The Java EE 5 Tutorial

Container-Managed Transactions

In an enterprise bean with **container-managed transaction demarcation**, the EJB container sets the boundaries of the transactions. You can use container-managed transactions with any type of enterprise bean: session, or message-driven. Container-managed transactions simplify development because the enterprise bean code does not explicitly mark the transaction's boundaries. The code does not include statements that begin and end the transaction.

By default if no transaction demarcation is specified enterprise beans use container-managed transaction demarcation.

Typically, the container begins a transaction immediately before an enterprise bean method starts. It commits the transaction just before the method exits. Each method can be associated with a single transaction. Nested or multiple transactions are not allowed within a method.

Container-managed transactions do not require all methods to be associated with transactions. When developing a bean, you can specify which of the bean's methods are associated with transactions by setting the transaction attributes.

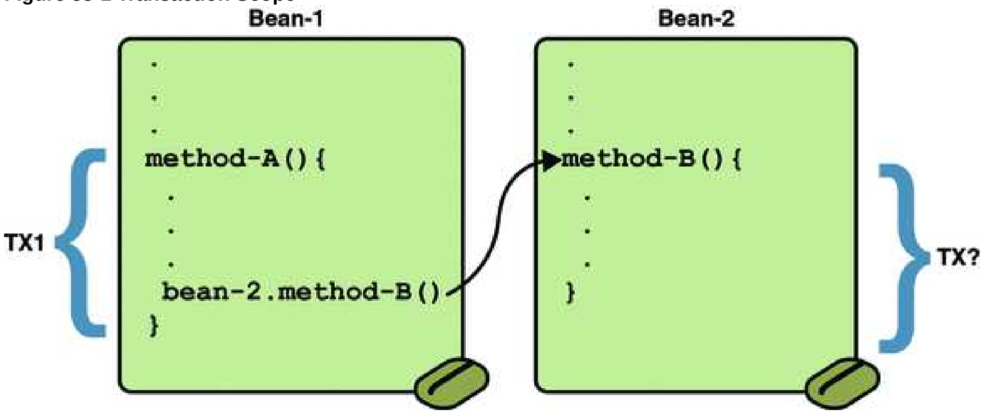
Enterprise beans that use container-managed transaction demarcation must not use any transaction management methods that interfere with the container's transaction demarcation boundaries. Examples of such methods are the `commit`, `setAutoCommit`, and `rollback` methods of `java.sql.Connection` or the `commit` and `rollback` methods of `javax.jms.Session`. If you require control over the transaction demarcation, you must use application-managed transaction demarcation.

Enterprise beans that use container-managed transaction demarcation also must not use the `javax.transaction.UserTransaction` interface.

Transaction Attributes

A **transaction attribute** controls the scope of a transaction. Figure 33-1 illustrates why controlling the scope is important. In the diagram, `method-A` begins a transaction and then invokes `method-B` of `Bean-2`. When `method-B` executes, does it run within the scope of the transaction started by `method-A`, or does it execute with a new transaction? The answer depends on the transaction attribute of `method-B`.

Figure 33-1 Transaction Scope



A transaction attribute can have one of the following values:

- `Required`
- `RequiresNew`
- `Mandatory`
- `NotSupported`
- `Supports`
- `Never`

`Required` Attribute

If the client is running within a transaction and invokes the enterprise bean's method, the method executes within the client's transaction. If the client is not associated with a transaction, the container starts a new transaction before running the method.

The `Required` attribute is the implicit transaction attribute for all enterprise bean methods running with container-managed transaction demarcation. You typically do not set the `Required` attribute unless you need to override another transaction attribute. Because transaction attributes are declarative, you can easily change them later.

`RequiresNew` Attribute

If the client is running within a transaction and invokes the enterprise bean's method, the container takes the following steps:

1. Suspends the client's transaction
2. Starts a new transaction
3. Delegates the call to the method
4. Resumes the client's transaction after the method completes

If the client is not associated with a transaction, the container starts a new transaction before running the method.

You should use the `RequiresNew` attribute when you want to ensure that the method always runs within a new transaction.

`Mandatory` Attribute

If the client is running within a transaction and invokes the enterprise bean's method, the method executes within the client's transaction. If the client is not associated with a transaction, the container throws the `TransactionRequiredException`.

Use the `Mandatory` attribute if the enterprise bean's method must use the transaction of the client.

`NotSupported` Attribute

If the client is running within a transaction and invokes the enterprise bean's method, the container suspends the client's transaction before invoking the method. After the method has completed, the container resumes the client's transaction.

If the client is not associated with a transaction, the container does not start a new transaction before running the method.

Use the `NotSupported` attribute for methods that don't need transactions. Because transactions involve overhead, this attribute may improve performance.

`Supports` Attribute

If the client is running within a transaction and invokes the enterprise bean's method, the method executes within the client's transaction. If the client is not associated with a transaction, the container does not start a new transaction before running the method.

