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What's new in Java Message Service 2.0?

Nigel Deakin
JSR 343 Specification Lead
Oracle

MAKE THE FUTURE JAVA

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BOF

Meet the experts:
JMS 2.0 expert group

Tuesday 2 Oct 2012
1630 - 1715
Parc 55: Cyril Magnin II/III

JMS

- A Java API for sending and receiving messages
- Many competing implementations
- Two distinct API variants
  - Java SE applications
  - Java EE applications (web, EJB, application client)
    - adds support for JTA transactions, MDBs
    - removes features considered inappropriate in a managed application server environment

What JMS is and isn't

- A standard API
  - Not a messaging system in itself
  - Not a wire protocol
- Defines Java API only
  - Doesn't define API for non-Java clients (e.g. C++, HTTP) - but many implementations do)
- An application API
  - Not (currently) an admin, management or monitoring API

JMS 2.0

- JMS 1.1 last updated in 2002
- JMS 2.0 launched in 2011 as JSR 343
  - Expert group contains 20 members,
    including FuseSource, IBM, Oracle, Pramati, Red Hat, TIBCO
  - Early Draft published Feb 2012
  - NOT FINISHED!
  - Final release planned Q2 2013 (aligned with Java EE 7)
  - More information at http://jms-spec.java.net
  - Join the user email alias and get involved

Goals of JMS 2.0

- Simplicity and ease of use
- New messaging features
- Better Java EE integration
  - define the slightly different JMS API more clearly
  - simpler resource configuration
  - standardized configuration of JMS MDBs
  - better application server pluggability
- Minor corrections and clarifications
- Cloud / PaaS features deferred to Java EE 8

JMS 2.0:
Simplifying the JMS API

What's wrong with the JMS 1.1 API?

JMS 1.1: Sending a message

```
@Resource(lookup = "java:global/jms/demoConnectionFactory")
ConnectionFactory connectionFactory;

@Resource(lookup = "java:global/jms/demoQueue")
Queue demoQueue;

public void sendMessage(String payload) {
   try {
      Connection connection = connectionFactory.createConnection();
      try {
         Session session = connection.createSession(false,Session.AUTO_ACKNOWLEDGE);
         MessageProducer messageProducer = session.createProducer(demoQueue);
         TextMessage textMessage = session.createTextMessage(payload);
         messageProducer.send(textMessage);
      } finally {
         connection.close();
      }
   } catch (JMSException ex) {
      Logger.getLogger(getClass().getName()).log(Level.SEVERE, null, ex);
   }
}
```

13 lines of code just to send a message

JMS 1.1: Sending a message

```
@Resource(lookup = "java:global/jms/demoConnectionFactory")
ConnectionFactory connectionFactory;

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Queue demoQueue;

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         messageProducer.send(textMessage);
      } finally {
         connection.close();
      }
   } catch (JMSException ex) {
      Logger.getLogger(getClass().getName()).log(Level.SEVERE, null, ex);
   }
}
```

must create several intermediate objects

JMS 1.1: Sending a message

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         messageProducer.send(textMessage);
      } finally {
         connection.close();
      }
   } catch (JMSException ex) {
      Logger.getLogger(getClass().getName()).log(Level.SEVERE, null, ex);
   }
}
```

redundant and misleading arguments

JMS 1.1: Sending a message

```
@Resource(lookup = "java:global/jms/demoConnectionFactory")
ConnectionFactory connectionFactory;

@Resource(lookup = "java:global/jms/demoQueue")
Queue demoQueue;

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      try {
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         MessageProducer messageProducer = session.createProducer(demoQueue);
         TextMessage textMessage = session.createTextMessage(payload);
         messageProducer.send(textMessage);
      } finally {
         connection.close();
      }
   } catch (JMSException ex) {
      Logger.getLogger(getClass().getName()).log(Level.SEVERE, null, ex);
   }
}
```

boilerplate code

JMS 1.1: Sending a message

```
@Resource(lookup = "java:global/jms/demoConnectionFactory")
ConnectionFactory connectionFactory;

