WebSphere MQ

Using Java

SC34-6066-02

WebSphere MQ

Using Java

SC34-6066-02

Note!
Before using this information and the product it supports, be sure to read the general information under Appendix J, "Notices," on page 505.

Third edition (January 2004)

This is the third edition of this book that applies to WebSphere MQ. It applies to the following products:

- IBM WebSphere MQ for AIX, Version 5.3
- IBM WebSphere MQ for HP-UX, Version 5.3
- IBM WebSphere MQ for iSeries, Version 5.3
- IBM WebSphere MQ for Linux for Intel, Version 5.3
- IBM WebSphere MQ for Linux for zSeries, Version 5.3
- IBM WebSphere MQ for Solaris, Version 5.3
- IBM WebSphere MQ for Windows, Version 5.3
- IBM WebSphere MQ for z/OS, Version 5.3

with fix pack 6 (CSD06) or later, and to any subsequent releases and modifications until otherwise indicated in new editions.

Contents

Figures

Tables

About this book

This book describes:

- WebSphere® MQ classes for Java™, which can be used to access WebSphere MQ systems
- WebSphere MQ classes for Java Message Service, which can be used to access both Java Message Service (JMS) and WebSphere MQ applications

Note: Consult the README file for information that expands and corrects information in this book. The README file is installed with the WebSphere MQ Java code and can be found in the `doc` subdirectory.

Who this book is for

This information is written for programmers who are familiar with the procedural WebSphere MQ application programming interface as described in the *WebSphere MQ Application Programming Guide*. It shows how to transfer this knowledge to become productive with the WebSphere MQ Java programming interfaces.

What you need to know to understand this book

You need:

- Knowledge of the Java programming language
- Understanding of the purpose of the message queue interface (MQI) as described in the *WebSphere MQ Application Programming Guide* and the chapter about Call Descriptions in the *WebSphere MQ Application Programming Reference*
- Experience of WebSphere MQ programs in general, or familiarity with the content of the other WebSphere MQ publications

Users intending to use the WebSphere MQ base Java with CICS® Transaction Server for OS/390® also need to be familiar with:

- Customer Information Control System (CICS) concepts
- Using the CICS Java Application Programming Interface (API)
- Running Java programs from within CICS

Users intending to use VisualAge® for Java to develop OS/390 UNIX® System Services High Performance Java (HPJ) applications should be familiar with the Enterprise Toolkit for OS/390 (supplied with VisualAge for Java Enterprise Edition for OS/390, Version 2).

How to use this book

Part 1 of this book tells you how to use WebSphere MQ base Java and WebSphere MQ JMS; Part 2 helps programmers wanting to use WebSphere MQ base Java; Part 3 helps programmers wanting to use WebSphere MQ JMS.

First, read the chapters in Part 1 that introduce you to WebSphere MQ base Java and WebSphere MQ JMS. Then use the programming guidance in Part 2 or 3 to understand how to use the classes to send and receive WebSphere MQ messages in the environment you want to use.

Remember to check the README file installed with the WebSphere MQ Java code for later or more specific information for your environment.

Terms used in this book

The term *WebSphere MQ base Java* means WebSphere MQ classes for Java.

The term *WebSphere MQ JMS* means WebSphere MQ classes for Java Message Service.

The term *WebSphere MQ Java* means WebSphere MQ classes for Java and WebSphere MQ classes for Java Message Service combined.

The term *Version 5.3 products* means:
- WebSphere MQ for AIX®, Version 5.3
- WebSphere MQ for HP-UX, Version 5.3
- WebSphere MQ for iSeries™, Version 5.3
- WebSphere MQ for Linux for Intel™, Version 5.3
- WebSphere MQ for Linux for zSeries™, Version 5.3
- WebSphere MQ for Sun Solaris, Version 5.3
- WebSphere MQ for Windows®, Version 5.3
- WebSphere MQ for z/OS®, Version 5.3

The term *WebSphere MQ for UNIX systems* means:
- WebSphere MQ for AIX
- WebSphere MQ for HP-UX
- WebSphere MQ for Linux for Intel
- WebSphere MQ for Linux for zSeries
- WebSphere MQ for Sun Solaris

UNIX systems is also used as a general term for the UNIX platforms.

The term *WebSphere MQ for Windows systems* means WebSphere MQ running on the following Windows platforms:
- Windows NT®
- Windows 2000
- Windows XP

Windows systems, or just *Windows*, is also used as a general term for these Windows platforms.

Summary of changes

This section describes changes in this edition of *WebSphere MQ Using Java*. Changes since the previous edition of the book are marked by vertical lines to the left of the changes.

Changes for this edition (SC34–6066–02)

This edition includes documentation to support the following new function:

- An implementation of Version 1.1 of the JMS API specification
- Direct connection to a WebSphere Business Integration Event Broker or WebSphere Business Integration Message Broker broker using:
  - SSL authentication
  - Multicast
  - HTTP tunnelling
  - Connect via proxy
- Connecting to a WebSphere MQ queue manager through a firewall
- Sparse subscriptions
- Message selection by the broker
- User defined prefixes for WebSphere MQ dynamic queues
- Configuring a connection pool for an MQSimpleConnectionManager object in WebSphere MQ classes for Java

This edition also contains various editorial improvements, clarifications, and corrections.

Changes for the second edition (SC34-6066-01)

This edition includes the following changes:

- A section listing JMS exception messages.
  See Appendix I, "JMS exception messages," on page 489.
- Miscellaneous corrections and clarifications.

Changes for the first edition (SC34-6066-00)

This edition includes the following changes:

- Changes for
  - Integration with the WebSphere MQ product
  - JMS Postcard
  - Secure Sockets Layer (SSL) support
- Miscellaneous corrections and clarifications.

Part 1. Guidance for users

Chapter 1. Getting started

This chapter gives an overview of WebSphere MQ classes for Java and WebSphere MQ classes for Java Message Service and their uses.

What are WebSphere MQ classes for Java?

WebSphere MQ classes for Java (also referred to as WebSphere MQ base Java) allow a program written in the Java programming language to:

- Connect to WebSphere MQ as a WebSphere MQ client
- Connect directly to a WebSphere MQ server

WebSphere MQ base Java enables Java applets, applications, and servlets to issue calls and queries to WebSphere MQ. This gives access to mainframe and legacy applications, typically over the Internet, without necessarily having any other WebSphere MQ code on the client machine. With WebSphere MQ base Java, Internet users can become true participants in transactions, rather than just givers and receivers of information.

What are WebSphere MQ classes for Java Message Service?

WebSphere MQ classes for Java Message Service (also referred to as WebSphere MQ JMS) is a set of Java classes that implement Sun's Java Message Service (JMS) interfaces to enable JMS programs to access WebSphere MQ systems. This book describes an implementation of Version 1.1 of the JMS API specification, which is backwards compatible with Version 1.0.2b. Any features of the implementation that apply only to Version 1.1 of the specification, and not to Version 1.0.2b, are clearly marked. Both the point-to-point and publish/subscribe models of JMS are supported.

Using WebSphere MQ JMS as the API to write WebSphere MQ applications has a number of benefits. Some advantages derive from JMS being an open standard with multiple implementations. Other advantages come from additional features that are present in WebSphere MQ JMS, but not in WebSphere MQ base Java.

Benefits arising from the use of an open standard include:

- The protection of investment, both in skills and application code
- The availability of people skilled in JMS application programming
- The ability to plug in different JMS implementations to fit different requirements

Sun's Web site at `http://java.sun.com` provides more information about the benefits of the JMS API.

The extra function provided over WebSphere MQ base Java includes:

- Asynchronous message delivery. Messages can be delivered to an application as they arrive, on a separate thread.
- Message selectors.
- Support for publish/subscribe messaging.
- Structured, more abstract, message classes. Implementation details are left to the JMS provider.

Who should use WebSphere MQ Java?

If your enterprise fits any of the following scenarios, you can gain significant advantage by using WebSphere MQ classes for Java and WebSphere MQ classes for Java Message Service:

- A medium or large enterprise that is introducing intranet-based client/server solutions. Here, Internet technology provides low cost easy access to global communications; WebSphere MQ connectivity provides high integrity with assured delivery and time independence.
- A medium or large enterprise with a need for reliable business-to-business communications with partner enterprises. Here again, the Internet provides low-cost easy access to global communications; WebSphere MQ connectivity provides high integrity with assured delivery and time independence.
- A medium or large enterprise that wants to provide access from the public Internet to some of its enterprise applications. Here, the Internet provides global reach at a low cost; WebSphere MQ connectivity provides high integrity through the queuing paradigm. In addition to low cost, the business can achieve improved customer satisfaction through 24 hour a day availability, fast response, and improved accuracy.
- An Internet Service provider, or other Value Added Network provider. These companies can exploit the low cost and easy communications provided by the Internet. They can also add value with the high integrity provided by WebSphere MQ connectivity. An Internet Service provider that exploits WebSphere MQ can immediately acknowledge receipt of input data from a Web browser, guarantee delivery, and provide an easy way for the user of the Web browser to monitor the status of the message.

WebSphere MQ and WebSphere MQ classes for Java Message Service provide an excellent infrastructure to access enterprise applications and develop complex Web applications. A service request from a Web browser can be queued then processed when possible, allowing a timely response to be sent to the end user, regardless of system loading. By placing this queue *close* to the user in network terms, the load on the network does not impact the timeliness of the response. Also, the transactional nature of WebSphere MQ messaging means that a simple request from the browser can be expanded safely into a sequence of individual back end processes in a transactional manner.

WebSphere MQ classes for Java also enables application developers to exploit the power of the Java programming language to create applets and applications that can run on any platform that supports the Java runtime environment. These factors combine to reduce the development time for multi-platform WebSphere MQ applications significantly. Also, if there are enhancements to applets in the future, end users automatically pick these up as the applet code is downloaded.

Connection options

Programmable options allow WebSphere MQ Java to connect to WebSphere MQ in either of the following ways:

- As a WebSphere MQ client using Transmission Control Protocol/Internet Protocol (TCP/IP)
- In bindings mode, connecting directly to WebSphere MQ

Table 1 on page 5 shows which of these connection modes can be used for each platform.

In addition, WebSphere MQ JMS publish/subscribe applications can connect directly across TCP/IP to the IBM® WebSphere MQ Event Broker program. For more information about this connection see Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213.

Table 1. Platforms and connection modes

Server platform	Client	Bindings
Windows NT	yes	yes
Windows 2000	yes	yes
Windows XP	yes	yes
AIX	yes	yes
Solaris (v2.6, v2.8, V7, or SunOS v5.6, v5.7)	yes	yes
OS/400®	yes	yes
HP-UX	yes	yes
OS/390 and z/OS	no	yes
Linux on Intel	yes	yes
Linux on zSeries	yes	no

Notes:

1. HP-UX Java bindings support is available only for HP-UXv11 systems running the POSIX draft 10 pthreaded version of WebSphere MQ.
2. On Linux on zSeries, only TCP/IP client connectivity is supported.

The following sections describe these options in more detail.

Client connection

To use WebSphere MQ Java as a WebSphere MQ client, you can install it either on the WebSphere MQ server machine, which may also contain a Web server, or on a separate machine. If you install WebSphere MQ Java on the same machine as a Web server, you can download and run WebSphere MQ client applications on machines that do not have WebSphere MQ Java installed locally.

Wherever you choose to install the client, you can run it in three different modes:

From within any Java-enabled Web browser
In this mode, the locations of the WebSphere MQ queue managers that can be accessed are constrained by the security restrictions of the browser that is used.

Using an appletviewer
To use this method, you must have the Java Development Kit (JDK™) or Java Runtime Environment (JRE) installed on the client machine.

As a standalone Java program or in a Web application server
To use this method, you must have the Java Development Kit (JDK) or Java Runtime Environment (JRE) installed on the client machine.

Bindings connection

When used in bindings mode, WebSphere MQ Java uses the Java Native Interface (JNI) to call directly into the existing queue manager API, rather than communicating through a network. This provides better performance for

WebSphere MQ applications than using network connections. Unlike the client mode, applications that are written using the bindings mode cannot be downloaded as applets.

To use the bindings connection, you must install WebSphere MQ Java on the WebSphere MQ server.

Prerequisites

To run WebSphere MQ base Java, you need the following software:

- WebSphere MQ for the server platform you want to use.
- Java Development Kit (JDK) for the server platform.
- Java Development Kit, Java Runtime Environment (JRE), or Java-enabled Web browser for client platforms. (See "Client connection" on page 5.)
- For z/OS and OS/390, OS/390 Version 2 Release 9 or higher, or z/OS, with UNIX System Services (USS).
- For OS/400, the iSeries Developer Kit for Java, 5769-JV1, and the Qshell Interpreter, OS/400 (5769-SS1) Option 30.

The following list shows the supported Java 2 Software Development Kits and Java Runtime Environments:

- IBM Developer Kit for AIX, Java Technology Edition, Version 1.3.1
- IBM Developer Kit for Linux, Java Technology Edition, Version 1.3.1
- IBM Developer Kit for OS/390, Java Technology Edition, Version 1.3.1
- IBM Developer Kit for Windows, Java Technology Edition, Version 1.3.0
- IBM iSeries Developer Kit for Java, Version 1.3
- HP-UX SDK, for the Java platform, Version 1.3.1
- Java 2 Standard Edition, for the Solaris Operating Environment, SDK 1.3.1

To fully support Secure Socket Layer (SSL) authentication, you need a Java Runtime Environment at Version 1.4.0 for your platform. SSL support enables WebSphere MQ Java and Java Message Service (JMS) applications to benefit from secure connection to the queue manager, providing authentication, message integrity, and data encryption.

Check the README file for the latest information about operating system levels this product has been tested against.

To use the WebSphere MQ JMS administration tool (see Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41), you need one of the following service provider packages, supplied with WebSphere MQ:

- Lightweight Directory Access Protocol (LDAP) - `ldap.jar`, `providerutil.jar`.
- File system - `fscontext.jar`, `providerutil.jar`.

These packages provide the Java Naming and Directory Service (JNDI) service. This is the resource that stores physical representations of the administered objects. Users of WebSphere MQ JMS probably use an LDAP server for this purpose, but the tool also supports the use of the file system context service provider. If you use an LDAP server, configure it to store JMS objects. For information to assist with this configuration, refer to Appendix C, "LDAP schema definition for storing Java objects," on page 463.

To use publish/subscribe applications, you need one of the following:

- SupportPac™ MA0C: MQSeries® Publish/Subscribe. You can find this at:

www.ibm.com/software/ts/mqseries/txppacs/ma0c.html

- WebSphere MQ Integrator Version 2
- WebSphere MQ Event Broker Version 2.1
- WebSphere Business Integration Message Broker Version 5.0
- WebSphere Business Integration Event Broker Version 5.0

To use the XOpen/XA facilities of WebSphere MQ JMS on OS/400 you need a specific PTF. Check the README file for further information.

Chapter 2. Installation

This chapter tells you how to install the WebSphere MQ classes for Java and WebSphere MQ classes for Java Message Service code.

What is installed

The latest versions of both WebSphere MQ base Java and WebSphere MQ JMS (together known as WebSphere MQ Java) are installed with WebSphere MQ. You might need to override default installation options to make sure this is done.

Refer to the following books for more information about installing WebSphere MQ:

WebSphere MQ for AIX, V5.3 Quick Beginnings
WebSphere MQ for HP-UX, V5.3 Quick Beginnings
WebSphere MQ for iSeries V5.3 Quick Beginnings
WebSphere MQ for Linux, V5.3 Quick Beginnings
WebSphere MQ for Sun Solaris, Version 5.3 Quick Beginnings
WebSphere MQ for Windows NT and Windows 2000, Version 5.3 Quick Beginnings
WebSphere MQ for z/OS Program Directory

WebSphere MQ base Java is contained in the following Java `.jar` files:

com.ibm.mq.jar	This code includes support for all the connection options.
com.ibm.mqbind.jar	This code supports only the bindings connection and is not supplied or supported on all platforms. We recommend that you do not use it in any new applications.

WebSphere MQ JMS is contained in the following Java `.jar` file:

com.ibm.mqjms.jar

The following Java libraries from Sun Microsystems are distributed with the WebSphere MQ JMS product:

connector.jar	Version 1.0
fscontext.jar	Version 1.2
jms.jar	Version 1.1
jndi.jar	Version 1.2.1 (except for z/OS and OS/390)
ldap.jar	Version 1.2.2 (except for z/OS and OS/390)
providerutil.jar	Version 1.2
jta.jar	Version 1.0.1

When installation is complete, files and samples are installed in the locations shown in "Installation directories" on page 10.

We also supply **postcard.jar** for the Postcard application; see "JMS Postcard" on page 19.

After installation, update your environment variables, as shown in "Environment variables."

Note: Do not install the product, then subsequently install or reinstall a version of SupportPac MA88, or your WebSphere MQ Java support might revert to an earlier level.

Installation directories

The WebSphere MQ Java V5.3 files are installed in the directories shown in Table 2.

Table 2. Product installation directories

Platform	Directory
AIX	/usr/mqm/java/
z/OS and OS/390	*install_dir*/mqm/java/
iSeries and AS/400®	/QIBM/ProdData/mqm/java/
HP-UX and Solaris	/opt/mqm/java/
Linux	/opt/mqm/java/
Windows systems	\Program Files\IBM\WebSphere MQ\java
Note: On z/OS and OS/390, *install_dir* is the directory in which you installed the product; this is likely to be /usr/lpp.	

Some sample programs, such as the Installation Verification Programs (IVP), are supplied. Table 3 lists the directory path to these on different platforms. WebSphere MQ base Java samples are within a subdirectory `base` and WebSphere MQ JMS samples are within a subdirectory `jms`.

Table 3. Samples directories

Platform	Directory
AIX	/usr/mqm/samp/java/
z/OS and OS/390	*install_dir*/mqm/java/samples/
iSeries and AS/400	/QIBM/ProdData/mqm/java/samples/
HP-UX and Solaris	/opt/mqm/samp/java/
Linux	/opt/mqm/samp/java/
Windows systems	\Program Files\IBM\WebSphere MQ\tools\Java\
Note: On z/OS and OS/390, *install_dir* is the directory in which you installed the product; this is likely to be /usr/lpp.	

Environment variables

After installation, update your CLASSPATH environment variable to include the WebSphere MQ base Java code and samples directories. Table 4 on page 11 shows typical CLASSPATH settings for the various platforms.

WebSphere MQ Java uses other environment variables. Some are platform dependent and are listed in Table 5 on page 12. MQ_JAVA_INSTALL_PATH and MQ_JAVA_DATA_PATH are common across platforms. On Windows systems, these variables are automatically set by the installation program, but on other platforms you need to set them manually to complete installation.

MQ_JAVA_INSTALL_PATH points to the product installation directory, as shown in Table 2 on page 10. MQ_JAVA_DATA_PATH points to the root directory for logging and tracing, and is included so that you can use the same directory for WebSphere MQ Java and the base WebSphere MQ product.

Table 4. Sample CLASSPATH statements for the product

Platform	Sample CLASSPATH
AIX	CLASSPATH=/usr/mqm/java/lib/com.ibm.mq.jar: /usr/mqm/java/lib/connector.jar: /usr/mqm/samp/java/base:
HP-UX and Solaris	CLASSPATH=/opt/mqm/java/lib/com.ibm.mq.jar: /opt/mqm/java/lib/connector.jar: /opt/mqm/samp/java/base:
Windows systems	CLASSPATH=*mq_root_dir*[1]\java\lib\com.ibm.mq.jar; *mq_root_dir*\java\lib\connector.jar; *mq_root_dir*\tools\java\base\; *mq_root_dir*\java\lib\jta.jar;
z/OS and OS/390	CLASSPATH=*install_dir*[2]/mqm/java/lib/com.ibm.mq.jar: *install_dir*/mqm/java/lib/connector.jar: *install_dir*/mqm/java/samples/base:
iSeries and AS/400	CLASSPATH=/QIBM/ProdData/mqm/java/lib/com.ibm.mq.jar: /QIBM/ProdData/mqm/java/lib/connector.jar: /QIBM/ProdData/mqm/java/samples/base:
Linux	CLASSPATH=/opt/mqm/java/lib/com.ibm.mq.jar: /opt/mqm/java/lib/connector.jar: /opt/mqm/samp/java/base:

Notes:

1. *mq_root_dir* stands here for the directory used to install WebSphere MQ on Windows systems. This is normally `C:\Program Files\IBM\WebSphere MQ\`.
2. *install_dir* is the directory in which you installed the product

To use WebSphere MQ JMS, you must include additional jar files in the classpath. These are listed in "Post installation setup" on page 25.

If there are existing applications with a dependency on the deprecated bindings package `com.ibm.mqbind`, you must also add the file `com.ibm.mqbind.jar` to your classpath.

You must update additional environment variables on some platforms, as shown in Table 5 on page 12.

Table 5. Environment variables for the product

Platform	Environment variable
AIX	LIBPATH=/usr/mqm/java/lib
HP-UX	SHLIB_PATH=/opt/mqm/java/lib
Solaris	LD_LIBRARY_PATH=/opt/mqm/java/lib
Windows systems	PATH=*install_dir*\lib
z/OS and OS/390	LIBPATH=*install_dir*/mqm/java/lib
Linux	LD_LIBRARY_PATH=/opt/mqm/java/lib
Note: *install_dir* is the installation directory for the product	

Notes:

1. To use WebSphere MQ Bindings for Java on OS/400, ensure that the library QMQMJAVA is in your library list.
2. Ensure that you append the WebSphere MQ variables and do not overwrite any of the existing system environment variables. If you overwrite existing system environment variables, the application might fail during compilation or at runtime.

STEPLIB configuration on z/OS and OS/390

On z/OS and OS/390, the STEPLIB used at runtime must contain the WebSphere MQ SCSQAUTH library. From UNIX System Services, you can add this using a line in your `.profile` as shown below, replacing `thlqual` with the high level data set qualifier that you chose when installing WebSphere MQ:

```
export STEPLIB=thlqual.SCSQAUTH:$STEPLIB
```

In other environments, you typically need to edit the startup JCL to include SCSQAUTH on the STEPLIB concatenation:

```
STEPLIB DD DSN=thlqual.SCSQAUTH,DISP=SHR
```

Web server configuration

If you install WebSphere MQ Java on a Web server, you can download and run WebSphere MQ Java applications on machines that do not have WebSphere MQ Java installed locally. To make the WebSphere MQ Java files accessible to your Web server, set up your Web server configuration to point to the directory where the client is installed. Consult your Web server documentation for details of how to configure this.

Note: On z/OS and OS/390, the installed classes do not support client connection and cannot be usefully downloaded to clients. However, jar files from another platform can be transferred to z/OS and OS/390 and served to clients.

Running WebSphere MQ Java applications under the Java 2 Security Manager

WebSphere MQ Java can run with the Java 2 Security Manager enabled. To successfully run applications with the Security Manager enabled, you must configure your JVM with a suitable policy definition file.

The simplest way to do this is to change the policy file supplied with the JRE. On most systems this file is stored in the path `lib/security/java.policy`, relative to your JRE directory. You can edit policy files using your preferred editor or the `policytool` program supplied with your JRE.

You need to give authority to the com.ibm.mq.jar and com.ibm.mqjms.jar files so that they can:

- Create sockets (in client mode)
- Load the native library (in bindings mode)
- Read various properties from the environment

The system property os.name must be available to the WebSphere MQ Java classes when running under the Java 2 Security Manager.

Here is an example of a policy file entry that allows WebSphere MQ Java to run successfully under the default security manager. Replace the string `/opt/mqm` in this example with the location where WebSphere MQ Java is installed on your system.

```
grant codeBase "file:/opt/mqm/java/lib/com.ibm.mq.jar" {
  permission java.net.SocketPermission "*","connect";
  permission java.lang.RuntimePermission "loadLibrary.*";
};

grant codeBase "file:/opt/mqm/java/lib/com.ibm.mqjms.jar" {
  permission java.util.PropertyPermission "MQJMS_LOG_DIR","read";
  permission java.util.PropertyPermission "MQJMS_TRACE_LEVEL","read";
  permission java.util.PropertyPermission "MQJMS_TRACE_DIR","read";
  permission java.util.PropertyPermission "MQ_JAVA_INSTALL_PATH","read";
  permission java.util.PropertyPermission "file.separator","read";
  permission java.util.PropertyPermission "os.name","read";
  permission java.util.PropertyPermission "user.name","read";
  permission java.util.PropertyPermission "com.ibm.mq.jms.cleanup","read";
};
```

This example of a policy file enables the WebSphere MQ Java classes to work correctly under the security manager, but you might still need to enable your own code to run correctly before your applications will work.

The sample code shipped with WebSphere MQ Java has not been specifically enabled for use with the security manager; however the IVT tests run with the above policy file and the default security manager in place.

Chapter 3. Using WebSphere MQ classes for Java (WebSphere MQ base Java)

This chapter tells you how to:

- Configure your system to run the sample applet and application programs to verify your WebSphere MQ base Java installation.
- Modify the procedures to run your own programs.

Remember to check the README file installed with the WebSphere MQ Java code for later or more specific information for your environment.

The procedures depend on the connection option you want to use. Follow the instructions in the section that is appropriate for your requirements.

Configuring your queue manager to accept client connections

Use the following procedures to configure your queue manager to accept incoming connection requests from the clients.

TCP/IP client

1. Define a server connection channel using the following procedures:

   For the OS/400 platform:

   a. Start your queue manager by using the STRMQM command.

   b. Define a sample channel called JAVA.CHANNEL by issuing the following command:

   ```
   CRTMQMCHL CHLNAME(JAVA.CHANNEL) CHLTYPE(*SVRCN) MQMNAME(QMGRNAME)
             MCAUSERID(SOMEUSERID)
             TEXT('Sample channel for WebSphere MQ classes for Java')
   ```

   where `QMGRNAME` is the name of your queue manager, and `SOMEUSERID` is an OS/400 user ID with appropriate authority to the WebSphere MQ resources.

   For z/OS or OS/390 platforms:

   Note: You must have the Client attachment feature installed on your target queue manager in order to connect using TCP/IP.

   a. Start your queue manager by using the START QMGR command.

   b. Define a sample channel called JAVA.CHANNEL by issuing the following command:

   ```
   DEF CHL('JAVA.CHANNEL') CHLTYPE(SVRCONN) TRPTYPE(TCP)
   DESCR('Sample channel for WebSphere MQ classes for Java')
   ```

   For other platforms:

   a. Start your queue manager by using the `strmqm` command.

   b. Type the following command to start the runmqsc program:

   ```
   runmqsc [QMNAME]
   ```

   c. Define a sample channel called JAVA.CHANNEL by issuing the following command:

```
DEF CHL('JAVA.CHANNEL') CHLTYPE(SVRCONN) TRPTYPE(TCP) MCAUSER(' ') +
DESCR('Sample channel for WebSphere MQ classes for Java')
```

2. Start a listener program with the following commands:

   For Windows NT, Windows 2000 operating systems:
   Issue the command:

   ```
   runmqlsr -t tcp [-m QMNAME] -p 1414
   ```

   Note: If you use the default queue manager, you can omit the -m option.

   For UNIX operating systems:
   Configure the inetd daemon, so that the inetd starts the WebSphere MQ channels. See *WebSphere MQ Clients* for instructions on how to do this.

   For the OS/400 operating system:
   Issue the command:

   ```
   STRMQMLSR MQMNAME(QMGRNAME)
   ```

   where `QMGRNAME` is the name of your queue manager.

   For the z/OS or OS/390 operating system:

   a. Ensure your channel initiator is started. If not, start it by issuing the START CHINIT command.
   b. Start the listener by issuing the command START LISTENER TRPTYPE(TCP) PORT(1414)

Verifying with the sample application

An installation verification program, MQIVP, is supplied with WebSphere MQ base Java. You can use this application to test all the connection modes of WebSphere MQ base Java. The program prompts for a number of choices and other data to determine which connection mode you want to verify. Use the following procedure to verify your installation:

1. To test a client connection:
   a. Configure your queue manager, as described in "Configuring your queue manager to accept client connections" on page 15.
   b. Carry out the rest of this procedure on the client machine.

   To test a bindings connection, carry out the rest of this procedure on the WebSphere MQ server machine.
2. Change to your samples directory.

   See Table 3 on page 10 to find where this is.
3. Type:

   ```
   java MQIVP
   ```

   The program tries to:
   a. Connect to, and disconnect from, the named queue manager.
   b. Open, put, get, and close the system default local queue.
   c. Return a message if the operations are successful.
4. At the prompt [(1)]:
   - To use a TCP/IP connection, enter a WebSphere MQ server host name.
   - To use native connection (bindings mode), leave the field blank. (Do not enter a name.)

Here is an example of the prompts and responses you might see. The actual prompts and your responses depend on your WebSphere MQ network.

```
Please enter the IP address of the MQ server              : ipaddress(1)
Please enter the port to connect to                       : (1414)(2)
Please enter the server connection channel name            : channelname(2)
Please enter the queue manager name                       : qmname
Success: Connected to queue manager.
Success: Opened SYSTEM.DEFAULT.LOCAL.QUEUE
Success: Put a message to SYSTEM.DEFAULT.LOCAL.QUEUE
Success: Got a message from SYSTEM.DEFAULT.LOCAL.QUEUE
Success: Closed SYSTEM.DEFAULT.LOCAL.QUEUE
Success: Disconnected from queue manager


Tests complete -
SUCCESS: This MQ Transport is functioning correctly.
Press Enter to continue ...
```

Notes:

1. If you choose server connection, you do not see the prompts marked (2).
2. On z/OS and OS/390, leave the field blank at prompt (1).
3. On OS/400, you can run the command `java MQIVP` only from the Qshell interactive interface (the Qshell is option 30 of OS/400, 5769-SS1). Alternatively, you can run the application by using the CL command `RUNJVA CLASS(MQIVP)`.
4. To use the WebSphere MQ bindings for Java on OS/400, you must ensure that the library QMQMJAVA is in your library list.

Running your own WebSphere MQ base Java programs

To run your own Java applets or applications, use the procedures described for the verification programs, substituting your application name in place of MQIVP.

For information on writing WebSphere MQ base Java applications and applets, see Part 2, "Programming with WebSphere MQ base Java," on page 61.

Solving WebSphere MQ base Java problems

If a program does not complete successfully, run the installation verification applet or installation verification program, and follow the advice given in the diagnostic messages. Both of these programs are described in Chapter 3, "Using WebSphere MQ classes for Java (WebSphere MQ base Java)," on page 15.

If the problems continue and you need to contact the IBM service team, you might be asked to turn on the trace facility. Refer to the following sections for the appropriate procedures for your system.

Tracing the sample application

To trace the `MQIVP` program, enter the following:

```
java MQIVP -trace n
```

where `n` is a number between 1 and 5, depending on the level of detail required. (The greater the number, the more information is gathered.)

For more information about how to use trace, see "Tracing WebSphere MQ base Java programs" on page 94.

Error messages

Here are some of the more common error messages that you might see:

Unable to identify local host IP address
The server is not connected to the network.

Connect the server to the network and retry.

MQRC_ADAPTER_CONN_LOAD_ERROR
If you see this z/OS error , ensure that the WebSphere MQ SCSQANLE and SCSQAUTH datasets are in your STEPLIB statement.

Chapter 4. Using WebSphere MQ classes for Java Message Service (WebSphere MQ JMS)

This chapter tells you how to:

- Set up and use JMS Postcard
- Set up your system to use the test and sample programs
- Run the point-to-point Installation Verification Test (IVT) program to verify your WebSphere MQ classes for Java Message Service installation
- Run the sample publish/subscribe Installation Verification Test (PSIVT) program to verify your publish/subscribe installation
- Run your own programs

JMS Postcard

JMS Postcard is a simple way to do the following:

- Verify that you have successfully installed WebSphere MQ and WebSphere MQ JMS on one computer and, optionally, on others as well
- Introduce you to messaging

Note: JMS Postcard is ***not*** supported on WebSphere MQ for z/OS or WebSphere MQ for iSeries.

Setting up JMS Postcard

To use JMS Postcard, make sure that the Java Messaging feature of WebSphere MQ for Windows NT and Windows 2000 (WebSphere MQ JMS) is installed. You also need a working Java Runtime Environment (JRE) at Java 1.3 level.

Before you can successfully run the JMS Postcard application, define the environment variables CLASSPATH, LIBPATH, MQ_JAVA_INSTALL_PATH, and MQ_JAVA_DATA_PATH. On Windows systems these variables are set as part of the install process. On other platforms you must set them yourself. For more information about these variables, see "Environment variables" on page 10.

Many operations that the Postcard application carries out on your behalf require the user to be a member of the WebSphere MQ administrators group (mqm). If you are not a member of mqm, get a member of the mqm group to set up the *default configuration* on your behalf. See "JMS Postcard default configuration" on page 22.

Starting

To start the JMS Postcard application, run the `postcard` script. This is supplied in the `java/bin` directory of the WebSphere MQ installation.

The first time that you run JMS Postcard, it asks you to complete the default configuration, which sets up a suitable queue manager to act as mailbox. See "JMS Postcard default configuration" on page 22.

Whenever you start a Postcard application, you must sign on and enter a nickname. (There are advanced options available on the sign-on dialog, see "Sign-on advanced options" on page 20 for details).

Sign-on

The sign-on dialog has a check box labelled Advanced. Check this to see the extended dialog where you can choose which queue manager is used by the Postcard program.

Notes:

1. If you have no queue managers at all, or just the default configuration, the checkbox is disabled.
2. Depending on what queue managers and clusters you have, the checkbox and options are in one of various combinations of enabled, disabled, and preselected.

Sign-on advanced options

Use default configuration as mailbox

This is the easiest way to use JMS Postcard on one or several computers. Make sure that the default configuration is installed on all the computers, that one of them holds the repository, and that all the others use the first one as their repository; this puts them all in the same cluster.

Choose queue manager as mailbox

Use the drop-down list to choose any one of your local queue managers. If you want to send postcards between two queue managers (on one or more computers) this way, make sure that one of the following conditions is true:

- The queue managers are in the same cluster (for more information about clusters, see the *WebSphere MQ Queue Manager Clusters* book).
- There are explicit connections between the queue managers.

Sending a postcard

To send a postcard successfully, you need two instances of the Postcard application with different nicknames. For example, suppose you start the Postcard application and use the nickname Will, and then start it again using the nickname Tim. Will can send postcards to Tim and Tim can send postcards to Will.

If Will and Tim are connected to the same queue manager, see "Running JMS Postcard with one queue manager."

If Tim is on a different queue manager manager (on the same or a different computer from Will), see "Running JMS Postcard with two queue managers" on page 21.

When the postcard arrives successfully, you know that your WebSphere MQ installation and WebSphere MQ JMS are working correctly.

For an alternative way of verifying the installation of WebSphere MQ JMS, run the IVTRun application from the command line. See "Running the point-to-point IVT" on page 31 for more information about this.

Running JMS Postcard with one queue manager

If you have already started the Postcard application with a nickname, for example, Will, and you want to send a postcard to a second nickname on this computer, follow these steps:

1. Move the first Postcard (Will) to one side of your screen, then start a second Postcard by running the `postcard` shell script again.

2. Enter your second nickname, for example Tim.
3. On Will's Postcard fill in the **To** field with your second nickname, Tim. (You can leave the **On** field empty and Postcard will fill it in for you, or you can type in the queue manager name that you see below the **Message** box after **On**).
4. Click in the **Message** box, type your message in, and click the **Send** button.
5. Look in Tim's Postcard to see the message arrive, and double-click on it to see the postcard itself.
6. Try using Tim to send a message back to Will. You can do this by selecting the message that arrived in Tim's list, and clicking the **Reply** button.

Note: See "JMS Postcard configuration" on page 22 for advice about configuration.

Running JMS Postcard with two queue managers

If you have already started JMS Postcard with a nickname, for example Will, and you want to send a postcard to a second nickname on a second queue manager on this, or another, computer, follow these steps:

1. Start the second Postcard, choosing one of the following:
   - JMS Postcard
     - On this computer, run the **postcard** shell script again, then in the sign-on dialog check Advanced and select the second queue manager you want to use.
     - On another computer, run the **postcard** shell script; or, on Windows systems, open WebSphere MQ First Steps and click on JMS Postcard.
   - MQI Postcard on Windows systems:

     either start from WebSphere MQ First Steps (to use the default configuration), or open the WebSphere MQ Explorer, right-click on the queue manager you want to use and click **All Tasks->Start a Postcard...**
2. When the sign-on dialog appears, enter your second nickname (for example, Tim).
3. In the Postcard application on Will's computer, fill in the **To** field with your second nickname (Tim), and in the **On** field put the queue manager name of the second postcard where Tim is. If you don't know this name, on Tim's computer in the Postcard look below the Message box after **On:**; alternatively if both queue managers are in the default configuration cluster, you can just type in the short TCP/IP name of Tim's computer and Postcard builds that into the queue manager name in the same way that the task that creates the default configuration does.
4. Type your message, and click **Send**.

   Look in Tim's Postcard to see the message arrive, and double-click on it to see the postcard itself.
5. Try sending a message from Tim's computer back to Will.

   You can do this by selecting the message that arrived in Tim's list, and clicking **Reply**.

Note: See "JMS Postcard configuration" on page 22.

See also "How JMS Postcard works" on page 22.

JMS Postcard configuration

The Postcard application needs a suitable queue manager to act as mailbox. See "JMS Postcard default configuration" for the easiest way to get one. You will be prompted to install this default configuration the first time you start the Postcard application (see "Starting" on page 19).

Instead of using the default configuration, you can also start the Postcard application using any other local queue manager.

If you want to send postcards to another computer, or to other queue managers, the default configuration must include the option of being joined in the same cluster. The other queue managers must either be in the same cluster or you must create a connection explicitly between them.

See also "How JMS Postcard works."

JMS Postcard default configuration

Installing the default configuration creates a special queue manager (with queues and channels), and optionally joins it to a cluster, to enable you to use the JMS Postcard application to verify your installation and see messaging working.

On WebSphere MQ for Windows NT and Windows 2000, the Default Configuration Wizard automatically opens when JMS Postcard is started and the wizard has not already been run on this computer.

On platforms other than Windows systems, you can also run the `DefaultConfiguration` script, provided that there are no existing queue managers on this computer. On Windows systems, run Default Configuration from First Steps.

Note: You must be a member of the WebSphere MQ administrators group (mqm) to complete default configuration successfully. If you are not a member of mqm, get a member of the mqm group to set up the default configuration on your behalf.

How JMS Postcard works

This section tells you how the JMS Postcard works, including:

Starting up

When JMS Postcard starts, it checks to see what queue managers exist on this computer, and initializes the sign-on dialog accordingly. If there are no queue managers at all, it prompts you to install the default configuration.

JMS Postcard uses the Java Message Service method queueConnectionFactory.createQueueConnection() to connect to the default queue manager.

Receiving messages

All the time JMS Postcard is running, it polls a queue called postcard for incoming messages from other Postcard applications. If there is no queue called postcard, JMS Postcard creates one.

When JMS Postcard starts running, it creates a Java Message Service QueueReceiver object for the local postcard queue, providing as a parameter a selector string that filters the messages to be received from the queue by the Correlation Identifier (CorrelId field). The selector string defines that the postcard client should only receive messages where the CorrelId field matches the nickname of the user. The words from the message data are then presented in the JMS Postcard window.

Sending messages

If you did not enter a computer name in the **On:** field, JMS Postcard assumes that the recipient is on the same queue manager.

If you entered a name, JMS Postcard checks for the existence of a queue manager with this name, first using the exact name supplied, and then using a prefix in the same format as that created by the default configuration.

In both cases, it issues a session.createQueue('postcard'), and sets the base queue manager name to the string supplied.

Finally, it builds a JMS BytesMessage from your nickname and the words you typed in, and runs queueSender.send(theMessage) to put the message onto the queue.

How the postcards get there

When other instances of Postcard on this computer use the same queue manager and queue, the messages are being put and got from the one queue. This does, however, verify that the WebSphere MQ code installed on this computer is configured and working correctly.

JMS Postcard can only send to another queue manager if a connection to that queue manager exists. This connection exists because either both queue managers are members of the same cluster, or you have explicitly created a connection yourself. JMS Postcard can therefore assume that it can connect to the queue manager, and connects to it, opens the queue, and puts a message, as already described, leaving all the work of getting the message there to the WebSphere MQ cluster code. In other words, JMS Postcard uses only one piece of code for putting the message, and does not need to know whether the message is going to another computer.

In JMS Postcard, when session.createSender('postcard') is called, the cluster code checks the repository to find the other queue manager, and to check that the queue exists, and throws an exception if this was not possible for any reason.

When queueSender.send(theMessage) is called, the cluster code opens a channel to the other queue manager (creating it if necessary) and sends the message.

Discard the channel afterwards, if the cluster optimizing code does not need it. If the queue managers are on different computers, that is all handled by the cluster code.

Tidying up undeliverable messages

If you sent a postcard message to John, but never ran a Postcard application with the nickname John, the message would sit on the queue for ever. To prevent this, JMS Postcard sets the Message Lifetime (Expiry) field in the Message Descriptor (MQMD) to 48 hours. After that time, the message is discarded, wherever it may be (possibly even still in transmission).

Exchanging messages between different WebSphere MQ Postcard applications

You can exchange messages between all the different types of Postcard application as follows:

- **MQI Postcard** on WebSphere MQ for Windows NT and Windows 2000.
- **JMS Postcard** on Windows systems and other operating systems such as UNIX.
- **MQSeries Postcard** on previous versions of MQSeries for Windows, with the exception that it cannot *receive* messages from JMS Postcard.
- **MQ Everyplace Postcard** on WebSphere MQ Everyplace on pervasive devices. For this, a connection must be explicitly set up between the queue managers. See the WebSphere MQ Everyplace product documentation for further information.

Customizing JMS Postcard

Normally JMS Postcard uses standard Java Swing settings for font size and background color. But if it detects a `postcard.ini` file on startup, JMS Postcard uses settings specified in this file instead. You can also change the trace setting.

Edit the sample file `postcard.ini` in the `bin` directory of the WebSphere MQ classes for Java installation and set your preferred settings for font size, and screen foreground and background colors.

Note: The precise use of upper and lower case letters in the keywords, as in the following examples, must be strictly observed when you set these properties.

Setting screen colors

By setting the Background and Foreground properties, you can change the background and foreground colors of controls used in the Postcard application.

```
Background=000000
Foreground=FFFFFF
```

This example selects white text on a black background. The values represent intensity levels for red, green, and blue colors using a hexadecimal scale from 00 to FF. Other examples of colors are FF0000 (bright red), 00FF00 (bright green) and 0000FF (bright blue).

Setting font size

```
MinimumFont=20
```

This example selects a minimum font size of 20 points. Any value smaller than 13 is ignored.

Using an external browser for online help

```
WebBrowser=nautilus
```

This setting is only applicable on non-Windows systems. The internal browser used for displaying online help information cannot be customized. This setting allows you to identify an alternative browser.

Tracing the Postcard application

`Trace=1`

Set this to start trace output. Note that the trace output is sent to the `trc` subdirectory of the directory defined by the MQ_JAVA_DATA_PATH system environment variable. If the application cannot write to this directory, trace output is directed to the system console.

You can also use the MQJMS_TRACE_LEVEL parameter on the `java` command line to start tracing. See "Tracing programs" on page 38 for more about tracing applications.

Post installation setup

Note: Remember to check the README file installed with the WebSphere MQ Java programs for information that may supersede this book.

To make all the necessary resources available to WebSphere MQ JMS programs, you need to update the following system variables:

Classpath

Successful operation of JMS programs requires a number of Java packages to be available to the JVM. You must specify these on the classpath after you have obtained and installed the necessary packages.

Add the following .jar files to the classpath:

- com.ibm.mq.jar
- com.ibm.mqjms.jar
- connector.jar
- jms.jar
- jndi.jar
- jta.jar
- providerutil.jar
- fscontext.jar
- ldap.jar

Notes:

1. For z/OS and OS/390, use `ibmjndi.jar` and `jndi.jar` from `/usr/lpp/ldap/lib` instead of `jndi.jar` and `ldap.jar`. These files are supplied with the operating system.
2. Include the java/lib directory itself in the classpath to access the properties files used by the base Java API.
3. Include providerutil.jar, jndi.jar, and either ldap.jar or fscontext.jar if you need to access a JNDI namespace.
4. In certain environments, typically J2EE application servers, classes contained in these jars are provided by the environment. In these circumstances, use the classes provided by the environment instead of those provided with WebSphere MQ.

Environment variables

There are a number of scripts in the `bin` subdirectory of the WebSphere MQ JMS installation. These are for use as convenient shortcuts for a number of common actions. Many of these scripts assume that the environment variables `MQ_JAVA_INSTALL_PATH` and `MQ_JAVA_DATA_PATH` are

defined, pointing to the directory in which WebSphere MQ JMS is installed and a directory for log and trace output, respectively. If you do not set these variables, you must edit the scripts in the `bin` directory accordingly.

On Windows NT, you can set the classpath and other environment variables by using the **Environment** tab of System Properties. On Windows 2000 and Windows XP, Environment is a button on the **Advanced** tab of System Properties. On UNIX, these are normally set from each user's logon scripts. On any platform, you can use scripts to maintain different classpaths and other environment variables for different projects.

Note: If you are migrating from the SupportPac MA88, be aware that the connector.jar is now packaged in the java/lib directory with the other jar files, with the following consequences:

- You need an entry for connector.jar in the classpath, as explained above.
- If you have previously implemented your own ConnectionManagers, as described in "Supplying your own ConnectionManager" on page 85, you must replace references to com.ibm.mq.resource and com.ibm.mq.resource.spi with references to javax.resource and javax.resource.spi respectively.

Additional setup for publish/subscribe mode

Before you can use the WebSphere MQ JMS implementation of JMS publish/subscribe, some additional setup is required:

- Ensure that you have access to a publish/subscribe broker.
- Ensure that the broker is running.
- Create the WebSphere MQ JMS system queues.

  This step is not required for direct connection across a TCP/IP socket to a WebSphere MQ Event Broker broker.

You also need to know publish/subscribe concepts as discussed in Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213.

Ensure that you have access to a publish/subscribe broker

With WebSphere MQ JMS you have the choice of three brokers:

- WebSphere MQ with SupportPac MA0C (also known as MQSeries Publish/Subscribe)
- WebSphere MQ Integrator V2
- WebSphere MQ Event Broker

Differences between these brokers are discussed in Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213. Read the documentation for each broker for installation and configuration instructions.

Note: To use broker-based subscription stores, you must use SupportPac MA0C or the WebSphere MQ Event Broker. No other combination of queue manager and broker supports this option. For more information about subscription stores, see "Subscription stores" on page 227. For information specific to JMS 1.1, see "Subscription stores" on page 246.

Ensure that the broker is running

MQSeries Publish/Subscribe

To verify that the broker is installed and running, use the command:

```
dspmqbrk -m MY.QUEUE.MANAGER
```

where `MY.QUEUE.MANAGER` is the name of the queue manager on which the broker is running. If the broker is running, a message similar to the following is displayed:

```
WebSphere MQ message broker for queue manager MY.QUEUE.MANAGER running.
```

If the operating system reports that it cannot run the `dspmqbrk` command, ensure that the MQSeries Publish/Subscribe broker is installed properly.

If the operating system reports that the broker is not active, start it using the command:

```
strmqbrk -m MY.QUEUE.MANAGER
```

WebSphere MQ Integrator V2

To verify that the broker provided in WebSphere MQ Integrator V2 is installed and running, refer to the product documentation.

The command to start the broker in WebSphere MQ Integrator V2 is:

```
mqsistart MYBROKER
```

where `MYBROKER` is the name of the broker.

WebSphere MQ Event Broker

To verify that the broker provided in WebSphere MQ Event Broker is installed and running, refer to the product documentation.

The command to start the broker in WebSphere MQ Event Broker is:

```
wmqpsstart MYBROKER
```

where `MYBROKER` is the name of the broker.

Create the WebSphere MQ JMS system queues

This does not apply if you use a direct connection across TCP/IP to WebSphere MQ Event Broker.

For a publish/subscribe implementation to work correctly, you must create a number of system queues. A script is supplied, in the `bin` subdirectory of the WebSphere MQ JMS installation, to assist with this task. To use the script, enter the following commands:

For iSeries and AS/400:

1. Copy the script from the integrated file system to a native file system library using a command similar to:

   ```
   CPYFRMSTMF FROMSTMF('/QIBM/ProdData/mqm/java/bin/MQJMS_PSQ.mqsc')
              TOMBR('/QSYS.LIB/QGPL.LIB/QCLSRC.FILE/MQJMS_PSQ.MBR')
   ```

2. Call the script file using STRMQMMQSC:

   ```
   STRMQMMQSC  SRCMBR(MQJMS_PSQ) SRCFILE(QGPL/QCLSRC)
   ```

For z/OS and OS/390:

1. Copy the script from the HFS into a PDS using a TSO command similar to

   ```
   OGET '/usr/lpp/mqm/java/bin/MQJMS_PSQ.mqsc' 'USERID.MQSC(MQJMSPSQ)'
   ```

   The PDS should be of fixed-block format with a record length of 80.

2. Either use the CSQUTIL application to execute this command script, or add the script to the CSQINP2 DD concatenation in your queue manager's started task JCL. In either case, refer to the *WebSphere MQ for z/OS System Setup Guide* and the *WebSphere MQ for z/OS System Administration Guide* for further details.

For other platforms:

```
runmqsc MY.QUEUE.MANAGER < MQJMS_PSQ.mqsc
```

If an error occurs, check that you typed the queue manager name correctly and that the queue manager is running.

For a broker running on a remote queue manager

For operation with a broker running on a remote queue manager, further setup is required.

1. Define a transmission queue on the remote queue manager with a queue name matching the local queue manager. These names must match for correct routing of messages by WebSphere MQ.
2. Define a sender channel on the remote queue manager and a receiver channel on the local queue manager. The sender channel should use the transmission queue defined in step 1.
3. Set up the local queue manager for communication with the remote broker:
   a. Define a local transmission queue with the same name as the queue manager running the remote broker.
   b. Define local sender and remote receiver channels to the remote broker queue manager. The sender channel must use the transmission queue defined in step 3a.
4. To operate the remote broker, take the following steps:
   a. Start the remote broker queue manager.
   b. Start a listener for the remote broker queue manager (TCP/IP channels).
   c. Start the sender and receiver channels to the local queue manager.
   d. Start the broker on the remote queue manager.

      An example command is

      ```
      strmqbrk -m MyBrokerMgr
      ```

5. To operate the local queue manager to communicate with the remote broker, take the following steps:

a. Start the local queue manager.
b. Start a listener for the local queue manager.
c. Start the sender and receiver channels to the remote broker queue manager.

Queues that require authorization for non-privileged users

Non-privileged users need authorization granted to access the queues used by JMS. For details about access control in WebSphere MQ, see the chapter about protecting WebSphere MQ objects in the *WebSphere MQ System Administration Guide*.

For JMS point-to-point mode, the access control issues are similar to those for the WebSphere MQ classes for Java:

- Queues that are used by QueueSender need put authority.
- Queues that are used by QueueReceivers and QueueBrowsers need get, inq, and browse authorities.
- The QueueSession.createTemporaryQueue method needs access to the model queue that is defined in the QueueConnectionFactory temporaryModel field (by default this is SYSTEM.DEFAULT.MODEL.QUEUE).

For JMS publish/subscribe mode, the following system queues are used:

SYSTEM.JMS.ADMIN.QUEUE
SYSTEM.JMS.REPORT.QUEUE
SYSTEM.JMS.MODEL.QUEUE
SYSTEM.JMS.PS.STATUS.QUEUE
SYSTEM.JMS.ND.SUBSCRIBER.QUEUE
SYSTEM.JMS.D.SUBSCRIBER.QUEUE
SYSTEM.JMS.ND.CC.SUBSCRIBER.QUEUE
SYSTEM.JMS.D.CC.SUBSCRIBER.QUEUE
SYSTEM.BROKER.CONTROL.QUEUE

Also, any application that publishes messages needs access to the STREAM queue that is specified in the topic connection factory being used. The default value for this is SYSTEM.BROKER.DEFAULT.STREAM.

If you use ConnectionConsumer, additional authorization might be needed. Queues to be read by the ConnectionConsumer must have get, inq and browse authorities. The system dead-letter queue, and any backout-requeue queue or report queue used by the ConnectionConsumer must have put and passall authorities.

Using the sample JMS applet to verify the TCP/IP client

WebSphere MQ JMS includes an installation verification applet, `test.html`. You can use the applet to verify the TCP/IP connected client mode of WebSphere MQ JMS except on the z/OS and OS/390 platform, where the TCP/IP connected client mode is not supported.

The standard security settings for applets in Java 1.2 and higher require that all referenced classes are loaded from the same location as the applet you want to run. For information on how to ensure that applets using WebSphere MQ JMS work, see Appendix F, “Using WebSphere MQ Java in applets with Java 1.2 or later,” on page 481.

The applet connects to a given queue manager, exercises all the WebSphere MQ calls, and produces diagnostic messages if there are any failures. If the applet does not complete successfully, follow the advice given in the diagnostic messages and run the applet again.

Using the sample applet with OS/400

The OS/400 operating system does not have a native Graphical User Interface (GUI). To run the sample applet, you need to use the Remote Abstract Window Toolkit for Java (AWT), or the Class Broker for Java (CBJ), on graphics capable hardware.

Running the sample applet

First make sure that your queue manager can accept client connections. For details of this, see "Configuring your queue manager to accept client connections" on page 15.

There are different ways of running the JMS sample applet. Each has slightly different properties because of the security restrictions on applets imposed by the Java virtual machine.

Normal Java security settings cause the appletviewer or browser to ignore your system CLASSPATH, so the WebSphere MQ base Java and WebSphere MQ JMS libraries must be present in the same location as the applet class file. For further details of applets and security settings, see Appendix F, "Using WebSphere MQ Java in applets with Java 1.2 or later," on page 481.

Running from a web server (in appletviewer or in a browser):

Invoke the applet using a command line like the following:

```
appletviewer http://<web.server.host/jmsapplet>/test.html
```

or by pointing your Java 1.3 enabled browser at this Web page. Change the string *<web.server.host/jmsapplet>* as appropriate to the URL of the Web server you are using.

Running in appletviewer from the local machine:

Invoke the applet using a command line like the following:

```
appletviewer test.html
```

Remember that the WebSphere MQ base Java and WebSphere MQ JMS libraries must be present in the same local directory as the applet class file. Also, in this case, the applet might connect only to queue managers on the local machine.

Running the applet as an application:

Compile the applet using the command:

```
javac JMSTestApplet.java
```

Then run the applet using the command:

```
java JMSTestApplet
```

The JMS sample applet contains a main method that allows the applet to run as a standalone Java application.

This option requires the WebSphere MQ base Java and WebSphere MQ JMS libraries to be present in the system CLASSPATH, as for your own

WebSphere MQ JMS applications. It allows you to connect to any host and queue manager to which you have TCP/IP access.

Tracing the sample as an application

To trace the sample as an application, alter the command line parameters as shown below, in the same way as you would trace your own JMS applications:

```
java -DMQJMS_TRACE_LEVEL=on JMSTestApplet
```

More details can be found in "Tracing programs" on page 38.

Running the point-to-point IVT

This section describes the point-to-point installation verification test program (IVT) that is supplied with WebSphere MQ JMS.

The IVT verifies the installation by connecting to the default queue manager on the local machine, using the WebSphere MQ JMS in bindings mode. It then sends a message to the `SYSTEM.DEFAULT.LOCAL.QUEUE` queue and reads it back again.

You can run the program in one of two possible modes.

With JNDI lookup of administered objects
JNDI mode forces the program to obtain its administered objects from a JNDI namespace, which is the expected operation of JMS client applications. (See "Administering JMS objects" on page 45 for a description of administered objects). This invocation method has the same prerequisites as the administration tool (see Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41).

Without JNDI lookup of administered objects
If you do not want to use JNDI, you can create the administered objects at runtime by running the IVT in non-JNDI mode. Because a JNDI-based repository is relatively complex to set up, run the IVT first without JNDI.

Point-to-point verification without JNDI

A script, named `IVTRun` on UNIX, or `IVTRun.bat` on Windows systems, is provided to run the IVT. This file is installed in the `bin` subdirectory of the installation.

To run the test without JNDI, issue the following command:

```
IVTRun [-t] -nojndi [-m <qmgr>]
```

For client mode, to run the test without JNDI, issue the following command:

```
IVTRun [-t] -nojndi -client -m <qmgr> -host <hostname> [-port <port>]
            [-channel <channel>]
```

where:

-t	turns tracing on (by default, tracing is off)
qmgr	is the name of the queue manager to which you want to connect
hostname	is the host on which the queue manager is running
port	is the TCP/IP port on which the queue manager's listener is running (default 1414)
channel	is the client connection channel (default SYSTEM.DEF.SVRCONN)

If the test completes successfully, you should see output similar to the following:

```
5648-C60, 5724-B41, 5655-F10 (c) Copyright IBM Corp. 2002. All Rights Reserved.
Websphere MQ classes for Java(tm) Message Service 5.300
Installation Verification Test


Creating a QueueConnectionFactory
Creating a Connection
Creating a Session
Creating a Queue
Creating a QueueSender
Creating a QueueReceiver
Creating a TextMessage
Sending the message to SYSTEM.DEFAULT.LOCAL.QUEUE
Reading the message back again

Got message:
JMS Message class: jms_text
  JMSType:         null
  JMSDeliveryMode: 2
  JMSExpiration:   0
  JMSPriority:     4
  JMSMessageID:    ID:414d5120415343415249202020202020207cce883c03300020
  JMSTimestamp:    1016124013892
  JMSCorrelationID:null
  JMSDestination:  queue:///SYSTEM.DEFAULT.LOCAL.QUEUE
  JMSReplyTo:      null
  JMSRedelivered:  false
  JMS_IBM_PutDate:20020314
  JMSXAppID:java
  JMS_IBM_Format:MQSTR
  JMS_IBM_PutApplType:6
  JMS_IBM_MsgType:8
  JMSXUserID:parkiw
  JMS_IBM_PutTime:16401390
  JMSXDeliveryCount:1
A simple text message from the MQJMSIVT program
Reply string equals original string
Closing QueueReceiver
Closing QueueSender
Closing Session
Closing Connection
IVT completed OK
IVT finished
```

Point-to-point verification with JNDI

To run the IVT with JNDI, the LDAP server must be running and must be configured to accept Java objects. If the following message occurs, it indicates that there is a connection to the LDAP server, but that the server is not correctly configured:

```
Unable to bind to object
```

This message means that either the server is not storing Java objects, or the permissions on the objects or the suffix are not correct. See “Checking your LDAP server configuration” on page 463.

Also, the following administered objects must be retrievable from a JNDI namespace:

- MQQueueConnectionFactory
- MQQueue

A script, named `IVTSetup` on UNIX, or `IVTSetup.bat` on Windows systems, is provided to create these objects automatically. Enter the command:

```
IVTSetup
```

The script invokes the WebSphere MQ JMS Administration tool (see Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41) and creates the objects in a JNDI namespace.

The MQQueueConnectionFactory is bound under the name `ivtQCF` (for LDAP, `cn=ivtQCF`). All the properties are default values:

```
TRANSPORT(BIND)
PORT(1414)
HOSTNAME(localhost)
CHANNEL(SYSTEM.DEF.SVRCONN)
VERSION(1)
CCSID(819)
TEMPMODEL(SYSTEM.DEFAULT.MODEL.QUEUE)
QMANAGER()
```

The MQQueue is bound under the name `ivtQ` (`cn=ivtQ`). The value of the `QUEUE` property becomes `QUEUE(SYSTEM.DEFAULT.LOCAL.QUEUE)`. All other properties have default values:

```
PERSISTENCE(APP)
QUEUE(SYSTEM.DEFAULT.LOCAL.QUEUE)
EXPIRY(APP)
TARGCLIENT(JMS)
ENCODING(NATIVE)
VERSION(1)
CCSID(1208)
PRIORITY(APP)
QMANAGER()
```

Once the administered objects are created in the JNDI namespace, run the `IVTRun` (`IVTRun.bat` on Windows systems) script using the following command:

```
IVTRun [ -t ]  -url "<providerURL>" [ -icf <initCtxFact> ]
```

where:

-t turns tracing on (by default, tracing is off)

providerURL

Note: Enclose the *providerURL* string in quotation marks (").
This is the JNDI location of the administered objects. If the default initial context factory is in use, this is an LDAP URL of the form:

```
"ldap://hostname.company.com/contextName"
```

If a file system service provider is used, (see `initCtxFact` below), the URL is of the form:

```
"file://directorySpec"
```

initCtxFact is the classname of the initial context factory. The default is for an LDAP service provider, and has the value:

```
com.sun.jndi.ldap.LdapCtxFactory
```

If a file system service provider is used, set this parameter to:

```
com.sun.jndi.fscontext.RefFSContextFactory
```

If the test completes successfully, the output is similar to the non-JNDI output, except that the create `QueueConnectionFactory` and `Queue` lines indicate retrieval of the object from JNDI. The following shows an example.

```
5648-C60, 5724-B41, 5655-F10 (c) Copyright IBM Corp. 2002. All Rights Reserved.
Websphere MQ classes for Java(tm) Message Service 5.300
Installation Verification Test

Using administered objects, please ensure that these are available

Retrieving a QueueConnectionFactory from JNDI
Creating a Connection
Creating a Session
Retrieving a Queue from JNDI
Creating a QueueSender
Creating a QueueReceiver
Creating a TextMessage
Sending the message to SYSTEM.DEFAULT.LOCAL.QUEUE
Reading the message back again

Got message:
JMS Message class: jms_text
  JMSType:         null
 ...
 ...
```

Although not strictly necessary, it is good practice to remove objects that are created by the IVTSetup script from the JNDI namespace. A script called `IVTTidy` (`IVTTidy.bat` on Windows systems) is provided for this purpose.

IVT error recovery

If the test is not successful, note the following:

- For help with any error messages involving the classpath, check that your classpath is set correctly, as described in "Post installation setup" on page 25.
- The IVT might fail with a message `failed to create MQQueueManager`, with an additional message including the number 2059. This indicates that WebSphere MQ failed to connect to the default local queue manager on the machine on which you ran the IVT. Check that the queue manager is running, and that it is marked as the default queue manager.
- A message `failed to open MQ queue` indicates that WebSphere MQ connected to the default queue manager, but could not open the SYSTEM.DEFAULT.LOCAL.QUEUE. This might indicate that either the queue does not exist on your default queue manager, or that the queue is not enabled for PUT and GET. Add or enable the queue for the duration of the test.

Table 6 lists the classes that are tested by IVT, and the package that they come from:

Table 6. Classes that are tested by IVT

Class	Jar file
WebSphere MQ JMS classes	com.ibm.mqjms.jar
com.ibm.mq.MQMessage	com.ibm.mq.jar
javax.jms.Message	jms.jar
javax.naming.InitialContext	jndi.jar
javax.resource.cci.Connection	connector.jar
javax.transaction.xa.XAException	jta.jar
com/sun/jndi/toolkit/ComponentDirContext	providerutil.jar
com.sun.jndi.ldap.LdapCtxFactory	ldap.jar

The publish/subscribe installation verification test

The publish/subscribe installation verification test (PSIVT) program is supplied only in compiled form. It is in the `com.ibm.mq.jms` package.

The test requires a broker such as the MQSeries Publish/Subscribe broker (SupportPac MA0C) or WebSphere MQ Integrator V2 to be installed and running.

The PSIVT attempts to:

1. Create a publisher, `p`, publishing on the topic `MQJMS/PSIVT/Information`
2. Create a subscriber, `s`, subscribing on the topic `MQJMS/PSIVT/Information`
3. Use `p` to publish a simple text message
4. Use `s` to receive a message waiting on its input queue

When you run the PSIVT, the publisher publishes the message, and the subscriber receives and displays the message. The publisher publishes to the broker's default stream. The subscriber is non-durable, does not perform message selection, and accepts messages from local connections. It performs a synchronous receive, waiting a maximum of 5 seconds for a message to arrive.

You can run the PSIVT, like the IVT, in either JNDI mode or standalone mode. JNDI mode uses JNDI to retrieve a `TopicConnectionFactory` and a `Topic` from a JNDI namespace. If JNDI is not used, these objects are created at runtime.

Publish/subscribe verification without JNDI

A script named `PSIVTRun` (`PSIVTRun.bat` on Windows systems) is provided to run PSIVT. The file is in the `bin` subdirectory of the installation.

To run the test without JNDI, issue the following command:

```
PSIVTRun -nojndi [-m <qmgr>] [-bqm <broker>] [-t]
```

For client mode, to run the test without JNDI, issue the following command:

```
PSIVTRun -nojndi -client -m <qmgr> -host <hostname> [-port <port>]
               [-channel <channel>] [-bqm <broker>] [-t]
```

where:

-nojndi indicates no JNDI lookup of the administered objects

qmgr is the name of the queue manager to which you wish to connect

hostname is the host on which the queue manager is running

port is the TCP/IP port on which the queue manager's listener is running (default 1414)

channel is the client connection channel (default SYSTEM.DEF.SVRCONN)

broker is the name of the remote queue manager on which the broker is running. If this is not specified, the value used for **qmgr** is assumed.

-t turns tracing on (default is off)

If the test completes successfully, output is similar to the following:

```
5648-C60, 5724-B41, 5655-F10 (c) Copyright IBM Corp. 2002. All Rights Reserved.
Websphere MQ classes for Java(tm) Message Service 5.300
Publish/Subscribe Installation Verification Test
```

```
Creating a Connection
Creating a TopicConnectionFactory
Creating a Session
Creating a Topic
Creating a TopicPublisher
Creating a TopicSubscriber
Creating a TextMessage
Adding text
Publishing the message to topic://MQJMS/PSIVT/Information
Waiting for a message to arrive [5 secs max]...

Got message:
JMS Message class: jms_text
  JMSType:         null
  JMSDeliveryMode: 2
  JMSExpiration:   0
  JMSPriority:     4
  JMSMessageID:    ID:414d5120415343415249202020202020207cce883c19230020
  JMSTimestamp:    1016124933637
  JMSCorrelationID:ID:414d5120415343415249202020202020207cce883c09320020
  JMSDestination:  topic://MQJMS/PSIVT/Information
  JMSReplyTo:      null
  JMSRedelivered:  false
  JMS_IBM_PutDate:20020314
  JMSXAppID:ASCARI
  JMS_IBM_Format:MQSTR
  JMS_IBM_PutApplType:26
  JMS_IBM_MsgType:8
  JMSXUserID:parkiw
  JMS_IBM_PutTime:16553367
  JMSXDeliveryCount:1
A simple text message from the MQJMSPSIVT program
Reply string equals original string
Closing TopicSubscriber
Closing TopicPublisher
Closing Session
Closing Connection
PSIVT finished
```

Publish/subscribe verification with JNDI

To run the PSIVT in JNDI mode, two administered objects must be retrievable from a JNDI namespace:

- A TopicConnectionFactory bound under the name `ivtTCF`
- A Topic bound under the name `ivtT`

You can define these objects by using the WebSphere MQ JMS Administration Tool (see Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41) and using the following commands:

```
DEFINE TCF(ivtTCF)
```

This command defines the TopicConnectionFactory.

```
DEFINE T(ivtT) TOPIC(MQJMS/PSIVT/Information)
```

This command defines the Topic.

These definitions assume that a default queue manager, on which the broker is running, is available. For details on configuring these objects to use a non-default queue manager, see "Administering JMS objects" on page 45. These objects must reside in a context pointed to by the `-url` command-line parameter described below.

To run the test in JNDI mode, enter the following command:

```
PSIVTRun [ -t ]  -url "<providerURL>" [ -icf <initCtxFact> ]
```

where:

-t means turn tracing on (by default, tracing is off)

providerURL

Note: Enclose the *providerURL* string in quotation marks (").
This is the JNDI location of the administered objects. If the default initial context factory is in use, this is an LDAP URL of the form:

```
"ldap://hostname.company.com/contextName"
```

If a file system service provider is used, (see `initCtxFact` below), the URL is of the form:

```
"file://directorySpec"
```

initCtxFact is the classname of the initial context factory. The default is for an LDAP service provider, and has the value:

```
com.sun.jndi.ldap.LdapCtxFactory
```

If a file system service provider is used, set this parameter to:

```
com.sun.jndi.fscontext.RefFSContextFactory
```

If the test completes successfully, output is similar to the non-JNDI output, except that the create `QueueConnectionFactory` and `Queue` lines indicate retrieval of the object from JNDI.

PSIVT error recovery

If the test is not successful, note the following:

- The following message:

  ```
  *** No broker response. Please ensure broker is running. ***
  ```

  indicates that the broker is installed on the target queue manager, but its control queue contains some outstanding messages. For instructions on how to start it, see "Additional setup for publish/subscribe mode" on page 26.
- If the following message is displayed:

  ```
  Unable to connect to queue manager: <default>
  ```

  ensure that your WebSphere MQ system has configured a default queue manager.
- If the following message is displayed:

  ```
  Unable to connect to queue manager: ...
  ```

  ensure that the administered TopicConnectionFactory that the PSIVT uses is configured with a valid queue manager name. Alternatively, if you used the `-nojndi` option, ensure that you supplied a valid queue manager (using the `-m` option).
- If the following message is displayed:

  ```
  Unable to access broker control queue on queue manager: ...
  Please ensure the broker is installed on this queue manager
  ```

ensure that the administered TopicConnectionFactory that the PSIVT uses is configured with the name of the queue manager on which the broker is installed. If you used the `-nojndi` option, ensure that you supplied a queue manager name (using the `-m` option).

Running your own WebSphere MQ JMS programs

For information about writing your own WebSphere MQ JMS programs, see Part 3, "Programming with WebSphere MQ JMS," on page 195.

WebSphere MQ JMS includes a utility file, `runjms` (`runjms.bat` on Windows systems), to help you to run the supplied programs and programs that you have written.

The utility provides default locations for the trace and log files, and enables you to add any application runtime parameters that your application needs. The supplied script assumes that the environment variable MQ_JAVA_INSTALL_PATH is set to the directory in which WebSphere MQ JMS is installed. The script also assumes that the subdirectories `trace` and `log` within the directory pointed to by MQ_JAVA_DATA_PATH are used for trace and log output, respectively.

Use the following command to run your application:

```
runjms <classname of application> [application-specific arguments]
```

Solving problems

If a program does not complete successfully, run the installation verification program, which is described in "Running the point-to-point IVT" on page 31, and follow the advice given in the diagnostic messages.

Tracing programs

The WebSphere MQ JMS trace facility is provided to help IBM staff to diagnose customer problems.

Trace is disabled by default, because the output rapidly becomes large, and is unlikely to be of use in normal circumstances.

If you are asked to provide trace output, enable it by setting the Java property MQJMS_TRACE_LEVEL to one of the following values:

on traces WebSphere MQ JMS calls only

base traces both WebSphere MQ JMS calls and the underlying WebSphere MQ base Java calls

For example:

```
java -DMQJMS_TRACE_LEVEL=base MyJMSProg
```

To disable trace, set MQJMS_TRACE_LEVEL to **off**.

By default, trace is output to a file named `mqjms.trc` in the current working directory. You can redirect it to a different directory by using the Java property `MQJMS_TRACE_DIR`.

For example:

```
java -DMQJMS_TRACE_LEVEL=base -DMQJMS_TRACE_DIR=/somepath/tracedir MyJMSProg
```

The runjms utility script sets these properties by using the environment variables MQJMS_TRACE_LEVEL and MQ_JAVA_DATA_PATH, as follows:

```
java -DMQJMS_LOG_DIR=%MQ_JAVA_DATA_PATH%\log
-DMQJMS_TRACE_DIR=%MQ_JAVA_DATA_PATH%\trace
-DMQJMS_TRACE_LEVEL=%MQJMS_TRACE_LEVEL% %1 %2 %3 %4 %5 %6 %7 %8 %9
```

This is the default; change it as required.

Logging

The WebSphere MQ JMS log facility is provided to report serious problems, particularly those that might indicate configuration errors rather than programming errors. By default, log output is sent to the System.err stream, which usually appears on the stderr of the console in which the JVM is run.

You can redirect the output to a file by using a Java property that specifies the new location, for example:

```
java -DMQJMS_LOG_DIR=/mydir/forlogs MyJMSProg
```

The utility script runjms, in the bin directory of the WebSphere MQ JMS installation, sets this property to:

```
<MQ_JAVA_DATA_PATH>/log
```

where MQ_JAVA_DATA_PATH is set, on Windows systems, to the path to your WebSphere MQ Java installation. On other platforms you need to set this environment variable.

When the log is redirected to a file, it is output in a binary form. To view the log, the utility formatLog (formatLog.bat on Windows systems) is provided, which converts the file to plain text format. The utility is stored in the bin directory of your WebSphere MQ JMS installation. Run the conversion as follows:

```
formatLog <inputfile> <outputfile>
```

Logging

Chapter 5. Using the WebSphere MQ JMS administration tool

The administration tool enables administrators to define the properties of eight types of WebSphere MQ JMS object and to store them within a JNDI namespace. Then, JMS clients can use JNDI to retrieve these administered objects from the namespace and use them.

The JMS objects that you can administer by using the tool are:

- MQConnectionFactory (JMS 1.1 only)
- MQQueueConnectionFactory
- MQTopicConnectionFactory
- MQQueue
- MQTopic
- MQXAConnectionFactory (JMS 1.1 only)
- MQXAQueueConnectionFactory
- MQXATopicConnectionFactory
- JMSWrapXAQueueConnectionFactory
- JMSWrapXATopicConnectionFactory

For details about these objects, refer to "Administering JMS objects" on page 45.

Note: JMSWrapXAQueueConnectionFactory and JMSWrapXATopicConnectionFactory are classes that are specific to WebSphere Application Server. They are contained in the package **com.ibm.ejs.jms.mq**.

The tool also allows administrators to manipulate directory namespace subcontexts within the JNDI. See "Manipulating subcontexts" on page 45.

Invoking the administration tool

The administration tool has a command line interface. You can use this interactively, or use it to start a batch process. The interactive mode provides a command prompt where you can enter administration commands. In the batch mode, the command to start the tool includes the name of a file that contains an administration command script.

To start the tool in interactive mode, enter the command:

```
JMSAdmin [-t] [-v] [-cfg config_filename]
```

where:

-t	Enables trace (default is trace off)
-v	Produces verbose output (default is terse output)
-cfg config_filename	Names an alternative configuration file (see "Configuration" on page 42)

A command prompt is displayed, which indicates that the tool is ready to accept administration commands. This prompt initially appears as:

```
InitCtx>
```

indicating that the current context (that is, the JNDI context to which all naming and directory operations currently refer) is the initial context defined in the PROVIDER_URL configuration parameter (see "Configuration").

As you traverse the directory namespace, the prompt changes to reflect this, so that the prompt always displays the current context.

To start the tool in batch mode, enter the command:

```
JMSAdmin <test.scp
```

where *test.scp* is a script file that contains administration commands (see "Administration commands" on page 44). The last command in the file must be the `END` command.

Configuration

Configure the administration tool with values for the following three properties:

INITIAL_CONTEXT_FACTORY
The service provider that the tool uses. There are three explicitly supported values for this property:

- com.sun.jndi.ldap.LdapCtxFactory (for LDAP)
- com.sun.jndi.fscontext.RefFSContextFactory (for file system context)
- com.ibm.websphere.naming.WsnInitialContextFactory (to work with WebSphere Application Server's CosNaming repository)

On z/OS and OS/390, com.ibm.jndi.LDAPCtxFactory is also supported and provides access to an LDAP server. However, this is incompatible with com.sun.jndi.ldap.LdapCtxFactory, in that objects created using one InitialContextFactory cannot be read or modified using the other.

You can also use an InitialContextFactory that is not in the list above. See "Using an unlisted InitialContextFactory" on page 43 for more details.

PROVIDER_URL
The URL of the session's initial context; the root of all JNDI operations carried out by the tool. Three forms of this property are supported:

- ldap://hostname/contextname (for LDAP)
- file:[drive:]/pathname (for file system context)
- iiop://hostname[:port] /[?TargetContext=ctx] (to access base WebSphere Application Server CosNaming namespace)

SECURITY_AUTHENTICATION
Whether JNDI passes security credentials to your service provider. This property is used only when an LDAP service provider is used. This property can take one of three values:

- none (anonymous authentication)
- simple (simple authentication)
- CRAM-MD5 (CRAM-MD5 authentication mechanism)

If a valid value is not supplied, the property defaults to none. See "Security" on page 43 for more details about security with the administration tool.

These properties are set in a configuration file. When you invoke the tool, you can specify this configuration by using the `-cfg` command-line parameter, as described

in "Invoking the administration tool" on page 41. If you do not specify a configuration file name, the tool attempts to load the default configuration file (JMSAdmin.config). It looks for this file first in the current directory, and then in the <MQ_JAVA_INSTALL_PATH>/bin directory, where <MQ_JAVA_INSTALL_PATH> is the path to your WebSphere MQ JMS installation.

The configuration file is a plain-text file that consists of a set of key-value pairs, separated by =. This is shown in the following example:

```
#Set the service provider
    INITIAL_CONTEXT_FACTORY=com.sun.jndi.ldap.LdapCtxFactory
#Set the initial context
    PROVIDER_URL=ldap://polaris/o=ibm_us,c=us
#Set the authentication type
    SECURITY_AUTHENTICATION=none
```

(A # in the first column of the line indicates a comment, or a line that is not used.)

The installation comes with a sample configuration file that is called JMSAdmin.config, and is found in the <MQ_JAVA_INSTALL_PATH>/bin directory. Edit this file to suit the setup of your system.

Using an unlisted InitialContextFactory

You can use the administration tool to connect to JNDI contexts other than those listed in "Configuration" on page 42 by using three parameters defined in the JMSAdmin configuration file.

To use a different InitialContextFactory:

1. Set the INITIAL_CONTEXT_FACTORY property to the required class name.
2. Define the behavior of the InitialContextFactory using the USE_INITIAL_DIR_CONTEXT, NAME_PREFIX and NAME_READABILITY_MARKER properties.

The settings for these properties are described in the sample configuration file comments.

You do not need to define the three properties listed here, if you use one of the supported INITIAL_CONTEXT_FACTORY values. However, you can give them values to override the system defaults. If you omit one or more of the three InitialContextFactory properties, the administration tool provides suitable defaults based on the values of the other properties.

Security

You need to understand the effect of the SECURITY_AUTHENTICATION property described in "Configuration" on page 42.

- If you set this parameter to none, JNDI does not pass any security credentials to the service provider, and *anonymous authentication* is performed.
- If you set the parameter to either simple or CRAM-MD5, security credentials are passed through JNDI to the underlying service provider. These security credentials are in the form of a user distinguished name (User DN) and password.

If security credentials are required, you are prompted for these when the tool initializes. Avoid this by setting the PROVIDER_USERDN and PROVIDER_PASSWORD properties in the JMSAdmin configuration file.

Note: If you do not use these properties, the text typed, *including the password*, is echoed to the screen. This may have security implications.

The tool does no authentication itself; the task is delegated to the LDAP server. The LDAP server administrator must set up and maintain access privileges to different parts of the directory. If authentication fails, the tool displays an appropriate error message and terminates.

More detailed information about security and JNDI is in the documentation at Sun's Java web site (`http://java.sun.com`).

Configuring for WebSphere Application Server V3.5

For the administration tool (or any client application that needs to do subsequent lookups) to work with WebSphere Application Server's CosNaming repository, you need the following configuration:

- CLASSPATH must include WebSphere Application Server's JNDI-related jar file, `<WSAppserver>\lib\ujc.jar`
- PATH must include `<WSAppserver>\jdk\jre\bin`, where `<WSAppserver>` is the install path for WebSphere Application Server

Administration commands

When the command prompt is displayed, the tool is ready to accept commands. Administration commands are generally of the following form:

```
verb [param]*
```

where `verb` is one of the administration verbs listed in Table 7. All valid commands consist of at least one (and only one) verb, which appears at the beginning of the command in either its standard or short form.

The parameters a verb can take depend on the verb. For example, the `END` verb cannot take any parameters, but the `DEFINE` verb can take any number of parameters. Details of the verbs that take at least one parameter are discussed in later sections of this chapter.

Table 7. Administration verbs

Verb	Short form	Description
ALTER	ALT	Change at least one of the properties of a given administered object
DEFINE	DEF	Create and store an administered object, or create a new subcontext
DISPLAY	DIS	Display the properties of one or more stored administered objects, or the contents of the current context
DELETE	DEL	Remove one or more administered objects from the namespace, or remove an empty subcontext
CHANGE	CHG	Alter the current context, allowing the user to traverse the directory namespace anywhere below the initial context (pending security clearance)
COPY	CP	Make a copy of a stored administered object, storing it under an alternative name
MOVE	MV	Alter the name under which an administered object is stored

Table 7. Administration verbs (continued)

Verb	Short form	Description
END		Close the administration tool

Verb names are not case-sensitive.

Usually, to terminate commands, you press the carriage return key. However, you can override this by typing the + symbol directly before the carriage return. This enables you to enter multiline commands, as shown in the following example:

```
DEFINE Q(BookingsInputQueue) +
       QMGR(QM.POLARIS.TEST) +
       QUEUE(BOOKINGS.INPUT.QUEUE) +
       PORT(1415) +
       CCSID(437)
```

Lines beginning with one of the characters *, #, or / are treated as comments, or lines that are ignored.

Manipulating subcontexts

Use the verbs `CHANGE`, `DEFINE`, `DISPLAY` and `DELETE` to manipulate directory namespace subcontexts. Their use is described in Table 8.

Table 8. Syntax and description of commands used to manipulate subcontexts

Command syntax	Description
DEFINE CTX(ctxName)	Attempts to create a new child subcontext of the current context, having the name ctxName. Fails if there is a security violation, if the subcontext already exists, or if the name supplied is not valid.
DISPLAY CTX	Displays the contents of the current context. Administered objects are annotated with `a`, subcontexts with `[D]`. The Java type of each object is also displayed.
DELETE CTX(ctxName)	Attempts to delete the current context's child context having the name ctxName. Fails if the context is not found, is non-empty, or if there is a security violation.
CHANGE CTX(ctxName)	Alters the current context, so that it now refers to the child context having the name ctxName. One of two special values of ctxName can be supplied: **=UP** moves to the current context's parent **=INIT** moves directly to the initial context Fails if the specified context does not exist, or if there is a security violation.

Administering JMS objects

This section describes the eight types of object that the administration tool can handle. It includes details about each of their configurable properties and the verbs that can manipulate them.

Object types

Table 9 on page 46 shows the eight types of administered objects. The Keyword column shows the strings that you can substitute for *TYPE* in the commands shown

in Table 10 on page 47.

Table 9. The JMS object types that are handled by the administration tool

Object Type	Keyword	Description
MQConnectionFactory[1]	CF	The WebSphere MQ implementation of the JMS ConnectionFactory interface. This represents a factory object for creating connections in the both the point-to-point and publish/subscribe domains.
MQQueueConnectionFactory	QCF	The WebSphere MQ implementation of the JMS QueueConnectionFactory interface. This represents a factory object for creating connections in the point-to-point domain.
MQTopicConnectionFactory	TCF	The WebSphere MQ implementation of the JMS TopicConnectionFactory interface. This represents a factory object for creating connections in the publish/subscribe domain.
MQQueue	Q	The WebSphere MQ implementation of the JMS Queue interface. This represents a destination for messages in the point-to-point domain.
MQTopic	T	The WebSphere MQ implementation of the JMS Topic interface. This represents a destination for messages in the publish/subscribe domain.
MQXAConnectionFactory[12]	XACF	The WebSphere MQ implementation of the JMS XAConnectionFactory interface. This represents a factory object for creating connections in both the point-to-point and publish/subscribe domains, and where the connections use the XA versions of JMS classes.
MQXAQueueConnectionFactory[2]	XAQCF	The WebSphere MQ implementation of the JMS XAQueueConnectionFactory interface. This represents a factory object for creating connections in the point-to-point domain that use the XA versions of JMS classes.
MQXATopicConnectionFactory[2]	XATCF	The WebSphere MQ implementation of the JMS XATopicConnectionFactory interface. This represents a factory object for creating connections in the publish/subscribe domain that use the XA versions of JMS classes.

Table 9. The JMS object types that are handled by the administration tool (continued)

Object Type	Keyword	Description
JMSWrapXAQueueConnectionFactory[3]	WSQCF	The WebSphere MQ implementation of the JMS QueueConnectionFactory interface. This represents a factory object for creating connections in the point-to-point domain that use the XA versions of the JMS classes with a version of WebSphere Application Server before Version 5.
JMSWrapXATopicConnectionFactory[3]	WSTCF	The WebSphere MQ implementation of the JMS TopicConnectionFactory interface. This represents a factory object for creating connections in the publish/subscribe domain that use the XA versions of the JMS classes with a version of WebSphere Application Server before Version 5.

1. This object type applies to JMS 1.1 only.
2. These classes are provided for use by vendors of application servers. They are unlikely to be directly useful to application programmers.
3. Use this style of ConnectionFactory if you want your JMS sessions to participate in global transactions that are coordinated by a version of WebSphere Application Server before Version 5.

Verbs used with JMS objects

You can use the verbs `ALTER`, `DEFINE`, `DISPLAY`, `DELETE`, `COPY`, and `MOVE` to manipulate administered objects in the directory namespace. Table 10 summarizes their use. Substitute *`TYPE`* with the keyword that represents the required administered object, as listed in Table 9 on page 46.

Table 10. Syntax and description of commands used to manipulate administered objects

Command syntax	Description
ALTER *TYPE*(name) [property]*	Attempts to update the given administered object's properties with the ones supplied. Fails if there is a security violation, if the specified object cannot be found, or if the new properties supplied are not valid.
DEFINE *TYPE*(name) [property]*	Attempts to create an administered object of type *`TYPE`* with the supplied properties, and store it under the name `name` in the current context. Fails if there is a security violation, if the supplied name is not valid or already exists, or if the properties supplied are not valid.
DISPLAY *TYPE*(name)	Displays the properties of the administered object of type *`TYPE`*, bound under the name `name` in the current context. Fails if the object does not exist, or if there is a security violation.
DELETE *TYPE*(name)	Attempts to remove the administered object of type *`TYPE`*, having the name `name`, from the current context. Fails if the object does not exist, or if there is a security violation.

Table 10. Syntax and description of commands used to manipulate administered objects (continued)

Command syntax	Description
COPY *TYPE*(nameA) *TYPE*(nameB)	Makes a copy of the administered object of type *TYPE*, having the name nameA, naming the copy nameB. This all occurs within the scope of the current context. Fails if the object to be copied does not exist, if an object of name nameB already exists, or if there is a security violation.
MOVE *TYPE*(nameA) *TYPE*(nameB)	Moves (renames) the administered object of type *TYPE*, having the name nameA, to nameB. This all occurs within the scope of the current context. Fails if the object to be moved does not exist, if an object of name nameB already exists, or if there is a security violation.

Creating objects

Objects are created and stored in a JNDI namespace using the following command syntax:

```
DEFINE TYPE(name) [property]*
```

That is, the DEFINE verb, followed by a *TYPE*(name) administered object reference, followed by zero or more *properties* (see "Properties" on page 49).

LDAP naming considerations

To store your objects in an LDAP environment, you must give them names that comply with certain conventions. One of these is that object and subcontext names must include a prefix, such as cn= (common name), or ou= (organizational unit).

The administration tool simplifies the use of LDAP service providers by allowing you to refer to object and context names without a prefix. If you do not supply a prefix, the tool automatically adds a default prefix to the name you supply. For LDAP this is cn=.

You can change the default prefix by setting the NAME_PREFIX property in the JMSAdmin configuration file, as described in "Using an unlisted InitialContextFactory" on page 43.

This is shown in the following example.

```
InitCtx> DEFINE Q(testQueue)

InitCtx> DISPLAY CTX

    Contents of InitCtx

      a  cn=testQueue              com.ibm.mq.jms.MQQueue

     1 Object(s)
       0 Context(s)
       1 Binding(s), 1 Administered
```

Note that, although the object name supplied (testQueue) does not have a prefix, the tool automatically adds one to ensure compliance with the LDAP naming convention. Likewise, submitting the command DISPLAY Q(testQueue) also causes this prefix to be added.

You might need to configure your LDAP server to store Java objects. Information to assist with this configuration is provided in Appendix C, "LDAP schema definition for storing Java objects," on page 463.

Properties

A property consists of a name-value pair in the format:

```
PROPERTY_NAME(property_value)
```

Property names are not case-sensitive, and are restricted to the set of recognized names shown in Table 11. This table also shows the valid property values for each property.

Table 11. Property names and valid values

Property	Short form	Valid values (defaults in bold)
BROKERCCDSUBQ[1]	CCDSUB	• **SYSTEM.JMS.D.CC.SUBSCRIBER.QUEUE** • Any string
BROKERCCSUBQ	CCSUB	• **SYSTEM.JMS.ND.CC.SUBSCRIBER.QUEUE** • Any string
BROKERCONQ	BCON	Any string
BROKERDURSUBQ[1]	BDSUB	• **SYSTEM.JMS.D.SUBSCRIBER.QUEUE** • Any string
BROKERPUBQ	BPUB	• **SYSTEM.BROKER.DEFAULT.STREAM** • Any string
BROKERQMGR	BQM	Any string
BROKERSUBQ	BSUB	• **SYSTEM.JMS.ND.SUBSCRIBER.QUEUE** • Any string
BROKERVER	BVER	• **V1** - To use the WebSphere MQ broker. Also to use the WebSphere MQ Integrator V2 or WebSphere MQ Event Broker brokers in compatibility mode. • V2 - To use the WebSphere MQ Integrator V2 or WebSphere MQ Event Broker brokers in native mode
CCSID	CCS	Any positive integer
CHANNEL	CHAN	Any string
CLEANUP	CL	• **SAFE** • ASPROP • NONE • STRONG
CLEANUPINT	CLINT	• **3600000** • Any positive integer
CLIENTID	CID	Any string
DESCRIPTION	DESC	Any string
DIRECTAUTH	DAUTH	• **BASIC** - No authentication, username authentication, or password authentication • CERTIFICATE - Public key certificate authentication
ENCODING	ENC	See "The ENCODING property" on page 57

Table 11. Property names and valid values (continued)

Property	Short form	Valid values (defaults in bold)
EXPIRY	EXP	• **APP** - Expiry may be defined by the JMS application. • UNLIM - No expiry occurs. • Any positive integer representing expiry in milliseconds.
FAILIFQUIESCE	FIQ	• **Yes** - Applications return from a method call if the queue manager has entered a controlled shutdown. • No - Applications continue to carry out operations against a quiescing queue manager, preventing that queue manager's shutdown.
HOSTNAME	HOST	• **localhost** • Any string
LOCALADDRESS	LA	• **Not set** • A string in the format: [*ip-addr*][(*low-port*[,*high-port*])] Here are some examples: 9.20.4.98 The channel binds to address 9.20.4.98 locally 9.20.4.98(1000) The channel binds to address 9.20.4.98 locally and uses port 1000 9.20.4.98(1000,2000) The channel binds to address 9.20.4.98 locally and uses a port in the range 1000 to 2000 (1000) The channel binds to port 1000 locally (1000,2000) The channel binds to a port in the range 1000 to 2000 locally You can specify a host name instead of an IP address. For direct connections, this property applies only when multicast is used and the value of the property must not contain a port number. If it does contain a port number, the connection is rejected. Therefore, the only valid values of the property are null, an IP address, or a host name.
MSGBATCHSZ	MBS	• **10** • Any positive integer
MSGRETENTION	MRET	• **Yes** - Unwanted messages remain on the input queue • No - Unwanted messages are dealt with according to their disposition options
MSGSELECTION	MSEL	• **CLIENT** - Message selection is done by the client. • BROKER - Message selection is done by the broker.

Table 11. Property names and valid values (continued)

Property	Short form	Valid values (defaults in bold)
MULTICAST	MCAST	• **DISABLED** - Multicast is disabled. This is the default value for ConnectionFactory and TopicConnectionFactory objects. • **ASCF** - Same as the setting for the ConnectionFactory or TopicConnectionFactory object. This value is valid only for Topic objects, and is the default value for Topic objects. • RELIABLE - Multicast is enabled with reliable delivery only. • ENABLED - Multicast is enabled if it is available. Using this value might provide a reliable multicast connection depending on the server configuration. • NOTR - As ENABLED, but does not provide a reliable multicast connection. This value is used to enable multicast for legacy applications.
PERSISTENCE	PER	• **APP** - Persistence is defined by the JMS application. • QDEF - Persistence takes the value of the queue default. • PERS - Messages are persistent. • NON - Messages are non-persistent.
POLLINGINT	PINT	• **5000** • Any positive integer
PORT		• **1414** (for TRANSPORT set to BIND or CLIENT); **1506** (for TRANSPORT set to DIRECT) • Any positive integer
PRIORITY	PRI	• **APP** - Priority is defined by the JMS application. • QDEF - Priority takes the value of the queue default. • Any integer in the range 0-9.
PROXYHOSTNAME	PHOST	• **Not set** • The host name of the proxy server
PROXYPORT	PPORT	• **443** • The port number of the proxy server
PUBACKINT	PAI	• **25** • Any positive integer
QMANAGER	QMGR	Any string
QUEUE	QU	Any string
RECEXIT	RCX	Any string
RECEXITINIT	RCXI	Any string
SECEXIT	SCX	Any string
SECEXITINIT	SCXI	Any string
SENDEXIT	SDX	Any string
SENDXITINIT	SDXI	Any string
SPARSESUBS	SSUBS	• **NO** - Subscriptions receive frequent matching messages. • YES - Subscriptions receive infrequent matching messages. This value requires that the subscription queue can be opened for browse.

Table 11. Property names and valid values (continued)

Property	Short form	Valid values (defaults in bold)
SSLCIPHERSUITE	SCPHS	• **Not set** • See "SSL properties" on page 58
SSLCRL	SCRL	• **Not set** • Space-separated list of LDAP URLs. See "SSL properties" on page 58
SSLPEERNAME	SPEER	• **Not set** • See "SSL properties" on page 58
STATREFRESHINT	SRI	• **60000** • Any positive integer
SUBSTORE	SS	• **MIGRATE** • QUEUE • BROKER
SYNCPOINTALLGETS	SPAG	• **No** • Yes
TARGCLIENT	TC	• **JMS** - The target of the message is a JMS application. • MQ - The target of the message is a non-JMS WebSphere MQ application.
TEMPMODEL	TM	Any string
TEMPQPREFIX	TQP	Any string
TOPIC	TOP	Any string
TRANSPORT	TRAN	• **BIND** - For a bindings connection • CLIENT - For a client connection • DIRECT - For a direct connection to a WebSphere MQ Event Broker, WebSphere Business Integration Event Broker, or WebSphere Business Integration Message Broker broker • DIRECTHTTP - For a direct connection using HTTP tunnelling.
USECONNPOOLING	UCP	• **Yes** • No

Notes:

1. In certain environments, specifying the same queue name for the BROKERCCDSUBQ and BROKERDURSUBQ properties of an MQTopic object can cause a JMSException to be thrown. You are advised, therefore, to specify different queue names for these properties.

