup

As installed, the Oracle ATG Web Commerce default configuration enables event messaging for distributed TCP caching mode; you only need to ensure that the `das_gsa_subscriber` table is properly created in your database.

Event server

All SQL repositories in a given Oracle ATG Web Commerce instance set their `eventServer` property to the same event server component. The default component path is:

```
/atg/dynamo/server/SQLRepositoryEventServer
```

Event server ports

By default, each event server listens for cache invalidation events on a port that is randomly assigned by the operating system. Alternatively, you can set an event server component's `port` property to a permanent port number—for example, in order to bypass a firewall.

Event server connection timeout

Occasionally, an Oracle ATG Web Commerce instance's event server is inaccessible—for example, the host machine has gone down. You can control the length of time allowed to establish a socket connection to an event server through its `connectTimeout` property—by default, set to 60000 milliseconds.

If a connection attempt times out, the event server attempting to connect prints a warning message. Also, the routing information for the item descriptor on the unresponsive Oracle ATG Web Commerce instance is removed from `das_gsa_subscriber`. The event server starts a new connection attempt after the time span specified in its `connectRetryTimeout` property, initially set to 120000 milliseconds.

GSAEvent timeout

An event server determines whether other event servers are alive by their responses to the GSAEvents that it sends. If an event server does not respond within the time span specified by its `sendRemoteEventTimeout` property—by default, 60000 milliseconds—the sending event server assumes an invalid socket connection to the non-responding event server and drops the corresponding GSAConnection from its connection table. It then attempts to reconnect within the time span specified by its `connectTimeout` property.

An event server uses its `sendRemoteEventTimeout` property only if its `enableSendRemoteEventTimeout` property is set to `true` (the default setting).

Restoring Subscriber Data

When an event server is removed from `das_gsa_subscriber` for a given item descriptor—for example, due to a connection timeout—it can be restored in two ways:

- Each time the event server sends a cache invalidation event for an item descriptor, it checks whether it is itself listed for that item descriptor in `das_gsa_subscriber`. If it is missing, it prints a warning and adds itself to the table.
- The `GSARepository` class's `checkSubscriptions()` method can be called periodically on a repository —for example, by a scheduled service—to ensure that all item descriptors defined in that repository to use distributed TCP caching are registered in the `das_gsa_subscriber` table.

  `checkSubscriptions()` queries `das_gsa_subscriber` for each item descriptor. If the method finds that the repository's event server is not listed for an item descriptor, it issues a warning and flushes the item type's cache, in order to safeguard against invalid data. It also adds itself to `das_gsa_subscriber`.

Note: `das_gsa_subscriber` is updated with repository data only if the repository's `autoUpdateSubscribers` property is set to true (the default).

Invalidating Cached Items

When an Oracle ATG Web Commerce application modifies an item that uses distributed TCP caching, the following occurs:

1. When the local repository item cache is updated, the repository looks up the specified item descriptor in the `das_gsa_subscriber` table, and determines whether other Oracle ATG Web Commerce instances define this item descriptor.
2. If the item descriptor is found, the event server connects to the other event servers identified in `das_gsa_subscriber`.
3. An invalidation event is sent to the target event servers with the pertinent information: event type, item descriptor, and repository ID.
4. The receiving repositories invalidate caches for that item descriptor.

Disabling Automatic Updates to das_gsa_subscriber

You can configure an SQL repository so it does not automatically update the `das_gsa_subscriber` table, by setting the SQL Repository component's `autoUpdateSubscribers` property to `false`. In general, you do this in order to protect a live site from updates that are liable to degrade performance.

When updates to `das_gsa_subscriber` are disabled, Oracle ATG Web Commerce does not add or remove items from the `das_gsa_subscriber` table. In this case, it only prints warnings when an event server:

- Tries to send a cache invalidation event and cannot find itself in the table.
- Cannot send a cache invalidation event to a server that is listed in the table.

You can confirm that cache invalidation events are distributed correctly if you can modify items that use distributed TCP caching on each server and avoid any warnings.

Populating das_gsa_subscriber

A site that prohibits updates to `das_gsa_subscriber` assumes that the table is fully populated with valid caching data. However, this table can only be populated if updates are initially enabled. In order to populate the das_gsa_subscriber and disable it for subsequent updates, follow these steps:

1. On each participating Oracle ATG Web Commerce instance, set the event server component's `port` property to an available port.
2. For each repository that uses distributed TCP caching mode, make sure that its SQL Repository component's `autoUpdateSubscriber` property is set to true (the default).
3. Start all Oracle ATG Web Commerce instances in the cluster.
4. After all Oracle ATG Web Commerce instances start, the contents of `das_gsa_subscriber` should be populated with unique port numbers.
5. Dump the contents of `das_gsa_subscriber` to a backup file, so the data can be restored later.
6. Stop all Oracle ATG Web Commerce instances that participate in distributed TCP caching.
7. For each repository that uses distributed TCP caching mode, reset its SQL Repository component's `autoUpdateSubscriber` property to false.
8. Insert the dumped output into `das_gsa_subscriber`.
9. Restart the Oracle ATG Web Commerce instances.

Distributed JMS Caching

When an item descriptor's caching mode is set to `distributedJMS`, all cache invalidation events sent for items of that type use JMS, which persists cache invalidation event messages in the SQL database until delivery is complete. By contrast, Distributed TCP Caching (page 115) cannot guarantee that all servers receive cache invalidation events. For example, a server might fail to connect to another server, and there is no guarantee that all delayed events are delivered after the connection is reestablished.

Note: Use distributed JMS caching only for items that are infrequently updated, as its performance is much slower than using distributed TCP caching.

Distributed JMS Caching Setup

Under distributed JMS caching, participating Oracle ATG Web Commerce instances act as message sources and sinks for invalidation events. As installed, Oracle ATG Web Commerce provides two components that are already configured as Patch Bay message sources and sinks:

- `/atg/dynamo/service/GSAInvalidatorService` is configured as a Patch Bay message source. When a repository item that uses distributed JMS caching is updated, the GSAInvalidatorService component generates a JMS cache invalidation event of class `atg.adapter.gsa.invalidator.MultiTypeInvalidationMessage`.

- `/atg/dynamo/service/GSAInvalidatorReceiver` is configured as a Patch Bay message sink and is a durable subscriber to invalidation topics. When one Oracle ATG Web Commerce instance generates a JMS cache invalidation event, the GSAInvalidatorReceiver on other instances receives the message and invalidates the appropriate item caches.

As installed, Oracle ATG Web Commerce defines the SQL JMS topics that are used by the GSAInvalidatorService and GSAInvalidatorReceiver components.

To set up distributed JMS caching:

- On each Oracle ATG Web Commerce instance that uses distributed JMS caching, enable the GSAInvalidatorService by configuring the `/atg/dynamo/Configuration` component as follows:

  ```
  gsaInvalidatorEnabled=true
  ```

- Optionally, configure each SQL Repository's `invalidatorService` property to a GSAInvalidatorService component. If this property is not set, the repository uses the default GSAInvalidatorService component as a Patch Bay message source: `/atg/dynamo/service/GSAInvalidatorService`.

- Optionally, configure each GSAInvalidatorService component's `maxItemsPerEvent` property. This property specifies the maximum number of cached items that a single `MultiTypeInvalidationMessage` can invalidate—by default, 200. If an event exceeds this limit, the entire cache of the invalidated item is flushed. A value of 0 ensures that every event always flushes the entire cache of the invalidated item.

  This mechanism can significantly reduce message payload, as a message that affects large numbers of items only needs to contain information about the item types to invalidate, rather than individual items.

- Configure PatchBay in each participating Oracle ATG Web Commerce instance to access the same SQL JMS database tables.

Distributed Hybrid Caching

Distributed hybrid caching provides intelligent cache invalidation across multiple Oracle ATG Web Commerce instances. Unlike distributed JMS and TCP caching, which broadcast invalidation events to all participating servers, distributed hybrid caching sends invalidation events only to servers where the items are cached, which can significantly reduce network traffic.

Distributed hybrid caching is suitable for sites with the following requirements:

- Real-time access to item changes

- Large number of items to monitor across many clients

To achieve optimal performance, a site that uses distributed hybrid caching must provide enough server memory to support a GSACacheServerManager (page 120) that can monitor all distributed hybrid items; and clients must have enough memory to cache locally all distributed hybrid items. For more information, see Optimizing Performance (page 123) later in this chapter.

Distributed Hybrid Caching Setup

Distributed hybrid caching relies on four elements:

- GSACacheClientManager (page 120) must be configured on each Oracle ATG Web Commerce instance that participates in distributed hybrid caching. It initiates invalidation events for repository items that use distributed hybrid caching, and sends event messages to the GSACacheServerManager for distribution to other Oracle ATG Web Commerce instances.
- GSACacheServerManager (page 120) directs cache invalidation events to Oracle ATG Web Commerce instances that contain the affected repository items.
- ServerLockManager (page 121) connects each GSACacheClientManager to the GSACacheServerManager. The ServerLockManager and GSACacheServerManager must be configured on the same Oracle ATG Web Commerce instance.
- An invalidation event of class GSACacheEvent (page 121) conveys a cache invalidation event for repository items that use distributed hybrid caching.

GSACacheClientManager

A GSACacheClientManager must be configured on each Oracle ATG Web Commerce instance where one or more repository item descriptors have their caching mode set to `distributedHybrid`. The GSACacheClientManager has the following Nucleus component path:

`/atg/dynamo/service/GSACacheClientManager`

Each GSACacheClientManager must set the following properties:

```
lockServerAddress=host[, host]
lockServerPort=port-num[, port-num]
enabled=true
```

`host` and *`port-num`* specify the ServerLockManager (page 121) 's address and port. If two ServerLockManagers are specified for failover purposes, `lockServerAddress` and `lockServerPort` must list their respective addresses and ports in the same order.

For example, given two ServerLockManagers on hosts `tartini.acme-widgets.com` and `corelli.acme-widgets.com`, where both use port 9010, you can configure a GSACacheClientManager component as follows:

```
lockServerAddress=tartini.acme-widgets.com,corelli.acme-widgets.com
lockServerPort=9010,9010
enabled=true
```

Each ServerLockManager must run in the same Oracle ATG Web Commerce instance as a GSACacheServerManager, and must be configured to support distributed hybrid caching. During repository startup, the GSACacheClientManager connects to the ServerLockManager, which hands over the connection to the GSACacheSeverManager; this connection becomes the communication channel between the GSACacheClientManager and GSACacheServerManager for cache invalidation events.

For debugging purposes, you can also set the `loggingDebug` property to true.

GSACacheServerManager

A GSACacheServerManager maintains routing information for all cached repository items that use distributed hybrid caching. When a cache invalidation event occurs on a repository, that repository's

GSACacheClientManager sends the event to its GSACacheServerManager; the GSACacheServerManager relays this event to the appropriate clients.

The GSACacheServerManager has the following Nucleus component path:

```
/atg/dynamo/service/GSACacheServerManager
```

To enable a GSACacheServerManager, set its `enabled` property to `true`. You can also configure its `defaultItemCacheSize` property, which sets the maximum number of items that are mapped for each item descriptor. This property is initially set to 1000. For more information on setting this property, see Optimizing Performance (page 123) later in this chapter.

Each GSACacheServerManager is associated with a ServerLockManager that runs in the same Oracle ATG Web Commerce instance, via the connection information specified by GSACacheClientManagers. You can provide a backup GSACacheServerManager by configuring those GSACacheClientManagers to connect to the same secondary ServerLockManager. Precedence of GSACacheServerManagers is set by their respective ServerLockManagers (see ServerLockManager Failover (page 108)).

For debugging purposes, you can also set the `loggingDebug` property to true.

ServerLockManager

In order to enable distributed hybrid caching, a ServerLockManager must be configured on the same instance as the GSACacheServerManager with the following setting:

```
handleDistributedHybridCacheEvent=true
```

When thus enabled, the ServerLockManager hands over the connection from a GSACacheClientManager to the GSACacheSeverManager; this connection becomes the communication channel between them for all subsequent cache invalidation events.

GSACacheEvent

GSACacheClientManagers and GSACacheServerManager communicate with each other by passing GSACacheEvent objects, which encapsulate invalidation events with the following information:

- Repository item ID
- Item descriptor name
- Event type

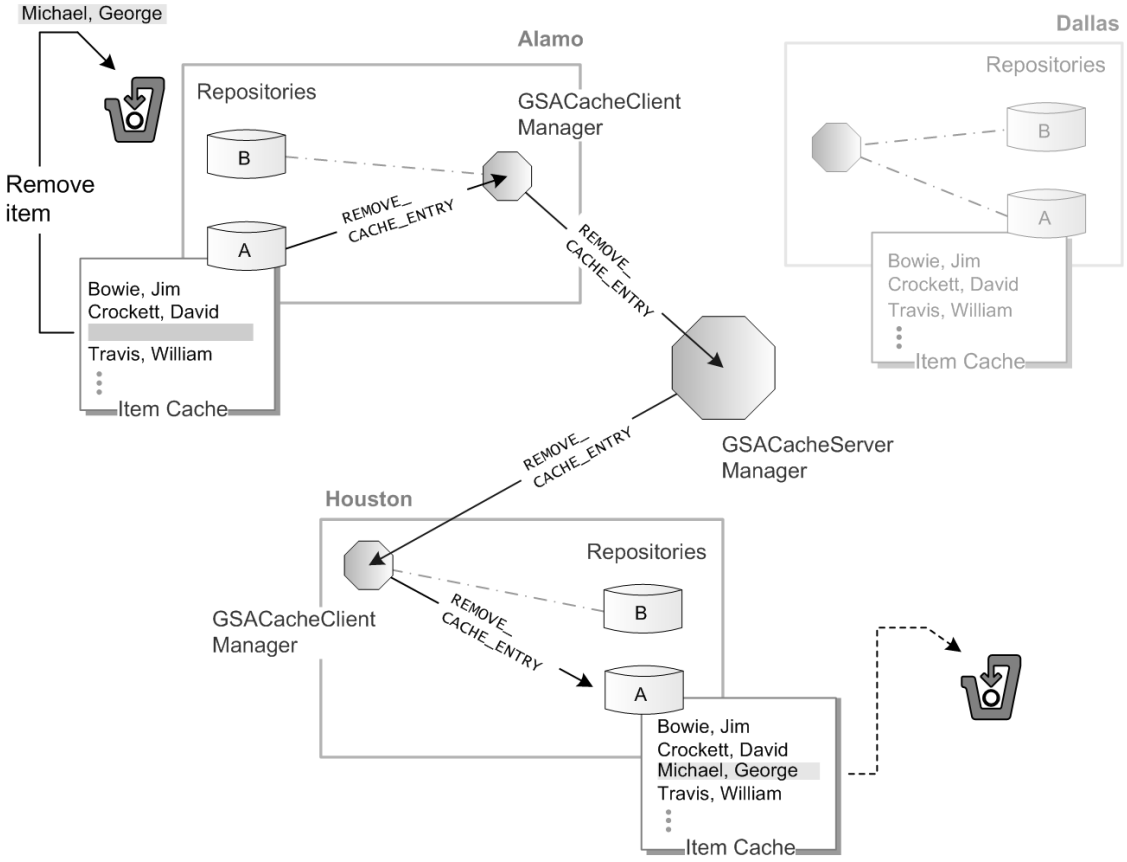
The following table describes the four types of GSACacheEvents:

GSACacheEvent Type	Description
`INVALIDATE_CACHE_ENTRY`	Sent when a repository item or item descriptor is invalidated. The GSACacheServerManager determines which clients cache the item; it then relays the event to their respective GSACacheClientManagers for delivery to the target repositories. If the GSACacheEvent provides a repository item ID, only the specified repository item is invalidated. If the GSACacheEvent omits a repository item ID, the entire item descriptor is invalidated, and the corresponding item caches are flushed.

GSACacheEvent Type	Description
LOAD_INTO_CACHE	Sent when a repository item is cached.
REMOVE_CACHE_ENTRY	Sent when a repository item is deleted. On receiving this GSACacheEvent, the GSACacheServerManager determines which clients cache the item; it then relays the event to their respective GSACacheClientManagers for delivery to the target repositories.
REMOVE_FROM_CACHE	Confirms that a repository item is removed from the cache. On receiving this event, the GSACacheServerManager removes the item from the list of items that it manages for that GSACacheClientManager.

All events except LOAD_INTO_CACHE are sent asynchronously. LOAD_INTO_CACHE is sent synchronously in order to ensure a consistent view of item data across all repositories and handle rare race conditions. The GSACacheClientManager property synchronousMessageTimeout determines the maximum amount of time each GSACacheClientManager waits for the GSACacheServerManager to reply before caching an item. This property ensures threads wait only a finite period of time for a reply from the GSACacheServerManager. The default setting is 500 milliseconds.

The following graphic shows how removal of repository item on Oracle ATG Web Commerce server Alamo triggers an invalidation event for all repository caches that also contain that item—in this case, on Oracle ATG Web Commerce server Houston.



Distributed Hybrid Caching Initialization

A distributed hybrid caching system initializes itself as follows:

1. The GSACacheClientManager tries to connect to a ServerLockManager, as specified in its `lockServerAddress` and `lockServerPort` properties, within the time allowed by its `connectTimeout` property. If it cannot connect to a ServerLockManager, it issues a warning message and the item descriptors use Simple Caching (page 106).

2. Immediately after the ServerLockManager connects to the GSACacheClientManager, it hands over the connection to the GSACacheServerManager.

Optimizing Performance

In order to obtain maximum benefit from distributed hybrid caching mode, it is important to set the following attributes correctly:

- Set the size of each item cache that participates in distributed hybrid caching to the maximum number of items. This must be done on each repository instance, on all servers.

- Set the GSACacheServerManager's `defaultItemCacheSize` property to the maximum number of items that use distributed hybrid caching across all client servers. This can be expressed by the following formula:

  `item-cache-size * num-clients[+ item-cache-size * num-clients]...`

For example, a site might be set up as follows:

- The item descriptor `user` in the ProfileAdapterRepository is set to `distributedHybrid` caching mode.

- The site has 10 servers in the page serving cluster and 5 servers in the agent cluster, and they all require access to `user` items; thus, each server must have an instance of the ProfileAdapterRepository.

- The number of stored `user` items is currently just over 700. Allowing for future growth, each instance of ProfileAdapterRepository has its `user` cache size set to 1000. This ensures that all user caches have the capacity to store all potential `user` items.

If no other item descriptors specify distributed hybrid caching, the GSACacheServerManager should set `defaultItemCacheSize` to 15 thousand. With this setting, it can keep track of all the `user` items that might be cached across all servers.

Setting the item cache size or `defaultItemCacheSize` too low is liable to incur increased network activity as follows:

- **Insufficient item cache capacity**: For each new item that is loaded into the cache, an old item must be unloaded; each action requires a separate call to the GSACacheServerManager to update its routing information.

- **defaultItemCacheSize is less than the total number of cached (distributed hybrid) items on all servers**: For each newly cached item, the GSACacheServerManager must unload routing information for another (older) cached item. As a result, routing information is liable to be missing for some cached items; attempts to access those items requires an invalidation message to be broadcast to all servers, whether or not they cache the item. This behavior is similar to Distributed TCP Caching (page 115).

Overall, the additional network activity can cause a slowdown in site performance that significantly overshadows the benefit of real-time updates. In general, if memory is limited, it is best to limit usage of

distributed hybrid caching to item types that store a relatively small number of items, in order to minimize network overhead.

Monitoring Cache Manager Activity

You can use the Component Browser of the Dynamo Server Admin to monitor the current state of GSACacheClientManagers and the GSACacheServerManager. Data for these components is accessible from this page:

`http://host:port/dyn/admin/nucleus/atg/dynamo/service/`

The GSACacheClientManager and GSACacheServerManager pages provide links that can help you troubleshoot distributed hybrid caching.

GSACacheClientManager page

Provides a link *Display ItemDescriptor List* that lists all item descriptors managed by this GSACacheClientManager .

GSACacheServerManager page

Provides two links:

- Display Client List lists all of GSACacheClientManagers currently connected to this GSACacheServerManager .
- Display Repository List provides lists all repositories that this server manages. From this page, you can drill down to specific item information:
  - Click on a repository to list all item descriptors that use hybrid caching.
  - Click on an item descriptor to display an input field for entering a repository item ID.
  - Enter a repository item ID and click Get Clients to obtain all GSACacheClientManagers that currently cache this item.

Distributed External Caching

When the cache mode for a repository item is set to `distributedExternal`, cached data is either partially or completely stored by an external distributed cache application. The Oracle ATG Web Commerce platform includes an adapter for the Oracle Coherence distributed cache application. See information about using `distributedExternal` caching mode in *External SQL Repository Caching* (page 139).

Cache Configuration

The SQL repository maintains separate item caches and query caches for unrelated item descriptors. Thus, each one can be configured independently—for example, each item cache can have its own size and caching mode.

Item descriptors within an inheritance tree also maintain their own query caches. Thus, each item descriptor can set its own Query cache attributes (page 125): `query-cache-size` and `query-expire-timeout`.

Item descriptors within an inheritance tree (see Item Descriptor Inheritance (page 46)) share the same item cache; however, related item descriptors set Item cache attributes (page 125) independently, with one exception: the last-read item descriptor's `item-cache-size` setting applies to all item descriptors within the inheritance tree. In order to ensure the desired item cache size, be sure to assign the same `item-cache-size` to all related item descriptors.

Item cache attributes

You can configure item caches with the following `<item-descriptor>` attributes:

Attribute	Description
`item-cache-size`	The maximum number of items of this type to store in the item cache. When this maximum is exceeded, the oldest items are removed from the cache. **Note:** Within an inheritance tree, the last-read item descriptor's `item-cache-size` setting applies to all item descriptors within the inheritance tree. In order to ensure the desired item cache size, be sure to assign the same `item-cache-size` to all related item descriptors Default: 1000
`item-expire-timeout`	The maximum time in milliseconds that an entry can remain in the item cache before its content becomes stale. After turning stale, the item cache entry is reloaded from the database the next time it is accessed. See Cache Timeout (page 126) for more information. Default 0 (cached data is not refreshed)
`item-cache-timeout`	The time in milliseconds that an item cache entry can remain unused before its content becomes stale. After turning stale, the item cache entry is reloaded from the database the next time it is accessed. See Cache Timeout (page 126) for more information. Default: 0 (cached data is not refreshed)

Query cache attributes

You can configure query caches with the following `<item-descriptor>` attributes:

Attribute	Description
`query-cache-size`	The maximum number of queries for items of this type to store in the query cache. When this maximum is exceeded, the oldest queries are removed from the cache. Default: 0

Attribute	Description
`query-expire-timeout`	The maximum time in milliseconds that an entry can remain in the query cache before its content becomes stale. After turning stale, the result set is reloaded from the database the next time the entry is accessed. See Cache Timeout (page 126) for more information. Default: 0 (items remain cached indefinitely or until invalidated)

Note: While it might be useful to disable caching during evaluation and development by setting cache sizes to 0, be sure to set caches to appropriate sizes for testing and deployment. For information about analyzing cache usage, see Monitoring Cache Usage (page 127) in this chapter.

Query Cache Tuning

A query cache size should anticipate the number of queries that are typically executed against that repository. For example, a query cache is probably not effective for the profile repository, as the most common type of query is the login query, which is executed once for each login/password combination. A query whose parameters are subject to frequent changes—for example, a query parameter that is set to system time—is also not a good candidate for caching.

It is generally safe to set the size of the query cache to 1000 or higher. Query caches only contain the query parameters and string IDs of the result set items, so large query cache sizes can usually be handled comfortably without running out of memory.

Item Cache Tuning: ATG Commerce

In an ATG Commerce application, caches for the product catalog repository should be large enough to accommodate the entire catalog—its categories, products and SKUs—or the data that is most frequently accessed. In general, a site can comfortably cache a catalog that contains up to 2 thousand categories, 10 thousand products, and 100 thousand SKUs.

In order to set cache sizes for `/atg/commerce/order/OrderRepository`, estimate the number of concurrent sessions, and the number of expected orders, items, and shipping groups. The following table provides some guidance on how to set cache sizes for various item descriptors:

Item Descriptor	Typical Site Usage	Item Cache Size
orders	500 concurrent user sessions	500-700
commerce	3 items per order (average)	1500
shippingGroup	2 shipping groups per order	1000

Cache Timeout

An item descriptor can limit the lifetime of cached items in two ways:

- Force refreshes of items in the item and query caches (page 127)
- Refresh unused item cache entries (page 127)

Force refreshes of items in the item and query caches

An item descriptor's `item-expire-timeout` and `query-expire-timeout` attributes specify how long items can stay in the item and query caches, respectively, before they are invalidated. For example, if the `item-expire-timeout` for a cached item is set to `60000` (milliseconds), its data becomes stale after 60 seconds; and the item must be reloaded from the database when it is next accessed.

The following `item-descriptor` tag sets attributes `item-expire-timeout` and `query-expire-timeout` to 180 seconds:

```
<item-descriptor name="order" cache-mode="simple"
      item-expire-timeout="180000"
      query-expire-timeout="180000">
...
</item-descriptor>
```

Refresh unused item cache entries

An item cache entry is regarded as stale if it is not accessed within the time span specified in its `item-cache-timeout` attribute. A stale item must be reloaded from the database the next time it is accessed. If set to 0 (the default), the item can remain indefinitely in the item cache until it is otherwise invalidated.

The following `item-descriptor` tag sets attribute `item-cache-timeout` to 180 seconds:

```
<item-descriptor name="order" cache-mode="simple"
                 item-cache-timeout="180000">
...
</item-descriptor>
```

You can use cache timeout attributes together with simple caching to control the behavior of repository caches. Cache timeout attributes are useful for caching user data associated with a particular session. A user session is typically handled by a single Oracle ATG Web Commerce server for as long as the session lasts. If the user session expires and the user moves to another Oracle ATG Web Commerce server, the cached data expires before the user can log back on to a server that might have previously cached stale data for that user.

Monitoring Cache Usage

You can view details on usage of repository caches with the Administrative Interface Component Browser. For example, the Profile Repository's page in the Component Browser can be found at:

`http://`*`hostname`*`:`*`port`*`/dyn/admin/nucleus/atg/userprofiling/ProfileAdapterRepository/`

where *`hostname`* is the name of the application server's host machine, and *`port`* is the port where the application server listens for HTTP requests. Cache metrics are displayed under the heading Cache Usage Statistics.

You should monitor cache usage during testing and after deployment, in order to determine the cache sizes required to optimize application performance. For example, if the item cache records a high number of failed

access tries and no successful tries, it is likely that caching items of this type yields no benefit and caching can be disabled; if it shows a mix of successful and unsuccessful access tries, the cache is probably too small; and if it records a high number of successful access tries and no failures, the cache is probably big enough.

The cache usage statistics table contains the following data:

Property	Description
`entryCount`	Current number of cache entries
`cacheSize`	Maximum cache size
`usedRatio`	Percent of the cache in use. If the value is close to 100, you should probably increase the item descriptor's `cacheSize` setting.
`accessCount`	Total tries, successful and unsuccessful, to retrieve items or query results since cache startup
`hitCount`	Total number of successful access tries since cache startup
`missCount`	Total number of failed access tries since cache startup
`hitRatio`	The `hitCount` percentage of `accessCount`. For example, if `accessCount` is 100 and `hitCount` is 75, `hitRatio` is 75%.
`cacheInvalidations`	Number of times the entire cache was invalidated since cache startup
`entryInvalidations`	Number of invalidated entries since cache startup

You can also examine the contents of a cache in the Admin UI, by executing the XML tag <dump-caches<dump-caches> (page 185) on a repository. See Preloading Caches (page 130) later in this chapter.

Weak Cache Hashtable

Only one `GSAItem` can be kept in memory with the same ID. If the system maintains a reference to an item that has been removed from the cache, it would continue to use the item. When a new item with the same ID is created later, the repository can no longer synchronize all of the changes made. To prevent this, whenever an item is removed from the cache, it is added to a weak reference Hashtable. When an item is not found in the cache, the repository references this Hashtable. If the item is found, it is added back to the cache.

The weak cache stores items that have been removed from the cache, but have not yet been run through the garbage collection process. Entries in this table have been tagged as weak, indicating that they will be passed through the garbage collection process as soon as no further references are found for them.

The weak cache table contains the following data:

Property	Description
`weakentryCount`	Current number of weak cache entries

Property	Description
weakHitCount	Number of cache hits that are found in the weak cache
mainRLUTotalItemsCulled	Number of times that the least recently used (LRU) list of the main cache was cleaned of entries that were both not recently used, and extended the maximum size of the LRU list
mainLRUMaxItemsCulled	Maximum number of items that were culled from the LRU list of the main cache
weakLRUCulls	Number of times the LRU list of the weak cache was cleaned from entries that were both not used recently, and extended the maximum size of the LRU list
weakLRUTotalItemsCulled	Total number of items that were culled from the LRU list
weakLRUMaxItemsCulled	The maximum number of items that were culled from the LRU list

Caching by Repository IDs

If a repository item property references a large sub-tree of items, it can be inefficient to retrieve and cache the child items each time the parent item is cached. In this case, you can specify to cache only the repository IDs of the child items, by setting the property's `cacheReferencesById` to true. For example:

```
<property name="childProducts" ...>
...
    <attribute name="cacheReferencesById" value="true"/>
</property>
```

Restoring Item Caches

You can configure a GSARepository component so it automatically saves its item caches when the repository is stopped; when the repository restarts, it reloads caches with the same items. To enable this, set the following property:

```
restoreCacheOnRestart=true
```

When this property is set to true, the repository saves the names of cached items to the XML file specified by the repository's `cacheRestoreFile` property.

Note: this property does not affect external caching software such as Oracle Coherence. See *External SQL Repository Caching* (page 139).

Preloading Caches

You can achieve better performance in an application that uses SQL repositories by preloading caches. You can configure the SQL repository to save and restore caches automatically. It is generally good practice to put cache-loading tags in a separate XML file with the same name as the repository definition file, and rely on XML file combination to invoke the queries. For more about XML file combination, see the *Nucleus: Organizing JavaBean Components* chapter of the *Platform Programming Guide*

If you preload caches, the loading strategy of the preloaded items on startup should be set to eager (the default). Alternatively, you might optimize performance by lazy loading repository items. For more information, see Enabling Lazy Loading (page 131) later in this chapter.

Note: Performance improvement by preloading caches slows application startup.

You can specify to load certain items into repository caches on application startup in several ways:

- Load specific repository items (page 130)
- Load queried items (page 130)
- Load from a dump log (page 131)

Load specific repository items

A repository definition file can include a `<load-items>` tag to specify one or more repository items to cache on application startup. The tag specifies the items to cache through a comma-delimited list of repository IDs.

For example, the following `<load-items>` tag specifies to load four items of the `products` item type that match the listed repository IDs:

```
<load-items item-descriptor="product">
   prod10001,prod100001,prod100002,prod100003
</load-items>
```

The `<load-items>` tag can restrict the cached data to specific properties through the `properties` attribute. The previous example can be modified to cache only the data of properties `displayName` and `description`, as follows:

```
<load-items item-descriptor="product" properties="displayName,description">
   prod10001,prod100001,prod100002,prod100003
</load-items>
```

Load queried items

A repository definition file can include `<query-items>` tags in order to cache query results on application startup. For example:

```
<query-items item-descriptor="users">ALL</query-items>
```

The `<query-items>`tag can also set the `quiet` attribute to `true`, to suppress log messages that the query otherwise generates:

```
<query-items item-descriptor="product" quiet="true">ALL</query-items>
```

You can set the `id-only` attribute to `true` or `false`:

- `true`: Preload only repository IDs of result set items.
- `false`: Include primary item properties in the preload operation.

For example:

```
<query-items item-descriptor="product" id-only="true">ALL</query-items>
```

For more information, see the Querying Items (page 151) section in the *Developing and Testing an SQL Repository* (page 147) chapter.

Load from a dump log

You can use the Admin UI to dump the contents of a repository's item cache at runtime, by executing the `<dump-caches`<dump-caches> (page 185) tag in the Admin UI utility Run XML Operation Tags on the Repository. If the tag's `dump-type` attribute is set to `queries`, the tag logs a `<load-items`<load-items> (page 184) tag that can be used to reload all the items that were in the cache at the time of the dump. For example:

```
<dump-caches item-descriptors="product" dump-type="queries"/>
```

This tag might yield the following log:

```
*** begin pre-cache XML output

<load-items item-descriptor="product">
   prod100003,prod100002,prod100001,prod10001
/load-items>

*** end pre-cache XML output
```

Enabling Lazy Loading

You can lazy load multi-valued property items and query result sets in order to minimize database access and enhance application performance. When you enable lazy loading on an item type or a repository, the cache initially loads only the stubs of the multi-valued property items or the query result set; these include only the repository IDs.

To accelerate item access, lazy loading is integrated with batch loading: when a lazy-loaded item is requested, it is loaded into the cache with a number of related—often contiguous—items, thereby facilitating access within the batch.

It makes sense to enable lazy loading in two cases:

- Multi-valued properties contain a large number of items.
- A query returns a very large result set.

In both cases, you should enable lazy loading if the potential number of items returned is very large, and you only need access to a relatively small subset. For example, if a multi-valued property or query is likely to return 10,000 items and users are likely to access only the first 100 of these, it makes sense to enable lazy loading for

that item type or its repository. Conversely, eager loading provides better performance if you need access to all items or a wide spectrum of them.

Lazy Loading Settings

You can enable lazy loading at several levels. In ascending levels of precedence, these are:

- Repository lazyLoadItems Property (page 132)
- Item Descriptor loadingStrategy Attribute (page 132)
- API (page 132)

Repository lazyLoadItems Property

Set the repository's `lazyLoadItems` property to `true`. As installed, Oracle ATG Web Commerce enables lazy loading on a number of its versioned and non-versioned repositories. To verify whether a given repository uses lazy loading, check its `lazyLoadItems` property.

Item Descriptor loadingStrategy Attribute

Set the `loadingStrategy` attribute to `lazy`. You can set the `loadingStrategy` property on the item type to collect, or on the multi-valued property that references that item type. The `loadingStrategy` setting of a multi-valued property takes precedence over the referenced item type.

The following example shows how you might define the multi-valued property `categoryProducts`, which references a list of `product` components, and sets its `loadingStrategy` attribute to `lazy`:

```
<property category-resource="categoryProducts" name="fixedChildProducts"
data-type="list" component-item-type="product" column-name="child_prd_id"
queryable="true" display-name-resource="fixedChildProducts">

   <attribute name="loadingStrategy" value="lazy"/>
   <attribute name="propertySortPriority" value="-4"/>
   <attribute name="references" value="true"/>
</property>
```

Note: If you preload an item type to a repository's cache on startup, you must disable lazy loading for the item-type until the preload operation is complete (see Preloading Caches (page 130) earlier in this chapter).

API

You can set the loading strategy programmatically any time after startup. The following code shows how you might use the `atg.adapter.gsa.LoadingStrategyContext` methods `pushLoadStrategy()` and `popLoadStrategy()`, to override and restore the current thread's loading strategy, respectively:

```
try {
  LoadingStrategyContext.pushLoadStrategy("lazy");  // or set to "eager"

  // access a collection property that references other items
  List listItems =
    (List) someItem.getPropertyValue("collectionProperty");

  // or run a query
```

```
  RepositoryItem [] queryResults = rqlStatement.executeQuery(view, null);

} finally {
  LoadingStrategyContext.popLoadStrategy();
}
```

For full information about the `LoadingStrategyContext` class and all its methods, see the online *ATG Platform API Reference*.

Integration with Batch Loading

If lazy-loading is enabled, batch-loading for lazy-loaded items is deferred until the data of an item is actually required. In that event, it and related items are batch-loaded to the repository cache as follows:

- The size of each batch is set by the repository's `loadItemBatchSize` and `queryBatchSize` properties.
- Batch-loaded items remain valid for the length of time set by the repository's `lazyBatchLoadTimeout` property—by default, set to 10 minutes. After a batch's timeout period elapses, items in that batch are loaded individually, which can adversely affect performance.

Using Preloading Hints in Lazy-Loaded Queries

By default, lazy-loaded query result sets contain only repository IDs. If the required data is limited to a few properties, and those properties belong only to the primary table, you can modify lazy-loaded caching by embedding preloading hints in the RQL statement. The result set that is lazy-loaded into the cache includes those properties together with repository IDs

For example, the following RQL specifies to lazy-load the `login` property:

```
RepositoryView view = repository.getView("user");

// to display only logins, preload the login property
RqlStatement statement =
   RqlStatement.parseRqlStatement("firstName = ?0 PROPERTY HINTS login");

Object params[] = new Object[1];
params[0] = "Maria";

RepositoryItem [] items = statement.executeQuery (view, params);
```

You can also use the interface `atg.repository.Repository` to embed preloading hints in a query programmatically. The following code excerpt is equivalent to the RQL example shown above:

```
// Somehow, get the repository
Repository rep = getRepository();
RepositoryItemDescriptor desc = rep.getItemDescriptor("user");

// RepositoryView is a ParameterSupportView, so it supports parameters in queries
// This assumes advanced knowledge that the view is an instance of a
// ParameterSupportView
ParameterSupportView view = (ParameterSupportView)desc.getRepositoryView();
QueryBuilder qb = view.getQueryBuilder();
```

```
// firstName = 'Maria'
QueryExpression firstNameProp = qb.createPropertyQueryExpression("firstName");
QueryExpression parameterValue = qb.createParameterQueryExpression();
Query firstNameQuery = qb.createComparisonQuery
                      (firstNameProp, parameterValue, QueryBuilder.EQUALS);

// arguments
Object[] args = new Object[1];
args[0] = new String("Maria");

// preload "login" property in order to display it without loading full items
String [] precachedProperties = new String[1];
precachedProperties[0] = "login";
QueryOptions options = new QueryOptions(0, -1, null, precachedProperties);

RepositoryItem[] mariaItems = view.executeQuery(firstNameQuery, options, args);
```

Cache Flushing

The Oracle ATG Web Commerce distribution provides class methods that you can use to explicitly flush item and query caches at several levels, as described in the following sections:

- Flushing All Repository Caches (page 134)
- Flushing Item Caches (page 135)
- Flushing Query Caches (page 136)

The following table summarizes these methods:

Class	Methods
`atg.repository.RepositoryImpl`	`invalidateCaches()`

`atg.repository.ItemDescriptorImpl`	`removeItemFromCache()`
	`invalidateItemCache()`
	`invalidateCaches()`

`atg.repository.RepositoryViewImpl`	`invalidateQueryCache()`

Flushing All Repository Caches

The class `atg.repository.RepositoryImpl` provides the method `invalidateCaches()`, which clears all caches from the target repository:

```
void invalidateCaches()
void invalidateCaches(boolean pGlobal)
```

If you supply an argument of true to the boolean version, the method is invoked on all cluster repositories.

Two exceptions apply:

- If you call the non-boolean version on a repository where item descriptors are set to Distributed Hybrid Caching (page 119), a cache invalidation event is triggered for each of those item descriptors, which the GSACacheServerManager distributes accordingly.
- The boolean version has no affect on remote item caches that use Distributed TCP Caching (page 115).

Flushing Item Caches

The class `atg.repository.ItemDescriptorImpl` provides three methods that can be called on an item descriptor in order to flush its cache. Each method provides an overloaded version with a boolean parameter, where an argument of `true` specifies to invoke the method across the entire cluster; an argument of `false` limits the flush operation to the local repository.

Note: If the item descriptor is set to distributed hybrid caching, any action on the local repository is propagated to other Oracle ATG Web Commerce instances, whether invoked by the boolean or non-boolean method version.

In order to use these methods, `atg.repository.RepositoryItemDescriptor` must be cast to `atg.repository.ItemDescriptorImpl`.

invalidateItemCache()
Invalidates item caches for this item descriptor:

```
void invalidateItemCache()
void invalidateItemCache(boolean pGlobal)
```

For example:

```
RepositoryImpl rep = getRepository();
ItemDescriptorImpl d = (ItemDescriptorImpl)rep.getItemDescriptor("user");
d.invalidateItemCache();
```

Note: This method's boolean has no affect on remote item caches that use distributed TCP caching; it only invalidates the local item cache.

invalidateCaches()
Invalidates item and query caches for this item descriptor:

```
void invalidateCaches()
void invalidateCaches(boolean pGlobal)
```

removeItemFromCache()
Removes the specified item from the cache:

```
void removeItemFromCache(String pId)
void removeItemFromCache(String pId, boolean pGlobal)
void removeItemFromCache(
String pId, boolean pGlobal, boolean pRemoveTransientProperties)
```

The version with the boolean parameter `pRemoveTransientProperties` forces removal of transient property values from the cache. The other method versions have no effect on these properties.

Flushing Query Caches

The class `atg.repository.RepositoryViewImpl` provides the method `invalidateQueryCache()`, which clears the query cache:

```
public void invalidateQueryCache()
```

Cache Invalidation Service

Oracle ATG Web Commerce includes a JMS-based system for explicitly invalidating caches in an SQL repository, where Oracle ATG Web Commerce servers in a cache invalidation cluster act as message sinks and sources. Cache invalidation messages are initially created by invoking a client method remotely via RMI to a specific server. All servers in the cluster, configured as message sinks or subscribers to the GSA Invalidation topic, accept the message and perform the appropriate cache invalidation as specified by message parameters.

You can specify several levels of cache invalidation:

- Invalidate the cache of a given repository item.
- Invalidate all repository items of an item descriptor.
- Invalidate all repository items.

The Cache Invalidator can be used in two different ways:

- Invoke the Cache Invalidator Manually (page 136) from the command line for repository items that you specify.
- Use the Cache Invalidator with Distributed JMS Caching (page 137) so it is invoked automatically for repository items whose cache mode is set to `distributedJMS`.

Enabling the Cache Invalidator

The Cache Invalidator is disabled by default. If your installation includes the DPS module, the SQL-JMS system is preconfigured to work with the Cache Invalidator. In this case, you can enable the Cache Invalidator by setting the property `gsaInvalidatorEnabled` property to `true` in this component:

```
/atg/dynamo/Configuration
```

Note: All Oracle ATG Web Commerce instances participating in the Cache Invalidator scheme must be configured to access the same SQL-JMS database with the appropriate JDBC datasource configurations. The SQL repository or repositories that are invalidated might or might not be part of the same datasource.

Invoke the Cache Invalidator Manually

You can invoke the Cache Invalidator Client from a command shell as follows:

```
java -Datg.adapter.gsa.invalidator.uri=
rmi://host:8860/atg/dynamo/service/GSAInvalidatorService
```

```
atg.adapter.gsa.invalidator.GSAInvalidatorClient /repository-path
[ item-descriptor-name | repository-item-id ]
```

The Cache Invalidator action is initiated by performing a RMI call to the `GSAInvalidatorService.invalidate()` method. The RMI call is made by executing the GSA Invalidator Client, which is supplied one or more of the following arguments:

Argument	Description
repository-path	Required, the Nucleus path of the SQL repository If this is the only argument, then the cache is invalidated for the entire repository.
item-descriptor-name	Optional, invalidates all items of this item type.
repository-item-id	Optional, invalidates a specific item from the repository.

You can enable additional debugging messages by setting the property `loggingDebug=true` in the following components:

- `/atg/dynamo/service/GSAInvalidatorService`: producer or message source debugging
- `/atg/dynamo/service/GSAInvalidationReceiver`: consumer or message sink debugging

Use the Cache Invalidator with Distributed JMS Caching

For items where `cache-mode="distributedJMS"`, the `GSAInvalidatorService` is used to send cache invalidation events via JMS. To do this, the service sends a JMS event of class `atg.adapter.gsa.invalidator.MultiTypeInvalidationMessage`, which invalidates a set of items or item types for a given repository. When a transaction is committed, this event is used to invalidate the caches of all items modified in the transaction that use the `distributedJMS` cache mode.

Because transactions can be arbitrarily large, it is necessary to specify the maximum size of a `MultiTypeInvalidationMessage` event. The `GSAInvalidatorService` component includes a property called `maxItemsPerEvent`, which specifies the maximum number of repository items that one `MultiTypeInvalidationMessage` can invalidate . The default value for this property is 200. If the number of items to invalidate after a transaction exceeds this threshold, the message invalidates the caches of the updated item types, rather than invalidating caches of individual items. This mechanism keeps the message from growing too large, because it needs only contain information about the item types to invalidate, rather than a list of individual items.

There is no command-line interface for sending `MultiTypeInvalidationMessage` events. These events are used only for Distributed JMS Caching (page 118).

11 External SQL Repository Caching

Use external caching to improve performance by storing SQL repository data in the memory of a separate distributed cache application. Caching SQL repository data speeds your application by avoiding database transactions when that data is required by users. External distributed cache applications coordinate cache management for a cluster of application servers, offloading data from the Java virtual machine and increasing the amount of memory available to the application.

This section explains how to configure the way your Oracle ATG Web Commerce application uses external caching. See information about configuring the Oracle ATG Web Commerce platform to connect to a distributed cache in the *Installation and Configuration Guide*.

The Oracle ATG Web Commerce platform includes an adapter for the Oracle Coherence distributed cache application. You will need to understand how to configure that product in order to use the external caching feature. See information about Oracle Coherence at http://www.oracle.com/technetwork/middleware/coherence/documentation/index.html.

Choosing Repository Items for External Caching

Typically, you will use external caching to increase the memory that is available to your Oracle ATG Web Commerce application. Consider using external caching for a repository if it meets the following criteria.

- There is more data in the repository than can easily be held in your application server's Java Virtual Machine (JVM) memory. This may occur when there are hundreds of thousands of repository items and will typically occur when there are millions of items in the repository. These numbers are approximate and will vary depending on your application and server resources.
- Your application accesses the data in the repository in a way that requires most of that data to be cached at the same time.

For example, the `ProductCatalog` repository may benefit from external caching. Catalogs typically have a large number of repository items and having them all cached in memory speeds page loading time.

Configuring Repository Items for External Caching

This section contains information about configuring external caching for repositories and repository items. See general information about configuring repository items in *SQL Repository Overview* (page 27).

Cache Locality

Cache locality controls the way that the Generic SQL Adapter (GSA) uses in-memory caching. Specifically, it determines whether the GSA will cache data using its own caching functionality, using the caching functionality of the Oracle Coherence distributed cache application, or a mix of both methods.

Set cache locality either for an entire repository or for individual items. See Setting Cache Locality For an Entire Repository (page 140) and Setting Cache Locality For a Repository Item Descriptor (page 140). The setting for a repository item descriptor will override the setting for an entire repository.

Settings for cache locality are explained in the following table.

Setting	Explanation
`local`	The GSA uses its own caching functionality within its own Java virtual machine. There is no external caching.
`mixed`	The GSA uses its own caching functionality and also uses an external distributed caching application as a secondary store.
`external`	The GSA does not use its own caching functionality. It only stores data in an external distributed caching application.

Setting Cache Locality For an Entire Repository

To set the cache locality for an entire repository:

1. Edit the properties file for the repository component.
2. Set the `cacheLocality` property to one of the cache locality settings: local, mixed, or external.

   ```
   cacheLocality=external
   ```

3. Restart your Oracle ATG Web Commerce server.

Setting Cache Locality For a Repository Item Descriptor

To set the cache locality for an individual repository item descriptor:

1. Edit the repository definition file for the repository item. Find the `item-descriptor` element for the repository item descriptor.
2. Set the value of the cache-locality attribute to one of the cache locality settings: local, mixed, or external.
3. Restart your Oracle ATG Web Commerce server.

The following example shows the cache-locality attribute for a repository item descriptor.

```
<gsa-template>
  <item-descriptor name="catalog"
                   cache-locality="external"
```

```
                    cache-mode="distributedExternal" />
</gsa-template>
```

Best Practices

If you set the cache locality for repository item descriptors to external, consider using the near cache configuration for Oracle Coherence. Near cache configuration allows Oracle Coherence to store some data in your application server's Java virtual machine. Since your Oracle ATG Web Commerce server is not caching data in the Java virtual machine itself, allowing Oracle Coherence to keep copies of data locally may improve performance.

When you first initiate external caching, you will see an increase in cache hit counts, because external caching stores all items by reference rather than by value, so each time an item reference is hit, it goes back into the cache. Note that this increase is technically accurate, but does not interfere with the caching process.

Note: If you set the cache locality for repository item descriptors to `mixed`, do not use the Oracle Coherence `near-cache` configuration for them. Doing this will duplicate cached data in the Java virtual machine for your Oracle ATG Web Commerce application server.

Use the `cacheLocality` and `defaultCacheNamePrefix` properties to control the way that Oracle ATG Web Commerce interacts with Oracle Coherence. See information about `defaultCacheNamePrefix` in External Cache Naming (page 143). See information about cache topologies in the Oracle Coherence documentation (http://www.oracle.com/technetwork/middleware/coherence/documentation/index.html).

The following table shows common cache topologies and example `cacheLocality` and `defaultCacheNamePrefix` property settings that may be used for them.

Topology Summary	Example Settings
Oracle ATG Web Commerce local cache, Oracle Coherence distributed cache	`cacheLocality=mixed` `defaultCacheNamePrefix=dist-cache`
Oracle Coherence local cache, Oracle Coherence distributed cache	`cacheLocality=external` `defaultCacheNamePrefix=near-cache`
Entire cache in Oracle Coherence, external to JVM	`cacheLocality=external` `defaultCacheNamePrefix=remote-cache`

Cache Modes for External Caching

Configure either `simple` or `distributedExternal` caching mode for repository item descriptors that use external caching. See information about cache modes in Caching Modes (page 104).

Do not configure modes other than `simple` and `distributedExternal` for repository item descriptors that use external caching.

The following table explains the recommended uses for `simple` and `distributedExternal` caching modes.

Cache Mode	Recommended Use
`simple`	Use `simple` caching mode for repository item descriptors that will not be invalidated by changes. Simple mode offers a performance advantage for repository item descriptors that are read and not written by the production server. In simple mode, your Oracle ATG Web Commerce application server will not communicate cache invalidation events to other servers in its cluster.
`distributedExternal`	Use `distributedExternal` mode for repository item descriptors that may be invalidated by changes. In this mode your Oracle ATG Web Commerce server will communicate cache invalidation events to other servers in its cluster.

Note: if you configure a cache mode other than `simple` or `distributedExternal` for a repository item descriptor that uses external caching, Oracle ATG Web Commerce will reset the cache mode to `simple` when you restart your server.