@Resource(lookup = "java:global/jms/demoQueue")
Queue demoQueue;

public void sendMessage(String payload) {
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      try {
         Session session = connection.createSession(false,Session.AUTO_ACKNOWLEDGE);
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         TextMessage textMessage = session.createTextMessage(payload);
         messageProducer.send(textMessage);
      } finally {
         connection.close();
      }
   } catch (JMSException ex) {
      Logger.getLogger(getClass().getName()).log(Level.SEVERE, null, ex);
   }
}
```

must close resources after use!

JMS 1.1: Sending a message

```
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ConnectionFactory connectionFactory;

@Resource(lookup = "java:global/jms/demoQueue")
Queue demoQueue;

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         TextMessage textMessage = session.createTextMessage(payload);
         messageProducer.send(textMessage);
      } finally {
         connection.close();
      }
   } catch (JMSException ex) {
      Logger.getLogger(getClass().getName()).log(Level.SEVERE, null, ex);
   }
}
```

all methods throw checked exceptions

Simplifying the JMS API

Strategy

- Simplify existing JMS 1.1 API where it won't break compatibility
- Define new simplified API requiring fewer objects
  - JMSContext, JMSProducer, JMSConsumer
- In Java EE, allow JMSContext to be injected and managed by the container

Simplifying the existing JMS 1.1 API

Simpler API to create a Session

- Need to maintain backwards compatibility limits scope for change
- New methods on **`javax.jms.Connection`** to create a Session:
  - Existing method (will remain)

```
connection.createSession(transacted,deliveryMode)
```

  - New method mainly for Java SE

```
connection.createSession(sessionMode)
```

  - New method mainly for Java EE

```
connection.createSession()
```

Simplifying the existing JMS 1.1 API

Simpler API to close JMS objects

- Make JMS objects implement **`java.jang.AutoCloseable`**
  - **`Connection`**
  - **`Session`**
  - **`MessageProducer`**
  - **`MessageConsumer`**
  - **`QueueBrowser`**
- Requires Java SE 7

Simplifying the existing JMS 1.1 API

Simpler API to close JMS objects

```
@Resource(lookup = "jms/connFactory")
ConnectionFactory cf;

@Resource(lookup="jms/inboundQueue")
Destination dest;

public void sendMessage (String payload) throws JMSException {
   try ( Connection conn = connectionFactory.createConnection();
         Session session = conn.createSession();
         MessageProducer producer = session.createProducer(dest);
   ){
      Message mess = sess.createTextMessage(payload);
      producer.send(mess);
   } catch(JMSException e){
      // exception handling
   }
}
```

Create closeable resources in a try-with-resources block

close() is called automatically at end of block

New simplified API for JMS 2.0

Introducing JMSContext and JMSProducer

```
@Resource(lookup = "java:global/jms/demoConnectionFactory")
ConnectionFactory connectionFactory;

@Resource(lookup = "java:global/jms/demoQueue")
Queue demoQueue;

public void sendMessageNew(String payload) {
   try (JMSContext context = connectionFactory.createContext();){
      context.createProducer().send(demoQueue, payload);
   } catch (JMSRuntimeException ex) {
      Logger.getLogger(getClass().getName()).log(Level.SEVERE, null, ex);
   }
}
```

13 lines reduced to 5

New simplified API for JMS 2.0

Introducing JMSContext and JMSProducer

```
@Resource(lookup = "java:global/jms/demoConnectionFactory")
ConnectionFactory connectionFactory;

@Resource(lookup = "java:global/jms/demoQueue")
Queue demoQueue;

public void sendMessageNew(String payload) {
    try (JMSContext context = connectionFactory.createContext();){
        context.createProducer().send(demoQueue, payload);
    } catch (JMSRuntimeException ex) {
        Logger.getLogger(getClass().getName()).log(Level.SEVERE, null, ex);
    }
}
```

JMSContext combines Connection and Session

Payload can be sent directly

close() is called automatically at end of block

No checked exceptions thrown

JMSContext (1/2)

- A new object which encapsulates a Connection, a Session and an anonymous MessageProducer
- Created from a ConnectionFactory

```
JMSContext context = connectionFactory.createContext(sessionMode);
```

- Call close() after use, or create in a try-with-resources block
- Can also be injected (into a Java EE web or EJB application)

JMSContext (2/2)

- Can also create from an existing JMSContext (to reuse its connection – Java SE only)

