

# CmpE 473

## Internet Programming

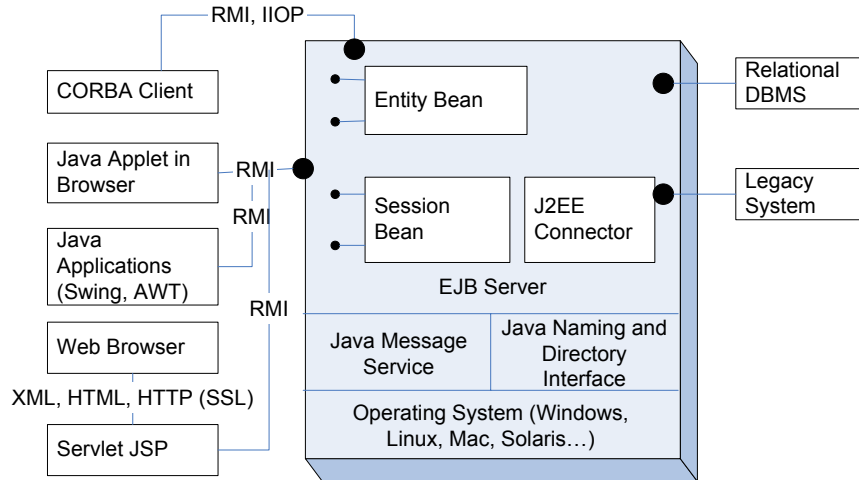
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## Chapter 6

### Enterprise Architectures

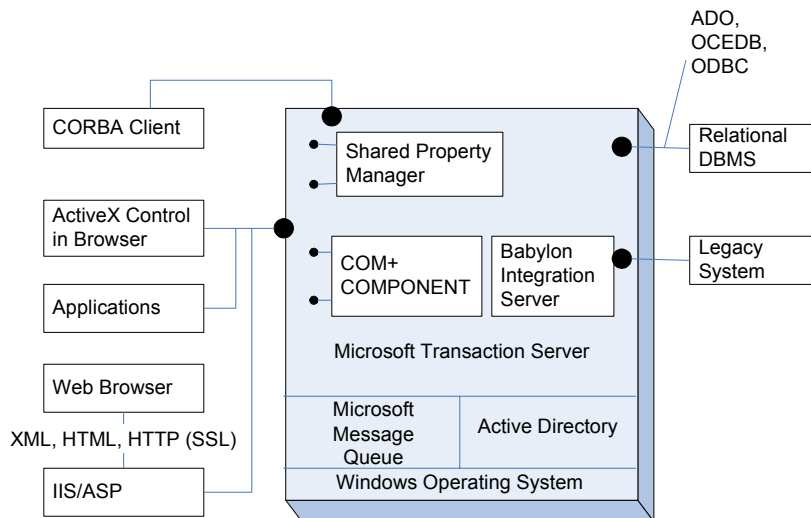
# J2EE Technology



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# .NET Technology



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## Messaging

- **Between loosely-coupled systems**
  - A component sends a message to a destination
  - The receiver picks it up whenever it wants
- **Asynchronous**
  - Messages delivered as recipients become online
- **Contrast with RMI**
  - No need to know the internal details of others
  - No need to be available at the same time
- **JMS: Java API**

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## When to use it?

- Components should not depend on others' interfaces
- Application should run even when some components are not available
- Components can work without receiving immediate responses (non-blocking)

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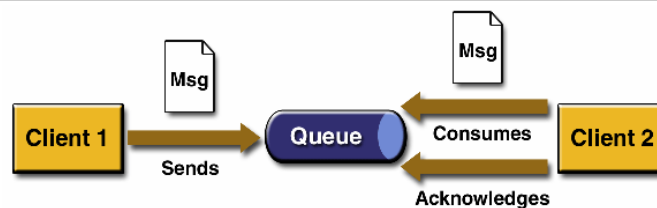
## JMS API

- JMS Provider implements JMS interface
  - Comes in J2EE
- JMS Clients produce and consume messages
- Messages are the communication objects
- Providers implement point-to-point and publish/subscribe