External Caching and Cache Invalidation

The `invalidateExternalCacheOnFullInvalidate` property controls whether the cache invalidation service and explicit cache invalidation will affect the externally cached data for a repository component. See Cache Invalidation Service (page 136).

Use this property to reduce the number of invalidation messages that your Oracle ATG Web Commerce server cluster sends to your external distributed cache application. If you have several Oracle ATG Web Commerce servers, allow a small number of them to invalidate the external cache as needed and set this property to `false` for the rest.

This property controls whether the external cache for a repository is affected by either full cache invalidation, selective cache invalidation, or calls to the `invalidateCaches()` method for a repository.

Setting	Explanation
`true`	The cache invalidation service will invalidate the externally cached data for the repository component. The default value for this property is `true`.
`false`	The cache invalidation service will not affect the externally cached data for the repository component.

External Caching and Cache Warming

The `warmCacheIfExternal` property controls whether deployment will warm, or load, externally cached data for a repository component. See information about cache warming in the *Content Administration Programming Guide*.

Use this property to reduce the number of Oracle ATG Web Commerce servers in your cluster that warm the external cache. If you have several Oracle ATG Web Commerce servers, allow a small number of them to warm the external cache and set this property to `false` for the rest.

Setting	Explanation
`true`	A deployment to this repository will warm the externally cached data for it. The default value for this property is `true`.
`false`	A deployment to this repository will not warm the externally cached data for it.

External Cache Naming

You can control the prefix that Oracle ATG Web Commerce gives to each cache that it stores in Oracle Coherence. The prefix of cache names affects the way that Oracle Coherence handles stored data. See information about the way cache name prefixes affect Oracle Coherence functionality in the documentation for that product (http://www.oracle.com/technetwork/middleware/coherence/documentation/index.html).

Cache names are composed of the prefix, the SQL repository name, and the repository item descriptor name. The strings are joined by the underscore/underbar character. For example, the cache name for the `catalog` item descriptor in the `ProductCatalog` repository might be:

```
near-cache_ProductCatalog_catalog
```

Control the cache name prefix by setting properties of the `/atg/adapter/gsa/externalcache/GSACoherenceManager` component of your Oracle ATG Web Commerce application.

Property	Explanation
`defaultCacheNamePrefix`	The string that will be prepended to the repository name and repository item descriptor name to form a cache name. This value may be overridden for specific repositories or repository item descriptor names by the `cacheNamePrefixMap` property. The default value for this property is `near-cache`.

Property	Explanation

cacheNamePrefixMap	A comma separated list of repository item descriptors and the cache name prefixes that will be prepended to them to form a cache name.
	
	Use the asterisk (*) as a wildcard character in place of an entire repository or repository item descriptor name. Wildcard characters will not select a partial name.
	
	For example:
	
	`cacheNamePrefixMap=\`
	`ProductCatalog_*=dist-cache,\`
	`*_product=near-cache,\`
	`ProductCatalog_media=remote-cache`
	
	Note: Repository or item descriptor names that include the underscore/underbar character will break the syntax of this property. If you need to override the cache name prefix for one of these names, change the prefix map separator character to something else. The `prefixMapSeparator` property controls which character that is.

prefixMapSeparator	The character that separates repository names and repository item descriptor names in the `cacheNamePrefixMap` property. This property controls the way that Oracle ATG Web Commerce interprets `cacheNamePrefixMap` values. It does not affect the separator character used between the elements of actual cache names. The default value for this property is the underscore/underbar character.

External Caching Statistics

Use the Dynamo Server Admin user interface to view information about the way your Oracle ATG Web Commerce application is using an external cache. The administration user interface reports the following statistics.

- The number of times your application accessed the external cache for a repository item type and found data in it. This is labeled `externalHits` in the administration user interface.
- The number of times your application accessed the external cache for a repository item type and did not find data in it. This is labeled `externalMisses` in the administration user interface.
- The number of repository items of a specific type that are stored in the external cache. This is labeled `externalEntries` in the administration user interface.

To view information about external cache usage:

1. Log in to the Dynamo Server Admin user interface. See information about the Dynamo Server Admin in the *Platform Programming Guide*.
2. Navigate to the repository component using the Component Browser.

3. Find the repository item display and the repository item type that is externally cached.

4. Read the columns labeled `externalHits`, `externalMisses`, and `externalEntities`.

Batch Mode for External Caching

Use batch mode to improve external caching performance by combining multiple requests for cached repository item data into a single request. If you enable batch mode for external caching, your application will keep track of the repository items it retrieves from the external cache for each URL request. When the application handles the same URL request again, it determines whether all of the repository items are in the local cache. If some or all of the items are not available from the local cache, the application requests all of the missing items from the external cache in a single batch.

Using batch mode for external caching will improve performance if the external cache contains more data than the local cache in the Java Virtual Machine (JVM) can store. It may not improve performance if most of the externally cached data will fit in the local cache.

If the repository items that are required by a URL request may vary based on POST arguments or other factors, batch mode for external caching may not improve performance.

Enabling Batch Mode for External Caching

To enable batch mode external caching:

1. Make sure you have configured your repositories to use external caching. See Configuring Repository Items for External Caching (page 139).

2. Initialize the `/atg/adapter/gsa/externalcache/ExternalCacheBatchingServlet` component. Add the `/atg/adapter/gsa/externalcache/ExternalCacheBatchingServlet` component to the `initialServices` property of the `/atg/dynamo/servlet/dafpipeline/Initial` component. For example, add the following to the configuration path for the `/atg/dynamo/servlet/dafpipeline/Initial` component.

   ```
   initialServices+=/atg/adapter/gsa/externalcache/
   ExternalCacheBatchingServlet
   ```

3. Configure the `batchingExtensions` and `URIPrefixesToIgnore` properties of the `/atg/adapter/gsa/externalcache/ExternalCacheBatchingServlet` component to control which URL requests will trigger batch external caching.

   Include the filename extensions of the URLs that **will** trigger batch external caching in the `batchingExtensions` property. This property includes the `jsp` filename extension by default. This property is case sensitive.

   ```
   batchingExtensions+=jhtml,JHTML,JSP
   ```

   Include directory paths in the document root for your Web application that **will not** trigger batch external caching in the `URIPrefixesToIgnore` property. This property is set to null by default.

   ```
   URIPrefixesToIgnore+=/mystore/aboutus/
   ```

4. Set the `enableExternalCacheBatching` property to `true` for each repository component that will use batch external caching. For example, set the `enableExternalCacheBatching` property of the `/atg/commerce/catalog/ProductCatalog` component to `true`.

5. If needed, adjust the `externalCacheBatchInfoSize` and `externalCacheBatchInfoTimeout` properties for each repository component that will use batch external caching.

   These properties control the number of URLs that your Web application monitors for external caching requirements and the frequency that the cached data associated with each URL is refreshed. See Repository Configuration for Batch Mode (page 146).

Repository Configuration for Batch Mode

Repository components include the `externalCacheBatchInfoSize` and `externalCacheBatchInfoTimeout` properties to control the number of URLs that your Web application monitors for external caching requirements and the frequency that the cached data associated with each URL is refreshed.

externalCacheBatchInfoSize

Set the `externalCacheBatchInfoSize` property to the approximate number of URLs in your Web application that require externally cached repository data. This is the number of URLs that your Web application will monitor for external caching requirements and use batch mode external caching if needed. The number of independent URLs depends on the nature of your Web application. The `externalCacheBatchInfoSize` property is set to 1000 by default.

Your Web application maintains a list of URLs for each repository item descriptor in a repository. The `externalCacheBatchInfoSize` property limits the number of URLs that are recorded for each item descriptor.

If you set the `externalCacheBatchInfoSize` to a number that is lower than the number of URLs that require a particular repository item descriptor, the most recent URL added to the list will push the oldest URL off the list. Batch mode external caching will continue to function properly but will not improve performance to the extent that it is capable of.

If you set the `externalCacheBatchInfoSize` to a number that is higher than the number of URLs that require externally cached repository item data, the list of URLs will grow to the size required. Setting `externalCacheBatchInfoSize` too high will not consume unnecessary resources.

externalCacheBatchInfoTimeout

Set the `externalCacheBatchInfoTimeout` property to control how frequently your Web application will refresh the list of cached data that is associated with URLs. Set the frequency in milliseconds. The `externalCacheBatchInfoTimeout` property is set to 600000 (ten minutes) by default.

If your site does not change rapidly during a period of minutes or hours, a reasonable frequency may be from two to 24 hours. If your site is highly dynamic and does change rapidly, increase the frequency. A reasonable frequency for a rapidly changing site may be every ten minutes.

12 Developing and Testing an SQL Repository

The XML document type definition for the SQL repository includes operation tags whose primary purpose is to help you develop, test, and debug your SQL repository template. You can use these tags to modify your repository's database to perform the following tasks:

- Adding Items (page 147)
- Updating Items (page 149)
- Removing Items (page 150)
- Querying Items (page 151)
- Importing and Exporting Items and DDLs (page 151)

These tags are used by the startSQLRepository (page 151) script, which is described in this chapter.

To use these developmental tags:

1. Go to the repository's page in the Administration Interface. For example, for the SQL Profile Repository, go to:

   hostname:8830/nucleus/atg/userprofiling/ProfileAdapterRepository

2. In the Run XML Operation Tags on the Repository text area, enter the developmental tags and click Enter.

You can also run the `startSQLRepository` script from a command line. Create an XML repository definition file and pass it to the `startSQLRepository` script with appropriate arguments. See the startSQLRepository (page 151) section in this chapter for more information.

Note: If you add or remove an item descriptor in your repository definition file, you must close and reassemble, redeploy, and restart your application, which restarts the ACC and DAF. Otherwise, errors may result. For example, if you remove an item descriptor, the item descriptor still appears as an option in the ACC query editor (List items of type...) and might cause errors if selected. For instructions on assembling applications, see the *Platform Programming Guide*.

Adding Items

You can use an XML template to add repository items. Use an `<add-item>` tag for each repository item you want to add. Each `<add-item>` tag must include an `item-descriptor` attribute to specify the name of the item descriptor to which this repository item should belong. You can nest `<set-property>` tags within the

<add-item> tag to set property values of the new repository item. Any properties you do not set have the default property value for that item descriptor.

For example, the following tags add to the database an instance of users with id = 1. It sets the username property to Marty.

```
<add-item item-descriptor="users" id="1">
<set-property name="username" value="Marty"/>
</add-item>
```

Note that <add-item> tags are processed one at a time. They cannot make forward references to other items and no attempt is made to satisfy database integrity constraints (beyond that automatically done with the cascade operator). Use the <import-items> tag if you want to load in items with forward references.

Note also that if you specify the ID of an existing repository item, you update that item, overwriting the values of the existing item with the values you specify in the <add-item> tag. Any add or remove attributes in a <set-property> tag within an <add-item> tag are ignored.

Adding Items with Composite IDs

If your repository uses composite repository item IDs, you can specify the ID with its encoded form, or in brackets as comma-delimited ID elements. For example, if an ID is composed of the string elements Massachusetts, USA, and Earth and the separator character is the default, : (colon), you can specify the ID in one of these forms:

```
<add-item item-descriptor="states" id="Massachusetts:USA:Earth">
    <set-property name="capital" value="Boston"/>
</add-item>
```

```
<add-item item-descriptor="states" id="[Massachusetts,USA,Earth]">
    <set-property name="capital" value="Boston"/>
</add-item>
```

Adding Items without Specifying IDs

When you add a repository item with the <add-item> tag, you can use the tag attribute in place of the id attribute. If you use a tag attribute, the SQL repository chooses a unique repository ID for the item using the IdGenerator and associates that tag with that ID. You can then refer to that particular tag name within that .XML file with a tag attribute. Alternatively, refer to the tag with this special syntax:

```
$tag:<name>$
```

The $tag:<*name*>$ syntax can be used only in:

- the value attribute or body of a <set-value> tag
- the query attribute or the body of a <query-items> tag

The template parser substitutes the ID of the item you created with that tag.

For example, you might want to add an item, one of whose properties is another repository item—for example, a book item, where the book item has an author property which is itself a repository item. If you do not want to supply the repository ID for the author repository item, you can use a tag attribute placeholder like this:

```
<add-item item-descriptor="author" tag="AUTHORID_TAG">
    <set-property name="authorName" value="Arthur Ransome"/>
...
</add-item>

<add-item item-descriptor="book">
    <set-property name="title" value="Swallows & Amazons"/>
    <set-property name="author" value="$tag:AUTHORID_TAG$"/>
</add-item>
```

Adding Items to Multi-Item Properties

If you add items that are themselves properties of other repository items, make sure the item is added before the item that refers to it. This is necessary because a new repository item cannot make forward references to another repository item that is not yet defined.

For example, suppose you have a `user` item type with a `dependents` property that refers to a separate `dependent` item type. Add the `dependent` items before you add a `user` item that refers to those `dependent` items, as in this example:

```
<add-item item-descriptor="dependent" id="1234">
    <set-property name="firstName" value="JoeBob"/>
</add-item>
<add-item item-descriptor="dependent" id="1235">
    <set-property name="firstName" value="Mikey"/>
</add-item>
<add-item item-descriptor="user" id="1">
    <set-property name="login" value="toml"/>
    <set-property name="firstName" value="Tom"/>
    <set-property name="dependents" value="1234,1235"/>
</add-item>
```

Updating Items

You can update repository items with the <update-item> tag. The <update-item> tag encloses one or more <set-property> tags that specify the properties and values being set. Each <update-item> tag must include an `item-descriptor` attribute to specify the name of the item descriptor of the repository item being removed. You can also use the `skip-update` attribute to set properties in the item, but avoid the update item call until the transaction is committed.

For example, the following element changes the value of the `dependents` property of the user with `id` of `1`:

```
<update-item item-descriptor="user" id="1" skip-update="true">
    <set-property name="dependents" value="1414,1732"/>
</update-item>
```

You can use the `add` or `remove` attributes to add or remove values from multi-item properties without overwriting the whole property value. For example, to add another value to the `dependents` property:

```
<update-item item-descriptor="user" id="1" skip-update="true">
    <set-property name="dependents" value="1799" add="true"/>
</update-item>
```

Removing Items

You can remove items from the repository with the <remove-item> (page 180) tag. Each `<remove-item>` tag must include an `item-descriptor` attribute to specify the name of the item descriptor of the repository item being removed.

For example, the following tag removes a repository item that uses the item descriptor `users` and whose repository ID is `1`:

```
<remove-item item-descriptor="users" id="1"/>
```

Removing References to Items

When you remove an item, you generally also need to remove references to the item. The `atg.repository.RepositoryUtils` class includes two methods that are useful in this context.

The `removeReferencesToItem` method removes any references to a given item from other items in its repository. This method can only remove references in queryable properties. You can invoke the `removeReferencesToItem` method by setting `remove-references-to="true"` in a <remove-item> (page 180) tag.

The changes to the data caused by the `removeReferencesToItem` method depend on the reference type. For example, you might delete an item of type X, where type Y references X. Item descriptor Y might reference item descriptor X in three ways:

If Y references X in this way…	Delete the reference to X as follows…
Y has a non-required property whose item-type is X	Set the reference property to null and update item of type Y, essentially nullifying the foreign key.
Y has a required property whose item-type is X	Delete the item of type Y, because the foreign key cannot be set to null.
Y has a multi-valued property whose component-item-type is X	Remove the element in the multi-valued property in Y that refers to the item of type X. This deletes the one-to-many or many-to-many row that represents the Y to X reference. The item of type Y is not deleted.

Data in an auxiliary table is always deleted by a `<remove-item>` tag regardless of the `remove-references-to` attribute because it is not considered a reference.

The `anyReferencesToItem` method queries whether any cross-references to a repository item exist within the repository that contains that item. It uses the same logic as the `removeReferencesToItem` method to

determine whether references exist. The `anyReferencesToItem` method can only detect references through queryable properties.

Calling these methods generates multiple repository queries per call, one for each property descriptor that might refer to the item. For example, if the item's type is `contact-info`, one query is performed for each property descriptor whose type is `contact-info`, or any multi-valued type that might contain a list of items of type `contact-info`. The queries each fetch at most one item from the repository, so the effect on the repository's cache should be minimal.

Querying Items

You can perform queries against the repository through the `<query-items>` tag. The query itself may be specified as a query attribute of the `<query-items>` tag or as PCDATA between the opening and closing tags. The query uses the Repository Query Language (RQL) described in the Repository Query Language (page 18) section of the *Repository Queries* (page 13) chapter.

For example, the following tag queries the database for any repository items whose item descriptor is named `users` and whose `username` property is `Marty`:

```
<query-items item-descriptor="users">username="Marty"</query-items>
```

Queries can be used in this way to preload repository caches. See Preloading Caches (page 130) in the *SQL Repository Caching* (page 103) chapter.

Importing and Exporting Items and DDLs

Some operations tags let you import items from another repository or export items. You can also print out the DDLs used in setting up the tables corresponding to the repository template. See the descriptions of the following tags in the SQL Repository Definition Tag Reference (page 161):

- <remove-all-items> (page 181)
- <export-items> (page 184)
- <import-items> (page 183)
- <print-ddl> (page 186)

You can also use the startSQLRepository (page 151) script to export, import, and print repository items, as described in the next section.

startSQLRepository

You can use the utility program `startSQLRepository` in order to read a repository definition from an XML file or DOM. `startSQLRepository` can perform these tasks:

- Verify the XML is correctly formed and complies with the DTD.
- Parse and process optional operation tags like <add-item>, <remove-item>, and <query-items>. These tags provide a means for adding, removing, updating items in your SQL repository.
- Generate SQL statements that are required to create the appropriate database table structure when you use the –outputSQL flag.
- Return results of <query-items> and <print-item> requests in the form of <add-item> tags. This lets you easily copy and paste the results into another XML template, so you can add the items to another repository.
- Import and export items and item descriptors.

Note: When running startSQLRepository on a third-party application server, you must configure the server to use an Oracle ATG Web Commerce data source and transaction manager, not your native application server's data source and transaction manager.

Requirements

The following requirements apply if the template contains <table> tags:

- The database accessed by your repository is running.
- The database contains the appropriate tables.
- You have appropriate database access to perform import and create database operations.

The following requirements apply to ensure that the import operation reserves all the IDs it encounters for the repository items that it creates in the target database.

- Repository IDs in the source repository do not collide with repository IDs in the target repository.
- The source and target databases contain IdSpaces, where IdSpaces in both share the same name.
- The name of the IdSpaces used by each item descriptor is the same in the source and target repositories for export and import operations, respectively.

for more information about IdSpaces, see the *Core Dynamo Services* chapter of the *Platform Programming Guide* .

Syntax

startSQLRepository uses the following syntax:

```
startSQLRepository arguments xml-file[ ...]
```

You can supply multiple XML files to startSQLRepository, and it processes them in the order specified. For example, you can pass your full repository definition file together with a test file that uses the test operation tags to manipulate repository items, as shown in SQL Repository Test Example (page 157).

The following example loads an XML template whose configuration path name is /atg/test.xml in a repository with a Nucleus address of /atg/userprofiling/ProfileAdapterRepository:

```
startSQLRepository -m DPS
–repository /atg/userprofiling/ProfileAdapterRepository /atg/test.xml
```

The XML template file name is located in the application's configuration path. For example, you can reference a file in the localconfig directory as */file-name*. You can also use a file with the same name as your

repository's existing definition file and omit the file name argument from the `startSQLRepository` command. The `startSQLRepository` script uses XML file combination to combine all files with the same name into a single repository definition. See the *Nucleus: Organizing JavaBean Components* chapter of the *Platform Programming Guide*.

For example, you can use `startSQLRepository` to print all profiles in the Profile repository by including the following file in:

```
<ATG11dir>/home/localconfig/atg/userprofiling/userProfile.xml
```

```
<gsa-template>
  <print-item item-descriptor="user"/>
</gsa-template>
```

You can use the `startSQLRepository` script together with the test operation tags described earlier in this chapter to quickly test a query, or add, update, remove, or print an item.

General Arguments

The `startSQLRepository` scripts take the following arguments:

Argument	Purpose
`-m` *`startup-module`*	Lists a module to load which contains the target repositories. Supply multiple `–m` options in order to start more than one module. For example: startSQLRepository -m moduleA -m moduleB This argument must precede all others, including `-import`.
`-s` *`server-name`*	The Oracle ATG Web Commerce instance on which to run this script. Use this argument when you have multiple servers running on your machine. This argument must precede all others except `-m`.

`-database` *`vendor`*	Customizes the DDL for the SQL variant used by the specified vendor's database software, where *`vendor`* can be one of the following values:
	
	`db2`
	`microsoft`
	`oracle`

`-debug`	Outputs additional logging information. This option is equivalent to setting the `loggingDebug` property to `true` for the repository.
`-encoding` *`encoding`*	If the content you are exporting contains non-ASCII characters, use this option to specify an encoding such as 8859_1 or SJIS in which to save your content.

Argument	Purpose
`-export "item-type[,...]" file`	Exports items of one or more item descriptors to an XML repository definition file, where *`file`* is relative to the `<ATG11dir>/home` directory.
`-export all file`	Exports all items of all item descriptors in this repository to a file, where *`file`* is relative to the `<ATG11dir>/home` directory.
`-exportRepositories repository-path[,...] file`	To export data from more than one repository into the same file, use this option. This might be preferable to the `-export` option if repositories are linked, as it prevents duplicating linked item descriptors in multiple files.
`-exportRepositories all file`	Exports all repositories to one file, where *`file`* is relative to the `<ATG11dir>/home` directory.
`-import input-file`	The XML file or DOM that contains the repository definition to import into the target repository, where input-file is a file created from running `startSQLRepository` with `-export` or `-export all`. The path of *`input-file`* can be absolute or relative to the current directory.
`-noTransaction`	If you use this argument, this operation is not wrapped in a transaction. Using a transaction for large operations can run into database limitations on transaction sizes and numbers of permitted row-level locks.
`-output file`	Sends all output from `<print-item>` and `<query-item>` tags to the specified file, instead of standard output.
`-outputSQL`	Outputs a DDL (SQL) file for the XML templates in the repository to standard output.
`-outputSQLFile file`	Outputs a DDL (SQL) file for the XML templates in the repository to the specified file.
`-repository path`	The Nucleus path of the repository. For example: `-repository /atg/dynamo/service/jdbc/SQLRepository` If you run `startSQLRepository` with the DPS module or a module that requires the DPS module, you can omit this argument, and the script uses the first repository registered in the component `/atg/registry/ContentRepositories`. If you use `startSQLRepository` to import assets into a versioned repository, this argument is required the input file specifies the target repository with `add-item` and `update-item` tags.

Argument	Purpose
`-skipReferences`	By default, when you use one of the export arguments, all referenced item descriptors are automatically added to the list of item descriptors to be exported. If you use the `-skipReferences` argument, referenced item descriptors are added only if you affirmatively include them.
`-verboseSQL`	Outputs additional logging information, equivalent to setting `loggingSQLInfo` and `loggingSQLDebug` properties to `true` for the repository's `JTDataSource`. All SQL emitted is logged.

Exporting Repository Data

You can use `startSQLRepository` to export data from a database to an XML file, which you can later import to another database.

You can export all repositories, or individual repositories from the specified modules. In both cases, first make sure the source database is running.

Exporting all repositories

To export the data from all SQL repositories registered in the `/atg/registry/ContentRepositories` component, use the following syntax:

```
bin/startSQLRepository -m module -exportRepositories all output-file
```

The location of the resulting file is relative to the `<ATG11dir>/home` directory.

Exporting individual repositories

To export the data from individual SQL repositories, use the following syntax:

```
bin/startSQLRepository -m module -export all output-file
-repository repository-path
```

For example, the following command exports the Product Catalog from a Pioneer Cycling store database to `products.xml`:

```
bin/startSQLRepository -m PioneerCycling -export all products.xml
-repository /atg/commerce/catalog/ProductCatalog
```

Note: when binary data in repository items is exported, it is represented in base64 encoding.

Importing Repository Data

After you use `startSQLRepository` to export repository data to an XML file, you can use the XML file to transfer this data to another database:

1. Add a JDBC driver for your database and configure the JDBC connection pool. For more information, see the *Installation and Configuration Guide*.

2. Run `startSQLRepository` to import the contents of the XML file to the destination database with the following syntax:

```
startSQLRepository -m module -import input-file
-repository repository-path
```

3. For example, given the earlier example, you can import the content from the Pioneer Cycling `products.xml` file as follows:

```
startSQLRepository -m PioneerCycling -import products.xml
-repository /atg/commerce/catalog/ProductCatalog
```

Importing to a Versioned Repository

You can use `startSQLRepository` to import repository data into versioned repositories. Before you run this script, format the repository data in an XML file that adheres to the SQL repository definition file syntax.

Note: When running `startSQLRepository` on a third-party application server, configure the server to use an Oracle ATG Web Commerce data source and transaction manager, not your native application server's data source and transaction manager.

Use the following syntax in order to import repository assets to a versioned repository:

```
startSQLRepository [-m startup-module]... [-s server-name]
-import input-file -repository path
{project-spec | workspace-spec} -comment
[arguments]
```

Importing to a project or workspace

The import operation must be directed to a project or to a workspace, as follows:

- `-project name [-workflow name] –user username –comment text`
- `-workspace name –comment text`

Note: After deployment targets are initialized, use `–project` with `startSQLRepository` instead of `-workspace`. When `–project` is used, assets are imported into a new project with the default or specified workflow. Users can then access this project and perform the tasks associated with its workflow.

Versioning arguments

The following arguments are specific to the versioning system.

Argument	Description

`-project` *name*
`[ -workflow` *name*`]`
`[ -activity` *name*`]`
	The name of the project to create and use for the import. After running `startSQLRepository` with this argument, the imported assets must be checked in manually through the Oracle ATG Web Commerce Business Control Center. This option is available only if the Publishing module is running.
	
	You must specify this option or `-workspace`.
	
	Qualifiers:
	
	If qualified by the `workflow` option, the project uses the named workflow; otherwise, it uses the common workflow:
	
	`/Common/commonWorkflow.wdl`
	
	If qualified by the `–activity` option, the project opens in the named application; otherwise, it opens as a Content Administration project. The following arguments are supported for `–activity`:
	
	`-merchandising.manageCommerceAssets`: Creates a Merchandising project.
	
	`-personalization.editSegmentsAndTargeters`: Creates a Personalization project.

`-workspace` *name*	Specifies the workspace to use during the import operation, where *name* is a user-defined string with no embedded spaces and is unique among all workspace names. Use `-workspace` only during the initial import to the target repository, before you initialize any target sites. The workspace is the area in the VersionManager where the import takes place. If the specified workspace does not exist, the system creates it. Importing into a workspace requires you to supply a check in comment through `-comment`. You must specify this option or `-project`.
`-user` *username*	The user who performs the import. If a secured repository is accessed for the import, this user's authorization is checked. This argument is required when the `project` argument is supplied, so the user can be identified as the project creator.
`-comment` *text*	Comment to use for each item when checking in imported data. This comment is stored in each item's version history. It should not contain spaces.

SQL Repository Test Example

The following is a simple example of how you can create a test repository definition file that defines item descriptors and also uses `<add-item>`, `<remove-item>`, and `<query-items>` tags to manipulate repository items.

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>

<!--
This is a simple xml template demonstrating add-item, remove-item, and query-items
 tags.
-->

<!DOCTYPE gsa-template SYSTEM "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">

<gsa-template>

  <header>
    <name>Test 1</name>
    <author>Marty</author>
    <version>1</version>
  </header>

<!-- This defines the item-descriptor -->
  <item-descriptor name="users" default="true">
       <table name="users" id-column-names="id" type="primary">
         <property name="prop1"/>
       </table>
  </item-descriptor>

<!-- This removes from the database any of 'users' with id = 1 -->
  <remove-item item-descriptor="users" id="1"/>

<!-- This adds to the database an instance of 'users' with id = 1 -->
  <add-item item-descriptor="users" id="1">
        <set-property name="prop1" value="Marty"/>
  </add-item>

<!-- This queries the database for any of 'users' with prop1 = "Marty" -->
  <query-items item-descriptor="users">
        prop1="Marty"
  </query-items>


</gsa-template>
```

Using Operation Tags in the Repository Administration Interface

You can also use the operation tags described in this section in the Component Browser of the HTML Administration Interface. Open the HTML Component Browser page for a Repository component. For example, there is an SQL Repository component with a Component Browser URL of:

`http://hostname:port/nucleus/atg/dynamo/service/jdbc/SQLRepository`

In this URL, *`hostname`* represents the name of the machine that runs your application server and *`port`* represents the port number that your application server uses to listen for HTTP requests. To find your default port, see the *Installation and Configuration Guide*.

In the text field, you can enter any XML operations tags against the current repository as if they were commands. Click Enter, and the page displays the output obtained by running the `startSQLRepository` script against the repository.

Debug Levels

The SQL Repository component has a `debugLevel` property you can use to adjust the debug log entries. This property is an integer from 0 to 15, with 15 resulting in the greatest frequency of debug log entries.

The default level is 5; this typically is the level desired when contacting Oracle ATG Web Commerce support to diagnose problems. Level 5 is the lowest level at which SQL debugging statements are issued.

If `loggingDebug` is set to true on the SQL Repository component, the debug level must be equal to or greater than 6 in order to set loggingDebug of the transaction manager also to true, as Transaction Manager debugging is often needed in conjunction with SQL debugging. Even at level 0, some debug statements are issued.

You can also get debugging messages for an individual item descriptor or property. Turn on logging debug in the Dynamo Administration Interface page for the Repository component.

You can also turn on debug messages by including a `loggingDebug` attribute tag in the repository definition for that item descriptor or property. For example:

```
<item-descriptor name="user" ...>
<attribute name="loggingDebug" value="true" />
...<property ... />
</item-descriptor>
```

Modifying a Repository Definition

In the course of developing your site or after your site has gone live, you may want to modify your repository schema, adding or removing repository item properties or item descriptors, or altering your database schema. Modifying the repository schema is much like setting it up to begin with:

1. Modify your database, running the appropriate DDLs to make any necessary changes.
2. Edit your repository definition file.
3. Restart your Oracle ATG Web Commerce application.

13 SQL Repository Reference

This chapter includes reference information about the SQL repository:

- SQL Repository Definition Tag Reference (page 161)
- DTD for SQL Repository Definition Files (page 186)
- Sample SQL Repository Definition Files (page 192)
- Configuring the SQL Repository Component (page 203)

SQL Repository Definition Tag Reference

This section describes `gsa-template` elements as they are defined in `gsa_1.0.dtd`. The complete DTD for SQL Repository Definition Files (page 186) can be found later in this chapter.

A number of tags can be grouped into two categories, and are discussed in detail elsewhere in this guide:

- Named Query Tags (page 161)
- Development Operation Tags (page 161)

Named Query Tags

The following tags are used to define named queries:

<named-query> (page 177)
<rql-query> (page 177)
<rql> (page 177)
<sql-query> (page 177)
<sql> (page 177)
<input-parameter-types> (page 178)
<returns> (page 178)
<dependencies> (page 178)

For more information, see Named Queries (page 87) in the *SQL Repository Queries* (page 81) chapter.

Development Operation Tags

The following tags are used primarily during development, testing, and debugging a repository; they are not typically used in production environments:

<transaction> (page 178)
<rollback-transaction> (page 179)
<add-item> (page 179)
<update-item> (page 180)
<remove-item> (page 180)
<remove-all-items> (page 181)
<query-items> (page 181)
<print-item> (page 182)
<set-property> (page 183)
<import-items> (page 183)
<export-items> (page 184)
<load-items> (page 184)
<dump-caches> (page 185)
<print-ddl> (page 186)

For more information, see the *Developing and Testing an SQL Repository* (page 147) chapter.

<!DOCTYTPE>

All SQL repository templates start with a DOCTYPE declaration that references this document type definition (DTD) file:

`gsa_1.0.dtd`

This DTD is installed within the `<ATG11dir>/DAS/lib/classes.jar` archive, but can be referenced with this URL:

`http://www.atg.com/dtds/gsa/gsa_1.0.dtd`

For example:

```
<!DOCTYPE gsa-template
     PUBLIC "-//Art Technology Group, Inc.//DTD General SQL Adapter//EN"
     "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">
```

If your SQL repository definition is comprised of multiple files through XML file combination, include the DOCTYPE declaration only in the file that is first in the application's configuration path. For more information about XML file combination, see the *Platform Programming Guide*.

<gsa-template>

```
<!ELEMENT gsa-template (<header> (page 162)?,
     (<item-descriptor> (page 163) | <add-item> (page 179) | <update-item> (page 180)
 | <print-item> (page 182) | <remove-item> (page 180) |
     <transaction> (page 178) | development-line | <query-items> (page 181) | <remove-
all-items> (page 181) |
     <export-items> (page 184) | <import-items> (page 183) | <print-ddl> (page 186)
 | <dump-caches> (page 185) | <load-items> (page 184))*)>
```

The <gsa-template> tag is the top-level tag in a repository definition file.

<header>

```
<!ELEMENT header (name?, author*, version?, description?)>
```

Parent: <gsa-template> (page 162)

The <header> tag provides information that can help you manage the creation and modification of repository definition files.

For example:

```
<header>
  <name>Catalog Template</name>
  <author>Herman Melville</author>
  <author>Emily Dickinson</author>
  <version>$Id: catalog.xml,v 1.10 2000/12/24 03:34:26 hm Exp $</version>
  <description>Template for the store catalog</description>
</header>
```

<item-descriptor>

```
<!ELEMENT item-descriptor ((<property> (page 168) | <table> (page 175)
 | <attribute> (page 174) | <named-query> (page 177))*,
                          <rql-filter> (page 82)?,
                          (<property> (page 168) | <table> (page 175)
 | <attribute> (page 174) | <named-query> (page 177))*)>
```

Parent: <gsa-template> (page 162)

The SQL repository template contains one <item-descriptor> tag for each set of repository items that share the same attributes.

The following sections describe <item-descriptor> attributes:

- General Attributes (page 163)
- Content Item Attributes (page 167)

General Attributes

Attribute	Description
name	The name of this item descriptor, unique within the repository (required). This property is case-insensitive—for example, you cannot set the name property for two item descriptors in the same repository to gender and GENDER. To reference an item descriptor by multiple names, set the itemDescriptorAliases property of the Repository component.
cache-locality	Controls whether the Generic SQL Adapter (GSA) will cache this item's data in its own cache, an external distributed cache application or both. See *External SQL Repository Caching* (page 139).

Attribute	Description
cache-mode	The caching mode for this item descriptor, one of the following: disabled simple (default) locked distributed distributedJMS distributedHybrid distributedExternal Caching can also be disabled for individual properties by setting their cache-mode attribute. See the *SQL Repository Caching* (page 103) chapter.
copy-from	The name of the item descriptor whose properties are inherited by this item descriptor. See Item Descriptor Inheritance (page 46).
default	Boolean, specifies whether this is the repository's default item descriptor. The default item descriptor is used for new repository items if no item descriptor is explicitly specified. If no item descriptor is designated as the default, the first item descriptor in the repository definition file is the default. Default: false
description	Optionally describes this item descriptor. Default: value of name
description-resource	If a resource bundle is specified for this property with the tag <attribute name=resourceBundle>, this attribute specifies the resource bundle key to the item descriptor's description. See *Localizing SQL Repository Definitions* (page 99).
display-name	The name of the item descriptor as displayed in the ATG Control Center interface. If no display-name is specified, the name attribute is used.
display-name-resource	If a resource bundle is specified for this property with the tag <attribute name=resourceBundle>, this attribute specifies the resource bundle key to the item descriptor's display name. See *Localizing SQL Repository Definitions* (page 99).
display-property	Specifies a property of this item descriptor that is used to represent items of this type in a user interface. For example, a profile item descriptor might set display-property to login. Then, each repository item is represented using the value of the item's login property.
expert	Boolean, where true specifies to display this item descriptor only to expert users. Default: false

Attribute	Description
`hidden`	Boolean, where `true` suppresses display of this item types in the ATG Control Center. Default: false
`id-separator`	A character used to separate elements of a multi-column repository ID when the ID is string encoded. Default: colon (`:`)
`id-space-names`	The name of the ID space to use for this item descriptor. The default settings are as follows: - Item descriptor with a single-column repository ID: Item descriptor name. - Item descriptor with a multi-column repository ID: The name of the primary table and the names of the ID column in that table. For more information about ID space names and how they affect the IDs of newly generated items, see IdSpaces and the id Property (page 37) earlier in this manual; and the *Platform Programming Guide*, the *Core Dynamo Services* chapter.
`item-cache-size`	The maximum number of items of this item descriptor that the item cache can store. When the number of items requested exceeds this number, the least recently accessed item is removed from the cache. See the *SQL Repository Caching* (page 103) chapter. Default: `1000`
`item-cache-timeout`	The time in milliseconds that an item cache entry can remain unused before its content becomes stale. After turning stale, the item cache entry is reloaded from the database the next time it is accessed. See Cache Timeout (page 126) for more information. Default: 0 (items remain in the cache indefinitely until otherwise invalidated) **Note**: cache time out settings do not affect external distributed caching applications. If you use external caching, configure your external caching application to time out cached data. See *External SQL Repository Caching* (page 139).

Attribute	Description
`item-expire-timeout`	The maximum time in milliseconds that an entry can remain in the item cache before it is refreshed. See Cache Timeout (page 126) for more information. Default: `0` (items remain in the cache indefinitely until otherwise invalidated) **Note**: cache time out settings do not affect external distributed caching applications. If you use external caching, configure your external caching application to time out cached data. See *External SQL Repository Caching* (page 139).
`query-cache-size`	The maximum number of queries of this item descriptor to store in the query cache. When the number of queries issued against this item descriptor exceeds this number, the least recently used query is removed from the cache. See the *SQL Repository Caching* (page 103) chapter. Default: `0` (disables the query cache)
`query-expire-timeout`	The maximum time in milliseconds that an entry can remain in the query cache before it is refreshed. See Cache Timeout (page 126) for more information. Default: `0` (items remain in the cache indefinitely until otherwise invalidated)
`sub-type-property`	The name of a property in this item descriptor that specifies the names of its child item descriptors. See Item Descriptor Inheritance (page 46).
`sub-type-value`	Set to a value that is defined in the parent item descriptor's `sub-type-property`, which enables inheritance from that parent. See Item Descriptor Inheritance (page 46).
`super-type`	The name of this item descriptor's parent. See Item Descriptor Inheritance (page 46).
`text-search-properties`	A comma-separated list of properties to search if a text search query does not explicitly specify any properties. See Text Search Queries (page 92) in the *SQL Repository Queries* (page 81) chapter.
`versionable`	Used only in versioned repositories, specifies whether items of this type should be versioned. Use this attribute to override the setting in the repository property `versionItemsByDefault`. For more information about this attribute, and versioned repositories in general, see the *Content Administration Programming Guide*.
`version-property`	A integer property whose value is used as a version control mechanism for items of this type. The value in `version-property` is incremented each time the item is updated.
`Xml:id`	Typically used for XML file combination, where elements with the same ID are regarded as the same element.

Content Item Attributes

The following <item-descriptor> attributes are used in content repositories. A content repository includes one item descriptor that manages the folder hierarchy, and one or more item descriptors that define content items. A content item has a property that specifies the item's folder parent, and a property that is used to store or reference the content data itself. The content data property is usually a java.io.File, String or a byte[] data type. Items in the content item descriptor implement the ContentRepositoryItem interface. Items in the folder item descriptor implement the FolderItem interface, as well as the MutableRepositoryItem interface. For more detail, see the *SQL Content Repositories* (page 213) chapter.

Attribute	Description
content	Boolean, specifies whether items of this type are content items. If set to true, settings are also required for the following attributes: -folder-id-property - content-property - One or more of: content-name-property, content-path-property, and use-id-for-path Default: false
content-checksum-property	Specifies a numeric property in this item descriptor that holds the checksum for a content item descriptor. For example, the PublishingFileRepository automatically updates this property when an item's content property changes.
content-length-property	A property in this item descriptor that contains the number of bytes in the content. This property is used by the method ContentRepositoryItem.getContentLength().
content-name-property	A property in this item descriptor that defines the name of this content item or folder item in the folder hierarchy. Unlike content-path-property, the value of this attribute should not include any path separator characters or the names of any parent folders.
content-path-property	A property in this item descriptor that defines the absolute path name of this item in the folder hierarchy. The setting in content-path-property should include a leading path separator character.
content-property	Required if content is set to true, the property that contains the content of the content items. The data type of the specified property must be one of the following: - File - byte[] - String Content items of type String or byte[] store their data in the database; content items of type File store their data in the file system with the FilePropertyDescriptor.

Attribute	Description
folder	Boolean, specifies whether items of this type are folder items. Only one item descriptor in a repository can set this property to true. If set to true, settings are also required for the following attributes: - folder-id-property - content-property - One or more of: content-name-property, content-path-property, and use-id-for-path Default: false
folder-id-property	A property in this item descriptor that specifies the ID of the folder containing this folder or content item. This property must be set for all item descriptors of content and folder items.
last-modified-property	A property in this item descriptor that contains the time when item content was last modified. The property's data type must be date or timestamp. This property is used by the method ContentRepositoryItem.getContentLastModified().
use-id-for-path	Boolean, specifies whether the repository ID for items of this type is the item's relative path name in the folder hierarchy. Use this attribute if the column used to store the content-path-property is the primary key for the table containing the item. Default: false

<property>

```
<!ELEMENT property (<derivation> (page 173)?, (<option> (page 173)
 | <attribute> (page 174))*)>
```

Parent: <item-descriptor> (page 163), <<table> (page 175)>

A <property> tag can be a child of the <item-descriptor> (page 163) tag or a <table> (page 175) tag:

- If a child of an <item-descriptor> (page 163) tag, <property> defines a transient property of the repository item. Because such a transient property is not associated with any database table, it is not stored when the repository item is updated in the database. Transient properties are readable and writable, but are not queryable. See the Transient Properties (page 70) section of this chapter.
- If a child of a <table> (page 175) tag, <property> defines a persistent property in a repository item. A <property> tag that is a direct child of an <item-descriptor> tag defines a transient characteristic of a repository item. Because such a transient property is not associated with any database table, it is not stored when the repository item is updated in the database.

Attributes

Attribute	Description
`name`	The property name (required)

`cache-mode`	The caching mode for this property, one of the following:
	
	`disabled`
	`inherit`
	
	A property's caching mode supersedes the item descriptor's caching mode. To restore the default caching mode, set `cache-mode` to `inherit`. See *SQL Repository Caching* (page 103).

`cascade`	One or more of the following, separated by commas:
	
	`insert`
	`update`
	`delete`
	
	See Cascading Data Relationships (page 43).

`category`	Specifies a category that this property shares with other item properties. Item properties that belong to the same category can be grouped together in a user interface, rather than in alphabetical order according to their `display-name` attributes. See Grouping and Sorting Properties (page 64) in the *SQL Repository Item Properties* (page 59) chapter.
`category-resource`	If a resource bundle is specified for this property with the tag `<attribute name=resourceBundle>`, this attribute specifies the resource bundle key to the property's category. See *Localizing SQL Repository Definitions* (page 99).
`column-names`	The column name or names in the SQL database Default: value of `name`
`component-data type`	If `data-type` is set to an array, list, set or map of primitive values, this attribute specifies the primitive data type. The `data-type` can be any valid value other than `array`, `list`, `set` or `map`. Every element that the property references must be of this data type.
`component-item-type`	The `name` of another item descriptor referenced by this property. If `data-type` is set to `array`, `list`, `set`, or `map`, this attribute specifies the type of items that are referenced. All referenced items must be of the same base type.

Attribute	Description
data-type	Required unless item-type or property-type is set, one of the following: string int byte array big string short binary set enumerated long date list boolean float timestamp map double See Data Type Mappings: Java and SQL (page 172) in this section for information about how these values map to Java and SQL data types.
default	A default value for the property if none is supplied when the repository item is created. A default value cannot be set for multi-valued properties.
description	Optionally describes this property. Default: value of name
description-resource	If a resource bundle is specified for this property with the tag <attribute name=resourceBundle>, this attribute specifies the resource bundle key to the property's description. See *Localizing SQL Repository Definitions* (page 99).
display-name	Optional, used to identify the property in the user interface. Default: value of name
display-name-resource	If a resource bundle is specified for this property with the tag <attribute name=resourceBundle>, this attribute specifies the resource bundle key to the property's display name. See *Localizing SQL Repository Definitions* (page 99).
editor-class	The Java class name of a PropertyEditor to use for this property. See the JavaBeans specification for a description of PropertyEditors.
expert	Boolean Default: false
group	Specifies a group shared with other properties so they can be loaded in the same SELECT statement. The default group name is the table name. You can set the group for a property to add or remove properties from these default groups. This gives you a simple way to optimize the SQL generated by the repository.
hidden	Boolean, if true, suppresses display in the ATG Control Center. Default: false

Attribute	Description
item-type	The name of another <item-descriptor>. If the value of this property is another repository item, specifies the item descriptor type of that repository item. Required if the data-type or property-type attribute is not specified.
property-type	The Java class of a user-defined property. See User-Defined Property Types (page 73). Do not use this attribute for id properties.
queryable	Boolean, can be true for transient properties only if the entire item descriptor is also transient. See Transient Properties (page 70) in this chapter. Default: true
readable	Boolean Default: true
repository	The Nucleus address of another repository, specifies that this property's value refers to one or more repository items in the specified repository. If you specify a relative path, it is relative to this repository. See Linking between Repositories (page 72).
required	Boolean, must be set to true if the corresponding database column is defined as NOT NULL. Default: false
sql-type	The SQL type of the corresponding column if it is different from the default type for the data-type, as specified under Data Type Mappings: Java and SQL (page 172).
writable	Boolean Default: true
Xml:id	Typically used for XML file combination, where elements with the same ID are regarded as the same element.

Data Type Settings

The data-type attribute in a <property> tag defines the data type of a repository item property. A data type can be a primitive type or refer to an item descriptor type. If you want to define a property that refers to another item, use the item-type attribute to refer to that item's item descriptor.

For multi-valued types, set data-type to array, list, set, or map. If the elements referenced by this property are primitives or user-defined property types, set their data type with the component-data-type attribute. Note that the SQL repository does not support multi-valued properties that reference binary type elements. If a multi-valued property references repository items, specify their item type with the property's component-

item-type attribute. For user-defined properties, use the property-type attribute to specify the Java class of the property's type.

Data Type Mappings: Java and SQL

The following table shows how the data-type attribute names for the primitive types correspond to Java object types and SQL data types. Some SQL data types vary according to your SQL implementation. You can explicitly specify a SQL data type mapping by setting the sql-type attribute.

data-type value	Java object type	Recommended SQL data type
array	xxx[]	none
big string	String	LONG VARCHAR, CLOB TEXT (MS)
binary	byte[]	BINARY, VARBINARY, IMAGE (MS) LONG RAW, BLOB (Oracle) BLOB (DB2)
boolean	Boolean	NUMERIC(1) TINYINT (MS)
byte	Byte	INTEGER
date	java.util.Date	DATETIME (MS) DATE (DB2, Oracle)
double	Double	DOUBLE (DB2, MS) NUMBER (Oracle)
enumerated	String	INTEGER
float	Float	FLOAT (DB2, MS) NUMBER (Oracle)
int	Integer	INTEGER
list	java.util.List	none
long	Long	NUMERIC(19) BIGINT (DB2, MS)
map	java.util.Map	none
set	java.util.Set	none
short	Short	INTEGER SMALLINT (DB2, MS)
string	String	VARCHAR VARCHAR, CLOB (Oracle)

data-type value	Java object type	Recommended SQL data type
`timestamp`	`java.sql.Timestamp`	`DATETIME` (MS) `DATE` (Oracle 8i) `TIMESTAMP` (DB2, Oracle 9i)

CLOB and BLOB constraints

If you plan to use BLOBs (Binary Large Objects) or CLOBs (Character Large Objects), be sure that your database and JDBC driver work with the data and queries you plan to use. Comparison queries (=, `!=`, <, <=, >, >=) do not work with BLOBs or CLOBs. Also, Oracle versions before 9.2 do not support pattern-match queries (`CONTAINS`, `STARTS_WITH`, `ENDS_WITH`) against CLOBs.

<derivation>

```
<!ELEMENT derivation (<expression> (page 176)*)>
```

Parent: <property> (page 168)

The `<derivation>` tag is used for derived properties. For detailed information on usage, see Derived Properties (page 50) in the *SQL Repository Data Models* (page 35) chapter.

Attributes

Attribute	Description

`method`	The derivation method to use for the derivation logic, set to one of the following:
	
	`firstNonNull`
	`firstWithAttribute`
	`firstWithLocale`
	`alias`
	`union`
	`collectiveUnion`
	
	Default: `firstNonNull`

`user-method`	A user-defined derivation method to use.
`override-property`	The name of a property that, when set explicitly, overrides the derived property value that is otherwise used.

<option>

```
<!ELEMENT option EMPTY>
```

Parent: <property> (page 168)

If a property's `data-type` property is set to `enumerated`, use `<option>` tags to indicate the possible values of the enumerated properties. For example:

```
<property name="gender" data-type="enumerated">
      <option value="male" code="0"/>
      <option value="female" code="1"/>
</property>
```

Attributes

Attribute	Description
`value`	The value of the enumerated option.
`code`	The integer code that represents the enumerated option in the database. If no code is specified, an appropriate code is generated by the SQL repository. The value of the `code` attribute is a sequential integer, with the first option beginning at `0`.
`resource`	If a resource bundle is specified for this property with the tag `<attribute name=resourceBundle>`, this attribute specifies the resource bundle key to the property option's the string value. See *Localizing SQL Repository Definitions* (page 99).
`xml:id`	Typically used for XML file combination, where elements with the same ID are regarded as the same element.

<attribute>

```
<!ELEMENT attribute EMPTY>
```

Parent: <item-descriptor> (page 163), <property> (page 168), <table> (page 175)

A Java Beans `PropertyDescriptor` can store an arbitrary set of name/value pairs called *feature descriptor attributes*. You can use the `<attribute>` tag in the SQL repository as a child of a `<property>` or an `<item-descriptor>` tag to supply parameters that affect the behavior of properties or item types in your repository definition.

The `<attribute>` tag is an empty tag that defines the parent's feature descriptor value or values. This tag lets you associate arbitrary name/string value pairs with any property or item type. The name/value pairs are added to the property descriptor via the `setValue` method of `java.beans.FeatureDescriptor`, and can later be used by the application. For example:

```
<property name="employeeNumber" data-type="string">
  <attribute name="PCCExpert" value="true" data-type="boolean"/>
</property>
```

See User-Defined Property Types (page 73) for more information.

You can refer to values of Nucleus components with the bean attribute of the <attribute> tag. For example:

```
<attribute name="documentRootPath"
 bean="/atg/demo/QuincyFunds/repositories/FeaturesDataStore.relativePathPrefix" />
```

Attribute tags must be empty and have no child tags.

Attributes

Attribute	Description
name	The name of the name/value pair. You can specify any name here and it is added to the list of feature descriptor attributes for your property.
value	The value of the name/value pair. The data type of this value is defined by the data-type attribute supplied to this tag. If no data-type attribute is provided, the value of the attribute is a string.
data-type	The primitive data-type of the value, one of the following: string* int byte short date long timestamp float double *default
bean	The name of a Nucleus component or property that is the value of the attribute. If a relative address is specified, the address is relative to the Repository component. See the Assigning FeatureDescriptorValues with the <attribute> Tag (page 70) section in this chapter.
Xml:id	Typically used for XML file combination, where elements with the same ID are regarded as the same element.

<table>

```
<!ELEMENT table (<property> (page 168) | <attribute> (page 174))*>
```

Parent: <item-descriptor> (page 163)

The <table> tag specifies an SQL database table that store properties of repository items defined by this item descriptor.

Attribute	Description
name	The table's database name.

Attribute	Description
`id-column-names`	The name or names of the database columns that correspond to the repository ID.
`multi-column-name`	For multi-valued properties of type `array`, `list` or `map`, specifies which column to use to sort `array` or `list` elements, or `map` keys.

`type`	The table's type, one of the following:
	
	`primary`
	`auxiliary` (default)
	`multi`

`shared-table-sequence`	Typically used only in versioned repositories, this attribute is set to an integer between 1-9, which specifies the relationship of this table to other tables in a many-to-many relationship. In a two-sided many-to-many relationship, the table with the 'second' side should set this attribute to 2; the table with the 'first' side should set this attribute to 1. In a versioned repository, set this attribute to `1` for the table that contains the `asset_version` column; set it to `2` for the table that contains the `sec_asset_version` table. Default: `1`
`Xml:id`	Typically used for XML file combination, where elements with the same ID are regarded as the same element.

<expression>

```
<!ELEMENT derivation (expression*)>
```

Parent: <derivation> (page 173)

The <expression> tag encloses a repository item property name. One or more <expression> tags provide the sources of a derived property.

For detailed information on usage, see Derived Properties (page 50) in the *SQL Repository Data Models* (page 35) chapter.

<rql-filter>

```
<!ELEMENT rql-filter (<rql> (page 177),<param> (page 177)*)>
```

Parent: <item-descriptor> (page 163)

The <rql-filter> tag can be used to define a filter for database read operations. The <rql-filter> tag encloses a Repository Query Language (RQL) string that defines the filter query. See the Repository Filtering (page 81) section in this chapter.

<named-query>

```
<!ELEMENT <named-query> (page 177) (<rql-query> (page 177) | <sql-query> (page 177))>
```

Parent: <item-descriptor> (page 163)

<rql-query>

```
<!ELEMENT rql-filter (<rql> (page 177),<param> (page 177)*)>
```

Parent: <named-query> (page 177)

<rql>

```
<!ELEMENT rql (#PCDATA)>
```

Parent: <rql-query> (page 177), <rql-filter> (page 82)

<param>

```
<!ELEMENT param EMPTY>
```

Parent: <rql-query> (page 177), <rql-filter> (page 82)

<sql-query>

```
<!ELEMENT sql-query (query-name, <sql> (page 177), <returns> (page 178)?,<input-
parameter-types> (page 178)?,
          <dependencies> (page 178)?)>
```

Parent: <named-query> (page 177)

This element defines a specific SQL statement to be used in the named query.

<sql>

```
<!ELEMENT sql (#PCDATA)>
```

Parent: <sql-query> (page 177)

The body of this tag specifies the SQL string to be used in the named query.

For stored procedures, use the appropriate stored procedure invocation syntax along with the `stored-procedure` attribute in the `<sql>` tag:

```
<sql stored-procedure="true">
```

<input-parameter-types>

```
<!ELEMENT input-parameter-types (#PCDATA)>
```

Parent: <sql-query> (page 177)

The `<input-parameter-types>` element is a comma-separated list of class names that any parameters in the query must be an instance of. There must be as many class names as parameters.

<returns>

```
<!ELEMENT returns (#PCDATA)>
```

Parent: <sql-query> (page 177)

The body of this optional tag specifies a comma-separated list of Repository property names that are returned by this query.

<dependencies>

```
<!ELEMENT dependencies (#PCDATA)>
```

Parent: <sql-query> (page 177)

If any properties specified by the body of the `<dependencies>` tag are changed, this query is flushed from the query cache.

<transaction>

```
<!ELEMENT transaction (<add-item> (page 179) | <update-item> (page 180) | <print-
item> (page 182) | <remove-item> (page 180) |
                      <transaction> (page 178) | <query-items> (page 181) | <remove-
all-items> (page 181) |
                      <export-items> (page 184) | <load-items> (page 184) | <rollback-
transaction> (page 179))*>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

You can use a `<transaction>` tag to group a set of test operation tags. A `<transaction>` tag takes no attributes. If a `<transaction>` tag appears inside of another transaction, the outer transaction is suspended while the inner transaction executes, and resumes when it ends.

