NSY102

Conception de logiciels Intranet : Patrons et Canevas.

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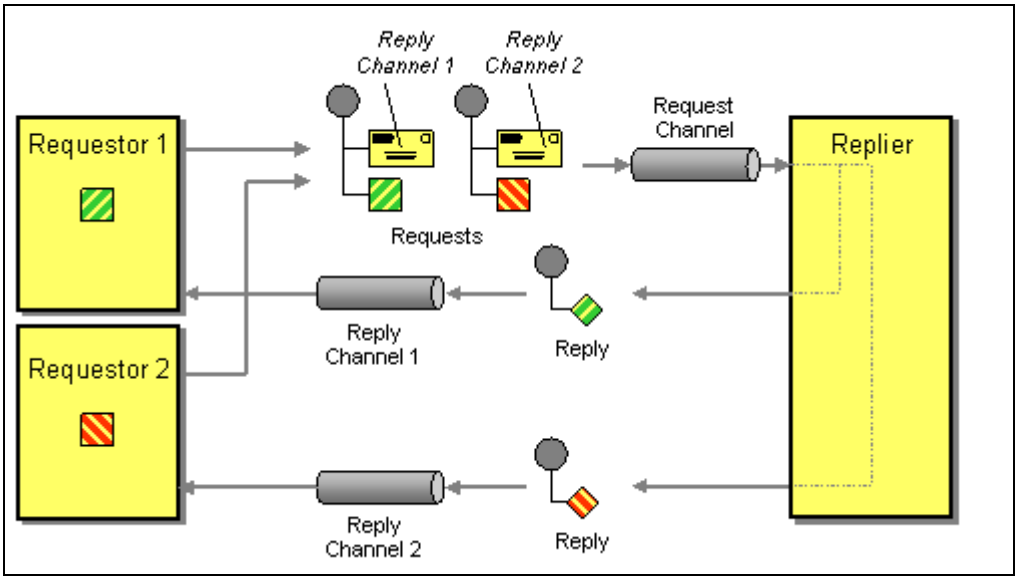
Cnam / Paris-FOD Nationale

Sommaire :

Question 1: Patron *Return Address*

Le message envoyé contient entre autres une « Adresse de Retour » qui désigne de fait le récepteur du résultat.

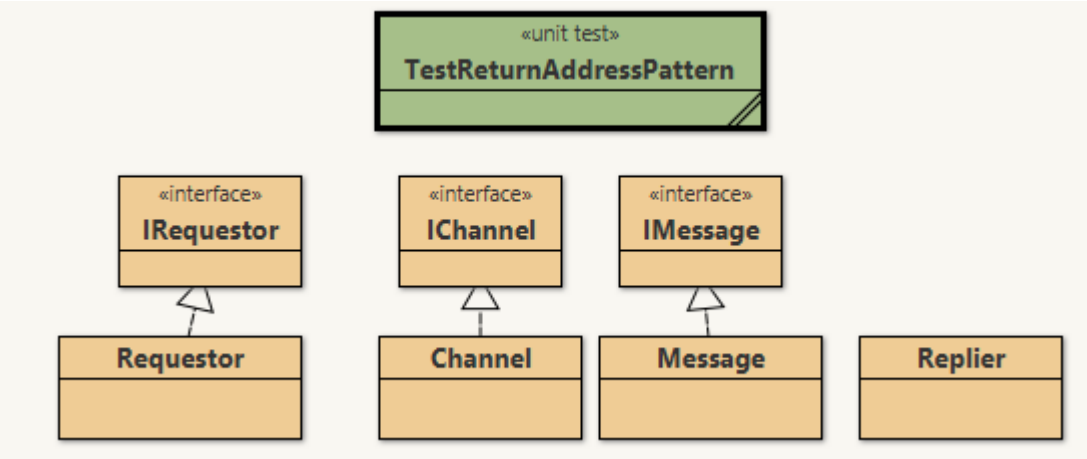


Source : http://www.enterpriseintegrationpatterns.com/ReturnAddress.html

Le message contient un canal de communication (*ReplyChannel*), sur lequel est envoyé le traitement effectué par le receveur (*Replier*). Cette encapsulation permet au receveur (*Replier*), d'ignorer le demandeur du traitement à accomplir.

