JMS 2.0 – An Introduction

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Introduction & Aims

- Aims for you:
  - Get some education on what's new and different in JMS 2.0
- Aims for us:
  - How much interest is there in JMS 2.0?
  - What business use cases for the new features can you think of?

References:

- JMS 2.0 – JSR 343 Java Message Service (JMS 2.0)
  - http://jcp.org/en/jsr/detail?id=343
- Final release on 21 May 2013.
  - https://java.net/projects/jms-spec/pages/JMS20FinalRelease

Headlines – What's new? [§1.2]

- *Specification updates and clarifications*
  - Point to Point *AND* Publish/Subscribe domains required
- *New Messaging Features*
  - Delivery Delay
  - Asynchronous Send
  - Subscriptions can be shared across a messaging provider
- *API Changes*
  - Use of `java.lang.AutoCloseable`
  - Simplified API
  - Session doesn't need parameters (for JavaEE)
- *JavaEE Updates*
  - *Recommendation* on provision of a Resource Adapter, and clarifications
  - Part of Java EE 7 (and uses Java 7 Runtime class libraries)

Simplified API

Messaging Features

JavaEE

Updates

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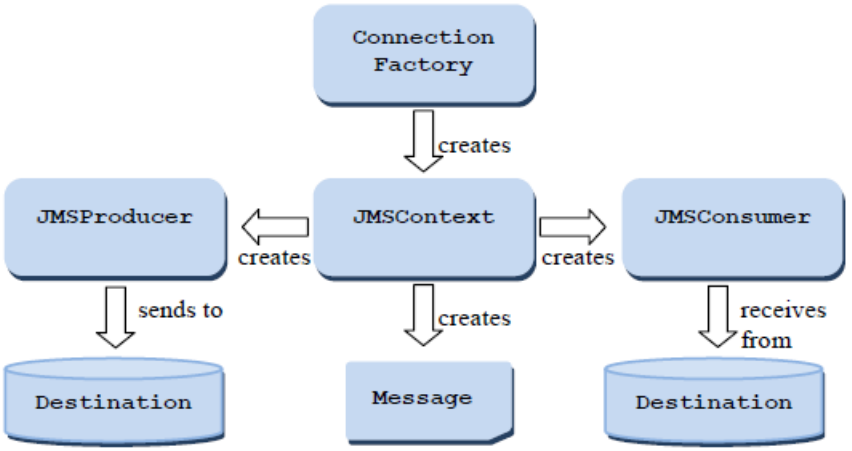
Architecture & Simplified API [§2]

- Overall architecture still the same
- Best practices all the same
- Still a specification for a messaging and and state model

- *Simplified API*
  - New set of interface to reduce number of objects needed
  - Make easier to use within both JavaEE and JavaSE
  - Faster access to data for creating and manipulating message objects
  - Error handling changes

Simplified API [§2.8]

- **ConnectionFactory**
  an administered object to create a Connection. As used by the classic API.
- **JMSContext**
  an active connection to a JMS provider and a single-threaded context for sending and receiving messages
- **JMSProducer**
  created by a **JMSContext,** used for sending messages to a queue or topic
- **JMSConsumer**
  created by a **JMSContext,** used for receiving messages sent to a queue or topic



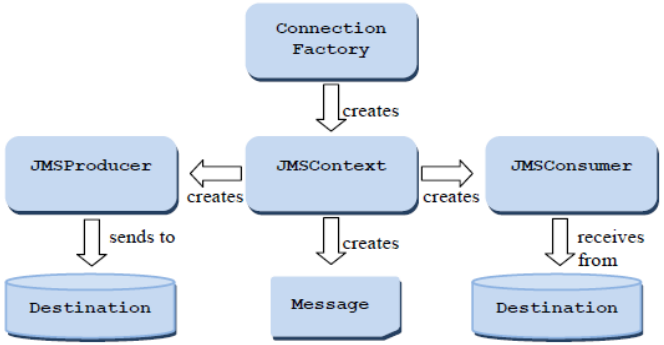
- All based on JMS1.1 *Unified Domain* concepts

JMSContext Features [§6]

- Connection and Session abstraction
- eg. Temporary destinations – for JMSContext scoped by concept of underlying connection

- AutoStart of underlying connection – i.e. can forget to forget starting the connection
- Can create duplicate JMSContext, but using same underlying connection.