```
JMSContext context2 = context1.createContext(sessionMode);
```

- Used to create JMSProducer objects for sending messages
- Used to create JMSConsumer objects for receiving messages
- Methods on JMSContext, JMSProducer and JMSConsumer throw only unchecked exceptions

JMSProducer

- Messages are sent by creating a JMSProducer object
  - does *not* encapsulate a MessageProducer so is lightweight
  - supports method chaining for a fluid style
- JMS 1.1

```
MessageProducer producer = session.createProducer();
producer.send(destination,message);
```

- JMS 2.0

```
JMSProducer producer = context.createProducer();
producer.send(destination,message);
```

JMSProducer

Setting message delivery options using method chaining

- JMS 1.1

```
MessageProducer producer = session.createProducer();
producer.setDeliveryMode(DeliveryMode.NON_PERSISTENT);
producer.setPriority(1);
producer.setTimeToLive(1000);
producer.send(destination,message);
```

- JMS 2.0

```
context.createProducer().setDeliveryMode(DeliveryMode.NON_PERSISTENT).
   setPriority(1).setTimeToLive(1000).send(destination,message);
```

JMSProducer

Setting message properties and headers

- JMS 1.1 (need to set on the message)

```
MessageProducer producer = session.createProducer();
TextMessage textMessage = session.createTextMessage("Hello);
textMessage.setStringProperty("foo","bar");
producer.send(destination,message);
```

- JMS 2.0 (can also set on the JMSProducer)

```
context.createProducer().setProperty("foo","bar").send(destination,"Hello");
```

JMSProducer

Sending message payloads directly

- Methods on JMSProducer to send a Message
  - `send(Destination dest, Message message)`
- No need to create a Message
  - `send(Destination dest, Map<String,Object> payload)`
  - `send(Destination dest, Serializable payload)`
  - `send(Destination dest, String payload)`
  - `send(Destination dest, byte[] payload)`
- Use methods on JMSProducer to set delivery options, message headers and message properties

JMSConsumer

- Messages are consumed by creating a JMSConsumer object
  - encapsulates a MessageConsumer
  - similar functionality and API to MessageConsumer
- Synchronous

```
JMSConsumer consumer = context.createConsumer(destination);
Message message = consumer.receive(1000);
```

- Asynchronous

```
JMSConsumer consumer = context.createConsumer(destination);
consumer.setMessageListener(messageListener);
```

- Connection is automatically started (configurable)

JMSConsumer
Receiving message payloads directly

- Methods on JMSConsumer that return a Message
  - `Message receive();`
  - `Message receive(long timeout);`
  - `Message receiveNoWait();`
- Methods on JMSConsumer that return message payload directly
  - `<T> T receivePayload(Class<T>  c);`
  - `<T> T receivePayload(Class<T> c, long timeout);`
  - `<T> T receivePayloadNoWait(Class<T> c);`

JMSConsumer
Receiving message payloads directly

```
public String receiveMessage() throws NamingException {
   InitialContext initialContext = getInitialContext();
   ConnectionFactory connectionFactory =
      (ConnectionFactory) initialContext.lookup("jms/connectionFactory");
   Queue inboundQueue = (Queue)initialContext.lookup("jms/inboundQueue");

   try (JMSContext context = connectionFactory.createContext();) {
      JMSConsumer consumer = context.createConsumer(inboundQueue);
      return consumer.receivePayload(String.class);
   }
}
```

Injection of JMSContext objects

into a Java EE web or EJB container

```
@Inject
@JMSConnectionFactory("jms/connectionFactory")
private JMSContext context;

@Resource(mappedName = "jms/inboundQueue")
private Queue inboundQueue;

public void sendMessage (String payload) {
   context.createProducer().send(inboundQueue, payload);
}
```

Injection of JMSContext objects

into a Java EE web or EJB container

```
@Inject
@JMSConnectionFactory("jms/connectionFactory")
private JMSContext context;

@Resource(mappedName = "jms/inboundQueue")
private Queue inboundQueue;

public void sendMessage (String payload) {
   context.createProducer().send(inboundQueue, payload);
}
```

Use @Inject to inject the JMSContext, specifying connection factory to use

Container will close JMSContext automatically at end of transaction

Injection of JMSContext objects

into a Java EE web or EJB container

- Connection factory will default to platform default JMS

```
@Inject private JMSContext context;
```

- Specifying session mode

```
@Inject
@JMSConnectionFactory("jms/connectionFactory")
@JMSSessionMode(JMSContext.AUTO_ACKNOWLEDGE)
private JMSContext context;
```

- Specifying user and password (may be aliased)