<add-item> (page 179) tags in this element are processed one at a time. They cannot make forward references to other items and no attempt is made to satisfy database integrity constraints (beyond that automatically done with the cascade operator). Use the <import-items> (page 183) tag to load items with forward references.

By default, all test operation tags are enclosed in a single transaction . But to avoid database deadlocks, you should place all test operation tags inside `<transaction>` tags . For example, given this pattern:

```
<add-item item-descriptor="foo" id="1"/>

<transaction>
  <print-item item-descriptor="foo" id="1"/>
</transaction>
```

the <print-item> (page 182) tag cannot find item 1 because that item is not yet committed. Also, you can run into deadlocks with this pattern if you try to access or modify items that may be locked by operations in the outer tag. Instead, use a pattern like this:

```
<transaction>
  <add-item item-descriptor="foo" id="1"/>
</transaction>
<transaction>
  <print-item item-descriptor="foo" id="1"/>
</transaction>
```

<rollback-transaction>

```
<!ELEMENT rollback-transaction EMPTY>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

The `<rollback-transaction>` tag is used only in the `<transaction>` test operation tag, to mark the transaction as rollback only. It must be empty and has no child tags or attributes.

<add-item>

```
<!ELEMENT add-item (set-property*)>
```

Parent: <gsa-template> (page 162), <transaction> (page 178), <<import-items> (page 183)>

Attributes

Attribute	Description
`item-descriptor`	The name of the item descriptor to use when adding items to the repository (required)

Attribute	Description
id	The RepositoryId to use for the added item. The value must be unique among all items.
repository	The Nucleus address of the repository where the item is to be added, optional if the item is added to the base repository specified in the startSQLRepository command.
on-commit	Boolean. If set to true, indicates to add the item only after the transaction is committed.
skip-add	Boolean. If set to true, indicates not to add the item when the transaction is committed. Use this attribute to create transient items.
tag	Use this to add a new item with a guaranteed unique RepositoryId . You can refer to this item with this tag attribute in print-item and update-item tags within the same XML file. This is useful for writing test scripts that are run over and over again on the same database, each time operating on different items.

<update-item>

```
<!ELEMENT update-item (set-property*)>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

See Updating Items (page 149) in the chapter *Developing and Testing an SQL Repository* (page 147).

Attributes

Attribute	Description
item-descriptor	The name of the item descriptor to use when updating items (required)
id	Specifies a repository ID to use for this item. You must specify id or tag.
tag	If you added your item with an <add-item> tag using the tag attribute, an <update-item> tag in the same XML file can refer to that item with the tag.
skip-update	Boolean. If set to true, specifies to update the item with property changes only when the transaction is committed.. Default: false

<remove-item>

```
<!ELEMENT remove-item EMPTY>
```

The <remove-item> tag is a procedural tag for removing items from the repository.

Parent: <gsa-template> (page 162), <transaction> (page 178)

Attributes

Attribute	Description
item-descriptor	The item descriptor to use when removing an item (required)
id	RepositoryId of the item to remove (required)
tag	If you added your item with an <add-item> tag using the tag attribute, a <remove-item> tag in the same XML file can refer to that item with the tag.
remove-references-to	Boolean. If true, items that reference the item to remove are removed also. Default: false

<remove-all-items>

The <remove-all-items> tag is a procedural tag for removing all items in the repository. This tag is enabled only if the system property atg.allowRemoveAllItems is set on application startup. You can set this property by adding -Datg.allowRemoveAllItems to the JAVA_ARGS in your <ATG11dir>/home/localconfig/environment.bat or environment.sh file

<query-items>

```
<!ELEMENT query-items (#PCDATA)>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

This tag performs queries against the repository. For detailed information, see Querying Items (page 151) in the *Developing and Testing an SQL Repository* (page 147) chapter.

This tag can also be used for loading caches. See Preloading Caches (page 130) in the *SQL Repository Caching* (page 103) chapter.

Attributes

Attribute	Description
item-descriptor	The item descriptor to use when querying items in the repository (required)
query	Contains the RQL query to issue against item-descriptor. You can also specify the query in the tag body.

Attribute	Description
id-only	Boolean. If true, logs only the repository ID of the items returned by the query. Default: false
quiet	Boolean. If true, eliminates log messages for each item returned. Default: false
print-content	Boolean. If true, prints the content property of the repository items returned by the query. Default: false

<print-item>

```
<!ELEMENT print-item EMPTY>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

Attributes

Attribute	Description
item-descriptor	The item descriptor to use when printing an item (required). If you omit the id, tag, and path attributes, all items in this item descriptor are printed.
folder	The path name of the folder to print. When a folder is printed, each of its children is displayed, using the display-property attribute.
id	The ID to use for this item. If you do not set id, tag, or path all items in the descriptor are printed. Optional RepositoryId of item
path	Specifies an item or folder to print. When a folder is printed, each of its children is displayed, with the display-property attribute. Path name of item or folder
tag	If you add your item with an <add-item> tag with the tag attribute, you can refer to that item in the same XML file with the tag attribute in the <print-item> tag.
print-content	Boolean. If set to true, prints the item's entire content and its properties. Default: false

<set-property>

```
<!ELEMENT set-property (#PCDATA)>
```

The `<set-property>` tag is used only in the <add-item> (page 179) and <update-item> (page 180) test operation tags.

Parent: <gsa-template> (page 162), <transaction> (page 178)

Property-setting Syntax

You specify to set properties as follows:

- To set the value of an Array, List, or Set property, use a comma-separated list of values:

  ```
  <set-property name="interests" value="fishing,fussing,wrassling"/>
  ```

- To set the value of a Map property, use a comma-separated list of key=value pairs:

  ```
  <set-property name="homes" value=
  "Jefferson=Monticello,Jackson=Hermitage,Madison=Montpelier"/>
  ```

- To add or remove a value to a multi-valued property, use the Boolean `add` or `remove` attributes. For example, to add a value to the preceding example:

  ```
  <set-property name="homes" value="Buchanan=Wheatland" add="true"/>
  ```

- To set the value of a property that refers to another repository item, use the ID of the other repository item:

  ```
  <set-property name="bestBuddy" value="10022349_5"/>
  ```

- To set a property to null, use this form:

  ```
  <set-property name="foo" value="__NULL__"/>
  ```

Attributes

Attribute	Description
`Name`	The name of the property to set (required)
`Value`	The value to assign to the property (required)
`Add`	Boolean. If `true`, add this value to a multi-valued property.
`Remove`	Boolean. If `true`, remove this value from a multi-valued property.

<import-items>

```
<!ELEMENT import-items (add-item)*>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

The `<import-items>` tag is a procedural tag that can be used to add items to a repository in a more complex way than is possible with <add-item> (page 179) tags in a <transaction> (page 178) tag.

As child elements of `<import-items>`, `<add-item>` tags are processed differently than as children of a `<transaction>` tag in that they can have forward references. When the template is parsed, the parser makes three passes through the `<add-item>` tags in an `<import-items>` tag. On the first pass, the items are created. On the second pass, it sets required properties and properties that do not reference other items, then calls add-item. On the final pass, it sets any remaining properties and calls update-item if necessary.

<export-items>

```
<!ELEMENT export-items EMPTY>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

The `<export-items>` tag is a procedural tag for exporting the data required to recreate one or more item descriptors. The data is exported as XML to standard output. Using this tag is similar to running the `startSQLRepository` script with the `-export` argument. See the startSQLRepository (page 151) section in the *Developing and Testing an SQL Repository* (page 147) chapter.

Attributes

`item-descriptors`	Specifies a comma-separated list of one or more item descriptor names. For example: `<export-items item-descriptors="authors,books"/>` If none are specified, all item descriptors are exported.
`skip-references`	By default, when you use `<export-items>` tag, all referenced item descriptors are automatically added to the list of item descriptors to be exported. If you use the `skip-references="true"` attribute, referenced item descriptors are added only if you affirmatively include them.

<load-items>

```
<!ELEMENT load-items (#PCDATA)>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

The `<load-items>` body is a comma-separated list of the repository IDs of the items that should be loaded into the item cache. Loading an item cache can improve performance, as it otherwise can take some time for the normal run of queries to fill the caches.

Attributes

Attribute	Description
item-descriptor	The item descriptor whose item cache should be loaded (required)
properties	A list of properties to cache. If no properties are specified, no properties of the items are cached.
load-all-items	Boolean. If set to true, the <load-items> tag loads all items for the given item descriptor, ignoring the list of repository IDs in the body of the tag. Default: false
quiet	If this attribute is set to true, the <load-items> tag produces no output. Default: false

<dump-caches>

```
<!ELEMENT dump-caches EMPTY>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

The <dump-caches> tag can be used to print out the contents of the item cache for one or more item descriptors.

Attributes

Attribute	Description
dump-type	Set to one of the following: - debug: Cached items are logged. - queries: Creates a log entry consisting of the <load-items> (page 184) tag that is used to reload the cache. - both: Combines the output of debug and queries.
item-descriptors	A comma-separated list of one or more item descriptor names. If no item descriptors are specified, all item descriptor caches are exported.

For example, given this <dump-caches> tag:

```
<dump-caches item-descriptors="product" dump-type="queries"/>
```

The following output might be logged, if there are four product items in the cache:

```
============== START BUFFER PRECACHE ==============
<load-items item-descriptor="product">
prod100003,prod100002,prod100001,prod10001
</load-items>
=============== END BUFFER PRECACHE===============
```

<print-ddl>

```
<!ELEMENT dump-caches EMPTY>
```

Parent: <gsa-template> (page 162), <transaction> (page 178)

This tag prints the DDLs that are used and exports the data to standard output. Using this tag is similar to running the `startSQLRepository` script with the `-outputSQL` or `-outputSQLFile` *<file>* argument. See the startSQLRepository (page 151) section in the *Developing and Testing an SQL Repository* (page 147) chapter.

Attributes

Attribute	Description

database-name	Specifies the database vendor so you can generate SQL appropriate for your production database software; one of the following:
	
	`db2`
	`microsoft`
	`oracle`

DTD for SQL Repository Definition Files

The DTD for SQL repository definition files is installed in the `<ATG11dir>/DAS/lib/classes.jar` archive. It can also be referenced with this URL:

`http://www.atg.com/dtds/gsa/gsa_1.0.dtd`

```
<!--
========================================================================
gsa_1.0.dtd - document type for GSA templates
@version $Id: //product/DAS/version/11.0/Java/atg/dtds/gsa/gsa_1.0.dtd#2
$$Change: 534451 $
========================================================================
-->

<!-- Flag datatype, and values -->
<!ENTITY % flag "(true | false)">

<!-- The whole template -->
<!ELEMENT gsa-template (header?,
     (item-descriptor | add-item | update-item | print-item | remove-item |
```

```
     transaction | development-line | query-items | remove-all-items |
     export-items | import-items | print-ddl | dump-caches | load-items)*)>

<!-- The header -->
<!ELEMENT header (name?, author*, version?, description?)>

<!-- Name of template -->
<!ELEMENT name (#PCDATA)>

<!-- The author(s) -->
<!ELEMENT author (#PCDATA)>

<!-- Version string -->
<!ELEMENT version (#PCDATA)>

<!-- Description string -->
<!ELEMENT description (#PCDATA)>


<!-- cache-mode datatype and values -->
<!ENTITY % cache-mode "(disabled | simple | locked | distributed | distributedJMS
 | distributedHybrid )">

<!ENTITY % property-cache-mode "(disabled | inherit)">

<!-- Item descriptors -->
<!ELEMENT item-descriptor ((property | table | attribute | named-query)*,
                          rql-filter?,
                          (property | table | attribute | named-query)*)>

<!ATTLIST item-descriptor
        xml:id          ID      #IMPLIED
        nameCDATA#REQUIRED
        display-name    CDATA   #IMPLIED
        display-name-resource CDATA   #IMPLIED
        default %flag;"false"
        super-type      CDATA   #IMPLIED
        sub-type-property CDATA #IMPLIED
        sub-type-value  CDATA   #IMPLIED
        copy-from      CDATA   #IMPLIED
        content        %flag;  "false"
        folder         %flag;  "false"
        use-id-for-path %flag;  "false"
        content-name-property CDATA #IMPLIED
        content-path-property CDATA #IMPLIED
        content-property CDATA #IMPLIED
        content-length-property CDATA #IMPLIED
        content-checksum-property CDATA #IMPLIED
        folder-id-property CDATA #IMPLIED
        last-modified-property CDATA #IMPLIED
        display-property CDATA #IMPLIED
        version-property CDATA #IMPLIED
        hidden%flag;"false"
        expert%flag;"false"
        writable%flag;"true"
        descriptionCDATA#IMPLIED
        description-resourceCDATA#IMPLIED
        cache-mode%cache-mode;"simple"
        id-space-name   CDATA   #IMPLIED
        id-space-names   CDATA   #IMPLIED
```

```
        text-search-properties  CDATA   #IMPLIED
        item-cache-sizeCDATA   #IMPLIED
        item-cache-timeout CDATA   #IMPLIED
        item-expire-timeout CDATA   #IMPLIED
        query-cache-size CDATA   #IMPLIED
        query-expire-timeout CDATA   #IMPLIED
        id-separator CDATA  ":"
        versionable %flag;   #IMPLIED
>

<!-- Property tag - defines one property descriptor for an item descriptor -->
<!ELEMENT property (derivation?, (option | attribute)*)>
<!ATTLIST property
        xml:id          ID      #IMPLIED
        nameCDATA#REQUIRED
        column-nameCDATA#IMPLIED
        column-namesCDATA#IMPLIED
        property-type   CDATA   #IMPLIED
        data-type       CDATA#IMPLIED
        data-types       CDATA#IMPLIED
        item-type       CDATA#IMPLIED
        sql-type        CDATA   #IMPLIED
        sql-types       CDATA   #IMPLIED
        component-item-type CDATA #IMPLIED
        component-data-type CDATA #IMPLIED
        display-nameCDATA#IMPLIED
        display-name-resource CDATA #IMPLIED
        descriptionCDATA#IMPLIED
        description-resourceCDATA#IMPLIED
        required%flag;"false"
        readable%flag;"true"
        writable%flag;"true"
        queryable%flag;"true"
        default         CDATA  #IMPLIED
        hidden%flag;"false"
        expert%flag;"false"
        editor-class    CDATA   #IMPLIED
        category        CDATA   #IMPLIED
        category-resource        CDATA   #IMPLIED
        cascade         CDATA   #IMPLIED
        repository      CDATA   #IMPLIED
        cache-mode%property-cache-mode;"inherit"
        group           CDATA   #IMPLIED
>

<!-- Derived properties have an associated derivation which
     specifies how the dervied property values are derived -->
<!ELEMENT derivation (expression*)>
<!ATTLIST derivation
          method              CDATA     #IMPLIED
          user-method         CDATA     #IMPLIED
          override-property   CDATA     #IMPLIED
>

<!-- A derived property expression, when evaluated
     specifies a value used in deriving a derived
     property value -->
<!ELEMENT expression (#PCDATA)>

<!-- Defines a table for an item descriptor -->
```

```
<!ELEMENT table (property | attribute)*>
<!ATTLIST table
        xml:id          ID      #IMPLIED
        nameCDATA      #REQUIRED
        multi-column-name   CDATA         #IMPLIED
        type                (primary|auxiliary|multi)     "auxiliary"
        id-column-name      CDATA          #IMPLIED
        id-column-names     CDATA          #IMPLIED
        shared-table-sequence   (1|2|3|4|5|6|7|8|9)     "1"
>

<!-- Options are possible values for enumerated attributes -->
<!ELEMENT option EMPTY>
<!ATTLIST option
          xml:id          ID      #IMPLIED
          value         CDATA           #IMPLIED
          resource      CDATA           #IMPLIED
          bean          CDATA           #IMPLIED
          code          CDATA           #IMPLIED>

<!-- The attribute tag is used to specify the list of feature descriptor values
-->
<!ELEMENT attribute EMPTY>
<!ATTLIST attribute
          xml:id          ID      #IMPLIED
          name          CDATA           #REQUIRED
          value         CDATA           #IMPLIED
          bean          CDATA           #IMPLIED
          data-type     CDATA           #IMPLIED>

<!-- this tag specifies an RQL statement to be used as a filter
     for an item descriptor
  -->
<!ELEMENT rql-filter (rql,param*)>

<!-- RQL query string itself -->
<!ELEMENT rql (#PCDATA)>

<!-- RQL query parameters -->
<!ELEMENT param EMPTY>
<!ATTLIST param
          name          CDATA           #IMPLIED
          value         CDATA           #IMPLIED
          bean          CDATA           #IMPLIED
          data-type     CDATA           #IMPLIED>

<!-- The named-query element. This specifies an association between a
     user-defined name and a Query representation -->
<!ELEMENT named-query (rql-query | sql-query)>

<!-- The rql-query element. Identifies an association between a user-defined
     name and an RQL query string, that can later be retrieved by name from
     the corresponding repository view that this tag is found under -->
<!ELEMENT rql-query (query-name, rql)>

<!ELEMENT sql-query (query-name,
                     sql,
         returns?,
         input-parameter-types?,
         dependencies?)>
```

```
<!ELEMENT sql (#PCDATA)>
<!ATTLIST sql
         stored-procedure %flag; #IMPLIED
>
<!ELEMENT returns (#PCDATA)>
<!ELEMENT input-parameter-types (#PCDATA)>
<!ELEMENT dependencies (#PCDATA)>

<!-- The query-name element, which indicates the user-defined name of a named
     query instance -->
<!ELEMENT query-name (#PCDATA)>

<!-- The transaction element.  It surround the operation elements
     add-item, print-item etc.  Note that add-item tags in this element
     are processed one at a time.  They cannot make forward references
     to other items and no attempt is made to satisfy database integrity
     constraints (beyond that automatically done with the cascade operator)
     Use the import-items tag if you want to load in items with forward
     references.  -->
<!ELEMENT transaction (add-item | update-item | print-item | remove-item |
                       transaction | query-items | remove-all-items |
                       export-items | load-items | rollback-transaction)*>

<!-- The development-line element. It surround the operation elements
     add-item, print-item etc.  Note that add-item tags in this element
     are processed one at a time.  They cannot make forward references
     to other items and no attempt is made to satisfy database integrity
     constraints (beyond that automatically done with the cascade operator)
     Use the import-items tag if you want to load in items with forward
     references.  -->
<!ELEMENT development-line (add-item | update-item | print-item | remove-item |
                       transaction | query-items | remove-all-items |
                       export-items | load-items)*>
<!ATTLIST development-line
 idCDATA #REQUIRED
>

<!--
  The import-items element.  This tag only contains add-item tags.  These
  tags can contain forward references.  The tags are processed in three
  passes - pass one creates all items.  Pass two, sets required properties
  and optional properties which do not refer to other items.  Pass three
  sets the remaining properties and updates the item -->
<!ELEMENT import-items (add-item)*>

<!-- Procedural tags for adding and modifying items -->
<!ELEMENT add-item (set-property*)>
<!ATTLIST add-item
          item-descriptor CDATA         #REQUIRED
          id              CDATA         #IMPLIED
          tag             CDATA         #IMPLIED
          on-commit       CDATA         #IMPLIED
          skip-add        CDATA         #IMPLIED
          repository      CDATA         #IMPLIED
          no-checkin      %flag;        "false"
>

<!-- Procedural tags for adding and modifying items -->
<!ELEMENT update-item (set-property*)>
<!ATTLIST update-item
```

```
          item-descriptor CDATA         #REQUIRED
          id              CDATA         #IMPLIED
          tag             CDATA         #IMPLIED
          skip-update     CDATA         #IMPLIED
>

<!-- Procedural tag for removing an item -->
<!ELEMENT remove-item EMPTY>
<!ATTLIST remove-item
          item-descriptor CDATA         #REQUIRED
          id              CDATA         #IMPLIED
          tag             CDATA         #IMPLIED
          remove-references-to %flag;   "false"
>

<!--
 Procedural tag for removing all items.  Only enabled if the system
 property atg.allowRemoveAllItems is set on startup
 -->
<!ELEMENT remove-all-items EMPTY>
<!ATTLIST remove-all-items
          item-descriptor CDATA         #REQUIRED
>

<!-- Procedural tag for exporting the data required to recreate one or more
     item-descriptors.  The item-descriptors attribute specifies a comma
     separated list of one or more item descriptor names.  If none are
     specified, all item-descriptors are exported -->
<!ELEMENT export-items EMPTY>
<!ATTLIST export-items
          item-descriptors CDATA        #IMPLIED
          skip-references  %flag;        "false"
>

<!-- Procedural tag for querying and printing an item -->
<!ELEMENT query-items (#PCDATA)>
<!ATTLIST query-items
          item-descriptor CDATA         #REQUIRED
          query           CDATA         #IMPLIED
          print-content   CDATA         #IMPLIED
          quiet           %flag;        "false"
          id-only         %flag;        "false"
>

<!-- Procedural tag for caching a list of items -->
<!ELEMENT load-items (#PCDATA)>
<!ATTLIST load-items
          item-descriptor CDATA         #REQUIRED
          properties      CDATA         #IMPLIED
          load-all-items  %flag;        "false"
          quiet           %flag;        "false"
>

<!-- Procedural tag for printing an item -->
<!ELEMENT print-item EMPTY>
<!ATTLIST print-item
          item-descriptor CDATA         #IMPLIED
          path            CDATA         #IMPLIED
          folder          CDATA         #IMPLIED
          id              CDATA         #IMPLIED
```

```
          tag             CDATA         #IMPLIED
          print-content   CDATA         #IMPLIED
>

<!-- Sets a property value.  Used only in the add-item and update-item tags -->
<!ELEMENT set-property (#PCDATA)>
<!ATTLIST set-property
          name          CDATA           #REQUIRED
          value         CDATA           #IMPLIED
    add %flag;        "false"
    remove %flag;          "false"
>

<!-- Sets a property value.  Used only in the add-item and update-item tags -->
<!ELEMENT rollback-transaction EMPTY>

<!-- Procedural tag for printing the DDL needed -->
<!ELEMENT print-ddl EMPTY>
<!ATTLIST print-ddl
          database-name CDATA           #IMPLIED
>

<!-- Procedural tag for dumping the caches of one or more
     item-descriptors.  The item-descriptors attribute specifies a comma
     separated list of one or more item descriptor names.  If none are
     specified, all of the caches for the repository are dumped. The
     dump-type attribute specifies if the output should be formatted as
     a list of item ids or as XML that can be later used to pre-cache
     the items -->
<!ELEMENT dump-caches EMPTY>
<!ATTLIST dump-caches
          item-descriptors CDATA        #IMPLIED
          dump-type (debug|queries|both)     "debug"
>
```

Sample SQL Repository Definition Files

This section includes a number of simple examples of SQL repository definition files and the corresponding SQL statements to create the tables described by the definition files. These examples demonstrate a variety of data relationship mappings:

- Simple One-to-One (page 193) maps a repository item to a single table row. It includes just a primary table, with no joins with other tables. This is the simplest case.
- One-to-One with Auxiliary Table (page 194) maps a repository item to a primary table and an auxiliary table (a one-to-one relationship). Each user has a job title and function.
- One-to-Many with an Array (page 195) maps a repository item to a primary table and a multi-value table with an array property. This demonstrates a one-to-many relationship. The `multi` table, named `subjects_tbl`, contains a list of a user's favorite subjects (simple strings). When using an `array` or `list` type property, the `multi` table requires a `multi-column-name` attribute (in this example, `seq_num`) to ensure that the ordering of the multi-values are maintained.

- One-to-Many with a Set (page 196) maps a repository item to a primary table and a multi-value table with a set type property. This is another example of one-to-many relationship. Because a set is used, a `multi-column-name` attribute is not required.
- One-to-Many with a Map (page 197) maps a repository item to a primary table and a multi-value table with a map property. When using a `map` type property, the `multi` table requires a `multi-column-name` attribute (in this example, `card_key`). This column contains keys that uniquely identify each of the multi-values. For example, each user has many credit cards; the keys are strings that identify each of the user's cards (like business card, frequent flyer card, personal card.
- One-to-Many Mapping to Other Repository Items (page 198) maps a one-to-many relationship. It defines two item types, `user` and `address`. Each user can have many addresses.
- Ordered One-to-Many (page 199) demonstrates an ordered one-to-many relationship with a `list` type property. It defines two item types, `author` and `book`. Each author can have many books, and the order of the books is considered significant.
- Many-to-Many (page 200) maps a many-to-many relationship. It defines two item types, `user` and `address`. Each user can have many addresses. Many users may live at the same address.
- Multi-Column Repository IDs (page 201) demonstrates the use of composite repository IDs.

Simple One-to-One

This example maps a repository item to a single table row. It includes just a primary table, with no joins with other tables.

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template
  PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
         "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">

<gsa-template>
    <header>
      <name>Repository Example Version A</name>
      <author>Pat Durante</author>
      <description>
         This template maps a repository item to a single
         table row.  Just a primary table...no joins with
         other tables.  Simplest case.
      </description>
    </header>

    <item-descriptor name="user" default="true">
       <table name="usr_tbl" type="primary" id-column-names="id">
          <property name="id" data-type="string"/>
          <property name="name" column-names="nam_col" data-type="string"/>
          <property name="age" column-names="age_col" data-type="int"/>
       </table>
    </item-descriptor>
</gsa-template>
```

SQL Statements

```
drop table usr_tbl;
```

```
CREATE TABLE usr_tbl (
        id                      VARCHAR(32)     not null,
        nam_col                 VARCHAR(32)     null,
        age_col                 INTEGER null,
        primary key(id)
);
```

One-to-One with Auxiliary Table

This example maps a repository item to a primary table and an auxiliary table (a one-to-one relationship).

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template
  PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
         "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">

<gsa-template>
    <header>
      <name>Repository Example Version B</name>
      <author>Pat Durante</author>
      <description>
         This template maps a repository item to a
         primary table and an auxiliary table (a one-to-one
         relationship.)  Each user has a job title and
         function.
      </description>
    </header>

    <item-descriptor name="user" default="true">
       <table name="usr_tbl" type="primary" id-column-names="id">
          <property name="id" data-type="string"/>
          <property name="name" column-names="nam_col" data-type="string"/>
          <property name="age" column-names="age_col" data-type="int"/>
       </table>

       <table name="job_tbl" type="auxiliary" id-column-names="id">
          <property name="function"/>
          <property name="title"/>
       </table>
    </item-descriptor>
</gsa-template>
```

SQL Statements

```
drop table usr_tbl;
drop table job_tbl;

CREATE TABLE usr_tbl (
        id                      VARCHAR(32)     not null,
        nam_col                 VARCHAR(32)     null,
        age_col                 INTEGER null,
        primary key(id)
);
```

```
CREATE TABLE job_tbl (
        id                      VARCHAR(32)     not null references usr_tbl(id),
        function                VARCHAR(32)     null,
        title                   VARCHAR(32)     null,
        primary key(id)
);
```

One-to-Many with an Array

This example maps a repository item to a primary table and a multi-value table with an array property. This demonstrates a one-to-many relationship.

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template
  PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
         "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">

<gsa-template>
  <header>
    <name>Repository Example Version C</name>
    <author>Pat Durante</author>
    <description>
         This template maps a repository item to a primary
         table and a multi-value table using an array property.
         A one-to-many relationship. The "multi" table
         contains a list of a user's favorite subjects
         (simple strings).  When using an "array" property,
         the "multi" table requires a "multi-column-name"
         (e.g., seq_num) to ensure that the ordering of the
         multi-values are maintained.
    </description>
  </header>

  <item-descriptor name="user" default="true">
    <table name="usr_tbl" type="primary" id-column-names="id">
       <property name="id" data-type="string"/>
       <property name="name" column-names="nam_col" data-type="string"/>
       <property name="age" column-names="age_col" data-type="int"/>
    </table>

    <table name="subjects_tbl" type="multi" id-column-names="id"
                multi-column-name="seq_num">
        <property name="favoriteSubjects" column-names="subject" data-type="array"
                  component-data-type="string"/>
    </table>
  </item-descriptor>
</gsa-template>
```

SQL Statements

```
drop table usr_tbl;
drop table subjects_tbl;

CREATE TABLE usr_tbl (
```

```
        id                      VARCHAR(32)     not null,
        nam_col                 VARCHAR(32)     null,
        age_col                 INTEGER null,
        primary key(id)
);

CREATE TABLE subjects_tbl (
        id                      VARCHAR(32)     not null references usr_tbl(id),
        seq_num                 INTEGER not null,
        subject                 VARCHAR(32)     null,
        primary key(id, seq_num)
);
```

One-to-Many with a Set

This example maps a repository item to a primary table and a multi-value table with a set type property.

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template
  PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
         "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">

<gsa-template>
    <header>
      <name>Repository Example Version D</name>
      <author>Pat Durante</author>
      <description>
        This template maps a repository item to a primary
        table and a multi-value table using a set property.
        A one-to-many relationship.  Since we are using a
        "set", we are not required to use a
        "multi-column-name" attribute.  Demonstrates that D5
        repositories (unlike D4.5) do not require a
        "seq_num" column.
      </description>
    </header>

  <item-descriptor name="user" default="true">
     <table name="usr_tbl" type="primary" id-column-names="id">
        <property name="id" data-type="string"/>
        <property name="name" column-names="nam_col" data-type="string"/>
        <property name="age" column-names="age_col" data-type="int"/>
     </table>

    <table name="subjects_tbl" type="multi" id-column-names="id">
        <property name="favoriteSubjects" column-names="subject" data-type="set"
                  component-data-type="string"/>
    </table>
  </item-descriptor>
</gsa-template>
```

SQL Statements

```
drop table subjects_tbl;
drop table usr_tbl;
```

```
CREATE TABLE usr_tbl (
        id                      VARCHAR(32)     not null,
        nam_col                 VARCHAR(32)     null,
        age_col                 INTEGER null,
        primary key(id)
);

CREATE TABLE subjects_tbl (
        id                      VARCHAR(32)     not null references usr_tbl(id),
        subject                 VARCHAR(32)     not null,
        primary key(id, subject)
);
```

One-to-Many with a Map

This example maps a repository item to a primary table and a multi-value table with a map property.

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template
  PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
         "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">

<gsa-template>
    <header>
      <name>Repository Example Version E</name>
      <author>Pat Durante</author>
      <description>
          This template maps a repository item to a primary
          table and a multi-value table using a map property.
          A one-to-many relationship.  When using a "map"
          property, the "multi" table requires a
          "multi-column-name" (e.g., card_key).  This
          column will contain keys that uniquely identify
          each of the multi-values (For example, each user
          has many credit cards...the keys are strings that
          identify each of the user's cards (like business
          card, frequent flyer card, personal card.)
      </description>
    </header>

  <item-descriptor name="user" default="true">
    <table name="usr_tbl" type="primary" id-column-names="id">
        <property name="id" data-type="string"/>
        <property name="name" column-names="nam_col" data-type="string"/>
        <property name="age" column-names="age_col" data-type="int"/>
    </table>

    <table name="credit_card_tbl" type="multi" id-column-names="id"
           multi-column-name="card_key">
        <property name="card_num" column-names="card_num" data-type="map"
                  component-data-type="string"/>
    </table>
  </item-descriptor>
</gsa-template>
```

SQL Statements

```
drop table credit_card_tbl;
drop table usr_tbl;


CREATE TABLE usr_tbl (
     id                VARCHAR(32)     not null,
     nam_col           VARCHAR(32)     null,
     age_col           INTEGER     null,
     primary key(id)
);

CREATE TABLE credit_card_tbl (
     id                VARCHAR(32)     not null references usr_tbl(id),
     card_key          VARCHAR(32)     not null,
     card_num          VARCHAR(32)     null,
     primary key(id, card_key)
);

CREATE INDEX credit_card_tbl_idx ON credit_card_tbl(id);
```

One-to-Many Mapping to Other Repository Items

This example maps out a one-to-many relationship between `user` items and `address` items. It demonstrates the use of the `component-item-type` attribute, which allows one repository item to contain other repository items. Each `user` item can contain many `address` items, such as home address, shipping address, business address.

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template
PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
"http://www.atg.com/dtds/gsa/gsa_1.0.dtd">
<gsa-template>
  <header>
    <name>Repository Mapping Example Version F</name>
    <author>Ben Erwin</author>
    <description>
This template maps out a one-to-many relationship
between user items and address items. It
demonstrates the use of the component-item-type
attribute (which allows one repository item
to contain other repository items.) Each user
item will contain many address items (home address,
business address, etc.)
    </description>
  </header>
  <item-descriptor name="address">
    <table name="addr_tbl" type="primary" id-column-name="addr_id">
        <property name="user" column-name="user_id" item-type="user"/>
        <property name="street" data-type="string"/>
        <property name="city" data-type="string"/>
    </table>
  </item-descriptor>
  <item-descriptor name="user" default="true">
```

```
    <table name="usr_tbl" type="primary" id-column-name="id">
        <property name="id" data-type="string"/>
        <property name="name" column-name="nam_col" data-type="string"/>
        <property name="age" column-name="age_col" data-type="string"/>
    </table>
    <table name="addr_tbl" type="multi" id-column-name="user_id">
        <property name="addresses" column-name="addr_id" data-type="set"
                  component-item-type="address"/>
    </table>
  </item-descriptor>
</gsa-template>
```

SQL Statements

```
CREATE TABLE usr_tbl (
  id VARCHAR(32) not null,
  nam_col VARCHAR(32) null,
  age_col VARCHAR(32) null,
  primary key(id)
);

CREATE TABLE addr_tbl (
  addr_id VARCHAR(32) not null,
  user_id VARCHAR(32) null references usr_tbl(id),
  street VARCHAR(32) null,
  city VARCHAR(32) null,
  primary key(addr_id)
);
```

Ordered One-to-Many

Another data model you can use in the SQL Repository is an ordered one-to-many relationship. Suppose you have an author item descriptor and you want to model each author's books in the order they were published. Your SQL repository definition file can define two item descriptors that look something like this:

```
<item-descriptor name="author">
  <table name="author" type="primary" id-column-name="author_id">
  </table>
<table name="book" type="multi" id-column-name="author_id"
       multi-column-name="sequence_num">
    <property name="books" data-type="list" component-item-type="book"
              column-name="book_id"/>
   </table>
 </item-descriptor>
 <item-descriptor name="book">
   <table name="book" type="primary" id-column-name="book_id">
     <property name="author" item-type="author" column-name="author_id"/>
    <property name="seq" data-type="int" column-name="sequence_num"/>
    </table>
  </item-descriptor>
```

Note some limitations for this data model:

- You must use the `List` data type to represent the ordered "many" side of the relationship.

- The sequence_num and author_id columns in the book table cannot be specified as not null, as the SQL Repository tries to set these fields to null when items in the List are removed.
- The book item descriptor needs to define a property to point to the sequence_num field, like this:

```
<property name="seq" data-type="int" column-name="sequence_num"/>
```

SQL Statements

```
CREATE TABLE author (
  author_id VARCHAR(32) not null,
  primary key(author_id)
);

CREATE TABLE book (
  book_id VARCHAR(32) not null,
  sequence_num  INTEGER,
  author_id VARCHAR(32) references author(author_id),
  primary key(book_id)
);
```

Many-to-Many

This example maps out a many-to-many relationship. It defines two item types, user and address. Each user can have many addresses. Many users may live at the same address.

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template
  PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
         "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">

<gsa-template>
    <header>
      <name>People Repository Version H</name>
      <author>Pat Durante</author>
      <description>
        This template maps out a many-to-many relationship
        between user items and address items.  Each user can
        have many addresses.  Many users may live at the
        same address.
      </description>
    </header>

  <item-descriptor name="address">
    <table name="addr_tbl" type="primary" id-column-names="address_id">
        <property name="street" data-type="string"/>
        <property name="city" data-type="string"/>
    </table>

    <table name="user_address_tbl" type="multi" id-column-names="addr_id">
        <property name="users" column-names="user_id" data-type="set"
                  component-item-type="user"/>
    </table>
  </item-descriptor>

  <item-descriptor name="user" default="true">
```

```
    <table name="usr_tbl" type="primary" id-column-names="id">
        <property name="id" data-type="string"/>
        <property name="name" column-names="nam_col" data-type="string"/>
        <property name="age" column-names="age_col" data-type="int"/>
    </table>

    <table name="user_address_tbl" type="multi" id-column-names="user_id">
        <property name="addresses" column-names="addr_id" data-type="set"
                  component-item-type="address"/>
    </table>
  </item-descriptor>
</gsa-template>
```

SQL Statements

```
drop table addr_tbl;
drop table user_address_tbl;
drop table usr_tbl;

CREATE TABLE addr_tbl (
     address_id        VARCHAR(32)      not null,
     street            VARCHAR(32)      null,
     city              VARCHAR(32)      null,
     primary key(addr_id)
);
CREATE TABLE user_address_tbl (
     addr_id            VARCHAR(32)     not null references addr_tbl(address_id),
     user_id            VARCHAR(32)     not null references usr_tbl(id),
     primary key(addr_id, user_id)
);

CREATE INDEX user_address_tbl_user_idx ON user_address_tbl(user_id);

CREATE TABLE usr_tbl (
     id                 VARCHAR(32)     not null,
     nam_col            VARCHAR(32)     null,
     age_col            INTEGER     null,
     primary key(id)
);
```

Multi-Column Repository IDs

This example demonstrates the use of multi-column or composite repository IDs.

