Joram 5.4
User's Guide

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1. Installation

Joram 5.3 basically includes:

- A **messaging server** (or MOM), providing the messaging functionalities: basically hosting and routing the messages exchanged by the client applications.

- A **JNDI** compliant naming server, distributed (since release 4.1) persistent and reliable.

- **Client classes** allowing applications to access the MOM functionalities. Those interfaces are defined by the **JMS 1.1** specifications.

- **Samples** illustrating the various features provided by Joram.

- JCA 1.5 connector allowing deployment in J2EE 1.4 platform.

1.1. Requirements

Joram can run on a wide variety of platform, a typical hardware and software platform is:

Hardware requirements

- Year 2000 compliant 32-bit Intel based PC hardware (or equivalent)

- 256 Mb RAM, 5 Gb disk,

- Communication hardware supporting TCP/IP

Software requirements

- Operating system: Linux, Windows 2000 and XP, etc.

- Connectivity: TCP/IP.

- Java environment: JDK 1.4 and later.

1.2. Getting Joram binary distribution

The packages are downloadable from the following location:

- http://forge.ow2.org/project/showfiles.php?group_id=4.

For release **x.y.z**, the following tar file provided:

- `joram-x.y.z.tgz`, including the client and server libraries, as well as the javadoc and the samples sources.

This package is expanded by UNIX users with the `gunzip` and `tar` commands; Windows users can use the **7-Zip** utility.

The distribution is expanded in a `joram-x.y.z/` directory. It includes the following directories:

- `doc/`
- `samples/`
    - o `bin/…`
    - o `config/…`
    - o `src/joram/…`

- ship/
  - o lib/
  - o licenses/

1.3. Running a Joram server

To run a server you have just to launch the `fr.dyade.aaa.agent.AgentServer` class with 2 parameters, the first one is the unique identifier of the server and the second one is the path of storage directory. For example:

```
java -cp …  fr.dyade.aaa.agent.AgentServer 0 ./s0
```

During its first initialisation the server will be configured according to the a3servers.xml configuration file (see below) then the configuration will be kept in the storage directory.

```xml
<?xml version="1.0"?>
<config>
  <server id="0" name="S0" hostname="localhost">
    <service class="org.objectweb.joram.mom.proxies.ConnectionManager"
            args="root root"/>
    <service class="org.objectweb.joram.mom.proxies.tcp.TcpProxyService"
            args="16010"/>
    <service class="fr.dyade.aaa.jndi2.server.JndiServer"
            args="16400"/>
  </server>
</config>
```

A simple « a3servers.xml » configuration file

The «a3servers.xml» configuration file above simply defines a centralized Joram JMS server including a JNDI service, the JMS service is listening on TCP port 16010 and the JNDI service on TCP port 16400. The chapter 3.3. which describes more precisely the configuration of a Joram platform.

2. Using samples

This chapter describes the samples provided with JORAM and for each, the architecture of the underlying platform. The samples are provided with the JORAM distributions under the `samples/` directory. It's a good way to verify the correctness of Joram installation.

The **samples/src/joram** directory includes the samples codes of JORAM clients. Compiling and launching are done with the *ant* command.

Configuration files are located in the **samples/config** directory. They might be edited and adapted to your environment. For more information, please refer to the administration part of this document (chapter 3.Administration Guide). This directory contains:

- `a3config.dtd`, the DTD for server configuration;
- `a3debug.cfg`, a default logger configuration file;
- `centralized_a3servers.xml`, a configuration file for a centralized server architecture;
- `distributed_a3servers.xml`, a configuration file for a distributed servers architecture;
- `jndi.properties`, a default configuration file for JNDI's clients.

The **samples/bin** directory provides Unix and Windows script files for launching JORAM servers and clients if you don't want to use ant targets.

All examples creates a **samples/run** where logging files and the persistence root (if any) are created. Current configuration files are copied in this directory. When starting a platform with a new configuration, or when a clean platform is expected, this directory should be removed.

2.1. Compiling JORAM samples

The Joram samples need to be compiled. Under the `samples/src/joram` directory, simply type:

```
ant clean compile
```

This creates a `samples/classes/joram/` directory holding the compiled classes. For removing this directory, type:

```
ant clean
```

2.2. Running Joram samples

2.2.1. The classic sample

The JMS API provides a separate domain for each messaging approach, *point-to-point* or *publish/subscribe*:

- The *point-to-point* domain is built around the concept of queues, senders and receivers.
- The *publish/subscribe* domain is built around the concept of topic, publisher and subscriber
- Additionally it provides an unified domain with common interfaces that enable the use of queue and topic. This domain is defines the concept of producers and consumers.

This sample demonstrates the different messaging domains of JMS, *point-to-point* with a sender, a receiver and a queue browser, *publish/subscribe* with a subscriber and a publisher, and unified with messages producers and consumers.

The classic sample uses a very simple configuration (centralized) made of one server hosting a queue and a topic. The server is administratively configured for accepting connections requests from the *anonymous* user.

The platform is run in non persistent mode (property "Transaction" is set to "fr.dyade.aaa.util.NullTransaction" in a3servers.xml configuration file).
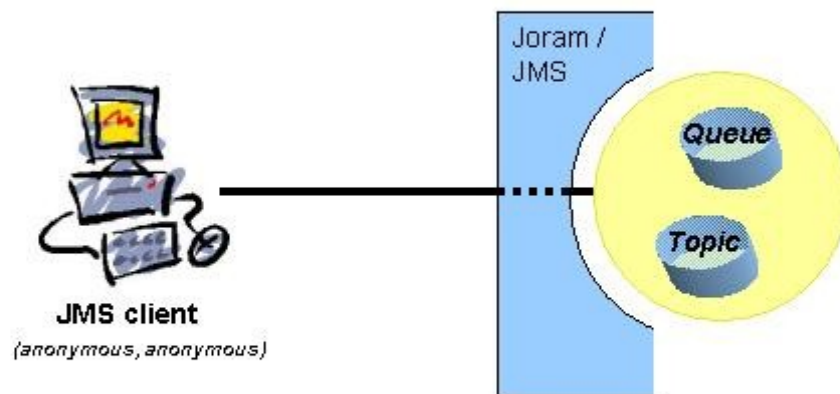
Figure 1 - Classic samples configuration

Running the demo with Ant:

- For starting the platform:

  ant reset single_server

  - As defined in the configuration file (run/a3servers.xml) it launches a Joram server without persistency. It creates a ConnectionManager, a TCP/IP entry point and a JndiServer (port 16400); the ConnectionManager defines a default administrator (username "root", password "root"). The reset target is used to removes all out-of-date data in the run directory.

- For running the admin code:

  ant classic_admin

  - This client connects to the Joram's server, then creates 2 JMS destinations (a queue and a topic) and an anonymous user. It defines 3 different ConnectionFactory, one for each messaging domain.
  - Each administered objects is then bound in JNDI.

- Using the *point-to-point* messaging domain:

  o It uses the *QueueConnectionFactory* "qcf", and the *Queue* "queue" retrieved from JNDI.

  o For running the sender sample, type "*ant sender*"; each time, it sends 10 messages to the defined queue.

  o For running the browser sample, type "*ant browser*"; it allows to look messages on queue without removing them.

  o For running the receiver sample, type "*ant receiver*"; each time, it consumes 10 messages from the queue. If there is not enough messages, it stops until new messages are produced.

- Using the *publish/subscribe* messaging domain:

- o It uses the `TopicConnectionFactory` "tcf", and the `Topic` "topic" retrieved from JNDI.

- o For running the subscriber sample, type "`ant subscriber`". It subscribes to the defined topic, and then receives all messages later published on this topic.

- o For running the publisher sample, type "`ant publisher`". It publishes 10 messages on the topic.

- ▪ Using the unified messaging domain:

- o It uses the common `ConnectionFactory` "cf", and the `Destination` "queue" and "topic" retrieved from JNDI.

- o For running the consumer sample, type "ant consumer_queue" or "ant consumer_topic". It continuously reads messages sent to the queue or the topic.

- o For running the producer sample, type "ant producer_queue" or "ant producer_topic". It sends 10 messages to the queue, and 10 messages to the topic.

2.2.2. *The chat sample*

The chat sample uses a very simple configuration (centralized) made of one server hosting a single queue. The server is administratively configured for accepting connections requests from the *anonymous* user.

The platform is run in non persistent mode (property "Transaction" is set to "fr.dyade.aaa.util.NullTransaction" in a3servers.xml configuration file).
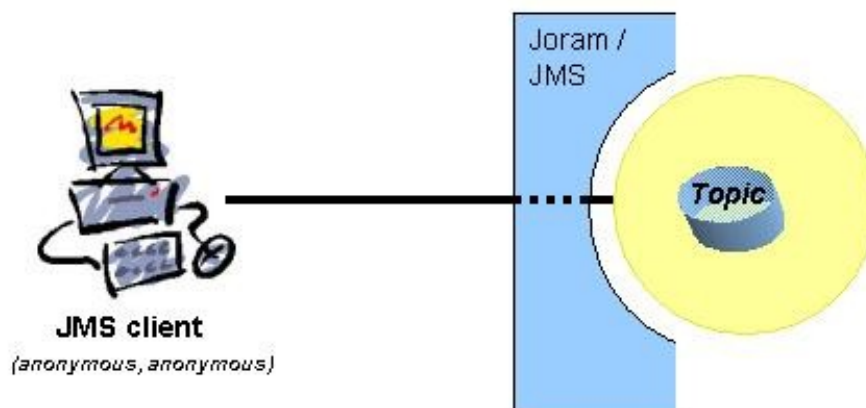
Figure 2 - Chat sample configuration

Running the demo:

- ▪ For starting the platform:

  `ant reset single_server`

- ▪ For running the admin code:

  `ant chat_admin`

  - ▪ This client connects to the Joram's server, and then creates a topic and an anonymous user. It defines a TopicConnectionFactory. Each administered objects is then bind in JNDI.

- ▪ To start a chat client, type "`ant chat1`". It launches a chat client with user1 speudo, then each message typed at console is sent to the topic, and each message published on the topic is written to the console.

■ To start a second chat client, type "`ant chat2`". It simply launches a chat client with user2 speudo.

2.2.3. The distributed sample

The distributed sample illustrates Joram under a distributed architecture. Its configuration involves three servers. The clients producing messages (sender and publisher) connect to server 0. The clients consuming the messages (receiver and subscriber) connect to server 2. The destinations they interact with are deployed on server 1. The platform is run in persistent mode. The provided configuration locates all three servers on "localhost" host.
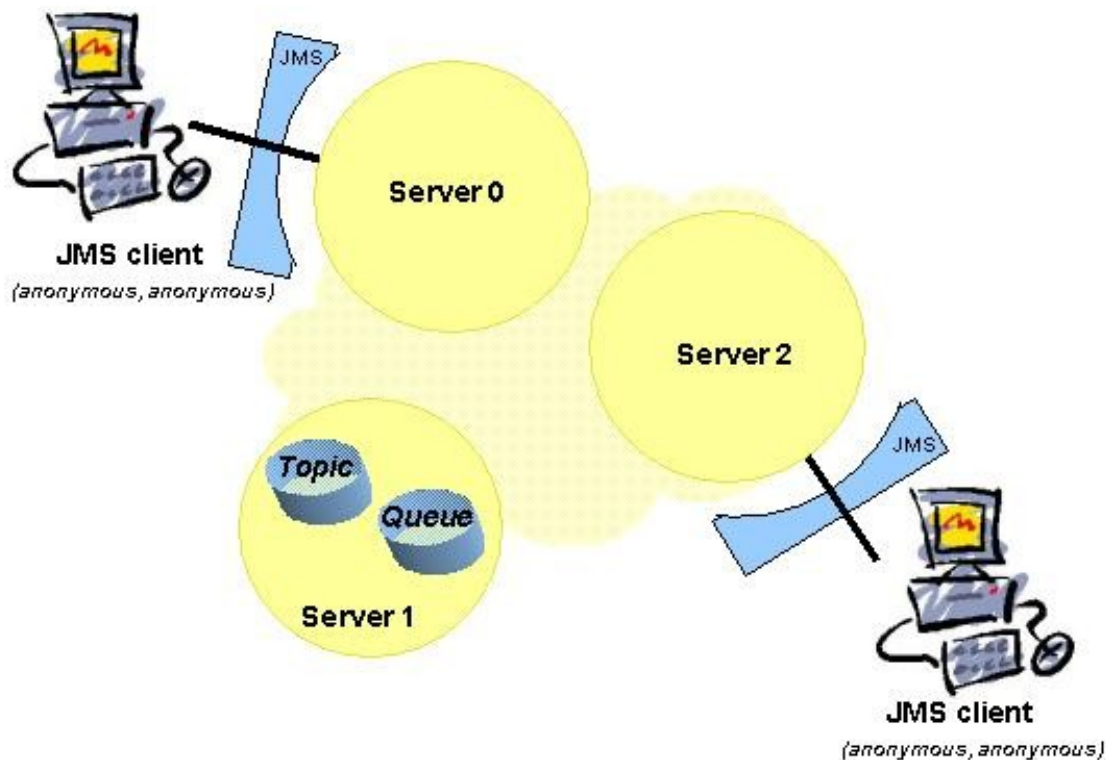
Figure 3 - Distributed sample configuration

Running the demo:

■ Starting the configuration, type "`ant reset servers`". It cleans the run directory the launches the 3 servers. You can start separately each servers by typing:

```
ant reset
ant server0
ant server1
ant server2
```

■ Running the admin code:

```
ant archi_admin
```

■ Running the producers:

```
ant archi_sender
ant archi_pub
```

■ Running the consumers:

```
ant archi_receiver
```

```
ant archi_sub
```

2.2.4.   The dotcom demo

The dotcom demo simulates what could be a commercial transaction involving many participants:

- Web server: server on which a customer order items.
- Customer server: centralizes the processing of the orders.
- Inventory server: checks if the items ordered are available.
- Billing server: centralizes the processing of the bank references.
- Control server: checks the bank references of the customers.
- Delivery server: receives the order ready for delivery.

The next picture shows the actors of this simulation and the destinations through which they interact. The provided architecture is centralized. The platform runs in persistent mode.
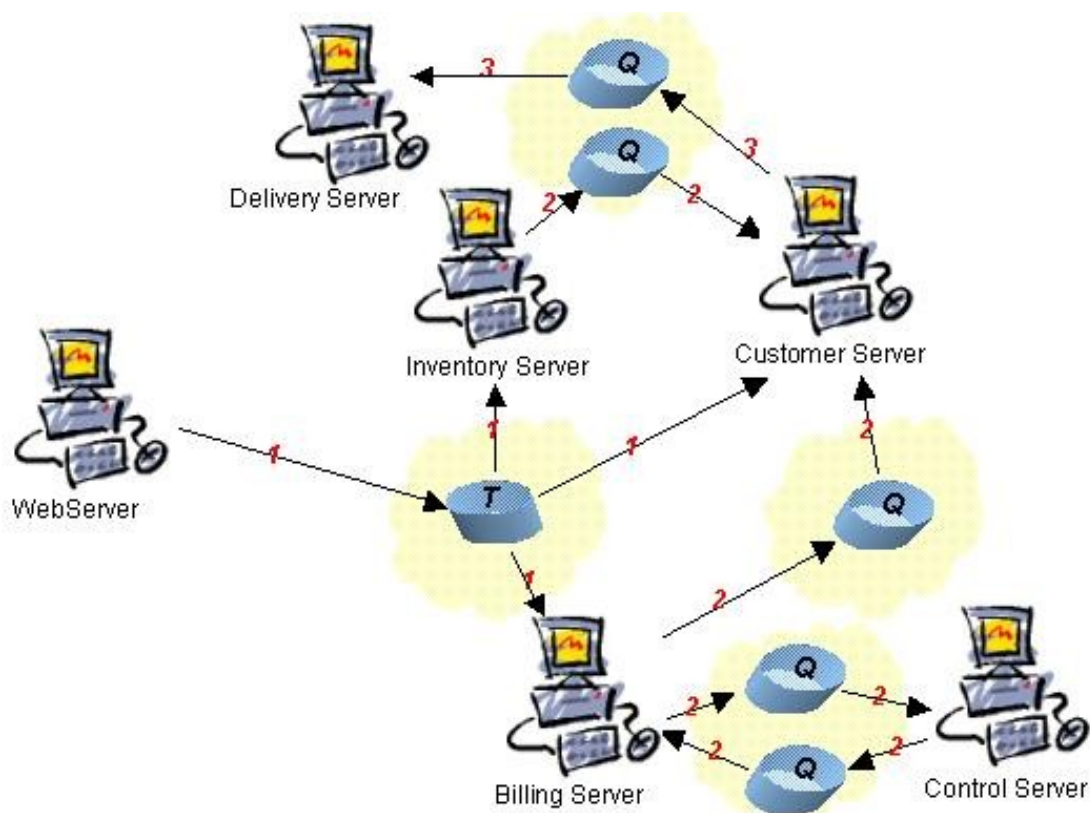
Figure 4 - Dotcom sample configuration

Scenario:

1. A customer buys an item on a web site. The Web Server publishes the order on a topic to which the Customer Server, the Inventory Server and the Billing Server have subscribed.

2. The Inventory Server checks if the item ordered is available and sends his answer back to the Customer Server. The Billing Server forwards the order to the Control Server who will check the bank references of the customer and send his answer back to the Billing Server. Then, the Billing Server forwards that answer to the Customer Server.

3. If the order has been validated by both Inventory Server and Billing Server, the Customer Server forwards it to the Delivery Server for delivery.

Running the demo:

- ▪ Starting the configuration:

  ant reset single_server

- ▪ Running the admin:

  ant dotcom_admin

- ▪ Running the servers:

  ant webServers

- ▪ Running the client:

  ant webClient

The dotcom sample's GUI:

A GUI allows to interact with the demo. Each time a server receives a message, its window appears.

The WebServer's interface simulates the choice the user has to make between items: shoes, socks, trousers, shirt and hat. He must select one and then Send the order or set an Other order. The Send button must be pressed after the last order. It commits all previous orders. For cancellation, the Cancel button rollsback the orders. The Quit button sends the quit command to the other participants, closes the connections of the Web Server and terminates the program. Quit doesn't kill the middleware, thus it is possible to simply restart the application without having to relaunch the Agent server and the Admin.

Figure 5 - Web Server's interface

The Inventory and Control Servers windows allow to simulate the work of those servers by validating or not the order they received.

Figure 6 - Inventory Server's and Control Server's interfaces

According to the results of previous controls, the Customer Server either will be able to ask for delivery, or won't.

Figure 7 - Customer Server's interfaces

Finally, if sent by the Customer Server, the order reaches the Delivery Server.
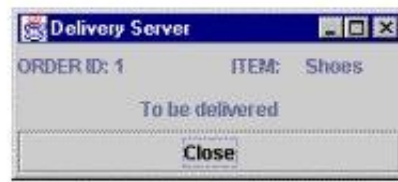
Figure 8 - Delivery Server's interface

2.2.5. The perfs samples

The perfs samples have been developed for checking Joram's performances. What is actually measured is the messages mean travel time (travel from the producer to the consumer). The configuration used is centralized, made of one queue and one topic. For testing PTP and Pub/Sub modes, the available clients are a Sender, a Publisher, a Receiver and a Subscriber.

These clients, as provided, are non transactional, subscriber is non durable. Of course these parameters may be changed for testing various configurations. Tests might be run on a persistent platform or a non persistent one.

The receiver and subscriber samples produce a PerfsFile file containing the mean messages travel time (computed for groups of 10 messages in the PTP case, 50 messages in the Pub/Sub case).

Starting the platform:

- Persistent platform:

    ant reset server0

- Or non persistent platform:

    ant reset single_server

- Running the admin code:

    ant perfs_admin

Testing the PTP mode:

- Running the receiver:

    ant perfs_receiver

- Running the sender:

    ant perfs_sender

Testing the Pub/Sub mode:

- Running the subscriber:

    ant perfs_sub

- Running the publisher:

    ant perfs_pub

2.3. Using scripts

In the previous sections, it has been explained how to launch the provided samples through *Ant* targets. It is also possible to use the script files located in the samples/bin directory. This section explains how to use those scripts.

2.3.1.   First step

The first step consists in fixing the JAVA_HOME and the JORAM_HOME environment variables. The JAVA_HOME property value must point to your Java installation directory. The JORAM_HOME value must point to your JORAM directory (the directory actually containing the `samples/` sub-directories).