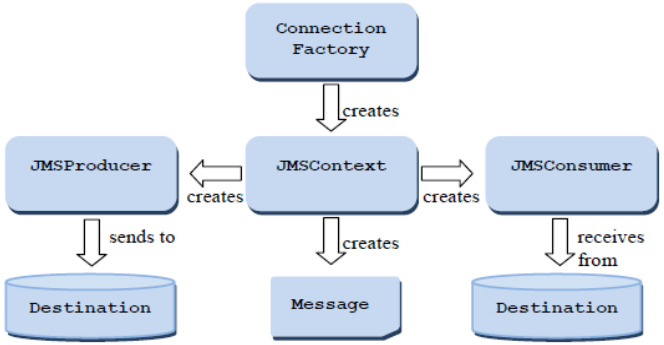
- Application Managed – from `createContext()` on ConnectionFactory
- Container Managed - @Inject annotation



Producing Messages [§7]

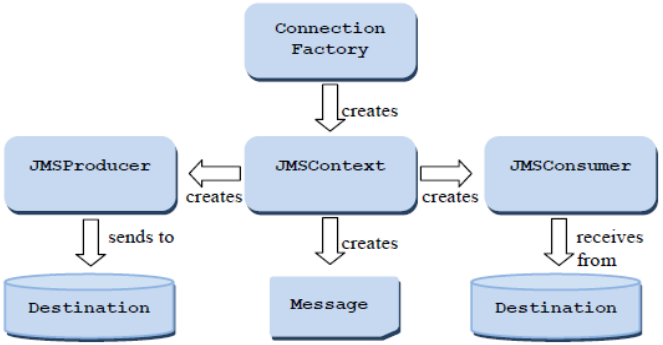
- **JMSProducer**
  - Can take on role of being 'proxy' message object.
  - Message properties set on the producer object prior to sending a 'body'
  - Existing MessageProducers can't do that; though have been extended for new messaging styles
  - Method chaining
  - 'lightweight object' therefore no close

```
11      producer.setProperty("MyProperty", "JMS2.0").send(destination, "SimplePTP: ");
12
13      context.createProducer().setTimeToLive(1000).setDeliveryMode(NON_PERSISTENT).send(dataQueue, body);
```



Consuming messages [§8]

- Async and Sync consumption as before
- **JMSConsumer**
  - `ReceiveBody(...)` methods - message bodies only.
  - Not completely symmetrical with sending – i.e. if want properties still need a message object
- Can closed from another thread
  - Waits on in-progress consumption to finish

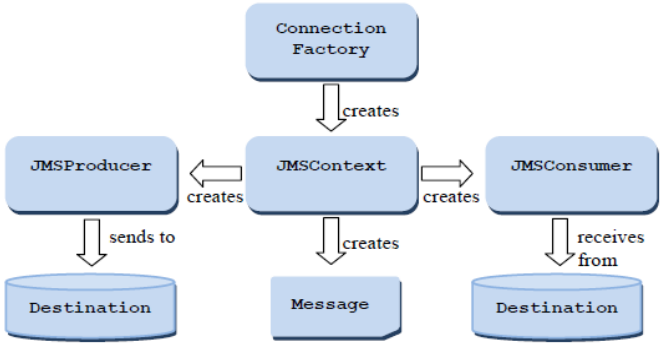


Messages [§3]

- Message Body only
  - JMSProducer/JMSConsumers can now work with the message bodies without message objects
  - Message's getBody method

- After sending message, application free to modify message

- JMSXDeliveryCount mandatory [§3.5.11]
  - Doens't have to be exactly correct – i.e. no persistence of value required
  - If JMSRedelivered=true, then JMSXDevlieryCount>=2



Receiving Message Bodies Synchronously [§8.6]