Le message est transmis au receveur par le canal (*RequestChannel*). Ce message contient un « objet java » sérialisé, , , le canal pour le retour et également un champ nommé *correlationId*

Ci dessous, une architecture de classes Java en notation UML/BlueJ.



- L'interface ***IChannel,*** représente les canaux de communication

```
/** Canal de communication entre un émetteur et un récepteur.
 * Une file de messages de type LinkedBlockingQueue en interne
 * est utilisée.
 * @see java.util.concurrent.LinkedBlockingQueue
 */
public interface IChannel{

  /** Envoi d'un message sur ce canal.
    * Appel non bloquant, la file interne a une capacité ad'hoc (illimitée).
    * @param message le message envoyé
    */
  public void put(IMessage message);

  /** Réception d'un message.
   * Le récepteur est bloqué si aucun message n'est disponible.
   * @param timeOut le délai de garde au delà duquel
   * une exception (InterruptedException) est levée.
   * @return le message reçu
   * @throws InterruptedException Lorsque le délai de garde est dépassé
   */
  public IMessage get(long timeOut) throws InterruptedException;
}
```

- L'interface ***IRequestor,*** est à implémenter par les émetteurs,

```
public interface IRequestor {

  /** Envoi d'un message sur le canal RequestChannel.
   * (Le canal RequestChannel est affecté lors de la construction de l'objet)
   * @param message le message à envoyer
   */
  public void send(IMessage message) throws Exception;

  /** Réception d'un message.
   * (Le canal ReplyChannel est affecté lors de la construction de l'objet)
   * La lecture est soumise à un délai de garde.
   * @param timeout le délai de garde
   * @exception si le délai de garde est dépassé
   */
  public IMessage receive(long timeout)throws InterruptedException;
}
```

- La classe ***Replier,***
  - Le receveur contient un *thread* , dont l'exécution permet :
    - d'attendre un message sur le canal en entrée,
    - d'envoyer le résultat dans un nouveau message sur le canal *ReplyChannel* issu du message émis.

- L'interface ***IMessage*** ci-dessous, contient les accès au contenu du message, ainsi qu'au canal pour la réponse et au champ de corrélation.

```
public interface IMessage{

  public Object getContent();
  public IChannel getReplyChannel();
  public long getCorrelationId();

}
```

Ci-dessous une implémentation possible de l'interface ***IMessage*** :

```
public class Message implements IMessage{
  private Object  content;
  private IChannel replyChannel;
  private long    correlationId;

  public Message(Object content, IChannel replyChannel, long correlationId){
    this.content       = content;
    this.replyChannel  = replyChannel;
    this.correlationId = correlationId;

  }

  public Message(IMessage message){
    this.content       = message.getContent();
    this.replyChannel  = message.getReplyChannel();
    this.correlationId = message.getCorrelationId();

  }

  public Message(String content){
    this(content, null, -1L);
  }
  public IChannel getReplyChannel(){
    return replyChannel;
  }
  public Object getContent(){
    return content;
  }
  public String toString(){
    return "<" + content + "," + replyChannel + "," + correlationId + ">";
  }
  public long getCorrelationId(){
     return correlationId;
  }
  public boolean equals(Object obj){
    if(!(obj instanceof Message)) return false;
    Message msg = (Message) obj;
    return content.equals(msg.getContent()) &&
           replyChannel==msg.getReplyChannel() &&
           correlationId==msg.getCorrelationId();
  }

}
```

