Advanced Repository Concepts

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Agenda

- ATG Repository Transaction Management
- Developing and Testing a SQL Repository

Learning Objectives

At the end of this lesson, you should be able to:

- Apply transaction management features to ensure data integrity
- Learn about ATG Trasaction support
- Use Transaction demarcation to initialize transaction behavior
- Demarcate sections in JSP Pages using Trasaction droplets
- Understand the role of Two Phase Commit in ATG applications
- Use startSQLRepository to perform various repository operations

Section 1:
Repository Transaction Management

Transaction Overview

- Transaction is a set of actions that are treated as an atomic unit, all or none principle.
- Transaction is defined by ACID properties:
  - Atomicity,
  - Consistency,
  - Isolation,
  - Durability.
- Transaction management is a complex task.
  - Single request might require many actions to be completed.
  - One transactional resource is involved in the transaction.
  - Multiple transactions run within an App server.
- Application servers manage transactions.

Transaction Object

- Each active transaction is represented by a transaction object, which implements javax.transaction.Transaction.
- Transaction object keeps track of its own status such as active, committed, or rolled back.
- It also keeps tracks of resources enlisted with it.
- A transaction object is created when a transaction starts and is discarded when a transaction ends.
- It is associated with a thread. Only one transaction can be associated with a thread at any one time, which is the current transaction.
- A running application may have many transactions at once associated with different threads running in the server.

Transaction Manager

- Transaction manager is a central service which keeps track of transactions and the threads they are associated with.
- It creates the transaction objects and discards them.
- Java Transaction API (JTA) provides two main interfaces for managing transactions:
  - **TransactionManager** is intended to be used by ***application servers*** and provides a full range of methods.
  - **UserTransaction** is intended for use by the ***J2EE applications*** and provides a subset of functionality like begin, commit, and rollback. It cannot suspend, resume, or directly access the transaction object.
- Both managers always operate in the context of the calling thread. Hence a begin would start a new transaction associated with that thread.

ATG Transaction Support

- ATG exposes the JTA transaction managers as nucleus components:
  - /atg/dynamo/transaction/TransactionManager,
  - /atg/dynamo/transaction/UserTransaction.
- ATG TransactionManager typically points to the appropriate TransactionManager implementation based on the application server.
- It keeps track of transactions running in ATG applications and which threads are associated with which transactions.
- ATG exposes the managers to standard J2EE components through the JNDI name:
  - dynamo:/atg/dynamo/transaction/TransactionManager,
  - dynamo:/atg/dynamo/transaction/UserTransaction.

Working with Transactions

- As a developer, there are two ways of working with transactions:
  - Using the Java transaction API and the transaction manager,
  - Transaction demarcation.
- Using the transaction manager directly gives a lot of power to the developer.
- It is harder to implement correctly.
- Transaction demarcation is easier to use and depends on marking sections of code enclosed in some sort of transaction behavior.

Transaction Demarcation

- Transaction demarcation wraps a sequence of actions.
- The demarcation initializes some transactional behavior before the demarcated area begins, then ends the transactional behavior when the demarcated area ends.
- The application server uses these demarcations to determine the appropriate calls to the Transaction Manager object.
- There is a helper method to simplify transaction management.
- It is a recommended best practice unless the functionality provided does not suffice to adequately satisfy the business requirements.

Using Transaction Demarcation

- Transaction demarcation has two key methods:
  - **`begin`**() and **`end`**().
- There are six transaction demarcation modes that can be used to determine transaction boundaries:
  - Required, RequiresNew, NotSupported, Supports, Mandatory, and Never.
- Transaction boundaries are set using constants on the TransactionDemarcation object.
- Transaction demarcation can be used:
  - In Java code programatically,
  - In JSP pages using ATG servlet beans.

Transaction Demarcation Modes

- The six transaction modes are as follows:

Mode	Explanation
REQUIRED	Transaction must be in place. If one is not in place, a new one is started.
REQUIRES_NEW	A new transaction is needed. If one is in place, it is suspended and restarted.
NOT_SUPPORTED	A transaction must not be used. If one is in place, it is suspended and restarted.
SUPPORTS	A transaction, if in place is used. If not, the area is not in a transaction.
MANDATORY	A transaction is required. If no transaction is in place, an exception is thrown.
NEVER	A transaction must not be in place. If it is, an exception is thrown.