2.3.2.   Launching a JORAM platform

Launching a JORAM platform with the scripts has the same effects as using the *Ant* targets.

Depending on the script, it will set the appropriate configuration: copy the rigth `a3servers.xml` and `jndi.properties` from `config/` directory in the created `run/` directory, etc.

Those scripts are:

- *single_server.[sh/bat]* : copies the `config/centralized_a3servers.xml` file as `a3servers.xml` and `config/jndi.properties` in `run` directory. If not already done, creates the `run/` directory. Then launches the non persistent server 0.

- *server.[sh/bat] x* : copies `distributed_a3servers.xml` as `a3servers.xml` and `jndi.properties` as `jndi.properties` if not already done, creates the `run/` directory if it does not exist, and launches the persistent server x.

- *clean.[sh/bat]* : deletes the `a3servers.xml` and `jndi.properties` files, deletes the `run/` directory.

When starting a new persistent server, the *clean* script must be executed in order to remove any existing persistence root which may alter the way the server starts. When re-starting a stopped or crashed persistent server, the *clean* script should not be called in order to keep the needed persistence root.

2.3.3.   Launching a JORAM client

The *jmsclient* script may be used for launching a client. It takes as argument the class of the client to execute. For example, for launching the classic sender class:

jmsClient classic.ClassicSender

Of course, this supposes that the samples have been compiled (and that the JORAM platform has been administered for the classic samples, either by running the `ClassicAdmin` client, or by using the administration graphical tool).

2.3.4.   Running the classic samples using script files

The example below use '.sh' scripts on a Linux platform; if you use a Windows™ platform you may use the corresponding '.bat' scripts. All theses scripts need the definition of `JAVA_HOME` and `JORAM_HOME` environment variable:

- Set `JAVA_HOME` to the directory where JDK is installed.

- Set `JORAM_HOME` to the directory that you installed Joram (the directory containing the `ship` and `samples` directories.

First cleans the persistence directory and configuration settings, then launches the server.

```
$> cd $JORAM_HOME/bin
$> ./clean.sh
== Cleaning the persistence directories and configuration settings ==

$> ./single_server.sh
```

```
== Launching a non persistent server#0 ==
AgentServer#0 started: OK
```

You can create all needed administered objects through the `ClassicAdmin` class.

```
$> ./jmsclient.sh classic.ClassicAdmin
== Launching the classic.ClassicAdmin client ==


Classic administration...
Admin closed.
```

Then you can send or receive messages using the Sender/Receiver or Publisher/Subscriber classes; for example:

```
$> ./jmsclient.sh classic.Sender
== Launching the classic.Sender client ==


Sends messages on the queue...
10 messages sent.


$> ./jmsclient.sh classic.Receiver
== Launching the classic.Receiver client ==


Requests to receive messages...
Msg received: Test number 0
Msg received: Test number 1
Msg received: Test number 2
Msg received: Test number 3
Msg received: Test number 4
Msg received: Test number 5
Msg received: Test number 6
Msg received: Test number 7
Msg received: Test number 8
Msg received: Test number 9


10 messages received.
```

You can launch the administration GUI JAMT using the admin.sh (respectively admin.bat) script:

```
$> ./admin.sh
== Launching the graphical administration tool ==
```

2.4. *Administration through XML scripts*

There is three way to deploy Joram's administered objects: the administration API, the graphical administration tool (JAMT) and now the XML scripting capability.

This feature use the AdminModule to execute the corresponding XML script. The script allows describing the administration connection, creating and binding administered objects (see chapter 3.6.ScriptsXML).

2.4.1. *Classic sample administration using XML script*

The ant target `classic_adminxml` uses the AdminModule main static method to execute the administration script, this script is equivalent to the `ClassicAdmin` code.

```
$> ant classic_adminxml
Buildfile: build.xml

init:

classic_adminxml:
     [copy] Copying 1 file to C:\cygwin\home\freyssin\owjoram\joram\samples\run

BUILD SUCCESSFUL
Total time: 3 seconds
```

In the script (see file samples/src/joram/classic/joramAdmin.xml) we described:

- The connection to Joram's configuration: a default TCP connection with hostname, port, username and password.

- The connection factory and the JNDI binding:

  - an unified TCPConnectionFactory named "cf",

  - a QueueTCPConnectionFactory named "qcf"

  - and TopicTCPConnectionFactory named "tcf".

- The anonymous user.

- The destinations with their JNDI binding and security settings: a queue and a topic with freereader and freewriter settings.

3. Administration Guide

3.1. Introduction

JORAM provides a messaging platform allowing distributed applications to exchange data through message communication (Figure 9).

Figure 9 - Applications exchanging data through messaging

The messaging system takes care of distributing the data produced by an application to another application. Applications do not need to know each other, or to be present at the same time.

In order to provide a standardized way to access its messaging functionalities, JORAM implements the set of classes and methods defined by the JMS API. JMS "client" applications may then, without any modification, use JORAM messaging platform.

This document presents how to configure and start the underlying messaging platform, and how to administer it so that it is usable by standard JMS clients.

3.2. Administration concepts

3.2.1. Overall view

A Joram messaging platform is constituted by one or many servers, interconnected, possibly running on remote nodes (Figure 10).

- A **Joram server** is a Java process providing the messaging functionalities, and hosting messaging destinations.
- A **Joram JMS client** is a Java process using the messaging functionalities through the JMS interfaces. In order to do so it connects to a Joram server.
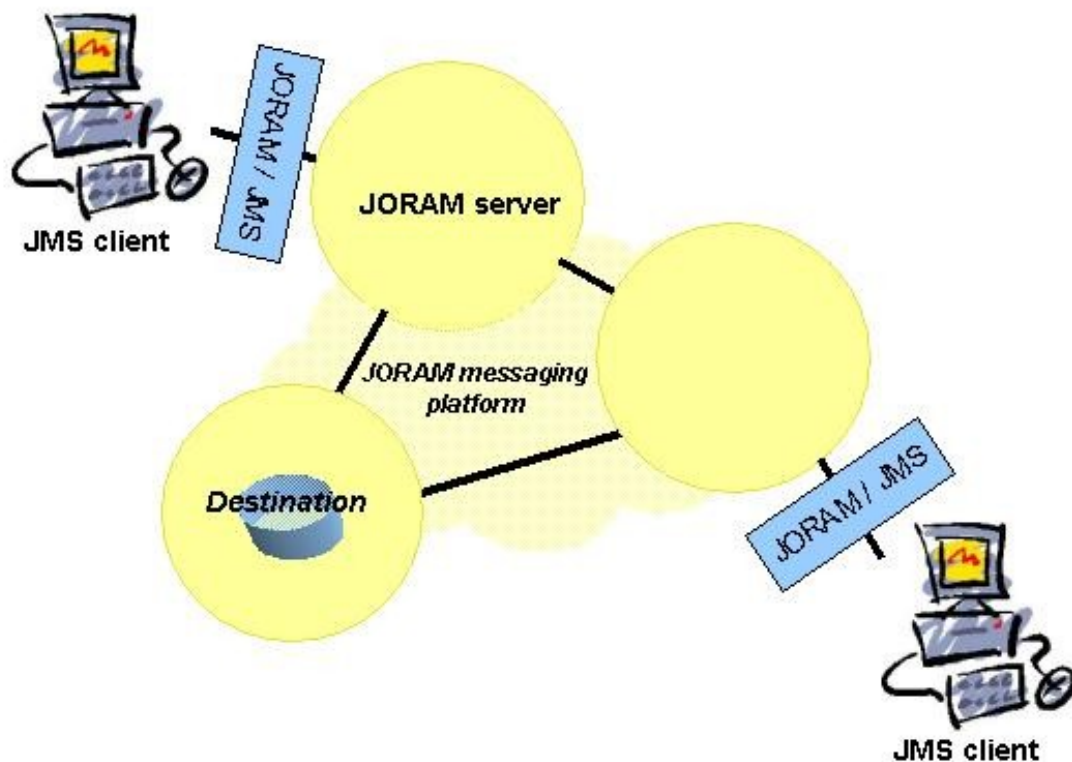
Figure 10 - Joram platform and clients

The goal of administration is to start and configure the messaging platform so that it provides all the features needed by the "client" applications. It is also to administer this platform so that standard JMS clients can access it and use it for their messaging operations.

The basic administration tasks are creating and deleting physical destinations on the messaging platform, setting or removing user's access to this platform.

To have the platform usable by standard JMS clients, the administration phase also consists in creating the `javax.jms.ConnectionFactory` and `javax.jms.Destination` administered objects (see JMS specification, §4.2), and to bind those instances to a JNDI compliant naming server.

3.2.2. User

A user access to a JORAM platform is fully described by:

- server parameters (such as host name and port number), identifying to which server of the platform the user will connect;

- a protocol, used for the client – server communication (usually TCP, might be "local", for collocated client and server);

- a user identification (name and password).

The actual "physical" connection is wrapped by a `javax.jms.Connection` instance. A JMS `Connection` is created by calling the `createConnection` method on a `javax.jms.ConnectionFactory` instance. It is this `ConnectionFactory` instance which wraps the server and communication protocol parameters. This standard object allows to isolate clients from the proprietary parameters needed for opening a connection with a messaging platform (Figure 11).
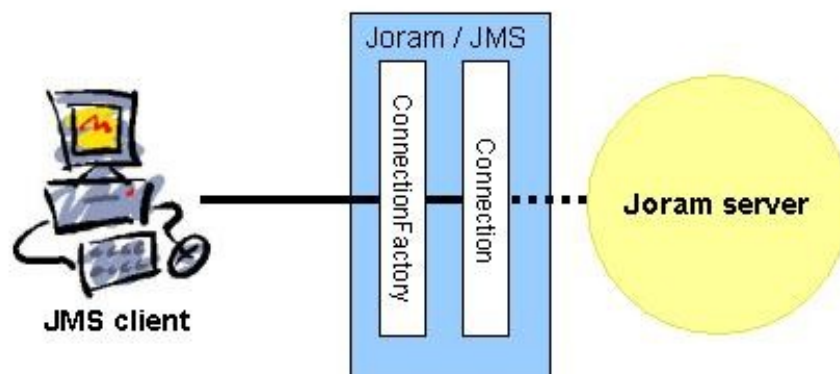
Figure 11 - A client connected to a server "through" a standard ConnectionFactory

A connection is opened by calling the `ConnectionFactory.createConnection` method. You can either use the method specifying an explicit user identity (login name and password) or assume the default identity (login "anonymous", password "anonymous"). The default identity may be adjusted client side by setting the JoramDfltLogin and JoramDfltPassword properties.

If the user identification (either *anonymous – anonymous*, or *name – password*) is unknown server side, the `createConnection` methods won't succeed and will throw a `JMSSecurityException`.

Allowing a client access to the platform requires then:

1. to create the appropriate `ConnectionFactory` instance wrapping the parameters of a server of the plaform, and of the communication protocol;

2. to bind this instance in a name space such as JNDI server so that users may later retrieve it;

3. to set the client as a user on this server.

3.2.3. *Destinations*

Client applications exchange messages not directly but through destinations. A destination is, server side, an instance of an object receiving messages from producers and answering to consuming requests from consumers. As shown on Figure 12, a destination may be deployed on any server of a configuration, whatever the servers the clients are connected to.

Server-side physical destinations are "represented" client side by `javax.jms.Destination` instances. A `Destination` instance wraps the parameters of the corresponding physical destination, and allows clients to be isolated from the proprietary parameters of a physical server side destination (Figure 12).
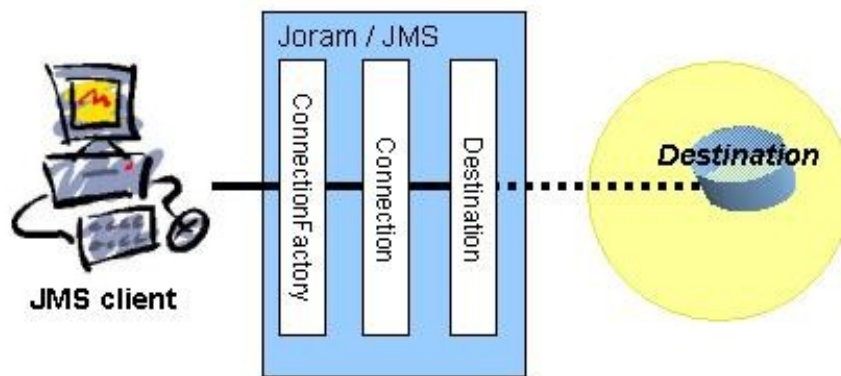
Figure 12 - A client accessing a server destination"through" a standard Destination

A destination might either be a "queue" or a "topic". Messaging semantics is what makes the difference (check any documentation about message-oriented-middleware or the JMS spec §5 and §6):

- • Queue: each messages is read only by a single client.

- • Topic: All clients that have previously subscribed to this topic are notified of the corresponding message.

Beyond this main characteristic, each destination may have a particular semantic; Joram supply many specific destinations : hierarchical or clustered destinations, bridge, etc.

The creation of a destination is then a three steps process:

1. first, creating the physical destination on a given server of the platform,

2. second, creating the corresponding `javax.jms.Destination` instance wrapping the parameters of the server side destination,

3. third, binding the `Destination` instance in a name space such as a JNDI server, so that clients may then retrieve it.

Once retrieved, a destination allows clients to perform operations according to their access rights. A client set as a READER will be able to request messages from the destination (either as a subscriber to a topic, or as a receiver or browser on a queue). A client set as a WRITER will be able to send messages to the destination.

Dead Message Queue (DMQ)

The Dead Message Queue (DMQ) is a particular queue used to store the dead messages. A dead message is a message that can not be delivered for various reasons (see chapter 4.1), The DMQ can be configured at different levels: server, destination, etc.

3.3.   Platform configuration

Configuring a JORAM messaging platform consists in defining the number of servers that will constitute it, where they will run, and in defining services each will provide. The minimal configuration is a single server configuration. A platform configuration is described by an XML configuration file.

A dynamic configuration feature is available since Joram 4.2 , it allows to modify a Joram platform at run-time by adding and removing servers.

Server services

The services a server may host are:

- A **connection manager service**, managing the connection requests from "external" clients. This service may also authorize the connection of an administrator client, authenticated by a name and a password. It is required on any server accepting at least a client connection. At the platform level at least one server must accept an administrator connection, meaning that at least one server must host a connection manager service authorizing an administrator connection.

- A **TCP proxy service**, allowing TCP clients to connect to the server. This service takes as argument a port number, defining on which port the TCP connection requests should be made.

- A **JNDI service**, listening to a given port, providing a naming server to clients for binding and retrieving administered objects. It is required on one of the platform servers if clients and administrators intend to use JORAM's naming server. If this service is provided by none of the platform's servers, that means that clients and administrators do not intend to use JNDI, or that they will use an other JNDI implementation than the one provided by JORAM.

3.3.1. *Centralized configuration*

The example below sets a configuration made of one server running on host *localhost.* This server, identified by the number *0*, is named *s0*. It provides a connection manager service allowing an administrator identified by *root – root* to connect, and a TCP proxy service listening on port *16010*. A JNDI service is also provided, listening to JNDI requests on port *16400*.

```xml
<?xml version="1.0"?>
<config>
  <property name="Transaction" value="fr.dyade.aaa.util.NullTransaction"/>
  <server id="0" name="S0" hostname="localhost">
    <service
     class="org.objectweb.joram.mom.proxies.ConnectionManager"
     args="root root"/>
    <service
     class="org.objectweb.joram.mom.proxies.tcp.TcpProxyService"
     args="16010"/>
    <service class="fr.dyade.aaa.jndi2.server.JndiServer"
     args="16400"/>
  </server>
  </config>
```

The above platform is non persistent, meaning that if it crashes and is then re-started, pre-crash data is lost. To have a platform able to retrieve its pre-crash state when re-starting, it should run in persistent mode. If message persistence is required, this is the mode to use (see below).

In order to allow a standard JNDI access to administrators and clients, a `jndi.properties` file is provided. It must be accessible to the administrators and clients through their classpath.

For the above configuration, this file looks as follows:

```
java.naming.factory.initial fr.dyade.aaa.jndi2.client.NamingContextFactory
java.naming.factory.host localhost
java.naming.factory.port 16400
```

It allows retrieving the naming context through:

```
javax.naming.Context jndiCtx = new javax.naming.InitialContext();
```

Running a platform

The configuration file is named `a3servers.xml`, and it must be accessible through the classpath. Then, the server is launched by typing:

> *java fr.dyade.aaa.agent.AgentServer 0 ./s0*

Configuring a persistent server

In order to configure a persistent server you have to change the `Transaction` property in `a3servers.xml` configuration file. For example you may use fr.dyade.aaa.util.NTransaction class.

When such a persistent server is stopped or crashes, there are two options when re-starting it:

- Either it is expected to resume the operations it was involved in before the crash, in which case the persistence directory `s0` should not be deleted; it may happen that a `Lock` file in this directory remains and should be removed.

- Or it is a bright new server that is expected to start, in which case the persistence directory `s0` should be totally removed.

3.3.2.   Distributed configuration

A distributed configuration made of three persistent server (as on figure 2) looks as follows:

```xml
<?xml version="1.0"?>
<config>
  <property name="Transaction" value="fr.dyade.aaa.util.NTransaction"/>
  <domain name="D1"/>
  <server id="0" name="S0" hostname="localhost">
    <network domain="D1" port="16301"/>
    <service class="org.objectweb.joram.mom.proxies.ConnectionManager"
            args="root root"/>
    <service class="org.objectweb.joram.mom.proxies.tcp.TcpProxyService"
            args="16010"/>
    <service class="fr.dyade.aaa.jndi2.server.JndiServer"
            args="16400"/>
  </server>
  <server id="1" name="S1" hostname="host1">
  <network domain="D1" port="16301"/>
    <service class="org.objectweb.joram.mom.proxies.ConnectionManager"/>
    <service class="org.objectweb.joram.mom.proxies.tcp.TcpProxyService"
            args="16010"/>
  </server>
  <server id="2" name="S2" hostname="host2">
    <network domain="D1" port="16301"/>
    <service class="org.objectweb.joram.mom.proxies.ConnectionManager"/>
  </server>
</config>
```

This configuration is made of 3 persistent servers, each running on a given node (*host0*, *host1* and *host2*). All are part of the same domain (multiple domains might be needed for very large configurations). The server 0 of the configuration provides the same services as server 0 of the previous centralized configuration. Server 1 allows TCP connection on its local 16010 port, no administrator access, and no JNDI server. Server 2 allows client connections (thanks to the

connection manager service) but the TCP protocol is not supported (the protocol might then be "local").

The `jndi.properties` file needed by administrators and clients should look as follows:

```
java.naming.factory.initial fr.dyade.aaa.jndi2.client.NamingContextFactory
java.naming.factory.host host0
java.naming.factory.port 16400
```

Running a platform

Each host on which a server of the configuration will run must have a copy of the `a3servers.xml` file, and this copy must be accessible through the classpath.

Then, the servers of the configuration are launched one by one:

- On node 0:

  java fr.dyade.aaa.agent.AgentServer 0 ./s0

- On node 1:

  java fr.dyade.aaa.agent.AgentServer 1 ./s1

- On node 2:

  java fr.dyade.aaa.agent.AgentServer 2 ./s2

Warning: Be careful, removing the persistence directory of one server in a distributed configuration may cause damages.

3.3.3.   Stopping a server

A method is provided for stopping a given server of the administered JORAM platform. If the server to stop is the server to which the administrator is connected, the admin session is automatically terminated and closed.

Stopping server 0:

```
AdminModule.stopServer(0);
```

3.3.4.   Dynamic configuration

The dynamic configuration feature is available from the Joram version 4.2. It allows to modify a Joram platform at run-time by adding and removing servers. As the servers can be gathered into several domains you can also add and remove domains.