Ci-dessous la classe ***TestReturnAddress*** : une classe de tests, reflétant cette architecture qui est à lire **attentivement** …

```
public class TestReturnAddressPattern extends junit.framework.TestCase{


    // selon http://www.enterpriseintegrationpatterns.com/ReturnAddress.html
    public void testReturnAddressPattern() throws Exception{
            // les canaux request, reply1, reply2
            IChannel requestChannel = new Channel("Request Channel");
            IChannel replyChannel_1 = new Channel("Reply Channel 1");
            IChannel replyChannel_2 = new Channel("Reply Channel 2");

            // Requestor 1 et Requestor 2
            IRequestor requestor_1 = new Requestor(requestChannel,replyChannel_1);
            IRequestor requestor_2 = new Requestor(requestChannel,replyChannel_2);
```

```
        // Replier avec un délai de garde de 10 sec
        IReplier replier = new Replier(requestChannel, 10000);

        IMessage message1 = new Message("message_1", replyChannel_1, 1L);
        IMessage message2 = new Message("message_2", replyChannel_2, 2L);

        System.out.println("Envoi de " + message2 + " depuis requestor_2" );
        requestor_2.send(message2);
        System.out.println("Envoi de " + message1 + " depuis requestor_1" );
        requestor_1.send(message1);
        Thread.sleep(2000); // attente de quelques secondes
        IMessage received = requestor_1.receive(10000);
        System.out.println("\n\tRéception de " + received + " par requestor_1");
        assertEquals("message_1", received.getContent().toString());
        assertEquals(1L, received.getCorrelationId());

        received = requestor_2.receive(10000);
        System.out.println("\n\tRéception de " + received + " par requestor_2");
        assertEquals("message_2", received.getContent().toString());
        assertEquals(2L, received.getCorrelationId());

    }
```

La trace obtenue sur la console

```
 Envoi de <message_2,Reply Channel 2,2> depuis requestor_2
Envoi de <message_1,Reply Channel 1,1> depuis requestor_1

        Réception de <message_1,Reply Channel 1,1> par requestor_1

        Réception de <message_2,Reply Channel 2,2> par requestor_2
```

Question)

- Ecrivez les 3 implémentations suivantes
    - **Requestor, Channel, Replier**

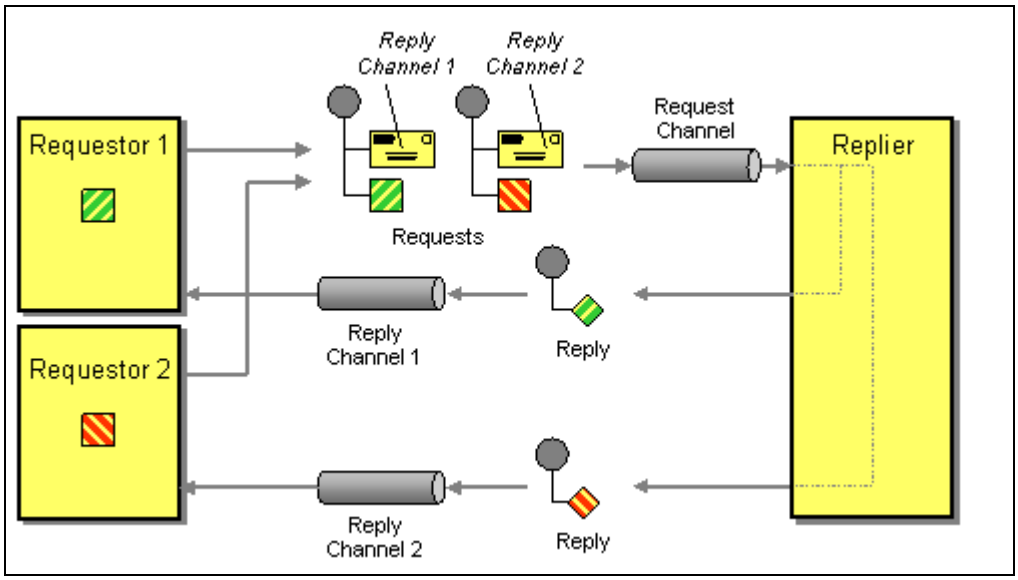
Notez que :

Pour la classe **Requestor (implements IRequestor)** l'appel de la méthode ***receive*** est bloquante (jusqu'à « l'arrivée » d'un message).

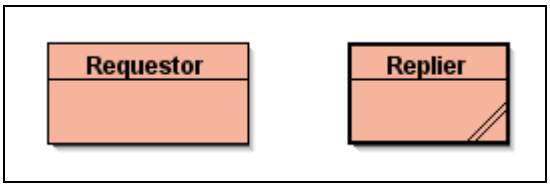
Pour la classe **Channel (implements IChannel)** une file de messages synchronisée dont la taille peut croître dynamiquement est utilisée en interne, cf. par exemple LinkedBlockingQueue.