Transaction Demarcation Classes

- ATG platform provides two classes:
  - **UserTransactionDemarcation** to be used for basic transaction demarcation. It uses UserTransaction object.
  - **TransactionDemarcation** can be used for fine grained demarcation of code. This uses the TransactionManager object.
- UserTransactionDemarcation's **`begin`**() method only implements REQUIRED transaction Mode.
- TransactionDemarcation's **`begin`**() method takes an argument to specify one of the 6 transaction modes.
- The code must ensure the **`end`**() method is always called, typically by using a final block.
- Both **`begin`**() and **`end`**() methods can throw TransactionDemarcationException().

Example: Use TransactionDemarcation

```
TransactionDemarcation td = new TransactionDemarcation();

try {
   try {
     td.begin(getTransactionManager(),td.REQUIRED);

      . . . create new item in repository…

   }catch (RepositoryException re) {
     getTransactionManager().setRollbackOnly();
   }finally {
     td.end();
   }
}catch (TransactionDemarcationException tde) {
 ... handle the exception ...
}
```

- Example shows the proper use of begin and end using transaction demarcation.

Example: Using UserTransactionDemarcation

```
UserTransactionDemarcation td
                = new UserTransactionDemarcation ();

try {
    try {
          td.begin ();
          ... do transactional work ...
    }finally {
          td.end ();
    }
}catch (TransactionDemarcationException exc) {
    ... handle the exception ...
}
```

- No mode needs to be specified on UserTransactionDemarcation.
- It is always REQUIRED.

Demarcation in Pages (1)

- ATG's DSP tag libraries include several tags that you can use to demarcate transactions in JSPs:
  - **dsp:beginTransaction** initiates a transaction and tracks its status.
  - **dsp:commitTransaction** commits the current transaction.
  - **dsp:rollbackTransaction** rolls back the current transaction.
  - **dsp:demarcateTransaction** begins the transaction, executes one or more operations within the transaction, and then commits the transaction.
  - **dsp:setTrasactionRollbackOnly** marks the current transaction for rollback only.
  - **dsp:transactionStatus** returns the status of the current transaction.

Demarcation in Pages (2)

- In addition to transaction handling tags, ATG has servlet beans for demarcating transactions.
  - **Transaction** Droplet marks the bounds of a transaction within a JSP.
  - **EndTransaction** Droplet commits or rolls back the current operation.

```
<dsp:droplet
       name="/atg/dynamo/transaction/droplet/Transaction">
   <dsp:param name="transAttribute" value="requiresNew"/>
   <dsp:oparam name="output">

     ... portion of page executed in demarcated area ...

   </dsp:oparam>
</dsp:droplet>
```

Marking Transactions for Rollback

- As a result of error condition or exception, an application can determine that the current transaction should be rolled back.
- A good way to do this is to mark the transaction for rollback only. This sets a flag on the transaction that it cannot be committed.
- You can either use the TransactionManager or UserTransaction's methods:
  - **`getStatus`**() gets the status of the transaction,
  - **`getRollbackOnly`**() and **`setRollbackOnly`**() to get/ set rollback flag.
- You can also do this:
  - Using **`dsp:setTransactionRollbackOnly`** tag.
  - By calling transaction demarcation's **`end(true)`** method. The **`true`** indicates that the transaction should be marked for rollback only.

Repositories and Transactions

- The default behavior of the repository API:
  - If a JTA transaction is in progress, all repository changes are part of that transaction, and are committed when it completes.
  - If there is no transaction in place, each SQL repository operation call that modifies the repository occurs in its own transaction.
- If no transaction exists:
  - Begin JTA transaction.
  - Call setPropertyValue.
  - Commit JTA transaction. SQL is issued and changes are committed.
- The SQL repository implements transaction isolation.
  - If an item is accessed in a transaction, it is guaranteed to be up to date at that time.
  - If another transaction changes the item, those changes are not visible in this transaction.