Adding a new server

You can dynamically configure your Joram platform by adding new Joram servers. This is a two steps operation:

1. define the new server in the platform configuration using the Joram administration API

2. start the new server

Let's take an example in order to illustrate how it works. This simple scenario starts from a very simple Joram platform configuration that contains only one server called `S0`. This configuration is defined in Joram user guide (chapter 3.3.1).

```xml
<?xml version="1.0"?>
<config>
  <property name="Transaction" value="fr.dyade.aaa.util.NullTransaction"/>
  <server id="0" name="S0" hostname="localhost">
```

```
    <service class="org.objectweb.joram.mom.proxies.ConnectionManager" args="root
root"/>
    <service class="org.objectweb.joram.mom.proxies.tcp.TcpProxyService"
args="16010"/>
    <service class="fr.dyade.aaa.jndi2.server.JndiServer" args="16400"/>
  </server>
</config>
```

Server definition

The definition of a new server is programmatically done using the class `AdminModule` from Joram's administration API (package `org.objectweb.joram.jms.admin`).

```
import org.objectweb.joram.client.jms.admin.AdminModule;
```

First you need to connect the `AdminModule` to the Joram server `S0`:

```
AdminModule.connect("localhost", 16010, "root", "root", 60);
```

In order to define a new server you must specify in which domain the server is added. As the initial configuration doesn't define any domain, you have to add a first domain to the platform configuration.

A domain is defined by three parameters:

1. its name (unique inside a platform)
2. the name of an existing server that will be the first server belonging to this domain. When this server already belongs to a domain, it becomes the router between this domain and the new domain.
3. the port used by the first server to communicate with the other servers from this domain (none at the beginning)

The following code adds the domain `D0` that contains the server `S0`. The port used by `S0` to communicate inside `D0` is `17770`.

```
AdminModule.addDomain("D0", "S0", 17770);
```

Once the domain `D0` is added you can add a new server `S1` into this domain. A server is defined by five parameters:

1. the identifier of the server (unique inside a platform)
2. the address or name of the host where the server is running
3. the name of the domain where the server is added
4. the port used by the server to communicate with other servers inside the domain
5. its name (may be not unique)

```
AdminModule.addServer("localhost", 1, "D0", 17771, "S1");
```

Now the server `S1` has been added you need to get the overall configuration of the platform in order to start `S1`.

```
String platformConfig = AdminModule.getConfiguration();
```

The configuration is returned as a `String` which content is:

```
<?xml version="1.0"?>
<!DOCTYPE config SYSTEM "a3config.dtd">


<config>

  <domain name="D0" network="fr.dyade.aaa.agent.SimpleNetwork"/>
```

```
  <server hostname="localhost" id="1" name="S1">
    <network domain="D0" port="17771"/>
    <service class="org.objectweb.joram.mom.proxies.ConnectionManager" args="root
root"/>
  </server>

  <server hostname="localhost" id="0" name="S0">
    <network domain="D0" port="17770"/>
    <service class="org.objectweb.joram.mom.proxies.ConnectionManager" args="root
root"/>
    <service class="org.objectweb.joram.mom.proxies.tcp.TcpProxyService"
args="16010"/>
    <service class="fr.dyade.aaa.jndi2.server.JndiServer" args="16400"/>
  </server>

</config>
```

As you can see, the initial platform configuration has been extended with the definition of a new domain `D0` and a new server `S1`.

Store this configuration into a file `a3servers_updated.xml`. This file is necessary to start the new server `S1`.

```
File platformConfigFile = new File("a3servers_updated.xml");
FileOutputStream fos = new FileOutputStream(platformConfigFile);
PrintWriter pw = new PrintWriter(fos);
pw.println(platformConfig);
pw.flush();
pw.close();
fos.close();
```

Server start

The server `S1` is started in the same way as described in Joram user guide (see 3.3.2., running a platform):

1. copy the file a3servers_updated.xml in the directory where you want to start `S1` and rename it to `a3servers.xml`. You also need to put the DTD file `a3config.dtd` in the same directory.

1. customize the configuration of `S1` by modifying the file `a3servers.xml`. For example, you can add services (e.g. distributed `JndiServer`).

2. start the server with the following commands:

   cd <S1_Running_Dir>

   java fr.dyade.aaa.AgentServer 1 ./s1

Removing a server

This is a two steps operation:

1. stop the server
2. remove the server from the platform configuration using the Joram administration API

Notice that you can also remove it first from the configuration and then stop it.

Server stop

To stop a server you need to specify the identifier of the server. Notice that this operation is not synchronous, i.e. the server is asynchronously stopped. The server may still be running a while after the method `stopServer` returned.

```
AdminModule.stopServer(1);
```

Server removal

To remove a server from the platform configuration, you need to give the identifier of the server. This operation destroys all the pending messages sent to the removed server through the whole platform.

```
AdminModule.removeServer(1);
```

You can also remove a domain even if it is not empty. In this last case, the servers inside this domain are also removed. So you have to stop them.

```
AdminModule.removeDomain("D0");
```

This last operation removes the domain `D0` but not the server `S0` because it is used to make the dynamic configuration.

When you manipulate configurations with multiple domains by removing servers and/or domains, be careful not to split your platform into several parts.

3.3.5. *Logging configuration*

JORAM uses **Monolog** (see http://monolog.ow2.org/) for logging. Monolog is an API which abstracts log operations from their implementation.

Logging is configured in an `a3debug.cfg` file. It has to be in the classpath of the client and of the server (the server's process as well as the client's might be logged).

The `a3debug.cfg` configuration file defines the *appenders* used to log. By defaults, it logs on the standard output but a file is usable instead.

This file also defines all the categories which are available for logging. These categories are:

- Agent logs (categories starting with fr.dyade.aaa.agent): these categories log what happens in the low level messaging platform.
- MOM logs (categories starting with org.objectweb.joram.mom): these categories log what happens in a JORAM server, more particularly:
- in the server's proxies (org.objectweb.joram.mom.Proxy),
- in the server's destinations (org.objectweb.joram.mom.Destination).
- JORAM logs (org.objectweb.joram.client.jms.Client category): this category logs JMS client operations.
- JNDI logs (fr.dyade.aaa.jndi2): this category logs all JNDI operations, more particularly:
- in JNDI's server side (fr.dyade.aaa.jndi2.server),
- in JNDI's client side (fr.dyade.aaa.jndi2.client).

3.4. *High level administration*

When the messaging platform has been configured and started, the situation looks as follows:

- one or many interconnected servers run;
- each server may provide services for connecting and administering.

At that point an administrator client needs to connect to the platform and further configure it for allowing JMS clients to access and use it.

This administrator works either through a Java application using proprietary JORAM administration methods (described in this section), or through a web admin interface documented separately.

When the administration process is performed by a Java application, it uses JORAM's proprietary administration methods and objects. Those objects are:

- org.objectweb.joram.client.jms.admin.AdminModule
- org.objectweb.joram.client.jms.admin.AdminHelper
- org.objectweb.joram.client.jms.admin.User
- org.objectweb.joram.client.jms.Queue
- org.objectweb.joram.client.jms.Topic

And the various connection factory objects located in:

- org.objectweb.joram.client.jms.local
- org.objectweb.joram.client.jms.tcp

Exceptions describing failing administration requests are of this class:

- org.objectweb.joram.client.jms.admin.AdminException

3.4.1. *Administration "session"*

Administration operations (calls to administration methods) may be performed within an administration "session". Such a session is started when an administration connection is established with the JORAM platform to administer.

The utility class for managing administrator sessions is **org.objectweb.joram.client.jms.admin.AdminModule**.

TCP administrator connection

Such a connection is opened as follows:

```
AdminModule.connect("host1", 16010, "root", "root", 60);
```

This connects an application to a JORAM server running on "host1" and listening to port 16010 through the TCP protocol. It will work if the target server on "host1" provides the following services:

```
<service class="org.objectweb.joram.mom.proxies.ConnectionManager"
        args="root root"/>
<service class="org.objectweb.joram.mom.proxies.tcp.TcpProxyService"
        args="16010"/>
```

The last parameter of the connecting method (60), is the timer in seconds during which connecting to the server is attempted. This timer will be useful is the server is not yet started when the administration code is launched.

It is also possible to establish a "default" TCP connection to the server running on "localhost" and listening to port 16010 as follows:

```
AdminModule.connect("root", "root", 60);
```

If the connecting request finally fails because the server is not reachable, the methods throw a `ConnectException`. If the administrator identification is incorrect, the methods throw an `AdminException`.

Disconnecting the administrator

The administration session ends by calling:

```
AdminModule.disconnect();
```

Any call to any administration method outside the `AdminModule.connect()` and `AdminModule.disconnect()` boundaries will fail (a `ConnectException` will be thrown).

3.4.2.   Managing a user

User identity

Users are manipulated through the helper class **User** from package **org.objectweb.joram.jms.admin**. An instance of this class represents a given user and provides methods for administering it.

Creating a user

- `User.create(String name, String password, int server)` is a static method setting a user with a given identification on a given server, and creating the corresponding `User` instance.

- `User.create(String name, String password)` is similar to the previous method, except that it creates the user on the server the administrator is connected to (local server).

```
User user = User.create("name", "pass", 0);
```

- An `AdminException` is thrown if the user creation fails server side or if the server is not part of the platform. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Updating a user identity

- `User.update(String newName, String newPass)`: updates the user identification.

```
user.update("newName", "newPass");
```

- An `AdminException` is thrown if the user has been deleted server side, or if its new identification is already taken on its server. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Deleting a user

- `User.delete()`: unsets the user.

```
user.delete();
```

- The request is not effective if the user has already been deleted server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

3.4.3.   User connectivity

A given user accesses the JORAM platform by connecting to a given server (set when actually creating the user, last section). The connection might be of different kinds:

- either a TCP connection;
- or "collocated" (documented in 5.Using a collocated server).

The `javax.jms.ConnectionFactory` class is meant to determine to which server and through which protocol a client application will connect when calling the `createConnection` method.

Creating a `ConnectionFactory` instance for the TCP protocol

- `TcpConnectionFactory.create(String host, int port)`: static method creating a `ConnectionFactory` instance for accessing a server running on a given host and listening to a given port.

- `TcpConnectionFactory.create()`: static method creating a `ConnectionFactory` instance for accessing the server the administrator is connected to.

```
ConnectionFactory cnxFact =  TcpConnectionFactory.create(
        "localhost", 16010);
```

- `QueueTcpConnectionFactory.create(String host, int port)`: static method creating a `QueueConnectionFactory` instance for accessing a server running on a given host and listening to a given port.

- `QueueTcpConnectionFactory.create()`: static method creating a `QueueConnectionFactory` instance for accessing the server the administrator is connected to.

- `TopicTcpConnectionFactory.create(String host, int port)`: static method creating a `TopicConnectionFactory` instance for accessing a server running on a given host and listening to a given port.

- `TopicTcpConnectionFactory.create()`: static method creating a `TopicConnectionFactory` instance for accessing the server the administrator is connected to.

- `XATcpConnectionFactory.create(String host, int port)`: static method creating a `XAConnectionFactory` instance for accessing a server running on a given host and listening to a given port.

- `XATcpConnectionFactory.create()`: static method creating a `XAConnectionFactory` instance for accessing the server the administrator is connected to.

- `XAQueueTcpConnectionFactory.create(String host, int port)`: static method creating a `XAQueueConnectionFactory` instance for accessing a server running on a given host and listening to a given port.

- `XAQueueTcpConnectionFactory.create()`: static method creating a `XAQueueConnectionFactory` instance for accessing the server the administrator is connected to.

- `XATopicTcpConnectionFactory.create(String host, int port)`: static method creating a `XATopicConnectionFactory` instance for accessing a server running on a given host and listening to a given port.

- `XATopicTcpConnectionFactory.create()`: static method creating a `XATopicConnectionFactory` instance for accessing the server the administrator is connected to.

Setting the factory parameters

The following parameters may be set on a factory:

- Connecting timer: time (in seconds) during which connecting is attempted in case of failures.

- Transaction pending timer: time (in seconds) during which a transacted JMS session might be inactive before being automatically rolled back.

- Connection pending timer: time (in milliseconds) between two "ping" requests sent by the connection to the server; a connection is kept alive server side during twice the value of this parameter.

Those parameters are accessible through a FactoryParameters object (class `FactoryParameters` in package `org.objectweb.joram.client.jms`), obtainable by calling the `getParameters()` method on the factories.

When a client detects a connection failure, it automatically tries to reconnect every 2 seconds, during the period defined by the connecting timer parameter.

3.4.4.   Managing a destination

Destinations are manipulated through the classes **`org.objectweb.joram.jms.Queue`** and **`org.objectweb.joram.jms.Topic`**. An instance of one of these classes represents a given destination and provides methods for administering it. Specialized destination management requires additional classes (see specific documentation: 4.Specialized destinations).

Creating a destination: Queue or Topic

- `Queue.create(int server)`: static method creating a queue on a given server, and creating the corresponding `Queue` instance.

- `Queue.create()` is similar to the previous method, except that it creates the queue on the server the administrator is connected to (local server).

- `Topic.create(int server)`: static method creating a topic on a given server, and creating the corresponding `Topic` instance.

- `Topic.create()` is similar to the previous method, except that it creates the topic on the server the administrator is connected to (local server).

```
Queue queue = Queue.create();
Topic topic = Topic.create();
```

- An `AdminException` is thrown if the destination deployment fails server side, or if the server is not part of the platform. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Creating a destination with a specified name

When creating a destination, queue or topic, you can specify an internal name[1]; if a destination exists with the specified name it is returned to the user, in the contrary case it is created and registered in the internal naming service.

- `Queue.create(int server, String name)`

  `Queue.create(String name)`: creates a queue on the given or default server with the specified name. If the named queue already exists it is simply returned.

- `Topic.create(int server, String name)`

  `Topic.create(String name)`: creates a topic on the given or default server with the specified name. If the named topic already exists it is simply returned.

Setting the configuration parameters

Options can be set using properties at queue/topic creation time, by sending a message to the collector queue/topic or by Mbean queue/topic component. The following options are available:

- "period": defines the time in millisecond to run tasks at regular interval: cleaning of out-of-date messages, etc.

Setting free access on a destination

- `Destination.setFreeReading()`: grants the READ right to all on the destination.

---

[1]   Not a JNDI's name.

```
dest.setFreeReading();
```

- ▪ `Destination.setFreeWriting()`: grants the WRITE right to all on the destination.

```
dest.setFreeWriting();
```

- ▪ An `AdminException` is thrown if the destination has been deleted server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Unsetting free access on a destination

- ▪ `Destination.unsetFreeReading()`: removes the READ right to all on the destination.

```
dest.unsetFreeReading();
```

- ▪ `Destination.unsetFreeWriting()`: removes the WRITE right to all on the destination.

```
dest.unsetFreeWriting();
```

- ▪ An `AdminException` is thrown if the destination has been deleted server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Setting a right for a user on a destination

- ▪ `Destination.setReader(User user)`: sets a given user as a reader on the destination.

```
dest.setReader(user);
```

- ▪ `Destination.setWriter(User user)`: sets a given user as a writer on the destination.

```
dest.setWriter(user);
```

- ▪ An `AdminException` is thrown if the destination or the user does not exist server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Unsetting a right for a user on a destination

- ▪ `Destination.unsetReader(User user)`: unsets a given user as a reader on the destination.

```
dest.unsetReader(user);
```

- ▪ `Destination.unsetWriter(User user)`: unsets a given user as a writer on the destination.

```
dest.unsetWriter(user);
```

- ▪ An `AdminException` is thrown if the destination does not exist server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Getting the access rights

- ▪ `Destination.isFreelyReadable()`: returns `true` if the READ right is granted to all on the destination.
- ▪ `Destination.isFreelyWriteable()`: returns `true` if the WRITE right is granted to all on the destination.

- ▪ `Destination.getReaders()`: returns a `List` of users granted with the READ right on the destination.

- ▪ `Destination.getWriters()`: returns a `List` of users granted with the WRITE right on the destination.

  - ▪ An `AdminException` is thrown if the destination does not exist server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Handling the DMQ setting (see chapter 4.1)

- ▪ `Destination.setDMQ(DeadMQueue)`: sets the given Dead Message Queue as the default DMQ for the destination.

- ▪ `Destination.getDMQ()`: returns the default Dead Message Queue instance set for the destination, `null` if none.

  - ▪ An `AdminException` is thrown if the destination does not exist server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Deleting a destination

- ▪ `Destination.delete()`: deletes the destination.

```
dest.delete ();
```

  - ▪ The request is not effective if the destination does not exist server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

3.4.5. Managing a Queue

Getting the state

- ▪ `Queue.getPendingMessages()`: returns the number of messages on the queue waiting to be delivered.

- ▪ `Queue.getPendingRequests()`: returns the number of "receive" requests on the queue waiting for matching messages.

  - ▪ An `AdminException` is thrown if the queue does not exist server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Handling the queue threshold

The threshold value determine the maximum number of times a message can be denied. It allows to avoid an erroneous message to be delivered infinitely; the guilty message is then forwarded to the Dead Message Queue if any (deleted otherwise).

- ▪ `Queue.setThreshold(int threshold)`: sets the threshold value for the queue.

- ▪ `Queue.getThreshold()`: returns the threshold value set on the queue (-1 for none).

  - ▪ An `AdminException` is thrown if the queue does not exist server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Handling the queue limit

A maximum number of undelivered messages can be set for the queue. Additional messages are forwarded to the Dead Message Queue if any (deleted otherwise).

- `Queue.setNbMaxMsg(int nbMaxMsg)`: sets the maximum number of undelivered messages for the queue (-1 for no limit).
- `Queue.getNbMaxMsg()`: returns the maximum number of undelivered messages value set on the queue (-1 for none).

3.4.6.   Managing a Topic

A topic manages subsciptions. Subscription can be retrieved from User objects.

Getting the state

- `Topic.getSubscriptions()`: returns the number of active subscriptions on the topic.
- `Topic.getSubscriberIds()`: returns the list of user's proxy ids registered.
   - An `AdminException` is thrown if the topic does not exist server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

3.4.7.   Managing the platform

Methods are also provided for getting information about how the platform has been configured. Data is available at the platform, server, destination and user levels.

Getting the servers of the platform

- `AdminModule.getServersIds()`: returns a `List` containing the identifiers of all the servers involved in the monitored JORAM platform.
   - A `ConnectException` is thrown if the admin connection to the server is closed or lost.

Handling default DMQ settings

- `AdminModule.getDefaultDMQ(int serverId)`: returns the `DeadMQueue` instance representing the default DMQ of a given server, null if none.
   - An `AdminException` is thrown if the target server does not belong to the platform. A `ConnectException` is thrown if the admin connection to the server is closed or lost.
- `AdminModule.getDefaultDMQ()` is similar to the previous method, except that it returns the default DMQ of the server the administrator is connected to.
   - A `ConnectException` is thrown if the admin connection to the server is closed or lost.
- `AdminModule.getDefaultThreshold(int serverId)`: returns the default threshold value of a given server.
   - An `AdminException` is thrown if the target server does not belong to the platform. A `ConnectException` is thrown if the admin connection to the server is closed or lost.
- `AdminModule.getDefaultThreshold()` is similar to the previous method, except that it returns the default threshold of the server the administrator is connected to.
   - A `ConnectException` is thrown if the admin connection to the server is closed or lost.

Getting the destinations

- `AdminModule.getDestinations(int serverId)`: returns a `List` containing `Destination` instances representing all the destinations deployed on a given server.

- An `AdminException` is thrown if the target server does not belong to the platform. A `ConnectException` is thrown if the admin connection to the server is closed or lost.

- `AdminModule.getDestinations()` is similar to the previous method, except that it returns the destinations of the server the administrator is connected to.

  - A `ConnectException` is thrown if the admin connection to the server is closed or lost.

Getting the users

- `AdminModule.getUsers(int serverId)`: returns a `List` containing `User` instances representing all the users set on a given server.

  - An `AdminException` is thrown if the target server does not belong to the platform. A `ConnectException` is thrown if the admin connection to the server is closed or lost.

- `AdminModule.getUsers()` is similar to the previous method, except that it returns the users of the server the administrator is connected to.

  - A `ConnectException` is thrown if the admin connection to the server is closed or lost.

3.5. JMX administration of Joram

You can configure your Joram server to export some MXBean, so you can monitor and handle it through a JMX console. This example is designed in a JDK 1.5 environment with the integrated JMX 1.2 implementation.

To launch a Joram server with JMX capabilities enabled, you just have to fix the environment variable MXServer; for example typing `-DMXServer=com.scalagent.jmx.JMXServer` in the command line.