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## Point-to-Point

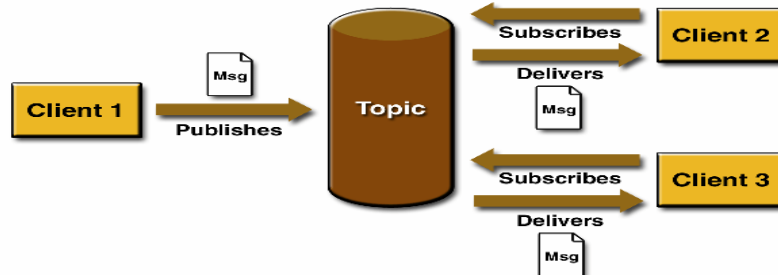


- Client1 produces messages for a particular queue
- Client2 consumes the messages and acknowledges receipt
- Queue keeps messages until they are consumed or until they expire

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## Publish/Subscribe



- Multiple producers; multiple consumers
- Topic retains messages until all subscribers are receive them
- Consumers start consuming after they subscribe

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## Message Consuming

- Conceptually asynchronous:
  - No need to be available at the same time
- Synchronous access:
  - Subscriber or receiver fetches messages by calling `receive`
  - Either blocks or wait for a time period
- Asynchronous access:
  - Consumer registers with a `message listener`
  - When a message arrives at the destination, JMS provider calls client's `onMessage` method
  - Similar to the JAVA delegation event model

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## Administered Objects

- Connection Factories
  - Object used by the client to connect to the provider
  - Contains configuration information
  - Instance of the following interfaces
    - QueueConnectionFactory
    - TopicConnectionFactory
  - **Default QueueConnectionFactory and TopicConnectionFactory objects**

## Connection Factories

```
Context ctx = new InitialContext();
• Looks for jndi.properties file
• JNDI implementation and namespaces to use
QueueConnectionFactory queueConnectionFactory
= (QueueConnectionFactory)
ctx.lookup("QueueConnectionFactory");
TopicConnectionFactory topicConnectionFactory =
(TopicConnectionFactory)
ctx.lookup("TopicConnectionFactory");
```

## Destination

- Target for produced messages
- Source for consumed messages
- Create a queue or a topic
  - `j2eeadmin -addJmsDestination queue_name queue`
  - `j2eeadmin -addJmsDestination topic_name topic`
- To look up a destination
  - `Queue myQueue = (Queue) ctx.lookup("MyQueue");`

## Connection

- Denotes a virtual connection with the provider
- Use connection to create sessions
  - `QueueConnection queueConnection = queueConnectionFactory.createQueueConnection();`
- Close the connection at the end
  - `queueConnection.close();`

## Session

- Context for producing and consuming messages
- Used to create messages, message producers, and consumers
- Transaction option
  - Two values: Transaction set and acknowledgement
  - QueueSession queueSession =  
queueConnection.createQueueSession(true, 0);
  - TopicSession topicSession =  
topicConnection.createTopicSession(false,  
Session.AUTO\_ACKNOWLEDGE);
- Session.CLIENT\_ACKNOWLEDGE:
  - Acknowledges all messages consumed so far

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## Message Producer

- Used for sending messages to a destination
- Create a message producer
  - QueueSender queueSender =  
queueSession.createSender(myQueue);
  - TopicPublisher topicPublisher =  
topicSession.createPublisher(myTopic);
- Send a message
  - queueSender.send(message);

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## Message Consumer

- Used for receiving messages from a destination
- Create a message consumer
  - `QueueReceiver queueReceiver = queueSession.createReceiver(myQueue);`
  - `TopicSubscriber topicSubscriber = topicSession.createSubscriber(myTopic);`
- Start the connection
  - `queueConnection.start();`
- Receive messages synchronously
  - `Message m = queueReceiver.receive();`

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## Message Listener

- Asynchronous message handler object
- Implements `MessageListener` interface
  - `onMessage(Message)` method
  - `TopicListener` implements `MessageListener`
  - `TopicListener topicListener = new TopicListener();`
- Register the message listener with a `TopicSubscriber`
  - `topicSubscriber.setMessageListener(topicListener);`
- Start the connection
  - `queueConnection.start();`
- Consumer calls `messageListener`'s `onMessage`

