

MQSeries[®] Everyplace for Multiplatforms



Programming Guide

Version 1.2.6

MQSeries[®] Everyplace for Multiplatforms



Programming Guide

Version 1.2.6

Take Note!

Before using this information and the product it supports, be sure to read the general information under “Appendix C. Notices” on page 237

License warning

MQSeries Everyplace for Multiplatforms Version 1.2.6 is a toolkit that enables users to write MQSeries Everyplace applications and to create an environment in which to run them.

Before deploying this product, or applications that use it, in a production environment, please make sure that you have the necessary licenses.

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Seventh Edition (December 2001)

This edition applies to MQSeries Everyplace for Multiplatforms Version 1.2.6 and to all subsequent releases and modifications until otherwise indicated in new editions.

This document is continually being updated with new and improved information. For the latest edition, please see the Websphere MQ family library Web page at <http://www.ibm.com/software/ts/mqseries/library/>.

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About this book

This book is a programming guide for the MQSeries Everyplace for Multiplatforms product (generally referred to in this book as MQSeries Everyplace). It contains information on how to use the MQSeries Everyplace Java class libraries that are described in *MQSeries Everyplace for Multiplatforms Programming Reference*.

It provides guidance to help you to decide which classes to use for common messaging tasks, and in many cases example code is supplied.

For information on the writing C- based programs for MQSeries Everyplace, see *MQSeries Everyplace for Multiplatforms C Programming Guide* and *MQSeries Everyplace for Multiplatforms C Programming Reference*

The “Chapter 1. Overview” on page 1 provides a brief introduction for those who are unfamiliar with the concepts and components of MQSeries Everyplace. “Chapter 2. Getting Started” on page 11 provides help for setting up your environment, and shows you how to use examples to create applications. The rest of the book contains more detailed information about various aspects of programming with MQSeries Everyplace.

You should use this book in conjunction with the *MQSeries Everyplace for Multiplatforms Programming Reference* and existing books or manuals on Java programming.

This document is continually being updated with new and improved information. For the latest edition, please see the Websphere MQ family library Web page at <http://www.ibm.com/software/mqseries/library/>.

Who should read this book

This book is intended for anyone who wants to write Java based MQSeries Everyplace programs to exchange secure messages within MQSeries Everyplace systems, and between MQSeries Everyplace systems and other members of the Websphere MQ family of messaging and queueing products.

For information on the availability of development kits for environments other than Java, see the Websphere MQ Web site at <http://www.ibm.com/software/mqseries/>

Prerequisite knowledge

This book assumes that the reader has a working knowledge of Java and object oriented programming techniques.

An initial understanding of the concepts of secure messaging is an advantage. If you do not have this understanding, you may find it useful to read the following Websphere MQ books:

- *Websphere MQ An Introduction to Messaging and Queuing*
- *Websphere MQ for Windows NT[®] V5R1 Quick Beginnings*, or the Websphere MQ Quick Beginnings book that is relevant to the operating system that you are using.

These books are available in softcopy form from the Book section of the online Websphere MQ library. The library can be reached from the Websphere MQ Web site, URL address <http://www.ibm.com/software/Websphere MQ/library/>

Terms used in this book

The following terms are used throughout this book:

Websphere MQ family

refers to the following Websphere MQ products:

- **Websphere MQ Workflow** simplifies integration across the whole enterprise by automating business processes involving people and applications
- **Websphere MQ Integrator** is powerful message-brokering software that provides real-time, intelligent rules-based message routing, and content transformation and formatting
- **Websphere MQ Messaging** provides any-to-any connectivity from desktop to mainframe, through business quality messaging, with over 35 platforms supported

Websphere MQ Messaging

refers to the following messaging product groups:

- **Distributed messaging:** Websphere MQ for Windows NT, AIX®, AS/400®, HP-UX, Sun Solaris, and other platforms
- **Host messaging:** Websphere MQ for OS/390®
- **Workstation messaging:** Websphere MQ for Windows
- **Pervasive messaging:** MQSeries Everyplace

Websphere MQ

refers to the following three Websphere MQ Messaging product groups:

- Distributed messaging
- Host messaging
- Workstation messaging

MQSeries Everyplace

Refers to the fourth Websphere MQ Messaging product group, pervasive messaging.

Device platform

A small computer that is capable of running MQSeries Everyplace only as a client.