In order to allow a remote access to theses beans, you may either declare the JMXRIHttpService (`com.scalagent.jmx.JMXRIHttpService` class) in `a3servers.xml` configuration file or use a standard adapter. For example, if using JDK1.5, you can declare `-Dcom.sun.management.jmxremote` in the command line and then use the jconsole graphical tool to browse the beans:
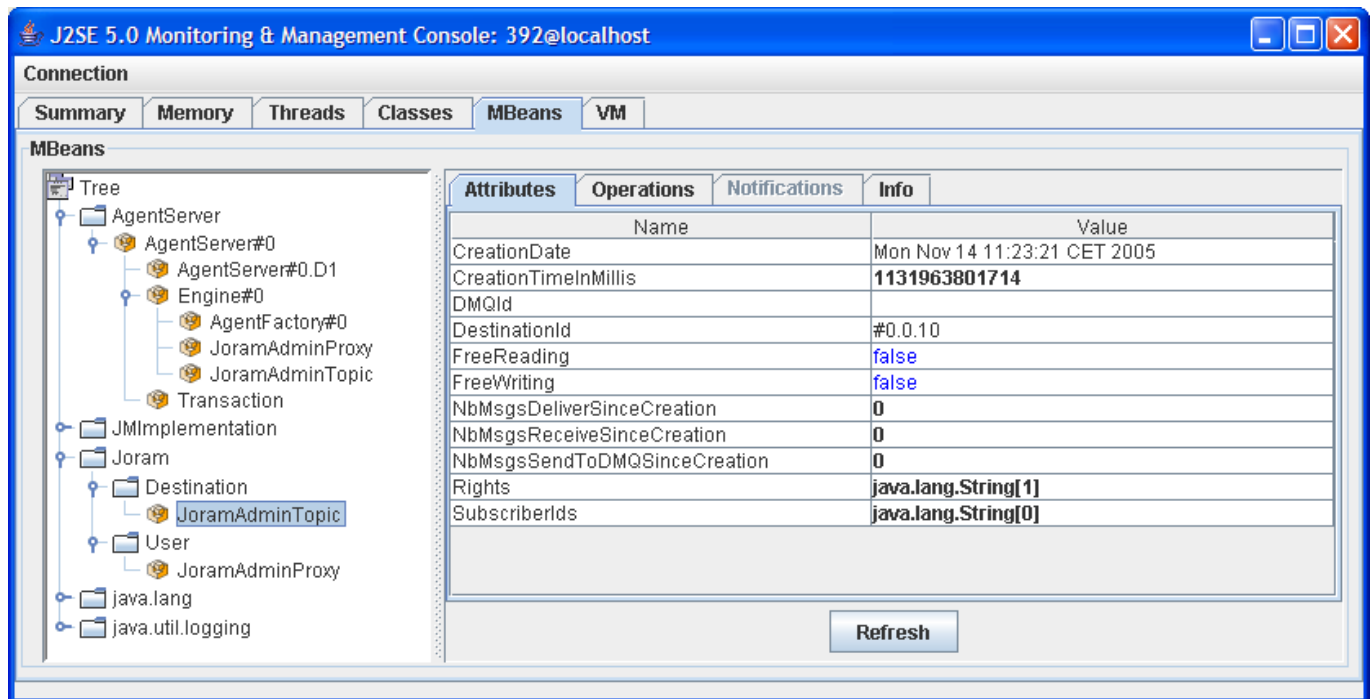
Jconsole View

At starting you there is two nodes added in the MBean's tree:

- The first one, named **AgentServer**, describes the ScalAgent platform: domains and networks, engine and agents.

- The second one, named **Joram**, allows the handling of Joram's users and destinations.

3.6.   ScriptsXML

This feature allows to execute administration operation using an XML script. It is possible to create and bind in JNDI connection factories, destinations and users. The complete DTD is available in CVS: "joram/src/org/objectweb/joram/client/jms/admin/joramAdmin.dtd".

3.6.1.   Administrator connection

First, it needs to define the administration connection through a connect tag; you can define various attributes:

- `host`: the DNS name or IP address of the machine hosting the server (default localhost).

- `port`: the listen port of the Joram's TCP service (default 16010).

- `name`: the user identity of administrator (default root).

- `password`: the password for the administrator user (default root).

- `cnxTimer`: time-out value in seconds for the connection (default 60).

- `reliableClass`: implementation class for the protocol between the client and the server. By default it use the TCP protocol:

`org.objectweb.joram.client.jms.tcp.ReliableTcpClient`.

3.6.2. Naming

If you want to register all created objects in a JNDI's repository you have to declare an InitiallContext element defining properties `java.naming.factory.initial`, `java.naming.factory.host` and `java.naming.factory.host`.

3.6.3. User and connectivity

ConnectionFactory

Each ConnectionFactory is defined by an element with an attribute class specifying the classname of the implementation:

- `name`: the name of the ConnectionFactory needed for later use in the script (building of clustered destination's for example).
- `classname`: the implementation class, by default a TcpConnectionFactory.

The ConnectionFactory is completed by a protocol element (local or tcp for example) and usually a jndi binding:

- `local`: empty element defining a colocated connection.
- `tcp`: define the tcp settings for a TCPConnectionFactory:
    - `host` and `port`: host address and listen port for server, by default `localhost:16010`.
    - `reliableClass`: the class implementation.

User

A user definition is a simple XML element, you must at least define name and password properties:

- `name`: the name of the user needed for later use in the script (handling of destination's rights for example).
- `login, password`: login and password for user, if the login is not fixed the name is used by default.
- `serverId`: unique identifier of location server. If not set the user is created on the server the administrator is connected.
- `dmq, threshold`: Dead Message Queue settings for the user.

3.6.4. Destination

The syntax allows to create queue, topic and Dead Message Queue, specialized destinations can be deployed specifying the MOM's implementation class of the destination:

Queue

A queue definition defines some optional properties, it can be completed by JNDI or security elements:

- `name`: the Joram's internal name for the queue.
- `serverId`: unique identifier of location server. If not set the queue is created on the server the administrator is connected.
- `dmq, threshold`: Dead Message Queue settings for the queue.
- `NbMaxMsg`:

- • `className`: the real class name of the MOM's destination. By default a simple queue, `org.objectweb.joram.mom.dest.Queue`.

Topic

A topic definition defines some optional properties, it can be completed by JNDI or security elements:

- • `name`: the Joram's internal name for the topic.

- • `serverId`: unique identifier of location server. If not set the topic is created on the server the administrator is connected.

- • `parent`: the internal name of the hierarchical parent of this topic.

- • `className`: the real class name of the MOM's destination. By default a simple topic, `org.objectweb.joram.mom.dest.Topic`.

DMQueue

- • `name`: the Joram's internal name for the Dead Message Queue.

- • `serverId`: unique identifier of location server. If not set the DMQ is created on the server the administrator is connected.

3.6.5. Destination security and naming

Destination element can be completed by security or naming settings:

freeReader

Grants the read right to all on this destination.

freeWriter

Grants the write right to all on this destination.

reader

Sets a user as a potential reader on the destination, the user name is given in the attribute `user`.

writer

Sets a user as a potential writer on the destination, the user name is given in the attribute `user`.

jndi

Registers the destination in JNDI context. The symbolic name is given in the attribute `name`.

property

Additional properties can be defined for destinations. Each property is an element with two attributes: `name` and `value`.

3.6.6. Example

In the example below (from the classic sample) we first define an administration connection through TCP to the local host on port 16010. The administrator's login is "root" and the password is "root".

Remark: as their values are the default ones, these parameter's definitions can be omitted.

A TCPConnectionFactory (localhost:16010) is defined and bind in JNDI (name "cf").

A user named "anonymous is created (password "anonymous"), then a queue named "queue" and a topic named "topic" are created. All these objects are created on the default server. The Read and write right are granted for all, the queue is bind in JNDI with the name "queue", and the topic with the name "topic".

```xml
<JoramAdmin>
  <AdminModule>
    <connect hostName="localhost" port="16010" name="root" password="root"/>
  </AdminModule>

  <ConnectionFactory
    className="org.objectweb.joram.client.jms.tcp.TcpConnectionFactory">
    <tcp host="localhost" port="16010"/>
    <jndi name="cf"/>
  </ConnectionFactory>

  <User name="anonymous" password="anonymous"/>

  <Queue name="queue">
    <freeReader/>
    <freeWriter/>
    <jndi name="queue"/>
  </Queue>

  <Topic name="topic">
    <freeReader/>
    <freeWriter/>
    <jndi name="topic"/>
  </Topic>
</JoramAdmin>
```

4. Specialized destinations

4.1. Dead Message Queue

4.1.1. Introduction

Any queue can be a dead message queue. In fact, a dead message queue is a classic queue, but used in a particular way: its purpose is to collect dead messages. A dead message is a message located server side and considered as undeliverable for various reasons. The reason can be:

- the target destination does not exist,

- the sender does not have the writing right on the target destination,

- the message expires before it is delivered,

- the message is constantly denied by the consuming client,

- the maximum number of messages in the queue has been reached,

- the message has been deleted on the queue.

An application may also consider a message it got has to be sent to the DMQ. This "manual" sending is allowed to any application.

The Figure 13 shows an example of DMQ usage. A DMQ has been set as the DMQ of a given queue. This queue receives a message from a producer and tries to deliver it to a consumer. This consumer keeps denying the received message. When the number of delivery attempts overtakes a given threshold value, the message is removed from the queue and sent to the DMQ.
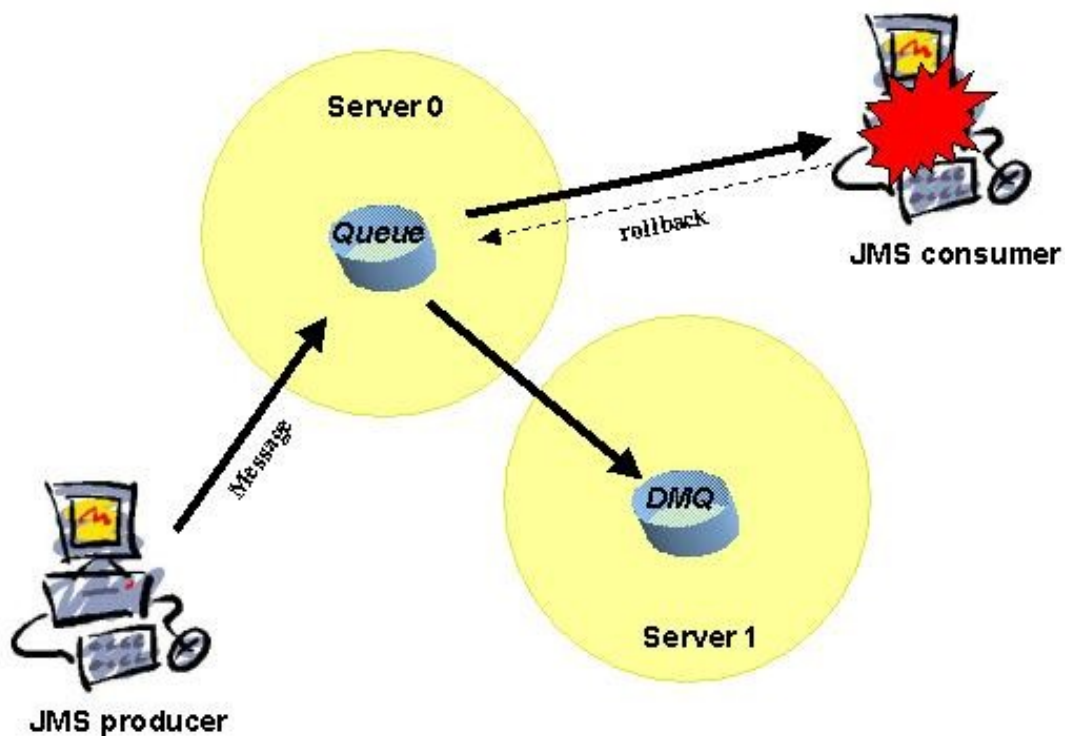
Figure 13 - Messages on a queue sent to a DMQ

Creating and setting a dead message queue

As any destination, a dead message queue may be deployed on any server of the configuration, even if it is intended to log dead messages of destinations located on other servers.

The setting of a dead message queue may take place at various levels. A dead message queue may be set as the dead message queue for:

- the destinations and users on a given server (it is then considered as the default DMQ for this server),
- a given destination,
- a given user.

A threshold value may also be set. If set, this value is the number of times a message may be delivered to a consumer before being considered as undeliverable. Its setting takes place at the same levels as for DMQs:

- as the default value for the queues and subscribers of a given server,
- for a queue,
- for a user.

The settings for a given destination and a given user precede the default settings (see the scenarios). No setting means that message is indefinitely delivered, even to failing consumers.

Scenarios

1. the target destination does not exist: the produced messages are sent to the producer's DMQ if set, or to the default producer server's DMQ if set.

2. the target destination is not writable: the produced messages are sent to the producer's DMQ if set, or to the default producer's server's DMQ if set, or to the destination's DMQ if set, or to the default destination's server's DMQ if set.

3. a message expires on a queue: it is sent to the queue's DMQ if set or to the queue's server's default DMQ if set.

4. a message on a queue reaches the maximum delivery attempts: it is sent to the queue's DMQ if set, or to the queue's server's default DMQ if set; the threshold value is the queue's one if set, or the queue's server's default one if set.

5. a message for a given subscriber expires: it is sent to the subscriber's DMQ if set, or to the subscriber's server's default DMQ if set.

6. a message for a given subscriber reaches the maximum delivery attempts: it is sent to the subscriber's DMQ if set, or to the subscriber's server's default DMQ if set; the threshold value is the subscriber's one if set, or the subscriber's server's default one if set.

Watching a dead message queue

Accessing a dead message queue through a JMS client means that the DMQ has preliminary been bound in a name space like JNDI, as any "normal" destination. Also, watching a dead message queue requires a JMS client granted with a READ access on it.

The client may consume or browse the queue. Remember DMQ is a "normal" queue, the only difference is the origin of the messages. It can even log its own messages as dead messages on other DMQs.

Dead messages carry special properties describing why they were considered as "dead". Those properties are:

- `JMS_JORAM_ERRORCOUNT`, this property is mapped to an integer telling the number of consecutive errors which happened.

- `JMS_JORAM_ERRORCODE_X`, with $1 \leq X \leq$ ERRORCOUNT returns the error code of the error number X.

- `JMS_JORAM_ERRORCAUSE_X`, with $1 \leq X \leq$ ERRORCOUNT is mapped to a string detailing the error. This can be one of the following:

    - `Deleted destination`, if the target destination of the message could not be found,

    - `Destination is not writable`, if the target destination of the message did not accept the sender as a WRITER,

    - `Expired at XXX`, if the message expired before delivery. The `XXX` stands for a long number holding the date when the message expired.

    - `Undeliverable after X tries`, if the number of delivery attempts of the message overtook the threshold. The `X` is replaced by the threshold value.

    - `Message deleted by an admin`, if the message being dead is the result of an admin deletion with `queue.deleteMessage(String msgId)` or `queue.clear()` methods.

    - `Queue full`, if the queue has reached its maximum number of messages.

    - `Unexpected error`, if there was an unexpected error, for example a connection problem while using a mail queue.

The `JMSXDeliveryCount` property is also available for getting the number of delivery attempts of the message, including the delivery to the DMQ consumer. All those properties are available trough the dedicated `Message` methods. A typical check can be as following:

```
// Getting a dead message through a DMQ consumer:
Message deadM = (Message) deadMconsumer.receive();

int errorCount = deadM.getIntProperty("JMS_JORAM_ERRORCOUNT");
for (int i = 1; i <= errorCount; i++) {
  System.out.println(deadM.getIntProperty("JMS_JORAM_ERRORCODE_" + i));
  System.out.println(deadM.getIntProperty("JMS_JORAM_ERRORCAUSE_" + i));

  // Do specific things if the message has expired.
  if(deadM.getIntProperty("JMS_JORAM_ERRORCODE_" + i) ==
          MessageErrorConstants.EXPIRED) {
    ...
  }
}
```

4.1.2. *Managing a Dead Message Queue*

Creating a dead message queue

A dead message queue is basically a "normal" queue:

- `Queue.create(int server)`: creates a queue on a given server, and instantiates the corresponding `Queue` object.

- `Queue.create()` is similar to the previous method, except that it creates the dead message queue on the server the administrator is connected to.

```
Queue dmq = Queue.create(0);
```

- An `AdminException` is thrown if the destination deployment fails server side, or if the server is not part of the platform. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Setting a dead message queue

- AdminModule.setDefaultDMQ(int serverId, Queue dmq): sets a given DMQ as the default DMQ for the destinations and users on a given server (set DMQ as null for unsetting it).

- AdminModule.setDefaultDMQ(Queue dmq) is similar to the previous method except that it sets the DMQ on the server the administrator is connected to.

```
AdminModule.setDefaultDMQ(0, dmq);
```

- A `ConnectException` is thrown if the admin connection to the server is closed or lost. An `AdminException` is thrown if the server is not known in the platform, or if the DMQ has been deleted server side.

- Destination.setDMQ(Queue dmq): sets a given DMQ as the DMQ for the destination (set DMQ as null for unsetting it).

- User.setDMQ(Queue dmq): sets a given DMQ as the DMQ for the user (set DMQ as null for unsetting it).

```
topic.setDMQ(dmq);
user.setDMQ(null);
```

- An `AdminException` is thrown if the destination or the user has been deleted server side. A `ConnectException` is thrown if the admin connection to the server is closed or lost.

Setting a threshold value

- AdminModule.setDefaultThreshold(int serverId, int threshold): sets a given value as the default threshold for the queues and users on a given server (set threshold to -1 for unsetting it).

- AdminModule.setDefaultThreshold(int threshold) is similar to the previous method except that it sets the threshold on the server the administrator is connected to.

```
AdminModule.setDefaultThreshold(0, 5);
```

- A `ConnectException` is thrown if the admin connection to the server is closed or lost. An `AdminException` is thrown if the server is not known in the platform.

- Queue.setThreshold(int threshold): sets a given value as the threshold for the queue.

- User.setThreshold(int threshold): sets a given value as the threshold for the user.

```
queue.setThreshold(5);
user.setThreshold(-1);
```

- An `AdminException` is thrown if the queue or the user has been deleted server side. A `ConnectException` is thrown if the admin connection to the server is closed or lost.

4.1.3.   Running the "Dead Message Queue" sample

The dead message queue sample simulates various cases where messages are considered as undeliverable. It involves a message producer, a failing consumer, and a DMQ watcher actually consuming the messages on the DMQ.