Many of the properties are relevant only to a specific subset of the object types. Table 12 on page 53 shows for each property which object types are valid, and gives a brief description of each property. The object types are identified using keywords; refer to Table 9 on page 46 for an explanation of these.

Numbers refer to notes at the end of the table. See also "Property dependencies" on page 56. Appendix A, "Mapping between administration tool properties and programmable properties," on page 457 shows the relationship between properties set by the tool and programmable properties.

Table 12. The valid combinations of property and object type

Property	CF[1]	QCF	TCF	Q	T	XACF[1]	WSQCF XAQCF	WSTCF XATCF	Description
BROKERCCDSUBQ					Y				The name of the queue from which durable subscription messages are retrieved for a ConnectionConsumer
BROKERCCSUBQ	Y		Y			Y		Y	The name of the queue from which non-durable subscription messages are retrieved for a ConnectionConsumer
BROKERCONQ	Y		Y			Y		Y	Broker's control queue name
BROKERDURSUBQ					Y				The name of the queue from which durable subscription messages are retrieved
BROKERPUBQ	Y		Y			Y		Y	The name of the broker input queue (stream queue)
BROKERQMGR	Y		Y			Y		Y	The queue manager on which the broker is running
BROKERSUBQ	Y		Y			Y		Y	The name of the queue from which non-durable subscription messages are retrieved
BROKERVER	Y[2]		Y[2]		Y	Y		Y	The version of the broker being used
CCSID	Y	Y	Y	Y	Y				The coded-character-set-ID to be used on connections
CHANNEL	Y	Y	Y						The name of the client connection channel being used
CLEANUP	Y		Y			Y		Y	Cleanup Level for BROKER or MIGRATE Subscription Stores
CLEANUPINT	Y		Y			Y		Y	The interval between background executions of the publish/subscribe cleanup utility
CLIENTID	Y[2]	Y	Y[2]			Y	Y	Y	A string identifier for the client
DESCRIPTION	Y[2]	Y	Y[2]	Y	Y	Y	Y	Y	A description of the stored object
DIRECTAUTH	Y		Y						To enable SSL authentication for a direct connection [3]
ENCODING				Y	Y				The encoding scheme used for this destination
EXPIRY				Y	Y				The period after which messages at a destination expire
HOSTNAME[4]	Y[2]	Y	Y[2]						The name of the host on which the queue manager or WebSphere MQ Event Broker broker resides. A dotted-decimal TCP/IP address can also be used.
LOCALADDRESS	Y	Y	Y						The range of local ports to be used when making a connection to a WebSphere MQ queue manager
MSGBATCHSZ	Y	Y	Y			Y	Y	Y	The maximum number of messages to be taken from a queue in one packet when using asynchronous message delivery

Table 12. The valid combinations of property and object type (continued)

Property	CF[1]	QCF	TCF	Q	T	XACF[1]	WSQCF XAQCF	WSTCF XATCF	Description
MSGRETENTION	Y	Y				Y	Y		Whether or not the connection consumer keeps unwanted messages on the input queue
MSGSELECTION	Y		Y			Y		Y	Determines whether message selection is done by the JMS client or by the broker. If TRANSPORT has the value DIRECT, message selection is always done by the broker and the value of MSGSELECTION is ignored. Message selection by the broker is not supported when BROKERVER has the value V1.
MULTICAST	Y		Y		Y				To enable multicast on a direct connection[3]
PERSISTENCE				Y	Y				The persistence of messages sent to a destination
POLLINGINT	Y	Y	Y			Y	Y	Y	The interval, in milliseconds, between scans of all receivers during asynchronous message delivery
PORT[4]	Y[2]	Y	Y[2]						The port on which the queue manager or broker listens
PRIORITY				Y	Y				The priority for messages sent to a destination
PROXYHOSTNAME	Y		Y						The host name of the proxy server for a direct connection[3]
PROXYPORT	Y		Y						The port number of the proxy server for a direct connection[3]
PUBACKINT	Y		Y			Y		Y	The interval, in number of messages, between publish requests that require acknowledgement from the broker
QMANAGER	Y	Y	Y	Y		Y	Y	Y	The name of the queue manager to connect to
QUEUE				Y					The underlying name of the queue representing this destination
RECEXIT	Y	Y	Y						The fully-qualified class name of the receive exit being used
RECEXITINIT	Y	Y	Y						The receive exit initialization string
SECEXIT	Y	Y	Y						The fully-qualified class name of the security exit being used
SECEXITINIT	Y	Y	Y						The security exit initialization string
SENDEXIT	Y	Y	Y						The fully-qualified class name of the send exit being used
SENDEXITINIT	Y	Y	Y						The send exit initialization string
SPARSESUBS	Y		Y			Y		Y	Controls the message retrieval policy of a TopicSubscriber object
SSLCIPHERSUITE	Y	Y	Y						The cipher suite to use for SSL connection

Table 12. The valid combinations of property and object type (continued)

Property	CF[1]	QCF	TCF	Q	T	XACF[1]	WSQCF XAQCF	WSTCF XATCF	Description
SSLCRL	Y	Y	Y						CRL servers to check for SSL certificate revocation
SSLPEERNAME	Y	Y	Y						For SSL, a *distinguished name* skeleton that must match that provided by the queue manager
STATREFRESHINT	Y		Y			Y		Y	The interval, in milliseconds, between transactions to refresh publish/subscribe status
SUBSTORE	Y		Y			Y		Y	Where WebSphere MQ JMS should store persistent data relating to active subscriptions
SYNCPOINTALLGETS	Y	Y	Y			Y	Y	Y	Whether all gets should be performed under syncpoint
TARGCLIENT[5]				Y	Y				Whether the WebSphere MQ RFH2 format is used to exchange information with target applications
TEMPMODEL	Y	Y				Y	Y		The name of the model queue from which temporary queues are created
TEMPQPREFIX	Y	Y				Y	Y		The prefix that is used to form the name of a WebSphere MQ dynamic queue. The rules for forming the prefix are the same as those for forming the contents of the *DynamicQName* field in a WebSphere MQ object descriptor, structure MQOD, but the last non blank character must be an asterisk. If no value is specified for the property, the value used is `CSQ.*` on z/OS and `AMQ.*` on the other platforms.
TOPIC					Y				The underlying name of the topic representing this destination
TRANSPORT[4]	Y[2]	Y	Y[2]			Y[6]	Y[6]	Y[6]	Whether connections use the WebSphere MQ bindings, a client connection, or WebSphere MQ Event Broker.
USECONNPOOLING	Y	Y	Y			Y	Y	Y	Whether to use connection pooling

Table 12. The valid combinations of property and object type (continued)

Property	CF[1]	QCF	TCF	Q	T	XACF[1]	WSQCF XAQCF	WSTCF XATCF	Description

Notes:

1. This object type applies to JMS 1.1 only.
2. Only the BROKERVER, CLIENTID, DESCRIPTION, HOSTNAME, PORT, and TRANSPORT properties are supported for a TopicConnectionFactory object, or a JMS 1.1 domain independent ConnectionFactory object, when connecting directly to WebSphere MQ Event Broker over TCP/IP.
3. See Appendix D, "Connecting to other products," on page 469.
4. HOSTNAME, PORT, and TRANSPORT are also used to identify if you are connecting to WebSphere MQ Event Broker and the broker's IP hostname and listening port.

   For more information about using WebSphere MQ Event Broker, see Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213.
5. The TARGCLIENT property indicates whether the WebSphere MQ RFH2 format is used to exchange information with target applications.

   The MQJMS_CLIENT_JMS_COMPLIANT constant indicates that the RFH2 format is used to send information. Applications that use WebSphere MQ JMS understand the RFH2 format. Set the MQJMS_CLIENT_JMS_COMPLIANT constant when you exchange information with a target WebSphere MQ JMS application.

   The MQJMS_CLIENT_NONJMS_MQ constant indicates that the RFH2 format is not used to send information. Typically, this value is used for an existing WebSphere MQ application (that is, one that does not handle RFH2).
6. For XACF, XAQCF, XATCF, WSQCF, and WSTCF objects, only the BIND transport type is allowed.

Property dependencies

Some properties have dependencies on each other. This might mean that it is meaningless to supply a property unless another property is set to a particular value. The specific property groups where this can occur are

- Client properties
- Properties for connecting to WebSphere MQ Event Broker
- Exit initialization strings

Client properties

Some properties are only relevant to a connection with the `TRANSPORT` property set to the value CLIENT. If this property is not explicitly set on a connection factory to one of the values CLIENT or DIRECT, the transport used on connections provided by the factory is WebSphere MQ Bindings. Consequently, none of the client properties on this connection factory can be configured. These are:

- HOST
- PORT
- CHANNEL
- CCSID
- RECEXIT
- RECEXITINIT
- SECEXIT
- SECEXITINIT
- SENDEXIT
- SENDEXITINIT
- SSLCIPHERSUITE

- SSLCRL
- SSLPEERNAME

It is an error to set any of these properties without setting the TRANSPORT property to CLIENT (or, for some, DIRECT; see "Properties for connecting to WebSphere MQ Event Broker").

Properties for connecting to WebSphere MQ Event Broker

The only properties used with a direct connection to WebSphere MQ Event Broker are BROKERVER, CLIENTID, DESCRIPTION, HOSTNAME, PORT, and TRANSPORT.

The default values for PORT and BROKERVER are set by the definition of TRANSPORT:

1. Defining a connection factory with TRANSPORT as CLIENT sets:
   - BROKERVER to V1
   - PORT to 1414
2. Defining a connection factory with TRANSPORT as DIRECT sets:
   - BROKERVER to V2
   - PORT to 1506

If you explicitly set the value of PORT or BROKERVER, a later change to the value of TRANSPORT does not override your choices.

Exit initialization strings

Do not set any of the exit initialization strings without supplying the corresponding exit name. The exit initialization properties are:

- RECEXITINIT
- SECEXITINIT
- SENDEXITINIT

For example, specifying RECEXITINIT(myString) without specifying RECEXIT(some.exit.classname) causes an error.

The ENCODING property

The valid values that the ENCODING property can take are constructed from three sub-properties:

integer encoding	Either normal or reversed
decimal encoding	Either normal or reversed
floating-point encoding	IEEE normal, IEEE reversed, or z/OS.

The ENCODING is expressed as a three-character string with the following syntax:
{N|R}{N|R}{N|R|3}

In this string:

- N denotes normal
- R denotes reversed
- 3 denotes z/OS
- The first character represents *integer encoding*
- The second character represents *decimal encoding*
- The third character represents *floating-point encoding*

This provides a set of twelve possible values for the ENCODING property.

There is an additional value, the string NATIVE, which sets appropriate encoding values for the Java platform.

The following examples show valid combinations for ENCODING:

```
ENCODING(NNR)
ENCODING(NATIVE)
ENCODING(RR3)
```

SSL properties

When you specify TRANSPORT(CLIENT), you can enable Secure Sockets Layer (SSL) encrypted communication using the SSLCIPHERSUITE property. Set this property to a valid CipherSuite provided by your JSSE provider; it must match the CipherSpec named on the SVRCONN channel named by the CHANNEL property.

However, CipherSpecs (as specified on the SVRCONN channel) and CipherSuites (as specified on ConnectionFactory objects) use different naming schemes to represent the same SSL encryption algorithms. If a recognized CipherSpec name is specified on the SSLCIPHERSUITE property, JMSAdmin issues a warning and maps the CipherSpec to its equivalent CipherSuite. See Appendix H, "SSL CipherSuites supported by WebSphere MQ," on page 487 for a list of CipherSpecs recognized by WebSphere MQ and JMSAdmin.

The SSLPEERNAME matches the format of the SSLPEER parameter, which can be set on channel definitions. It is a list of attribute name and value pairs separated by commas or semicolons. For example:

```
SSLPEERNAME(CN=QMGR.*, OU=IBM, OU=WEBSPHERE)
```

The set of names and values makes up a *distinguished name*. For more details about distinguished names and their use with WebSphere MQ, see the *WebSphere MQ Security* book.

The example given checks the identifying certificate presented by the server at connect-time. For the connection to succeed, the certificate must have a Common Name beginning QMGR., and must have at least two Organizational Unit names, the first of which is IBM and the second WEBSPHERE. Checking is case-insensitive.

If SSLPEERNAME is not set, no such checking is performed. SSLPEERNAME is ignored if SSLCIPHERSUITE is not specified.

The SSLCRL property specifies zero or more CRL (Certificate Revocation List) servers. Use of this property requires a JVM at Java 2 v1.4. This is a space-delimited list of entries of the form:

```
ldap://hostname:[port]
```

optionally followed by a single /. If *port* is omitted, the default LDAP port of 389 is assumed. At connect-time, the SSL certificate presented by the server is checked against the specified CRL servers. See the *WebSphere MQ Security* book for more about CRL security.

If SSLCRL is not set, no such checking is performed. SSLCRL is ignored if SSLCIPHERSUITE is not specified.

Sample error conditions

The following are examples of the error conditions that might arise when creating an object:

CipherSpec mapped to CipherSuite

```
InitCtx/cn=Trash> DEFINE QCF(testQCF) SSLCIPHERSUITE(RC4_MD5_US)
  WARNING: Converting CipherSpec RC4_MD5_US to
  CipherSuite SSL_RSA_WITH_RC4_128_MD5
```

Invalid property for object

```
InitCtx/cn=Trash> DEFINE QCF(testQCF) PRIORITY(4)
  Unable to create a valid object, please check the parameters supplied
  Invalid property for a QCF: PRI
```

Invalid type for property value

```
InitCtx/cn=Trash> DEFINE QCF(testQCF) CCSID(english)
  Unable to create a valid object, please check the parameters supplied
  Invalid value for CCS property: English
```

Property clash - client/bindings

```
InitCtx/cn=Trash> DEFINE QCF(testQCF) HOSTNAME(polaris.hursley.ibm.com)
  Unable to create a valid object, please check the parameters supplied
  Invalid property in this context: Client-bindings attribute clash
```

Property clash - Exit initialization

```
InitCtx/cn=Trash> DEFINE QCF(testQCF) SECEXITINIT(initStr)
  Unable to create a valid object, please check the parameters supplied
  Invalid property in this context: ExitInit string supplied
  without Exit string
```

Property value outside valid range

```
InitCtx/cn=Trash> DEFINE Q(testQ) PRIORITY(12)
  Unable to create a valid object, please check the parameters supplied
  Invalid value for PRI property: 12
```

Unknown property

```
InitCtx/cn=Trash> DEFINE QCF(testQCF) PIZZA(ham and mushroom)
  Unable to create a valid object, please check the parameters supplied
  Unknown property: PIZZA
```

The following are examples of error conditions that might arise on Windows when looking up JNDI administered objects from a JMS client. If your JMS application is running in a WebSphere Application Server environment, these error conditions might occur only if you are using a version of WebSphere Application Server before Version 5.

1. If you are using the WebSphere JNDI provider, com.ibm.websphere.naming.WsnInitialContextFactory, you must use a forward slash (/) to access administered objects defined in sub-contexts; for example, jms/MyQueueName. If you use a backslash (\), an InvalidNameException is thrown.
2. If you are using the Sun JNDI provider, com.sun.jndi.fscontext.RefFSContextFactory, you must use a backslash (\) to access administered objects defined in sub-contexts; for example, ctx1\\fred. If you use a forward slash (/), a NameNotFoundException is thrown.

Part 2. Programming with WebSphere MQ base Java

Chapter 6. Introduction for programmers

This chapter contains general information for programmers. For more detailed information about writing programs, see Chapter 7, "Writing WebSphere MQ base Java programs," on page 67.

Why should I use the Java interface?

The WebSphere MQ classes for Java programming interface makes the many benefits of Java available to you as a developer of WebSphere MQ applications:

- The Java programming language is **easy to use**.

  There is no need for header files, pointers, structures, unions, and operator overloading. Programs written in Java are easier to develop and debug than their C and C++ equivalents.
- Java is **object-oriented**.

  The object-oriented features of Java are comparable to those of C++, but there is no multiple inheritance. Instead, Java uses the concept of an interface.
- Java is inherently **distributed**.

  The Java class libraries contain a library of routines for coping with TCP/IP protocols like HTTP and FTP. Java programs can access URLs as easily as accessing a file system.
- Java is **robust**.

  Java puts a lot of emphasis on early checking for possible problems, dynamic (runtime) checking, and the elimination of situations that are error prone. Java uses a concept of references that eliminates the possibility of overwriting memory and corrupting data.
- Java is **secure**.

  Java is intended to be run in networked or distributed environments, and a lot of emphasis has been placed on security. Java programs cannot overrun their runtime stack and cannot corrupt memory outside their process space. When Java programs are downloaded from the Internet, they cannot even read or write local files.
- Java programs are **portable**.

  There are no implementation-dependent aspects of the Java specification. The Java compiler generates an architecture-neutral object file format. The compiled code is executable on many processors, as long as the Java runtime system is present.

If you write your application using WebSphere MQ classes for Java, users can download the Java byte codes (called *applets*) for your program from the Internet. Users can then run these applets on their own machines. This means that users with access to your Web server can load and run your application with no prior installation needed on their machines.

When an update to the program is required, you update the copy on the Web server. The next time that users access the applet, they automatically receive the latest version. This can significantly reduce the costs involved in installing and updating traditional client applications where a large number of desktops are involved.

If you place your applet on a Web server that is accessible outside the corporate firewall, anyone on the Internet can download and use your application. This means that you can get messages into your WebSphere MQ system from anywhere on the Internet. This opens the door to building a whole new set of Internet accessible service, support, and electronic commerce applications.

The WebSphere MQ classes for Java interface

The procedural WebSphere MQ application programming interface is built around the following verbs:

```
MQBACK, MQBEGIN, MQCLOSE, MQCMIT, MQCONN, MQCONNX,
MQDISC, MQGET, MQINQ, MQOPEN, MQPUT, MQPUT1, MQSET
```

These verbs all take, as a parameter, a handle to the WebSphere MQ object on which they are to operate. Because Java is object-oriented, the Java programming interface turns this round. Your program consists of a set of WebSphere MQ objects, which you act upon by calling methods on those objects.

When you use the procedural interface, you disconnect from a queue manager by using the call MQDISC(Hconn, CompCode, Reason), where *Hconn* is a handle to the queue manager.

In the Java interface, the queue manager is represented by an object of class MQQueueManager. You disconnect from the queue manager by calling the disconnect() method on that class.

```
// declare an object of type queue manager
MQQueueManager queueManager=new MQQueueManager();
...
// do something...
...
// disconnect from the queue manager
queueManager.disconnect();
```

Java Development Kit

Before you can compile any applets or applications that you write, you must have access to a Java Development Kit (JDK) for your development platform. The JDK contains all the standard Java classes, variables, constructors, and interfaces on which the WebSphere MQ classes for Java classes depend. It also contains the tools required to compile and run the applets and programs on each supported platform.

You can download IBM Developer Kits for Java from the IBM Software Download Catalog, which is available on the World Wide Web at location:

```
http://www.ibm.com/developerworks/java
```

To compile Java applications on the iSeries and AS/400 platforms, you must first install:

- The AS/400 Developer Kit for Java, 5769-JV1
- The Qshell Interpreter, OS/400 (5769-SS1) Option 30

WebSphere MQ classes for Java class library

WebSphere MQ classes for Java is a set of Java classes that enable Java applets and applications to interact with WebSphere MQ.

The following classes are provided:
- MQChannelDefinition
- MQChannelExit
- MQDistributionList
- MQDistributionListItem
- MQEnvironment
- MQException
- MQGetMessageOptions
- MQManagedObject
- MQMessage
- MQMessageTracker
- MQPoolServices
- MQPoolServicesEvent
- MQPoolToken
- MQPutMessageOptions
- MQProcess
- MQQueue
- MQQueueManager
- MQSimpleConnectionManager

The following Java interfaces are provided:
- MQC
- MQPoolServicesEventListener
- MQReceiveExit
- MQSecurityExit
- MQSendExit

Implementation of the following Java interfaces is also provided. However, these interfaces are not intended for direct use by applications:
- MQConnectionManager
- javax.resource.spi.ManagedConnection
- javax.resource.spi.ManagedConnectionFactory
- javax.resource.spi.ManagedConnectionMetaData

In Java, a *package* is a mechanism for grouping sets of related classes together. The WebSphere MQ classes and interfaces are shipped as a Java package called `com.ibm.mq`. To include the WebSphere MQ classes for Java package in your program, add the following line at the top of your source file:

```
import com.ibm.mq.*;
```

WebSphere MQ base Java class library

Chapter 7. Writing WebSphere MQ base Java programs

To use WebSphere MQ classes for Java to access WebSphere MQ queues, you write Java programs that contain calls that put messages onto, and get messages from, WebSphere MQ queues. The programs can take the form of Java *applets*, Java *servlets*, or Java *applications*.

This chapter provides information to assist with writing Java applets, servlets, and applications to interact with WebSphere MQ systems. For details of individual classes, see Chapter 9, "The WebSphere MQ base Java classes and interfaces," on page 101.

Should I write applets or applications?

Whether you write applets, servlets, or applications depends on the connection that you want to use and from where you want to run the programs.

The main differences between applets, servlets, and applications are:

- Applets are run with an applet viewer or in a Web browser, servlets are run in a Web application server, and applications are run standalone.
- Applets can be downloaded from a Web server to a Web browser machine, but applications and servlets are not.
- Applets run with additional security rules limiting what they can do.

  See Appendix F, "Using WebSphere MQ Java in applets with Java 1.2 or later," on page 481 for more information about this.

The following general rules apply:

- If you want to run your programs from machines that do not have WebSphere MQ classes for Java installed locally, write applets.
- The native bindings mode of WebSphere MQ classes for Java does not support applets. Therefore, if you want to use your programs in all connection modes, including the native bindings mode, write servlets or applications.

Connection differences

The way you program for WebSphere MQ classes for Java has some dependencies on the connection modes you want to use.

Client connections

When WebSphere MQ classes for Java is used as a client, it is similar to the WebSphere MQ C client, but has the following differences:

- It supports only TCP/IP.
- It does not support connection tables.
- It does not read any WebSphere MQ environment variables at startup.
- Information that would be stored in a channel definition and in environment variables is stored in a class called Environment. Alternatively, this information can be passed as parameters when the connection is made.
- Error and exception conditions are written to a log specified in the MQException class. The default error destination is the Java console.

The WebSphere MQ classes for Java clients do not support the MQBEGIN verb or fast bindings.

For general information on WebSphere MQ clients, see the *WebSphere MQ Clients* book.

Bindings mode

The bindings mode of WebSphere MQ classes for Java differs from the client modes in the following ways:

- Most of the parameters provided by the MQEnvironment class are ignored
- The bindings support the MQBEGIN verb and fast bindings into the WebSphere MQ queue manager

Note: WebSphere MQ for iSeries and WebSphere MQ for z/OS do not support the use of MQBEGIN to initiate global units of work that are coordinated by the queue manager.

Defining which connection to use

The connection is determined by the setting of variables in the MQEnvironment class.

MQEnvironment.properties
This can contain the following key/value pairs:
- For client and bindings connections:

```
MQC.TRANSPORT_PROPERTY, MQC.TRANSPORT_MQSERIES
```

MQEnvironment.hostname
Set the value of this variable follows:
- For client connections, set this to the host name of the WebSphere MQ server to which you want to connect
- For bindings mode, set this to null

Specifying a range of ports for client connections

If a JMS application attempts to connect to a WebSphere MQ queue manager in client mode, a firewall might allow only those connections that originate from specified ports or a range of ports. In this situation, you can specify a port, or a range of points, that the application can bind to. You can do this in either of the following ways:

- You can add a key-value pair to the `properties` variable in the MQEnvironment class. The relevant key is MQC.LOCAL_ADDRESS_PROPERTY. Here is an example:

```
(MQEnvironment.properties).put(MQC.LOCAL_ADDRESS_PROPERTY,
                               "9.20.0.1(2000,3000)");
```

- You can set the `localAddressSetting` variable in the MQEnvironment class. Here is an example:

```
MQEnvironment.localAddressSetting = "9.20.0.1(2000,3000)";
```

In each of these examples, when the application connects to a queue manager subsequently, the application binds to a local IP address and port number in the range 9.20.0.1(2000) to 9.20.0.1(3000).

Connection errors might occur if you restrict the range of ports. If an error occurs, an MQException is thrown containing the WebSphere MQ reason code, MQRC_Q_MGR_NOT_AVAILABLE. An error might occur if all the ports in the

specified range are in use, or if a specified IP address, host name, or port number is not valid; a negative port number, for example.

Example code fragments

This section includes two example code fragments; Figure 1 on page 70 and Figure 2 on page 73. Each one uses a particular connection and includes notes to describe the changes needed to use alternative connections.

Example applet code

The following code fragment demonstrates an applet that uses a TCP/IP connection to:

1. Connect to a queue manager
2. Put a message onto SYSTEM.DEFAULT.LOCAL.QUEUE
3. Get the message back

Example code

```
// ============================================================================
//
// Licensed Materials - Property of IBM
//
// 5639-C34
//
// (c) Copyright IBM Corp. 1995,2002
//
// ============================================================================
// WebSphere MQ Client for Java sample applet
//
// This sample runs as an applet using the appletviewer and HTML file,
// using the command :-
//            appletviewer MQSample.html
// Output is to the command line, NOT the applet viewer window.
//
// Note. If you receive WebSphere MQ error 2 reason 2059 and you are sure your
// WebSphere MQ and TCP/IP setup is correct,
// you should click on the "Applet" selection in the Applet viewer window
// select properties, and change "Network access" to unrestricted.
import com.ibm.mq.*;            // Include the WebSphere MQ classes for Java package

public class MQSample extends java.applet.Applet
{

  private String hostname = "your_hostname";      // define the name of your
                                                  // host to connect to
  private String channel  = "server_channel";     // define name of channel
                                                  // for client to use
                                                  // Note. assumes WebSphere MQ Server
                                                  // is listening on the default
                                                  // TCP/IP port of 1414
  private String qManager = "your_Q_manager";     // define name of queue
                                                  // manager object to
                                                  // connect to.

  private MQQueueManager qMgr;                    // define a queue manager object

  // When the class is called, this initialization is done first.

  public void init()
  {
     // Set up WebSphere MQ environment
     MQEnvironment.hostname = hostname;           // Could have put the
                                                  // hostname & channel
     MQEnvironment.channel  = channel;            // string directly here!

     MQEnvironment.properties.put(MQC.TRANSPORT_PROPERTY,//Set TCP/IP or server
                                  MQC.TRANSPORT_MQSERIES);//Connection

  } // end of init
```

Figure 1. WebSphere MQ classes for Java example applet (Part 1 of 3)

```
public void start()
{

  try {
    // Create a connection to the queue manager
    qMgr = new MQQueueManager(qManager);

    // Set up the options on the queue we wish to open...
    // Note. All WebSphere MQ Options are prefixed with MQC in Java.
     int openOptions = MQC.MQOO_INPUT_AS_Q_DEF |
                       MQC.MQOO_OUTPUT ;
    // Now specify the queue that we wish to open, and the open options...

    MQQueue system_default_local_queue =
            qMgr.accessQueue("SYSTEM.DEFAULT.LOCAL.QUEUE",
                             openOptions);

    // Define a simple WebSphere MQ message, and write some text in UTF format..

    MQMessage hello_world = new MQMessage();
    hello_world.writeUTF("Hello World!");

    // specify the message options...

    MQPutMessageOptions pmo = new MQPutMessageOptions();  // accept the defaults,
                                                          // same as
                                                          // MQPMO_DEFAULT
                                                          // constant
    // put the message on the queue

    system_default_local_queue.put(hello_world,pmo);

    // get the message back again...
    // First define a WebSphere MQ message buffer to receive the message into..

    MQMessage retrievedMessage = new MQMessage();
    retrievedMessage.messageId = hello_world.messageId;

    // Set the get message options..

    MQGetMessageOptions gmo = new MQGetMessageOptions();  // accept the defaults
                                                          // same as
                                                          // MQGMO_DEFAULT
    // get the message off the queue..

    system_default_local_queue.get(retrievedMessage, gmo);

    // And prove we have the message by displaying the UTF message text

    String msgText = retrievedMessage.readUTF();
    System.out.println("The message is: " + msgText);

    // Close the queue

    system_default_local_queue.close();

    // Disconnect from the queue manager

    qMgr.disconnect();

  }

  // If an error has occurred in the above, try to identify what went wrong.
  // Was it a WebSphere MQ error?
```

Figure 1. WebSphere MQ classes for Java example applet (Part 2 of 3)

```
    catch (MQException ex)
    {
      System.out.println("A WebSphere MQ error occurred : Completion code " +
                         ex.completionCode +
                         " Reason code " + ex.reasonCode);
    }
    // Was it a Java buffer space error?
    catch (java.io.IOException ex)
    {
      System.out.println("An error occurred whilst writing to the
      message buffer: " + ex);
    }

  } // end of start

} // end of sample
```

Figure 1. WebSphere MQ classes for Java example applet (Part 3 of 3)

Example application code

The following code fragment demonstrates an application that uses bindings mode to:

1. Connect to a queue manager
2. Put a message onto SYSTEM.DEFAULT.LOCAL.QUEUE
3. Get the message back again

```
// ============================================================================
// Licensed Materials - Property of IBM
// 5639-C34
// (c) Copyright IBM Corp. 1995, 2002
// ============================================================================
// WebSphere MQ classes for Java sample application
//
// This sample runs as a Java application using the command :- java MQSample

import com.ibm.mq.*;            // Include the WebSphere MQ classes for Java package


public class MQSample
{
  private String qManager = "your_Q_manager";  // define name of queue
                                               // manager to connect to.
  private MQQueueManager qMgr;                 // define a queue manager
                                               // object
  public static void main(String args[]) {
     new MQSample();
  }

  public MQSample() {
   try {

      // Create a connection to the queue manager

      qMgr = new MQQueueManager(qManager);

      // Set up the options on the queue we wish to open...
      // Note. All WebSphere MQ Options are prefixed with MQC in Java.

      int openOptions = MQC.MQOO_INPUT_AS_Q_DEF |
                        MQC.MQOO_OUTPUT ;

      // Now specify the queue that we wish to open,
      // and the open options...

      MQQueue system_default_local_queue =
              qMgr.accessQueue("SYSTEM.DEFAULT.LOCAL.QUEUE",
                               openOptions);

      // Define a simple WebSphere MQ message, and write some text in UTF format..

      MQMessage hello_world = new MQMessage();
      hello_world.writeUTF("Hello World!");

      // specify the message options...

      MQPutMessageOptions pmo = new MQPutMessageOptions(); // accept the // defaults,
                                                           // same as MQPMO_DEFAULT
```

Figure 2. WebSphere MQ classes for Java example application (Part 1 of 2)

```
     // put the message on the queue

      system_default_local_queue.put(hello_world,pmo);

      // get the message back again...
      // First define a WebSphere MQ message buffer to receive the message into..

      MQMessage retrievedMessage = new MQMessage();
      retrievedMessage.messageId = hello_world.messageId;

      // Set the get message options...

      MQGetMessageOptions gmo = new MQGetMessageOptions(); // accept the defaults
                                                           // same as  MQGMO_DEFAULT
      // get the message off the queue...

      system_default_local_queue.get(retrievedMessage, gmo);

      // And prove we have the message by displaying the UTF message text

      String msgText = retrievedMessage.readUTF();
      System.out.println("The message is: " + msgText);
      // Close the queue...
      system_default_local_queue.close();
      // Disconnect from the queue manager

      qMgr.disconnect();
    }
      // If an error has occurred in the above, try to identify what went wrong
      // Was it a WebSphere MQ error?
    catch (MQException ex)
    {
      System.out.println("A WebSphere MQ error occurred : Completion code " +
                         ex.completionCode + " Reason code " + ex.reasonCode);
    }
      // Was it a Java buffer space error?
    catch (java.io.IOException ex)
    {
      System.out.println("An error occurred whilst writing to the message buffer: " + ex);
    }
  }
} // end of sample
```

Figure 2. WebSphere MQ classes for Java example application (Part 2 of 2)

Operations on queue managers

This section describes how to connect to, and disconnect from, a queue manager using WebSphere MQ classes for Java.

Setting up the WebSphere MQ environment

Note: This step is not necessary when using WebSphere MQ classes for Java in bindings mode. In that case, go directly to "Connecting to a queue manager" on page 75. Before you use the client connection to connect to a queue manager, you must set up the MQEnvironment.

The C based WebSphere MQ clients rely on environment variables to control the behavior of the MQCONN call. Because Java applets have no access to environment variables, the Java programming interface includes a class MQEnvironment. This class allows you to specify the following details that are to be used during the connection attempt:

- Channel name
- Host name
- Port number
- User ID
- Password

To specify the channel name and host name, use the following code:

```
MQEnvironment.hostname = "host.domain.com";
MQEnvironment.channel  = "java.client.channel";
```

This is equivalent to an MQSERVER environment variable setting of:

```
"java.client.channel/TCP/host.domain.com".
```

By default, the Java clients attempt to connect to a WebSphere MQ listener at port 1414. To specify a different port, use the code:

```
MQEnvironment.port = nnnn;
```

The user ID and password default to blanks. To specify a non-blank user ID or password, use the code:

```
MQEnvironment.userID   = "uid";  // equivalent to env var MQ_USER_ID
MQEnvironment.password = "pwd";  // equivalent to env var MQ_PASSWORD
```

Connecting to a queue manager

You are now ready to connect to a queue manager by creating a new instance of the MQQueueManager class:

```
MQQueueManager queueManager = new MQQueueManager("qMgrName");
```

To disconnect from a queue manager, call the disconnect() method on the queue manager:

```
queueManager.disconnect();
```

If you call the disconnect method, all open queues and processes that you have accessed through that queue manager are closed. However, it is good programming practice to close these resources explicitly when you finish using them. To do this, use the close() method.

The commit() and backout() methods on a queue manager replace the MQCMIT and MQBACK calls that are used with the procedural interface.

Accessing queues and processes

To access queues and processes, use the MQQueueManager class. The MQOD (object descriptor structure) is collapsed into the parameters of these methods. For example, to open a queue on a queue manager called queueManager, use the following code:

```
MQQueue queue = queueManager.accessQueue("qName",
                                         MQC.MQOO_OUTPUT,
                                         "qMgrName",
                                         "dynamicQName",
                                         "altUserId");
```

The *options* parameter is the same as the Options parameter in the MQOPEN call.

The accessQueue method returns a new object of class MQQueue.

Queue and process access

When you have finished using the queue, use the close() method to close it, as in the following example:

```
queue.close();
```

With WebSphere MQ classes for Java, you can also create a queue by using the MQQueue constructor. The parameters are exactly the same as for the accessQueue method, with the addition of a queue manager parameter. For example:

```
MQQueue queue = new MQQueue(queueManager,
                            "qName",
                            MQC.MQOO_OUTPUT,
                            "qMgrName",
                            "dynamicQName",
                            "altUserId");
```

Constructing a queue object in this way enables you to write your own subclasses of MQQueue.

To access a process, use the accessProcess method in place of accessQueue. This method does not have a *dynamic queue name* parameter, because this does not apply to processes.

The accessProcess method returns a new object of class MQProcess.

When you have finished using the process object, use the close() method to close it, as in the following example:

```
process.close();
```

With WebSphere MQ classes for Java, you can also create a process by using the MQProcess constructor. The parameters are exactly the same as for the accessProcess method, with the addition of a queue manager parameter. Constructing a process object in this way enables you to write your own subclasses of MQProcess.

Handling messages

Put messages onto queues using the put() method of the MQQueue class. You get messages from queues using the get() method of the MQQueue class. Unlike the procedural interface, where MQPUT and MQGET put and get arrays of bytes, the Java programming language puts and gets instances of the MQMessage class. The MQMessage class encapsulates the data buffer that contains the actual message data, together with all the MQMD (message descriptor) parameters that describe that message.

To build a new message, create a new instance of the MQMessage class, and use the writeXXX methods to put data into the message buffer.

When the new message instance is created, all the MQMD parameters are automatically set to their default values, as defined in the *WebSphere MQ Application Programming Reference*. The put() method of MQQueue also takes an instance of the MQPutMessageOptions class as a parameter. This class represents the MQPMO structure. The following example creates a message and puts it onto a queue:

```
// Build a new message containing my age followed by my name
MQMessage myMessage = new MQMessage();
myMessage.writeInt(25);

String name = "Charlie Jordan";
```

```
myMessage.writeInt(name.length());
myMessage.writeBytes(name);

// Use the default put message options...
MQPutMessageOptions pmo = new MQPutMessageOptions();

// put the message!
queue.put(myMessage,pmo);
```

The get() method of MQQueue returns a new instance of MQMessage, which represents the message just taken from the queue. It also takes an instance of the MQGetMessageOptions class as a parameter. This class represents the MQGMO structure.

You do not need to specify a maximum message size, because the get() method automatically adjusts the size of its internal buffer to fit the incoming message. Use the readXXX methods of the MQMessage class to access the data in the returned message.

The following example shows how to get a message from a queue:

```
// Get a message from the queue
MQMessage theMessage    = new MQMessage();
MQGetMessageOptions gmo = new MQGetMessageOptions();
queue.get(theMessage,gmo);  // has default values

// Extract the message data
int age = theMessage.readInt();
int strLen = theMessage.readInt();
byte[] strData = new byte[strLen];
theMessage.readFully(strData,0,strLen);
String name = new String(strData,0);
```

You can alter the number format that the read and write methods use by setting the *encoding* member variable.

You can alter the character set to use for reading and writing strings by setting the *characterSet* member variable.

See “MQMessage” on page 126 for more details.

Note: The writeUTF() method of MQMessage automatically encodes the length of the string as well as the Unicode bytes it contains. When your message will be read by another Java program (using readUTF()), this is the simplest way to send string information.

Handling errors

Methods in the Java interface do not return a completion code and reason code. Instead, they throw an exception whenever the completion code and reason code resulting from a WebSphere MQ call are not both zero. This simplifies the program logic so that you do not have to check the return codes after each call to WebSphere MQ. You can decide at which points in your program you want to deal with the possibility of failure. At these points, you can surround your code with `try` and `catch` blocks, as in the following example:

```
try {
    myQueue.put(messageA,putMessageOptionsA);
    myQueue.put(messageB,putMessageOptionsB);
}
catch (MQException ex) {
```

```
    // This block of code is only executed if one of
    // the two put methods gave rise to a non-zero
    // completion code or reason code.
    System.out.println("An error occurred during the put operation:" +
                          "CC = " + ex.completionCode +
                          "RC = " + ex.reasonCode);
    System.out.println("Cause exception:" + ex.getCause() );
}
```

The WebSphere MQ call reason codes reported back in Java exceptions are documented in a chapter called "Return Codes" in the *WebSphere MQ Application Programming Reference*.

Sometimes the reason code does not convey all details associated with the error. This can occur if WebSphere MQ uses services provided by another product (for example, a JSSE implementation) that throws a java.lang.Exception to WebSphere MQ Java. In this case, the method MQException.getCause() retrieves the underlying java.lang.Exception that caused the error.

Getting and setting attribute values

For many of the common attributes, the classes MQManagedObject, MQQueue, MQProcess, and MQQueueManager contain getXXX() and setXXX() methods. These methods allow you to get and set their attribute values. Note that for MQQueue, the methods work only if you specify the appropriate inquire and set flags when you open the queue.

For less common attributes, the MQQueueManager, MQQueue, and MQProcess classes all inherit from a class called MQManagedObject. This class defines the inquire() and set() interfaces.

When you create a new queue manager object by using the *new* operator, it is automatically opened for inquire. When you use the accessProcess() method to access a process object, that object is automatically opened for inquire. When you use the accessQueue() method to access a queue object, that object is *not* automatically opened for either inquire or set operations. This is because adding these options automatically can cause problems with some types of remote queues. To use the inquire, set, getXXX, and setXXX methods on a queue, you must specify the appropriate inquire and set flags in the openOptions parameter of the accessQueue() method.

The inquire and set methods take three parameters:
- selectors array
- intAttrs array
- charAttrs array

You do not need the SelectorCount, IntAttrCount, and CharAttrLength parameters that are found in MQINQ, because the length of an array in Java is always known. The following example shows how to make an inquiry on a queue:

```
// inquire on a queue
final static int MQIA_DEF_PRIORITY = 6;
final static int MQCA_Q_DESC = 2013;
final static int MQ_Q_DESC_LENGTH = 64;

int[] selectors  = new int[2];
int[] intAttrs   = new int[1];
byte[] charAttrs = new byte[MQ_Q_DESC_LENGTH]

selectors[0] = MQIA_DEF_PRIORITY;
```

```
selectors[1] = MQCA_Q_DESC;

queue.inquire(selectors,intAttrs,charAttrs);

System.out.println("Default Priority = " + intAttrs[0]);
System.out.println("Description : " + new String(charAttrs,0));
```

Multithreaded programs

Multithreaded programs are hard to avoid in Java. Consider a simple program that connects to a queue manager and opens a queue at startup. The program displays a single button on the screen. When a user presses that button, the program fetches a message from the queue.

The Java runtime environment is inherently multithreaded. Therefore, your application initialization occurs in one thread, and the code that executes in response to the button press executes in a separate thread (the user interface thread).

With the C based WebSphere MQ client, this would cause a problem, because handles cannot be shared across multiple threads. WebSphere MQ classes for Java relaxes this constraint, allowing a queue manager object (and its associated queue and process objects) to be shared across multiple threads.

The implementation of WebSphere MQ classes for Java ensures that, for a given connection (MQQueueManager object instance), all access to the target WebSphere MQ queue manager is synchronized. A thread that wants to issue a call to a queue manager is blocked until all other calls in progress for that connection are complete. If you require simultaneous access to the same queue manager from multiple threads within your program, create a new MQQueueManager object for each thread that requires concurrent access. (This is equivalent to issuing a separate MQCONN call for each thread.)

Writing user exits

WebSphere MQ classes for Java allows you to provide your own send, receive, and security exits.

To implement an exit, you define a new Java class that implements the appropriate interface. Three exit interfaces are defined in the WebSphere MQ package:

- MQSendExit
- MQReceiveExit
- MQSecurityExit

Note: User exits are supported for client connections only; they are not supported for bindings connections.

Any SSL encryption defined for a connection is performed *after* the send exit has been invoked. Similarly, decryption is performed *before* the receive or security exits are invoked.

The following sample defines a class that implements all three:

```
class MyMQExits implements MQSendExit, MQReceiveExit, MQSecurityExit {

  // This method comes from the send exit
  public byte[] sendExit(MQChannelExit channelExitParms,
                         MQChannelDefinition channelDefParms,
```

```
                        byte agentBuffer[])
  {
     // fill in the body of the send exit here
  }


  // This method comes from the receive exit
  public byte[] receiveExit(MQChannelExit channelExitParms,
                            MQChannelDefinition channelDefParms,
                            byte agentBuffer[])
  {
     // fill in the body of the receive exit here
  }


  // This method comes from the security exit
  public byte[] securityExit(MQChannelExit channelExitParms,
                             MQChannelDefinition channelDefParms,
                             byte agentBuffer[])
  {
     // fill in the body of the security exit here
  }

}
```

Each exit is passed an MQChannelExit and an MQChannelDefinition object instance. These objects represent the MQCXP and MQCD structures defined in the procedural interface.

For a Send exit, the *agentBuffer* parameter contains the data that is about to be sent. For a Receive exit or a Security exit, the *agentBuffer* parameter contains the data that has just been received. You do not need a length parameter, because the expression agentBuffer.length indicates the length of the array.

For the Send and Security exits, your exit code should return the byte array that you want to send to the server. For a Receive exit, your exit code must return the modified data that you want WebSphere MQ classes for Java to interpret.

The simplest possible exit body is:

```
{
  return agentBuffer;
}
```

If your program is to run as a downloaded Java applet, the security restrictions that apply mean that you cannot read or write any local files. If your exit needs a configuration file, you can place the file on the Web and use the java.net.URL class to download it and examine its contents.

Connection pooling

WebSphere MQ classes for Java provides additional support for applications that deal with multiple connections to WebSphere MQ queue managers. When a connection is no longer required, instead of destroying it, it can be pooled and later reused. This can provide a substantial performance enhancement for applications and middleware that connect serially to arbitrary queue managers.

WebSphere MQ provides a default connection pool. Applications can activate or deactivate this connection pool by registering and deregistering tokens through the MQEnvironment class. If the pool is active when WebSphere MQ base Java constructs an MQQueueManager object, it searches this default pool and reuses

any suitable connection. When an MQQueueManager.disconnect() call occurs, the underlying connection is returned to the pool.

Alternatively, applications can construct an MQSimpleConnectionManager connection pool for a particular use. Then, the application can either specify that pool during construction of an MQQueueManager object, or pass that pool to MQEnvironment for use as the default connection pool.

To prevent connections from using too much resource, you can limit the total number of connections that an MQSimpleConnectionManager object can handle, and you can limit the size of the connection pool. Setting limits is useful if there are conflicting demands for connections within a JVM.

By default, the getMaxConnections() method returns the value zero, which means that there is no limit to the number of connections that the MQSimpleConnectionManager object can handle. You can set a limit by using the setMaxConnections() method. If you set a limit and the limit is reached, a request for a further connection might cause an MQException to be thrown, with a reason code of MQRC_MAX_CONNS_LIMIT_REACHED.

Also, WebSphere MQ base Java provides a partial implementation of the Java 2 Platform Enterprise Edition (J2EE) Connector Architecture. Applications running under a Java 2 v1.3 JVM with JAAS 1.0 (Java Authentication and Authorization Service) can provide their own connection pool by implementing the **javax.resource.spi.ConnectionManager** interface. Again, this interface can be specified on the MQQueueManager constructor, or specified as the default connection pool.

Controlling the default connection pool

Consider the following example application, MQApp1:

```
import com.ibm.mq.*;
public class MQApp1
{
      public static void main(String[] args) throws MQException
      {
         for (int i=0; i<args.length; i++) {
            MQQueueManager qmgr=new MQQueueManager(args[i]);
            :
            : (do something with qmgr)
            :
            qmgr.disconnect();
         }
      }
}
```

MQApp1 takes a list of local queue managers from the command line, connects to each in turn, and performs some operation. However, when the command line lists the same queue manager many times, it is more efficient to connect only once, and to reuse that connection many times.

WebSphere MQ base Java provides a default connection pool that you can use to do this. To enable the pool, use one of the MQEnvironment.addConnectionPoolToken() methods. To disable the pool, use MQEnvironment.removeConnectionPoolToken().

The following example application, MQApp2, is functionally identical to MQApp1, but connects only once to each queue manager.

```
import com.ibm.mq.*;
public class MQApp2
{
      public static void main(String[] args) throws MQException
      {
         MQPoolToken token=MQEnvironment.addConnectionPoolToken();

         for (int i=0; i<args.length; i++) {
            MQQueueManager qmgr=new MQQueueManager(args[i]);
            :
            : (do something with qmgr)
            :
            qmgr.disconnect();
         }

         MQEnvironment.removeConnectionPoolToken(token);

      }
}
```

The first bold line activates the default connection pool by registering an MQPoolToken object with MQEnvironment.

The MQQueueManager constructor now searches this pool for an appropriate connection and only creates a connection to the queue manager if it cannot find an existing one. The qmgr.disconnect() call returns the connection to the pool for later reuse. These API calls are the same as the sample application MQApp1.

The second highlighted line deactivates the default connection pool, which destroys any queue manager connections stored in the pool. This is important because otherwise the application would terminate with a number of live queue manager connections in the pool. This situation could cause errors that would appear in the queue manager logs.

The default connection pool stores a maximum of ten unused connections, and keeps unused connections active for a maximum of five minutes. The application can alter this (for details, see “Supplying a different connection pool” on page 84).

Instead of using MQEnvironment to supply an MQPoolToken, the application can construct its own:

```
MQPoolToken token=new MQPoolToken();
MQEnvironment.addConnectionPoolToken(token);
```

Some applications or middleware vendors provide subclasses of MQPoolToken in order to pass information to a custom connection pool. They can be constructed and passed to addConnectionPoolToken() in this way so that extra information can be passed to the connection pool.

The default connection pool and multiple components

MQEnvironment holds a static set of registered MQPoolToken objects. To add or remove MQPoolTokens from this set, use the following methods:

- MQEnvironment.addConnectionPoolToken()
- MQEnvironment.removeConnectionPoolToken()

An application might consist of many components that exist independently and perform work using a queue manager. In such an application, each component should add an MQPoolToken to the MQEnvironment set for its lifetime.

For example, the example application MQApp3 creates ten threads and starts each one. Each thread registers its own MQPoolToken, waits for a length of time, then connects to the queue manager. After the thread disconnects, it removes its own MQPoolToken.

The default connection pool remains active while there is at least one token in the set of MQPoolTokens, so it will remain active for the duration of this application. The application does not need to keep a master object in overall control of the threads.

```
import com.ibm.mq.*;
public class MQApp3
{
      public static void main(String[] args)
      {
         for (int i=0; i<10; i++) {
            MQApp3_Thread thread=new MQApp3_Thread(i*60000);
            thread.start();
         }
      }
}

class MQApp3_Thread extends Thread
{
      long time;

      public MQApp3_Thread(long time)
      {
         this.time=time;
      }

      public synchronized void run()
      {
         MQPoolToken token=MQEnvironment.addConnectionPoolToken();
         try {
            wait(time);
            MQQueueManager qmgr=new MQQueueManager("my.qmgr.1");
            :
            : (do something with qmgr)
            :
            qmgr.disconnect();
         }
         catch (MQException mqe) {System.err.println("Error occurred!");}
         catch (InterruptedException ie) {}

         MQEnvironment.removeConnectionPoolToken(token);
      }
}
```

Supplying a different connection pool

This section describes how to use the class **com.ibm.mq.MQSimpleConnectionManager** to supply a different connection pool. This class provides basic facilities for connection pooling, and applications can use this class to customize the behavior of the pool.

Once it is instantiated, an MQSimpleConnectionManager can be specified on the MQQueueManager constructor. The MQSimpleConnectionManager then manages the connection that underlies the constructed MQQueueManager. If the MQSimpleConnectionManager contains a suitable pooled connection, that connection is reused and returned to the MQSimpleConnectionManager after an MQQueueManager.disconnect() call.

The following code fragment demonstrates this behavior:

```
MQSimpleConnectionManager myConnMan=new MQSimpleConnectionManager();
myConnMan.setActive(MQSimpleConnectionManager.MODE_ACTIVE);
MQQueueManager qmgr=new MQQueueManager("my.qmgr.1", myConnMan);
:
: (do something with qmgr)
:
qmgr.disconnect();

MQQueueManager qmgr2=new MQQueueManager("my.qmgr.1", myConnMan);
:
: (do something with qmgr2)
:
qmgr2.disconnect();
myConnMan.setActive(MQSimpleConnectionManager.MODE_INACTIVE);
```

The connection that is forged during the first MQQueueManager constructor is stored in myConnMan after the qmgr.disconnect() call. The connection is then reused during the second call to the MQQueueManager constructor.

The second line enables the MQSimpleConnectionManager. The last line disables MQSimpleConnectionManager, destroying any connections held in the pool. An MQSimpleConnectionManager is, by default, in MODE_AUTO, which is described later in this section.

An MQSimpleConnectionManager allocates connections on a most-recently-used basis, and destroys connections on a least-recently-used basis. By default, a connection is destroyed if it has not been used for five minutes, or if there are more than ten unused connections in the pool. You can alter these values using:

- MQSimpleConnectionManager.setTimeout()
- MQSimpleConnectionManager.setHighThreshold()

You can also set up an MQSimpleConnectionManager for use as the default connection pool, to be used when no Connection Manager is supplied on the MQQueueManager constructor.

The following application demonstrates this:

```
import com.ibm.mq.*;
public class MQApp4
{
      public static void main(String []args)
      {
         MQSimpleConnectionManager myConnMan=new MQSimpleConnectionManager();
         myConnMan.setActive(MQSimpleConnectionManager.MODE_AUTO);
         myConnMan.setTimeout(3600000);
         myConnMan.setMaxConnections(75);
         myConnMan.setMaxUnusedConnections(50);
         MQEnvironment.setDefaultConnectionManager(myConnMan);
          MQApp3.main(args);
      }
}
```

The bold lines create and configure an MQSimpleConnectionManager object. The configuration does the following:

- Ends connections that are not used for an hour
- Limits the number of connections managed by myConnMan to 75
- Limits the number of unused connections in the pool to 50
- Sets MODE_AUTO, which is the default. This means that the pool is active only if it is the default connection manager, and there is at least one token in the set of MQPoolTokens held by MQEnvironment.

The new MQSimpleConnectionManager is then set as the default connection manager.

In the last line, the application calls MQApp3.main(). This runs a number of threads, where each thread uses WebSphere MQ independently. These threads use myConnMan when they forge connections.

Supplying your own ConnectionManager

Under Java 2 v1.3, with JAAS 1.0 installed, applications and middleware providers can provide alternative implementations of connection pools. WebSphere MQ base Java provides a partial implementation of the J2EE Connector Architecture. Implementations of **javax.resource.spi.ConnectionManager** can either be used as the default Connection Manager or be specified on the MQQueueManager constructor.

WebSphere MQ base Java complies with the Connection Management contract of the J2EE Connector Architecture. Read this section in conjunction with the Connection Management contract of the J2EE Connector Architecture (refer to Sun's Web site at `http://java.sun.com`).

The ConnectionManager interface defines only one method:

```
package javax.resource.spi;
public interface ConnectionManager {
      Object allocateConnection(ManagedConnectionFactory mcf,
                                ConnectionRequestInfo cxRequestInfo);
}
```

The MQQueueManager constructor calls allocateConnection on the appropriate ConnectionManager. It passes appropriate implementations of ManagedConnectionFactory and ConnectionRequestInfo as parameters to describe the connection required.

The ConnectionManager searches its pool for a javax.resource.spi.ManagedConnection object that has been created with identical ManagedConnectionFactory and ConnectionRequestInfo objects. If the ConnectionManager finds any suitable ManagedConnection objects, it creates a java.util.Set that contains the candidate ManagedConnections. Then, the ConnectionManager calls the following:

```
ManagedConnection mc=mcf.matchManagedConnections(connectionSet, subject,
cxRequestInfo);
```

The WebSphere MQ implementation of ManagedConnectionFactory ignores the subject parameter. This method selects and returns a suitable ManagedConnection from the set, or returns null if it does not find a suitable ManagedConnection. If there is not a suitable ManagedConnection in the pool, the ConnectionManager can create one by using:

```
ManagedConnection mc=mcf.createManagedConnection(subject, cxRequestInfo);
```

Again, the subject parameter is ignored. This method connects to a WebSphere MQ queue manager and returns an implementation of javax.resource.spi.ManagedConnection that represents the newly-forged connection. Once the ConnectionManager has obtained a ManagedConnection (either from the pool or freshly created), it creates a connection handle using:

```
Object handle=mc.getConnection(subject, cxRequestInfo);
```

This connection handle can be returned from allocateConnection().

A ConnectionManager must register an interest in the ManagedConnection through:

```
mc.addConnectionEventListener()
```

The ConnectionEventListener is notified if a severe error occurs on the connection, or when MQQueueManager.disconnect() is called. When MQQueueManager.disconnect() is called, the ConnectionEventListener can do either of the following:

- Reset the ManagedConnection using the mc.cleanup() call, then return the ManagedConnection to the pool
- Destroy the ManagedConnection using the mc.destroy() call

If the ConnectionManager is the default ConnectionManager, it can also register an interest in the state of the MQEnvironment-managed set of MQPoolTokens. To do so, first construct an MQPoolServices object, then register an MQPoolServicesEventListener object with the MQPoolServices object:

```
MQPoolServices mqps=new MQPoolServices();
mqps.addMQPoolServicesEventListener(listener);
```

The listener is notified when an MQPoolToken is added or removed from the set, or when the default ConnectionManager changes. The MQPoolServices object also provides a way to query the current size of the set of MQPoolTokens.

JTA/JDBC coordination using WebSphere MQ base Java

WebSphere MQ base Java supports the MQQueueManager.begin() method, which allows WebSphere MQ to act as a coordinator for a database which provides a JDBC 2 compliant driver. Currently this support is available on Solaris, AIX, and Windows systems with Oracle or DB2 databases.

Installation

In order to use the XA-JTA support, you must use the special JTA switch library. The method for using this library varies depending on whether you are using Windows systems or one of the other platforms.

Installation on Windows systems

On Windows systems, the new XA library is supplied as a complete DLL. The name of this DLL is `jdbcxxx.dll` where `xxx` indicates the database for which the switch library has been compiled. This library is in the `java/lib/jdbc` directory of your WebSphere MQ base Java installation.

Installation on other platforms

The switch file is supplied as an object file that you must link yourself using the supplied makefile. This is necessary because certain libraries required by the switch library might be in different locations on different systems. Because the switch library is loaded by the queue manager, which runs in a setuid environment, you cannot use the dynamic library path variable to locate these libraries. You therefore need to put the full path names to these libraries in the switch library itself.

The object files are called `jdbcxxx.o` where `xxx` indicates which database the object file is for. When linked, a switch file called jdbcxxx is produced; add this to the qm.ini file in the same manner as the standard switch libraries.

To create the switch library, go into the `java/lib/jdbc` subdirectory of your WebSphere MQ base Java installation and run make with your target database as a parameter. Currently supported targets for XA-JTA are `oracle` and `db2`. For example:

```
make db2
```

The makefiles are set up to link against the databases and JDKs in their standard installed location. The exception to this is Oracle, which can be installed anywhere on the system. The makefile uses Oracle's ORACLE_HOME environment variable to link the library correctly. If your JDK is in a non-standard location, you can override the default directory with the JAVA_HOME definition:

```
make JAVA_HOME=/usr/my_jdk13 oracle
```

The above command produces a switch file named jdbcora, which is used in the same way as a standard switch library, including using the same XAOpenString. If you have previously configured an XAResourceManager in your qm.ini, replace the SwitchFile line with a reference to the new JTA-specific switch file. If you have not previously used an XA switch file, refer to the *WebSphere MQ System Administration Guide* for of configuring the XAResourceManager stanza for different databases, remembering to replace the standard switch file with the Java-specific one.

Once you have updated the qm.ini, restart the queue manager. Ensure that all appropriate database environment variables have been set before calling strmqm.

Usage

The basic sequence of API calls for a user application is:

```
qMgr = new MQQueueManager("QM1")
Connection con = qMgr.getJDBCConnection( xads );
qMgr.begin()

< Perform MQ and DB operations to be grouped in a unit of work >

qMgr.commit() or qMgr.backout();
con.close()
qMgr.disconnect()
```

`xads` in the getJDBCConnection call is a database-specific implementation of the XADataSource interface, which defines the details of the database to connect to. See the documentation for your database to determine how to create an appropriate XADataSource object to pass into getJDBCConnection.

You also need to update your CLASSPATH with the appropriate database-specific jar files for performing JDBC work.

If you need to connect to multiple databases, you might have to call getJDBCConnection several times to perform the transaction across several different connections.

There are two forms of the getJDBCConnection, reflecting the two forms of XADataSource.getXAConnection:

```
public java.sql.Connection getJDBCConnection(javax.sql.XADataSource xads)
  throws MQException, SQLException, Exception

public java.sql.Connection getJDBCConnection(XADataSource dataSource,
                                             String userid, String password)
  throws MQException, SQLException, Exception
```

These methods declare Exception in their throws clauses to avoid problems with the JVM verifier for customers who are not using the JTA functionality. The actual exception thrown is javax.transaction.xa.XAException. which requires the jta.jar file to be added to the classpath for programs that did not previously require it.

Known problems and limitations

Because this support makes calls to JDBC drivers, the implementation of those JDBC drivers can have significant impact on the system behavior. In particular, tested JDBC drivers behave differently when the database is shut down while an application is running. **Always** avoid abruptly shutting down a database while there are applications holding open connections to it.

Oracle 8.1.7
Calling the JDBC Connection.close() method after MQQueueManager.disconnect() generates an SQLException. Either call Connection.close() before MQQueueManager.disconnect(), or omit the call to Connection.close().

DB2® Sometimes DB2 returns a SQL0805N error. This problem can be resolved with the following CLP command:

```
DB2 bind @db2cli.lst blocking all grant public
```

Refer to the DB2 documentation for more information.

Solaris and JDK 1.3

When running on Solaris with JDK 1.3, attempting to start the queue manager from a user ID other than root or mqm is likely to fail to load the jdbcora switch file with the following message being put to the error log:

```
AMQ6175: The system could not dynamically load the library /opt/mqm/java/lib/jdbcora.
The error message was ld.so.1: amqzxma0: fatal: libverify.so: open failed:
No such file or directory. The Queue Manager will continue without this module.
```

The problem arises because of a dependency between two libraries in JDK1.3 that cannot be resolved by the dynamic linker when the invoking program has the setuid bit set (as strmqm does).

Under these circumstances, start the queue manager from the mqm user ID; if this is not practical, make a symbolic link for libverify into `/usr/lib`. For example:

```
ln -s /usr/j2se/jre/lib/sparc/libverify.so /usr/lib/libverify.so
```

Solaris and multiple XAResourceManager stanzas

When attempting to use multiple XAResourceManager stanzas on any given queue manager on Solaris, the commit call might fail. Treat this as an unsupported combination; it does not affect queue managers with a single XAResourceManager stanza.

Windows systems

The JDBC libraries supplied with WebSphere MQ Java (jdbcdb2.dll and jdbcora.dll) have a dependency on jvm.dll, which is supplied with the JVM. However, depending on the JVM used, this DLL might be in a subdirectory that is not on the path; for example, `jre/bin/classic/jvm.dll`.

If jvm.dll cannot be found when the queue manager starts, the queue manager produces a message like the following (this example is for DB2):

```
AMQ6174: The library C:\Program Files\IBM\MQSeries\Java\lib\jdbc\jdbcdb2.dll
was not found. The queue manager will continue without this module.
```

In fact, the file not found is jvm.dll. The solution is to either copy jvm.dll to somewhere already on the path or update the path to include the location of jvm.dll.

Secure Sockets Layer (SSL) support

WebSphere MQ base Java client applications and WebSphere MQ JMS connections using TRANSPORT(CLIENT) support Secure Sockets Layer (SSL) encryption. SSL provides communication encryption, authentication, and message integrity. It is typically used to secure communications between any two peers on the Internet or within an intranet.

WebSphere MQ classes for Java uses Java Secure Socket Extension (JSSE) to handle SSL encryption, and so requires a JSSE provider. J2SE v1.4 JVMs have a JSSE provider built in. Details of how to manage and store certificates can vary from provider to provider. For information about this, refer to your JSSE provider's documentation.

This section assumes that your JSSE provider is correctly installed and configured, and that suitable certificates have been installed and made available to your JSSE provider.

Enabling SSL

SSL is supported only for client connections. To enable SSL, you must specify the CipherSuite to use when communicating with the queue manager, and this must match the CipherSpec set on the target channel. Additionally, the named CipherSuite must be supported by your JSSE provider. However, CipherSuites are distinct from CipherSpecs and so have different names. Appendix H, "SSL CipherSuites supported by WebSphere MQ," on page 487 contains a table mapping the CipherSpecs supported by WebSphere MQ to their equivalent CipherSuites as known to JSSE.

To enable SSL, specify the CipherSuite using the sslCipherSuite static member variable of MQEnvironment. The following example attaches to a SVRCONN channel named SECURE.SVRCONN.CHANNEL, which has been set up to require SSL with a CipherSpec of RC4_MD5_EXPORT:

```
MQEnvironment.hostname       = "your_hostname";
MQEnvironment.channel        = "SECURE.SVRCONN.CHANNEL";
MQEnvironment.sslCipherSuite = "SSL_RSA_EXPORT_WITH_RC4_40_MD5";
MQQueueManager qmgr = new MQQueueManager("your_Q_manager");
```

Note that, although the channel has a CipherSpec of RC4_MD5_EXPORT, the Java application must specify a CipherSuite of SSL_RSA_EXPORT_WITH_RC4_40_MD5. For more information about CipherSpecs and CipherSuites, see the *WebSphere MQ Security* book. See Appendix H, "SSL CipherSuites supported by WebSphere MQ," on page 487 for a list of mappings between CipherSpecs and CipherSuites.

The sslCipherSuite property can also be set using the MQC.SSL_CIPHER_SUITE_PROPERTY in the Hash table of connection properties.

To successfully connect using SSL, the JSSE TrustStore must be set up with Certificate Authority root certificates from which the certificate presented by the queue manager can be authenticated. Similarly, if SSLClientAuth on the SVRCONN channel has been set to MQSSL_CLIENT_AUTH_REQUIRED, the JSSE KeyStore must contain an identifying certificate that is trusted by the queue manager.

Using the distinguished name of the queue manager

The queue manager identifies itself using an SSL certificate, which contains a *Distinguished Name* (DN). A WebSphere MQ Java client application can use this DN to ensure that it is communicating with the correct queue manager. A DN pattern is specified using the sslPeerName variable of MQEnvironment. For example, setting:

```
MQEnvironment.sslPeerName = "CN=QMGR.*, OU=IBM, OU=WEBSPHERE";
```

allows the connection to succeed only if the queue manager presents a certificate with a Common Name beginning QMGR., and at least two Organizational Unit names, the first of which must be IBM and the second WEBSPHERE.

The sslPeerName property can also be set using the MQC.SSL_PEER_NAME_PROPERTY in the hash table of connection properties. For more information about distinguished names, refer to *WebSphere MQ Security*.

If sslPeerName is set, connections succeed only if it is set to a valid pattern and the queue manager presents a matching certificate.

Using certificate revocation lists

A certificate revocation list (CRL) is a set of certificates that have been revoked, either by the issuing Certificate Authority or by the local organization. CRLs are typically hosted on LDAP servers. With Java 2 v1.4, a CRL server can be specified at connect-time and the certificate presented by the queue manager is checked against the CRL before the connection is allowed. For more information about certificate revocation lists and WebSphere MQ, see *WebSphere MQ Security*.

Note: To use a CertStore successfully with a CRL hosted on an LDAP server, make sure that your Java Software Development Kit (SDK) is compatible with the CRL. Some SDKs require that the CRL conforms to RFC 2587, which defines a schema for LDAP v2. Most LDAP v3 servers use RFC 2256 instead.

The CRLs to use are specified through the java.security.cert.CertStore class. Refer to documentation on this class for full details of how to obtain instances of CertStore. To create a CertStore based on an LDAP server, first create an LDAPCertStoreParameters instance, initialized with the server and port settings to use. For example:

```
import java.security.cert.*;
CertStoreParameters csp = new LDAPCertStoreParameters("crl_server", 389);
```

Having created a CertStoreParameters instance, use the static constructor on CertStore to create a CertStore of type LDAP:

```
CertStore cs = CertStore.getInstance("LDAP", csp);
```

Other CertStore types (for example, Collection) are also supported. Commonly there are several CRL servers set up with identical CRL information to give redundancy. Once you have a CertStore object for each of these CRL servers, place them all in a suitable Collection. The following example shows the CertStore objects placed in an ArrayList:

```
import java.util.ArrayList;
Collection crls = new ArrayList();
crls.add(cs);
```

This Collection can be set into the MQEnvironment static variable, sslCertStores, before connecting to enable CRL checking:

```
MQEnvironment.sslCertStores = crls;
```

The certificate presented by the queue manager when a connection is being set up is validated as follows:

1. The first CertStore object in the Collection identified by sslCertStores is used to identify a CRL server.
2. An attempt is made to contact the CRL server.
3. If the attempt is successful, the server is searched for a match for the certificate.
   a. If the certificate is found to be revoked, the search process is over and the connection request fails with reason code MQRC_SSL_CERTIFICATE_REVOKED.
   b. If the certificate is not found, the search process is over and the connection is allowed to proceed.
4. If the attempt to contact the server is unsuccessful, the next CertStore object is used to identify a CRL server and the process repeats from step 2.

   If this was the last CertStore in the Collection, or if the Collection contains no CertStore objects, the search process has failed and the connection request fails with reason code MQRC_SSL_CERT_STORE_ERROR.

The Collection object determines the order in which CertStores are used.

The Collection of CertStores can also be set using the MQC.SSL_CERT_STORE_PROPERTY. As a convenience, this property also allows a single CertStore to be specified without needing to be a member of a Collection.

If sslCertStores is set to null, no CRL checking is performed. This property is ignored if sslCipherSuite is not set.

Supplying a customized SSLSocketFactory

Different JSSE implementations can provide different features. For example, a specialized JSSE implementation could allow configuration of a particular model of encryption hardware. Additionally, some JSSE providers allow customization of KeyStores and TrustStores by program, or allow the choice of identity certificate from the KeyStore to be altered. In JSSE, all these customizations are abstracted into a factory class, javax.net.ssl.SSLSocketFactory.

Refer to your JSSE documentation for details of how to create a customized SSLSocketFactory implementation. The details vary from provider to provider, but a typical sequence of steps might be:

1. Create an SSLContext object using a static method on SSLContext
2. Initialize this SSLContext with appropriate KeyManagers and TrustManager implementations (created from their own factory classes)
3. Create an SSLSocketFactory from the SSLContext

When you have an SSLSocketFactory object, set the MQEnvironment.sslSocketFactory to the customized factory object. For example:

```
javax.net.ssl.SSLSocketFactory sf = sslContext.getSocketFactory();
MQEnvironment.sslSocketFactory = sf;
```

WebSphere MQ classes for Java then use this SSLSocketFactory to connect to the WebSphere MQ queue manager. This property can also be set using the MQC.SSL_SOCKET_FACTORY_PROPERTY. If sslSocketFactory is set to null, the JVM's default SSLSocketFactory is used. This property is ignored if sslCipherSuite is not set.

Error handling when using SSL

The following reason codes can be issued by WebSphere MQ classes for Java when connecting to a queue manager using SSL:

MQRC_SSL_NOT_ALLOWED
The sslCipherSuite property was set, but bindings connect was used. Only client connect supports SSL.

MQRC_JSSE_ERROR
The JSSE provider reported an error that could not be handled by WebSphere MQ. This could be caused by a configuration problem with JSSE, or because the certificate presented by the queue manager could not be validated. The exception produced by JSSE can be retrieved using the getCause() method on MQException.

MQRC_SSL_PEER_NAME_MISMATCH
The DN pattern specified in the sslPeerName property did not match the DN presented by the queue manager.

MQRC_SSL_PEER_NAME_ERROR
The DN pattern specified in the sslPeerName property was not valid.

MQRC_UNSUPPORTED_CIPHER_SUITE
The CipherSuite named in sslCipherSuite was not recognized by the JSSE provider. A full list of CipherSuites supported by the JSSE provider can be obtained by a program using the SSLSocketFactory.getSupportedCipherSuites() method. A list of CipherSuites that can be used to communicate with WebSphere MQ can be found in Appendix H, "SSL CipherSuites supported by WebSphere MQ," on page 487.

MQRC_SSL_CERTIFICATE_REVOKED
The certificate presented by the queue manager was found in a CRL specified with the sslCertStores property. Update the queue manager to use trusted certificates.

MQRC_SSL_CERT_STORE_ERROR
None of the supplied CertStores could be searched for the certificate presented by the queue manager. The MQException.getCause() method returns the error that occurred while searching the first CertStore attempted. If the causal exception is NoSuchElementException, ClassCastException, or NullPointerException, check that the Collection specified on the sslCertStores property contains at least one valid CertStore object.

Compiling and testing WebSphere MQ base Java programs

Before compiling WebSphere MQ base Java programs, you must ensure that your WebSphere MQ classes for Java installation directory is in your CLASSPATH environment variable, as described in Chapter 2, "Installation," on page 9.

To compile a class called MyClass.java, use the command:

```
javac MyClass.java
```

Running WebSphere MQ base Java applets

If you write an applet (subclass of java.applet.Applet), you must create an HTML file referencing your class before you can run it. A sample HTML file might look as follows:

```
<html>
<body>
<applet code="MyClass.class" width=200 height=400>
</applet>
</body>
</html>
```

Run your applet either by loading this HTML file into a Java-enabled Web browser, or by using the appletviewer that comes with the Java Development Kit (JDK).

To use the applet viewer, enter the command:

```
appletviewer myclass.html
```

Running WebSphere MQ base Java applications

If you write an application (a class that contains a main() method), using either the client or the bindings mode, run your program using the Java interpreter. Use the command:

```
java MyClass
```

Note: The .class extension is omitted from the class name.

Tracing WebSphere MQ base Java programs

WebSphere MQ base Java includes a trace facility, which you can use to produce diagnostic messages if you suspect that there might be a problem with the code. (You normally need to use this facility only at the request of IBM service.)

Tracing is controlled by the enableTracing and disableTracing methods of the MQEnvironment class. For example:

```
MQEnvironment.enableTracing(2);   // trace at level 2
 ...                              // these commands will be traced
MQEnvironment.disableTracing();   // turn tracing off again
```

The trace is written to the Java console (`System.err`).

If your program is an application, or if you run it from your local disk using the appletviewer command, you can also redirect the trace output to a file of your choice. The following code fragment shows an example of how to redirect the trace output to a file called `myapp.trc`:

```
import java.io.*;

try {
  FileOutputStream
  traceFile = new FileOutputStream("myapp.trc");
  MQEnvironment.enableTracing(2,traceFile);
}
catch (IOException ex) {
  // couldn't open the file,
  // trace to System.err instead
  MQEnvironment.enableTracing(2);
}
```

There are five different levels of tracing:

1. Provides entry, exit, and exception tracing
2. Provides parameter information in addition to 1
3. Provides transmitted and received WebSphere MQ headers and data blocks in addition to 2
4. Provides transmitted and received user message data in addition to 3
5. Provides tracing of methods in the Java Virtual Machine in addition to 4

To trace methods in the Java Virtual Machine with trace level 5:

- For an application, run it by issuing the command `java_g` (instead of `java`)
- For an applet, run it by issuing the command `appletviewer_g` (instead of `appletviewer`)

Note: `java_g` is not supported on OS/400, but similar function is provided by using `OPTION(*VERBOSE)` on the RUNJVA command.

Chapter 8. Environment-dependent behavior

WebSphere MQ classes for Java allow you to create applications that can run against different versions of WebSphere MQ and MQSeries. This chapter describes the behavior of the Java classes dependent on these different versions.

WebSphere MQ classes for Java provides a core of classes, which provide consistent function and behavior in all the environments. Features outside this core depend on the capability of the queue manager to which the application is connected.

Except where noted here, the behavior exhibited is as described in the Application Programming Reference book appropriate to the queue manager.

Core details

WebSphere MQ classes for Java contains the following core set of classes, which can be used in all environments with only the minor variations listed in "Restrictions and variations for core classes" on page 96.

- MQEnvironment
- MQException
- MQGetMessageOptions

  Excluding:
  - MatchOptions
  - GroupStatus
  - SegmentStatus
  - Segmentation
- MQManagedObject

  Excluding:
  - inquire()
  - set()
- MQMessage

  Excluding:
  - groupId
  - messageFlags
  - messageSequenceNumber
  - offset
  - originalLength
- MQPoolServices
- MQPoolServicesEvent
- MQPoolServicesEventListener
- MQPoolToken
- MQPutMessageOptions

  Excluding:
  - knownDestCount
  - unknownDestCount
  - invalidDestCount
  - recordFields
- MQProcess
- MQQueue
- MQQueueManager

Excluding:
  – begin()
  – accessDistributionList()
- MQSimpleConnectionManager
- MQC

Notes:

1. Some constants are not included in the core (see "Restrictions and variations for core classes" for details); do not use them in completely portable programs.
2. Some platforms do not support all connection modes. On these platforms, you can use only the core classes and options that relate to the supported modes. (See Table 1 on page 5.)

Restrictions and variations for core classes

The core classes generally behave consistently across all environments, even if the equivalent MQI calls normally have environment differences. The behavior is as if a Windows or UNIX WebSphere MQ queue manager is used, except for the following minor restrictions and variations.

MQGMO_* values

The following MQGMO_* values are not supported by all queue managers, and their use might throw MQException from an MQQueue.get():

MQGMO_SYNCPOINT_IF_PERSISTENT
MQGMO_MARK_SKIP_BACKOUT
MQGMO_BROWSE_MSG_UNDER_CURSOR
MQGMO_LOCK
MQGMO_UNLOCK
MQGMO_LOGICAL_ORDER
MQGMO_COMPLETE_MESSAGE
MQGMO_ALL_MSGS_AVAILABLE
MQGMO_ALL_SEGMENTS_AVAILABLE

Additionally, MQGMO_SET_SIGNAL is not supported when used from Java.

MQPMRF_* values

These are used only when putting messages to a distribution list, and are supported only by queue managers supporting distribution lists. For example, z/OS and OS/390 queue managers do not support distribution lists.

MQPMO_* values

The following MQPMO_* values are not supported by all queue managers, and their use might throw MQException from an MQQueue.put() or an MQQueueManager.put():

MQPMO_NEW_MESSAGE_ID
MQPMO_NEW_CORREL_ID
MQPMO_LOGICAL_ORDER

MQCNO_FASTPATH_BINDING

This value is ignored on queue managers that do not support it, or when using a TCP/IP client connection.

MQRO_* values

The following report options can be set but are ignored by some queue managers. This can affect applications connected to a queue manager that honors the report options when the report message is generated by a remote queue manager that does not. Avoid relying on these options if there is a possibility that a queue manager involved does not support them.

MQRO_EXCEPTION_WITH_FULL_DATA
MQRO_EXPIRATION_WITH_FULL_DATA
MQRO_COA_WITH_FULL_DATA
MQRO_COD_WITH_FULL_DATA
MQRO_DISCARD_MSG

Miscellaneous differences with z/OS and OS/390

Message priority

When a message is put with a priority greater than MaxPriority, a z/OS or OS/390 queue manager rejects the put with MQCC_FAILED and MQRC_PRIORITY_ERROR. Other platforms complete the put with MQCC_WARNING and MQRC_PRIORITY_EXCEEDS_MAXIMUM, and treat the message as if it were put with MaxPriority.

BackoutCount

A z/OS or OS/390 queue manager returns a maximum BackoutCount of 255, even if the message has been backed out more than 255 times.

Default dynamic queue prefix

When connected to a z/OS or OS/390 queue manager using a bindings connection, the default dynamic queue prefix is CSQ.*. Otherwise, the default dynamic queue prefix is AMQ.*.

MQQueueManager constructor

Client connect is not supported on z/OS and OS/390. Attempting to connect with client options results in an MQException with MQCC_FAILED and MQRC_ENVIRONMENT_ERROR. The MQQueueManager constructor might also fail with MQRC_CHAR_CONVERSION_ERROR (if it fails to initialize conversion between the IBM-1047 and ISO8859-1 code pages), or MQRC_UCS2_CONVERSION_ERROR (if it fails to initialize conversion between the queue manager's code page and Unicode). If your application fails with one of these reason codes, ensure that the National Language Resources component of Language Environment® is installed, and ensure that the correct conversion tables are available.

Conversion tables for Unicode are installed as part of the OS/390 C/C++ optional feature. See the *OS/390: C/C++ Programming Guide* (SC09-2362) for more information about enabling UCS-2 conversions.

Features outside the core

The WebSphere MQ classes for Java contain the following functions that are specifically designed to use API extensions that are not supported by all queue managers. This section describes how they behave when using a queue manager that does *not* support them.

MQQueueManager constructor option

The MQQueueManager constructor includes an optional integer argument. This maps onto the MQI's MQCNO options field, and is used to switch between normal and fast path connection. This extended form of the constructor is accepted in all environments, provided that the only options used are MQCNO_STANDARD_BINDING or MQCNO_FASTPATH_BINDING. Any other options cause the constructor to fail with MQRC_OPTIONS_ERROR. The fast path option MQC.MQCNO_FASTPATH_BINDING is honored only when with a bindings connection to a queue manager that supports it. In other environments, it is ignored.

MQQueueManager.begin() method

This can be used only against a WebSphere MQ queue manager on UNIX or Windows systems in bindings mode. Otherwise, it fails with MQRC_ENVIRONMENT_ERROR. See "JTA/JDBC coordination using WebSphere MQ base Java" on page 87 for more details.

MQGetMessageOptions fields

When using a queue manager that does not support the Version 2 MQGMO structure, leave the following fields set to their default values:

GroupStatus
SegmentStatus
Segmentation

Also, the MatchOptions field support only MQMO_MATCH_MSG_ID and MQMO_MATCH_CORREL_ID. If you put unsupported values into these fields, the subsequent MQQueue.get() fail with MQRC_GMO_ERROR. If the queue manager does not support the Version 2 MQGMO structure, these fields are not updated after a successful MQQueue.get().

Distribution lists

The following classes are used to create distribution lists:

MQDistributionList
MQDistributionListItem
MQMessageTracker

You can create and populate MQDistributionLists and MQDistributionListItems in any environment, but not all queue managers allow you to open an MQDistributionList. In particular, z/OS and OS/390 queue managers do not support distribution lists. Attempting to open an MQDistributionList when using such a queue manager results in MQRC_OD_ERROR.

MQPutMessageOptions fields

Four fields in the MQPMO are rendered as the following member variables in the MQPutMessageOptions class:

knownDestCount

unknownDestCount
invalidDestCount
recordFields

These fields are primarily intended for use with distribution lists. However, a queue manager that supports distribution lists also fills in the DestCount fields after an MQPUT to a single queue. For example, if the queue resolves to a local queue, knownDestCount is set to 1 and the other two count fields are set to 0.

If the queue manager does not support distribution lists, these values are simulated as follows:

- If the put() succeeds, unknownDestCount is set to 1, and the others are set to 0.
- If the put() fails, invalidDestCount is set to 1, and the others are set to 0.

The recordFields variable is used with distribution lists. A value can be written into recordFields at any time, regardless of the environment. It is ignored if the MQPutMessageOptions object is used on a subsequent MQQueue.put() or MQQueueManager.put(), rather than MQDistributionList.put().

MQMD fields

The following MQMD fields are largely concerned with message segmentation:

GroupId
MsgSeqNumber
Offset
MsgFlags
OriginalLength

If an application sets any of these MQMD fields to values other than their defaults, and then does a put() or get() on a queue manager that does not support these, the put() or get() raises an MQException with MQRC_MD_ERROR. A successful put() or get() with such a queue manager always leaves the MQMD fields set to their default values. Do not send a grouped or segmented message to a Java application that runs against a queue manager that does not support message grouping and segmentation.

If a Java application attempts to get() a message from a queue manager that does not support these fields, and the physical message to be retrieved is part of a group of segmented messages (that is, it has non-default values for the MQMD fields), it is retrieved without error. However, the MQMD fields in the MQMessage are not updated, the MQMessage format property is set to MQFMT_MD_EXTENSION, and the true message data is prefixed with an MQMDE structure that contains the values for the new fields.

Chapter 9. The WebSphere MQ base Java classes and interfaces

This chapter describes all the WebSphere MQ classes for Java classes and interfaces. It includes details of the variables, constructors, and methods in each class and interface.

The following classes are described:
- MQChannelDefinition
- MQChannelExit
- MQDistributionList
- MQDistributionListItem
- MQEnvironment
- MQException
- MQGetMessageOptions
- MQManagedObject
- MQMessage
- MQMessageTracker
- MQPoolServices
- MQPoolServicesEvent
- MQPoolToken
- MQPutMessageOptions
- MQProcess
- MQQueue
- MQQueueManager
- MQSimpleConnectionManager

The following interfaces are described:
- MQC
- MQPoolServicesEventListener
- MQConnectionManager
- MQReceiveExit
- MQSecurityExit
- MQSendExit
- ManagedConnection
- ManagedConnectionFactory
- ManagedConnectionMetaData

MQChannelDefinition

```
java.lang.Object
  |
  └ com.ibm.mq.MQChannelDefinition
```

public class **MQChannelDefinition**
extends **Object**

Use the MQChannelDefinition class to pass information concerning the connection to the queue manager to the send, receive, and security exits.

Note: This class does not apply when connecting directly to WebSphere MQ in bindings mode.

Variables

channelName
`public String channelName`

The name of the channel through which the connection is established.

connectionName
`public String connectionName`

The TCP/IP hostname of the machine on which the queue manager resides.

maxMessageLength
`public int maxMessageLength`

The maximum length of message that can be sent to the queue manager.

queueManagerName
`public String queueManagerName`

The name of the queue manager to which the connection is made.

receiveUserData
`public String receiveUserData`

A storage area for the receive exit to use. Information placed here is preserved across invocations of the receive exit, and is also available to the send and security exits.

remotePassword
`public String remotePassword`

The password used to establish the connection.

remoteUserId
`public String remoteUserId`

The user id used to establish the connection.

securityUserData
`public String securityUserData`

A storage area for the security exit to use. Information placed here is preserved across invocations of the security exit, and is also available to the send and receive exits.

sendUserData
`public String sendUserData`

A storage area for the send exit to use. Information placed here is preserved across invocations of the send exit, and is also available to the security and receive exits.

sslPeerName

```
public String sslPeerName
```

If SSL is used to encrypt data on the wire, this is set to the Distinguished Name presented by the queue manager during connection. If SSL is not used, it is left at null.

Constructors

MQChannelDefinition

```
public MQChannelDefinition()
```

MQChannelExit

```
java.lang.Object
   |
   └ com.ibm.mq.MQChannelExit
```

public class **MQChannelExit**
extends **Object**

This class defines context information passed to the send, receive, and security exits when they are invoked. The exit must set the exitResponse member variable to indicate what action the WebSphere MQ Client for Java should take next.

Note: This class does not apply when connecting directly to WebSphere MQ in bindings mode.

Variables

MQXCC_CLOSE_CHANNEL
public final static int MQXCC_CLOSE_CHANNEL

MQXCC_OK
public final static int MQXCC_OK

MQXCC_SUPPRESS_FUNCTION
public final static int MQXCC_SUPPRESS_FUNCTION

MQXCC_SEND_AND_REQUEST_SEC_MSG
public final static int MQXCC_SEND_AND_REQUEST_SEC_MSG

MQXCC_SEND_SEC_MSG
public final static int MQXCC_SEND_SEC_MSG

MQXCC_SUPPRESS_EXIT
public final static int MQXCC_SUPPRESS_EXIT

MQXR_INIT
public final static int MQXR_INIT

MQXR_INIT_SEC
public final static int MQXR_INIT_SEC

MQXR_SEC_MSG
public final static int MQXR_SEC_MSG

MQXR_TERM
public final static int MQXR_TERM

MQXR_XMIT
public final static int MQXR_XMIT

MQXT_CHANNEL_SEC_EXIT
public final static int MQXT_CHANNEL_SEC_EXIT

MQXT_CHANNEL_SEND_EXIT
public final static int MQXT_CHANNEL_SEND_EXIT

MQXT_CHANNEL_RCV_EXIT
public final static int MQXT_CHANNEL_RCV_EXIT

capabilityFlags
public static final int capabilityFlags

Indicates the capability of the queue manager.

Only the MQC.MQCF_DIST_LISTS flag is supported.

exitID `public int exitID`

The type of exit that has been invoked. For an MQSecurityExit this is always MQXT_CHANNEL_SEC_EXIT; for an MQSendExit this is always MQXT_CHANNEL_SEND_EXIT; for an MQReceiveExit this is always MQXT_CHANNEL_RCV_EXIT.

exitReason
`public int exitReason`

The reason for invoking the exit. Possible values are:

MQXR_INIT
Exit initialization; called after the channel connection conditions have been negotiated, but before any security flows have been sent.

MQXR_INIT_SEC
Indicates that the exit is to initiate the security dialog with the queue manager.

MQXR_SEC_MSG
Indicates to the security exit that a security message has been received from the queue manager.

MQXR_TERM
Exit termination; called after the disconnect flows have been sent but before the socket connection is destroyed.

MQXR_XMIT
For a send exit, indicates that data is to be transmitted to the queue manager.

For a receive exit, indicates that data has been received from the queue manager.

exitResponse
`public int exitResponse`

Set by the exit to indicate the action that WebSphere MQ classes for Java should take next. Valid values are:

MQXCC_CLOSE_CHANNEL
Set by any exit to indicate that the connection to the queue manager should be closed.

MQXCC_OK
Set by the security exit to indicate that security exchanges are complete.

Set by send exit to indicate that the returned data is to be transmitted to the queue manager.

Set by the receive exit to indicate that the returned data is available for processing by the WebSphere MQ Client for Java.

MQXCC_SEND_AND_REQUEST_SEC_MSG
Set by the security exit to indicate that the returned data is to be transmitted to the queue manager, and that a response is expected from the queue manager.

MQXCC_SEND_SEC_MSG
Set by the security exit to indicate that the returned data is to be transmitted to the queue manager, and that no response is expected.

MQXCC_SUPPRESS_EXIT
Set by any exit to indicate that it should no longer be called.

MQXCC_SUPPRESS_FUNCTION
Set by the security exit to indicate that communications with the queue manager should be shut down.

exitUserArea
```
public byte exitUserArea[]
```

A storage area available for the exit to use.

Any data placed in the exitUserArea is preserved by the WebSphere MQ Client for Java across exit invocations with the same exitID. (That is, the send, receive, and security exits each have their own, independent, user areas.)

fapLevel
```
public static final int fapLevel
```

The negotiated Format and Protocol (FAP) level.

maxSegmentLength
```
public int maxSegmentLength
```

The maximum length for any one transmission to a queue manager.

If the exit returns data that is to be sent to the queue manager, the length of the returned data must not exceed this value.

Constructors

MQChannelExit
```
public MQChannelExit()
```

MQDistributionList

```
java.lang.Object
   |
   +-- com.ibm.mq.MQManagedObject
          |
          +-- com.ibm.mq.MQDistributionList
```

public class **MQDistributionList**
extends **MQManagedObject** (See page 123.)

Create an MQDistributionList using the MQDistributionList constructor or the accessDistributionList method for MQQueueManager.

A distribution list represents a set of open queues to which messages can be sent using a single call to the put() method. (See "Distribution lists" in the *WebSphere MQ Application Programming Guide*.)

Constructors

MQDistributionList

```
public MQDistributionList(MQQueueManager qMgr,
              MQDistributionListItem[] litems,
              int openOptions,
              String alternateUserId)
                        throws MQException
```

`qMgr` is the queue manager where the list is to be opened.

`litems` are the items to be included in the distribution list.

See "accessDistributionList" on page 166 for details of the remaining parameters.

Methods

getFirstDistributionListItem

```
public MQDistributionListItem getFirstDistributionListItem()
```

Returns the first item in the distribution list, or *null* if the list is empty.

getInvalidDestinationCount

```
public int getInvalidDestinationCount()
```

Returns the number of items in the distribution list that failed to open successfully.

getValidDestinationCount

```
public int getValidDestinationCount()
```

Returns the number of items in the distribution list that were opened successfully.

put

```
public synchronized void put(MQMessage message,
             MQPutMessageOptions putMessageOptions )
                          throws MQException
```

Puts a message to the queues on the distribution list.

Parameters

message
An input/output parameter containing the message descriptor information and the returned message data.

putMessageOptions
Options that control the action of MQPUT. (See "MQPutMessageOptions" on page 152 for details.)

Throws MQException if the put fails.

MQDistributionListItem

```
java.lang.Object
   |
   +-- com.ibm.mq.MQMessageTracker
          |
          +-- com.ibm.mq.MQDistributionListItem
```

public class **MQDistributionListItem**
extends **MQMessageTracker** (See page 144.)

An MQDistributionListItem represents a single item (queue) within a distribution list.

Variables

completionCode
`public int completionCode`

The completion code resulting from the last operation on this item. If this was the construction of an MQDistributionList, the completion code relates to the opening of the queue. If it was a put operation, the completion code relates to the attempt to put a message onto this queue.

The initial value is 0.

queueManagerName
`public String queueManagerName`

The name of the queue manager on which the queue is defined.

The initial value is "".

queueName
`public String queueName`

The name of a queue you want to use with a distribution list. This cannot be the name of a model queue.

The initial value is "".

reasonCode
`public int reasonCode`

The reason code resulting from the last operation on this item. If this was the construction of an MQDistributionList, the reason code relates to the opening of the queue. If it was a put operation, the reason code relates to the attempt to put a message onto this queue.

The initial value is 0.

Constructors

MQDistributionListItem
`public MQDistributionListItem()`

Construct a new MQDistributionListItem object.

MQEnvironment

```
java.lang.Object
   |
   +-- com.ibm.mq.MQEnvironment
```

public class **MQEnvironment**
extends **Object**

Note: All the methods and attributes of this class apply to the WebSphere MQ classes for Java client connections, but only enableTracing, disableTracing, properties, and version_notice apply to bindings connections.

MQEnvironment contains static member variables that control the environment in which an MQQueueManager object (and its corresponding connection to WebSphere MQ) is constructed.

Values set in the MQEnvironment class take effect when the MQQueueManager constructor is called, so set the values in the MQEnvironment class before you construct an MQQueueManager instance.

Variables

Note: Variables marked with * do not apply when connecting directly to WebSphere MQ in bindings mode.

CCSID*

```
public static int CCSID
```

The CCSID used by the client.

Changing this value affects the way that the queue manager you connect to translates information in the WebSphere MQ headers. All data in WebSphere MQ headers is drawn from the invariant part of the ASCII codeset, except for the data in the applicationIdData and the putApplicationName fields of the MQMessage class. (See "MQMessage" on page 126.)

If you avoid using characters from the variant part of the ASCII codeset for these two fields, you are then safe to change the CCSID from 819 to any other ASCII codeset.

If you change the client's CCSID to be the same as that of the queue manager to which you are connecting, you gain a performance benefit at the queue manager because it does not attempt to translate the message headers.

The default value is 819.

channel*

```
public static String channel
```

The name of the channel to connect to on the target queue manager. You *must* set this member variable, or the corresponding property, before constructing an MQQueueManager instance for use in client mode.

hostname*

```
public static String hostname
```

The TCP/IP hostname of the machine on which the WebSphere MQ server resides. If the hostname is not set, and no overriding properties are set, bindings mode is used to connect to the local queue manager.

localAddressSetting*

```
public static String localAddressSetting
```

The local address, including a range of ports, that is used when connecting to a WebSphere MQ queue manager through a firewall. The format of a local address is [*ip-addr*][(*low-port*[,*high-port*])]. Here are some examples:

9.20.4.98
: The channel binds to address 9.20.4.98 locally

9.20.4.98(1000)
: The channel binds to address 9.20.4.98 locally and uses port 1000

9.20.4.98(1000,2000)
: The channel binds to address 9.20.4.98 locally and uses a port in the range 1000 to 2000

(1000) The channel binds to port 1000 locally

(1000,2000)
: The channel binds to a port in the range 1000 to 2000 locally

You can specify a host name instead of an IP address. The variable is initialized from a system property called com.ibm.mq.localAddress when you start the JVM. The default value is null.

password*

```
public static String password
```

Equivalent to the WebSphere MQ environment variable MQ_PASSWORD.