Server platform

A computer of any size that is capable of running MQSeries Everyplace as a server or client.

Gateway

A computer of any size running MQSeries Everyplace programs that include Websphere MQ-bridge function.

Summary of changes

This section describes changes to this edition of *MQSeries Everyplace for Multiplatforms Programming Guide*. Within the book, changes since the previous edition are marked by vertical lines to the left of the changes.

Changes for this edition (SC34-5845-06)

In addition to editorial corrections and improvements to the text, the following information has been modified or added:

- Product version number
- Additional Websphere MQ-bridge examples

Changes for previous editions

SC34-5845-05

In addition to editorial corrections and improvements to the text, the following information has been modified or added:

- Product version number

SC34-5845-04

In addition to editorial corrections and improvements to the text, the following information has been modified or added:

- Modified maintenance procedures.

SC34-5845-03

In addition to editorial corrections and improvements to the text, the following information has been modified or added:

- Registry Adapter

SC34-5845-02

Minor errors and omissions have been corrected.

References to High Security Edition have been removed.

The following information has been added:

- Browsing and getting messages from bridge queues
- Diagnostic tool
- Using the Websphere Everyplace Suite (WES) authentication and proxy services.
- New adapter examples
- New message store function

SC34-5845-01

Some of the information in this book has been restructured to reduce duplication and repetition. Minor errors and omissions have also been corrected.

The following information has been added:

- Details for using MQSeries Everyplace on AIX and Solaris.
- Readers comment form.

changes

Migration notes

This section contains information that you may need to consider when migrating from one version or release of MQSeries Everyplace to a higher version or release.

Migrating from version 1.2.5 or lower

If you are migrating to a higher version or release from version 1.2.5 or lower, the following files are no longer needed.

- com.ibm.mqe.MQeAbstractQueueComponent
- com.ibm.mqe.MQeAbstractQueueManagerProxy
- com.ibm.mqe.MQeAdministrator
- com.ibm.mqe.MQeFilter
- com.ibm.mqe.MQeLocalQueueManagerProxy
- com.ibm.mqe.MQeMessageAcceptor
- com.ibm.mqe.MQeMessageDispatcher
- com.ibm.mqe.MQeRemoteQueueManagerProxy
- com.ibm.mqe.MQeVector
- com.ibm.mqe.MQeVectorElement
- com.ibm.mqe.MQeWriteOnlyFunctionFilter
- com.ibm.mqe.messagestore.MQeIndexEntryConstants

You should delete these files from your upgraded system to avoid unnecessary footprint being consumed.

Chapter 1. Overview

MQSeries Everyplace code can run on a large range of platforms including pervasive and mobile devices. Unlike base Websphere MQ, MQSeries Everyplace has a single queue manager type. However, MQSeries Everyplace queue managers can be programmed to act as traditional clients or servers.

The fundamental elements of the MQSeries Everyplace programming model are *messages*, *queues* and *queue managers*. MQSeries Everyplace messages are objects that contain application-defined content. When stored, they are held in a queue and such messages may be moved across an MQSeries Everyplace network. Queues can either be local or remote and are managed by queue managers.

MQSeries Everyplace queue managers communicate through MQSeries Everyplace channels. These channels are created on demand and are referred to as *dynamic*, differentiating them from Websphere MQ channels which have to be explicitly created. They can also be configured in two different ways, in *peer-to-peer* mode, and in *client-server* mode (see “MQSeries Everyplace channels” on page 6).

The Websphere MQ-bridge component also supports Websphere MQ client channels to enable MQSeries Everyplace networks to communicate with Websphere MQ networks.

Figure 1 shows an example of an MQSeries Everyplace network linked to a Websphere MQ server and the following sections of this chapter give brief descriptions of MQSeries Everyplace objects and their uses.