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## Message

- Contains header (required), properties, body
- Message header
  - Send or publish method sets the following
    - JMSDestination, JMSDeliveryMode (Default persistent)
    - JMSExpiration (Default: No expiration), setTimeToLive
    - JMSPriority (Range: 0—9; Default:4)
    - JMSMessageID, JMSTimestamp
  - Client sets the following
    - JMSCorrelationID, JMSReplyTo, JMSType
  - JMS Provider sets: JMSRedelivered

## Message

- Message body
  - TextMessage: java.lang.String object (for XML)
  - MapMessage: Name (string)/ value (primitive) pairs
  - BytesMessage: A stream of bytes
  - StreamMessage: A stream of primitive values
  - ObjectMessage: A serializable Java object
  - Message: No body

## Example

- To create and send a text message  

```
TextMessage message = queueSession.createTextMessage();  
message.setText(msg_text); // msg_text is a String  
queueSender.send(message);
```
- On the receiving side, cast the message as needed  

```
Message m = queueReceiver.receive();  
if (m instanceof TextMessage) {  
    TextMessage message = (TextMessage) m;  
    System.out.println("Reading message: " +  
        message.getText());  
} else { // Handle error }
```

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## Exceptions

- JMS exceptions descend from `JMSException`
  - `IllegalStateException`
  - `InvalidClientIDException`
  - `InvalidDestinationException`
  - `InvalidSelectorException`
  - `JMSecurityException`
  - `MessageEOFException`
  - `MessageFormatException`
  - `MessageNotReadableException`
  - `MessageNotWriteableException`
  - `ResourceAllocationException`
  - `TransactionInProgressException`
  - `TransactionRolledBackException`

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## Point-to-Point Example

- SimpleQueueSender.java; SimpleQueueReceiver.java
- CLASSPATH contains \$J2EE\_HOME/lib/j2ee.jar; \$J2EE\_HOME/lib/locale
- Start J2EE server to start JMS Provider
  - j2ee -verbose
- Create JMS administered objects (j2eeadmin → asadmin)
  - j2eeadmin -addJmsDestination MyQueue queue
- Start the sender
  - java -Djms.properties=%J2EE\_HOME%\config\jms\_client.properties SimpleQueueSender MyQueue 3
- Start the receiver
  - java -Djms.properties=%J2EE\_HOME%\config\jms\_client.properties SimpleQueueReceiver MyQueue

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## Publish/Subscribe Example

- SimpleTopicPublisher.java; SimpleTopicSubscriber.java; TextListener.java
- Create JMS administered objects
  - j2eeadmin -addJmsDestination MyTopic topic
- Start the sender
  - java -Djms.properties=%J2EE\_HOME%\config\jms\_client.properties SimpleTopicSubscriber MyTopic
- Start the receiver
  - java -Djms.properties=%J2EE\_HOME%\config\jms\_client.properties SimpleTopicPublisher MyTopic 3
- Stop the topic
  - j2eeadmin -removeJmsDestination MyTopic
- Easier to use: <http://localhost:4848/asadmin>

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## Clients on different hosts

- Both hosts are running the J2EE Server
  - Start the server on both hosts (earth, mars)
- Create a connection factory on Earth
  - `j2eeadmin -addJmsFactory jms/EarthQCF queue`
- Create a connection factory on Mars and have it point to Earth's connection factory
  - `j2eeadmin -addJmsFactory jms/EarthQCF queue -props url=corbaname:iiop:earth:1050#earth`
- Modify the source codes so they show
  - `queueConnectionFactory = (QueueConnectionFactory) jndiContext.lookup("jms/EarthQCF");`

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## Clients on different hosts

- One host is running the J2EE Server
  - Start the server on Earth
- Create a connection factory on Earth
  - `j2eeadmin -addJmsFactory jms/EarthQCF queue`
- Use the following as an extra parameter to access the server
  - `-Dorg.omg.CORBA.ORBInitialHost=hostname`
  - `hostname: Server`
- Start the subscriber
  - `java -Djms.properties=%J2EE_HOME%\config\jms_client.properties -Dorg.omg.CORBA.ORBInitialHost=earth SimpleTopicSubscriber MyTopic`

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