```
<item-descriptor name="typeX" id-separator=":">
  <table name="TYPEX" type="primary" id-column-names="TYPEX_ID">
    <property name="id" column-names="TYPEX_ID" data-type="string" />
    <property name="name" column-names="NAME" data-type="string" />
  </table>
  <table name="TYPEXY" type="multi" id-column-names="TYPEX_ID">
    <property name="typeXYs" component-item-type="typeXY"
              column-names="TYPEX_ID,TYPEY_ID" data-type="set" />
  </table>
</item-descriptor>
```

```
<item-descriptor name="typeY" id-separator=":">
  <table name="TYPEY" type="primary" id-column-names="TYPEY_ID">
    <property name="id" column-names="TYPEY_ID" data-type="string" />
    <property name="name" column-names="NAME" data-type="string" />
  </table>
</item-descriptor>

<item-descriptor name="typeZ" id-separator=":">
  <table name="TYPEZ" type="primary" id-column-names="TYPEZ_ID">
    <property name="id" column-names="TYPEZ_ID" data-type="string" />
    <property name="name" column-names="NAME" data-type="string" />
  </table>
</item-descriptor>

<item-descriptor name="typeXY" id-separator=":">
  <table name="TYPEXY" type="primary" id-column-names="TYPEX_ID,TYPEY_ID">
    <property name="id" column-names="TYPEX_ID,TYPEY_ID"
              data-types="string,string" />
    <property name="name" column-names="NAME" data-type="string" />
    <property name="x" column-names="TYPEX_ID" item-type="typeX" />
    <property name="y" column-names="TYPEY_ID" item-type="typeY" />
  </table>
  <table name="TYPEXYZ" type="multi" id-column-names="TYPEX_ID,TYPEY_ID">
    <property name="typeXYZs" component-item-type="typeXYZ"
              column-names="TYPEX_ID,TYPEY_ID,TYPEZ_ID" data-type="set" />
  </table>
</item-descriptor>

<item-descriptor name="typeXYZ" id-separator=":">
  <table name="TYPEXYZ" type="primary"
         id-column-names="TYPEX_ID,TYPEY_ID,TYPEZ_ID">
    <property name="id" column-names="TYPEX_ID,TYPEY_ID,TYPEZ_ID"
              data-types="string,string,string" />
    <property name="name" column-names="NAME" data-type="string" />
    <property name="x" column-names="TYPEX_ID" item-type="typeX" />
    <property name="y" column-names="TYPEY_ID" item-type="typeY" />
    <property name="z" column-names="TYPEZ_ID" item-type="typeZ" />
    <property name="xy" column-names="TYPEX_ID,TYPEY_ID" item-type="typeXY" />
  </table>
</item-descriptor>
```

SQL Statements

```
drop table TYPEXYZ;
drop table TYPEXY;
drop table TYPEZ;
drop table TYPEY;
drop table TYPEX;

CREATE TABLE TYPEX (
     TYPEX_ID          VARCHAR(32)     not null,
     NAME               VARCHAR(32)     null,
     primary key(TYPEX_ID)
);

CREATE TABLE TYPEY (
     TYPEY_ID          VARCHAR(32)     not null,
     NAME               VARCHAR(32)     null,
```

```
     primary key(TYPEY_ID)
);

CREATE TABLE TYPEZ (
     TYPEZ_ID          VARCHAR(32)     not null,
     NAME               VARCHAR(32)     null,
     primary key(TYPEZ_ID)
);

CREATE TABLE TYPEXY (
     TYPEX_ID                VARCHAR(32)     not null,
     TYPEY_ID                VARCHAR(32)     not null,
     NAME                    VARCHAR(32)     null,
     primary key(TYPEX_ID, TYPEY_ID),
     foreign key (TYPEX_ID) references TYPEX(TYPEX_ID),
     foreign key (TYPEY_ID) references TYPEY(TYPEY_ID)
);

CREATE TABLE TYPEXYZ(
     TYPEX_ID                VARCHAR(32)     not null,
     TYPEY_ID                VARCHAR(32)     not null,
     TYPEZ_ID                VARCHAR(32)     not null,
     NAME                    VARCHAR(32)     null,
     primary key(TYPEX_ID, TYPEY_ID,TYPEZ_ID),
     foreign key (TYPEX_ID) references TYPEX(TYPEX_ID),
     foreign key (TYPEY_ID) references TYPEY(TYPEY_ID),
     foreign key (TYPEZ_ID) references TYPEZ(TYPEZ_ID)
);
```

Configuring the SQL Repository Component

Each SQL repository is a component of class `atg.adapter.gsa.GSARepository`. This class implements `atg.repository.MutableRepository` and `atg.repository.content.ContentRepository` and extends `atg.repository.RepositoryImpl`. The Oracle ATG Web Commerce platform includes a sample SQL Repository component with a Nucleus address of `/atg/dynamo/service/jdbc/SQLRepository`. You can use this component, or create your own. An Oracle ATG Web Commerce instance can have any number of SQL Repository components running at the same time.

Registering a Content Repository

Content repositories must be added to the list of repositories in the `initialRepositories` property of the `/atg/registry/ContentRepositories` component. This also causes the new repository to show up in the Content window of the ATG Control Center. To cause a repository to appear instead in the Portal or the Commerce window of the ACC, edit the Repository Editor's definition in the `/atg/devtools/admins.xml` file. This XML file should be placed in the application's configuration path at `/atg/devtools`. In the `/atg/devtools/admins.xml` file, set `task` to the ACC task area where you want the repository to appear. For example:

```
<custom-admin id="CustomProductCatalog">
  <display-name>My Product Catalog</display-name>
```

```
  <task>commerce</task>
...
</custom-admin>
```

The repository is displayed in the ATG Control Center under the name specified by the `<display-name>` tag. The repository's `repositoryName` property must match the value specified by the `<repository-name>` tag in the `/atg/devtools/admins.xml` file. For example:

```
<default-admin id="StandardProductCatalog" xml-combine="replace">
  <display-name>Catalog Elements (En)</display-name>
  <task>commerce</task>
  <repository-name>ProductCatalog</repository-name>
  <folder-view>true</folder-view>
  <create-bean-displays>
...
  </create-bean-displays>
  <standard-bean-displays>
...
  </standard-bean-displays>

</default-admin>
```

SQL Repository Component Properties

An SQL Repository component is derived from the class `atg.adapter.gsa.GSARepository` and includes the following properties:

Property	Description
`allowNullValues`	Boolean, specifies whether to allow null values in multi-valued properties: `false` (default): null values are automatically removed from multi-valued properties; an attempt to add null value to this property yields an exception. `true`: null values can be set in multi-valued properties. You can also enable null values for individual multi-valued properties by setting the `allowNullValues` attribute to `true` in its `<property>` tag.
`autoCommitInitialization`	If `setAutoCommit` and `localTransactionModeInitialization` are both true, JDBC connections are explicitly set with the value of `autoCommitInitialization`. Otherwise JDBC connections are left as is. Default: `true`

Property	Description
autoUpdateSubscribers	For distributed TCP caching mode, should Oracle ATG Web Commerce automatically populate the das_gsa_subscriber database table? Default: true
cacheRestoreFile	If restoreCacheOnRestart is true, an XML file used to reload item caches on restart is written to this location.
cacheSwitchHot	If a target site is configured for switch deployment, specifies whether to pre-populate repository caches before the data source is switched. If this property is set to true, the repository prepopulates an on-deck set of caches with data from the next DataSource before the switch occurs. Default: false **Note:** This property must be set to false if you use Content Administration for deployment. For information about optimizing switch deployment caching, see the *Content Administration Programming Guide*.
checkTables	If set to true, the GSARepository verifies each database table with a simple SQL query at application startup. To skip the validity check and achieve faster startups, set this to false. Default: false
databaseName	This property is used by the startSQLRepository script. Do not change its value.
databaseTableInfo	This property is used by the startSQLRepository script. Do not change its value.
dataSource	This refers to a datasource (javax.sql.DataSource) to use for obtaining connections. Datasources should typically implement resource pooling for best performance. This property is typically set as follows: /atg/dynamo/service/jdbc/*pool-name*
debugLevel	An integer value that indicates the detail of debugging messages printed out when the Repository's loggingDebug property is set to true. Higher values generate more messages. The range is from 0-15. You can also set the debug level for an individual item descriptor or property in the Dynamo Administration Interface or with the loggingDebug attribute tag. See Debug Levels (page 159) in the *Developing and Testing an SQL Repository* (page 147) chapter. Default: 5

Property	Description
definitionFiles	The location of the repository definition XML files, specified as an absolute name on the application configuration path. Oracle ATG Web Commerce uses XML file combination to collate multiple definition files into a single repository definition.
disableItemCachesAtStartup	If true the repository disables all item caches when it starts up. This overrides all item cache size settings in the definition file. The caches can still be turned on later programmatically. This is mostly for debugging. Default: false
disableQueryCachesAtStartup	If true the repository disables all query caches when it starts up. This overrides all query cache size settings in the definition file. The caches can still be turned on later programmatically. This is mostly for debugging. Default: false
enforceRequiredProperties	If true, the repository checks to make sure all required properties are present when adding repository items and forbids the setting of a required property to null. Default: true
escapeWildcards	The characters % and _ are typically treated as wildcards in database queries. If this property is set to true, the GSARepository uses an escape character before % and _ in all pattern-match queries. The one exception is when a pattern-match query is used to simulate a text search query, as in that case, wildcards should be allowed to be passed through. The escape character is specified by the wildcardEscapeCharacter property and the default value is \. Default: true
eventServer	The event server component that handles cache invalidation messages for item descriptors that use distributed TCP caching mode. /atg/dynamo/server/SQLRepositoryEventServer
groupContainer	If you want to define profile groups or content groups, set this to the RepositoryGroups component. See the *Personalization Programming Guide* for more information about profile groups and content groups. Default: /atg/registry/RepositoryGroups
idGenerator	An IdGenerator to use for generating unique IDs for items. Default: /atg/dynamo/service/IdGenerator

Property	Description
itemDescriptorAliases	A map that you can use to allow one item descriptor to be accessed by more than one name. You configure it as a Map that maps the alias to the existing item descriptor name that is its equivalent. For example, this setting allows the name All Profiles to be used to refer to the item descriptor named user: itemDescriptorAliases=All Profiles=user
loadItemBatchSize	The maximum number of items to load from the database at one time. This property is consulted by getItems() and the hot cache switching logic. Default: 200
localeSensitiveSorting	If true, sorted query results are sorted in a locale sensitive manner. More specifically, String values are compared using java.text.Collator. Because most databases cannot handle sorting with multiple locales, setting this option to true also means that the repository performs all sorting in memory. If false, database sorting (via ORDER BY) is used where applicable and Strings are compared using String.compareTo(). If database sorting is adequate for your purposes, leaving this property set to false provides better performance. Default: false
localTransactionModeInitializatiIf	true, use local transaction mode for initializing the service. Some database/JDBC driver combinations require this mode for JDBC meta-data queries when the GSARepository initializes. If false, a TransactionDemarcation with mode REQUIRED is used. Default: true
lockManager	A ClientLockManager to use for locked mode caching. See the *SQL Repository Caching* (page 103) chapter. Default: ClientLockManager
metaDataSchemaPattern	The name of the database account that was used to create the tables that underlie the repository. See Table Ownership Issues (page 96). Default: DYNAMO
metaDataCatalogName	The name of a metadata catalog. See Table Ownership Issues (page 96) in the *SQL Repository Queries* (page 81) chapter.
outerJoinSupport	Configures the syntax to use for outer joins. See Outer Joins (page 95) in the *SQL Repository Queries* (page 81) chapter in the *SQL Repository Queries* (page 81) chapter for valid settings.

Property	Description
`pathSeparator`	Change this property only if paths in your content folders use a separator different than the default `/` (forward slash).

`prohibitCollectionDuplicates`	Boolean, specifies whether this repository allows duplicate values in ordered multi-valued properties of type List and Array.
	
	For example, if this property is set to `true`, you cannot set duplicate values in the String list property `myList`. Thus, attempts to update the datastore with the following additions will yield an error on the third duplicate item:
	
	`myList.add("one");`
	`myList.add("two");`
	`myList.add("one");`
	
	This setting can be overridden by individual properties (see Prohibiting Duplicate Values (page 69) in the chapter *SQL Repository Item Properties* (page 59).
	
	Default: `false`

`repositoryName`	The repository name.
`restoreCacheOnRestart`	If `true`, the repository automatically dumps the contents of its item caches when it is stopped and reloads the same items into the caches when it is started again. Tags that reload the caches are written into the file specified by the `cacheRestoreFile` property. Default: `false` **Note**: this property does not affect external caching software such as Oracle Coherence. See *External SQL Repository Caching* (page 139).
`safeSQLTypes`	A comma-separated list of SQL types for which the repository always uses the default JDBC type. You can set this property to string values of SQL types like `varchar`, or to the corresponding integer values specified in the class `java.sql.Types` (for example, -4). Default: `null`
`selectiveCacheInvalidationEnabled`	Boolean, if set to true enables selective cache invalidation. For more information, see the *Content Administration Programming Guide*.

Property	Description
setAutoCommit	If true, the Repository calls Connection.setAutoCommit() as needed. If false, the repository does not call that API. Some JDBC drivers, due to bugs, may cause errors in the GSARepository.initialize() method unless this property is set to false. If you need to set it to false, set autoCommitInitialization or localTransactionModeInitialization to false. Default: false
simulateTextSearchQueries	If true, substitute pattern match queries for text search queries. This setting is not supported for production Oracle ATG Web Commerce applications. See Text Search Queries (page 92). Default: false
SQLLowerFunction	The name of the SQL function to use to lower-case an expression. This is used for case-insensitive querying. If this property is null, no attempt is made to lower-case database expressions. Default: lower
storeTransientItems	If true, the getItem method returns items that are cached, but not yet added. Default: true
subscriberRepository	If you use distributed TCP caching mode, Oracle ATG Web Commerce maintains an item descriptor for the das_gsa_subscriber table. This property specifies which repository that item descriptor belongs to. By default, this item descriptor is in the /atg/dynamo/service/jdbc/SQLRepository repository. If for any reason you desire to use a different repository instance, you must make sure that each repository that uses distributed TCP caching mode has the same value for its subscriberRepository property. Default: /atg/dynamo/service/jdbc/SQLRepository
synchronousInvalidationEvents	For distributed TCP caching mode, should invalidation events be sent asynchronously, for better performance, or synchronously, to avoid a slight window of stale cache? Default: false
tablePrefix	A string that is prepended to the table name when inserts or updates are made. See Table Ownership Issues (page 96).
transactionManager	A TransactionManager to use for all transactions. All code in the same server typically use the same TransactionManager. Default: /atg/dynamo/transaction/TransactionManager

Property	Description
updateSchemaInfoCache	If true, the Repository creates files that store the SQL type for each column in the database schema. Default: false
useCacheForDelete	If true, the Repository tries to optimize certain SQL delete operations based on the values in the cache. For certain usage patterns, such as when there are many multi-valued properties, setting this to true can result in a significant performance gain. Set this property to true only when (a) you define a version property for each item descriptor or (b) you use locked caching mode. Setting this property causes it to be set in each of the item descriptors defined in the Repository. Default: false
userPropertyDescriptors	The Java class names of user defined property descriptors that should be loaded for this repository. User defined property descriptors register themselves in a static system-wide table. This property enables you to ensure that these classes are loaded before the repository loads any XML definitions that might refer to them.
useSetAsciiStream	If useSetAsciiStream is set to true, the SQL repository always uses setAsciiStream() instead of setString() in prepared statements. You can useSetAsciiStream instead of useSetUnicodeStream, but you lose the ability to handle internationalized values in the database. Default: false
useSetBinaryStream	If useSetBinaryStream is set to true, the SQL repository always uses setBinaryStream() instead of setBytes() in prepared statements. The setBinaryStream() is required for large byte arrays in some JDBC drivers. Default: false
useSetObject	If useSetObject is set to true, the SQL repository always uses setObject() instead of setInt(), setFloat(), setDouble(), or setString() in prepared statements. Default: false

Property	Description
useSetUnicodeStream	If useSetUnicodeStream is set to true, the SQL repository always uses setUnicodeStream() instead of setString() in prepared statements. The setUnicodeStream() method is required for large Strings in some JDBC drivers. Setting useSetUnicodeStream to true is recommended if you use Oracle with internationalized content, but is not recommended if you do not have internationalized content in your database. Note that if you use MS SQL Server, you must set useSetUnicodeStream to false. Default: true
useTransactionsForCachedReads	By default, the SQL repository does not use transactions when reading from the cache. This improves performance. To disable this optimization, set this property to true. Default: false
wildcardEscapeCharacter	This character is used in queries to escape characters that are otherwise treated as wildcards. See the description of the escapeWildcards property. Default: \
XMLToDomParser	The parser used to parse the XML definition file. This value is read-only Default: atg.xml.tools.XMLToDomParser
XMLToolsFactory	An XMLToolsFactory to use in parsing XML templates. Default: /atg/dynamo/service/xml/XMLToolsFactory

14 SQL Content Repositories

A content repository comprises repository items that correspond to documents maintained in a hierarchical name space. A content repository typically serves as a source of content items to display to a user, directly or as an element in a page.

An SQL repository implemented through the Generic SQL Adapter connector can act as a content repository, storing content items that are displayed in pages. Because the `GSARepository` class implements two interfaces —`atg.repository.Repository` and `atg.repository.content.ContentRepository`—and a repository can contain multiple repository item types, a single repository can contain both content repository items (arranged in a hierarchical structure with folders that can contain repository items and other folders) and non-content repository items (arranged in a flat structure).

You can use a content repository to serve targeted content, as described in the *Creating Rules for Targeting Content* and *Setting Up Targeting Services* chapters of the *Personalization Programming Guide*. A product catalog in a commerce application is also typically a content repository, as described in the *Using and Extending the Default Catalog* chapter of the *Commerce Programming Guide*.

Note that the essential feature of a content repository is that it represents a hierarchical structure of folders and repository items, like a directory structure. The repository items themselves do not necessarily represent content that is displayed in a Web application, although in most cases they do. What is significant is whether the repository items are maintained in a hierarchical structure.

You can define one or more item descriptors in an SQL repository to be a content item descriptor that defines a type of `ContentRepositoryItem`. When you retrieve one of these items by calling any Repository methods, the repository item implements the `atg.repository.content.ContentRepositoryItem` interface. You can have other item descriptors in the same repository that do not implement this interface and do not define content items.

The Repository Loader is a utility that handles the work of creating and updating content repository items from documents on your file system. The repository template can be configured so the loader assigns the values of your content repository item's properties from selected portions of these documents while still allowing access to the entire document. These properties include metadata about the document file such as its length and the time it was last modified. The Repository Loader can be configured to periodically scan the file system and synchronize it with the repository representation, adding, updating and deleting content repository items as necessary. See the *Repository Loader* (page 223) chapter for more information.

Setting Up an SQL Content Repository

You can think of a content repository item as consisting of content and metadata. For example, if your content repository includes repository items that are news stories, the metadata might include a story's byline, dateline,

length, and keywords, while the content includes the text of the story itself. You can adopt one of two basic architectural styles when you set up an SQL content repository:

- You can store both the content and the metadata in your SQL database. A content repository item includes a property whose value was the content.
- You can store the metadata in the database, and the content in your file system. In this case, the metadata includes properties that indicate how to look up the content in the file system. A content repository item includes a property whose value was a pointer to the content in the file system.

As with other repositories, setting up an SQL content repository involves the following steps:

1. Design the item types you want to include in your content repository. For each type of repository item, decide what sorts of properties you want to have available to you for searching and targeting content in the repository.
2. Set up an SQL database containing content repository items, to act as the data store of the repository.
3. Create a repository definition. This is an XML file that describes the repository's item descriptors and property descriptors, and defines the relationship among these items and the rows and tables of the database. See Creating an SQL Content Repository Definition (page 214).
4. Configure an SQL Repository component that interacts with the data store you set up in step 2 to create, modify, and retrieve repository items. See Configuring an SQL Content Repository (page 222).

A repository that contains content items must include item descriptors flagged with the `folder` and `content` attributes of the `<item-descriptor>` tag in the SQL repository definition.

Creating an SQL Content Repository Definition

An SQL content repository is an implementation of the Generic SQL Adapter. Its repository definition follows the SQL repository definition file syntax described in the SQL Repository Definition Tag Reference (page 161) in the *SQL Repository Reference* (page 161) chapter. In particular, an SQL content repository is characterized by the <item-descriptor> (page 163) attributes described in the Content Item Attributes (page 167) section.

Note the following points that are particular to SQL content repositories:

- A repository that contains content items must include one item descriptor flagged with the `folder` and one or more item descriptors flagged with the `content` attributes of the `<item-descriptor>` tag in the SQL repository definition. See Folder and Content Item Descriptors (page 214).
- The `folder` item descriptor and the `content` item descriptors must define properties that define the pathname of each folder and content item. These properties are used to retrieve the content item and identify the place of each folder or content item in the content repository's hierarchical namespace. See Path and Item ID Attributes (page 215).

Folder and Content Item Descriptors

An SQL content repository must contain:

- One item descriptor that defines repository items that act as folders (the `folder` item descriptor)

- One or more item descriptors that define content repository items (the `content` item descriptors).

Items defined by the `content` item descriptor implement the `atg.repository.content.ContentRepositoryItem` interface. Items defined by the `folder` item descriptor implement the `atg.repository.content.FolderItem` interface, as well as the `atg.repository.MutableRepositoryItem` interface.

Path and Item ID Attributes

The folder and content item descriptors must define properties that represent the name or path of the items. These properties must be mapped directly to columns of the database so queries can be performed against them.

You can use one of three different techniques to specify how path information is stored in the database:

- use-id-for-path (page 215)
- content-name-property (page 216)
- content-path-property (page 216)

Regardless of how you store path information in the database, you can get the path of an item with this method in the `atg.repository.content.FolderItem` interface (which is extended by the `ContentRepositoryItem` interfaces):

```
public String getItemPath()
```

This method returns the path of this item, represented as a relative path from the repository's root folder

use-id-for-path

This is the simplest mechanism. In this mode, the relative path name of the item is used as the ID of the repository item. Your database must then include an ID column that is a string large enough to hold the entire relative path name of each folder item and content item. Put this ID column in your primary table and set the `id-column-name` attribute of the primary table to point to this column. You then set `use-id-for-path="true"` for that item descriptor. For example:

```
<item-descriptor name="folder" folder="true"
  use-id-for-path="true" folder-id-property="folder-id">
    <table name="folder" id-column-name="id">
      <property name="id" column-names="id"/>
      <property name="folder-id" column-names="folder_id"/>
...
    </table>
</item-descriptor>
<item-descriptor name="article" content="true"
  use-id-for-path="true" folder-id-property="folder-id">
    <table name="articles" id-column-names="id">
      <property name="id" column-names="id"/>
      <property name="folder-id" column-names="folder_id"/>
...
    </table>
</item-descriptor>
```

The `use-id-for-path` mode may not work if you have an existing database schema that does not follow this format. This approach also might not work if path names in your repository are longer than the size of `varchar`

you can efficiently store and query against in your database. Some databases impose a 255-character limit on the size of queryable columns. This may be too small to hold the entire path for some content repositories.

Note that even though you put the entire path name in the property designated by the `id-column-names` attribute, you still need to use the `folder-id-property` attribute to designate a property that holds the name of the parent folder of the item. In the preceding example, the `folder-id` property holds the name of the folder.

content-name-property

You can set the item descriptor's `content-name-property` attribute. In this case, you can store just the name of the repository item itself (rather than the entire path name) in one property of the repository item and use the `content-name-property` to designate the name of this property. The `content-name-property` specifies the property representing the name of the folder item or content item, while the `folder-id-property` specifies the property representing the parent folder of the folder item or content item. From these two pieces of information let you compute the path for a given item by walking up the content hierarchy.

The operation of computing the path for this item is more expensive in this mode, because you query up the folder hierarchy to compute the path for an item rather than get the path from a single property. However, this mode can overcome the problem of the size limitation on queryable columns. Now the column size for the content name limits the size of each individual component of the file name, not the size of the entire path.

A `folder-id-property` is required for all content repositories, whichever method they use to specify how path information is stored in the database. The data type of the `folder-id-property` can be `data-type="string"` (or whatever type you define your repository IDs to be), or you can specify that its `item-type` is the name of the folder item descriptor. This enables you to conveniently access folder information from the item itself. For example:

```
<item-descriptor name="folder" folder="true"
  content-name-property="filename" folder-id-property="folder-id">
    <table name="folder" id-column-names="id">
      <property name="filename" data-type="string"/>
      <property name="folder-id" item-type="folder"/>
...
    </table>
</item-descriptor>
```

Because this `content-name` property is not guaranteed to be unique across the repository, you have a separate column for the ID of this repository

content-path-property

You might be unable to use the repository item's path as its repository ID. If that is the case, perhaps due to references to these rows from other tables, and if you can store the entire path name of the item as a column in your table, you can use a third alternative. In this mode, you can set the `content-path-property` to refer to a property that holds the path name of the item. You then use a separate property and column in your table to refer to the ID for this item. For example:

```
<item-descriptor name="folder" folder="true"
  content-path-property="pathname">
    <table name="folder" id-column-names="id">
      <property name="id" data-type="long"/>
      <property name="pathname" data-type="string"/>
...
    </table>
```

```
</item-descriptor>
```

Defining Content Item Descriptors

The `<item-descriptor>` tags in a repository definition file can include a set of attributes that are specific to content repositories. These attributes are described in the Content Item Attributes (page 167) section in the *SQL Repository Reference* (page 161) chapter. These `<item-descriptor>` tag attributes are:

```
content
folder
content-name-property
content-path-property
use-id-for-path
folder-id-property
content-property
content-length-property
last-modified-property
```

Content Attributes and Properties

A content item descriptor must define a `content-property` property and optionally can define a `lastModified` or `length` property. The `content-property` attribute specifies the name of an item descriptor property that is used to store or reference the content data itself. The content property is usually a `java.io.File`, `String` or a `byte[]` data type.

These properties can be implemented as user-defined properties so they can be computed at run time. This approach enables them to be taken from the file system, not stored in the database. For example:

```
<item-descriptor name="files" content-length-property="length"
                 last-modified-property="lastModified" content-property="data">
  <table name="media_files" type="auxiliary" id-column-names="media_id">
    <property name="length" data-type="long" column-names="length"/>
    <property name="lastModified" data-type="timestamp"
              column-names="last_modified"/>
    <property name="data" data-type="binary" column-names="data"/>
  </table>
</item-descriptor>
```

You configure your content item descriptors by naming the properties to use to retrieve each of these values. This is done with the following attributes in the `<item-descriptor>` tag:

Attribute Name	Description
`content-path-property`	Specifies the ID of the folder containing this folder or content item.
`content-name-property`	Refers to the name of this folder or content item (not the full path name)
`content-property`	For content item descriptors, this is the name of the property that holds the content itself.

Attribute Name	Description
last-modified-property	For content item descriptors, this optionally is used to specify a property that can be used to retrieve the last modified time for that piece of content.

Storing Content on a File System

If you want to keep the repository content on a file system rather than in your database, you can use a property descriptor, atg.repository.FilePropertyDescriptor, as the property type of your content-property. The FilePropertyDescriptor is a simple read-only property descriptor that takes a path name and converts it to a java.io.File object. Use a pathPrefix attribute in the property definition to specify the parent directory of the content.

In the following example, the articleText property is defined with the atg.repository.FilePropertyDescriptor property type. The pathPrefix is defined as /tmp/:

```
<item-descriptor name="articles ...
                 content-property="articleText">
...
   <property name="articleText"
             property-type="atg.repository.FilePropertyDescriptor">
  <!--
    Looks for content starting in the /tmp directory. The item-path is
    appended to the pathPrefix to create the file system path
    -->
      <attribute name="pathPrefix" value="/tmp/"/>
   </property>
...
</item-descriptor>
```

Content Repository Example

This section demonstrates the design and configuration of a simple repository. For another example, see the Repository Loader Example (page 241) in the *Repository Loader* chapter. In this example, the repository supports a Web site that talks about books. Each book has an author, a title, a cover illustration, and a descriptive text.

The book as a business entity has a corresponding repository item type in this example. Its attributes are maintained as properties of the book item type. The book item type is defined in the example repository definition file with this item descriptor element:

```
<item-descriptor name="book"
                 display-property="title"
                 content="true"
                 content-property="bookcover_image"
                 content-path-property="filePath"
                 folder-id-property="parentFolder">
```

```
  <table name="book_info" id-column-name="id" type="primary">
          <property name="filePath" data-type="big string"/>
          <property name="parentFolder" item-type="book_folder"/>
          <property name="title" data-type="big string"/>
          <property name="author" data-type="big string"/>
  </table>

  <property name="bookcover_image"
            property-type="atg.repository.FilePropertyDescriptor"/>
</item-descriptor>
```

Book Item Type Properties

The book item descriptor contains the following properties:

- author and title are strings, with one-to-one relationships between books and authors and books and titles. More complex relationships are possible, of course.
- bookcover_image is defined outside the <table> tag, which indicates that the property is transient and maintained outside the database. The property is defined as a file type, maintained on the file system, as follows:

  property-type="atg.repository.FilePropertyDescriptor"

  As described in the Storing Content on a File System (page 218) section, this property type indicates that the repository should use the property's path name and convert it to a java.io.File object.

Locating the Content with Path and Folder Properties

In order to keep a hierarchical directory structure, define a folder item type named book_folder:

```
<item-descriptor name="book_folder"
                 display-property="folderPath"
                 folder="true"
                 content-path-property="folderPath"
                 folder-id-property="parentFolder">
  <table name="book_folder" id-column-name="id" type="primary">
          <property name="parentFolder" item-type="book_folder"/>
          <property name="folderPath" data-type="big string"/>
  </table>
</item-descriptor>
```

This item type is specified to be a folder with the attribute folder="true". The folder-id-property attribute in the item-descriptor tag indicates that this item stores its parent folder ID in the database with a property named parentFolder.

The book and the book_folder item types store their paths in the database with the content-path-property attribute. The content-path-property attribute indicates the property of this item that defines the absolute path name of this item in the folder hierarchy. In this example, the path is stored in the property named folderPath. If the example has especially deep hierarchies, resulting in excessively long path names, it might instead store just the name of this item with the content-name-property attribute, and have the repository calculate the item's absolute path by determining its parent folders, with the property indicated by the folder-id-property attribute.

Book Example Repository Definition File

The complete example repository definition file used in this example is as follows:

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template PUBLIC "-//Art Technology Group, Inc.//
DTD Dynamo Security//EN" "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">

<gsa-template>

  <item-descriptor name="book_folder"
                   display-property="folderPath"
                         folder="true"
                         content-path-property="folderPath"
                         folder-id-property="parentFolder">

   <table name="book_folder" id-column-name="id" type="primary">
          <property name="parentFolder" item-type="book_folder"/>
          <property name="folderPath" data-type="big string"/>
   </table>
  </item-descriptor>

  <item-descriptor name="book"
                    display-property="title"
                    content="true"
                    content-property="bookcover_image"
                    content-path-property="filePath"
                    folder-id-property="parentFolder">

     <table name="book_info" id-column-name="id" type="primary">
          <property name="filePath" data-type="big string"/>
          <property name="parentFolder" item-type="book_folder"/>
          <property name="title" data-type="big string"/>
          <property name="author" data-type="big string"/>
     </table>

     <property name="bookcover_image"
             property-type="atg.repository.FilePropertyDescriptor"/>

  </item-descriptor>

</gsa-template>
```

Book Example SQL Table Creation Statements

The following SQL creates the tables used by the book example content repository:

```
-- drop table book_folder;
-- drop table book_info;

CREATE TABLE book_folder (
     id               VARCHAR(32)     not null,
     parentFolder     VARCHAR(32)     null references book_folder(id),
     folderPath       long varchar    null,
     primary key(id)
);
```

```
CREATE TABLE book_info (
     id                 VARCHAR(32)     not null,
     filePath           long varchar     null,
     parentFolder       VARCHAR(32)     null references book_folder(id),
     title              long varchar     null,
     author             long varchar     null,
     primary key(id)
);
```

Adding Content to the Content Repository

You can add items to the content repository with the tags described in the *Developing and Testing an SQL Repository* (page 147) chapter. For a more scalable method of adding items to the repository, see the *Repository Loader* (page 223) chapter.

For example, the following three `add-item` tags:

1. Create a `book_folder` item named `/`.

```
<add-item item-descriptor="book_folder" id="folder:/">
<set-property name="folderPath" value="/"/>
</add-item>
```

2. Create a subfolder of `/` named `foo`, with a path of `/foo`.

```
<add-item item-descriptor="book_folder" id="folder:/foo">
<set-property name="parentFolder" value="folder:/"/>
<set-property name="folderPath" value="/foo"/>
</add-item>
```

3. Create a `book` item titled `bar`, with a path of `/foo/bar`.

```
<add-item item-descriptor="content" id="content:/foo/bar">
<set-property name="parentFolder" value="folder:/foo"/>
<set-property name="filePath" value="/foo/bar"/>
<set-property name="title" value="bar"/>
</add-item>
```

Accessing Items in the Content Repository

After you have set up a content repository, you can use it to serve targeted content, as described in the *Creating Rules for Targeting Content* and *Setting Up Targeting Services* chapters of the *Personalization Programming Guide*. You can also search for text in content items as described in the Text Search Queries (page 92) section of the *SQL Repository Queries* (page 81) chapter.

You can also get repository items programmatically, given a repository ID:

```
// repository id of the item we want to get
   String id = "1001";

   // name of item descriptor describing the type of item we want
   String descriptorName = "book";
```

```
// get the item from the repository
RepositoryItem item = pRepository.getItem(id, descriptorName);

// make sure we have an item
if (item == null)
  {
    pln("Item not found, descriptor=" + descriptorName +
        ", id=" + id);
    return;
  }

// get the author property of the item
String author = (String)item.getPropertyValue("author");
```

Configuring an SQL Content Repository

The Repository component for an SQL content repository is a standard SQL Repository component of class `atg.adapter.gsa.GSARepository`. The Configuring the SQL Repository Component (page 203) section of the *SQL Repository Reference* (page 161) chapter describes the properties you can configure.

15 Repository Loader

For many development environments, it often makes sense to create the content of repository items directly on a file system, then load those items into an Oracle ATG Web Commerce repository. The Oracle ATG Web Commerce Repository Loader provides a flexible way to take files that are stored in a file system, convert them into repository items, and load the items into the repository.

The Repository Loader can load into an SQL repository HTML files, XML files, and binary media such as image or audio files. The Repository Loader can transform files into XML files, then transform the XML files into repository items.

You can configure the Repository Loader to perform the load operation in two ways:

- Scan the file system and identify the files to load, then load the files on command or on a specified schedule.
- Submit a manifest file to the Repository Loader that specifies the files to load.

Scanning the file system requires less administrative effort; using a manifest file incurs less system overhead. The number of files to scan and load generally determines which option is best.

This chapter includes the following sections:

- Repository Loader Architecture (page 223)
- Repository Loader Components (page 224)
- Repository Loader Administration (page 233)
- RLClient (page 234)
- Importing Versioned Repository Data (page 236)
- Repository Loader Example (page 241)

Repository Loader Architecture

The Repository Loader is implemented by the following components:

- FileSystemMonitorScheduler (page 225) sets up a schedule to start the FileSystemMonitorService, and whether to scan recursively.
- FileSystemMonitorService (page 225) specifies which files to scan for upload to the repository.

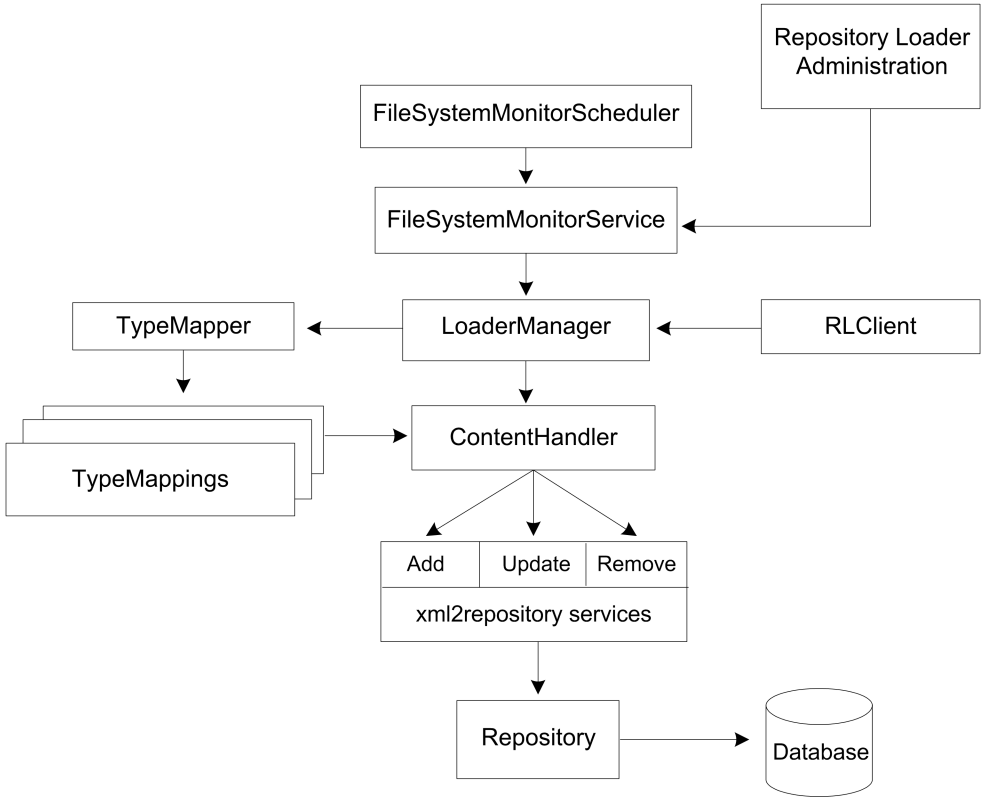
- LoaderManager (page 227) accepts repository loader jobs. It maintains a queue of pending jobs, and uploads the job for type mapping processing
- TypeMapper and TypeMappings (page 229) map file types to specific content handlers.
- ContentHandlers (page 232) transform the file into a repository item and invoke a back end system to perform add, update, and remove operations on the repository.

Repository Loader interfaces

Oracle ATG Web Commerce provides two interfaces to invoke and manage the Repository Loader:

- Repository Loader Administration (page 233) is a Web-based interface that lets you start and manage repository load jobs. With this interface, you interactively identify the directories whose contents you wish to load into the repository.
- RLClient (page 234) is a command line RMI utility; it requires a manifest file that identifies the files to load into the repository.

A fully-configured Repository Loader setup can be represented as follows:



Repository Loader Components

The following sections describe Repository Loader components in detail—their interfaces and classes, and properties.

FileSystemMonitorScheduler

You can configure a FileSystemMonitorScheduler component to initiate scheduled file system scans by the FileSystemMonitorService (page 225). If enabled, this component initiates the scan according to the specified schedule. If set to false, the load process must be initiated by the Repository Loader Administration (page 233) or the RLClient (page 234).

FileSystemMonitorScheduler properties

The FileSystemMonitorScheduler has the following configurable properties:

Property	Description
`enabled`	A Boolean property, determines whether the scheduler is enabled. Default: `false`
`fileSystemManager`	Specifies the implementation of interface `fileSystemManager`. Default: `FileSystemMonitorService`

`lastScannedStorage`	Specifies the URI of a file that stores the time of the last file scan:
	
	Default:
	`{serverHomeDirResource?resourceURI=`
	`data/rl/FileSystemMonitorLastScan.txt}`

`recursiveScan`	A Boolean property, specifies whether the FileSystemMonitorService (page 225) recursively scans the supplied paths. Default: `true`
`schedule`	The schedule for scanning the file system. For example: `schedule=every 2 hours in 15 minutes` For information about valid formats for this property, see the *Core Dynamo Services* chapter of the *Platform Programming Guide*. Default: `Every\ 240\ seconds\ without\ catchup`
`scheduler`	The Nucleus address of the Scheduler component, which initiates the file scan. If set to null, no rescanning occurs. Default: `/atg/dynamo/service/Scheduler`

FileSystemMonitorService

The `FileSystemMonitorService` class implements two interfaces:

- `atg.repository.loader.FileSystemMonitor`
- `atg.repository.loader.FileSystemManager`

A component of the `FileSystemMonitorService` class is configured to scan a specified file directory and identify the files to upload. A FileSystemMonitorService can be invoked by the FileSystemMonitorScheduler (page 225) or the Repository Loader Administration (page 233).

You can configure a FileSystemMonitorService so it uploads only files that meet one or more of the following criteria:

- Reside in a specified folder and, optionally, its subfolders
- Modified since the time the file system was last scanned
- Named with specific file extensions

After the FileSystemMonitorService identifies the files to upload, it supplies these files to a LoaderManager (page 227) component as an array of files, or in the form of a manifest file if the component's `createManifestMode` property is set to true.

When you start the Repository Loader module, the path to the `FileSystemMonitorService` component is `/atg/dynamo/service/loader/FileSystemMonitorService`.

FileSystemMonitorService properties

A FileSystemMonitorService component has the following configurable properties:

Property	Description
`createManifestMode`	A Boolean property, set to true to indicate that a large file system is being processed. The FileSystemMonitorService passes files to the LoaderManager in the form of a manifest file, rather than as an array of files. You can supply the name of the manifest file by setting the `manifestFile` property. Default: `true`
`escapeManifestUsing CDATASection`	A Boolean property, set to true in if `createManifestMode` property is set to true and file system names contain special characters such as ampersand (&) that must be escaped in the generated manifest's XML. Default: `false`
`filters`	A String array of file extension strings to use as filter criteria when gathering updates. Only files whose file extensions match one of the strings in this property are scanned. For example: `filters=.html,.htm,.wml`
`includeFolders`	A Boolean property, specifies whether to include the content folders in the scan results. Set to `true` in order for folders to be created as folder repository items in a content repository. Default: `false`
`lastScanned`	A timestamp property, specifies the last time the FileSystemMonitorService executed. Default: `0` (load all files)

Property	Description
loaderManager	The Nucleus address of the LoaderManager component.
manifestFile	The manifest file name to use if createManifestMode is set to true. Default: RL*xxxx*.xml *xxxx* is a unique name assigned to the file using the method File.createTempFile.
rootPath	The root path to monitor. All files to scan must be in or under this path.
typeMapper	The Nucleus address of the TypeMapper component. This setting has precedence over the LoaderManager (page 227) configuration's defaultTypeMapper setting. If a manifest file specifies its own TypeMappings, those have precedence.

LoaderManager

The LoaderManagerImpl class implements the interface atg.repository.loader.LoaderManager. A LoaderManager component of type LoaderManagerImpl accepts Repository Loader jobs. Repository jobs can be initiated from two sources:

- FileSystemMonitorService (page 225)
- RLClient (page 234) (Repository Loader RMI client)

In both cases, the LoaderManager component passes the files to a TypeMapper component, which determines how to process them. Alternatively, the TypeMapping can be specified directly or in a manifest file.

Setting the repository path separator on Windows

Before submitting an import job to the LoaderManager on Windows, the target repository's pathSeparator property must be set to backslash (\). After the import completes, reset this property to forward slash (/).

Note: If you set this pathSeparator directly in a properties file rather than in the ACC, use this format:

```
pathSeparator=\\
```

LoaderManager Properties

A LoaderManager component has the following configurable properties:

Property	Description
cancelledJobsFifoSize	The number of cancelled jobs that can be kept in the queue and are viewable in the Repository Loader Administration Default: 0
completedJobsFifoSize	The number of completed jobs that should be kept in the queue Default: 20

Property	Description
defaultBatchSize	The number of files to handle in a single transaction. This value can be overridden by a batch size argument provided in the LoaderManager's load() and remove() methods. A batch size of -1 means to handle the entire job in one transaction. A batch size of 0 or 1 means to treat each file as a separate transaction. Default: -1
defaultTypeMapper	The default TypeMapper that the LoaderManager uses if no TypeMapper is provided in the LoaderManager methods load() or processManifest(), or by the FileSystemMonitorService. If a manifest file specifies its own TypeMappings, those have precedence. Type: atg.repository.loader.TypeMapper Default: /atg/dynamo/service/loader/FileExtensionTypeMapper
jobEventListeners	An array of components that listen to JobEvents Type: atg.repository.loader.JobEventListener[]
jobIdGenerator	An IdGenerator component that creates job IDs Type: atg.service.idgen.IdGenerator Default: /atg/dynamo/service/FileIdGenerator
jobIdPrefix	A string to prepend to JobIds Default: RLJob
jobIdSpace	The name of the IdSpace used to generate JobIds Default: RLModuleJobIdSpace
jobQueueSize	The number of threads used in the jobs queue Default: 1
loaderErrorEventListeners	An array of components that listen to error LoaderEvents Type: atg.repository.loader.LoaderErrorEventListener[] Default: null
loaderEventListeners	An array of components that listen to add, update and remove LoaderEvents. Type: atg.repository.loader.LoaderEventListener[]

Property	Description
`suspendedJobsFifoSize`	The number of suspended jobs that should be kept in the queue Default: `10`
`suspendFailedJobs`	A Boolean property, specifies whether to suspend or cancel failed jobs. Default: `true`

Error policies

The LoaderManager uses a configurable error handling policy, defined by the Repository Loader's ErrorPolicy component. Each job processed by the LoaderManager might contain files that cause exceptions to be thrown. The LoaderManager consults the ErrorPolicy component to determine how to handle exceptions. All exceptions are logged. The Repository Loader sets a success state for each job and each batch. ErrorPolicy methods also determine how to proceed after encountering a problem while processing a job:

ErrorPolicy method	Returns
`checkIsExceptionFatal`	`true`: The exception terminated a job. `false`: Invoked `checkRequiresNewTransaction` method.
`checkRequiresNewTransaction`	`true`: The exception required a new transaction in order to continue.
`checkEndTransactionWithBatchState`	`true`: Transaction demarcations should end using the value of the job's `batchFailed` property. If a batch fails, all subsequent batches in the job are rolled back, whether or not they contain errors.

TypeMapper and TypeMappings

Your file system might have different file types, where each type has different requirements for conversion into a repository item. The TypeMapper component determines which of the configured set of TypeMapping components is appropriate for a given file. Each TypeMapping specifies a content handler component. The file is routed to the appropriate ContentHandler for its type.

TypeMapper component

A TypeMapper component can be created from one of two classes:

- `atg.repository.loader.ExtFilterTypeMapper` specifies one or more file extensions in its `extensions` property. Source file extensions are thereby mapped to the appropriate TypeMappings.
- `atg.repository.loader.DirFilterTypeMapper` specifies one or more source file parent directories in its `directories` property. These directories determine the location of source file type mappings.

In both cases, the `extensions` and `directories` are array properties whose elements map to the corresponding elements in the `typeMappings` property.

In the following example, a TypeMapper configuration maps five file extensions to five TypeMappings. Thus, files with extension `.cfo` map to TypeMapping `CatalogFolderTypeMapping`, `.ctg` maps to `CatalogTypeMapping`, and so on:

```
$class=atg.repository.loader.ExtFilterTypeMapper
$scope=global

extensions+=.cfo,.ctg,.cat,.prd,.sku
typeMappings+=\
  CatalogFolderTypeMapping,\
  CatalogTypeMapping,\
  CategoryTypeMapping,\
  ProductTypeMapping,\
  SkuTypeMapping
```

TypeMapper properties

A TypeMapper component is configured with the following properties:

Property	Description
`folderTypeMapping`	The Nucleus address of the TypeMapping that handles folder item descriptors. This property is required if any source files are content item types.
`typeMappings`	An array of Nucleus addresses of the TypeMappings used by this TypeMapper component.
`extensions`	An array of file extensions, specified in TypeMappers of class `atg.repository.loader.ExtFilterTypeMapper`.
`directories`	An array of directories, provided in TypeMappers of class `atg.repository.loader.ExtFilterTypeMapper`.

TypeMapping properties

The Repository Loader includes a `TypeMappingImpl` implementation of the `TypeMapping` interface. You can configure an instance of `TypeMappingImpl` for a given item descriptor with the following properties:

Property	Description
`contentIsXML`	A boolean property, specifies whether files assigned to this mapping contain XML content.
`parseContent`	A boolean property, specifies whether to parse the content of files assigned to this mapping for property values.
`itemDescriptorName`	The name of the item descriptor handled by this TypeMapping.

Property	Description
`contentHandler`	The Nucleus address of the ContentHandler component that handles content for this mapping.
`contentRootPathProvider`	The Nucleus address of the ContentRootPathProvider component used by this mapping, if any.
`encodingTyper`	The Nucleus address of the PageEncodingTyper used by this mapping, if any.
`pathPropertyName`	If the item descriptor is not a content item descriptor, set this property to the name of a repository item property to hold the file path of the items.
`repository`	The Nucleus address of the MutableRepository that contains the item descriptor handled by this TypeMapping.

`updatePropertyConfiguration`	Specifies how this mapping uses ID and path properties to create, update, and remove items, one of the following:
	
	`CONTENT_ITEM_DESCRIPTOR_ID_AND_PATH_PROP`
	`CONTENT_DEFINED_ID_AND_NO_PATH_PROP`
	`CONTENT_DEFINED_ID_AND_NAMED_PATH_PROP`
	`GENERATED_ID_AND_NO_PATH_PROP`
	`GENERATED_ID_AND_NAMED_PATH_PROP`
	`ID_EQUALS_FILE_PATH`
	
	For information about these settings, see Setting Repository IDs (page 231).

Setting Repository IDs

When the Repository Loader creates a repository item from a file, it must assign that item a repository item ID. A TypeMapping's `updatePropertyConfiguration` property points to an enumeration (of class `UpdatePropertyConfiguration`) that describes how repository item IDs and path properties are used by the repository, and the TypeMapping used to set the repository item ID and locate repository items for update.

The enumeration can be set to one of the following values:

- `CONTENT_ITEM_DESCRIPTOR_ID_AND_PATH_PROP`

  For content item descriptor types only, use descriptor metadata to determine which properties should be used to assign the repository item ID and path properties. IDs can still be assigned from content data.

  If you use this value, make sure the source files do not include an ID tag, or set their TypeMapping's `parseContent` property to `false`.

- `CONTENT_DEFINED_ID_AND_NO_PATH_PROP`

  The repository item ID property is set as part of the file parsing process. Because the file content uniquely and persistently defines the repository item's ID, no path property needs to be assigned.

- `CONTENT_DEFINED_ID_AND_NAMED_PATH_PROP`

The repository item ID property is set as part of the file parsing process. Set the repository item property specified by the TypeMapping's `pathPropertyName` property with the file's path.

- `GENERATED_ID_AND_NO_PATH_PROP`

  Use a value generated by the `IdGenerator` for the repository item ID, using the `IdGenerator` specified by the `TypeMapping`'s `idGenerator` property. If no `idGenerator` is specified, errors result. No path property is set. As a consequence, files assigned to this mapping cannot be updated or removed with the Repository Loader.

- `GENERATED_ID_AND_NAMED_PATH_PROP`

  Use a value generated by the `IdGenerator` for the repository item ID, using the `IdGenerator` specified by the `TypeMapping`'s `idGenerator` property. If no `idGenerator` is specified, errors result. Set the repository item property specified by the `TypeMapping`'s `pathPropertyName` property with the file's path.

- `ID_EQUALS_FILE_PATH`

  For non-content item descriptors. Use the file's path as both its repository item ID and its path value. If you use this value, make sure the source files do not include an ID tag, or set their TypeMapping's `parseContent` property to `false`.

ContentHandlers

Files are routed to ContentHandler components according to the mapping of file types and item descriptors, as established by TypeMapping components. Each ContentHandler transforms files into repository items and invokes a back end system to perform add, update, and remove operations on the repository.

The Oracle ATG Web Commerce platform provides one ContentHandler class:

`atg.repository.loader.Xml2RepositoryContentHandler`

This class transforms source files into XML files that conform to the provided xml2repository Schemas (page 245), then transforms the XML files into repository items.

ContentHandler properties

A ContentHandler component has the following configurable properties:

Property	Description
`addService`	The component that handles repository add operations.
`removeService`	The component that handles repository remove operations.
`updateService`	The component that handles repository update operations.
`enableTransforms`	Boolean, specifies whether an XMLTransformer component (page 233) is enabled.
`transformFilter`	The `FileMappingFilter` that determines whether to run a file through the XMLTransformer component (page 233).

Property	Description
exceptionOnZeroRemove	Boolean, specifies whether to throw an exception if a remove operation removed no repository items.
idPropertyNameForQueries	The name of the property to use for queries where the TypeMapping updatePropertyConfiguration property is set to one of the following: CONTENT_DEFINED_ID_AND_NO_PATH_PROP CONTENT_DEFINED_ID_AND_NAMED_PATH_PROP

Note: In order to add repository items, set the property updateService.addWhenNoMatchedItems to true; this enables execution of the component specified by the ContentHandler's addService property.

XMLTransformer component

The XMLTransformer component has a stylesheets property, which is set to one or more style sheet files; these enable transformation of XML files at load time into the required format. Depending on the number and complexity of the stylesheets, this can be a resource-intensive operation.

An XMLTransformer instance is found in Nucleus at:

```
/atg/dynamo/service/loader/typemapping/SampleXMLTransformer
```

Repository Loader Administration

The Repository Loader includes a Web application comprised of administration JSPs and form handlers, where you create, delete, and monitor Repository Loader jobs. To use the Repository Loader Administration, include the RL module among the Oracle ATG Web Commerce modules that are specified when assembling the application EAR file.

You access the Repository Loader Administration from this URL:

```
http://hostname:port/rl
```

For example, if you use JBoss and the default JBoss port and your browser runs on the same machine as your Web server, use the following URL:

```
http://localhost:8080/rl
```

For details about using the Repository Loader Administration, see the Repository Loader Example (page 241) section.

RLClient

RLClient is an RMI client you can use to submit manifests that identify the files to load into the repository. Manifests are processed by the RemoteManifestProcess component `/atg/dynamo/repository/loader/RemoteManifestProcessorService`. You invoke the RLClient with this script:

```
<ATG11dir>/RL/bin/RLClient.{bat|sh}
```

Note: Before you run the script, set the `DYNAMO_HOME` variable.

See Repository Loader Manifest (page 235) for information about the manifest file format.

Command-line arguments

The following table describes the command-line arguments supplied to the `RLClient` script.

Required arguments	Description
`-m` *`manifestFilePath`* `-mp` *`manifestFilePath`*	The `-m` and `-mp` switches specify the server-side path to the manifest that contains the desired load commands. Use the `-mp` switch if the RLClient and host run on different operating systems.
`-h` *`hostname`*	Name of the host where the RemoteManifestProcessor runs.

Optional arguments	Description
`-p` *`propertiesFilePath`*	Path to a properties file that contains additional LoaderManager parameters. See Supplemental RLClient Parameters (page 234).
`-r` *`RMIPort`*	RMI port of the host where the RemoteManifestProcessor runs. If omitted, the default port is 8860.
`-s` *`servicename`*	Nucleus address of the RemoteManifestProcessorService component. If omitted, the default value is: `/atg/dynamo/repository/loader/RemoteManifestProcessorService`

Supplemental RLClient Parameters

You can supply RLClient the address of a properties file via its `-p` switch, which provides more LoaderManager parameters. This file can set the following properties:

Property	Description
batchSize	The number of files to process in each transaction. If omitted, RLClient uses the value of the LoaderManager's defaultBatchSize property. This property's default value is -1, which specifies to handle the entire import in one transaction.
numElementsInManifest	The total number of files in the manifest

For example:

```
atg.repository.loader.batchSize=2
atg.repository.loader.numElementsInManifest=725
```

Repository Loader Manifest

If the content root in the file system for your repository contains a large number of files, the FileSystemMonitorService might require a long time to identify which files and folders to load into the repository, and for the LoaderManager and ContentHandlers to convert the files and folders into repository items. You can reduce processing overhead by creating a Repository Loader manifest file that identifies in advance the files and folders to load.

For example, the following Repository Loader manifest file adds five files:

```
<manifest>
  <add>/main/Dynamo/RL/sample-data/user001.xml</add>
  <add>/main/Dynamo/RL/sample-data/user002.xml</add>
  <add>/main/Dynamo/RL/sample-data/user003.xml</add>
  <add>/main/Dynamo/RL/sample-data/user004.xml</add>
  <add>/main/Dynamo/RL/sample-data/user005.xml</add>
</manifest>
```

Elements in a Repository Loader manifest file are handled in order of appearance, so one element should not depend on a later element. For example, a content repository requires a folder hierarchy; so a content item should not precede the folder that contains it.

Document Type Definition

The Repository Loader manifest file is an XML file that conforms to the following DTD:

```
<!--
========================================================================
rl-manifest_1.0.dtd - document type for Repository Loader manifests
Version: $Id: //product/DAS/main/Java/atg/dtds/rl/rl-manifest_1.0.dtd#1 $
$Change: 286550 $
========================================================================
-->
<!-- A single manifest composed of any number of add, update, remove tags -->
<!ELEMENT manifest (add | update | remove)*>
<!ATTLIST manifest num-elements CDATA #IMPLIED>
<!ELEMENT add (#PCDATA)>
<!ATTLIST add type-mapping CDATA #IMPLIED>
```

```
<!ELEMENT update (#PCDATA)>
<!ATTLIST update type-mapping CDATA #IMPLIED>
<!ELEMENT remove (#PCDATA)>
<!ATTLIST remove type-mapping CDATA #IMPLIED>
```

Manifest File Tags and Attributes

The Repository Loader manifest file uses the following XML elements:

Tag/Attribute	Description
`<manifest>`	Wraps the entire manifest.
`num-elements`	An attribute of the `<manifest>` tag, optionally indicates the total number of `add`, `remove`, and `update` elements in the manifest file.