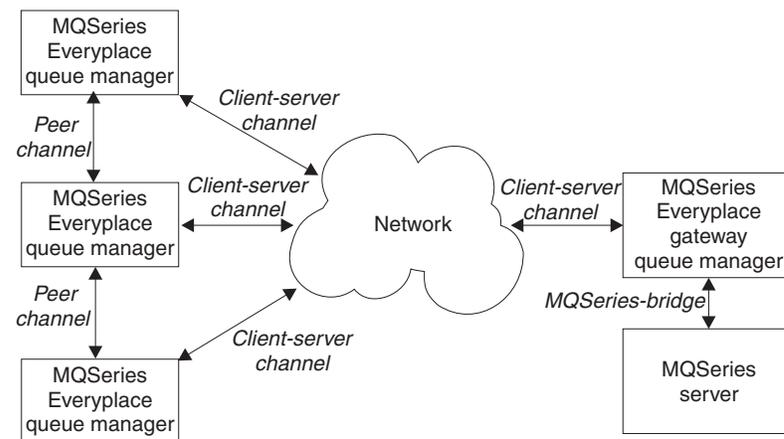


Figure 1. MQSeries Everyplace client

MQSeries Everyplace queue manager

The MQSeries Everyplace queue manager is the focal point of the MQSeries Everyplace system. It provides:

- A central point of access to a messaging and queueing network for MQSeries Everyplace applications
- Optional client-side queuing
- Optional administration functions
- Once-only guaranteed delivery of messages
- Full recovery from failure conditions
- Extendable rules-based behavior

The design of the MQSeries Everyplace queue manager is object-oriented. Objects can inherit behavior from their parent classes. Queue manager behavior can also be customized by the use of rules.. The MQSeries Everyplace queue manager is code imbedded within user written programs and these programs can run on any MQSeries Everyplace supported device or platform.

Queue managers can be configured in a number of different 'styles', the main ones being *client* (also known as peer, or device), *server*, and *gateway*. See "Starting queue managers" on page 33 for descriptions of these styles.

An MQSeries Everyplace queue manager can control the various types of queue that are described in "MQSeries Everyplace queues" on page 3. Communication with other queue managers on the Websphere MQ messaging network can be synchronous or asynchronous. If you want to use synchronous communications, the originator, and the target MQSeries Everyplace queue managers must both be available on the network. Asynchronous communication allows an MQSeries Everyplace application to send messages even when the remote queue manager is offline.

For more detailed information about MQSeries Everyplace queue managers see "Chapter 4. Queue managers, messages, and queues" on page 27

MQSeries Everyplace queues

There are several different types of *queue &class*; that you can use in an MQSeries Everyplace environment. The types that are available in the MQSeries Everyplace development package are:

- Local
- Remote
- Store-and-forward
- Home-server
- Websphere MQ-bridge

Queues may have characteristics , such as authentication, compression and encryption. These characteristics are set using attributes, and are used when a message object is stored on a queue.

Local queue

The simplest type of queue is a local queue. These are real queues that are the final destination for all messages. This type of queue is local to, and owned by, a specific queue manager. Applications on the owning queue manager can interact directly with the queue to store messages in safe and secure way (excluding hardware failures or loss of the device). These queues can be used on a standalone queue manager, or on a queue manager that is connected to a network.

The queue owns access and security and may allow a remote queue manager to use these characteristics (when connected to a network). This allows others to send or receive messages to the queue.

For more detailed information about local queues, see “Local queue” on page 101.

Remote queue

This type of queue does not reside in the local environment. There is a local queue definition that identifies the real queue and the queue manager that owns it.

You can access remote queues either synchronously or asynchronously. If there is a local definition of the remote queue, the mode of access is based on the definition. In this case, the mode of access may be either synchronous or asynchronous. However, if there is no local definition, *queue discovery* occurs. MQSeries Everyplace retrieves the characteristics (authentication, cryptography, and compression) from the real queue, and forces the mode of access to synchronous.

For more information on remote queues, see “Remote queue” on page 104.

Store-and-forward queue

A store-and-forward queue stores messages on behalf of other queue managers until they are ready to receive them. This type of queue is normally defined on a server and can be configured to perform either of the following:

- Push messages either to the target queue manager or to another queue manager between the sending and the target queue managers
- Wait for the target queue manager to pull messages destined for it

overview - queues

Store-and-forward queues can hold messages for many target queue managers, or there may be one store-and-forward queue for each target queue manager. For more detailed information about store-and-forward queues, see “Store-and-forward queue” on page 108.

Home-server queue

This type of queue usually resides on a client and points to a store-and-forward queue on a server known as the *home-server*. The home-server queue pulls messages from the home-server store-and-forward queue when the client connects on the network.

Home-server queues normally have a polling interval that causes them to check for any pending messages on the server while the network is connected.

When this queue pulls a message from the server, it uses assured message delivery to put the message to the local queue manager. The message is then stored on the target queue.