If a security exit is not defined for this client, the value of password is transmitted to the server and is available to the server security exit when it is invoked. Use the value to verify the identity of the WebSphere MQ client.

The default value is "".

port* `public static int port`

The port to connect to. This is the port on which the WebSphere MQ server is listening for incoming connection requests. The default value is 1414.

properties

```
public static java.util.Hashtable properties
```

A set of key/value pairs defining the WebSphere MQ environment.

This hash table allows you to set environment properties as key/value pairs rather than as individual variables.

The properties can also be passed as a Hashtable in a parameter on the MQQueueManager constructor. Properties passed on the constructor take precedence over values set with this properties variable, but they are otherwise interchangeable. The order of precedence of finding properties is:

1. `properties` parameter on MQQueueManager constructor
2. MQEnvironment.properties
3. Other MQEnvironment variables

4. Constant default values

The possible key/value pairs are shown in the following table:

Key	Value
MQC.CCSID_PROPERTY	Integer (overrides MQEnvironment.CCSID)
MQC.CHANNEL_PROPERTY	String (overrides MQEnvironment.channel)
MQC.CONNECT_OPTIONS_PROPERTY	Integer, defaults to MQC.MQCNO_NONE
MQC.HOST_NAME_PROPERTY	String (overrides MQEnvironment.hostname)
MQC.LOCAL_ADDRESS_PROPERTY	String (overrides MQEnvironment.localAddressSetting)
MQC.ORB_PROPERTY	org.omg.CORBA.ORB (optional)
MQC.PASSWORD_PROPERTY	String (overrides MQEnvironment.password)
MQC.PORT_PROPERTY	Integer (overrides MQEnvironment.port)
MQC.RECEIVE_EXIT_PROPERTY	MQReceiveExit (overrides MQEnvironment.receiveExit)
MQC.SECURITY_EXIT_PROPERTY	MQSecurityExit (overrides MQEnvironment.securityExit)
MQC.SEND_EXIT_PROPERTY	MQSendExit (overrides MQEnvironment.sendExit)
MQC.SSL_CERT_STORE_PROPERTY	java.util.Collection, or java.security.cert.CertStore (overrides MQEnvironment.sslCertStores)
MQC.SSL_CIPHER_SUITE_PROPERTY	String (overrides MQEnvironment.sslCipherSuite)
MQC.SSL_PEER_NAME_PROPERTY	String (overrides MQEnvironment.sslPeerName)
MQC.SSL_SOCKET_FACTORY_PROPERTY	javax.net.ssl.SSLSocketFactory (overrides MQEnvironment.sslSocketFactory)
MQC.TRANSPORT_PROPERTY	MQC.TRANSPORT_MQSERIES_BINDINGS or MQC.TRANSPORT_MQSERIES_CLIENT or MQC.TRANSPORT_MQSERIES (the default, which selects bindings or client, based on the value of hostname.)
MQC.USER_ID_PROPERTY	String (overrides MQEnvironment.userID.)

receiveExit*

```
public static MQReceiveExit receiveExit
```

A receive exit allows you to examine, and possibly alter, data received from a queue manager. It is normally used in conjunction with a corresponding send exit at the queue manager.

To provide your own receive exit, define a class that implements the MQReceiveExit interface, and assign receiveExit to an instance of that class. Otherwise, you can leave receiveExit set to null, in which case no receive exit is called.

See also “MQReceiveExit” on page 182.

securityExit*

```
public static MQSecurityExit securityExit
```

A security exit allows you to customize the security flows that occur when an attempt is made to connect to a queue manager.

To provide your own security exit, define a class that implements the MQSecurityExit interface, and assign securityExit to an instance of that class. Otherwise, you can leave securityExit set to null, in which case no security exit is called.

See also "MQSecurityExit" on page 184.

sendExit*

```
public static MQSendExit sendExit
```

A send exit allows you to examine, and possibly alter, the data sent to a queue manager. It is normally used in conjunction with a corresponding receive exit at the queue manager.

To provide your own send exit, define a class that implements the MQSendExit interface, and assign sendExit to an instance of that class. Otherwise, you can leave sendExit set to null, in which case no send exit is called.

See also "MQSendExit" on page 186.

sslCertStores*

```
public static java.util.Collection sslCertStores
```

A Collection of CertStore objects used for certificate revocation checking. Use of this variable requires a JVM at Java 2 v1.4 or later. If sslCipherSuite is set, this variable can be used to ensure that the queue manager's certificate has not become revoked. Each CertStore in the Collection represents an identical copy of the certificate revocation list (CRL). For more information on the behaviour of sslCertStores, refer to "Using certificate revocation lists" on page 91. If set to null (default), the certificate presented by the queue manager is not checked against any certificate revocation list. This variable is ignored if sslCipherSuite is null.

sslCipherSuite*

```
public static String sslCipherSuite
```

If set, SSL is enabled for the connection. Set the sslCipherSuite to the CipherSuite name matching the CipherSpec set on the SVRCONN channel. If set to null (default), no SSL encryption is performed.

sslPeerName*

```
public static String sslPeerName
```

A distinguished name pattern. If sslCipherSuite is set, this variable can be used to ensure the correct queue manager is used. For a description of the format for this value, see "Using the distinguished name of the queue manager" on page 90. If set to null (default), no checking of the queue manager's DN is performed. This variable is ignored if sslCipherSuite is null.

sslSocketFactory*

```
public static javax.net.ssl.SSLSocketFactory sslSocketFactory
```

The factory to use when connecting with SSL encryption. If sslCipherSuite is set, this variable can be used to customize all aspects of the SSL connection. For more information on constructing and customizing SSLSocketFactory instances, refer to your JSSE provider; for information regarding the use of this variable, refer to “Supplying a customized SSLSocketFactory” on page 92. If set to null (default) and SSL encryption is requested, the default SSLSocketFactory is used. This variable is ignored if sslCipherSuite is null.

userID*

```
public static String userID
```

Equivalent to the WebSphere MQ environment variable MQ_USER_ID.

If a security exit is not defined for this client, the value of userID is transmitted to the server and is available to the server security exit when it is invoked. Use the value to verify the identity of the WebSphere MQ client.

The default value is "".

version_notice

```
public final static String version_notice
```

The current version of WebSphere MQ classes for Java.

Constructors

MQEnvironment

```
public MQEnvironment()
```

Methods

addConnectionPoolToken

```
public static void addConnectionPoolToken(MQPoolToken token)
```

Adds the supplied MQPoolToken to the set of tokens. A default ConnectionManager can use this as a hint; typically, it is enabled only while there is at least one token in the set.

Parameters:

token The MQPoolToken to add to the set of tokens.

addConnectionPoolToken

```
public static MQPoolToken addConnectionPoolToken()
```

Constructs an MQPoolToken and adds it to the set of tokens. The MQPoolToken is returned to the application to be passed later into removeConnectionPoolToken().

disableTracing

```
public static void disableTracing()
```

Turns off the WebSphere MQ Client for Java trace facility.

enableTracing

```
public static void enableTracing(int level)
```

Turns on the WebSphere MQ Client for Java trace facility.

Parameters

level The level of tracing required, from 1 to 5 (5 being the most detailed).

enableTracing

```
public static void enableTracing(int level,
                                 OutputStream stream)
```

Turns on the WebSphere MQ Client for Java trace facility.

Parameters:

level The level of tracing required, from 1 to 5 (5 being the most detailed).

stream The stream to which the trace is written.

getDefaultConnectionManager

```
public static javax.resource.spi.ConnectionManager
                                getDefaultConnectionManager()
```

Returns the default ConnectionManager. If the default ConnectionManager is actually an MQConnectionManager, returns null.

getVersionNotice()

```
public static final String getVersionNotice()
```

Returns the current version of the WebSphere MQ base Java.

removeConnectionPoolToken

```
public static void removeConnectionPoolToken(MQPoolToken token)
```

Removes the specified MQPoolToken from the set of tokens. If that MQPoolToken is not in the set, there is no action.

Parameters:

token The MQPoolToken to remove from the set of tokens.

setDefaultConnectionManager

```
public static void setDefaultConnectionManager(
                                      MQConnectionManager cxManager)
```

Sets the supplied MQConnectionManager to be the default ConnectionManager. The default ConnectionManager is used when there is no ConnectionManager specified on the MQQueueManager constructor. This method also empties the set of MQPoolTokens.

Parameters:

cxManager
The MQConnectionManager to be the default ConnectionManager.

setDefaultConnectionManager

```
public static void setDefaultConnectionManager
                    (javax.resource.spi.ConnectionManager cxManager)
```

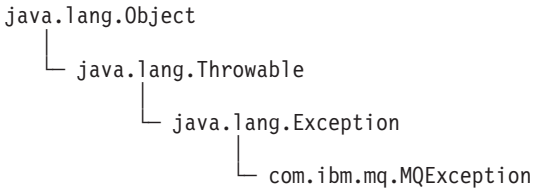
Sets the default ConnectionManager, and empties the set of MQPoolTokens. The default ConnectionManager is used when there is no ConnectionManager specified on the MQQueueManager constructor.

This method requires a JVM at Java 2 v1.3 or later, with JAAS 1.0 or later installed.

Parameters:

cxManager
The default ConnectionManager (which implements the javax.resource.spi.ConnectionManager interface).

MQException



public class **MQException**
extends **Exception**

An MQException is thrown whenever a WebSphere MQ error occurs. You can change the output stream for the exceptions that are logged by setting the value of MQException.log. The default value is System.err. This class contains definitions of completion code and error code constants. Constants beginning MQCC_ are WebSphere MQ completion codes, and constants beginning MQRC_ are WebSphere MQ reason codes. The *WebSphere MQ Application Programming Reference* contains a full description of these errors and their probable causes.

Variables

completionCode

```
public int completionCode
```

WebSphere MQ completion code giving rise to the error. The possible values are:

- MQException.MQCC_WARNING
- MQException.MQCC_FAILED

exceptionSource

```
public Object exceptionSource
```

The object instance that threw the exception. You can use this as part of your diagnostics when determining the cause of an error.

log `public static` **`java.io.outputStreamWriter`** `log`

Stream to which exceptions are logged. (The default is System.err.) If you set this to null, no logging occurs.

reasonCode

```
public int reasonCode
```

WebSphere MQ reason code describing the error. For a full explanation of the reason codes, refer to the *WebSphere MQ Application Programming Reference*.

Constructors

MQException

```
public MQException(int completionCode,
                   int reasonCode,
                   Object source)
```

Construct a new MQException object.

Parameters

completionCode
The WebSphere MQ completion code.

reasonCode
The WebSphere MQ reason code.

source The object in which the error occurred.

Methods

getCause

```
public Throwable getCause()
```

Returns the cause of this MQException, or null if the cause is nonexistent or unknown. Note that this method is available on MQException even under JVMs before Java 2 v1.4.

initCause

```
public Throwable initCause(Throwable cause)
```

Initializes the cause of this MQException to the specified value. Throws IllegalArgumentException if the cause is this MQException or IllegalStateException if the cause has already been set. Returns this MQException. Note that this method is available on MQException even under JVMs before Java 2 v1.4. Applications do not normally use this method.

MQGetMessageOptions

```
java.lang.Object
   |
   +-- com.ibm.mq.MQGetMessageOptions
```

public class **MQGetMessageOptions**
extends **Object**

This class contains options that control the behavior of MQQueue.get().

Note: The behavior of some of the options available in this class depends on the environment in which they are used. These elements are marked with a *. See Chapter 8, "Environment-dependent behavior," on page 95 for details.

Variables

groupStatus*

```
public char groupStatus
```

This is an output field that indicates whether the retrieved message is in a group, and if it is, whether it is the last in the group. Possible values are:

MQC.MQGS_LAST_MSG_IN_GROUP
Message is the last in the group. This is also the value returned if the group consists of only one message.

MQC.MQGS_MSG_IN_GROUP
Message is in a group, but is not the last in the group.

MQC.MQGS_NOT_IN_GROUP
Message is not in a group.

matchOptions*

```
public int matchOptions
```

Selection criteria that determine which message is retrieved. The following match options can be set:

MQC.MQMO_MATCH_CORREL_ID
Correlation id to be matched.

MQC.MQMO_MATCH_GROUP_ID
Group id to be matched.

MQC.MQMO_MATCH_MSG_ID
Message id to be matched.

MQC.MQMO_MATCH_MSG_SEQ_NUMBER
Match message sequence number.

MQC.MQMO_NONE
No matching required.

options

```
public int options
```

Options that control the action of MQQueue.get. Any or none of the following values can be specified. If more than one option is required, the values can be added together or combined using the bitwise OR operator.

MQC.MQGMO_ACCEPT_TRUNCATED_MSG
Allow truncation of message data.

MQC.MQGMO_BROWSE_FIRST
Browse from start of queue.

MQC.MQGMO_BROWSE_MSG_UNDER_CURSOR*
Browse message under browse cursor.

MQC.MQGMO_BROWSE_NEXT
Browse from the current position in the queue.

MQC.MQGMO_CONVERT
Request the application data to be converted, to conform to the characterSet and encoding attributes of the MQMessage, before the data is copied into the message buffer. Because data conversion is also applied as the data is retrieved from the message buffer, applications do not usually set this option.

Using this option can cause problems when converting from single byte character sets to double byte character sets. Instead, do the conversion using the readString, readLine, and writeString methods after the message has been delivered.

MQC.MQGMO_FAIL_IF_QUIESCING
Fail if the queue manager is quiescing.

MQC.MQGMO_LOCK*
Lock the message that is browsed.

MQC.MQGMO_MARK_SKIP_BACKOUT*
Allow a unit of work to be backed out without reinstating the message on the queue.

MQC.MQGMO_MSG_UNDER_CURSOR
Get message under browse cursor.

MQC.MQGMO_NONE
No other options have been specified; all options assume their default values.

MQC.MQGMO_NO_SYNCPOINT
Get message without syncpoint control.

MQC.MQGMO_NO_WAIT
Return immediately if there is no suitable message.

MQC.MQGMO_SYNCPOINT
Get the message under syncpoint control; the message is marked as being unavailable to other applications, but it is deleted from the queue only when the unit of work is committed. The message is made available again if the unit of work is backed out.

MQC.MQGMO_SYNCPOINT_IF_PERSISTENT*
Get message with syncpoint control if message is persistent.

MQC.MQGMO_UNLOCK*
Unlock a previously locked message.

MQC.MQGMO_WAIT
Wait for a message to arrive.

Segmenting and grouping WebSphere MQ messages can be sent or received as a single entity, can be split into several segments for sending and receiving, and can also be linked to other messages in a group.

Each piece of data that is sent is known as a *physical* message, which can be a complete *logical* message, or a segment of a longer logical message.

Each physical message usually has a different `MsgId`. All the segments of a single logical message have the same `groupId` value and `MsgSeqNumber` value, but the `Offset` value is different for each segment. The `Offset` field gives the offset of the data in the physical message from the start of the logical message. The segments usually have different `MsgId` values, because they are individual physical messages.

Logical messages that form part of a group have the same `groupId` value, but each message in the group has a different `MsgSeqNumber` value. Messages in a group can also be segmented.

The following options can be used for dealing with segmented or grouped messages:

MQC.MQGMO_ALL_MSGS_AVAILABLE*
Retrieve messages from a group only when all the messages in the group are available.

MQC.MQGMO_ALL_SEGMENTS_AVAILABLE*
Retrieve the segments of a logical message only when all the segments in the group are available.

MQC.MQGMO_COMPLETE_MSG*
Retrieve only complete logical messages.

MQC.MQGMO_LOGICAL_ORDER*
Return messages in groups, and segments of logical messages, in logical order.

resolvedQueueName

```
public String resolvedQueueName
```

This is an output field that the queue manager sets to the local name of the queue from which the message was retrieved. This is different from the name used to open the queue if an alias queue or model queue was opened.

segmentation*

```
public char segmentation
```

This is an output field that indicates whether or not segmentation is allowed for the retrieved message. Possible values are:

MQC.MQSEG_INHIBITED
Segmentation not allowed.

MQC.MQSEG_ALLOWED
Segmentation allowed.

segmentStatus*

```
public char segmentStatus
```

This is an output field that indicates whether the retrieved message is a segment of a logical message. If the message is a segment, the flag indicates whether or not it is the last segment. Possible values are:

MQC.MQSS_LAST_SEGMENT
Message is the last segment of the logical message. This is also the value returned if the logical message consists of only one segment.

MQC.MQSS_NOT_A_SEGMENT
Message is not a segment.

MQC.MQSS_SEGMENT
Message is a segment, but is not the last segment of the logical message.

waitInterval
```
public int waitInterval
```

The maximum time (in milliseconds) that an MQQueue.get call waits for a suitable message to arrive (used in conjunction with MQC.MQGMO_WAIT). A value of MQC.MQWI_UNLIMITED indicates that an unlimited wait is required.

Constructors

MQGetMessageOptions
```
public MQGetMessageOptions()
```

Construct a new MQGetMessageOptions object with options set to MQC.MQGMO_NO_WAIT, a wait interval of zero, and a blank resolved queue name.

MQManagedObject

```
java.lang.Object
   |
   +-- com.ibm.mq.MQManagedObject
```

public class **MQManagedObject**
extends **Object**

MQManagedObject is a superclass for MQQueueManager, MQQueue, and MQProcess. It provides the ability to inquire and set attributes of these resources.

Variables

alternateUserId
`public String alternateUserId`

The alternate user ID (if any) specified when this resource was opened. Setting this attribute has no effect.

closeOptions
`public int closeOptions`

Set this attribute to control the way the resource is closed. The default value is MQC.MQCO_NONE, and this is the only permissible value for all resources other than permanent dynamic queues, and temporary dynamic queues that are being accessed by the objects that created them. For these queues, the following additional values are permissible:

MQC.MQCO_DELETE
Delete the queue if there are no messages.

MQC.MQCO_DELETE_PURGE
Delete the queue, purging any messages on it.

connectionReference
`public  MQQueueManager connectionReference`

The queue manager to which this resource belongs. Setting this attribute has no effect.

isOpen
`public boolean isOpen`

Indicates whether this resource is currently open. This attribute is *deprecated* and setting it has no effect.

name `public String name`

The name of this resource (either the name supplied on the access method, or the name allocated by the queue manager for a dynamic queue). Setting this attribute has no effect.

openOptions
`public int openOptions`

The options specified when this resource was opened. Setting this attribute has no effect.

Constructors

MQManagedObject

```
protected MQManagedObject()
```

Constructor method.

Methods

close

```
public synchronized void close()
```

Throws MQException.

Closes the object. No further operations against this resource are permitted after this method has been called. To change the behavior of the close method, set the closeOptions attribute.

Throws MQException if the WebSphere MQ call fails.

getDescription

```
public String getDescription()
```

Throws MQException.

Returns the description of this resource as held at the queue manager.

If this method is called after the resource has been closed, an MQException is thrown.

inquire

```
public void inquire(int selectors[],
                    int intAttrs[],
                    byte charAttrs[])
```

Throws MQException.

Returns an array of integers and a set of character strings containing the attributes of an object (queue, process, or queue manager).

The attributes to be queried are specified in the selectors array. Refer to the *WebSphere MQ Application Programming Reference* for details of the permissible selectors and their corresponding integer values.

Many of the more common attributes can be queried using the getXXX() methods defined in MQManagedObject, MQQueue, MQQueueManager, and MQProcess.

Parameters

selectors
Integer array identifying the attributes with values to be inquired on.

intAttrs
The array in which the integer attribute values are returned. Integer attribute values are returned in the same order as the integer attribute selectors in the selectors array.

charAttrs
The buffer in which the character attributes are returned, concatenated. Character attributes are returned in the same order as the character attribute selectors in the selectors array. The length of each attribute string is fixed for each attribute.

Throws MQException if the inquire fails.

isOpen

```
public boolean isOpen()
```

Returns the value of the `isOpen` variable.

set

```
public synchronized void set(int selectors[],
                             int intAttrs[],
                             byte charAttrs[])
```

Throws MQException.

Sets the attributes defined in the selector's vector.

The attributes to be set are specified in the selectors array. Refer to the *WebSphere MQ Application Programming Reference* for details of the permissible selectors and their corresponding integer values.

Some queue attributes can be set using the setXXX() methods defined in MQQueue.

Parameters

selectors
Integer array identifying the attributes with values to be set.

intAttrs
The array of integer attribute values to be set. These values must be in the same order as the integer attribute selectors in the selectors array.

charAttrs
The buffer in which the character attributes to be set are concatenated. These values must be in the same order as the character attribute selectors in the selectors array. The length of each character attribute is fixed.

Throws MQException if the set fails.

MQMessage

```
java.lang.Object
   |
   └ com.ibm.mq.MQMessage
```

public class **MQMessage**
implements **DataInput**, **DataOutput**

MQMessage represents both the message descriptor and the data for a WebSphere MQ message. There is group of readXXX methods for reading data from a message, and a group of writeXXX methods for writing data into a message. The format of numbers and strings used by these read and write methods can be controlled by the encoding and characterSet member variables. The remaining member variables contain control information that accompanies the application message data when a message travels between sending and receiving applications. The application can set values into the member variable before putting a message to a queue and can read values after retrieving a message from a queue.

Variables

accountingToken

```
public byte accountingToken[]
```

Part of the identity context of the message; it allows an application to charge for work done as a result of the message.

The default value is MQC.MQACT_NONE.

applicationIdData

```
public String applicationIdData
```

Part of the identity context of the message; it is information that is defined by the application suite, and can be used to provide additional information about the message or its originator.

The default value is "".

applicationOriginData

```
public String applicationOriginData
```

Information defined by the application that can be used to provide additional information about the origin of the message.

The default value is "".

backoutCount

```
public int backoutCount
```

A count of the number of times the message has previously been returned by an MQQueue.get() call as part of a unit of work, and subsequently backed out.

The default value is zero.

characterSet

```
public int characterSet
```

The coded character set identifier of character data in the application message data. The behavior of the readString, readLine, and writeString methods is altered accordingly.

The default value for this field is MQC.MQCCSI_Q_MGR. If the default value is used, CharacterSet 819 (iso-8859-1/latin/ibm819) is assumed. The character set values you can use depend upon the JVM you use. Table 13 shows coded character set identifiers and the characterSet values to use:

Table 13. Character set identifiers

characterSet	Description
37	ibm037
437	ibm437 / PC Original
500	ibm500
819	iso-8859-1 / latin1 / ibm819
1200	Unicode
1208	UTF-8
273	ibm273
277	ibm277
278	ibm278
280	ibm280
284	ibm284
285	ibm285
297	ibm297
420	ibm420
424	ibm424
737	ibm737 / PC Greek
775	ibm775 / PC Baltic
813	iso-8859-7 / greek / ibm813
838	ibm838
850	ibm850 / PC Latin 1
852	ibm852 / PC Latin 2
855	ibm855 / PC Cyrillic
856	ibm856
857	ibm857 / PC Turkish
860	ibm860 / PC Portuguese
861	ibm861 / PC Icelandic
862	ibm862 / PC Hebrew
863	ibm863 / PC Canadian French
864	ibm864 / PC Arabic
865	ibm865 / PC Nordic
866	ibm866 / PC Russian
868	ibm868
869	ibm869 / PC Modern Greek
870	ibm870
871	ibm871
874	ibm874
875	ibm875
912	iso-8859-2 / latin2 / ibm912
913	iso-8859-3 / latin3 / ibm913
914	iso-8859-4 / latin4 / ibm914
915	iso-8859-5 / cyrillic / ibm915
916	iso-8859-8 / hebrew / ibm916
918	ibm918
920	iso-8859-9 / latin5 / ibm920
921	ibm921
922	ibm922
930	ibm930
932	PC Japanese

Table 13. Character set identifiers (continued)

characterSet	Description
933	ibm933
935	ibm935
937	ibm937
939	ibm939
942	ibm942
948	ibm948
949	ibm949
950	ibm950 / Big 5 Traditional Chinese
954	EUCJIS
964	ibm964 / CNS 11643 Traditional Chinese
970	ibm970
1006	ibm1006
1025	ibm1025
1026	ibm1026
1089	iso-8859-6 / arabic / ibm1089
1097	ibm1097
1098	ibm1098
1112	ibm1112
1122	ibm1122
1123	ibm1123
1124	ibm1124
1250	Windows Latin 2
1251	Windows Cyrillic
1252	Windows Latin 1
1253	Windows Greek
1254	Windows Turkish
1255	Windows Hebrew
1256	Windows Arabic
1257	Windows Baltic
1258	Windows Vietnamese
1381	ibm1381
1383	ibm1383
2022	JIS
5601	ksc-5601 Korean
33722	ibm33722

correlationId

```
public byte correlationId[]
```

For an MQQueue.get() call, the correlation identifier of the message to be retrieved. Normally the queue manager returns the first message with a message identifier and correlation identifier that match those specified. The special value MQC.MQCI_NONE allows *any* correlation identifier to match.

For an MQQueue.put() call, this specifies the correlation identifier to use.

The default value is MQC.MQCI_NONE.

encoding

```
public int encoding
```

The representation used for numeric values in the application message data; this applies to binary, packed decimal, and floating point data. The behavior of the read and write methods for these numeric formats is altered accordingly.

The following encodings are defined for binary integers:

MQC.MQENC_INTEGER_NORMAL
Big-endian integers, as in Java

MQC.MQENC_INTEGER_REVERSED
Little-endian integers, as used by PCs.

The following encodings are defined for packed-decimal integers:

MQC.MQENC_DECIMAL_NORMAL
Big-endian packed-decimal, as used by z/OS.

MQC.MQENC_DECIMAL_REVERSED
Little-endian packed-decimal.

The following encodings are defined for floating-point numbers:

MQC.MQENC_FLOAT_IEEE_NORMAL
Big-endian IEEE floats, as in Java.

MQC.MQENC_FLOAT_IEEE_REVERSED
Little-endian IEEE floats, as used by PCs.

MQC.MQENC_FLOAT_S390
z/OS format floating points.

Construct a value for the encoding field by adding together one value from each of these three sections (or using the bitwise OR operator). The default value is:

```
MQC.MQENC_INTEGER_NORMAL |
MQC.MQENC_DECIMAL_NORMAL |
MQC.MQENC_FLOAT_IEEE_NORMAL
```

For convenience, this value is also represented by MQC.MQENC_NATIVE. This setting causes writeInt() to write a big-endian integer, and readInt() to read a big-endian integer. If you set the flag MQC.MQENC_INTEGER_REVERSED flag instead, writeInt() writes a little-endian integer, and readInt() reads a little-endian integer.

A loss in precision can occur when converting from IEEE format floating points to zSeries® format floating points.

expiry `public int expiry`

An expiry time expressed in tenths of a second, set by the application that puts the message. After a message's expiry time has elapsed, it is eligible to be discarded by the queue manager. If the message specified one of the MQC.MQRO_EXPIRATION flags, a report is generated when the message is discarded.

The default value is MQC.MQEI_UNLIMITED, meaning that the message never expires.

feedback
`public int feedback`

Used with a message of type MQC.MQMT_REPORT to indicate the nature of the report. The following feedback codes are defined by the system:
- MQC.MQFB_EXPIRATION
- MQC.MQFB_COA
- MQC.MQFB_COD
- MQC.MQFB_QUIT
- MQC.MQFB_PAN
- MQC.MQFB_NAN
- MQC.MQFB_DATA_LENGTH_ZERO
- MQC.MQFB_DATA_LENGTH_NEGATIVE
- MQC.MQFB_DATA_LENGTH_TOO_BIG
- MQC.MQFB_BUFFER_OVERFLOW
- MQC.MQFB_LENGTH_OFF_BY_ONE
- MQC.MQFB_IIH_ERROR

Application-defined feedback values in the range MQC.MQFB_APPL_FIRST to MQC.MQFB_APPL_LAST can also be used.

The default value of this field is MQC.MQFB_NONE, indicating that no feedback is provided.

format

```
public String format
```

A format name used by the sender of the message to indicate the nature of the data in the message to the receiver. You can use your own format names, but names beginning with the letters MQ have meanings that are defined by the queue manager. The queue manager built-in formats are:

MQC.MQFMT_ADMIN
Command server request/reply message.

MQC.MQFMT_COMMAND_1
Type 1 command reply message.

MQC.MQFMT_COMMAND_2
Type 2 command reply message.

MQC.MQFMT_DEAD_LETTER_HEADER
Dead-letter header.

MQC.MQFMT_EVENT
Event message.

MQC.MQFMT_NONE
No format name.

MQC.MQFMT_PCF
User-defined message in programmable command format.

MQC.MQFMT_STRING
Message consisting entirely of characters.

MQC.MQFMT_TRIGGER
Trigger message

MQC.MQFMT_XMIT_Q_HEADER
Transmission queue header.

The default value is MQC.MQFMT_NONE.

groupId
```
public byte[] groupId
```
A byte string that identifies the message group to which the physical message belongs.

The default value is MQC.MQGI_NONE.

messageFlags
```
public int messageFlags
```
Flags controlling the segmentation and status of a message.

messageId
```
public byte messageId[]
```
For an MQQueue.get() call, this field specifies the message identifier of the message to be retrieved. Normally, the queue manager returns the first message with a message identifier and correlation identifier that match those specified. The special value MQC.MQMI_NONE allows *any* message identifier to match.

For an MQQueue.put() call, this specifies the message identifier to use. If MQC.MQMI_NONE is specified, the queue manager generates a unique message identifier when the message is put. The value of this member variable is updated after the put, to indicate the message identifier that was used.

The default value is MQC.MQMI_NONE.

messageSequenceNumber
```
public int messageSequenceNumber
```
The sequence number of a logical message within a group.

messageType
```
public int messageType
```
Indicates the type of the message. The following values are currently defined by the system:
- MQC.MQMT_DATAGRAM
- MQC.MQMT_REPLY
- MQC.MQMT_REPORT
- MQC.MQMT_REQUEST

Application-defined values can also be used, in the range MQC.MQMT_APPL_FIRST to MQC.MQMT_APPL_LAST.

The default value of this field is MQC.MQMT_DATAGRAM.

offset `public int offset`

In a segmented message, the offset of data in a physical message from the start of a logical message.

originalLength
```
public int originalLength
```
The original length of a segmented message.

persistence
```
public int persistence
```
Message persistence. The following values are defined:
- MQC.MQPER_NOT_PERSISTENT

- MQC.MQPER_PERSISTENT
- MQC.MQPER_PERSISTENCE_AS_Q_DEF

The default value is MQC.MQPER_PERSISTENCE_AS_Q_DEF, which takes the persistence for the message from the default persistence attribute of the destination queue.

priority

```
public int priority
```

The message priority. The special value MQC.MQPRI_PRIORITY_AS_Q_DEF can also be set in outbound messages, in which case the priority for the message is taken from the default priority attribute of the destination queue.

The default value is MQC.MQPRI_PRIORITY_AS_Q_DEF.

putApplicationName

```
public String putApplicationName
```

The name of the application that put the message. The default value is "".

putApplicationType

```
public int putApplicationType
```

The type of application that put the message. This can be a system-defined or user-defined value. The following values are defined by the system:

- MQC.MQAT_AIX
- MQC.MQAT_CICS
- MQC.MQAT_DOS
- MQC.MQAT_IMS
- MQC.MQAT_MVS
- MQC.MQAT_OS2
- MQC.MQAT_OS400
- MQC.MQAT_QMGR
- MQC.MQAT_UNIX
- MQC.MQAT_WINDOWS
- MQC.MQAT_JAVA

The default value is the special value MQC.MQAT_NO_CONTEXT, which indicates that no context information is present in the message.

putDateTime

```
public GregorianCalendar putDateTime
```

The time and date that the message was put.

replyToQueueManagerName

```
public String replyToQueueManagerName
```

The name of the queue manager to which reply or report messages should be sent.

The default value is "".

If the value is "" on an MQQueue.put() call, the QueueManager fills in the value.

replyToQueueName

```
public String replyToQueueName
```

The name of the message queue to which the application that issued the get request for the message should send MQC.MQMT_REPLY and MQC.MQMT_REPORT messages.

The default value is "".

report `public int report`

A report is a message about another message. This member variable enables the application sending the original message to specify which report messages are required, whether the application message data is to be included in them, and how to set the message and correlation identifiers in the report or reply. Any, all, or none of the following report types can be requested:
- Exception
- Expiration
- Confirm on arrival
- Confirm on delivery

For each type, only one of the three corresponding values below should be specified, depending on whether the application message data is to be included in the report message.

Note: Values marked with ** in the following list are not supported by z/OS™ queue managers; do not use them if your application is likely to access a z/OS queue manager, regardless of the platform on which the application is running.

The valid values are:
- MQC.MQRO_COA
- MQC.MQRO_COA_WITH_DATA
- MQC.MQRO_COA_WITH_FULL_DATA**
- MQC.MQRO_COD
- MQC.MQRO_COD_WITH_DATA
- MQC.MQRO_COD_WITH_FULL_DATA**
- MQC.MQRO_EXCEPTION
- MQC.MQRO_EXCEPTION_WITH_DATA
- MQC.MQRO_EXCEPTION_WITH_FULL_DATA**
- MQC.MQRO_EXPIRATION
- MQC.MQRO_EXPIRATION_WITH_DATA
- MQC.MQRO_EXPIRATION_WITH_FULL_DATA**

You can specify one of the following to control how the message Id is generated for the report or reply message:
- MQC.MQRO_NEW_MSG_ID
- MQC.MQRO_PASS_MSG_ID

You can specify one of the following to control how the correlation Id of the report or reply message is to be set:
- MQC.MQRO_COPY_MSG_ID_TO_CORREL_ID
- MQC.MQRO_PASS_CORREL_ID

You can specify one of the following to control the disposition of the original message when it cannot be delivered to the destination queue:
- MQC.MQRO_DEAD_LETTER_Q
- MQC.MQRO_DISCARD_MSG **

If no report options are specified, the default is:

```
MQC.MQRO_NEW_MSG_ID |
MQC.MQRO_COPY_MSG_ID_TO_CORREL_ID |
MQC.MQRO_DEAD_LETTER_Q
```

You can specify one or both of the following to request that the receiving application sends a positive action or negative action report message.
- MQRO_PAN
- MQRO_NAN

userId `public String userId`

Part of the identity context of the message; it identifies the user that originated this message.

The default value is "".

Constructors

MQMessage

`public MQMessage()`

Creates a new message with default message descriptor information and an empty message buffer.

Methods

clearMessage

`public void clearMessage()`

Throws IOException.

Discards any data in the message buffer and set the data offset back to zero.

getDataLength

`public int getDataLength()`

Throws MQException.

The number of bytes of message data remaining to be read.

getDataOffset

`public int getDataOffset()`

Throws IOException.

Returns the current cursor position within the message data (the point at which read and write operations take effect).

getMessageLength

`public int getMessageLength`

Throws IOException.

The number of bytes of message data in this MQMessage object.

getTotalMessageLength

`public int getTotalMessageLength()`

The total number of bytes in the message as stored on the message queue from which this message was retrieved. When an MQQueue.get() method fails with a message-truncated error code, this method tells you the total size of the message on the queue.

See also "MQQueue.get" on page 156.

getVersion

```
public int getVersion()
```

Returns the version of the structure in use.

readBoolean

```
public boolean readBoolean()
```

Throws IOException.

Reads a (signed) byte from the current position in the message buffer.

readChar

```
public char readChar()
```

Throws IOException, EOFException.

Reads a Unicode character from the current position in the message buffer.

readDecimal2

```
public short readDecimal2()
```

Throws IOException, EOFException.

Reads a 2-byte packed decimal number (-999 to 999). The behavior of this method is controlled by the value of the encoding member variable. A value of MQC.MQENC_DECIMAL_NORMAL reads a big-endian packed decimal number; a value of MQC.MQENC_DECIMAL_REVERSED reads a little-endian packed decimal number.

readDecimal4

```
public int readDecimal4()
```

Throws IOException, EOFException.

Reads a 4-byte packed decimal number (-9999999 to 9999999). The behavior of this method is controlled by the value of the encoding member variable. A value of MQC.MQENC_DECIMAL_NORMAL reads a big-endian packed decimal number; a value of MQC.MQENC_DECIMAL_REVERSED reads a little-endian packed decimal number.

readDecimal8

```
public long readDecimal8()
```

Throws IOException, EOFException.

Reads an 8-byte packed decimal number (-999999999999999 to 999999999999999). The behavior of this method is controlled by the encoding member variable. A value of MQC.MQENC_DECIMAL_NORMAL reads a big-endian packed decimal number; a value of MQC.MQENC_DECIMAL_REVERSED reads a little-endian packed decimal number.

readDouble

```
public double readDouble()
```

Throws IOException, EOFException.

Reads a double from the current position in the message buffer. The value of the encoding member variable determines the behavior of this method.

Values of MQC.MQENC_FLOAT_IEEE_NORMAL and MQC.MQENC_FLOAT_IEEE_REVERSED read IEEE standard doubles in big-endian and little-endian formats respectively.

A value of MQC.MQENC_FLOAT_S390 reads a System/390 format floating point number.

readFloat

```
public float readFloat()
```

Throws IOException, EOFException.

Reads a float from the current position in the message buffer. The value of the encoding member variable determines the behavior of this method.

Values of MQC.MQENC_FLOAT_IEEE_NORMAL and MQC.MQENC_FLOAT_IEEE_REVERSED read IEEE standard floats in big-endian and little-endian formats respectively.

A value of MQC.MQENC_FLOAT_S390 reads a System/390 format floating point number.

readFully

```
public void readFully(byte b[])
```

Throws Exception, EOFException.

Fills the byte array `b` with data from the message buffer.

readFully

```
public void readFully(byte b[],
                      int off,
                      int len)
```

Throws IOException, EOFException.

Fills *len* elements of the byte array b with data from the message buffer, starting at offset *off*.

readInt

```
public int readInt()
```

Throws IOException, EOFException.

Reads an integer from the current position in the message buffer. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_INTEGER_NORMAL reads a big-endian integer; a value of MQC.MQENC_INTEGER_REVERSED reads a little-endian integer.

readInt2

```
public short readInt2()
```

Throws IOException, EOFException.

Synonym for readShort(), provided for cross-language WebSphere MQ API compatibility.

readInt4

```
public int readInt4()
```

Throws IOException, EOFException.

Synonym for readInt(), provided for cross-language WebSphere MQ API compatibility.

readInt8

```
public long readInt8()
```

Throws IOException, EOFException.

Synonym for readLong(), provided for cross-language WebSphere MQ API compatibility.

readLine

```
public String readLine()
```

Throws IOException.

Converts from the codeset identified in the characterSet member variable to Unicode, and then reads in a line that has been terminated by \n, \r, \r\n, or EOF.

readLong

```
public long readLong()
```

Throws IOException, EOFException.

Reads a long from the current position in the message buffer. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_INTEGER_NORMAL reads a big-endian long; a value of MQC.MQENC_INTEGER_REVERSED reads a little-endian long.

readObject

```
public Object readObject()
```

Throws OptionalDataException, ClassNotFoundException, IOException.

Reads an object from the message buffer. The class of the object, the signature of the class, and the value of the non-transient and non-static fields of the class are all read.

readShort

```
public short readShort()
```

Throws IOException, EOFException.

Reads a short from the current position in the message buffer. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_INTEGER_NORMAL reads a big-endian short; a value of MQC.MQENC_INTEGER_REVERSED reads a little-endian short.

readString

```
public String readString(int length)
```

Throws IOException, EOFException.

Reads a string in the codeset identified by the characterSet member variable, and convert it into Unicode.

Parameters:

length The number of characters to read (which may differ from the number of bytes according to the codeset, because some codesets use more than one byte per character).

readUInt2

```
public int readUInt2()
```

Throws IOException, EOFException.

Synonym for readUnsignedShort(), provided for cross-language WebSphere MQ API compatibility.

readUnsignedByte

```
public int readUnsignedByte()
```

Throws IOException, EOFException.

Reads an unsigned byte from the current position in the message buffer.

readUnsignedShort

```
public int readUnsignedShort()
```

Throws IOException, EOFException.

Reads an unsigned short from the current position in the message buffer. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_INTEGER_NORMAL reads a big-endian unsigned short; a value of MQC.MQENC_INTEGER_REVERSED reads a little-endian unsigned short.

readUTF

```
public String readUTF()
```

Throws IOException.

Reads a UTF string, prefixed by a 2-byte length field, from the current position in the message buffer.

resizeBuffer

```
public void resizeBuffer(int size)
```

Throws IOException.

A hint to the MQMessage object about the size of buffer that might be required for subsequent get operations. If the message currently contains message data, and the new size is less than the current size, the message data is truncated.

seek

```
public void seek(int pos)
```

Throws IOException.

Moves the cursor to the absolute position in the message buffer given by *pos*. Subsequent reads and writes act at this position in the buffer.

Throws EOFException if pos is outside the message data length.

setDataOffset

```
public void setDataOffset(int offset)
```

Throws IOException.

Moves the cursor to the absolute position in the message buffer. This method is a synonym for seek(), and is provided for cross-language compatibility with the other WebSphere MQ APIs.

setVersion

```
public void setVersion(int version)
```

Specifies which version of the structure to use. Possible values are:
- MQC.MQMD_VERSION_1
- MQC.MQMD_VERSION_2

You do not need to call this method unless you want to force the client to use a version 1 structure when connected to a queue manager that is capable of handling version 2 structures. In all other situations, the client determines the correct version of the structure to use by querying the queue manager's capabilities.

skipBytes

```
public int skipBytes(int n)
```

Throws IOException, EOFException.

Moves forward `n` bytes in the message buffer.

This method blocks until one of the following occurs:
- All the bytes are skipped
- The end of message buffer is detected
- An exception is thrown

Returns the number of bytes skipped, which is always n.

write

```
public void write(int b)
```

Throws IOException.

Writes a byte into the message buffer at the current position.

write

```
public void write(byte b[])
```

Throws IOException.

Writes an array of bytes into the message buffer at the current position.

write

```
public void write(byte b[],
                  int off,
                  int len)
```

Throws IOException.

Writes a series of bytes into the message buffer at the current position. *len* bytes are written, taken from offset *off* in the array b.

writeBoolean

```
public void writeBoolean(boolean v)
```

Throws IOException.

Writes a boolean into the message buffer at the current position.

writeByte

```
public void writeByte(int v)
```

Throws IOException.

Writes a byte into the message buffer at the current position.

writeBytes

```
public void writeBytes(String s)
```

Throws IOException.

Writes the string to the message buffer as a sequence of bytes. Each character in the string is written in sequence by discarding its high eight bits.

writeChar

```
public void writeChar(int v)
```

Throws IOException.

Writes a Unicode character into the message buffer at the current position.

writeChars

```
public void writeChars(String s)
```

Throws IOException.

Writes a string as a sequence of Unicode characters into the message buffer at the current position.

writeDecimal2

```
public void writeDecimal2(short v)
```

Throws IOException.

Writes a 2-byte packed decimal format number into the message buffer at the current position. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_DECIMAL_NORMAL writes a big-endian packed decimal; a value of MQC.MQENC_DECIMAL_REVERSED writes a little-endian packed decimal.

Parameters

v can be in the range -999 to 999.

writeDecimal4

```
public void writeDecimal4(int v)
```

Throws IOException.

Writes a 4-byte packed decimal format number into the message buffer at the current position. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_DECIMAL_NORMAL writes a big-endian packed decimal; a value of MQC.MQENC_DECIMAL_REVERSED writes a little-endian packed decimal.

Parameters

v can be in the range -9999999 to 9999999.

writeDecimal8

```
public void writeDecimal8(long v)
```

Throws IOException.

Writes an 8-byte packed decimal format number into the message buffer at the current position. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_DECIMAL_NORMAL writes a big-endian packed decimal; a value of MQC.MQENC_DECIMAL_REVERSED writes a little-endian packed decimal.

Parameters:

v can be in the range -999999999999999 to 999999999999999.

writeDouble

```
public void writeDouble(double v)
```

Throws IOException

Writes a double into the message buffer at the current position. The value of the encoding member variable determines the behavior of this method.

Values of MQC.MQENC_FLOAT_IEEE_NORMAL and MQC.MQENC_FLOAT_IEEE_REVERSED write IEEE standard floats in big-endian and little-endian formats respectively.

A value of MQC.MQENC_FLOAT_S390 writes a System/390 format floating point number. Note that the range of IEEE doubles is greater than the range of S/390® double precision floating point numbers, so very large numbers cannot be converted.

writeFloat

```
public void writeFloat(float v)
```

Throws IOException.

Writes a float into the message buffer at the current position. The value of the encoding member variable determines the behavior of this method.

Values of MQC.MQENC_FLOAT_IEEE_NORMAL and MQC.MQENC_FLOAT_IEEE_REVERSED write IEEE standard floats in big-endian and little-endian formats respectively.

A value of MQC.MQENC_FLOAT_S390 writes a System/390 format floating point number.

writeInt

```
public void writeInt(int v)
```

Throws IOException.

Writes an integer into the message buffer at the current position. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_INTEGER_NORMAL writes a big-endian integer; a value of MQC.MQENC_INTEGER_REVERSED writes a little-endian integer.

writeInt2

```
public void writeInt2(int v)
```

Throws IOException.

Synonym for writeShort(), provided for cross-language WebSphere MQ API compatibility.

writeInt4

```
public void writeInt4(int v)
```

Throws IOException.

Synonym for writeInt(), provided for cross-language WebSphere MQ API compatibility.

writeInt8

```
public void writeInt8(long v)
```

Throws IOException.

Synonym for writeLong(), provided for cross-language WebSphere MQ API compatibility.

writeLong

```
public void writeLong(long v)
```

Throws IOException.

Writes a long into the message buffer at the current position. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_INTEGER_NORMAL writes a big-endian long; a value of MQC.MQENC_INTEGER_REVERSED writes a little-endian long.

writeObject

```
public void writeObject(Object obj)
```

Throws IOException.

Writes the specified object to the message buffer. The class of the object, the signature of the class, and the values of the non-transient and non-static fields of the class and all its supertypes are all written.

writeShort

```
public void writeShort(int v)
```

Throws IOException.

Writes a short into the message buffer at the current position. The value of the encoding member variable determines the behavior of this method.

A value of MQC.MQENC_INTEGER_NORMAL writes a big-endian short; a value of MQC.MQENC_INTEGER_REVERSED writes a little-endian short.

writeString

```
public void writeString(String str)
```

Throws IOException.

Writes a string into the message buffer at the current position, converting it to the codeset identified by the characterSet member variable.

writeUTF

```
public void writeUTF(String str)
```

Throws IOException.

Writes a UTF string, prefixed by a 2-byte length field, into the message buffer at the current position.

MQMessageTracker

```
java.lang.Object
   |
   └ com.ibm.mq.MQMessageTracker
```

public abstract class **MQMessageTracker**
extends **Object**

Note: You can use this class only when connected to a WebSphere MQ queue manager.

This class is inherited by MQDistributionListItem (on page 109) where it is used to tailor message parameters for a given destination in a distribution list.

Variables

accountingToken

```
public byte accountingToken[]
```

Part of the identity context of the message. It allows an application to charge for work done as a result of the message.

The default value is MQC.MQACT_NONE.

correlationId

```
public byte correlationId[]
```

The correlation identifier to use when the message is put.

The default value is MQC.MQCI_NONE.

feedback

```
public int feedback
```

Used with a message of type MQC.MQMT_REPORT to indicate the nature of the report. The following feedback codes are defined by the system:

- MQC.MQFB_BUFFER_OVERFLOW
- MQC.MQFB_COA
- MQC.MQFB_COD
- MQC.MQFB_DATA_LENGTH_NEGATIVE
- MQC.MQFB_DATA_LENGTH_TOO_BIG
- MQC.MQFB_DATA_LENGTH_ZERO
- MQC.MQFB_EXPIRATION
- MQC.MQFB_IIH_ERROR
- MQC.MQFB_LENGTH_OFF_BY_ONE
- MQC.MQFB_NAN
- MQC.MQFB_NONE
- MQC.MQFB_PAN
- MQC.MQFB_QUIT

Application-defined feedback values in the range MQC.MQFB_APPL_FIRST to MQC.MQFB_APPL_LAST can also be used.

The default value of this field is MQC.MQFB_NONE, indicating that no feedback is provided.

groupId

```
public byte[] groupId
```

A byte string that identifies the message group to which the physical message belongs.

The default value is MQC.MQGI_NONE.

messageId

```
public byte messageId[]
```

The message identifier to use when the message is put. If MQC.MQMI_NONE is specified, the queue manager generates a unique message identifier when the message is put. The value of this member variable is updated after the put to indicate the message identifier that was used.

The default value is MQC.MQMI_NONE.

MQPoolServices

```
java.lang.Object
   |
   └ com.ibm.mq.MQPoolServices
```

public class **MQPoolServices**
extends **Object**

Note: Normally, applications do not use this class.

The MQPoolServices class can be used by implementations of ConnectionManager that are intended for use as the default ConnectionManager for WebSphere MQ connections.

A ConnectionManager can construct an MQPoolServices object and, through it, register a listener. This listener receives events that relate to the set of MQPoolTokens that MQEnvironment manages. The ConnectionManager can use this information to perform any necessary startup or cleanup work.

See also "MQPoolServicesEvent" on page 147 and "MQPoolServicesEventListener" on page 180.

Constructors

MQPoolServices

```
public MQPoolServices()
```

Construct a new MQPoolServices object.

Methods

addMQPoolServicesEventListener

```
public void addMQPoolServicesEventListener
                              (MQPoolServicesEventListener listener)
```

Adds an MQPoolServicesEventListener. The listener receives an event whenever a token is added or removed from the set of MQPoolTokens that MQEnvironment controls, or whenever the default ConnectionManager changes.

getTokenCount

```
public int getTokenCount()
```

Returns the number of MQPoolTokens that are currently registered with MQEnvironment.

removeMQPoolServicesEventListener

```
public void removeMQPoolServicesEventListener
                                 (MQPoolServicesEventListener listener)
```

Removes an MQPoolServicesEventListener.

MQPoolServicesEvent

```
java.lang.Object
   |
   +-- java.util.EventObject
          |
          +-- com.ibm.mq.MQPoolServicesEvent
```

Note: Normally, applications do not use this class.

An MQPoolServicesEvent is generated whenever an MQPoolToken is added to, or removed from, the set of tokens that MQEnvironment controls. An event is also generated when the default ConnectionManager is changed.

See also "MQPoolServices" on page 146 and "MQPoolServicesEventListener" on page 180.

Variables

DEFAULT_POOL_CHANGED
`public static final int DEFAULT_POOL_CHANGED`

The event ID used when the default ConnectionManager changes.

ID `protected int ID`

The event ID. Valid values are:

TOKEN_ADDED
TOKEN_REMOVED
DEFAULT_POOL_CHANGED

TOKEN_ADDED
`public static final int TOKEN_ADDED`

The event ID used when an MQPoolToken is added to the set.

TOKEN_REMOVED
`public static final int TOKEN_REMOVED`

The event ID used when an MQPoolToken is removed from the set.

token `protected MQPoolToken token`

The token. When the event ID is DEFAULT_POOL_CHANGED, this is null.

Constructors

MQPoolServicesEvent
`public MQPoolServicesEvent(Object source, int eid)`

Constructs an MQPoolServicesEvent based on the event ID.

MQPoolServicesEvent
`public MQPoolServicesEvent(Object source, int eid, MQPoolToken token)`

Constructs an MQPoolServicesEvent based on the event ID and the token.

Methods

getId `public int getId()`

Gets the event ID.

Returns

The event ID, with one of the following values:

DEFAULT_POOL_CHANGED

TOKEN_ADDED

TOKEN_REMOVED

getToken

`public MQPoolToken getToken()`

Returns the token that was added to, or removed from, the set. If the event ID is DEFAULT_POOL_CHANGED, this is null.

MQPoolToken

```
java.lang.Object
   |
   └ com.ibm.mq.MQPoolToken
```

public class **MQPoolToken**
extends **Object**

Use an MQPoolToken to enable the default connection pool. MQPoolTokens are registered with the MQEnvironment class before an application component connects to WebSphere MQ. Later, they are deregistered when the component has finished using WebSphere MQ. Typically, the default ConnectionManager is active while the set of registered MQPoolTokens is not empty.

MQPoolToken provides no methods or variables. ConnectionManager providers can choose to extend MQPoolToken so that hints can be passed to the ConnectionManager.

See "MQEnvironment.addConnectionPoolToken" on page 114 and "MQEnvironment.removeConnectionPoolToken" on page 115.

Constructors

MQPoolToken

```
public MQPoolToken()
```

Construct a new MQPoolToken object.

MQProcess

```
java.lang.Object
   |
   +-- com.ibm.mq.MQManagedObject
          |
          +-- com.ibm.mq.MQProcess
```

public class **MQProcess**
extends **MQManagedObject**. (See page 123.)

MQProcess provides inquire operations for WebSphere MQ processes.

Constructors

MQProcess

```
public MQProcess(MQQueueManager qMgr,
                 String processName,
                 int openOptions,
                 String queueManagerName,
                 String alternateUserId)
          throws MQException
```

Access a process on the queue manager `qMgr`. See `accessProcess` in the "MQQueueManager" on page 163 for details of the remaining parameters.

Methods

close

```
public synchronized void close()
```

Throws MQException.

Overrides "MQManagedObject.close" on page 124.

getApplicationId

```
public String getApplicationId()
```

A character string that identifies the application to be started. This information is for use by a trigger monitor application that processes messages on the initiation queue; the information is sent to the initiation queue as part of the trigger message.

Throws MQException if you call this method after you have closed the process.

getApplicationType

```
public int getApplicationType()
```

Throws MQException (see page 117).

Identifies the nature of the program to be started in response to the receipt of a trigger message. The application type can take any value, but the following values are recommended for standard types:

- MQC.MQAT_AIX
- MQC.MQAT_CICS
- MQC.MQAT_DOS
- MQC.MQAT_IMS
- MQC.MQAT_MVS
- MQC.MQAT_OS2

- MQC.MQAT_OS400
- MQC.MQAT_UNIX
- MQC.MQAT_WINDOWS
- MQC.MQAT_WINDOWS_NT
- MQC.MWQAT_USER_FIRST (lowest value for user-defined application type)
- MQC.MQAT_USER_LAST (highest value for user-defined application type)

getEnvironmentData

```
public String getEnvironmentData()
```

Throws MQException.

A string containing environment-related information pertaining to the application to be started.

getUserData

```
public String getUserData()
```

Throws MQException.

A string containing user information relevant to the application to be started.

MQPutMessageOptions

```
java.lang.Object
   |
   └ com.ibm.mq.MQPutMessageOptions
```

public class **MQPutMessageOptions**
extends **Object**

This class contains options that control the behavior of MQQueue.put().

Note: The behavior of some of the options available in this class depends on the environment in which they are used. These elements are marked with a *. See Chapter 8, "Environment-dependent behavior," on page 95 for more details.

Variables

contextReference
`public MQQueue ContextReference`

An input field that indicates the source of the context information.

If the `options` field includes MQC.MQPMO_PASS_IDENTITY_CONTEXT, or MQC.MQPMO_PASS_ALL_CONTEXT, set this field to refer to the MQQueue from which to take the context information.

The initial value of this field is null.

invalidDestCount *
`public int invalidDestCount`

An output field set by the queue manager to the number of messages that could not be sent to queues in a distribution list. The count includes queues that failed to open as well as queues that were opened successfully, but for which the put operation failed. This field is also set when opening a single queue that is not part of a distribution list.

knownDestCount *
`public int knownDestCount`

An output field set by the queue manager to the number of messages that the current call has sent successfully to queues that resolve to local queues. This field is also set when opening a single queue that is not part of a distribution list.

options
`public int options`

Options that control the action of MQQueue.put. Any or none of the following values can be specified. If more than one option is required, the values can be added together or combined using the bitwise OR operator.

MQC.MQPMO_DEFAULT_CONTEXT
Associate default context with the message.

MQC.MQPMO_FAIL_IF_QUIESCING
Fail if the queue manager is quiescing.

MQC.MQPMO_LOGICAL_ORDER*
Put logical messages and segments in message groups into their logical order.

MQC.MQPMO_NEW_CORREL_ID*
Generate a new correlation id for each sent message.

MQC.MQPMO_NEW_MSG_ID*
Generate a new message id for each sent message.

MQC.MQPMO_NONE
No options specified. Do not use in conjunction with other options.

MQC.MQPMO_NO_CONTEXT
No context is to be associated with the message.

MQC.MQPMO_NO_SYNCPOINT
Put a message without syncpoint control. Note that, if the syncpoint control option is not specified, a default of no syncpoint is assumed. This applies to all supported platforms.

MQC.MQPMO_PASS_ALL_CONTEXT
Pass all context from an input queue handle.

MQC.MQPMO_PASS_IDENTITY_CONTEXT
Pass identity context from an input queue handle.

MQC.MQPMO_SET_ALL_CONTEXT
Set all context from the application.

MQC.MQPMO_SET_IDENTITY_CONTEXT
Set identity context from the application.

MQC.MQPMO_SYNCPOINT
Put a message with syncpoint control. The message is not visible outside the unit of work until the unit of work is committed. If the unit of work is backed out, the message is deleted.

recordFields *

```
public int recordFields
```

Flags indicating which fields are to be customized in each queue when putting a message to a distribution list. One or more of the following flags can be specified:

MQC.MQPMRF_ACCOUNTING_TOKEN
Use the accountingToken attribute in the MQDistributionListItem.

MQC.MQPMRF_CORREL_ID
Use the correlationId attribute in the MQDistributionListItem.

MQC.MQPMRF_FEEDBACK
Use the feedback attribute in the MQDistributionListItem.

MQC.MQPMRF_GROUP_ID
Use the groupId attribute in the MQDistributionListItem.

MQC.MQPMRF_MSG_ID
Use the messageId attribute in the MQDistributionListItem.

The special value MQC.MQPMRF_NONE indicates that no fields are to be customized.

resolvedQueueManagerName

```
public String resolvedQueueManagerName
```

An output field set by the queue manager to the name of the queue manager that owns the queue specified by the remote queue name. This

might be different from the name of the queue manager from which the queue was accessed if the queue is a remote queue.

resolvedQueueName

```
public String resolvedQueueName
```

An output field that is set by the queue manager to the name of the queue on which the message is placed. This might be different from the name used to open the queue if the opened queue was an alias or model queue.

unknownDestCount *

```
public int unknownDestCount
```

An output field set by the queue manager to the number of messages that the current call has sent successfully to queues that resolve to remote queues. This field is also set when opening a single queue that is not part of a distribution list.

Constructors

MQPutMessageOptions

```
public MQPutMessageOptions()
```

Construct a new MQPutMessageOptions object with no options set, and a blank resolvedQueueName and resolvedQueueManagerName.

MQQueue

```
java.lang.Object
   |
   +-- com.ibm.mq.MQManagedObject
          |
          +-- com.ibm.mq.MQQueue
```

public class **MQQueue**
extends **MQManagedObject**. (See page 123.)

MQQueue provides inquire, set, put, and get operations for WebSphere MQ queues. The inquire and set capabilities are inherited from MQ.MQManagedObject.

See also "MQQueueManager.accessQueue" on page 168.

Constructors

MQQueue

```
public MQQueue(MQQueueManager qMgr, String queueName, int openOptions,
               String queueManagerName, String dynamicQueueName,
               String alternateUserId )
               throws MQException
```

Access a queue on the queue manager `qMgr`.

See "MQQueueManager.accessQueue" on page 168 for details of the remaining parameters.

Methods

close

```
public synchronized void close()
```

Throws MQException.

Overrides "MQManagedObject.close" on page 124.

get

```
public synchronized void get(MQMessage message,
                             MQGetMessageOptions getMessageOptions,
                             int MaxMsgSize)
```

Throws MQException.

Retrieves a message from the queue, up to a maximum specified message size.

This method takes an MQMessage object as a parameter. It uses some of the fields in the object as input parameters, in particular the messageId and correlationId, so it is important to ensure that these are set as required. (See "Message" on page 349.)

If the get fails, the MQMessage object is unchanged. If it succeeds, the message descriptor (member variables) and message data portions of the MQMessage are completely replaced with the message descriptor and message data from the incoming message.

All calls to WebSphere MQ from a given MQQueueManager are synchronous. Therefore, if you perform a get with wait, all other threads using the same MQQueueManager are blocked from making further WebSphere MQ calls until the get completes. If you need multiple threads to access WebSphere MQ simultaneously, each thread must create its own MQQueueManager object.

Parameters

message
An input/output parameter containing the message descriptor information and the returned message data.

getMessageOptions
Options controlling the action of the get. (See "MQGetMessageOptions" on page 119.)

Using option MQC.MQGMO_CONVERT might result in an exception with reason code MQException.MQRC_CONVERTED_STRING_TOO_BIG when converting from single byte character codes to double byte codes. In this case, the message is copied into the buffer but remains encoded using its original character set.

MaxMsgSize
The largest message this call can receive. If the message on the queue is larger than this size, one of two things occurs:

1. If the MQC.MQGMO_ACCEPT_TRUNCATED_MSG flag is set in the options member variable of the MQGetMessageOptions object, the message is filled with as much of the message data as will fit in the specified buffer size, and an exception is thrown with completion code MQException.MQCC_WARNING and reason code MQException.MQRC_TRUNCATED_MSG_ACCEPTED.
2. If the MQC.MQGMO_ACCEPT_TRUNCATED_MSG flag is not set, the message is left on the queue and an MQException is raised with completion code MQException.MQCC_WARNING and reason code MQException.MQRC_TRUNCATED_MSG_FAILED.

Throws MQException if the get fails.

get

```
public synchronized void get(MQMessage message,
                             MQGetMessageOptions getMessageOptions)
```

Throws MQException.

Retrieves a message from the queue, regardless of the size of the message. For large messages, the get method might have to issue two calls to WebSphere MQ on your behalf, one to establish the required buffer size and one to get the message data itself.

This method takes an MQMessage object as a parameter. It uses some of the fields in the object as input parameters, in particular the messageId and correlationId, so it is important to ensure that these are set as required. (See "Message" on page 349.)

If the get fails, the MQMessage object is unchanged. If it succeeds, the message descriptor (member variables) and message data portions of the MQMessage are completely replaced with the message descriptor and message data from the incoming message.

All calls to WebSphere MQ from a given MQQueueManager are synchronous. Therefore, if you perform a get with wait, all other threads using the same MQQueueManager are blocked from making further WebSphere MQ calls until the get completes. If you need multiple threads to access WebSphere MQ simultaneously, each thread must create its own MQQueueManager object.

Parameters

message
An input/output parameter containing the message descriptor information and the returned message data.

getMessageOptions
Options controlling the action of the get. (See "MQGetMessageOptions" on page 119 for details.)

Throws MQException if the get fails.

get

```
public synchronized void get(MQMessage message)
```

A simplified version of the get method previously described.

Parameters

MQMessage
An input/output parameter containing the message descriptor information and the returned message data.

This method uses a default instance of MQGetMessageOptions to do the get. The message option used is MQGMO_NOWAIT.

getCreationDateTime

```
public GregorianCalendar getCreationDateTime()
```

Throws MQException.

The date and time that this queue was created.

getQueueType

```
public int getQueueType()
```

Throws MQException

Returns
The type of this queue with one of the following values:
- MQC.MQQT_ALIAS
- MQC.MQQT_LOCAL
- MQC.MQQT_REMOTE
- MQC.MQQT_CLUSTER

getCurrentDepth

```
public int getCurrentDepth()
```

Throws MQException.

Gets the number of messages currently on the queue. This value is incremented during a put call, and during backout of a get call. It is decremented during a non-browse get and during backout of a put call.

getDefinitionType

```
public int getDefinitionType()
```

Throws MQException.

How the queue was defined.

Returns

One of the following:
- MQC.MQQDT_PREDEFINED
- MQC.MQQDT_PERMANENT_DYNAMIC
- MQC.MQQDT_TEMPORARY_DYNAMIC

getInhibitGet

```
public int getInhibitGet()
```

Throws MQException.

Whether get operations are allowed for this queue.

Returns

The possible values are:
- MQC.MQQA_GET_INHIBITED
- MQC.MQQA_GET_ALLOWED

getInhibitPut

```
public int getInhibitPut()
```

Throws MQException.

Whether put operations are allowed for this queue.

Returns

One of the following:
- MQC.MQQA_PUT_INHIBITED
- MQC.MQQA_PUT_ALLOWED

getMaximumDepth

```
public int getMaximumDepth()
```

Throws MQException.

The maximum number of messages that can exist on the queue at any one time. An attempt to put a message to a queue that already contains this many messages fails with reason code MQException.MQRC_Q_FULL.

getMaximumMessageLength

```
public int getMaximumMessageLength()
```

Throws MQException.

The maximum length of the application data that can exist in each message on this queue. An attempt to put a message larger than this value fails with reason code MQException.MQRC_MSG_TOO_BIG_FOR_Q.

getOpenInputCount

```
public int getOpenInputCount()
```

Throws MQException.

The number of handles that are currently valid for removing messages from the queue. This is the *total* number of such handles known to the local queue manager, not just those created by the WebSphere MQ classes for Java (using accessQueue).

getOpenOutputCount

```
public int getOpenOutputCount()
```

Throws MQException.

The number of handles that are currently valid for adding messages to the queue. This is the *total* number of such handles known to the local queue manager, not just those created by the WebSphere MQ classes for Java (using accessQueue).

getShareability

```
public int getShareability()
```

Throws MQException.

Whether the queue can be opened for input multiple times.

Returns

One of the following:
- MQC.MQQA_SHAREABLE
- MQC.MQQA_NOT_SHAREABLE

getTriggerControl

```
public int getTriggerControl()
```

Throws MQException.

Whether trigger messages are written to an initiation queue, to start an application to service the queue.

Returns

The possible values are:
- MQC.MQTC_OFF
- MQC.MQTC_ON

getTriggerData

```
public String getTriggerData()
```

Throws MQException.

The free-format data that the queue manager inserts into the trigger message when a message arriving on this queue causes a trigger message to be written to the initiation queue.

getTriggerDepth

```
public int getTriggerDepth()
```

Throws MQException.

The number of messages that have to be on the queue before a trigger message is written when trigger type is set to MQC.MQTT_DEPTH.

getTriggerMessagePriority

```
public int getTriggerMessagePriority()
```

Throws MQException.

The message priority below which messages do not contribute to the generation of trigger messages (that is, the queue manager ignores these messages when deciding whether to generate a trigger). A value of zero causes all messages to contribute to the generation of trigger messages.

getTriggerType

```
public int getTriggerType()
```

Throws MQException.

The conditions under which trigger messages are written as a result of messages arriving on this queue.

Returns

The possible values are:

- MQC.MQTT_NONE
- MQC.MQTT_FIRST
- MQC.MQTT_EVERY
- MQC.MQTT_DEPTH

put

```
public synchronized void put(MQMessage message,
                             MQPutMessageOptions putMessageOptions)
```

Throws MQException.

Places a message onto the queue.

Note: For simplicity and performance, if you want to put just a single message to a queue, use the put() method on your MQQueueManager object. For this you do not need to have an MQQueue object. See “MQQueueManager.put” on page 174.

This method takes an MQMessage object as a parameter. The message descriptor properties of this object can be altered as a result of this method. The values that they have immediately after the completion of this method are the values that were put onto the WebSphere MQ queue.

Modifications to the MQMessage object after the put has completed do not affect the actual message on the WebSphere MQ queue.

A put updates the messageId and correlationId. Consider this when making further calls to put/get using the same MQMessage object. Also, calling put does not clear the message data, so:

```
msg.writeString("a");
q.put(msg,pmo);
msg.writeString("b");
q.put(msg,pmo);
```

puts two messages. The first contains `a` and the second `ab`.

Parameters

message
Message Buffer containing the Message Descriptor data and message to be sent.

putMessageOptions
Options controlling the action of the put. (See "MQPutMessageOptions" on page 152)

Throws MQException if the put fails.

put

```
public synchronized void put(MQMessage message)
```

A simplified version of the put method previously described.

Parameters

MQMessage
Message Buffer containing the Message Descriptor data and message to be sent.

This method uses a default instance of MQPutMessageOptions to do the put.

setInhibitGet

```
public void setInhibitGet(int inhibit)
```

Throws MQException.

Controls whether get operations are allowed for this queue. The permissible values are:
- MQC.MQQA_GET_INHIBITED
- MQC.MQQA_GET_ALLOWED

setInhibitPut

```
public void setInhibitPut(int inhibit)
```

Throws MQException.

Controls whether put operations are allowed for this queue. The permissible values are:
- MQC.MQQA_PUT_INHIBITED
- MQC.MQQA_PUT_ALLOWED

setTriggerControl

```
public void setTriggerControl(int trigger)
```

Throws MQException.

Controls whether trigger messages are written to an initiation queue to start an application to service the queue. The permissible values are:
- MQC.MQTC_OFF
- MQC.MQTC_ON

setTriggerData

```
public void setTriggerData(String data)
```

Throws MQException.

Sets the free-format data that the queue manager inserts into the trigger message when a message arriving on this queue causes a trigger message to be written to the initiation queue. The maximum permissible length of the string is given by MQC.MQ_TRIGGER_DATA_LENGTH.

setTriggerDepth

```
public void setTriggerDepth(int depth)
```

Throws MQException.

Sets the number of messages that have to be on the queue before a trigger message is written when trigger type is set to MQC.MQTT_DEPTH.

setTriggerMessagePriority

```
public void setTriggerMessagePriority(int priority)
```

Throws MQException.

Sets the message priority below which messages do not contribute to the generation of trigger messages (that is, the queue manager ignores these messages when deciding whether a trigger should be generated). A value of zero causes all messages to contribute to the generation of trigger messages.

setTriggerType

```
public void setTriggerType(int type)
```

Throws MQException.

Sets the conditions under which trigger messages are written as a result of messages arriving on this queue. The possible values are:
- MQC.MQTT_NONE
- MQC.MQTT_FIRST
- MQC.MQTT_EVERY
- MQC.MQTT_DEPTH

MQQueueManager

```
java.lang.Object
   |
   +-- com.ibm.mq.MQManagedObject
          |
          +-- com.ibm.mq.MQQueueManager
```

public class **MQQueueManager**
extends **MQManagedObject**. (See page 123.)

Note: The behavior of some of the options available in this class depends on the environment in which they are used. These elements are marked with a *. See Chapter 8, "Environment-dependent behavior," on page 95 for details.

Variables

isConnected

```
public boolean isConnected
```

True if the connection to the queue manager is still open.

Constructors

MQQueueManager

```
public MQQueueManager(String queueManagerName)
```

Throws MQException.

Creates a connection to the named queue manager.

Note: When using WebSphere MQ classes for Java, the hostname, channel name, and port to use during the connection request are specified in the MQEnvironment class. This must be done *before* calling this constructor.

The following example shows a connection to a queue manager MYQM, running on a machine with hostname fred.mq.com.

```
MQEnvironment.hostname = "fred.mq.com";  // host to connect to
MQEnvironment.port     = 1414;           // port to connect to.
                                         // If I don't set this,
                                         // it defaults to 1414
                                         // (the default WebSphere MQ port)
MQEnvironment.channel  = "channel.name"; // the CASE-SENSITIVE
                                         //  name of the
                                         // SVR CONN channel on
                                         // the queue manager
MQQueueManager qMgr    = new MQQueueManager("MYQM");
```

If the queue manager name is left blank (null or ""), a connection is made to the default queue manager.

See also "MQEnvironment" on page 110.

MQQueueManager

```
public MQQueueManager(String queueManagerName,
                      MQConnectionManager cxManager)
```

Throws MQException.

Connects to the specified Queue Manager, using the properties in MQEnvironment. The specified MQConnectionManager manages the connection.

MQQueueManager

```
public MQQueueManager(String queueManagerName,
                      ConnectionManager cxManager)
```

Throws MQException.

Connects to the specified Queue Manager, using the properties in MQEnvironment. The specified ConnectionManager manages the connection. If the value of cxManager is null, then the default ConnectionManger is used.

This constructor requires a JVM at at least Java 2 v1.3, with at least JAAS 1.0 installed.

MQQueueManager

```
public MQQueueManager(String queueManagerName,
                      int options)
```

Throws MQException.

This version of the constructor is intended for use only in bindings mode. It uses the extended connection API (MQCONNX) to connect to the queue manager. The *options* parameter allows you to choose fast or normal bindings. Possible values are:

- MQC.MQCNO_FASTPATH_BINDING for fast bindings *.
- MQC.MQCNO_STANDARD_BINDING for normal bindings.

MQQueueManager

```
public MQQueueManager(String queueManagerName,
                      int options,
                      MQConnectionManager cxManager)
```

Throws MQException.

Performs an MQCONNX, passing the supplied options. The specified MQConnectionManager manages the connection.

MQQueueManager

```
public MQQueueManager(String queueManagerName,
                      int options,
                      ConnectionManager cxManager)
```

Throws MQException.

Performs an MQCONNX, passing the supplied options. The specified ConnectionManager manages the connection.

This constructor requires a JVM at at least Java 2 v1.3, with at least JAAS 1.0 installed.

MQQueueManager

```
public MQQueueManager(String queueManagerName,
                      java.util.Hashtable properties)
```

The properties parameter takes a series of key/value pairs that describe the WebSphere MQ environment for this particular queue manager. These properties, where specified, override the values set by the MQEnvironment class, and allow the individual properties to be set on a queue manager by queue manager basis. See “MQEnvironment.properties” on page 111.

MQQueueManager

```
public MQQueueManager(String queueManagerName,
                      Hashtable properties,
                      MQConnectionManager cxManager)
```

Throws MQException.

This constructor connects to the named Queue Manager, using the supplied hash table of properties to override those in MQEnvironment. The specified MQConnectionManager manages the connection.

MQQueueManager

```
public MQQueueManager(String queueManagerName,
                      Hashtable properties,
                      ConnectionManager cxManager)
```

Throws MQException.

Connects to the named Queue Manager, using the supplied hash table of properties to override those in MQEnvironment. The specified ConnectionManager manages the connection.

This constructor requires a JVM at at least Java 2 v1.3, with at least JAAS 1.0 installed.

Methods

accessDistributionList

```
public synchronized MQDistributionList accessDistributionList
          (MQDistributionListItem[] litems, int openOptions,
           String alternateUserId)
```

Throws MQException.

Parameters

litems The items to be included in the distribution list.

openOptions
Options that control the opening of the distribution list.

alternateUserId
If MQOO_ALTERNATE_USER_AUTHORITY is specified in the openOptions parameter, specifies the alternate user identifier that is used to check the authorization for the open. If MQOO_ALTERNATE_USER_AUTHORITY is not specified, this parameter can be left blank (or null).

Returns
A newly-created MQDistributionList, which is open and ready for put operations.

Throws MQException if the open fails.

See also "MQQueueManager.accessQueue" on page 168.

accessDistributionList

This is a simplified version of the AccessDistributionList method previously described.

```
public synchronized MQDistributionList accessDistributionList
          (MQDistributionListItem[] litems,
           int openOptions)
```

Throws MQException.

Parameters

litems The items to be included in the distribution list.

openOptions
Options that control the opening of the distribution list.

See the full description of "accessDistributionList" above for details of the other parameters.

alternateUserId is set to "".

accessProcess

```
public synchronized MQProcess accessProcess
                      (String processName,
                     int openOptions,
                     String queueManagerName,
                     String alternateUserId)
```

Throws MQException.

Establishes access to a WebSphere MQ process on this queue manager to inquire about the process attributes.

Parameters

processName
Name of process to open.

openOptions
Options that control the opening of the process. Inquire is automatically added to the options specified, so there is no need to specify it explicitly.

Valid options are:

MQC.MQOO_ALTERNATE_USER_AUTHORITY
Validate with the specified user ID

MQC.MQOO_FAIL_IF_QUIESCING
Fail if the queue manager is quiescing

If more than one option is required, the values can be added together or combined using the bitwise OR operator. See the *WebSphere MQ Application Programming Reference* for a fuller description of these options.

queueManagerName
Name of the queue manager on which the process is defined. Applications should leave this parameter blank or null.

alternateUserId
If MQOO_ALTERNATE_USER_AUTHORITY is specified in the openOptions parameter, this parameter specifies the alternate user identifier that is used to check the authorization for the open. If MQOO_ALTERNATE_USER_AUTHORITY is not specified, this parameter can be left blank (or null).

accessProcess

This is a simplified version of the AccessProcess method previously described.

```
public synchronized MQProcess accessProcess
                      (String processName,
                       int openOptions)
```

Parameters

processName
The name of the process to open.

openOptions
Options that control the opening of the process.

See the full description of "accessProcess" on page 167 above for details of the other options.

queueManagerName and *alternateUserId* are set to "".

accessQueue

```
public synchronized MQQueue accessQueue
                        (String queueName, int openOptions,
                         String queueManagerName,
                         String dynamicQueueName,
                         String alternateUserId)
```

Throws MQException.

Establishes access to a WebSphere MQ queue on this queue manager to get or browse messages, put messages, inquire about the attributes of the queue or set the attributes of the queue.

If the queue named is a model queue, a dynamic local queue is created. The name of the created queue can be determined from the `name` attribute of the returned MQQueue object.

Parameters

queueName
Name of queue to open.

openOptions
Options that control the opening of the queue. Valid options are:

MQC.MQOO_ALTERNATE_USER_AUTHORITY
Validate with the specified user identifier.

MQC.MQOO_BIND_AS_QDEF
Use default binding for queue.

MQC.MQOO_BIND_NOT_FIXED
Do not bind to a specific destination.

MQC.MQOO_BIND_ON_OPEN
Bind handle to destination when queue is opened.

MQC.MQOO_BROWSE
Open to browse message.

MQC.MQOO_FAIL_IF_QUIESCING
Fail if the queue manager is quiescing.

MQC.MQOO_INPUT_AS_Q_DEF
Open to get messages using queue-defined default.

MQC.MQOO_INPUT_SHARED
Open to get messages with shared access.

MQC.MQOO_INPUT_EXCLUSIVE
Open to get messages with exclusive access.

MQC.MQOO_INQUIRE
Open for inquiry - required if you wish to query properties.

MQC.MQOO_OUTPUT
Open to put messages.

MQC.MQOO_PASS_ALL_CONTEXT
Allow all context to be passed.

MQC.MQOO_PASS_IDENTITY_CONTEXT
Allow identity context to be passed.

MQC.MQOO_SAVE_ALL_CONTEXT
Save context when message retrieved*.

MQC.MQOO_SET
Open to set attributes.

MQC.MQOO_SET_ALL_CONTEXT
Allows all context to be set.

MQC.MQOO_SET_IDENTITY_CONTEXT
Allows identity context to be set.

If more than one option is required, the values can be added together or combined using the bitwise OR operator. See the *WebSphere MQ Application Programming Reference* for a fuller description of these options.

queueManagerName
Name of the queue manager on which the queue is defined. A name that is entirely blank or null denotes the queue manager to which this MQQueueManager object is connected.

dynamicQueueName
This parameter is ignored unless queueName specifies the name of a model queue. If it does, this parameter specifies the name of the dynamic queue to be created. A blank or null name is not valid if queueName specifies the name of a model queue. If the last non-blank character in the name is an asterisk (*), the queue manager replaces the asterisk with a string of characters that guarantees that the name generated for the queue is unique on this queue manager.

alternateUserId
If MQOO_ALTERNATE_USER_AUTHORITY is specified in the openOptions parameter, this parameter specifies the alternate user identifier that is used to check the authorization for the open. If MQOO_ALTERNATE_USER_AUTHORITY is not specified, this parameter can be left blank (or null).

Returns
MQQueue that has been successfully opened.

Throws MQException if the open fails.

accessQueue

```
public synchronized MQQueue accessQueue
                          (String queueName,
                           int openOptions)
```

Throws MQException if you call this method after disconnecting from the queue manager.

Parameters

queueName
Name of queue to open

openOptions
Options that control the opening of the queue

See the description of "MQQueueManager.accessQueue" on page 168 for details of the parameters.

For this version of the method, *queueManagerName*, *dynamicQueueName*, and *alternateUserId* are set to "".

Returns
MQProcess that has been successfully opened.

Throws MQException if the open fails.

backout

```
public synchronized void backout()
```

Throws MQException.

Calling this method indicates to the queue manager that all the message gets and puts that have occurred since the last syncpoint are to be backed out. Messages put as part of a unit of work (with the MQC.MQPMO_SYNCPOINT flag set in the options field of MQPutMessageOptions) are deleted; messages retrieved as part of a unit of work (with the MQC.MQGMO_SYNCPOINT flag set in the options field of MQGetMessageOptions) are reinstated on the queue.

See also the description of the commit method.

begin* (bindings connection only)

```
public synchronized void begin()
```

Throws MQException.

This method is supported only by the WebSphere MQ classes for Java in bindings mode. It signals to the queue manager that a new unit of work is starting. For a complete description of using this method, see "JTA/JDBC coordination using WebSphere MQ base Java" on page 87.

Do not use this method for applications that use local one-phase transactions.

commit

```
public synchronized void commit()
```

Throws MQException.

Calling this method indicates to the queue manager that the application has reached a syncpoint, and that all the message gets and puts that have occurred since the last syncpoint are to be made permanent. Messages put as part of a unit of work (with the MQC.MQPMO_SYNCPOINT flag set in the options field of MQPutMessageOptions) are made available to other applications. Messages retrieved as part of a unit of work (with the MQC.MQGMO_SYNCPOINT flag set in the options field of MQGetMessageOptions) are deleted.

See also the description of the backout method.

disconnect

```
public synchronized void disconnect()
```

Throws MQException.

Terminates the connection to the queue manager. All open queues and processes accessed by this queue manager are closed, and become unusable. When you have disconnected from a queue manager, the only way to reconnect is to create a new MQQueueManager object.

Normally, any work performed as part of a unit of work is committed. However, if this connection is managed by a ConnectionManager, rather than an MQConnectionManager, the unit of work might be rolled back.

getCharacterSet

```
public int getCharacterSet()
```

Throws MQException.

Returns the CCSID (Coded Character Set Identifier) of the queue manager's codeset. This defines the character set used by the queue manager for all character string fields in the application programming interface.

Throws MQException if you call this method after disconnecting from the queue manager.

getCommandInputQueueName

```
public String getCommandInputQueueName()
```

Throws MQException.

Returns the name of the command input queue defined on the queue manager. This is a queue to which applications can send commands, if authorized to do so.

Throws MQException if you call this method after disconnecting from the queue manager.

getCommandLevel

```
public int getCommandLevel()
```

Throws MQException.

Indicates the level of system control commands supported by the queue manager. The set of system control commands that correspond to a particular command level varies according to the architecture of the platform on which the queue manager is running. See the WebSphere MQ documentation for your platform for further details.

Throws MQException if you call this method after disconnecting from the queue manager.

Returns

One of the MQC.MQCMDL_LEVEL_xxx constants

getDistributionListCapable

```
public boolean getDistributionListCapable()
```

Indicates whether the queue manager supports distribution lists.

getJDBCConnection

```
public java.sql.Connection getJDBCConnection(XADataSource dataSource,
                                             String userid, String password)
  throws MQException, SQLException, Exception
```

Returns a Connection object for use with the JTA-JDBC support.

This method declares Exception in its throws clause to avoid problems with the JVM verifier for customers who are not using the JTA functionality. The actual exception thrown is javax.transaction.xa.XAException, which requires the jta.jar file to be added to the classpath for programs that did not previously require it.

Parameters

dataSource
A database-specific implementation of the XADataSource interface that defines the details of the database to connect to. See the documentation for your database to determine how to create an appropriate XADataSource object to pass into getJDBCConnection.

userid The user ID to use for this connection to the database. This is passed to the underlying XADataSource.getXAConnection method.

password
The password to use for this connection to the database. This is passed to the underlying XADataSource.getXAConnection method.

getJDBCConnection

```
public java.sql.Connection getJDBCConnection(javax.sql.XADataSource xads)
  throws MQException, SQLException, Exception
```

Returns a Connection object for use with the JTA-JDBC support.

This method declares Exception in its throws clause to avoid problems with the JVM verifier for customers who are not using the JTA functionality. The actual exception thrown is javax.transaction.xa.XAException, which requires the jta.jar file to be added to the classpath for programs that did not previously require it.

Parameters

xads A database-specific implementation of the XADataSource interface that defines the details of the database to connect to. See the documentation for your database to determine how to create an appropriate XADataSource object to pass into getJDBCConnection.

getMaximumMessageLength

```
public int getMaximumMessageLength()
```

Throws MQException.

Returns the maximum length of a message (in bytes) that can be handled by the queue manager. No queue can be defined with a maximum message length greater than this.

Throws MQException if you call this method after disconnecting from the queue manager.

getMaximumPriority

```
public int getMaximumPriority()
```

Throws MQException.

Returns the maximum message priority supported by the queue manager. Priorities range from zero (lowest) to this value.

Throws MQException if you call this method after disconnecting from the queue manager.

getSyncpointAvailability

```
public int getSyncpointAvailability()
```

Throws MQException.

Indicates whether the queue manager supports units of work and syncpointing with the MQQueue.get and MQQueue.put methods.

Returns
- MQC.MQSP_AVAILABLE if syncpointing is available.
- MQC.MQSP_NOT_AVAILABLE if syncpointing is not available.

Throws MQException if you call this method after disconnecting from the queue manager.

isConnected

```
public boolean isConnected()
```

Returns the value of the isConnected variable.

put

```
public synchronized void put(String qName,
                             String qmName,
                             MQMessage msg,
                             MQPutMessageOptions pmo,
                             String altUserId)
```

Throws MQException.

Places a single message onto a queue without having to create an MQQueue object first.

The qName (queue name) and qmName (queue manager name) parameters identify where the message is placed. If the queue is a model queue, an MQException is thrown.

In other respects, this method behaves like the put method on the MQQueue object. It is an implementation of the MQPUT1 MQI call. See "MQQueue.put" on page 160.

Parameters

qName The name of the queue onto which to place the message.

qmName
The name of the queue manager on which the queue is defined.

msg The message to send.

pmo Options controlling the actions of the put. See "MQPutMessageOptions" on page 152 for more details.

altUserid
Specifies an alternative user identifier used to check authorization when placing the message on a queue. If you do **not** specify MQPMO_ALTERNATE_USER, this parameter is ignored.

put

```
public synchronized void put(String qName,
                             String qmName,
                             MQMessage msg,
                             MQPutMessageOptions pmo)
```

Throws MQException.

Places a single message onto a queue without having to create an MQQueue object first.

This version of the method allows you to omit the altUserid parameter. See the fully-specified method (“MQQueueManager.put” on page 174) for details of the parameters.

put

```
public synchronized void put(String qName,
                             String qmName,
                             MQMessage msg)
```

Throws MQException.

Places a single message onto a queue without having to create an MQQueue object first.

This version of the method allows you to omit the put message options (pmo) and altUserid parameters. See the fully-specified method (“MQQueueManager.put” on page 174) for details of the parameters.

put

```
public synchronized void put(String qName,
                             MQMessage msg,
                             MQPutMessageOptions pmo)
```

Throws MQException.

Places a single message onto a queue without having to create an MQQueue object first.

This version of the method allows you to omit the qmName and altUserid parameters. See the fully-specified method (“MQQueueManager.put” on page 174) for details of the parameters.

put

```
 public synchronized void put(String qName,
                             MQMessage msg)
```

Throws MQException.

Places a single message onto a queue without having to create an MQQueue object first.

This version of the method allows you to omit the qmName, put message options (pmo), and altUserid parameters. See the fully-specified method (“MQQueueManager.put” on page 174) for details of the parameters.

MQSimpleConnectionManager

```
java.lang.Object      com.ibm.mq.MQConnectionManager
   |                          |
   |                          |
   └─ com.ibm.mq.MQSimpleConnectionManager
```

public class **MQSimpleConnectionManager**
implements **MQConnectionManager** (See page 181.)

An MQSimpleConnectionManager provides basic connection pooling function. You can use an MQSimpleConnectionManager either as the default Connection Manager, or as a parameter to an MQQueueManager constructor. When an MQQueueManager is constructed, the most recently used connection in the pool is used.

Connections are destroyed by a separate thread when they are unused for a specified period, when there are more than a specified number of unused connections in the pool, or when the maximum number of connections has been reached and room must be made for new connections. You can specify the timeout period, the maximum number of managed connections, and the maximum number of unused connections.

Variables

MODE_ACTIVE
`public static final int MODE_ACTIVE`. See “setActive” on page 177.

MODE_AUTO
`public static final int MODE_AUTO`. See “setActive” on page 177.

MODE_INACTIVE
`public static final int MODE_INACTIVE`. See “setActive” on page 177.

Constructors

MQSimpleConnectionManager
`public MQSimpleConnectionManager()`

Constructs an MQSimpleConnectionManager.

Methods

getActive
`public int getActive()`

Gets the mode of the connection pool.

Returns

The current active mode of the connection pool, with one of the following values (see “setActive” on page 177):
MODE_ACTIVE
MODE_AUTO
MODE_INACTIVE

getHighThreshold (deprecated)
`public int getHighThreshold()`

Do not use this method in new applications. It performs the same function as getMaxUnusedConnections and returns the maximum number of unused connections in the pool.

getMaxConnections

```
public int getMaxConnections()
```

Returns the maximum number of connections managed by the connection manager.

getMaxUnusedConnections

```
public int getMaxUnusedConnections()
```

Returns the maximum number of unused connections in the pool.

getTimeout

```
public long getTimeout()
```

Returns the timeout value.

setActive

```
public void setActive(int mode)
```

Sets the active mode of the connection pool.

Parameters

mode The required active mode of the connection pool. Valid values are:

MODE_ACTIVE
The connection pool is always active. When MQQueueManager.disconnect() is called, the underlying connection is pooled and potentially reused the next time that an MQQueueManager object is constructed. Connections are destroyed by a separate thread if they are unused for longer than the timeout period, if the number of unused connections in the pool exceeds the value set by setMaxUnusedConnections(), or if room must be made for a new connection.

MODE_AUTO
The connection pool is active while the connection manager is the default connection manager and there is at least one token in the set of MQPoolToken objects held by the MQEnvironment object. This is the default mode.

MODE_INACTIVE
The connection pool is always inactive. When this mode is entered, the pool of connections to WebSphere MQ is cleared. When MQQueueManager.disconnect() is called, the connection that underlies any active MQQueueManager object ends.

setHighThreshold (deprecated)

```
public void setHighThreshold(int threshold)
```

Do not use this method in new applications. It performs the same function as setMaxUnusedConnections and sets the maximum number of unused connections in the pool.

Parameters

threshold
The maximum number of unused connections in the pool.

setMaxConnections

```
public void setMaxConnections(int maxConnections)
```

Sets the maximum number of connections to be managed. To prevent this number from being exceeded, the oldest unused connection in the pool might be destroyed or a request for a new connection might be refused. If the latter event occurs, an MQException is thrown with reason code MQRC_MAX_CONNS_LIMIT_REACHED.

Parameters

maxConnections
The maximum number of connections in the pool.

setMaxUnusedConnections

```
public void setMaxUnusedConnections(int maxUnusedConnections)
```

Sets the maximum number of unused connections in the pool. To prevent this number from being exceeded, the oldest unused connection in the pool is destroyed.

Parameters

maxUnusedConnections
The maximum number of unused connections in the pool.

setTimeout

```
public void setTimeout(long timeout)
```

Sets the timeout value, where connections that remain unused for this length of time are destroyed by a separate thread.

Parameters

timeout
The value of the timeout in milliseconds.

MQC

public interface **MQC**
extends **Object**

The MQC interface defines all the constants used by the WebSphere MQ Java programming interface (except for completion code constants and error code constants). To refer to one of these constants from within your programs, prefix the constant name with MQC.. For example, you can set the close options for a queue as follows:

```
MQQueue queue;
 ...
queue.closeOptions = MQC.MQCO_DELETE; // delete the
                                      // queue when
                                      // it is closed
 ...
```

A full description of these constants is in the *WebSphere MQ Application Programming Reference*.

Completion code and error code constants are defined in the MQException class. See “MQException” on page 117.

MQPoolServicesEventListener

public interface **MQPoolServicesEventListener**
extends **Object**

Note: Normally, applications do not use this interface.

MQPoolServicesEventListener is for implementation by providers of default ConnectionManagers. When an MQPoolServicesEventListener is registered with an MQPoolServices object, the event listener receives an event whenever an MQPoolToken is added to, or removed from, the set of MQPoolTokens that MQEnvironment manages. It also receives an event whenever the default ConnectionManager changes.

See also "MQPoolServices" on page 146 and "MQPoolServicesEvent" on page 147.

Methods

defaultConnectionManagerChanged

```
public void defaultConnectionManagerChanged(MQPoolServicesEvent event)
```

Called when the default ConnectionManager is set. The set of MQPoolTokens is cleared.

tokenAdded

```
public void tokenAdded(MQPoolServicesEvent event)
```

Called when an MQPoolToken is added to the set.

tokenRemoved

```
public void tokenRemoved(MQPoolServicesEvent event)
```

Called when an MQPoolToken is removed from the set.

MQConnectionManager

This is a private interface that cannot be implemented by applications. WebSphere MQ classes for Java supplies an implementation of this interface (MQSimpleConnectionManager), which you can specify on the MQQueueManager constructor, or through MQEnvironment.setDefaultConnectionManager.

See “MQSimpleConnectionManager” on page 176.

Applications or middleware that want to provide their own ConnectionManager must implement javax.resource.spi.ConnectionManager. This requires Java 2 v1.3 with JAAS 1.0 installed.

MQReceiveExit

public interface **MQReceiveExit**
extends **Object**

The receive exit interface allows you to examine and possibly alter the data received from the queue manager by the WebSphere MQ classes for Java.

Note: This interface does not apply when connecting directly to WebSphere MQ in bindings mode.

To provide your own receive exit, define a class that implements this interface. Create a new instance of your class and assign the MQEnvironment.receiveExit variable to it before constructing your MQQueueManager object. For example:

```
// in MyReceiveExit.java
class MyReceiveExit implements MQReceiveExit {
  // you must provide an implementation
  // of the receiveExit method
  public byte[] receiveExit(
   MQChannelExit       channelExitParms,
   MQChannelDefinition channelDefinition,
   byte[]              agentBuffer)
  {
   // your exit code goes here...
  }
}
// in your main program...
MQEnvironment.receiveExit = new MyReceiveExit();
 ...    // other initialization
MQQueueManager qMgr        = new MQQueueManager("");
```

Methods

receiveExit

```
public abstract byte[] receiveExit(MQChannelExit channelExitParms,
                                   MQChannelDefinition channelDefinition,
                                   byte agentBuffer[])
```

The receive exit method that your class must provide. This method is invoked whenever the WebSphere MQ classes for Java receives some data from the queue manager.

Parameters

channelExitParms
Contains information regarding the context in which the exit is being invoked. The exitResponse member variable is an output parameter that you use to tell the WebSphere MQ classes for Java what action to take next. See “MQChannelExit” on page 104 for further details.

channelDefinition
Contains details of the channel through which all communications with the queue manager take place.

agentBuffer
If the channelExitParms.exitReason is MQChannelExit.MQXR_XMIT, agentBuffer contains the data received from the queue manager; otherwise agentBuffer is null.