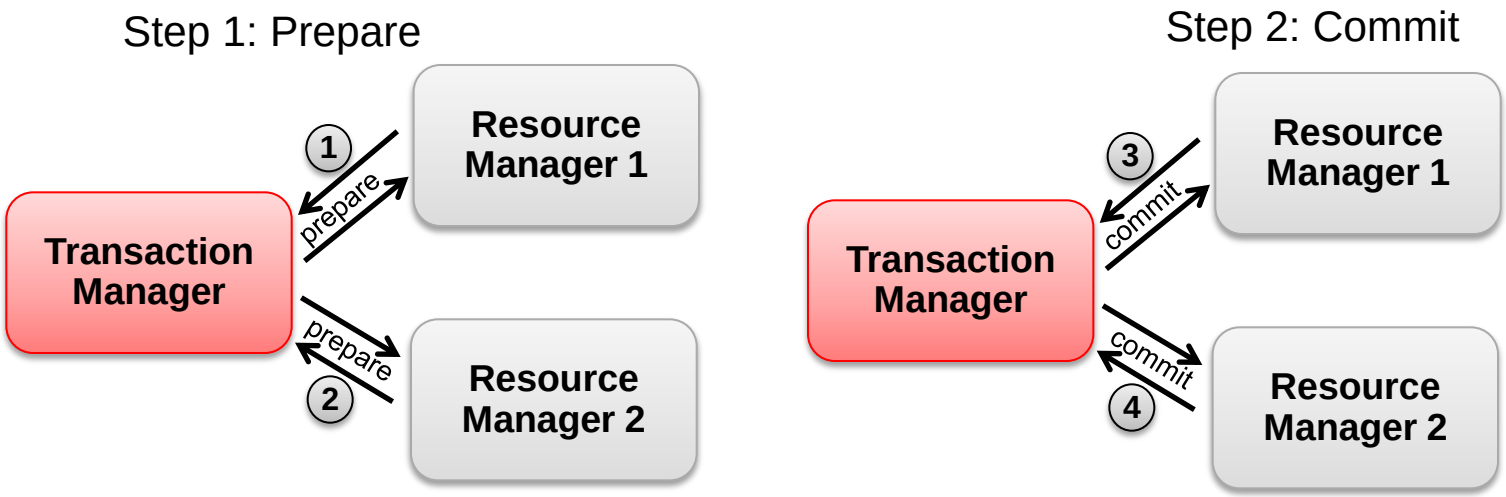
Managing Transactions with Repositories

- Though repositories changes occur by default in their own transaction, it is not optimal.
- Any code making repository changes should create their own transactions for efficiency and consistency.
- ATG provides different methods to manage transactions while dealing with repositories:
  - Use the transaction servlet bean,
  - Use JTA programatically,
  - Use a FormHandler using TransactionalFormHandler.
- Transaction form handler automatically wraps a transaction around all property get method calls and another transaction around all set and handle classes.

Two Phase Commit Protocol (1)

- Two phase commit is required when:
  - More than one resource in involved in a transaction.
  - e.g. ‘More than one database’ or ‘one database and one JMS system.’
- The two phase commit protocol consists of a prepare phase and a commit phase.
  - Phase 1: Prepare
    - Each resource votes to commit or rollback.
  - Phase 2: Commit
    - If all resources voted to commit, then the transaction object issues a commit against each resource.
    - If any resource votes to rollback, then all resources are instructed to rollback.

Two Phase Commit Protocol (2)



- Most ATG applications use and require two phase commit capability.
- Developers and administrators must ensure that a two phase commit capable XA data source and database drivers are used.

Section 1 ✔
Check Your Understanding

Name the ACID Properties that define a transaction.

Answer:

Atomicity, consistency, isolation, durability.

Section 1 ✔
Check Your Understanding

What keeps track of the status of a transaction, whether it is committed, rolled back, or still active?

Answer:

The transaction object.

Section 1 
Check Your Understanding

What is the primary purpose of a transaction manager?