For more detailed information about home-server queues, see “Home-server queue” on page 111.

Websphere MQ-bridge queue

This type of queue is always defined on an MQSeries Everyplace gateway queue manager and provides a path from the MQSeries Everyplace environment to the Websphere MQ environment. The Websphere MQ-bridge queue is a remote queue definition that refers to a queue residing on a Websphere MQ queue manager.

Applications can use **put**, **get**, and **browse** operations on this type of queue, as if it were a local MQSeries Everyplace queue.

For more detailed information about the Websphere MQ-bridge queue, see “Websphere MQ-bridge queue” on page 113.

Dead-letter queue

MQSeries Everyplace has a similar dead-letter queue concept to Websphere MQ. Such queues store message that cannot be delivered. However, there are important differences in the manner they are used.

- In Websphere MQ, if a message is being moved from queue manager A to queue manager B, then if the channel connecting A to B cannot deliver the message, the message can be placed on the *receiving queue manager's* (B's) dead-letter queue.
- In MQSeries Everyplace, if a message is being sent from queue manager A to queue manager B, but it cannot be delivered, the message can be placed on the *sending queue manager's* (A's) dead letter queue.

The use of dead-letter queues with an Websphere MQ-bridge needs special consideration, see “Handling undeliverable messages” on page 156 for more details.

Administration queue

The administration queue is a specialized queue that processes administration messages.

Messages put to the administration queue are processed internally. Because of this applications cannot get messages directly from the administration queue. Only one

message is processed at a time, other messages that arrive while a message is being processed are queued up and processed in the sequence in which they arrive.

MQSeries Everyplace channels

MQSeries Everyplace supports a method of establishing connections between queue managers, that is termed an MQSeries Everyplace *channel*. A channel is a logical connection between the two parties, and is established for the purposes of sending or receiving data.

MQSeries Everyplace clients and servers can communicate over two types of connections, *peer channels* and *client-server channels*. MQSeries Everyplace channels are created on demand and are referred to as *dynamic*. This differentiates them from Websphere MQ channels which have to be explicitly created.

Client-server channels have the following attributes:

- They are created on demand.
- The channel connection can only be established from the client-side of the connection.
- A client can connect to many servers with each connection using a separate channel.
- The server-side queue manager can accept many connections simultaneously, from a multitude of different clients, using a channel manager and listener.
- They work through a firewall, if the server-side of the connection is behind the firewall. (This depends on the configuration of the firewall.)
- They are *unidirectional* and support the full range of functions provided by MQSeries Everyplace, including both synchronous and asynchronous messaging.

Note: Unidirectional means that the client can send data to, or request data from the server, but the server-side cannot initiate requests of the client.

Peer channels have the following attributes:

- They are created on demand
- The channel can be established from either end of the connection.
- A queue manager can connect to peer channel listeners on many other queue managers with each connection using a separate channel.
- A queue manager can only have one peer channel listener at once (current restriction). This means that only one other external client or server can establish a peer channel to the queue manager at any one time. This restriction means that this channel type is normally used only between clients as server queue managers usually want to handle multiple incoming requests concurrently.
- They are not generally for use over a firewall, as it is difficult, and sometimes impossible, to configure peer channels in this environment.
- They are bidirectional and support the full range of functions provided by MQSeries Everyplace, including both synchronous and asynchronous messaging.

Note: Bidirectional means that the queue managers on each end of the channel can request, and pass data over the channel.

Channels can have various attributes or characteristics, such as authentication, cryptography, compression, or the transmission protocol to use. Different channels can use different characteristics. Each channel can have its own value set for each of the following attributes:

Authenticator

This attribute causes authentication to be performed. This is a security function that challenges the putting application environment or user to prove their identity.

Cryptor

This attribute causes encryption and decryption to be performed on messages passing through the channel. This is a security function that encodes the messages during transit so that they cannot be read without the decoding information.

Compressor

This attribute causes compression and decompression to be performed on messages passing through the channel. This attempts to reduce the size of messages while they are being transmitted and stored.

Destination

The server and port number that this channel connects to.

Typically the authenticator is only used when setting up the channel, compressors and cryptors are normally used on all flows.

For more detailed information about channels see "Connections" on page 95, and for more information about authenticators, compressors and cryptors, see "Chapter 8. Security" on page 169.