Pour la classe **Replier** un « thread » interne permet de réceptionner un message et de le retourner tel quel, sans traitement ici, au délai de garde échu un affichage d'un message est effectué et le récepteur est de nouveau prêt à recevoir.

Question2 : Patron *ReturnAddress* avec JMS



Question2) Proposez le même patron en utilisant l'API JMS, JAVA Message Service, les files RequestChannel, ReplyChannel_1 et ReplyChannel_2 ont été créées par l'administrateur JMS.



Complétez les classes ***Requestor*** et ***Replier*** ci-dessous, en proposant respectivement les méthodes de classe *newRequestor* et *newReplier*

La classe *Requestor* à compléter :

```
public class Requestor implements MessageListener {
  private static Context context;

        // à compléter sur votre copie
```

```
 public static void main(String[] args) throws Exception{

  Hashtable<String,String> properties = new Hashtable<String,String>();
  properties.put(Context.INITIAL_CONTEXT_FACTORY, "org.exolab.jms.jndi.InitialContextFactory");
  properties.put(Context.PROVIDER_URL, "tcp://localhost:3035/");
```

```
  Requestor.context = new InitialContext(properties);

  // look up the ConnectionFactory
  ConnectionFactory factory = (ConnectionFactory) context.lookup("ConnectionFactory");

  // look up the Destination
  Destination requestChannel = (Destination) context.lookup("RequestChannel");

  // create the connection
  Connection connection = factory.createConnection();

  // args[0] le nom de la file : ReplyChannel_1 ou ReplyChannel_2
  Requestor requestor = Requestor.newRequestor(connection, requestChannel, args[0]);
  // args[1] le message
  requestor.send(args[1]); // le message
}
```

La classe *Replier* à compléter

```
      public class Replier implements MessageListener {

      private Session session;
      private static Context context;public static void main(String[] args) throws
Exception{
    // create the JNDI initial context
    // nsy102 lignes extraites de http://openjms.sourceforge.net/usersguide/using.html
    Hashtable<String,String> properties = new Hashtable<String,String>();
    properties.put(Context.INITIAL_CONTEXT_FACTORY,
"org.exolab.jms.jndi.InitialContextFactory");
    properties.put(Context.PROVIDER_URL, "tcp://localhost:3035/");

    Replier.context = new InitialContext(properties);

    // look up the ConnectionFactory
    ConnectionFactory factory = (ConnectionFactory) context.lookup("ConnectionFactory");

      // create the connection
    Connection connection = factory.createConnection();

        Replier replier = Replier.newReplier(connection, "RequestChannel");

        Thread.sleep(Long.MAX_VALUE);
      }
}
```

Question3 : Patron *Return Address* avec JMX

Question3) Proposez une implémentation java du « Channel » de la question1 permettant avec la technologie JMX d'être notifié à chaque réception, émission et exception de messages sur un canal.