The next picture shows the DMQ configuration. The configuration used is centralized and the server run in non persistent mode
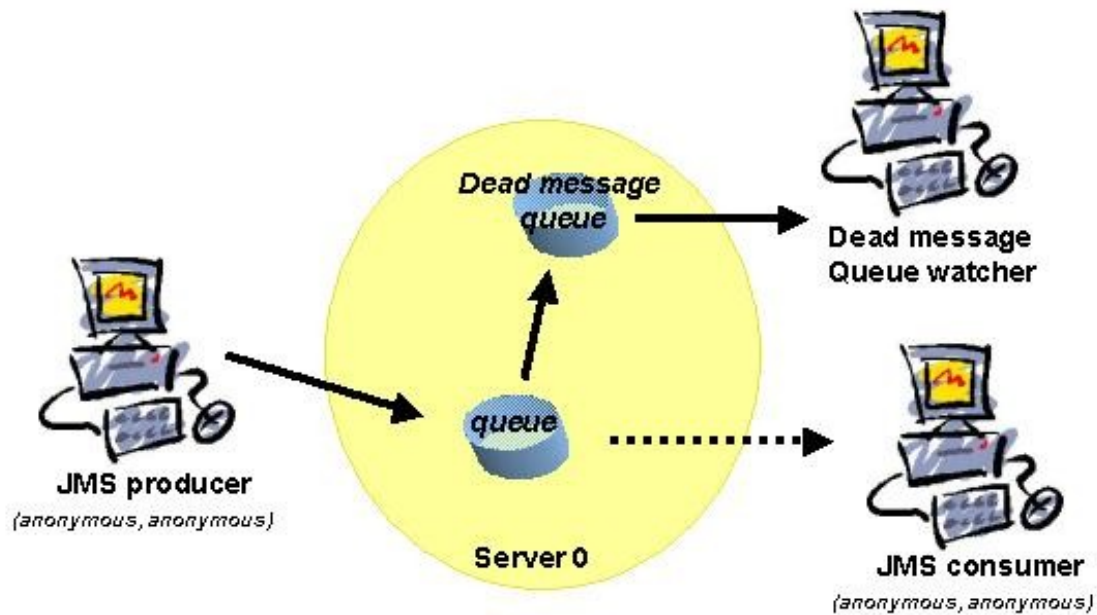
Figure 14 - Dead message queue sample

Running the demo:

- Start the platform:

  ant reset single_server

- Run the admin code:

  ant dmq_admin

- Launch the watcher:

  ant dmq_watcher

- Launch the producer and the consumer:

  ant dmq_client

4.2. Hierarchical Topic

4.2.1. Hierarchical topic

Introduction

The JMS specification allows topics to have a hierarchical structure such as the one shown in Figure 15. The interest of such a structure is to allow a subscriber to specifically choose the type of information it is interested in, by allowing it to subscribe to the corresponding subtopic. To the contrary, a subscriber may want to get all the sub information by subscribing to the topic root or father.
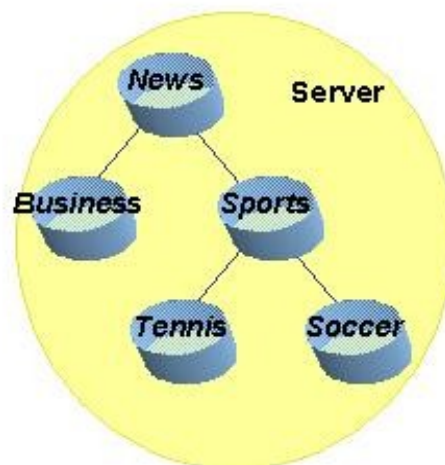
Figure 15 - A Hierarchical topic

Example

The example of Figure 15 shows a hierarchy of news. A subscriber to the Tennis topic would only get the news concerning tennis, whereas a subscriber to the Sports topic would get the news concerning tennis and soccer and sports in general. Also, a subscriber to the Business topic would get business information only, whereas a subscriber to the News topic will get the business related news, the sports related news, and news in general.

Creation

Creating such a hierarchy requires first to create the topics that will constitute it, then to notify each topic of the hierarchy it is part of.

Each topic of the hierarchy may be bound in a name space such as JNDI, so that clients may then retrieve them. Access rights are managed individually, on each topic of the hierarchy.

Distributed deployment

To be noted, a hierarchy may be spread over many servers (Figure 16). A distributed architecture introduces flexibility and availability. If server 1 is down, for example, the News and Business leafs of the hierarchy would go on working. Subscribers to the news and to the business would get information related to news and business (News subscribers would get nothing related to sports until server 1 is started again).
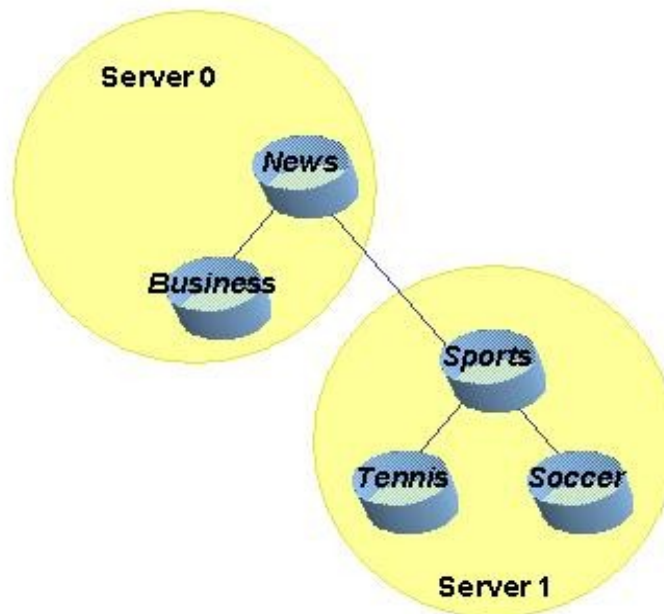
Figure 16 - A distributed Hierarchical topic

4.2.2.   Managing a Hierarchical Topic

Creating a hierarchical topic

Creating a hierarchical topic requires first to create all the topics of the hierarchy. If we consider the example shown on figure 6:

```
Topic news = Topic.create(0);
Topic business = Topic.create(0);
Topic sports = Topic.create(0);
Topic tennis = Topic.create(0);
Topic soccer = Topic.create(0);
```

The hierarchy needs then to be constructed. Topics are linked two by two with the following method:

- ▪ `Topic.setParent(Topic father)`: sets a given topic as the father of an other topic.

Going back to our example:

```
business.setParent(news);
sports.setParent(news);
tennis.setParent(sports);
soccer.setParent(sports);
```

An `AdminException` is thrown if one of the topics has been deleted server side, or is already part of a cluster, or if the son parameter already has a father. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Modifying a hierarchy

A hierarchy might be modified either by adding a new branch, or by modifying the existing ones, or by removing the existing ones. The following method is provided:

- ▪ `Topic.unsetParent()`: unsets the father of the topic.

For example, for unsetting the link between the sports related informations and the general news:

```
sports.unsetParent();
```

Subscribers to the `sports` topic would still get the `tennis` and `soccer` news, but subscribers to the `news` topic would not get anything related to `sports`.

A `ConnectException` is thrown if the admin connection with the server is closed or lost. An `AdminException` is thrown if the topic has been deleted server side or does not have a father.

Also, removing a topic of the hierarchy removes the links this topic was involved in. For example, by calling:

```
sports.delete();
```

the `tennis` and `soccer` topics become independent. News subscribers won't get anything related to tennis or soccer.

Getting info about cluster or hierarchy

- `Topic.getClusterFellows()`: returns a `List` of `Topic` instances representing other topics part of a same cluster.

- `Topic.getHierarchicalFather()`: returns a `Topic` instance representing the topic set as hierarchical father.

An `AdminException` is thrown if the topic does not exist server side. A `ConnectException` is thrown if the admin connection with the server is closed or lost.

4.2.3.   Running the topic tree sample

The topic tree sample illustrates the use of a hierarchical topic. A producer produces various informations destinated to the leafs of a hierarchical topic: news, business, sports, tennis. A consumer subscribes to all these leafs. Its subscription to the news will get all the messages. Its subscription to the business information will only get the messages related to business. Its subscription to the sports will get all the sports-related messages, and its subscription to the tennis news will only get the messages about tennis.

The next picture shows the topic tree configuration. The configuration used is centralized and the server run in non persistent mode.
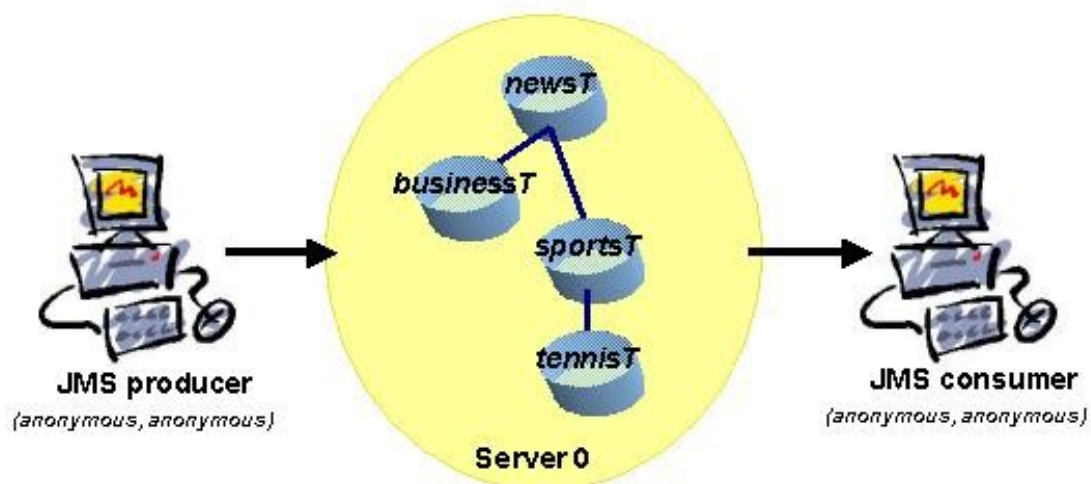
Figure 17 - Topic tree sample

Running the demo:

- For starting the platform:

  ant reset single_server

- For running the admin code:

  ant tree_admin

- For launching the consumer:

  ant tree_consumer

- To start the producer:

  ant tree_producer

4.3. Clustered Topic

4.3.1. Introduction

A non hierarchical topic might also be distributed among many servers. Such a topic, to be considered as a single logical topic, it made of topics representatives, one per server. Figure 18 shows such a topic located on three servers.

Such an architecture allows a publisher to publish messages on a representative of the topic. In the example shown in Figure 18, the publisher works with the representative on server 1. If a subscriber subscribed to any other representative (on server 2 in our example), it will get the messages produced by the publisher.
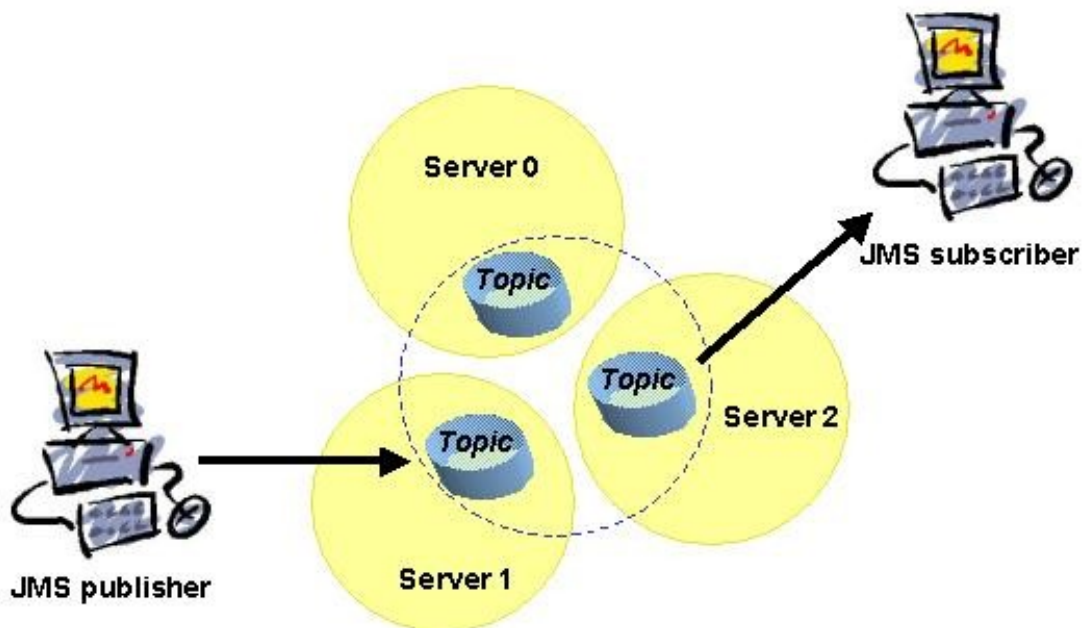
Figure 18 - A clustered topic

Added value

This special feature introduces more flexibility and availability to Publish/Subscribe communication. If server 0 is down, for example, the other representatives of the topic would go on working. The publisher would successfully send its messages to the representative on server 1, and a subscriber to the representative on server 2 would go on getting those messages.

Whereas a regular topic totally depends on the server it is deployed on, a clustered topic still partly works when some (not all) of the servers it is deployed on are down.

Creation and configuration

Creating a clustered topic requires first to create all its representatives. When it is done, each representative must be notified of the cluster it is part of.

Each clustered topic representative must be bound in a name space such as JNDI, so that clients may then retrieve them. Clients do not access the single logical topic, but a given representative of the cluster. Access rights are managed individually, on each topic of the cluster.

4.3.2.   Managing a clustered topic

Creating a cluster

Creating a cluster requires first to create all the topics of the cluster. If we consider the example shown on figure 8:

```
Topic topic0 = Topic.create(0);
Topic topic1 = Topic.create(1);
Topic topic2 = Topic.create(2);
```

The cluster needs then to be constructed. Topics are linked two by two with the following method:

- ▪ `Topic.addClusteredTopic(Topic addedTopic)`: adds a given topic to a cluster by joining it to a topic already belonging to the cluster, or chosen as the initiator of the cluster.

Going back to our example:

```
topic0.addClusteredTopic(topic1);
topic0.addClusteredTopic(topic2);
```

An `AdminException` is thrown if one of the topics has been deleted server side, or if one of the topics is part of a hierarchy. If the joining topic is already part of a cluster the command is silently ignored.

A `ConnectException` is thrown if the admin connection with the server is closed or lost.

Modifying a cluster

A cluster might be modified either by adding a new topic to it, or by removing a topic from it. The following method is provided:

- ▪ `Topic.removeFromCluster()`: notifies a given topic to leave the cluster it is part of.

For example, for removing the representative on server 2 from the cluster:

```
topic2.removeFromCluster();
```

A `ConnectException` is thrown if the admin connection with the server is closed or lost. An `AdminException` is thrown if the topic has been deleted server side, or is not part of any cluster.

This method is similar to removing the topic representative through the `Topic.delete()` method, except that it does not remove the topic. It simply becomes independent.

Using clustered JNDI's object

An object representing the cluster, and which may be bound to a JNDI server, should be instantiated once the cluster is set server side. This object wraps the information allowing a given client application to access the right topic of the cluster according to the server it connects to.

The ClusteredTopic object may be handled either through the administration API or the XML scripting capabilities.

Let assume that there is three existing clustered topics `topic0` (server 0), `topic1` (server 1) and `topic2` (server 2), and the corresponding ConnectionFactory `cf0`, `cf1` and `cf2`. The ClusterConnectionFactory and ClusterTopic objects allow to handle the clustered objects as a whole through a single object; each object is registered with a property specific to its location.

```
ClusterConnectionFactory clusterCF = new ClusterConnectionFactory();
clusterCF.addConnectionFactory("server0", cf0);
clusterCF.addConnectionFactory("server1", cf1);
clusterCF.addConnectionFactory("server2", cf2);
ictx.rebind("clusterCF", clusterCF);


ClusterTopic clusterTopic = new ClusterTopic();
clusterTopic.addDestination("server0", topic0);
clusterTopic.addDestination("server1", topic1);
clusterTopic.addDestination("server2", topic2);
ictx.rebind("clusterTopic", clusterTopic);
```

These objects can be registered in JNDI, then retrieved by a JMS client. When the client creates the JMS connection through the clustered ConnectionFactory, the connection is established depending of the "location" JVM property[2]. Then the client can create the Session and the MessageConsumer; the physical topic used will also depend of the "location" property so the connection and the topic will formed a coherent pair.

```
ConnectionFactory cf = ictx.lookup("clusterCF");
Topic clusterTopic = ictx.lookup("clusterTopic");
..
Connection cnx =  cf.createConnection(...);
Session session = cnx.createSession(...);
MessageConsumer consumer = Session.createConsumer(clusterTopic);
```

Setting the access rights

Access rights to the cluster may be set individually, for each topic. They may also be set for the whole cluster, using the same methods. Simply, instead of manipulating `Topic` instances, you have to manipulate the `ClusterTopic` instance.

```
clusterTopic.setFreeReading();
clusterTopic.setFreeWriting();
```

4.3.3.   Running the "Clustered Topic" Sample

This sample illustrates the use of Joram's clustered topic. A clustered topic is a group of topics deployed on different servers behaving as a unique "logical" topic. This sample configuration is made of 3 servers, each server hosting a topic part of the cluster. The platform is run in persistent mode. The provided configuration locates all three servers on "localhost" host.

---

[2] This property must be fixed according to the client needs; if it is not fixed the location is randomly set for later usage.
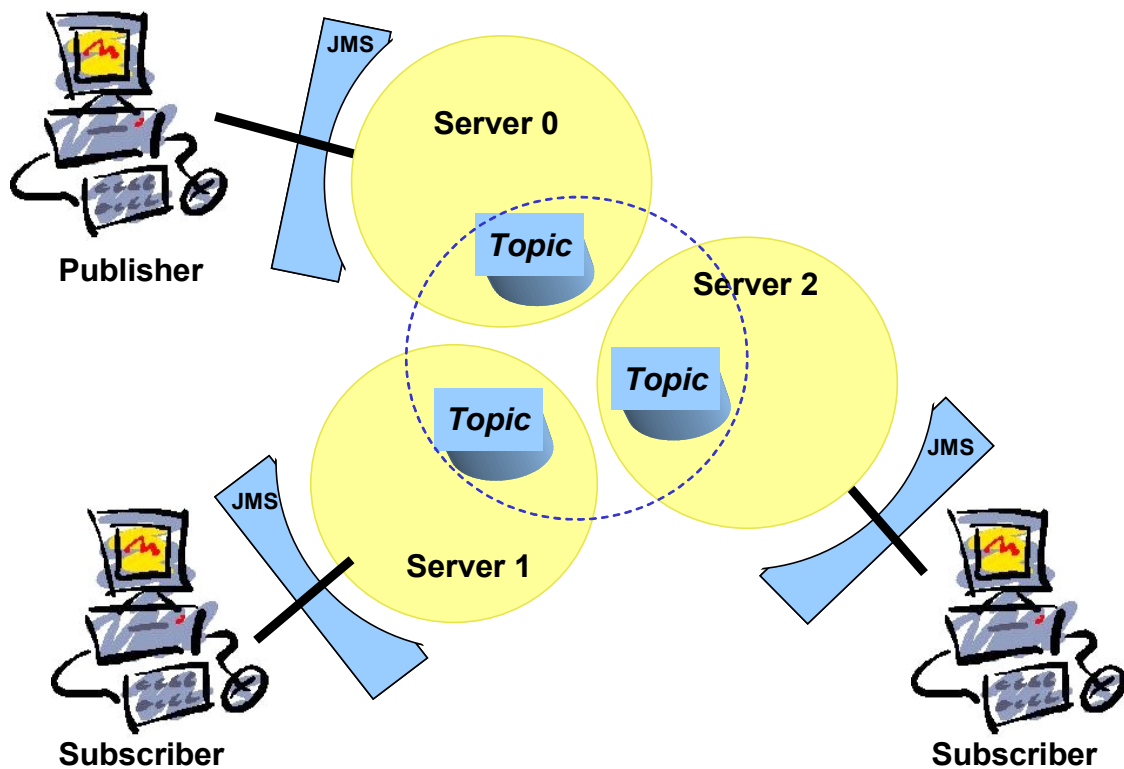
Figure 19 - Cluster sample configuration

This sample code is located in the **samples/src/joram/cluster/topic** directory. In order to run the demo described below you must go to the **samples/src/joram** directory.

The publisher connects to a server and publishes messages on the local topic of this server. The subscriber connects to a server and subscribes to the local topic of this server. You can either fix dynamically the server used for the connection (giving its identification 0, 1 or 2 when *ant* prompt for it) or use a randomly chosen server (using the '-' key at prompt).

Running the demo

- For compiling the sample code:

  ant clean compile

- For starting the configuration:

  ant reset servers

- For running the administration code:

  ant topic_cluster_admin

  or

  ant topic_cluster_adminxml

- For running a subscriber:

  ant topic_cluster_subscriber

- For running a publisher

  ant topic_cluster_publisher

Scenario:

When you launch a publisher on any server, all subscribers receives the messages sent.

4.3.4.   Using XML Scripts

The XML scripting facility allows to create and bind in JNDI clustered ConnectionFactory and Destination.

ClusterConnectionFactory

A ClusterConnectionFactory is defined through a ClusterCF element. It is made up of a set of predefined ConnectionFactory element pointed out by their names. It can be completed by a JNDI declaration.