```
@Inject
@JMSConnectionFactory("jms/connectionFactory")
@JMSPasswordCredential(userName="admin",password="mypassword")
private JMSContext context;
```

Injection of JMSContext objects

into a Java EE web or EJB container

- Injected JMSContext objects have a scope
  - In a JTA transaction, scope is the transaction
  - If no JTA transaction, scope is the request
- JMSContext is automatically closed when scope ends
- Inject two JMSContext objects within the same scope and you get the same object
  - if @JMSConnectionFactory, @JMSPasswordCredential and @JMSSessionMode annotations match
  - Makes it easier to use same session within a transaction

JMS 2.0:
New API features

Making durable subscriptions easier to use

- Durable subscriptions are identified by {clientId, subscriptionName}
- ClientId will no longer be mandatory when using durable subscriptions
- For a MDB, container will generate default subscription name (EJB 3.2)

Delivery delay

- Allows a JMS client to schedule the future delivery of a message
- New method on MessageProducer

```
public void setDeliveryDelay(long deliveryDelay)
```

- New method on JMSProducer

```
public JMSProducer setDeliveryDelay(long deliveryDelay)
```

- Sets minimum time in ms from that a message should be retained by the messaging system before delivery to a consumer
- *Why?* If the business requires deferred processing, e.g. end of day

Async send

- Send a message and return immediately without blocking until an acknowledgement has been received from the server.
- Instead, when the acknowledgement is received, an asynchronous callback will be invoked
- New methods on MessageProducer

```
messageProducer.send(message,completionListener)
```

- Feature also available on JMSProducer
- *Why?* Allows thread to do other work whilst waiting for the acknowledgement

Async send

- Application specifies a CompletionListener instance

```
public interface CompletionListener {
   void onCompletion(Message message);
   void onException(Message message, Exception exception);
}
```

Better handling of "poison" messages

Make JMSMXDeliveryCount mandatory

- JMS 1.1 defines an optional JMS defined message property **`JMSXDeliveryCount`**.
  - When used, this is set by the JMS provider when a message is received, and is set to the number of times this message has been delivered (including the first time). The first time is 1, the second time 2, etc
- JMS 2.0 will make this mandatory

- *Why?* Allows app servers and applications to handle "poisonous" messages better

Multiple consumers on a topic subscription

- Allows scalable consumption of messages from a topic subscription
  - multiple threads, multiple JVMs
- New methods needed for non-durable subscriptions

```
MessageConsumer messageConsumer=
    session.createSharedConsumer(topic,sharedSubscriptionName);
```

- Existing methods used for durable subscriptions

```
MessageConsumer messageConsumer=
    session.createDurableConsumer(topic,durableSubscriptionName);
```

- Also available on JMSContext

Easier definition of JMS resources in Java EE

Joint effort with
JSR 342 (Java EE 7 platform)

Easier definition of JMS resources in Java EE

The problem

- Java EE and JMS recommend applications should obtain JMS ConnectionFactory and Destination resources by lookup from JNDI

```
@Resource(lookupName = "jms/inboundQueue")
private Queue inboundQueue;
```

- Keeps application code portable
- Creating these resources is a burden on the deployer, and is non-standard

Platform default connection factory

Making the simple case simple

- if you simply want to use the application server's built in JMS

```
@Resource(lookup="java:comp/defaultJMSConnectionFactory")
ConnectionFactory myJMScf;
```

Easier definition of JMS resources in Java EE

New optional feature in Java EE 7

- Application may specify the JMS connection factories and JMS destinations that it needs using annotations
- Deployer can further define requirements using deployment descriptor elements
- Application server can use this information to create resources automatically when application is deployed
- The JMS equivalent to @DataSourceDefinition annotations
- Supporting these automatically is *optional*

Easier definition of JMS resources in Java EE

Application defines required resources using annotations

```
@JMSConnectionFactoryDefinition(
    name="java:global/jms/demoConnectionFactory",
    className= "javax.jms.ConnectionFactory",
    description="ConnectionFactory to use in demonstration")
```