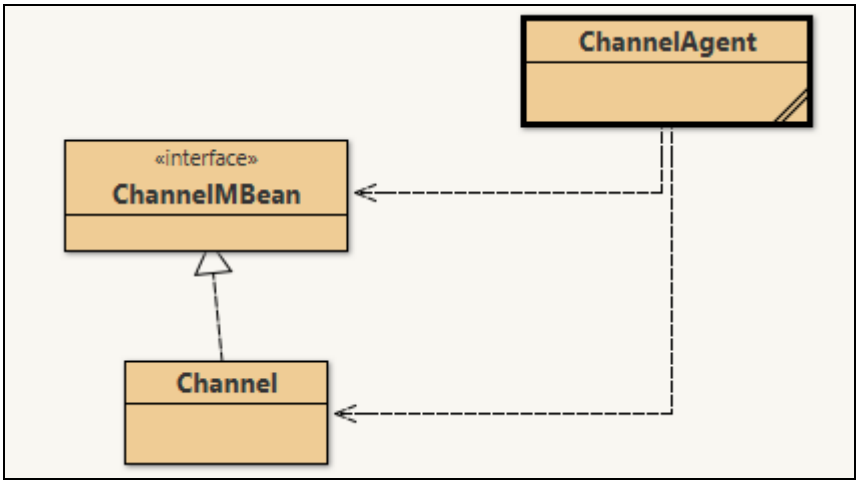
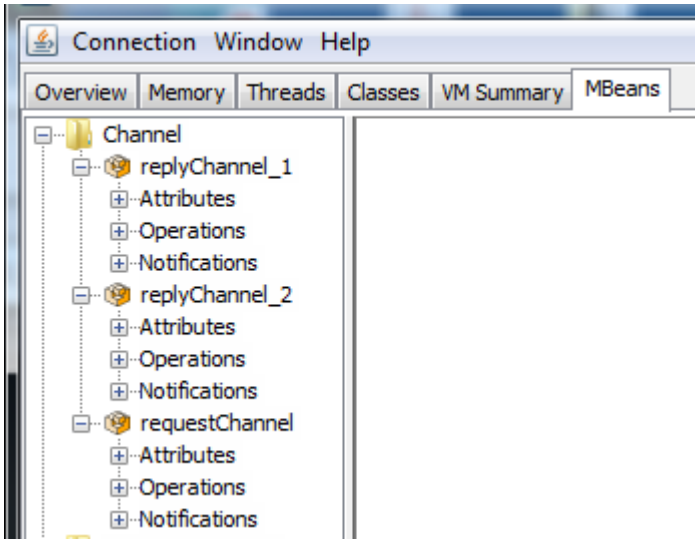
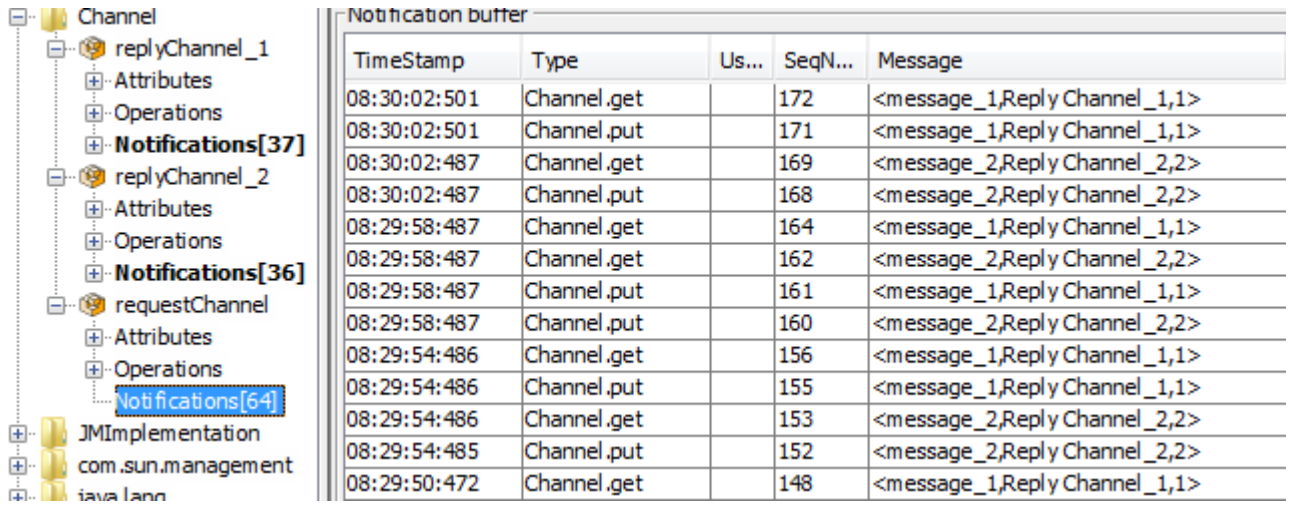


Diagramme de type "UML/BlueJ"

Proposez une interface *ChannelMBean* et une implémentation d'un canal "JMX" *Channel*, ainsi que l'agent JMX *ChannelAgent* qui se charge d'enregistrer les différents canaux auprès de la plateforme par défaut.