Because the transactional behavior of the method may vary, you should use the `Supports` attribute with caution.

`Never` Attribute

If the client is running within a transaction and invokes the enterprise bean's method, the container throws a `RemoteException`. If the client is not associated with a transaction, the container does not start a new transaction before running the method.

Summary of Transaction Attributes

Table 33-1 summarizes the effects of the transaction attributes. Both the `T1` and the `T2` transactions are controlled by the container. A `T1` transaction is associated with the client that calls a method in the enterprise bean. In most cases, the client is another enterprise bean. A `T2` transaction is started by the container just before the method executes.

In the last column of Table 33-1, the word **None** means that the business method does not execute within a transaction controlled by the container. However, the database calls in such a business method might be controlled by the transaction manager of the DBMS.

Table 33-1 Transaction Attributes and Scope

Transaction Attribute	Client's Transaction	Business Method's Transaction
`Required`	None	`T2`
	`T1`	`T1`
`RequiresNew`	None	`T2`
	`T1`	`T2`
`Mandatory`	None	error
	`T1`	`T1`
`NotSupported`	None	None
	`T1`	None

Supports	None	None
	T1	T1
Never	None	None
	T1	Error

Setting Transaction Attributes

Transaction attributes are specified by decorating the enterprise bean class or method with a `javax.ejb.TransactionAttribute` annotation, and setting it to one of the `javax.ejb.TransactionAttributeType` constants.

If you decorate the enterprise bean class with `@TransactionAttribute`, the specified `TransactionAttributeType` is applied to all the business methods in the class. Decoration a business method with `@TransactionAttribute` applies the `TransactionAttributeType` only to that method. If a `@TransactionAttribute`annotation decorates both the class and the method, the method `TransactionAttributeType` overrides the class `TransactionAttributeType`.

The `TransactionAttributeType` constants encapsulate the transaction attributes described earlier in this section.

- `Required`: `TransactionAttributeType.REQUIRED`
- `RequiresNew`: `TransactionAttributeType.REQUIRES_NEW`
- `Mandatory`: `TransactionAttributeType.MANDATORY`
- `NotSupported`: `TransactionAttributeType.NOT_SUPPORTED`
- `Supports`: `TransactionAttributeType.SUPPORTS`
- `Never`: `TransactionAttributeType.NEVER`

The following code snippet demonstrates how to use the `@TransactionAttribute` annotation:

```
@TransactionAttribute(NOT_SUPPORTED)
@Stateful
public class TransactionBean implements Transaction {
...
    @TransactionAttribute(REQUIRES_NEW)
    public void firstMethod() {...}

    @TransactionAttribute(REQUIRED)
    public void secondMethod() {...}

    public void thirdMethod() {...}

    public void fourthMethod() {...}
}
```

In this example, the `TransactionBean` class's transaction attribute has been set to `NotSupported`. `firstMethod` has been set to `RequiresNew`, and `secondMethod` has been set to `Required`. Because a `@TransactionAttribute` set on a method overrides the class `@TransactionAttribute`, calls to `firstMethod` will create a new transaction, and calls to `secondMethod` will either run in the current transaction, or start a new transaction. Calls to `thirdMethod` or `fourthMethod` do not take place within a transaction.

Rolling Back a Container-Managed Transaction

There are two ways to roll back a container-managed transaction. First, if a system exception is thrown, the container will automatically roll back the transaction. Second, by invoking the `setRollbackOnly` method of the `EJBContext` interface, the bean method instructs the container to roll back the transaction. If the bean throws an application exception, the rollback is not automatic but can be initiated by a call to `setRollbackOnly`.

Synchronizing a Session Bean's Instance Variables

The `SessionSynchronization` interface, which is optional, allows stateful session bean instances to receive transaction synchronization notifications. For example, you could synchronize the instance variables of an enterprise bean with their corresponding values in the database. The container invokes the `SessionSynchronization` methods (`afterBegin`, `beforeCompletion`, and `afterCompletion`) at each of the main stages of a transaction.

The `afterBegin` method informs the instance that a new transaction has begun. The container invokes `afterBegin` immediately before it invokes the business method.

The container invokes the `beforeCompletion` method after the business method has finished, but just before the transaction commits. The `beforeCompletion` method is the last opportunity for the session bean to roll back the transaction (by calling `setRollbackOnly`).

The `afterCompletion` method indicates that the transaction has completed. It has a single `boolean` parameter whose value is `true` if the transaction was committed and `false` if it was rolled back.

Methods Not Allowed in Container-Managed Transactions

You should not invoke any method that might interfere with the transaction boundaries set by the container. The list of prohibited methods follows:

- The `commit`, `setAutoCommit`, and `rollback` methods of `java.sql.Connection`
- The `getUserTransaction` method of `javax.ejb.EJBContext`
- Any method of `javax.transaction.UserTransaction`

You can, however, use these methods to set boundaries in application-managed transactions.