```
@JMSDestinationDefinition(
    name = "java:global/jms/demoQueue",
    description = "Queue to use in demonstration",
    className = "javax.jms.Queue",
    destinationName="demoQueue")
```

- Can also specify deployment-specific properties via annotations, but these are best added at deployment time

Easier definition of JMS resources in Java EE

Deployer adds further requirements using deployment descriptor

```
<jms-destination>
   <name>"java:global/jms/demoQueue</name>
   <class-name>javax.jms.Queue</class-name>
   <resource-adapter-name>jmsra</resource-adapter-name>
   <destination-name>demoQueue</destination-name>
</jms-destination>
```

```
 <jms-connection-factory>
   <name>java:global/jms/demoConnectionFactory</name>
   <property>
      <name>addressList</name>
      <value>mq://localhost:7676</value>
   </property>
   <max-pool-size>30</max-pool-size>
   <min-pool-size>20</min-pool-size>
   <max-idle-time>5</max-idle-time>
</jms-connection-factory>
```

non-standard properties may be specified if needed

More standardized configuration of JMS MDBs

Joint effort with JSR 345 (EJB 3.2)

More standardized configuration of JMS MDBs

- Configuration of JMS MDBs is surprisingly non-standard
- EJB 3.1 does not define how to specify
  - JNDI name of queue or topic (using annotation)
  - JNDI name of connection factory
  - clientID
  - durableSubscriptionName
- EJB 3.1 does not define how topic messages delivered to clustered MDBs

More standardized configuration of JMS MDBs

New activation property to specify the queue or topic

```
@MessageDriven(activationConfig =  {
   @ActivationConfigProperty(
      propertyName = "destinationLookup",
      propertyValue = "jms/myTopic"),
   . . .
})
```

- Can also be configured in **`ejb-jar.xml`**

More standardized configuration of JMS MDBs

New activation property to specify the connection factory

```
@MessageDriven(activationConfig =  {
   @ActivationConfigProperty(
      propertyName = "connectionFactoryLookup",
      propertyValue = "jms/myCF"),
   . . .
})
```

- Can also be configured in **`ejb-jar.xml`**

More standardized configuration of JMS MDBs

New activation properties to specify durable subscriptions