Returns

If the exit response code (in channelExitParms) is set so that the WebSphere MQ classes for Java can now process the data (MQXCC_OK), your receive exit method must return the data to be processed. The simplest receive exit, therefore, consists of the single line `return agentBuffer;`.

See also:
- "MQC" on page 179
- "MQChannelDefinition" on page 102

MQSecurityExit

public interface **MQSecurityExit**
extends **Object**

The security exit interface allows you to customize the security flows that occur when an attempt is made to connect to a queue manager.

Note: This interface does not apply when connecting directly to WebSphere MQ in bindings mode.

To provide your own security exit, define a class that implements this interface. Create a new instance of your class and assign the MQEnvironment.securityExit variable to it before constructing your MQQueueManager object. For example:

```
// in MySecurityExit.java
class MySecurityExit implements MQSecurityExit {
  // you must provide an implementation
  // of the securityExit method
  public byte[] securityExit(
    MQChannelExit       channelExitParms,
    MQChannelDefinition channelDefinition,
    byte[]              agentBuffer)
  {
    // your exit code goes here...
  }
}
// in your main program...
MQEnvironment.securityExit = new MySecurityExit();
 ...    // other initialization
MQQueueManager qMgr        = new MQQueueManager("");
```

Methods

securityExit

```
public abstract byte[] securityExit(MQChannelExit channelExitParms,
                                    MQChannelDefinition channelDefinition,
                                    byte agentBuffer[])
```

The security exit method that your class must provide.

Parameters

channelExitParms
Contains information regarding the context in which the exit is being invoked. The exitResponse member variable is an output parameter that you use to tell the WebSphere MQ Client for Java what action to take next. See the "MQChannelExit" on page 104 for further details.

channelDefinition
Contains details of the channel through which all communications with the queue manager take place.

agentBuffer
If the channelExitParms.exitReason is MQChannelExit.MQXR_SEC_MSG, agentBuffer contains the security message received from the queue manager; otherwise agentBuffer is null.

Returns

If the exit response code (in channelExitParms) is set so that a message is to be transmitted to the queue manager, your security exit method must return the data to be transmitted.

See also:
- "MQC" on page 179
- "MQChannelDefinition" on page 102

MQSendExit

public interface **MQSendExit**
extends **Object**

The send exit interface allows you to examine and possibly alter the data sent to the queue manager by the WebSphere MQ Client for Java.

Note: This interface does not apply when connecting directly to WebSphere MQ in bindings mode.

To provide your own send exit, define a class that implements this interface. Create a new instance of your class and assign the MQEnvironment.sendExit variable to it before constructing your MQQueueManager object. For example:

```
// in MySendExit.java
class MySendExit implements MQSendExit {
  // you must provide an implementation of the sendExit method
  public byte[] sendExit(
    MQChannelExit       channelExitParms,
    MQChannelDefinition channelDefinition,
    byte[]              agentBuffer)
  {
    // your exit code goes here...
  }
}
// in your main program...
MQEnvironment.sendExit = new MySendExit();
 ...    // other initialization
MQQueueManager qMgr        = new MQQueueManager("");
```

Methods

sendExit

```
public abstract byte[] sendExit(MQChannelExit channelExitParms,
                                MQChannelDefinition channelDefinition,
                                byte agentBuffer[])
```

The send exit method that your class must provide. This method is invoked whenever the WebSphere MQ classes for Java wishes to transmit some data to the queue manager.

Parameters

channelExitParms
Contains information regarding the context in which the exit is being invoked. The exitResponse member variable is an output parameter that you use to tell the WebSphere MQ classes for Java what action to take next. See “MQChannelExit” on page 104 for further details.

channelDefinition
Contains details of the channel through which all communications with the queue manager take place.

agentBuffer
If the channelExitParms.exitReason is MQChannelExit.MQXR_XMIT, agentBuffer contains the data to be transmitted to the queue manager; otherwise agentBuffer is null.

Returns

If the exit response code (in channelExitParms) is set so that a message is to be transmitted to the queue manager (MQXCC_OK), your send exit method must return the data to be transmitted. The simplest send exit, therefore, consists of the single line `return agentBuffer;`.

See also:
- "MQC" on page 179
- "MQChannelDefinition" on page 102

ManagedConnection

public interface **javax.resource.spi.ManagedConnection**

Note: Normally, applications do not use this class; it is intended for use by implementations of ConnectionManager.

WebSphere MQ classes for Java provides an implementation of ManagedConnection that is returned from ManagedConnectionFactory.createManagedConnection. This object represents a connection to a WebSphere MQ Queue Manager. For more details about this interface, see the J2EE Connector Architecture specification (refer to Sun's Web site at `http://java.sun.com`).

Methods

addConnectionEventListener

```
public void addConnectionEventListener(ConnectionEventListener listener)
```

Adds a ConnectionEventListener to the ManagedConnection instance.

The listener is notified if a severe error occurs on the ManagedConnection, or when MQQueueManager.disconnect() is called on a connection handle that is associated with this ManagedConnection. The listener is not notified about local transaction events (see "getLocalTransaction" on page 189).

associateConnection

```
public void associateConnection(Object connection)
```

Throws ResourceException.

WebSphere MQ classes for Java does not currently support this method. A javax.resource.NotSupportedException is thrown.

cleanup

```
public void cleanup()
```

Throws ResourceException.

Closes all open connection handles, and resets the physical connection to an initial state ready to be pooled. Any pending local transaction is rolled back. For more details, see "getLocalTransaction" on page 189.

destroy

```
public void destroy()
```

Throws ResourceException.

Destroys the physical connection to the WebSphere MQ Queue Manager. Any pending local transaction is committed. For more details, see "getLocalTransaction" on page 189.

getConnection

```
public Object getConnection(javax.security.auth.Subject subject,
                            ConnectionRequestInfo cxRequestInfo)
```

Throws ResourceException.

Creates a new connection handle for the physical connection represented by the ManagedConnection object. For WebSphere MQ classes for Java, this returns an MQQueueManager object. The ConnectionManager normally returns this object from allocateConnection.

The subject parameter is ignored. If the cxRequestInfo parameter is not suitable, a ResourceException is thrown. Multiple connection handles can be used simultaneously for each single ManagedConnection.

getLocalTransaction

```
public LocalTransaction getLocalTransaction()
```

Throws ResourceException.

WebSphere MQ classes for Java does not currently support this method. A javax.resource.NotSupportedException is thrown.

Currently, a ConnectionManager cannot manage the WebSphere MQ local transaction, and registered ConnectionEventListeners are not informed about events relating to the local transaction. When cleanup() occurs, any ongoing unit of work is rolled back. When destroy() occurs, any ongoing unit of work is committed.

Existing API behavior is that an ongoing unit of work is committed at MQQueueManager.disconnect(). This existing behavior is preserved only when an MQConnectionManager (rather than a ConnectionManager) manages the connection.

getLogWriter

```
public java.io.PrintWriter getLogWriter()
```

Throws ResourceException.

Returns the log writer for this ManagedConnection.

WebSphere MQ classes for Java does not currently use the log writer. See “MQException.log” on page 117 for more information about logging.

getMetaData

```
public ManagedConnectionMetaData getMetaData()
```

Throws ResourceException.

Gets the meta data information for the underlying Queue Manager. See “ManagedConnectionMetaData” on page 193.

getXAResource

```
public javax.transaction.xa.XAResource getXAResource()
```

Throws ResourceException.

WebSphere MQ classes for Java does not currently support this method. A javax.resource.NotSupportedException is thrown.

removeConnectionEventListener

```
public void removeConnectionEventListener(ConnectionEventListener listener)
```

Removes a registered ConnectionEventListener.

setLogWriter

```
public void setLogWriter(java.io.PrintWriter out)
```

Throws ResourceException.

Sets the log writer for this ManagedConnection. When a ManagedConnection is created, it inherits the log writer from its ManagedConnectionFactory.

WebSphere MQ classes for Java does not currently use the log writer. See “MQException.log” on page 117 for more information about logging.

ManagedConnectionFactory

public interface **javax.resource.spi.ManagedConnectionFactory**

Note: Normally, applications do not use this class; it is intended for use by implementations of ConnectionManager.

WebSphere MQ classes for Java provides an implementation of this interface to ConnectionManagers. A ManagedConnectionFactory is used to construct ManagedConnections and to select suitable ManagedConnections from a set of candidates. For more details about this interface, see the J2EE Connector Architecture specification (refer to Sun's Web site at `http://java.sun.com`).

Methods

createConnectionFactory

```
public Object createConnectionFactory()
```

Throws ResourceException.

WebSphere MQ classes for Java does not currently support the createConnectionFactory methods. This method throws a javax.resource.NotSupportedException.

createConnectionFactory

```
public Object createConnectionFactory(ConnectionManager cxManager)
```

Throws ResourceException.

WebSphere MQ classes for Java does not currently support the createConnectionFactory methods. This method throws a javax.resource.NotSupportedException.

createManagedConnection

```
public ManagedConnection createManagedConnection
                               (javax.security.auth.Subject subject,
                                ConnectionRequestInfo cxRequestInfo)
```

Throws ResourceException.

Creates a new physical connection to a WebSphere MQ Queue Manager, and returns a ManagedConnection object that represents this connection. WebSphere MQ ignores the subject parameter.

equals

```
public boolean equals(Object other)
```

Checks whether this ManagedConnectionFactory is equal to another ManagedConnectionFactory. Returns true if both ManagedConnectionFactories describe the same target Queue Manager.

getLogWriter

```
public java.io.PrintWriter getLogWriter()
```

Throws ResourceException.

Returns the log writer for this ManagedConnectionFactory.

WebSphere MQ classes for Java does not currently use the log writer. See “MQException.log” on page 117 for more information about logging.

hashCode

```
public int hashCode()
```

Returns the hash code for this ManagedConnectionFactory.

matchManagedConnection

```
public ManagedConnection matchManagedConnection
                                (java.util.Set connectionSet,
                                 javax.security.auth.Subject subject,
                                 ConnectionRequestInfo cxRequestInfo)
```

Throws ResourceException.

Searches the supplied set of candidate ManagedConnections for an appropriate ManagedConnection. Returns either null, or a suitable ManagedConnection from the set that meets the criteria for connection.

setLogWriter

```
public void setLogWriter(java.io.PrintWriter out)
```

Throws ResourceException.

Sets the log writer for this ManagedConnectionFactory. When a ManagedConnection is created, it inherits the log writer from its ManagedConnectionFactory.

WebSphere MQ classes for Java does not currently use the log writer. See “MQException.log” on page 117 for more information about logging.

ManagedConnectionMetaData

public interface **javax.resource.spi.ManagedConnectionMetaData**

Note: Normally, applications do not use this interface; it is intended for use by implementations of ConnectionManager.

A ConnectionManager can use this interface to retrieve meta data that is related to an underlying physical connection to a Queue Manager. An implementation of this interface is returned from ManagedConnection.getMetaData(). For more details about this interface, see the J2EE Connector Architecture specification (refer to Sun's Web site at `http://java.sun.com`).

Methods

getEISProductName

```
public String getEISProductName()
```

Throws ResourceException.

Returns `IBM WebSphere MQ`.

getMaxConnections

```
public int getMaxConnections()
```

Throws ResourceException.

Returns 0.

getProductVersion

```
public String getProductVersion()
```

Throws ResourceException.

Returns a string that describes the command level of the WebSphere MQ queue manager to which the ManagedConnection is connected.

getUserName

```
public String getUserName()
```

Throws ResourceException.

If the ManagedConnection represents a client connection to a queue manager, this returns the user ID used for the connection. Otherwise, it returns an empty string.

Part 3. Programming with WebSphere MQ JMS

Chapter 10. Writing WebSphere MQ JMS applications

This chapter provides information to help with writing WebSphere MQ JMS applications. It gives a brief introduction to the JMS model, and detailed information on programming some common tasks that application programs are likely to need to perform.

The JMS model

JMS defines a generic view of a message passing service. The generic JMS model is based around the following interfaces that are defined in Sun's `javax.jms` package:

Connection
Provides access to the underlying transport, and is used to create *Sessions*.

Session
Provides a context for producing and consuming messages, including the methods used to create *MessageProducers* and *MessageConsumers*.

MessageProducer
Used to send messages.

MessageConsumer
Used to receive messages.

A Connection is thread safe, but Sessions, MessageProducers, and MessageConsumers are not. The recommended strategy is to use one Session per application thread.

In WebSphere MQ terms:

Connection
Provides a scope for temporary queues. Also, it provides a place to hold the parameters that control how to connect to WebSphere MQ. Examples of these parameters are the name of the queue manager, and the name of the remote host if you use the WebSphere MQ Java client connectivity.

Session
Contains an `HCONN` and therefore defines a transactional scope.

MessageProducer and MessageConsumer
Contain an `HOBJ` that defines a particular queue for writing to or reading from.

Note that normal WebSphere MQ rules apply:

- Only a single operation can be in progress per HCONN at any given time. Therefore, the MessageProducers or MessageConsumers associated with a Session cannot be called concurrently. This is consistent with the JMS restriction of a single thread per Session.
- PUTs can use remote queues, but GETs can only be applied to queues on the local queue manager.

The generic JMS interfaces are subclassed into more specific versions for point-to-point and publish/subscribe behavior.

The point-to-point versions are:

- QueueConnection
- QueueSession
- QueueSender
- QueueReceiver

When using JMS, always write application programs that use only references to the interfaces in `javax.jms`. All vendor-specific information is encapsulated in implementations of:
- QueueConnectionFactory
- TopicConnectionFactory
- Queue
- Topic

These are known as *administered objects*, that is, objects that can be built using a vendor-supplied administration tool and stored in a JNDI namespace. A JMS application can retrieve these objects from the namespace and use them without needing to know which vendor provided the implementation.

Building a connection

Connections are not created directly, but are built using a connection factory. Factory objects can be stored in a JNDI namespace, insulating the JMS application from provider-specific information. Details of how to create and store factory objects are in Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41.

If you do not have a JNDI namespace available, see "Creating factories at runtime" on page 201.

Retrieving the factory from JNDI

To retrieve an object from a JNDI namespace, set up an initial context, as shown in this fragment taken from the `IVTRun` sample file:

```
import javax.jms.*;
import javax.naming.*;
import javax.naming.directory.*;
 .
 .
 .
  java.util.Hashtable environment = new java.util.Hashtable();
  environment.put(Context.INITIAL_CONTEXT_FACTORY, icf);
  environment.put(Context.PROVIDER_URL, url);
  Context ctx = new InitialDirContext( environment );
```

where:

icf defines a factory class for the initial context

url defines a context specific URL

For more details about JNDI usage, see Sun's JNDI documentation.

Note: Some combinations of the JNDI packages and LDAP service providers can result in an LDAP error 84. To resolve the problem, insert the following line before the call to `InitialDirContext`.

```
environment.put(Context.REFERRAL, "throw");
```

Once an initial context is obtained, objects are retrieved from the namespace by using the `lookup()` method. The following code retrieves a QueueConnectionFactory named `ivtQCF` from an LDAP-based namespace:

```
QueueConnectionFactory factory;
factory = (QueueConnectionFactory)ctx.lookup("cn=ivtQCF");
```

Using the factory to create a connection

The `createQueueConnection()` method on the factory object is used to create a Connection, as shown in the following code:

```
QueueConnection connection;
connection = factory.createQueueConnection();
```

Creating factories at runtime

If a JNDI namespace is not available, it is possible to create factory objects at runtime. However, using this method reduces the portability of the JMS application because it requires references to WebSphere MQ specific classes.

The following code creates a QueueConnectionFactory with all default settings:

```
factory = new com.ibm.mq.jms.MQQueueConnectionFactory();
```

(You can omit the `com.ibm.mq.jms.` prefix if you import the `com.ibm.mq.jms` package instead.)

A connection created from the above factory uses the Java bindings to connect to the default queue manager on the local machine. The `set` methods shown in Table 14 on page 202 can be used to customize the factory with WebSphere MQ specific information.

The only way to create a TopicConnectionFactory object at runtime is to construct it using the MQTopicConnectionFactory constructor. For example:

```
MQTopicConnectionFactory fact = new MQTopicConnectionFactory();
```

This creates a default TopicConnectionFactory object with the bindings transportType and all other default settings.

It is possible to change the transportType for the TopicConnectionFactory using its setTransportType() method. For example:

```
fact.setTransportType(JMSC.MQJMS_TP_BINDINGS_MQ);     // Bindings mode
fact.setTransportType(JMSC.MQJMS_TP_CLIENT_MQ_TCPIP); // Client mode
fact.setTransportType(JMSC.MQJMS_TP_DIRECT_TCPIP);    // Direct TCP/IP mode
```

The full JMS TopicConnectionFactory interface has been implemented. Refer to "TopicConnectionFactory" on page 423 for more details. Note that certain combinations of property settings are not valid for TopicConnectionFactory objects. See "Properties" on page 49 for more details.

Starting the connection

The JMS specification defines that connections should be created in the *stopped* state. Until the connection starts, MessageConsumers that are associated with the connection cannot receive any messages. To start the connection, issue the following command:

```
connection.start();
```

Table 14. Set methods on MQQueueConnectionFactory

Method	Description
setCCSID(int)	Used to set the `MQEnvironment.CCSID` property
setChannel(String)	The name of the channel for a client connection
setFailIfQuiesce(int)	Defines the behavior an application exhibits when making calls (for example, send and receive) against a quiescing queue manager. The options are: • JMSC.MQJMS_FIQ_NO • JMSC.MQJMS_FIQ_YES (the default)
setHostName(String)	The name of the host for a client connection
setPort(int)	The port for a client connection
setQueueManager(String)	The name of the queue manager
setTemporaryModel(String)	The name of a model queue used to generate a temporary destination as a result of a call to `QueueSession.createTemporaryQueue()`. Make this the name of a temporary dynamic queue, rather than a permanent dynamic queue.
setTempQPrefix(String)	The prefix that is used to form the name of a WebSphere MQ dynamic queue.
setTransportType(int)	How to connect to WebSphere MQ. The options are: • JMSC.MQJMS_TP_BINDINGS_MQ (the default) • JMSC.MQJMS_TP_CLIENT_MQ_TCPIP `JMSC` is in the package `com.ibm.mq.jms`
setReceiveExit(String) setSecurityExit(String) setSendExit(String) setReceiveExitInit(String) setSecurityExitInit(String) setSendExitInit(String)	Allow the use of the send, receive, and security exits provided by the underlying WebSphere MQ Classes for Java. The `set*Exit` methods take the name of a class that implements the relevant exit methods. (See the WebSphere MQ product documentation for details.) The class must implement a constructor with a single `String` parameter. This string provides any initialization data required by the exit, and is set to the value provided in the corresponding `set*ExitInit` method.

Choosing client or bindings transport

WebSphere MQ JMS can communicate with WebSphere MQ using either the client or bindings transports. (However, client transport is not supported on the z/OS and OS/390 platforms.) If you use the Java bindings, the JMS application and the WebSphere MQ queue manager must be located on the same machine. If you use the client, the queue manager can be on a different machine from the application.

The contents of the connection factory object determine which transport to use. Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41 describes how to define a factory object for use with client or bindings transport.

The following code fragment illustrates how you can define the transport within an application:

```
String HOSTNAME = "machine1";
String QMGRNAME = "machine1.QM1";
String CHANNEL = "SYSTEM.DEF.SVRCONN";

factory = new MQQueueConnectionFactory();
```

```
factory.setTransportType(JMSC.MQJMS_TP_CLIENT_MQ_TCPIP);
factory.setQueueManager(QMGRNAME);
factory.setHostName(HOSTNAME);
factory.setChannel(CHANNEL);
```

Specifying a range of ports for client connections

If a JMS application attempts to connect to a WebSphere MQ queue manager in client mode, a firewall might allow only those connections that originate from specified ports or a range of ports. In this situation, you can use the LOCALADDRESS property of a QueueConnectionFactory or TopicConnectionFactory object to specify a port, or a range of points, that the application can bind to.

You can set the LOCALADDRESS property by using the WebSphere MQ JMS administration tool, or by calling the setLocalAddress() method in a JMS application. Here is an example of setting the property from within an application:

```
mqConnectionFactory.setLocalAddress("9.20.0.1(2000,3000)");
```

When the application connects to a queue manager subsequently, the application binds to a local IP address and port number in the range 9.20.0.1(2000) to 9.20.0.1(3000).

Connection errors might occur if you restrict the range of ports. If an error occurs, a JMSException is thrown with an embedded MQException that contains the WebSphere MQ reason code, MQRC_Q_MGR_NOT_AVAILABLE. An error might occur if all the ports in the specified range are in use, or if the LOCALADDRESS property contains an IP address, host name, or port number that is not valid; a negative port number, for example.

Because the WebSphere MQ JMS client might create connections other than those required by an application, always consider specifying a range of ports. In general, every Session created by an application requires one port and the WebSphere MQ JMS client might require three additional ports. If a connection error does occur, increase the range of ports.

JMS connection pooling might have an effect on the speed at which ports can be reused. As a result, a connection error might occur while ports are being freed.

Obtaining a session

Once a connection is made, use the `createQueueSession` method on the QueueConnection to obtain a session.

The method takes two parameters:

1. A boolean that determines whether the session is *transacted* or *non-transacted*.
2. A parameter that determines the *acknowledge* mode.

Obtaining a session

The simplest case is that of the non-transacted session with AUTO_ACKNOWLEDGE, as shown in the following code fragment:

```
QueueSession session;

boolean transacted = false;
session = connection.createQueueSession(transacted,
                                        Session.AUTO_ACKNOWLEDGE);
```

Note: A connection is thread safe, but sessions (and objects that are created from them) are not. The recommended practice for multithreaded applications is to use a separate session for each thread.

Sending a message

Messages are sent using a MessageProducer. For point-to-point this is a QueueSender that is created using the createSender method on QueueSession. A QueueSender is normally created for a specific queue, so that all messages sent using that sender are sent to the same destination. The destination is specified using a Queue object. Queue objects can be either created at runtime, or built and stored in a JNDI namespace.

Queue objects are retrieved from JNDI in the following way:

```
Queue ioQueue;
ioQueue = (Queue)ctx.lookup( qLookup );
```

WebSphere MQ JMS provides an implementation of Queue in com.ibm.mq.jms.MQQueue. It contains properties that control the details of WebSphere MQ specific behavior, but in many cases it is possible to use the default values. JMS defines a standard way to specify the destination that minimizes the WebSphere MQ specific code in the application. This mechanism uses the QueueSession.createQueue method, which takes a string parameter describing the destination. The string itself is still in a vendor-specific format, but this is a more flexible approach than directly referring to the vendor classes.

WebSphere MQ JMS accepts two forms for the string parameter of createQueue().

- The first is the name of the WebSphere MQ queue, as illustrated in the following fragment taken from the IVTRun program in the samples directory:

  ```
  public static final String QUEUE = "SYSTEM.DEFAULT.LOCAL.QUEUE" ;
   .
   .
   .
    ioQueue = session.createQueue( QUEUE );
  ```

- The second, and more powerful, form is based on *uniform resource identifiers* (URIs). This form allows you to specify remote queues (queues on a queue manager other than the one to which you are connected). It also allows you to set the other properties contained in a com.ibm.mq.jms.MQQueue object.

  The URI for a queue begins with the sequence queue://, followed by the name of the queue manager on which the queue resides. This is followed by a further /, the name of the queue, and optionally, a list of name-value pairs that set the remaining Queue properties. For example, the URI equivalent of the previous example is:

  ```
  ioQueue = session.createQueue("queue:///SYSTEM.DEFAULT.LOCAL.QUEUE");
  ```

  The name of the queue manager is omitted. This is interpreted as the queue manager to which the owning QueueConnection is connected at the time when the Queue object is used.

Note: When sending a message to a cluster, leave the Queue Manager field in the JMS Queue object blank. This enables an MQOPEN to be performed in BIND_NOT_FIXED mode, which allows the queue manager to be determined. Otherwise an exception is returned reporting that the queue object cannot be found. This applies when using JNDI or defining queues at runtime.

The following example connects to queue Q1 on queue manager HOST1.QM1, and causes all messages to be sent as non-persistent and priority 5:

```
ioQueue = session.createQueue("queue://HOST1.QM1/Q1?persistence=1&priority=5");
```

The following is an example of creating a topic URI:

```
session.createTopic("topic://Sport/Football/Results?multicast=7");
```

Table 15 lists the names that can be used in the name-value part of the URI. A disadvantage of this format is that it does not support symbolic names for the values, so where appropriate, the table also indicates *special* values, which might change. (See "Setting properties with the set method" on page 206 for an alternative way of setting properties.)

Table 15. Property names for queue and topic URIs

Property	Description	Values
CCSID	Character set of the destination	integers - valid values listed in base WebSphere MQ documentation
encoding	How to represent numeric fields	An integer value as described in the base WebSphere MQ documentation
expiry	Lifetime of the message in milliseconds	0 for unlimited, positive integers for timeout (ms)
multicast	Sets multicast mode for direct connections	-1=ASCF, 0=DISABLED, 3=NOTR, 5=RELIABLE, 7=ENABLED
persistence	Whether the message should be *hardened* to disk	1=non-persistent, 2=persistent, -1=QDEF, -2=APP
priority	Priority of the message	0 through 9, -1=QDEF, -2=APP
targetClient	Whether the receiving application is JMS compliant	0=JMS, 1=MQ
The special values are: **QDEF** Determine the property from the configuration of the WebSphere MQ queue. **APP** The JMS application can control this property.		

Once the Queue object is obtained (either using `createQueue` as above or from JNDI), it must be passed into the `createSender` method to create a QueueSender:

```
QueueSender queueSender = session.createSender(ioQueue);
```

The resulting `queueSender` object is used to send messages by using the `send` method:

```
queueSender.send(outMessage);
```

Setting properties with the set method

You can set Queue properties by first creating an instance of `com.ibm.mq.jms.MQQueue` using the default constructor. Then you can fill in the required values by using public `set` methods. This method means that you can use symbolic names for the property values. However, because these values are vendor-specific, and are embedded in the code, the applications become less portable.

The following code fragment shows the setting of a queue property with a `set` method.

```
com.ibm.mq.jms.MQQueue q1 = new com.ibm.mq.jms.MQQueue();
      q1.setBaseQueueManagerName("HOST1.QM1");
      q1.setBaseQueueName("Q1");
      q1.setPersistence(DeliveryMode.NON_PERSISTENT);
      q1.setPriority(5);
```

Table 16 shows the symbolic property values that are supplied with WebSphere MQ JMS for use with the `set` methods.

Table 16. Symbolic values for queue properties

Property	Admin tool keyword	Values
expiry	UNLIM APP	JMSC.MQJMS_EXP_UNLIMITED JMSC.MQJMS_EXP_APP
priority	APP QDEF	JMSC.MQJMS_PRI_APP JMSC.MQJMS_PRI_QDEF
persistence	APP QDEF PERS NON	JMSC.MQJMS_PER_APP JMSC.MQJMS_PER_QDEF JMSC.MQJMS_PER_PER JMSC.MQJMS_PER_NON
targetClient	JMS MQ	JMSC.MQJMS_CLIENT_JMS_COMPLIANT JMSC.MQJMS_CLIENT_NONJMS_MQ
encoding	Integer(N) Integer(R) Decimal(N) Decimal(R) Float(N) Float(R) Native	JMSC.MQJMS_ENCODING_INTEGER_NORMAL JMSC.MQJMS_ENCODING_INTEGER_REVERSED JMSC.MQJMS_ENCODING_DECIMAL_NORMAL JMSC.MQJMS_ENCODING_DECIMAL_REVERSED JMSC.MQJMS_ENCODING_FLOAT_IEEE_NORMAL JMSC.MQJMS_ENCODING_FLOAT_IEEE_REVERSED JMSC.MQJMS_ENCODING_NATIVE
multicast	ASCF DISABLED NOTR RELIABLE ENABLED	JMSC.MQJMS_MULTICAST_AS_CF JMSC.MQJMS_MULTICAST_DISABLED JMSC.MQJMS_MULTICAST_NOT_RELIABLE JMSC.MQJMS_MULTICAST_RELIABLE JMSC.MQJMS_MULTICAST_ENABLED

See “The ENCODING property” on page 57 for a discussion of encoding.

Message types

JMS provides several message types, each of which embodies some knowledge of its content. To avoid referring to the vendor-specific class names for the message types, methods are provided on the Session object for message creation.

In the sample program, a text message is created in the following manner:

```
System.out.println( "Creating a TextMessage" );
TextMessage outMessage = session.createTextMessage();
System.out.println("Adding Text");
outMessage.setText(outString);
```

The message types that can be used are:
- BytesMessage
- MapMessage
- ObjectMessage
- StreamMessage
- TextMessage

Details of these types are in Chapter 15, "JMS interfaces and classes," on page 295.

Receiving a message

Messages are received using a QueueReceiver. This is created from a Session by using the `createReceiver()` method. This method takes a Queue parameter that defines from where the messages are received. See "Sending a message" on page 204 for details of how to create a Queue object.

The sample program creates a receiver and reads back the test message with the following code:

```
QueueReceiver queueReceiver = session.createReceiver(ioQueue);
Message inMessage = queueReceiver.receive(1000);
```

The parameter in the receive call is a timeout in milliseconds. This parameter defines how long the method should wait if there is no message available immediately. You can omit this parameter, in which case, the call blocks indefinitely. If you do not want any delay, use the `receiveNoWait()` method.

The receive methods return a message of the appropriate type. For example, if a `TextMessage` is put on a queue, when the message is received the object that is returned is an instance of `TextMessage`.

To extract the content from the body of the message, it is necessary to cast from the generic Message class (which is the declared return type of the receive methods) to the more specific subclass, such as `TextMessage`. If the received message type is not known, you can use the `instanceof` operator to determine which type it is. It is good practice always to test the message class before casting, so that unexpected errors can be handled gracefully.

The following code illustrates the use of `instanceof`, and extraction of the content from a TextMessage:

```
if (inMessage instanceof TextMessage) {
  String replyString = ((TextMessage) inMessage).getText();
  .
  .
  .
} else {
  // Print error message if Message was not a TextMessage.
  System.out.println("Reply message was not a TextMessage");
}
```

Message selectors

JMS provides a mechanism to select a subset of the messages on a queue so that this subset is returned by a receive call. When creating a QueueReceiver, you can

provide a string that contains an SQL (Structured Query Language) expression to determine which messages to retrieve. The selector can refer to fields in the JMS message header as well as fields in the message properties (these are effectively application-defined header fields). Details of the header field names, as well as the syntax for the SQL selector, are in Chapter 13, "JMS messages," on page 257.

The following example shows how to select for a user-defined property named `myProp`:

```
queueReceiver = session.createReceiver(ioQueue, "myProp = 'blue'");
```

Note: The JMS specification does not permit the selector associated with a receiver to be changed. Once a receiver is created, the selector is fixed for the lifetime of that receiver. This means that, if you require different selectors, you must create new receivers.

Asynchronous delivery

An alternative to making calls to `QueueReceiver.receive()` is to register a method that is called automatically when a suitable message is available. The following fragment illustrates the mechanism:

```
import javax.jms.*;

public class MyClass implements MessageListener
{
  // The method that will be called by JMS when a message
  // is available.
  public void onMessage(Message message)
  {
    System.out.println("message is "+message);

    // application specific processing here
    .
    .
    .
  }
}

 .
 .
 .
  // In Main program (possibly of some other class)
  MyClass listener = new MyClass();
  queueReceiver.setMessageListener(listener);

  // main program can now continue with other application specific
  // behavior.
```

Note: Use of asynchronous delivery with a QueueReceiver marks the entire Session as asynchronous. It is an error to make an explicit call to the `receive` methods of a QueueReceiver that is associated with a Session that is using asynchronous delivery.

Closing down

Garbage collection alone cannot release all WebSphere MQ resources in a timely manner, especially if the application needs to create many short-lived JMS objects at the Session level or lower. It is therefore important to call the `close()` methods of the various classes (QueueConnection, QueueSession, QueueSender, and QueueReceiver) when the resources are no longer required.

Java Virtual Machine hangs at shutdown

If an application using WebSphere MQ JMS finishes without calling `Connection.close()`, some JVMs appear to hang. If this problem occurs, either edit the application to include a call to `Connection.close()`, or terminate the JVM using the `Ctrl-C` keys.

Handling errors

Any runtime errors in a JMS application are reported by exceptions. The majority of methods in JMS throw JMSExceptions to indicate errors. It is good programming practice to catch these exceptions and display them on a suitable output.

A JMSException can contain a further exception embedded in it. For JMS, this can be a valuable way to pass important detail from the underlying transport. In the case of WebSphere MQ JMS, when WebSphere MQ raises an MQException, this exception is usually included as the embedded exception in a JMSException.

The implementation of JMSException does not include the embedded exception in the output of its `toString()` method. Therefore, it is necessary to check explicitly for an embedded exception and print it out, as shown in the following fragment:

```
try {
  .
  . code which may throw a JMSException
  .
} catch (JMSException je) {
  System.err.println("caught "+je);
  Exception e = je.getLinkedException();
  if (e != null) {
    System.err.println("linked exception: "+e);
  }
}
```

Exception listener

For asynchronous message delivery, the application code cannot catch exceptions raised by failures to receive messages. This is because the application code does not make explicit calls to `receive()` methods. To cope with this situation, it is possible to register an `ExceptionListener`, which is an instance of a class that implements the `onException()` method. When a serious error occurs, this method is called with the JMSException passed as its only parameter. Further details are in Sun's JMS documentation.

User exits

WebSphere MQ JMS allows you to code and use implementations of the WebSphere MQ base Java send, receive, and security exits. For WebSphere MQ JMS, ensure that your exit has a constructor that takes a single string argument. See the description of exit-related set methods in Table 14 on page 202 and "Property dependencies" on page 56.

Using Secure Sockets Layer (SSL)

WebSphere MQ base Java client applications and WebSphere MQ JMS connections using TRANSPORT(CLIENT) support Secure Sockets Layer (SSL) encryption. SSL provides communication encryption, authentication, and message integrity. It is typically used to secure communications between any two peers on the Internet or within an intranet.

WebSphere MQ classes for Java uses Java Secure Socket Extension (JSSE) to handle SSL encryption, and so requires a JSSE provider. J2SE v1.4 JVMs have a JSSE provider built in. Details of how to manage and store certificates can vary from provider to provider. For information about this, refer to your JSSE provider's documentation.

This section assumes that your JSSE provider is correctly installed and configured, and that suitable certificates have been installed and made available to your JSSE provider.

SSL administrative properties

This section introduces the SSL administrative properties, as follows:

SSLCIPHERSUITE object property

To enable SSL encryption on a ConnectionFactory, use JMSAdmin to set the SSLCIPHERSUITE property to a CipherSuite supported by your JSSE provider. This must match the CipherSpec set on the target channel. However, CipherSuites are distinct from CipherSpecs and so have different names. Appendix H, "SSL CipherSuites supported by WebSphere MQ," on page 487 contains a table mapping the CipherSpecs supported by WebSphere MQ to their equivalent CipherSuites as known to JSSE. Additionally, the named CipherSuite must be supported by your JSSE provider. For more information about CipherSpecs and CipherSuites with WebSphere MQ, see the *WebSphere MQ Security* book.

For example, to set a QueueConnectionFactory to connect to an SSL-enabled SVRCONN channel using a CipherSpec of RC4_MD5_EXPORT, issue the following command to JMSAdmin:

```
ALTER QCF(my.qcf) SSLCIPHERSUITE(SSL_RSA_EXPORT_WITH_RC4_40_MD5)
```

This can also be set from a program, using the setSSLCipherSuite() method on MQConnectionFactory.

For convenience, if a CipherSpec is specified on the SSLCIPHERSUITE property, JMSAdmin attempts to map the CipherSpec to an appropriate CipherSuite and issues a warning. This attempt to map is not made if the property is specified by a program.

SSLPEERNAME object property

A JMS application can ensure that it has connected to the correct queue manager, by specifying a distinguished name (DN) pattern. The connection succeeds only if

the queue manager presents a DN that matches the pattern. For more details of the format of this pattern, refer to *WebSphere MQ Security* or the *WebSphere MQ Script (MQSC) Command Reference*.

The DN is set using the SSLPEERNAME property of ConnectionFactory. For example, the following JMSAdmin command sets the ConnectionFactory to expect the queue manager to identify itself with a Common Name beginning QMGR. with at least two Organizational Unit names, the first of which must be IBM and the second WEBSPHERE:

```
ALTER QCF(my.qcf) SSLPEERNAME(CN=QMGR.*, OU=IBM, OU=WEBSPHERE)
```

Checking is case-insensitive, and semicolons can be used in place of the commas. This can also be set from a program, using the setSSLPeerName() method on MQConnectionFactory. If this property is not set, no checking is performed on the Distinguished Name supplied by the queue manager. This property is ignored if no CipherSuite is set.

SSLCERTSTORES object property

It is common to use a certificate revocation list (CRL) to manage revocation of certificates that have become untrusted. These are typically hosted on LDAP servers; JMS allows an LDAP server to be specified for CRL checking under Java 2 v1.4 or later. The following JMSAdmin example directs JMS to use a CRL hosted on an LDAP server named crl1.ibm.com:

```
ALTER QCF(my.qcf) SSLCRL(ldap://crl1.ibm.com)
```

Note: To use a CertStore successfully with a CRL hosted on an LDAP server, make sure that your Java Software Development Kit (SDK) is compatible with the CRL. Some SDKs require that the CRL conforms to RFC 2587, which defines a schema for LDAP v2. Most LDAP v3 servers use RFC 2256 instead.

If your LDAP server is not running on the default port of 389, the port can be specified by appending a colon and the port number to the host name. If the certificate presented by the queue manager is present in the CRL hosted on crl1.ibm.com, the connection does not complete. To avoid single-point-of-failure, JMS allows multiple LDAP servers to be supplied, by supplying a space-delimited list of LDAP servers. For example:

```
ALTER QCF(my.qcf) SSLCRL(ldap://crl1.ibm.com ldap://crl2.ibm.com)
```

When multiple LDAP servers are specified, JMS tries each one in turn until it finds a server with which it can successfully verify the queue manager's certificate. Each server must contain identical information.

A string of this format can be supplied by a program on the MQConnectionFactory.setSSLCertStores() method. Alternatively, the application can create one or more java.security.cert.CertStore objects, place these in a suitable Collection object, and supply this Collection to the setSSLCertStores() method. In this way, the application can customize CRL checking. Refer to your JSSE documentation for details on constructing and using CertStore objects.

The certificate presented by the queue manager when a connection is being set up is validated as follows:

1. The first CertStore object in the Collection identified by sslCertStores is used to identify a CRL server.
2. An attempt is made to contact the CRL server.
3. If the attempt is successful, the server is searched for a match for the certificate.

a. If the certificate is found to be revoked, the search process is over and the connection request fails with reason code MQRC_SSL_CERTIFICATE_REVOKED.
b. If the certificate is not found, the search process is over and the connection is allowed to proceed.

4. If the attempt to contact the server is unsuccessful, the next CertStore object is used to identify a CRL server and the process repeats from step 2.

   If this was the last CertStore in the Collection, or if the Collection contains no CertStore objects, the search process has failed and the connection request fails with reason code MQRC_SSL_CERT_STORE_ERROR.

The Collection object determines the order in which CertStores are used.

If your application uses setSSLCertStores() to set a Collection of CertStore objects, the MQConnectionFactory can no longer be bound into a JNDI namespace. Attempting to do so causes an exception. If the sslCertStores property is not set, no revocation checking is performed on the certificate provided by the queue manager. This property is ignored if no CipherSuite is set.

SSLSocketFactory object property

You might want to customize other aspects of the SSL connection for an application. For example, you might want to initialize cryptographic hardware or change the KeyStore and TrustStore in use. To do this, the application must first create a javax.net.ssl.SSLSocketFactory instance customized accordingly. Refer to your JSSE documentation for information on how to do this, as the customizable features vary from provider to provider. Once a suitable SSLSocketFactory has been obtained, use the MQConnectionFactory.setSSLSocketFactory() method to configure JMS to use the customized SSLSocketFactory.

If your application uses setSSLSocketFactory() to set a customized SSLSocketFactory, the MQConnectionFactory can no longer be bound into a JNDI namespace. Attempting to do so causes an exception. If this property is not set, the default SSLSocketFactory is used; refer to your JSSE documentation for details on the behavior of the default SSLSocketFactory. This property is ignored if no CipherSuite is set.

Important: Do not assume that use of the SSL properties ensures security when the ConnectionFactory is retrieved from a JNDI namespace that is not itself secure. Specifically, the standard LDAP implementation of JNDI is not secure; an attacker can imitate the LDAP server, misleading a JMS application into connecting to the wrong server without noticing. With suitable security arrangements in place, other implementations of JNDI (such as the fscontext implementation) are secure.

Chapter 11. Writing WebSphere MQ JMS publish/subscribe applications

You can write applications with WebSphere MQ JMS using two programming models:

- Point-to-point
- Publish/subscribe

This section considers publish/subscribe and how publish/subscribe messaging is implemented in WebSphere MQ JMS.

Introduction

With publish/subscribe messaging, one message producer can send messages to many message consumers at one time. The message producer need know nothing about the consumers receiving its messages, it needs to know only about the common destination. Similarly, the message consumers need to know only about the common destination. This common destination is called a *topic*.

A message producer that sends messages to a topic is a *publisher* and a message consumer that receives messages from a topic is a *subscriber*.

A message consumer receives messages on all topics to which it has subscribed. To receive messages from a topic, a message consumer must first subscribe to that topic. All messages sent to a topic are forwarded to all the message consumers subscribed to that topic at that time. Each consumer receives its own copy of each message.

JMS clients can establish durable subscriptions that allow consumers to disconnect and later reconnect and collect messages published while they were disconnected.

The connection between messages issued by publishers and the subscribers is made, in WebSphere MQ, by the publish/subscribe *broker*. The broker (sometimes referred to as the message broker) has a record of all the subscribers registered to a topic. When a message is published to a topic, the broker manages the forwarding of that message to the topic's subscribers.

To run a WebSphere MQ JMS publish/subscribe application, you must be able to connect to a message broker.

Getting started with WebSphere MQ JMS and publish/subscribe

Before you can start developing publish/subscribe applications, you need to choose the broker to use and set that broker up to run the WebSphere MQ JMS.

Choosing a broker

WebSphere MQ offers a choice of three brokers:

- The MQSeries Publish/Subscribe broker uses WebSphere MQ and a SupportPac.

  The SupportPac MA0C is available for download from:

  `http://www.ibm.com/software/ts/mqseries/txppacs`

If you want to use the broker-based subscription store, you must use WebSphere MQ with the MQSeries Publish/Subscribe broker. No other combination of queue manager and broker supports this store.

- WebSphere MQ Integrator provides a broker that can be run in one of two modes. Compatibility mode, which provides a broker of equivalent functionality to the MQSeries Publish/Subscribe broker; and native mode, which provides additional functionality. WebSphere MQ JMS can connect to WebSphere MQ Integrator in native mode with JMS Version 5.2.1 and later. With earlier JMS versions, it can connect to WebSphere MQ Integrator in compatibility mode only.
- WebSphere MQ Event Broker Version 2.1, WebSphere Business Integration Event Broker Version 5.0, and WebSphere Business Integration Message Broker Version 5.0 each provide a broker that can be connected to in two different ways:

  Using message queues and WebSphere MQ
  With this connection, you can run the broker in either compatibility mode or native mode.

  Directly using a TCP/IP socket
  With this connection, you can run the broker only in native mode. Also there is no support for:
  – Persistent messages
  – Transacted messages
  – Durable subscriptions

  This has implications for the implementation of the JMS specification for direct connections to the WebSphere MQ Event Broker:
  – Because there are no persistent messages, JMSDeliveryMode is always NON_PERSISTENT and JMSExpiration has no meaning on messages received on direct connections.
  – Because there are no transacted messages, JMSRedelivered has no meaning on messages received on direct connections.

  Refer to Chapter 15, “JMS interfaces and classes,” on page 295 for specific information on each publish and subscribe interface.

Setting up the broker to run the WebSphere MQ JMS

Broker setup depends on the broker you intend to use and how you intend to use it. Each broker provides its own documentation describing installation and setup. However, for convenience and because of WebSphere MQ JMS requirements, some setup instructions are given here.

Connecting to your broker using WebSphere MQ

This section applies to the MQSeries Publish/Subscribe broker and the broker in WebSphere MQ Integrator. It also applies to the WebSphere MQ Event Broker when you choose to connect to it using WebSphere MQ.

Each broker requires its own queue manager. Refer to the broker’s documentation regarding installation and setup.

For the WebSphere MQ JMS publish/subscribe implementation to work correctly, a number of system queues must be created on the queue manager on which the broker is running. Create these message queues on each queue manager for each broker you want to run WebSphere MQ JMS. WebSphere MQ JMS provides a script that creates these queues (see “Create the WebSphere MQ JMS system queues” on page 27).

Run the script to create the system queues. If you are using the MQSeries Publish/Subscribe broker, your broker is now fully configured. To check that the broker is correctly configured, run the publish/subscribe verification as described in "Publish/subscribe verification without JNDI" on page 35.

If you are using the broker provided by WebSphere MQ Integrator or WebSphere MQ Event Broker, configure a publish/subscribe message flow in the broker for messages to be correctly routed. The method for creating the required message flow is similar in both cases. Refer to Appendix D, "Connecting to other products," on page 469 for details.

Connecting to your broker directly

This is possible only when you use the broker provided in WebSphere MQ Event Broker, WebSphere Business Integration Event Broker, or WebSphere Business Integration Message Broker. Because the connection to this broker is made directly, no system queues are required. However, you must set up a publish/subscribe message flow in the broker for messages to be correctly routed. Refer to Appendix D, "Connecting to other products," on page 469 for details.

Writing a simple publish/subscribe application connecting through WebSphere MQ

This section provides a walkthrough of a simple WebSphere MQ JMS application.

Here is the complete example. Individual sections are discussed after.

```
/**
 * Basic pub/sub example
 *
 * A TopicConnectionFactory object is retrieved from LDAP; this is used
 * to create a TopicConnection. The TopicConnection is used to create
 * a TopicSession, which creates two publishers and two subscribers.
 * Both publishers subscribe to a topic; both subscribers then receive.
 */

import javax.jms.*;                 // JMS interfaces
import javax.naming.*;              // Used for JNDI lookup of
import javax.naming.directory.*;    //    administered objects

import java.io.*;                   // Java IO classes
import java.util.*;                 // Java Util classes


class PubSubSample {

    // using LDAP
    String icf = "com.sun.jndi.ldap.LdapCtxFactory";  // initial context factory
    String url = "ldap://server.company.com/o=company_us,c=us";  //url

    private String tcfLookup = "cn=testTCF";  // TopicConnectionFactory (TCF) lookup
    private String tLookup    = "cn=testT";    // topic lookup

    // Pub/Sub objects used by this program
    private TopicConnectionFactory fact = null;
    private Topic topic = null;

    public static void main(String args[])
    {
        // Initialise JNDI properties
        Hashtable env = new Hashtable();
        env.put( Context.INITIAL_CONTEXT_FACTORY, icf );
        env.put( Context.PROVIDER_URL, url );
        env.put( Context.REFERRAL, "throw" );
```

```
Context ctx = null;
try {
    System.out.print( "Initialising JNDI... " );
    ctx = new InitialDirContext( env );
    System.out.println( "Done!" );
} catch ( NamingException nx ) {
    System.out.println( "ERROR: " + nx );
    System.exit(-1);
}

// Lookup TCF
try {
    System.out.print( "Obtaining TCF from JNDI... " );
    fact = (TopicConnectionFactory)ctx.lookup( tcfLookup );
    System.out.println( "Done!" );
} catch ( NamingException nx ) {
    System.out.println( "ERROR: " + nx );
    System.exit(-1);
}
// Lookup Topic
try {
    System.out.print( "Obtaining topic T from JNDI... " );
    topic = (Topic)ctx.lookup( tLookup );
    System.out.println( "Done!" );
} catch ( NamingException nx ) {
    System.out.println( "ERROR: " + nx );
    System.exit(-1);
}


try {
    ctx.close();
} catch ( NamingException nx ) {
    // Just ignore an exception on closing the context
}


try {
    // Create connection
    TopicConnection conn = fact.createTopicConnection();
    // Start connection
    conn.start();

    // Session
    TopicSession sess = conn.createTopicSession(false,
                                Session.AUTO_ACKNOWLEDGE);

    // Create a topic dynamically
    Topic t = sess.createTopic("myTopic");

    // Publisher
    TopicPublisher pub = sess.createPublisher(t);
    // Subscriber
    TopicSubscriber sub = sess.createSubscriber(t);
    // Publisher
    TopicPublisher pubA = sess.createPublisher(topic);
    // Subscriber
    TopicSubscriber subA = sess.createSubscriber(topic);


    // Publish "Hello World"
    TextMessage  hello = sess.createTextMessage();
    hello.setText("Hello World");
    pub.publish(hello);
    hello.setText("Hello World 2");
    pubA.publish(hello);
```

```
            // Receive message
            TextMessage m = (TextMessage) sub.receive();
            System.out.println("Message Text = " + m.getText());
            m = (TextMessage) subA.receive();
            System.out.println("Message Text = " + m.getText());

            // Close publishers and subscribers
            pub.close();
            pubA.close();
            sub.close();
            subA.close();

            // Close session and connection
            sess.close();
            conn.close();

            System.exit(0);

        }

        catch ( JMSException je ) {
            System.out.println("ERROR: " + je);
            System.out.println("LinkedException: " +
                                       je.getLinkedException());
            System.exit(-1);
        }
    }
}
```

Import required packages

The import statements for an application using WebSphere MQ classes for Java Message Service must include at least the following:

```
import javax.jms.*;                // JMS interfaces
import javax.naming.*;             // Used for JNDI lookup of
import javax.naming.directory.*;   //    administered objects
```

Obtain or create JMS objects

The next step is to obtain or create a number of JMS objects:

1. Obtain a TopicConnectionFactory
2. Create a TopicConnection
3. Create a TopicSession
4. Obtain a Topic from JNDI
5. Create TopicPublishers and TopicSubscribers

Many of these processes are similar to those that are used for point-to-point, as shown in the following:

Obtain a TopicConnectionFactory

The preferred way to do this is to use JNDI lookup, to maintain portability of the application code. The following code initializes a JNDI context:

```
 String icf = "com.sun.jndi.ldap.LdapCtxFactory";  // initial context factory
 String url = "ldap://server.company.com/o=company_us,c=us";  // url

// Initialise JNDI properties
Java.util.Hashtable env = new Hashtable();
env.put( Context.INITIAL_CONTEXT_FACTORY, icf );
env.put( Context.PROVIDER_URL, url );
env.put( Context.REFERRAL, "throw" );

 Context ctx = null;
try {
```

```
      System.out.print( "Initialising JNDI... " );
      ctx = new InitialDirContext( env );
      System.out.println( "Done!" );
} catch ( NamingException nx ) {
      System.out.println( "ERROR: " + nx );
      System.exit(-1);
}
```

Note: Change the `icf` and `url` variables to suit your installation and your JNDI service provider.

The properties required by JNDI initialization are in a Hashtable, which is passed to the InitialDirContext constructor. If this connection fails, an exception is thrown to indicate that the administered objects required later in the application are not available.

Obtain a TopicConnectionFactory using a lookup key that the administrator has defined:

```
// LOOKUP TCF
try {
    System.out.print( "Obtaining TCF from JNDI... " );
    fact = (TopicConnectionFactory)ctx.lookup( tcfLookup );
    System.out.println( "Done!" );
} catch ( NamingException nx ) {
    System.out.println( "ERROR: " + nx );
    System.exit(-1);
}
```

If a JNDI namespace is not available, you can create a TopicConnectionFactory at runtime. You create a new com.ibm.mq.jms.MQTopicConnectionFactory as described in "Creating factories at runtime" on page 201.

Create a TopicConnection

This is created from the TopicConnectionFactory object. Connections are always initialized in a `stop` state and must be started with the following code:

```
// create connection
TopicConnection conn = fact.createTopicConnection();
//start connection
conn.start();
```

Create a TopicSession

This is created using the TopicConnection. This method takes two parameters: one to signify whether the session is transacted, and one to specify the acknowledgement mode:

```
TopicSession sess = conn.createTopicSession(false,
                                  Session.AUTO_ACKNOWLEDGE);
```

Obtain a Topic

This object can be obtained from JNDI, for use with TopicPublishers and TopicSubscribers that are created later. The following code retrieves a Topic:

```
Topic topic = null;
try {
    System.out.print( "Obtaining topic T from JNDI... " );
    topic = (Topic)ctx.lookup( tLookup );
    System.out.println( "Done!" );
}
```

```
catch ( NamingException nx ) {
    System.out.println( "ERROR: " + nx );
    System.exit(-1);
}
```

If a JNDI namespace is not available, you can create a Topic at runtime, as described in "Creating topics at runtime" on page 223.

The following code creates a Topic at runtime:

```
// topic
Topic t = sess.createTopic("myTopic");
```

Create consumers and producers of publications

Depending on the nature of the JMS client application that you write, a subscriber, a publisher, or both must be created. Use the `createPublisher` and `createSubscriber` methods as follows:

```
// publisher
TopicPublisher pub = sess.createPublisher(t);
// subscriber
TopicSubscriber sub = sess.createSubscriber(t);
// publisher
TopicPublisher pubA = sess.createPublisher(topic);
// subscriber
TopicSubscriber subA = sess.createSubscriber(topic);
```

Publish messages

The TopicPublisher object, `pub`, is used to publish messages, rather like a QueueSender is used in the point-to-point domain. The following fragment creates a TextMessage using the session, and then publishes the message:

```
// publish "hello world"
TextMessage  hello = sess.createTextMessage();
hello.setText("Hello World");
pub.publish(hello);
hello.setText("Hello World 2");
pubA.publish(hello);
```

Receive subscriptions

Subscribers must be able to read the subscriptions that are delivered to them, as in the following code:

```
// receive message
TextMessage m = (TextMessage) sub.receive();
System.out.println("Message Text = " + m.getText());
m = (TextMessage) subA.receive();
System.out.println("Message Text = " + m.getText());
```

This fragment of code performs a *get-with-wait*, which means that the receive call blocks until a message is available. Alternative versions of the receive call are available (such as receiveNoWait). For details, see "TopicSubscriber" on page 440.

Close down unwanted resources

It is important to free up all the resources used by the application when it terminates. Use the `close()` method on objects that can be closed (publishers, subscribers, sessions, and connections):

```
// close publishers and subscribers
pub.close();
pubA.close();
sub.close();
subA.close();
```

```
sess.close();

// close session and connection
sess.close();
conn.close();
```

TopicConnectionFactory administered objects

In the example, the TopicConnectionFactory object is obtained from JNDI name space. The TopicConnectionFactory in this case is an administered object that has been created and administered using the JMSAdmin tool. Use this method of obtaining TopicConnectionFactory objects because it ensures code portability.

The TopicConnectionFactory in the example is testTCF in JMSAdmin. Create testTCF in JMSAdmin **before** running the application. You must also create a Topic in JMSAdmin; see "Topic administered objects."

To create a TopicConnectionFactory object, invoke the JMSAdmin tool, as described in "Invoking the administration tool" on page 41, and execute one of the following commands, depending on the type of connection you want to make to the broker:

Bindings connection

```
InitCtx> def tcf(testTCF) transport(bind)
```

or, because this is the default transport type for TopicConnectionFactory objects:

```
InitCtx> def tcf(testTCF)
```

This creates a TopicConnectionFactory with default settings for bindings transport, connecting to the default queue manager.

Client connection

```
InitCtx> def tcf(testTCF) transport(client)
```

This creates a TopicConnectionFactory with default settings for the client transport type, connecting to localhost, on port 1414, using channel SYSTEM.DEF.SVRCONN.

Direct TCP/IP connection to WebSphere MQ Event Broker

```
InitCtx> def tcf(testTCF) transport(direct)
```

This creates a TopicConnectionFactory to make direct connections to a WebSphere MQ Event Broker, connecting to localhost on port 1506.

Topic administered objects

In the example, one of the Topic objects has been obtained from JNDI name space. This Topic is an administered object that has been created and administered in the JMSAdmin tool. Use this method of obtaining Topic objects because it ensures code portability.

To run the example application above, create the Topic called testT in JMSAdmin **before** running the application.

To create a Topic object, invoke the JMSAdmin tool, as described in "Invoking the administration tool" on page 41, and execute one of the following commands, depending on the type of connection you want to make to the broker:

Compatibility mode, or MQSeries Publish/Subscribe (SupportPac MA0C)

```
InitCtx> def t(testT) bver(V1) topic(test/topic)
```

Native mode, or direct to WebSphere MQ Event Broker

```
InitCtx> def t(testT) bver(V2) topic(test/topic)
```

Using topics

This section discusses the use of JMS Topic objects in WebSphere MQ classes for Java Message Service applications.

Topic names

This section describes the use of topic names within WebSphere MQ classes for Java Message Service.

Note: The JMS specification does not specify exact details about the use and maintenance of topic hierarchies. Therefore, this area can vary from one provider to the next.

Topic names in WebSphere MQ JMS are arranged in a tree-like hierarchy, an example of which is shown in Figure 3.

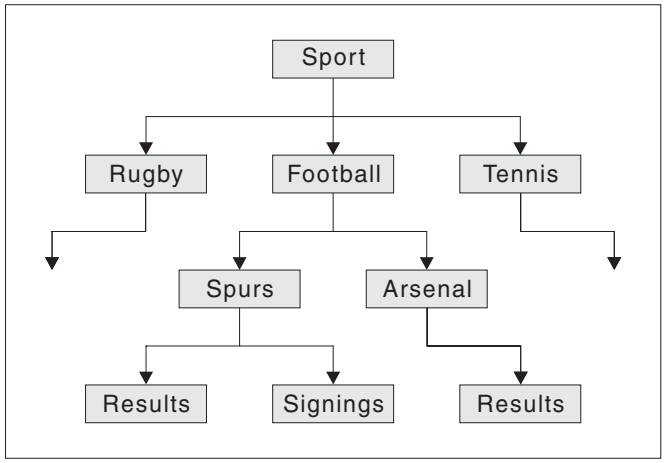


Figure 3. WebSphere MQ classes for Java Message Service topic name hierarchy

In a topic name, levels in the tree are separated by the / character. This means that the Signings node in Figure 3 is identified by the topic name:

```
Sport/Football/Spurs/Signings
```

A powerful feature of the topic system in WebSphere MQ classes for Java Message Service is the use of wildcards. These allow subscribers to subscribe to more than one topic at a time. Different brokers use different wildcard characters and different rules for their substitution. Use the broker version property of the topic (`BROKERVER`) to define which type of wildcards apply.

Note: The broker version of a topic must match the broker version of the topic connection factory you are using.

Broker Version 1 wildcards

The * wildcard matches zero or more characters; the ? wildcard matches a single character.

If a subscriber subscribes to the topic represented by the following topic name:

```
Sport/Football/*/Results
```

it receives publications on topics including:
- Sport/Football/Spurs/Results
- Sport/Football/Arsenal/Results

If the subscription topic is:

```
Sport/Football/Spurs/*
```

it receives publications on topics including:
- Sport/Football/Spurs/Results
- Sport/Football/Spurs/Signings

If the subscription topic is:

```
Sport/Football/*
```

it receives publications on topics including:
- Sport/Football/Arsenal/Results
- Sport/Football/Spurs/Results
- Sport/Football/Spurs/Signings

Broker Version 2 wildcards

The # wildcard matches multiple levels in a topic; the + wildcard matches a single level.

These wildcards can be used only to stand for complete levels within a topic; that is they can be preceded only by / or start-of-string, and they can be followed only by / or end-of-string.

If a subscriber subscribes to the topic represented by the following topic name:

```
Sport/Football/+/Results
```

it receives publications on topics including:
- Sport/Football/Spurs/Results
- Sport/Football/Arsenal/Results

If a subscriber subscribes to the topic represented by the following topic name:

```
Sport/#/Results
```

it receives publications on topics including:
- Sport/Football/Spurs/Results
- Sport/Football/Arsenal/Results

Although `Sport/Football/Spur?/Results` works with broker Version 1, there is no equivalent for broker Version 2, which does not support single character substitutions.

There is no need to administer the topic hierarchies that you use on the broker-side of your system explicitly. When the first publisher or subscriber on a given topic comes into existence, the broker automatically creates the state of the topics currently being published on, and subscribed to.

Unicode characters are supported.

Note: A publisher cannot publish on a topic whose name contains wildcards.

Creating topics at runtime

There are four ways to create Topic objects at runtime:

1. Construct a topic using the one-argument `MQTopic` constructor
2. Construct a topic using the default `MQTopic` constructor, and then call the `setBaseTopicName(..)` method
3. Use the session's `createTopic(..)` method
4. Use the session's `createTemporaryTopic()` method

Method 1: Using MQTopic(..)

This method requires a reference to the WebSphere MQ implementation of the JMS Topic interface, and therefore renders the code non-portable.

The constructor takes one argument, which must be a uniform resource identifier (URI). For WebSphere MQ classes for Java Message Service Topics, this must be of the form:

```
topic://TopicName[?property=value[&property=value]*]
```

For further details on URIs and the permitted name-value pairs, see "Sending a message" on page 204.

The following code creates a topic for non-persistent, priority 5 messages:

```
// Create a Topic using the one-argument MQTopic constructor
String tSpec = "Sport/Football/Spurs/Results?persistence=1&priority=5";
Topic rtTopic = new MQTopic( "topic://" + tSpec );
```

Method 2: Using MQTopic(), then setBaseTopicName(..)

This method uses the default `MQTopic` constructor, and therefore renders the code non-portable.

After the object is created, set the `baseTopicName` property using the `setBaseTopicName` method, passing in the required topic name.

Note: The topic name used here is the non-URI form, and cannot include name-value pairs. Set these by using the set methods, as described in "Setting properties with the set method" on page 206. The following code uses this method to create a topic:

```
// Create a Topic using the default MQTopic constructor
Topic rtTopic = new MQTopic();

// Set the object properties using the setter methods
((MQTopic)rtTopic).setBaseTopicName( "Sport/Football/Spurs/Results" );
((MQTopic)rtTopic).setPersistence(1);
((MQTopic)rtTopic).setPriority(5);
```

Method 3: Using session.createTopic(..)

You can also create a Topic object using the `createTopic` method of TopicSession, which takes a topic URI as follows:

```
// Create a Topic using the session factory method
Topic rtTopic = session.createTopic( "topic://Sport/Football/Spurs/Results" );
```

Although the createTopic method is in the JMS specification, the format of the string argument is vendor-specific. Therefore, using this method might make your code non-portable.

Method 4: Using session.createTemporaryTopic()

A TemporaryTopic is a Topic that can be consumed only by subscribers that are created by the same TopicConnection. A TemporaryTopic is created as follows:

```
// Create a TemporaryTopic using the session factory method
Topic rtTopic = session.createTemporaryTopic();
```

Subscriber options

There are a number of different ways to use JMS subscribers. This section describes some examples of their use.

JMS provides two types of subscribers:

Non-durable subscribers

These subscribers receive messages on their chosen topic, only if the messages are published while the subscriber is active.

Durable subscribers

These subscribers receive all the messages published on a topic, including those that are published while the subscriber is inactive.

Creating non-durable subscribers

The subscriber created in "Create consumers and producers of publications" on page 218 is non-durable and is created with the following code:

```
// Create a subscriber, subscribing on the given topic
 TopicSubscriber sub = session.createSubscriber( topic );
```

Creating durable subscribers

Durable subscribers cannot be configured with a direct connection to WebSphere MQ Event Broker.

Creating a durable subscriber is very similar to creating a non-durable subscriber, but you must also provide a name that uniquely identifies the subscriber:

```
// Create a durable subscriber, supplying a uniquely-identifying name
TopicSubscriber sub = session.createDurableSubscriber( topic, "D_SUB_000001" );
```

Non-durable subscribers automatically deregister themselves when their `close()` method is called (or when they fall out of scope). However, if you want to terminate a durable subscription, you must explicitly notify the system. To do this, use the session's `unsubscribe()` method and pass in the unique name that created the subscriber:

```
// Unsubscribe the durable subscriber created above
session.unsubscribe( "D_SUB_000001" );
```

A durable subscriber is created at the queue manager specified in the MQTopicConnectionFactory queue manager parameter. If there is a subsequent attempt to create a durable subscriber with the same name at a different queue manager, a new and completely independent durable subscriber is returned.

Using message selectors

You can use message selectors to filter out messages that do not satisfy given criteria. For details about message selectors, see "Message selectors" on page 207. Message selectors are associated with a subscriber as follows:

```
// Associate a message selector with a non-durable subscriber
String selector = "company = 'IBM'";
TopicSubscriber sub = session.createSubscriber( topic, selector, false );
```

You can control whether the JMS client or the broker performs message filtering by setting the MessageSelection property on the TopicConnectionFactory. If the broker is capable of performing message selection, it is generally preferable to let the broker do it because it reduces the number of messages sent to your client. However, if the broker is very heavily loaded, it might be preferable to let the client perform message selection instead.

Suppressing local publications

You can create a subscriber that ignores publications that are published on the subscriber's own connection. Set the third parameter of the `createSubscriber` call to true, as follows:

```
// Create a non-durable subscriber with the noLocal option set
TopicSubscriber sub = session.createSubscriber( topic, null, true );
```

Combining the subscriber options

You can combine the subscriber variations, so that you can create a durable subscriber that applies a selector and ignores local publications. The following code fragment shows the use of the combined options:

```
// Create a durable, noLocal subscriber with a selector applied
String selector = "company = 'IBM'";
TopicSubscriber sub = session.createDurableSubscriber( topic, "D_SUB_000001",
                                                       selector, true );
```

Configuring the base subscriber queue

Subscriber queues cannot be configured for a direct connection to WebSphere MQ Event Broker.

There are two ways in which you can configure subscribers:

- Multiple queue approach

  Each subscriber has an exclusive queue assigned to it, from which it retrieves all its messages. JMS creates a new queue for each subscriber. This is the only approach available with WebSphere MQ JMS V1.1.
- Shared queue approach

  A subscriber uses a shared queue, from which it, and other subscribers, retrieve their messages. This approach requires only one queue to serve multiple subscribers. This is the default approach used with WebSphere MQ JMS.

You can choose which approach to use, and configure which queues to use.

In general, the shared queue approach gives a modest performance advantage. For systems with a high throughput, there are also large architectural and administrative advantages, because of the significant reduction in the number of queues required.

In some situations, there are still good reasons for using the multiple queue approach:

- The theoretical physical capacity for message storage is greater.

  A WebSphere MQ queue cannot hold more than 640000 messages, and in the shared queue approach, this must be divided between all the subscribers that share the queue. This issue is more significant for durable subscribers, because

the lifetime of a durable subscriber is usually much longer than that of a non-durable subscriber. Therefore, more messages might accumulate for a durable subscriber.

- External administration of subscription queues is easier.

  For certain application types, administrators might want to monitor the state and depth of particular subscriber queues. This task is much simpler when there is one to one mapping between a subscriber and a queue.

Default configuration

The default configuration uses the following shared subscription queues:

- SYSTEM.JMS.ND.SUBSCRIBER.QUEUE for non-durable subscriptions
- SYSTEM.JMS.D.SUBSCRIBER.QUEUE for durable subscriptions

These are created for you when you run the MQJMS_PSQ.MQSC script.

If required, you can specify alternative physical queues. You can also change the configuration to use the multiple queue approach.

Configuring non-durable subscribers

You can set the non-durable subscriber queue name property in either of the following ways:

- Use the WebSphere MQ JMS administration tool (for JNDI retrieved objects) to set the BROKERSUBQ property
- Use the setBrokerSubQueue() method in your program

For non-durable subscriptions, the queue name you provide should start with the following characters:

SYSTEM.JMS.ND.

To select a shared queue approach, specify an explicit queue name, where the named queue is the one to use for the shared queue. The queue that you specify must already physically exist before you create the subscription.

To select the multiple queue approach, specify a queue name that ends with the * character. Subsequently, each subscriber that is created with this queue name creates an appropriate dynamic queue, for exclusive use by that particular subscriber. MQ JMS uses its own internal model queue to create such queues. Therefore, with the multiple queue approach, all required queues are created dynamically.

When you use the multiple queue approach, you cannot specify an explicit queue name. However, you can specify the queue prefix. This enables you to create different subscriber queue domains. For example, you could use:

SYSTEM.JMS.ND.MYDOMAIN.*

The characters that precede the * character are used as the prefix, so that all dynamic queues that are associated with this subscription have queue names that start with SYSTEM.JMS.ND.MYDOMAIN.

Configuring durable subscribers

As discussed earlier, there might still be good reasons to use the multiple queue approach for durable subscriptions. Durable subscriptions are likely to have a longer life span, so it is possible that a large number of unretrieved messages could accumulate on the queue.

Therefore, the durable subscriber queue name property is set in the Topic object (that is, at a more manageable level than TopicConnectionFactory). This enables you to specify a number of different subscriber queue names, without needing to re-create multiple objects starting from the TopicConnectionFactory.

You can set the durable subscriber queue name in either of the following ways:

- Use the WebSphere MQ JMS administration tool (for JNDI retrieved objects) to set the BROKERDURSUBQ property
- Use the setBrokerDurSubQueue() method in your program:

  ```
  // Set the MQTopic durable subscriber queue name using
  // the multi-queue approach
  sportsTopic.setBrokerDurSubQueue("SYSTEM.JMS.D.FOOTBALL.*");
  ```

  Once the Topic object is initialized, it is passed into the TopicSession createDurableSubscriber() method to create the specified subscription:

  ```
  // Create a durable subscriber using our earlier Topic
  TopicSubscriber sub = new session.createDurableSubscriber
                                              (sportsTopic, "D_SUB_SPORT_001");
  ```

For durable subscriptions, the queue name you provide must start with the following characters:

SYSTEM.JMS.D.

To select a shared queue approach, specify an explicit queue name, where the named queue is the one to use for the shared queue. The queue that you specify must already physically exist before you create the subscription.

To select the multiple queue approach, specify a queue name that ends with the * character. Subsequently, each subscriber that is created with this queue name creates an appropriate dynamic queue, for exclusive use by that subscriber. MQ JMS uses its own internal model queue to create such queues. Therefore, with the multiple queue approach, all required queues are created dynamically.

When you use the multiple queue approach, you cannot specify an explicit queue name. However, you can specify the queue prefix. This enables you to create different subscriber queue domains. For example, you could use:

SYSTEM.JMS.D.MYDOMAIN.*

The characters that precede the * character are used as the prefix, so that all dynamic queues that are associated with this subscription have queue names that start with SYSTEM.JMS.D.MYDOMAIN.

You cannot change the queue used by a durable subscriber. To do so, for example to move from the multiple queue approach to the single queue approach, first delete the old subscriber (using the unsubscribe() method) and create the subscription again from new. This removes any unconsumed messages on the durable subscription.

Subscription stores

There is no subscription store with a direct connection to WebSphere MQ Event Broker.

WebSphere MQ JMS maintains a persistent store of subscription information, used to resume durable subscriptions and cleanup after failed non-durable subscribers. This information can be managed by the publish/subscribe broker.

See the README provided with WebSphere MQ JMS for information about suitable levels of queue manager and broker.

The choice of subscription store is based on the SUBSTORE property of the TopicConnectionFactory. This takes one of three values: QUEUE, BROKER, or MIGRATE.

SUBSTORE(QUEUE)
Subscription information is stored on SYSTEM.JMS.ADMIN.QUEUE and SYSTEM.JMS.PS.STATUS.QUEUE on the local queue manager.

WebSphere MQ JMS maintains an extra connection for a long-running transaction used to detect failed subscribers. There is a connection to each queue manager in use. In a busy system, this might cause the queue manager logs to fill up, resulting in errors from both the queue manager and its applications.

If you experience these problems, the system administrator can add extra log files or datasets to the queue manager. Alternatively, reduce the STATREFRESHINT property on the TopicConnectionFactory. This causes the long-running transaction to be refreshed more frequently, allowing the logs to reset themselves.

After a non-durable subscriber has failed:

- Information is left on the two SYSTEM.JMS queues, which allows a later JMS application to clean up after the failed subscriber. See "Subscriber cleanup utility" on page 230 for more information.
- Messages continue to be delivered to the subscriber until a later JMS application is executed.

SUBSTORE(QUEUE) is provided for compatibility with versions of MQSeries JMS.

SUBSTORE(BROKER)
Subscription information is stored by the publish/subscribe broker used by the application. This option requires recent levels of queue manager and publish/subscribe broker. See the README provided with WebSphere MQ JMS for information about suitable levels of queue manager and broker. This subscription store requires recent levels of both queue manager and publish/subscribe broker. It is designed to provide improved resilience.

When a non-durable subscriber fails, the subscription is deregistered from the broker as soon as possible. The broker adds a response to this deregistration onto the SYSTEM.JMS.REPORT.QUEUE, which is used to clean up after the failed subscriber. With SUBSTORE(BROKER), a separate cleanup thread is run regularly in the background of each JMS publish/subscribe application.

Cleanup is run once every 10 minutes by default, but you can change this using the CLEANUPINT property on the TopicConnectionFactory. To customize the actions performed by cleanup, use the CLEANUP property on the TopicConnectionFactory.

See "Subscriber cleanup utility" on page 230 for more information about the different behaviors of cleanup with SUBSTORE(BROKER).

SUBSTORE(MIGRATE)
MIGRATE is the default value for SUBSTORE.

This option dynamically selects the queue-based or broker-based subscription store based on the levels of queue manager and publish/subscribe broker installed. If both queue manager and broker are capable of supporting SUBSTORE(BROKER), this behaves as SUBSTORE(BROKER); otherwise it behaves as SUBSTORE(QUEUE). Additionally, SUBSTORE(MIGRATE) transfers durable subscription information from the queue-based subscription store to the broker-based store.

This provides an easy migration path from older versions of WebSphere MQ JMS, WebSphere MQ, and publish/subscribe broker. This migration occurs the first time the durable subscription is opened when both queue manager and broker are capable of supporting the broker-based subscription store. Only information relating to the subscription being opened is migrated; information relating to other subscriptions is left in the queue-based subscription store.

Migration and coexistence considerations

Except when SUBSTORE(MIGRATE) is used, the two subscription stores are entirely independent.

A durable subscription is created in the store specified by the TopicConnectionFactory. If there is a subsequent attempt to create a durable subscriber with the same name and ClientID but with the other subscription store, a new durable subscription is created.

When a connection uses SUBSTORE(MIGRATE), subscription information is automatically transferred from the queue-based subscription store to the broker-based subscription store when createDurableSubscriber() is called. If a durable subscription with matching name and ClientID already exists in the broker-based subscription store, this migration cannot complete and an exception is thrown from createDurableSubscriber().

Once a subscription has been migrated, it is important not to access the subscription from an application using an older version of WebSphere MQ JMS, or an application running with SUBSTORE(QUEUE). This would create a subscription in the queue-based subscription store, and prevent an application running with SUBSTORE(MIGRATE) from using the subscription.

To recover from this situation, either use SUBSTORE(BROKER) from your application or unsubscribe from the subscription with SUBSTORE(QUEUE).

For SUBSTORE(BROKER) to function, or for SUBSTORE(MIGRATE) to use the broker-based subscription store, suitable versions of both queue manager and broker need to be available to WebSphere MQ JMS. Refer to the README for information regarding suitable levels.

Solving publish/subscribe problems

This section describes some problems that can occur when you develop JMS client applications that use the publish/subscribe domain. It discusses problems that are specific to the publish/subscribe domain. Refer to “Handling errors” on page 209 and “Solving problems” on page 38 for more general troubleshooting guidance.

Incomplete publish/subscribe close down

It is important that JMS client applications surrender all external resources when they terminate. To do this, call the `close()` method on all objects that can be closed once they are no longer required. For the publish/subscribe domain, these objects are:

- TopicConnection
- TopicSession
- TopicPublisher
- TopicSubscriber

The WebSphere MQ classes for Java Message Service implementation eases this task by using a *cascading close*. With this process, a call to close on a TopicConnection results in calls to close on each of the TopicSessions it created. This in turn results in calls to close on all TopicSubscribers and TopicPublishers the sessions created.

To ensure the proper release of external resources, call `connection.close()` for each of the connections that an application creates.

There are some circumstances where this close procedure might not complete. These include:

- Loss of a WebSphere MQ client connection
- Unexpected application termination

In these circumstances, the `close()` is not called, and external resources remain open on the terminated application's behalf. The main consequences of this are:

Broker state inconsistency
The WebSphere MQ Message Broker might contain registration information for subscribers and publishers that no longer exist. This means that the broker might continue forwarding messages to subscribers that will never receive them.

Subscriber messages and queues remain
Part of the subscriber deregistration procedure is the removal of subscriber messages. If appropriate, the underlying WebSphere MQ queue that was used to receive subscriptions is also removed. If normal closure has not occurred, these messages and queues remain. If there is broker state inconsistency, the queues continue to fill up with messages that will never be read.

Additionally, if the broker resides on a queue manager other than the application's local queue manager, correct operation of WebSphere MQ JMS depends on the communication channels between the two queue managers. If these channels fail for any reason, problems such as the above can occur until the channels restart. When diagnosing problems relating to channels, be careful not to lose WebSphere MQ JMS control messages on the transmission queue.

Subscriber cleanup utility

To avoid the problems associated with non-graceful closure of subscriber objects, WebSphere MQ JMS includes a subscriber cleanup utility that attempts to detect any earlier WebSphere MQ JMS publish/subscribe problems that could have resulted from other applications. This utility runs transparently in the background and should not affect other WebSphere MQ JMS operations. If a large number of problems are detected against a given queue manager, you might see some performance degradation while resources are cleaned up.

Note: Close all subscriber objects gracefully whenever possible, to avoid a buildup of subscriber problems.

The exact behavior of the utility depends on the subscription store in use:

Subscriber cleanup with SUBSTORE(QUEUE)
When using the queue-based subscription store, cleanup runs on a queue manager when the first TopicConnection to use that physical queue manager initializes.

If all the TopicConnections on a given queue manager close, when the next TopicConnection initializes for that queue manager, the utility runs again.

The cleanup utility uses information found on the SYSTEM.JMS.ADMIN.QUEUE and SYSTEM.JMS.PS.STATUS.QUEUE to detect previously failed subscribers. If any are found, it cleans up associated resources by deregistering the subscriber from the broker, and cleaning up any unconsumed messages or temporary queues associated with the subscription.

Subscriber cleanup with SUBSTORE(BROKER)
With the broker-based subscription store, cleanup runs regularly on a background thread while there is an open TopicConnection to a particular physical queue manager. One instance of the cleanup thread is created for each physical queue manager to which a TopicConnection exists within the JVM.

The cleanup utility uses information found on the SYSTEM.JMS.REPORT.QUEUE (typically responses from the publish/subscribe broker) to remove unconsumed messages and temporary queues associated with a failed subscriber. It can be a few seconds after the subscriber fails before the cleanup routine can remove the messages and queues.

Two properties on the TopicConnectionFactory control behavior of this cleanup thread: CLEANUP and CLEANUPINT. CLEANUPINT determines how often (in milliseconds) cleanup is executed against any given queue manager. CLEANUP takes one of four possible values:

CLEANUP(SAFE)
This is the default value.

The cleanup thread tries to remove unconsumed subscription messages or temporary queues for failed subscriptions. This mode of cleanup does not interfere with the operation of other JMS applications.

CLEANUP(STRONG)
The cleanup thread performs as CLEANUP(SAFE), but also clears the SYSTEM.JMS.REPORT.QUEUE of any unrecognized messages.

This mode of cleanup can interfere with the operation of JMS applications running with later versions of WebSphere MQ JMS. If multiple JMS applications are using the same queue manager, but using different versions of WebSphere MQ JMS, only clients using the most recent version of WebSphere MQ JMS must use this option.

CLEANUP(NONE)
In this special mode, no cleanup is performed, and no cleanup

thread exists. Additionally, if the application is using the single-queue approach, unconsumed messages can be left on the queue.

This option can be useful if the application is distant from the queue manager, and especially if it only publishes rather than subscribes. However, one application must clean up the queue manager to deal with any unconsumed messages. This can be a JMS application with CLEANUP(SAFE) or CLEANUP(STRONG), or the manual cleanup utility described in "Manual cleanup."

CLEANUP(ASPROP)
The style of cleanup to use is determined by the system property com.ibm.mq.jms.cleanup, which is queried at JVM startup.

This property can be set on the Java command-line using the -D option, to NONE, SAFE, or STRONG. Any other value causes an exception. If not set, the property defaults to SAFE.

This allows easy JVM-wide change to the cleanup level without updating every TopicConnectionFactory used by the system. This is useful for applications or application servers that use multiple TopicConnectionFactory objects.

Where multiple TopicConnections exist within a JVM against the same queue manager, but with differing values for CLEANUP and CLEANUPINT, the following rules are used to determine behavior:

1. A TopicConnection with CLEANUP(NONE) does not attempt to clean up immediately after its subscription has closed. However, if another TopicConnection is using SAFE or STRONG cleanup, the cleanup thread eventually cleans up after the subscription.
2. If any TopicConnection is using STRONG Cleanup, the cleanup thread operates at STRONG level. Otherwise, if any TopicConnection uses SAFE Cleanup, the cleanup thread operates at SAFE level. Otherwise, there is no cleanup thread.
3. The smallest value of CLEANUPINT for those TopicConnections with SAFE or STRONG Cleanup is used.

Manual cleanup

If you use the broker-based subscription store, you can operate cleanup manually from the command-line. The syntax for bindings attach is:

```
Cleanup [-m <qmgr>] [-r <interval>]
          [SAFE | STRONG | FORCE | NONDUR] [-t]
```

or, for client attach:

```
Cleanup -client [-m <qmgr>] -host <hostname> [-port <port>]
         [-channel <channel>] [-r <interval>]
         [SAFE | STRONG | FORCE | NONDUR] [-t]
```

Where:

- `qmgr`, `hostname`, `port`, and `channel` determine connection settings for the queue manager to clean up.
- `-r` sets the interval between executions of cleanup, in minutes. If not set, cleanup is performed once.
- `-t` enables tracing, to the mqjms.trc file.
- SAFE, STRONG, FORCE, and NONDUR set the cleanup level, as follows:

– SAFE and STRONG cleanup behave like the CLEANUP(SAFE) and CLEANUP(STRONG) options discussed in "Subscriber cleanup utility" on page 230.
– FORCE cleanup behaves like STRONG Cleanup. However, STRONG cleanup leaves messages that could not be processed on the SYSTEM.JMS.REPORT.QUEUE; FORCE cleanup removes all messages even if it encounters an error during processing.

Warning
This is a dangerous option that can leave an inconsistent state between the queue manager and the broker. It cannot be run while any WebSphere MQ JMS publish/subscribe application is running against the queue manager; doing so causes the cleanup utility to abort.

– NONDUR behaves like FORCE cleanup.

  After clearing the SYSTEM.JMS.REPORT.QUEUE, it attempts to remove any remaining unconsumed messages sent to non-durable subscribers. If the queue manager's command server is running on any queue beginning SYSTEM.JMS.ND.*, messages are cleared and the queue itself might be deleted. Otherwise, only SYSTEM.JMS.ND.SUBSCRIBER.QUEUE and SYSTEM.JMS.ND.CC.SUBSCRIBER.QUEUE are cleared of messages.

Cleanup from within a program

You can use a programming interface to the cleanup routines for use with SUBSTORE(BROKER), through the class com.ibm.mq.jms.Cleanup. Instances of this class have getter/setter methods for each of the connection properties; and also for the cleanup level and interval.

It exposes two methods:

cleanup()
Executes cleanup once

run() Runs cleanup at intervals determined by the properties of the cleanup object

This class allows complete customization of publish/subscribe Cleanup, but it is intended for use by system administration programs rather than application programs.

For more details, refer to "Cleanup *" on page 308.

Handling broker reports

The WebSphere MQ JMS implementation uses report messages from the broker to confirm registration and deregistration commands. These reports are normally consumed by the WebSphere MQ classes for Java Message Service implementation, but under some error conditions, they might remain on the queue. These messages are sent to the `SYSTEM.JMS.REPORT.QUEUE` queue on the local queue manager.

A Java application, `PSReportDump`, is supplied with WebSphere MQ classes for Java Message Service, which dumps the contents of this queue in plain text format. The information can then be analyzed, either by you, or by IBM support staff. You can also use the application to clear the queue of messages after a problem is diagnosed or fixed.

The compiled form of the tool is installed in the <MQ_JAVA_INSTALL_PATH>/bin directory. To invoke the tool, change to this directory, then use the following command:

```
java PSReportDump [-m queueManager] [-clear]
```

where:

-m queueManager
The name of the queue manager to use

-clear Clear the queue of messages after dumping its contents

Attention: Do not use this option if you are using the broker-based subscription store. Instead, run the manual cleanup utility at FORCE level.

Output is sent to the screen, or you can redirect it to a file.

Other considerations

If a large number of JMS clients connect directly to a WebSphere MQ Event Broker broker on Windows, and the connections happen almost simultaneously, a java.net.BindException address in use exception might be thrown in response to a TopicConnection call. You can try to avoid this by catching the exception and retrying, or by pacing the connections.

Chapter 12. Writing WebSphere MQ JMS 1.1 applications

This chapter provides information to help you write WebSphere MQ JMS 1.1 applications. It covers information similar to that provided in Chapter 10, "Writing WebSphere MQ JMS applications," on page 199 and Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213, but from a JMS 1.1 perspective.

The JMS 1.1 model

You can write a JMS application using two styles of messaging:

- Point-to-point
- Publish/subscribe

These styles of messaging are also referred to as *messaging domains* and you can combine both styles of messaging in one application.

With versions of JMS before JMS 1.1, programming for the point-to-point domain uses one set of interfaces and methods, and programming for the publish/subscribe domain uses another set. The two sets are similar, but separate. With JMS 1.1, you can use a common set of interfaces and methods that support both messaging domains. The common interfaces provide a *domain independent* view of each messaging domain. Table 17 lists the JMS 1.1 domain independent interfaces and their corresponding *domain specific* interfaces.

Table 17. The JMS 1.1 domain independent interfaces

Domain independent interfaces	Domain specific interfaces for the point-to-point domain	Domain specific interfaces for the publish/subscribe domain
ConnectionFactory	QueueConnectionFactory	TopicConnectionFactory
Connection	QueueConnection	TopicConnection
Destination	Queue	Topic
Session	QueueSession	TopicSession
MessageProducer	QueueSender	TopicPublisher
MessageConsumer	QueueReceiver QueueBrowser	TopicSubscriber

JMS 1.1 retains all the domain specific interfaces in JMS 1.0.2b, and so existing applications can still use these interfaces. For new applications, however, consider using the JMS 1.1 domain independent interfaces.

In the WebSphere MQ JMS implementation of JMS 1.1, the administered objects are the following:

- ConnectionFactory
- Queue
- Topic

Destination is an abstract superclass of Queue and Topic, and so an instance of Destination is either a Queue or a Topic object. The domain independent interfaces

treat a queue or a topic as a destination. The messaging domain for a MessageConsumer or a MessageProducer object is determined by whether the destination is a queue or a topic.

Building a connection

Connections are not created directly, but are built using a connection factory. ConnectionFactory objects can be stored in a JNDI namespace, insulating the JMS application from provider specific information. For information about how to create and store ConnectionFactory objects, see Chapter 5, “Using the WebSphere MQ JMS administration tool,” on page 41.

Retrieving a connection factory from JNDI

To retrieve a ConnectionFactory object from a JNDI namespace, you must first set up an initial context as shown in the following code:

```
import javax.jms.*;
import javax.naming.*;
import javax.naming.directory.*;
 .
 .
 .
  java.util.Hashtable environment = new java.util.Hashtable();
  environment.put(Context.INITIAL_CONTEXT_FACTORY, icf);
  environment.put(Context.PROVIDER_URL, url);
  Context ctx = new InitialDirContext( environment );
```

In this code:

icf Defines a factory class for the initial context

url Defines a context specific URL

For more details about using a JNDI namespace, see Sun’s JNDI documentation.

Note: Some combinations of the JNDI packages and LDAP service providers can result in an LDAP error 84. To resolve the problem, insert the following line before the call to InitialDirContext:

```
environment.put(Context.REFERRAL, "throw");
```

After an initial context is obtained, you can retrieve a ConnectionFactory object from the JNDI namespace by using the lookup() method. The following code retrieves a ConnectionFactory object named CF from an LDAP based namespace:

```
ConnectionFactory factory;
factory = (ConnectionFactory)ctx.lookup("cn=CF");
```

Using a connection factory to create a connection

You can use the createConnection() method on a ConnectionFactory object to create a Connection object, as shown in the following example:

```
Connection connection;
connection = factory.createConnection();
```

Both QueueConnectionFactory and TopicConnectionFactory inherit the createConnection() method from ConnectionFactory. You can therefore use createConnection() to create a domain specific object, as shown in the following code:

```
QueueConnectionFactory QCF;
Connection connection;
connection = QCF.createConnection();
```

This code creates a QueueConnection object. An application can now perform a domain independent operation on this object, or an operation that is applicable only to the point-to-point domain. If the application attempts to perform an operation that is applicable only to the publish/subscribe domain, an IllegalStateException is thrown with the message `MQJMS1112: JMS 1.1 Invalid operation for a domain specific object.` This is because the connection was created from a domain specific connection factory.

Creating a connection factory at runtime

If a JNDI namespace is not available, it is possible to create a ConnectionFactory object at runtime. However, using this method reduces the portability of a JMS application because the application must then include references to WebSphere MQ specific classes.

The following code creates a ConnectionFactory object with all the default settings:

```
factory = new com.ibm.mq.jms.MQConnectionFactory();
```

The default transport type is bindings. You can change the transport type for a connection factory by using the setTransportType() method. Here are some examples:

```
fact.setTransportType(JMSC.MQJMS_TP_BINDINGS_MQ);     // Bindings mode
fact.setTransportType(JMSC.MQJMS_TP_CLIENT_MQ_TCPIP); // Client mode
fact.setTransportType(JMSC.MQJMS_TP_DIRECT_TCPIP);    // Direct TCP/IP mode
```

For information about transport types in each of the specific messaging domains, see “Choosing client or bindings transport” on page 202, for the point-to-point domain, and “TopicConnectionFactory administered objects” on page 220, for the publish/subscribe domain.

Note that you cannot use the point-to-point style of messaging if the transport type is direct. If an application uses Connection and Session objects that are created from a ConnectionFactory object whose transport type is direct, the application can perform only publish/subscribe operations.

A ConnectionFactory object has the same properties as those of a QueueConnectionFactory object and a TopicConnectionFactory object combined. However, certain combinations of property settings are not valid for a ConnectionFactory object. See “Properties” on page 49 for more details.

Starting the connection

The JMS specification states that a connection is created in the `stopped` state. Until the connection starts, a message consumer that is associated with the connection cannot receive any messages. To start the connection, issue the following command:

```
connection.start();
```

Specifying a range of ports for client connections

If a JMS application attempts to connect to a WebSphere MQ queue manager in client mode, a firewall might allow only those connections that originate from specified ports or a range of ports. In this situation, you can use the

LOCALADDRESS property of a ConnectionFactory, QueueConnectionFactory, or TopicConnectionFactory object to specify a port, or a range of points, that the application can bind to.

You can set the LOCALADDRESS property by using the WebSphere MQ JMS administration tool, or by calling the setLocalAddress() method in a JMS application. Here is an example of setting the property from within an application:

```
mqConnectionFactory.setLocalAddress("9.20.0.1(2000,3000)");
```

When the application connects to a queue manager subsequently, the application binds to a local IP address and port number in the range 9.20.0.1(2000) to 9.20.0.1(3000).

Connection errors might occur if you restrict the range of ports. If an error occurs, a JMSException is thrown with an embedded MQException that contains the WebSphere MQ reason code, MQRC_Q_MGR_NOT_AVAILABLE. An error might occur if all the ports in the specified range are in use, or if the LOCALADDRESS property contains an IP address, host name, or port number that is not valid; a negative port number, for example.

Because the WebSphere MQ JMS client might create connections other than those required by an application, always consider specifying a range of ports. In general, every Session created by an application requires one port and the WebSphere MQ JMS client might require three additional ports. If a connection error does occur, increase the range of ports.

JMS connection pooling, which is used by default, might have an effect on the speed at which ports can be reused. As a result, a connection error might occur while ports are being freed.

Obtaining a session

After a connection is made, use the createSession() method on the Connection object to obtain a session. The method has two parameters:

1. A boolean parameter that determines whether the session is transacted or non-transacted.
2. A parameter that determines the acknowledge mode.

The simplest case is obtaining a non-transacted session with an acknowledge mode of AUTO_ACKNOWLEDGE, as shown in the following code:

```
Session session;
.
.
.
boolean transacted = false;
session = connection.createSession(transacted, Session.AUTO_ACKNOWLEDGE);
```

Note: A connection is thread safe, but sessions (and the objects that are created from them) are not. The recommended practice for multithreaded applications is to use a separate session for each thread.

Destinations

The Destination interface is the abstract superclass of Queue and Topic. In the WebSphere MQ JMS implementation of JMS 1.1, Queue and Topic objects encapsulate addresses in WebSphere MQ and the broker. For example, a Queue object encapsulates the name of a WebSphere MQ queue.

For information about using Queue objects in the point-to-point domain, see "Sending a message" on page 204 and, for information about using Topic objects in the publish/subscribe domain, see "Using topics" on page 221. The following is a overview from a domain independent perspective.

Queue and Topic objects are retrieved from a JNDI namespace in the following way:

```
Queue ioQueue;
ioQueue = (Queue)ctx.lookup( qLookup );
.
.
.
Topic ioTopic;
ioTopic = (Topic)ctx.lookup( tLookup );
```

The WebSphere MQ JMS implementation of Queue and Topic interfaces are in the com.ibm.mq.jms.MQQueue and com.ibm.qm.jms.MQTopic classes respectively. These classes contain properties that control the behavior of WebSphere MQ and the broker but, in many cases, it is possible to use the default values. As well as being able to administer Queue and Topic objects in a JNDI namespace, JMS defines a standard way of specifying a destination at runtime that minimizes the WebSphere MQ specific code in the application. This mechanism uses the Session.createQueue() and Session.createTopic() methods, which take a string parameter that specifies the destination. The string is still in a provider specific format, but this approach is more flexible than referring directly to the provider classes.

WebSphere MQ JMS accepts two forms for the string parameter of createQueue():

- The first is the name of a WebSphere MQ queue:

  ```
  public static final String QUEUE = "SYSTEM.DEFAULT.LOCAL.QUEUE" ;
  .
  .
  .
  ioQueue = session.createQueue( QUEUE );
  ```

- The second, and more powerful, form is a uniform resource identifier (URI). This form allows you to specify a remote queue, which is a queue on a queue manager other than the one to which you are connected. It also allows you to set the other properties of a com.ibm.mq.jms.MQQueue object.