`<add>`
 	
`<remove>`
 	
`<update>`
	Contains the path name of the source file or folder. For example:
	
	`<add>/home/Dynamo/RL/sample-data/user001.xml</add>`
	`<update>/home/Dynamo/RL/sample-data/user002.xml</update>`

`type-mapping`	An attribute of an `add`, `remove`, or `update` tag, optionally specifies the TypeMapping for processing this file. The attribute value must be the absolute Nucleus path of a component that implements `atg.repository.loader.TypeMapping`. **Note:** if no type-mapping is provided, the Repository Loader uses the TypeMapper that is specified by the LoaderManager (page 227) configuration.

Importing Versioned Repository Data

You can use the Repository Loader to import data into ATG Content Administration versioned repositories. The loader can perform these tasks:

- Import file asset metadata into the PublishingFileRepository and write the file contents to the file system. It can also import file asset data into any custom versioned repositories that store content repository assets.
- Import repository assets into a versioned repository.

The Repository Loader module is included automatically when you use the `Publishing.base` module or any module that requires `Publishing.base`.

This section contains information that is specific to configuring and using the Repository Loader to import assets into Content Administration repositories. It includes these topics:

- Configuring the VersionedLoaderEventListener (page 237)

- Importing Targeters that Reference rules Files (page 240)
- Configuring TypeMapping Components for the PublishingFileRepository (page 241)

Configuring the VersionedLoaderEventListener

In order to import repository assets into versioned repositories, you must configure a VersionedLoaderEventListener, whose tasks include creating and checking in the workspace that is used during the import. You create a VersionedLoaderEventListener component from this class:

`atg.epub.loader.VersionedLoaderEventListener`

VersionedLoaderEventListener properties

The following table describes VersionedLoaderEventListener properties:

Property	Description
`appendTimeToProcessName`	Set to `true` in order to append the import time to the name of the project created and used for the import. Default: `true`
`checkinOnCompletion`	Set to `true` if the workspace (and its assets) should be checked in. Otherwise, `false`. If the `workspaceName` property is set to the name of an existing workspace—typically, an active project's workspace—the Repository Loader blocks the check-in no matter how this property is set. If a project's workspace is checked in while the project itself remains active, various problems result. For example, users cannot complete or delete the project, or view imported assets in the project. Default: `true`
`createProjects`	Set to `true` in order to create a project and import assets into it. If set to `true`, the Repository Loader creates a project for importing file assets, under the name specified by properties `processNamePrefix` and `timeFormat`. Default: `false`
`disallowWorkspaceImportAfterTargetsCreated`	Specifies whether you can import an asset into an existing workspace specified by `workspaceName` after deployment target sites are initialized. If target sites are already initialized, this property must be set to `false` in order to allow import operations to succeed. Default: `true`
`password`	Password of the user to authenticate. Default: `admin`

Property	Description
`personaPrefix`	The substring in an ACL that is used to identify the user in the `UserAuthority`, set as follows: `Admin$user$`: The user who performs the import is using an ACC account. `Profile$login$`: The user who performs the import is using an Oracle ATG Web Commerce Business Control Center account. Default: `Admin$user$`
`processDescription`	An arbitrary string. Default: `Imported by the RepositoryLoader`
`processNamePrefix`	Together with `timeFormat`, specifies the name of the project used if `createProjects` is set to `true`. Default: `Content Administration Import`

`rootPath`	The fully qualified path of the parent folder of the top-level folder in the manifest to import, or the folder system to scan. All folders and files to import must be in or under this root folder.
	
	For example, you might set `rootPath` to `/users/joe/import` and import the following files via an automatic import:
	
	`/users/joe/import/file1`
	`/users/joe/import/dir/file2`
	`/users/joe/import/dir/dir2/file3`
	
	The directories and files imported into the `PublishingFileRepository` are as follows (specified from the repository's root):
	
	`/file1`
	`/dir/file2`
	`/dir/dir2/file3`
	
	Note 1: When performing imports on Windows, use double backslashes (`\\`)as path separators. For example:
	
	`C:\\ATG\\ATG11.0\\MyProductionModule\\config`
	
	Note 2: When importing the initial set of Oracle ATG Web Commerce assets from your production module, such as scenarios and slots, the root path is the production module's `config` directory, which contains the Oracle ATG Web Commerce assets.

Property	Description
timeFormat	The format to use when appending the import time to the name of project used for the import. The default format is: MMMMM dd, yyyy hh:mm:ss aaa For information on changing the default value, see the API reference for class java.text.SimpleDateFormat.
userAuthority	The userAuthority that resolves the user specified in the username property. Default: /atg/dynamo/security/UserAuthority
userName	The username of the user to authenticate. Default: admin
workFlowName	Default: /Common/commonWorkflow.wdl
workspaceName	The name of the workspace to use for the import. If the corresponding workspace does not exist, it is created by the system. All workspace names must be unique. The import fails if the name corresponds to a completed project's workspace (because it is already checked in). If createProjects is set to false (the default), the system creates a workspace for the import. If the workspaceName property is not set (the default), the system creates a workspace name from the IdGenerator; otherwise, it uses the name specified in this property. If createProjects is set to true, the system ignores this property and creates a project for the import.

Project properties

After you initialize a target site, the Repository Loader must import assets into a project. In order to do so, set the VersionedLoaderEventListener's createProjects property to true. When you run the Repository Loader on these assets, it performs these tasks:

- Creates a project, concatenating the project name from the values specified in the VersionedLoaderEventListener properties processNamePrefix and timeFormat.
- Imports the assets into that project.

User access configuration

The properties userAuthority, personaPrefix, userName, and password collectively verify user access to the secured versioned repository where file assets are imported—for example, /atg/epub/file/SecuredPublishingFileRepository.

Default configuration

By default, the VersionedLoaderEventListener is configured as follows:

```
$class=atg.epub.loader.VersionedLoaderEventListener

versionManager=/atg/epub/version/VersionManagerService

rootPath={appModuleResource?moduleID=home&resourceURI=}

createProjects=false
projectNamePrefix=Content Administration Import
appendTimeToProjectName=true
projectDescription=Imported by the RepositoryLoader
timeFormat=MMMMM dd, yyyy hh:mm:ss aaa

# The activity to associate with a project created by the loader
# activityId=merchandising.manageCommerceAssets
fworkflowName=/Common/commonWorkflow.wdl
userAuthority=/atg/dynamo/security/UserAuthority
personaPrefix=Admin$user$
userName=admin
password=admin

checkinOnCompletion=true
checkinComment=

idGenerator=/atg/dynamo/service/IdGenerator
workspaceNameIdSpace=repositoryLoaderWkspName
#workspaceName=RepLoader-1
```

Importing Targeters that Reference rules Files

Manually created targeters can store their rule sets in separate `.rules` files. If so, you must edit each applicable `RuleSetService` configuration file to specify the virtual file system that stores the `.rules` files, `ConfigFileSystem`. This also ensures deployment of the `.rules` file together with the `RuleSetService` to the corresponding `ConfigFileSystem` on the production site.

Note: This step is optional if the rule set is stored in the `RuleSetService's ruleSet` property; this is always true for targeters that you create in the Oracle ATG Web Commerce Control Center.

For each targeter that stores its rule set in a separate `.rules` file, modify the `RuleSetService` configuration file as follows:

```
rulesFileSystem=/atg/epub/file/ConfigFileSystem
```

For example:

```
$class=atg.targeting.RuleSetService

rulesFileSystem=/atg/epub/file/ConfigFileSystem
rulesFilePath=targeting/rulesets/NewEnglandSnowboarders.rules
updatesEnabled=true
rulesFileCheckSeconds=0
```

The property `rulesFileSystem` specifies the VFS that stores the `.rules` file, providing the system with a reference to the file via the VFS. This setting ensures the file is exposed properly in the content development environment and is deployed to the correct asset destination, the ConfigFileSystem.

Configuring TypeMapping Components for the PublishingFileRepository

Oracle ATG Web Commerce Content Administration provides a set of TypeMapping components for the default content item descriptors in the PublishingFileRepository, and a `PublishingTypeMapper` component that defines this array of TypeMapping components. These components are located in:

`<ATG11dir>/Publishing/base/config/atg/epub/file/typemappers`

You can configure additional TypeMapping components by extending the PublishingFileRepository to support additional content item descriptors (see the section Configure Support for Other File Assets in the *Content Administration Programming Guide*).

Repository Loader Example

The Repository Loader module includes a simple example of an SQL repository that uses the Repository Loader. The Repository Loader example is in the `<ATG11dir>/RL/Example` directory. It loads the files in the FileSystemMonitorService's root path:

`<ATG11dir>/RL/Example/j2ee-apps/example/web-app/public`

The SQL repository in this example is a GSARepository component with this Nucleus address:

`/atg/rl-example/ExampleRepository`

Repository item types in `ExampleRepository` are specified by this repository definition file:

`<ATG11dir>/RL/Example/config/atg/rl-example/exampleRepository.xml`.

This XML file defines the following item types in its item descriptors (note how content item types use item descriptor inheritance):

Item descriptor name	Description
`fileFolder`	A content folder item type.
`fileAsset`	A content item type. This is the super-type for a series of item types that inherit from the `fileAsset` item type. The type property specifies which subtype (`textFileAsset`, `binaryFileAsset`, `htmlArticle`, `txtPressRelease`, `xmlPressRelease`, `gifImage`, or `jpgImage`) an item belongs to. A `fileAsset` item also defines `lastModified`, `size`, and `parentFolder` properties.
`textFileAsset`	A content item type that inherits from `fileAsset`. It is designed for text files. The text content is stored in the `content` big string property. It has subtypes named `htmlArticle`, `txtPressRelease`, and `xmlPressRelease`.
`binaryFileAsset`	A content item type that inherits from `fileAsset`. The content is stored in the `content` binary property. It has subtypes named `gifImage` and `jpgImage`.
`htmlArticle`	A content item type that inherits from `fileAsset` and from `textFileAsset`. It defines a `published` timestamp property and a `keywords` string property.

Item descriptor name	Description
txtPressRelease	A content item type that inherits from fileAsset and from textFileAsset.
xmlPressRelease	A content item type that inherits from fileAsset and from textFileAsset.
gifImage	A content item type that inherits from fileAsset and from binaryFileAsset.
jpgImage	A content item type that inherits from fileAsset and from binaryFileAsset.
address	A simple non-content item type. Used by the user item type's addresses property.
contact	A non-content item type. Used by the user item type's contacts property.
phone	A simple non-content item type. Used by the user item type's numbers property.
user	A complex non-content item type. The user item type is described in detail in the User Item Type (page 242) section.

User Item Type

The user item type demonstrates a variety of data relationships. It shows how an item type can use properties that nest other item types. The user item descriptor is defined as follows:

```
<item-descriptor name="user" default="true">
    <table name="rlex_user" type="primary" id-column-name="id">
      <property name="id" data-type="string"/>
      <property name="name" column-name="nam_col" data-type="string"/>
      <property name="age" column-name="age_col" data-type="string"/>
    </table>

    <!-- a set of address items -->
    <table name="rlex_address" type="multi" id-column-name="user_id">
      <property name="addresses" column-name="addr_id" data-type="set"
                component-item-type="address" cascade="delete,update"/>
    </table>

    <!-- a set of contact items -->
    <table name="rlex_contact" type="multi" id-column-name="user_id">
      <property name="contacts" column-name="con_id" data-type="set"
                component-item-type="contact" cascade="delete,update"/>
    </table>

    <!-- a map of phone items -->
    <table name="rlex_phone" type="multi" id-column-name="user_id"
           multi-column-name="kind">
      <property name="numbers" column-name="phone_id" data-type="map"
                component-item-type="phone" cascade="delete,update"/>
    </table>

    <!-- a one-to-one mapping in an aux table -->
    <table name="rlex_job" type="auxiliary" id-column-names="id">
       <property name="jobtype"/>
       <property name="title"/>
```

```
    </table>

    <!-- a multivalue property (array)  -->
    <table name="rlex_subjects" type="multi" id-column-names="id"
           multi-column-name="seq_num">
      <property name="favoriteSubjects"
                column-names="subject" data-type="array"
                component-data-type="string"/>
    </table>

    <!-- a multivalue property (list)  -->
    <table name="rlex_worst" type="multi" id-column-names="id"
           multi-column-name="seq_num">
      <property name="worstSubjects"
                column-names="subject" data-type="list"
                component-data-type="string"/>
    </table>

    <!-- a multivalue property (map)  -->
    <table name="rlex_credit_card" type="multi" id-column-names="id"
           multi-column-name="card_key">
          <property name="card_num"
                    column-names="card_num" data-type="map"
                    component-data-type="string"/>
    </table>

</item-descriptor>
```

Item properties

The `user` item type defines in its primary table three string properties:

```
id
name
age
```

User contact information is defined in three multi-valued properties:

```
addresses
contacts
numbers
```

The values of each of these multi-valued properties are other repository items—`address`, `contact`, and `phone`, respectively.

The item type also defines these properties:

- `jobType` and `title` are string properties that use a one-to-one mapping in an auxiliary table.
- `favoriteSubjects`, `worstSubjects`, and `card_num` are multi-valued properties that use a one-to-many mapping in a multi table.

Item Pathnames

The Repository Loader example repository uses a `parentFolder` property in each content item type, along with the item's file name, in order to determine the item's path. Each TypeMapping component in the example uses this property setting:

```
updatePropertyConfiguration=CONTENT_ITEM_DESCRIPTOR_ID_AND_PATH_PROP
```

Type Mappings and Content Handlers

The Repository Loader example is configured with TypeMapping components for each of its item types. The TypeMapping determines which ContentHandler component processes items. The following table shows which TypeMapping and ContentHandler components are defined in the Nucleus directory `/atg/rl-example/ExampleRepository`:

Item type	TypeMapping component	ContentHandler component
`fileFolder`	FolderTypeMapping	ContentHandler
`textFileAsset`	UnparsedContentTypeMapping	ContentHandler
`htmlArticle`	HtmlArticleTypeMapping	HtmlArticleContentHandler
`txtPressRelease`	PressReleaseTXTTypeMapping	ContentHandler
`xmlPressRelease`	PressReleaseXMLTypeMapping	ContentHandler
`gifImage`	GifImageTypeMapping	ContentHandler
`jpgImage`	JpgImageTypeMapping	ContentHandler
`user`	UserTypeMapping	UserContentHandler

Note: All type mappings that do not require XSL preprocessing use the ContentHandler component.

TypeMapper

The Repository Loader example is configured with a TypeMapper component that maps file extensions to TypeMappings, with the following property configuration:

```
extensions=.xml,.txt,.gif,.jpg,.html,.eml

typeMappings=pressReleaseXMLTypeMapping,\
             pressReleaseTXTTypeMapping,\
             gifImageTypeMapping,\
             jpgImageTypeMapping,\
             htmlArticleTypeMapping,\
             userTypeMapping
```

The yields the following mappings:

This file extension:	Maps to this TypeMapping component:
.xml	pressReleaseXMLTypeMapping
.txt	pressReleaseTXTTypeMapping
.gif	gifImageTypeMapping
.jpg	jpgImageTypeMapping
.html	htmlArticleTypeMapping
.eml	userTypeMapping

xml2repository Schemas

The Repository Loader uses XML schemas to represent repository items as XML files. You can load the repository using XML files that conform to the schema, or export existing repository items in the form of XML files that can be loaded later.

The Repository Loader example includes an XML schema for each of the repository item types listed below, in the following directory:

```
<ATG11dir>/RL/Example/repository2xml/schemas
```

Item type	Schema file
fileFolder	RL-ExampleRepository+fileFolder.xsd
htmlArticle	RL-ExampleRepository+htmlArticle.xsd
txtPressRelease	RL-ExampleRepository+txtPressRelease.xsd
xmlPressRelease	RL-ExampleRepository+xmlPressRelease.xsd
gifImage	RL-ExampleRepository+gifImage.xsd
jpgImage	RL-ExampleRepository+jpgImage.xsd

Running the Repository Loader Example

You can use the Repository Loader example to perform two tasks:

- Convert files to repository items (page 245)
- Export repository items to XML (page 246)

Convert files to repository items

In order to run the Repository Loader example, follow these steps:

1. During application assembly, specify the following module so you can use the Repository Loader example:

   `RL.Example`

   Note: To avoid conflicts among database connection configurations, exclude from the application any other Oracle ATG Web Commerce demos, examples, or reference application modules that include the Repository Loader.

2. If you are running on Windows, set the `pathSeparator` property of the `/atg/rl-example/ExampleRepository` component to backslash (\).

   Note: if you set this property directly in a properties file rather than in the ACC, use this format:

   `pathSeparator=\\`

3. After the application starts, navigate to the Repository Loader Administration, on this page:

   `http://`*`hostname`*`:`*`port`*`/rl`

   - *`hostname`*: the application server machine
   - *`port`*: the port your application server uses to listen for HTTP requests.

   For example:

   `http://skua:8180/rl`

4. On the Repository Loader Admin page, click Create Job.

5. In the Create Job page:

   - Set Recurse to `Yes`
   - Click Add Files

This loads the files from the root path into the ExampleRepository as repository items. The Repository Loader Administration should show the job as completed.

Export repository items to XML

You can use the Repository Loader example to evaluate output by exporting a repository item to XML. Navigate to this page:

`http://hostname:port/rl-example/itemAsXml.jsp`

This page takes a hard-coded repository item (user001) and outputs it as an XML file.

Examining the XML format generated for a given item descriptor can help you generate compliant XML, or write an XSL stylesheet for the Repository Loader to apply before processing a file's contents.

Note that for XML documents loading an item descriptor, only one item descriptor can be defined. All generated XML must conform to the ATG schema, however, you can use an XSLT style sheet to put it into the correct format.

16 Purging Repository Items

Use the asset purge feature of Oracle ATG Web Commerce to remove large amounts of repository data that you no longer need in your Web application. For example, many Oracle ATG Web Commerce applications create anonymous user profiles when site visitors do not create an account or log in. You can use the asset purge feature to remove older anonymous user profiles when they accumulate and consume data storage capacity unnecessarily.

Web application administrators use the asset purge feature from the Dynamo Server Admin on the production Web application server. Deleting repository items with the asset purge feature affects your production Web application immediately. Before using the asset purge feature, be sure that you understand how to control the delete function and that you have a database backup process in place. The asset purge feature does not include a function to restore deleted data.

To use the asset purge function:

1. Log into the Dynamo Server Admin user interface on the production Web application server. See information about the Dynamo Server Admin in the *Platform Programming Guide*.
2. Choose Asset Purge from the main menu. Choose the asset type that you want to delete on the Asset Purge page.
3. Choose parameters for selecting repository items by doing one or both of the following:
   - Select options in the Asset conditions section of the screen.
   - Enter a Repository Query Language (RQL) query in the Custom RQL field.

   See Selecting Repository Items (page 248).
4. Choose the related conditions and actions that you want to apply to the purge operation in the Related conditions and actions section of the screen. See Related Conditions and Actions (page 249).
5. Choose Preview. When the preview statistics are available on the screen, verify that the scope of the asset purge matches the approximate number of repository items you intend to delete. See information about preview statistics in Selecting Repository Items (page 248).
6. Choose Start purge. Choose OK in the confirmation dialog box.
7. Choose Refresh information to reload the page. Check the status of the asset purge operation in the Completed Purges section of the screen. Click the link in the Status column to see detailed information about the results of the operation. See Purge Statistics (page 249).

The asset purge feature is intended to be used as a development framework within which you can create functions that remove any unneeded data that your Web application may accumulate. By default, Oracle ATG Web Commerce includes an asset purge function for removing user profiles. You can create additional functions to remove other repository item types.

- See information about the default function for deleting user profiles in Using the Profile Asset Purge Function (page 253).
- See information about creating your own functions in Creating and Configuring an Asset Purge Function (page 254).

Note: Use the asset purge function for bulk operations. You can remove individual repository items by using the repository API. See Core Repository API Elements (page 6).

Selecting Repository Items

When an administrator initiates an asset purge operation, the asset purge function identifies a set of repository items that it attempts to delete. Asset purge functions are configured for a specific repository component and item type. If an administrator does not apply any other criteria, the asset purge function selects all the repository items in the repository and of the item type. Typically, an asset purge function includes asset conditions that limit the repository items that it selects. For example, the profile asset purge function includes an asset condition that selects only anonymous user profiles, not registered site users.

Choose the asset conditions that an asset purge function uses to select repository items in the Asset conditions section of the asset purge function page. The asset purge function uses **all** of the conditions you choose. For example, if you choose two conditions, the asset purge function selects repository items that satisfy the first condition **and** the second condition.

If needed, you can enter a Repository Query Language (RQL) query in the Custom RQL text box. See Repository Query Language (page 18). The RQL query is applied in addition to the other asset conditions that you choose.

An asset purge function may include related conditions and actions. These are additional steps in the purge process that may prevent a repository item from being deleted or perform additional processing. Related conditions and actions affect the asset purge process after it selects repository items and begins to process them. See Related Conditions and Actions (page 249).

You can see how many repository items an asset purge function selects by using the preview tool. After you select asset conditions, choose Preview and review the preview statistics when they appear. Preview statistics do not include the effect of any related conditions and actions that you may have applied. See Related Conditions and Actions (page 249).

The following table describes the information provided by the preview statistics.

Statistic	Description
Assets selected	The total number of repository items that are selected for the purge operation The number of repository items that are actually affected by the purge operations may be different if you choose related conditions and actions. See Related Conditions and Actions (page 249).
Percent of total	Compares the number of repository items that are selected for the purge operation to the total number of repository items that are in the repository and of the item type configured for the asset purge function

Statistic	Description
Generated RQL	Displays the Repository Query Language (RQL) query that the asset purge function will use to select repository items. The RQL query is applied to the repository and item type that are configured for the asset purge function. The generated RQL includes all of the asset conditions that are selected. It also includes any RQL queries in the Custom RQL field. See Repository Query Language (page 18).

Related Conditions and Actions

Related conditions and actions perform decision making and other operations after an asset purge function has started. They handle each selected repository item as it passes through the asset purge processor pipeline.

- Related conditions evaluate each repository item and determine whether to delete it or skip it. Related conditions are unlike asset conditions in that they can use information that is not directly associated with the repository item type that is being deleted. Related conditions may perform more resource-intensive decision making based on information from several sources.
- Related actions evaluate each repository item and may perform operations on resources other than the repository item that is being deleted.

Choose the related conditions and actions that you will apply to an asset purge operation from the Related conditions and actions section of the asset purge page. Related conditions do not affect preview statistics because they are only evaluated after the asset purge process begins. Some asset purge functions do not have any related conditions or related actions.

See information about creating a related condition for an asset purge function in Configuring Related Condition Components (page 257). See information about creating a related action for an asset purge function in Configuring Related Action Components (page 260).

Purge Statistics

When the asset purge feature starts a purge operation, it displays information about the operation while it is in progress. See this information in the In Progress Purge table at the top of the asset purge page. Click the In-Progress link in the Status column to display additional information about the purge in progress. Choose the Refresh information button to display updated information about the purge that is in progress.

When the asset purge feature completes a purge operation, it displays information about the results of the operation. See this information in the Completed Purges table at the bottom of the asset purge page. Click the done (or cancelled) link in the Status column to display additional information about the Completed Purge.

The following table explains the statistical information that is provided in the In Progress Purge table and the Completed Purges table.

Statistic	Description
Status	The status of the purge operation A purge operation is “in-progress” if it is currently being executed by the asset purge feature. A purge operation is “done” if it has been completed by the asset purge feature. A purge operation is “cancelled” if it was stopped by an administrator.
Assets purged	The number of repository items deleted during the asset purge operation This does not include any repository items that may have been deleted by related actions. See Related Conditions and Actions (page 249).
Start time	The date and time that the asset purge operation began
Update time	(In-progress only) The date and time that the information about the purge operation was refreshed
End time	(done and cancelled only) The date and time that the asset purge operation stopped
Duration	The number of seconds that the asset purge operation was in progress
% Completed	(in-progress only) The percentage of the total repository items selected by a purge operation that have been processed
% of total	(done and cancelled only) The percent of the repository items that existed before an asset purge operation that were deleted during the asset purge operation
Selected assets of total	The percent of the total number of repository items that are selected by asset conditions
Actual processed assets	The number of the selected repository items that were evaluated for deletion during the asset purge operation This number may include repository items that were processed but not deleted because of related conditions. See Related Conditions and Actions (page 249).
Purged assets	The number of repository items deleted during the asset purge operation
Skipped assets	The number of repository items skipped based on related conditions during the asset purge operation
Error assets	The number of repository items that encountered errors while being processed during the asset purge operation

Statistic	Description
Generated RQL	The Repository Query Language (RQL) query used to select assets for the asset purge operation See Selecting Repository Items (page 248) and Repository Query Language (page 18).
Related conditions	The related conditions and related actions that were applied to the asset purge operation See Related Conditions and Actions (page 249).
Error message	Portions of any error messages encountered during the asset purge operation

Scheduling a Purge Operation

Use a component based on the `atg.purge.PurgeService` class to schedule asset purge operations. The `PurgeService` class implements the `atg.service.scheduler.SingletonSchedulableService` interface and invokes an asset purge function. You can use a component based on `PurgeService` with the scheduler services provided with Oracle ATG Web Commerce. See information about using scheduler services in the *Platform Programming Guide*.

To schedule an asset purge function:

1. Configure a component based on the `atg.purge.PurgeService` class.
   - Set its `purgeProducer` property to the Nucleus path of the PurgeProducer component for the asset purge function. See Configuring Basic Purging Components (page 264).
   - Set its `purgeConfiguration` property to the Nucleus path of the PurgeConfiguration component for the asset purge function. See Configuring Basic Purging Components (page 264).
2. Configure additional properties as required by the Oracle ATG Web Commerce scheduler services. See information about scheduler services in the *Platform Programming Guide*.

The following example shows the asset purge component property values for a scheduling component based on `atg.purge.PurgeService`.

```
$class=atg.purge.PurgeService

purgeProducer=/mycompany/purge/OrganizationPurgeProducer
purgeConfiguration=/mycompany/purge/OrganizationPurgeConfiguration

# Configure properties as required by scheduler services
```

Stopping a Purge Operation

To stop an asset purge operation while it is in progress:

1. Click the Refresh information button on the asset purge screen to display the In Progress Purge table.
2. Click the Cancel purge button in the Action column. Confirm that you want to cancel the purge process.
3. Click the Refresh information button. Confirm that the purge operation appears in the Completed Purges table and that its status is cancelled.

Note: if an asset purge operation remains in progress after you have cancelled it and allowed time for the server to stop the process, click the Force Quit button in the Action column. This resets the asset purge feature and allows you to run a new asset purge operation.

Asset Purge Error Handling

If an asset purge function encounters an error while it attempts to delete a repository item, it may continue with the overall purge operation or it may stop it. You can control this behavior by setting the `stopOnError` property of the `ProcessConfiguration` component of an asset purge function. See information about the `ProcessConfiguration` component in Configuring Basic Purging Components (page 264).

For example, the Nucleus path of the `ProcessConfiguration` component for the profile asset purge function is:

```
/atg/purge/ProfileProcessConfiguration
```

Throttling and Performance

You can restrict the speed of an asset purge function to prevent it from reducing the performance of your production server. You can also control the number of independent threads of execution that an asset purge function uses. The following sections provide information about these throttling and performance configurations.

- Configuring Throttle Settings for an Asset Purge Function (page 252)
- Configuring the Thread Count for an Asset Purge Function (page 253)

Configuring Throttle Settings for an Asset Purge Function

By default, asset purge functions delete repository items as quickly as possible, regardless of server resources. You can configure throttle settings for an asset purge function that restricts its speed. Lower the speed of an

asset purge function if it reduces the performance of other aspects of your Web application to an unacceptable level.

Throttle settings specify the number of repository items that it may delete in an interval of time, for example, no more than 10 repository items in 10 seconds. Lower the speed by reducing the number of repository items per time period until the performance of your Web application is acceptable.

To configure throttle settings for an asset purge function:

1. Configure a component based on the `atg.purge.throttle.FrequencyThrottleAlgorithmFactory` class. Set its `numberTasks` property to the number of repository items your asset purge function may delete in an interval of time. Set its `seconds` property to specify the length of that interval in seconds. For example:

   ```
   $class=atg.purge.throttle.FrequencyThrottleAlgorithmFactory
   numberTasks=10
   seconds=10
   ```

2. Set the `factory` property of the `PurgeExecutor` component for your asset purge function. Set its value to the Nucleus path of the `FrequencyThrottleAlgorithmFactory` component that you configured. See information about the `PurgeExecutor` component in Configuring Basic Purging Components (page 264). For example:

   ```
   factory=/mycompany/purge/throttle/FrequencyThrottleAlgorithmFactory
   ```

Configuring the Thread Count for an Asset Purge Function

You can specify how many independent threads of execution your asset purge function uses to delete repository items. Set the `threadPoolSize` property of the `PurgeExecutor` component for your asset purge function to control the number of threads it uses. See information about the `PurgeExecutor` component in Configuring Basic Purging Components (page 264).

If you include related actions or additional processing components in your asset purge function, make sure that the actions or additional processing are compatible with the number of threads you specify. For example, some complicated repository updates may encounter errors if multiple threads attempt to perform updates at the same time. If the actions or additional processing for your asset purge function require synchronization to make them thread safe, your asset purge function may be effectively limited to one thread. If needed, you can set the `threadPoolSize` property to `1`.

Using the Profile Asset Purge Function

Use the profile asset purge function to remove unnecessary user profile repository items from your Web application. See instructions for using an asset purge function in *Purging Repository Items* (page 247). The following table describes the asset conditions that are configured for the profile asset purge function.

Asset Condition	Description
Anonymous users	Oracle ATG Web Commerce creates anonymous user profiles when a site visit is not associated with any registered user profile. This condition selects anonymous user profile repository items.

Asset Condition	Description
Registered users	Registered users have created a user profile for your Web application. For example, they have entered a username and set a password. This condition selects registered user profile repository items.
Inactive for more than *[text box]* days (based on last activity)	Oracle ATG Web Commerce records activity such as site visits for user profiles. A user profile is inactive for the period of time between the most recent record of activity and the present time. This condition selects user profile repository items that have been inactive for longer than the number of days specified.

Creating and Configuring an Asset Purge Function

Create an asset purge function to delete unneeded repository items that accumulate in your Web application. Oracle ATG Web Commerce includes a user profile asset purge function by default. Add a new asset purge function if you need to delete a different type of repository item.

Administrator users can run the asset purge function that you create as needed by the Web application. See information about using an asset purge function in *Purging Repository Items* (page 247).

The asset purge feature of Oracle ATG Web Commerce provides a development framework in which you can create your own purge features. The framework selects repository items and passes them through a processor pipeline that you configure. See information about this process in Asset Purge Process Overview (page 255).

To create an asset purge function:

1. Configure the set of components that select repository items for purging. See Configuring Asset Condition Components (page 256).
2. Configure the set of components that evaluate additional conditions and perform additional actions. See Configuring Related Condition Components (page 257) and Configuring Related Action Components (page 260).
3. Configure the set of components that handle the basic operations of the purging process. See Configuring Basic Purging Components (page 264).
4. Configure components to handle any additional processing that is required to delete the repository items. For example, if you need to remove references to a repository item from other repository items, you may need to add a processing component. See Configuring Additional Processing Components (page 267).
5. Configure the asset purge pipeline with the components for your asset purge function. See Configuring the Asset Purge Pipeline (page 267).
6. Configure a link to your asset purge function on the asset purge user interface page. The asset purge user interface page in the Dynamo Server Admin holds links to each asset purge function. See Configuring the Asset Purge User Interface (page 270).

The following sections provide examples that implement an asset purge function that deletes organization repository items. Organizations are entities that can include groups of user profiles and information such as addresses and methods of payment. In actual use, you may not accumulate large numbers of unneeded

organization repository items. Use the example configurations as a template to develop your own asset purge functions.

Asset Purge Process Overview

When a user starts an asset purge operation, the development framework does the following:

1. The asset purge function selects a set of repository items based on the asset conditions that are set by the administrator who invokes the purge function. All the items are from the same repository and are of the same type. See Selecting Repository Items (page 248).
2. The asset purge function passes each repository item through a pipeline of processor components.
3. If related conditions or actions are configured for the purge function, the pipeline processors for those conditions handle each item. The processors for related conditions may skip certain items so that they are not deleted. The processors for related actions perform additional operations for each item. See Related Conditions and Actions (page 249).
4. You can add processing steps to the pipeline if required by your specific situation. See Configuring Additional Processing Components (page 267).
5. A final processor in the pipeline removes each item from the repository.
6. The asset purge feature presents information about the items it processed. See Purge Statistics (page 249).

Repository Path and Item Descriptor

Several asset purge components use configuration properties that hold the Nucleus path of a repository component and a repository item type descriptor. A specific repository and item type define the asset for an asset purge function. See information about repositories, repository items, and item type descriptors in *Repository API* (page 3).

PurgeItem Parameters

The asset purge feature includes a set of parameters with each repository item that it selects and passes through the asset purge pipeline processors. Each processor in the pipeline can access the parameters and use the information they contain.

The parameters for the repository items in the asset purge pipeline are determined by the related condition and action components for the asset purge function. If you configure a related condition or action component, you can provide a parameter name and value. Users who invoke the asset purge function can select a related condition or action and include its parameter or deselect the related condition or action and omit the parameter.

The `atg.purge.PurgeItem` object for each repository item has a `java.util.Map` of parameters. Processors can access the parameter `Objects` in this map by their `String` keys. The following example shows how a processor method that takes the `PurgeItem` as its `pPurgeItem` argument can use the `PurgeItem.getParameters()` method to access an integer parameter.

```
// Get an integer value from a PurgeItem parameter.
int someint = Integer.parseInt((String)
pPurgeItem.getParameters().get("parameterkey"));
```

See more detailed examples in Overriding the canPurge Method (page 259) and Adding a Pipeline Processor for Related Actions (page 262).

Configuring Asset Condition Components

Configure components for each of the conditions that you use to select repository items for your asset purge function. This is the base set of repository items that passes through the processors in the asset purge pipeline. See Selecting Repository Items (page 248).

You can select repository items based on the properties of the item type itself. For example, you can select user profile items based on the properties of the user profile repository item type. The specific repository and item type for an asset purge function are configured by components described in Configuring Basic Purging Components (page 264). If you need to base the decision to delete or skip a repository item on information that is not stored in the properties for the item itself, add a related condition. For example, you might want to skip a user profile if there is an order associated with it. See Configuring Related Condition Components (page 257).

Base asset condition components on classes that implement the `atg.purge.condition.PurgeCondition` interface. Oracle ATG Web Commerce provides classes in the `atg.purge.condition` package that implement this interface. These classes are described in the following table.

Class	Description
`PurgeDateCondition`	Use this class for conditions that select repository items based on dates. For example, a condition could select user profile repository items that have a `lastActivity` property timestamp that is more than 180 days earlier than the current date. See an example component configuration in PurgeDateCondition Condition (page 256).
`PurgeTextCondition`	Use this class for conditions that select repository items based on a Repository Query Language (RQL) query. See Repository Query Language (page 18). See an example component configuration in PurgeTextCondition Condition (page 257).

PurgeDateCondition Condition

Configure a condition component based on the `atg.purge.condition.PurgeDateCondition` class in order to select repository items based on Date or Timestamp property values.

The following example configuration could be used to select repository items that have a `lastActivity` property that holds values of type `java.sql.Timestamp`. The query generated by the example configuration selects items if the `lastActivity` value is at least 180 days before the current date. The specific repository and item type are configured by components described in Configuring Basic Purging Components (page 264).

```
$class=atg.purge.condition.PurgeDateCondition

# The date or timestamp property
propertyName=lastActivity

# The default number of days that will be compared to the propertyName value
days=180
```

```
# The type of comparison. Supply one of the comparison relation integer values
#defined by the constant field values of atg.repository.QueryBuilder.
comparison=6

# A user-interface label that describes the condition
# Include the $X placeholder for the text box that holds the days value.
defaultName=Inactive for more than $X days (based on last activity)

# Controls whether the condition is selected by default
enabled=true
```

PurgeTextCondition Condition

Configure a condition component based on the `atg.purge.condition.PurgeTextCondition` class in order to select repository items based on a Repository Query Language (RQL) query. See Repository Query Language (page 18).

The following example configuration could be used to select repository items that have a `description` property. The specific repository and item type are configured by components described in Configuring Basic Purging Components (page 264).

```
$class=atg.purge.condition.PurgeTextCondition

# The Repository Query Language (RQL) query used to select repository items
rql=description IS NULL

# A user-interface label that describes the condition
defaultName=Description is null

# Controls whether the condition is selected by default
enabled=false
```

Configuring Related Condition Components

Include related conditions in your asset purge function if you need to determine whether to delete a repository item based on information that is not stored in the properties of the item itself. See Related Conditions and Actions (page 249).

To configure a related condition component:

1. Create a component based on the `atg.purge.condition.SimpleRelatedCondition` class. See Property Configuration for Related Condition Components (page 258).
2. Include the Nucleus path to your related condition component in the `relatedConditions` property value for your `PurgeConfiguration` component. See PurgeConfiguration Component (page 264).
3. Override the `canPurge` method for the pipeline component that is based on the `atg.purge.pipeline.processor.CanPurgeProcessor` class. This processor component determines whether to delete each repository item that passes through the purge pipeline. See information about this and other basic asset purge components in Configuring Basic Purging Components (page 264).

   By default, the `canPurge` method returns the boolean value `true`. Implement your own logic and return either `true` to delete an item or `false` to skip it. See an example Java class in Overriding the canPurge Method (page 259).

Property Configuration for Related Condition Components

Include the properties described in the following table for a related condition component:

Property	Description
`defaultName`	The user-interface label that describes the related condition. The label includes a text box to display or edit the parameter value. Include the variable `$X` in this property value to place the text box inside the label string. If you do not include `$X`, the text box appears at the end of the label string. If you need to localize the Dynamo Server Admin user interface, you can supply the resource bundle key for this label in the `displayKey` property. Include the `displayKey` property instead of the `defaultName` property. See information about localizing Web applications in the *Platform Programming Guide*.
`parameterName`	The key for the parameter in the `java.util.Map` of parameters for the `PurgeItem` objects that represent each repository item in the asset purge pipeline. See PurgeItem Parameters (page 255).
`parameterValue`	The value of the parameter in the `java.util.Map` of parameters for the `PurgeItem` objects that represent each repository item in the asset purge pipeline. See PurgeItem Parameters (page 255). The asset purge user interface displays the parameter value along with the label for the related condition. The value appears in a text box at the end of the label. You can move the text box into the label string by including the `$X` variable in the label text. See the description for the `defaultName` property. **Note**: the label for a related condition always contains a text box to display the parameter value, even if you do not specify or use the value. Users can enter or make changes to the parameter value if the `editable` property is set to `true`.
`editable`	Controls whether users can enter or make changes to the parameter value. See the description of the `parameterValue` property.
`enabled`	Controls whether the related condition is selected in the user interface by default.

The following example configuration file sets the property values for a related condition component.

```
$class=atg.purge.condition.SimpleRelatedCondition

# A user-interface label that describes the related condition
defaultName=Skip if there are more than $X member orders
```

```
# The key for the parameter associated with this condition in the
# Map of parameters for the PurgeItem
parameterName=maxorders
# The value for the parameter in the Map of parameters
parameterValue=2

# Determines whether the end user can alter the parameter value
editable=true

# Determines whether the related condition is selected by default
enabled=true
```

Overriding the canPurge Method

The basic components of the asset purge development framework include a pipeline processor that controls whether each selected repository item is deleted or skipped. By default, this component is based on the `atg.purge.pipeline.processor.CanPurgeProcessor` class and it deletes all of the items that it handles. See information about the default processor component in CanPurgeProcessor Component (page 265).

The `CanPurgeProcessor` class includes a `canPurge` method that returns a Boolean value. If you include a related condition in your asset purge function, create a subclass of `CanPurgeProcessor` and override its `canPurge` method. Include the logic that determines whether an item is deleted or skipped in this method.

- Return `true` to delete the current repository item.
- Return `false` to skip the current repository item.

The following example shows a Java class that overrides the `canPurge` method. It uses two properties to hold Nucleus paths:

- The path to the repository that includes the repository items to be purged
- The path to an `OrderQueries` component that provides tools for accessing information about orders

These two properties are only used in this example. They are not directly related to overriding the `canPurge` method.

```
package mycompany;
import java.util.ArrayList;
import java.util.Set;
import atg.commerce.order.OrderQueries;
import atg.purge.PurgeItem;
import atg.purge.pipeline.processor.CanPurgeProcessor;
import atg.repository.Repository;
import atg.repository.RepositoryItem;

public class MyNewCanPurgeProcessor extends CanPurgeProcessor {

  // The repository and orderQueries properties are used in
  // the example code shown here and are not directly related
  // to overriding the canPurge method.
  // Set the repository from the configuration file.

  Repository mRepository;
  public void setRepository(Repository pRepository)
  {mRepository = pRepository;}
  public Repository getRepository()
  {return mRepository;}
  // Set the OrderQueries path from the configuration file.
```

```
  OrderQueries mOrderQueries;
  public void setOrderQueries(OrderQueries pOrderQueries)
  {mOrderQueries = pOrderQueries;}
  public OrderQueries getOrderQueries()
  {return mOrderQueries;}

  // Override the canPurge method with logic based on your related conditions.
  @Override
  protected boolean canPurge(PurgeItem pPurgeItem) throws Exception {
    // Get the repository item that is currently being handled.
    RepositoryItem organization = getRepository().getItem(pPurgeItem.getId(),
      pPurgeItem.getItemType());

    // For example, you could determine how many orders are associated with the
    // users in this organization.

    int ordersforthisorg = 0;
    // Get the user profiles from the members property of the organization.
    Set memberset = (Set) organization.getPropertyValue("members");
    ArrayList<RepositoryItem> members = new ArrayList<RepositoryItem>(memberset);
    for (RepositoryItem member : members) {
      // get the number of orders associated with the profile
      int memberorders =
        getOrderqueries().getOrderCountForProfile(member.getRepositoryId());
      // and add it to the total orders for the organization
      ordersforthisorg = ordersforthisorg + memberorders;
    }

    // This example compares the maximum number of orders from the related
    // condition to the number of orders for the members of the organization.
    // Return true (delete) or false (skip) based on what you find.
    // If the parameter is not present in the PurgeItem, return true.
    // If the user does not select this related condition, the parameter
    // will not be present.

    // Get the maximum number of orders from the PurgeItem parameter with
    // the key "maxorders."
    int maxordersfromassociatedcondition = Integer.parseInt((String)
      pPurgeItem.getParameters().get("maxorders"));
    // Compare the numbers.
    if (pPurgeItem.getParameters().get("maxorders") != null &&
      ordersforthisorg > maxordersfromassociatedcondition) {
      // Do not delete the organization.
      return false;
    } else {
      // Delete the organization.
      return true;
    }
  }
}
```

Configuring Related Action Components

Include related actions in your asset purge function if you need to perform additional steps when deleting repository items. See Related Conditions and Actions (page 249).

To configure a related condition component:

1. Create a component based on the `atg.purge.condition.SimpleRelatedCondition` class. See Property Configuration for Related Action Components (page 261).

2. Include the Nucleus path to your related action component in the `relatedConditions` property value for your `PurgeConfiguration` component. See PurgeConfiguration Component (page 264).

3. Create a pipeline processor component to perform the related action for each repository item that is handled by the asset purge function. Base the component on a subclass of `atg.purge.pipeline.processor.RepositoryItemPurgeProcessor`. Override the `runProcess` method and include your own action in the method body. See Adding a Pipeline Processor for Related Actions (page 262).

4. Include your new pipeline processor component in the asset purge pipeline. See Configuring the Asset Purge Pipeline (page 267).

Property Configuration for Related Action Components

Include the properties described in the following table for a related action component:

Property	Description
`defaultName`	The user-interface label that describes the related action. The label includes a text box to display or edit the parameter value. Include the variable `$X` in this property value to place the text box inside the label string. If you do not include `$X`, the text box appears at the end of the label string. If you need to localize the Dynamo Server Admin user interface, you can supply the resource bundle key for this label in the `displayKey` property. Include the `displayKey` property instead of the `defaultName` property. See information about localizing Web applications in the *Platform Programming Guide*.
`parameterName`	The key for the parameter in the `java.util.Map` of parameters for the `PurgeItem` objects that represent each repository item in the asset purge pipeline. See PurgeItem Parameters (page 255).
`parameterValue`	The value of the parameter in the `java.util.Map` of parameters for the `PurgeItem` objects that represent each repository item in the asset purge pipeline. See PurgeItem Parameters (page 255). The asset purge user interface displays the parameter value along with the label for the related action. The value appears in a text box at the end of the label. You can move the text box into the label string by including the `$X` variable in the label text. See the description for the `defaultName` property. **Note**: the label for a related action always contains a text box to display the parameter value, even if you do not specify or use the value. Users can enter or make changes to the parameter value if the `editable` property is set to `true`.

Property	Description
`editable`	Controls whether users can enter or make changes to the parameter value. See the description of the `parameterValue` property.
`enabled`	Controls whether the related action is selected in the user interface by default.

The following example configuration file sets the property values for a related action component.

```
$class=atg.purge.condition.SimpleRelatedCondition

# A user-interface label that describes the related action
defaultName=Delete organization credit cards

# The key for the parameter associated with this action in the
# Map of parameters for the PurgeItem
parameterName=creditCards

# In this example, the parameter does not need a value. The asset purge feature
# will perform the related action if the parameter is present. A user can
# deselect the related action and omit the parameter. In that case, the
# asset purge feature will not perform the related action.
# See the Java code that checks for the presence of the parameter in
# Adding a Pipeline Processor for Related Actions (page 262).

# Determines whether the end user can alter the parameter value
editable=false

# Determines whether the related action is selected by default
enabled=true
```

Adding a Pipeline Processor for Related Actions

Create a pipeline processor component for the related actions that you add to your asset purge function. The asset purge feature invokes your new processor for each repository item that passes through the pipeline.

Base your pipeline processor component on a subclass of `atg.purge.pipeline.processor.RepositoryItemPurgeProcessor`. Override the `runProcess` method and include your own action in the method body. When your related action is complete, return an integer value to indicate success. The integer values are defined by the `atg.purge.pipeline.ProcessorConstants` interface. The `RepositoryItemPurgeProcessor` class implements `ProcessorConstants` and has access to its constant values. For example, return one of the following:

```
return RETCODE_OK;
```

```
return RETCODE_NOT_OK;
```

The following example component configuration file and Java class show how to override the `runProcess` method. This example corresponds to the related action component configuration shown in Property Configuration for Related Action Components (page 261).

```
$class=mycompany.MyNewProcessor

# The Nucleus path of the repository that holds the
# repository items that are being purged
repository=/atg/userprofiling/ProfileAdapterRepository

# The type of the repository items that are being purged
itemDescriptorName=organization
```

This Java class overrides the `runProcess` method.

```
package mycompany;
import java.util.ArrayList;
import java.util.Iterator;
import java.util.Map;
import atg.beans.DynamicBeans;
import atg.purge.PurgeItem;
import atg.purge.pipeline.processor.RepositoryItemPurgeProcessor;
import atg.repository.MutableRepositoryItem;
import atg.repository.RepositoryItem;
import atg.service.pipeline.PipelineResult;

public class MyNewProcessor extends RepositoryItemPurgeProcessor {
  @Override
  public int runProcess(Object pParam, PipelineResult pResult) throws Exception {

    // Get the repository item that is currently being handled

    PurgeItem item = (PurgeItem) DynamicBeans.getPropertyValue(pParam, PURGE_ITEM);
    RepositoryItem organization =
      getRepository().getItem(item.getId(), item.getItemType());

    // Perform additional actions based on parameters if they are present.
    // This example deletes credit card repository items that are associated
    // an organization. The organization repository item is the PurgeItem.
    // The related action component configuration adds a parameter named
    // "creditCards" to the PurgeItem

    if (item.getParameters().get("creditCards") != null) {
      // Get the credit cards associated with the current organization.
      Map creditcardmap = (Map) organization.getPropertyValue("creditCards");
      Iterator iterator = creditcardmap.entrySet().iterator();
      ArrayList<RepositoryItem> creditcards = new ArrayList<RepositoryItem>();
      while (iterator.hasNext()) {
        Map.Entry entry = (Map.Entry) iterator.next();
        RepositoryItem card = (RepositoryItem) entry.getValue();
        creditcards.add(card);
      }

      // Set the creditCards property to null.

      MutableRepositoryItem mutableorganization =
        getRepository().getItemForUpdate(item.getId(), item.getItemType());
      mutableorganization.setPropertyValue("creditCards", null);
      getRepository().updateItem(mutableorganization);

      // Delete each credit card repository item.
      for (RepositoryItem card : creditcards) {
```

```
        getRepository().removeItem(card.getRepositoryId(), "credit-card");
      }
    }

    // Return an atg.purge.pipeline.ProcessorConstants constant value to
    // indicate success.
    return RETCODE_OK;
  }
}
```

Configuring Basic Purging Components

Configure the following components for your asset purge function. These components handle interactions between the overall asset purge feature framework and your custom asset purge functionality.

- PurgeConfiguration Component (page 264)
- ProcessConfiguration Component (page 264)
- PipelinePurgeHandler Component (page 265)
- CanPurgeProcessor Component (page 265)
- RepositoryItemPurgeProcessor Component (page 266)
- PurgeExecutor Component (page 266)
- PurgeProducer Component (page 266)

PurgeConfiguration Component

Base your `PurgeConfiguration` component on the `atg.purge.PurgeConfiguration` class. Configure property values to hold the Nucleus paths of your asset selection conditions, related conditions, and related actions as shown in the example configuration file below.