Une copie d'écran avec l'outil prédéfini jconsole,
ici les 3 canaux de l'exemple de la question1,
replyChannel_1, replyChannel_2, requestChannel



TimeStamp	Type	Us...	SeqN...	Message
08:30:02:501	Channel.get		172	<message_1,Reply Channel_1,1>
08:30:02:501	Channel.put		171	<message_1,Reply Channel_1,1>
08:30:02:487	Channel.get		169	<message_2,Reply Channel_2,2>
08:30:02:487	Channel.put		168	<message_2,Reply Channel_2,2>
08:29:58:487	Channel.get		164	<message_1,Reply Channel_1,1>
08:29:58:487	Channel.get		162	<message_2,Reply Channel_2,2>
08:29:58:487	Channel.put		161	<message_1,Reply Channel_1,1>
08:29:58:487	Channel.put		160	<message_2,Reply Channel_2,2>
08:29:54:486	Channel.get		156	<message_1,Reply Channel_1,1>
08:29:54:486	Channel.put		155	<message_1,Reply Channel_1,1>
08:29:54:486	Channel.get		153	<message_2,Reply Channel_2,2>
08:29:54:485	Channel.put		152	<message_2,Reply Channel_2,2>
08:29:50:472	Channel.get		148	<message_1,Reply Channel_1,1>

Une copie d'écran
après avoir souscrit depuis l'outil jconsole à "RequestChannel",

```
  public static void main(String[] args)throws Exception{
    ChannelAgent agent = new ChannelAgent();

    Thread.sleep(10000); // attente de quelques secondes,
                         // le temps d'exécuter jconsole…


    IChannel requestChannel = agent.requestChannel;
    IChannel replyChannel_1 = agent.replyChannel_1;
    IChannel replyChannel_2 = agent.replyChannel_2;

    // Requestor 1 et Requestor 2
    IRequestor requestor_1 = new Requestor(requestChannel,replyChannel_1);
    IRequestor requestor_2 = new Requestor(requestChannel,replyChannel_2);

    // Replier avec un délai de garde de 10 sec
    IReplier replier = new Replier(requestChannel, 10000);

    IMessage message1 = new Message("message_1", replyChannel_1, 1L);
    IMessage message2 = new Message("message_2", replyChannel_2, 2L);

    for(int i=0;i<100;i++){ // 100 envois afin d'avoir le temps de s'abonner
        System.out.println("Envoi de " + message2 + " depuis requestor_2" );
        requestor_2.send(message2);
        System.out.println("Envoi de " + message1 + " depuis requestor_1" );
        requestor_1.send(message1);
        Thread.sleep(2000); // attente de quelques secondes
        IMessage received = requestor_1.receive(10000);
        System.out.println("\n\tRéception de " + received + " par requestor_1");
        assert "message_1".equals(received.getContent().toString());
        assert 1L == received.getCorrelationId();

        received = requestor_2.receive(10000);
        System.out.println("\n\tRéception de " + received + " par requestor_2");
        assert "message_2".equals(received.getContent().toString());
        assert 2L == received.getCorrelationId();
        Thread.sleep(2000L);
    }
    Thread.sleep(Integer.MAX_VALUE);

}
```

javax.jms
Interface Connection

All Known Subinterfaces:
QueueConnection, TopicConnection, XAQueueConnection, XATopicConnection

---

public interface **Connection**

A `Connection` object is a client's active connection to its JMS provider. It typically allocates provider resources outside the Java virtual machine (JVM).

Connections support concurrent use.

See Also:
`ConnectionFactory`, `QueueConnection`, `TopicConnection`

Method Summary	
void	**start**() Starts (or restarts) a connection's delivery of incoming messages.

javax.jms
Interface Destination

All Known Subinterfaces:
Queue, TemporaryQueue, TemporaryTopic, Topic

---

public interface **Destination**

---

javax.jms
Interface Message

All Known Subinterfaces:
…, TextMessage

---

public interface **Message**

The `Message` interface is the root interface of all JMS messages. It defines the message header and the `acknowledge` method used for all messages.

Method Summary	
java.lang.String	**getJMSCorrelationID**() Gets the correlation ID for the message.
java.lang.String	**getJMSMessageID**() Gets the message ID.
Destination	**getJMSReplyTo**() Gets the `Destination` object to which a reply to this message should be sent.
void	**setJMSReplyTo**(Destination replyTo) Sets the `Destination` object to which a reply to this message should be sent.

javax.jms
Interface MessageConsumer

All Known Subinterfaces:
QueueReceiver, TopicSubscriber

---

public interface **MessageConsumer**

A client uses a `MessageConsumer` object to receive messages from a destination. A `MessageConsumer` object is created by passing a `Destination` object to a message-consumer creation method supplied by a session.