  The URI for a queue begins with the sequence `queue://`, followed by the name of the queue manager on which the queue resides. This is followed by a further forward slash (/), the name of the queue, and, optionally, a list of name-value pairs that set the remaining queue properties. For example, the URI equivalent of the previous example is the following:

  ```
  ioQueue = session.createQueue("queue:///SYSTEM.DEFAULT.LOCAL.QUEUE");
  ```

  The name of the queue manager is omitted. This is interpreted to mean as the queue manager to which the owning Connection object is connected at the time when the Queue object is used.

Note: When sending a message to a cluster, leave the queue manager field in the Queue object blank. This enables an MQOPEN call to be performed in BIND_NOT_FIXED mode, which allows the queue manager to be determined. Otherwise an exception is returned reporting that the Queue object cannot be found. This applies when using JNDI or defining a queue at runtime.

WebSphere MQ JMS accepts a topic URI for the string parameter of createTopic(), as shown in the following example:

```
Topic topic = session.createTopic( "topic://Sport/Football/Spurs/Results" );
```

Although the createTopic() method is in the JMS specification, the format of the string argument is provider specific. Therefore, using this method can make your code non-portable.

Other ways of creating a Topic object at runtime are as follows:

Using MQTopic(..)

This way requires a reference to the WebSphere MQ JMS implementation of the Topic interface, and therefore renders the code non-portable.

The constructor takes one argument, which must be a URI. For a WebSphere MQ JMS topic, this must be of the form:

```
topic://TopicName[?property=value[&property=value]*]
```

For example, the following code creates a topic for nonpersistent messages with a priority of 5:

```
// Create a Topic using the one-argument MQTopic constructor
String tSpec = "Sport/Football/Spurs/Results?persistence=1&priority=5";
Topic rtTopic = new MQTopic( "topic://" + tSpec );
```

Using MQTopic(), then setBaseTopicName(..)

This way uses the default MQTopic constructor, and therefore renders the code non-portable. Here is an example:

```
// Create a Topic using the default MQTopic constructor
Topic rtTopic = new MQTopic();
.
.
.
// Set the object properties using the setter methods
((MQTopic)rtTopic).setBaseTopicName( "Sport/Football/Spurs/Results" );
((MQTopic)rtTopic).setPersistence(1);
((MQTopic)rtTopic).setPriority(5);
```

Using session.createTemporaryTopic()

A temporary topic is created by a session, and only message consumers created by the same session can consume messages from the topic. A TemporaryTopic object is created as follows:

```
// Create a TemporaryTopic using the session factory method
Topic rtTopic = session.createTemporaryTopic();
```

Sending a message

An application sends messages using a MessageProducer object. A MessageProducer object is normally created for a specific destination so that all messages sent using that message producer are sent to the same destination. The destination is specified using either a Queue or a Topic object. Queue and Topic objects can be created at runtime, or built and stored in a JNDI namespace, as described in “Destinations” on page 239.

After a Queue or a Topic object is obtained, an application can pass the object to the createProducer() method to create a MessageProducer object, as shown in the following example:

```
MessageProducer messageProducer = session.createProducer(ioDestination);
```

The parameter ioDestination can be either a Queue or a Topic object.

The application can then use the send() method on the MessageProducer object to send messages. Here is an example:

```
messageProducer.send(outMessage);
```

You can use the send() method to send messages in either messaging domain. The nature of the destination determines the actual domain used. However, TopicPublisher, the sub-interface for MessageProducer that is specific to the publish/subscribe domain, uses a publish() method instead.

An application can create a MessageProducer object with no specified destination. In this case, the application must specify the destination in the send() method.

Message types

JMS provides several message types, each of which embodies some knowledge of its content. To avoid referring to the provider specific class names for the message types, methods for creating messages are provided on a Session object.

For example, a text message can be created in the following manner:

```
System.out.println( "Creating a TextMessage" );
TextMessage outMessage = session.createTextMessage();
System.out.println("Adding Text");
outMessage.setText(outString);
```

Here are the message types you can use:

- BytesMessage
- MapMessage
- ObjectMessage
- StreamMessage
- TextMessage

Details of these types are in Chapter 15, “JMS interfaces and classes,” on page 295.

Receiving a message

An application receives messages using a MessageConsumer object. The application creates a MessageConsumer object by using the createConsumer() method on a Session object. This method has a destination parameter that defines where the messages are received from. See “Destinations” on page 239 for details of how to create a destination, which is either a Queue or a Topic object.

In the point-to-point domain, the following code creates a MessageConsumer object and then uses the object to receive a message:

```
MessageConsumer messageConsumer = session.createConsumer(ioQueue);
Message inMessage = messageConsumer.receive(1000);
```

The parameter on the receive() call is a timeout in milliseconds. This parameter defines how long the method must wait if no message is available immediately.

You can omit this parameter; in which case, the call blocks until a suitable message arrives. If you do not want any delay, use the receiveNoWait() method.

The receive() methods return a message of the appropriate type. For example, suppose a text message is put on a queue. When the message is received, the object that is returned is an instance of TextMessage.

To extract the content from the body of the message, it is necessary to cast from the generic Message class (which is the declared return type of the receive() methods) to the more specific subclass, such as TextMessage. If the received message type is not known, you can use the `instanceof` operator to determine which type it is. It is good practice always to test the message class before casting so that unexpected errors can be handled gracefully.

The following code uses the `instanceof` operator and shows how to extract the content of a text message:

```
if (inMessage instanceof TextMessage) {
  String replyString = ((TextMessage) inMessage).getText();
  .
  .
  .
} else {
  // Print error message if Message was not a TextMessage.
  System.out.println("Reply message was not a TextMessage");
}
```

JMS provides two types of message consumer:

Nondurable message consumer
A nondurable message consumer receives messages from its chosen destination only if the messages are available while the consumer is active.

In the point-to-point domain, whether a consumer receives messages that are sent while the consumer is inactive depends on how WebSphere MQ is configured to support that consumer. In the publish/subscribe domain, a consumer does not receive messages that are sent while the consumer is inactive.

Durable topic subscriber
A durable topic consumer receives all the messages sent to a destination, including those sent while the consumer is inactive.

The following sections describe how to create a durable topic subscriber, and how to configure WebSphere MQ and the broker to support either type of message consumer.

Creating durable topic subscribers

You cannot create a durable topic subscriber if the transport type is direct.

Durable topic subscribers are used when an application needs to receive messages that are published even while the application is inactive. Creating a durable topic subscriber is very similar to creating a nondurable message consumer, but you must also provide a name that uniquely identifies the subscription, as in the following example:

```
// Create a durable subscriber, supplying a uniquely-identifying name
TopicSubscriber sub = session.createDurableSubscriber( topic, "D_SUB_000001" );
```

A durable topic subscriber is created for the queue manager specified by the QMANAGER property of the MQTopicConnectionFactory object. If there is a subsequent attempt to create a durable topic subscriber with the same name for a different queue manager, a new and completely independent durable topic subscriber is returned.

Nondurable message consumers in the publish/subscribe domain automatically deregister themselves when their close() method is called, or when they fall out of scope. However, if you want to terminate a durable subscription, you must explicitly notify the broker. To do this, use the unsubscribe() method of the session and pass in the name that uniquely identifies the subscription:

```
// Unsubscribe the durable subscriber created above
session.unsubscribe( "D_SUB_000001" );
```

Message selectors

JMS allows an application to specify that only messages that satisfy certain criteria are returned by successive receive() calls. When creating a MessageConsumer object, you can provide a string that contains an SQL (Structured Query Language) expression, which determines which messages are retrieved. This SQL expression is called a *selector*. The selector can refer to fields in the JMS message header as well as fields in the message properties (these are effectively application defined header fields). Details of the header field names, as well as the syntax for an SQL selector, are in Chapter 13, “JMS messages,” on page 257.

The following example shows how to select messages based on a user defined property called myProp:

```
messageConsumer = session.createConsumer(ioQueue, "myProp = 'blue'");
```

Note: The JMS specification does not permit the selector associated with a message consumer to be changed. After a message consumer is created, the selector is fixed for the lifetime of that consumer. This means that, if you require different selectors, you must create new message consumers.

In the publish/subscribe domain, you can control whether the JMS client or the broker performs message filtering by setting the MSGSELECTION property on the ConnectionFactory object. If the broker is capable of performing message selection, it is generally preferable to let the broker do it because it reduces the amount of work done by the client. However, if the broker is very heavily loaded, it might be preferable to let the client perform message selection instead.

Suppressing local publications

You can create a message consumer that ignores publications published on the consumer’s own connection. To do this, set the third parameter on the createConsumer() call to `true`, as shown in the following example:

```
// Create a nondurable message consumer with the noLocal option set
MessageConsumer con = session.createConsumer( topic, null, true );
```

The example that follows shows how to create a durable topic subscriber that applies a selector and ignores local publications:

```
// Create a durable, noLocal subscriber with a selector applied
String selector = "company = 'IBM'";
TopicSubscriber sub = session.createDurableSubscriber( topic, "D_SUB_000001",
                                                       selector, true );
```

Configuring the consumer queue

You cannot configure a consumer queue if the transport type is direct.

In the publish/subscribe messaging domain, you can configure message consumers in two ways:

- The multiple queue approach.

  Each consumer has its own exclusive queue and retrieves all its messages from this queue. JMS creates a new queue for each consumer.
- The shared queue approach.

  Each consumer retrieves its messages from a queue that is shared with other consumers. This approach requires only one queue to serve multiple consumers. It is the default approach used with WebSphere MQ JMS.

You can choose which approach to use, and configure which queues to use.

In general, there is a modest performance advantage if you use the shared queue approach. For systems with a high throughput, there are also large system management and administrative advantages because of the significant reduction in the number of queues required.

In some situations, however, there are good reasons for using the multiple queue approach:

- In theory, you can store more messages.

  A WebSphere MQ queue cannot hold more than 640000 messages and so, in the shared queue approach, the total number of messages for all the message consumers that share the queue cannot exceed this limit. This issue is more significant for durable topic subscribers, because the lifetime of a durable topic subscriber is usually much longer than that of a nondurable message consumer. Therefore, more messages might accumulate for a durable subscriber.
- The WebSphere MQ administration of consumer queues is easier.

  For certain applications, an administrator might want to monitor the state and depth of particular consumer queues. This task is much simpler when each consumer has its own queue.

Default configuration

The default WebSphere MQ JMS configuration for the publish/subscribe domain uses the following shared consumer queues:

- SYSTEM.JMS.ND.SUBSCRIBER.QUEUE for nondurable message consumers
- SYSTEM.JMS.D.SUBSCRIBER.QUEUE for durable topic subscribers

These are created for you when you run the MQJMS_PSQ.MQSC script.

If required, you can specify alternative WebSphere MQ queues. You can also change the configuration to use the multiple queue approach.

Configuring nondurable message consumers

You can specify the name of the consumer queue for nondurable message consumers in either of the following ways:

- Use the WebSphere MQ JMS administration tool to set the BROKERSUBQ property.
- Use the setBrokerSubQueue() method in your application.

The queue name you provide must start with the following characters:

SYSTEM.JMS.ND.

To use the shared queue approach, specify the complete name of the shared queue. The queue must exist before you can create a subscription.

To use the multiple queue approach, specify a queue name that ends with an asterisk (*). Subsequently, when an application creates a nondurable message consumer specifying this queue name, WebSphere MQ JMS creates a temporary dynamic queue for exclusive use by that consumer. With the multiple queue approach, therefore, all the required queues are created dynamically.

If you use the multiple queue approach, you cannot specify the complete name of a queue, only a prefix. This allows you to create different domains of consumer queues. For example, you can use:

SYSTEM.JMS.ND.MYDOMAIN.*

The characters that precede the asterisk (*) are used as the prefix, so that all dynamic queues for nondurable message consumers specifying this prefix have queue names that start with SYSTEM.JMS.ND.MYDOMAIN.

Configuring durable topic subscribers

As stated previously, there might still be good reasons to use the multiple queue approach for durable topic subscribers. Durable topic subscribers are likely to have a longer life span, and so it is possible for a large number of messages for a durable subscriber to accumulate on a queue.

The name of the consumer queue for a durable topic subscriber is a property of a Topic object. This allows you to specify a number of different consumer queue names without having to create multiple objects starting from a ConnectionFactory object.

You can specify the name of the consumer queue for durable topic subscribers in either of the following ways:

- Use the WebSphere MQ JMS administration tool to set the BROKERDURSUBQ property.
- Use the setBrokerDurSubQueue() method in your application.

The queue name you provide must start with the following characters:

SYSTEM.JMS.D.

To use the shared queue approach, specify the complete name of the shared queue. The queue must exist before you can create a subscription.

To use the multiple queue approach, specify a queue name that ends with an asterisk (*). Subsequently, when an application creates a durable topic subscriber specifying this queue name, WebSphere MQ JMS creates a permanent dynamic queue for exclusive use by that subscriber. With the multiple queue approach, therefore, all the required queues are created dynamically.

Here is an example of using the multiple queue approach:

```
// Set the MQTopic durable subscriber queue name using
// the multi-queue approach
sportsTopic.setBrokerDurSubQueue("SYSTEM.JMS.D.FOOTBALL.*");
```

After the Topic object is initialized, it can be passed into the createDurableSubscriber() method of a Session object to create a durable topic subscriber:

```
// Create a durable subscriber using our earlier Topic
TopicSubscriber sub = session.createDurableSubscriber(sportsTopic,
                                                      "D_SUB_SPORT_001");
```

If you use the multiple queue approach, you cannot specify the complete name of a queue, only a prefix. This allows you to create different domains of consumer queues. For example, you can use:

SYSTEM.JMS.D.MYDOMAIN.*

The characters that precede the asterisk (*) are used as the prefix, so that all dynamic queues for durable topic subscribers specifying this prefix have queue names that start with SYSTEM.JMS.D.MYDOMAIN.

You cannot change the consumer queue of a durable topic subscriber. If, for example, you want to move from the multiple queue approach to the single queue approach, you must first delete the old subscriber using the unsubscribe() method and then create a new subscriber. Deleting the old subscriber also deletes any unconsumed messages for that subscriber.

Subscription stores

A subscription store is not used if the transport type is direct.

When an application creates a message consumer in the publish/subscribe domain, information about the subscription is created at the same time. WebSphere MQ JMS maintains a persistent store of subscription information called a *subscription store*. A subscription store is used to reopen durable topic subscribers and to clean up after a nondurable message consumer fails. A subscription store can be managed by the local queue manager or by the publish/subscribe broker.

The SUBSTORE property of a ConnectionFactory object determines the location of a subscription store. SUBSTORE has three possible values:

SUBSTORE(QUEUE)

Subscription information is stored in the queues, SYSTEM.JMS.ADMIN.QUEUE and SYSTEM.JMS.PS.STATUS.QUEUE, on the local queue manager.

WebSphere MQ JMS maintains an extra connection to each queue manager used by applications. This connection is used to detect an application that fails and to clean up after the application. In a busy system, this might cause the queue manager logs to fill up resulting in errors from both the queue manager and the applications connected to it.

If you experience these problems, the system administrator can add extra log files or data sets to the queue manager. Alternatively, you can reduce the STATREFRESHINT property of the ConnectionFactory object. This causes the long running transaction to be refreshed more frequently allowing the logs to reset themselves.

After a nondurable message consumer fails, the following occurs:

- Subscription information related to the failed consumer remains on the two queues implementing the subscription store. This information can be removed by a cleanup utility supplied with WebSphere MQ JMS. See “Consumer cleanup utility for the publish/subscribe domain” on page 248 for more information.
- Messages continue to be delivered to the consumer until the cleanup utility runs.

This option is provided for compatibility with versions of MQSeries JMS.

SUBSTORE(BROKER)
Subscription information is stored by the publish/subscribe broker used by the application, not in WebSphere MQ queues. This means that, if a JMS client fails, the broker can clean up the resources associated with the JMS client without having to wait for the JMS client to reconnect. See the README provided with WebSphere MQ JMS for information about which release levels of WebSphere MQ and the broker support this option.

If a nondurable message consumer fails, the subscription is de-registered from the broker as soon as possible. In response to the de-registration, the broker puts a report message on the queue, SYSTEM.JMS.REPORT.QUEUE. This message is used to clean up after the failed consumer.

If you use this option, a separate cleanup thread is run in the background. By default, the cleanup utility runs once every 10 minutes, but you can change this interval by setting the CLEANUPINT property of the ConnectionFactory object. To customize the actions performed by the cleanup utility, use the CLEANUP property of the ConnectionFactory object. For more information about how the cleanup utility works, see "Consumer cleanup utility for the publish/subscribe domain" on page 248.

SUBSTORE(MIGRATE)
This is the default value.

This option dynamically selects a queue based or a broker based subscription store depending on the release levels of WebSphere MQ and the publish/subscribe broker that are installed. If both WebSphere MQ and the broker are capable of supporting the SUBSTORE(BROKER) option, this option behaves like the SUBSTORE(BROKER) option; otherwise, it behaves like the SUBSTORE(QUEUE) option.

If this option behaves like the SUBSTORE(BROKER) option, the option additionally migrates durable subscription information from the queue based subscription store to the broker based store. This migration occurs the first time a durable subscription is opened when both WebSphere MQ and the broker are capable of supporting a broker based subscription store. Only information related to the subscription being opened is migrated. Information related to other subscriptions is left in the queue based subscription store. This option therefore provides an easy migration path from older versions of WebSphere MQ JMS, WebSphere MQ, and the publish/subscribe broker.

Migration and coexistence considerations

Except when the SUBSTORE(MIGRATE) option is used, a queue based subscription store and a broker based subscription store are entirely independent.

A durable subscription is created in the subscription store specified by the ConnectionFactory object. If there is a subsequent attempt to create a durable subscription with the same name and ClientID, but with the other subscription store, a new durable subscription is created.

When a connection uses the SUBSTORE(MIGRATE) option, subscription information is automatically migrated from the queue based subscription store to the broker based subscription store when the application calls the createDurableSubscriber() method. If a durable subscription with a matching name and ClientID already exists in the broker based subscription store, the migration cannot complete and an exception is thrown by the createDurableSubscriber() call.

After a subscription is migrated, it is important not to access the subscription from an application using an older version of WebSphere MQ JMS, or from an application running with the SUBSTORE(QUEUE) option. Doing either of these creates a subscription in the queue based subscription store and prevents an application running with the SUBSTORE(MIGRATE) option from using the subscription.

To recover from this situation if it occurs, run your application with the SUBSTORE(BROKER) option, or unsubscribe from the subscription that is held in the queue based subscription store.

Asynchronous delivery

An application can call the MessageConsumer.receive() method to receive messages. As an alternative, an application can register a method that is called automatically when a suitable message is available. This is called *asynchronous delivery* of messages. The following code illustrates the mechanism:

```
import javax.jms.*;

public class MyClass implements MessageListener
{
  // The method that will be called by JMS when a message
  // is available.
  public void onMessage(Message message)
  {
    System.out.println("message is "+message);

    // application specific processing here
    .
    .
    .
  }
}
 .
 .
 .
  // In Main program (possibly of some other class)
  MyClass listener = new MyClass();
  messageConsumer.setMessageListener(listener);

  // main program can now continue with other application specific
  // behavior.
```

Note: Using asynchronous delivery with a message consumer marks the entire session as using asynchronous delivery. An application cannot call the receive() methods of a message consumer if the message consumer is associated with a session that is using asynchronous delivery.

Consumer cleanup utility for the publish/subscribe domain

To avoid the problems associated with message consumer objects in the publish/subscribe domain not closing gracefully, WebSphere MQ JMS supplies a consumer cleanup utility that attempts to clean up the resources associated with a consumer that has failed. This utility runs in the background and does not affect other WebSphere MQ JMS operations. If the utility detects a large number of problems associated with a given queue manager, you might see some performance degradation while resources are being cleaned up.

Note: Whenever possible, close all message consumer objects gracefully to avoid an accumulation of these types of problems.

If applications use the domain independent classes, the cleanup utility is invoked only if the applications perform publish/subscribe operations, such as creating a Topic object, or creating a MessageConsumer object with a Topic object retrieved from a JNDI namespace. This is to prevent the cleanup utility from being invoked in an environment in which applications are performing only point-to-point operations.

The exact behavior of the cleanup utility depends on where the subscription store is located:

Queue based subscription store

For a queue based subscription store, the cleanup utility runs against a queue manager when the first Connection object to use that queue manager initializes. If all the Connection objects that use a given queue manager close, the utility runs again only when the next Connection object to use that queue manager initializes.

The cleanup utility uses the information in the queues, SYSTEM.JMS.ADMIN.QUEUE and SYSTEM.JMS.PS.STATUS.QUEUE, to detect nondurable message consumers that have failed previously. If it finds a failed consumer, the utility cleans up the resources associated with the consumer by de-registering the consumer from the broker and deleting its consumer queue, provided it is not a shared queue, and any unconsumed messages on the queue.

Broker based subscription store

For a broker based subscription store, the cleanup utility runs at regular intervals on a background thread while there is at least one Connection object that uses a given queue manager. One cleanup thread is created for each queue manager for which a Connection object exists within the JVM.

The cleanup utility uses information in the queue, SYSTEM.JMS.REPORT.QUEUE (the messages in this queue are typically report messages from the publish/subscribe broker), to perform any necessary cleanup. This might involve deleting consumer queues and unconsumed messages that are no longer required.

Two properties of a ConnectionFactory object control the behavior of the cleanup thread: CLEANUPINT and CLEANUP. CLEANUPINT determines how often, in milliseconds, the cleanup utility is run against any given queue manager. CLEANUP has four possible values:

CLEANUP(SAFE)

This is the default value.

The cleanup thread tries to delete any consumer queues and unconsumed messages that are no longer required. This mode of cleanup does not interfere with the operation of other JMS applications.

CLEANUP(STRONG)

The cleanup thread performs like the CLEANUP(SAFE) option, but it also deletes any messages on the queue, SYSTEM.JMS.REPORT.QUEUE, that it does not recognize.

This mode of cleanup can interfere with the operation of JMS applications running with later versions of WebSphere MQ JMS. If multiple JMS applications are using the same queue manager, but

using different versions of WebSphere MQ JMS, only applications using the most recent version of WebSphere MQ JMS must use this option.

CLEANUP(NONE)
In this special mode, no cleanup is performed, and consumer queues and unconsumed messages that are no longer required are not deleted.

This option can be useful if the application and the queue manager are on a different systems, especially if the application only sends messages and does not receive them. At some time, however, cleanup must be initiated to delete consumer queues and unconsumed messages that are no longer required. This can be done by a JMS application that uses a ConnectionFactory object with the property CLEANUP(SAFE) or CLEANUP(STRONG), or by using the manual cleanup utility, which is described in "Manual cleanup."

CLEANUP(ASPROP)
The mode of cleanup is determined by the system property com.ibm.mq.jms.cleanup, which is queried when the JVM starts.

This property can be set on the Java command line by using the -D option. Its value can be SAFE, STRONG, or NONE. Any other value causes an exception. If the property not set, its value defaults to SAFE.

This option allows you to change the mode of cleanup within an entire JVM without having to update every ConnectionFactory object. This is useful for applications or application servers that use multiple ConnectionFactory objects.

If multiple Connection objects for the same queue manager exist within a JVM, but the Connection objects use different values for the CLEANUPINT and CLEANUP properties, the following rules determine the behavior of the cleanup utility:

1. If a Connection object using the CLEANUP(NONE) option fails, cleanup does not run. The cleanup thread eventually runs, however, if another Connection object is using the CLEANUP(SAFE) or CLEANUP(STRONG) option.
2. If any Connection object is using the CLEANUP(STRONG) option, the cleanup thread operates in STRONG mode. Otherwise, if any Connection object is using the CLEANUP(SAFE) option, the cleanup thread operates in SAFE mode. Otherwise, there is no cleanup thread.
3. The cleanup utility runs at intervals determined by the smallest value of the CLEANUPINT property of those Connections that are using the CLEANUP(SAFE) or CLEANUP(STRONG) option.

Manual cleanup

If you use a broker based subscription store, you can operate the cleanup utility manually from the command line. Here is the syntax of the command:

For a bindings connection:

```
Cleanup [-m <qmgr>] [-r <interval>]
          [SAFE | STRONG | FORCE | NONDUR] [-t]
```

For a client connection:

```
Cleanup -client [-m <qmgr>] -host <hostname> [-port <port>]
         [-channel <channel>] [-r <interval>]
         [SAFE | STRONG | FORCE | NONDUR] [-t]
```

The parameters of the command are as follows:

- `qmgr`, `hostname`, `port`, and `channel` enable the cleanup utility to connect to a queue manager.
- `-r` sets the interval, in minutes, between each run of the cleanup utility. If the parameter is not set, the cleanup utility runs once only.
- `-t` enables tracing. The output is sent to the file mqjms.trc.
- `SAFE`, `STRONG`, `FORCE`, or `NONDUR` sets the cleanup level as follows:
  - SAFE and STRONG behave like the CLEANUP(SAFE) and CLEANUP(STRONG) modes discussed in "Consumer cleanup utility for the publish/subscribe domain" on page 248.
  - FORCE behaves like STRONG mode. But, whereas STRONG mode leaves any messages that cannot be processed on the queue, SYSTEM.JMS.REPORT.QUEUE, FORCE mode deletes all the messages even if it encounters an error during processing.

    Warning
    This is a dangerous mode that can leave an inconsistent state between the queue manager and the broker. You cannot run the cleanup utility in this mode while any WebSphere MQ JMS publish/subscribe applications are connected to the queue manager. If you try to do so, the cleanup utility ends.

  - NONDUR behaves like FORCE mode but, in addition, this mode deletes all the messages on queues whose names begin with the characters SYSTEM.JMS.ND. To do this successfully, the command server of the queue manager must be running.

Cleanup from within a program

You can use a programming interface to invoke the cleanup utility that is used with a broker based subscription store. Instances of the class com.ibm.mq.jms.Cleanup have getter and setter methods for each of the properties that are used to connect to a queue manager, and also for the cleanup level and cleanup interval. It exposes two additional methods:

cleanup()
: Executes the cleanup utility once only.

run() Runs cleanup at intervals determined by cleanup interval property.

This class allows complete customization of the publish/subscribe cleanup utility, but it is intended for use by system administration programs rather than application programs.

For more details, see "Cleanup *" on page 308.

Closing down

Garbage collection alone cannot release all WebSphere MQ resources in a timely manner, especially if an application creates many short lived JMS objects at the session level or lower. It is therefore important for an application to call the appropriate close() method to close a Connection, Session, MessageConsumer, or MessageProducer object when it is no longer required.

Java Virtual Machine hangs at shutdown

If an application using WebSphere MQ JMS finishes without calling Connection.close(), some JVMs appear to hang. If this problems occurs, you can end the JVM by entering Ctrl-C. To avoid the problem in the future, consider modifying the application to include a call to Connection.close().

Handling errors

Any runtime errors in a JMS application are reported by exceptions. The majority of JMS methods throw a JMSException to indicate an error. It is good programming practice to catch these exceptions and display them on a suitable output device.

A JMSException can contain a further exception embedded within it. For JMS, this can be a valuable way to pass important information about the error from the underlying transport. In the case of WebSphere MQ JMS, an MQException is thrown in WebSphere MQ base Java whenever an error occurs in WebSphere MQ, and this exception is usually included as the embedded exception in a JMSException.

The implementation of JMSException does not include the embedded exception in the output of its toString() method. Therefore, you must check explicitly for an embedded exception and print it out, as shown in the following example:

```
try {
  .
  . code which may throw a JMSException
  .
} catch (JMSException je) {
  System.err.println("caught "+je);
  Exception e = je.getLinkedException();
  if (e != null) {
    System.err.println("linked exception: "+e);
  }
}
```

Exception listener

For asynchronous message delivery, the application code cannot catch exceptions raised by failures to receive messages. This is because the application code does not make explicit calls to receive() methods. To cope with this situation, you can register an ExceptionListener, which is an instance of a class that implements the onException() method. When a serious error occurs, this method is called with the JMSException passed as its only parameter. Further details are in Sun's JMS documentation.

Handling broker reports

The WebSphere MQ JMS implementation uses report messages from the broker to confirm whether registration and de-registration requests have been successful. These report messages are sent to the queue, SYSTEM.JMS.REPORT.QUEUE, on

the local queue manager and are normally consumed by the WebSphere MQ JMS. Under some error conditions, however, they might remain on the queue.

WebSphere MQ JMS supplies a Java application, PSReportDump, which dumps the contents of the queue, SYSTEM.JMS.REPORT.QUEUE, in plain text format. The information in the dump can be analyzed by you or by IBM support staff. You can also use the application to delete all the messages in the queue after a problem is diagnosed or fixed.

The compiled form of the application is in the <*MQ_JAVA_INSTALL_PATH*>/bin directory. To start the application, change to this directory and use the following command:

```
java PSReportDump [-m queueManager] [-clear]
```

where:

-m queueManager
is the name of the queue manager to use

-clear causes all the messages on the queue to be deleted after their contents have been dumped

Attention: Do not use this option if you are using a broker based subscription store. Instead, run the manual cleanup utility in FORCE mode.

The output from the application is sent to the screen, or you can redirect it to a file.

Other considerations

If a large number of JMS clients connect directly to a WebSphere MQ Event Broker broker on Windows, and the connections happen almost simultaneously, a java.net.BindException address in use exception might be thrown in response to a request to connect to the broker. You can try to avoid this by catching the exception and retrying, or by pacing the connections.

User exits

WebSphere MQ JMS allows you to implement send, receive, and security exits using interfaces supplied by WebSphere MQ base Java. For WebSphere MQ JMS, ensure that your exit has a constructor that takes a single string argument. See the description of exit related set methods in Table 14 on page 202 and “Property dependencies” on page 56.

Using Secure Sockets Layer (SSL)

WebSphere MQ base Java client applications and WebSphere MQ JMS connections using TRANSPORT(CLIENT) support Secure Sockets Layer (SSL) encryption. SSL provides communication encryption, authentication, and message integrity. It is typically used to secure communications between any two peers on the Internet or within an intranet.

WebSphere MQ classes for Java uses Java Secure Socket Extension (JSSE) to handle SSL encryption, and so requires a JSSE provider. J2SE v1.4 JVMs have a JSSE provider built in. Details of how to manage and store certificates can vary from provider to provider. For information about this, refer to your JSSE provider’s documentation.

This section assumes that your JSSE provider is correctly installed and configured, and that suitable certificates have been installed and made available to your JSSE provider.

SSL administrative properties

This section introduces the SSL administrative properties, as follows:

- "SSLCIPHERSUITE object property"
- "SSLPEERNAME object property"
- "SSLCERTSTORES object property" on page 255
- "SSLSocketFactory object property" on page 256

SSLCIPHERSUITE object property

To enable SSL encryption on a ConnectionFactory object, use JMSAdmin to set the SSLCIPHERSUITE property to a CipherSuite supported by your JSSE provider. This must match the CipherSpec set on the target channel. However, CipherSuites are distinct from CipherSpecs and so have different names. Appendix H, "SSL CipherSuites supported by WebSphere MQ," on page 487 contains a table mapping the CipherSpecs supported by WebSphere MQ to their equivalent CipherSuites as known to JSSE. Additionally, the named CipherSuite must be supported by your JSSE provider. For more information about CipherSpecs and CipherSuites with WebSphere MQ, see the *WebSphere MQ Security* book.

For example, to set up a ConnectionFactory object that can be used to create a connection over an SSL enabled MQI channel with a CipherSpec of RC4_MD5_EXPORT, issue the following command to JMSAdmin:

```
ALTER CF(my.cf) SSLCIPHERSUITE(SSL_RSA_EXPORT_WITH_RC4_40_MD5)
```

This can also be set from an application, using the setSSLCipherSuite() method on an MQConnectionFactory object.

For convenience, if a CipherSpec is specified on the SSLCIPHERSUITE property, JMSAdmin attempts to map the CipherSpec to an appropriate CipherSuite and issues a warning. This attempt to map is not made if the property is specified by an application.

SSLPEERNAME object property

A JMS application can ensure that it connects to the correct queue manager by specifying a distinguished name (DN) pattern. The connection succeeds only if the queue manager presents a DN that matches the pattern. For more details of the format of this pattern, refer to *WebSphere MQ Security* or the *WebSphere MQ Script (MQSC) Command Reference*.

The DN is set using the SSLPEERNAME property of a ConnectionFactory object. For example, the following JMSAdmin command sets a ConnectionFactory object to expect the queue manager to identify itself with a Common Name beginning with the characters `QMGR.`, and with at least two Organizational Unit names, the first of which must be IBM and the second WEBSPHERE:

```
ALTER CF(my.cf) SSLPEERNAME(CN=QMGR.*, OU=IBM, OU=WEBSPHERE)
```

Checking is not case sensitive and semicolons can be used in place of commas. This can also be set from an application using the setSSLPeerName() method on an MQConnectionFactory object. If this property is not set, no checking is performed on the Distinguished Name supplied by the queue manager. This property is ignored if no CipherSuite is set.

SSLCERTSTORES object property

It is common to use a certificate revocation list (CRL) to identify certificates that are no longer trusted. CRLs are typically hosted on LDAP servers. JMS allows an LDAP server to be specified for CRL checking under Java 2 v1.4 or later. The following JMSAdmin example directs JMS to use a CRL hosted on an LDAP server named crl1.ibm.com:

```
ALTER CF(my.cf) SSLCRL(ldap://crl1.ibm.com)
```

Note: To use a CertStore successfully with a CRL hosted on an LDAP server, make sure that your Java Software Development Kit (SDK) is compatible with the CRL. Some SDKs require that the CRL conforms to RFC 2587, which defines a schema for LDAP v2. Most LDAP v3 servers use RFC 2256 instead.

If your LDAP server is not running on the default port of 389, the port can be specified by appending a colon (:) and the port number to the host name. If the certificate presented by the queue manager is present in the CRL hosted on crl1.ibm.com, the connection does not complete. To avoid a single point of failure, JMS allows multiple LDAP servers to be supplied by supplying a list of LDAP servers delimited by the space character. Here is an example:

```
ALTER CF(my.cf) SSLCRL(ldap://crl1.ibm.com ldap://crl2.ibm.com)
```

When multiple LDAP servers are specified, JMS tries each one in turn until it finds a server with which it can successfully verify the queue manager's certificate. Each server must contain identical information.

A string in this format can be supplied by an application on the MQConnectionFactory.setSSLCertStores() method. Alternatively, the application can create one or more java.security.cert.CertStore objects, place these in a suitable Collection object, and supply this Collection object to the setSSLCertStores() method. In this way, the application can customize CRL checking. Refer to your JSSE documentation for details on constructing and using CertStore objects.

The certificate presented by the queue manager when a connection is being set up is validated as follows:

1. The first CertStore object in the Collection identified by sslCertStores is used to identify a CRL server.
2. An attempt is made to contact the CRL server.
3. If the attempt is successful, the server is searched for a match for the certificate.
   a. If the certificate is found to be revoked, the search process is over and the connection request fails with reason code MQRC_SSL_CERTIFICATE_REVOKED.
   b. If the certificate is not found, the search process is over and the connection is allowed to proceed.
4. If the attempt to contact the server is unsuccessful, the next CertStore object is used to identify a CRL server and the process repeats from step 2.

   If this was the last CertStore in the Collection, or if the Collection contains no CertStore objects, the search process has failed and the connection request fails with reason code MQRC_SSL_CERT_STORE_ERROR.

The Collection object determines the order in which CertStores are used.

If your application uses `setSSLCertStores()` to set a Collection of CertStore objects, the MQConnectionFactory can no longer be bound into a JNDI namespace. Attempting to do so causes an exception. If the sslCertStores property is not set, no

revocation checking is performed on the certificate provided by the queue manager. This property is ignored if no CipherSuite is set.

SSLSocketFactory object property

You might want to customize other aspects of the SSL connection for an application. For example, you might want to initialize cryptographic hardware or change the KeyStore and TrustStore in use. To do this, the application must first create a javax.net.ssl.SSLSocketFactory object that is customized accordingly. Refer to your JSSE documentation for information on how to do this, as the customizable features vary from provider to provider. After a suitable SSLSocketFactory object is obtained, use the MQConnectionFactory.setSSLSocketFactory() method to configure JMS to use the customized SSLSocketFactory object.

If your application uses the setSSLSocketFactory() method to set a customized SSLSocketFactory object, the MQConnectionFactory object can no longer be bound into a JNDI namespace. Attempting to do so causes an exception. If this property is not set, the default SSLSocketFactory object is used. Refer to your JSSE documentation for details on the behavior of the default SSLSocketFactory object. This property is ignored if no CipherSuite is set.

Important: Do not assume that the use of the SSL properties ensures security when a ConnectionFactory object is retrieved from a JNDI namespace that is not itself secure. Specifically, the standard LDAP implementation of JNDI is not secure. An attacker can imitate the LDAP server, misleading a JMS application into connecting to the wrong server without noticing. With suitable security arrangements in place, other implementations of JNDI (such as the fscontext implementation) are secure.

Chapter 13. JMS messages

JMS messages are composed of the following parts:

Header All messages support the same set of header fields. Header fields contain values that are used by both clients and providers to identify and route messages.

Properties Each message contains a built-in facility to support application-defined property values. Properties provide an efficient mechanism to filter application-defined messages.

Body JMS defines several types of message body that cover the majority of messaging styles currently in use.

JMS defines five types of message body:

Stream A stream of Java primitive values. It is filled and read sequentially.

Map A set of name-value pairs, where names are strings and values are Java primitive types. The entries can be accessed sequentially or randomly by name. The order of the entries is undefined.

Text A message containing a java.util.String.

Object a message that contains a serializable Java object

Bytes A stream of uninterpreted bytes. This message type is for literally encoding a body to match an existing message format.

The JMSCorrelationID header field is used to link one message with another. It typically links a reply message with its requesting message. JMSCorrelationID can hold a provider-specific message ID, an application-specific String, or a provider-native byte[] value.

Message selectors

A message contains a built-in facility to support application-defined property values. In effect, this provides a mechanism to add application-specific header fields to a message. Properties allow an application, using message selectors, to have a JMS provider select or filter messages on its behalf, using application-specific criteria. Application-defined properties must obey the following rules:

- Property names must obey the rules for a message selector identifier.
- Property values can be boolean, byte, short, int, long, float, double, and string.
- The JMSX and JMS_ name prefixes are reserved.

Property values are set before sending a message. When a client receives a message, the message properties are read-only. If a client attempts to set properties at this point, a MessageNotWriteableException is thrown. If clearProperties is called, the properties can now be both read from, and written to.

A property value might duplicate a value in a message's body. JMS does not define a policy for what should or should not be made into a property. However, application developers must be aware that JMS providers probably handle data in a message's body more efficiently than data in a message's properties. For best performance, applications must use message properties only when they need to customize a message's header. The primary reason for doing this is to support customized message selection.

A JMS message selector allows a client to specify the messages that it is interested in by using the message header. Only messages whose headers match the selector are delivered.

Message selectors cannot refer to message body values.

A message selector matches a message when the selector evaluates to true when the message's header field and property values are substituted for their corresponding identifiers in the selector.

A message selector is a String, whose syntax is based on a subset of the SQL92 conditional expression syntax. The order in which a message selector is evaluated is from left to right within a precedence level. You can use parentheses to change this order. Predefined selector literals and operator names are written here in upper case; however, they are not case-sensitive.

A selector can contain:

- Literals
  - A string literal is enclosed in single quotes. A doubled single quote represents a single quote. Examples are 'literal' and 'literal''s'. Like Java string literals, these use the Unicode character encoding.
  - An exact numeric literal is a numeric value without a decimal point, such as 57, -957, and +62. Numbers in the range of Java long are supported.
  - An approximate numeric literal is a numeric value in scientific notation, such as 7E3 or -57.9E2, or a numeric value with a decimal, such as 7., -95.7, or +6.2. Numbers in the range of Java double are supported.
  - The boolean literals TRUE and FALSE.
- Identifiers:
  - An identifier is an unlimited length sequence of Java letters and Java digits, the first of which must be a Java letter. A letter is any character for which the method Character.isJavaLetter returns true. This includes _ and $. A letter or digit is any character for which the method Character.isJavaLetterOrDigit returns true.
  - Identifiers cannot be the names NULL, TRUE, or FALSE.
  - Identifiers cannot be NOT, AND, OR, BETWEEN, LIKE, IN, or IS.
  - Identifiers are either header field references or property references.
  - Identifiers are case-sensitive.
  - Message header field references are restricted to:
    - JMSDeliveryMode
    - JMSPriority
    - JMSMessageID
    - JMSTimestamp
    - JMSCorrelationID

- JMSType

  JMSMessageID, JMSTimestamp, JMSCorrelationID, and JMSType values can be null, and if so, are treated as a NULL value.

  – Any name beginning with JMSX is a JMS-defined property name.
  – Any name beginning with JMS_ is a provider-specific property name.
  – Any name that does not begin with JMS is an application-specific property name. If there is a reference to a property that does not exist in a message, its value is NULL. If it does exist, its value is the corresponding property value.

- White space is the same as it is defined for Java: space, horizontal tab, form feed, and line terminator.
- Expressions:
  – A selector is a conditional expression. A selector that evaluates to true matches; a selector that evaluates to false or unknown does not match.
  – Arithmetic expressions are composed of themselves, arithmetic operations, identifiers (whose value is treated as a numeric literal), and numeric literals.
  – Conditional expressions are composed of themselves, comparison operations, and logical operations.
- Standard bracketing (), to set the order in which expressions are evaluated, is supported.
- Logical operators in precedence order: NOT, AND, OR.
- Comparison operators: =, >, >=, <, <=, <> (not equal).
  – Only values of the same type can be compared. One exception is that it is valid to compare exact numeric values and approximate numeric values. (The type conversion required is defined by the rules of Java numeric promotion.) If there is an attempt to compare different types, the selector is always false.
  – String and boolean comparison is restricted to = and <>. Two strings are equal only if they contain the same sequence of characters.
- Arithmetic operators in precedence order:
  – +, - unary.
  – *, /, multiplication, and division.
  – +, -, addition, and subtraction.
  – Arithmetic operations on a NULL value are not supported. If they are attempted, the complete selector is always false.
  – Arithmetic operations must use Java numeric promotion.
- arithmetic-expr1 [NOT] BETWEEN arithmetic-expr2 and arithmetic-expr3 comparison operator:
  – Age BETWEEN 15 and 19 is equivalent to age >= 15 AND age <= 19.
  – Age NOT BETWEEN 15 and 19 is equivalent to age < 15 OR age > 19.
  – If any of the expressions of a BETWEEN operation are NULL, the value of the operation is false. If any of the expressions of a NOT BETWEEN operation are NULL, the value of the operation is true.
- identifier [NOT] IN (string-literal1, string-literal2,...) comparison operator where identifier has a String or NULL value.
  – Country IN ('UK', 'US', 'France') is true for 'UK' and false for 'Peru'. It is equivalent to the expression (Country = 'UK') OR (Country = 'US') OR (Country = 'France').
  – Country NOT IN ('UK', 'US', 'France') is false for 'UK' and true for 'Peru'. It is equivalent to the expression NOT ((Country = 'UK') OR (Country = 'US') OR (Country = 'France')).

  - If the identifier of an IN or NOT IN operation is NULL, the value of the operation is unknown.
- identifier [NOT] LIKE pattern-value [ESCAPE escape-character] comparison operator, where identifier has a string value. pattern-value is a string literal, where _ stands for any single character and % stands for any sequence of characters (including the empty sequence). All other characters stand for themselves. The optional escape-character is a single character string literal, whose character is used to escape the special meaning of the _ and % in pattern-value.
  - phone LIKE '12%3' is true for 123 and 12993 and false for 1234.
  - word LIKE 'l_se' is true for lose and false for loose.
  - underscored LIKE '_%' ESCAPE '\' is true for _foo and false for bar.
  - phone NOT LIKE '12%3' is false for 123 and 12993 and true for 1234.
  - If the identifier of a LIKE or NOT LIKE operation is NULL, the value of the operation is unknown.
- identifier IS NULL comparison operator tests for a null header field value, or a missing property value.
  - prop_name IS NULL.
- identifier IS NOT NULL comparison operator tests for the existence of a non-null header field value or a property value.
  - prop_name IS NOT NULL.

The following message selector selects messages with a message type of car, color of blue, and weight greater than 2500 lbs:

```
"JMSType = 'car' AND color = 'blue' AND weight > 2500"
```

As noted above, property values can be NULL. The evaluation of selector expressions that contain NULL values is defined by SQL 92 NULL semantics. The following is a brief description of these semantics:

- SQL treats a NULL value as unknown.
- Comparison or arithmetic with an unknown value always yields an unknown value.
- The IS NULL and IS NOT NULL operators convert an unknown value into the respective TRUE and FALSE values.

Although SQL supports fixed decimal comparison and arithmetic, JMS message selectors do not. This is why exact numeric literals are restricted to those without a decimal. It is also why there are numerics with a decimal as an alternate representation for an approximate numeric value.

SQL comments are not supported.

Mapping JMS messages onto WebSphere MQ messages

This section describes how the JMS message structure that is described in the first part of this chapter is mapped onto a WebSphere MQ message. It is of interest to programmers who want to transmit messages between JMS and traditional WebSphere MQ applications. It is also of interest to people who want to manipulate messages transmitted between two JMS applications, for example, in a message broker implementation.

This section does not apply when you use a direct connection to WebSphere MQ Event Broker.

WebSphere MQ messages are composed of three components:
- The WebSphere MQ Message Descriptor (MQMD)
- A WebSphere MQ MQRFH2 header
- The message body.

The MQRFH2 is optional, and its inclusion in an outgoing message is governed by a flag in the JMS Destination class. You can set this flag using the WebSphere MQ JMS administration tool. Because the MQRFH2 carries JMS-specific information, always include it in the message when the sender knows that the receiving destination is a JMS application. Normally, omit the MQRFH2 when sending a message directly to a non-JMS application. This is because such an application does not expect an MQRFH2 in its WebSphere MQ message. Figure 4 shows how the structure of a JMS message is transformed to a WebSphere MQ message and back again:

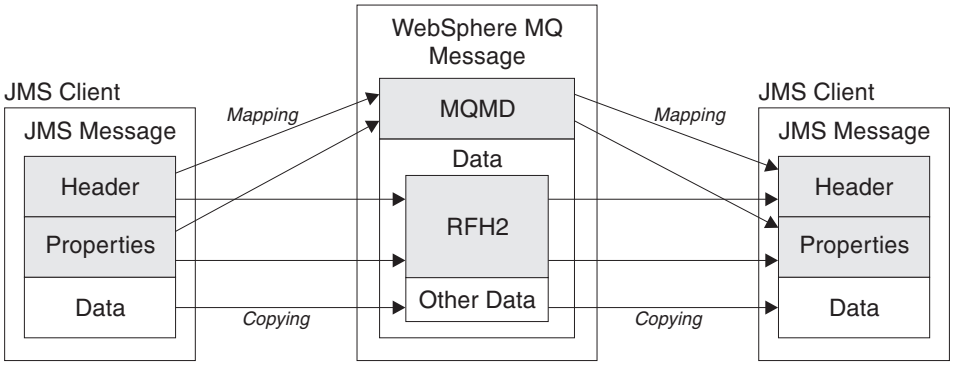


Figure 4. How messages are transformed between JMS and WebSphere MQ using the MQRFH2 header

The structures are transformed in two ways:

Mapping
Where the MQMD includes a field that is equivalent to the JMS field, the JMS field is mapped onto the MQMD field. Additional MQMD fields are exposed as JMS properties, because a JMS application might need to get or set these fields when communicating with a non-JMS application.

Copying
Where there is no MQMD equivalent, a JMS header field or property is passed, possibly transformed, as a field inside the MQRFH2.

The MQRFH2 header

This section describes the MQRFH Version 2 header, which carries JMS-specific data that is associated with the message content. The MQRFH2 Version 2 is an extensible header, and can also carry additional information that is not directly associated with JMS. However, this section covers only its use by JMS.

There are two parts of the header, a fixed portion and a variable portion.

Fixed portion

The fixed portion is modelled on the *standard* WebSphere MQ header pattern and consists of the following fields:

StrucId (MQCHAR4)

Structure identifier.

Must be MQRFH_STRUC_ID (value: “RFH ”) (initial value).

MQRFH_STRUC_ID_ARRAY (value: “R”,“F”,“H”,“ ”) is also defined in the usual way.

Version (MQLONG)

Structure version number.

Must be MQRFH_VERSION_2 (value: 2) (initial value).

StrucLength (MQLONG)

Total length of MQRFH2, including the NameValueData fields.

The value set into StrucLength must be a multiple of 4 (the data in the NameValueData fields can be padded with space characters to achieve this).

Encoding (MQLONG)

Data encoding.

Encoding of any numeric data in the portion of the message following the MQRFH2 (the next header, or the message data following this header).

CodedCharSetId (MQLONG)

Coded character set identifier.

Representation of any character data in the portion of the message following the MQRFH2 (the next header, or the message data following this header).

Format (MQCHAR8)

Format name.

Format name for the portion of the message following the MQRFH2.

Flags (MQLONG)

Flags.

MQRFH_NO_FLAGS =0. No flags set.

NameValueCCSID (MQLONG)

The coded character set identifier (CCSID) for the NameValueData character strings contained in this header. The NameValueData can be coded in a character set that differs from the other character strings that are contained in the header (StrucID and Format).

If the NameValueCCSID is a 2-byte Unicode CCSID (1200, 13488, or 17584), the byte order of the Unicode is the same as the byte ordering of the numeric fields in the MQRFH2. (For example, Version, StrucLength, and NameValueCCSID itself.)

The NameValueCCSID takes values from the following table:

Table 18. Possible values for NameValueCCSID field

Value	Meaning
1200	UCS2 open-ended
1208	UTF8
13488	UCS2 2.0 subset
17584	UCS2 2.1 subset (includes Euro symbol)

Variable portion

The variable portion follows the fixed portion. The variable portion contains a variable number of MQRFH2 folders. Each folder contains a variable number of elements or properties. Folders group together related properties. The MQRFH2 headers created by JMS can contain up to three folders:

The <mcd> folder

This contains properties that describe the *shape* or *format* of the message. For example, the `Msd` property identifies the message as being Text, Bytes, Stream, Map, Object, or null. This folder is always present in a JMS MQRFH2.

The <jms> folder

This is used to transport JMS header fields, and JMSX properties that cannot be fully expressed in the MQMD. This folder is always present in a JMS MQRFH2.

The <usr> folder

This is used to transport any application-defined properties associated with the message. This folder is only present if the application has set some application-defined properties.

Table 19 shows a full list of property names.

Table 19. MQRFH2 folders and properties used by JMS

JMS field name	Java type	MQRFH2 folder name	Property name	Type/values
JMSDestination	Destination	jms	Dst	string
JMSExpiration	long	jms	Exp	i8
JMSPriority	int	jms	Pri	i4
JMSDeliveryMode	int	jms	Dlv	i4
JMSCorrelationID	String	jms	Cid	string
JMSReplyTo	Destination	jms	Rto	string
JMSTimestamp	long	jms	Tms	i8
JMSType	String	mcd	Type, Set, Fmt	string
JMSXGroupID	String	jms	Gid	string
JMSXGroupSeq	int	jms	Seq	i4
xxx (user defined)	Any	usr	xxx	any

Table 19. MQRFH2 folders and properties used by JMS (continued)

JMS field name	Java type	MQRFH2 folder name	Property name	Type/values
		mcd	Msd	jms_none jms_text jms_bytes jms_map jms_stream jms_object

The syntax used to express the properties in the variable portion is as follows:

NameValueLength (MQLONG)
Length in bytes of the NameValueData string that immediately follows this length field (it does not include its own length). The value set into NameValueLength is always a multiple of 4 (the NameValueData field is padded with space characters to achieve this).

NameValueData (MQCHARn)
A single character string, whose length in bytes is given by the preceding NameValueLength field. It contains a folder holding a sequence of properties. Each property is a name/type/value triplet, contained within an XML element whose name is the folder name, as follows:

```
<foldername> triplet1 triplet2 .....   tripletn </foldername>
```

The closing `</foldername>` tag can be followed by spaces as padding characters. Each triplet is encoded using an XML-like syntax:

```
<name dt='datatype'>value</name>
```

The `dt='datatype'` element is optional and is omitted for many properties, because the datatype is predefined. If it is included, one or more space characters must be included before the `dt=` tag.

name is the name of the property; see Table 19 on page 263.

datatype
must match, after folding, one of the literal datatype values in Table 20.

value is a string representation of the value to be conveyed, using the definitions in Table 20.

A null value is encoded using the following syntax:

```
<name dt="DataType" xsi:nil="true"></name>
```

Do not use `xsi:nil="false"`.

Table 20. Property datatype values and definitions

Datatype value	Definition
string	Any sequence of characters excluding < and &
boolean	The character 0 or 1 (1 = ″true″)

Table 20. Property datatype values and definitions (continued)

Datatype value	Definition
bin.hex	Hexadecimal digits representing octets
i1	A number, expressed using digits 0..9, with optional sign (no fractions or exponent). Must lie in the range -128 to 127 inclusive
i2	A number, expressed using digits 0..9, with optional sign (no fractions or exponent). Must lie in the range -32768 to 32767 inclusive
i4	A number, expressed using digits 0..9, with optional sign (no fractions or exponent). Must lie in the range -2147483648 to 2147483647 inclusive
i8	A number, expressed using digits 0..9, with optional sign (no fractions or exponent). Must lie in the range -9223372036854775808 to 9223372036854775807 inclusive
int	A number, expressed using digits 0..9, with optional sign (no fractions or exponent). Must lie in the same range as i8. This can be used in place of one of the i* types if the sender does not want to associate a particular precision with the property
r4	Floating point number, magnitude <= 3.40282347E+38, >= 1.175E-37 expressed using digits 0..9, optional sign, optional fractional digits, optional exponent
r8	Floating point number, magnitude <= 1.7976931348623E+308, >= 2.225E-307 expressed using digits 0..9, optional sign, optional fractional digits, optional exponent

A string value can contain spaces. You must use the following escape sequences in a string value:

`&` for the & character
`<` for the < character

You can use the following escape sequences, but they are not required:

`>` for the > character
`&apos;` for the ' character
`&quot;` for the " character

JMS fields and properties with corresponding MQMD fields

Table 21 lists the JMS header fields and Table 22 on page 266 lists the JMS properties that are mapped directly to MQMD fields. Table 23 on page 266 lists the provider specific properties and the MQMD fields that they are mapped to.

Table 21. JMS header fields mapping to MQMD fields

JMS header field	Java type	MQMD field	C type
JMSDeliveryMode	int	Persistence	MQLONG
JMSExpiration	long	Expiry	MQLONG
JMSPriority	int	Priority	MQLONG
JMSMessageID	String	MessageID	MQBYTE24
JMSTimestamp	long	PutDate PutTime	MQCHAR8 MQCHAR8
JMSCorrelationID	String	CorrelId	MQBYTE24

Table 22. JMS properties mapping to MQMD fields

JMS property	Java type	MQMD field	C type
JMSXUserID	String	UserIdentifier	MQCHAR12
JMSXAppID	String	PutApplName	MQCHAR28
JMSXDeliveryCount	int	BackoutCount	MQLONG
JMSXGroupID	String	GroupId	MQBYTE24
JMSXGroupSeq	int	MsgSeqNumber	MQLONG

Table 23. JMS provider specific properties mapping to MQMD fields

JMS provider specific property	Java type	MQMD field	C type
JMS_IBM_Report_Exception	int	Report	MQLONG
JMS_IBM_Report_Expiration	int	Report	MQLONG
JMS_IBM_Report_COA	int	Report	MQLONG
JMS_IBM_Report_COD	int	Report	MQLONG
JMS_IBM_Report_PAN	int	Report	MQLONG
JMS_IBM_Report_NAN	int	Report	MQLONG
JMS_IBM_Report_Pass_Msg_ID	int	Report	MQLONG
JMS_IBM_Report_Pass_Correl_ID	int	Report	MQLONG
JMS_IBM_Report_Discard_Msg	int	Report	MQLONG
JMS_IBM_MsgType	int	MsgType	MQLONG
JMS_IBM_Feedback	int	Feedback	MQLONG
JMS_IBM_Format	String	Format	MQCHAR8
JMS_IBM_PutApplType	int	PutApplType	MQLONG
JMS_IBM_Encoding	int	Encoding	MQLONG
JMS_IBM_Character_Set	String	CodedCharacterSetId	MQLONG
JMS_IBM_PutDate	String	PutDate	MQCHAR8
JMS_IBM_PutTime	String	PutTime	MQCHAR8
JMS_IBM_Last_Msg_In_Group	boolean	MsgFlags	MQLONG

Mapping JMS fields onto WebSphere MQ fields (outgoing messages)

Table 24 on page 267 shows how the JMS header fields are mapped into MQMD/RFH2 fields at send() or publish() time. Table 25 on page 267 shows how JMS properties and Table 26 on page 267 shows how JMS provider specific properties are mapped to MQMD fields at send() or publish() time,

For fields marked Set by Message Object, the value transmitted is the value held in the JMS message immediately before the send() or publish() operation. The value in the JMS message is left unchanged by the operation.

For fields marked Set by Send Method, a value is assigned when the send() or publish() is performed (any value held in the JMS message is ignored). The value in the JMS message is updated to show the value used.

Fields marked as Receive-only are not transmitted and are left unchanged in the message by send() or publish().

Table 24. Outgoing message field mapping

JMS header field name	MQMD field used for transmission	Header	Set by
JMSDestination		MQRFH2	Send Method
JMSDeliveryMode	Persistence	MQRFH2	Send Method
JMSExpiration	Expiry	MQRFH2	Send Method
JMSPriority	Priority	MQRFH2	Send Method
JMSMessageID	MessageID		Send Method
JMSTimestamp	PutDate/PutTime		Send Method
JMSCorrelationID	CorrelId	MQRFH2	Message Object
JMSReplyTo	ReplyToQ/ReplyToQMgr	MQRFH2	Message Object
JMSType		MQRFH2	Message Object
JMSRedelivered			Receive-only

Table 25. Outgoing message JMS property mapping

JMS property name	MQMD field used for transmission	Header	Set by
JMSXUserID	UserIdentifier		Send Method
JMSXAppID	PutApplName		Send Method
JMSXDeliveryCount			Receive-only
JMSXGroupID	GroupId	MQRFH2	Message Object
JMSXGroupSeq	MsgSeqNumber	MQRFH2	Message Object

Table 26. Outgoing message JMS provider specific property mapping

JMS provider specific property name	MQMD field used for transmission	Header	Set by
JMS_IBM_Report_Exception	Report		Message Object
JMS_IBM_Report_Expiration	Report		Message Object
JMS_IBM_Report_COA/COD	Report		Message Object
JMS_IBM_Report_NAN/PAN	Report		Message Object
JMS_IBM_Report_Pass_Msg_ID	Report		Message Object
JMS_IBM_Report_Pass_Correl_ID	Report		Message Object
JMS_IBM_Report_Discard_Msg	Report		Message Object
JMS_IBM_MsgType	MsgType		Message Object
JMS_IBM_Feedback	Feedback		Message Object
JMS_IBM_Format	Format		Message Object
JMS_IBM_PutApplType	PutApplType		Send Method
JMS_IBM_Encoding	Encoding		Message Object
JMS_IBM_Character_Set	CodedCharacterSetId		Message Object
JMS_IBM_PutDate	PutDate		Send Method
JMS_IBM_PutTime	PutTime		Send Method

Table 26. Outgoing message JMS provider specific property mapping (continued)

JMS provider specific property name	MQMD field used for transmission	Header	Set by
JMS_IBM_Last_Msg_In_Group	MsgFlags		Message Object

Mapping JMS header fields at send() or publish()

The following notes relate to the mapping of JMS fields at send() or publish():

JMSDestination to MQRFH2

This is stored as a string that serializes the salient characteristics of the destination object, so that a receiving JMS can reconstitute an equivalent destination object. The MQRFH2 field is encoded as URI (see "uniform resource identifiers" on page 204 for details of the URI notation).

JMSReplyTo to MQMD ReplyToQ, ReplyToQMgr, MQRFH2

The queue and queue manager name are copied to the MQMD ReplyToQ and ReplyToQMgr fields respectively. The destination extension information (other useful details that are kept in the destination object) is copied into the MQRFH2 field. The MQRFH2 field is encoded as a URI (see "uniform resource identifiers" on page 204 for details of the URI notation).

JMSDeliveryMode to MQMD Persistence

The JMSDeliveryMode value is set by the send() or publish() Method or MessageProducer, unless the Destination Object overrides it. The JMSDeliveryMode value is mapped to the MQMD Persistence field as follows:

- JMS value PERSISTENT is equivalent to MQPER_PERSISTENT
- JMS value NON_PERSISTENT is equivalent to MQPER_NOT_PERSISTENT

If the MQQueue persistence property is not set to JMSC.MQJMS_PER_QDEF, the delivery mode value is also encoded in the MQRFH2.

JMSExpiration to/from MQMD Expiry, MQRFH2

JMSExpiration stores the time to expire (the sum of the current time and the time to live), whereas MQMD stores the time to live. Also, JMSExpiration is in milliseconds, but MQMD.expiry is in centiseconds.

- If the send() method sets an unlimited time to live, MQMD Expiry is set to MQEI_UNLIMITED, and no JMSExpiration is encoded in the MQRFH2.
- If the send() method sets a time to live that is less than 214748364.7 seconds (about 7 years), the time to live is stored in MQMD. Expiry, and the expiration time (in milliseconds), are encoded as an i8 value in the MQRFH2.
- If the send() method sets a time to live greater than 214748364.7 seconds, MQMD.Expiry is set to MQEI_UNLIMITED. The true expiration time in milliseconds is encoded as an i8 value in the MQRFH2.

JMSPriority to MQMD Priority

Directly map JMSPriority value (0-9) onto MQMD priority value (0-9). If JMSPriority is set to a non-default value, the priority level is also encoded in the MQRFH2.

JMSMessageID from MQMD MessageID

All messages sent from JMS have unique message identifiers assigned by

WebSphere MQ. The value assigned is returned in the MQMD messageId field after the MQPUT call, and is passed back to the application in the JMSMessageID field. The WebSphere MQ messageId is a 24-byte binary value, whereas the JMSMessageID is a string. The JMSMessageID is composed of the binary messageId value converted to a sequence of 48 hexadecimal characters, prefixed with the characters ID:. JMS provides a hint that can be set to disable the production of message identifiers. This hint is ignored, and a unique identifier is assigned in all cases. Any value that is set into the JMSMessageId field before a send() is overwritten.

JMSTimestamp to MQRFH2
During a send, the JMSTimestamp field is set according to the JVM's clock. This value is set into the MQRFH2. Any value that is set into the JMSTimestamp field before a send() is overwritten. See also the JMS_IBM_PutDate and JMS_IBM_PutTime properties.

JMSType to MQRFH2
This string is set into the MQRFH2 mcd.Type field. If it is in URI format, it can also affect mcd.Set and mcd.Fmt fields. See also Appendix D, "Connecting to other products," on page 469.

JMSCorrelationID to MQMD CorrelId, MQRFH2
The JMSCorrelationID can hold one of the following:

A provider specific message ID
This is a message identifier from a message previously sent or received, and so should be a string of 48 hexadecimal digits that are prefixed with ID:. The prefix is removed, the remaining characters are converted into binary, and then they are set into the MQMD CorrelId field. No CorrelId value is encoded in the MQRFH2.

A provider-native byte[] value
The value is copied into the MQMD CorrelId field - padded with nulls, or truncated to 24 bytes if necessary. No CorrelId value is encoded in the MQRFH2.

An application-specific string
The value is copied into the MQRFH2. The first 24 bytes of the string, in UTF8 format, are written into the MQMD CorrelID.

Mapping JMS property fields

These notes refer to the mapping of JMS property fields in WebSphere MQ messages:

JMSXUserID from MQMD UserIdentifier
JMSXUserID is set on return from send call.

JMSXAppID from MQMD PutApplName
JSMXAppID is set on return from send call.

JMSXGroupID to MQRFH2 (point-to-point)
For point-to-point messages, the JMSXGroupID is copied into the MQMD GroupID field. If the JMSXGroupID starts with the prefix ID:, it is converted into binary. Otherwise, it is encoded as a UTF8 string. The value is padded or truncated if necessary to a length of 24 bytes. The MQMF_MSG_IN_GROUP flag is set.

JMSXGroupID to MQRFH2 (publish/subscribe)
For publish/subscribe messages, the JMSXGroupID is copied into the MQRFH2 as a string.

JMSXGroupSeq MQMD MsgSeqNumber (point-to-point)
For point-to-point messages, the JMSXGroupSeq is copied into the MQMD MsgSeqNumber field. The MQMF_MSG_IN_GROUP flag is set.

JMSXGroupSeq MQMD MsgSeqNumber (publish/subscribe)
For publish/subscribe messages, the JMSXGroupSeq is copied into the MQRFH2 as an i4.

Mapping JMS provider-specific fields

The following notes refer to the mapping of JMS Provider specific fields into WebSphere MQ messages:

JMS_IBM_Report_<name> to MQMD Report
A JMS application can set the MQMD Report options, using the following JMS_IBM_Report_XXX properties. The single MQMD is mapped to several JMS_IBM_Report_XXX properties. The application must set the value of these properties to the standard WebSphere MQ MQRO_ constants (included in com.ibm.mq.MQC). So, for example, to request COD with full Data, the application must set JMS_IBM_Report_COD to the value MQC.MQRO_COD_WITH_FULL_DATA.

JMS_IBM_Report_Exception

MQRO_EXCEPTION or
MQRO_EXCEPTION_WITH_DATA or
MQRO_EXCEPTION_WITH_FULL_DATA

JMS_IBM_Report_Expiration

MQRO_EXPIRATION or
MQRO_EXPIRATION_WITH_DATA or
MQRO_EXPIRATION_WITH_FULL_DATA

JMS_IBM_Report_COA

MQRO_COA or
MQRO_COA_WITH_DATA or
MQRO_COA_WITH_FULL_DATA

JMS_IBM_Report_COD

MQRO_COD or
MQRO_COD_WITH_DATA or
MQRO_COD_WITH_FULL_DATA

JMS_IBM_Report_PAN
MQRO_PAN

JMS_IBM_Report_NAN
MQRO_NAN

JMS_IBM_Report_Pass_Msg_ID
MQRO_PASS_MSG_ID

JMS_IBM_Report_Pass_Correl_ID
MQRO_PASS_CORREL_ID

JMS_IBM_Report_Discard_Msg
MQRO_DISCARD_MSG

JMS_IBM_MsgType to MQMD MsgType
Value maps directly onto MQMD MsgType. If the application has not set

an explicit value of JMS_IBM_MsgType, a default value is used. This default value is determined as follows:

- If JMSReplyTo is set to a WebSphere MQ queue destination, MSGType is set to the value MQMT_REQUEST
- If JMSReplyTo is not set, or is set to anything other than a WebSphere MQ queue destination, MsgType is set to the value MQMT_DATAGRAM

JMS_IBM_Feedback to MQMD Feedback
Value maps directly onto MQMD Feedback.

JMS_IBM_Format to MQMD Format
Value maps directly onto MQMD Format.

JMS_IBM_Encoding to MQMD Encoding
If set, this property overrides the numeric encoding of the Destination Queue or Topic.

JMS_IBM_Character_Set to MQMD CodedCharacterSetId
If set, this property overrides the coded character set property of the Destination Queue or Topic.

JMS_IBM_PutDate from MQMD PutDate
The value of this property is set, during send, directly from the PutDate field in the MQMD. Any value that is set into the JMS_IBM_PutDate property before a send is overwritten. This field is a String of eight characters, in the WebSphere MQ Date format of YYYYMMDD. This property can be used in conjunction with the JMS_IBM_PutTime property to determine the time the message was put according to the queue manager.

JMS_IBM_PutTime from MQMD PutTime
The value of this property is set, during send, directly from the PutTime field in the MQMD. Any value that is set into the JMS_IBM_PutTime property before a send is overwritten. This field is a String of eight characters, in the WebSphere MQ Time format of HHMMSSTH. This property can be used in conjunction with the JMS_IBM_PutDate property to determine the time the message was put according to the queue manager.

JMS_IBM_Last_Msg_In_Group to MQMD MsgFlags
For point-to-point messaging, this boolean value maps to the MQMF_LAST_MSG_IN_GROUP flag in the MQMD MsgFlags field. It is normally used in conjunction with the JMSXGroupID and JMSXGroupSeq properties to indicate to a legacy WebSphere MQ application that this is the last message in a group. This property is ignored for publish/subscribe messaging.

Mapping WebSphere MQ fields onto JMS fields (incoming messages)

Table 27 on page 272 shows how JMS header fields and Table 28 on page 272 shows how JMS property fields are mapped into MQMD/MQRFH2 fields at send() or publish() time. Table 29 on page 272 shows how JMS provider specific properties are mapped.

Table 27. Incoming message JMS header field mapping

JMS header field name	MQMD field retrieved from	MQRFH2 field retrieved from
JMSDestination		jms.Dst
JMSDeliveryMode	Persistence[1]	jms.Dlv[1]
JMSExpiration		jms.Exp
JMSPriority	Priority	
JMSMessageID	MessageID	
JMSTimestamp	PutDate[1] PutTime[1]	jms.Tms[1]
JMSCorrelationID	CorrelId[1]	jms.Cid[1]
JMSReplyTo	ReplyToQ[1] ReplyToQMgr[1]	jms.Rto[1]
JMSType		mcd.Type, mcd.Set, mcd.Fmt
JMSRedelivered	BackoutCount	

Notes:

1. For properties that can have values retrieved from the MQRFH2 or the MQMD, if both are available, the setting in the MQRFH2 is used.

Table 28. Incoming message property mapping

JMS property name	MQMD field retrieved from	MQRFH2 field retrieved from
JMSXUserID	UserIdentifier	
JMSXAppID	PutApplName	
JMSXDeliveryCount	BackoutCount	
JMSXGroupID	GroupId[1]	jms.Gid[1]
JMSXGroupSeq	MsgSeqNumber[1]	jms.Seq[1]

Notes:

1. For properties that can have values retrieved from the MQRFH2 or the MQMD, if both are available, the setting in the MQRFH2 is used.

Table 29. Incoming message provider specific JMS property mapping

JMS property name	MQMD field retrieved from	MQRFH2 field retrieved from
JMS_IBM_Report_Exception	Report	
JMS_IBM_Report_Expiration	Report	
JMS_IBM_Report_COA	Report	
JMS_IBM_Report_COD	Report	
JMS_IBM_Report_PAN	Report	
JMS_IBM_Report_NAN	Report	
JMS_IBM_Report_ Pass_Msg_ID	Report	
JMS_IBM_Report_Pass_Correl_ID	Report	
JMS_IBM_Report_Discard_Msg	Report	

Table 29. Incoming message provider specific JMS property mapping (continued)

JMS property name	MQMD field retrieved from	MQRFH2 field retrieved from
JMS_IBM_MsgType	MsgType	
JMS_IBM_Feedback	Feedback	
JMS_IBM_Format	Format	
JMS_IBM_PutApplType	PutApplType	
JMS_IBM_Encoding [1]	Encoding	
JMS_IBM_Character_Set [1]	CodedCharacterSetId	
JMS_IBM_PutDate	PutDate	
JMS_IBM_PutTime	PutTime	
JMS_IBM_Last_Msg_In_Group	MsgFlags	
1. Only set if the incoming message is a Bytes Message.		

Mapping JMS to a native WebSphere MQ application

This section describes what happens if you send a message from a JMS client application to a traditional WebSphere MQ application with no knowledge of MQRFH2 headers. Figure 5 shows the mapping.

The administrator indicates that the JMS client is communicating with such an application by setting the WebSphere MQ destination's TargetClient value to JMSC.MQJMS_CLIENT_NONJMS_MQ. This indicates that no MQRFH2 field is to be produced. Note that if this is not done, the receiving application must be able to handle the MQRFH2 field.

The mapping from JMS to MQMD targeted at a native WebSphere MQ application is the same as mapping from JMS to MQMD targeted at a true JMS client. If JMS receives a WebSphere MQ message with the MQMD format field set to other than MQFMT_RFH2, data is being received from a non-JMS application. If the format is MQFMT_STRING, the message is received as a JMS text message. Otherwise, it is received as a JMS bytes message. Because there is no MQRFH2, only those JMS properties that are transmitted in the MQMD can be restored.

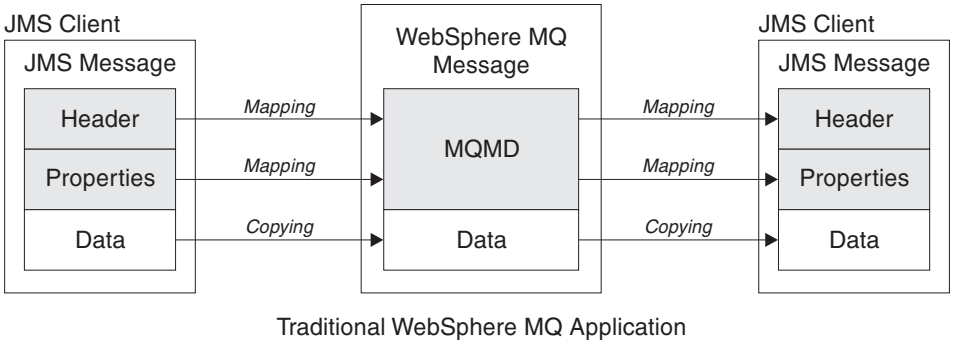


Figure 5. How JMS messages are transformed to WebSphere MQ messages (no MQRFH2 header)

Message body

This section discusses the encoding of the message body itself. The encoding depends on the type of JMS message:

ObjectMessage
is an object serialized by the Java Runtime in the normal way.

TextMessage
is an encoded string. For an outgoing message, the string is encoded in the character set given by the destination object. This defaults to UTF8 encoding (the UTF8 encoding starts with the first character of the message; there is no length field at the start). It is, however, possible to specify any other character set supported by WebSphere MQ Java. Such character sets are used mainly when you send a message to a non-JMS application.

If the character set is a double-byte set (including UTF16), the destination object's integer encoding specification determines the order of the bytes.

An incoming message is interpreted using the character set and encoding that are specified in the message itself. These specifications are in the last WebSphere MQ header (or MQMD if there are no headers). For JMS messages, the last header is usually the MQRFH2.

BytesMessage
is, by default, a sequence of bytes as defined by the JMS 1.0.2 specification and associated Java documentation.

For an outgoing message that was assembled by the application itself, the destination object's encoding property can be used to override the encodings of integer and floating point fields contained in the message. For example, you can request that floating point values are stored in S/390 rather than IEEE format).

An incoming message is interpreted using the numeric encoding specified in the message itself. This specification is in the rightmost WebSphere MQ header (or MQMD if there are no headers). For JMS messages, the rightmost header is usually the MQRFH2.

If a BytesMessage is received, and is re-sent without modification, its body is transmitted byte for byte, as it was received. The destination object's encoding property has no effect on the body. The only string-like entity that can be sent explicitly in a BytesMessage is a UTF8 string. This is encoded in Java UTF8 format, and starts with a 2-byte length field. The destination object's character set property has no effect on the encoding of an outgoing BytesMessage. The character set value in an incoming WebSphere MQ message has no effect on the interpretation of that message as a JMS BytesMessage.

Non-Java applications are unlikely to recognize the Java UTF8 encoding. Therefore, for a JMS application to send a BytesMessage that contains text data, the application itself must convert its strings to byte arrays, and write these byte arrays into the BytesMessage.

MapMessage
is a string containing a set of XML name/type/value triplets, encoded as:

```
<map><elementName1 dt='datatype'>value</elementName1>
<elementName2 dt='datatype'>value</elementName2>.....
</map>
```

where `datatype` can take one of the values described in Table 20 on page 264, and `string` is the default datatype, so `dt='string'` is omitted.

The character set used to encode or interpret the XML string that makes up the MapMessage body is determined following the rules that apply to a TextMessage.

StreamMessage
is like a map, but without element names:

```
<stream><elt dt='datatype'>value</elt>
<elt dt='datatype'>value</elt>.....</stream>
```

Every element is sent using the same tag name (elt). The default type is string, so `dt='string'` is omitted for string elements.

The character set used to encode or interpret the XML string that makes up the StreamMessage body is determined following the rules that apply to a TextMessage.

The MQRFH2.format field is set as follows:

MQFMT_NONE
for ObjectMessage, BytesMessage, or messages with no body.

MQFMT_STRING
for TextMessage, StreamMessage, or MapMessage.

Chapter 14. WebSphere MQ JMS Application Server Facilities

WebSphere MQ JMS supports the Application Server Facilities (ASF) that are specified in the Java Message Service 1.0.2 specification (see Sun's Java Web site at `http://java.sun.com`). This specification identifies three roles within this programming model:

- **The JMS provider** supplies ConnectionConsumer and advanced Session functionality.
- **The application server** supplies ServerSessionPool and ServerSession functionality.
- **The client application** uses the functionality that the JMS provider and application server supply.

This chapter does not apply if you use a direct connection to WebSphere MQ Event Broker.

The following sections contain details about how WebSphere MQ JMS implements ASF:

- "ASF classes and functions" describes how WebSphere MQ JMS implements the ConnectionConsumer class and advanced functionality in the Session class.
- "Application server sample code" on page 283 describes the sample ServerSessionPool and ServerSession code that is supplied with WebSphere MQ JMS.
- "Examples of ASF use" on page 287 describes supplied ASF samples and examples of ASF use from the perspective of a client application.

Note: The Java Message Service 1.0.2 specification for ASF also describes JMS support for distributed transactions using the X/Open XA protocol. For details of the XA support that WebSphere MQ JMS provides, see Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475.

ASF classes and functions

WebSphere MQ JMS implements the ConnectionConsumer class and advanced functionality in the Session class. For details, see:

- "ConnectionConsumer" on page 318
- "QueueConnection" on page 379
- "Session" on page 393
- "TopicConnection" on page 420

ConnectionConsumer

The JMS specification enables an application server to integrate closely with a JMS implementation by using the `ConnectionConsumer` interface. This feature provides concurrent processing of messages. Typically, an application server creates a pool of threads, and the JMS implementation makes messages available to these threads. A JMS-aware application server can use this feature to provide high-level messaging functionality, such as message processing beans.

Normal applications do not use the ConnectionConsumer, but expert JMS clients might use it. For such clients, the ConnectionConsumer provides a high-performance method to deliver messages concurrently to a pool of threads. When a message arrives on a queue or a topic, JMS selects a thread from the pool and delivers a batch of messages to it. To do this, JMS runs an associated MessageListener's `onMessage()` method.

You can achieve the same effect by constructing multiple Session and MessageConsumer objects, each with a registered MessageListener. However, the ConnectionConsumer provides better performance, less use of resources, and greater flexibility. In particular, fewer Session objects are required.

To help you develop applications that use ConnectionConsumers, WebSphere MQ JMS provides a fully-functioning example implementation of a pool. You can use this implementation without any changes, or adapt it to suit the specific needs of the application.

Planning an application

This section tells you how to plan an application including:

- "General principles for point-to-point messaging"
- "General principles for publish/subscribe messaging" on page 279
- "Handling poison messages" on page 280
- "Removing messages from the queue" on page 281

General principles for point-to-point messaging

When an application creates a ConnectionConsumer from a QueueConnection object, it specifies a JMS queue object and a selector string. The ConnectionConsumer then begins to provide messages to sessions in the associated ServerSessionPool. Messages arrive on the queue, and if they match the selector, they are delivered to sessions in the associated ServerSessionPool.

In WebSphere MQ terms, the queue object refers to either a QLOCAL or a QALIAS on the local queue manager. If it is a QALIAS, that QALIAS must refer to a QLOCAL. The fully-resolved WebSphere MQ QLOCAL is known as the *underlying QLOCAL*. A ConnectionConsumer is said to be *active* if it is not closed and its parent QueueConnection is started.

It is possible for multiple ConnectionConsumers, each with different selectors, to run against the same underlying QLOCAL. To maintain performance, unwanted messages must not accumulate on the queue. Unwanted messages are those for which no active ConnectionConsumer has a matching selector. You can set the QueueConnectionFactory so that these unwanted messages are removed from the queue (for details, see "Removing messages from the queue" on page 281). You can set this behavior in one of two ways:

- Use the JMS administration tool to set the QueueConnectionFactory to MRET(NO).
- In your program, use:

  ```
  MQQueueConnectionFactory.setMessageRetention(JMSC.MQJMS_MRET_NO)
  ```

If you do not change this setting, the default is to retain such unwanted messages on the queue.

It is possible that ConnectionConsumers that target the same underlying QLOCAL could be created from multiple QueueConnection objects. However, for

performance reasons, we recommend that multiple JVMs do not create ConnectionConsumers against the same underlying QLOCAL.

When you set up the WebSphere MQ queue manager, consider the following points:

- The underlying QLOCAL must be enabled for shared input. To do this, use the following MQSC command:

  ```
  ALTER QLOCAL(your.qlocal.name) SHARE GET(ENABLED)
  ```

- Your queue manager must have an enabled dead-letter queue. If a ConnectionConsumer experiences a problem when it puts a message on the dead-letter queue, message delivery from the underlying QLOCAL stops. To define a dead-letter queue, use:

  ```
  ALTER QMGR DEADQ(your.dead.letter.queue.name)
  ```

- The user that runs the ConnectionConsumer must have authority to perform MQOPEN with MQOO_SAVE_ALL_CONTEXT and MQOO_PASS_ALL_CONTEXT. For details, see the WebSphere MQ documentation for your specific platform.
- If unwanted messages are left on the queue, they degrade the system performance. Therefore, plan your message selectors so that between them, the ConnectionConsumers will remove all messages from the queue.

For details about MQSC commands, see the *WebSphere MQ Script (MQSC) Command Reference*.

General principles for publish/subscribe messaging

When an application creates a ConnectionConsumer from a TopicConnection object, it specifies a Topic object and a selector string. The ConnectionConsumer then begins to receive messages that match the selector on that Topic.

Alternatively, an application can create a durable ConnectionConsumer that is associated with a specific name. This ConnectionConsumer receives messages that have been published on the Topic since the durable ConnectionConsumer was last active. It receives all such messages that match the selector on the Topic.

For non-durable subscriptions, a separate queue is used for ConnectionConsumer subscriptions. The CCSUB configurable option on the TopicConnectionFactory specifies the queue to use. Normally, the CCSUB specifies a single queue for use by all ConnectionConsumers that use the same TopicConnectionFactory. However, it is possible to make each ConnectionConsumer generate a temporary queue by specifying a queue name prefix followed by a *.

For durable subscriptions, the CCDSUB property of the Topic specifies the queue to use. Again, this can be a queue that already exists or a queue name prefix followed by a *. If you specify a queue that already exists, all durable ConnectionConsumers that subscribe to the Topic use this queue. If you specify a queue name prefix followed by a *, a queue is generated the first time that a durable ConnectionConsumer is created with a given name. This queue is reused later when a durable ConnectionConsumer is created with the same name.

When you set up the WebSphere MQ queue manager, consider the following points:

- Your queue manager must have an enabled dead-letter queue. If a ConnectionConsumer experiences a problem when it puts a message on the dead-letter queue, message delivery from the underlying QLOCAL stops. To define a dead-letter queue, use:

```
ALTER QMGR DEADQ(your.dead.letter.queue.name)
```

- The user that runs the ConnectionConsumer must have authority to perform MQOPEN with MQOO_SAVE_ALL_CONTEXT and MQOO_PASS_ALL_CONTEXT. For details, see the WebSphere MQ documentation for your platform.
- You can optimize performance for an individual ConnectionConsumer by creating a separate, dedicated, queue for it. This is at the cost of extra resource usage.

Handling poison messages

Sometimes, a badly-formatted message arrives on a queue. Such a message might make the receiving application fail and back out the receipt of the message. In this situation, such a message might be received, then returned to the queue, repeatedly. These messages are known as *poison messages*. The ConnectionConsumer must be able to detect poison messages and reroute them to an alternative destination.

When an application uses ConnectionConsumers, the circumstances in which a message is backed out depend on the session that the application server provides:

- When the session is non-transacted, with AUTO_ACKNOWLEDGE or DUPS_OK_ACKNOWLEDGE, a message is backed out only after a system error, or if the application terminates unexpectedly.
- When the session is non-transacted with CLIENT_ACKNOWLEDGE, unacknowledged messages can be backed out by the application server calling `Session.recover()`.

  Typically, the client implementation of MessageListener or the application server calls `Message.acknowledge()`. `Message.acknowledge()` acknowledges all messages delivered on the session so far.
- When the session is transacted, the application server usually commits the session. If the application server detects an error, it may choose to back out one or more messages.
- If the application server supplies an XASession, messages are committed or backed out depending on a distributed transaction. The application server takes responsibility for completing the transaction.

The WebSphere MQ queue manager keeps a record of the number of times that each message has been backed out. When this number reaches a configurable threshold, the ConnectionConsumer requeues the message on a named backout queue. If this requeue fails for any reason, the message is removed from the queue and either requeued to the dead-letter queue, or discarded. See “Removing messages from the queue” on page 281 for more details.

On most platforms, the threshold and requeue queue are properties of the WebSphere MQ QLOCAL. For point-to-point messaging, this is the underlying QLOCAL. For publish/subscribe messaging, this is the CCSUB queue defined on the TopicConnectionFactory, or the CCDSUB queue defined on the Topic. To set the threshold and requeue queue properties, issue the following MQSC command:

```
ALTER QLOCAL(your.queue.name) BOTHRESH(threshold) BOQUEUE(your.requeue.queue.name)
```

For publish/subscribe messaging, if your system creates a dynamic queue for each subscription, these settings are obtained from the WebSphere MQ JMS model queue. To alter these settings, you can use:

```
ALTER QMODEL(SYSTEM.JMS.MODEL.QUEUE) BOTHRESH(threshold) BOQUEUE(your.requeue.queue.name)
```

If the threshold is zero, poison message handling is disabled, and poison messages remain on the input queue. Otherwise, when the backout count reaches the threshold, the message is sent to the named requeue queue. If the backout count reaches the threshold, but the message cannot go to the requeue queue, the message is sent to the dead-letter queue or discarded. This situation occurs if the requeue queue is not defined, or if the ConnectionConsumer cannot send the message to the requeue queue. On some platforms, you cannot specify the threshold and requeue queue properties. On these platforms, messages are sent to the dead-letter queue, or discarded, when the backout count reaches 20. See "Removing messages from the queue" for further details.

Removing messages from the queue

When an application uses ConnectionConsumers, JMS might need to remove messages from the queue in a number of situations:

Badly formatted message
A message might arrive that JMS cannot parse.

Poison message
A message might reach the backout threshold, but the ConnectionConsumer fails to requeue it on the backout queue.

No interested ConnectionConsumer
For point-to-point messaging, when the QueueConnectionFactory is set so that it does not retain unwanted messages, a message arrives that is unwanted by any of the ConnectionConsumers.

In these situations, the ConnectionConsumer attempts to remove the message from the queue. The disposition options in the report field of the message's MQMD set the exact behavior. These options are:

MQRO_DEAD_LETTER_Q
The message is requeued to the queue manager's dead-letter queue. This is the default.

MQRO_DISCARD_MSG
The message is discarded.

The ConnectionConsumer also generates a report message, and this also depends on the report field of the message's MQMD. This message is sent to the message's ReplyToQ on the ReplyToQmgr. If there is an error while the report message is being sent, the message is sent to the dead-letter queue instead. The exception report options in the report field of the message's MQMD set details of the report message. These options are:

MQRO_EXCEPTION
A report message is generated that contains the MQMD of the original message. It does not contain any message body data.

MQRO_EXCEPTION_WITH_DATA
A report message is generated that contains the MQMD, any MQ headers, and 100 bytes of body data.

MQRO_EXCEPTION_WITH_FULL_DATA
A report message is generated that contains all data from the original message.

default
No report message is generated.

When report messages are generated, the following options are honored:

- MQRO_NEW_MSG_ID
- MQRO_PASS_MSG_ID
- MQRO_COPY_MSG_ID_TO_CORREL_ID
- MQRO_PASS_CORREL_ID

If a ConnectionConsumer cannot follow the disposition options or exception report options in the message's MQMD, its action depends on the persistence of the message. If the message is non-persistent, the message is discarded and no report message is generated. If the message is persistent, delivery of all messages from the QLOCAL stops.

It is important to define a dead-letter queue, and to check it regularly to ensure that no problems occur. Particularly, ensure that the dead-letter queue does not reach its maximum depth, and that its maximum message size is large enough for all messages.

When a message is requeued to the dead-letter queue, it is preceded by a WebSphere MQ dead-letter header (MQDLH). See the *WebSphere MQ Application Programming Reference* for details about the format of the MQDLH. You can identify messages that a ConnectionConsumer has placed on the dead-letter queue, or report messages that a ConnectionConsumer has generated, by the following fields:

- PutApplType is `MQAT_JAVA (0x1C)`
- PutApplName is "`MQ JMS ConnectionConsumer`"

These fields are in the MQDLH of messages on the dead-letter queue, and the MQMD of report messages. The feedback field of the MQMD, and the Reason field of the MQDLH, contain a code describing the error. For details about these codes, see "Error handling." Other fields are as described in the *WebSphere MQ Application Programming Reference*.

Error handling

This section covers various aspects of error handling, including "Recovering from error conditions" and "Reason and feedback codes" on page 283.

Recovering from error conditions

If a ConnectionConsumer experiences a serious error, message delivery to all ConnectionConsumers with an interest in the same QLOCAL stops. Typically, this occurs if the ConnectionConsumer cannot requeue a message to the dead-letter queue, or it experiences an error when reading messages from the QLOCAL.

When this occurs, any ExceptionListener that is registered with the affected Connection is notified.

You can use these to identify the cause of the problem. In some cases, the system administrator must intervene to resolve the problem.

There are two ways in which an application can recover from these error conditions:

- Call `close()` on all affected ConnectionConsumers. The application can create new ConnectionConsumers only after all affected ConnectionConsumers are closed and any system problems are resolved.
- Call `stop()` on all affected Connections. Once all Connections are stopped and any system problems are resolved, the application should be able to `start()` all Connections successfully.

Reason and feedback codes

To determine the cause of an error, you can use:

- The feedback code in any report messages
- The reason code in the MQDLH of any messages in the dead-letter queue

ConnectionConsumers generate the following reason codes.

MQRC_BACKOUT_THRESHOLD_REACHED (0x93A; 2362)

Cause The message has reached the Backout Threshold defined on the QLOCAL, but no Backout Queue is defined.

On platforms where you cannot define the Backout Queue, the message has reached the JMS-defined backout threshold of 20.

Action If this is not wanted, define the Backout Queue for the relevant QLOCAL. Also look for the cause of the multiple backouts.

MQRC_MSG_NOT_MATCHED (0x93B; 2363)

Cause In point-to-point messaging, there is a message that does not match any of the selectors for the ConnectionConsumers monitoring the queue. To maintain performance, the message is requeued to the dead-letter queue.

Action To avoid this situation, ensure that ConnectionConsumers using the queue provide a set of selectors that deal with all messages, or set the QueueConnectionFactory to retain messages.

Alternatively, investigate the source of the message.

MQRC_JMS_FORMAT_ERROR (0x93C; 2364)

Cause JMS cannot interpret the message on the queue.

Action Investigate the origin of the message. JMS usually delivers messages of an unexpected format as a BytesMessage or TextMessage. Occasionally, this fails if the message is very badly formatted.

Other codes that appear in these fields are caused by a failed attempt to requeue the message to a Backout Queue. In this situation, the code describes the reason that the requeue failed. To diagnose the cause of these errors, refer to the *WebSphere MQ Application Programming Reference*.

If the report message cannot be put on the ReplyToQ, it is put on the dead-letter queue. In this situation, the feedback field of the MQMD is filled in as described above. The reason field in the MQDLH explains why the report message could not be placed on the ReplyToQ.

Application server sample code

Figure 6 on page 284 summarizes the principles of ServerSessionPool and ServerSession functionality.

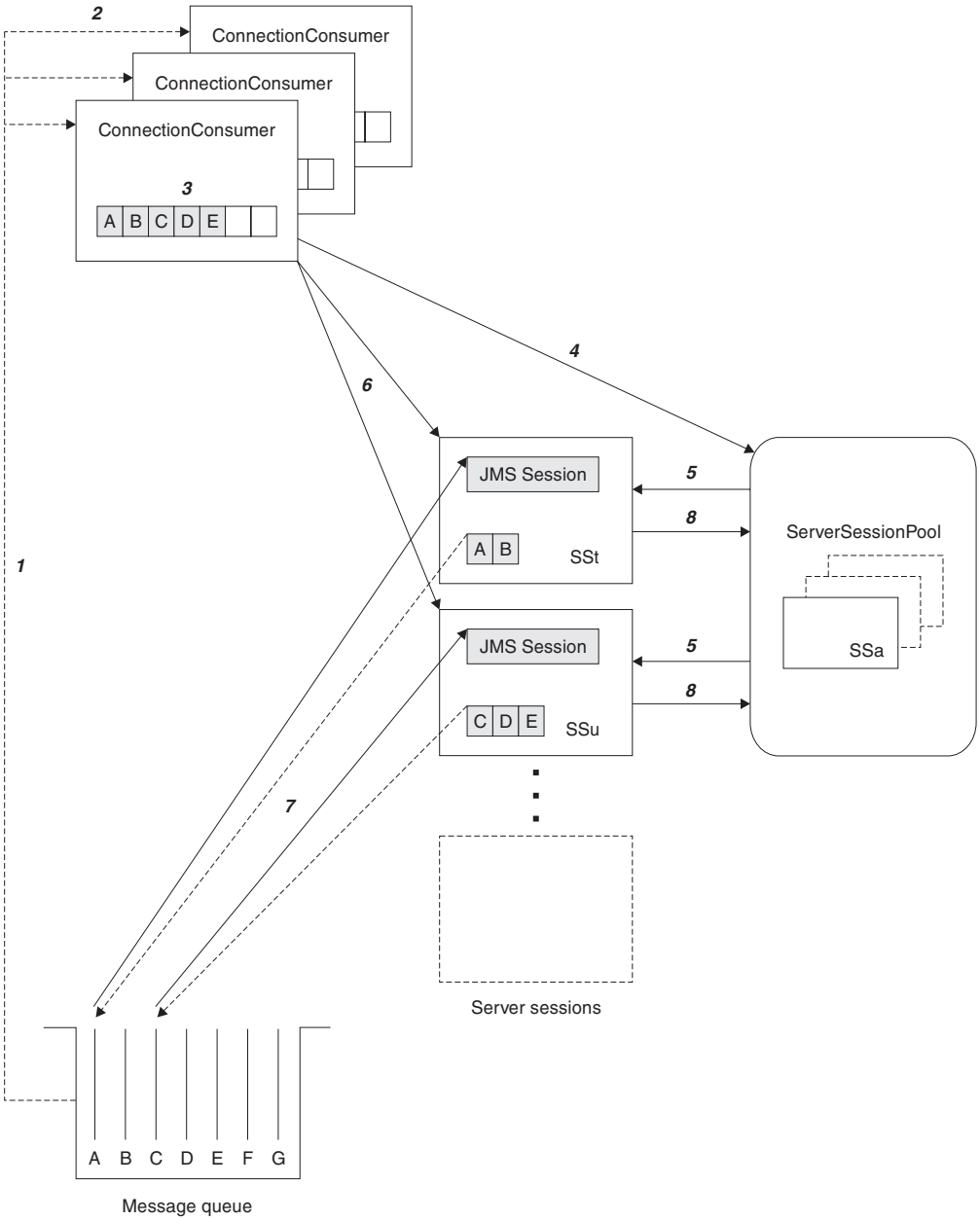


Figure 6. ServerSessionPool and ServerSession functionality

1. The ConnectionConsumers get message references from the queue.
2. Each ConnectionConsumer selects specific message references.
3. The ConnectionConsumer buffer holds the selected message references.
4. The ConnectionConsumer requests one or more ServerSessions from the ServerSessionPool.
5. ServerSessions are allocated from the ServerSessionPool.
6. The ConnectionConsumer assigns message references to the ServerSessions and starts the ServerSession threads running.
7. Each ServerSession retrieves its referenced messages from the queue. It passes them to the `onMessage` method from the MessageListener that is associated with the JMS Session.
8. After it completes its processing, the ServerSession is returned to the pool.