Note: your asset purge function may not include related conditions or related actions. If your asset purge function does not include related conditions or related actions, omit the `relatedConditions` property.

```
$class=atg.purge.PurgeConfiguration

# The Nucleus paths of your asset selection conditions
# See Configuring Asset Condition Components (page 256).
predefinedConditions=/mycompany/purge/condition/MyCondition

# The Nucleus paths of your related conditions and related actions
# See Configuring Related Condition Components (page 257) and
# Configuring Related Action Components (page 260).
relatedConditions=/mycompany/purge/condition/MyRelatedCondition,\
/mycompany/purge/condition/MyRelatedAction
```

ProcessConfiguration Component

Base your `ProcessConfiguration` component on the `atg.purge.ProcessConfiguration` class. Configure the `stopOnError` property value as shown in the example configuration file below.

```
$class=atg.purge.ProcessConfiguration
```

```
# Controls whether the asset purge function will stop processing repository
# items if it encounters an error. See Asset Purge Error Handling (page 252).
stopOnError=false
```

Set the `stopOnError` property to `true` or `false` based on the nature of your asset purge function.

PipelinePurgeHandler Component

Base your `PipelinePurgeHandler` component on the `atg.purge.handler.PipelinePurgeHandler` class. Configure property values to hold the Nucleus path to the `PipelineManager` component and the name of your asset purge function pipeline chain as shown in the example configuration file below.

```
$class=atg.purge.handler.PipelinePurgeHandler

# The Nucleus path of the PipelineManager component provided
# with Oracle ATG Web Commerce (provides required functions)
pipelineManager=/atg/purge/pipeline/PipelineManager

# The name attribute of the pipelinechain element in your XML
# asset purge pipeline configuration file.
# See Configuring the Asset Purge Pipeline (page 267).
pipelineChainId=organizationPurge
```

CanPurgeProcessor Component

The `CanPurgeProcessor` component is one of the processors in the asset purge processor pipeline. It handles each repository item that passes through the pipeline and determines whether the asset purge function attempts to delete it.

If you do not configure any related conditions for your asset purge function, base your `CanPurgeProcessor` component on the `atg.purge.pipeline.processor.CanPurgeProcessor` class. Your `CanPurgeProcessor` component always determines that repository items should be deleted because the `CanPurgeProcessor.canPurge` method always returns `true`.

When you configure related conditions, base your `CanPurgeProcessor` component on a subclass of `atg.purge.pipeline.processor.CanPurgeProcessor` and override the `canPurge` method. Include your own logic for determining whether a repository item should be deleted. See Configuring Related Condition Components (page 257).

The following example configures a `CanPurgeProcessor` component for an asset purge function that **does not** include related conditions.

```
$class=atg.purge.pipeline.processor.CanPurgeProcessor

# Components based on the CanPurgeProcessor class do not require
# property configuration
```

The following example configures a `CanPurgeProcessor` component for an asset purge function that **does** include related conditions.

```
$class=mycompany.MyNewCanPurgeProcessor

# Configure any properties that are required by your custom
# implementation of the canPurge method. For example, your
# custom implementation might need properties like these:
```

```
repository=/atg/userprofiling/ProfileAdapterRepository
orderQueries=/atg/commerce/order/OrderQueries
```

RepositoryItemPurgeProcessor Component

Base your `RepositoryItemPurgeProcessor` component on the `atg.purge.pipeline.processor.RepositoryItemPurgeProcessor` class. Configure property values to hold the Nucleus path and item type of the repository items that your asset purge function deletes as shown in the example configuration file below.

```
$class=atg.purge.pipeline.processor.RepositoryItemPurgeProcessor

# The Nucleus path of the repository component that holds the repository items
# that your asset purge function will delete
# See Repository Path and Item Descriptor (page 255).
repository=/atg/userprofiling/ProfileAdapterRepository

# The type of repository item that your asset purge function will delete
# See Repository Path and Item Descriptor (page 255).
itemDescriptorName=organization
```

PurgeExecutor Component

Base your `PurgeExecutor` component on the `atg.purge.PurgeExecutor` class. Configure property values to hold the Nucleus paths to other components and to set the number of simultaneous threads as shown in the example configuration file below.

```
$class=atg.purge.PurgeExecutor

# The Nucleus path to the PipelinePurgeHandler component for your asset
# purge function. See PipelinePurgeHandler Component (page 265).
purgeHandler=/mycompany/purge/handler/OrganizationPurgeHandler

# The Nucleus path to the ProcessConfiguration component for your asset
# purge function. See ProcessConfiguration Component (page 264).
processConfiguration=/mycompany/purge/OrganizationPurgeProcessConfiguration

# The Nucleus path to the TransactionManager component provided with
# Oracle ATG Web Commerce
transactionManager=/atg/dynamo/transaction/TransactionManager

# The number of simultaneous threads of execution used for your asset
# purge function. See Throttling and Performance (page 252).
threadPoolSize=1
```

PurgeProducer Component

Base your `PurgeProducer` component on the `atg.purge.PurgeProducer` class. Configure property values to hold the Nucleus paths to other components and the repository item type that your asset purge function deletes as shown in the example configuration file below.

```
$class=atg.purge.PurgeProducer

# The Nucleus path of the PurgeExecutor component for your asset purge
# function. See PurgeExecutor Component (page 266).
```

```
purgeExecutor=/mycompany/purge/OrganizationPurgeExecutor

# The Nucleus path of the PurgeProgressTools component that is provided
# with Oracle ATG Web Commerce
purgeProgressTools=/atg/purge/PurgeProgressTools

# The Nucleus path of the TransactionManager component that is provided
# with Oracle ATG Web Commerce
transactionManager=/atg/dynamo/transaction/TransactionManager

# The Nucleus path of the repository component that holds the repository items
# that your asset purge function will delete
# See Repository Path and Item Descriptor (page 255).
repository=/atg/userprofiling/ProfileAdapterRepository

# The type of repository item that your asset purge function will delete
# See Repository Path and Item Descriptor (page 255).
itemDescriptorName=organization

# The Nucleus path of the PurgeConfiguration component for your asset
# purge function. See PurgeConfiguration Component (page 264).
purgeConfiguration=/mycompany/purge/OrganizationPurgeConfiguration

# The Nucleus path of the ProcessConfiguration component for your asset
# purge function. See ProcessConfiguration Component (page 264).
processConfiguration=/mycompany/purge/OrganizationPurgeProcessConfiguration
```

Configuring Additional Processing Components

You may need to configure your asset purge function to perform additional operations before it deletes repository items. For example, if other repository item records contain references to the items that you are deleting, you may need to remove those references. Configure additional processing components in your asset purge function if you need to perform operations before deleting repository items.

To configure an additional processing component:

1. Create a pipeline processor component to perform the additional operations for each repository item that is handled by the asset purge function. Base the component on a subclass of `atg.purge.pipeline.processor.RepositoryItemPurgeProcessor`. Override the `runProcess` method and include your own action in the method body.

   See an example of a subclass of `RepositoryItemPurgeProcessor` that overrides the `runProcess` method in Adding a Pipeline Processor for Related Actions (page 262). You can add operations that are required by your asset purge function in the same way that you would for related actions. If your asset purge function also includes related actions, you can insert the required operations in the pipeline processor along with those related actions.

2. Include your new pipeline processor component in the asset purge pipeline. See Configuring the Asset Purge Pipeline (page 267).

Configuring the Asset Purge Pipeline

The asset purge feature uses a sequence of processor components to select and delete repository items. This processor chain is controlled by the Oracle ATG Web Commerce pipeline manager. See information about processor chains and pipeline managers in the *Commerce Programming Guide*.

Include the processor components in the pipeline definition for the `/atg/purge/pipeline/PipelineManager` component. You can view the existing definition for this pipeline in the Dynamo Server Admin user interface for your production server. From the admin menu, choose Component Browser and navigate to the `/atg/purge/pipeline/PipelineManager` component. Click the link for the `definitionFile` property of the component to view the combined XML definition file.

To add the processor components of your asset purge function to the asset purge pipeline:

1. Place an XML pipeline definition file named `pipeline.xml` in the configuration path of your server. See an example file in Example Asset Purge pipeline.xml File (page 268). Place the file at the following location in the configuration path:

   ```
   /atg/purge/pipeline/PipelineManager/pipeline.xml
   ```

2. Include a `pipelinechain` element for your asset purge function. Make sure the `name` attribute is unique to your asset purge function. Set the `headlink` attribute to the name you use for the `CanPurgeProcessor` component in its `pipelinelink` element.

3. Include `pipelinelink` elements for your `CanPurgeProcessor` and `RepositoryItemPurgeProcessor` components. Include a `processor` element and set its `jndi` attribute to the Nucleus path of each component. Include transition elements with link attribute values as shown in Example Asset Purge pipeline.xml File (page 268).

   See information about these processor components in Configuring Basic Purging Components (page 264).

4. Include a `pipelinelink` element for the `/atg/purge/pipeline/processor/NoOpProcessor` as shown in Example Asset Purge pipeline.xml File (page 268).

Example Asset Purge pipeline.xml File

The following example configures the asset purge pipeline manager with the components of an asset purge function. See detailed information about configuring processor chains and pipeline managers in the *Commerce Programming Guide*.

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE pipelinemanager
  PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Pipeline Manager//EN"
         'http://www.atg.com/dtds/pipelinemanager/pipelinemanager_1.0.dtd'>
<pipelinemanager>

  <!-- Provide a unique name and headlink attribute in the
       pipeline chain element for your asset purge function. -->

  <pipelinechain
    resultclassname="atg.service.pipeline.PipelineResultImpl"
    transaction="TX_REQUIRED"
    classname="atg.service.pipeline.PipelineChain"
    name="organizationPurge" headlink="canOrganizationPurge">

    <!-- Include a pipelinelink element for your CanPurgeProcessor
         component. -->

    <pipelinelink transaction="TX_MANDATORY" name="canOrganizationPurge">
      <processor jndi="/mycompany/purge/pipeline/processor/
CanOrganizationPurgeProcessor" />
      <transition returnvalue="1" link="executeOrganizationPurge" />
      <!-- RETCODE_OK -->
      <transition returnvalue="2" link="ignoreOrganizationPurge" />
```

```
      <!-- RETCODE_NOT_OK -->
    </pipelinelink>

    <!-- Include a pipelinelink element for your RepositoryItemPurgeProcessor
         component. -->

    <pipelinelink transaction="TX_MANDATORY" name="executeOrganizationPurge">
      <processor jndi="/mycompany/purge/pipeline/processor/
OrganizationPurgeProcessor" />
    </pipelinelink>

    <!-- Include a pipelinelink element for the asset purge NoOpProcessor
         component. -->

    <pipelinelink transaction="TX_MANDATORY" name="ignoreOrganizationPurge">
      <processor jndi="/atg/purge/pipeline/processor/NoOpProcessor" />
    </pipelinelink>
  </pipelinechain>
</pipelinemanager>
```

Inserting an Additional Asset Purge Pipeline Processor

The following example shows elements of the `pipeline.xml` configuration file that insert an additional processor into the asset purge pipeline. Make sure that the transition elements link the `CanPurgeProcessor` component to the processor components you add. Make sure that the transition elements for the components you add link to the `RepositoryItemPurgeProcessor` component.

See detailed information about configuring processor chains and pipeline managers in the *Commerce Programming Guide*.

```
<pipelinemanager>
  <pipelinechain>

    <!-- elements omitted -->

    <pipelinelink transaction="TX_MANDATORY" name="canOrganizationPurge">

    <!-- elements omitted -->

      <!-- If the processor component for this pipelinelink element
           returns 1, invoke the additional pipeline processor. -->
      <transition returnvalue="1" link="prepareOrganizationPurge" />
      <!-- RETCODE_OK -->
      <transition returnvalue="2" link="ignoreOrganizationPurge" />
      <!-- RETCODE_NOT_OK -->
    </pipelinelink>

    <!-- The following pipelinelink element configures the additional
         processor in the pipeline. -->

    <pipelinelink transaction="TX_MANDATORY" name="prepareOrganizationPurge">
      <processor jndi="/mycompany/purge/pipeline/processor/
PrepareOrganizationPurgeProcessor" />

      <!-- If the processor component for this pipelinelink element
           returns 1, invoke the additional pipeline processor. -->
      <transition returnvalue="1" link="executeOrganizationPurge" />
      <!-- RETCODE_OK -->
```

```
      <transition returnvalue="2" link="ignoreOrganizationPurge" />
      <!-- RETCODE_NOT_OK -->
    </pipelinelink>
    <pipelinelink transaction="TX_MANDATORY" name="executeOrganizationPurge">

    <!-- elements omitted -->

    </pipelinelink>
  </pipelinechain>
</pipelinemanager>
```

Configuring the Asset Purge User Interface

Add your asset purge function to the list of asset purge function links in the Dynamo Server Admin user interface. Administrator users follow this link to the page for the asset purge function that you have created.

To add your asset purge function to the asset purge page:

1. Add a key string and label string to the `elements` property of the `/atg/purge/PurgeUIDefinition` component. For example, the following example content in `/atg/purge/PurgeUIDefinition.properties` adds the label "Organizations" to the list. It associates that label with the key string "organization."

   ```
   elements+=organization=Organizations
   ```

2. Add the key string you registered in the `PurgeUIDefinition` component and the Nucleus path of your `PurgeConfiguration` component to the `configurations` property of the `/atg/purge/PurgeFormHandler` component. For example:

   ```
   configurations+=organization=/mycompany/purge/OrganizationPurgeConfiguration
   ```

   See information about the `PurgeConfiguration` component for your asset purge function in Configuring Basic Purging Components (page 264).

3. Add the key string you registered in the `PurgeUIDefinition` component and the Nucleus path of your `PurgeProducer` component to the `producers` property of the `/atg/purge/PurgeFormHandler` component. For example:

   ```
   producers+=organization=/mycompany/purge/OrganizationPurgeProducer
   ```

   See information about the `PurgeProducer` component for your asset purge function in Configuring Basic Purging Components (page 264).

17 Repository Web Services

The Oracle ATG Web Commerce platform provides infrastructure and tools for accessing Oracle ATG Web Commerce repositories with Web services. The *Web Services Guide* describes how to create a Web service that exposes a particular repository item descriptor, or an individual repository item property. Repository items can be passed via a Web service in the form of an XML file created with the Oracle ATG Web Commerce xml2repository feature, described in the *Repository to XML Data Binding* section of the *Platform Programming Guide*.

This chapter describes three generalized Web services you can use to provide access to Oracle ATG Web Commerce repositories:

- GetRepositoryItem Web Service (page 271)
- PerformRQLQuery Web Service (page 274)
- PerformRQLCountQuery Web Service (page 275)

These Web services are packaged in the `<ATG11dir>/DAS/WebServices` directory. For information about how to deploy these and other Web services, see the *Platform Programming Guide*.

Note that the descriptions of these Web services include URLs that begin `http://hostname:port` where *`hostname`* machine running your application server and *`port`* is the port your application server uses to listen for HTTP requests. To find the default port, see the *Installation and Configuration Guide*.

Also to these repository Web services, Oracle ATG Web Commerce Personalization and Oracle ATG Web Commerce contain several Web services that provide access to specific Oracle ATG Web Commerce repositories and repository item types. A complete list of the Web services included in the Oracle ATG Web Commerce platform can be found in the *Web Services Guide*.

GetRepositoryItem Web Service

The `GetRepositoryItem` Web service retrieves an item with the given repository ID and item type from the given repository. The item is returned in XML format. The Web service method calls directly through to the `getRepositoryItem` method of the `atg.repository.RepositoryServices` class, which handles all logic, error checking, and result transformation.

Web Service Implementation

Web Service URL	`http://hostname:port/repository/generic/getRepositoryItem/getRepositoryItem`
Web Service Class Name	`webservice.GetRepositoryItemsEIImpl`
Nucleus Component	`/atg/repository/RepositoryServices`
Method Name	`getRepositoryItem`

Input Parameters	`String pRepositoryPath`
	the path of the repository component from which to retrieve the item
	
	`String pItemDescriptorName`
	the item type of the item to retrieve
	
	`String pRepositoryId`
	the repository ID of the repository item to retrieve

Output	`String` the found `RepositoryItem` in XML format, or null if no item with that repository ID exists
Exceptions	`atg.repository.RepositoryException` if a repository error occurs `atg.repository.xml.GetException` if an error occurs translating the item into XML

GetRepositoryItem Exceptions

Exceptions generated by the `GetRepositoryItem` Web service may occur for the following reasons:

RepositoryException

- The `pRepositoryPath` specified by the argument is null, or empty
- The `pRepositoryPath` specified by the argument does not resolve to a component
- The `pRepositoryPath` specified by the argument does not resolve to a Repository
- The call to `Repository.getItem` throws a `RepositoryException`

GetException

- The call to `GetService.getItemAsXML` throws a `GetException`

Web Service Generation

The following parameters are used to generate this Web service, using the `WebServiceGeneratorImpl` class:

Parameter	Value
NucleusPath	/atg/repository/RepositoryServices
MethodName	getRepositoryItem
EarFileName	repositoryWebServices.ear
AppName	RepositoryWebServices
AppDescription	A collection of Web services used to make repository calls
ServletName	getRepositoryItem
ServletDisplayName	GetRepositoryItem
ServletDescription	When called, gets a repository using the given arguments
URLPattern	GetRepositoryItem
WebURI	generic.war
ContextPath	repository/generic
WebAppDisplayName	RepositoryServices
WebAppDescription	A collection of generic repository Web services, where the user must provide information about which repository is being acted upon
Host	null (will be dynamic)
Port	null (will be dynamic)
ParameterNames	pRepositoryPath, pItemDescriptorName, pRepositoryId
UseSession	true

Web Service Security

By default, the `GetRepositoryItem` Web service uses a security policy that allows access only by Administrators. You are free to change this to suit your needs, depending on how you expect to use this service.

1. *FunctionalName:* `GenericRepositoryUser`
2. *SecurityPolicy:* `StandardSecurityPolicy`
3. *ACL:* Administrators

PerformRQLQuery Web Service

The `PerformRQLQuery` Web service executes a given RQL string on the repository specified by the `pRepositoryPath` argument, and returns items of the type specified by the `pItemDescriptorName` argument. The given RQL string cannot contain parameters, as RQL expects parameters in the form of an array of Objects. The Web service calls through to the `performRQLQuery` method of the `atg.repository.RepositoryServices` class, which handles all logic, error checking, and result transformation.

Web Service Implementation

Web Service URL	`http://hostname:port/repository/generic/performRQLQuery/performRQLQuery`
Web Service Class Name	`webservice.PerformRQLQuerySEIImpl`
Nucleus Component	`/atg/repository/RepositoryServices`
Method Name	`performRqlQuery`

Input Parameters	`String pRepositoryPath`
	The path of the repository component to query against.
	
	`String pItemDescriptorName`
	The item type of the repository items to query against.
	
	`String pRQLString`
	The RQL string to execute. Note that this string cannot contain parameters.

Output	`String[]` The found `RepositoryItems` in XML format, or null if no items satisfy the given query.
Exceptions	`atg.repository.RepositoryException` if a repository error occurs `atg.repository.xml.GetException` if an error occurs translating the item into XML

PerformRQLQuery Exceptions

Exceptions generated by the `PerformRQLQuery` Web service may occur for the following reasons:

RepositoryException

- The `pRepositoryPath` specified by the argument is null, or empty.
- The `pRepositoryPath` specified by the argument does not resolve to a component.
- The `pRepositoryPath` specified by the argument does not resolve to a Repository.
- The `pItemDescriptorName` specified by the argument does not identify an `ItemDescriptor` of the given repository.
- The `pRQLString` specified by the argument is null, or empty.

- The RQL code throws an exception during parsing or execution.

GetException

The call to `GetService.getItemAsXML` throws a `GetException` for any found items.

Web Service Generation

The following parameters are used to generate this Web service, using the `WebServiceGeneratorImpl` class:

Parameter	Value
`NucleusPath`	`/atg/repository/RepositoryServices`
`MethodName`	`performRQLQuery`
`EarFileName`	`repositoryWebServices.ear`
`AppName`	`RepositoryWebServices`
`AppDescription`	A collection of Web services used to make repository calls
`ServletName`	`performRQLQuery`
`ServletDisplayName`	`PerformRQLQuery`
`ServletDescription`	When called, executes the given query against the specified repository
`URLPattern`	`PerformRQLQuery`
`WebURI`	`generic.war`
`ContextPath`	`repository/generic`
`WebAppDisplayName`	`RepositoryServices`
`WebAppDescription`	A collection of generic repository Web services, where the user must provide information about which repository is being acted upon
`Host`	`null` (will be dynamic)
`Port`	`null` (will be dynamic)
`ParameterNames`	`pRepositoryPath, pItemDescriptorName, pRQLString`
`UseSession`	`true`

PerformRQLCountQuery Web Service

The `PerformRQLCountQuery` Web service executes a given RQL string on the repository specified by the `pRepositoryPath` argument, and returns the number of items that satisfy that query. The given RQL string

cannot contain parameters, as RQL expects parameters in the form of an array of Objects and a Web service request cannot pass an array of Objects. The Web service calls through to the `performRQLCountQuery` method of the `atg.repository.RepositoryServices` class, which handles all logic and error checking.

Web Service Implementation

Web Service URL	`http://`*`hostname:port`*`/repository/generic /performRQLCountQuery/performRQLCountQuery`
Web Service Class Name	`webservice.PerformRQLCountQuerySEIImpl`
Nucleus Component	`/atg/repository/RepositoryServices`
Method Name	`performRqlCountQuery`

Input Parameters	`String pRepositoryPath`
	The path of the repository component to query against.
	
	`String pItemDescriptorName`
	The item type of the repository items to query against.
	
	`String pRQLString`
	The RQL string to execute. Note that this string cannot contain parameters.

Output	`int` The number of `RepositoryItems` that satisfy the given query.
Exception	`atg.repository.RepositoryException` if a repository error occurs

PerformRQLCountQuery Exceptions

Exceptions generated by the `PerformRQLCountQuery` Web service may occur for the following reasons:

RepositoryException

- The `pRepositoryPath` specified by the argument is null, or empty.
- The `pRepositoryPath` specified by the argument does not resolve to a component.
- The `pRepositoryPath` specified by the argument does not resolve to a Repository.
- The `pItemDescriptorName` specified by the argument does not identify an `ItemDescriptor` of the given repository.
- The `pRQLString` specified by the argument is null, or empty.
- The RQL code throws an exception during parsing or execution.

Web Service Generation

The following parameters are used to generate this Web service, using the `WebServiceGeneratorImpl` class:

Parameter	Value
NucleusPath	/atg/repository/RepositoryServices
MethodName	performRQLCountQuery
EarFileName	repositoryWebServices.ear
AppName	RepositoryWebServices
AppDescription	A collection of Web services used to make repository calls
ServletName	performRQLCountQuery
ServletDisplayName	PerformRQLCountQuery
ServletDescription	Performs a repository count query using the given repository path, item descriptor name and RQL string
WebURI	generic.war
ContextPath	repository/generic
WebAppDisplayName	RepositoryServices
WebAppDescription	A collection of generic repository Web services, where the user must provide information about which repository is being acted upon
Host	null (will be dynamic)
Port	null (will be dynamic)
ParameterNames	pRepositoryPath, pItemDescriptorName, pRQLString
UseSession	true

Repository Web Service Security

Each repository Web service defines a security function. This function lets you define a security policy that can be applied across many services at once. You can define these functional names and security policy relationships in the Web Service Security Configuration section of the Oracle ATG Web Commerce Web Service Administration interface. Refer to the *Web Services Guide* for more information.

If you want to change any of these functional names in order to change the way different Web services are grouped, you must regenerate the Web services, because the functional name for security policy purposes is hard coded into the generated class. The functional name for each of the three repository Web services included in the Oracle ATG Web Commerce platform is `repositoryOperation`. By default, this functional name is mapped to a security policy that allows access only by Administrators. You are free to change this to suit your needs, depending on how you expect to use this service.

18 Composite Repositories

All Oracle ATG Web Commerce repositories provide a means for representing information in a data store as Java objects. The composite repository lets you use more than one data store as the source for a single repository. The composite repository consolidates all data sources in a single data model, making the data model flexible enough to support the addition of new data sources. Additionally, the composite repository allows all properties in each composite repository item to be queryable. Thus, from the point of view of your Oracle ATG Web Commerce application, the composite repository presents a consistent view of your data, regardless of which underlying data store the data may reside in.

The composite repository is a repository that unifies multiple data sources. Its purpose is to make any number of repositories appear in an Oracle ATG Web Commerce application as a single repository. The composite repository defines a mapping between item descriptors and properties as they appear to facilities that use the composite repository and item descriptors and properties of the data models that comprise the composite data model. A composite repository is composed of any number of composite item descriptors. Each item descriptor can draw on different data models from different repositories, and map underlying data model attributes in different ways.

Use Example

Suppose you maintain profile data both in an SQL database and an LDAP directory. Oracle ATG Web Commerce's profile repository ships with a `user` composite item descriptor comprised of just one primary item descriptor and no contributing item descriptors. The primary item descriptor is the `user` item descriptor. You can add to the composite item descriptor the `user` item descriptor from the LDAP repository as a contributing item descriptor. If there are any property name collisions between the SQL repository and the LDAP repository, you can resolve them by mapping the properties explicitly to different names in the composite repository configuration. After you've done this, your Oracle ATG Web Commerce applications can view both LDAP profile information and SQL database profile information as properties of composite items in the composite `user` item descriptor.

Primary and Contributing Item Descriptors

Each composite item descriptor is composed of any number of contributing item descriptors. One of these contributing item descriptors must be designated as the primary item descriptor. The primary item descriptor's main purpose is to provide the ID space for the composite item descriptor. The composite item descriptor

can incorporate any number of contributing item descriptors, which contribute properties to the composite repository items.

Each contributing item has one or more relationships to the primary item. These relationships are defined in the contributing item descriptor. Each relationship defines a unique ID attribute in the primary item descriptor, as well as a unique ID attribute in the contributing item descriptor. The attribute can be the repository item ID or a unique property. A contributing item is linked to a primary item if the value of its unique ID attribute matches the value of the primary item's unique ID attribute. If multiple relationships are defined, they are AND'd together.

For example, suppose you have a contributing item descriptor that defines two relationships to the primary item descriptor. One says that a primary item's `firstName` property must match the contributing item's `userFirstName` property and the other says that the primary item's `lastName` property must match the contributing item's `userLastName`. These two relationships together mean that a user's first names and last names must each match for two items to be related. This is useful in situations where no one property uniquely identifies a user. See <link-via-property> (page 292) for an example of defining a relationship with two or more properties.

Item Inheritance and Composite Repositories

A composite repository can handle item descriptor inheritance only for its primary item descriptors. For example, suppose you have a `user` composite item descriptor. Its primary item descriptor is named `person` and is part of an LDAP repository. The contributing item descriptor is named `user` and is part of an SQL repository. The `user` item descriptor has a subtype named `broker`. The composite items have access to the properties of the `person` item descriptor and the `user` item descriptor, but not to properties that exist only in the `broker` item descriptor.

Transient Properties and Composite Repositories

An LDAP repository does not support transient properties. Therefore, if you want to use transient properties in your composite item descriptor, the transient properties must be derived from an SQL repository or other repository that does support transient properties.

Non-Serializable Items and Composite Repositories

An LDAP repository item is not serializable. Therefore, if you have a property that derives from an LDAP repository item, you should mark the property as not serializable by setting the `serialize` attribute to `false`:

```
<property name="propName" >
   ...
    <attribute name="serialize" value="false"/>
   ...
```

```
</property>
```

Property Derivation

The properties in a composite item descriptor are determined as follows:

1. If configured to do so, all properties from the primary and contributing item descriptors are combined into the composite item descriptor, with each property retaining its property name and property type.
2. Any properties marked as excluded are removed from the composite item descriptor. See Excluding Properties (page 282).
3. All property mappings are performed. This means that a primary or contributing property that is to be mapped gets renamed in the composite item descriptor. See Property Mappings (page 281).
4. If there are any two properties in the composite item descriptor that have the same name, an error results. The composite repository requires that all composite property names map explicitly to only one primary or contributing property.

Configuring a Composite Repository

1. Design the composite repository. Pick what item types you want to represent in your composite repository's composite item descriptors
2. Specify the primary item descriptor. This is where the composite repository item's repository item IDs come from
3. Specify any contributing item descriptors you need to supplement the primary item descriptor.
4. Resolve any property name collisions between properties in the primary item descriptor and the contributing item descriptors. See Property Mappings (page 281).
5. Determine whether you want to use static or dynamic linking for properties whose types are repository items. See Link Methods (page 282).
6. Determine what item creation policy you want the composite repository to implement. See Creating Composite and Contributing Items (page 283).
7. Determine whether there are any properties in your primary or contributing item descriptors that you want to exclude from the composite item descriptor. See Excluding Properties (page 282).
8. Create and configure a `CompositeRepository` component. See Configuring the Composite Repository Component (page 284).

Property Mappings

The composite repository requires that all composite property names map explicitly to only one primary or contributing property. If primary or contributing item descriptors contain one or more properties with the same

name, you must exclude one of the properties (see Excluding Properties (page 282)) or map it to another name.

You can map a property with the `mapped-property-name` attribute in an item descriptor's `property` tag. For example, given two contributing item descriptors, where each has a `login` property, you can map one of the properties to a different name like this:

```
<property name="ldapLogin" ... mapped-property-name="login"/>
```

In this example, the `name` attribute specifies the property name in the composite item descriptor and the `mapped-property-name` attribute specifies the name of the property in the primary or contributing item descriptor to which this property maps.

Excluding Properties

Sometimes you may not want to expose absolutely every property from the underlying primary and contributing item descriptors in the composite item descriptor. You can configure the item descriptor to exclude those contributing properties that are not desired. You do this by setting a property tag's `exclude` attribute to `true`:

```
<property name="password ... exclude="true"/>
```

Link Methods

The `link-method` attribute determines what happens when the composite repository needs to get a property value that belongs to a contributing repository item. For example, a process might call:

```
CompositeItem.getPropertyValue("ldapFirstName");
```

where `ldapFirstName` is a property of a contributing repository item in an LDAP repository. The `CompositeItem` that is being asked for the property needs to look for this contributing item. If it can find it, it retrieves the property value and acts according to the value of the `link-method` attribute: `static` or `dynamic`.

Static link method

If `link-method` is set to `static`, the contributing item is stored in a member variable of that composite repository item. The next time a property is requested from that same item, it retrieves it from this variable instead of finding it again from the underlying contributing repository. This saves some computational effort and results in faster property retrieval.

If the value of the property or properties used to link to the underlying contributing item changes, the data in the member variable is stale. This occurs only if a linking property in the underlying data store changes. For example, if you link to a contributing item descriptor using a `login` property, static linking can result in stale data only if the `login` property changes in an underlying repository.

Dynamic link method

If `link-method` attribute is set to `dynamic`, the composite repository queries the underlying repository for the contributing item every time a property is requested from it. This might result in slower performance, but it also means that data is never out of sync at the repository level.

Methods compared

Dynamic link mode might seem like the most technically correct implementation, because the data model is guaranteed to reflect the latest information. Because dynamic link mode requires a query each time information

is needed from a composite item, it can impair performance. Usually, the information that links items rarely changes. Static linking is generally provides correct data model linking.

Creating Composite and Contributing Items

The `contributing-item-creation-policy` dictates how contributing items are created (if at all) in a `MutableRepository`. This attribute can have a value of `eager`, `lazy`, or `none`.

eager

When users create a new composite item via the `createItem()` method in `MutableCompositeRepository`, new instances of the primary item and of all contributing items are created. So, for example, if you have a `user` item type defined in your composite repository that borrows properties from the SQL and LDAP repositories, any new `user` composite repository item that is created creates both an SQL repository item and an LDAP repository item. However, before these items can be added to their respective repositories, the correct link needs to exist between them. If the items are linked by a certain property, this property needs to be set on the primary item before the items are added, otherwise an error occurs as those two items cannot be linked back together later.

lazy

If this option is chosen, contributing items are created only when they are needed. In this case, when users call `setPropertyValue` on a property that is defined in the contributing repository, the composite repository creates the item in the contributing then and there. There are two different behaviors depending on whether the `CompositeItem` is transient or not.

- If the item is transient, wait until the item is persisted before checking to see that all appropriate linking properties are set, so they can be propagated to the new contributing item.
- If the item is not transient, check whether the correct linking properties are set on the primary item, then add the contributing item to its repository. If there any properties used for linking are missing, an error is returned.

The check for valid linking properties occurs during the `updateItem` call, and not during the `setPropertyValue` call on the contributing item. So if you use lazy item creation and call `setPropertyValue` on a persistent item, you do not need to already have valid values set for any linking properties on the primary item at that exact point in time. As long as the values of the linking properties are set before `updateItem` is called, the item should be successfully created.

none

If this option is chosen, no repository items are created in the underlying repositories under any circumstance. Any contributing items used in the composite repository must already exist in order for valid results to be returned from property value requests.

Missing Contributing Items

The `null-contributing-item-policy` attribute determines how the composite repository should behave if it tries to get the value of a property from a contributing repository item, but the repository cannot find a contributing item that links with the primary item. There are three possible behaviors:

error

If there is no contributing item found, a `RuntimeException` is thrown.

default

If there is no contributing item found, the default value for that property in the contributing item descriptor is returned. If there is no default value, null is returned

null

If there is no contributing item found, null is returned automatically.

Configuring the Composite Repository Component

The `CompositeRepository` component, whose class is `atg.adapter.composite.MutableCompositeRepository`, is the central component of a composite repository. Create a component of this class and set its `configurationFile` property to the Nucleus address of the composite repository definition file. You can configure the following properties of this component:

Property	Description	Value
`configurationFile`	The Nucleus address of an XML file that uses the Composite Repository DTD. See the Composite Repository Definition Tag Reference (page 285).	
`cumulativeDebug`	If `true`, output from all debug levels lower than the current debug level are printed to the log.	Boolean Default: `true`
`debugLevel`	An integer from 0 to 23 that indicates the frequency with which debug log messages are generated. The higher the value, the greater the frequency of debug log entries. See Debug Levels (page 159) in the *Developing and Testing an SQL Repository* (page 147) chapter.	Integer Default: 5
`queryBatchSize`	The maximum number of items that are returned by a single query to an underlying repository. Before the `queryBatchSize` is used, the `CompositeRepository` checks to see if the query contains a class that refers to properties from different contributing repositories.	Integer Default: 1000.
`repositoryName`	The name of the composite repository	String

Composite Repository Queries

All queries in the Repository Query API are supported in the composite repository. However, a query against the composite repository should use only queries that are supported in the underlying repositories. You can make queries that reference properties of different underlying repositories. Be aware, however, that queries with expressions that involve joins across multiple repositories may be slower than single-repository queries. Queries

that may perform extremely poorly are of the form "find all users whose dayPhone is equal to their workPhone," where dayPhone and workPhone are stored in different repositories. If you construct a complex query that needs to retrieve some properties from one underlying repository and other properties from a separate underlying repository, the query must be broken down into separate queries directed at each repository. The results of the sub-queries are combined appropriately using AND or OR rules and the final result set is returned in the composite repository.

Note in particular that COUNT queries perform poorly if the query spans repository views or if the underlying repository does not support executing count queries. LDAP repositories do not support COUNT queries, for example, and you should avoid using COUNT queries if any part of the result set might come from the LDAP repository.

Composite Repository Caching

The composite repository does not maintain items or queries in its own caches. Instead, it relies on the caches maintained by its underlying repositories. See the *SQL Repository Caching* (page 103) chapter and Configuring LDAP Repository Components (page 334) in the *LDAP Repositories* (page 319) chapter for information about how those repositories handle caching.

Composite Repository Definition Tag Reference

This section describes composite-repository-template elements as they are defined in composite-repository_1.0.dtd. The complete DTD for composite repository definition files can be found later in this chapter.

This section describes the XML tags that can be used in a composite repository definition file, as defined in the DTD for Composite Repository Definition Files (page 292).

<composite-repository-template>

```
<!ELEMENT composite-repository-template (header?, item-descriptor*)>
```

The composite-repository-template tag encloses the entire composite repository definition.

<header> (composite repository)

```
<!ELEMENT header (name?, author*, version?, description?)>
```

Parent: <composite-repository-template> (page 285)

The <header> tag provides information that can help you manage create and modify repository definition files.

For example:

```
<header>
  <name>Catalog Template</name>
  <author>Neal Stephenson</author>
  <author>Emily Dickinson</author>
  <version>$Id: catalog.xml,v 1.10 2000/12/24 03:34:26 hm Exp $</version>
  <description>Template for the store catalog</description>
</header>
```

<item-descriptor> *composite repository*

```
<!ELEMENT item-descriptor (attribute*, <primary-item-descriptor> (page 287),
                           <contributing-item-descriptor> (page 288)*)>
```

Parent: <composite-repository-template> (page 285)

The `<item-descriptor>` tag specifies the primary and contributing item descriptors that comprise a composite item descriptor.

Attributes

Attribute	Description
`name`	The name of the composite item descriptor, unique within the repository (required). This property is case-insensitive.
`default`	Boolean, specifies whether this is the composite repository's default item descriptor. The default item descriptor is used for new repository items if no item descriptor is explicitly specified. If no item descriptor is designated as the default, the first item descriptor in the repository definition file is the default. Default: `false`
`display-property`	Specifies a property of this item descriptor that is used to represent items of this type in a user interface. For example, a profile item descriptor might set `display-property` to `login`. Then, each repository item is represented using the value of the item's `login` property.
`display-name-resource`	If a resource bundle is specified for this property with the tag `<attribute name=resourceBundle>`, this attribute specifies the resource bundle key to the item descriptor's display name. See *Localizing SQL Repository Definitions* (page 99).

Attribute	Description
`link-method`	The method for retrieving properties from contributing repository items, one of the following: `static` (default) `dynamic` See Link Methods (page 282).

`contributing-item-creation-policy`	Specifies how contributing repository items are created, one of the following:
	
	`lazy` (default)
	`eager`
	`none`
	
	See Creating Composite and Contributing Items (page 283).

`null-contributing-item-policy`	Specifies what to do if a contributing repository item is requested but not found in the underlying repository, one of the following:
	
	`default` (default)
	`error`
	`null`
	
	See Missing Contributing Items (page 283).

Example

```
<item-descriptor name="compositeUser" default="true"
         display-property="fooProperty"
         display-name-resource="itemDescriptorUser">
   <attribute name="resourceBundle"
              value="atg.userprofiling.CompositeProfileTemplateResources"
              data-type="string"/>
   <primary-item-descriptor.../>
   <contributing-item-descriptor.../>
...
</item-descriptor>
```

<primary-item-descriptor>

```
<!ELEMENT primary-item-descriptor (property*)>
```

Parent: `item-descriptor`

One item descriptor is designated as the primary item descriptor; it provides the ID space for the composite item descriptor.

Attributes

Note: The following attributes are also defined for the <contributing-item-descriptor> element.

Attribute	Description
`name`	The name of the composite item descriptor, unique within the repository (required). This property is case-insensitive.
`repository-item-descriptor-name`	The name of this item descriptor in its source repository (required).
`repository-nucleus-name`	The Nucleus address of this item descriptor's repository (required).
`all-properties-propagate`	Boolean. If this attribute is set to `true`, the composite repository tries to make all properties of the primary or contributing item descriptor available to the composite item descriptor. Default: `false`
`all-properties-queryable`	Boolean, specifies whether properties of this item descriptor are queryable by default. This setting can be overridden by explicitly setting the property's `queryable` attribute. Default: `true`

<contributing-item-descriptor>

```
<!ELEMENT contributing-item-descriptor (property*, <primary-item-descriptor-
link> (page 290))>
```

Parent: `item-descriptor`

The `contributing-item-descriptor` element whose properties are combined with the primary item descriptor properties.

Attributes

See <primary-item-descriptor> (page 287)

<attribute> composite repository

```
<!ELEMENT attribute EMPTY>
```

Parent: `<item-descriptor>`, `<property>`

The <attribute> tag associates arbitrary name/string value pairs with a property or item type, which determine its behavior. The name/value pairs are added to the property descriptor via the setValue method of java.beans.FeatureDescriptor, and can later be used by the application.

For example:

```
<property name="employeeNumber" data-type="string">
  <attribute name="PCCExpert" value="true" data-type="boolean"/>
</property>
```

See User-Defined Property Types (page 73) for more information.

Attributes

Attribute	Description
name	The name of the name/value pair, required. You can specify any name here and it is added to the list of feature descriptor attributes for your property.
value	The value of the name/value pair, required. The data type of this value is defined by the data-type attribute supplied to this tag. If no data-type attribute is provided, the value of the attribute is a string.
data-type	The primitive data-type of the value, one of the following: string* int byte short date long timestamp float double * default

<property> composite repository

```
<!ELEMENT property (attribute*)>
```

Parent: <primary-item-descriptor> (page 287)>, <contributing-item-descriptor> (page 288)>

The <property> tag maps a property in a composite repository to a property in a primary or contributing item descriptor. This allows two or more contributing item descriptors to have properties with the same name.

Attributes

Attribute	Description
name	The name of this composite property.

Attribute	Description
mapped-property-name	The name of the property in the primary or contributing item descriptor to which this property maps (required).
queryable	Boolean. Default: true
required	Boolean. Default: false
expert	Boolean. Expert properties are not displayed in the default view of the ATG Control Center. Default: false
hidden	Boolean, if true, suppresses display in the ATG Control Center. Default: false
readable	Boolean. Default: false
writable	Boolean. Default: false
category-resource	If a resource bundle is specified for this property with the tag <attribute name=resourceBundle>, this attribute specifies the resource bundle key to the property's category. See *Localizing SQL Repository Definitions* (page 99).
display-name-resource	If a resource bundle is specified for this property with the tag <attribute name=resourceBundle>, this attribute specifies the resource bundle key to the property's display name. See *Localizing SQL Repository Definitions* (page 99).
exclude	Boolean. If set to true, excludes this property from the composite item descriptor. See Excluding Properties (page 282). Default: false

Example

```
<property name="ldapFirstName" mapped-property-name="firstName"
    queryable="false" required="false" expert="false"
    hidden="false" readable="true" writable="true"
    category-resource="categoryBasics"
    display-name-resource="ldapFirstName">
...
</property>
```

<primary-item-descriptor-link>

```
<!ELEMENT primary-item-descriptor-link (link-via-id | link-via-property+)>
```

Parent: <contributing-item-descriptor> (page 288)

The `<primary-item-descriptor-link>` tag specifies how to link items in contributing item descriptors to items in the primary item descriptor, by embedding a <link-via-id> (page 291) tag or one or more <link-via-property> (page 292) tags:

- If the `primary-item-descriptor-link` tag encloses a <link-via-id> (page 291) tag, the repository ID of the item is used for linking.
- If the `primary-item-descriptor-link` tag encloses a <link-via-property> (page 292) tag, a unique item property specified in the `link-via-property` tag is used for linking.

Examples

In the first example, the contributing item descriptor's items are linked to the primary item descriptor's items by the common repository ID of the items:

```
<primary-item-descriptor-link>
  <link-via-id/>
</primary-item-descriptor-link>
```

In the next example, a primary item is linked to an item in this contributing item descriptor if two conditions are true:

- The value of the primary item's `firstName` property matches the value of the contributing item's `userFirstName` property
- The value of the primary item's `lastName` property matches the value of the contributing item's `userLastName` property.

This is useful when no one property in the primary item descriptor or the contributing item descriptor is uniquely valued. The relationships are AND'd together.

```
<primary-item-descriptor-link>
  <link-via-property primary="firstName" contributing="userFirstName"/>
  <link-via-property primary="lastName" contributing="userLastName"/>
</primary-item-descriptor-link>
```

See Link Methods (page 282) for more information.

<link-via-id>

```
<!ELEMENT link-via-id EMPTY>
```

Parent: <primary-item-descriptor-link> (page 290)

The `link-via-id` tag specifies to use the item's repository ID to link the primary item descriptor to the contributing item descriptor.

<link-via-property>

```
<!ELEMENT link-via-property EMPTY>
```

Parent: <primary-item-descriptor-link> (page 290)

The `link-via-property` specifies to use one or more properties to link the primary item descriptor to the contributing item descriptor.

Attributes

Attribute	Description
`primary`	The name of the property in the primary item descriptor used for linking. The property name used is the name in the underlying repository and not the names in the composite repository.
`contributing`	The name of the property in the contributing item descriptor used for linking. The property name used is the name in the underlying repository and not the names in the composite repository.

DTD for Composite Repository Definition Files

The DTD for composite repository definition files is installed in the archive `<ATG11dir>/DAS/lib/classes.jar`. It can also be referenced with this URL:

`http://www.atg.com/dtds/gsa/ composite-repository_1.0.dtd`

```
<?xml encoding="UTF-8"?>

<!-- ============================================================== -->
<!-- composite-repository_1.0.dtd - Composite Repository configuration spec  -->
<!-- @version $Id: //product/DAS/version/11.0/Java/atg/dtds/composite
-repository/composite-repository_1.0.dtd#1 $$Change: 531151 $       -->
<!-- ============================================================== -->

<!-- Flag datatype, and values -->
<!ENTITY % flag "(true | false)">

<!-- The attribute tag is used to specify the list of feature descriptor values --
>
<!ELEMENT attribute EMPTY>
<!ATTLIST attribute
          name         CDATA          #REQUIRED
          value        CDATA          #REQUIRED
          data-type    CDATA          #IMPLIED
>

<!-- ============================================================== -->
<!-- composite-repository-configuration - top level element          -->
```

```
<!-- ============================================================ -->

<!ELEMENT composite-repository-template (header?, item-descriptor*)>

<!-- The header -->
<!ELEMENT header (name?, author*, version?, description?)>

<!-- Name of template -->
<!ELEMENT name (#PCDATA)>

<!-- The author(s) -->
<!ELEMENT author (#PCDATA)>

<!-- Version string -->
<!ELEMENT version (#PCDATA)>

<!-- Description string -->
<!ELEMENT description (#PCDATA)>

<!-- ============================================================ -->
<!-- composite-view element:                                      -->
<!--  The definition of a view as it appears to code that calls the  -->
<!--  composite repository.                                       -->
<!-- ============================================================ -->

<!ELEMENT item-descriptor (attribute*, primary-item-descriptor, contributing-item
-descriptor*)>

<!ATTLIST item-descriptor
          name    CDATA     #REQUIRED
          default  %flag;   "false"
          display-property CDATA #IMPLIED
          display-name-resource CDATA   #IMPLIED
          link-method CDATA #IMPLIED
          contributing-item-creation-policy CDATA #IMPLIED
          null-contributing-item-policy CDATA #IMPLIED
>
<!-- ============================================================ -->
<!-- The primary item descriptor definition                       -->
<!--  The primary view's propertty values take precedence over       -->
<!--  contributing views' property values.  Also, a composite item's -->
<!--  primary item provides the composite item's id.               -->
<!--  The repository-nucleus-name and view-name specify the primary  -->
<!--  view.  The unique-id-property specifies which property in the  -->
<!--  uniquely identifies items in the primary view.               -->
<!-- ============================================================ -->
<!ELEMENT primary-item-descriptor (property*)>

<!ATTLIST primary-item-descriptor
     name     CDATA     #REQUIRED
     repository-nucleus-name     CDATA     #REQUIRED
     repository-item-descriptor-name     CDATA     #REQUIRED
     all-properties-propagate     %flag;     "false"
     all-properties-queryable     %flag;     "true"
>


<!ELEMENT contributing-item-descriptor (property*, primary-item-descriptor-link)>

<!ATTLIST contributing-item-descriptor
```

```
     name     CDATA     #REQUIRED
     repository-nucleus-name     CDATA     #REQUIRED
     repository-item-descriptor-name     CDATA     #REQUIRED
     all-properties-propagate     %flag;     "false"
     all-properties-queryable     %flag;     "true"
>

<!ELEMENT property (attribute*)>

<!ATTLIST property
     name     CDATA     #IMPLIED
     mapped-property-name     CDATA     #REQUIRED
     queryable     %flag;     "true"
     required     %flag;     "false"
     expert     %flag;     "false"
     hidden     %flag;     "false"
     readable     %flag;     "true"
     writable     %flag;     "true"
     category-resource     CDATA     #IMPLIED
     display-name-resource     CDATA     #IMPLIED
     exclude     %flag;     "false"
>

<!ELEMENT primary-item-descriptor-link (link-via-id | link-via-property+)>
<!ELEMENT link-via-id EMPTY>
<!ELEMENT link-via-property EMPTY>

<!ATTLIST link-via-property
     primary     CDATA     #REQUIRED
     contributing     CDATA     #REQUIRED
     sort-property    %flag;     #IMPLIED
>
```

Sample Composite Repository Definition File

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

<!DOCTYPE scenario-manager-configuration
     PUBLIC "-//Art Technology Group, Inc.//DTD Scenario Manager//EN"
     'http://www.atg.com/dtds/composite-repository/composite-repository_1.0.dtd'>

<!-- composite repository definition -->
<composite-repository-template>

  <!-- Header similar to GSA DTD -->
  <header>
    <!-- name of this document -->
    <name>A sample Composite Repository template</name>
    <!-- author of this document -->
    <author>Graham Mather</author>
    <!-- version of this document -->
    <version>$Change: 226591 $$DateTime: 2002/01/22 15:50:56 $$Author: gm $
    </version>
  </header>
```

```
<!-- composite item descriptor definition -->
<!-- name: name of the composite item descriptor -->
<!-- default: is this the composite repository's default item descriptor? -->
<!-- display-property: the property used when display items of this type -->
<!-- display-name-resource: resource which defines the display name -->
<item-descriptor name="compositeUser" default="true"
  display-property="fooProperty"
  display-name-resource="itemDescriptorUser">

  <!-- resource bundle from whence this item descriptor's resources come -->
  <attribute name="resourceBundle"
             value="atg.userprofiling.CompositeProfileTemplateResources"
             data-type="string"/>
  <!-- icon for items of this type -->
  <attribute name="icon" value="userIcon" data-type="string"/>
  <!-- "basics" category sort priority -->
  <attribute name="categoryBasicsPriority" value="10" data-type="int"/>

  <!-- primary view definition -->
    <!-- name: the name of the primary view, as it appears internally to the
    composite repository.  The primary view and all composite views must have
    unique internal view names -->
    <!-- repository-nucleus-name: the nucleus path of the repository in which
    the primary view resides -->
    <!-- repository-item-descriptor-name: the name of the view in the given
    repository which acts as the primary item descriptor for this composite item
    descriptor -->
    <!-- all-properties-propagate: if true, composite repository attempts to
    make all properties in the primary item descriptor available in the
    composite item descriptor.  Default is false  -->
    <!-- all-properties-queryable: if true, all properties in the view are
    queryable unless otherwise specified.  If false, all properties are not
    queryable unless otherwise specified. default is true -->
  <primary-item-descriptor name="user"
    repository-nucleus-name="/atg/userprofiling/ProfileAdapterRepository"
    repository-item-descriptor-name="user"
    all-properties-propagate="true"
    all-properties-queryable="true">

    <!--
    Can also contain explicit property mappings and explicit property exclusions
    -->

    <property mapped-property-name="lastName" exclude="true"/>
    <property mapped-property-name="email" exclude="true"/>

  </primary-item-descriptor>

  <!-- contributing view definition -->
  <!-- name: the name of this contributing view, as it appears to the composite
  repository -->
  <!-- repository-nucleus-name: the nucleus path of the repository in which the
  primary view resides -->
  <!-- repository-item-descriptor-name: the name of the view in the given
  repository which acts as the primary item descriptor for this composite item
  descriptor -->
  <!-- all-properties-propagate: if true, composite repository attempts to make
  all properties in the primary item descriptor available in the composite item
  descriptor.  Default is false  -->
```

```
<!-- all-properties-queryable: if true, all properties in the view are
queryable unless otherwise specified.  If false, all properties are not
queryable unless otherwise specified. default is true -->

<contributing-item-descriptor name="UserProfile-LDAP"
  repository-nucleus-name="/atg/adapter/ldap/LDAPRepository"
  repository-item-descriptor-name="user"
  all-properties-propagate="true"
  all-properties-queryable="true">


<!-- explicit property mapping
sometimes it's advantageous to explicitly map a property in a composite view
to a particular property in either the primary or a contributing view.
For example, perhaps two contributing views have properties with the same
name. This gets around the "no contributing views with same property names"
rule.
-->

<!-- name: name of this composite property -->
<!-- mappedPropertyName: the property to which this property maps -->
<!-- queryable: property queryable flag -->
<!-- required:  property required flag-->
<!-- expert: property expert flag -->
<!-- hidden: property hidden flag -->
<!-- readable: property readable flag -->
<!-- writable: property writable flag -->
<!-- category-resource: resource for category name -->
<!-- display-name-resource: resource for display name -->
<property name="ldapFirstName" mapped-property-name="firstName"
queryable="false" required="false" expert="false"
hidden="false" readable="true" writable="true"
category-resource="categoryBasics"
display-name-resource="ldapFirstName">

  <!-- bundle for this property's resources -->
  <attribute name="resourceBundle"
  value="atg.userprofiling.CompositeProfileTemplateResources"
  data-type="string"/>
  <!-- flag for ui being able to write this property -->
  <attribute name="uiwritable" value="true" data-type="boolean"/>
  <!-- maximum length for this property -->
  <attribute name="maxLength" value="32" data-type="int"/>
  <!-- does this property's value have to be unique? -->
  <attribute name="unique" value="true" data-type="boolean"/>
  <!-- sort priority -->
  <attribute name="propertySortPriority" value="10" data-type="int"/>

</property>

<!-- explicit property exclusion
Sometimes users will not want to expose absolutely every property from
the underlying primary and contributing views in the composite view. An
explicit property removal allows the user to make the composite view
contain only those contributing properties that are desired.
-->
<property mapped-property-name="login" exclude="true"/>
<property mapped-property-name="password" exclude="true"/>
<property mapped-property-name="id" exclude="true"/>
```

```
    <!--
    2) a composite view's property names are determined thusly:

       a) If all-properties-propagate is true, all properties from the primary and
       contributing views are combined into the composite view, retaining their
       property names, property types, and any metadata they may have defined.

       b) All property exclusions are performed.  This means that any properties
       to be excluded are removed from the composite view.

       c) All property mappings are performed.  This means that a primary or
       contributing property that is to be mapped gets renamed in the composite
       view.

       d) If there are any two properties in the composite view that have the same
       name, error.  The composite repository requires that all composite property
       names map explicitly to only one primary or contributing property.

      -->

      <!-- the primary view link describes how items in the contributing view are
       linked to items in the primary view.  For each primary-contributing
       relationship, the user picks a unique id attribute for the primary and the
       contributing view. The attribute can be either the repository id of the
      item or a uniquely-valued property of the item (e.g. login).  A primary item
      is linked to a contributing item if its unique id attribute value matches
      the unique id attribute value of the contributing item. There must be at
      least one primary view link, but there is primary view link limit.  -->

      <!-- example: this primary view link defines a relationship where an item in
      the primary view is linked to an item in this contributing view if the
      contributing item has a repository id which is the same as the primary
      item's id.
-->

<!--
      <primary-item-descriptor-link>
        <link-via-id/>
      </primary-item-descriptor-link>
-->

      <!-- OR:

      This primary view link defines a relationship where a primary view item is
      linked to an item in this contributing view if the value of the primary
      item's "login" property matches the value of the contributing item's
      "userLoginName" property.
      -->

      <primary-item-descriptor-link>
        <link-via-property primary="login" contributing="login"/>
      </primary-item-descriptor-link>

      <!-- OR:

      This primary view link defines a relationship where a primary view item is
      linked to an item in this contributing view if the value of the primary
      item's "firstName" property matches the value of the contributing item's
      "userFirstName" property AND the value of the primary item's "lastName"
       property matches the value of the contributing item's "userLastName"
```

```
        property.  This is useful in the case where no one property in the primary
        view or the contributing view is uniquely valued. The relationships are
        ANDed together

       <primary-item-descriptor-link>
         <link-via-property primary="firstName" contributing="userFirstName"/>
         <link-via-property primary="lastName" contributing="userLastName"/>
       </primary-item-descriptor-link>

       -->

     </contributing-item-descriptor>

  </item-descriptor>
</composite-repository-template>
```

19 Secured Repositories

The Oracle ATG Web Commerce secured repository system works in conjunction with the Oracle ATG Web Commerce Security System to provide fine-grained access control to repository item descriptors, individual repository items, and individual properties through Access Control List (ACL) settings.