Answer:

Transaction manager is a central service which keeps track of transactions and the threads they are associated with.

Section 1 ✔
Check Your Understanding

What is the difference between transaction manager and UserTransaction manager?

Answer:

UserTransaction is intended for use by the J2EE applications and provides a subset of functionality provided by the transaction manager.

Section 1 ✔
Check Your Understanding

Name the six transaction demarcation modes.

Answer:

Required, RequiresNew, NotSupported, Supports, Mandatory, and Never.

Summary

- Transaction is a set of actions that are treated as an atomic unit, all or none principle.
- Each active transaction is represented by a transaction object.
- Transaction manager is a central service which keeps track of transactions and the threads they are associated with.
- ATG exposes transaction manager as a nucleus component for use by developers.
- ATG developers should be using transaction demarcation as it is simpler and less error prone.

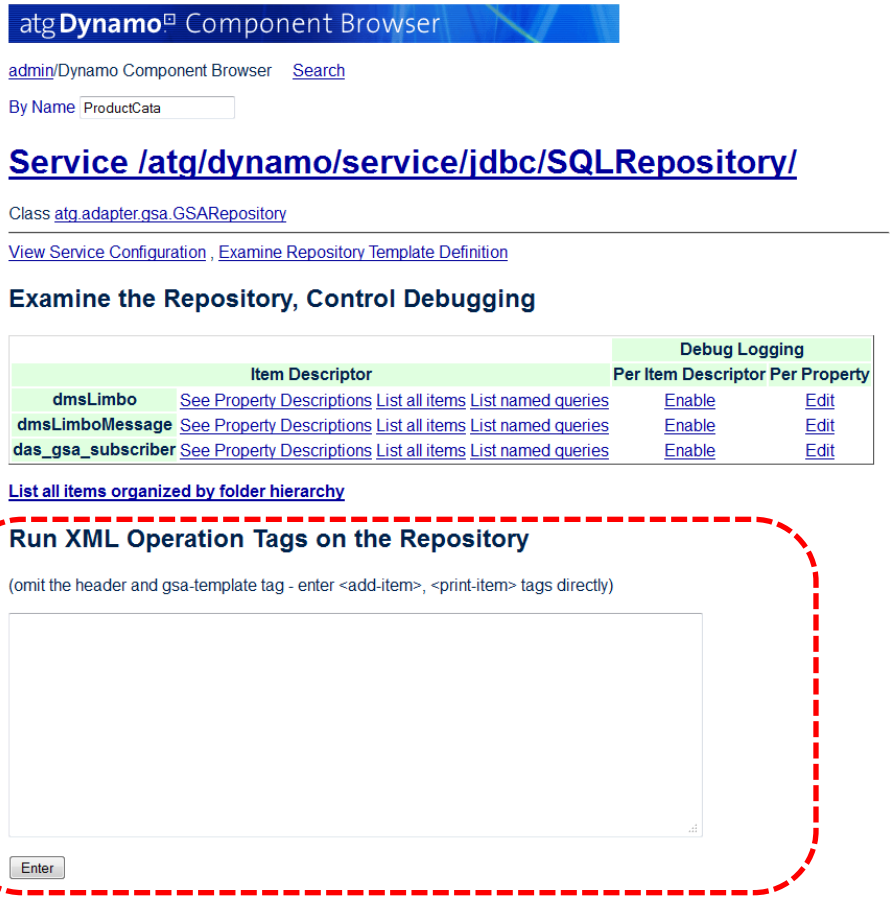
Section 2:
Developing and Testing a SQL Repository

Developing and Testing a SQL Repository

- ATG provides an easy way for developers to create and test SQL repositories.
- The XML document type definition for the SQL repository includes operation tags whose primary purpose is to help you develop, test, import/ export, and debug your SQL repositories.
- What can you do?
  - Add items,
  - Update items,
  - Remove items,
  - Query items,
  - Import/ export items and DDLs.

Use Operation Tags in the Repository Administration Interface

- Developers can use these operations through the Dyn Admin interface.
- In the UI text field, you can enter any XML operations tags against the current repository.
- Click ‘Enter’ and the page displays the output.