Normally, the application server supplies ServerSessionPool and ServerSession functionality. However, WebSphere MQ JMS is supplied with a simple implementation of these interfaces, with program source. These samples are in the following directory, where <install_dir> is the installation directory for WebSphere MQ JMS:

```
<install_dir>/samples/jms/asf
```

These samples enable you to use the WebSphere MQ JMS ASF in a standalone environment (that is, you do not need a suitable application server). Also, they provide examples of how to implement these interfaces and take advantage of the WebSphere MQ JMS ASF. These examples are intended to aid both WebSphere MQ JMS users, and vendors of other application servers.

MyServerSession.java

This class implements the `javax.jms.ServerSession` interface. It associates a thread with a JMS session. Instances of this class are pooled by a ServerSessionPool (see "MyServerSessionPool.java"). As a ServerSession, it must implement the following two methods:

- `getSession()`, which returns the JMS Session associated with this ServerSession
- `start()`, which starts this ServerSession's thread and results in the JMS Session's `run()` method being invoked

MyServerSession also implements the `Runnable` interface. Therefore, the creation of the ServerSession's thread can be based on this class, and does not need a separate class.

The class uses a `wait()-notify()` mechanism that is based on the values of two boolean flags, ready and quit. This mechanism means that the ServerSession creates and starts its associated thread during its construction. However, it does not automatically execute the body of the `run()` method. The body of the `run()` method is executed only when the ready flag is set to true by the `start()` method. The ASF calls the `start()` method when it is necessary to deliver messages to the associated JMS session.

For delivery, the `run()` method of the JMS session is called. The WebSphere MQ JMS ASF will have already loaded the `run()` method with messages.

After delivery completes, the ready flag is reset to false, and the owning ServerSessionPool is notified that delivery is complete. The ServerSession then remains in a wait state until either the `start()` method is called again, or the `close()` method is invoked and ends this ServerSession's thread.

MyServerSessionPool.java

This class implements the `javax.jms.ServerSessionPool` interface, creating and controlling access to a pool of ServerSessions.

In this implementation, the pool consists of a static array of ServerSession objects that are created during the construction of the pool. The following four parameters are passed into the constructor:

- `javax.jms.Connection` *`connection`*

  The connection used to create JMS sessions.

- `int` *`capacity`*

  The size of the array of MyServerSession objects.

- `int ackMode`

  The required acknowledge mode of the JMS sessions.
- `MessageListenerFactory mlf`

  The MesssageListenerFactory that creates the message listener that is supplied to the JMS sessions. See "MessageListenerFactory.java."

The pool's constructor uses these parameters to create an array of MyServerSession objects. The supplied connection is used to create JMS sessions of the given acknowledge mode and correct domain (QueueSessions for point-to-point and TopicSessions for publish/subscribe). The sessions are supplied with a message listener. Finally, the ServerSession objects, based on the JMS sessions, are created.

This sample implementation is a static model. That is, all the ServerSessions in the pool are created when the pool is created, and after this the pool cannot grow or shrink. This approach is just for simplicity. It is possible for a ServerSessionPool to use a sophisticated algorithm to create ServerSessions dynamically, as needed.

MyServerSessionPool keeps a record of which ServerSessions are currently in use by maintaining an array of boolean values called inUse. These booleans are all initialized to false. When the `getServerSession` method is invoked and requests a ServerSession from the pool, the inUse array is searched for the first false value. When one is found, the boolean is set to true and the corresponding ServerSession is returned. If there are no false values in the inUse array, the `getServerSession` method must `wait()` until notification occurs.

Notification occurs in either of the following circumstances:

- The pool's `close()` method is called, indicating that the pool must be shut down.
- A ServerSession that is currently in use completes its workload and calls the `serverSessionFinished` method. The `serverSessionFinished` method returns the ServerSession to the pool, and sets the corresponding inUse flag to false. The ServerSession then becomes eligible for reuse.

MessageListenerFactory.java

In this sample, a message listener factory object is associated with each ServerSessionPool instance. The MessageListenerFactory class represents a very simple interface that is used to obtain an instance of a class that implements the `javax.jms.MessageListener` interface. The class contains a single method:

```
javax.jms.MessageListener createMessageListener();
```

An implementation of this interface is supplied when the ServerSessionPool is constructed. This object is used to create message listeners for the individual JMS sessions that back up the ServerSessions in the pool. This architecture means that each separate implementation of the `MessageListenerFactory` interface must have its own ServerSessionPool.

WebSphere MQ JMS includes a sample MessageListenerFactory implementation, which is discussed in "CountingMessageListenerFactory.java" on page 288.

Examples of ASF use

There is a set of classes, with their source, in the directory <install_dir>/samples/jms/asf (where <install_dir> is the installation directory for WebSphere MQ JMS). These classes use the WebSphere MQ JMS application server facilities that are described in "ASF classes and functions" on page 277, within the sample standalone application server environment that is described in "Application server sample code" on page 283.

These samples provide examples of ASF use from the perspective of a client application:

- A simple point-to-point example uses:
  - ASFClient1.java
  - Load1.java
  - CountingMessageListenerFactory.java
- A more complex point-to-point example uses:
  - ASFClient2.java
  - Load2.java
  - CountingMessageListenerFactory.java
  - LoggingMessageListenerFactory.java
- A simple publish/subscribe example uses:
  - ASFClient3.java
  - TopicLoad.java
  - CountingMessageListenerFactory.java
- A more complex publish/subscribe example uses:
  - ASFClient4.java
  - TopicLoad.java
  - CountingMessageListenerFactory.java
  - LoggingMessageListenerFactory.java
- A publish/subscribe example using a durable ConnectionConsumer uses:
  - ASFClient5.java
  - TopicLoad.java

The following sections describe each class in turn.

Load1.java

This class is a generic JMS application that loads a given queue with a number of messages, then terminates. It can either retrieve the required administered objects from a JNDI namespace, or create them explicitly, using the WebSphere MQ JMS classes that implement these interfaces. The administered objects that are required are a QueueConnectionFactory and a queue. You can use the command line options to set the number of messages with which to load the queue, and the sleep time between individual message puts.

This application has two versions of the command line syntax.

For use with JNDI, the syntax is:

```
java Load1 [-icf jndiICF] [-url jndiURL] [-qcfLookup qcfLookup]
           [-qLookup qLookup] [-sleep sleepTime] [-msgs numMsgs]
```

For use without JNDI, the syntax is:

```
java Load1 -nojndi [-qmgr qMgrName] [-q qName]
                   [-sleep sleepTime] [-msgs numMsgs]
```

Table 30 describes the parameters and gives their defaults.

Table 30. Load1 parameters and defaults

Parameter	Meaning	Default
jndiICF	Initial context factory class used for JNDI	com.sun.jndi.ldap.LdapCtxFactory
jndiURL	Provider URL used for JNDI	ldap://localhost/o=ibm,c=us
qcfLookup	JNDI lookup key used for QueueConnectionFactory	cn=qcf
qLookup	JNDI lookup key used for Queue	cn=q
qMgrName	Name of queue manager to connect to	"" (use the default queue manager)
qName	Name of queue to load	SYSTEM.DEFAULT.LOCAL.QUEUE
sleepTime	Time (in milliseconds) to pause between message puts	0 (no pause)
numMsgs	Number of messages to put	1000

If there are any errors, an error message is displayed and the application terminates.

You can use this application to simulate message load on a WebSphere MQ queue. In turn, this message load can trigger the ASF-enabled applications described in the following sections. The messages put to the queue are simple JMS TextMessage objects. These objects do not contain user-defined message properties, which could be useful to make use of different message listeners. The source code is supplied so that you can modify this load application if necessary.

CountingMessageListenerFactory.java

This file contains definitions for two classes:

- CountingMessageListener
- CountingMessageListenerFactory

CountingMessageListener is a very simple implementation of the `javax.jms.MessageListener` interface. It keeps a record of the number of times its `onMessage` method has been invoked, but does nothing with the messages it is passed.

CountingMessageListenerFactory is the factory class for CountingMessageListener. It is an implementation of the `MessageListenerFactory` interface described in "MessageListenerFactory.java" on page 286. This factory keeps a record of all the message listeners that it produces. It also includes a method, `printStats()`, which displays usage statistics for each of these listeners.

ASFClient1.java

This application acts as a client of the WebSphere MQ JMS ASF. It sets up a single ConnectionConsumer to consume the messages in a single WebSphere MQ queue. It displays throughput statistics for each message listener that is used, and terminates after one minute.

The application can either retrieve the required administered objects from a JNDI namespace, or create them explicitly, using the WebSphere MQ JMS classes that implement these interfaces. The administered objects that are required are a QueueConnectionFactory and a queue.

This application has two versions of the command line syntax:

For use with JNDI, the syntax is:

```
java ASFClient1 [-icf jndiICF] [-url jndiURL] [-qcfLookup qcfLookup]
                [-qLookup qLookup] [-poolSize poolSize] [-batchSize batchSize]
```

For use without JNDI, the syntax is:

```
java ASFClient1 -nojndi [-qmgr qMgrName] [-q qName]
                        [-poolSize poolSize] [-batchSize batchSize]
```

Table 31 describes the parameters and gives their defaults.

Table 31. ASFClient1 parameters and defaults

Parameter	Meaning	Default
jndiICF	Initial context factory class used for JNDI	com.sun.jndi.ldap.LdapCtxFactory
jndiURL	Provider URL used for JNDI	ldap://localhost/o=ibm,c=us
qcfLookup	JNDI lookup key used for QueueConnectionFactory	cn=qcf
qLookup	JNDI lookup key used for Queue	cn=q
qMgrName	Name of queue manager to connect to	"" (use the default queue manager)
qName	Name of queue to consume from	SYSTEM.DEFAULT.LOCAL.QUEUE
poolSize	The number of ServerSessions created in the ServerSessionPool being used	5
batchSize	The maximum number of message that can be assigned to a ServerSession at a time	10

The application obtains a QueueConnection from the QueueConnectionFactory.

A ServerSessionPool, in the form of a MyServerSessionPool, is constructed using:

- The QueueConnection that was created previously
- The required poolSize
- An acknowledge mode, AUTO_ACKNOWLEDGE
- An instance of a CountingMessageListenerFactory, as described in "CountingMessageListenerFactory.java" on page 288

The connection's `createConnectionConsumer` method is invoked, passing in:

- The queue that was obtained earlier
- A null message selector (indicating that all messages should be accepted)
- The ServerSessionPool that was just created
- The batchSize that is required

The consumption of messages is then started by invoking the connection's `start()` method.

The client application displays throughput statistics for each message listener that is used, displaying statistics every 10 seconds. After one minute, the connection is closed, the server session pool is stopped, and the application terminates.

Load2.java

This class is a JMS application that loads a given queue with a number of messages, then terminates, in a similar way to Load1.java. The command line syntax is also similar to that for Load1.java (substitute Load2 for Load1 in the syntax). For details, see "Load1.java" on page 287.

The difference is that each message contains a user property called `value`, which takes a randomly selected integer value between 0 and 100. This property means that you can apply message selectors to the messages. Consequently, the messages can be shared between the two consumers that are created in the client application described in "ASFClient2.java."

LoggingMessageListenerFactory.java

This file contains definitions for two classes:

- LoggingMessageListener
- LoggingMessageListenerFactory

LoggingMessageListener is an implementation of the `javax.jms.MessageListener` interface. It takes the messages that are passed to it and writes an entry to the log file. The default log file is `./ASFClient2.log`. You can inspect this file and check the messages that are sent to the connection consumer that is using this message listener.

LoggingMessageListenerFactory is the factory class for LoggingMessageListener. It is an implementation of the `MessageListenerFactory` interface described in "MessageListenerFactory.java" on page 286.

ASFClient2.java

ASFClient2.java is a slightly more complicated client application than ASFClient1.java. It creates two ConnectionConsumers that feed off the same queue, but that apply different message selectors. The application uses a CountingMessageListenerFactory for one consumer, and a LoggingMessageListenerFactory for the other. Use of two different message listener factories means that each consumer must have its own server session pool.

The application displays statistics that relate to one ConnectionConsumer on screen, and writes statistics that relate to the other ConnectionConsumer to a log file.

The command line syntax is similar to that for "ASFClient1.java" on page 289 (substitute ASFClient2 for ASFClient1 in the syntax). Each of the two server session pools contains the number of ServerSessions set by the poolSize parameter.

There should be an uneven distribution of messages. The messages loaded onto the source queue by Load2 contain a user property, where the value is between 0 and 100, evenly and randomly distributed. The message selector `value>75` is applied to highConnectionConsumer, and the message selector `value≤75` is applied to normalConnectionConsumer. The highConnectionConsumer's messages (approximately 25% of the total load) are sent to a LoggingMessageListener. The normalConnectionConsumer's messages (approximately 75% of the total load) are sent to a CountingMessageListener.

When the client application runs, statistics that relate to the normalConnectionConsumer, and its associated CountingMessageListenerFactories, are printed to screen every 10 seconds. Statistics that relate to the highConnectionConsumer, and its associated LoggingMessageListenerFactories, are written to the log file.

You can inspect the screen and the log file to see the real destination of the messages. Add the totals for each of the CountingMessageListeners. As long as the client application does not terminate before all the messages are consumed, this accounts for approximately 75% of the load. The number of log file entries accounts for the remainder of the load. (If the client application terminates before all the messages are consumed, you can increase the application timeout.)

TopicLoad.java

This class is a JMS application that is a publish/subscribe version of the Load2 queue loader described in "Load2.java" on page 290. It publishes the required number of messages under the given topic, then terminates. Each message contains a user property called `value`, which takes a randomly selected integer value between 0 and 100.

To use this application, ensure that the broker is running and that the required setup is complete. For details, see "Additional setup for publish/subscribe mode" on page 26.

This application has two versions of the command line syntax.

For use with JNDI, the syntax is:

```
java TopicLoad [-icf jndiICF] [-url jndiURL] [-tcfLookup tcfLookup]
               [-tLookup tLookup] [-sleep sleepTime] [-msgs numMsgs]
```

For use without JNDI, the syntax is:

```
java TopicLoad -nojndi [-qmgr qMgrName] [-t tName]
                       [-sleep sleepTime] [-msgs numMsgs]
```

Table 32 describes the parameters and gives their defaults.

Table 32. TopicLoad parameters and defaults

Parameter	Meaning	Default
jndiICF	Initial context factory class used for JNDI	com.sun.jndi.ldap.LdapCtxFactory
jndiURL	Provider URL used for JNDI	ldap://localhost/o=ibm,c=us

Table 32. TopicLoad parameters and defaults (continued)

Parameter	Meaning	Default
tcfLookup	JNDI lookup key used for TopicConnectionFactory	cn=tcf
tLookup	JNDI lookup key used for Topic	cn=t
qMgrName	Name of queue manager to connect to, and broker queue manager to publish messages to	"" (use the default queue manager)
tName	Name of topic to publish to	MQJMS/ASF/TopicLoad
sleepTime	Time (in milliseconds) to pause between message puts	0 (no pause)
numMsgs	Number of messages to put	200

If there are any errors, an error message is displayed and the application terminates.

ASFClient3.java

ASFClient3.java is a client application that is a publish/subscribe version of "ASFClient1.java" on page 289. It sets up a single ConnectionConsumer to consume the messages published on a single Topic. It displays throughput statistics for each message listener that is used, and terminates after one minute.

This application has two versions of the command line syntax.

For use with JNDI, the syntax is:

```
java ASFClient3 [-icf jndiICF] [-url jndiURL] [-tcfLookup tcfLookup]
                [-tLookup tLookup] [-poolsize poolSize] [-batchsize batchSize]
```

For use without JNDI, the syntax is:

```
java ASFClient3 -nojndi [-qmgr qMgrName] [-t tName]
                        [-poolsize poolSize] [-batchsize batchSize]
```

Table 33 describes the parameters and gives their defaults.

Table 33. ASFClient3 parameters and defaults

Parameter	Meaning	Default
jndiICF	Initial context factory class used for JNDI	com.sun.jndi.ldap.LdapCtxFactory
jndiURL	Provider URL used for JNDI	ldap://localhost/o=ibm,c=us
tcfLookup	JNDI lookup key used for TopicConnectionFactory	cn=tcf
tLookup	JNDI lookup key used for Topic	cn=t
qMgrName	Name of queue manager to connect to, and broker queue manager to publish messages to	"" (use the default queue manager)
tName	Name of topic to consume from	MQJMS/ASF/TopicLoad
poolSize	The number of ServerSessions created in the ServerSessionPool being used	5

Table 33. ASFClient3 parameters and defaults (continued)

Parameter	Meaning	Default
batchSize	The maximum number of message that can be assigned to a ServerSession at a time	10

Like ASFClient1, the client application displays throughput statistics for each message listener that is used, displaying statistics every 10 seconds. After one minute, the connection is closed, the server session pool is stopped, and the application terminates.

ASFClient4.java

ASFClient4.java is a more complex publish/subscribe client application. It creates three ConnectionConsumers that all feed off the same topic, but each one applies different message selectors.

The first two consumers use *high* and *normal* message selectors, in the same way as described for the application "ASFClient2.java" on page 290. The third consumer does not use any message selector. The application uses two CountingMessageListenerFactories for the two selector-based consumers, and a LoggingMessageListenerFactory for the third consumer. Because the application uses different message listener factories, each consumer must have its own server session pool.

The application displays statistics that relate to the two selector-based consumers on screen. It writes statistics that relate to the third ConnectionConsumer to a log file.

The command line syntax is similar to that for "ASFClient3.java" on page 292 (substitute ASFClient4 for ASFClient3 in the syntax). Each of the three server session pools contains the number of ServerSessions set by the poolSize parameter.

When the client application runs, statistics that relate to the normalConnectionConsumer and the highConnectionConsumer, and their associated CountingMessageListenerFactories, are printed to screen every 10 seconds. Statistics that relate to the third ConnectionConsumer, and its associated LoggingMessageListenerFactories, are written to the log file.

You can inspect the screen and the log file to see the real destination of the messages. Add the totals for each of the CountingMessageListeners and inspect the number of log file entries.

The distribution of messages is different from the distribution obtained by a point-to-point version of the same application (ASFClient2.java). This is because, in the publish/subscribe domain, each consumer of a topic obtains its own copy of each message published on that topic. In this application, for a given topic load, the high and normal consumers receive approximately 25% and 75% of the load, respectively. The third consumer still receives 100% of the load. Therefore, the total number of messages received is greater than 100% of the load originally published on the topic.

ASFClient5.java

This sample exercises the durable publish/subscribe ConnectionConsumer functionality in WebSphere MQ JMS.

You invoke it with the same command-line options as the ASFClient4 sample, and, as with the other samples, the TopicLoad sample application can be used to trigger the consumer that is created. For details of TopicLoad, see "TopicLoad.java" on page 291.

When invoked, ASFClient5 displays a menu of three options:

```
1. Create/reactivate a durable ConnectionConsumer
2. Unsubscribe a durable ConnectionConsumer
X. Exit
```

If you choose option 1, and this is the first time this sample has been run, a new durable ConnectionConsumer is created using the given name. It then displays one minute's worth of throughput statistics, rather like the other samples, before closing the connection and terminating.

Having created a durable consumer, messages published on the topic in question continues to arrive at the consumer's destination even though the consumer is inactive.

This can be confirmed by running ASFClient5 again, and selecting option 1. This reactivates the named durable consumer, and the statistics displayed show that any relevant messages published during the period of inactivity were subsequently delivered to the consumer.

If you run ASFClient5 again and select option 2, this unsubscribes the named durable ConnectionConsumer and discards any outstanding messages delivered to it. Do this to ensure that the broker does not continue to deliver unwanted messages.

Chapter 15. JMS interfaces and classes

WebSphere MQ classes for Java Message Service consists of a number of Java classes and interfaces that are based on the Sun javax.jms package of interfaces and classes. Write your clients using the Sun interfaces and classes that are listed below, and that are described in detail in the following sections. The names of the WebSphere MQ objects that implement the Sun interfaces and classes have a prefix of MQ (unless stated otherwise in the object description). The descriptions include details about any deviations of the WebSphere MQ objects from the standard JMS definitions. These deviations are marked with *.

Sun Java Message Service classes and interfaces

The following tables list the JMS objects contained in the package **javax.jms**. Interfaces marked with * are implemented by applications. Interfaces marked with ** are implemented by application servers.

Table 34. Summary of interfaces in package javax.jms

Interface	Description
BytesMessage	Used to send a message containing a stream of uninterpreted bytes.
Connection	A client's active connection to its JMS provider.
ConnectionConsumer	For application servers, a special facility for creating a ConnectionConsumer.
ConnectionFactory	A set of connection configuration parameters that an administrator has defined. In JMS 1.1 only, a client can use a ConnectionFactory to create a Connection to a JMS point-to-point provider, a JMS publish/subscribe provider, or both.
ConnectionMetaData	Information that describes the Connection.
DeliveryMode	Delivery modes supported by JMS.
Destination	Parent interface for Queue and Topic.
ExceptionListener*	Used to receive exceptions thrown by Connections asynchronous delivery threads.
MapMessage	Used to send a set of name-value pairs where names are Strings and values are Java primitive types.
Message	Root interface of all JMS messages.
MessageConsumer	In JMS 1.1, a client uses a MessageConsumer to receive messages from a Destination.
MessageListener*	Used to receive asynchronously delivered messages.
MessageProducer	Used by a client to send messages to a destination.
ObjectMessage	Used to send a message that contains a serializable Java object.
Queue	A provider-specific queue name.
QueueBrowser	Used by a client to look at messages on a queue without removing them.
QueueConnection	An active connection to a JMS point-to-point provider.

Table 34. Summary of interfaces in package javax.jms (continued)

Interface	Description
QueueConnectionFactory	Used by a client to create QueueConnections with a JMS point-to-point provider.
QueueReceiver	Used by a client to receive messages that have been delivered to a queue.
QueueSender	Used by a client to send messages to a queue.
QueueSession	Provides methods to create QueueReceivers, QueueSenders, QueueBrowsers and TemporaryQueues.
ServerSession **	An object implemented by an application server.
ServerSessionPool **	An object implemented by an application server to provide a pool of ServerSessions for processing the messages of a ConnectionConsumer.
Session	A single-threaded context for producing and consuming messages.
StreamMessage	Used to send a stream of Java primitives.
TemporaryQueue	A unique queue object created for the duration of a QueueConnection.
TemporaryTopic	A unique Topic object created for the duration of a TopicConnection.
TextMessage	Used to send a message containing a `java.lang.String`.
Topic	A provider-specific topic name.
TopicConnection	An active connection to a JMS Publish/Subscribe provider.
TopicConnectionFactory	Used by a client to create TopicConnections with a JMS Publish/Subscribe provider.
TopicPublisher	Used by a client to publish messages on a topic.
TopicSession	Provides methods to create TopicPublishers, TopicSubscribers and TemporaryTopics.
TopicSubscriber	Used by a client to receive messages that have been published to a topic.
XAConnection	Extends the capability of Connection by providing an XASession.
XAConnectionFactory	Used by some application servers to provide support for grouping Java Transaction Service (JTS)-capable resource use into a distributed transaction.
XAQueueConnection	Provides the same create options as QueueConnection.
XAQueueConnectionFactory	Provides the same create options as a QueueConnectionFactory.
XAQueueSession	Provides a regular QueueSession that can be used to create QueueReceivers, QueueSenders and QueueBrowsers.
XASession	Extends the capability of Session by adding access to a JMS provider's support for the Java Transaction API (JTA).
XATopicConnection	Provides the same create options as TopicConnection.
XATopicConnectionFactory	Provides the same create options as TopicConnectionFactory.

Table 34. Summary of interfaces in package javax.jms (continued)

Interface	Description
XATopicSession	Provides a regular TopicSession which can be used to create TopicSubscribers and TopicPublishers.

Table 35. Summary of classes in package javax.jms

Class	Description
QueueRequestor	A helper class to simplify making service requests.
TopicRequestor	A helper class to simplify making service requests.

WebSphere MQ JMS classes

Two packages contain the WebSphere MQ classes for Java Message Service that implement the Sun interfaces. Table 36 shows the interfaces implemented by classes in the **com.ibm.mq.jms** package; Table 37 on page 299 shows the interfaces implemented by classes in the **com.ibm.jms** package.

You do not usually use the implementation classes directly; you program to the JMS interfaces. Many of the interfaces do not apply when running a publish/subscribe application on a direct connection to the IBM WebSphere MQ Event Broker. Where the names of implementation classes are listed, provider-specific methods are documented in this chapter.

Table 36. Summary of classes in package com.ibm.mq.jms

JMS interface	Client or bindings implementation	Direct connection to WebSphere MQ Event Broker implementation
	Cleanup	
Connection	MQConnection	Y
ConnectionConsumer	MQConnectionConsumer	
ConnectionFactory	MQConnectionFactory	Y
ConnectionMetaData	MQConnectionMetaData	Y
Destination	MQDestination	
MessageConsumer	MQMessageConsumer	
MessageProducer	MQMessageProducer	
Queue	MQQueue	
QueueBrowser	MQQueueBrowser	
QueueConnection	MQQueueConnection	
QueueConnectionFactory	MQQueueConnectionFactory	
	MQQueueEnumeration	
QueueReceiver	MQQueueReceiver	
QueueSender	MQQueueSender	
QueueSession	MQQueueSession	
Session	MQSession	Y
TemporaryQueue	MQTemporaryQueue	
TemporaryTopic	MQTemporaryTopic	Y
Topic	MQTopic	Y
TopicConnection	MQTopicConnection	Y
TopicConnectionFactory	MQTopicConnectionFactory	Y
TopicPublisher	MQTopicPublisher	Y
TopicSession	MQTopicSession	Y
TopicSubscriber	MQTopicSubscriber	Y
XAConnection	MQXAConnection	
XAConnectionFactory	MQXAConnectionFactory	
XAQueueConnection	MQXAQueueConnection	

Table 36. Summary of classes in package com.ibm.mq.jms (continued)

JMS interface	Client or bindings implementation	Direct connection to WebSphere MQ Event Broker implementation
XAQueueConnectionFactory	MQXAQueueConnectionFactory	
XAQueueSession	MQXAQueueSession	
XASession	MQXASession	
XATopicConnection	MQXATopicConnection	
XATopicConnectionFactory	MQXATopicConnectionFactory	
XATopicSession	MQXATopicSession	

Table 37. Summary of classes in package com.ibm.jms

JMS interface	Client or bindings implementation	Direct connection to WebSphere MQ Event Broker implementation
BytesMessage	Y	Y
MapMessage	Y	Y
Message	Y	Y
ObjectMessage	Y	Y
StreamMessage	Y	Y
TextMessage	Y	Y

A sample implementation of the following JMS interfaces is supplied in the WebSphere MQ classes for Java Message Service.

- ServerSession
- ServerSessionPool

See “Application server sample code” on page 283 for more information

BytesMessage

public interface **BytesMessage**
extends **Message**

WebSphere MQ class: **JMSBytesMessage**

```
java.lang.Object
   |
   +----com.ibm.jms.JMSMessage
           |
           +----com.ibm.jms.JMSBytesMessage
```

Use a BytesMessage to send a message containing a stream of uninterpreted bytes. It inherits **Message** and adds a bytes message body. The receiver of the message supplies the interpretation of the bytes.

Note: This message type is for client encoding of existing message formats. If possible, use one of the other self-defining message types instead.

See also: **MapMessage**, **Message**, **ObjectMessage**, **StreamMessage**, and **TextMessage**

Methods

getBodyLength (JMS 1.1 only)

```
public long getBodyLength() throws JMSException
```

Get the number of bytes in the message body when the message is in read-only mode. The value returned can be used to allocate a byte array. The value is the entire length of the message body regardless of where the pointer for reading the message is currently located.

Returns:

The number of bytes in the message

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageNotReadableException if the message is in write-only mode.

readBoolean

```
public boolean readBoolean() throws JMSException
```

Read a `boolean` from the bytes message.

Returns:

The `boolean` value read.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if it is the end of the message bytes.

readByte

```
public byte readByte() throws JMSException
```

Read a signed 8-bit value from the bytes message.

Returns:

The next byte from the bytes message as a signed 8-bit `byte`.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.
- JMSException if JMS fails to read the message because of an internal JMS error.

readBytes

```
public int readBytes(byte[] value) throws JMSException
```

Read a byte array from the bytes message. If there are sufficient bytes remaining in the stream, the entire buffer is filled; if not, the buffer is partially filled.

Parameters:

`value`: the buffer into which the data is read.

Returns:

The total number of bytes read into the buffer, or -1 if there is no more data because the end of the bytes has been reached.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- JMSException if JMS fails to read the message because of an internal JMS error.

readBytes

```
public int readBytes(byte[] value, int length)
                                        throws JMSException
```

Read a portion of the bytes message.

Parameters:

- `value`: the buffer into which the data is read.
- `length`: the number of bytes to read.

Returns:

The total number of bytes read into the buffer, or -1 if there is no more data because the end of the bytes has been reached.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- IndexOutOfBoundsException if `length` is negative, or is less than the length of the array `value`
- JMSException if JMS fails to read the message because of an internal JMS error.

readChar

```
public char readChar() throws JMSException
```

Read a Unicode character value from the bytes message.

Returns:
The next two bytes from the bytes message as a Unicode character.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.
- JMSException if JMS fails to read the message because of an internal JMS error.

readDouble

```
public double readDouble() throws JMSException
```

Read a `double` from the bytes message.

Returns:
The next eight bytes from the bytes message, interpreted as a `double`.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.
- JMSException if JMS fails to read the message because of an internal JMS error.

readFloat

```
public float readFloat() throws JMSException
```

Read a `float` from the bytes message.

Returns:
The next four bytes from the bytes message, interpreted as a `float`.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.
- JMSException if JMS fails to read the message because of an internal JMS error.

readInt

```
public int readInt() throws JMSException
```

Read a signed 32-bit integer from the bytes message.

Returns:
The next four bytes from the bytes message, interpreted as an `int`.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.

- JMSException if JMS fails to read the message because of an internal JMS error.

readLong

```
public long readLong() throws JMSException
```

Read a signed 64-bit integer from the bytes message.

Returns:

The next eight bytes from the bytes message, interpreted as a `long`.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.
- JMSException if JMS fails to read the message because of an internal JMS error.

readShort

```
public short readShort() throws JMSException
```

Read a signed 16-bit number from the bytes message.

Returns:

The next two bytes from the bytes message, interpreted as a signed 16-bit number.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.
- JMSException if JMS fails to read the message because of an internal JMS error.

readUnsignedByte

```
public int readUnsignedByte() throws JMSException
```

Read an unsigned 8-bit number from the bytes message.

Returns:

The next byte from the bytes message, interpreted as an unsigned 8-bit number.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.
- JMSException if JMS fails to read the message because of an internal JMS error.

readUnsignedShort

```
public int readUnsignedShort() throws JMSException
```

Read an unsigned 16-bit number from the bytes message.

Returns:

The next two bytes from the bytes message, interpreted as an unsigned 16-bit integer.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.
- JMSException if JMS fails to read the message because of an internal JMS error.

readUTF

```
public java.lang.String readUTF() throws JMSException
```

Read a string that has been encoded using a modified UTF-8 format from the bytes message. The first two bytes are interpreted as a 2-byte length field.

Returns:

A Unicode string from the bytes message.

Throws:

- MessageNotReadableException if the message is in write-only mode.
- MessageEOFException if it is the end of the message bytes.
- JMSException if JMS fails to read the message because of an internal JMS error.

reset

```
public void reset() throws JMSException
```

Put the message body in read-only mode, and reposition the stream of bytes to the beginning.

Throws:

- JMSException if JMS fails to reset the message because of an internal JMS error.
- MessageFormatException if message has an incorrect format

writeBoolean

```
public void writeBoolean(boolean value) throws JMSException
```

Write a `boolean` to the bytes message as a 1-byte value. The value `true` is written out as the value `(byte)1`; the value `false` is written out as the value `(byte)0`.

Parameters:

`value`: the `boolean` value to be written.

Throws:

- MessageNotWriteableException if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeByte

```
public void writeByte(byte value) throws JMSException
```

Write a `byte` to the bytes message as a 1-byte value.

Parameters:

`value`: the `byte` value to be written.

Throws:

- MessageNotWriteableException if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeBytes

```
public void writeBytes(byte[] value) throws JMSException
```

Write a byte array to the bytes message.

Parameters:

`value`: the byte array to be written.

Throws:

- MessageNotWriteableException if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeBytes

```
public void writeBytes(byte[] value,
                       int offset, int length) throws JMSException
```

Write a portion of a byte array to the bytes message.

Parameters:

- `value`: the byte array value to be written.
- `offset`: the initial offset within the byte array.
- `length`: the number of bytes to use.

Throws:

- MessageNotWriteableException if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeChar

```
public void writeChar(char value) throws JMSException
```

Write a `char` to the bytes message as a 2-byte value, high byte first.

Parameters:

`value`: the `char` value to be written.

Throws:

- MessageNotWriteableException if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeDouble

```
public void writeDouble(double value) throws JMSException
```

Convert the double argument to a `long` using `doubleToLongBits` method in class `Double`, and then write that `long` value to the bytes message as an 8-byte quantity.

Parameters:

`value`: the `double` value to be written.

Throws:

- MessageNotWriteableException if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeFloat

```
public void writeFloat(float value) throws JMSException
```

Convert the float argument to an `int` using `floatToIntBits` method in class `Float`, and then write that `int` value to the bytes message as a 4-byte quantity.

Parameters:

`value`: the `float` value to be written.

Throws:

- MessageNotWriteableException - if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeInt

```
public void writeInt(int value) throws JMSException
```

Write an `int` to the bytes message as four bytes.

Parameters:

`value`: the `int` to be written.

Throws:

- MessageNotWriteableException if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeLong

```
public void writeLong(long value) throws JMSException
```

Write a `long` to the bytes message as eight bytes,

Parameters:

`value`: the `long` to be written.

Throws:

- MessageNotWriteableException if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeObject

```
public void writeObject(java.lang.Object value)
                                    throws JMSException
```

Write a Java object to the bytes message.

Note: This method works only for the primitive object types (such as Integer, Double, and Long), Strings, and byte arrays.

Parameters:

`value`: the Java object to be written.

Throws:

- MessageNotWriteableException if message in read-only mode.
- MessageFormatException if object is not a valid type.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeShort

```
public void writeShort(short value) throws JMSException
```

Write a `short` to the bytes message as two bytes.

Parameters:

`value`: the `short` to be written.

Throws:

- MessageNotWriteableException - if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

writeUTF

```
public void writeUTF(java.lang.String value)
                             throws JMSException
```

Write a string to the bytes message using UTF-8 encoding in a machine-independent manner. The UTF-8 string written to the buffer starts with a 2-byte length field.

Parameters:

`value`: the `String` value to be written.

Throws:

- MessageNotWriteableException if message in read-only mode.
- JMSException if JMS fails to write the message because of an internal JMS error.

Cleanup *

public class **Cleanup**
implements **Runnable**

WebSphere MQ class: **Cleanup**

Cleanup contains utilities for dealing with broken non-durable subscriptions using the SUBSTATE(BROKER) option. It is not applicable if you use a direct connection to WebSphere MQ Event Broker.

See also: **ConnectionFactory**.

WebSphere MQ constructor

Cleanup

```
public Cleanup()
```

Default constructor.

Cleanup

```
public Cleanup(MQTopicConnectionFactory mqtcf) throws JMSException
```

Constructor that copies property values from the supplied MQTopicConnectionFactory.

Methods

cleanup

```
public void cleanup() throws JMSException
```

Executes Cleanup once. If cleanupLevel is NONE, throws an IllegalStateException.

getCCSID

```
public int getCCSID()
```

Get the character set of the queue manager.

getChannel

```
public String getChannel()
```

For client only, get the channel that was used.

getCleanupInterval

```
public long getCleanupInterval()
```

Retrieve the cleanup interval.

getCleanupLevel

```
public int getCleanupLevel()
```

Retrieve the cleanup level.

getExceptionListener

```
public ExceptionListener getExceptionListener()
```

Return the ExceptionListener.

getHostName

```
public String getHostName()
```

Retrieve the name of the host.

getPort

```
public int getPort()
```

For client connections, get the port number.

getQueueManager

```
public String getQueueManager()
```

Get the name of the queue manager.

getReceiveExit

```
public String getReceiveExit()
```

Get the name of the receive exit class.

getReceiveExitInit

```
public String getReceiveExitInit()
```

Get the initialization string that was passed to the receive exit class.

getSecurityExit

```
public String getSecurityExit()
```

Get the name of the security exit class.

getSecurityExitInit

```
public String getSecurityExitInit()
```

Get the security exit initialization string.

getSendExit

```
public String getSendExit()
```

Get the name of the send exit class.

getSendExitInit

```
public String getSendExitInit()
```

Get the send exit initialization string.

getTransportType

```
public int getTransportType()
```

Retrieve the transport type.

isRunning

```
public boolean isRunning()
```

Return true if the run() method is currently active.

main

```
public static void main(String args[])
                  throws java.io.UnsupportedEncodingException
```

Invoke the utility from a command line. For details of the invocation options and parameters, see "Manual cleanup" on page 232. For information specific to JMS 1.1, see "Manual cleanup" on page 250.

run

```
public void run()
```

Run this utility in the background at intervals, as determined by the cleanupLevel and cleanupInterval properties.

setCCSID

```
public void setCCSID(int x) throws JMSException
```

Set the character set to be used when connecting to the queue manager. See Table 13 on page 127 for a list of allowed values. We recommend that you use the default value (819) for most situations.

setChannel

```
public void setChannel(String x) throws JMSException
```

For client only, set the channel to use.

setCleanupInterval

```
public void setCleanupInterval(long interval) throws JMSException
```

Set the cleanupInterval.

Parameters:

- `interval`: length of time in milliseconds between runs of the cleanup utility

Throws:

JMSException if interval is less than 0

setCleanupLevel

```
public void setCleanupLevel(int level) throws JMSException
```

Set the cleanup level to use. It can be one of
JMSC.MQJMS_CLEANUP_NONE
JMSC.MQJMS_CLEANUP_SAFE
JMSC.MQJMS_CLEANUP_STRONG
JMSC.MQJMS_CLEANUP_FORCE
JMSC.MQJMS_CLEANUP_NONDUR

setExceptionListener

```
public void setExceptionListener(ExceptionListener el)
```

Set the ExceptionListener. If set, the ExceptionListener receives any exceptions caused during the run() method. Shortly after issuing the exception to the ExceptionListener, Cleanup terminates.

setHostName

```
public void setHostName(String hostname)
```

For client connections, the name of the host to connect to.

setPort

```
public void setPort(int port) throws JMSException
```

Set the port for a client connection.

Parameters:
`port`: the new value to use.

Throws:
JMSException if the port is negative.

setQueueManager

```
public void setQueueManager(String x) throws JMSException
```

Set the name of the queue manager to connect to.

setReceiveExit

```
public void setReceiveExit(String receiveExit)
```

The name of a class that implements a receive exit.

setReceiveExitInit

```
public void setReceiveExitInit(String x)
```

Initialization string that is passed to the constructor of the receive exit class.

setSecurityExit

```
public void setSecurityExit(String securityExit)
```

The name of a class that implements a security exit.

setSecurityExitInit

```
public void setSecurityExitInit(String x)
```

Initialization string that is passed to the security exit constructor.

setSendExit

```
public void setSendExit(String sendExit)
```

The name of a class that implements a send exit.

setSendExitInit

```
public void setSendExitInit(String x)
```

Initialization string that is passed to the constructor of send exit.

setTransportType

```
public void setTransportType(int x) throws JMSException
```

Set the transport type to use. It can be one of the following:
JMSC.MQJMS_TP_BINDINGS_MQ
JMSC.MQJMS_TP_CLIENT_MQ_TCPIP

stop

```
public void stop()
```

Stop any currently running cleanup thread. Return when cleanup has finished. Do nothing if cleanup is not running.

Connection

public interface **Connection**
Subinterfaces: **QueueConnection**, **TopicConnection**, **XAConnection**, **XAQueueConnection**, and **XATopicConnection**

WebSphere MQ class: **MQConnection**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQConnection
```

A JMS Connection is a client's active connection to its JMS provider.

See also: **ConnectionFactory**, **QueueConnection**, and **TopicConnection**

Methods

close

```
public void close() throws JMSException
```

Because a provider can allocate some resources outside the JVM on behalf of a Connection, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough. There is no need to close the sessions, producers, and consumers of a closed connection.

Closing a connection causes any of its sessions' in-process transactions to be rolled back. If a session's work is coordinated by an external transaction manager, when using XASession, a session's commit and rollback methods are not used and the result of a closed session's work is determined later by a transaction manager. Closing a connection does **not** force an acknowledgement of client acknowledged sessions.

WebSphere MQ JMS keeps a pool of WebSphere MQ hConns available for use by sessions. Under some circumstances, Connection.close() clears this pool. If an application uses multiple connections sequentially, you can force the pool to remain active between JMS connections. To do this, register an MQPoolToken with com.ibm.mq.MQEnvironment for the lifetime of your JMS application. For details, see "Connection pooling" on page 80 and "MQEnvironment" on page 110.

Throws:

JMSException if the JMS implementation fails to close the connection because of an internal error. Examples are a failure to release resources or to close a socket connection.

createConnectionConsumer (JMS 1.1 only)

```
public ConnectionConsumer createConnectionConsumer
                                    (Destination destination,
                                     java.lang.String messageSelector,
                                     ServerSessionPool sessionPool,
                                     int maxMessages) throws JMSException
```

Create a connection consumer for this connection. This is an expert facility that is not used by regular JMS clients.

Parameters:

- `destination`: the destination to access.
- `messageSelector`: deliver only those messages with properties that match the message selector expression. A value of null or an empty string indicates that there is no message selector for the message consumer.
- `sessionPool`: the server session pool to associate with this connection consumer.
- `maxMessages`: the maximum number of messages that can be assigned to a server session at one time.

Returns:

The connection consumer.

Throws:

- JMSException if the connection fails to create a connection consumer because of an internal JMS error, or because of incorrect arguments for sessionPool and messageSelector.
- InvalidDestinationException if the destination is not valid.
- InvalidSelectorException if the message selector is not valid.

See also:

ConnectionConsumer

createDurableConnectionConsumer (JMS 1.1 only)

```
public ConnectionConsumer createDurableConnectionConsumer
                                    (Topic topic,
                                     java.lang.String subscriptionName,
                                     java.lang.String messageSelector,
                                     ServerSessionPool sessionPool,
                                     int maxMessages) throws JMSException
```

Create a durable connection consumer for this connection. This is an expert facility that is not used by regular JMS clients.

Note

For a direct connection to WebSphere MQ Event Broker, WebSphere Business Integration Event Broker, or WebSphere Business Integration Message Broker, this method throws a JMSException.

Parameters:

- `topic`: the topic to access.
- `subscriptionName`: the name of the durable subscription.

- `messageSelector`: deliver only those messages with properties that match the message selector expression. A value of null or an empty string indicates that there is no message selector for the message consumer.
- `sessionPool`: the server session pool to associate with this durable connection consumer.
- `maxMessages`: the maximum number of messages that can be assigned to a server session at one time.

Returns:
The durable connection consumer.

Throws:
- JMSException if the connection fails to create a connection consumer because of an internal JMS error, or because of incorrect arguments for sessionPool and messageSelector.
- InvalidDestinationException if the destination is not valid.
- InvalidSelectorException if the message selector is not valid.

See also:
ConnectionConsumer

createSession (JMS 1.1 only)

```
public Session createSession(boolean transacted,
                             int acknowledgeMode) throws JMSException
```

Create a session.

Parameters:
- `transacted`: if `true`, the session is transacted.
- `acknowledgeMode`: indicates whether the consumer or the client acknowledges any messages it receives. Possible values are:

  Session.AUTO_ACKNOWLEDGE

  Session.CLIENT_ACKNOWLEDGE

  Session.DUPS_OK_ACKNOWLEDGE

  This parameter is ignored if the session is transacted.

Returns:
A newly created session.

Throws:
JMSException if the connection fails to create a session because of an internal JMS error, or because of lack of support for the specific transaction and acknowledgement mode.

See also:
Session.AUTO_ACKNOWLEDGE,
Session.CLIENT_ACKNOWLEDGE,
Session.DUPS_OK_ACKNOWLEDGE

getClientID

```
public java.lang.String getClientID()
                                  throws JMSException
```

Get the client identifier for this connection. The client identifier can either be preconfigured by the administrator in a ConnectionFactory, or assigned by calling setClientId.

Returns:
The unique client identifier.

Throws:
JMSException if the JMS implementation fails to return the client ID for this connection because of an internal error.

getExceptionListener

```
public ExceptionListener getExceptionListener()
                                            throws JMSException
```

Get the ExceptionListener for this connection.

Returns:
The ExceptionListener for this connection

Throws:
JMSException general exception if the JMS implementation fails to get the exception listener for this connection.

getMetaData

```
public ConnectionMetaData getMetaData() throws JMSException
```

Get the metadata for this connection.

Returns:
The connection metadata.

Throws:
JMSException general exception if the JMS implementation fails to get the connection metadata for this connection.

See also:
"ConnectionMetaData" on page 335

setClientID

```
public void setClientID(java.lang.String clientID)
                                             throws JMSException
```

Set the client identifier for this connection.

Note: The client identifier is ignored for point-to-point connections.

WebSphere MQ Event Broker note
This method always throws an IllegalStateException when you make a direct connection to WebSphere MQ Event Broker.

Parameters:
`clientID`: the unique client identifier.

Throws:

- JMSException if the JMS implementation fails to set the client ID for this Connection because of an internal error.
- InvalidClientIDException if the JMS client specifies a non valid or duplicate client ID.
- IllegalStateException if attempting to set a connection's client identifier at the wrong time, or if it has been configured administratively.

setExceptionListener

```
public void setExceptionListener(ExceptionListener listener)
                                                    throws JMSException
```

Set an exception listener for this connection.

Parameters:

`handler`: the exception listener.

Throws:

JMSException general exception if the JMS implementation fails to set the exception listener for this connection.

start

```
public void start() throws JMSException
```

Start (or restart) a connection's delivery of incoming messages. Starting a started session is ignored. Use the `stop` method to stop delivery.

Throws:

JMSException if the JMS implementation fails to start the message delivery because of an internal error.

stop

```
public void stop() throws JMSException
```

Used to stop a connection's delivery of incoming messages temporarily. It can be restarted using its `start` method. When stopped, delivery to all the connection's message consumers is inhibited. Synchronous receives are blocked, and messages are not delivered to message listeners.

Stopping a session has no affect on its ability to send messages. Stopping a stopped session is ignored.

Throws:

JMSException if the JMS implementation fails to stop the message delivery because of an internal error.

ConnectionConsumer

public interface **ConnectionConsumer**

WebSphere MQ class: **MQConnectionConsumer**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQConnectionConsumer
```

For application servers, Connections provide a special facility to create a ConnectionConsumer. A Destination and a Property Selector specify the messages that it is to consume. Also, a ConnectionConsumer must be given a ServerSessionPool to use to process its messages.

See also: **QueueConnection**, and **TopicConnection**.

Methods

close()

```
public void close() throws JMSException
```

Because a provider can allocate some resources outside the JVM on behalf of a ConnectionConsumer, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough.

Throws:

JMSException if a JMS implementation fails to release resources on behalf of ConnectionConsumer, or if it fails to close the connection consumer.

getServerSessionPool()

```
public ServerSessionPool getServerSessionPool()
                                        throws JMSException
```

Get the server session associated with this connection consumer.

Returns:

The server session pool used by this connection consumer.

Throws:

JMSException if a JMS implementation fails to get the server session pool associated with this connection consumer because of an internal error.

ConnectionFactory

public interface **ConnectionFactory**
Subinterfaces: **QueueConnectionFactory**, **TopicConnectionFactory**, **XAQueueConnectionFactory**, and **XATopicConnectionFactory**

WebSphere MQ class: **MQConnectionFactory**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQConnectionFactory
```

A ConnectionFactory encapsulates a set of connection configuration parameters that has been defined by an administrator. A client uses it to create a Connection with a JMS provider.

Note
For direct connections to WebSphere MQ Event Broker, WebSphere Business Integration Event Broker, or WebSphere Business Integration Message Broker, properties accessed by methods marked with a § are ignored.

See also: **Connection**, **QueueConnectionFactory**, and **TopicConnectionFactory**

WebSphere MQ constructor

MQConnectionFactory

```
public MQConnectionFactory()
```

Methods

createConnection (JMS 1.1 only)

```
public Connection createConnection() throws JMSException
```

Create a connection with the default user identity. The connection is created in stopped mode. No messages are delivered until the Connection.start method is called explicitly.

Returns:
A newly created connection.

Throws:

- JMSException if JMS fails to create the connection because of an internal JMS error.
- JMSSecurityException if client authentication fails because the user name or password is not valid.

createConnection (JMS 1.1 only)

```
public Connection createConnection(java.lang.String userName,
                                   java.lang.String password)
                                   throws JMSException
```

Create a connection with the specified user identity. The connection is created in stopped mode. No messages are delivered until the Connection.start method is called explicitly.

Parameters:

- `userName`: the user name of the caller.
- `password`: the password of the caller.

Returns:

A newly created connection.

Throws:

- JMSException if JMS fails to create the connection because of an internal JMS error.
- JMSSecurityException if client authentication fails because the user name or password is not valid.

getBrokerCCSubQueue * §

```
public String getBrokerCCSubQueue()
```

Get method for brokerCCSubQueue attribute.

Returns:

The name of the nondurable subscription queue to use for a connection consumer.

getBrokerControlQueue * §

```
public String getBrokerControlQueue()
```

Get method for brokerControlQueue attribute.

Returns:

The broker's control queue name

getBrokerPubQueue * §

```
public String getBrokerPubQueue()
```

Get method for brokerPubQueue attribute.

Returns:

The broker's publish queue name.

getBrokerQueueManager * §

```
public String getBrokerQueueManager()
```

Get method for brokerQueueManager attribute.

Returns:

The broker's queue manager name.

getBrokerSubQueue * §

```
public String getBrokerSubQueue()
```

Get method for brokerSubQueue attribute.

Returns:
The name of the nondurable subscription queue to use.

getBrokerVersion *

```
public int getBrokerVersion()
```

Get method for brokerVersion attribute.

Returns:
The broker's version number

getCCSID * §

```
public int getCCSID()
```

Get the character set of the queue manager.

getChannel * §

```
public String getChannel()
```

For client only, get the channel that was used.

getCleanupInterval * §

```
public long getCleanupInterval()
```

Get method for cleanupInterval attribute.

Returns:
How often the cleanup utility runs, in milliseconds

getCleanupLevel * §

```
public int getCleanupLevel()
```

Get method for cleanupLevel attribute.

Returns:
The value of cleanupLevel

getClientId *

```
public String getClientId()
```

Get the client identifier that is used for all connections that are created using this ConnectionFactory.

getDescription *

```
public String getDescription()
```

Retrieve the object description.

getDirectAuth *

```
public int getDirectAuth()
```

Get method for the direct authentication attribute.

Returns:
The value of the direct authentication attribute

See also:
setDirectAuth()

getFailIfQuiesce * §

```
public int getFailIfQuiesce()
```

Get the default behavior of applications accessing a quiescing queue manager when using destinations created using this ConnectionFactory object.

getHostName *

```
public String getHostName()
```

Retrieve the name of the host.

getLocalAddress *

```
public String getLocalAddress()
```

Get the local address.

See also:
setLocalAddress()

getMessageRetention *

```
public int getMessageRetention()
```

Get method for messageRetention attribute.

Returns:

- JMSC.MQJMS_MRET_YES: unwanted messages remain on the input queue.
- JMSC.MQJMS_MRET_NO: unwanted messages are dealt with according to their disposition options.

getMessageSelection * §

```
public int getMessageSelection()
```

Get method for the message selection attribute.

Returns:
The value of the message selection attribute

See also:
setMessageSelection()

getMsgBatchSize * §

```
public int getMsgBatchSize()
```

Return the current value of this property.

getMulticast *

```
public int getMulticast()
```

Get method for the multicast attribute.

Returns:

An integer representing the current multicast setting.

See also:

setMulticast()

getPollingInterval * §

```
public int getPollingInterval()
```

Return the current value of this property.

getPort *

```
public int getPort()
```

For client connections or direct TCP/IP connection to WebSphere MQ Event Broker, get the port number.

getProxyHostName *

```
public String getProxyHostName()
```

Get method for the proxy host name attribute.

Returns:

The host name of the proxy server when establishing a direct connection, or `null` if no proxy server is used.

getProxyPort *

```
public int getProxyPort()
```

Get method for the proxy port attribute.

Returns:

The port number to connect to on the proxy server.

getPubAckInterval * §

```
public int getPubAckInterval()
```

Get method for pubAckInterval attribute.

Returns:

The interval, in number of messages, between publish requests that require acknowledgement from the broker.

getQueueManager * §

```
public String getQueueManager()
```

Get the name of the queue manager.

getReceiveExit * §

```
public String getReceiveExit()
```

Get the name of the receive exit class.

getReceiveExitInit * §

```
public String getReceiveExitInit()
```

Get the initialization string that was passed to the receive exit class.

getReference *

```
public Reference getReference() throws NamingException
```

Return a reference for this connection factory.

Returns:
A reference for this object.

Throws:
NamingException.

getSecurityExit * §

```
public String getSecurityExit()
```

Get the name of the security exit class.

getSecurityExitInit * §

```
public String getSecurityExitInit()
```

Get the security exit initialization string.

getSendExit * §

```
public String getSendExit()
```

Get the name of the send exit class.

getSendExitInit * §

```
public String getSendExitInit()
```

Get the send exit initialization string.

getSparseSubscriptions *

```
public boolean getSparseSubscriptions()
```

Get method for the sparse subscriptions attribute.

Returns:
The value of the sparse subscriptions attribute

See also:
setSparseSubscriptions()

getSSLCertStores * §

```
public java.util.Collection getSSLCertStores()
```

Return a collection of CertStore objects. If setSSLCertStores() was used to set a collection of CertStore objects, the value returned from getSSLCertStores() is a copy of the original collection. If setSSLCertStores() was used to set a string detailing a list of LDAP URIs, this method returns a collection of CertStore objects representing the LDAP CRLs.

getSSLCertStoresAsString * §

```
public String getSSLCertStoresAsString()
              throws JMSException
```

Return the string of LDAP URIs, set with setSSLCertStores. Throws JMSException if a collection of CertStores was set.

getSSLCipherSuite * §

```
public String getSSLCipherSuite()
```

Return the CipherSuite used for SSL encryption.

getSSLPeerName * §

```
public String getSSLPeerName()
```

Return the distinguished name pattern used to validate the queue manager.

getSSLSocketFactory * §

```
public javax.net.ssl.SSLSocketFactory getSSLSocketFactory()
```

Return the SSLSocketFactory used with SSL encryption.

getStatusRefreshInterval * §

```
public int getStatusRefreshInterval()
```

Get method for statusRefreshInterval attribute.

Returns:

The number of milliseconds between transactions to refresh publish/subscribe status.

getSubscriptionStore * §

```
public int getSubscriptionStore()
```

Get method for the SUBSTORE property.

Returns:

An integer representing the current SUBSTORE property.

getSyncpointAllGets * §

```
public boolean getSyncpointAllGets()
```

Return the current value of this property.

getTemporaryModel *

```
public String getTemporaryModel()
```

getTempQPrefix *

```
public String getTempQPrefix()
```

Get the prefix that is used to form the name of a WebSphere MQ dynamic queue.

Returns:

The prefix that is used to form the name of a WebSphere MQ dynamic queue.

getTransportType *

```
public int getTransportType()
```

Retrieve the transport type.

getUseConnectionPooling * §

```
public boolean getUseConnectionPooling()
```

Return the current value of this property.

setBrokerCCSubQueue * §

```
public void setBrokerCCSubQueue(String x) throws JMSException
```

Set method for brokerCCSubQueue attribute.

Parameters:

`brokerSubQueue`: the name of the nondurable subscription queue to use for a connection consumer.

setBrokerControlQueue * §

```
public void setBrokerControlQueue(String x) throws JMSException
```

Set method for brokerControlQueue attribute.

Parameters:

`brokerControlQueue`: the name of the broker control queue.

setBrokerPubQueue * §

```
public void setBrokerPubQueue(String x) throws JMSException
```

Set method for brokerPubQueue attribute.

Parameters:

`brokerPubQueue`: the name of the broker publish queue.

setBrokerQueueManager * §

```
public void setBrokerQueueManager(String x) throws JMSException
```

Set method for brokerQueueManager attribute.

Parameters:

brokerQueueManager: the name of the broker's queue manager.

setBrokerSubQueue * §

```
public void setBrokerSubQueue(String x) throws JMSException
```

Set method for brokerSubQueue attribute.

Parameters:

brokerSubQueue: the name of the nondurable subscription queue to use.

setBrokerVersion *

```
public void setBrokerVersion(int x) throws JMSException
```

Set method for brokerVersion attribute.

Parameters:

An integer representing one of the valid broker version number values. These are represented by the constants:
JMSC.MQJMS_BROKER_V1
JMSC.MQJMS_BROKER_V2

setCCSID * §

```
public void setCCSID(int x) throws JMSException
```

Set the character set to be used when connecting to the queue manager. See Table 13 on page 127 for a list of allowed values. We recommend that you use the default value (819) for most situations.

setChannel * §

```
public void setChannel(String x) throws JMSException
```

For client only, set the channel to use.

setCleanupInterval * §

```
public void setCleanupInterval(long x) throws JMSException
```

Set method for cleanupInterval attribute.

Parameters:

How often the cleanup utility runs, in milliseconds

setCleanupLevel * §

```
public void setCleanupLevel(int x) throws JMSException
```

Set method for cleanupLevel attribute.

Parameters:

An integer representing one of the valid cleanup levels. These are represented by the constants:
JMSC.MQJMS_CLEANUP_NONE
JMSC.MQJMS_CLEANUP_SAFE
JMSC.MQJMS_CLEANUP_STRONG
JMSC.MQJMS_CLEANUP_AS_PROPERTY

setClientId *

```
public void setClientId(String x)
```

Set the client Identifier to be used for all connections created using this connection.

WebSphere MQ Event Broker note
This method always throws an IllegalStateException when you make a direct connection to WebSphere MQ Event Broker.

setDescription *

```
public void setDescription(String x)
```

A short description of the object.

setDirectAuth *

```
public void setDirectAuth(int x) throws JMSException
```

Set method for the direct authentication attribute.

Parameters:

x: an integer specifying the type of direct authentication that is required. The following are symbolic constants that represent the valid values of the parameter:
JMSC.MQJMS_DIRECTAUTH_BASIC
JMSC.MQJMS_DIRECTAUTH_CERTIFICATE

setFailIfQuiesce * §

```
public void setFailIfQuiesce(int fiqValue) throws JMSException
```

Set the default behavior of applications accessing a quiescing queue manager when using destinations created using this ConnectionFactory object.

Takes values of:
- JMSC.MQJMS_FIQ_YES (default)
- JMSC.MQJMS_FIQ_NO

setHostName *

```
public void setHostName(String hostname)
```

For client connections or direct TCP/IP connections to WebSphere MQ Event Broker, the name of the host to connect to.

setLocalAddress *

```
public void setLocalAddress(String localAddress) throws JMSException
```

Set the local address.

Parameters:

`localAddress`: the local address to be used.

The format of a local address is [*ip-addr*][(*low-port*[,*high-port*])]. Here are some examples:

9.20.4.98
The channel binds to address 9.20.4.98 locally

9.20.4.98(1000)
The channel binds to address 9.20.4.98 locally and uses port 1000

9.20.4.98(1000,2000)
The channel binds to address 9.20.4.98 locally and uses a port in the range 1000 to 2000

(1000) The channel binds to port 1000 locally

(1000,2000)
The channel binds to a port in the range 1000 to 2000 locally

You can specify a host name instead of an IP address.

Specify a range of ports to allow for connections that are required internally as well as those explicitly used by an application. The number of ports required depends on the application and the facilities it uses. Typically, this is the number of sessions the application uses plus three or four additional ports. If an application is having difficulty making connections, increase the number of ports in the range.

Note that connection pooling has an effect on how quickly a port can be reused. In JMS, connection pooling is switched on by default and it might be some minutes before a port can be reused and connection errors may occur in the meantime.

For direct connections, the local address determines which of the local network interfaces is used for multicast connections. When specifying a local address for a direct connection, do not include a port number. A port number is not valid for multicast and, if specified, causes a failure at connect time.

Throws:
JMSException if the format of the local address is incorrect.

setMessageRetention *

```
public void setMessageRetention(int x) throws JMSException
```

Set method for messageRetention attribute.

Parameters:
Valid values are:

- JMSC.MQJMS_MRET_YES: unwanted messages remain on the input queue.
- JMSC.MQJMS_MRET_NO: unwanted messages are dealt with according to their disposition options. For more information on this, see "General principles for point-to-point messaging" on page 278.

setMessageSelection * §

```
public void setMessageSelection(int x)
```

Set method for the message selection attribute.

Parameters:

x: an integer indicating whether the client or the broker performs message selection. The following are symbolic constants that represent the valid values of the parameter:

JMSC.MQJMS_MSEL_CLIENT
JMSC.MQJMS_MSEL_BROKER

setMsgBatchSize * §

```
public void setMsgBatchSize(int x)
```

Set the maximum number of messages to be taken at once when using asynchronous delivery.

setMulticast *

```
public void setMulticast(int x) throws JMSException
```

Set method for the multicast attribute.

Parameters:

x: an integer specifying a multicast setting. The following are symbolic constants that represent the valid values of the parameter:

JMSC.MQJMS_MULTICAST_DISABLED
JMSC.MQJMS_MULTICAST_NOT_RELIABLE
JMSC.MQJMS_MULTICAST_RELIABLE
JMSC.MQJMS_MULTICAST_ENABLED

setPollingInterval * §

```
public void setPollingInterval(int x)
```

Set the interval between scans of all receivers during asynchronous message delivery. The value is a number of milliseconds.

setPort *

```
public void setPort(int port) throws JMSException
```

Set the port for a client connection or direct TCP/IP connection to WebSphere MQ Event Broker.

Parameters:

port: the new value to use.

Throws:

JMSException if the port is negative.

setProxyHostName *

```
public void setProxyHostName(String proxyHostName) throws JMSException
```

Set method for the proxy host name attribute.

Parameters:

`proxyHostName`: the host name of the proxy server when establishing a direct connection, or `null` if no proxy server is used.

setProxyPort *

```
public void setProxyPort(int proxyPort) throws JMSException
```

Set method for the proxy port attribute.

Parameters:

`proxyPort`: the port number of the proxy server when establishing a direct connection.

setPubAckInterval * §

```
public void setPubAckInterval(int x)
```

Set method for pubAckInterval attribute. The number of messages to publish between requiring acknowledgement from the broker. The default is 25. Applications do not normally alter this value, and must not rely on this acknowledgement.

Parameters:

`pubAckInterval`: the number of messages to use as an interval.

setQueueManager * §

```
public void setQueueManager(String x) throws JMSException
```

Set the name of the queue manager to connect to.

setReceiveExit * §

```
public void setReceiveExit(String receiveExit)
```

The name of a class that implements a receive exit.

setReceiveExitInit * §

```
public void setReceiveExitInit(String x)
```

Initialization string that is passed to the constructor of the receive exit class.

setSecurityExit * §

```
public void setSecurityExit(String securityExit)
```

The name of a class that implements a security exit.

setSecurityExitInit * §

```
public void setSecurityExitInit(String x)
```

Initialization string that is passed to the security exit constructor.

setSendExit * §

```
public void setSendExit(String sendExit)
```

The name of a class that implements a send exit.

setSendExitInit * §

```
public void setSendExitInit(String x)
```

Initialization string that is passed to the constructor of send exit.

setSparseSubscriptions *

```
public void setSparseSubscriptions(boolean x)
```

Set method for the sparse subscriptions attribute. A sparse subscription is one that receives infrequent matching messages. The default value of this attribute is `false`. A value of `true` might be required if an application using sparse subscriptions fails to receive messages because of log overflow. If you set the attribute to `true`, the application must be able to open the consumer queue for browsing messages.

Parameters:

x: indicates whether sparse subscriptions are selected.

setSSLCertStores * §

```
public void setSSLCertStores(java.util.Collection stores)
```

Provide a collection of CertStore objects used for CRL checking. The certificate provided by the queue manager is checked against one of the CertStore objects contained within the collection; if the certificate is found, the connection attempt fails. At connect-time, each CertStore in the collection is tried in turn until one is successfully used to verify the queue manager's certificate. If set to null (the default), no checking of the queue manager's certificate is performed. This property is ignored if sslCipherSuite is null. Use of this property requires Java 2 v1.4.

If CertStores are specified using this method, the MQConnectionFactory cannot be bound into a JNDI namespace. Attempting to do so will result in an exception.

Note: To use a CertStore successfully with a CRL hosted on an LDAP server, make sure that your Java Software Development Kit (SDK) is compatible with the CRL. Some SDKs require that the CRL conforms to RFC 2587, which defines a schema for LDAP v2. Most LDAP v3 servers use RFC 2256 instead.

setSSLCertStores * §

```
public void setSSLCertStores(String storeSpec)
            throws JMSException
```

Specify a list of LDAP servers used for CRL checking. This string must consist of a sequence of space-delimited LDAP URIs of the form `ldap://host[:port]`. If no port is specified, the LDAP default of 389 is assumed. The certificate provided by the queue manager is checked against one of the listed LDAP CRL servers; if found, the connection fails. Each LDAP server is tried in turn until one is successfully used to verify the queue manager's certificate. If set to null (the default), no checking of the queue manager's certificate is performed. Throws JMSException if the

supplied list of LDAP URIs is not valid. This property is ignored if sslCipherSuite is null. Use of this property requires Java 2 v1.4.

Note: To use a CertStore successfully with a CRL hosted on an LDAP server, make sure that your Java Software Development Kit (SDK) is compatible with the CRL. Some SDKs require that the CRL conforms to RFC 2587, which defines a schema for LDAP v2. Most LDAP v3 servers use RFC 2256 instead.

setSSLCipherSuite * §

```
public void setSSLCipherSuite(String cipherSuite)
```

Set this to the CipherSuite matching the CipherSpec set on the SVRCONN channel. If set to null (the default), no SSL encryption is performed. See Appendix H, "SSL CipherSuites supported by WebSphere MQ," on page 487 for a list of CipherSuites and their associated CipherSpecs.

setSSLPeerName * §

```
public void setSSLPeerName(String peerName)
            throws JMSException
```

Sets sslPeerName to a distinguished name pattern. If sslCipherSuite is set, this variable can be used to ensure the correct queue manager is used. For a description of the format for this value, see "Using the distinguished name of the queue manager" on page 90. The distinguished name provided by the queue manager must match this pattern, or the connection attempt fails. If set to null (the default), no checking of the queue manager's DN is performed. Throws JMSException if the supplied pattern is not valid. This property is ignored if sslCipherSuite is null.

setSSLSocketFactory * §

```
public void setSSLSocketFactory(javax.net.ssl.SSLSocketFactory sf)
```

Set the SSLSocketFactory for use with SSL encryption. Use this to customize all aspects of SSL encryption. For more information on constructing and customizing SSLSocketFactory instances, refer to your JSSE provider's documentation. If set to null (default), the JSSE default SSLSocketFactory is used when SSL encryption is requested. This property is ignored if sslCipherSuite is null.

If a custom SSLSocketFactory is specified, the MQConnectionFactory cannot be bound into a JNDI namespace. Attempting to do so results in an exception.

setStatusRefreshInterval * §

```
public void setStatusRefreshInterval(int x)
```

Set method for statusRefreshInterval attribute.

Parameters:

`statusRefreshInterval`: the number of milliseconds between transactions to refresh publish/subscribe status.

setSubscriptionStore * §

```
public void setSubscriptionStore(int x) throws JMSException
```

Set method for the SUBSTORE property.

Parameters:

SubStoretype: an integer representing one of the valid values of the SUBSTORE property. The following symbolic constants represent the valid values:

JMSC.MQJMS_SUBSTORE_QUEUE
JMSC.MQJMS_SUBSTORE_BROKER
JMSC.MQJMS_SUBSTORE_MIGRATE

setSyncpointAllGets * §

```
public void setSyncpointAllGets(boolean x)
```

Choose whether to do all GET operations within a syncpoint. The default setting for this property is false. This allows GET operations not under transaction management to perform more quickly.

setTemporaryModel *

```
public void setTemporaryModel(String x) throws JMSException
```

setTempQPrefix *

```
public void setTempQPrefix(java.lang.String tempQPrefix) throws JMSException
```

Set the prefix to be used to form the name of a WebSphere MQ dynamic queue.

Parameters:

tempQPrefix: the prefix to be used to form the name of a WebSphere MQ dynamic queue.

Throws:

JMSException if the string is null, empty, greater than 33 characters in length, or consists solely of a single asterisk (*).

setTransportType *

```
public void setTransportType(int x) throws JMSException
```

Set the transport type to use. It can be one of the following:

JMSC.MQJMS_TP_BINDINGS_MQ
JMSC.MQJMS_TP_CLIENT_MQ_TCPIP
JMSC.MQJMS_TP_DIRECT_TCPIP
JMSC.MQJMS_TP_DIRECT_HTTP

setUseConnectionPooling * §

```
public void setUseConnectionPooling(boolean x)
```

Choose whether to use connection pooling. If you set this to true, JMS enables connection pooling for the lifetime of any connections created through the ConnectionFactory. This also affects connections created with UseConnectionPooling set to false; to disable connection pooling throughout a JVM, ensure that all ConnectionFactories used within the JVM have ConnectionPooling set to false. The default, and recommended, value is true. You can disable connection pooling if, for example, your applications run in an environment that performs its own pooling.

ConnectionMetaData

public interface **ConnectionMetaData**

WebSphere MQ class: **MQConnectionMetaData**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQConnectionMetaData
```

ConnectionMetaData provides information that describes the connection.

WebSphere MQ constructor

MQConnectionMetaData

```
public MQConnectionMetaData()
```

Methods

getJMSMajorVersion

```
public int getJMSMajorVersion() throws JMSException
```

Get the JMS major version number.

Returns:
The JMS major version number.

Throws:
JMSException if an internal error occurs in JMS implementation during the metadata retrieval.

getJMSMinorVersion

```
public int getJMSMinorVersion() throws JMSException
```

Get the JMS minor version number.

Returns:
The JMS minor version number.

Throws:
JMSException if an internal error occurs in JMS implementation during the metadata retrieval.

getJMSProviderName

```
public java.lang.String getJMSProviderName()
                                        throws JMSException
```

Get the JMS provider name.

Returns:
The JMS provider name.

Throws:
JMSException if an internal error occurs in JMS implementation during the metadata retrieval.

getJMSVersion

```
public java.lang.String getJMSVersion() throws JMSException
```

Get the JMS version.

Returns:
The JMS version.

Throws:
JMSException if an internal error occurs in JMS implementation during the metadata retrieval.

getJMSXPropertyNames

```
public java.util.Enumeration getJMSXPropertyNames()
                                                  throws JMSException
```

Get an enumeration of the names of the JMSX Properties supported by this connection.

Returns:
An enumeration of JMSX PropertyNames.

Throws:
JMSException if an internal error occurs in JMS implementation during the property names retrieval.

getProviderMajorVersion

```
public int getProviderMajorVersion() throws JMSException
```

Get the JMS provider major version number.

Returns:
The JMS provider major version number.

Throws:
JMSException - if an internal error occurs in JMS implementation during the metadata retrieval.

getProviderMinorVersion

```
public int getProviderMinorVersion() throws JMSException
```

Get the JMS provider minor version number.

Returns:
The JMS provider minor version number.

Throws:
JMSException if an internal error occurs in JMS implementation during the metadata retrieval.

getProviderVersion

```
public java.lang.String getProviderVersion()
                                           throws JMSException
```

Get the JMS provider version.

Returns:
The JMS provider version.

Throws:
JMSException if an internal error occurs in JMS implementation during the metadata retrieval.

toString *

```
public String toString()
```

Overrides:
toString in class Object.

DeliveryMode

public interface **DeliveryMode**

Delivery modes supported by JMS.

Fields

NON_PERSISTENT

```
public static final int NON_PERSISTENT
```

The lowest overhead delivery mode, because it does not require that the message be logged to stable storage.

PERSISTENT

```
public static final int PERSISTENT
```

Instruct the JMS provider to log the message to stable storage as part of the client's send operation.

Destination

public interface **Destination**
Subinterfaces: **Queue**, **TemporaryQueue**, **TemporaryTopic**, and **Topic**

WebSphere MQ class: **MQDestination**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQDestination
```

The Destination object encapsulates provider-specific addresses.

See also: **Queue**, **TemporaryQueue**, **TemporaryTopic**, and **Topic**

WebSphere MQ constructors

MQDestination

```
public MQDestination()
```

Methods

getCCSID *

```
public int getCCSID()
```

Get the name of the character set that is used by this destination.

getDescription *

```
public String getDescription()
```

Get the description of the object.

getEncoding *

```
public int getEncoding()
```

Get the encoding that is used for this destination.

getExpiry *

```
public int getExpiry()
```

Get the value of the expiry for this destination.

getFailIfQuiesce *

```
public int getFailIfQuiesce()
```

Get the behavior of applications accessing a quiescing queue manager with this destination.

getPersistence *

```
public int getPersistence()
```

Get the value of the persistence for this destination.

getPriority *

```
public int getPriority()
```

Get the override priority value.

getTargetClient *

```
public int getTargetClient()
```

Get the JMS compliance indicator flag.

setCCSID *

```
public void setCCSID(int x) throws JMSException
```

Character set to be used to encode text strings in messages sent to this destination. See Table 13 on page 127 for a list of allowed values. The default value is 1208 (UTF8).

setDescription *

```
public void setDescription(String x)
```

A short description of the object.

setEncoding *

```
public void setEncoding(int x) throws JMSException
```

The encoding to be used for numeric fields in messages sent to this destination. See Table 13 on page 127 for a list of allowed values.

setExpiry *

```
public void setExpiry(int expiry) throws JMSException
```

Override the expiry of all messages sent to this destination.

setFailIfQuiesce *

```
public void setFailIfQuiesce(int fiqValue) throws JMSException
```

Set the behavior of applications accessing a quiescing queue manager with this destination.

Takes values of:
- JMSC.MQJMS_FIQ_YES (default)
- JMSC.MQJMS_FIQ_NO

setPersistence *

```
public void setPersistence(int persistence)
                                  throws JMSException
```

Override the persistence of all messages sent to this destination.

setPriority *

```
public void setPriority(int priority) throws JMSException
```

Override the priority of all messages sent to this destination.

setTargetClient *

```
public void setTargetClient(int targetClient)
                                  throws JMSException
```

Whether the remote application is JMS compliant.

ExceptionListener

public interface **ExceptionListener**

If a JMS provider detects a serious problem with a connection, it informs the connection's ExceptionListener if one has been registered. It does this by calling the listener's onException() method, passing it a JMSException that describes the problem.

This allows a client to be asynchronously notified of a problem. Some connections only consume messages, so they have no other way to learn that their Connection has failed.

Exceptions are delivered when:
- There is a failure in receiving an asynchronous message
- A message throws a runtime exception

Methods

onException

```
public void onException(JMSException exception)
```

Notify user of a JMS exception.

Parameters:

`exception`: the JMS exception. These are exceptions that result from asynchronous message delivery. Typically, they indicate a problem with receiving a message from the queue manager, or possibly an internal error in the JMS implementation.

MapMessage

public interface **MapMessage**
extends **Message**

WebSphere MQ class: **JMSMapMessage**

```
java.lang.Object
   |
   +----com.ibm.jms.JMSMessage
           |
           +----com.ibm.jms.JMSMapMessage
```

Use a MapMessage to send a set of name-value pairs where names are strings and values are Java primitive types. The entries can be accessed sequentially or randomly by name. The order of the entries is undefined.

See also: **BytesMessage**, **Message**, **ObjectMessage**, **StreamMessage**, and **TextMessage**

Methods

getBoolean

```
public boolean getBoolean(java.lang.String name) throws JMSException
```

Return the boolean value with the given name.

Parameters:
`name`: the name of the boolean

Returns:
The boolean value with the given name.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getByte

```
public byte getByte(java.lang.String name) throws JMSException
```

Return the byte value with the given name.

Parameters:
`name`: the name of the byte.

Returns:
The byte value with the given name.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getBytes

```
public byte[] getBytes(java.lang.String name) throws JMSException
```

Return the byte array value with the given name.

Parameters:

name: the name of the byte array.

Returns:

A copy of the byte array value with the given name. If there is no item by this name, a null value is returned.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type of conversion is not valid.

getChar

```
public char getChar(java.lang.String name) throws JMSException
```

Return the Unicode character value with the given name.

Parameters:

name: the name of the Unicode character.

Returns:

The Unicode character value with the given name.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getDouble

```
public double getDouble(java.lang.String name) throws JMSException
```

Return the double value with the given name.

Parameters:

name: the name of the double.

Returns:

The double value with the given name.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getFloat

```
public float getFloat(java.lang.String name) throws JMSException
```

Return the float value with the given name.

Parameters:

name: the name of the float.

Returns:

The float value with the given name.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getInt

```
public int getInt(java.lang.String name) throws JMSException
```

Return the integer value with the given name.

Parameters:

name: the name of the integer.

Returns:

The integer value with the given name.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getLong

```
public long getLong(java.lang.String name) throws JMSException
```

Return the long value with the given name.

Parameters:

name: the name of the long.

Returns:

The long value with the given name.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getMapNames

```
public java.util.Enumeration getMapNames() throws JMSException
```

Return an enumeration of all the map message's names.

Returns:

An enumeration of all the names in this map message.

Throws:

JMSException if JMS fails to read the message because of an internal JMS error.

getObject

```
public java.lang.Object getObject(java.lang.String name) throws JMSException
```

Return the Java object value with the given name. This method returns in object format, a value that has been stored in the map either using the setObject method call, or the equivalent primitive set method.

Parameters:

name: the name of the Java object.

Returns:

A copy of the Java object value with the given name, in object format (if it is set as an int, an Integer is returned). If there is no item by this name, a null value is returned.

Throws:

JMSException if JMS fails to read the message because of an internal JMS error.

getShort

```
public short getShort(java.lang.String name) throws JMSException
```

Return the short value with the given name.

Parameters:

name: the name of the short.

Returns:

The short value with the given name.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getString

```
public java.lang.String getString(java.lang.String name) throws JMSException
```

Return the string value with the given name.

Parameters:

name: the name of the string.

Returns:

The string value with the given name. If there is no item by this name, a null value is returned.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

itemExists

```
public boolean itemExists(java.lang.String name)
                                        throws JMSException
```

Check if an item exists in this MapMessage.

Parameters:

name: the name of the item to test.

Returns:

True if the item exists.

Throws:

JMSException - if a JMS error occurs.

setBoolean

```
public void setBoolean(java.lang.String name,
                       boolean value) throws JMSException
```

Set a boolean value with the given name into the map.

Parameters:

- name: the name of the boolean.
- value: the boolean value to set in the Map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

setByte

```
public void setByte(java.lang.String name,
                    byte value) throws JMSException
```

Set a byte value with the given name into the map.

Parameters:

- name: the name of the byte.
- value: the byte value to set in the Map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error
- MessageNotWriteableException if the message is in read-only mode.

setBytes

```
public void setBytes(java.lang.String name,
                     byte[] value) throws JMSException
```

Set a byte array value with the given name into the map.

Parameters:

- name: the name of the byte array.
- value: the byte array value to set in the map.

  The array is copied, so the value in the map is not altered by subsequent modifications to the array.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

setBytes

```
public void setBytes(java.lang.String name,
                     byte[] value,
                     int offset,
                     int length) throws JMSException
```

Set a portion of the byte array value with the given name into the mp.

The array is copied, so the value in the map is not altered by subsequent modifications to the array.

Parameters:

- `name`: the name of the byte array.
- `value`: the byte array value to set in the Map.
- `offset`: the initial offset within the byte array.
- `length`: the number of bytes to be copied.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

setChar

```
public void setChar(java.lang.String name,
                    char value) throws JMSException
```

Set a Unicode character value with the given name into the map.

Parameters:

- `name`: the name of the Unicode character.
- `value`: the Unicode character value to set in the map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

setDouble

```
public void setDouble(java.lang.String name,
                      double value) throws JMSException
```

Set a double value with the given name into the map.

Parameters:

- `name`: the name of the double.
- `value`: the double value to set in the Map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

setFloat

```
public void setFloat(java.lang.String name,
                     float value) throws JMSException
```

Set a float value with the given name into the map.

Parameters:

- name: the name of the float.
- value: the float value to set in the map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

setInt

```
public void setInt(java.lang.String name,
                   int value) throws JMSException
```

Set an integer value with the given name into the map.

Parameters:

- name: the name of the integer.
- value: the integer value to set in the map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

setLong

```
public void setLong(java.lang.String name,
                    long value) throws JMSException
```

Set a long value with the given name into the map.

Parameters:

- name: the name of the long.
- value: the long value to set in the map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

setObject

```
public void setObject(java.lang.String name,
                      java.lang.Object value) throws JMSException
```

Set a Java object value with the given name into the map. This method works only for object primitive types (for example, Integer, Double, and Long), strings and byte arrays.

Parameters:

- `name`: the name of the Java object.
- `value`: the Java object value to set in the map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageFormatException if object is not valid.
- MessageNotWriteableException if the message is in read-only mode.

setShort

```
public void setShort(java.lang.String name,
                     short value) throws JMSException
```

Set a short value with the given name into the map.

Parameters:

- `name`: the name of the short.
- `value`: the short value to set in the map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException - if the message is in read-only mode.

setString

```
public void setString(java.lang.String name,
                      java.lang.String value) throws JMSException
```

Set a string value with the given name into the map.

Parameters:

- `name`: the name of the string.
- `value`: the string value to set in the map.

Throws:

- JMSException if JMS fails to write message due to some internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

Message

public interface **Message**
Subinterfaces: **BytesMessage**, **MapMessage**, **ObjectMessage**, **StreamMessage**, and **TextMessage**

WebSphere MQ class: **JMSMessage**

```
java.lang.Object
  |
  +----com.ibm.jms.MQJMSMessage
```

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

Fields

DEFAULT_DELIVERY_MODE

```
public static final int DEFAULT_DELIVERY_MODE
```

The default delivery mode value.

DEFAULT_PRIORITY

```
public static final int DEFAULT_PRIORITY
```

The default priority value.

DEFAULT_TIME_TO_LIVE

```
public static final long DEFAULT_TIME_TO_LIVE
```

The default time-to-live value.

Methods

acknowledge

```
public void acknowledge() throws JMSException
```

Acknowledge this and all previous messages received by the session.

Throws:

JMSException if JMS fails to acknowledge because of an internal JMS error.

clearBody

```
public void clearBody() throws JMSException
```

Clear out the message body. All other parts of the message are left untouched.

Throws:

JMSException if JMS fails to because of an internal JMS error.

clearProperties

```
public void clearProperties() throws JMSException
```

Clear a message's properties. The header fields and message body are not cleared.

Throws:

JMSException if JMS fails to clear JMS message properties because of an internal JMS error.

getBooleanProperty

```
public boolean getBooleanProperty(java.lang.String name)
                                                    throws JMSException
```

Return the boolean property value with the given name.

Parameters:

name: the name of the boolean property.

Returns:

The boolean property value with the given name.

Throws:

- JMSException if JMS fails to get the property because of an internal JMS error.
- MessageFormatException if this type conversion is not valid

getByteProperty

```
public byte getByteProperty(java.lang.String name)
                                                throws JMSException
```

Return the byte property value with the given name.

Parameters:

name: the name of the byte property.

Returns:

The byte property value with the given name.

Throws:

- JMSException if JMS fails to get the property because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getDoubleProperty

```
public double getDoubleProperty(java.lang.String name)
                                                  throws JMSException
```

Return the double property value with the given name.

Parameters:

name: the name of the double property.

Returns:

The double property value with the given name.

Throws:

- JMSException if JMS fails to get the property because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getFloatProperty

```
public float getFloatProperty(java.lang.String name)
                                                throws JMSException
```

Return the float property value with the given name.

Parameters:

name: the name of the float property.

Returns:

The float property value with the given name.

Throws:

- JMSException if JMS fails to get the property because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getIntProperty

```
public int getIntProperty(java.lang.String name)
                                             throws JMSException
```

Return the integer property value with the given name.

Parameters:

name: the name of the integer property.

Returns:

The integer property value with the given name.

Throws:

- JMSException if JMS fails to get the property because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getJMSCorrelationID

```
public java.lang.String getJMSCorrelationID()
                                          throws JMSException
```

Get the correlation ID for the message.

Returns:

The correlation ID of a message as a string.

Throws:

JMSException if JMS fails to get the correlation ID because of an internal JMS error.

See also:

setJMSCorrelationID(), getJMSCorrelationIDAsBytes(), setJMSCorrelationIDAsBytes()

getJMSCorrelationIDAsBytes

```
public byte[] getJMSCorrelationIDAsBytes()
                                                    throws JMSException
```

Get the correlation ID as an array of bytes for the message.

Returns:
The correlation ID of a message as an array of bytes.

Throws:
JMSException if JMS fails to get correlation ID because of an internal JMS error.

See also:
setJMSCorrelationID(), getJMSCorrelationID(), setJMSCorrelationIDAsBytes()

getJMSDeliveryMode

```
public int getJMSDeliveryMode() throws JMSException
```

Get the delivery mode for this message.

Returns:
The delivery mode of this message.

Throws:
JMSException if JMS fails to get JMS DeliveryMode because of an internal JMS error.

See also:
setJMSDeliveryMode(), DeliveryMode

getJMSDestination

```
public Destination getJMSDestination() throws JMSException
```

Get the destination for this message.

Returns:
The destination of this message.

Throws:
JMSException if JMS fails to get JMS Destination because of an internal JMS error.

See also:
setJMSDestination()

getJMSExpiration

```
public long getJMSExpiration() throws JMSException
```

Get the message's expiration value.

Returns:
The time that the message expires. It is the sum of the time-to-live value specified by the client, and the GMT at the time of the send.

Throws:
JMSException if JMS fails to get JMS message expiration because of an internal JMS error.

See also:
setJMSExpiration()

getJMSMessageID

```
public java.lang.String getJMSMessageID()
                                        throws JMSException
```

Get the message ID.

Returns:
The message ID.

Throws:
JMSException if JMS fails to get the message ID because of an internal JMS error.

See also:
setJMSMessageID()

getJMSPriority

```
public int getJMSPriority() throws JMSException
```

Get the message priority.

Returns:
The message priority.

Throws:
JMSException if JMS fails to get JMS message priority because of an internal JMS error.

See also:
setJMSPriority() for priority levels

getJMSRedelivered

```
public boolean getJMSRedelivered() throws JMSException
```

Get an indication of whether this message is being redelivered.

If a client receives a message with the redelivered indicator set, it is likely, but not guaranteed, that this message was delivered to the client earlier, but that the client did not acknowledge its receipt at that earlier time.

Returns:
Set to true if this message is being redelivered.

Throws:
JMSException if JMS fails to get JMS redelivered flag because of an internal JMS error.

See also:
setJMSRedelivered()

getJMSReplyTo

```
public Destination getJMSReplyTo() throws JMSException
```

Get where a reply to this message should be sent.

Returns:
Where to send a response to this message

Throws:
JMSException if JMS fails to get ReplyTo destination because of an internal JMS error.

See also:
setJMSReplyTo()

getJMSTimestamp

```
public long getJMSTimestamp() throws JMSException
```

Get the message timestamp.

Returns:
The message timestamp.

Throws:
JMSException if JMS fails to get the timestamp because of an internal JMS error.

See also:
setJMSTimestamp()

getJMSType

```
public java.lang.String getJMSType() throws JMSException
```

Get the message type.

Returns:
The message type.

Throws:
JMSException if JMS fails to get JMS message type because of an internal JMS error.

See also:
setJMSType()

getLongProperty

```
public long getLongProperty(java.lang.String name)
                                                throws JMSException
```

Return the long property value with the given name.

Parameters:
`name`: the name of the long property.

Returns:
The long property value with the given name.

Throws:

- JMSException if JMS fails to get the property because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getObjectProperty

```
public java.lang.Object getObjectProperty (java.lang.String name)
                                                              throws JMSException
```

Return the Java object property value with the given name.

Parameters:
`name`: the name of the Java object property.

Returns:
The Java object property value with the given name, in object format (for example, if it set as an int, an Integer is returned). If there is no property by this name, a null value is returned.

Throws:

JMSException if JMS fails to get the property because of an internal JMS error.

getPropertyNames

```
public java.util.Enumeration getPropertyNames()
                                              throws JMSException
```

Return an enumeration of all the property names.

Returns:

An enumeration of all the names of property values.

Throws:

JMSException if JMS fails to get the property names because of an internal JMS error.

getShortProperty

```
public short getShortProperty(java.lang.String name)
                                                  throws JMSException
```

Return the short property value with the given name.

Parameters:

name: the name of the short property.

Returns:

The short property value with the given name.

Throws:

- JMSException if JMS fails to get the property because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

getStringProperty

```
public java.lang.String getStringProperty (java.lang.String name)
                                                        throws JMSException
```

Return the string property value with the given name.

Parameters:

name: the name of the string property

Returns:

The string property value with the given name. If there is no property by this name, a null value is returned.

Throws:

- JMSException if JMS fails to get the property because of an internal JMS error.
- MessageFormatException if this type conversion is not valid.

propertyExists

```
public boolean propertyExists(java.lang.String name)
                                                    throws JMSException
```

Check if a property value exists.

Parameters:

name: the name of the property to test.

Returns:

True if the property does exist.

Throws:

JMSException if JMS fails to check whether a property exists because of an internal JMS error.

setBooleanProperty

```
public void setBooleanProperty(java.lang.String name,
                               boolean value) throws JMSException
```

Set a boolean property value with the given name into the message.

Parameters:

- name: the name of the boolean property.
- value: the boolean property value to set in the message.

Throws:

- JMSException if JMS fails to set property because of an internal JMS error.
- MessageNotWriteableException if the properties are read-only.

setByteProperty

```
public void setByteProperty(java.lang.String name,
                            byte value) throws JMSException
```

Set a byte property value with the given name into the message.

Parameters:

- name: the name of the byte property.
- value: the byte property value to set in the message.

Throws:

- JMSException if JMS fails to set property because of an internal JMS error.
- MessageNotWriteableException if the properties are read-only.

setDoubleProperty

```
public void setDoubleProperty(java.lang.String name,
                              double value) throws JMSException
```

Set a double property value with the given name into the message.

Parameters:

- name: the name of the double property.
- value: the double property value to set in the message.

Throws:

- JMSException if JMS fails to set the property because of an internal JMS error.
- MessageNotWriteableException if the properties are read-only.

setFloatProperty

```
public void setFloatProperty(java.lang.String name,
                             float value) throws JMSException
```

Set a float property value with the given name into the message.

Parameters:

- `name`: the name of the float property.
- `value`: the float property value to set in the message.

Throws:

- JMSException if JMS fails to set the property because of an internal JMS error.
- MessageNotWriteableException if the properties are read-only.

setIntProperty

```
public void setIntProperty(java.lang.String name,
                           int value) throws JMSException
```

Set an integer property value with the given name into the message.

Parameters:

- `name`: the name of the integer property.
- `value`: the integer property value to set in the message.

Throws:

- JMSException if JMS fails to set property because of an internal JMS error.
- MessageNotWriteableException if the properties are read-only.

setJMSCorrelationID

```
public void setJMSCorrelationID
                  (java.lang.String correlationID)
                                      throws JMSException
```

Set the correlation ID for the message.

A client can use the JMSCorrelationID header field to link one message with another. A typical use is to link a response message with its request message.

Note: The use of a byte[] value for JMSCorrelationID is non-portable.

Parameters:

`correlationID`: the message ID of a message being referred to.

Throws:

JMSException if JMS fails to set the correlation ID because of an internal JMS error.

See also:

getJMSCorrelationID(), getJMSCorrelationIDAsBytes(), setJMSCorrelationIDAsBytes()

setJMSCorrelationIDAsBytes

```
public void setJMSCorrelationIDAsBytes(byte[]
                                       correlationID)
                                         throws JMSException
```

Set the correlation ID as an array of bytes for the message. A client can use this call to set the correlationID equal either to a messageID from a previous message, or to an application-specific string. Application-specific strings must not start with the characters ID.

Parameters:

`correlationID`: the correlation ID as a string, or the message ID of a message being referred to.

Throws:

JMSException if JMS fails to set the correlation ID because of an internal JMS error.

See also:

setJMSCorrelationID(), getJMSCorrelationID(), getJMSCorrelationIDAsBytes()

setJMSDeliveryMode

```
public void setJMSDeliveryMode(int deliveryMode)
                                 throws JMSException
```

Set the delivery mode for this message.

Any value set using this method is ignored when the message is sent, but this method can be used to change the value in a received message.

To alter the delivery mode when a message is sent, use the setDeliveryMode method on the QueueSender or TopicPublisher (this method is inherited from MessageProducer).

Parameters:

`deliveryMode`: the delivery mode for this message.

Throws:

JMSException if JMS fails to set JMS DeliveryMode because of an internal JMS error.

See also:

getJMSDeliveryMode(), DeliveryMode

setJMSDestination

```
public void setJMSDestination(Destination destination)
                                throws JMSexception
```

Set the destination for this message.

Any value set using this method is ignored when the message is sent, but this method can be used to change the value in a received message.

Parameters:

`destination`: the destination for this message.

Throws:

JMSException if JMS fails to set JMS destination because of an internal JMS error.

See also:
getJMSDestination()

setJMSExpiration

```
public void setJMSExpiration(long expiration)
                                        throws JMSException
```

Set the message's expiration value.

Any value set using this method is ignored when the message is sent, but this method can be used to change the value in a received message.

Parameters:
`expiration`: the message's expiration time.

Throws:
JMSException if JMS fails to set JMS message expiration because of an internal JMS error.

See also:
getJMSExpiration()

setJMSMessageID

```
public void setJMSMessageID(java.lang.String id)
                                          throws JMSException
```

Set the message ID.

Any value set using this method is ignored when the message is sent, but this method can be used to change the value in a received message.

Parameters:
`id`: the ID of the message.

Throws:
JMSException if JMS fails to set the message ID because of an internal JMS error.

See also:
getJMSMessageID()

setJMSPriority

```
public void setJMSPriority(int priority)
                                     throws JMSException
```

Set the priority for this message.

JMS defines a ten-level priority value, with 0 as the lowest priority, and 9 as the highest. In addition, clients must consider priorities 0-4 as gradations of normal priority, and priorities 5-9 as gradations of expedited priority.

Parameters:
`priority`: the priority of this message.

Throws:
JMSException if JMS fails to set JMS message priority because of an internal JMS error.

See also:
getJMSPriority()

setJMSRedelivered

```
public void setJMSRedelivered(boolean redelivered)
                                                throws JMSException
```

Set to indicate whether this message is being redelivered.

Any value set using this method is ignored when the message is sent, but this method can be used to change the value in a received message.

Parameters:

`redelivered`: an indication of whether this message is being redelivered.

Throws:

JMSException if JMS fails to set JMSRedelivered flag because of an internal JMS error.

See also:

getJMSRedelivered()

setJMSReplyTo

```
public void setJMSReplyTo(Destination replyTo)
                                            throws JMSException
```

Set where a reply to this message should be sent.

Parameters:

`replyTo`: where to send a response to this message. A null value indicates that no reply is expected.

Throws:

JMSException if JMS fails to set ReplyTo destination because of an internal JMS error.

See also:

getJMSReplyTo()

setJMSTimestamp

```
public void setJMSTimestamp(long timestamp)
                                          throws JMSException
```

Set the message timestamp.

Any value set using this method is ignored when the message is sent, but this method can be used to change the value in a received message.

Parameters:

`timestamp`: the timestamp for this message.

Throws:

JMSException if JMS fails to set the timestamp because of an internal JMS error.

See also:

getJMSTimestamp()

setJMSType

```
public void setJMSType(java.lang.String type)
                                          throws JMSException
```

Set the message type.

JMS clients must assign a value to type whether the application makes use of it or not. This ensures that it is properly set for those providers that require it.

Parameters:

type: the class of message.

Throws:

JMSException if JMS fails to set JMS message type because of an internal JMS error.

See also:

getJMSType()

setLongProperty

```
public void setLongProperty(java.lang.String name,
                            long value) throws JMSException
```

Set a long property value with the given name into the message.

Parameters:

- name: the name of the long property.
- value: the long property value to set in the message.

Throws:

- JMSException if JMS fails to set property because of an internal JMS error.
- MessageNotWriteableException if the properties are read-only.

setObjectProperty

```
public void setObjectProperty(java.lang.String name,
                              java.lang.Object value) throws JMSException
```

Set a property value with the given name into the message.

Parameters:

- name: the name of the Java object property.
- value: the Java object property value to set in the message.

Throws:

- JMSException if JMS fails to set property because of an internal JMS error.
- MessageFormatException if the object is not valid.
- MessageNotWriteableException - if the properties are read-only.

setShortProperty

```
public void setShortProperty(java.lang.String name,
                             short value) throws JMSException
```

Set a short property value with the given name into the message.

Parameters:

- `name`: the name of the short property.
- `value`: the short property value to set in the message.

Throws:

- JMSException if JMS fails to set property because of an internal JMS error.
- MessageNotWriteableException if the properties are read-only.

setStringProperty

```
public void setStringProperty(java.lang.String name,
                              java.lang.String value) throws JMSException
```

Set a string property value with the given name into the message.

Parameters:

- `name`: the name of the string property.
- `value`: the string property value to set in the message.

Throws:

- JMSException if JMS fails to set the property because of an internal JMS error.
- MessageNotWriteableException if the properties are read-only.

MessageConsumer

public interface **MessageConsumer**
Subinterfaces: **QueueReceiver** and **TopicSubscriber**

WebSphere MQ class: **MQMessageConsumer**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQMessageConsumer
```

MessageConsumer is the parent interface for all message consumers. A client uses a message consumer to receive messages from a Destination.