This chapter includes the following sections:

- Features and Architecture (page 299)
- Creating a Secured Repository (page 301)
- ACL Syntax (page 309)
- Secured Repository Definition File Tag Reference (page 311)
- DTD for Secured Repository Definition File (page 315)
- Secured Repository Example (page 305)

Features and Architecture

Secured repositories provide the following control features:

Feature	Description
Control access to repository item descriptors	Control who can create, add, remove, and query items defined by an item descriptor; similar to controlling access to a whole database table.
Control access to individual repository items	Control who can read, write, destroy, and query a repository item.; similar to controlling access to a single database row.
Control access to properties of all repository items in a repository item descriptor	Control who can read or write a property in any repository item defined by an item descriptor; similar to controlling access to a database table column. A default ACL can be assigned to all items in the item descriptor that lack an explicit ACL.

Feature	Description
Control access to properties of an individual repository item	Control who can read or write a particular property in a repository item; similar to controlling the field of a database table row. An ACL that is assigned to a property overrides the ACL that is specified for that property in the item descriptor definition.
Limit query results	Control who can receive repository items that are returned by a repository query.
Set ownership of a repository item	At creation time, the current user is assigned as the owner of the new repository item. The owner can query a repository item and modify its ACL; otherwise this is simply an association of an identity to an Item.
Automatically generate ACLs for new repository items	When a repository item is created, it is assigned an ACL that is constructed out of an ACL fragment and a template for the creator/owner (creator) and each group the owner belongs to.

These features are configured according to the needs of your application. Some features require additional storage in the underlying repository, or can have a significant impact on performance (see Performance Considerations (page 317) later in this chapter). Consequently, you should only enable those features that the application requires.

Access rights

Access to secured repositories is managed by building ACLs that associate certain access rights with certain identities—individual users, as well as groups, organizations, and roles that are associated with multiple users. The following table lists access rights that apply to the secured repository system.

Note: Not all access rights are available in all implementations or instances of a secured repository.

Action/targets	Access right
CREATE RepositoryItem Descriptor	Create a repository item with an item descriptor. **Note:** Adding a new item to the repository also requires WRITE access to the same `RepositoryItemDescriptor`.
DELETE RepositoryItem Descriptor	Remove items of this `RepositoryItemDescriptor` type. **Note:** Deleting an item also requires DESTROY access to that Item.
DESTROY RepositoryItem	Remove the repository item from the repository and destroy its contents. **Note:** Most secured repositories also require DELETE access to the item's `RepositoryItemDescriptor`.
LIST RepositoryItem	Query a repository item. LIST access is required in order for queries to return this repository item. An item's owner implicitly has LIST access.

Action/targets	Access right
READ RepositoryItemDescriptor RepositoryItem Property	Enable read access to items of this `RepositoryItemDescriptor` type; or to the specified repository item; or to the specified item property.
READ_ACL RepositoryItem	Inspect the ACL of a repository item. This access right is implicitly granted to the repository item's owner.
READ_OWNER RepositoryItem	Inspect the owner of a repository item.
WRITE RepositoryItemDescriptor RepositoryItem Property	Enable addition of items of this `RepositoryItemDescriptor` type; or updates to the contents of the specified repository item or the specified item property. **Note:** WRITE access to an item descriptor only enables addition of repository items; it does not allow updates to repository items.
WRITE_ACL RepositoryItem	Change the ACL of a repository item. This access right is implicitly granted to the repository item's owner.
WRITE_OWNER RepositoryItem	Change the owner of a repository item.

Note: Securing a repository does not provide complete security within an application: the unprotected repository that it overlays is still available within the Nucleus name space, so it remains available to developers. The Oracle ATG Web Commerce Control Center can be configured to hide unprotected repositories, and an application can choose not to use an unprotected repository, so as not to expose unprotected data to end users.

Creating a Secured Repository

To overlay an existing repository with a secured repository:

1. Modify the Underlying Repository (page 301) by editing the definitions of the item descriptors you wish to secure.
2. Configure the Secured Repository Adapter Component (page 302) component.
3. Register the Secured Repository Adapter Component (page 303).
4. Create the Secured Repository Definition File (page 304), an XML file that specifies access rights and owner information. Access rights are specified with the syntax described in the ACL Syntax (page 309) section.

Modify the Underlying Repository

In order to secure a repository item descriptor, create a property that stores the ACL for that item. In order to define an owner for an item type, also create a property that stores the owner's name. For example:

```
<item-descriptor name="cheese">
  <property name="country" data-type="string" />
  <property name="runniness" data-type="int" />
  <property name="ACL" data-type="string" />
  <property name="cheeseOwner" component-type="user" />
</item-descriptor>
```

The properties that you add to the underlying repository are identified in the secured repository definition file by these two tags:

```
<owner-property name="value"/>
<acl-property name="value"/>
```

For example, given the previous example, you update the secured repository's `item-descriptor` definition as follows:

```
<acl-property name="ACL" />
<owner-property name="cheeseOwner" />
```

ACL property length constraints

The length of an ACL is limited by the amount of space available in the ACL property that is defined in the unsecure (underlying) repository. An overlong ACL generates a repository exception when it is set. This problem can occur when you use the `create-group-acl-template` in the secured repository definition to define an ACL for the owner's group, and the owner belongs to many groups.

To avoid this problem, define the ACL property as an array of strings, so the ACL is concatenated from the stored substrings. For example:

```
<item-descriptor name="cheese">
  ...
  <table name="test_items_acls"
        type="multi"
        id-column-names="id"
        multi-column-name="index">
    <property name="ACL" column-names="acl" data-type="array"
              component-data-type="string">
      <attribute name="maxFragmentSize" value="254"/>
    </property>
  </table>
</item-descriptor>
```

The `maxFragmentSize` attribute sets the maximum length of a string in any array index. The default value is 254. Set `maxFragmentSize` to the size of the database string column. For many databases, 254 is the appropriate value for a VARCHAR of unspecified length.

Configure the Secured Repository Adapter Component

You configure a secured repository adapter component by setting the following properties:

- $class (page 303)
- name (page 303)

- repositoryName (page 303)
- repository (page 303)
- configurationFile (page 303)
- securityConfiguration (page 303)

$class

Java class, one of the following:

- Unversioned repository:
  `atg.adapter.secure.GenericSecuredMutableRepository`
- Unversioned content repository:
  `atg.adapter.secure.GenericSecuredMutablContentRepository`
- Versioned repository:
  `atg.adapter.secure.GenericSecuredMutableVersionRepository`
- Versioned content repository:
  `atg.adapter.secure.GenericSecuredMutableVersionContentRepository`

name

A description of the Secured Repository component that appears in the ACC.

repositoryName

The name of the Secured Repository component. For example:

```
SecuredTestRepository
```

repository

The name of the underlying repository that the secured repository adapter acts on. For example:

```
TestRepository
```

configurationFile

The repository definition file used by the secured repository adapter. See Create the Secured Repository Definition File (page 304). For example:

```
secured-test-repository.xml
```

securityConfiguration

The `atg.security.SecurityConfiguration` component to use. For more information about security policies and other security features, see the *Managing Access Control* chapter in the *Platform Programming Guide*. For example:

```
/atg/dynamo/security/SecuredRepositorySecurityConfiguration
```

Register the Secured Repository Adapter Component

After you configure a secured repository adapter, you register it with the `/atg/registry/ContentRepositories` component, by adding it to its `initialRepositories` property:

```
initialRepositories+=/SecuredTestRepository
```

This exposes the secured repository adapter to the ATG Control Center Repository Editor, and ensures its activation on application startup.

Create the Secured Repository Definition File

The secured repository adapter's `configurationFile` property specifies an XML file that defines the behavior of the secured repository. The default name of this file is `secured-test-repository.xml`. Its format is similar to that of the definition file for the underlying repository, using the same `item-descriptor` and `property` tags to delimit information about individual item descriptors and their related properties. The DTD for this file is described later in this chapter, in DTD for Secured Repository Definition File (page 315).

The following table describes the attributes that can be defined for each item descriptor:

Attribute	Description
`descriptor-acl`	The ACL that applies to the item descriptor. This can contain any access right that applies to the item descriptor. The value of this tag is an ACL string, as defined in the ACL Syntax (page 309) section.
`default-acl`	The `default-acl` element specifies the ACL that is applied to an item or property descriptor when it has no other ACL. This ACL can contain any access right that applies to the item descriptor or property. The value of this tag is an ACL string, as defined in the ACL Syntax (page 309) section.
`owner-property`	This defines the name of the string property in the underlying repository that is to be used to store the name of the owner of a repository item.
`acl-property`	This defines the name of the string property in the underlying repository that is used to store the ACL for an individual repository item.
`creation-base-acl`	An ACL fragment that is inserted into the default ACL for a newly created repository item. Typically this defines global access rights for administrators and limited access rights for the user base as a whole. This ACL fragment can contain any access right that applies to a repository item.
`creation-owner-acl-template`	An ACL template that is used to generate an ACL fragment that applies to the owner (creator) of a newly created repository item. This is a standard format ACL string with a dollar sign ($) used to indicate the owner identity. No other identities may be used in the template.
`creation-group-acl-template`	An ACL template that is used to generate an ACL fragment that applies to each group that the owner (creator) is a member of in a newly created repository item. This is a standard format ACL string with a dollar sign ($) used to indicate the group identity. No other identities may be used in the template. Because a user may have a great many groups that they are a member of, it is suggested that this feature be used sparingly. For example, the ACC `admin` user may have enough groups to create an ACL that is too large for the example repository. For a description of what constitutes membership in a group, see Group Membership (page 305).

You can use a subset of these options to define ACLs for properties as well as item descriptors:

```
descriptor-acl
default-acl
acl-property
creation-base-acl
creation-owner-acl-template
creation-group-acl-template
```

See also the Secured Repository Definition File Tag Reference (page 311).

Group Membership

An identity is considered to be a group that the owner (creator) is a member of if the owner's Persona lists it with its `getSubPersonae()` call. Exactly what is returned by this call varies according to the implementation of the User Authority.

The standard User Authority used here is implemented on top of the User Directory interface, and includes every Effective Principal of the user as a sub-Persona. For the Profile User Directory, this includes all Organizations, Roles, and Relative Roles of the user as well as all Organizations, Roles and Relative Roles of any Organization they are members of (explicitly or implicitly). For the Admin User Directory, this includes all Groups that the ACC account is a member of, but not the Privileges that the Group is assigned.

ACLs and Personae

When creating ACLs, the Personae that are used for user identities must be created by the same User Authority that is used by the secured repository. The User Authority must not be a proxy even if the Personae produced by a proxy test are equivalent to the Personae produced by the User Authority for which it is a proxy. This is because the identity name spaces used by a User Authority and its proxies may not be the same, and the ACL parser cannot support multiple identity namespaces.

Secured Repository Example

This example shows how to add security to a simple repository. This repository contains a single secured item type with two properties, one secure and one unsecure.

You create a secure repository in the following steps:

1. Modify the SQL for the Repository Data Store (page 305).
2. Modify the XML definition file (page 306) of the unsecure repository.
3. Define the Secured Repository Adapter's Definition File (page 307).
4. Configure a Secured Repository Adapter Component (page 308).
5. Register the Repositories (page 309).

Modify the SQL for the Repository Data Store

The original SQL looks like this:

```
 -- test-repository.ddl
create table test_items (
 -- the ID of this item
 id varchar,
 -- a secured property of this item
 secured_property varchar,
 -- an unsecured property
 unsecured_property varchar,
)
```

Modifications

Add three fields to the SQL to enable storage of security information for the repository item's owner and ACL, and the secured property's ACL:

The modified SQL looks like this (changes are in boldface):

```
 --  Modified test-repository.ddl
create table test_items (
 -- the ID of this item
 id varchar,
 -- a secured property of this item
 secured_property varchar,
 -- an unsecured property
 unsecured_property varchar,
 -- the owner of this item
 item_owner varchar,
 -- the ACL that applies to this item
 item_acl varchar,
 -- the ACL that applies to this item's secured value
 secured_property_acl varchar
)
```

Modify the XML definition file

The original repository definition file looks like this:

```
# test-repository.xml
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template
       PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
       "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">
<gsa-template>
 <header>
   <name>Test Repository</name>
 </header>
 <item-descriptor name="test_items" default="true">
   <table name="test_items" type="primary" id-column-names="id">
     <property name="secured_property" column-names="secured_property"
               data-type="string"/>
     <property name="unsecured_property" column-names="unsecured_property"
               data-type="string"/>
   </table>
```

```
 </item-descriptor>
</gsa-template>
```

Modifications

As with the SQL, you must add properties to the repository definition as follows (changes are in boldface):

```
<!--  Modified test-repository.xml -->
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE gsa-template
       PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
       "http://www.atg.com/dtds/gsa/gsa_1.0.dtd">
<gsa-template>
 <header>
   <name>Test Repository</name>
 </header>
 <item-descriptor name="test_items" default="true">
   <table name="test_items" type="primary" id-column-names="id">
     <property name="secured_property" column-names="secured_property"
               data-type="string"/>
     <property name="unsecured_property" column-names="unsecured_property"
               data-type="string"/>
     <property name="item_owner" column-names="item_owner" data-type="string"/>
     <property name="item_acl" column-names="item_acl" data-type="string"/>
     <property name="secured_property_acl" column-names="secured_property_acl"
               data-type="string"/>
   </table>
 </item-descriptor>
</gsa-template>
```

Define the Secured Repository Adapter's Definition File

Create the secured repository layer over this SQL repository. The secured repository's XML definition file looks like this:

```
<!-- secured-test-repository.xml -->
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE secured-repository-template
 PUBLIC "-//Art Technology Group, Inc.//DTD Dynamo Security//EN"
 "http://www.atg.com/dtds/security/secured_repository_template_1.1.dtd">
<secured-repository-template>
 <item-descriptor name="test_items">

   <!-- The ACL that applies to the item view/descriptor -->
   <descriptor-acl value="Admin$role$administrators-group:
     read,write,create,delete;Admin$role$everyone-group:read"/>

   <!-- The property where the ownership is stored -->
   <owner-property name="item_owner"/>

   <!-- The property where ACL is stored in -->
   <acl-property name="item_acl"/>

   <!-- An ACL fragment that is assigned to all new items -->
```

```
   <creation-base-acl value="Admin$role$administrators-group:
      read,write,list,destroy,read_owner,write_owner,read_acl,write_acl;
      Admin$role$everyone-group:read,list"/>

   <!-- Access rights assigned to the owner when an item is created -->
   <creation-owner-acl-template value="$:read,write,list,destroy"/>

   <!-- Access rights assigned to all owner groups when an item is created.
        WARNING: This feature can be dangerous. -->
   <creation-group-acl-template value="$:read,list"/>

   <property name="secured_property">
     <!-- The ACL that applies to this property across all repository items -->
     <descriptor-acl value="Admin$role$administrators-group:
        read,write;Admin$role$everyone-group:read"/>

     <!-- The name of the item property where this property's ACL is stored. -->
     <acl-property name="secured_property_acl"/>

     <!-- An ACL fragment assigned to this property when an item is created. -->
     <creation-base-acl value="Admin$role$administrators-group:read,write"/>

     <!-- Access rights assigned to the owner when an item is created -->
     <creation-owner-acl-template value="$:read,write"/>

     <!-- Access rights assigned to all owner groups when an item is created.
          WARNING: This feature can be dangerous. -->
     <creation-group-acl-template value="$:read,write"/>

   </property>
 </item-descriptor>
</secured-repository-template>
```

Configure a Secured Repository Adapter Component

Configure the secured repository adapter component as follows:

```
# SecuredTestRepository.properties
$class=atg.adapter.secure.GenericSecuredMutableRepository
$scope=global
name=Test repository for the secured repository implementation
repositoryName=SecuredTestRepository
# the repository that we're wrapping
repository=TestRepository
# The template file that configures the repository
configurationFile=secured-test-repository.xml
# The security configuration component used by the repository
securityConfiguration=/atg/dynamo/security/SecuredRepositorySecurityConfiguration
# Various Dynamo services we need
XMLToolsFactory=/atg/dynamo/service/xml/XMLToolsFactory
transactionManager=/atg/dynamo/transaction/TransactionManager
```

Note: The previous example uses the `creation-group-acl-template` feature for both repository items and the secured property. This setting should generally be removed if you are setting up a repository based on this code. For more information, see <creation-group-acl-template> (page 314).

Register the Repositories

In order to expose the two repositories to the ATG Control Center Repository Editor, and to activate them on application startup, you must add them to the `initialRepositories` property of the `/atg/registry/ContentRepositories` component:

```
initialRepositories+=/TestRepository,/SecuredTestRepository
```

ACL Syntax

ACL strings in Oracle ATG Web Commerce are made up of a series of Access Control Entries (ACEs) separated from each other by semicolons:

```
ACL ::= ACE [ ';' ACE ]+
```

Each ACE is made up of colon-delimited parts:

- Identity
- List of access rights

These can be surrounded by an ACE type specifier that determines whether the ACE grants or denies rights:

```
ACE ::= (
( IDENTITY ':' ACCESS_RIGHTS_LIST ) |
( ( "grant" | "deny" ) '{' IDENTITY ':' ACCESS_RIGHTS_LIST '}' )
)
```

The `"grant"` modifier is the default, and can be omitted. If a `"deny"` ACE exists where a `"grant"` ACE also applies, the standard security policy denies access.

An identity is the literal string used by the User Authority to look up the identity's Persona. The standard User Authority (`/atg/dynamo/security/UserAuthority` in Nucleus) encodes the identity as follows:

`UD_IDENTITY ::= `*`UD-name`* `'$'` *`principal-type`* `'$'` *`UD-principal-key '$' partition-type '$' partition-id`*

where:

- *`UD-name`* is the name of the User Directory as configured in the User Directory User Authority (usually `Admin` for the ACC account database, or `Profile` for the Profile Repository)
- *`principal-type`* is `user`, `org` or `role`
- *`UD-principal-key`* is the primary key for looking up the principal in the User Directory. The primary key varies among User Directory implementations. The primary key is a numeric ID for Profile User Directories, but is the account name—for example, `admin`, `administrators-group`—for the ACC account User Directory.
- *`partition-type`* is an optional element that specifies whether the principal key is unique to a site or a profile realm. Include one of the values: `site` or `profileRealm`. See information about sites and profile realms in the *Multisite Administration Guide*.
- *`partition-id`* is an optional identifier of the site or profile realm.

Oracle ATG Web Commerce comes configured with three other User Authorities:

- `/atg/dynamo/security/AdminUserAuthority` for looking up ACC accounts
- `/atg/userprofiling/ProfileUserAuthority` for looking up Profile accounts
- `/atg/dynamo/service/j2ee/J2EEUserAuthority` for looking up J2EE accounts and roles.

These user authorities look up Persona information based on the unencoded name of the identity and are typically used for performing authentication. They are, however, front-ends for the standard User Authority and produce Personae that are equivalent to those produced by the standard User Authority. (Note the caveat regarding the mixing of User Authorities in the Create the Secured Repository Definition File (page 304): ACLs and Personae (page 305) topic.)

The list of access rights is a comma-separated list of access right names:

access-right-list ::= *access-right* [',' *access-right*]+

Standard Access Rights

The standard access right names are:

```
create
delete
destroy
execute
list
privilege
read
read_acl
read_owner
rename
traverse
write
write_acl
write_owner
```

Only the access rights appropriate for the ACL context are allowed. Access right names are tokens and cannot be internationalized.

ACL Examples

The following examples are coded using the syntax used by the standard `/atg/dynamo/security/UserAuthority` component.

The following ACL grants everyone with an ACC account the ability to read:

```
Admin$role$everyone-group:read;
```

Note that you should always end ACL strings with a semi-colon, as shown, even when the string is the last one in a list. Do not start ACLs with a semi-colon. Following this convention is important because it ensures that ACLs are interpreted correctly after XML-combine operations.

The following ACL grants the ACC `admin` account the ability to read and write, but every other ACC user only the ability to read:

```
Admin$user$admin:list,read,write;
Admin$role$everyone-group:list,read;
```

The following ACL grants the ACC Administrators group the ability to read, write and delete, but denies the ability to write and delete to ACC user `Fnord` even if he is a member of the Administrators group:

```
Admin$role$administrators-group:
list,read,write,delete;deny{Admin$user$Fnord:write,delete};
```

Secured Repository Definition File Tag Reference

This section describes all XML tags that can be used in a secured repository definition file, as defined in the DTD for Secured Repository Definition File (page 315).

<secured-repository-template>

```
<!ELEMENT secured-repository-template (item-descriptor)*>
```

The `secured-repository-template` tag encloses the whole secured repository definition. The `secured-repository-template` tag encloses one `item-descriptor` tag for each item descriptor in the underlying repository for which you want to specify access rights.

Example

```
<secured-repository-template>
  <item-descriptor name="..." />
...
</secured-repository-template>
```

<item-descriptor> secured repository

```
<!ELEMENT item-descriptor (<descriptor-acl> (page 312) |
                           <owner-property> (page 313) |
                           <default-acl> (page 312) |
                           <creation-base-acl> (page 313) |
                           <creation-owner-acl-template> (page 314) |
                           <creation-group-acl-template> (page 314) | property)*>
```

You should include one `item-descriptor` tag for each item descriptor in the underlying repository for which you want to specify access rights. Unlike the `item-descriptor` tag in the SQL repository, the `item-descriptor` tag in the secured repository has just one attribute, `name`, which must be the same as the `name` attribute in the underlying repository's `item-descriptor` tag.

Example

```
<item-descriptor name="feature">
  <descriptor-acl value="..."/>
  <owner-property name="..."/>
  <acl-property name="..."/>
```

```
...
</item-descriptor>
```

<property> secured repository

```
<!ELEMENT property (<descriptor-acl> (page 312) |
                    <default-acl> (page 312) |
                    <creation-base-acl> (page 313) |
                    <creation-owner-acl-template> (page 314) |
                    <creation-group-acl-template> (page 314))*>
```

Parent:

To apply access rights at the property level, rather than to the whole item, you can use the `property` tag.

Example

```
<property name="yumminess">
  <descriptor-acl value="..."/>
  <acl-property name="yummy_acl"/>
  <creation-base-acl value="...
...
</property>
```

<default-acl>

```
<!ELEMENT default-acl (#PCDATA)>
```

Parent: `<item-descriptor>`, `<property>`

The `default-acl` element specifies the ACL that is applied to an item or property descriptor when it has no other ACL. This ACL can contain any access right that applies to the item descriptor or property. The `value` attribute of the tag is an ACL string, using the syntax described in the ACL Syntax (page 309) section.

Example

```
<default-acl value="Admin$role$everyone-group:list,read;"/>
```

<descriptor-acl>

```
<!ELEMENT descriptor-acl (#PCDATA)>
```

Parent: `<item-descriptor>`, `<property>`

The `descriptor-acl` element specifies the ACL that applies to the item or property specified by the enclosing `item-descriptor` tag or `property` tag. This ACL can contain any access right that applies to the item

descriptor or property. The `value` attribute of the tag is an ACL string, using the syntax described in the ACL Syntax (page 309) section.

Example

```
<descriptor-acl value="Admin$role$administrators-group:list,read,write;
    Admin$role$everyone-group:list,read;"/>
```

<owner-property>

```
<!ELEMENT owner-property (#PCDATA)>
```

Parent: `<item-descriptor>`

The `owner-property` tag has one attribute, `name`, which specifies the `name` attribute of the property that stores the owner of the item in the underlying repository.

Example

If the item descriptor in the underlying repository stores the name of the item's owner in a property named `item_owner`, the `owner-property` tag looks like this:

```
<owner-property name="item_owner"/>
```

<acl-property>

```
<!ELEMENT acl-property (#PCDATA)>
```

Parent: `<item-descriptor>`, `<property>`

The `acl-property` tag has one attribute, `name`, which specifies the `name` attribute of the property that stores the ACL of the item in the underlying repository.

Example

If the item descriptor in the underlying repository stores the item's ACL in a property named `item_acl`, the `acl-property` tag would look like this:

```
<acl-property name="item_acl"/>
```

<creation-base-acl>

```
<!ELEMENT creation-base-acl (#PCDATA)>
```

Parent: `<item-descriptor>`, `<property>`

The `creation-base-acl` tag defines an ACL fragment that is inserted into the default ACL for a newly created repository item or property. Typically this defines global access rights for administrators and limited access rights for the user base as a whole. This ACL fragment can contain any access right that applies to a repository item or property.

Example

The following example gives all access rights to the administrators group, but only `read` and `list` rights to everyone else:

```
<creation-base-acl value="Admin$role$administrators-group:
    read,write,list,destroy,read_owner,write_owner,read_acl,write_acl;
    Admin$role$everyone-group:read,list;"/>
```

<creation-owner-acl-template>

```
<!ELEMENT creation-owner-acl-template (#PCDATA)>
```

Parent: `<item-descriptor>`, `<property>`

The `creation-owner-acl-template` tag specifies an ACL template that is used to generate an ACL fragment that applies to the owner (creator) of a newly created repository item. This is a standard format ACL string with a dollar sign ($) used to indicate the owner identity. No other identities may be used in the template.

Example

The following example gives the owners of an item access rights to read, write, list, or destroy items they own:

```
<creation-owner-acl-template value="$:read,write,list,destroy;"/>
```

<creation-group-acl-template>

```
<!ELEMENT creation-group-acl-template (#PCDATA)>
```

Parent: `<item-descriptor>`, `<property>`

The `creation-group-acl-template` tag specifies an ACL template that is used to generate an ACL fragment that applies to each group that the owner is a member of in a newly created repository item. This is a standard format ACL string with a dollar sign ($) used to indicate the group identity. No other identities may be used in the template.

Because a user may be a member of a large number of groups, you should use this feature sparingly. It can result in ACL strings that are too long to be stored in your repository's ACL property. For example, the ACC `admin` user may have enough groups to create an ACL that is too large for the example repository. For a description of what constitutes membership in a group, see Group Membership (page 305).

Example

The following example gives `read` and `list` access rights to every member of every group of which the item's owner is a member:

```
<creation-group-acl-template value="$:read,list;"/>
```

DTD for Secured Repository Definition File

The document type definition (DTD) for a secured repository definition is available at:

`http://www.atg.com/dtds/security/secured_repository_template_1.1.dtd`

The secured repository definition DTD looks like this:

```
<?xml encoding="UTF-8"?>

<!-- ================================================================ -->
<!-- secured_repository_template.dtd - Definition spec for secured   -->
<!-- repositories                                                     -->
<!-- Version: $Change: 166603 $$DateTime: 2001/04/20 20:05:51 $$Author:
     bbarber $ -->
<!-- ================================================================ -->

<!-- ================================================================ -->
<!-- secured-repository-template - top level element                  -->
<!-- ================================================================ -->

<!ELEMENT secured-repository-template (item-descriptor)*>

<!-- ================================================================ -->
<!-- account specifications - define an account of a particular type -->
<!-- ================================================================ -->

<!ELEMENT item-descriptor (descriptor-acl |
                           owner-property |
                           default-acl |
                           creation-base-acl |
                           creation-owner-acl-template |
                           creation-group-acl-template | property)*>
<!ATTLIST item-descriptor
     name          CDATA     #REQUIRED
>

<!ELEMENT property (descriptor-acl |
                    default-acl |
                    creation-base-acl |
                    creation-owner-acl-template |
                    creation-group-acl-template)*>
<!ATTLIST property
     name          CDATA     #REQUIRED
>

<!-- ================================================================ -->
<!-- descriptor-acl - specifies the ACL that is applied to either an -->
<!--                  item or property descriptor                     -->
<!-- ================================================================ -->
```

```
<!ELEMENT descriptor-acl (#PCDATA)>

<!ATTLIST descriptor-acl
     value          CDATA     #REQUIRED
>

<!-- ============================================================ -->
<!-- default-acl - specifies the ACL that is applied to either an    -->
<!--               item or property descriptor when it has no other  -->
<!--               ACL                                               -->
<!-- ============================================================ -->

<!ELEMENT default-acl (#PCDATA)>

<!ATTLIST default-acl
     value          CDATA     #REQUIRED
>

<!-- ============================================================ -->
<!-- owner-property - specifies the name of the property in which    -->
<!--                  the name of the owner of the item is stored    -->
<!-- ============================================================ -->

<!ELEMENT owner-property (#PCDATA)>

<!ATTLIST owner-property
     name           CDATA     #REQUIRED
>

<!-- ============================================================ -->
<!-- acl-property - specifies the name of the property in which      -->
<!--                the ACL for the item or property is stored       -->
<!-- ============================================================ -->

<!ELEMENT acl-property (#PCDATA)>

<!ATTLIST acl-property
     name           CDATA     #REQUIRED
>

<!-- ============================================================ -->
<!-- creation-base-acl - specifies the base ACL fragment that will   -->
<!--                     be applied to all new items or properties   -->
<!--                     when they are created                       -->
<!-- ============================================================ -->

<!ELEMENT creation-base-acl (#PCDATA)>

<!ATTLIST creation-base-acl
     value          CDATA     #REQUIRED
>

<!-- ============================================================ -->
<!-- creation-owner-acl-template - specifies the ACL fragment        -->
<!--                               template that will be applied to  -->
<!--                               all new items or properties when  -->
<!--                               they are created, utilizing the   -->
<!--                               owner (creator) of the object as  -->
<!--                               the identity in all ACEs.         -->
<!-- ============================================================ -->
```

```
<!ELEMENT creation-owner-acl-template (#PCDATA)>

<!ATTLIST creation-owner-acl-template
     value          CDATA     #REQUIRED
>

<!-- ============================================================= -->
<!-- creation-group-acl-template - specifies the ACL fragment      -->
<!--                               template that will be applied to  -->
<!--                               all new items or properties when  -->
<!--                               they are created, utilizing each  -->
<!--                               of the groups that the owner      -->
<!--                               (creator) of the object is a      -->
<!--                               member of as the identities in    -->
<!--                               all ACEs.                         -->
<!-- ============================================================= -->

<!ELEMENT creation-group-acl-template (#PCDATA)>

<!ATTLIST creation-group-acl-template
     value          CDATA     #REQUIRED
>
```

Performance Considerations

While care is taken to maintain high performance, use of the secured repository does have some impact on the performance of the repository and, in some cases, the impact is considerable.

For access control defined at the item descriptor level (for example, `Repository.getItem()`, `MutableRepository.createItem()`, `MutableRepository.addItem()`, `MutableRepository.updateItem()`) the overhead of handling access checks amounts to the testing of the access control list for the item descriptor. This is normally minimal.

The exception to this rule is with the use of the `RepositoryView.executeQuery()` and `RepositoryView.executeCountQuery()` family of methods whenever ACLs are specified for individual repository items. In this case, the ACL of each repository item must be consulted to determine if it should be allowed in the result of the query, or counted as part of a count query. If the result set is large, the time required to parse and check all ACLs can be long. Furthermore, in the count query case, a full query must be done and its results counted. Thus, if your application uses count queries to limit expensive queries, the features afforded by a secured repository are very expensive.

Access control overhead at the repository item level is noticeable, but is incremental. When the repository item is loaded, its ACL is parsed before any access checking occurs. Results of ACL parsing are cached to improve performance where possible. If ACLs are not being stored for each individual repository item, no parsing needs to be done beyond what is done during the initialization of the secured repository.

Because the secured repository sits on top of an underlying repository, you can consider whether features that need best possible performance should be written to use the underlying repository rather than going through the secured repository at the cost of the security features.

Exceptions Thrown by the Secured Repository

Most methods implemented by the secured repository can throw any exception that is a sub-class of `atg.security.SecurityException`. Each method that can throw a `SecurityException` is marked appropriately in one of the following interfaces:

- `SecuredRepository`
- `SecuredMutableRepository`
- `SecuredRepositoryItemDescriptor`
- `SecuredRepositoryView`
- `SecuredRepositoryItem`

Methods that are inherited from the normal Repository interfaces and are marked as capable of throwing an `atg.repository.RepositoryException` instead throw an `atg.repository.RepositorySecurityException`. You can use the method `RepositorySecurityException.getSecurityException()` to determine the nested exception.

Two methods do not throw a `RepositoryException`:

- `RepositoryItem.getPropertyValue()`
- `MutableRepositoryItem.setPropertyValue()`

It is necessary, however, for them to throw a `SecurityException`, so they throw an `atg.security.RuntimeSecurityException`. You can use the method `RuntimeSecurityException.getSecurityException()`to determine the nested exception.

20 LDAP Repositories

The Oracle ATG Web Commerce LDAP Repository is an implementation of the Repository API that enables you to store and access profile data in an LDAP (Lightweight Directory Access Protocol) directory. The LDAP repository is similar in functionality to the SQL repository, as described earlier in this guide. While by default Oracle ATG Web Commerce Scenario Personalization is configured to use an SQL profile repository, you can change the configuration to use an LDAP repository instead. See the *Personalization Programming Guide* for information about configuring Oracle ATG Web Commerce to use an LDAP profile repository. LDAP directories are widely used to store personnel information and other kinds of data. LDAP repository lets you to tap into the profile data you already have in an LDAP directory, and to share user information across multiple applications.

Also, you can configure Oracle ATG Web Commerce's application security scheme to use an LDAP repository, rather than an SQL repository. See the *Managing Access Control* chapter in the *Platform Programming Guide* for more information.

Just like the SQL repository, the LDAP repository implements the Oracle ATG Web Commerce Repository API to allow you to store, access, modify, and query user profile information. As in the SQL repository, repository items are first created as transient items (RAM profiles); they become persistent after they are added to the database.

It is important to note, however, that the LDAP repository implementation is not specific to user profiles in any way. Because an LDAP directory can be used to store any kind of data—people, groups, mailing lists, documents, printers—you can use the LDAP repository to expose any of that data in Oracle ATG Web Commerce. This chapter focuses on using LDAP as a profile repository, because that is the most common application of LDAP. However, other uses are possible.

Note: If you are using Oracle Access Management to provide Single Sign On functionality, ATG Business Control Center user profiles must be stored in an LDAP repository for authentication. Refer to the *Using Oracle Access Manager for Single Sign On* section of the *Installation and Configuration Guide*.

This chapter includes the following sections:

- Overview: Setting Up an LDAP Repository (page 320): An overview of the steps you should take in designing and setting up an LDAP repository.
- LDAP Directory Primer (page 320): A brief introduction to LDAP concepts and terminology
- LDAP Repository Architecture (page 324): A description of the way item descriptors and repository items work in the LDAP repository.
- Repository Views in the LDAP Repository (page 331): How multiple Repository Views can support multiple item descriptors in the same repository.
- LDAP Repository Queries (page 333): A brief look at how queries work in the LDAP repository.
- Configuring LDAP Repository Components (page 334): How to configure the components that make up the LDAP repository

- LDAP Repository Definition Tag Reference (page 341): A detailed reference on the XML tags used to define an LDAP repository.
- Sample LDAP Repository Definition File (page 351): An example of an XML file that defines a simple LDAP repository.
- DTD for LDAP Repository Definition Files (page 352): The XML DTD for LDAP repository definitions.

Overview: Setting Up an LDAP Repository

Setting up an LDAP repository on Oracle ATG Web Commerce involves the following steps:

1. Create the LDAP schema on your LDAP directory server. The methods for creating and modifying the LDAP schemas differ from server to server. Consult the documentation for your LDAP directory server.

   If your LDAP directory already exists, and you want to perform ID matching queries on the LDAP repository, make sure that LDAP entries include a property that corresponds to the ID property of the repository items. See LDAP Repository Queries (page 333).

2. Create the XML LDAP repository definition file for the LDAP repository to use. This XML template defines the item descriptors and repository item properties contained in your LDAP repository. It also describes the relationship of your LDAP directory entries to the item descriptors and repository items of the LDAP repository. See the LDAP Repository Architecture (page 324) section, and especially the Item Descriptors and LDAP Object Classes (page 325) subsection therein, for information about designing your LDAP repository components. See also the LDAP Repository Definition Tag Reference (page 341) for full details of the XML tags used to create the LDAP repository definition file. Note that while the LDAP repository definition is similar in many ways to the SQL repository definition, the LDAP repository definition uses its own XML document type definition and syntax.

3. Configure the ATG LDAP repository components. See Configuring LDAP Repository Components (page 334).

4. Configure Oracle ATG Web Commerce so Oracle ATG Web Commerce's user profiling components point to the LDAP repository, rather than to an SQL profile repository. See the *Setting Up an LDAP Profile Repository* chapter in the *Personalization Programming Guide*.

LDAP Directory Primer

This section briefly outlines the structure and contents of an LDAP directory, introduces the relevant terminology, and tries to summarize what you must know about LDAP in order to understand the LDAP repository. It includes the following topics:

- Hierarchical Tree Structure (page 321)
- LDAP Data Representation (page 321)
- Hierarchical Entry Types (page 322)
- Directory Schema (page 322)
- LDAP and JNDI (page 324)

- LDAP Sources (page 324)

Hierarchical Tree Structure

An LDAP directory is organized into a tree of *directory entries*. Each directory entry is uniquely identified by its *distinguished name* (DN). The root point of the tree is represented by a special entry whose DN is called the *directory suffix*.

For example, a company directory for Quincy Funds might have a directory suffix of `o=quincyfunds.com`. Branching off the tree root, there may be entries for the various departments within the organization, such as `ou=Finance,o=quincyfunds.com`, `ou=Marketing,o=quincyfunds.com`, and so on. Under the organizational unit subtrees, there might be entries representing individual people, for example, `uid=nat,ou=Finance,o=quincyfunds.com`.

As you can see above, a DN consists of a series of comma-separated attribute name/value pairs. The hierarchy is represented right-to-left in a DN, with the right-most pair indicating the top of the hierarchy. For example, `ou=Finance,o=quincyfunds.com` is a child of `o=quincyfunds.com`. The left-most attribute name/value pair is called a *relative distinguished name* (RDN).

The examples in this section demonstrate some standard attribute names, such as:

- o for organization
- ou for organizational unit
- cn for common name

These standard attribute names are inherited from the X.500 standard, which preceded LDAP. Their use is not required, but is a good convention to follow when possible. Note that you can also define an organization like this:

`dc=quincyfunds,dc=com`

The directory tree may be highly branched, with the entire organizational hierarchy reflected in the tree structure, or it may be almost flat, depending on the needs of the organization. An example of an almost flat directory structure is one where all the people entries reside under the same organizational unit entry, such as `ou=person,o=quincyfunds.com`. There may also be organizational unit entries for storing other types of information, for example, `ou=Groups,o=quincyfunds.com`, `ou=Customers,o=quincyfunds.com`, `ou=Devices,o=quincyfunds.com`, and so on.

A directory may have more than one directory suffix. This typically comes into play with very large directories which are spread across multiple machines, extranets, and ISPs. For example, an ISP whose directory service needs to support multiple enterprises might have a separate directory suffix for each of the enterprises.

LDAP Data Representation

All data associated with an LDAP entry is contained in the entry's *attributes*. For example, the entry whose distinguished name is `uid=nat,ou=person,o=quincyfunds.com` might have the following attributes:

```
objectClass: top
objectClass: person
objectClass: organizationalPerson
uid: nat
cn: Natalya Cohen
cn: Nat Cohen
sn: Cohen
```

```
givenName: Natalya
givenName: Nat
```

Many attributes in an LDAP directory can be multi-valued (such as the `cn`, `givenName`, and `objectClass` attributes in the example above).

One interesting point to note is that the attribute values comprising the entry's distinguished name do not necessarily have to correspond to the attribute values contained in the entry itself. For example, the entry above does not contain an `ou` attribute or an `o` attribute, even though the DN implies an `ou` value of `person` and an `o` value of `quincyfunds.com`. Even more confusing situations are possible (although, of course, not recommended by the directory providers), where the attribute is specified both in the DN and in the entry itself, but the two values differ.

For these kinds of cases, the thing to keep in mind is that the actual directory data is contained in the entry's attributes. The distinguished name is simply a name that can be used to uniquely identify the entry; it does not represent the actual attribute values. For example, when the directory is searched, it is not searched against the DN, but against the attribute values stored in the entries themselves.

Note however that you do use the DN to access a directory entry directly, without searching. Also, you must specify the DN when you create a new entry.

Hierarchical Entry Types

Each LDAP entry is associated with a type, or *object class*, which determines the attributes an entry is required to contain and allowed to contain. For example, the `person` object class has required attributes `cn` and `sn`, and optional attributes `description`, `seealso`, `telephonenumber`, and `userpassword`.

The entry's object class is stored in the entry itself, as the value of its `objectClass` attribute. When you create an LDAP entry, you must specify values for all the attributes required by the entry's object class, and you may specify values for any optional attributes.

The object class type can be a subtype of another object class. For example, the object class `organizationalPerson` is a subtype of the object class `person`. It happens to not add any required attributes, but it adds a number of optional ones, like `title`, `postaladdress`, and so on. The base (abstract) object class that every type inherits from is called `top`. Its single required attribute is `objectClass`.

Notice that the example entry in the LDAP Data Representation (page 321) section above has three values for its `objectClass` attribute: `top`, `person`, and `organizationalPerson`. The first two values seem unnecessary, because they are both ancestors of the `organizationalPerson` type. However, they are required because not all directory servers support type inheritance.

The `objectClass` values in an entry do not all have to be each other's ancestors, however. For example, one can create an entry that is both an `organizationalPerson` and a `mailGroupMember`, which itself inherits from `top`. In other words, multiple inheritance of types is allowed.

Directory Schema

The total set of object classes and attributes known to the LDAP directory is referred to as the *directory schema*. Each LDAP directory server comes with a standard schema that includes predefined object classes and attributes. Also, you can extend this standard schema to represent information unique to your enterprise.

For each object class, the schema contains information such as the names of the superior object classes from which this object class is derived, and the names of the required and optional attributes of the object class. For each of the attributes, the schema contains information about its syntax and whether the attribute is single- or multi-valued.

All LDAP directory implementations are expected to support the minimal default schema specified in RFC 2256. The tables below summarize those object classes and attributes in the default schema used by Oracle ATG Web Commerce's LDAP repository. For the full list of object classes and attributes, please refer to the RFC.

Sample LDAP Schema

The examples in this chapter use the LDAP schema described in the following two tables. The `inetorgPerson` object class represents a person entry. This object class inherits from `organizationalPerson` but is not part of the default LDAP schema. It is specific to the Oracle (formerly Sun ONE) Directory Server. The `inetorgPerson` object class and its associated attributes are shown in *italic* in the tables that follow.

Sample LDAP Object Classes

Name	Parent	Required Attributes	Optional Attributes
top		objectClass	
person	top	sn, cn	userPassword, telephoneNumber
organizationalPerson	person		title, *employeeNumber,* telephoneNumber, facsimileTelephoneNumber
inetorgPerson	*organizationalPerson*		*mail, uid*

Sample LDAP Entry Attributes

Name	Description	Single Value?
objectClass	describes the kind of object an entry represents	false
cn	common name of an object, for example, person's full name	false
sn	surname, or family name, of a person	false
o	name of an organization	false
ou	name of an organizational unit or department	false
givenName	person's first name	false
userPassword	user password as an Octet String	false
title	person's title in organizational context	false
telephoneNumber	telephone number	false
facsimileTelephoneNumber	fax number	false

Name	Description	Single Value?
uid	*unique id*	*false*
mail	*e-mail address*	*false*
employeeNumber	*employee number*	*false*

Notice that all attributes listed above are multi-valued. There are actually very few single-valued attributes in LDAP, for maximum flexibility.

LDAP and JNDI

The LDAP repository accesses data in the underlying LDAP directory using JNDI (Java Naming and Directory Interface). Oracle's (formerly Sun's) LDAP directory service provider, which implements the JNDI Service Provider Interface, is plugged in to allow Oracle ATG Web Commerce to use JNDI to access LDAP data. JNDI was designed so all the major JNDI operations are easily mapped onto the corresponding LDAP operations. Thus, JNDI provides a natural way to access LDAP data from Java applications.

Note that all the standard attributes are represented in Java as `String` or `byte[]` data types. That is, Oracle's LDAP service provider for JNDI expects as input and returns as output all attribute values as one of these two types. When using the LDAP provider, you must explicitly configure all the attributes that should be treated as `byte[]`; the rest are treated as `String`.

LDAP Sources

For more information about LDAP, consult the following:

- RFC 2251: Lightweight Directory Access Protocol (v3), specification of the LDAP version 3 protocol.
- RFC 2252: Lightweight Directory Access Protocol (v3): Attribute Syntax Definitions, more of same, with more detail on attributes.
- RFC 2254: The String Representation of LDAP Search Filters, describes the LDAP search filters, which are used by JNDI to perform directory searches. The LDAP repository's `QueryBuilder` implementation constructs Query objects, which are essentially LDAP search filters.
- RFC 2256: A Summary of the X.500(96) User Schema for use with LDAPv3, default LDAP v3 schema that all LDAP directory servers are expected to support.
- Your LDAP server-specific documentation.