First we have to define each ConnectionFactory, one for each server of the cluster. The declaration below defines three ConnectionFactory (TcpConnectionFactory by default), cf0 allows the connection to server #0, cf1 to server #1 and cf2 to server #2. Each ConnectionFactory can be bound individually in JNDI.

```
<ConnectionFactory name="cf0">
  <tcp host="localhost" port="16010"/>
  <jndi name="cf0"/>
</ConnectionFactory>

<ConnectionFactory name="cf1">
  <tcp host="localhost" port="16011"/>
  <jndi name="cf1"/>
</ConnectionFactory>

<ConnectionFactory name="cf2">
  <tcp host="localhost" port="16012"/>
  <jndi name="cf2"/>
</ConnectionFactory>
```

Second we can define the ClusterConnectionFactory associating each ConnectionFactory with a location property[3]. The declaration above defines a ClusterConnectionFactory made up of three TcpConnectionFactory named cf0, cf1 and cf2. The resulted ConnectionFactory is bound in JNDI with the name clusterCF.

```
<ClusterCF>
  <ClusterElement name="cf0" location="server0"/>
  <ClusterElement name="cf1" location="server1"/>
  <ClusterElement name="cf2" location="server2"/>
  <jndi name="clusterCF"/>
</ClusterCF>
```

ClusterTopic

A clustered topic is made up of a set of Topic elements; each destination needs to be created separately. It can be completed by a JNDI declaration.

```
<Topic name="topic0" serverId="0">
  <jndi name="topic0"/>
</Topic>
<Topic name="topic1" serverId="1">
  <jndi name="topic1"/>
</Topic>
```

---

[3] This property allows to choose the right association between the ConnectionFactory and the representative of clustered destinations (see paragraph "Using clustered JNDI's object").

```
<Topic name="topic2" serverId="2">
  <jndi name="topic2"/>
</Topic>
```

The destinations must be linked in the cluster. The declaration below defines a ClusteredTopic made up of three Topic objects named topic0, topic1 and topic2. The location property allows to associate each Topic object with the corresponding ConnectionFactory of the clusterCF object (see paragraph "Using clustered JNDI's object" above). The resulted queue is bound in JNDI with the name clusterTopic.

```
<ClusterTopic>
  <ClusterElement name="topic0" location="server0"/>
  <ClusterElement name="topic1" location="server1"/>
  <ClusterElement name="topic2" location="server2"/>
  <freeReader/>
  <freeWriter/>
  <jndi name="clusterTopic"/>
</ClusterTopic>
```

4.4. Clustered Queue

4.4.1. Introduction

The clustered queue feature provides a load balancing mechanism. A clustered queue is a cluster of queues (a given number of queue destinations, knowing each other), exchanging messages depending on their load. The figure 9 shows an example of a cluster made of two queues. An heavy producer accesses its local queue (queue 0) and sends messages. The queue is also accessed by a consumer but requesting few messages. It quickly becomes loaded and decides to forward messages to the other queue (queue 1) of its cluster, which is not under heavy load. Thus, the consumer on queue 1 also gets messages, and messages on queue 0 are consumed in a quicker way.
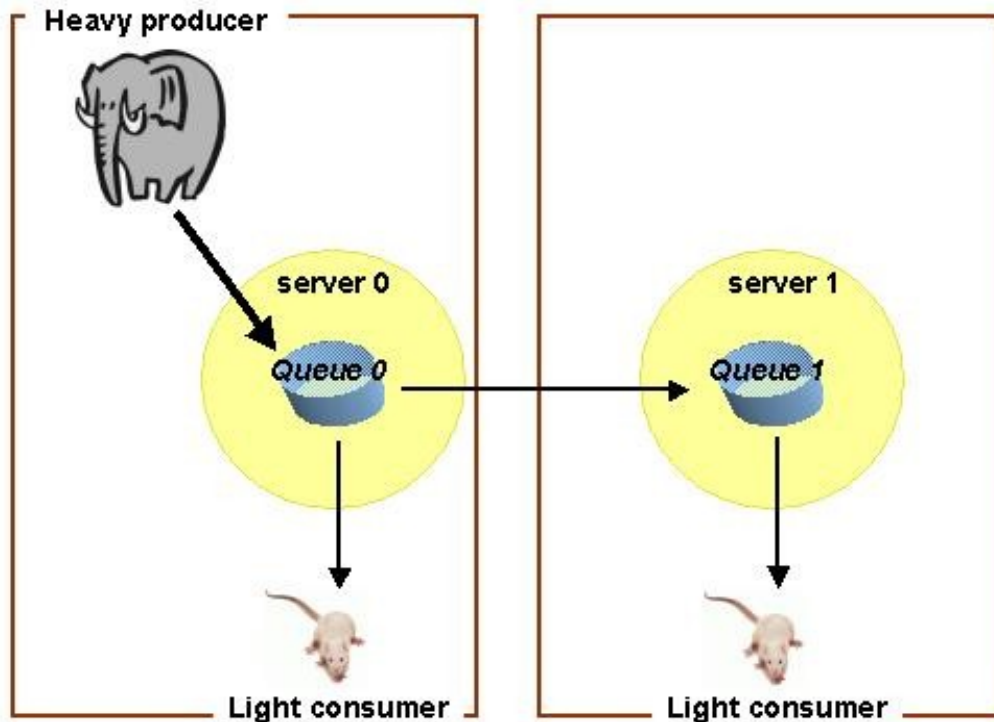
Figure 20 - A cluster of queues balancing heavy deliveries

Basic mechanism

Each queue of a cluster periodically re-evaluates its load factor and sends the result to the other queues of the cluster. When a queue hosts more messages than it is authorized to do, and according to the load factors of the cluster, it distributes the extra messages to the other queues. When a queue is requested to deliver messages but is empty, it requests messages from the other queues of the cluster. This mechanism guarantees that no queue is hyper-active while some others are lazy, and tends to distribute the work load among the servers involved in the cluster.

Creation and configuration

Creating a cluster of queues consists first in setting the cluster's parameters for load-balancing, then in creating the queues one by one, and finally in linking them as part of a same cluster. The needed configuration parameters are:

- a period of time before activating an automatic revaluation of the queues' load factor;

- a number of messages above which a queue is considered as over-loaded;

- a number of pending "receive" requests above which an empty queue requests messages from the other cluster queues;

- a period of time during which a queue which requested something from the cluster queues should not do it again.

Access rights to the cluster may be managed individually, for each queue, or for the whole cluster.

4.4.2. Managing a clustered queue

Setting the clustered queue parameters

Prior to creating the cluster, the following parameters must be set individually for each queue of the cluster[4]:

- "period": period in ms between two activations of the load factor evaluation routine for the queue;

- "producThreshold": number of messages above which a queue is considered loaded, a load factor evaluation launched, messages forwarded to other queues of the cluster;

- "consumThreshold": number of pending "receive" requests above which a queue will request messages from the other queues of the cluster;

- "autoEvalThreshold": set to "true" for requesting an automatic revaluation of the queues' thresholds values according to their activity;

- "waitAfterClusterReq": time (in ms) during which a queue which requested something from the cluster is not authorized to do it again.

Properties are set in a `java.util.Properties` instance. For example:

```
java.util.Properties prop = new java.util.Properties();
prop.setProperty("period", "10000");
prop.setProperty("producThreshold", "60");
prop.setProperty("consumThreshold", "2");
prop.setProperty("autoEvalThreshold", "true");
prop.setProperty("waitAfterClusterReq", "500");
```

Creating the clustered queues

Creating a clustered queue consists first in creating the queues that will be part of it. For a cluster of three queues, let's create queue0, queue1 and queue2 and servers 0, 1 and 2 through the `Queue.create` method.

```
String className = "org.objectweb.joram.mom.dest.ClusterQueue";

Queue queue0 = Queue.create(0, "queue0", className, prop);
Queue queue1 = Queue.create(1, "queue1", className, prop);
Queue queue2 = Queue.create(2, "queue2", className, prop);
```

The next step consists in clustering the queues. Queues are linked two by two using Queue class with the following method:

- `addClustered(Queue addedQueue)`: adds a given queue to a cluster by joining it to a queue already belonging to the cluster, or chosen as the initiator of the cluster.

Going back to our example:

```
queue0.addClusteredQueue(queue1);
queue0.addClusteredQueue(queue2);
```

An `IllegalArgumentException` is thrown by this latest method if one of the queues parameters is not a valid Joram queue. An `AdminException` is thrown if one of the queues does not exist server side, or if the joining queue is already part of a cluster. A `ConnectException` is thrown if the connection with the server is lost.

---

[4] Each queue can have a different configuration depending of the characteristics of the server, or the number of producer/consumer, etc.

Using clustered JNDI's object

An object representing the cluster, and which may be bound to a JNDI server, should be instantiated once the cluster is set server side. This object wraps the information allowing a given client application to access the right queue of the cluster according to the server it connects to.

The ClusteredQueue object may be handled either through the administration API or the XML scripting capabilities.

Let assume that there is three existing clustered queues `queue0` (server 0), `queue1` (server 1) and `queue2` (server 2), and the corresponding ConnectionFactory `cf0`, `cf1` and `cf2`. The ClusterConnectionFactory and ClusterQueue objects allow to handle the clustered objects as a whole through a single object; each object is registered in the clustered object with a property specific to its location.

```
ClusterConnectionFactory clusterCF = new ClusterConnectionFactory();
clusterCF.addConnectionFactory("server0", cf0);
clusterCF.addConnectionFactory("server1", cf1);
clusterCF.addConnectionFactory("server2", cf2);
ictx.rebind("clusterCF", clusterCF);


ClusterQueue clusterQueue = new ClusterQueue();
clusterQueue.addDestination("server0", queue0);
clusterQueue.addDestination("server1", queue1);
clusterQueue.addDestination("server2", queue2);
```

These objects can be registered in JNDI, then retrieved by a JMS client. When the client creates the JMS connection through the clustered ConnectionFactory, the connection is established depending of the "location" JVM property[5]. Then the client can create the Session and the MessageConsumer; the physical queue used will also depend of the "location" property so the connection and the queue will formed a coherent pair.

```
ConnectionFactory cf = ictx.lookup("clusterCF");
Queue queue = ictx.lookup("clusterQueue");
..
Connection cnx =  cf.createConnection(...);
Session session = cnx.createSession(...);
MessageConsumer consumer = Session.createConsumer(queue);
```

Setting the access rights

Access rights to the cluster may be set individually, for each queue. They may also be set for the whole cluster, using the same methods. Simply, instead of manipulating `Queue` instances, simply manipulate the `ClusterQueue` instance. For example:

```
clusterQueue.setFreeReading();
clusterQueue.setFreeWriting();
```

4.4.3.   *Running the "Clustered Queue" Sample*

This sample illustrates the use of Joram's clustered queues. A cluster queue is a group of queues deployed on different servers and handling the load-balancing.

This sample configuration is made of three servers, each server hosting a queue part of the cluster. The platform is run in persistent mode. The provided configuration locates all three servers on "localhost" host.

---

[5] This property must be fixed according to the client needs; if it is not fixed the location is randomly set for later usage.

This sample code is located in the **samples/src/joram/cluster/queue** directory. In order to run the demo described below you must go to the **samples/src/joram** directory.

Running the demo:

- Starting the configuration:

  ant reset servers

- Running the administration code: *ant queue_cluster_admin*.

  o This target creates and configures a cluster with 3 queues as described above.

- Running the consumers using the target *queue_cluster_consumer*.

  o This target launches a message consumer connected to one of the server, it indefinitely consumes messages on the corresponding queue.

- Running the producers using the target *queue_cluster_producer*.

  o This target launches a message producer connected to one of the server, it sends 1000 messages to the corresponding queue.

- Using the *queue_cluster_consumer* or *queue_cluster_producer* targets you can either fix dynamically the server used for the connection (giving its identification 0, 1 or 2 when ant prompt for it) or use a randomly chosen server (directly press the return key at prompt).

In order to view the load-balancing mechanism we can run two different scenarios.

Scenario 1:

In this scenario there is three message consumers, one for each queue of the cluster. Messages are all sent to queue0, the load-balancing mechanism dispatches them between the queues, then the consumers.

- Launching three consumers on queue0, queue1 and queue2:

  "ant queue_cluster_consumer" then type '0'.

  "ant queue_cluster_consumer" then type '1'.

  "ant queue_cluster_consumer" then type '2'.

- Launching multiples producers on queue0:

  "ant queue_cluster_producer" then type '0'.

  "ant queue_cluster_producer" then type '0'.

  "ant queue_cluster_producer" then type '0'.

Scenario 2:

In this scenario there is only two message consumers listening on queue0 and queue1. Messages are sent on queue1 and queue2, messages produced to queue2 by the second producer are dispatched between the two consumers by the load-balancing mechanism.

- Launching two consumers on queue0 and queue1

  "ant queue_cluster_consumer" then type '0'.

  "ant queue_cluster_consumer" then type '1'.

- Launching two producers on queue1 and queue2

  "ant queue_cluster_producer" then type '1'.

  "ant queue_cluster_producer" then type '2'.

4.4.4. Using XML Scripts

The XML scripting facility allows to create and bind in JNDI clustered ConnectionFactory and Destination.

ClusterConnectionFactory

A ClusterConnectionFactory is defined through a ClusterCF element. It is made up of a set of predefined ConnectionFactory element pointed out by their names. It can be completed by a JNDI declaration.

```xml
<ConnectionFactory name="cf0">
  <tcp host="localhost" port="16010"/>
  <jndi name="cf0"/>
</ConnectionFactory>


<ConnectionFactory name="cf1">
  <tcp host="localhost" port="16011"/>
  <jndi name="cf1"/>
</ConnectionFactory>


<ConnectionFactory name="cf2">
  <tcp host="localhost" port="16012"/>
  <jndi name="cf2"/>
</ConnectionFactory>
```

The declaration below defines a ClusterConnectionFactory JNDI's object made up of three TcpConnectionFactory named cf0, cf1 and cf2. Each ConnectionFactory is bound in the cluster with a key depending of its location. The resulted ConnectionFactory is bound in JNDI with the name clusterCF.

```xml
<ClusterCF>
  <ClusterElement name="cf0" location="server0"/>
  <ClusterElement name="cf1" location="server1"/>
  <ClusterElement name="cf2" location="server2"/>
  <jndi name="clusterCF"/>
</ClusterCF>
```

ClusterQueue

A clustered destination is made up of a set of Queue or Topic elements; each destination needs to be created separately then linked. It can be completed by a JNDI declaration.

```xml
<Queue name="queue0" serverId="0"
       className="org.objectweb.joram.mom.dest.ClusterQueue">
  <property name="period" value="10000"/>
  <property name="producThreshold" value="50"/>
  <property name="consumThreshold" value="2"/>
  <property name="autoEvalThreshold" value="false"/>
  <property name="waitAfterClusterReq" value="1000"/>
  <jndi name="queue0"/>
</Queue>

<Queue name="queue1" serverId="1"
```

```
                 className="org.objectweb.joram.mom.dest.ClusterQueue">
    <property name="period" value="10000"/>
    <property name="producThreshold" value="50"/>
    <property name="consumThreshold" value="2"/>
    <property name="autoEvalThreshold" value="false"/>
    <property name="waitAfterClusterReq" value="1000"/>
    <jndi name="queue1"/>
  </Queue>

  <Queue name="queue2" serverId="2"
              className="org.objectweb.joram.mom.dest.ClusterQueue">
    <property name="period" value="10000"/>
    <property name="producThreshold" value="50"/>
    <property name="consumThreshold" value="2"/>
    <property name="autoEvalThreshold" value="false"/>
    <property name="waitAfterClusterReq" value="1000"/>
    <jndi name="queue2"/>
  </Queue>
```

The declaration below defines a ClusteredQueue made up of three Queue objects named queue0, queue1 and queue2. Each queue is bound in the cluster with a key according to its location[6]. The location property allows to associate each Topic object with the corresponding ConnectionFactory of the clusterCF object (see paragraph "Using clustered JNDI's object" above). The resulted queue is bound in JNDI with the name clusterQueue.

```
<ClusterQueue>
    <freeReader/>
    <freeWriter/>
    <ClusterElement name="queue0" location="server0"/>
    <ClusterElement name="queue1" location="server1"/>
    <ClusterElement name="queue2" location="sserver2"/>
    <jndi name="clusterQueue"/>
</ClusterQueue>
```

4.5. SchedulerQueue

4.5.1. Introduction

A scheduler queue is a standard JMS queue extended with a timer behaviour. When a scheduler queue receives a message with a property called 'scheduleDate' (typed as a long) then the message is not available for delivery before the date specified by the property.

The scheduler queue feature is available since the Joram version 4.3.14.

4.5.2. Using a schedulerQueue

Create a scheduler queue

A scheduler queue is created by using the Joram administration API, calling the Queue creation method `create` from the class `org.objectweb.joram.client.jms.Queue`.

---

[6] This key must be the same that the key used for the corresponding ConnectionFactory.

```
queue = Queue.create(0, "schedulerQ", Queue.SCHEDULER_QUEUE, null);
```

Schedule a message

Scheduling a message requires to add a property called "scheduleDate" to the message. The value is the message delivery date typed as a long.

The following example shows how to schedule a message for 5 seconds later.

```
long scheduleDate = System.currentTimeMillis() + 5000L;
TextMessage msg = session.createTextMessage("hello");
msg.setLongProperty("scheduleDate", scheduleDate);
producer.send(msg);
```

A scheduled message is visible in the list of message of the queue but it cannot be delivered before its schedule date is reached (it is close to the use of a selector on all the receive requests verifying that the scheduled date is less than the current one).

Cancel a scheduled message

You can cancel a previously scheduled message by removing it from the scheduler queue. This removal operation can be performed through the Joram administration API.

```
queue.deleteMessage(msg.getJMSMessageID());
```

4.6.   Acquisition and distribution

4.6.1.   Introduction

Joram provides the ability to inject messages in the "JMS world" using non-JMS sources like an email account or a JMX server. That's the **acquisition** part. The acquisition destination will periodically search for new items to acquire and make them available as messages.

On the other hand, custom destinations are also available for **distribution**, which means distributing JMS messages outside the JMS world (e-mail, ftp, …). The distribution destination will forward every message handled to the corresponding recipient.

For example, using an e-mail account you can:

● forward Joram's messages to this external email account using distribution

● import emails from this external account and turn them into Joram's messages using acquisition

Acquisition and distribution are available for queues and topics, so we have respectively:

• Acquisition queue:

```
Queue queue = Queue.create(0, "queue", Queue.ACQUISITION_QUEUE, prop);
```

• Acquisition topic:

```
Topic topic = Topic.create(0, "topic", Topic.ACQUISITION_TOPIC, prop);
```

• Distribution queue:

```
Queue queue = Queue.create(0, "queue", Destination.DISTRIBUTION_QUEUE, prop);
```

• Distribution topic:

```
Topic topic = Topic.create(0, "topic", Destination.DISTRIBUTION_TOPIC, prop);
```

The acquisition and distribution destinations are available since the Joram version 5.3.2.

4.6.2.   Configuring an acquisition destination

A set of properties is used to configure the **acquisition** destination:

- `acquisition.className` – Mandatory property which indicates the acquisition class to use, depending on what content is acquired by the destination.
- `acquisition.period` – Tells the period between two acquisitions, default is 0 (no periodic acquisition)
- `persistent` – Tells if produced messages will be persistent, default is true (JMS default).
- `expiration` – Tells the life expectancy of produced messages, default is 0 (JMS default time to live).
- `priority` – Tells the JMS priority of produced messages, default is 4 (JMS default).

As the acquisition period can be null, the destination exists in two modes which will affect the way this acquisition destination will react to messages sent to it:

In **periodic mode** (period > 0), a message with non-null properties will be treated as a new configuration for the destination, and ignored otherwise.

In **request mode**, a message received will launch an acquisition process with the given message properties or use the last known properties if empty.

Destination mode can be changed using the "period" property.

Alternatively, the acquisition destination can work as an **acquisition daemon** which will be notified at any time a new message is coming. In this case, the previous `acquisition.period` property is inoperative. This acquisition method is useful in cases where the acquisition message is not acquired by polling it.

For example, the JMS acquisition bridge works this way because it sets up a MessageListener on a foreign JMS destination and as a consequence it will be notified whenever a new message is received.

The fact that the acquisition destination is a daemon or not depends on the class specified by the `acquisition.className` property. For now the only acquisition daemon destination is the JMS bridge acquisition destination.

4.6.3.   Configuring a distribution destination

A set of properties is used to configure the **distribution** destination:

- `distribution.className` – Mandatory property which indicates the distribution class to use, depending on what content is distributed by the destination.
- `distribution.keep` – Tells if distributed message is kept in destination, default is false.

The properties of distributed messages can be used to update distribution properties.