See also: **QueueReceiver**, **Session**, and **TopicSubscriber**

Methods

close

```
public void close() throws JMSException
```

Close the message consumer.

Because a provider can allocate some resources outside the JVM on behalf of a MessageConsumer, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough.

This call blocks until a receive or message listener in progress has completed.

Throws:
JMSException if JMS fails to close the consumer because of an error.

getMessageListener

```
public MessageListener getMessageListener()
                                        throws JMSException
```

Get the message consumer's MessageListener.

Returns:
The listener for the message consumer, or null if a listener is not set.

Throws:
JMSException if JMS fails to get the message listener because of a JMS error.

See also:
setMessageListener

getMessageSelector

```
public java.lang.String getMessageSelector()
                                  throws JMSException
```

Get this message consumer's message selector expression.

Returns:
The message consumer's message selector.

Throws:
JMSException if JMS fails to get the message selector because of a JMS error.

receive

```
public Message receive() throws JMSException
```

Receive the next message produced for this message consumer.

Returns:
The next message produced for this message consumer.

Throws:
JMSException if JMS fails to receive the next message because of an error.

receive

```
public Message receive(long timeOut) throws JMSException
```

Receive the next message that arrives within the specified timeout interval. A timeout value of zero causes the call to wait indefinitely until a message arrives.

Parameters:
`timeout`: the timeout value (in milliseconds).

Returns:
The next message produced for this message consumer, or null if one is not available.

Throws:
JMSException if JMS fails to receive the next message because of an error.

receiveNoWait

```
public Message receiveNoWait() throws JMSException
```

Receive the next message if one is immediately available.

Returns:
The next message produced for this message consumer, or null if one is not available.

Throws:
JMSException if JMS fails to receive the next message because of an error.

setMessageListener

```
public void setMessageListener(MessageListener listener)
                                                throws JMSException
```

Set the message consumer's MessageListener.

Parameters:

`messageListener`: the messages are delivered to this listener.

Throws:

JMSException if JMS fails to set message listener because of a JMS error.

See also:

getMessageListener

MessageListener

public interface **MessageListener**

Use a MessageListener to receive asynchronously delivered messages.

Methods

onMessage

```
public void onMessage(Message message)
```

Pass a message to the listener.

Parameters:

`message`: the message passed to the listener.

See also

Session.setMessageListener

MessageProducer

public interface **MessageProducer**
Subinterfaces: **QueueSender** and **TopicPublisher**

WebSphere MQ class: **MQMessageProducer**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQMessageProducer
```

A client uses a MessageProducer to send messages to a destination.

See also: **QueueSender**, **TopicPublisher**, and **Session.createProducer(javax.jms.Destination)**

WebSphere MQ constructors

MQMessageProducer

```
public MQMessageProducer()
```

Methods

close

```
public void close() throws JMSException
```

Because a provider can allocate some resources outside the JVM on behalf of a MessageProducer, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough.

Throws:
JMSException if JMS fails to close the producer because of an error.

getDeliveryMode

```
public int getDeliveryMode() throws JMSException
```

Get the producer's default delivery mode.

Returns:
The message delivery mode for this message producer.

Throws:
JMSException if JMS fails to get the delivery mode because of an internal error.

See also:
setDeliveryMode

getDestination (JMS 1.1 only)

```
public Destination getDestination() throws JMSException
```

Get the destination associated with the message producer.

Returns:
The message producer's destination.

Throws:
JMSException if JMS fails to get the destination because of an internal JMS error.

getDisableMessageID

```
public boolean getDisableMessageID() throws JMSException
```

Get an indication of whether message IDs are disabled.

Returns:
An indication of whether message IDs are disabled.

Throws:
JMSException if JMS fails to get the disabled message ID because of an internal error.

getDisableMessageTimestamp

```
public boolean getDisableMessageTimestamp()
                                        throws JMSException
```

Get an indication of whether message timestamps are disabled.

Returns:
An indication of whether message IDs are disabled.

Throws:
JMSException if JMS fails to get the disabled message timestamp because of an internal error.

getPriority

```
public int getPriority() throws JMSException
```

Get the producer's default priority.

Returns:
The message priority for this message producer.

Throws:
JMSException if JMS fails to get the priority because of an internal error.

See also:
setPriority

getTimeToLive

```
public long getTimeToLive() throws JMSException
```

Get the default length of time in milliseconds from its dispatch time that the message system retains a produced message.

Returns:
The message time-to-live in milliseconds; zero is unlimited.

Throws:
JMSException if JMS fails to get the time-to-live because of an internal error.

See also:
setTimeToLive

send (JMS 1.1 only)

```
public void send(Message message) throws JMSException
```

Send a message using the message producer's default delivery mode, default priority, and default time to live.

Parameters:
`message`: the message to send.

Throws:

- JMSException if JMS fails to send the message because of an internal JMS error.
- MessageFormatException if the message is not valid.
- InvalidDestinationException if a client uses this method with a message producer whose destination is not valid.
- java.lang.UnsupportedOperationException if a client uses this method with a message producer for which no destination was specified when it was created.

See also:
MessageProducer, Session.createProducer

send (JMS 1.1 only)

```
public void send(Message message, int deliveryMode,
                 int priority, long timeToLive) throws JMSException
```

Send a message specifying a delivery mode, a priority, and a time to live.

Parameters:

- `message`: the message to send.
- `deliveryMode`: the delivery mode to use
- `priority`: the priority for the message
- `timeToLive`: the lifetime of the message in milliseconds.

Throws:

- JMSException if JMS fails to send the message because of an internal JMS error.
- MessageFormatException if the message is not valid.
- InvalidDestinationException if a client uses this method with a message producer whose destination is not valid.

- java.lang.UnsupportedOperationException if a client uses this method with a message producer for which no destination was specified when the message producer was created.

See also:
Session.createProducer

send (JMS 1.1 only)

```
public void send(Destination destination, Message message)
                                        throws JMSException
```

Send a message to a destination if you are using a message producer for which no destination was specified when the message producer was created. The method uses the message producer's default delivery mode, default priority, and default time to live.

Typically, you specify a destination when you create a message producer but, if you do not, you must specify a destination every time you send a message.

Parameters:

- `destination`: the destination to send the message to.
- `message`: the message to send.

Throws:

- JMSException if JMS fails to send the message because of an internal JMS error.
- MessageFormatException if the message is not valid.
- InvalidDestinationException if the destination is not valid.
- java.lang.UnsupportedOperationException if a client uses this method with a message producer for which a destination was specified when the message producer was created.

See also:
MessageProducer, Session.createProducer

send (JMS 1.1 only)

```
public void send(Destination destination, Message message,
                 int deliveryMode, int priority,
                 long timeToLive) throws JMSException
```

Send a message to a destination if you are using a message producer for which no destination was specified when the message producer was created. The method specifies a delivery mode, a priority, and a time to live.

Typically, you specify a destination when you create a message producer but, if do not, you must specify a destination every time you send a message.

Parameters:

- `destination`: the destination to which to send the message.
- `message`: the message to send.
- `deliveryMode`: the delivery mode to use
- `priority`: the priority for the message
- `timeToLive`: the lifetime of the message in milliseconds.

Throws:

- JMSException if JMS fails to send the message because of an internal JMS error.
- MessageFormatException if the message is not valid.
- InvalidDestinationException if the destination is not valid.
- java.lang.UnsupportedOperationException if a client uses this method with a message producer for which a destination was specified when the message producer was created.

See also:

Session.createProducer

setDeliveryMode

```
public void setDeliveryMode(int deliveryMode)
                                          throws JMSException
```

Set the producer's default delivery mode; it is set to DeliveryMode.PERSISTENT by default.

Parameters:

`deliveryMode`: the message delivery mode for this message producer.

Throws:

JMSException if JMS fails to set the delivery mode because of an internal error.

See also:

getDeliveryMode, DeliveryMode.NON_PERSISTENT, DeliveryMode.PERSISTENT, Message.DEFAULT_DELIVERY_MODE

setDisableMessageID

```
public void setDisableMessageID(boolean value)
                                           throws JMSException
```

Set whether message IDs are disabled; they are enabled by default.

Note: This method is ignored in the WebSphere MQ classes for Java Message Service implementation.

Parameters:

`value`: indicates whether message IDs are disabled.

Throws:

JMSException if JMS fails to set the disabled message ID because of an internal error.

setDisableMessageTimestamp

```
public void setDisableMessageTimestamp(boolean value)
                                                  throws JMSException
```

Set whether message timestamps are disabled; they are enabled by default.

Note: This method is ignored in the WebSphere MQ classes for Java Message Service implementation.

Parameters:

`value`: indicates whether message timestamps are disabled.

Throws:
JMSException if JMS fails to set the disabled message timestamp because of an internal error.

setPriority

```
public void setPriority(int defaultPriority) throws JMSException
```

Set the producer's default priority (default 4).

Parameters:
`defaultPriority`: the message priority for this message producer.

Throws:
JMSException if JMS fails to set the priority because of an internal error.

See also:
getPriority, Message.DEFAULT_PRIORITY

setTimeToLive

```
public void setTimeToLive(long timeToLive)
                                    throws JMSException
```

Set the default length of time, in milliseconds from its dispatch time, that the message system retains a produced message.

Time-to-live is set to zero by default.

WebSphere MQ Event Broker note
This method throws a JMSException if set to other than 0 when you make a direct connection to WebSphere MQ Event Broker.

Parameters:
`timeToLive`: the message time to live in milliseconds; zero is unlimited.

Throws:
JMSException if JMS fails to set the time-to-live because of an internal error.

See also:
getTimeToLive, Message.DEFAULT_TIME_TO_LIVE

MQQueueEnumeration *

public class **MQQueueEnumeration**
extends **Object**
implements **Enumeration**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQQueueEnumeration
```

MQQueueEnumeration enumerates messages on a queue. This class is not defined in the JMS specification; it is created by calling the getEnumeration method of MQQueueBrowser. The class contains a base MQQueue instance to hold the browse cursor. The queue is closed once the cursor has moved off the end of the queue.

There is no way to reset an instance of this class; it acts as a *one-shot* mechanism.

See also: **MQQueueBrowser**

Methods

hasMoreElements

```
public boolean hasMoreElements()
```

Whether another message can be returned.

nextElement

```
public Object nextElement() throws NoSuchElementException
```

Return the current message.

If `hasMoreElements()` returns true, `nextElement()` always returns a message. It is possible for the returned message to pass its expiry date between the `hasMoreElements()` and the `nextElement` calls.

ObjectMessage

public interface **ObjectMessage**
extends **Message**

WebSphere MQ class: **JMSObjectMessage**

```
java.lang.Object
   |
   +----com.ibm.jms.JMSMessage
           |
           +----com.ibm.jms.JMSObjectMessage
```

Use an ObjectMessage to send a message that contains a serializable Java object. It inherits from Message and adds a body containing a single Java reference. Only serializable Java objects can be used.

See also: **BytesMessage**, **MapMessage**, **Message**, **StreamMessage**, and **TextMessage**

Methods

getObject

```
public java.io.Serializable getObject()
                             throws JMSException
```

Get the serializable object containing this message's data. The default value is null.

Returns:
The serializable object containing this message's data.

Throws:

- JMSException if JMS fails to get the object because of an internal JMS error.
- MessageFormatException if object deserialization fails.

setObject

```
public void setObject(java.io.Serializable object)
                                      throws JMSException
```

Set the serializable object containing this message's data. The ObjectMessage contains a snapshot of the object at the time setObject() is called. Subsequent modifications of the object have no effect on the ObjectMessage body.

Parameters:
`object`: the message's data.

Throws:

- JMSException if JMS fails to set the object because of an internal JMS error.
- MessageFormatException if object serialization fails.
- MessageNotWriteableException if the message is in read-only mode.

Queue

public interface **Queue**
extends **Destination**
Subinterfaces: **TemporaryQueue**

WebSphere MQ class: **MQQueue**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQDestination
           |
           +----com.ibm.mq.jms.MQQueue
```

A Queue object encapsulates a provider-specific queue name. It is the way that a client specifies the identity of a queue to JMS methods.

WebSphere MQ constructors

MQQueue *

```
public MQQueue()
```

Default constructor for use by the administration tool.

MQQueue *

```
public MQQueue(String URIqueue)
```

Create a new MQQueue instance. The string takes a URI format, as described on page 204.

MQQueue *

```
public MQQueue(String queueManagerName,
               String queueName)
```

Methods

getBaseQueueManagerName *

```
public String getBaseQueueManagerName()
```

Returns:
The value of the WebSphere MQ queue manager name.

getBaseQueueName *

```
public String getBaseQueueName()
```

Returns:
The value of the WebSphere MQ queue name.

getQueueName

```
public java.lang.String getQueueName()
                                  throws JMSException
```

Get the name of this queue.

Clients that depend upon the name are not portable.

Returns:
The queue name

Throws:
JMSException if JMS implementation for queue fails to return the queue name because of an internal error.

getReference *

```
public Reference getReference() throws NamingException
```

Create a reference for this queue.

Returns:
A reference for this object.

Throws:
NamingException.

setBaseQueueManagerName *

```
public void setBaseQueueManagerName(String x) throws JMSException
```

Set the value of the WebSphere MQ queue manager name.

Note: Only the administration tool can use this method.

setBaseQueueName *

```
public void setBaseQueueName(String x) throws JMSException
```

Set the value of the WebSphere MQ queue name.

Note: Only the administration tool can use this method. It makes no attempt to decode queue:qmgr:queue format strings.

toString

```
public java.lang.String toString()
```

Return a well-formatted printed version of the queue name.

Returns:
The provider-specific identity values for this queue.

Overrides:
toString in class java.lang.Object

QueueBrowser

public interface **QueueBrowser**

WebSphere MQ class: **MQQueueBrowser**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQQueueBrowser
```

A client uses a QueueBrowser to look at messages on a queue without removing them.

Note: The WebSphere MQ class **MQQueueEnumeration** is used to hold the browse cursor.

See also: **QueueReceiver**

Methods

close

```
public void close() throws JMSException
```

Because a provider can allocate some resources outside the JVM on behalf of a QueueBrowser, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough.

Throws:

JMSException if a JMS fails to close this browser because of a JMS error.

getEnumeration

```
public java.util.Enumeration getEnumeration() throws JMSException
```

Get an enumeration for browsing the current queue messages in the order that they are received.

Returns:

An enumeration for browsing the messages.

Throws:

JMSException if JMS fails to get the enumeration for this browser because of a JMS error.

Note: If the browser is created for a nonexistent queue, this is not detected until the first call to getEnumeration.

getMessageSelector

```
public java.lang.String getMessageSelector() throws JMSException
```

Get this queue browser's message selector expression.

Returns:

This queue browser's message selector.

Throws:

JMSException if JMS fails to get the message selector for this browser because of a JMS error.

getQueue

```
public Queue getQueue() throws JMSException
```

Get the queue associated with this queue browser.

Returns:
The queue.

Throws:
JMSException if JMS fails to get the queue associated with this browser because of a JMS error.

QueueConnection

public interface **QueueConnection**
extends **Connection**
Subinterfaces: **XAQueueConnection**

WebSphere MQ class: **MQQueueConnection**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQConnection
           |
           +----com.ibm.mq.jms.MQQueueConnection
```

A QueueConnection is an active connection to a JMS point-to-point provider. A client uses a QueueConnection to create one or more QueueSessions for producing and consuming messages.

See also: **Connection**, **QueueConnectionFactory**, and **XAQueueConnection**

Methods

close *

```
public void close() throws JMSException
```

Overrides:
Close in class MQConnection.

createConnectionConsumer

```
public ConnectionConsumer createConnectionConsumer
                                    (Queue queue,
                                     java.lang.String messageSelector,
                                     ServerSessionPool sessionPool,
                                     int maxMessages)
                                                throws JMSException
```

Create a connection consumer for this connection. This is an expert facility that is not used by regular JMS clients.

Parameters:

- `queue`: the queue to access.
- `messageSelector`: only messages with properties that match the message selector expression are delivered.
- `sessionPool`: the server session pool to associate with this connection consumer.
- `maxMessages`: the maximum number of messages that can be assigned to a server session at one time.

Returns:
The connection consumer.

Throws:

- JMSException if the JMS connection fails to create a connection consumer because of an internal error, or incorrect arguments for sessionPool and messageSelector.
- InvalidDestinationException if the queue is not valid.
- InvalidSelectorException if the message selector is not valid.

See also:

ConnectionConsumer

createQueueSession

```
public QueueSession createQueueSession(boolean transacted,
                                       int acknowledgeMode)
                                                throws JMSException
```

Create a QueueSession.

Parameters:

- `transacted`: if true, the session is transacted.
- `acknowledgeMode`: indicates whether the consumer or the client acknowledges any messages it receives. Possible values are:
  Session.AUTO_ACKNOWLEDGE
  Session.CLIENT_ACKNOWLEDGE
  Session.DUPS_OK_ACKNOWLEDGE

  This parameter is ignored if the session is transacted.

Returns:

A newly-created queue session.

Throws:

JMSException if JMS Connection fails to create a session because of an internal error, or lack of support for specific transaction and acknowledgement mode.

QueueConnectionFactory

public interface **QueueConnectionFactory**
extends **ConnectionFactory**
Subinterfaces: **XAQueueConnectionFactory**

WebSphere MQ class: **MQQueueConnectionFactory**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQConnectionFactory
           |
           +----com.ibm.mq.jms.MQQueueConnectionFactory
```

A client uses a QueueConnectionFactory to create QueueConnections with a JMS point-to-point provider.

See also: **ConnectionFactory** and **XAQueueConnectionFactory**

WebSphere MQ constructor

MQQueueConnectionFactory

```
public MQQueueConnectionFactory()
```

Methods

createQueueConnection

```
public QueueConnection createQueueConnection()
                                          throws JMSException
```

Create a queue connection with default user identity. The connection is created in stopped mode. No messages are delivered until Connection.start method is explicitly called.

Returns:
A newly-created queue connection.

Throws:

- JMSException if JMS provider fails to create queue connection because of an internal error.
- JMSSecurityException if client authentication fails because of a non valid user name or password.

createQueueConnection

```
public QueueConnection createQueueConnection
                                (java.lang.String userName,
                                 java.lang.String password)
                                                  throws JMSException
```

Create a queue connection with specified user identity.

Note: Use this method only with transport type JMSC.MQJMS_TP_CLIENT_MQ_TCPIP (see ConnectionFactory). The connection is created in stopped mode. No messages are delivered until Connection.start method is explicitly called.

Parameters:

- `userName`: the caller's user name.

- password: the caller's password.

Returns:
A newly-created queue connection.

Throws:
- JMSException if JMS Provider fails to create queue connection because of an internal error.
- JMSSecurityException if client authentication fails because of a non valid user name or password.

getMessageRetention *

```
public int getMessageRetention()
```

Get method for messageRetention attribute.

Returns:
- JMSC.MQJMS_MRET_YES: unwanted messages remain on the input queue.
- JMSC.MQJMS_MRET_NO: unwanted messages are dealt with according to their disposition options.

getReference *

```
public Reference getReference() throws NamingException
```

Return a reference for this queue connection factory.

Returns:
A reference for this object.

Throws:
NamingException.

getTemporaryModel *

```
public String getTemporaryModel()
```

getTempQPrefix *

```
public String getTempQPrefix()
```

Get the prefix that is used to form the name of a WebSphere MQ dynamic queue.

Returns:
The prefix that is used to form the name of a WebSphere MQ dynamic queue.

setMessageRetention *

```
public void setMessageRetention(int x) throws JMSException
```

Set method for messageRetention attribute.

Parameters:
Valid values are:
- JMSC.MQJMS_MRET_YES: unwanted messages remain on the input queue.
- JMSC.MQJMS_MRET_NO: unwanted messages are dealt with according to their disposition options. For more information on this, see "General principles for point-to-point messaging" on page 278.

setTemporaryModel *

```
public void setTemporaryModel(String x) throws JMSException
```

setTempQPrefix *

```
public void setTempQPrefix(java.lang.String tempQPrefix) throws JMSException
```

Set the prefix to be used to form the name of a WebSphere MQ dynamic queue.

Parameters:

`tempQPrefix`: the prefix to be used to form the name of a WebSphere MQ dynamic queue.

Throws:

JMSException if the string is null, empty, greater than 33 characters in length, or consists solely of a single asterisk (*).

QueueReceiver

public interface **QueueReceiver**
extends **MessageConsumer**

WebSphere MQ class: **MQQueueReceiver**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQMessageConsumer
           |
           +----com.ibm.mq.jms.MQQueueReceiver
```

A client uses a QueueReceiver to receive messages that have been delivered to a queue.

See also: **MessageConsumer**

This class inherits the following methods from **MQMessageConsumer**.
- receive
- receiveNoWait
- close
- getMessageListener
- setMessageListener

Methods

getQueue

```
public Queue getQueue() throws JMSException
```

Get the queue associated with this queue receiver.

Returns:
The queue.

Throws:
JMSException if JMS fails to get queue for this queue receiver because of an internal error.

QueueRequestor

public class **QueueRequestor**
extends **java.lang.Object**

```
java.lang.Object
    |
    +----javax.jms.QueueRequestor
```

The QueueRequestor helper class simplifies making service requests. The QueueRequestor constructor is given a non-transacted QueueSession and a destination Queue. It creates a TemporaryQueue for the responses, and provides a request() method that sends the request message and waits for its reply. Users are free to create more sophisticated versions.

See also: **TopicRequestor**

Constructors

QueueRequestor

```
public QueueRequestor(QueueSession session,
                      Queue queue)
                              throws JMSException
```

This implementation assumes that the session parameter is non-transacted and either AUTO_ACKNOWLEDGE or DUPS_OK_ACKNOWLEDGE.

Parameters:

- `session`: the queue session the queue belongs to.
- `queue`: the queue to perform the request/reply call on.

Throws:

JMSException if a JMS error occurs.

Methods

close

```
public void close() throws JMSException
```

Because a provider can allocate some resources outside the JVM on behalf of a QueueRequestor, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough.

Note: This method closes the session object passed to the QueueRequestor constructor.

Throws:

JMSException if a JMS error occurs.

request

```
public Message request(Message message)
                                  throws JMSException
```

Send a request and wait for a reply. The temporary queue is used for replyTo, and only one reply is expected for each request.

Parameters:
`message`: the message to send.

Returns:
The reply message.

Throws:
JMSException if a JMS error occurs.

QueueSender

public interface **QueueSender**
extends **MessageProducer**

WebSphere MQ class: **MQQueueSender**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQMessageProducer
           |
           +----com.ibm.mq.jms.MQQueueSender
```

A client uses a QueueSender to send messages to a queue.

A QueueSender is normally associated with a particular queue. However, it is possible to create an unidentified QueueSender that is not associated with any given queue.

See also: **MessageProducer**

Methods

close *

```
public void close() throws JMSException
```

Because a provider can allocate some resources outside the JVM on behalf of a QueueSender, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough.

Throws:
JMSException if JMS fails to close the producer because of some error.

Overrides:
Close in class MQMessageProducer.

getQueue

```
public Queue getQueue() throws JMSException
```

Get the queue associated with this queue sender.

Returns:
The queue.

Throws:
JMSException if JMS fails to get the queue for this queue sender because of an internal error.

send

```
public void send(Message message) throws JMSException
```

Send a message to the queue. Use the QueueSender's default delivery mode, time-to-live, and priority.

Parameters:

`message`: the message to be sent.

Throws:

- JMSException if JMS fails to send the message because of an error.
- MessageFormatException if a non valid message is specified.
- InvalidDestinationException if a client uses this method with a queue sender with a non valid queue.

send

```
public void send(Message message,
                 int deliveryMode,
                 int priority,
                 long timeToLive) throws JMSException
```

Send a message specifying delivery mode, priority, and time-to-live to the queue.

Parameters:

- `message`: the message to be sent.
- `deliveryMode`: the delivery mode to use.
- `priority`: the priority for this message.
- `timeToLive`: the message's lifetime (in milliseconds).

Throws:

- JMSException if JMS fails to send the message because of an internal error.
- MessageFormatException if a non valid message is specified.
- InvalidDestinationException if a client uses this method with a queue sender with a non valid queue.

send

```
public void send(Queue queue,
                 Message message) throws JMSException
```

Send a message to the specified queue with the QueueSender's default delivery mode, time-to-live, and priority.

Note: This method can be used only with unidentified QueueSenders.

Parameters:

- `queue`:- the queue that this message should be sent to.
- `message`: the message to be sent.

Throws:

- JMSException if JMS fails to send the message because of an internal error.
- MessageFormatException if a non valid message is specified.

- InvalidDestinationException if a client uses this method with a non valid queue.

send

```
public void send(Queue queue,
                 Message message,
                 int deliveryMode,
                 int priority,
                 long timeToLive) throws JMSException
```

Send a message to the specified queue with delivery mode, priority, and time-to-live.

Note: This method can be used only with unidentified QueueSenders.

Parameters:

- `queue`: the queue that this message should be sent to.
- `message`: the message to be sent.
- `deliveryMode`: the delivery mode to use.
- `priority`: the priority for this message.
- `timeToLive`: the message's lifetime (in milliseconds).

Throws:

- JMSException if JMS fails to send the message because of an internal error.
- MessageFormatException if a non valid message is specified.
- InvalidDestinationException if a client uses this method with a non valid queue.

QueueSession

public interface **QueueSession**
extends **Session**

WebSphere MQ class: **MQQueueSession**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQSession
           |
           +----com.ibm.mq.jms.MQQueueSession
```

A QueueSession provides methods to create QueueReceivers, QueueSenders, QueueBrowsers, and TemporaryQueues.

See also: **Session**

The following methods are inherited from **MQSession**:
- close
- commit
- rollback
- recover

Methods

createBrowser

```
public QueueBrowser createBrowser(Queue queue)
                                        throws JMSException
```

Create a QueueBrowser to peek at the messages on the specified queue.

Parameters:

queue: the queue to access.

Throws:

- JMSException if a session fails to create a browser because of a JMS error.
- InvalidDestinationException if a non valid queue is specified.

createBrowser

```
public QueueBrowser createBrowser(Queue queue,
                                  java.lang.String messageSelector)
                                  throws JMSException
```

Create a QueueBrowser to peek at the messages on the specified queue.

Parameters:

- queue: the queue to access.
- messageSelector: only deliver messages with properties that match the message selector expression.

Throws:

- JMSException if a session fails to create a browser because of a JMS error.
- InvalidDestinationException if a non valid queue is specified.
- InvalidSelectorException if the message selector is not valid.

createQueue

```
public Queue createQueue(java.lang.String queueName)
                                              throws JMSException
```

Create a queue with a queue name. This allows the creation of a queue with a provider-specific name. The string takes a URI format, as described on page 204.

Note: Clients that depend on this ability are not portable.

Parameters:

queueName: the name of this queue.

Returns:

A queue with the given name.

Throws:

JMSException if a session fails to create a queue because of a JMS error.

createReceiver

```
public QueueReceiver createReceiver(Queue queue)
                                              throws JMSException
```

Create a QueueReceiver to receive messages from the specified queue.

Parameters:

queue: the queue to access.

Throws:

- JMSException if a session fails to create a receiver because of a JMS error.
- InvalidDestinationException if a non valid queue is specified.

createReceiver

```
public QueueReceiver createReceiver(Queue queue,
                                    java.lang.String messageSelector)
                                    throws JMSException
```

Create a QueueReceiver to receive messages from the specified queue.

Parameters:

- queue: the queue to access.
- messageSelector: only messages with properties that match the message selector expression are delivered.

Throws:

- JMSException if a session fails to create a receiver because of a JMS error.
- InvalidDestinationException if a non valid queue is specified.
- InvalidSelectorException if the message selector is not valid.

createSender

```
public QueueSender createSender(Queue queue)
                                         throws JMSException
```

Create a QueueSender to send messages to the specified queue.

Parameters:

queue: the queue to access, or null if this is to be an unidentified producer.

Throws:

- JMSException if a session fails to create a sender because of a JMS error.
- InvalidDestinationException if a non valid queue is specified.

createTemporaryQueue

```
public TemporaryQueue createTemporaryQueue()
                                        throws JMSException
```

Create a temporary queue. Its lifetime is that of the QueueConnection unless deleted earlier.

Returns:

A temporary queue.

Throws:

JMSException if a session fails to create a temporary queue because of a JMS error.

Session

public interface **Session**
extends **java.lang.Runnable**
Subinterfaces: **QueueSession**, **TopicSession**, **XAQueueSession**, **XASession**, and **XATopicSession**

WebSphere MQ class: **MQSession**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQSession
```

A JMS session is a single-threaded context for producing and consuming messages.

See also: **QueueSession**, **TopicSession**, and **XASession**

Fields

AUTO_ACKNOWLEDGE

```
public static final int AUTO_ACKNOWLEDGE
```

With this acknowledgement mode, the session automatically acknowledges a message when it has either successfully returned from a call to receive, or the message listener it has called to process the message successfully returns.

CLIENT_ACKNOWLEDGE

```
public static final int CLIENT_ACKNOWLEDGE
```

With this acknowledgement mode, the client acknowledges a message by calling a message's acknowledge method.

DUPS_OK_ACKNOWLEDGE

```
public static final int DUPS_OK_ACKNOWLEDGE
```

This acknowledgement mode instructs the session to acknowledge the delivery of messages lazily.

SESSION_TRANSACTED

```
public static final int SESSION_TRANSACTED
```

The method getAcknowledgeMode returns this value if the session is transacted and ignores the acknowledgement mode.

Methods

close

```
public void close() throws JMSException
```

Because a provider can allocate some resources outside the JVM on behalf of a session, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough.

Closing a transacted session rolls back any in-progress transaction. Closing a session automatically closes its message producers and consumer, so there is no need to close them individually.

Throws:

JMSException if the JMS implementation fails to close a session because of an internal error.

commit

```
public void commit() throws JMSException
```

Commit all messages done in this transaction and release any locks currently held.

WebSphere MQ Event Broker note

This always throws a JMSException when you have a direct connection to WebSphere MQ Event Broker.

Throws:

- JMSException if JMS fails to commit the transaction because of an internal JMS error.
- TransactionRolledBackException if the transaction gets rolled back because of an internal error during commit.
- IllegalStateException if the method is not called by a transacted session.

createBrowser (JMS 1.1 only)

```
public QueueBrowser createBrowser(Queue queue) throws JMSException
```

Create a queue browser to browse the messages on the specified queue.

Parameters:

`queue`: the queue to access.

Throws:

- JMSException if the session fails to create a queue browser because of an internal JMS error.
- InvalidDestinationException if the destination is not valid.

createBrowser (JMS 1.1 only)

```
public QueueBrowser createBrowser(Queue queue,
                                  java.lang.String messageSelector)
                                  throws JMSException
```

Create a queue browser to browse the messages on the specified queue using a message selector.

Parameters:

- `queue`: the queue to access.
- `messageSelector`: deliver only those messages with properties that match the message selector expression. A value of null or an empty string indicates that there is no message selector for the message consumer.

Throws:

- JMSException if the session fails to create a queue browser because of an internal JMS error.
- InvalidDestinationException if the destination is not valid.
- InvalidSelectorException if the message selector is not valid.

createBytesMessage

```
public BytesMessage createBytesMessage()
                                throws JMSException
```

Create a BytesMessage. A BytesMessage is used to send a message containing a stream of uninterpreted bytes.

Throws:

JMSException if JMS fails to create this message because of an internal error.

createConsumer (JMS 1.1 only)

```
public MessageConsumer createConsumer(Destination destination)
                                      throws JMSException
```

Create a message consumer for the specified destination. Because Queue and Topic both inherit from Destination, they can be used in the destination parameter to create a message consumer.

A client uses a message consumer object to receive messages that are sent to a destination.

Parameters:

`destination`: the destination to access.

Throws:

- JMSException if the session fails to create a message consumer because of an internal JMS error.
- InvalidDestinationException if the destination is not valid.

createConsumer (JMS 1.1 only)

```
public MessageConsumer createConsumer(Destination destination,
                                      java.lang.String messageSelector)
                                      throws JMSException
```

Create a message consumer for the specified destination using a message selector. Because Queue and Topic both inherit from Destination, they can be used in the destination parameter to create a message consumer.

A client uses a message consumer object to receive messages that are sent to a destination.

Parameters:

- `destination`: the destination to access.
- `messageSelector`: deliver only those messages with properties that match the message selector expression. A value of null or an empty string indicates that there is no message selector for the message consumer.

Throws:

- JMSException if the session fails to create a message consumer because of an internal JMS error.
- InvalidDestinationException if the destination is not valid.
- InvalidSelectorException if the message selector is not valid.

createConsumer (JMS 1.1 only)

```
public MessageConsumer createConsumer(Destination destination,
                                      java.lang.String messageSelector,
                                      boolean NoLocal) throws JMSException
```

Create a message consumer for the specified destination using a message selector. Because Queue and Topic both inherit from Destination, they can be used in the destination parameter to create a message consumer. If the destination is a topic, you can use this method to specify whether the consumer can receive messages published by its own connection.

A client uses a message consumer to receive messages that are published to a destination.

A connection can publish and subscribe to the same topic. The NoLocal attribute of a consumer determines whether the consumer can receive messages published by its own connection. The default value of the attribute is `false`.

Parameters:

- `destination`: the destination to access.
- `messageSelector`: deliver only those messages with properties that match the message selector expression. A value of null or an empty string indicates that there is no message selector for the message consumer.
- `NoLocal`: if `true`, the consumer does not receive the messages published by its own connection. The action of this parameter is defined only if the destination is a topic, not a queue.

Throws:

- JMSException if the session fails to create a message consumer because of an internal JMS error.

- InvalidDestinationException if the destination is not valid.
- InvalidSelectorException if the message selector is not valid.

createDurableSubscriber (JMS 1.1 only)

```
public TopicSubscriber createDurableSubscriber(Topic topic,
                                                java.lang.String name)
                                                throws JMSException
```

Create a durable subscriber to the specified topic.

If a client needs to receive all the messages published on a topic, including the ones published while the subscriber is inactive, it uses a durable topic subscriber. The broker retains a record of this durable subscription and ensures that all messages from the publishers of the topic are retained until they are acknowledged by this durable subscriber or they expire.

Sessions with durable subscribers must always provide the same client identifier. In addition, each client must specify a name that uniquely identifies, within the client identifier, each durable subscription it creates. Only one session at a time can have a topic subscriber for a particular durable subscription.

A client can change an existing durable subscription by creating a durable topic subscriber with the same name, but with a new topic or message selector or both. Changing a durable subscriber is equivalent to unsubscribing the old one and creating a new one.

Parameters:

- `topic`: the topic to subscribe to. The topic must not be a temporary topic.
- `name`: the name used to identify the subscription.

Throws:

- JMSException if the session fails to create a subscriber because of an internal JMS error.
- InvalidDestinationException if the topic is not valid.

createDurableSubscriber (JMS 1.1 only)

```
public TopicSubscriber createDurableSubscriber
                                    (Topic topic,
                                     java.lang.String name,
                                     java.lang.String messageSelector,
                                     boolean noLocal) throws JMSException
```

Create a durable subscriber to the specified topic, using a message selector and specifying whether the subscriber can receive messages published by its own connection.

If a client needs to receive all the messages published on a topic, including the ones published while the subscriber is inactive, it uses a durable topic subscriber. The broker retains a record of this durable subscription and ensures that all messages from the publishers of the topic are retained until they are acknowledged by this durable subscriber or they expire.

Sessions with durable subscribers must always provide the same client identifier. In addition, each client must specify a name which uniquely identifies, within the client identifier, each durable subscription it creates.

Only one session at a time can have a topic subscriber for a particular durable subscription. An inactive durable subscriber is one that exists but does not currently have a message consumer associated with it.

A client can change an existing durable subscription by creating a durable topic subscriber with the same name, but with a new topic or message selector or both. Changing a durable subscriber is equivalent to unsubscribing the old one and creating a new one.

A connection can publish and subscribe to the same topic. The NoLocal attribute of a subscriber determines whether the subscriber can receive messages published by its own connection. The default value of the attribute is `false`.

Parameters:

- `topic`: the topic to subscribe to. The topic must not be a temporary topic.
- `name`: the name used to identify the subscription.
- `messageSelector`: deliver only those messages with properties that match the message selector expression. A value of null or an empty string indicates that there is no message selector for the message consumer.
- `noLocal`: if `true`, the subscriber does not receive the messages published by its own connection.

Throws:

- JMSException if the session fails to create a subscriber because of an internal JMS error.
- InvalidDestinationException if the topic is not valid.
- InvalidSelectorException if the message selector is not valid.

createMapMessage

```
public MapMessage createMapMessage() throws JMSException
```

Create a MapMessage. A MapMessage is used to send a self-defining set of name-value pairs, where names are strings, and values are Java primitive types.

Throws:

JMSException if JMS fails to create this message because of an internal error.

createMessage

```
public Message createMessage() throws JMSException
```

Create a message. The Message interface is the root interface of all JMS messages. It holds all the standard message header information. It can be sent when a message containing only header information is sufficient.

Throws:

JMSException if JMS fails to create this message because of an internal error.

createObjectMessage

```
public ObjectMessage createObjectMessage()
                                throws JMSException
```

Create an ObjectMessage. An ObjectMessage is used to send a message that contains a serializable Java object.

Throws:

JMSException if JMS fails to create this message because of an internal error.

createObjectMessage

```
public ObjectMessage createObjectMessage
                               (java.io.Serializable object)
                                throws JMSException
```

Create an initialized ObjectMessage. An ObjectMessage is used to send a message that contains a serializable Java object.

Parameters:

`object`: the object to use to initialize this message.

Throws:

JMSException if JMS fails to create this message because of an internal error.

createProducer (JMS 1.1 only)

```
public MessageProducer createProducer(Destination destination)
                                       throws JMSException
```

Create a message producer to send messages to the specified destination. Because Queue and Topic both inherit from Destination, they can be used in the destination parameter to create a message producer.

Parameters:

`destination`: the destination to send messages to, or null to create a message producer that does not have a specified destination.

Throws:

- JMSException if the session fails to create a message producer because of an internal JMS error.
- InvalidDestinationException if the destination is not valid.

createQueue (JMS 1.1 only)

```
public Queue createQueue(java.lang.String queueName) throws JMSException
```

Create a Queue object given a queue name. The queue name can be the name of a WebSphere MQ queue or it can be a queue URI. For information about URI format, see "Destinations" on page 239.

This method is provided for the rare cases where a client needs to work directly with a Queue object. The client can create the Queue object with a provider specific name. Clients that depend on this ability are not portable.

The method does not create the WebSphere MQ queue. Creating a WebSphere MQ queue is an administrative task and is not done through the JMS API. The one exception is creating a temporary queue, which is done using the createTemporaryQueue() method.

Parameters:

queueName: the name of the queue.

Returns:

A Queue object with the specified name.

Throws:

JMSException if the session fails to create a queue because of an internal JMS error.

createStreamMessage

```
public StreamMessage createStreamMessage()
                                  throws JMSException
```

Create a StreamMessage. A StreamMessage is used to send a self-defining stream of Java primitives.

Throws:

JMSException if JMS fails to create this message because of an internal error.

createTemporaryQueue (JMS 1.1 only)

```
public TemporaryQueue createTemporaryQueue() throws JMSException
```

Create a TemporaryQueue object. The temporary queue remains until the connection ends or the queue is explicitly deleted, whichever is the sooner.

Returns:

A TemporaryQueue object.

Throws:

JMSException if the session fails to create a temporary queue because of an internal JMS error.

createTemporaryTopic (JMS 1.1 only)

```
public TemporaryTopic createTemporaryTopic() throws JMSException
```

Create a TemporaryTopic object. The temporary topic remains until the connection ends or the topic is explicitly deleted, whichever is the sooner.

Returns:

A TemporaryTopic object.

Throws:

JMSException if the session fails to create a temporary topic because of an internal JMS error.

createTextMessage

```
public TextMessage createTextMessage() throws JMSException
```

Create a TextMessage. A TextMessage is used to send a message containing a string.

Throws:

JMSException if JMS fails to create this message because of an internal error.

createTextMessage

```
public TextMessage createTextMessage
                        (java.lang.String string)
                        throws JMSException
```

Create an initialized TextMessage. A TextMessage is used to send a message containing a string.

Parameters:

`string`: the string used to initialize this message.

Throws:

JMSException if JMS fails to create this message because of an internal error.

createTopic (JMS 1.1 only)

```
public Topic createTopic(java.lang.String topicName) throws JMSException
```

Create a Topic object given a topic name. The topic name can be the name of a broker topic or it can be a topic URI. For information about URI format, see "Destinations" on page 239.

This method is provided for the rare cases where a client needs to work directly with a Topic object. The client can create the Topic object with a provider specific name. Clients that depend on this ability are not portable.

This method does not create the broker topic. Creating a broker topic is an administrative task and is not done through the JMS API. The one exception is creating a temporary topic, which is done using the createTemporaryTopic() method.

Parameters:

`topicName`: the name of the topic.

Returns:

A Topic object with the specified name.

Throws:

JMSException if the session fails to create a topic because of an internal JMS error.

getAcknowledgeMode (JMS 1.1 only)

```
public int getAcknowledgeMode() throws JMSException
```

Return the acknowledgement mode for the session. The acknowledgement mode is specified when the session is created. A session that is transacted has no acknowledgement mode.

Returns:

The acknowledgement mode for the session, provided the session is not transacted. If the session is transacted, the method returns SESSION_TRANSACTED.

Throws:

JMSException if JMS fails to return the acknowledgment mode because of an internal JMS error.

See also:

Connection.createSession

getMessageListener

```
public MessageListener getMessageListener()
                                    throws JMSException
```

Return the session's distinguished message listener.

Returns:
The message listener associated with this session.

Throws:
JMSException if JMS fails to get the message listener because of an internal JMS error.

See also:
setMessageListener

getTransacted

```
public boolean getTransacted() throws JMSException
```

Whether the session is in transacted mode.

WebSphere MQ Event Broker note
This method always returns false when you have a direct connection to WebSphere MQ Event Broker.

Returns:
True if the session is in transacted mode.

Throws:
JMSException if JMS fails to return the transaction mode because of an internal error in JMS Provider.

recover

```
public void recover() throws JMSException
```

Stop the delivery of messages in this session, and restart the sending messages with the oldest unacknowledged message.

WebSphere MQ Event Broker note
This always throws a JMSException when you have a direct connection to WebSphere MQ Event Broker.

Throws:

- JMSException if JMS fails to stop the delivery of messages and restart the sending messages because of an internal JMS error.
- IllegalStateException if the method is called by a transacted session.

rollback

```
public void rollback() throws JMSException
```

Roll back any messages done in this transaction and release any locks currently held.

WebSphere MQ Event Broker note
This always throws a JMSException when you have a direct connection to WebSphere MQ Event Broker.

Throws:

- JMSException if JMS fails to roll back the transaction because of an internal JMS error.
- IllegalStateException if the method is not called by a transacted session.

run

```
public void run()
```

This method is intended for use only by application servers.

WebSphere MQ Event Broker note
This always throws an IllegalStateException when you have a direct connection to WebSphere MQ Event Broker.

Specified by:
`run` in the interface java.lang.Runnable

See also:
ServerSession

setMessageListener

```
public void setMessageListener(MessageListener listener)
                                            throws JMSException
```

Set the session's distinguished message listener. When it is set, no other form of message receipt in the session can be used. However, all forms of sending messages are still supported.

This is an expert facility that is not used by regular JMS clients.

Parameters:
`listener`: the message listener to associate with this session.

Throws:
JMSException if JMS fails to set the message listener because of an internal error in the JMS Provider.

See also:
getMessageListener

unsubscribe (JMS 1.1 only)

```
public void unsubscribe(java.lang.String name) throws JMSException
```

Unsubscribe a durable subscription that has been created by a client.

This method tells the broker that the durable subscription has ended and not to send any more messages to the subscriber.

It is not advisable for a client to delete a durable subscription while there is an active message consumer for the subscription, or while a consumed message is part of a pending transaction or has not been acknowledged in the session.

Note

For a direct connection to WebSphere MQ Event Broker, WebSphere Business Integration Event Broker, or WebSphere Business Integration Message Broker, this method throws a JMSException.

Parameters:

`name`: the name used to identify the subscription.

Throws:

- JMSException if the session fails to remove the durable subscription because of an internal JMS error.
- InvalidDestinationException if the subscription name is not valid.

StreamMessage

public interface **StreamMessage**
extends **Message**

WebSphere MQ class: **JMSStreamMessage**

```
java.lang.Object
   |
   +----com.ibm.jms.JMSMessage
           |
           +----com.ibm.jms.JMSStreamMessage
```

Use a StreamMessage to send a stream of Java primitives.

See also: **BytesMessage**, **MapMessage**, **Message**, **ObjectMessage** and **TextMessage**

Methods

readBoolean

```
public boolean readBoolean() throws JMSException
```

Read a boolean from the stream message.

Returns:
The boolean value read.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream is received.
- MessageFormatException if this type conversion is not valid.
- MessageNotReadableException if the message is in write-only mode.

readByte

```
public byte readByte() throws JMSException
```

Read a byte value from the stream message.

Returns:
The next byte from the stream message as an 8-bit byte.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream is received.
- MessageFormatException if this type conversion is not valid.
- MessageNotReadableException if the message is in write-only mode.

readBytes

```
public int readBytes(byte[] value)
             throws JMSExceptioneam message.
```

Read a byte array field from the stream message into the specified byte[] object (the read buffer). If the buffer size is less than, or equal to, the size of the data in the message field, an application must make further calls to this method to retrieve the remainder of the data. Once the first readBytes call on a byte[] field value has been done, the full value of the field must be read before it is valid to read the next field. An attempt to read the next field before that has been done throws a MessageFormatException.

Parameters:

`value`: the buffer into which the data is read.

Returns:

The total number of bytes read into the buffer, or -1 if there is no more data because the end of the byte field has been reached.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream is received.
- MessageFormatException if this type conversion is not valid.
- MessageNotReadableException if the message is in write-only mode.

readChar

```
public char readChar() throws JMSException
```

Read a Unicode character value from the stream message.

Returns:

A Unicode character from the stream message.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream is received.
- MessageFormatException if this type conversion is not valid.
- MessageNotReadableException if the message is in write-only mode.

readDouble

```
public double readDouble() throws JMSException
```

Read a double from the stream message.

Returns:

A double value from the stream message.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream is received.
- MessageFormatException if this type conversion is not valid.

- MessageNotReadableException if the message is in write-only mode.

readFloat

```
public float readFloat() throws JMSException
```

Read a float from the stream message.

Returns:

A float value from the stream message.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream
- MessageFormatException if this type conversion is not valid.
- MessageNotReadableException if the message is in write-only mode.

readInt

```
public int readInt() throws JMSException
```

Read a 32-bit integer from the stream message.

Returns:

A 32-bit integer value from the stream message, interpreted as an int.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream is received.
- MessageFormatException if this type conversion is not valid.
- MessageNotReadableException if the message is in write-only mode.

readLong

```
public long readLong() throws JMSException
```

Read a 64-bit integer from the stream message.

Returns:

A 64-bit integer value from the stream message, interpreted as a long.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream
- MessageFormatException if this type conversion is not valid.
- MessageNotReadableException if the message is in write-only mode.

readObject

```
public java.lang.Object readObject() throws JMSException
```

Read a Java object from the stream message.

Returns:

A Java object from the stream message in object format (for example, if it was set as an int, an integer is returned).

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream is received.
- NotReadableException if the message is in write-only mode.

readShort

```
public short readShort() throws JMSException
```

Read a 16-bit number from the stream message.

Returns:

A 16-bit number from the stream message.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream is received.
- MessageFormatException if this type conversion is not valid.
- MessageNotReadableException if the message is in write-only mode.

readString

```
public java.lang.String readString() throws JMSException
```

Read in a string from the stream message.

Returns:

A Unicode string from the stream message.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageEOFException if an end of message stream is received.
- MessageFormatException if this type conversion is not valid.
- MessageNotReadableException if the message is in write-only mode

reset

```
public void reset() throws JMSException
```

Put the message in read-only mode, and reposition the stream to the beginning.

Throws:

- JMSException if JMS fails to reset the message because of an internal JMS error.
- MessageFormatException if the message has an non valid format.

writeBoolean

```
public void writeBoolean(boolean value) throws JMSException
```

Write a boolean to the stream message.

Parameters:

`value`: the boolean value to be written.

Throws:

- JMSException if JMS fails to read the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

writeByte

```
public void writeByte(byte value) throws JMSException
```

Write a byte to the stream message.

Parameters:

`value`: the byte value to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

writeBytes

```
public void writeBytes(byte[] value) throws JMSException
```

Write a byte array to the stream message.

Parameters:

`value`: the byte array to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

writeBytes

```
public void writeBytes(byte[] value,
                       int offset,
                       int length) throws JMSException
```

Write a portion of a byte array to the stream message.

Parameters:

- `value`: the byte array value to be written.
- `offset`: the initial offset within the byte array.
- `length`: the number of bytes to use.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

writeChar

```
public void writeChar(char value) throws JMSException
```

Write a character to the stream message.

Parameters:

`value`: the character value to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

writeDouble

```
public void writeDouble(double value) throws JMSException
```

Write a double to the stream message.

Parameters:

`value`: the double value to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

writeFloat

```
public void writeFloat(float value) throws JMSException
```

Write a float to the stream message.

Parameters:

`value`: the float value to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.

- MessageNotWriteableException if the message is in read-only mode.

writeInt

```
public void writeInt(int value) throws JMSException
```

Write an integer to the stream message.

Parameters:

value: the integer to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

writeLong

```
public void writeLong(long value) throws JMSException
```

Write a long to the stream message.

Parameters:

value: the long to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

writeObject

```
public void writeObject(java.lang.Object value)
                                        throws JMSException
```

Write a Java object to the stream message. This method works only for object primitive types (for example, Integer, Double, Long), strings, and byte arrays.

Parameters:

value: the Java object to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.
- MessageFormatException if the object is not valid.

writeShort

```
public void writeShort(short value) throws JMSException
```

Write a short to the stream message.

Parameters:

value: the short to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

writeString

```
public void writeString(java.lang.String value)
                                          throws JMSException
```

Write a string to the stream message.

Parameters:

value: the string value to be written.

Throws:

- JMSException if JMS fails to write the message because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

TemporaryQueue

public interface **TemporaryQueue**
extends **Queue**

WebSphere MQ class: **MQTemporaryQueue**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQDestination
           |
           +----com.ibm.mq.jms.MQQueue
                   |
                   +----com.ibm.mq.jms.MQTemporaryQueue
```

A TemporaryQueue is a unique queue object that is created for the duration of a QueueConnection.

Methods

delete

```
public void delete() throws JMSException
```

Delete this temporary queue. If there are still existing senders or receivers using it, a JMSException is thrown.

Throws:

JMSException if JMS implementation fails to delete a TemporaryQueue because of an internal error.

TemporaryTopic

public interface **TemporaryTopic**
extends **Topic**

WebSphere MQ class: **MQTemporaryTopic**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQDestination
           |
           +----com.ibm.mq.jms.MQTopic
                   |
                   +----com.ibm.mq.jms.MQTemporaryTopic
```

A TemporaryTopic is a unique topic object created for the duration of a TopicConnection and can be consumed only by consumers of that connection.

WebSphere MQ constructor

MQTemporaryTopic

```
MQTemporaryTopic() throws JMSException
```

Methods

delete

```
public void delete() throws JMSException
```

Delete this temporary topic. If there are still existing publishers or subscribers using it, a JMSException is thrown.

Throws:

JMSException if JMS implementation fails to delete a TemporaryTopic because of an internal error.

TextMessage

public interface **TextMessage**
extends **Message**

WebSphere MQ class: **JMSTextMessage**

```
java.lang.Object
   |
   +----com.ibm.jms.JMSMessage
           |
           +----com.ibm.jms.JMSTextMessage
```

Use TextMessage to send a message containing a java.lang.String. It inherits from Message and adds a text message body.

See also: **BytesMessage**, **MapMessage**, **Message**, **ObjectMessage** and **StreamMessage**

Methods

getText

```
public java.lang.String getText() throws JMSException
```

Get the string containing this message's data. The default value is null.

Returns:
The string containing the message's data.

Throws:
JMSException if JMS fails to get the text because of an internal JMS error.

setText

```
public void setText(java.lang.String string)
                                        throws JMSException
```

Set the string containing this message's data.

Parameters:
`string`: the string containing the message's data.

Throws:

- JMSException if JMS fails to set text because of an internal JMS error.
- MessageNotWriteableException if the message is in read-only mode.

Topic

public interface **Topic**
extends **Destination**
Subinterfaces: **TemporaryTopic**

WebSphere MQ class: **MQTopic**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQDestination
           |
           +----com.ibm.mq.jms.MQTopic
```

A Topic object encapsulates a provider-specific topic name. It is the way that a client specifies the identity of a topic to JMS methods.

WebSphere MQ Event Broker note
For direct connections to WebSphere MQ Event Broker, properties accessed by methods marked with a § are ignored.

See also: **Destination**

WebSphere MQ constructor

MQTopic

```
public MQTopic()
public MQTopic(string URItopic)
```

See **TopicSession.createTopic**.

Methods

getBaseTopicName *

```
public String getBaseTopicName()
```

Get method for the underlying WebSphere MQ topic name.

getBrokerCCDurSubQueue * §

```
public String getBrokerCCDurSubQueue()
```

Get method for brokerCCDurSubQueue attribute.

Returns:
The name of the durable subscription queue (the brokerCCDurSubQueue) to use for a ConnectionConsumer.

getBrokerDurSubQueue * §

```
public String getBrokerDurSubQueue()
```

Get method for brokerDurSubQueue attribute.

Returns:
The name of the durable subscription queue (the brokerDurSubQueue) to use.

getBrokerVersion *

```
public int getBrokerVersion()
```

Get method for brokerVersion attribute.

Returns:
The broker's version number

getMulticast *

```
public int getMulticast()
```

Get method for the multicast attribute.

Returns:
An integer representing the current multicast setting.

See also:
setMulticast()

getReference *

```
public Reference getReference()
```

Create a reference for this topic.

Returns:
A reference for this object.

Throws:
NamingException.

getTopicName

```
public java.lang.String getTopicName() throws JMSException
```

Get the name of this topic in URI format. (URI format is described in "Creating topics at runtime" on page 223. For information specific to JMS 1.1, see "Destinations" on page 239.)

Note: Clients that depend upon the name are not portable.

Returns:
The topic name.

Throws:
JMSException if JMS implementation for topic fails to return the topic name because of an internal error.

setBaseTopicName *

```
public void setBaseTopicName(String x)
```

Set method for the underlying WebSphere MQ topic name.

setBrokerCCDurSubQueue * §

```
public void setBrokerCCDurSubQueue(String x) throws JMSException
```

Set method for brokerCCDurSubQueue attribute.

Parameters:

brokerCCDurSubQueue: the name of the durable subscription queue to use for a ConnectionConsumer.

setBrokerDurSubQueue * §

```
public void setBrokerDurSubQueue(String x) throws JMSException
```

Set method for brokerDurSubQueue attribute.

Parameters:

brokerDurSubQueue: the name of the durable subscription queue to use.

setBrokerVersion *

```
public void setBrokerVersion(int x) throws JMSException
```

Set method for brokerVersion attribute.

Parameters:

An integer representing one of the valid broker version number values. These are represented by the constants:

```
JMSC.MQJMS_BROKER_V1
JMSC.MQJMS_BROKER_V2
```

setMulticast *

```
public void setMulticast(int x) throws JMSException
```

Set method for the multicast attribute.

Parameters:

x: an integer specifying a multicast setting. The following are symbolic constants that represent the valid values of the parameter:

- JMSC.MQJMS_MULTICAST_AS_CF
- JMSC.MQJMS_MULTICAST_DISABLED
- JMSC.MQJMS_MULTICAST_NOT_RELIABLE
- JMSC.MQJMS_MULTICAST_RELIABLE
- JMSC.MQJMS_MULTICAST_ENABLED

Throws:

JMSException if the parameter does not represent a valid multicast setting.

toString

```
public String toString()
```

Return a well-formatted printed version of the topic name.

Returns:

The provider-specific identity values for this topic.

Overrides:

toString in class Object.

TopicConnection

public interface **TopicConnection**
extends **Connection**
Subinterfaces: **XATopicConnection**

WebSphere MQ class: **MQTopicConnection**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQConnection
           |
           +----com.ibm.mq.jms.MQTopicConnection
```

A TopicConnection is an active connection to a JMS publish/subscribe provider.

See also: **Connection**, **TopicConnectionFactory**, and **XATopicConnection**

Methods

createConnectionConsumer

```
public ConnectionConsumer createConnectionConsumer
                              (Topic topic,
                               java.lang.String messageSelector,
                               ServerSessionPool sessionPool,
                               int maxMessages)
                                        throws JMSException
```

Create a connection consumer for this connection. This is an expert facility that is not used by regular JMS clients.

WebSphere MQ Event Broker note
For a direct connection to WebSphere MQ Event Broker, this method throws a JMSException.

Parameters:

- `topic`: the topic to access.
- `messageSelector`: only deliver messages with properties that match the message selector expression.
- `sessionPool`: the server session pool to associate with this connection consumer.
- `maxMessages`: the maximum number of messages that can be assigned to a server session at one time.

Returns:
The connection consumer.

Throws:

- JMSException if the JMS Connection fails to create a connection consumer because of an internal error, or because of incorrect arguments for sessionPool.
- InvalidDestinationException if the topic is not valid.
- InvalidSelectorException if the message selector is not valid.

See also:
ConnectionConsumer

createDurableConnectionConsumer

```
public ConnectionConsumer createDurableConnectionConsumer
                                (Topic topic,
                                 java.lang.String subscriptionName
                                 java.lang.String messageSelector,
                                 ServerSessionPool sessionPool,
                                 int maxMessages)
                                         throws JMSException
```

Create a durable connection consumer for this connection. This is an expert facility that is not used by regular JMS clients.

WebSphere MQ Event Broker note

For a direct connection to WebSphere MQ Event Broker, this method throws a JMSException.

Parameters:

- `topic`: the topic to access.
- `subscriptionName`: the name of the durable subscription.
- `messageSelector`: deliver only messages with properties that match the message selector expression.
- `sessionPool`: the server session pool to associate with this durable connection consumer.
- `maxMessages`: the maximum number of messages that can be assigned to a server session at one time.

Returns:

The durable connection consumer.

Throws:

- JMSException if the JMS Connection fails to create a connection consumer because of an internal error, or because of incorrect arguments for sessionPool and messageSelector.
- InvalidDestinationException if the topic is not valid.
- InvalidSelectorException if the message selector is not valid.

See also:

ConnectionConsumer

createTopicSession

```
public TopicSession createTopicSession(boolean transacted,
                                       int acknowledgeMode)
                                       throws JMSException
```

Create a TopicSession.

WebSphere MQ Event Broker note

For a direct connection to WebSphere MQ Event Broker, if transacted is true, this method throws a JMSException.

Parameters:

- `transacted`: if true, the session is transacted.
- `acknowledgeMode`: one of:
  Session.AUTO_ACKNOWLEDGE

Session.CLIENT_ACKNOWLEDGE
Session.DUPS_OK_ACKNOWLEDGE

Indicates whether the consumer or the client acknowledge any messages that they receive. This parameter is ignored if the session is transacted.

Returns:

A newly-created topic session.

Throws:

JMSException if JMS Connection fails to create a session because of an internal error, or a lack of support for the specific transaction and acknowledgement mode.

TopicConnectionFactory

public interface **TopicConnectionFactory**
extends **ConnectionFactory**
Subinterfaces: **XATopicConnectionFactory**

WebSphere MQ class: **MQTopicConnectionFactory**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQConnectionFactory
           |
           +----com.ibm.mq.jms.MQTopicConnectionFactory
```

A client uses a TopicConnectionFactory to create TopicConnections with a JMS publish/subscribe provider.

Note

For direct connections to WebSphere MQ Event Broker, WebSphere Business Integration Event Broker, or WebSphere Business Integration Message Broker, properties accessed by methods marked with a § are ignored.

See also: **ConnectionFactory** and **XATopicConnectionFactory**

WebSphere MQ constructor

MQTopicConnectionFactory

```
public MQTopicConnectionFactory()
```

Methods

createTopicConnection

```
public TopicConnection createTopicConnection()
                                        throws JMSException
```

Create a topic connection with default user identity. The connection is created in stopped mode. No messages are delivered until Connection.start method is explicitly called.

Returns:

A newly-created topic connection.

Throws:

- JMSException if JMS Provider fails to create a Topic Connection because of an internal error.
- JMSSecurityException if client authentication fails because of a non valid user name or password.

createTopicConnection

```
public TopicConnection createTopicConnection
                                        (java.lang.String userName,
                                        java.lang.String password)
                                        throws JMSException
```

Create a topic connection with specified user identity. The connection is created in stopped mode. No messages are delivered until Connection.start method is explicitly called.

Parameters:

- `userName`: the caller's user name.
- `password`: the caller's password.

Returns:

A newly-created topic connection.

Throws:

- JMSException if JMS Provider fails to create a Topic Connection because of an internal error.
- JMSSecurityException if client authentication fails because of a non valid user name or password.

Note: This method is valid only for transport type IBM_JMS_TP_CLIENT_MQ_TCPIP. See ConnectionFactory.

getBrokerCCSubQueue * §

```
public String getBrokerCCSubQueue()
```

Get method for brokerCCSubQueue attribute.

Returns:

The name of the nondurable subscription queue to use for a connection consumer.

getBrokerControlQueue * §

```
public String getBrokerControlQueue()
```

Get method for brokerControlQueue attribute.

Returns:

The broker's control queue name

getBrokerPubQueue * §

```
public String getBrokerPubQueue()
```

Get method for brokerPubQueue attribute.

Returns:

The broker's publish queue name.

getBrokerQueueManager * §

```
public String getBrokerQueueManager()
```

Get method for brokerQueueManager attribute.

Returns:
The broker's queue manager name.

getBrokerSubQueue * §

```
public String getBrokerSubQueue()
```

Get method for brokerSubQueue attribute.

Returns:
The name of the nondurable subscription queue to use.

getBrokerVersion *

```
public int getBrokerVersion()
```

Get method for brokerVersion attribute.

Returns:
The broker's version number

getCleanupInterval * §

```
public long getCleanupInterval()
```

Get method for cleanupInterval attribute.

Returns:
How often the cleanup utility runs, in milliseconds

getCleanupLevel * §

```
public int getCleanupLevel()
```

Get method for cleanupLevel attribute.

Returns:
The value of cleanupLevel

getDirectAuth *

```
public int getDirectAuth()
```

Get method for the direct authentication attribute.

Returns:
The value of the direct authentication attribute

See also:
setDirectAuth()

getMessageSelection * §

```
public int getMessageSelection()
```

Get method for the message selection attribute.

Returns:
The value of the message selection attribute

See also:
setMessageSelection()

getMulticast *

```
public int getMulticast()
```

Get method for the multicast attribute.

Returns:
An integer representing the current multicast setting.

See also:
setMulticast()

getProxyHostName *

```
public String getProxyHostName()
```

Get method for the proxy host name attribute.

Returns:
The host name of the proxy server when establishing a direct connection, or `null` if no proxy server is used.

getProxyPort *

```
public int getProxyPort()
```

Get method for the proxy port attribute.

Returns:
The port number to connect to on the proxy server.

getPubAckInterval * §

```
public int getPubAckInterval()
```

Get method for pubAckInterval attribute.

Returns:
The interval, in number of messages, between publish requests that require acknowledgement from the broker.

getReference *

```
public Reference getReference()
```

Return a reference for this topic connection factory.

Returns:
A reference for this topic connection factory.

Throws:
NamingException.

getSparseSubscriptions *

```
public boolean getSparseSubscriptions()
```

Get method for the sparse subscriptions attribute.

Returns:
The value of the sparse subscriptions attribute

See also:
setSparseSubscriptions()

getStatusRefreshInterval * §

```
public int getStatusRefreshInterval()
```

Get method for statusRefreshInterval attribute.

Returns:
The number of milliseconds between transactions to refresh publish/subscribe status.

getSubscriptionStore * §

```
public int getSubscriptionStore()
```

Get method for the SUBSTORE property.

Returns:
An integer representing the current SUBSTORE property.

setBrokerCCSubQueue * §

```
public void setBrokerCCSubQueue(String x) throws JMSException
```

Set method for brokerCCSubQueue attribute.

Parameters:
`brokerSubQueue`: the name of the nondurable subscription queue to use for a connection consumer.

setBrokerControlQueue * §

```
public void setBrokerControlQueue(String x) throws JMSException
```

Set method for brokerControlQueue attribute.

Parameters:
`brokerControlQueue`: the name of the broker control queue.

setBrokerPubQueue * §

```
public void setBrokerPubQueue(String x) throws JMSException
```

Set method for brokerPubQueue attribute.

Parameters:
`brokerPubQueue`: the name of the broker publish queue.

setBrokerQueueManager * §

```
public void setBrokerQueueManager(String x) throws JMSException
```

Set method for brokerQueueManager attribute.

Parameters:

`brokerQueueManager`: the name of the broker's queue manager.

setBrokerSubQueue * §

```
public void setBrokerSubQueue(String x) throws JMSException
```

Set method for brokerSubQueue attribute.

Parameters:

`brokerSubQueue`: the name of the nondurable subscription queue to use.

setBrokerVersion *

```
public void setBrokerVersion(int x) throws JMSException
```

Set method for brokerVersion attribute.

Parameters:

An integer representing one of the valid broker version number values. These are represented by the constants:
JMSC.MQJMS_BROKER_V1
JMSC.MQJMS_BROKER_V2

setCleanupInterval * §

```
public void setCleanupInterval(long x) throws JMSException
```

Set method for cleanupInterval attribute.

Parameters:

How often the cleanup utility runs, in milliseconds

setCleanupLevel * §

```
public void setCleanupLevel(int x) throws JMSException
```

Set method for cleanupLevel attribute.

Parameters:

An integer representing one of the valid cleanup levels. These are represented by the constants:
JMSC.MQJMS_CLEANUP_NONE
JMSC.MQJMS_CLEANUP_SAFE
JMSC.MQJMS_CLEANUP_STRONG
JMSC.MQJMS_CLEANUP_AS_PROPERTY

setDirectAuth *

```
public void setDirectAuth(int x) throws JMSException
```

Set method for the direct authentication attribute.

Parameters:

x: an integer specifying the type of direct authentication that is required. The following are symbolic constants that represent the valid values of the parameter:

JMSC.MQJMS_DIRECTAUTH_BASIC
JMSC.MQJMS_DIRECTAUTH_CERTIFICATE

setMessageSelection * §

```
public void setMessageSelection(int x)
```

Set method for the message selection attribute.

Parameters:

x: an integer indicating whether the client or the broker performs message selection. The following are symbolic constants that represent the valid values of the parameter:

JMSC.MQJMS_MSEL_CLIENT
JMSC.MQJMS_MSEL_BROKER

setMulticast *

```
public void setMulticast(int x) throws JMSException
```

Set method for the multicast attribute.

Parameters:

x: an integer specifying a multicast setting. The following are symbolic constants that represent the valid values of the parameter:

JMSC.MQJMS_MULTICAST_DISABLED
JMSC.MQJMS_MULTICAST_NOT_RELIABLE
JMSC.MQJMS_MULTICAST_RELIABLE
JMSC.MQJMS_MULTICAST_ENABLED

setProxyHostName *

```
public void setProxyHostName(String proxyHostName) throws JMSException
```

Set method for the proxy host name attribute.

Parameters:

proxyHostName: the host name of the proxy server when establishing a direct connection, or `null` if no proxy server is used.

setProxyPort *

```
public void setProxyPort(int proxyPort) throws JMSException
```

Set method for the proxy port attribute.

Parameters:

proxyPort: the port number to connect to on the proxy server.

setPubAckInterval * §

```
public void setPubAckInterval(int x)
```

Set method for pubAckInterval attribute. The number of messages to publish between requiring acknowledgement from the broker. The default is 25. Applications do not normally alter this value, and must not rely on this acknowledgement.

Parameters:

`pubAckInterval`: the number of messages to use as an interval.

setSparseSubscriptions *

```
public void setSparseSubscriptions(boolean x)
```

Set method for the sparse subscriptions attribute. A sparse subscription is one that receives infrequent matching messages. The default value of this attribute is `false`. A value of `true` might be required if an application using sparse subscriptions fails to receive messages because of log overflow. If you set the attribute to `true`, the application must be able to open the subscriber queue for browsing messages.

Parameters:

`x`: indicates whether sparse subscriptions are selected.

setStatusRefreshInterval * §

```
public void setStatusRefreshInterval(int x)
```

Set method for statusRefreshInterval attribute.

Parameters:

`statusRefreshInterval`: the number of milliseconds between transactions to refresh publish/subscribe status.

setSubscriptionStore * §

```
public void setSubscriptionStore(int x) throws JMSException
```

Set method for the SUBSTORE property.

Parameters:

`SubStoretype`: an integer representing one of the valid values of the SUBSTORE property. The following symbolic constants represent the valid values:

JMSC.MQJMS_SUBSTORE_QUEUE
JMSC.MQJMS_SUBSTORE_BROKER
JMSC.MQJMS_SUBSTORE_MIGRATE

TopicPublisher

public interface **TopicPublisher**
extends **MessageProducer**

WebSphere MQ class: **MQTopicPublisher**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQMessageProducer
           |
           +----com.ibm.mq.jms.MQTopicPublisher
```

A client uses a TopicPublisher for publishing messages on a topic. TopicPublisher is the publish/subscribe variant of a JMS message producer.

Methods

close *

```
public void close() throws JMSException
```

Because a provider can allocate some resources outside the JVM on behalf of a TopicPublisher, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough.

Throws:
JMSException if JMS fails to close the producer because of an error.

Overrides:
close in class MQMessageProducer.

getTopic

```
public Topic getTopic() throws JMSException
```

Get the topic associated with this publisher.

Returns:
This publisher's topic

Throws:
JMSException if JMS fails to get the topic for this topic publisher because of an internal error.

publish

```
public void publish(Message message) throws JMSException
```

Publish a message to the topic. Use the topic's default delivery mode, time-to-live, and priority.

Parameters:
`message`: the message to publish

Throws:

- JMSException if JMS fails to publish the message because of an internal error.
- MessageFormatException if a non valid message is specified.
- InvalidDestinationException if a client uses this method with a Topic Publisher with a non valid topic.

publish

```
public void publish(Message message,
                    int deliveryMode,
                    int priority,
                    long timeToLive) throws JMSException
```

Publish a message to the topic specifying delivery mode, priority, and time-to-live to the topic.

WebSphere MQ Event Broker note

If deliveryMode is PERSISTENT or timeToLive is greater than 0, this method throws a JMSException when you have a direct connection to WebSphere MQ Event Broker.

Parameters:

- `message`: the message to publish.
- `deliveryMode`: the delivery mode to use.
- `priority`: the priority for this message.
- `timeToLive`: the message's lifetime (in milliseconds).

Throws:

- JMSException if JMS fails to publish the message because of an internal error.
- MessageFormatException if a non valid message is specified.
- InvalidDestinationException if a client uses this method with a Topic Publisher with a non valid topic.

publish

```
public void publish(Topic topic,
                    Message message) throws JMSException
```

Publish a message to a topic for an unidentified message producer. Use the topic's default delivery mode, time-to-live, and priority.

Parameters:

- `topic`: the topic to publish this message to.
- `message`: the message to send.

Throws:

- JMSException if JMS fails to publish the message because of an internal error.
- MessageFormatException if a non valid message is specified.
- InvalidDestinationException if a client uses this method with a non valid topic.

publish

```
public void publish(Topic topic,
                    Message message,
                    int deliveryMode,
                    int priority,
                    long timeToLive) throws JMSException
```

Publish a mssage to a topic for an unidentified message producer, specifying delivery mode, priority, and time-to-live.

WebSphere MQ Event Broker note

If deliveryMode is PERSISTENT or timeToLive is greater than 0, this method throws a JMSException when you have a direct connection to WebSphere MQ Event Broker.

Parameters:

- `topic`: the topic to publish this message to.
- `message`: the message to send.
- `deliveryMode`: the delivery mode to use.
- `priority`: the priority for this message.
- `timeToLive`: the message's lifetime (in milliseconds).

Throws:

- JMSException if JMS fails to publish the message because of an internal error.
- MessageFormatException if a non valid message is specified.
- InvalidDestinationException if a client uses this method with a non valid topic.

TopicRequestor

public class **TopicRequestor**
extends **java.lang.Object**

```
java.lang.Object
    |
    +----javax.jms.TopicRequestor
```

JMS provides this TopicRequestor class to assist with making service requests.

The TopicRequestor constructor is given a non-transacted TopicSession and a destination Topic. It creates a TemporaryTopic for the responses, and provides a request() method that sends the request message and waits for its reply. Users are free to create more sophisticated versions.

Constructors

TopicRequestor

```
public TopicRequestor(TopicSession session,
                      Topic topic) throws JMSException
```

Constructor for the TopicRequestor class. This implementation assumes that the session parameter is non-transacted, and either AUTO_ACKNOWLEDGE or DUPS_OK_ACKNOWLEDGE.

Parameters:

- `session`: the topic session the topic belongs to.
- `topic`: the topic to perform the request/reply call on.

Throws:
JMSException if a JMS error occurs.

Methods

close

```
public void close() throws JMSException
```

Because a provider can allocate some resources outside the JVM on behalf of a TopicRequestor, clients must close them when they are not needed. You cannot rely on garbage collection to reclaim these resources eventually, because this might not occur soon enough.

Note: This method closes the session object passed to the TopicRequestor constructor.

Throws:
JMSException if a JMS error occurs.

request

```
public Message request(Message message) throws JMSException
```

Send a request and wait for a reply.

Parameters:
`message`: the message to send.

Returns:
The reply message.

Throws:
JMSException if a JMS error occurs.

TopicSession

public interface **TopicSession**
extends **Session**

WebSphere MQ class: **MQTopicSession**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQSession
           |
           +----com.ibm.mq.jms.MQTopicSession
```

A TopicSession provides methods for creating TopicPublishers, TopicSubscribers, and TemporaryTopics.

See also: **Session**

WebSphere MQ constructor

MQTopicSession

```
public MQTopicSession(boolean transacted,
                      int acknowledgeMode) throws JMSException
```

See **TopicConnection.createTopicSession**.

Methods

createDurableSubscriber

```
public TopicSubscriber createDurableSubscriber
                           (Topic topic,
                            java.lang.String name) throws JMSException
```

Create a durable subscriber to the specified topic.

WebSphere MQ Event Broker note
This method throws a JMSException when you have a direct connection to WebSphere MQ Event Broker.

Parameters:

- `topic`: the topic to subscribe to.
- `name`: the name used to identify this subscription.

Throws:

- JMSException if a session fails to create a subscriber because of a JMS error.
- InvalidDestinationException if the topic specified is not valid.

See **TopicSession.unsubscribe**

createDurableSubscriber

```
public TopicSubscriber createDurableSubscriber
                                    (Topic topic,
                                     java.lang.String name,
                                     java.lang.String messageSelector,
                                     boolean noLocal)  throws JMSException
```

Create a durable subscriber to the specified topic. A client can change an existing durable subscription by creating a durable subscriber with the same name and a new topic or message selector or both.

WebSphere MQ Event Broker note
This method throws a JMSException when you have a direct connection to WebSphere MQ Event Broker.

Parameters:

- `topic`: the topic to subscribe to.
- `name`: the name used to identify this subscription.
- `messageSelector`: deliver only messages with properties that match the message selector expression. This value can be null.
- `noLocal`: if set, inhibits the delivery of messages published by its own connection.

Throws:

- JMSException if a session fails to create a subscriber because of a JMS error or non valid selector.
- InvalidDestinationException if the topic specified is not valid.
- InvalidSelectorException if the message selector is not valid.

createPublisher

```
public TopicPublisher createPublisher(Topic topic)
                                    throws JMSException
```

Create a publisher for the specified topic.

Parameters:

`topic`: the topic to publish to, or null if this is an unidentified producer.

Throws:

- JMSException if a session fails to create a publisher because of a JMS error.
- InvalidDestinationException if the topic specified is not valid.

createSubscriber

```
public TopicSubscriber createSubscriber(Topic topic)
                                        throws JMSException
```

Create a non-durable subscriber to the specified topic.

Parameters:

`topic`: the topic to subscribe to

Throws:

- JMSException - if a session fails to create a subscriber because of a JMS error.

- InvalidDestinationException if the topic specified is not valid.

createSubscriber

```
public TopicSubscriber createSubscriber
                            (Topic topic,
                             java.lang.String messageSelector,
                             boolean noLocal) throws JMSException
```

Create a non-durable subscriber to the specified topic.

Parameters:

- `topic`: the topic to subscribe to.
- `messageSelector`: deliver only messages with properties that match the message selector expression. This value can be null.
- `noLocal`: if set, inhibits the delivery of messages published by its own connection.

Throws:

- JMSException if a session fails to create a subscriber because of a JMS error or non valid selector.
- InvalidDestinationException if the topic specified is not valid.
- InvalidSelectorException if the message selector is not valid.

createTemporaryTopic

```
public TemporaryTopic createTemporaryTopic()
                                     throws JMSException
```

Create a temporary topic. Its lifetime is that of the TopicConnection unless deleted earlier.

Returns:

A temporary topic.

Throws:

JMSException if a session fails to create a temporary topic because of a JMS error.

createTopic

```
public Topic createTopic(java.lang.String topicName)
                                              throws JMSException
```

Create a topic given a URI format topic name. (URI format is described in "Creating topics at runtime" on page 223. For information specific to JMS 1.1, see "Destinations" on page 239.) This allows you to create a topic with a provider-specific name.

Note: Clients that depend on this ability are not portable.

Parameters:

`topicName`: the name of this topic.

Returns:

A topic with the given name.

Throws:

JMSException if a session fails to create a topic because of a JMS error.

unsubscribe

```
public void unsubscribe(java.lang.String name)
                                        throws JMSException
```

Unsubscribe a durable subscription that has been created by a client.

WebSphere MQ Event Broker note
This method throws a JMSException when you have a direct connection to WebSphere MQ Event Broker.

Note: Do not use this method while an active subscription exists. You must close() your subscriber first.

Parameters:
name: the name used to identify this subscription.

Throws:

- JMSException if JMS fails to unsubscribe the durable subscription because of a JMS error.
- InvalidDestinationException if the subscription name specified is not valid.

TopicSubscriber

public interface **TopicSubscriber**
extends **MessageConsumer**

WebSphere MQ class: **MQTopicSubscriber**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQMessageConsumer
           |
           +----com.ibm.mq.jms.MQTopicSubscriber
```

A client uses a TopicSubscriber to receive messages that have been published to a topic. TopicSubscriber is the publish/subscribe variant of a JMS message consumer.

See also: **MessageConsumer** and **TopicSession.createSubscriber**

MQTopicSubscriber inherits the following methods from MQMessageConsumer:
close
getMessageListener
receive
receiveNoWait
setMessageListener

Methods

getNoLocal

```
public boolean getNoLocal() throws JMSException
```

Get the NoLocal attribute for this TopicSubscriber. The default value for this attribute is false.

Returns:
Set to true if locally-published messages are being inhibited.

Throws:
JMSException if JMS fails to get NoLocal attribute for this topic subscriber because of an internal error.

getTopic

```
public Topic getTopic() throws JMSException
```

Get the topic associated with this subscriber.

Returns:
This subscriber's topic.

Throws:
JMSException if JMS fails to get topic for this topic subscriber because of an internal error.

XAConnection

public interface **XAConnection**
extends **Connection**
Subinterfaces: **XAQueueConnection** and **XATopicConnection**

WebSphere MQ class: **MQXAConnection**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQXAConnection
```

WebSphere MQ JMS exposes its JTS support in the XAConnectionFactory, XAConnection, and XASession classes. These classes are provided for use in a J2EE application server environment.

WebSphere Application Server Version 5 uses these classes to create and manage a pool of XAConnection and XASession objects. A JMS application does not need to use these classes directly if it is running in this environment.

A JMS application might need to use the XAConnection class only if it is running in a WebSphere Application Server environment with a version of WebSphere Application Server before Version 5. For more details, see Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475.

See also: **XAQueueConnection** and **XATopicConnection**

Methods

createSession (JMS 1.1 only)

```
public Session createSession(boolean transacted,
                             int acknowledgeMode) throws JMSException
```

Create a session.

Specified by:
createSession in the Connection interface.

Parameters:

- `transacted`: usage is undefined.
- `acknowledgeMode`: usage is undefined.

Returns:
A newly created session.

Throws:
JMSException if the XA connection fails to create a session because of an internal JMS error.

createXASession (JMS 1.1 only)

```
public XASession createXASession() throws JMSException
```

Create an XA session.

Returns:

A newly created XA session.

Throws:

JMSException if the XA connection fails to create an XA session because of an internal JMS error.

XAConnectionFactory

public interface **XAConnectionFactory**
Subinterfaces: **XAQueueConnectionFactory** and **XATopicConnectionFactory**

WebSphere MQ class: **MQXAConnectionFactory**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQXAConnectionFactory
```

WebSphere MQ JMS exposes its JTS support in the XAConnectionFactory, XAConnection, and XASession classes. These classes are provided for use in a J2EE application server environment.

WebSphere Application Server Version 5 uses these classes to create and manage a pool of XAConnection and XASession objects. A JMS application does not need to use these classes directly if it is running in this environment.

A JMS application might need to use the XAConnectionFactory class only if it is running in a WebSphere Application Server environment with a version of WebSphere Application Server before Version 5. For more details, see Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475.

See also: **XAQueueConnectionFactory** and **XATopicConnectionFactory**

Methods

createXAConnection (JMS 1.1 only)

```
public XAConnection createXAConnection() throws JMSException
```

Create an XA connection with the default user identity. The connection is created in stopped mode. No messages are delivered until the Connection.start() method is called explicitly.

Returns:

A newly created XA connection.

Throws:

- JMSException if JMS fails to create an XA connection because of an internal JMS error.
- JMSSecurityException if client authentication fails because the user name or password is not valid.

createXAConnection (JMS 1.1 only)

```
public XAConnection createXAConnection(java.lang.String userName,
                                       java.lang.String password)
                                       throws JMSException
```

Create an XA connection with the specified user identity. The connection is created in stopped mode. No messages are delivered until the Connection.start method is called explicitly.

Parameters:

- `userName`: the user name of the caller.
- `password`: the password of the caller.

Returns:

A newly created XA connection.

Throws:

- JMSException if JMS fails to create an XA connection because of an internal JMS error.
- JMSSecurityException if client authentication fails because the user name or password is not valid.

XAQueueConnection

public interface **XAQueueConnection**
extends **QueueConnection** and **XAConnection**

WebSphere MQ class: **MQXAQueueConnection**

```
java.lang.Object
    |
    +----com.ibm.mq.jms.MQConnection
            |
            +----com.ibm.mq.jms.MQQueueConnection
                    |
                    +----com.ibm.mq.jms.MQXAQueueConnection
```

XAQueueConnection provides the same create options as QueueConnection. The only difference is that, by definition, an XAConnection is transacted. Refer to Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475 for details about how WebSphere MQ JMS uses XA classes.

See also: **XAConnection** and **QueueConnection**

Methods

createQueueSession

```
public QueueSession createQueueSession(boolean transacted,
                                       int acknowledgeMode)
                                              throws JMSException
```

Create a QueueSession.

Parameters:

- `transacted`: if true, the session is transacted.
- `acknowledgeMode`: indicates whether the consumer or the client acknowledges any messages it receives. Possible values are:
  Session.AUTO_ACKNOWLEDGE
  Session.CLIENT_ACKNOWLEDGE
  Session.DUPS_OK_ACKNOWLEDGE

  This parameter is ignored if the session is transacted.

Returns:
A newly-created queue session (this is not an XA queue session).

Throws:
JMSException if JMS Connection fails to create a queue session because of an internal error.

createXAQueueSession

```
public XAQueueSession createXAQueueSession()
```

Create an XAQueueSession.

Throws:
JMSException if JMS Connection fails to create an XA queue session because of an internal error.

XAQueueConnectionFactory

public interface **XAQueueConnectionFactory**
extends **QueueConnectionFactory** and **XAConnectionFactory**

WebSphere MQ class: **MQXAQueueConnectionFactory**

```
java.lang.Object
    |
    +----com.ibm.mq.jms.MQConnectionFactory
            |
            +----com.ibm.mq.jms.MQQueueConnectionFactory
                    |
                    +----com.ibm.mq.jms.MQXAQueueConnectionFactory
```

An XAQueueConnectionFactory provides the same create options as a QueueConnectionFactory. Refer to Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475 for details about how WebSphere MQ JMS uses XA classes.

See also: **QueueConnectionFactory** and **XAConnectionFactory**

Methods

createXAQueueConnection

```
public XAQueueConnection createXAQueueConnection()
                                          throws JMSException
```

Create an XAQueueConnection using the default user identity. The connection is created in stopped mode. No messages are delivered until the Connection.start method is called explicitly.

Returns:

A newly-created XA queue connection.

Throws:

- JMSException if the JMS provider fails to create an XA queue connection because of an internal error.
- JMSSecurityException if client authentication fails because of a non valid user name or password.

createXAQueueConnection

```
public XAQueueConnection createXAQueueConnection
                                    (java.lang.String userName,
                                     java.lang.String password)
                                                  throws JMSException
```

Create an XA queue connection using a specific user identity. The connection is created in stopped mode. No messages are delivered until the Connection.start method is called explicitly.

Parameters:

- `userName`: the user name of the caller.
- `password`: the password for the caller.

Returns:

A newly-created XA queue connection.

Throws:

- JMSException if the JMS Provider fails to create an XA queue connection because of an internal error.
- JMSSecurityException if client authentication fails because of a non valid user name or password.