- `<T> T receiveBody( Class<T> c)`
  - Receives the next message produced for this JMSConsumer and returns its body as an object of the specified type
- `<T> T receiveBody( Class<T> c, long timeout)`
  - Receives the next message produced for this JMSConsumer that arrives within the specified timeout period, and returns its body as an object of the specified type
- `<T> T receiveBodyNoWait( Class<T> c)`
  - Receives the next message produced for this JMSConsumer if one is immediately available and returns its body as an object of the specified type
- Can throw a MessageFormatRuntimeException if wrong class used
  - If AUTO_ACK, will be as if method never called
  - ..else will be as if method failed, app must force rollback

Body Conversions

```
15      Message receivedMessage = consumer.receive(15000);
16      System.out.println("Received message:\n" + receivedMessage.getBody(String.class));
17      System.out.println(receivedMessage.getStringProperty("MyProperty"));
18
19      System.out.println("Message Body"+consumer.receiveBody(String.class));
```

Message Type	Parameter
TextMessage	String.class
ObjectMessage	Java.io.Serializable
MapMessage	Java.util.Map or java.lang.Object
BytesMessage	byte[].class
Message	*Always returns null*
<nobody>	*Always returns null*

JMS 1.1 Interfaces Updates [§6.1]

- **Connections**
  - New methods for creating session with no transaction arguments
  - Shared Connection Consumers
- **Sessions**
  - Creating share consumers
  - Creating JMS1.1 MessageConsumer for durable subscriptions
- **Message Producer**
  - New set/get for Delivery Delay
  - Send methods extended to supply Completion Listener
- **Message Consumer**
  - No change
- **Message**
  - For delivery delay – getJMSDeliveryTime()
  - New methods to directly access body data, getBody() isBodyAssignableTo()

Java 7 - Auto-Closeable

- Java 7 gives large variety of
  - new functions – class libraries
  - Java Language enhancements
  - New class file version
- JMS2.0 drives Java 7 specifically because of the try-with-resources enhancement

```
2   ConnectionFactory cf = createConnectionFactory();
3   try {
4     // Create JMS objects
5     connection = cf.createConnection();
6   } catch (JMSException jmsex) {
7     recordFailure(jmsex);
8   } finally {
9     if (connection != null) {
10      try {
11        connection.close();
12      } catch (JMSException jmsex) {
13        System.out.println("Connection could not be closed.");
14        recordFailure(jmsex);
15      }
16    }
17  }
```

```
2   ConnectionFactory cf = createConnectionFactory();
3
4   try (JMSContext jmsctx = cf.createContext();) {
5     producer = jmsctx.createProducer();
6   } catch (Exception jmsex) {
7     recordFailure(jmsex);
8   }
```

Exceptions and Exception Listeners [§10]

- New exception **`JMSRuntimeException`** thrown from new API calls
- JavaDoc shows mandatory cases
  - ...but... provider may thrown these for other cases as well

- Exceptions thrown on a JMS calls, <u>must not</u> be delivered to an ExceptionListener

- Compiler will not force you to do error checking
- Must take responsibility for doing it at suitable points

Simplified API

Messaging Features

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New messaging features - recap

- **Asynchronous Send**
  - Application sends messages via API that returns before server has processed messages
  - Confirmation via listener
- **Delayed Delivery**
  - Allow delivery at a later point in time
  - (not a database)
- **Shared Subscriptions**
  - Subscription which can opened by multiple consumers
  - Messages shared amongst consumers (no fairness rules provided)

Subscriptions
[§8.3 §4.2]

- **Unshared non-durable subscriptions**
  - As per JMS 1.1. non-durable subscription
- **Shared non-durable subscription**
  - Identified by 'sharedSubscriptionName' and 'clientId' if set
  - If clientId is set, all consumers must share the same clientId
  - Subscription/undelivered messages deleted when last consumer is closed
- **Unshared Durable Subscriptions**
  - As per JMS 1.1 Durable subscriptions
- **Shared Durable Subscriptions**
  - Has the features of a durable subscription but pulls in multiple consumers aspect
  - ClientId is optional
- Same 'sharedSubscriptionName' can be used for durable and non-durable

Asynchronous Send [§7.3]

- *Synchronous Send* means
  - Send message and wait for a response before returning from send call
- *Asynchronous Send* means
  - Send message and return from the send call before response from server

- Closing must wait for failure or completion of async sends
- Callbacks made in the same order the messages where sent
- Message objects not multi-threaded – don't modify until onCompletion
- `CompletionListener` called when response has been received.
  - Does not work like message listener in terms of thread of control
- Quality of Service
  - After `onCompletion` equal to sync send(...)