LDAP Repository Architecture

The Oracle ATG Web Commerce LDAP repository is an implementation of the Repository API that enables you to store and access profile data in an LDAP directory. Like other implementations of the Repository API, the LDAP repository uses Java components as representations of different elements of the data store. The LDAP directory corresponds to an LDAP repository. Each entry in the LDAP directory corresponds to a repository item, with the distinguished name of the LDAP entry serving as the repository ID of the corresponding repository

item. The object classes of the LDAP directory map generally to item descriptors and Repository Views in the repository. These corresponding elements of the LDAP directory and the LDAP repository are described further in the following sections:

- LDAP Repository Items and Repository IDs (page 325)
- Item Descriptors and LDAP Object Classes (page 325)
- Item Descriptor Hierarchies and Inheritance (page 327)
- Id and ObjectClasses Properties (page 328)
- Additional Property Tag Attributes (page 329)
- New Item Creation (page 330)

You define the relationship between the LDAP directory schema and an Oracle ATG Web Commerce LDAP repository in an XML file called an LDAP repository definition file. This XML template needs to be located in the application's configuration path. Unlike the SQL repository, the LDAP repository cannot use XML file combination to combine XML files in the configuration path that have the same name. Instead, you must use a single LDAP repository definition file in the configuration path.

This section introduces the principal features of the LDAP repository definition file. A complete reference to the repository definition file syntax is found in the LDAP Repository Definition Tag Reference (page 341) section of this chapter.

LDAP Repository Items and Repository IDs

The LDAP repository uses the distinguished name of an LDAP entry as the repository ID of the repository item that corresponds to the LDAP entry. This is a natural choice for an ID, because each LDAP entry has a DN, and all DNs are unique. Also, the entry's DN carries with it information about its location in the directory tree. This makes it very easy to retrieve items. No searching needs to be done; you simply access the entry directly with its DN.

The main question with using DNs for item IDs is what happens when a new item is created and added to the repository. If the ID is supplied for the item (for example, the DN `uid=nat,ou=Marketing,o=quincyfunds.com`), simply create the new entry with the specified DN in its parent context (in the example, `ou=Marketing,o=quincyfunds.com`). If the ID is not supplied, generate the DN before creating the directory entry.

The approach taken by the LDAP repository is to give the newly created repository item a temporary unique ID for the duration of the item's existence as a RAM profile. When the time comes to add the item to the repository, generate a DN for the new LDAP entry, and assign this DN as the value of the persistent item's ID. The DNs are generated with a pattern that you can configure. For example, one such pattern might be `uid=<login>,ou=Marketing,o=quincyfunds.com`, where `<login>` is the value of the item's `login` attribute. If an item is created with the `login` value of `nat`, its DN is `uid=nat,ou=Marketing,o=quincyfunds.com`. See the New Item Creation (page 330) section of this chapter for details on how to configure the way a new item's DN is set.

Item Descriptors and LDAP Object Classes

The repository items in an LDAP repository are defined by one or more item descriptors. Each item descriptor defines the properties that a repository item can have. There is a natural mapping between a repository item descriptor and an object class of an LDAP directory. For example, a repository might include a `user` item descriptor that describes people, with properties such as `login`, `password`, `firstName`, `lastName`, `phone`, and so on. In the LDAP directory, this item descriptor corresponds to an object class such as

inetorgPerson. The object class named inetorgPerson has attributes uid, userpassword, givenName, sn, and telephonenumber, corresponding to the properties of the item descriptor. In other words, the user item descriptor is analogous to the inetorgPerson object class schema.

Mapping an LDAP Schema onto an Item Descriptor

In the most straightforward mapping between an Oracle ATG Web Commerce LDAP repository and an LDAP directory, the repository's item descriptors have the same required and optional properties as the corresponding object classes of the LDAP directory. However, it is often desirable for the item descriptor to present a slightly different view of the LDAP directory schema. For example, the LDAP userpassword attribute is not required for the inetorgPerson object class. You might want to make the corresponding Profile property required, so when new profiles are created, the user password must be specified. Also, the inetorgPerson object class schema contains some attributes that might not be important to your Web application, such as seealso or x500uniqueidentifier. Unnecessary attributes should not be exposed as properties in the repository item descriptor.

Similarly, although each attribute in the LDAP directory already has a schema associated with it, it is often desirable for the repository's item descriptors to present a somewhat different view of the attribute schema. For example, the password attribute in the LDAP schema has the name userpassword, and a Binary syntax (in other words, it is represented in Java as byte[]). In the Oracle ATG Web Commerce profile repository, the name of the Profile property should be password, and its type should be String. An LDAP attribute such as age is represented in Java as a String. The Profile's age property type should probably be an Integer. Also, you probably want to provide default values for some of the properties.

The LDAP repository lets you specify an item descriptor with all the capabilities previously mentioned. To demonstrate, the following is a portion of the sample XML template that describes the user item descriptor. Pieces of the item descriptor definition are omitted for clarity; these are discussed later on. You can see the complete Sample LDAP Repository Definition File (page 351) later in this chapter. All tags you can use in the XML file that defines the LDAP repository are described in the LDAP Repository Definition Tag Reference (page 341) in this chapter.

```
<item-descriptor name="user">

  <!-- special properties -->
  ...

  <!-- object classes -->
  <object-class>top</object-class>
  <object-class>person</object-class>
  <object-class>organizationalPerson</object-class>
  <object-class>inetorgPerson</object-class>

  <!-- properties -->
  <property name="login" ldap-name="uid" data-type="string" required="true"/>
  <property name="password" ldap-name="userpassword" data-type="string"
    required="true"/>
  <property name="lastName" ldap-name="sn" data-type="string" required="true"/>
  <property name="firstName" ldap-name="givenName" data-type="string"/>
  <property name="names" ldap-name="cn" data-type="string" multi="true"
    required="true"/>
  <property name="email" ldap-name="mail" data-type="string"/>
  <property name="phone" ldap-name="telephonenumber" data-type="string"/>
  <property name="fax" ldap-name="facsimiletelephonenumber" data-type="string"
    default="(617) 555-1211"/>
  <property name="department" ldap-name="ou" data-type="string"/>
  <property name="title" data-type="string"/>
  <property name="employeeNumber" data-type="long"/>
```

```
  <!-- new item creation -->
  ...

</item-descriptor>
```

The `object-class` tags specify all the object class values corresponding to the given item descriptor. If the object class has ancestor object classes, they must all be specified, as demonstrated above. The object class information is required so when a new item is created for the given item descriptor and added to the repository, the corresponding LDAP entry is created with the given object class values. Thus, for example, if an item is created in the context of the `user` item descriptor, the new LDAP directory entry has `objectclass` attribute values of `top`, `person`, `organizationalPerson`, and `inetorgPerson`.

The LDAP repository definition uses <`property`> tags to map Profile properties to LDAP attributes. Each such <`property`>tag describes a property descriptor of its item descriptor. The <`property`>tags in the example above demonstrate that:

- Repository item property names can be different from LDAP attribute names. For example, the `lastName` property in the item descriptor maps to the `sn` attribute in the LDAP directory schema. If the `ldap-name` tag attribute is not specified, the repository item property name and the LDAP attribute name are the same.
- Repository item property types can be different from JNDI service provider types. For example, `userpassword` is exposed as a binary type by Oracle's LDAP service provider, but is a String property in the repository; `employeeNumber` is a String in Oracle's LDAP service provider, but a Long in the repository.
- Repository item properties can have default values. For example, the `fax` property has a default value of `(617) 555-1211`.

Also, the `user` item descriptor exposes only those attributes that are meaningful, and promotes some of the optional attributes into required ones. For example, the `password` attribute is optional in LDAP, but required in the Profile repository item.

Although attributes such as `givenName` and `sn` are multi-valued in the LDAP directory, they are exposed as single-valued properties in the repository. When getting the values for these properties, the LDAP repository ignores all but one of the returned values. It is not specified which of the values are returned. On the other hand, the LDAP repository item's `names` property is multi-valued, and corresponds to the LDAP directory's multi-valued `cn` attribute; in this case, the attribute value is returned as a String array.

For all of this to work, the repository item descriptor must not violate the LDAP directory schema. For example, because `cn` is a required attribute for the `inetorgPerson` class, one of the properties specified in the item descriptor must map to the `cn` attribute, and it must be required. As another example, the item descriptor cannot contain a property that does not correspond to an LDAP attribute. That is, the `ldap-name` tag attribute value must be a legal LDAP attribute name. The LDAP repository does no checking to ensure that the item descriptor conforms to the LDAP schema. If the schema is violated, a runtime exception (an object schema violation) is thrown by JNDI.

Item Descriptor Hierarchies and Inheritance

An LDAP repository may have any number of item descriptors. Because the LDAP directory might contain any kind of data, the item descriptors may represent different kinds of items—people, computers, and mailing lists. Each item descriptor simply maps to a particular set of object classes specified in the LDAP schema.

The LDAP model also nicely supports hierarchies of item descriptors that map to object class subtypes. For example, suppose the `inetorgPerson` object class has several subclasses, such as `engineeringPerson` and `salesPerson`. The `engineeringPerson` class contains all the same attributes as the `inetorgPerson` class, and adds a few, such as `engineerType` and `currentProject`. In the LDAP repository, you can define an

engineer item descriptor that inherits from the user item descriptor but supports these additional attributes. The following example shows how a portion of an LDAP repository definition might describe such an engineer item descriptor:

```
<item-descriptor name="engineer" parent="user">

  <!-- object classes (added to parent classes) -->
  <object-class>engineeringPerson</object-class>

  <!-- properties (added to parent properties) -->
  <property name="engineerType" data-type="enumerated" default="products"
    description="Type of engineer: products or services">
    <option>products</option>
    <option>services</option>
  </property>
  <property name="currentProject" data-type="string"
    description="Project or product the engineer is currently working on"/>

  <!-- child properties (override parent properties) -->
  <child-property name="department" default="Engineering"/>

  <!-- item creation (overrides parent behavior) -->
  ...

</item-descriptor>
```

The optional parent property of an <item-descriptor> specifies that the item descriptor inherits all parent's object classes and properties. Any additional object-class and property values are added to the list of the parent's object classes and properties.

You can also specify <child-property> tags to override any parent properties that have the same name. The only aspect of the parent property definition that can be overridden is the property's default value. The property's data-type and other attributes must stay the same. The example above demonstrates how the <child-property> tag can be used to assign the default value of Engineering to the parent's department property; the salespeople item descriptor might assign the default value of Sales to the same property.

Id and ObjectClasses Properties

In addition to the properties you specify, the LDAP repository creates two special properties for every item descriptor: the id attribute and the objectClasses attribute. Here is the relevant XML from the user item descriptor definition that was examined earlier:

```
<item-descriptor name="user">

  <!-- special properties -->
  <id-property name="id" in-ldap="true" ldap-name="dpsid"/>
  <object-classes-property name="objectClasses" ldap-name="objectclass"/>

  <!-- object classes -->
  <object-class>top</object-class>
  <object-class>person</object-class>
  <object-class>organizationalPerson</object-class>
  <object-class>inetorgPerson</object-class>
  <object-class>dpsUser</object-class>
```

```
  <!-- properties -->
  ...
  <!-- new item creation -->
  ...

</item-descriptor>
```

The purpose of the <id-property> tag is to expose the repository ID of a repository item as an attribute (of type String). Thus, assuming the definition above, an item with repository ID uid=nat,ou=Marketing,o=quincyfunds.com has an LDAP attribute named dpsid with the same value. The attribute value does not need to be set by the user; it is set automatically by Oracle ATG Web Commerce. Note that the ID property is populated from the DN; you should not try to create the DN from the ID property.

The rest of the id-property definition above specifies whether the id property of the repository item maps to an actual LDAP attribute, and if so, the LDAP attribute's name. If the value of in-ldap is false (the default), the id attribute exists only as a property of the repository item, and does not exist as an attribute in the LDAP entry. In that case, when the item's attribute values are written out to the LDAP directory, the ID attribute value is ignored, because there is no equivalent for it in the directory entry. If the value of in-ldap is true, as above, the ldap-name tag attribute specifies the name of the LDAP attribute to which the id should be written. As usual, if ldap-name is not specified, it is assumed to be the same as name. Thus, with the example item descriptor, when an item with ID uid=nat,ou=Marketing,o=quincyfunds.com is created and added to the repository, the resulting LDAP entry has an attribute named dpsid with value uid=nat,ou=Marketing,o=quincyfunds.com.

Saving the ID attribute value in the LDAP entry makes it easier to perform ID matching repository queries, as discussed in the LDAP Repository Queries (page 333) section in this chapter.

The <object-classes-property> tag is similar to <id-property>: it exposes the item's object class values as an attribute. The attribute's type is String[], which allows for a multi-valued attribute. For example, an item with a user item descriptor has an objectClasses attribute, whose value is an array with elements top, person, organizationalPerson, inetorgPerson, and dpsUser. The dpsUser object class supports the dpsid attribute, which allows incorporation of the repository ID as an attribute in the LDAP entry.

The <id-property> and <object-classes-property> tags are both required in a definition of a base item descriptor (that is, an item descriptor that does not have a parent); however, they are not allowed in child descriptor definition. The child item descriptors inherit the id and objectClasses properties from their parent.

Additional Property Tag Attributes

Each item descriptor includes <property> tags that define the properties of its repository items, how they correspond to the attributes of the corresponding LDAP entry, and how they are displayed in the ATG Control Center interface. Just as in the case of the SQL repository, the <property> tag has optional XML attributes such as required, readable, and hidden.

Here is an example of a property definition that contains all the optional tag attributes:

```
<property name="department" ldap-name="ou"
  data-type="string"
  multi="false"
  display-name="Department"
  description="Department within the organization"
  default="unknown"
  required="false"
  readable="true"
  writable="false"
```

```
  queryable="true"
  hidden="false"
  expert="false"/>
```

See the LDAP Repository Definition Tag Reference (page 341) in this chapter for full details.

For properties whose `data-type` attribute is set to `enumerated`, use `<option>` tags to specify the property's value choices, as in the `engineerType` attribute of the `engineer` item descriptor:

```
<property name="engineerType" data-type="enumerated" default="products"
  description="Type of engineer: products or services">
  <option>products</option>
  <option>services</option>
</property>
```

This approach is again inherited from the SQL repository definition file.

Just like the SQL repository, an LDAP repository's `<property>` tags can have zero or more `<attribute>` child tags. These child tags allow you to associate arbitrary name/string value pairs with any attribute. The name/value pairs are added to the attribute's property descriptor via `java.beans.FeatureDescriptor.setValue`, and can later be used by the application. Here is an example:

```
<property name="employeeNumber" data-type="string">
  <attribute name="unique" value="true"/>
</property>
```

You might use a descriptor like `unique` to specify that a property value can be assigned to only one repository item within the item type. This LDAP repository feature is similar to the feature described in User-Defined Property Types (page 73).

You can also specify a property editor class to use with a property with the `editor-class` attribute. For example, the following tag associates a special property editor with the password property:

```
<property name="password" ldap-name="userpassword"
    data-type="string" required="true"
    editor-class="atg.beans.PasswordPropertyEditor"/>
```

New Item Creation

Finally, an item descriptor definition includes a `<new-items>` tag. This tag describes the item descriptor's new item creation behavior. It specifies whether a new item of that item type can be created, and if so, describes how to create the DN (which is also the repository ID) for that item. This example completes the sample `user` and `engineer` item descriptor definitions:

```
<item-descriptor name="user">

  <!-- special properties -->
  ...
  <!-- object classes -->
  ...
  <!-- properties -->
  ...
```

```
  <!-- new item creation -->
  <new-items allowed="false">

</item-descriptor>

<item-descriptor name="engineer" parent="user">

  <!-- object classes  (added to parent classes) -->
  ...
  <!-- properties (added to parent properties) -->
  ...
  <!-- child properties (override parent properties) -->
  ...

  <!-- new item creation (overrides parent behavior) -->
  <new-items parent-dn="ou=Engineering,o=quincyfunds.com" rdn-property="login">

</item-descriptor>
```

The `<new-items>` tag in the `user` descriptor indicates that this descriptor does not allow new items to be created. The `user` descriptor basically acts as an abstract class — it provides a base set of object classes and properties for children descriptors to build on, but it does not allow items with those object classes and properties to be instantiated.

The `engineer` descriptor, on the other hand, does allow new items to be created. The `new-items` tag specifies where the newly created items should be placed in the LDAP directory. The new item's DN is constructed by appending the value of the `parent-dn` attribute to the RDN. The RDN is created from the value of the LDAP attribute that corresponds to the repository item property specified by the `rdn-property` XML attribute. For example, if a new item is created whose `login` property is `nat`, the corresponding RDN is `uid=nat` (because the Profile's `login` property maps to the `uid` attribute in the LDAP directory), and the DN is `uid=nat,ou=Engineering,o=quincyfunds.com`.

If a child descriptor definition does not contain a `<new-items>` tag, it inherits the parent's item creation behavior.

Repository Views in the LDAP Repository

In addition to supporting multiple item descriptors, the LDAP repository supports multiple Repository Views. For example, the `user` view might encompass all the people entries in the LDAP directory; the `engineer` and `salespeople` sub-views might contain only those people who are engineers and sales people, respectively. A `Devices` Repository View might span a completely separate space of device entries; and so on.

Repository View Definition

As demonstrated by the above example, there is typically a one-to-one correspondence between Repository Views and item descriptors. The `user` view is associated with the `user` item descriptor; the `engineer` view with the `engineer` item descriptor; and so on. In a sense, the item descriptor (in particular, its object classes) determines which items are contained by the view.

A Repository View's contents can also be restricted to a particular location or set of locations within the directory tree. For example, one might want to specify that the `engineer` view contains only entries in the

ou=Engineering,o=quincyfunds.com branch of the directory tree. Even if other items that satisfy the engineer item descriptor are encountered somewhere in the LDAP directory (perhaps for testing purposes), they are not considered to be part of the engineer view. The tree branches that comprise a Repository View are known as *search roots*, as they determine which parts of the directory tree are searched when a repository query is constructed on the view.

To summarize, the contents of each Repository View are determined by two factors: the object classes of its item descriptor, and its search roots. When a query is performed on the view, only those items that reside in one of the specified search roots and satisfy the view's item descriptor are returned. At least one search root must always be specified, but it may well point to the directory suffix (i.e., the search root may span the entire directory tree).

LDAP Repository View Example

The following example shows how the user and engineer Repository Views are defined in an LDAP profile repository definition. The one-to-one correspondence between Repository Views and item descriptors in the XML template is enforced by making the item-descriptor tag a sub-tag of view. The view tag also contains the search-root tags, if any.

```
<view name="user" default="true">

  <!-- item descriptor -->
  <item-descriptor name="user">
    ...
  </item-descriptor>

  <!-- search roots -->
  <search-root dn="o=quincyfunds.com"/>

</view>

<view name="engineer">

  <!-- item descriptor -->
  <item-descriptor name="engineer" parent="user">
    ...
  </item-descriptor>

  <!-- search roots -->
  <search-root dn="ou=Engineering,o=quincyfunds.com" recursive="false"
    check-classes="true"/>

</view>
```

In this example, the user view spans all of o=quincyfunds.com, including ou=Engineering,o=quincyfunds.com, ou=Sales,o=quincyfunds.com, and so on, whereas the engineer view is restricted to ou=Engineering,o=quincyfunds.com.

Note the default attribute in the user view specification, which designates user as the default view name.

Search Root Attributes

There are a couple of optional attributes specified in the <search-root> tag of the engineer view above. The recursive attribute specifies whether the tree branch should be searched recursively; the default is true. You can set this to false if you want to include only the root's immediate children, or if you know for sure that lower levels of the branch do not contain any relevant entries. This might be used for optimization purposes).

Similarly, in some cases you might be able to set the `check-classes` attribute to `false` to optimize search performance. In the default case, with `check-classes` set to `true`, when a repository query is constructed, it is automatically augmented with the object class constraints, so items that do not satisfy the item descriptor are not returned by the search. For example, suppose you had a repository query (using the LDAP search filter syntax), such as:

```
(currentProject=Quincy)
```

If this query is applied to the `ou=Engineering,o=quincyfunds.com` search root of the `engineer` Repository View, the query becomes:

```
(&(currentProject=Quincy)
  (objectclass=top)
  (objectclass=person)
  (objectclass=organizationalPerson)
  (objectclass=inetorgPerson)
  (objectclass=dpsUser)
  (objectclass=engineeringPerson))
```

If the value of `check-classes` is `false` for the search root, however, the query is left as is, and no object class checking is performed. Obviously, this optimization should only be turned on if you are absolutely sure that the search root contains only entries that satisfy the item descriptor.

LDAP Repository Queries

The LDAP repository supports most of the standard set of repository queries. See the Unsupported Queries in the LDAP Repository (page 334) topic of this section for a list of exceptions. You can use targeting rules and services (described in the *Creating Rules for Targeting Content* and *Setting Up Targeting Services* chapters of the *Personalization Programming Guide*) to query the LDAP repository. The LDAP query builder builds up an LDAP search filter string (as described in RFC 2254), which is used by the view to execute a series of searches (one for each search root) on the LDAP directory.

ID Matching Queries

The `idMatching` query is a special case. The LDAP search filter can only search for entries based on their attribute values. However, the LDAP repository uses the entry's DN, rather than any attribute value, as its ID. Thus, ID matching queries cannot be constructed with search filters, unless the LDAP entry's DN is also an LDAP attribute.

To implement ID matching queries, add an ID attribute to the LDAP entries, as described earlier in Id and ObjectClasses Properties (page 328). In this example, all `user` LDAP entries have an attribute called `dpsid`, which is mapped to the repository item's `id` attribute. The value of `dpsid` is automatically set to the DN when the item is first added to the repository. Because the ID can now be accessed as an attribute of an LDAP entry, full support for the ID matching query is provided in this case. Note, however, that directory entries that were not created by the repository must be manually modified to include a `dpsid` attribute, or they are not returned by the queries on the view.

If no ID attribute exists in the LDAP entries, the ID matching query is only supported as the top level query. That is, you can have a targeting rule that matches only items with specified IDs, but you cannot have a rule that

matches items with specified IDs and satisfies some other criteria. The top level query is implemented by simply calling `Repository.getItems` with the specified IDs. No checking is done to verify that the resulting items are actually contained by the view. Oracle ATG Web Commerce does not check that they have the correct object classes, and are located inside one of the search roots.

Unsupported Queries in the LDAP Repository

The LDAP repository does not support queries of the following types:

`includesAll`
`elementAt`
`indexOf`
`count`
`includesItem`
`textSearch`
`property` (when referring to sub-property (for example, `target="address.zip"`)
`patternMatch` (with "ignore case" flag; that is, `containsIgnoreCase`, `startsWithIgnoreCase`, `endsWithIgnoreCase`)

Configuring LDAP Repository Components

When you set up the LDAP repository, you must configure the `InitialContextEnvironment` (/atg/adapter/ldap/InitialContextEnvironment (page 337)) component to point to your LDAP server. You probably should also configure a number of other components that control the LDAP repository's settings, performance, and caching behavior. The LDAP repository includes the following components:

LDAP Repository Component	Description
/atg/adapter/ldap/LDAPRepository (page 335)	The repository of LDAP profiles.
/atg/adapter/ldap/InitialContextPool (page 336)	A resource pool (`JNDIInitialContextPool`) used to pool connections to the LDAP server.
/atg/adapter/ldap/InitialContextEnvironment (page 337)	Specifies the JNDI environment properties used to create a JNDI `InitialDirContext`.
/atg/adapter/ldap/LDAPItemCache (page 339)	An LRU cache that maps repository item IDs to persistent repository items.
/atg/adapter/ldap/LDAPItemCacheAdapter (page 339)	A component used by the `LDAPItemCache` to retrieve persistent repository items from the directory.
/atg/adapter/ldap/LDAPQueryCache (page 339)	An LRU cache that maps repository search queries to the repository item IDs of the query results.
/atg/adapter/ldap/LDAPQueryCacheAdapter (page 340)	A component used by the `LDAPQueryCache` to perform repository queries.

These LDAP repository components can be configured with the properties described below.

/atg/adapter/ldap/LDAPRepository

This component is the repository of LDAP profiles.

Property	Description
`$class`	class name Default: `atg.adapter.ldap.LDAPRepository`
`cacheItemProperties`	Should repository items cache their properties? Default: `true`
`cacheItems`	Should the repository cache directory items? Default: `true`
`cacheQueries`	Should Repository Views cache query results? Default: `false`
`definitionFile`	The location of the XML template in the application's configuration path. Note that the LDAP repository uses XML file combination to combine XML files in the application configuration path that have the same name. See the *Nucleus: Organizing JavaBean Components* chapter of the *Platform Programming Guide*. Default: `/atg/adapter/ldap/ldapUserProfile.xml`
`idGenerator`	The Nucleus address of the component that creates repository IDs for new repository items. Default: `/atg/dynamo/service/IdGenerator`
`initialContextPool`	The Nucleus address of the `JNDIInitialContextPool` used to obtain `InitialDirContext` objects. Default: `/atg/adapter/ldap/InitialContextPool`
`itemCache`	The Nucleus address of the repository item cache component. Default: `/atg/adapter/ldap/LDAPItemCache`
`prefetchItemProperties`	Should repository items prefetch their properties? If `true`, the first time any item property is accessed, all item property values are retrieved and cached. This value is used only if `cacheItemProperties` is set to `true`. Default: `true`

Property	Description
queryCache	The Nucleus address of the Query cache component. Default: /atg/adapter/ldap/LDAPQueryCache
repositoryName	Name of repository. Default: LDAP
shutdownDelay	How long (in seconds) to delay before shutting down. This value is used only if shutdownDynamoOnFatal is set to true. Default: 30
shutdownDynamoOnFatal	Should your application be shut down on fatal repository errors? Default: True
transactionManager	The Nucleus address of the Transaction Manager component. Default: /atg/dynamo/transaction/TransactionManager
XMLToolsFactory	The Nucleus address of the XMLToolsFactory component. Default: /atg/dynamo/service/xml/XMLToolsFactory

/atg/adapter/ldap/InitialContextPool

This component is a JNDIInitialContextPool used to pool connections to the LDAP server. This component's class extends atg.service.resourcepool.ResourcePool. See the *Core Dynamo Services* chapter of the *Platform Programming Guide* and the JavaDoc for the ResourcePool class in the *ATG Platform API Reference* for more information about the many properties available for configuring a connection pool. Getting connections from a resource pool yields better performance than creating a new connection for each request that needs to access the LDAP server. The following properties are particular to the JNDIInitialContextPool:

Property	Description
$class	class name Default: atg.service.resourcepool.JNDIInitialContextPool
JNDIEnvironment	The Nucleus address of the JNDI environment component to use when creating initial context objects Default: InitialContextEnvironment
createDirContexts	Should InitialDirContext objects be created rather than InitialContext objects? Default: true

Property	Description
createMonitoredContexts	Should the resource pool InitialContext (or InitialDirContext) objects be wrapped in MonitoredContext (or MonitoredDirContext) objects? If monitored contexts are being created, any JNDI service provider errors which occur as a result of operations performed on the contexts are reported, and the associated resource pool objects are invalidated. Default: True

/atg/adapter/ldap/InitialContextEnvironment

This component specifies the JNDI environment properties used to create a JNDI InitialDirContext. You must configure this component to point to your LDAP directory server. Typically, you set the following properties (other than the class definition):

Property	Description
$class	class name Default: atg.adapter.ldap.LDAPJNDIEnvironment
providerURL	URL of the LDAP server Default: ldap://localhost:389
securityAuthentication	Authentication mechanism for the provider to use. Some valid values are: Simple (default) Use weak authentication (cleartext password) none Use no authentication (anonymous). CRAM-MD5 Use the CRAM-MD5 (RFC-2195) SASL mechanism. See securityAuthentication Property (page 338) below for more information.
securityPrincipal	The identity of the principal to be authenticated, in the form of a distinguished name. Default: cn=ldapadmin
securityCredentials	The credentials of the principal to be authenticated Default: ldapadmin

Property	Description
otherProperties	Any additional environment properties you might need to set. The value of the otherProperties property is one or more comma-separated property/value pairs. For example, you can set: otherProperties= com.sun.jndi.ldap.someProperty=someValue Default: null

securityAuthentication Property

The securityAuthentication property must be set to match an appropriate type of security authentication for your LDAP server. For example, you can use the CRAM-MDS setting only if you have configured your LDAP directory server appropriately. Note also that if you set this property to none, the LDAP server treats the LDAP repository as an anonymous client. Depending on how your LDAP server is configured, you may therefore be unable to create, modify, or delete LDAP directory entries through the LDAP repository.

Other Environment Properties

Also, the InitialContextEnvironment component has the following properties, which correspond to environment properties of a JNDI context (as documented in the javax.naming.Context interface):

```
initialContextFactory
objectFactories
controlFactories
stateFactories
URLPkgPrefixes
DNSURL
authoritative
batchSize
referral
securityProtocol
language
```

See the JavaDoc for javax.naming.Context for more information about these properties.

Furthermore, the InitialContextEnvironment component has the following properties that apply to LDAP service providers in general or are specific to Oracle's (formerly Sun's) JNDI LDAP service provider:

```
LDAPVersion
binaryAttributes
connectControls
deleteRDN
derefAliases
typesOnly
refSeparator
socketFactory
referralLimit
BERTrace
schemaBugs
```

See the *JNDI Implementor Guidelines for LDAP Service Providers*, section 3, Environment Properties, at http://java.sun.com/products/jndi/jndi-ldap-gl.html#PROP for more information.

/atg/adapter/ldap/LDAPItemCache

This component is an LRU cache that maps repository item IDs to persistent repository items.

Property	Description
`$class`	Class name Default: `atg.service.cache.Cache`
`cacheAdapter`	The Nucleus address of the adapter that knows how to get objects not found in the cache Default: `/atg/adapter/ldap/LDAPItemCacheAdapter`
`maximumEntryLifetime`	The maximum time in milliseconds an entry lives in the cache. `0` : Cache nothing, always get objects from the `cacheAdapter` `-1` : Cache entries never expire Default: `-1`
`maximumCacheEntries`	The maximum number of entries in the cache. `0`: Cache nothing, always get objects from the `cacheAdapter` `-1`: Unlimited Default: `500`

/atg/adapter/ldap/LDAPItemCacheAdapter

This component is used by the `LDAPItemCache` to retrieve persistent repository items from the directory.

Property	Description
`$class`	Class name Default: `atg.adapter.ldap.LDAPItemCacheAdapter`
`repository`	The Nucleus address of the `LDAPRepository` that contains the cache Default: `/atg/adapter/ldap/LDAPRepository`

/atg/adapter/ldap/LDAPQueryCache

This component is an LRU cache that maps repository search queries to the repository item IDs of the query results.

Property	Description
$class	Class name Default: atg.service.cache.Cache
cacheAdapter	The Nucleus address of the adapter that knows how to get objects not found in the cache Default: /atg/adapter/ldap/LDAPQueryCacheAdapter
maximumEntryLifetime	The maximum time in milliseconds an entry lives in the cache. 0: Cache nothing, always get objects from the cacheAdapter -1: Cache entries never expire Default: -1
maximumCacheEntries	The maximum number of entries in the cache. 0: Cache nothing, always get objects from the cacheAdapter -1: Unlimited Default: 1000

/atg/adapter/ldap/LDAPQueryCacheAdapter

This component is used by the LDAPQueryCache to perform repository queries.

Property	Description
$class	Class name Default: atg.adapter.ldap.LDAPQueryCacheAdapter
repository	The Nucleus address of LDAPRepository that contains the cache Default: /atg/adapter/ldap/LDAPRepository

LDAP Password Encryption

The passwordHasher property of the /atg/userprofiling/PropertyManager component points to a password hasher component that handles password encryption. By default, this property is set like this:

```
passwordHasher=/atg/dynamo/security/DigestPasswordHasher
```

Change this property to ensure consistency with the LDAP password encryption method you've chosen. For Oracle (formerly Sun ONE) Directory Servers, set the passwordHasher property like this:

```
passwordHasher=/atg/adapter/ldap/NDSPasswordHasher
```

The NDSPasswordHasher component supports SHA or no encryption. Set the encryption property of the /atg/adapter/ldap/NDSPasswordHasher to the appropriate value:

- encryption=SHA: use SHA password encryption
- encryption=clearText: disable password encryption

For LDAP servers other than Oracle Directory Server, you might need to create your own PasswordHasher implementation, if none of the PasswordHasher implementations included in the Oracle ATG Web Commerce platform meet your requirements.

See the *Working with User Profiles* chapter of the *Personalization Programming Guide* for more information about configuring the PropertyManager component.

LDAP Repository Definition Tag Reference

The LDAP repository definition file uses the XML tags described in this section. See also, at the end of this chapter:

- Sample LDAP Repository Definition File (page 351)
- DTD for LDAP Repository Definition Files (page 352)

The LDAP repository definition is similar in many ways to the SQL repository definition. The following differences apply:

- LDAP repository definition uses its own XML document type definition and syntax.
- The LDAP repository cannot use XML file combination to combine XML files in the application configuration path that have the same name. Instead, you must use a single LDAP repository definition file in the application configuration path.

<!DOCTYPE>

LDAP repository

All SQL repository templates start with a DOCTYPE declaration that references this document type definition (DTD) file:

```
ldap_1.0.dtd
```

This DTD is installed within the <ATG11dir>/DAS/lib/classes.jar archive, but can be referenced with this URL:

```
http://www.atg.com/dtds/gsa/ ldap_1.0.dtd
```

For example:

```
<!DOCTYPE ldap-adapter-template
        PUBLIC "-//Art Technology Group, Inc.//DTD LDAP Adapter//EN"
```

```
"http://www.atg.com/dtds/ldap/ldap_1.0.dtd">
```

<ldap-adapter-template>

```
<!ELEMENT ldap-adapter-template (header, <view> (page 342)+)>
```

The <ldap-adapter-template> is the top-level tag in a repository definition file.

<header>

LDAP repository

```
<!ELEMENT header (name?, author*, version?)>
```

Parent: : <ldap-adapter-template> (page 342)

The <header> tag provides information that can help you create and modify a repository definition files.

<view>

```
<!ELEMENT view (item-descriptor, <search-root> (page 350)*)>
```

Parent: : <ldap-adapter-template> (page 342)

A repository definition file must include one <view> tag for each RepositoryView in your repository.

view attributes

Attribute	Description
name	The RepositoryView name: required and must be unique in the definition file.
default	Boolean, specifies whether this is the default view for repository items. Default: false

<item-descriptor>

LDAP repository

```
<!ELEMENT item-descriptor (id Property (page 35) | <object-classes-property> (page 344)
 | <object-class> (page 345) |
```

```
                        property | <child-property> (page 348) | <new-
items> (page 349))*>
```

Parent: <view> (page 342)

Each `RepositoryView` in the LDAP repository includes a single item descriptor, which is defined by an `<item-descriptor>` tag.

Attributes

Attribute	Description
`name`	The item descriptor name: required and must be unique in the definition file.
`parent`	The item descriptor from which this item descriptor inherits.

<id-property>

```
<!ELEMENT id-property EMPTY>
```

Parent: `<item-descriptor>`

The `<id-property>` tag defines the profile ID property in the `RepositoryItem` and the LDAP entry. The tag is always empty. For example:

```
<id-property name="id" in-ldap="true" ldap-name="dpsid"/>
```

The `<id-property>` tag is required in a definition of a base item descriptor (an item descriptor that does not have a parent) but is not allowed in a child item descriptor that inherits from a parent.

Attributes

Attribute	Description
`name`	Required, the ID property's name in the `RepositoryItem`.
`in-ldap`	Boolean, specifies whether the ID property corresponds to a single LDAP attribute. Default: `false`
`ldap-name`	The ID attribute's name in the LDAP directory. Default: value of `name`
`display-name`	The text identifying the ID property in the ATG Control Center. Default: value of `name`

Attribute	Description
description	The description of the ID property displayed in the ATG Control Center. Default: value of name

<object-classes-property>

```
<!ELEMENT object-classes-property EMPTY>
```

Parent: <item-descriptor>

The <object-classes-property> tag exposes the object classes of an LDAP entry as a property of a RepositoryItem. This tag is always empty. For example:

```
<object-classes-property name="objectClasses" ldap-name="objectclass"/>
```

Like the <id-property> tag, the <object-classes-property> tag is required in a definition of a base item descriptor (an item descriptor that does not have a parent) but is not allowed in a child item descriptor that inherits from a parent. The property's type is String[], a multi-valued String. For example, if an item descriptor definition has the <object-classes-property> tag in the preceding example and has the following object classes definition:

```
<object-class>top</object-class>
<object-class>person</object-class>
<object-class>organizationalPerson</object-class>
<object-class>inetorgPerson</object-class>
```

its repository items have the following objectClasses property:

```
objectClasses=top,person,organizationalPerson,inetorgPerson
```

Attributes

Attribute	Description
name	Required, the name of the repository item property that stores the item's LDAP object class values.
ldap-name	The property's name in the LDAP directory. Default: value of name
display-name	The text identifying the object classes property in the ATG Control Center. Default: value of name
display-property	Specifies a property of this item descriptor that is used to represent items of this type in a user interface. For example, a profile item descriptor might set display-property to login. Then, each repository item is represented using the value of the item's login property.

Attribute	Description
description	The description of the object classes property displayed in the ATG Control Center. Default: value of name

<object-class>

```
<!ELEMENT object-class (#PCDATA)>
```

Parent: <item-descriptor>

The object-class tags specify all the object class values corresponding to the given item descriptor. If the object class has ancestor object classes, they must all be specified. For example:

```
<object-class>top</object-class>
<object-class>person</object-class>
<object-class>organizationalPerson</object-class>
<object-class>inetorgPerson</object-class>
```

The object class information is required in the item descriptor specification so when a new item is created for the given item descriptor and added to the repository, the corresponding LDAP entry can be created with the given object class values. Thus, for example, if an item is created in the context of the user item descriptor, the new LDAP directory entry has objectclass attribute values of top, person, organizationalPerson, and inetorgPerson.

<property>

LDAP repository

```
<!ELEMENT property (option*, attribute*)>
```

Parent: <item-descriptor>

Property tags define the properties of a repository item and map the repository item properties to LDAP entry attributes.

Attributes

Attribute	Description
name	Required, the property's name
ldap-name	The property's name in the LDAP directory. Default: value of name

Attribute	Description

`data-type`	Required, the property's Java data type.
	
	`String int byte`
	`big string short binary`
	`enumerated long date`
	`boolean float timestamp`
	`double`
	
	The table under LDAP Data-type Correspondences (page 346) shows how data-type attribute names correspond to Java object types:

`multi`	Is this a multi-valued property? If `true`, the type is an array. Boolean Default: `false`
`display-name`	The text identifying the property in the ATG Control Center. Default: value of `name`
`description`	The description of the property displayed in the ATG Control Center. Default: value of `name`
`default`	A default value for the property, if another value is not specified when the profile is created This value will be applied to existing items if the property values for those items are null.
`required`	Boolean. Default: `false`
`readable`	Boolean. Default: `false`
`writable`	Boolean. Default: `false`
`queryable`	Boolean. Note that non-queryable properties are not indexed in the ATG Control Center. Default: `false`
`hidden`	Boolean. Hidden properties are not displayed in the ATG Control Center. Default: `false`
`expert`	Boolean. Default: `false`
`editor-class`	Associates a property editor class with the property. See the JavaBeans specification for a description of `PropertyEditors`.

LDAP Data-type Correspondences

The `data-type` attribute defines the data-type of a repository item property. The following table shows how the `data-type` attribute names correspond to Java object types.

Data-type attribute value	Java object type
string	String
big string	String
date	java.util.Date
timestamp	java.sql.Timestamp
enumerated	String
boolean	Boolean
int	Integer
byte	Byte
binary	byte[]
short	Short
float	Float
double	Double
long	Long

<option>

LDAP repository

```
<!ELEMENT option (#PCDATA)>
```

Parent: <property>

If a property's data-type property is set to enumerated, use <option> tags to indicate possible values of the enumerated properties. For example:

```
<property name="gender" data-type="enumerated">
      <option>male</option>
      <option>female</option>
</property>
```

<attribute>

LDAP repository

```
<!ELEMENT option (#PCDATA)>
```

Parent: <property>

The <attribute> tag associates arbitrary name/string value pairs with a property or item type, which determine its behavior. The name/value pairs are added to the property descriptor via the setValue method of java.beans.FeatureDescriptor, and can later be used by the application.

For example:

```
<property name="employeeNumber" data-type="string">
  <attribute name="unique" value="true"/>
</property>
```

Attributes

Attribute	Description
name	Required, the name of the name/value pair.
value	Required, the value of the name/value pair.

<child-property>

```
<!ELEMENT child-property EMPTY>
```

Parent: <item-descriptor>

If an item descriptor has a parent item-descriptor, use <child-property> tags to override inherited property values. The only aspect of the parent property definition that can be overridden is the property's default value. For example, given a parent item descriptor with the following property:

```
<item-descriptor name="user">
...
  <property name="department" default="Other"/>
...
</item-descriptor>
```

You can create a child property that overrides the default value of the department property:

```
<item-descriptor name="engineer" parent="user">

  <!-- object classes (added to parent classes) -->
  <object-class>engineeringPerson</object-class>

  <!-- properties (added to parent properties) -->
...
  <!-- child property (overrides parent properties) -->
  <child-property name="department" default="Engineering"/>

</item-descriptor>
```

See Item Descriptor Hierarchies and Inheritance (page 327) in the LDAP Repository Architecture (page 324) section of this chapter.

Attributes

Attribute	Description
`name`	Required, the attribute name, which is the same as the name of an attribute of the parent item descriptor.
`default`	Required, the default value for the attribute in the child item descriptor, overrides the default value of the corresponding attribute in the parent item descriptor.

<new-items>

```
<!ELEMENT new-items EMPTY>
```

Parent: `<item-descriptor>`

The `<new-items>` tag describes how new items within the item descriptor are created and identified.

Attributes

Attribute	Description
`allowed`	Boolean. If `false`, no new items can be created in this item descriptor; the item descriptor acts like an abstract class. Default: `true`
`parent-dn`	The distinguished name (DN) of the parent. The new item's DN is constructed by appending the value of `parent-dn` to the relative distinguished name, specified by the `rdn-property`.
`rdn-property`	The name of the repository item property that specifies the relative distinguished name of a new item.

For example, given the following `<new-items>` tag:

```
<new-items parent-dn="ou=Marketing,o=quincyfunds.com"
rdn-property="login">
```

a new item whose `login` property is `nat` has a corresponding RDN of `uid=nat` (because the LDAP repository's `login` property maps to the `uid` attribute in the LDAP directory), and the DN is `uid=nat,ou=Marketing,o=quincyfunds.com`.

If a child descriptor definition does not contain a <new-items> tag, it simply inherits the parent's item creation behavior. See New Item Creation (page 330) in the LDAP Repository Architecture (page 324) section of this chapter.

<search-root>

```
<!ELEMENT search-root EMPTY>
```

Parent: <view>

A Repository View's contents can be restricted to a location or set of locations within the directory tree. For example, you might want to specify that the engineer view contains only entries in the ou=Engineering,o=quincyfunds.com branch of the directory tree. Even if other items that satisfy the engineer item descriptor are encountered somewhere in the LDAP directory (perhaps for testing purposes), they are not considered to be part of the engineer view. The tree branches that comprise a Repository View are called *search roots*, as they determine which parts of the directory tree are searched when a repository query is constructed on the view. The <search-root> tag is a child tag of the <view> tag that limits the Repository View to the specified roots of the LDAP directory tree.

When a query is performed on the view, only those items that reside in one of the specified search roots and satisfy the view's item descriptor are returned. At least one search root must always be specified, but it may well point to the directory suffix (i.e., the search root may span the entire directory tree). See the Repository Views in the LDAP Repository (page 331) section of this chapter.

Attributes

Attribute	Description
dn	Required, the distinguished name (DN) of directory branches that can be part of the Repository View
recursive	Boolean, specifies whether the directory tree branch specified by the dn attribute should be searched recursively. Set to false if you want to include only the root's immediate children, or if you know for sure that lower levels of the branch do not contain any relevant entries. This might be used for optimization purposes. Default: true
check-classes	Boolean. If set to true, when a repository query is constructed, it is automatically augmented with the object class constraints, so items that do not satisfy the item descriptor are not returned by the search. If set to false for the search root, the query is left as is, and no object class checking is performed. This optimization should only be turned on if you are absolutely sure that the search root contains only entries that satisfy the item descriptor. Default: true

Sample LDAP Repository Definition File

The following sample LDAP repository definition file defines a base item descriptor and view named `user`.

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

<!DOCTYPE ldap-adapter-template
        PUBLIC "-//Art Technology Group, Inc.//DTD LDAP Adapter//EN"
        "http://www.atg.com/dtds/ldap/ldap_1.0.dtd">

<ldap-adapter-template>

<header>
  <name>ldapUserProfile.xml</name>
  <author>ATG</author>
  <version>$Id: ldapUserProfile.xml,v 1.5 2000/06/23 00:16:14 nat Exp $</version>
</header>

<!-- user view -->
<view name="user" default="true">

  <!-- item descriptor -->
  <item-descriptor name="user" display-name="User" display-property="login">

    <!-- special properties -->
    <id-property name="id" in-ldap="false"/>
    <object-classes-property name="objectClasses" ldap-name="objectclass"/>

    <!-- object classes -->
    <object-class>top</object-class>
    <object-class>person</object-class>
    <object-class>organizationalPerson</object-class>
    <object-class>inetorgPerson</object-class>

    <!-- properties -->
    <property name="login" ldap-name="uid" data-type="string" required="true">
      <attribute name="unique" value="true"/>
    </property>
    <property name="password" ldap-name="userpassword" data-type="string"
              required="true"
              editor-class="atg.beans.PasswordPropertyEditor"/>
    <property name="fullName" ldap-name="cn" data-type="string" required="true"/>
    <property name="lastName" ldap-name="sn" data-type="string" required="true"/>
    <property name="firstName" ldap-name="givenName" data-type="string"/>
    <property name="email" ldap-name="mail" data-type="string"/>

    <!-- item creation -->
    <new-items parent-dn="o=yourcompany.com" rdn-property="login"/>

  </item-descriptor>

  <!-- search roots -->
  <search-root dn="o=yourcompany.com"/>

</view>

</ldap-adapter-template>
```

DTD for LDAP Repository Definition Files

This is the XML Document Type Definition for LDAP repository definition files. Do not modify this file. You can also view this file at:

http://www.atg.com/dtds/ldap/ldap_1.0.dtd

```
<?xml encoding="UTF-8"?>
<!--
========================================================================
ldap-adapter-template.dtd - document type for LDAP Adapter templates
@version $Id: //product/DAS/version/11.0/Java/atg/dtds/ldap/ldap_1.0.dtd#1
$$Change: 531151 $
========================================================================
-->

<!-- Flag datatype, and values -->
<!ENTITY % flag "(true | false)">

<!-- The whole template -->
<!ELEMENT ldap-adapter-template (header, view+)>

<!-- The header -->
<!ELEMENT header (name?, author*, version?)>

<!-- Name of template -->
<!ELEMENT name (#PCDATA)>

<!-- The author(s) -->
<!ELEMENT author (#PCDATA)>

<!-- Version string -->
<!ELEMENT version (#PCDATA)>

<!-- View(s) -->
<!ELEMENT view (item-descriptor, search-root*)>
<!ATTLIST view
nameCDATA#REQUIRED
default %flag;"false"
>

<!-- Item descriptor(s) -->
<!ELEMENT item-descriptor (id-property | object-classes-property | object-class |
                           property | child-property | new-items)*>
<!ATTLIST item-descriptor
nameCDATA#REQUIRED
parentCDATA#IMPLIED
display-nameCDATA#IMPLIED
descriptionCDATA#IMPLIED
hidden%flag;"false"
expert%flag;"false"
display-property CDATA #IMPLIED
>

<!-- Id property -->
<!ELEMENT id-property EMPTY>
<!ATTLIST id-property
nameCDATA#REQUIRED
```

```
in-ldap%flag;"false"
ldap-nameCDATA#IMPLIED
display-nameCDATA#IMPLIED
descriptionCDATA#IMPLIED
>

<!-- Object classes property -->
<!ELEMENT object-classes-property EMPTY>
<!ATTLIST object-classes-property
nameCDATA#REQUIRED
ldap-nameCDATA#IMPLIED
display-nameCDATA#IMPLIED
descriptionCDATA#IMPLIED
>

<!-- Object class(es) -->
<!ELEMENT object-class (#PCDATA)>

<!-- Property(s) -->
<!ELEMENT property (option*, attribute*)>
<!ATTLIST property
nameCDATA#REQUIRED
ldap-nameCDATA#IMPLIED
data-typeCDATA   #REQUIRED
multi%flag;  "false"
display-nameCDATA#IMPLIED
descriptionCDATA#IMPLIED
defaultCDATA#IMPLIED
required%flag;"false"
readable%flag;"true"
writable%flag;"true"
queryable%flag;"true"
hidden%flag;"false"
expert%flag;"false"
        editor-class    CDATA   #IMPLIED
>

<!-- Options are possible values for enumerated properties -->
<!ELEMENT option (#PCDATA)>

<!-- Feature descriptor values -->
<!ELEMENT attribute EMPTY>
<!ATTLIST attribute
nameCDATA #REQUIRED
valueCDATA #IMPLIED
beanCDATA #IMPLIED
>

<!-- Child property(s) -->
<!ELEMENT child-property EMPTY>
<!ATTLIST child-property
nameCDATA #REQUIRED
defaultCDATA#REQUIRED
>

<!-- Item creation -->
<!ELEMENT new-items EMPTY>
<!ATTLIST new-items
allowed%flag;"true"
parent-dnCDATA#IMPLIED
```

```
rdn-propertyCDATA#IMPLIED
>

<!-- Search root(s) -->
<!ELEMENT search-root EMPTY>
<!ATTLIST search-root
dnCDATA#REQUIRED
recursive%flag;"true"
check-classes%flag;"true"
>
```

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