XAQueueSession

public interface **XAQueueSession**
extends **XASession**

WebSphere MQ class: **MQXAQueueSession**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQXASession
           |
           +----com.ibm.mq.jms.MQXAQueueSession
```

An XAQueueSession provides a regular QueueSession that can be used to create QueueReceivers, QueueSenders, and QueueBrowsers. Refer to Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475 for details about how WebSphere MQ JMS uses XA classes.

The XAResource that corresponds to the QueueSession can be obtained by calling the getXAResource method, which is inherited from XASession.

See also: **XASession**

Methods

getQueueSession

```
public QueueSession  getQueueSession()
                                throws JMSException
```

Get the queue session associated with this XAQueueSession.

Returns:
The queue session object.

Throws:
JMSException if a JMS error occurs.

XASession

public interface **XASession**
extends **java.lang.Runnable** and **Session**
Subinterfaces: **XAQueueSession** and **XATopicSession**

WebSphere MQ class: **MQXASession**

```
java.lang.Object
   |
   +----com.ibm.mq.jms.MQXASession
```

WebSphere MQ JMS exposes its JTS support in the XAConnectionFactory, XAConnection, and XASession classes. These classes are provided for use in a J2EE application server environment.

WebSphere Application Server Version 5 uses these classes to create and manage a pool of XAConnection and XASession objects. A JMS application does not need to use these classes directly if it is running in this environment.

A JMS application might need to use the XASession class only if it is running in a WebSphere Application Server environment with a version of WebSphere Application Server before Version 5. For more details, see Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475.

See also: **Session**

Methods

commit

```
public void commit()
            throws JMSException
```

Do not call this method for an XASession object. If it is called, it throws a TransactionInProgressException.

Specified by:
commit in the Session interface.

Throws:
TransactionInProgressException if this method is called on an XASession.

getSession (JMS 1.1 only)

```
public Session getSession() throws JMSException
```

Get the session associated with this XA session.

Returns:
The session.

Throws:
JMSException if JMS fails to return the session because of an internal JMS error.

getTransacted

```
public boolean getTransacted() throws JMSException
```

Indicates whether the session is in transacted mode.

Specified by:
getTransacted in the Session interface.

Returns:
True.

Throws:
JMSException if JMS fails to return the transaction mode because of an internal JMS error.

getXAResource

```
public javax.transaction.xa.XAResource getXAResource()
```

Return an XA resource to the caller.

Returns:
An XA resource to the caller.

rollback

```
public void rollback()
              throws JMSException
```

Do not call this method for an XASession object. If it is called, it throws a TransactionInProgressException.

Specified by:
rollback in the Session interface.

Throws:
TransactionInProgressException if this method is called on an XASession.

XATopicConnection

public interface **XATopicConnection**
extends **TopicConnection** and **XAConnection**

WebSphere MQ class: **MQXATopicConnection**

```
java.lang.Object
    |
    +----com.ibm.mq.jms.MQConnection
            |
            +----com.ibm.mq.jms.MQTopicConnection
                    |
                    +----com.ibm.mq.jms.MQXATopicConnection
```

An XATopicConnection provides the same create options as TopicConnection. The only difference is that an XAConnection is transacted. Refer to Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475 for details about how WebSphere MQ JMS uses XA classes.

See also: **TopicConnection** and **XAConnection**

Methods

createTopicSession

```
public TopicSession createTopicSession(boolean transacted,
                                       int acknowledgeMode)
                                throws JMSException
```

Create a TopicSession.

Specified by:
createTopicSession in interface TopicConnection.

Parameters:

- `transacted`: if true, the session is transacted.
- `acknowledgeMode`: one of:
  Session.AUTO_ACKNOWLEDGE
  Session.CLIENT_ACKNOWLEDGE
  Session.DUPS_OK_ACKNOWLEDGE

  Indicates whether the consumer or the client acknowledges any messages it receives. This parameter is ignored if the session is transacted.

Returns:
A newly-created topic session (this is not an XA topic session).

Throws:
JMSException if JMS Connection fails to create a topic session because of an internal error.

createXATopicSession

```
public XATopicSession createXATopicSession()
                                    throws JMSException
```

Create an XATopicSession.

Throws:
JMSException if the JMS Connection fails to create an XA topic session because of an internal error.

XATopicConnectionFactory

public interface **XATopicConnectionFactory**
extends **TopicConnectionFactory** and **XAConnectionFactory**

WebSphere MQ class: **MQXATopicConnectionFactory**

```
java.lang.Object
    |
    +----com.ibm.mq.jms.MQConnectionFactory
            |
            +----com.ibm.mq.jms.MQTopicConnectionFactory
                    |
                    +----com.ibm.mq.jms.MQXATopicConnectionFactory
```

An XATopicConnectionFactory provides the same create options as TopicConnectionFactory. Refer to Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475 for details about how WebSphere MQ JMS uses XA classes.

See also: **TopicConnectionFactory** and **XAConnectionFactory**

Methods

createXATopicConnection

```
public XATopicConnection createXATopicConnection()
                                        throws JMSException
```

Create an XA topic connection using the default user identity. The connection is created in stopped mode. No messages are delivered until the Connection.start method is called explicitly.

Returns:
A newly-created XA topic connection.

Throws:

- JMSException if the JMS Provider fails to create an XA topic connection because of an internal error.
- JMSSecurityException if client authentication fails because of a non valid user name or password.

createXATopicConnection

```
public XATopicConnection createXATopicConnection(java.lang.String userName,
                                                 java.lang.String password)
                                        throws JMSException
```

Create an XA topic connection using the specified user identity. The connection is created in stopped mode. No messages are delivered until the Connection.start method is called explicitly.

Parameters:

- `userName`: the user name of the caller
- `password`: the password of the caller

Returns:
A newly-created XA topic connection.

Throws:

- JMSException if the JMS Provider fails to create an XA topic connection because of an internal error.
- JMSSecurityException if client authentication fails because of a non valid user name or password.

XATopicSession

public interface **XATopicSession**
extends **XASession**

WebSphere MQ class: **MQXATopicSession**

```
java.lang.Object
    |
    +----com.ibm.mq.jms.MQXASession
            |
            +----com.ibm.mq.jms.MQXATopicSession
```

An XATopicSession provides a TopicSession, which you can use to create TopicSubscribers and TopicPublishers. Refer to Appendix E, "JMS JTA/XA interface with WebSphere Application Server V4," on page 475 for details about how WebSphere MQ JMS uses XA classes.

The XAResource that corresponds to the TopicSession can be obtained by calling the getXAResource method, which is inherited from XASession.

See also: **TopicSession** and **XASession**

Methods

getTopicSession

```
public TopicSession getTopicSession()
                              throws JMSException
```

Get the topic session associated with this XATopicSession.

Returns:

The topic session object.

Throws:

- JMSException if a JMS error occurs.

Part 4. Appendixes

Appendix A. Mapping between administration tool properties and programmable properties

WebSphere MQ classes for Java Message Service provides facilities to set and query the properties of administered objects either using the WebSphere MQ JMS administration tool, or in an application program. Table 38 shows the mapping between each property name used with the administration tool and the corresponding member variable it refers to. It also shows the mapping between symbolic property values used in the tool and their programmable equivalents.

Table 38. Comparison of representations of property values within the administration tool and within programs

Property	Member variable name	Tool property values	Program property values
BROKERCCDSUBQ	brokerCCDurSubQueue		
BROKERCCSUBQ	brokerCCSubQueue		
BROKERCONQ	brokerControlQueue		
BROKERDURSUBQ	brokerDurSubQueue		
BROKERPUBQ	brokerPubQueue		
BROKERQMGR	brokerQueueManager		
BROKERSUBQ	brokerSubQueue		
BROKERVER	brokerVersion	V1 V2	JMSC.MQJMS_BROKER_V1 JMSC.MQJMS_BROKER_V2
CCSID	CCSID		
CHANNEL	channel		
CLEANUP	cleanupLevel	NONE SAFE STRONG ASPROP	JMSC.MQJMS_CLEANUP_NONE JMSC.MQJMS_CLEANUP_SAFE JMSC.MQJMS_CLEANUP_STRONG JMSC.MQJMS_CLEANUP_AS_PROPERTY
CLEANUPINT	cleanupInterval		
CLIENTID	clientId		
DESCRIPTION	description		
DIRECTAUTH	directAuth	BASIC CERTIFICATE	JMSC.MQJMS_DIRECTAUTH_BASIC JMSC.MQJMS_DIRECTAUTH_CERTIFICATE
ENCODING	encoding		
EXPIRY	expiry	APP UNLIM	JMSC.MQJMS_EXP_APP JMSC.MQJMS_EXP_UNLIMITED
FAILIFQUIESCE	failIfQuiesce	YES NO	JMSC.MQJMS_FIQ_YES JMSC.MQJMS_FIQ_NO
HOSTNAME	hostName		
LOCALADDRESS	localAddress		
MSGBATCHSZ	msgBatchSize		
MSGRETENTION	messageRetention	YES NO	JMSC.MQJMS_MRET_YES JMSC.MQJMS_MRET_NO
MSGSELECTION	messageSelection	CLIENT BROKER	JMSC.MQJMS_MSEL_CLIENT JMSC.MQJMS_MSEL_BROKER

Table 38. Comparison of representations of property values within the administration tool and within programs (continued)

Property	Member variable name	Tool property values	Program property values
MULTICAST	multicast	DISABLED NOTR RELIABLE ENABLED ASCF	JMSC.MQJMS_MULTICAST_DISABLED JMSC.MQJMS_MULTICAST_NOT_RELIABLE JMSC.MQJMS_MULTICAST_RELIABLE JMSC.MQJMS_MULTICAST_ENABLED JMSC.MQJMS_MULTICAST_AS_CF
PERSISTENCE	persistence	APP QDEF PERS NON	JMSC.MQJMS_PER_APP JMSC.MQJMS_PER_QDEF JMSC.MQJMS_PER_PER JMSC.MQJMS_PER_NON
POLLINGINT	pollingInterval		
PORT	port		
PRIORITY	priority	APP QDEF	JMSC.MQJMS_PRI_APP JMSC.MQJMS_PRI_QDEF
PROXYHOSTNAME	proxyHostName		
PROXYPORT	proxyPort		
PUBACKINT	pubAckInterval		
QUEUE	baseQueueName		
QMANAGER	queueManager*		
RECEXIT	receiveExit		
RECEXITINIT	receiveExitInit		
SECEXIT	securityExit		
SECEXITINIT	securityExitInit		
SENDEXIT	sendExit		
SENDEXITINIT	sendExitInit		
SPARSESUBS	sparseSubscriptions	YES NO	`true` `false`
SSLCIPHERSUITE	sslCipherSuite		
SSLCRL	sslCertStores		
SSLPEERNAME	sslPeerName		
STATREFRESHINT	statusRefreshInterval		
SUBSTORE	subscriptionStore	MIGRATE QUEUE BROKER	JMSC.MQJMS_SUBSTORE_MIGRATE JMSC.MQJMS_SUBSTORE_QUEUE JMSC.MQJMS_SUBSTORE_BROKER
SYNCPOINTALLGETS	syncpointAllGets		
TARGCLIENT	targetClient	JMS MQ	JMSC.MQJMS_CLIENT_JMS_COMPLIANT JMSC.MQJMS_CLIENT_NONJMS_MQ
TEMPMODEL	temporaryModel		
TOPIC	baseTopicName		
TRANSPORT	transportType	BIND CLIENT DIRECT DIRECTHTTP	JMSC.MQJMS_TP_BINDINGS_MQ JMSC.MQJMS_TP_CLIENT_MQ_TCPIP JMSC.MQJMS_TP_DIRECT_TCPIP JMSC.MQJMS_TP_DIRECT_HTTP
USECONNPOOLING	useConnectionPooling		

Table 38. Comparison of representations of property values within the administration tool and within programs (continued)

Property	Member variable name	Tool property values	Program property values
Note: * for an MQQueue object, the member variable name is baseQueueManagerName			

Appendix B. Scripts provided with WebSphere MQ classes for Java Message Service

The following files are provided in the `bin` directory of your WebSphere MQ JMS installation. These scripts are provided to assist with common tasks that need to be performed while installing or using WebSphere MQ JMS. Table 39 lists the scripts and their uses.

Table 39. Utilities supplied with WebSphere MQ classes for Java Message Service

Utility	Use
Cleanup.bat	Runs the subscription cleanup utility as described in "Manual cleanup" on page 232, or the consumer cleanup utility as described in "Manual cleanup" on page 250..
DefaultConfiguration	Runs the default configuration application on non-Windows systems as described in "JMS Postcard configuration" on page 22.
formatLog.bat	Converts binary log files to plain text as described in "Logging" on page 39.
IVTRun.bat IVTTidy.bat IVTSetup.bat	Runs the point-to-point installation verification test program as described in "Running the point-to-point IVT" on page 31.
JMSAdmin.bat	Runs the administration tool as described in Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41.
JMSAdmin.config	Configuration file for the administration tool as described in "Configuration" on page 42.
postcard.bat	Starts the JMS Postcard application as described in "JMS Postcard" on page 19.
PSIVTRun.bat	Runs the publish/subscribe installation verification test program as described in "The publish/subscribe installation verification test" on page 35.
PSReportDump.class	Views broker report messages as described in "Handling broker reports" on page 233. For information specific to JMS 1.1, see "Handling broker reports" on page 252.
runjms.bat	Helps you to run JMS applications as described in "Running your own WebSphere MQ JMS programs" on page 38.
Note: On UNIX systems, the extension .bat is omitted from the filenames.	

Appendix C. LDAP schema definition for storing Java objects

This appendix gives details of the schema definitions (objectClass and attribute definitions) needed in an LDAP directory for it to store Java objects. Read it if you want to use an LDAP server as your JNDI service provider in which to store WebSphere MQ JMS administered objects. Ensure that your LDAP server schema contains the following definitions; the exact procedure to achieve this varies from server to server. How to make the changes to some specific LDAP servers is covered later in this section.

Much of the data contained in this appendix has been taken from RFC 2713 *Schema for Representing Java Objects in an LDAP Directory*, which can be found at http://www.faqs.org/rfcs/rfc2713.html. LDAP server-specific information has been taken from Sun Microsystems' JNDI 1.2.1 LDAP service provider, available at http://java.sun.com/products/jndi.

Checking your LDAP server configuration

To check whether the LDAP server is already configured to accept Java objects, run the WebSphere MQ JMS administration tool JMSAdmin against your LDAP server (see "Invoking the administration tool" on page 41).

Try to create and display a test object using the following commands:

```
DEFINE QCF(ldapTest)
DISPLAY QCF(ldapTest)
```

If no errors occur, your server is properly configured to store Java objects and you can proceed to store JMS objects. However, if your LDAP server contains older schema definitions (for example, from an earlier draft of RFC 2713 such as the now-obsolete draft-ryan-java-schema-00 and draft-ryan-java-schema-01 specifications), update them with those described here.

If a SchemaViolationException occurs, or if the message `Unable to bind to object` is returned, your server is not properly configured. Either your server is not configured to store Java objects, permissions on the objects are not correct, or the provided suffix or context has not been set up. The following information helps you with the schema configuration part of your server setup.

Attribute definitions

Table 40. Attribute settings for javaCodebase

Attribute	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.1.7
Syntax	IA5 String (1.3.6.1.4.1.1466.115.121.1.26)
Maximum length	2048
Single/multi-valued	Multi-valued
User modifiable	Yes
Matching rules	caseExactIA5Match
Access class	normal
Usage	userApplications
Description	URL(s) specifying the location of class definition

Table 41. Attribute settings for javaClassName

Attribute	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.1.6
Syntax	Directory String (1.3.6.1.4.1.1466.115.121.1.15)
Maximum length	2048
Single/multi-valued	Single-valued
User modifiable?	Yes
Matching rules	caseExactMatch
Access class	normal
Usage	userApplications
Description	Fully qualified name of distinguished Java class or interface

Table 42. Attribute settings for javaClassNames

Attribute	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.1.13
Syntax	Directory String (1.3.6.1.4.1.1466.115.121.1.15)
Maximum length	2048
Single/multi-valued	Multi-valued
User modifiable	Yes
Matching rules	caseExactMatch
Access class	normal
Usage	userApplications
Description	Fully qualified Java class or interface name

Table 43. Attribute settings for javaFactory

Attribute	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.1.10
Syntax	Directory String (1.3.6.1.4.1.1466.115.121.1.15)
Maximum length	2048
Single/multi-valued	Single-valued
User modifiable	Yes
Matching rules	caseExactMatch
Access class	normal
Usage	userApplications
Description	Fully qualified Java class name of a JNDI object factory

Table 44. Attribute settings for javaReferenceAddress

Attribute	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.1.11
Syntax	Directory String (1.3.6.1.4.1.1466.115.121.1.15)
Maximum length	2048
Single/multi-valued	Multi-valued
User modifiable	Yes
Matching rules	caseExactMatch
Access class	normal
Usage	userApplications
Description	Addresses associated with a JNDI Reference

Table 45. Attribute settings for javaSerializedData

Attribute	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.1.8
Syntax	Octet String (1.3.6.1.4.1.1466.115.121.1.40)
Single/multi-valued	Single-valued
User modifiable	Yes
Access class	normal
Usage	userApplications
Description	Serialized form of a Java object

objectClass definitions

Table 46. objectClass definition for javaSerializedObject

Definition	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.2.5
Extends/superior	javaObject
Type	AUXILIARY
Required (must) attrs	javaSerializedData

Table 47. objectClass definition for javaObject

Definition	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.2.4
Extends/superior	top
Type	ABSTRACT
Required (must) attrs	javaClassName
Optional (may) attrs	javaClassNames javaCodebase javaDoc description

Table 48. objectClass definition for javaContainer

Definition	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.2.1
Extends/superior	top
Type	STRUCTURAL
Required (must) attrs	cn

Table 49. objectClass definition for javaNamingReference

Definition	Value
OID (Object Identifier)	1.3.6.1.4.1.42.2.27.4.2.7
Extends/superior	javaObject
Type	AUXILIARY
Optional (may) attrs	javaReferenceAddress javaFactory

Server-specific configuration details

This section describes special steps you need to take to use the following servers:

- "Netscape Directory (4.1 and earlier)"
- "Microsoft Active Directory"
- "Sun Microsystems' schema modification applications" on page 467
- "OS/400 V4R5 Schema Modification" on page 467

Netscape Directory (4.1 and earlier)

This level of Netscape Directory does not support the Octet String syntax; use Binary syntax (1.3.6.1.4.1.1466.115.121.1.5) instead. Netscape Directory 4.1 also has problems parsing an object class definition that contains a MUST clause without parentheses. The workaround is to add a superfluous value (objectClass) to each MUST clause.

Alternatively, you can use the Sun-supplied schema modification applications described in "Sun Microsystems' schema modification applications" on page 467.

Microsoft Active Directory

Within Active Directory, only the names of structural classes (not auxiliary classes) can appear in the object class attribute of an entry. You must redefine the abstract and auxiliary classes in the Java schema definition as structural. This has the following effects:

- The javaObject class now inherits from javaContainer

- The javaNamingReference and javaSerializedObject classes now inherit from javaObject

Instead of making these changes manually, you can use the Sun-supplied schema modification applications described in "Sun Microsystems' schema modification applications."

Sun Microsystems' schema modification applications

You can use your LDAP server's administration tool (for example, the Directory Management Tool for IBM's SecureWay® Directory) to verify or add the definitions described above. Alternatively, Sun Microsystems' JNDI 1.2.1 LDAP service provider (available at http://java.sun.com/products/jndi) contains Java applications (CreateJavaSchema.java and UpdateJavaSchema.java) that add or update the required schema definitions automatically. These applications contain workarounds for schema bugs and server-specific behavior in both Netscape Directory Server (pre-4.1 and 4.1) and Microsoft® Windows 2000 Active Directory.

These applications are not packaged with WebSphere MQ classes for Java Message Service. Details on running them can be found in both the README and the application source contained in the Sun JNDI 1.2.1 LDAP service provider download.

OS/400 V4R5 Schema Modification

You can use your LDAP server's administration tool (the Directory Management Tool for IBM's SecureWay Directory) to verify or add the definitions described above.

OS/400 V4R5 LDAP Server is shipped with an out-of-date version of RFC 2713 schema for Java objects. Update this schema to the schema described above to operate correctly with JMSAdmin. When you modify the schema, delete any out-of-data definitions and uses of those definitions before adding the correct definitions.

OS/400 V5R1 is shipped with the current version of RFC 2713 and does not require these changes.

Appendix D. Connecting to other products

This section covers:

- How to configure a publish/subscribe broker for a connection from WebSphere MQ JMS in "Setting up a publish/subscribe broker"
- How to use WebSphere MQ Integrator V2 to route or transform messages sent to or from a JMS client in "Transformation and routing with WebSphere MQ Integrator V2" on page 471
- How to configure WebSphere MQ JMS for a direct connection to WebSphere Business Integration Event Broker Version 5.0 or WebSphere Business Integration Message Broker Version 5.0 in "Configuring WebSphere MQ JMS for a direct connection to WebSphere Business Integration Event Broker Version 5.0 and WebSphere Business Integration Message Broker Version 5.0" on page 472.

Setting up a publish/subscribe broker

You can use WebSphere MQ Integrator Version 2, WebSphere MQ Event Broker Version 2.1, WebSphere Business Integration Event Broker Version 5.0, or WebSphere Business Integration Message Broker Version 5.0 as the publish/subscribe broker for WebSphere MQ JMS. You can link to each of these brokers across a connection to base WebSphere MQ, or you can connect directly to WebSphere MQ Event Broker, WebSphere Business Integration Event Broker, or WebSphere Business Integration Message Broker over TCP/IP. Each method requires some setup activities:

Linking across WebSphere MQ

- Base WebSphere MQ

  First, create a broker publication queue. This is a WebSphere MQ queue on the broker queue manager; it is used to submit publications to the broker. You can choose your own name for this queue, but it must match the queue name in your TopicConnectionFactory's BROKERPUBQ property. By default, a TopicConnectionFactory's BROKERPUBQ property is set to the value SYSTEM.BROKER.DEFAULT.STREAM so, unless you want to configure a different name in the TopicConnectionFactory, name the queue SYSTEM.BROKER.DEFAULT.STREAM.

- WebSphere MQ Integrator V2

  The next step is to set up a *message flow* within an execution group for the broker. The purpose of this message flow is to read messages from the broker publication queue. (If you want, you can set up multiple publication queues; each needs its own TopicConnectionFactory and message flow.)

  The basic message flow consists of an MQInput node (configured to read from the SYSTEM.BROKER.DEFAULT.STREAM queue) whose output is connected to the input of a Publication (or MQOutput) node.

  The message flow diagram therefore looks similar to the following:

Figure 7. WebSphere MQ Integrator message flow

When this message flow is deployed and the broker is started, from the JMS application's perspective the WebSphere MQ Integrator V2 broker behaves like an MQSeries Publish/Subscribe broker. The current subscription state can be viewed using the WebSphere MQ Integrator Control Center.

Notes:

1. No modifications are required to WebSphere MQ classes for Java Message Service.
2. MQSeries Publish/Subscribe and WebSphere MQ Integrator V2 brokers cannot coexist on the same queue manager.
3. Details of the WebSphere MQ Integrator V2 installation and setup procedure are described in the *WebSphere MQ Integrator for Windows NT Version 2.0 Installation Guide*.

Direct connection to WebSphere MQ Event Broker Version 2.1 over TCP/IP

For this, set up a message flow within an execution group on WebSphere MQ Event Broker. This message flow is to read messages from the TCP/IP socket on which the broker is listening.

The basic message flow consists of a JMSIPOptimised flow set to listen on the port configured for direct connections. By default, this port is 1506.

Note: WebSphere MQ Event Broker can be configured to listen for both direct connections across TCP/IP from WebSphere MQ JMS and connections made across TCP/IP through WebSphere MQ. In this case, the two listeners must be configured on different ports. The default port for a WebSphere MQ connection is 1414.

Direct connection to WebSphere Business Integration Event Broker Version 5.0 or WebSphere Business Integration Message Broker Version 5.0

To configure a WebSphere Business Integration Event Broker or WebSphere Business Integration Message Broker broker for a direct connection from WebSphere MQ JMS, create a message flow to read messages from the TCP/IP port on which the broker is listening and publish the messages. You can do this in either of the following ways:

- You can create a message flow that contains a Real-timeOptimizedFlow message processing node.
- You can create a message flow that contains a Real-timeInput message processing node and a Publication message processing node.

You must configure the Real-timeOptimizedFlow or Real-timeInput node to listen on the port used for direct connections. By default, the port number for direct connections is 1506.

Transformation and routing with WebSphere MQ Integrator V2

You can use WebSphere MQ Integrator V2 to route or transform messages that are created by a JMS client application, and to send or publish messages to a JMS client.

The WebSphere MQ JMS implementation uses the mcd folder of the MQRFH2 to carry information about the message, as described in "The MQRFH2 header" on page 262. By default, the Message Domain (Msd) property is used to identify whether the message is a text, bytes, stream, map, or object message. This value is set depending on the type of the JMS message.

If the application calls setJMSType, it can set the mcd type field to a value of its choosing. This type field can be read by the WebSphere MQ Integrator message flow, and a receiving JMS application can use the getJMSType method to retrieve its value. This applies to all kinds of JMS message.

When a JMS application creates a text or bytes message, the application can set mcd folder fields explicitly by calling the setJMSType method and passing in a string argument in a special URI format as follows:

`mcd://domain/[set]/[type][?format=fmt]`

This URI form allows an application to set the mcd to a domain that is not one of the standard jms_xxxx values; for example, to domain mrm. It also allows the application to set any or all of the mcd set, type, and format fields.

The string argument to setJMSType is interpreted as follows:

1. If the string does not appear to be in the special URI format (it does not start with mcd://), the string is added to the mcd folder as the `type` field.
2. If the string starts with mcd://, conforms to the URI format, *and* the message is a Text or Bytes message, the URI string is split into its constituent parts. The domain part overrides the jms_text or jms_bytes value that would otherwise have been generated, and the remaining parts (if present) are used to set the set, type, and format fields in the mcd. Note that set, type, and format are all optional.
3. If the string starts with mcd:// and the message is a Map, Stream, or Object message, the setJMSType call throws an exception. So you cannot override the domain, or provide a set or format for these classes of message, but you can provide a type.

When a WebSphere MQ message is received with an Msd domain other than one of the standard jms_xxxx values, it is instantiated as a JMS text or bytes message and a URI-style JMSType is assigned to it. If the format field of the RFH2 is MQFMT_STRING, it becomes a TextMessage; otherwise it becomes a BytesMessage. The receiving application can read this using the getJMSType method.

Configuring WebSphere MQ JMS for a direct connection to WebSphere Business Integration Event Broker Version 5.0 and WebSphere Business Integration Message Broker Version 5.0

A WebSphere MQ JMS client can connect directly to a WebSphere Business Integration Event Broker or WebSphere Business Integration Message Broker broker over TCP/IP. The available function is comparable to that provided for a direct connection to a WebSphere MQ Event Broker Version 2.1 broker, but with the following additions:

- Secure Sockets Layer (SSL) authentication
- Multicast
- HTTP tunnelling
- Connect via proxy

For detailed information about this additional function, see the WebSphere Business Integration Event Broker or WebSphere Business Integration Message Broker Information Center. The following sections explain how to configure a WebSphere MQ JMS client in order to use this function.

Secure Sockets Layer (SSL) authentication

You can use SSL authentication when a WebSphere MQ JMS client connects directly to a WebSphere Business Integration Event Broker or WebSphere Business Integration Message Broker broker. Only SSL authentication is supported for this type of connection. SSL cannot be used to encrypt or decrypt message data that flows between the WebSphere MQ JMS client and the broker or to perform integrity checks on the data.

Note the difference between this situation and that when a WebSphere MQ JMS client connects to a WebSphere MQ queue manager. In the latter case, the WebSphere MQ SSL support can be used to encrypt and decrypt message data that flows between the client and the queue manager and to perform integrity checks on the data, as well as providing authentication.

If you want to protect message data on a direct connection to a broker, you can use function in the broker instead. You can assign a quality of protection (QoP) value to each topic whose associated messages you want to protect. This allows you to select a different level of message protection for each topic.

If client authentication is required, a WebSphere MQ JMS client can use the same digital certificate for connecting directly to a broker as it does for connecting to a WebSphere MQ queue manager.

You can configure a WebSphere MQ JMS client to use SSL authentication in either of the following ways:

- In a WebSphere MQ JMS application, use the setDirectAuth() method of an MQConnectionFactory or MQTopicConnectionFactory object to set the direct authentication attribute to JMSC.MQJMS_DIRECTAUTH_CERTIFICATE.
- Use the WebSphere MQ JMS administration tool to set the DIRECTAUTH property to CERTIFICATE.

Notes:

1. If the TRANSPORT property is set to DIRECT, then it is the DIRECTAUTH property, not the SSLCIPHERSUITE property, that determines whether SSL authentication is used.

2. If the DIRECTAUTH property is set to CERTIFICATE, the SSLPEERNAME and SSLCRL properties are used to perform the same checks as those performed when a WebSphere MQ JMS client connects to a WebSphere MQ queue manager using the WebSphere MQ SSL support.
3. The Java Secure Socket Extension (JSSE) KeyStore and TrustStore configurations determine which client certificate is used for authentication, and whether a server certificate is trusted, in the same way that they do when a WebSphere MQ JMS client connects to a WebSphere MQ queue manager using the WebSphere MQ SSL support.

Multicast

You can configure a WebSphere MQ JMS client multicast connection to a broker in either of the following ways:

- In a WebSphere MQ JMS application, use the setMulticast() method of an MQConnectionFactory, MQTopicConnectionFactory, or MQTopic object to set the multicast attribute.
- Use the WebSphere MQ JMS administration tool to set the MULTICAST property.

The TRANSPORT property must be set to DIRECT before the MULTICAST property has any effect.

HTTP tunnelling

A WebSphere MQ JMS client can connect to a broker using HTTP tunnelling. HTTP tunnelling is suitable for applets because the Java 2 Security Manager normally rejects any attempt by an applet to connect directly to the broker. Using HTTP tunnelling, which exploits the built in support in Web browsers, a WebSphere MQ JMS client can connect to the broker using the HTTP protocol as though connecting to a Web site.

You can configure a WebSphere MQ JMS client to use HTTP tunnelling in either of the following ways:

- In a WebSphere MQ JMS application, use the setTransportType() method of an MQConnectionFactory object to set the transport type attribute to JMSC.MQJMS_TP_DIRECT_HTTP.
- Use the WebSphere MQ JMS administration tool to set the TRANSPORT property to DIRECTHTTP.

SSL authentication cannot be used with HTTP tunnelling.

Connect via proxy

A WebSphere MQ JMS client can connect to a broker through a proxy server. The client connects directly to the proxy server and uses the Internet protocol defined in RFC 2817 to ask the proxy server to forward the connection request to the broker. This option does not work for applets because the Java 2 Security Manager normally rejects any attempt by an applet to connect directly to a proxy server.

You can configure a WebSphere MQ JMS client to connect to a broker through a proxy server in either of the following ways:

- In a WebSphere MQ JMS application, use the setProxyHostName() and setProxyPort() methods of an MQConnectionFactory or MQTopicConnectionFactory object to set the proxy host name and proxy port attributes.

- Use the WebSphere MQ JMS administration tool to set the PROXYHOSTNAME and PROXYPORT properties.

If the TRANSPORT property is set to DIRECT, the type of connection to the broker depends on the PROXYHOSTNAME property according to the following rules:

- If the PROXYHOSTNAME property is set to the empty string, the WebSphere MQ JMS client connects directly to the broker using the HOSTNAME and PORT properties to locate the broker.
- If the PROXYHOSTNAME property is set to a value other than the empty string, the WebSphere MQ JMS client connects to the broker through the proxy server identified by the PROXYHOSTNAME and PROXYPORT properties.

Appendix E. JMS JTA/XA interface with WebSphere Application Server V4

WebSphere MQ classes for Java Message Service includes the JMS XA interfaces. These allow WebSphere MQ JMS to participate in a two-phase commit that is coordinated by a transaction manager that complies with the Java Transaction API (JTA).

This section describes how to use these features with the WebSphere Application Server, Advanced Edition, so that WebSphere Application Server can coordinate JMS send and receive operations, and database updates, in a global transaction.

Note: Before you use WebSphere MQ JMS and the XA classes with WebSphere Application Server, there might be additional installation or configuration steps. Refer to the `Readme.txt` file on the WebSphere MQ Using Java SupportPac Web page for the latest information (`www.ibm.com/software/ts/mqseries/txppacs/ma88.html`).

Using the JMS interface with WebSphere Application Server

This section provides guidance on using the JMS interface with the WebSphere Application Server Version 4, Advanced Edition.

You must already understand the basics of JMS programs, WebSphere MQ, and EJB beans. These details are in the JMS specification, the EJB V2 specification (both available from Sun), this manual, the samples provided with WebSphere MQ JMS, and other manuals for WebSphere MQ and WebSphere Application Server.

Administered objects

JMS uses administered objects to encapsulate vendor-specific information. This minimizes the impact of vendor-specific details on end-user applications. Administered objects are stored in a JNDI namespace, and can be retrieved and used in a portable manner without knowing the vendor-specific contents.

For standalone use, WebSphere MQ JMS provides the following classes:

- MQQueueConnectionFactory
- MQQueue
- MQTopicConnectionFactory
- MQTopic

WebSphere Application Server provides an additional pair of administered objects so that WebSphere MQ JMS can integrate with WebSphere Application Server:

- JMSWrapXAQueueConnectionFactory
- JMSWrapXATopicConnectionFactory

You use these objects in exactly the same way as the MQQueueConnectionFactory and MQTopicConnectionFactory. However, behind the scenes they use the XA versions of the JMS classes, and enlist the WebSphere MQ JMS XAResource in the WebSphere Application Server transaction.

Container-managed versus bean-managed transactions

Container-managed transactions are transactions in EJB beans that are demarcated automatically by the EJB container. Bean-managed transactions are transactions in EJB beans that are demarcated by the program (using the UserTransaction interface).

Two-phase commit versus one-phase optimization

The WebSphere Application Server coordinator invokes a true two-phase commit only if more than one XAResource is used in a particular transaction. Transactions that involve a single resource are committed using a one-phase optimization. This largely removes the need to use different ConnectionFactories for distributed and non-distributed transactions.

Defining administered objects

You can use the WebSphere MQ JMS administration tool to define the WebSphere Application Server-specific connection factories and store them in a JNDI namespace. The admin.config file in *MQ_install_dir*/bin must contain the following lines:

```
INITIAL_CONTEXT_FACTORY=com.ibm.websphere.naming.WsnInitialContextFactory
PROVIDER_URL=iiop://hostname/
```

MQ_install_dir is the installation directory for WebSphere MQ JMS, and *hostname* is the name or IP address of the machine that is running WebSphere Application Server.

To access the com.ibm.ejs.ns.jndi.CNInitialContextFactory, you must add the file ejs.jar from the WebSphere Application Server lib directory to the CLASSPATH.

To create the new factories, use the define verb with the following two new types:

```
def WSQCF(name) [properties]
def WSTCF(name) [properties]
```

These new types use the same properties as the equivalent QCF or TCF types, except that only the BIND transport type is allowed (and therefore, client properties cannot be configured). For details, see “Administering JMS objects” on page 45.

Retrieving administration objects

In an EJB bean, you retrieve the JMS-administered objects using the InitialContext.lookup() method, for example:

```
InitialContext ic = new InitialContext();
TopicConnectionFactory tcf = (TopicConnectionFactory) ic.lookup("jms/Samples/TCF1");
```

The objects can be cast to, and used as, the generic JMS interfaces. Normally, there is no need to program to the WebSphere MQ specific classes in the application code.

Samples

There are three samples that illustrate the basics of using WebSphere MQ JMS with WebSphere Application Server Advanced Edition. These are in subdirectories of *MQ_samples_dir*/ws, where *MQ_samples_dir* is the samples directory for WebSphere MQ JMS. See Table 3 on page 10 to find where this is.

- Sample1 demonstrates a simple put and get for a message in a queue by using container-managed transactions.
- Sample2 demonstrates a simple put and get for a message in a queue by using bean-managed transactions.
- Sample3 illustrates the use of the publish/subscribe API.

For details about how to build and deploy the EJB beans, refer to the WebSphere Application Server documentation.

The readme.txt files in each sample directory include example output from each EJB bean. The scripts provided assume that a default queue manager is available on the local machine. If your installation varies from the default, you can edit these scripts.

Sample1

Sample1EJB.java, in the sample1 directory, defines two methods that use JMS:

- putMessage() sends a TextMessage to a queue, and returns the MessageID of the sent message
- getMessage() reads the message with the specified MessageID back from the queue

Before you run the sample, you must store two administered objects in the WebSphere Application Server JNDI namespace:

QCF1 a WebSphere Application Server-specific queue connection factory

Q1 a queue

Both objects must be bound in the jms/Samples sub-context.

To set up the administered objects, you can either use the WebSphere MQ JMS administration tool and set them up manually, or you can use the script provided.

The WebSphere MQ JMS administration tool must be configured to access the WebSphere Application Server namespace. For details about how to configure the administration tool, refer to "Configuring for WebSphere Application Server V3.5" on page 44.

To set up the administered objects with typical default settings, you can enter the following command to run the script `admin.scp`:

```
JMSAdmin < admin.scp
```

The bean must be deployed with the getMessage and putMessage methods marked as TX_REQUIRED. This ensures that the container starts a transaction before entering each method, and commits the transaction when the method completes. Within the methods, you do not need any application code that relates to the transactional state. However, the message sent from putMessage occurs under syncpoint, and does not become available until the transaction is committed.

In the sample1 directory, there is a simple client program, Sample1Client.java, to call the EJB bean. There is also a script, runClient, to simplify running this program.

The client program (or script) takes a single parameter, which is used as the body of a TextMessage that is sent by the EJB bean putMessage method. The getMessage

is called to read the message back off the queue and return the body to the client for display. The EJB bean sends progress messages to the standard output (stdout) of the application server, so you might want to monitor that output during the run.

If the application server is on a machine that is remote from the client, you might need to edit Sample1Client.java. If you do not use the defaults, you might need to edit the runClient script to match the local installation path and name of the deployed jar file.

Sample2

Sample2EJB.java, in the sample2 directory, performs the same task as sample1, and requires the same administered objects. Unlike sample1, sample2 uses bean-managed transactions to control the transactional boundaries.

If you have not already run sample1, ensure that you set up the administered objects QCF1 and Q1, as described in "Sample1" on page 477.

The putMessage methods and getMessage methods start by obtaining an instance of UserTransaction. They use this instance to create a transaction using the UserTransaction.begin() method. After that, the main body of the code is the same as sample1 until the end of each method. At the end of each method, the transaction is completed by the UserTransaction.commit() call.

In the sample2 directory, there is a simple client program, Sample2Client.java, to call the EJB bean. There is also a script, runClient, to simplify running this program. You can use these in the same way as described for "Sample1" on page 477.

Sample3

Sample3EJB.java, in the sample3 directory, demonstrates the use of the publish/subscribe API with WebSphere Application Server. Publishing a message is very similar to the point-to-point case. However, there are differences when receiving messages using a TopicSubscriber.

Publish/subscribe programs commonly use nondurable subscribers. These nondurable subscribers exist only for the lifetime of their owning sessions (or less if the subscriber is closed explicitly). Also, they can receive messages from the broker only during that lifetime.

To convert sample1 to publish/subscribe, create a durable subscriber before the message is published. Durable subscribers persist as a deliverable end-point beyond the lifetime of the session. Therefore, the message is available for retrieval during the call to getMessage().

The EJB bean includes two additional methods:

- createSubscription creates a durable subscription
- destroySubscription deletes a durable subscription

These methods (along with putMessage and getMessage) must be deployed with the TX_REQUIRED attribute.

Before you run sample3, you must store two administered objects in the WebSphere Application Server JNDI namespace:

TCF1
T1

Both objects must be bound in the jms/Samples sub-context.

To set up the administered objects, you can either use the WebSphere MQ JMS administration tool and set them up manually, or you can use a script. The script `admin.scp` is provided in the sample3 directory.

The WebSphere MQ JMS administration tool must be configured to access the WebSphere Application Server namespace. For details about how to configure the administration tool, refer to "Configuring for WebSphere Application Server V3.5" on page 44.

To set up the administered objects with typical default settings, you can enter the following command to run the script `admin.scp`:

```
JMSAdmin < admin.scp
```

If you have already run admin.scp to set up objects for sample1 or sample2, there will be error messages when you run admin.scp for sample3. (These occur when you attempt to create the jms and Samples sub-contexts.) You can safely ignore these error messages.

Also, before you run sample3, ensure that the WebSphere MQ publish/subscribe broker (SupportPac MA0C) is installed and running.

In the sample3 directory, there is a simple client program, Sample3Client.java, to call the EJB bean. There is also a script, runClient, to simplify running this program. You can use these in the same way as described for "Sample1" on page 477.

Appendix F. Using WebSphere MQ Java in applets with Java 1.2 or later

You might need to perform additional tasks to run an applet using WebSphere MQ Java classes in a Java virtual machine (JVM) at Java 1.2 level or greater. This is because the default security rules for applets with JVMs at these levels were changed to reduce the risk of damage by malevolent or misbehaving classes.

There are two different approaches that you can take:

1. Change the security settings on the browser and JVM to allow the use of WebSphere MQ Java packages.
2. Copy the WebSphere MQ Java classes to the same location as the applet you wish to run.

Changing browser security settings

Different errors can result from trying to run the same applet in different environments; for example, in IBM VisualAge for Java, in appletviewer (supplied with most Development Kits for Java) or in a Web browser such as Internet Explorer. The differences are to do with different security settings in each environment. You can change the behavior of the environments to allow an applet access to the classes it needs that are stored in package files.

In the following instructions, examples assume use of the Windows platforms. On other platforms, the instructions need slight modification.

For IBM VisualAge for Java:

Change the java.policy file found in `<vaj_install_dir>\ide\program\lib\security`, where `<vaj_install_dir>` is the directory in which you installed IBM VisualAge for Java.

Refer to "Running WebSphere MQ Java applications under the Java 2 Security Manager" on page 13 for general instructions about changes to this file. For applets, also check for the following changes to the permissions:

1. Comment out the line

   ```
   permission java.net.SocketPermission "localhost:1024-", "listen";
   ```

   and replace it with the following line:

   ```
   permission java.net.SocketPermission "*", "accept, connect, listen, resolve";
   ```

2. Add the following lines:

   ```
   permission java.util.PropertyPermission "MQJMS_LOG_DIR", "read";
   permission java.util.PropertyPermission "MQJMS_TRACE_DIR", "read";
   permission java.util.PropertyPermission "MQJMS_TRACE_LEVEL", "read";
   permission java.util.PropertyPermission "MQ_JAVA_INSTALL_PATH","read";
   permission java.util.PropertyPermission "file.separator","read";
   permission java.util.PropertyPermission "user.name","read";
   permission java.util.PropertyPermission "com.ibm.mq.jms.cleanup","read";
   permission java.lang.RuntimePermission "loadLibrary.*";
   ```

Notes:

1. You might need to restart VisualAge for Java if you get the error message `Unknown Java Error` after repeated tests.

2. Make sure that <install_dir>\java\lib is in the workspace classpath.

For appletviewer:

Find the policy file for your JDK and make the same changes as for IBM VisualAge for Java. For example, in the IBM Developer Kit for Windows, Java Technology Edition, Version 1.3, the java.policy file is found in the directory <jdk_install_dir>\jre\lib\security, where <jdk_install_dir> is the directory where the Developer Kit was installed.

For a Web browser:

To achieve consistent behavior for applets within different Web browsers, use the Sun Java plug-in.

1. Install the Sun Java plug-in 1.3.01 or later.

   From this level, Netscape 6 is also supported.
2. Make the same changes to the java.policy file as listed above.

   The policy file is found in <java_plugin_install_dir>\lib\security.
3. Make sure that your HTML applet tags are changed to run with the plug-in.

   Download and run the Sun HTML Converter v1.3 to make the necessary changes.

Copying package class files

When a Java program is executed in the context of an applet (which is what is done when appletviewer is executed or a Web browser is used), by default the Java program has significant security restrictions applied to it. One of these restrictions is that all environment variables in effect when the applet is launched are ignored. This includes CLASSPATH.

As a result, unless you make the changes described in "Changing browser security settings" on page 481, when an applet is executed, each and every class that it needs must also be available for download from the same location as the applet code itself.

To achieve this on a Windows system, perform the following steps (non-Windows users need to perform similar tasks):

1. Download and install WINZIP (http://www.winzip.com) or equivalent file unzipping utility
2. Find the files containing the WebSphere MQ Java, or other package, classes that your applet needs.

   For example, WebSphere MQ base Java classes are in a file called com.ibm.mq.jar usually found in the C:\Program Files\IBM\WebSphere MQ\Java\lib folder.
3. Using the unzipping utility you installed in step 1, extract *all* the files in the .jar file into the folder that contains your applet.

   For the samples supplied with WebSphere MQ Java, the folder to use is C:\Program Files\IBM\WebSphere MQ\Tools\Java\base

   This creates a sub-folder structure com\ibm.
4. Run your applet.

Appendix G. Information for SupportPac MA1G

This appendix contains information that is relevant to users of SupportPac MA1G "WebSphere MQ for MVS/ESA™ – WebSphere MQ classes for Java". MA1G provides support for WebSphere MQ classes for Java from versions of OS/390 not supported by WebSphere MQ Java. It also provides support for CICS and High Performance Java (HPJ).

Users intending to use the WebSphere MQ base Java with CICS Transaction Server for OS/390 must be familiar with:

- Customer Information Control System (CICS) concepts
- Using the CICS Java Application Programming Interface (API)
- Running Java programs from within CICS

Users intending to use VisualAge for Java to develop OS/390 UNIX System Services High Performance Java (HPJ) applications must be familiar with the Enterprise Toolkit for OS/390 (supplied with VisualAge for Java Enterprise Edition for OS/390, Version 2).

Environments supported by SupportPac MA1G

SupportPac MA1G provides support for WebSphere MQ base Java from the following environments:

- OS/390 V2R6 or higher
- Java for OS/390, V1.1.8 or higher
- IBM MQSeries for MVS/ESA, Version 1.2 or higher
- High Performance Java (HPJ)

SupportPac MA1G also provides support for CICS TS1.3 or higher. Support for HPJ in this environment requires OS/390 V2R9 or higher.

SupportPac MA1G does *not* provide support for JMS.

Obtaining and installing SupportPac MA1G

Obtain SupportPac MA1G from the WebSphere MQ web site http://www.ibm.com/software/integration/mqfamily/. Follow links to Download and then SupportPacs to find the WebSphere MQ Java code.

The following procedure installs the WebSphere MQ classes for Java. The directory used for the installation needs at least 2MB of free storage. In the following, replace `/u/joe/mqm` with the path name of the directory you choose:

1. Remove any previous installation of this product using the following commands in the OpenEdition shell:

   ```
   cd /u/joe
   chmod -fR 700 mqm
   rm -rf mqm
   mkdir mqm
   ```

2. Using FTP binary mode, upload the file ma1g.tar.Z from your workstation to the HFS directory `/u/joe/mqm`.

3. While in the OpenEdition shell, change to the installation directory `/u/joe/mqm`.
4. Uncompress and untar the file with the command
   ```
   tar -xpozf ma1g.tar.Z
   ```
5. Set up your CLASSPATH and LIBPATH as described in "Environment variables" on page 10.

Verifying installation using the sample program

To verify installation of MA1G from UNIX System Services (USS), follow the instructions in "Verifying with the sample application" on page 16.

To verify installation of MA1G from CICS Transaction Server:

1. Define the sample application program (MQIVP) to CICS.
2. Define a transaction to run the sample application.
3. Put the queue manager name into the file used for standard input.
4. Run the transaction.

The program output is placed in the files used for standard and error output.

Refer to CICS documentation for more information on running Java programs and setting the input and output files.

Features not provided by SupportPac MA1G

SupportPac MA1G provides a subset of features available to other WebSphere MQ base Java applications. In particular, it does not support the ConnectionPooling feature described in Chapter 7, "Writing WebSphere MQ base Java programs," on page 67. The following classes and methods are not supported:

- Classes and interfaces
  - MQPoolServices
  - MQPoolServicesEvent
  - MQPoolToken
  - MQSimpleConnectionManager
  - MQPoolServicesEventListener
  - MQConnectionManager
  - ManagedConnection
  - ManagedConnectionFactory
  - ManagedConnectionMetaData
- Methods
  - MQEnvironment.getDefaultConnectionManager()
  - MQEnvironment.setDefaultConnectionManager()
  - MQEnvironment.addConnectionPoolToken()
  - MQEnvironment.removeConnectionPoolToken()
  - The six MQQueueManager constructors which allow a ConnectionManager or MQConnectionManager to be specified.

Attempting to use these classes, interfaces, or methods results in compile-time errors or runtime exceptions.

Running WebSphere MQ base Java applications under CICS Transaction Server for OS/390

To run a Java application as a transaction under CICS, you must:

1. Define the application and transaction to CICS by using the supplied CEDA transaction.
2. Ensure that the WebSphere MQ CICS adapter is installed in your CICS system. (See *WebSphere MQ for z/OS System Setup Guide* for details.)
3. Ensure that the JVM environment specified in the DHFJVM parameter of your CICS startup JCL (Job Control Language) includes appropriate CLASSPATH and LIBPATH entries.
4. Initiate the transaction by using any of your normal processes.

For more information on running CICS Java transactions, refer to your CICS system documentation.

Restrictions under CICS Transaction Server

In the CICS Transaction Server for OS/390 environment, only the main (first) thread is allowed to issue CICS or WebSphere MQ calls. It is therefore not possible to share MQQueueManager or MQQueue objects between threads in this environment, or to create a new MQQueueManager on a child thread.

Chapter 8, "Environment-dependent behavior," on page 95 identifies some restrictions and variations that apply to the WebSphere MQ classes for Java when running against a z/OS or OS/390 queue manager. Additionally, when running under CICS, the transaction control methods on MQQueueManager are not supported. Instead of issuing MQQueueManager.commit() or MQQueueManager.backout(), applications use the JCICS task synchronization methods, Task.commit() and Task.rollback(). The Task class is supplied by JCICS in the com.ibm.cics.server package.

Appendix H. SSL CipherSuites supported by WebSphere MQ

The following table lists the CipherSpecs supported by WebSphere MQ, and their associated CipherSuite names. Specify the CipherSpec name in the SSLCIPH property of the SVRCONN channel on the queue manager. Specify the CipherSuite name:

- In MQEnvironment.sslCipherSuite or MQC.SSL_CIPHER_SUITE_PROPERTY of WebSphere MQ base Java
- Using the setSSLCipherSuite() method of MQConnectionFactory in JMS
- Using the SSLCIPHERSUITE (SCPHS) property from JMSAdmin

The set of supported CipherSuites varies between JSSE providers; those CipherSuites not supported by the IBM implementation of JSSE are marked with an asterisk.

Table 50. CipherSpecs and matching CipherSuites

CipherSpec	**CipherSuite**
DES_SHA_EXPORT	SSL_RSA_WITH_DES_CBC_SHA
DES_SHA_EXPORT1024	SSL_RSA_EXPORT1024_WITH_DES_CBC_SHA *
NULL_MD5	SSL_RSA_WITH_NULL_MD5
NULL_SHA	SSL_RSA_WITH_NULL_SHA
RC2_MD5_EXPORT	SSL_RSA_EXPORT_WITH_RC2_CBC_40_MD5
RC4_56_SHA_EXPORT1024	SSL_RSA_EXPORT1024_WITH_RC4_56_SHA *
RC4_MD5_US	SSL_RSA_WITH_RC4_128_MD5
RC4_MD5_EXPORT	SSL_RSA_EXPORT_WITH_RC4_40_MD5
RC4_SHA_US	SSL_RSA_WITH_RC4_128_SHA
TRIPLE_DES_SHA_US	SSL_RSA_WITH_3DES_EDE_CBC_SHA

Appendix I. JMS exception messages

This section lists most common exceptions that can be generated by WebSphere MQ JMS. It does *not* include all messages that can be written to a trace file. If you receive an exception message not in this list (except in a trace file), or if the cause seems to be an error in WebSphere MQ JMS, contact your IBM service representative.

A JMSException might have an embedded exception that contains a WebSphere MQ reason code. For an explanation of each WebSphere MQ reason code, see the *WebSphere MQ Application Programming Reference*.

Reading variables in a message

Some messages display text or numbers that vary according to the circumstances giving rise to the message; these are known as *message variables*. Message variables are indicated in this book by the use of numbers in braces; for example, {0}, {1}, and so on.

MQJMS0000 Method {0} has been invoked at an illegal or inappropriate time or if the provider is not in an appropriate state for the requested operation.

Explanation: The normal reason for this exception is that the SSL certificate stores have not been defined. {0} identifies the method that has caused the problem.

User Response: For more information, see "Using Secure Sockets Layer (SSL)" on page 210. For information specific to JMS 1.1, see "Using Secure Sockets Layer (SSL)" on page 253.

MQJMS0002 JMS Client attempted to set invalid clientId on a connection.

Explanation: An application attempted to set the clientId property of a valid connection to null, or attempted to set the clientId property of an invalid connection.

User Response: The clientId property on a connection can only be set once, only to a non-null value, and only before the connection is used. Ensure that the connection is valid and that the clientId value is not null.

MQJMS0003 Destination not understood or no longer valid.

Explanation: The queue or topic may have become unavailable, the application may be using an incorrect connection for the queue or topic, or the supplied destination is not of the correct type for this method.

User Response: Check that WebSphere MQ is still running and the queue manager is available. Check that the right connection is being used for your queue or topic.

MQJMS0004 JMS Client has given JMS Provider a message selector with invalid syntax.

Explanation: The message selector string is empty or contains an invalid value or syntax.

User Response: Check the linked WebSphere MQ exception reason and completion codes for more information.

MQJMS0005 Unexpected end of stream has been reached when a StreamMessage or BytesMessage is being read.

Explanation: The byte stream being read is shorter than the buffer supplied. This can also be caused by receiving a corrupt StreamMessage or BytesMessage.

User Response: Check the length of buffer supplied. Check system event logs for more information.

MQJMS0006 JMS Client attempts to use a data type not supported by a message or attempts to read data in the wrong type.

Explanation: Wrong data types used to read message property types.

User Response: Check that the message received and the properties to be read are of the type expected.

MQJMS0009 JMS Provider is unable to allocate the resources required for a method.

Explanation: Machine resources may be overloaded, the linked exception may give further information.

User Response: Check system resources and load.

MQJMS0010 Operation invalid because a transaction is in progress.
Explanation:
User Response: Wait for the current transaction to complete. See the linked WebSphere MQ exception for further information.

MQJMS0011 Call to Session.commit resulted in a rollback of the current transaction.
Explanation: The transaction failed resulting in a call to rollback to a safe state. See the linked exception for more information.

MQJMS1000 Failed to create JMS message.
Explanation: Invalid message type or properties were specified when creating a base message.
User Response: Check the linked WebSphere MQ exception Reason and Completion code for more information.

MQJMS1001 Unknown acknowledgement mode {0}.
Explanation: Invalid or no parameter {0} set for acknowledgement mode on the session.
User Response: See "Session" on page 393 for the possible values for acknowledgement mode.

MQJMS1004 Connection closed.
Explanation: An operation such as start() or stop() has been called on a connection that is already closed.
User Response: Ensure that the connection is open before performing any operation.

MQJMS1005 Unhandled state transition from {0} to {1}.
Explanation: The state transition is not valid, see log for more information.
User Response: Check the linked WebSphere MQ exception reason and completion code.

MQJMS1006 Invalid value for {0}: {1}
Explanation: Invalid value {1} for property {0}.
User Response: Check the linked WebSphere MQ exception reason and completion code. See Table 11 on page 49 for a list of valid values for this property.

MQJMS1008 Unknown value of transportType: {0}.
Explanation: The value given for transportType could not be used. {0} shows the invalid value.
User Response: See Table 11 on page 49 for a list of valid values for this property.

MQJMS1010 Not implemented.
Explanation: The function requested is not implemented. This can be thrown by message acknowledgement, if the session or acknowledgement parameters are invalid or incorrect.

MQJMS1011 Security credentials cannot be specified when using MQ bindings.
Explanation: The RRS queue does not support a client connection, and bindings connections do not support the specification of security credentials.
User Response: Ensure that you do not try to specify security credentials when using a bindings connection.

MQJMS1012 No message listener.
Explanation: The message listener has stopped or was never started.
User Response: Restart the message listener and retry.

MQJMS1013 Operation invalid while session is using asynchronous delivery.
Explanation: You cannot perform the requested operation while the session is actively using asynchronous delivery mode.
User Response: For more information, see "Asynchronous delivery" on page 208. For information specific to JMS 1.1, see "Asynchronous delivery" on page 248.

MQJMS1014 Operation invalid for identified producer.
Explanation: The QueueSender.send method has been performed on an identified QueueSender, which contradicts the JMS specification
User Response: See "QueueSender" on page 387 and the JMS specification (http://java.sun.com/products/jms/docs.html) for further information.

MQJMS1015 Unknown value of targetClient: {0}.
Explanation: The value for the targetClient property set by the application for this destination is not recognized by WebSphere MQ JMS.
User Response: See "Sending a message" on page 204 for valid values of the targetClient property.

MQJMS1017 Non-local MQ queue not valid for receiving or browsing.
Explanation: An attempt was made to perform an inappropriate operation on a non-local queue.
User Response: Check the queue properties.

MQJMS1018 No valid connection available.
Explanation: The queue is busy, there are network problems or a connection has not been defined for the object.
User Response: Create a valid connection for this operation.

MQJMS1019 Invalid operation for non-transacted session.
Explanation: Commit is not allowed on a session that is not transacted.
User Response: Check the linked IllegalStateException for more information. See "Session" on page 393 for further information.

MQJMS1020 Invalid operation for transacted session.
Explanation: Invalid acknowledgement mode for a transacted session. Acknowledge and Recover are not valid operations in transacted sessions.
User Response: See "Session" on page 393 for further information.

MQJMS1021 Recover failed: unacknowledged messages might not get redelivered.
Explanation: The system was unable to recover from a failure.
User Response: Consult the linked exception to determine why the call to recover failed.

MQJMS1022 Failed to redirect message.
Explanation: When performing asynchronous delivery, WebSphere MQ JMS attempted to redirect the message to the backout queue. No backout queue was defined.
User Response: Ensure that the backout queue is defined. Also, investigate why WebSphere MQ JMS was attempting to redirect the message. It might do so in response to a failing MessageListener implementation.

MQJMS1023 Rollback failed.
Explanation: The system was unable to rollback to a safe state.
User Response: Check the linked WebSphere MQ Exception reason and completion codes for further information.

MQJMS1024 Session closed.
Explanation: The session timed out or was closed; or either the connection or the queue manager was closed, implicitly closing the session.
User Response: Restart the session, and check all required resources are available.

MQJMS1025 Failed to browse message.
Explanation: No message was available for browsing. There may be no message on the Queue.
User Response: Check the linked WebSphere MQ Exception reason and completion codes. Check that a message is available for browsing.

MQJMS1026 ExceptionListener threw exception: {0}.
User Response: Check linked exceptions for further information.

MQJMS1027 Failed to reconstitute destination from {0}.
Explanation: A message has been received which contains invalid destination information in the RFH2 header.
User Response: Ensure that any messages being sent by non-JMS applications have correctly formatted destination information. In the case of RFH2 headers, pay special attention to the "Rto" (reply to) and "Dst" (destination) elements of the XML portion of the header. Valid destination strings must start either "queue" or "topic".

MQJMS1028 Element name is null.
Explanation: A null name string was passed to one of the "get value by name" methods of MapMessage.
User Response: Ensure that all name strings being used to retrieve values are non-null.

MQJMS1029 Property name is null.
Explanation: The itemExists method of MapMessage was invoked with a null item name; or a null name string was used as an argument to a method which retrieves property values by name from a JMS message.
User Response: Ensure that the name strings indicated do not have null values.

MQJMS1031 An internal error has occurred. Please contact your system administrator.
Explanation: Internal Error.
User Response: Contact your IBM representative.

MQJMS1032 close() failed because of {0}
Explanation: Internal Error. {0} indicates the reason for the error.
User Response: Contact your IBM representative.

MQJMS1033 start() failed because of {0}.
Explanation: {0} indicates why the session failed to start.
User Response: Contact your IBM representative.

MQJMS1034 MessageListener threw: {0}.
Explanation: When performing asynchronous delivery, the onMessage() method of the application's MessageListener failed with a Throwable. WebSphere MQ JMS tries to redeliver or requeue the message.
User Response: Do not throw Throwables from the onMessage() method of a MessageListener.

MQJMS1035 Cannot transmit non-MQ JMS messages.
Explanation: Wrong message type used. This is a possible internal problem.
User Response: Check the message type. Contact your IBM representative if there appears to be an internal error.

MQJMS1036 Failed to locate resource bundle.
Explanation: The resource bundle is either not present or not in the application's classpath.
User Response: Check that the classpath includes the location of property files.

MQJMS1038 Failed to log error.
Explanation: Log settings may be incorrect, see the linked LogException.
User Response: Check log settings are correct.

MQJMS1039 Trace file does not exist
Explanation: Trace settings may be incorrect.
User Response: Check trace settings and trace file existence. See "Tracing programs" on page 38 for more information on Trace.

MQJMS1040 Failed to connect to Trace stream.
Explanation: Trace settings may be incorrect.
User Response: See "Tracing programs" on page 38 for more information on Trace.

MQJMS1041 Failed to find system property {0}.
Explanation: The system property specified in {0} does not exist or was not found in the application's classpath.
User Response: Check the classpath settings and the product installation.

MQJMS1042 Invalid delivery mode.
Explanation: Either an invalid value was specified for the delivery mode of a message producer, or an invalid delivery mode value was specified when publishing a message.
User Response: Check to ensure that the value specified is a valid enumeration for delivery mode.

MQJMS1043 JNDI failed due to {0}.
Explanation: {0} gives further information.
User Response: Check settings for LDAP, JNDI, and in the JMSAdmin.config file.

MQJMS1044 String is not a valid hexadecimal number - {0}.
Explanation: An attempt was made to specify a group ID or correlation ID which starts with the prefix "ID:" but is not followed by a well-formed hex value; or an attempt was made to receive a message which contains an RFH2 property of type bin.hex that does not have a well-formed hex value.
User Response: Ensure that a valid hex value always follows the "ID:" prefix when setting group ID or correlation ID values. Ensure that any RFH2 headers generated by non-JMS applications are well-formed.

MQJMS1045 Number outside of range for double precision S/390 Float {0}.
Explanation: This is a z/OS and OS/390 specific error.

MQJMS1046 The character set {0} is not supported.
Explanation: An attempt was made to send or receive a map message, stream message or text message whose body is encoded using a character set not supported by the JVM. In the case of text messages, this exception may be thrown when the body of the message is first queried, rather than at receive time.
User Response: Only set character encoding on a message to values known to be available to the receiving application.

MQJMS1047 The map message has an incorrect format.
Explanation: A map message was received, but its RFH2 header information is badly formatted.
User Response: Ensure any non-JMS applications are building well-formed RFH2 header information for inclusion in map messages.

MQJMS1048 The stream message has an incorrect format.
Explanation: A stream message was received, but its RFH2 header information is badly formatted.
User Response: Ensure any non-JMS applications are building well-formed RFH2 header information for inclusion in stream messages.

MQJMS1049 The JMS client attempted to convert a byte array to a String.
Explanation: Attempting to receive a byte array from a stream message using the readString method.
User Response: Either use the appropriate method to receive the data, or format the data placed into the stream message correctly.

MQJMS1050 The MQRFH2 header has an incorrect format.
Explanation: Receiving a message with a badly formed RFH2 header.
User Response: Ensure that any non-JMS applications building messages with RFH2 headers create well-formed RFH2 headers.

MQJMS1053 Invalid UTF-16 surrogate detected {0}.
Explanation: An invalid UTF-16 surrogate character has been encountered as part of a topic name or RFH2 property.
User Response: Ensure that, when specifying UTF-16, topic names or RFH2 properties are well-formed.

MQJMS1054 Invalid XML escape sequence detected {0}.
Explanation: An invalid XML escape sequence has been encountered in the RFH2 header of a received message.
User Response: Ensure that only valid XML escape sequences are placed into any RFH2 headers built by non-JMS applications.

MQJMS1055 The property or element in the message has incompatible datatype {0}.
Explanation: Attempting to retrieve a property from a JMS message using a accessor method which specifies an incompatible type. For example, attempting to retrieve an integer property using the getBooleanProperty method.
User Response: Use an accessor method defined by the JMS specification as being able to retrieve property values of the required type.

MQJMS1056 Unsupported property or element datatype {0}.
Explanation: This error is caused by one of the following:

1. Attempting to set a property of a JMS message using an object which is not one of the supported types.
2. Attempting to set or receive a message whose RFH2 contains a element representing a property which does not have a valid type associated with it.

User Response: Ensure that when setting message properties, an object type described as being valid in the JMS specification is used. If this exception occurs when receiving a message containing an RFH2 header sent by a non-JMS application, ensure that the RFH2 header is well-formed.

MQJMS1057 Message has no session associated with it.
Explanation: An attempt was made to acknowledge a message on a session which is not in an open state.
User Response: Ensure that the session associated with the message has been correctly opened. Check that the session has not been closed.

MQJMS1058 Invalid message property name: {0}.
Explanation: Attempting to set a property that either does not have a valid property name, or is not a settable property.
User Response: Ensure that the property name used is a valid property name in accordance with the JMS specification. If the property name refers to a JMS or provider-specific extension property, ensure that this property is settable.

MQJMS1059 Fatal error - UTF8 not supported.
Explanation: The Java runtime environment you are using does not support the UTF-8 character encoding. JMS requires support for this encoding to perform some operations.
User Response: Consult the documentation and or provider of your Java runtime environment to determine how to obtain support for the UTF-8 character encoding.

MQJMS1060 Unable to serialize object.
Explanation: An attempt has been made to serialize an ObjectMessage which contains a non-serializable object.
User Response: Ensure that ObjectMessages only contain serializable objects. If the object placed inside an ObjectMessage references other objects, these must also be serializable.

MQJMS1061 Unable to deserialize object.
Explanation: De-serialization of an ObjectMessage failed.
User Response: Ensure that the ObjectMessage being received contains valid data. Ensure that the class files representing object data contained within the ObjectMessage are present on the machine deserializing the ObjectMessage. If the object contained within the ObjectMessage references other objects, ensure that these class files are also present.

MQJMS1066 Invalid message element name: {0}.
Explanation: Attempting to set a message property using either an invalid property name, or the name of a property which cannot have its value set.
User Response: Ensure that the property name specified conforms to the JMS specification. If the property name supplied is that of a JMS property, or a vendor specific extension, ensure that this property name is settable.

MQJMS1067 Timeout invalid for MQ.
Explanation: An attempt was made to invoke the receive method on either a QueueReceiver or TopicSubscriber method, specifying a long timeout value which is not valid.
User Response: Ensure the timeout value specified is not negative and not greater than the value of Integer.MAX_VALUE.

MQJMS1068 Failed to obtain XAResource.
Explanation: JMS failed to create an XA Queue resource due to an error.
User Response: See the linked XAException for more information.

MQJMS1072 Could not inquire upon queue manager name.
Explanation: In createConnectionConsumer() or createDurableConnectionConsumer(), JMS could not determine the name of the queue manager.
User Response: Check your queue manager error logs for problems which may cause this. If there are no other error conditions, contact your IBM representative.

MQJMS1073 Specified MQ Queue is neither a QLOCAL nor a QALIAS.
Explanation: createConnectionConsumer() was called, but a queue of the wrong type was specified. Only QALIAS and QLOCALs can be used with the ConnectionConsumer feature.
User Response: Specify a queue of the correct type.

MQJMS1074 Unable to process null message.
Explanation: Internal error in WebSphere MQ JMS.
User Response: Contact your IBM representative.

MQJMS1075 Error writing dead letter header.
Explanation: JMS attempted to requeue a message to the dead letter queue, but could not construct a dead letter header.
User Response: Use the linked exception to determine the cause of this error.

MQJMS1076 Error reading dead letter header.
Explanation: JMS attempted to interpret a message with a dead letter header, but encountered a problem.
User Response: Use the linked exception to determine the cause of this error.

MQJMS1077 Connection and Destination mismatch.
Explanation: An operation was requested, but the Destination class is incompatible with the Connection class. Topics cannot be used with QueueConnections and Queues cannot be used with TopicConnections.
User Response: Supply a suitable Destination. This may represent an internal error condition in JMS; in this case contact your IBM representative.

MQJMS1078 Invalid Session object.
Explanation: The JMS ConnectionConsumer feature attempted to deliver a batch of messages to a Session. However, the Session contained in the ServerSession object returned by the ServerSessionPool was not a WebSphere MQ JMS Session.
User Response: This is an error in the ServerSessionPool. If you have supplied a ServerSessionPool, check its behavior. In a J2EE application server, this may represent an error in the application server; in which case, refer to your application server's documentation.

MQJMS1079 Unable to write message to dead letter queue.
Explanation: JMS attempted to requeue a message to the dead letter queue, but failed.
User Response: Use the linked exception to determine the cause of this error. If there is no linked exception, check that the queue manager has a defined dead letter queue. Once JMS has sent a message to the dead letter queue, the reason code stored in the message's DLH can be used to determine why the message was dead-lettered.

MQJMS1080 No Backout-Requeue queue defined.
Explanation: JMS encountered a message which has been backed out more than the queue's Backout Threshold, however the queue doesn't have a Backout-Requeue queue defined.
User Response: Define a Backout-Requeue queue for the queue, or set the Backout Threshold to zero to disable poison message handling. Investigate the repeated backouts.

MQJMS1081 Message requeue failed.
Explanation: JMS found an error when requeuing a message which has been backed out more than the queue's Backout Threshold.
User Response: Use the linked exception to determine the cause of this error. Investigate the repeated backouts.

MQJMS1082 Failure while discarding message.
Explanation: JMS encountered an error while discarding a message, or while generating an exception report for a message to be discarded.
User Response: Use the linked exception to determine the cause of this error.

MQJMS1083 Invalid message batch size (must be >0).
Explanation: An invalid batch size parameter was passed to createConnectionConsumer() or createDurableConnectionConsumer().
User Response: Set a batch size greater than zero. In a J2EE application server, this may represent an error in the application server. Refer to your application server's documentation.

MQJMS1084 Null ServerSessionPool has been provided.
Explanation: The ServerSessionPool specified on createConnectionConsumer() or createDurableConnectionConsumer() was null.
User Response: Set an appropriate ServerSessionPool. In a J2EE application server, this may represent an error

in the application server. Refer to your application server's documentation.

MQJMS1085 Error writing RFH.
Explanation: JMS attempted to construct an RFH message header, but encountered an error.
User Response: Use the linked exception to determine the cause of this error.

MQJMS1086 Error reading RFH.
Explanation: JMS encountered an error while parsing an RFH message header.
User Response: Use the linked exception to determine the cause of this error.

MQJMS1087 Unrecognized or invalid RFH content.
Explanation: JMS expected to find an RFH message header, but found it to be missing, malformed or lacking required data.
User Response: Investigate the source of the message. This may represent an internal error condition in JMS; in this case, contact your IBM representative.

MQJMS1088 Mixed-domain consumers acting on the same input is forbidden.
Explanation: A point-to-point ConnectionConsumer is using the subscriber queue of a publish/subscribe ConnectionConsumer.
User Response: Do not attempt to access subscriber queues using the point-to-point ConnectionConsumer facilities of JMS. Check your TopicConnectionFactory and Topic objects to make sure they are not using a QLOCAL intended for use by point-to-point applications as a subscriber queue.

MQJMS1089 Exception occurred reading message body: {0}.
Explanation: JMS encountered an exception while reading data from a message. The message being read is likely to be a response message from the publish/subscribe broker.
User Response: Use the linked exception to determine the cause of this error.

MQJMS1111 JMS 1.1 The required queues or publish/subscribe services are not set up: {0}.
Explanation: The required WebSphere MQ setup for the messaging domain is not complete.
User Response: For the point-to-point messaging, make sure that you have started the queue manager and, if your JMS application is connecting as a client application, make sure that you have started a listener for the correct port. For publish/subscribe messaging, make sure that you have done the post installation setup, as described in "Additional setup for publish/subscribe mode" on page 26.

MQJMS1112 JMS 1.1 Invalid operation for a domain specific object.
Explanation: A JMS application attempted to perform an operation on domain specific object, but the operation is valid only for the other messaging domain.
User Response: Make sure that the JMS objects used by your application are relevant for the required messaging domain. If your application uses both messaging domains, consider using domain independent objects throughout the application.

MQJMS1113 JMS 1.1 Invalid attribute for a domain specific object.
Explanation: A JMS application attempted to set an attribute of a domain specific object, but the attribute is valid only for the other messaging domain.
User Response: Make sure that the JMS object types used by your application are relevant for the required messaging domain. If your application uses both messaging domains, consider using domain independent objects throughout the application.

MQJMS2000 Failed to close MQ queue.
Explanation: JMS attempted to close a WebSphere MQ queue, but encountered an error. The queue may already be closed, or another thread may be performing an MQGET while close() is called.
User Response: Use the linked exception to determine the cause of this error. You may be able to perform the close() later.

MQJMS2001 MQQueue reference is null.
Explanation: JMS attempted to perform some operation on a null MQQueue object.
User Response: Check your system setup, and that all required queue names have been specified. This may represent an internal error condition in JMS; in this case, contact your IBM representative.

MQJMS2002 Failed to get message from MQ queue.
Explanation: JMS attempted to perform an MQGET; however WebSphere MQ reported an error.
User Response: Use the linked exception to determine the cause of this error.

MQJMS2003 Failed to disconnect queue manager.
Explanation: JMS encountered an error while attempting to disconnect.
User Response: Use the linked exception to determine the cause of this error.

MQJMS2004 MQQueueManager reference is null.
Explanation: JMS attempted to perform an operation on a null MQQueueManager object.
User Response: Check that the relevant object has not been closed. This may represent an internal error

condition in JMS; in this case, contact your IBM representative.

MQJMS2005 Failed to create MQQueueManager for {0}.
Explanation: JMS could not connect to a queue manager. {0} gives the name of the queue manager.
User Response: Use the linked exception to determine the cause of this error. Check the queue manager is running and, if using client attach, that the listener is running and the channel, port and hostname are set correctly. If no queue manager name has been specified, check that the default queue manager has been defined.

MQJMS2006 MQ problem: {0}.
Explanation: JMS encountered some problem with WebSphere MQ. {0} describes the problem.
User Response: Use the included text and linked exception to determine the cause of this error.

MQJMS2007 Failed to send message to MQ queue.
Explanation: JMS attempted to perform an MQPUT; however WebSphere MQ reported an error.
User Response: Use the linked exception to determine the cause of this error.

MQJMS2008 Failed to open MQ queue.
Explanation: JMS attempted to perform an MQOPEN; however WebSphere MQ reported an error.
User Response: Use the linked exception to determine the cause of this error. Check that the specified queue and queue manager are defined correctly.

MQJMS2009 MQQueueManager.commit() failed.
Explanation: JMS attempted to perform an MQCMIT; however WebSphere MQ reported an error.
User Response: Use the linked exception to determine the cause of this error.

MQJMS2010 Unknown value for MQ queue definitionType: {0}.
Explanation: Unable to delete the temporary queue as the definitionType is not valid.
User Response: Check the setting of definitionType.

MQJMS2011 Failed to inquire MQ queue depth.
Explanation: WebSphere MQ JMS is unable to tell how many messages are on the queue.
User Response: Check that the queue and queue manager are available.

MQJMS2012 XACLOSE failed.
Explanation: See linked XAException for more details.

MQJMS2013 Invalid security authentication supplied for MQQueueManager.
Explanation: Bad username or password or both. In bindings mode, a supplied user ID does not match the logged in user ID.
User Response: Check that the user IDs used by WebSphere MQ are all assigned to the relevant groups and given appropriate user permissions.

MQJMS3000 Failed to create a temporary queue from {0}.
Explanation: Creation of temporary queue failed.
User Response: See linked exception for more information. Check that the TemporaryModel parameter against the QueueConnectionFactory is set to a valid model queue.

MQJMS3001 Temporary queue already closed or deleted.
Explanation: Temporary queue no longer exists or is equal to null.
User Response: Check to see that the queue has been created, and that the session is still available.

MQJMS3002 Temporary queue in use.
Explanation: Another program is using the queue.
User Response: Wait for the temporary queue to become free or create another.

MQJMS3003 Cannot delete a static queue.
Explanation: Attempted to delete a queue of type static, where a temporary queue was expected.
User Response: Check the expected queue type for deletion.

MQJMS3004 Failed to delete temporary queue.
Explanation: The temporary queue may be persistent or busy.
User Response: See the linked WebSphere MQ exception for more details. Wait if the queue is busy, or delete the queue manually if it is persistent.

MQJMS3005 Publish/Subscribe failed due to {0}.
Explanation: General error: {0} shows the reason.
User Response: Check the linked WebSphere MQ Exception reason and completion codes for more information. It is possible that the broker and queue manager versions are incompatible.

MQJMS3006 Topic reference is null.
Explanation: Topic supplied to a publisher is null.
User Response: Use non-null values.

MQJMS3008 Failed to build command {0}.
Explanation: Broker message command parameters incorrect.
User Response: Check linked exception for cause.

MQJMS3009 Failed to publish command to MQ queue.
Explanation: Invalid command, queue unavailable or broker errors.
User Response: Check linked WebSphere MQ exception reason and completion codes for more information.

MQJMS3010 Failed to build publish message.
Explanation: Unable to build the base message for the broker.
User Response: See the linked WebSphere MQ Exception for further details. Check settings and parameters are all correct. See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 for more information.

MQJMS3011 Failed to publish message to MQ queue.
Explanation: See linked Exception for more information.
User Response: Check settings and parameters are all correct. See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 for more information.

MQJMS3013 Failed to store admin. entry.
Explanation: An add to the admin or status queue failed due to duplication or some other error. See any linked exception for more information.
User Response: Check for duplicates and retry.

MQJMS3014 Failed to open subscriber queue {0}.
User Response: See linked exception for more information.

MQJMS3017 Failed to delete subscriber queue {0}.
Explanation: {0} gives the queue name. See linked exception for more information.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 for more information on solving publish/subscribe problems.

MQJMS3018 Unknown durable subscription {0}.
Explanation: Could not locate the given subscription. For example, during an unsubscribe request.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 for more information.

MQJMS3020 TemporaryTopic out of scope.
Explanation: The current connection ID does not match the connection that created the temporary topic.

MQJMS3021 Invalid subscriber queue prefix: {0}.
Explanation: The name specified is not valid. It must begin with SYSTEM.JMS.D for durable subscriptions or SYSTEM.JMS.ND for non-durable subscriptions.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 for naming conventions.

MQJMS3022 Durable re-subscribe must use same subscriber queue; specified: {0}, original: {1}.
Explanation: {0} and {1} show the differing queue names. Unable to get a subscription due to wrong queue manager or queue.
User Response: Check settings.

MQJMS3023 Subscription has an active TopicSubscriber.
Explanation: Can be caused by a queue open problem or if a subscription already exists on the JVM. If running in WebSphere Application Server there can be other causes. See linked exception, if set, for more information.
User Response: Check settings.

MQJMS3024 Illegal use of uninitialized clientId.
Explanation: The clientId in the connection has not been set.
User Response: Set the clientId before attempting to perform any operation.

MQJMS3025 TemporaryTopic in use.
Explanation: Something else is currently using the topic.
User Response: Wait until the topic is free or create another topic. Ensure subscribers de-register when finished.

MQJMS3026 QueueSender is closed.
User Response: Open or re-open the queue sender if required.

MQJMS3027 Local transactions not allowed with XA sessions.
Explanation: A call pertaining to a local transaction was made on a Session involved with XA-coordinated transactions
User Response: This typically represents an error in an application server. Consult your application server's documentation and any error logs.

MQJMS3028 TopicPublisher is closed.
User Response: Open or reopen the topic publisher if required.

MQJMS3029 Enlist failed (see linked Exception).
Explanation: JTSXA.enlist threw an exception that was caught by JMS.
User Response: Check the linked WebSphere MQ Exception reason and completion codes for more information. Contact your IBM representative.

MQJMS3031 clientId cannot be set after connection has been used.
Explanation: The clientId of a connection can be set only once and only before the connection is used.
User Response: Set the clientId before using the connection.

MQJMS3032 Resetting the clientId is not allowed.
Explanation: The clientId of a connection can be set only once and only before the connection is used.
User Response: Set the clientId before using the connection.

MQJMS3033 QueueReceiver is closed.
User Response: Open or reopen the receiver.

MQJMS3034 TopicSubscriber is closed.
User Response: Open or reopen the TopicSubscriber.

MQJMS3036 Broker side message selection valid only when using WebSphere MQ Integrator broker.
Explanation: Broker version and message selection are not consistent.
User Response: Ensure the broker version has been set in the ConnectionFactory. Use the method setBrokerVersion(JMSC.MQJMS_BROKER_V2) on the ConnectionFactory for WebSphere MQ Integrator or WebSphere MQ Event Broker.

MQJMS3037 Message Producer is closed.
Explanation: Either or both of the session and connection are closed.
User Response: Check to ensure that the session and connection are both available.

MQJMS3038 Message Consumer is closed.
Explanation: Either or both of the session and connection are closed.
User Response: Check to ensure that the session and connection are both available.

MQJMS3039 Illegal use of null name.
Explanation: Durable connection consumers must be named.
User Response: Check for null values.

MQJMS3040 Invalid broker control message content: {0}.
Explanation: {0} explains further.
User Response: Check the broker documentation for message content information.

MQJMS3042 Unrecognized message from Pub/Sub Broker.
Explanation: The message received from the broker was not of a recognized or supported format.
User Response: Check that the broker you are using is supported and refer to broker documentation for settings.

MQJMS3044 Cleanup level of NONE requested.
Explanation: Cleanup requested while cleanupLevel set to NONE.
User Response: Set cleanupLevel property to an appropriate value.

MQJMS3047 Subscription store type not supported by queue manager.
Explanation: Not an MQSPIQueue manager or deferred message not supported.
User Response: Possible incompatibility between queue manager version and broker. Specify a different type of subscription store or upgrade the queue manager. For more information, see “Subscription stores” on page 227. For information specific to JMS 1.1, see “Subscription stores” on page 246.

MQJMS3048 Incorrect subscription store type.
Explanation: Subscription store changed within TopicConnection.
User Response: Contact your IBM representative.

MQJMS3049 Incorrect subscription type for this subscription store.
Explanation: TopicSubscriber was created with a different SUBSTORE setting than current TopicConnection.
User Response: Ensure TopicSubscribers are only used during the lifetime of their parent TopicConnection. For more information, see “Subscription stores” on page 227. For information specific to JMS 1.1, see “Subscription stores” on page 246.

MQJMS4009 Context is not empty.
Explanation: Error deleting Context due to context not being empty.
User Response: Remove context contents before trying delete.

MQJMS4096 Binding non-administerable or not found.
Explanation: From JMSAdmin, an object was specified on the command line that either does not exist, or is not an object that JMSAdmin can administer.
User Response: Specify a valid obect on the JMSAdmin command line.

MQJMS4097 Context not found.
Explanation: Could not find a context to match the name given.
User Response: Ensure the correct context name is specified.

MQJMS4104 Object is inactive, so cannot perform directory operations.
Explanation: The JNDI service is inactive.
User Response: See Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41 for JMSAdmin and JNDI information.

MQJMS4106 Object is not a WebSphere MQ JMS administered object.
User Response: See Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41.

MQJMS4111 Unable to create context.
Explanation: Administration service failed.
User Response: Check LDAP and JNDI settings.

MQJMS4112 Unable to create a valid object, please check the parameters supplied.
Explanation: Consistency check failed.
User Response: Contact your IBM representative.

MQJMS4113 Unable to bind object.
Explanation: Administration service bind or copy or move operation failed.
User Response: Check that you have correctly set up your JNDI provider.

MQJMS4115 An invalid name was supplied.
Explanation: JMSAdmin error. An invalid name was supplied when trying to delete a context.
User Response: Refer to Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41 for more about using JMSAdmin.

MQJMS4121 Cannot open configuration file.
Explanation: Configuration file may not exist.
User Response: Check MQ_JAVA_INSTALL_PATH environment variable exists and points to the installation directory of the base Java classes.

MQJMS4127 Invalid property in this context.
Explanation: JMSAdmin object value is invalid in the current context.
User Response: See Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41 for more about JMSAdmin.

MQJMS4130 Context not found or unremovable.
Explanation: The specified child context could not be deleted.
User Response: Ensure the correct context name was specified.

MQJMS4131 Expected and actual object types do not match.
Explanation: Requested and retrieved objects are of different types.
User Response: Check that you have specified the correct object type.

MQJMS4132 Client-bindings attribute clash.
Explanation: Client properties specified for a bindings connection.
User Response: Ensure the ConnectionFactory properties are correct.

MQJMS4133 ExitInit string supplied without Exit string.
Explanation: ExitInit string supplied but Exit is not set.
User Response: Set appropriate exit, or unset ExitInit string.

MQJMS4137 Unable to create a WebSphere MQ specific class. The WebSphere MQ classes may not have been installed or added to the classpath.
User Response: Check WebSphere Application Server installation and classpath variable.

MQJMS4139 Invalid authentication type supplied - using 'none'.
Explanation: AdminService JNDI initialization parameters contain an invalid authorization scheme, so "none" is used as the value instead.
User Response: See Chapter 5, "Using the WebSphere MQ JMS administration tool," on page 41 for more information.

MQJMS5053 * No broker response. Please ensure that the broker is running. *****
Explanation: Possible causes:
1. Broker is not running.
2. You are using BrokerVersion=V2 in your TopicConnectionFactory with the MQSeries Publish/Subscribe broker, which does not support this.
3. The Broker has rejected the Publication or Subscription and placed it on the SYSTEM.DEAD.LETTER.QUEUE

User Response: Ensure that your broker is running. Check the system event log for broker error messages. Check that the broker supports the BrokerVersion you are using. Check the SYSTEM.DEAD.LETTER.QUEUE for rejected messages.

MQJMS5054 The broker appears to be running, but the message did not arrive.
Explanation: Thrown by Installation Verification Test when the subscriber fails to receive the published message.
User Response: Check that you have set up the broker correctly. Check system event logs for broker error messages. Check the SYSTEM.DEAD.LETTER.QUEUE for messages rejected by the broker.

MQJMS5060 Unable to connect to queue manager.
Explanation: Thrown by Installation Verification Test.
User Response: Check that the queue manager is running and that its name is specified correctly in the IVTTest parameters.

MQJMS5061 Unable to access broker control queue on queue manager.
User Response: Check that the control queue exists. The default name is SYSTEM.BROKER.CONTROL.QUEUE.

MQJMS6040 Invalid socket family name: {0}.
Explanation: An invalid socket family name was given to an instance of IMBSocketFactory. {0} shows the bad name.
User Response: Contact your IBM representative.

MQJMS6041 An exception occurred while attempting to load socket factory class {0}, exception: <{1}>.
Explanation: Either a ClassNotFoundException, an InstantiationException or an IllegalAccessException occurred while trying to load a particular IMBSocketFactory. {0} gives the name of the class.
User Response: Contact your IBM representative.

MQJMS6059 An exception occurred while loading the minimal client security implementation.
User Response: Contact your IBM representative.

MQJMS6060 An unexpected exception in minimal client, exception = {0}.
Explanation: An unusual or unexpected exception occurred at the minimal client. {0} gives more details.
User Response: Contact your IBM representative.

MQJMS6061 A specified topic was malformed, topic = {0}.
Explanation: {0} gives the name of the malformed topic.
User Response: See "Using topics" on page 221 for more information.

MQJMS6062 EOF was encountered while receiving data in the minimal client.
User Response: Contact your IBM representative.

MQJMS6063 The broker indicated an error on the minimal client connection.
User Response: Refer to JMS or broker documentation. Contact your IBM representative.

MQJMS6064 Connector.send was called with an illegal message value.
Explanation: Connector.send was called with an illegal message value.
User Response: See Chapter 7, "Writing WebSphere MQ base Java programs," on page 67 for more information.

MQJMS6065 An illegal value was encountered for a field, value = {0}.
Explanation: {0} shows the illegal value.
User Response: See Table 38 on page 457 for a list of properties and their possible values.

MQJMS6066 An unexpected internal error occurred in the minimal client.
Explanation: Internal problem.
User Response: Contact your IBM representative.

MQJMS6067 A bytes message operation was requested on something that is not a bytes message.
Explanation: The wrong message type was found.
User Response: Check message type before performing type specific operations.

MQJMS6068 A text message operation was requested on something that is not a text message.
Explanation: The wrong message type was found.
User Response: Check message type before performing type specific operations.

MQJMS6069 A stream message operation was requested on something that is not a stream message.
Explanation: The wrong message type was found.
User Response: Check message type before performing type specific operations.

MQJMS6070 A map message operation was requested on something that is not a map message.
Explanation: The wrong message type was found.
User Response: Check message type before performing type specific operations.

MQJMS6071 The broker sent an invalid message during authentication.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 and the broker documentation for more information.

MQJMS6072 The broker requested an unavailable protocol during authentication.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 and the broker documentation for more information.

MQJMS6073 Minimal client connection rejected because of authentication failure.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 and the broker documentation for more information.

MQJMS6074 No QOP available in the minimal client.
Explanation: Indicates that QOP is not implemented in the current version of the minimal client.
User Response: Contact your IBM representative.

MQJMS6078 An attempt was made to write an invalid object type of class {0}.
Explanation: {0} identifies the invalid object's class.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 and the broker documentation for more information.

MQJMS6079 An exception occurred while attempting to load thread pooling support, exception = {0}.
Explanation: An exception was caught while attempting to load thread pooling support in the JMS client. Parameter {0} will give details of the exception.
User Response: Contact your IBM representative.

MQJMS6081 An attempt was made to read from a Stream message before a previous read has completed.
Explanation: Internal error.
User Response: Contact your IBM representative.

MQJMS6083 An exception occurred while initializing a thread pool instance, exception = {0}.
Explanation: A SocketThreadPoolException was caught while initializing a thread pool instance in the JMS client. {0} gives details of the exception.
User Response: Contact your IBM representative.

MQJMS6085 No ExceptionListener has been set.
User Response: Create an ExceptionListener.

MQJMS6088 The client-side connection monitor is terminating.
User Response: Restart the connection.

MQJMS6090 Attempted to synchronously receive on a MessageConsumer for which a listener is active.
Explanation: MessageConsumer.receive() was called but a message listener is already active on the connection.
User Response: See Chapter 7, "Writing WebSphere MQ base Java programs," on page 67 for more information.

MQJMS6091 An IOException occurred when starting or stopping delivery on the connection, exception = {0}.
Explanation: Parameter {0} gives details of the exception.
User Response: Restart the connection.

MQJMS6093 An exception occurred during synchronous receive, exception = {0}.
Explanation: Internal error, parameter {0} gives details of the exception.
User Response: Restart connection.

MQJMS6096 A JMSPriority level of {0} is outside the range specified in JMS.
Explanation: Parameter {0} gives the value that is in error.
User Response: See Table 38 on page 457 for valid values.

MQJMS6097 The specified JMSMessageID, {0}, is invalid.
Explanation: Incorrect syntax was used to specify a message ID in Message.setJMSMessageID. The correct syntax is ID:[0-9]+.
User Response: Check parameters. See Chapter 13,

"JMS messages," on page 257 for more information on message IDs.

MQJMS6105 No more client parameter changes allowed.
Explanation: An attempt was made to set a SessionConfig parameter when no more changes are allowed. Internal error.
User Response: Contact your IBM representative.

MQJMS6106 An exception occurred when initializing parameter {0}, exception {1}.
Explanation: {0} identifies the failing parameter and {1} the caught exception.
User Response: Contact your IBM representative.

MQJMS6115 An exception occurred while creating the TopicConnection, exception {0}.
Explanation: {0} gives details of the exception.
User Response: Contact your IBM representative.

MQJMS6116 This operation is not permitted on an entity that is closed.
Explanation: An operation was requested on a closed publisher, session, or connection.
User Response: Ensure that the publisher, session, or connection is open before trying this operation.

MQJMS6117 The {0} implementation of Topic is not supported.
Explanation: The Topic instance passed to a TopicPublisher or TopicSession method has an unsupported run-time implementation. {0} gives the class name of the unsupported implementation.
User Response: See "Using topics" on page 221 for more information on Topic implementations.

MQJMS6118 Topic {0} contains a wildcard, which is invalid for publishing.
Explanation: The Topic specified to a TopicPublisher method contained a wildcard. Wildcards are not allowed in Topics when publishing messages. The failing Topic is given by {0}.
User Response: See "Using topics" on page 221 for more information.

MQJMS6119 An IOException occurred while publishing, exception {0}.
Explanation: An IOException was caught while publishing a message. {0} gives details of the exception.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 for more information.

MQJMS6120 Attempted to use a temporary topic not created on the current connection.
Explanation: Invalid use of temporary topics and connections.
User Response: See Chapter 15, "JMS interfaces and classes," on page 295 for more information.

MQJMS6121 An IOException occurred while subscribing, exception {0}.
Explanation: An IOException was caught while subscribing. {0} gives details of the exception.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 for more information.

MQJMS6122 An exception occurred when creating subscription to {0}, {1}.
Explanation: An invalid subject or query syntax was used in the creation of a subscriber, resulting in an exception. The topic name, and caught exception are included as parameters of this event.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 and the broker documentation for more information.

MQJMS6232 While creating a TopicSubscriber, attempting to add the subscription to the matching engine resulted in exception: {0}.
Explanation: {0} gives details of the exception.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 and the broker documentation for more information.

MQJMS6234 An attempt was made to remove an object with Topic {0} from an empty matching engine: {1}.
Explanation: An attempt was made to remove from a null tree in match space. {0} gives the Topic and {1} gives the MatchTarget. Internal error.
User Response: Contact your IBM representative.

MQJMS6235 An attempt was made to remove an object with a Topic {0} from the matching engine, but it did not have a cache entry: {1}.
Explanation: Internal error.
User Response: Contact your IBM representative.

MQJMS6238 In attempting to access a field of a message, the following exception occurred: {0}.
Explanation: A corrupt message format was discovered. Internal error.
User Response: Contact your IBM representative.

MQJMS6240 An EvalCache get or put operation specified an invalid id.
Explanation: An operation expected the MinValue of an EvalCache to be increased, but it won't be. Internal Error.
User Response: Contact your IBM representative.

MQJMS6241 Too many content attributes were specified.
Explanation: Too many non-topic attributes were specified in Factor.createMatcherInternal. Internal error.
User Response: Contact your IBM representative.

MQJMS6246 An incorrect use of a the Topic wildcard character {0} was detected.
Explanation: The failing Topic is given by parameter {0}.
User Response: See "Using topics" on page 221 for more information.

MQJMS6247 The Topic segment separator {0} appears in an incorrect position.
Explanation: A subscription Topic separator was used incorrectly. {0} shows the bad separator.
User Response: See "Using topics" on page 221 for more information.

MQJMS6249 The following exception occurred while parsing a subscription selector: {0}.
Explanation: A TypeCheckException occurred while loading or invoking the match parser. This may indicate a syntax error in your Selector.
User Response: For more information, see "Message selectors" on page 207. For information specific to JMS 1.1, see "Message selectors" on page 243.

MQJMS6250 The escape character was used to terminate the following pattern: {0}.
Explanation: This may indicate a syntax error in your Selector.
User Response: For more information, see "Message selectors" on page 207. For information specific to JMS 1.1, see "Message selectors" on page 243.

MQJMS6251 The escape character {0} passed to the pattern tool is longer than one character.
Explanation: This may indicate a syntax error in your Selector.
User Response: For more information, see "Message selectors" on page 207. For information specific to JMS 1.1, see "Message selectors" on page 243.

MQJMS6252 A message field was expected to contain a value of type {0} but contained one of type {1}.
Explanation: This may indicate a syntax error in your Selector.
User Response: For more information, see "Message selectors" on page 207. For information specific to JMS 1.1, see "Message selectors" on page 243.

MQJMS6312 Non-authorized subscription to topic {0}.
Explanation: Attempting to create a subscription to a Topic that is not authorized for the client. {0} gives the Topic string.
User Response: See Chapter 11, "Writing WebSphere MQ JMS publish/subscribe applications," on page 213 and the broker documentation for more information.

Appendix J. Notices

This information was developed for products and services offered in the United States. IBM may not offer the products, services, or features discussed in this information in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this information. The furnishing of this information does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.

For license inquiries regarding double-byte (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

IBM World Trade Asia Corporation
Licensing
2-31 Roppongi 3-chome, Minato-ku
Tokyo 106, Japan

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law:
INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the information. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this information at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

IBM United Kingdom Laboratories,
Mail Point 151,
Hursley Park,
Winchester,
Hampshire,
England
SO21 2JN.

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this information and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Programming License Agreement, or any equivalent agreement between us.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. You may copy, modify, and distribute these sample programs in any form without payment to IBM for the purposes of developing, using, marketing, or distributing application programs conforming to IBM's application programming interfaces.

Trademarks

The following terms are trademarks of International Business Machines Corporation in the United States, or other countries, or both:

AIX	AS/400	CICS
IBM	iSeries	Language Environment
MQSeries	MVS/ESA	OS/390
OS/400	SecureWay	SupportPac
System/390	S/390	VisualAge
WebSphere	z/OS	zSeries

Intel, Intel Inside (logos), MMX, and Pentium are trademarks of Intel Corporation in the United States, other countries, or both.

Java, HotJava, JDK, and all Java-based trademarks and logos are trademarks or registered trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Microsoft, Windows, and Windows NT are trademarks of Microsoft Corporation in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Other company, product, and service names may be trademarks or service marks of others.

Index

D

E

F

G

H

I

J

L

M

N

O

P

Q

R

S

T

U

V

W

X

Z

Sending your comments to IBM

If you especially like or dislike anything about this book, please use one of the methods listed below to send your comments to IBM.

Feel free to comment on what you regard as specific errors or omissions, and on the accuracy, organization, subject matter, or completeness of this book.

Please limit your comments to the information in this book and the way in which the information is presented.

To make comments about the functions of IBM products or systems, talk to your IBM representative or to your IBM authorized remarketer.

When you send comments to IBM, you grant IBM a nonexclusive right to use or distribute your comments in any way it believes appropriate, without incurring any obligation to you.

You can send your comments to IBM in any of the following ways:

- By mail, to this address:

  User Technologies Department (MP095)
  IBM United Kingdom Laboratories
  Hursley Park
  WINCHESTER,
  Hampshire
  SO21 2JN
  United Kingdom
- By fax:
  - From outside the U.K., after your international access code use 44–1962–816151
  - From within the U.K., use 01962–816151
- Electronically, use the appropriate network ID:
  - IBM Mail Exchange: GBIBM2Q9 at IBMMAIL
  - IBMLink™: HURSLEY(IDRCF)
  - Internet: idrcf@hursley.ibm.com

Whichever method you use, ensure that you include:

- The publication title and order number
- The topic to which your comment applies
- Your name and address/telephone number/fax number/network ID.

Printed in USA

SC34-6066-02

Spine information:

WebSphere MQ

Using Java