Method Summary

Message	**receive**() Receives the next message produced for this message consumer.
void	**setMessageListener**(MessageListener listener) Sets the message consumer's MessageListener.

javax.jms
Interface MessageListener

---

public interface **MessageListener**

Method Summary	
void	**onMessage**(Message message) Passes a message to the listener.

javax.jms
Interface MessageProducer

All Known Subinterfaces:
QueueSender, TopicPublisher

---

public interface **MessageProducer**

A client uses a MessageProducer object to send messages to a destination. A MessageProducer object is created by passing a Destination object to a message-producer creation method supplied by a session.

Method Summary	
void	**send**(Message message) Sends a message to the queue.

javax.jms
Interface TextMessage

All Superinterfaces:
Message

---

public interface **TextMessage**
extends Message

A TextMessage object is used to send a message containing a java.lang.String. It inherits from the Message interface and adds a text message body.

See Also:
Session.createTextMessage(), Session.createTextMessage(String), BytesMessage, MapMessage, Message, ObjectMessage, StreamMessage, String

---

Method Summary	
java.lang.String	**getText**() Gets the string containing this message's data.
void	**setText**(java.lang.String string) Sets the string containing this message's data.

java.util.concurrent
Class LinkedBlockingQueue<E>

java.lang.Object
  java.util.AbstractCollection<E>
    java.util.AbstractQueue<E>
      java.util.concurrent.LinkedBlockingQueue<E>

Type Parameters:
`E` - the type of elements held in this collection
All Implemented Interfaces:
Serializable, Iterable<E>, Collection<E>, BlockingQueue<E>, Queue<E>

```
public class LinkedBlockingQueue<E>
extends AbstractQueue<E>
implements BlockingQueue<E>, Serializable
```

An optionally-bounded blocking queue based on linked nodes. This queue orders elements FIFO (first-in-first-out). The *head* of the queue is that element that has been on the queue the longest time. The *tail* of the queue is that element that has been on the queue the shortest time. New elements are inserted at the tail of the queue, and the queue retrieval operations obtain elements at the head of the queue. Linked queues typically have higher throughput than array-based queues but less predictable performance in most concurrent applications.

The optional capacity bound constructor argument serves as a way to prevent excessive queue expansion. The capacity, if unspecified, is equal to `Integer.MAX_VALUE`. Linked nodes are dynamically created upon each insertion unless this would bring the queue above capacity.

This class and its iterator implement all of the *optional* methods of the `Collection` and `Iterator` interfaces.

This class is a member of the Java Collections Framework.

Since:
1.5
See Also:
Serialized Form

Constructor Summary
LinkedBlockingQueue() Creates a `LinkedBlockingQueue` with a capacity of `Integer.MAX_VALUE`.
LinkedBlockingQueue(Collection<? extends E> c) Creates a `LinkedBlockingQueue` with a capacity of `Integer.MAX_VALUE`, initially containing the elements of the given collection, added in traversal order of the collection's iterator.
LinkedBlockingQueue(int capacity) Creates a `LinkedBlockingQueue` with the given (fixed) capacity.

Method Summary	
void	**clear**() Atomically removes all of the elements from this queue.
int	**drainTo**(Collection<? super E> c) Removes all available elements from this queue and adds them to the given collection.
int	**drainTo**(Collection<? super E> c, int maxElements) Removes at most the given number of available elements from this queue and adds them to the given collection.
Iterator<E>	**iterator**() Returns an iterator over the elements in this queue in proper sequence.
boolean	**offer**(E e) Inserts the specified element at the tail of this queue if it is possible to do so immediately without exceeding the queue's capacity, returning `true` upon success and `false` if this queue is full.
boolean	**offer**(E e, long timeout, TimeUnit unit) Inserts the specified element at the tail of this queue, waiting if necessary up to the specified wait time for space to become available.
E	**peek**() Retrieves, but does not remove, the head of this queue, or returns `null` if this queue is empty.
E	**poll**() Retrieves and removes the head of this queue, or returns `null` if this queue is empty.
E	**poll**(long timeout, TimeUnit unit) Retrieves and removes the head of this queue, waiting up to the specified wait time if necessary for an element to become available.
void	**put**(E e) Inserts the specified element at the tail of this queue, waiting if necessary for space to become available.
int	**remainingCapacity**() Returns the number of additional elements that this queue can ideally (in the absence of memory or resource constraints) accept without blocking.
boolean	**remove**(Object o) Removes a single instance of the specified element from this queue, if it is present.
int	**size**() Returns the number of elements in this queue.