URL: http://***host:port***/nucleus/atg/dynamo/service/jdbc/SQLRepository

Query Items

- A repository definition file can include **<query-items>** tags in order to cache query results on application startup.
- Preloading items on startup can improve application performance in some cases.
- The query uses the Repository Query Language (RQL).

```
<query-items item-descriptor="users">
        username="Marty"
</query-items>
```

Add Items

- You can use the **<add-item>** tag to add items to the repository.
- Each <add-item> tag must include an item descriptor attribute.
- Nest <set-property> tags to set property values.
- If you specify the ID of an existing repository item, you update that item.

```
<add-item item-descriptor="users" id="1">
    <set-property name="username" value="Marty"/>
</add-item>
```

Update Items

- Update repository items with the **<update-item>** tag.
- Developers can use the add or remove attributes to add or remove values from multi-item properties without overwriting the whole property value.
- Set skip-update attribute to avoid the update item call until the transaction is committed which has better performance.

```
<update-item item-descriptor="user" id="1"
                                skip-update="true">
    <set-property name="dependents"
                        value="1799" add="true"/>
</update-item>
```

Remove Items

- Remove items from the repository with the **<remove-item>** tag.
- To remove reference items set remove-references-to attribute to true.

```
<remove-item item-descriptor="users" id="1"
        remove-references-to="true"/>
```

startSQLRepository

- startSQLRepository is a SQL multi-utility for developers.
- It can be used for:
  - Verifying the XML is correctly formed and complies with the DTD.
  - Parsing and processing optional operation tags.
  - Generating SQL statements that are required to create the appropriate database table structure.
  - Returning results of <query-items> and <print-item>.
  - Importing from XML to a repository.
  - Exporting repository into XML data.
- It is a command line tool that is part of ATG installation.
- It is located in <ATG_HOME>/bin folder.

startSQLRepository Parameters

- The startSQLRepository scripts take the following arguments:

List of Parameters	List of Parameters
-m startup-module -s server-name -debug vendor -encoding encoding -export "item-type[,...]" file -export all file -exportRepositories repository-path[,...] file -exportRepositories all file	-import input-file -noTransaction -output file -outputSQL Outputs -outputSQLFile file -repository path -skipReferences -verboseSQL

Examples

- This example loads an XML template whose configuration pathname is /atg/test.xml in a repository /atg/userprofiling/ProfileAdapterRepository:

```
bin/startSQLRepository -m DPS
  -repository /atg/userprofiling/ProfileAdapterRepository
   /atg/test.xml
```

- This example exports everything from product catalog repository in DCS module to a file called export-all.xml:

```
bin/startSQLRepository -m DCS -export all export-all.xml
  -repository /atg/commerce/catalog/ProductCatalog
```

Section 2 
Check Your Understanding

What are the possible operations you can perform with the XML document type for the SQL repository?

Answer:

You can add, update, remove, and query the items.

Section 2 ✔
Check Your Understanding

What interface can be used to execute some of the XML operation tags?

Answer:

Dyn Admin can be used to execute the tag operations.

Section 2 
Check Your Understanding

What is query tag used for?

Answer:

To check the repository or to preload the items on startup to improve performance.

Section 2
Check Your Understanding

How do you avoid update item call until the transaction is committed using an update items tag?

Answer:

Set skip-update attribute to true.

Section 2 
Check Your Understanding

Name a few uses of StartSQLRepository.

Answer:

Verify the XML is correctly formed and complies with the DTD, parse and process optional operation tags, etc.

Summary

- The XML document type definition for the SQL repository includes operation tags whose primary purpose is to help you develop, test, import/ export, and debug your SQL repositories.
- Developers can test operations through the Dyn Admin interface.
- A repository definition file can include <query-items> tags in order to cache query results on application startup.
- You can use the <add-item> tag to add items to the repository.
- Update repository items with the <update-item> tag.
- Remove items from the repository with the <remove-item> tag.
- startSQLRepository is a SQL multi-utility for developers.

Q&A

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