4.6.4.   Required libraries

As you can see in the previous configuring part, a class name must be specified as a property to specify the way acquisition or distribution is done. So, for the acquisition or distribution destination to work properly, this class must be accessible. This means that additional bundles must be installed and started when JORAM is running over OSGi. In order to do this, you can customize the file `config.properties` before launching the Joram server to modify the `felix.auto.start` property or the `felix.auto.deploy.dir` property. Additional details can be found in the config.properties file or on the felix website: http://felix.apache.org/site/index.html.

For example, for the mail destinations to work, you need to install the bundle `joram-mom-extensions-mail.jar`.

4.6.5.   *Mail acquisition / distribution*

Introduction

Using an e-mail account, mail destinations allow you to:

- forward Joram's messages to this external email account using distribution
- import emails from this external account and turn them into Joram's messages using acquisition

The mail acquisition class name is com.scalagent.joram.mom.dest.mail.MailAcquisition and the mail distribution class name is com.scalagent.joram.mom.dest.mail.MailDistribution. Both of these classes are located in the `joram-mom-extensions-mail.jar` bundle.

Mail acquisition properties

In addition to common acquisition properties, the following parameters must be set:

- `popServer` – the DNS name or IP address of the POP server;
- `popUser` – the login name for the email account;
- `popPassword` – the password for the email account;
- `expunge` – allows to remove or not email on the server.

Properties prop = new Properties();

```
prop.setProperty("acquisition.className",
    "com.scalagent.joram.mom.dest.mail.MailAcquisition");
prop.setProperty("acquisition.period", "30000");
prop.setProperty("popServer", popServer);
prop.setProperty("popUser", popUser);
prop.setProperty("popPassword", popPassword);
prop.setProperty("expunge", "false");
```

Remark: The current mechanism does not allow the use of protocol other than POP. The transformation is currently hard-coded it should be interesting to configure it.

Mail distribution properties

In addition to common distribution properties, the following parameters must be set:

- `smtpServer` – the DNS name or IP address of the SMTP server;
- `from` – the email address of the sender;
- `to, cc, bcc` – a comma separated list of recipients;
- `subject` – the subject of outgoing message;
- `selector` – additionally a selector can be added to filter the forwarded messages.

```
Properties prop = new Properties();
prop.setProperty("distribution.className",
    "com.scalagent.joram.mom.dest.mail.MailDistribution");
prop.setProperty("smtpServer", smtpServer);
prop.setProperty("from", from);
prop.setProperty("to", to);
prop.setProperty("subject", "JORAM MAIL");
prop.setProperty("selector", "");
```

Remark: The current mechanism does not allow the use of protocol other than SMTP. It could be interesting to allow the overloading of the default sending parameters by message properties.

Running the sample

This sample illustrates the use of Joram's e-mail acquisition and distribution destinations. It uses a mail topic to send email to a predefined account, and a mail queue to receive email from this identical account.

This sample configuration is made of a unique server located on "localhost" host. The platform is run in non-persistent mode.

Before running the sample, you must change two properties file defining the mail configuration. Theses files are pop.properties and smtp.properties, they are located in the joram/samples/config directory.

Figure 21 - The mail sample

Running the demo: in the joram/samples/src/joram directory.

- Compiling the samples:

  `ant clean compile`

- Starting the configuration:

  ant reset extended_server

- Running the administration code in a new console: this target creates a TcpConnectionFactory, an 'anonymous' user, a mail distribution topic for outgoing mail and a mail acquisition queue for incoming mail.

  ant mail_admin

- Running the producer: this target sends 5 messages on the mail topic. Theses messages will be forwarded using the SMTP protocol to the predefined mail account.

  `ant mail_producer`

- Running the consumers: this target launches a message listener on the mail queue. At defined interval the queue will scan the mail account to get new email, then forwards them to the listener.

  `ant mail_consumer`

4.6.6.   URL acquisition (collector)

Introduction

URL acquisition queue and topic are special destinations usable to collect a document on a specified URL.

They can be used to periodically :

- import a file from an URL to a Joram's message and store it in this queue.

- import a file from an URL to a Joram's message and forward to each subscribers.

The URL acquisition class name is com.scalagent.joram.mom.dest.collector.URLAcquisition and is located in the `joram-mom-extensions-collector.jar` bundle.

Setting the configuration parameters

In addition to common acquisition parameters (4.6.2.), some extra properties are used by the URL acquisition destination:

- `collector.url` – locates the element that will be collected.

- `collector.type` – indicates the type of the generated message. Default is Message.BYTES.

Creating the destination

A monitoring destination is created as any acquisition destination by using the Joram administration API with the previously defined properties.

For example using `org.objectweb.joram.client.jms.Queue` class:

```java
Properties prop = new Properties();
prop.setProperty("expiration", "0");
prop.setProperty("persistent", "true");
prop.setProperty("acquisition.period", "10000");
prop.setProperty("acquisition.className",
        "com.scalagent.joram.mom.dest.collector.URLAcquisition");
prop.setProperty("collector.url", url);
prop.setProperty("collector.type", "" + Message.BYTES);


Queue queue = Queue.create(0, "CollectorQueue", Queue.ACQUISITION_QUEUE, prop);
```

This method allows to specify the location server, an internal name, the implementation class and the configuration properties for the new URL acquisition queue/topic.

Running the sample

The sample shows how to collect a file from an URL and store it in the collector queue.

A consumer consumes the message and prints the file.

A producer send message to the collector queue to update some properties.
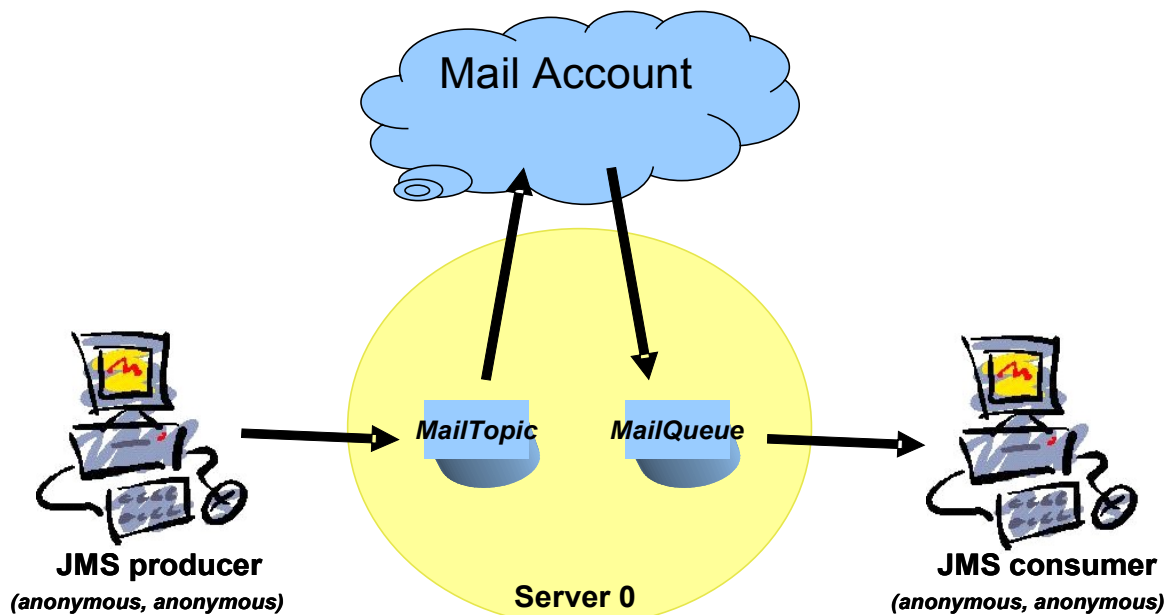
Running the demo: in the joram/samples/src/joram directory.

- Compile the samples:

  `ant clean compile`

- Start the configuration, this sample needs the joram-mom-extensions-collector.jar bundle so we use the extended_server ant target:

  ant reset extended_server

- Run the administration code: this target creates a ConnectionFactory, an 'anonymous' user and a collector queue. The initial configuration of the collector queue is to collect the file http://www.gnu.org/licenses/lgpl-2.1.txt every 10 seconds.

  ant collector_admin

- Run the collector: this target connects to the collector queue in order to be notified regularly about the collected file.

  ant collector_consumer

- Run the producer: this target update some properties on the collector queue, now the queue collects the file http://www.gnu.org/licenses/lgpl-3.0.txt every 30 seconds.

  ```
  ant collector_producer
  ```

4.6.7. JMX acquisition (monitoring)

Introduction

A monitoring acquisition destination is an acquisition destination configured to transform JMX informations into JMS messages.

It works in 2 modes:

- If the `acquisition.period` attribute is set (value greater than 0) the destination periodically scans the selected JMX attributes and generates a message with the value of these attributes.
- In the other case, the user sends to the destination a message with the list of JMX attributes to scan and the destination creates a message with these values, or use the last known JMX attributes.

If the destination is a queue, each message is delivered to a unique consumer, if it is a topic all subscribers receive it.

This topic is based on JMX monitoring so **you must enable JMX monitoring** to use it. See JMX administration of Joram in order to do it.

The JMX acquisition class name is org.objectweb.joram.mom.dest.MonitoringAcquisition and is directly located in the `joram-mom-core.jar` bundle, so you don't need to provide additional bundles for the JMX acquisition destination to work (contrary to other acquisition destinations).

Setting the parameters

Additionally to common acquisition parameters (4.6.2.), properties are used to indicate the list of JMX attributes that will be monitored. The property key is the name of the MBean and the value is a comma separated list of attributes to monitor for this MBean. The `'*'` character is allowed to monitor every parameter of the MBean.

- Accessing multiple MBeans is possible using wildcard characters, as defined in the `javax.management.ObjectName` class. See here for JDK6 details.

Example setting monitoring properties:

```
Properties props = new Properties();
props.put("acquisition.className",
        "org.objectweb.joram.mom.dest.MonitoringAcquisition");
props.put("acquisition.period", "5000");
props.put("Joram#0:type=Destination,name=queue",
        "NbMsgsDeliverSinceCreation,NbMsgsReceiveSinceCreation,PendingMessageCou
nt,NbMsgsSentToDMQSinceCreation");
props.put("Joram#0:type=Destination,name=topic",
        "NbMsgsDeliverSinceCreation,NbMsgsReceiveSinceCreation,NbMsgsSentToDMQSi
nceCreation");
```

Example sending a message to the destination:

```
Message msg = sess.createMessage();
msg.setStringProperty("Joram#0:type=Destination,name=*",
        "NbMsgsReceiveSinceCreation,NbMsgsSentToDMQSinceCreation");
```

Creating a monitoring destination

A monitoring destination is created as any acquisition destination by using the Joram administration API with the previously defined properties.

For example using `org.objectweb.joram.client.jms.Queue` class:

```
Queue mQueue = Queue.create(0, "MonitoringQueue",
                       Queue.ACQUISITION_QUEUE,
                       props);
```

This method allows to specify the location server, an internal name, the implementation class and the configuration properties for the new queue.

Running the sample

The sample shows how to monitor a single queue, it uses the well-known classic sample.

Running the demo: in the joram/samples/src/joram directory.

- Compile the samples:

  `ant clean compile`

- Start the configuration:

  ant reset single_server

- Run the administration code of the classic sample. This target creates, configures and registers a ConnectionFactory, an 'anonymous' user, a queue and a topic:

  ant classic_admin

- Run the administration code of the monitoring sample. This target creates 2 monitoring destinations, a queue and a topic. The queue is configured to reply to request, the topic is configured to periodically sends JMX information about the queue and topic of the classic sample each 5 seconds.

  ant monitoring_admin

- The '*monitoring_monitor*' target subscibes to the monitoring topic in order to be notified regularly about the parameters of the queue and the topic.

  ant monitoring_monitor

- The " target sends a message to the monitoring queue asking for the parameters of all destinations defined in the server.

  `ant monitoring_diagnose`

- In the other hand you can use the ant targets of the classic sample to produce and consume messages on the 2 destinations (see The classic sample).

  `ant producer_queue`

  `ant consumer_queue`

  `ant producer_topic`

  `ant consumer_topic`

You can launch multiple times the producer and the consumer to see the monitored parameters evolve.

4.6.8.   *JMS acquisition / distribution bridge*

Introduction

The JMS acquisition/distribution bridge allows a JORAM client application to communicate with a JMS destination hosted by a foreign JMS server (let's call it *XMQ*) in a completely standard way.

The link between the JORAM and *XMQ* heterogeneous platforms is provided by a specifically configured acquisition or distribution destination (a queue or a topic), connected to a *XMQ* destination as a standard (JMS 1.1) client application (as illustrated by Figure 22).
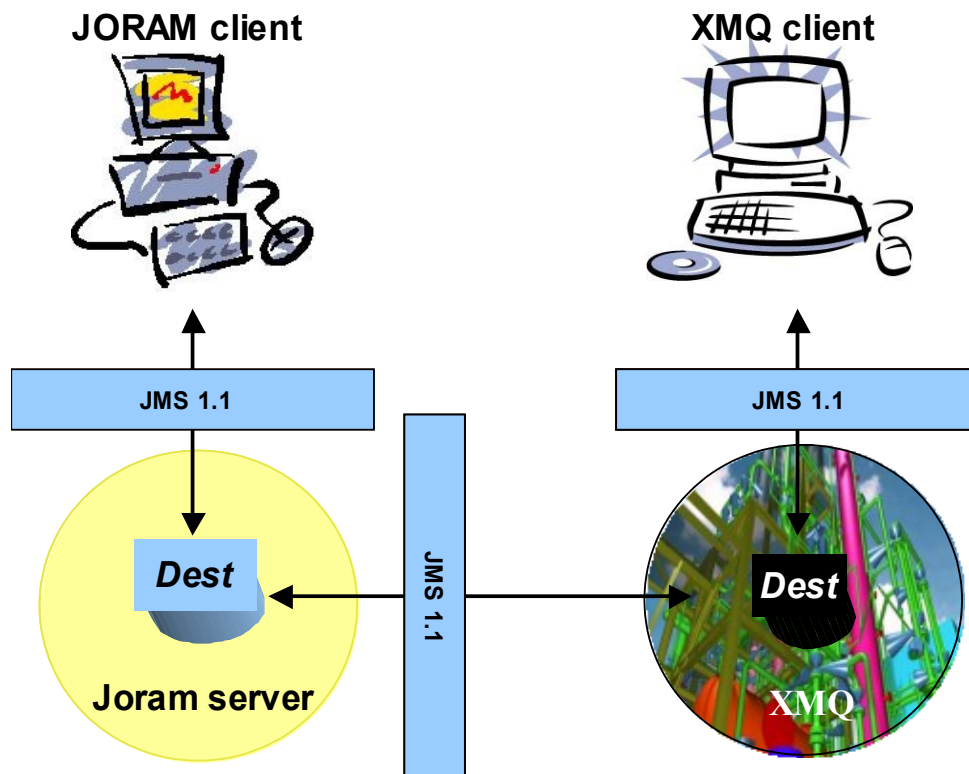
Figure 22 - A JORAM client communicating with a XMQ client

If the JORAM bridge destination is a distribution destination, the JORAM client can send a message to the bridge destination, and the message will be forwarded to the *XMQ* destination.

If the JORAM destination is an acquisition destination, it will automatically subscribe to the XMQ destination, so messages reaching XMQ destination will be forwarded to the bridge destination. Eventually it can be consumed as a regular message on the bridge destination.

From the JORAM client perspective, the target destination is a JORAM destination accessed through the JMS interfaces. It is a fully standard client. The facts that the messages it produces finally reach the *XMQ* destination, and that the messages it consumes originally come from the *XMQ* destination, are totally transparent to the JORAM user.

Acknowledgment policy

Acknowledgements are managed between the JORAM client and the JORAM bridge destination, and between the JORAM bridge destination and the *XMQ* destination, independently.

In fact, the only possible case of message denying between the JORAM bridge destination and the *XMQ* platform occurs when the JMS message delivered by the *XMQ* destination appears not to be readable and thus can not be converted into a JORAM JMS message.

This situation will likely evolve towards the "poison" message scenario, where a JMS client rolls back its session each time it receives the redelivered failing message. In order to avoid this, it is

hoped that *XMQ* provides a way to log such messages into a dead message queue. If yes, *XMQ* should be configured for doing so.

Once a message delivered by the *XMQ* destination has been successfully converted into a JORAM JMS message, the delivery is acknowledged. *XMQ* does not hold the message any more, it is JORAM which is now responsible for safely distributing it.

Finally, denying a message between the JORAM client and the bridge acquisition destination works the same way as between any JORAM client and JORAM destination. The message is available again for delivery, or logged to a dead message queue if any. In all cases the message stays on the JORAM platform, the *XMQ* destination is not notified of the JORAM client acknowledgements or denials.

Message selection

As for acknowledgements, message selection is handled separately between a JORAM client and the JORAM bridge acquisition destination it interacts with, and between the JORAM bridge destination and the *XMQ* destination. Selectors set-up is done at different times. The selector used for filtering the messages on the *XMQ* destination is set at administration time, when configuring the JORAM bridge destination.

The selector used by the JORAM client is set as a standard selector, when creating the `MessageConsumer` instance.

Connection failure handling

From an architectural point of view, the *XMQ* server might be seen as a JORAM server of a JORAM distributed configuration. It might happen that the JMS connection between the JORAM bridge destination and the *XMQ* platform breaks. This case is processed as any connection failure case between two JORAM servers. An automatic reconnection process is launched when the failure is detected (through the setting of a `javax.jms.ExceptionListener` by the JORAM bridge destination). When the JORAM bridge destination finally reconnects, the pending messages or requests are re-routed to the *XMQ* platform.

As a consequence, disconnections between JORAM and *XMQ* are totally transparent to the user, as disconnections between JORAM servers of a distributed JORAM platform.

The reconnection process is as follows:

1. first step: 30 connection trials, one per second;

2. second step: 55 connection trials, one every 5 seconds;

3. last step: infinite connection trials, one every minute.

Required libraries

The JMS bridge acquisition class name is org.objectweb.joram.mom.dest.jms.JMSAcquisition and the JMS bridge distribution class name is org.objectweb.joram.mom.dest.jms.JMSDistribution. Both of these classes are located in the `joram-mom-extensions-jmsbridge.jar` bundle.

Additionally, as these classes work as clients of the XMQ server, you need to provide bundles:

- all *XMQ* client jars;

- a `jms.jar` library compatible with the *XMQ* JMS implementation;

- the client jars of the used JNDI server;

This means the following bundles when XMQ is Joram:

- joram-client-jms.jar

- joram-shared.jar (already present in server)

- geronimo-jms_1.1_spec.jar

- jndi-client.jar

- jndi-shared.jar (already present in server)

JMS bridge properties

In addition to common acquisition parameters (4.6.2.), or common distribution parameters (4.6.3.), the following properties are required for setting the bridge destination:

- `connectionFactoryName` - JNDI name used to bound the *XMQ* JMS `ConnectionFactory` or XA `ConnectionFactory` object;

- `destinationName` - JNDI name used to bound the *XMQ* JMS `Destination` object;

The following properties are optional:

- `userName` - user identification that should be used by the bridge destination for opening a connection to *XMQ*; if not provided, the connection will be opened with no identification.

- `password` - user password that should be used by the bridge destination for opening a connection to *XMQ*; if not provided, the connection will be opened with no identification.

- `jndiFactory` - name of the JNDI initial context factory class (for example "fr.dyade.aaa.jndi2.client.NamingContextFactory"); if not provided, it is expected that environment variables are set or that a `jndi.properties` file is accessible through the server's classpath.

- `jndiUrl` - URL of the JNDI server (for example "scn://localhost:16400"); if not provided, it is expected that environment variables are set or that a `jndi.properties` file is accessible through the server's classpath.

- `clientId` - provided if *XMQ* requires the setting of such an identifier on its client connection.

- `selector` - selector expression used for filtering messages on the *XMQ* destination.

Steps

In order to be able to bind the foreign JMS provider administered objects, a naming server is the first thing to start. And in order to be able to successfully deploy a JORAM bridge destination, the foreign JMS administered objects must have been bound. As a consequence, the start-up steps are as follows:

1. starting a JNDI server;
2. creating the foreign JMS administered objects, binding them to the JNDI server;
3. starting and administering JORAM.

If the JNDI server used is hosted by the JORAM server, then the JORAM server is the first thing to start (in order to start the JNDI service). Then the XMQ JMS administered objects should be created and bound. Finally, the JORAM server should be administered, and particularly the bridge destination should be created.