E	**take**() Retrieves and removes the head of this queue, waiting if necessary until an element becomes available.
Object[]	**toArray**() Returns an array containing all of the elements in this queue, in proper sequence.
<T> T[]	**toArray**(T[] a) Returns an array containing all of the elements in this queue, in proper sequence; the runtime type of the returned array is that of the specified array.
String	**toString**() Returns a string representation of this collection.

javax.management
Interface NotificationBroadcaster

All Known Subinterfaces:
ModelMBean, ModelMBeanNotificationBroadcaster, NotificationEmitter
All Known Implementing Classes:
CounterMonitor, GaugeMonitor, JMXConnectorServer, MBeanServerDelegate, Monitor, NotificationBroadcasterSupport, RelationService, RequiredModelMBean, RMIConnectorServer, StandardEmitterMBean, StringMonitor, Timer

---

public interface **NotificationBroadcaster**

Interface implemented by an MBean that emits Notifications. It allows a listener to be registered with the MBean as a notification listener.

Method Summary	
void	**addNotificationListener**(NotificationListener listener, NotificationFilter filter, Object handback) Adds a listener to this MBean.
MBeanNotificationInfo[]	**getNotificationInfo**() Returns an array indicating, for each notification this MBean may send, the name of the Java class of the notification and the notification type.
void	**removeNotificationListener**(NotificationListener listener) Removes a listener from this MBean.

javax.management
class NotificationBroadcasterSupport

java.lang.Object
  └ **javax.management.NotificationBroadcasterSupport**

All Implemented Interfaces:
NotificationEmitter
Direct Known Subclasses:
JMXConnectorServer, Monitor, RelationService, Timer

Most common way to construct:

```
NotificationBroadcasterSupport broadcaster = new NotificationBroadcasterSupport();
```

Based on 50 examples

---

public class **NotificationBroadcasterSupport**
extends Object
implements NotificationEmitter

Constructor Summary
NotificationBroadcasterSupport() Constructs a NotificationBroadcasterSupport where each listener is invoked by the thread sending the notification.
NotificationBroadcasterSupport(Executor executor) Constructs a NotificationBroadcasterSupport where each listener is invoked using the given java.util.concurrent.Executor.
NotificationBroadcasterSupport(Executor executor, MBeanNotificationInfo[] info) Constructs a NotificationBroadcasterSupport with information about the notifications that may be sent, and where each listener is invoked using the given java.util.concurrent.Executor.
NotificationBroadcasterSupport(MBeanNotificationInfo[] info)

Constructs a NotificationBroadcasterSupport with information about the notifications that may be sent.

Method Summary	
void	**sendNotification**(Notification notification) Sends a notification.

javax.management
class Notification

java.lang.Object
  └ java.util.EventObject
    └ **javax.management.Notification**

All Implemented Interfaces:
Serializable
Direct Known Subclasses:
AttributeChangeNotification, JMXConnectionNotification, MBeanServerNotification, MonitorNotification, RelationNotification, TimerNotification

```
public class Notification
extends EventObject
```

Field Summary	
protected Object	**source** This field hides the java.util.EventObject.source field in the parent class to make it non-transient and therefore part of the serialized form.

Fields inherited from class java.util.EventObject
source

Constructor Summary
Notification(String type, Object source, long sequenceNumber) Creates a Notification object.
Notification(String type, Object source, long sequenceNumber, long timeStamp) Creates a Notification object.
Notification(String type, Object source, long sequenceNumber, long timeStamp, String message) Creates a Notification object.
Notification(String type, Object source, long sequenceNumber, String message) Creates a Notification object.