Message Delivery Delay [§7.9]

- Earliest Time JMS provider may give message to consumer
- Sets the minimum length of time (in ms) that must elapse after a message is sent before the JMS provider may deliver the message to a consumer
- For transacted sends, this time starts when the client sends the message, not when the transaction is committed.
- Delivery Delay set longer than expiry is an error!

Simplified API

Messaging Features

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JMS and JavaEE
[§12 §13]

- JMS one of the constituent specifications of JavaEE
- JavaEE 7 brings in JMS 2.0

- ASF Mode still present – extended for Shared Subscriptions
- Context APIs also include XA variants
- MDB Activation Specifications main way of driving messages into JavaEE

- Strongly *Recommended* to provide a JCA Resource Adapter

JMS and JavaEE – API updates [§12 §13]

- Prescriptive list of APIs that can not be called in the containers
  - No message listeners
  - Single session / connection
  - No connection consumers
  - No Asynchronous Send
  - Transaction control etc.

- Session/Context APIs - No local transactions or client acknowledgement
  - `javax.jms.Connection.createSession()`
  - `javax.jms.ConnectionFactory.createContext()`

Injection of JMSContext [§12.4.3]

- Can declare a JMSContext and annotate it with javax.inject.Inject annotation

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

- Specifying the Connection Factory to use

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

- With optional credentials

```
@JMSPasswordCredential(userName="admin",password="mypass
word")
@JMSPasswordCredential(username="admin",password="$
{ALIAS=myAdminPassword}")
```

- With container-applicable session mode

```
@JMSSessionMode(JMSContext.AUTO_ACKNOWLEDGE)
```

Scope of inject JMSContext

- Different depending if a JTA Transaction in progress or not.

- JTA transaction (*cf.* JTA Specification)
  - the scope will be @TransactionScoped.
  - automatically created the first time a method called within the transaction.
  - JMSContext will be automatically closed when the transaction is committed or rolled back.
  - Within the same JTA transaction, JMSContext injected using identical annotations will refer to the same JMSContext object.
- no JTA transaction (*cf.* CDI Specification)
  - the scope will be @RequestScoped.
  - automatically created the first time a method called within a request.
  - JMSContext will be automatically closed when the request ends.
  - Within the same request, JMSContext injected using identical annotations will refer to the same JMSContext object.

Resource Adapter [§13]

- Assumption that one will be provided

- Two additional properties for an activation specification
- *destinationLookup*
  - the JNDI name of javax.jms.Queue or javax.jms.Topic that defines the JMS queue or topic for the MDB
- *connectionFactoryLookup*
  - the JNDI name of javax.jms.ConnectionFactory, used to connect to the JMS provider

Simplified API

Messaging Features

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Updates

Notable specification Clarifications

- [§A.1.19 / §6.1.5]

  Stop blocks until message listeners complete. Listener must not attempt to stop it's own connection → IllegalStateException

- [§A.1.17]

  Message may be sent from any session

- [§A.1.18 / §6.1.7]

  Exception Listener clarifications
  - Exceptions from API should be thrown to listener
  - Stop/close must wait for exceptions to be delivered
  - Exception Listener can use API

Notable specification Clarifications

- [§A.1.20]

  noLocal and Durable Subscriptions
  - –Messages sent on the same connection or ClientID are subject to noLocal
  - –ClientIDs can only be used by one active connection at a time
- [§A.1.21]
  Defines properties that will be ignored if set by the application
- [§A.1.16]
  Minimum set of characters valid for a subscription name, must permit 128 length