Running the sample

A live demo of this sample is available on Joram website documentation: http://joram.ow2.org/doc/tutorials/bridge/bridge.htm.

The demo shows the use of a JMS bridge distribution queue and a JMS bridge acquisition topic (see Figure 23).

Running the demo: in the joram/samples/src/joram directory.

1. Starting a classic JORAM server which will work as the XMQ server. The classic sample (2.2.1.) is used to achieve this:

   ant reset single_server

2. Administering the XMQ JMS server, binding its administered objects.

   ant classic_admin

3. Starting the Joram server containing the JMS bridge and the additional JMS client bundles.

```
ant bridge_server
```

4. Administering this Joram bridge server:

```
ant bridge_admin
```

5. Sending messages to the bridge queue which will forward them to XMQ server:

```
ant bridge_producer
```

6. Consuming the messages on the foreign JMS destination:

```
ant consumer_queue
```

And on the opposite way:

7. Starting a consumer on the bridge topic

```
ant bridge_consumer
```

8. Sending messages to the topic on XMQ server and checking the previously launched consumer acquire them correctly:

```
ant producer_topic
```
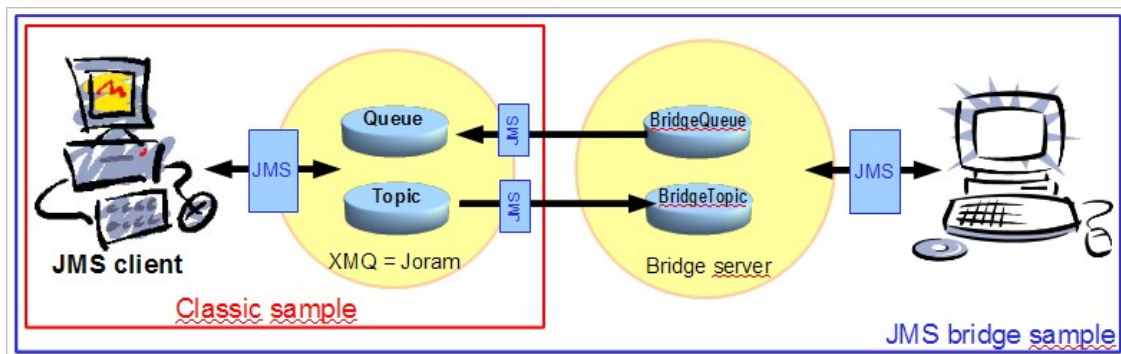

Figure 23 - 2 Joram clients communicating through the JMS bridge

4.7. FTPQueue

4.7.1. Introduction

Ftp queue is special destinations usable to transfer file by FTP.

The sender send the URL information file to the destination FTPQueue. This destination get the file, store in the local directory and generate a message who contain the URI localisation of the file.
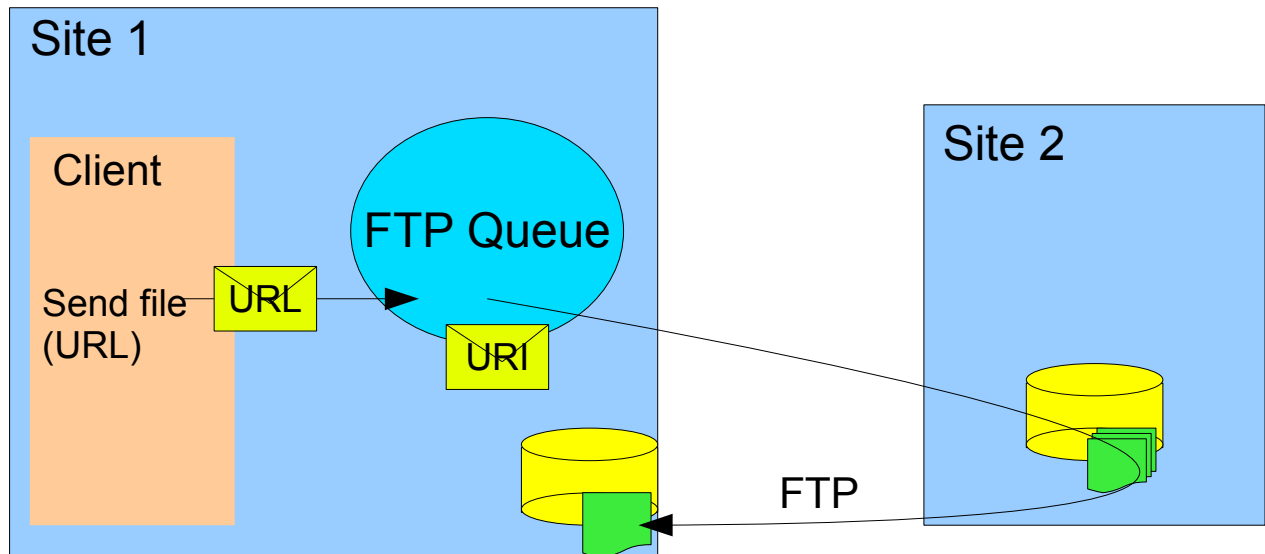
The Consumer receive a message who contain the URI localisation of the file.
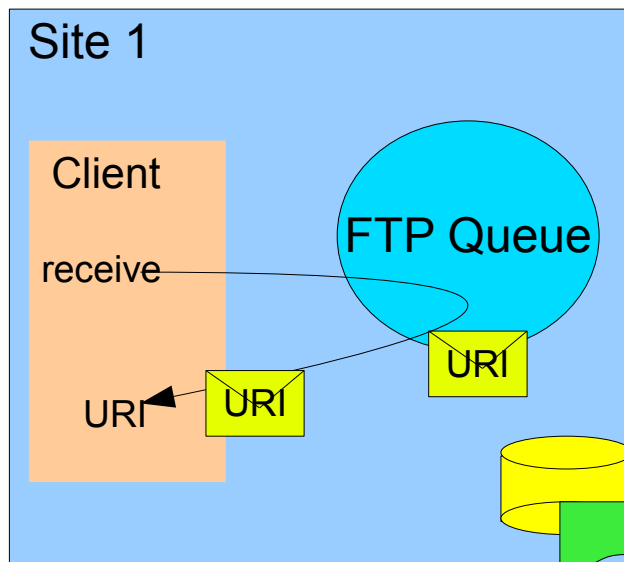
4.7.2.   *Managing a FTPQueue*

Setting the FTPQueue parameters

The options are set using properties at FTPQueue creation time.

- user: the user name for the FTP.

- pass: the user password for FTP.

- path: the local directory to store the file transferred. Default is the running directory (path=null).

- ftpImplName: The implantation of FTP module. We provide tow implantations the first (default `com.scalagent.joram.mom.dest.ftp.TransferImplRef`) is the JDK URL and the second is based on JFTP (`com.scalagent.joram.mom.dest.ftp.TransferImplJftp`).

The user and pass options are optional, because you can set this information in the sender URL request, like this:

```
msg.setStringProperty("url", "ftp://user:pass@host/file;type=i");
```

Creating the FTPQueue

A FTPQueue is created by using the Joram administration API, calling the Queue creation method `create` from the class `org.objectweb.joram.client.jms.Queue`.

```
prop = new Properties();
prop.setProperty("user", "my_FTP_name"); // optional
prop.setProperty("pass", "my_FTP_pass"); // optional
prop.setProperty("path", "the_local_path"); // optional
Queue queue = Queue.create(0, "ftpQueue",
"com.scalagent.joram.mom.dest.ftp.FtpQueue", prop);
```

This method allows to specify the location server, an internal name, the implementation class and the configuration properties for the new FTPQueue.

4.7.3.   Using a FTPQueue destination

Sending a message

Specify the fileName and user / password if the administrator don't set.

```
TextMessage msg = sess.createTextMessage();
msg.setText("transfer " + fileName);
if (user != null && pass != null)
  msg.setStringProperty("url", "ftp://user:pass@host/fileName;type=i");
else
  msg.setStringProperty("url", "ftp://host/fileName;type=i");
msg.setLongProperty("crc", new File(fileName).length());
msg.setBooleanProperty("ack", false);
```

When the FTPQueue destination receive the message, it run a task to get the file specify by the URL and store this file in a local directory. The sending message is drop and a new message containing the URI file location is generate and store in the FTPQueue.

4.7.4.   Running the sample

The sample shows how to get the "welcome.msg" file from ftp.kernel.org.

Running the demo: in the joram/samples/src/joram directory.

- Compile the samples:

  ```
  ant clean compile
  ```

- Start the configuration and run the server, this sample needs the joram-mom-extensions-ftp.jar bundle so we use the extended_server ant target:

  ```
  ant reset extended_server
  ```

- Run the administration code: this target creates a ConnectionFactory, an 'anonymous' user and a FTPQueue with user=anonymous and pass=anonymous.

  ```
  ant ftp_admin
  ```

- Run the producer: this target send a message to the FTPQueue with this URL "ftp://ftp.kernel.org/welcome.msg".

```
ant ftp_producer
```

- Run the receiver: this target connects to the FTPQueue and consume the message and print the file URL, crc and ack..

```
ant ftp_receiver
```

5. Using a collocated server

5.1. Introduction

A collocated Joram server is a standard Joram server running inside the same process (JVM) as one or more Joram clients. If your Java application needs to start such an embedded server you must configure this server, start it inside your application and connect your JMS clients to it.

A collocated Joram server can be part of a distributed configuration of multiples collocated or not servers, it can eventually be reach by other client through the TCP protocol.

5.2. Configure a collocated server

A collocated server is configured exactly like a non-collocated server, i.e. you don't need to declare any extra services to use a collocated server.

A typical configuration would be:

```xml
<?xml version="1.0"?>
<config>
  <property name="Transaction" value="fr.dyade.aaa.util.NullTransaction"/>
  <server id="0" name="S0" hostname="localhost">
    <service class="org.objectweb.joram.mom.proxies.ConnectionManager"
            args="root root"/>
    <service class="org.objectweb.joram.mom.proxies.tcp.TcpProxyService"
            args="16010"/>
  </server>
</config>
```

Notice that:

- in the above configuration, the collocated server can also be accessed from remote clients through the TCP protocol. If you don't need the TCP access point you can remove the service `TcpProxyService`.

- you can include a collocated server inside a distributed Joram platform: a collocated server is a server just like any other.

5.3. Start a collocated server

A collocated server must be pro grammatically started inside the same process as your Java client application.

The following code starts the server #0:

```
fr.dyade.aaa.agent.AgentServer.init((short) 0, "./s0", null);
```

```
fr.dyade.aaa.agent.AgentServer.start();
```

The method `init` initializes the server with three parameters:

1. its identifier: `0`

2. the directory where its persistent state is stored: `./s0`

3. the monolog logger factory: leave it to `null` if you want the server to configure it itself.

The method `start` actually starts the server.

You can also initialize and start a server by calling the method `AgentServer.main` which aggregates the initialization and the start into a single operation:

```
String args[] = {"0", "./s0"};
fr.dyade.aaa.agent.AgentServer.main(args);
```

5.4. Connect to the collocated server

5.4.1. Create local connections

The class `LocalConnectionFactory` enables you to create local connections to the collocated server:

```
import org.objectweb.joram.client.jms.local.*;

ConnectionFactory cnxFact = LocalConnectionFactory.create();
```

In the same package you can find several factories that you can use to create more specific connections: `<XA><Topic|Queue>LocalConnectionFactory`.

5.4.2. Connect the administration module

The class `AdminModule` provides a method `collocatedConnect` that must be called before doing administration operations through the collocated server.

```
import org.objectweb.joram.client.jms.admin.*;

AdminModule.collocatedConnect("root", "root");
```

5.5. Stop the collocated server

If you need to stop the collocated server without stopping the entire embedding Java application you must call the method `stop` provided by the class `AgentServer`:

```
fr.dyade.aaa.agent.AgentServer.stop();
```

You can then restart the server with the following code:

```
fr.dyade.aaa.agent.AgentServer.start();
```

5.6. Start the embedding Java application

You must ensure that the classpath contains:

- the jar files expected by a Joram server: joram-mom-core.jar, Jcup.jar, etc.
- the directory where the a3servers.xml configuration file is located.

6. Working with sources distribution

6.1. Getting Joram sources

6.1.1. Getting a packaged version of Joram

The packages are downloadable from the following location:

- http://forge.ow2.org/project/showfiles.php?group_id=4.

For release **x.y.z**, the following tar file is provided:

- `joram-release-x.y.z-src.zip`, including the client and server sources.

A package is expanded by UNIX users with the *gunzip* and *tar* commands; Windows developers can use the *Winzip* utility.

6.1.2. Getting Joram from SVN

JORAM SVN page is located at: http://forge.ow2.org/plugins/scmsvn/index.php?group_id=4. The module to extract is **joram**. A snapshot is regularly generated by bamboo continuous integration tool and can be downloaded at:

http://bamboo.ow2.org/browse/JORAM-ANT/latest/artifact/Releases/release/target.

6.1.3. Directory structure and description

Joram sources distribution

The distribution is expanded in a `joram-x.y.z/` directory. It includes the following directories:

- `a3/`
- `assembly/`
- `conf/`
- `jndi/`
  - `client/`
  - `server/`
  - `shared/`
- `joram/`
  - `client/`
  - `jca/`
  - `mom/`

```
                        o   security/
                        o   shared/
                        o   tools/
            ▪  licenses/
            ▪  samples/
                        o   bin/…
                        o   config/
                        o   src/
                              ▪   joram/…
```

a3/ **directory**

Contains the sources of the agent platform, foundation of Joram server.

conf/ **directory**

Contains the configuration used to launch Joram on the OSGi platform Felix.

jndi/ **directory**

Contains the sources of Joram's JNDI (server, client and shared classes).

joram/ **directory**

Contains the sources of Joram server (mom), client and shared classes. You can also find here the JCA connector, jaas security and a tool to access Joram with the STOMP protocol.

licenses/ **directory**

Contains the LGPL header displayed on top of each source file, as well as the licences of the external softwares provided in the distribution.

samples/ **directory**

Contains the Joram samples sources, configuration files, UNIX and Windows scripts for launching JORAM servers and clients (how to use them is explained in chapter 2.Using samples).

6.2. Compiling and shipping Joram

JORAM distribution is ready for compiling with Apache ***Maven*** tool. Maven can be downloaded from http://maven.apache.org/. Documentation is available at the same location.

6.2.1. Compiling Joram

The best way to build Joram is:

- Open a console and go to Joram main directory
- *mvn clean install (see result below)*

```
$ mvn clean install
[INFO] Scanning for projects...
[INFO] ------------------------------------------------------------------------
[INFO] Reactor Build Order:
[INFO]
[INFO] JORAM
[INFO] JORAM :: a3
[INFO] JORAM :: a3 :: common
[INFO] JORAM :: a3 :: rt
```

```
[INFO] JORAM :: a3 :: osgi
[INFO] JORAM :: jndi
[INFO] JORAM :: jndi :: shared
[INFO] JORAM :: jndi :: server
[INFO] JORAM :: jndi :: client
[INFO] JORAM :: joram
[INFO] JORAM :: joram :: shared
[INFO] JORAM :: joram :: mom
[INFO] JORAM :: joram :: mom :: core
[INFO] JORAM :: joram :: client
[INFO] JORAM :: joram :: client :: jms
[INFO] JORAM :: joram :: client :: JCA 1.5 connector
[INFO] JORAM :: joram :: mom :: extensions
[INFO] JORAM :: joram :: mom :: extensions :: collector
[INFO] JORAM :: joram :: mom :: extensions :: jmsbridge
[INFO] JORAM :: joram :: mom :: extensions :: mail
[INFO] JORAM :: joram :: mom :: extensions :: scheduler
[INFO] JORAM :: joram :: mom :: extensions :: ftp
[INFO] JORAM :: joram :: security
[INFO] JORAM :: joram :: tools
[INFO] JORAM :: joram :: tools :: jasp
[INFO] JORAM :: licenses
[INFO] JORAM :: conf
[INFO] JORAM :: assembly
[INFO] JORAM :: joram :: samples
[INFO]

…


…


[INFO] ------------------------------------------------------------------------
[INFO] Reactor Summary:
[INFO]
[INFO] JORAM ........................................... SUCCESS [0.141s]
[INFO] JORAM :: a3 ..................................... SUCCESS [0.015s]
[INFO] JORAM :: a3 :: common ........................... SUCCESS [1.797s]
[INFO] JORAM :: a3 :: rt ............................... SUCCESS [2.672s]
[INFO] JORAM :: a3 :: osgi ............................. SUCCESS [0.797s]
[INFO] JORAM :: jndi ................................... SUCCESS [0.016s]
[INFO] JORAM :: jndi :: shared ......................... SUCCESS [0.765s]
[INFO] JORAM :: jndi :: server ......................... SUCCESS [1.422s]
[INFO] JORAM :: jndi :: client ......................... SUCCESS [0.860s]
[INFO] JORAM :: joram ................................. SUCCESS [0.000s]
[INFO] JORAM :: joram :: shared ........................ SUCCESS [1.859s]
[INFO] JORAM :: joram :: mom ........................... SUCCESS [0.000s]
[INFO] JORAM :: joram :: mom :: core ................... SUCCESS [3.016s]
[INFO] JORAM :: joram :: client ........................ SUCCESS [0.000s]
[INFO] JORAM :: joram :: client :: jms ................. SUCCESS [3.031s]
[INFO] JORAM :: joram :: client :: JCA 1.5 connector ..... SUCCESS [1.313s]
```

```
[INFO] JORAM :: joram :: mom :: extensions ............... SUCCESS [0.015s]
[INFO] JORAM :: joram :: mom :: extensions :: collector .. SUCCESS [0.688s]
[INFO] JORAM :: joram :: mom :: extensions :: jmsbridge .. SUCCESS [1.172s]
[INFO] JORAM :: joram :: mom :: extensions :: mail ....... SUCCESS [0.906s]
[INFO] JORAM :: joram :: mom :: extensions :: scheduler .. SUCCESS [0.984s]
[INFO] JORAM :: joram :: mom :: extensions :: ftp ........ SUCCESS [1.422s]
[INFO] JORAM :: joram :: security ........................ SUCCESS [0.016s]
[INFO] JORAM :: joram :: tools ........................... SUCCESS [0.015s]
[INFO] JORAM :: joram :: tools :: jasp ................... SUCCESS [1.000s]
[INFO] JORAM :: licenses ................................. SUCCESS [0.219s]
[INFO] JORAM :: conf ..................................... SUCCESS [0.047s]
[INFO] JORAM :: assembly ................................. SUCCESS [8.500s]
[INFO] JORAM :: joram :: samples ......................... SUCCESS [1.797s]
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 34.969s
[INFO] Finished at: Mon Nov 08 14:15:22 CET 2010
[INFO] Final Memory: 69M/165M
[INFO] ------------------------------------------------------------------------
```

This creates a `target/` directory for each sub-module where you can find compiled classes and the produced artifact.

This also creates a `ship/` directory where you can find a Joram distribution similar to what you can obtain by downloading a binary version on Joram's website.

You can also compile only one sub-module using the previous method in the right directory.

For example, compiling jndi client:

```
$ cd jndi
$ cd client
$ mvn clean install
[INFO] Scanning for projects...
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] Building JORAM :: jndi :: client 5.4.1.54-SNAPSHOT
[INFO] ------------------------------------------------------------------------
[INFO]


…


…


[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 2.187s
[INFO] Finished at: Mon Nov 08 14:22:04 CET 2010
[INFO] Final Memory: 8M/20M
[INFO] ------------------------------------------------------------------------
```

6.2.2. Generating the javadoc

Joram uses a maven profile to easily build the javadoc:

```
mvn install -P doc
```

This creates the target/apidocs/ folder containing the whole javadoc.

6.2.3. Generating a distribution

There is another maven profile available to create a complete distribution of Joram:

```
mvn install -P release
```

The produced files are copied in the `release/target/` directory, they are equivalent to the ones available for download on Joram's web server.

Remark: This command only works when the Joram folder comes from the SVN as the `release/` directory is not included in the Joram sources distribution.

6.2.4. Cleaning

To remove the generated classes and libraries:

```
mvn clean
```

This removes all `target/` directories present in the project and the `ship/` directory containing an expanded Joram distribution.