```
@MessageDriven(activationConfig =  {
   @ActivationConfigProperty(
      propertyName = "subscriptionDurability",
      propertyValue = "Durable"),
   @ActivationConfigProperty(
      propertyName = "clientId",
      propertyValue = "myClientID"),
   @ActivationConfigProperty(
      propertyName = "subscriptionName",
      propertyValue = "MySub"),
   . . .
})
```

- Surprisingly, these have never been standardized before

Easier configuration of durable subscriptions

No need to specify clientId and subscription name

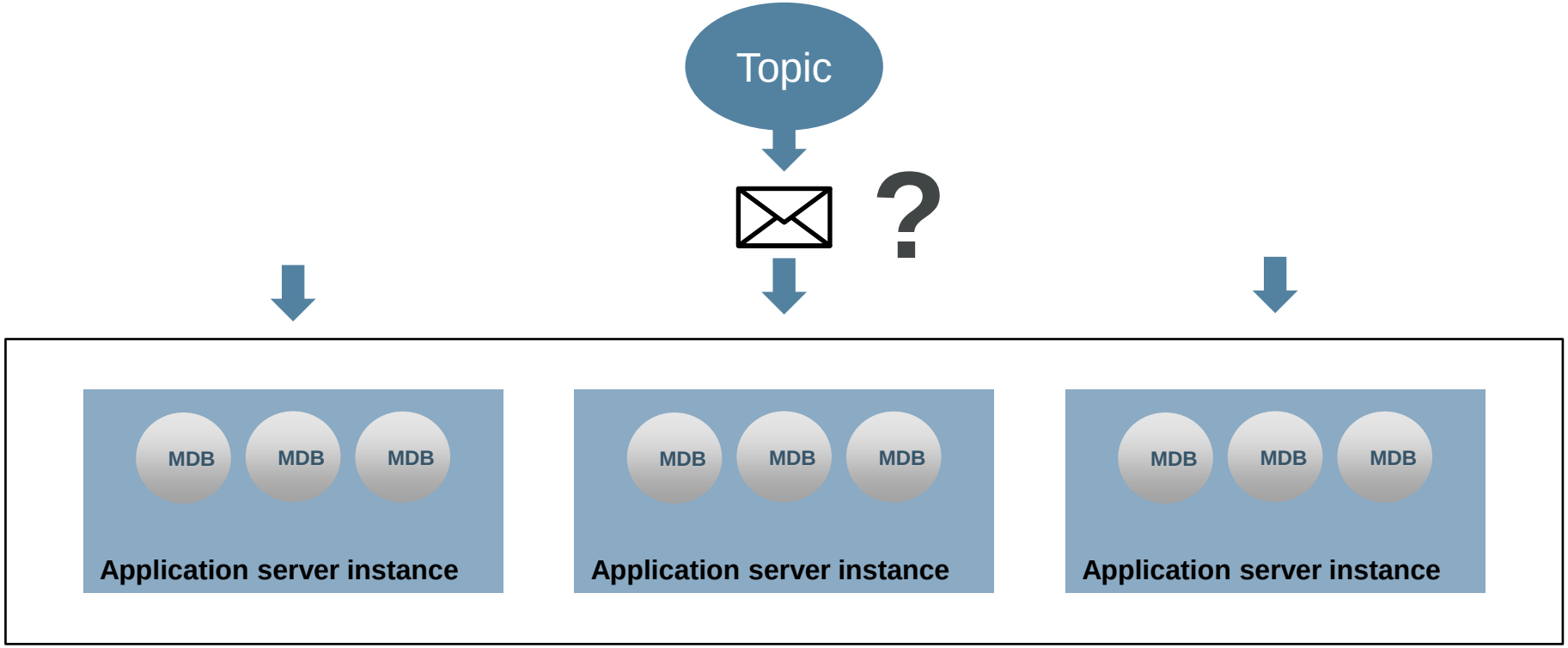
```
@MessageDriven(activationConfig =  {
   @ActivationConfigProperty(
      propertyName = "subscriptionDurability",
      propertyValue = "Durable"),
   @ActivationConfigProperty(
      propertyName = "clientId",
      propertyValue = "myClientID"),
   @ActivationConfigProperty(
      propertyName = "subscriptionName",
      propertyValue = "MySub"),
   . . .
})
```

clientId no longer required for durable subscriptions

if subscription name is omitted, the container generates a suitable name

Topic delivery to clustered application servers

One message per instance or one message per cluster?



Application server cluster

Topic delivery to clustered application servers

- Defined behavior if **subscriptionName** and **clientId** not set
  - each message will be delivered once per cluster
  - clustered app server instances will share the same subscription
- To disable, set **sharedSubscriptions** activation property to **false**
  - each message will be delivered once per instance
  - each app server instance will have a separate subscription
- Applies to both durable and non-durable subscriptions

Improved Java EE pluggability

Improved Java EE pluggability

- The goal
  - To make it easier to use a particular JMS provider in different Java EE application servers
  - e.g. GlassFish application sending messages to WebLogic JMS
- The solution
  - To require JMS providers to supply a JCA resource adapter

Improved Java EE pluggability

using the Java Connector Architecture (JCA)

- Java Connector Architecture is designed for this:
  - for integrating pooled, transactional resources in an application server
  - for async processing of messages by MDBs
- JCA support already mandatory in Java EE
- Many JMS vendors already provide JCA adapters
- **JMS 2.0 will make provision of a JCA adaptor mandatory**
- Should be invisible to applications!

What's new in JMS 2.0

- Simplicity and ease of use
- New messaging features
  - multi-threaded topic subscribers
  - delivery delay
  - async send
- Better Java EE integration
  - simpler resource configuration
  - standardized configuration of JMS MDBs
  - better application server pluggability
- Minor corrections and clarifications

Where to find out more

- See the demo at the Java EE booth in the DemoGrounds
- Come to the BOF tomorrow
- Read the draft spec and API docs at jms-spec.java.net
- Join users@jms-spec.java.net and send questions and comments
- Try the latest GlassFish and Open Message Queue builds

Try the new features as they are added

JMS 2.0, EJB 3.2 and Java EE

- GlassFish 4.0
  - http://glassfish.java.net/
  - http://dlc.sun.com.edgesuite.net/glassfish/4.0/promoted/
- Open Message Queue 5.0
  - http://mq.java.net/
  - http://mq.java.net/5.0.html
- These are not finished!

Any questions?

More time for questions and comments at our BOF tomorrow

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Tuesday 2 Oct 2012
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