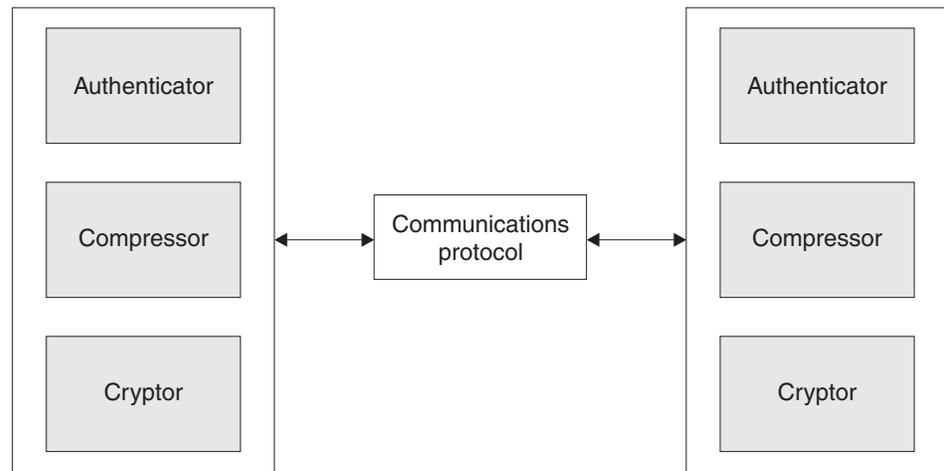


Figure 2. MQSeries Everyplace channel

MQSeries Everyplace channels can be established using a variety of protocols allowing them to connect in a number of different ways, using for example:

- Permanent connection, for example LAN, or leased line
- Dial out connection, for example using a standard modem to connect to an Internet service provider (ISP)
- Dial out and answer connection, using a CellPhone, or ScreenPhone for example

MQSeries Everyplace implements the communications protocols as a set of adapters, one for each of the supported protocols, this enables you to add new protocols very simply.

MQSeries Everyplace bridge to Websphere MQ

An MQSeries Everyplace queue manager can be an interface to a Websphere MQ server. This type of queue manager is referred to as a gateway queue manager. The Websphere MQ-bridge handles the transfer of messages between the two systems, including the translation between the different message formats. "Configuring the Websphere MQ-bridge" on page 129 provides a detailed description of this interface.

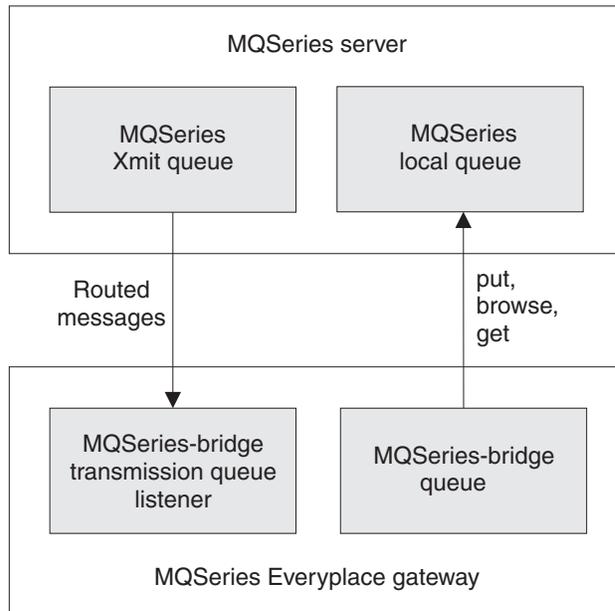


Figure 3. MQSeries Everyplace interface to Websphere MQ

Security

MQSeries Everyplace includes an integrated set of security features that provide protection for message data, when it is held locally, and when it is being transferred. There are three different categories of security:

Local security

Local security provides protection for MQSeries Everyplace messages while they are held by a local queue manager.

Queue-based security

Queue-based security automatically protects MQSeries Everyplace message data between an initiating queue manager and a target queue, so long as the target queue is defined with an attribute. This protection is independent of whether the target queue is owned by a local or a remote queue manager.

Message-level security

Message-level security provides protection for message data between an initiating and receiving MQSeries Everyplace application.

MQSeries Everyplace security uses the authenticator, cryptor, and compressor attributes referred to in “MQSeries Everyplace channels” on page 6. Queue based security is handled internally by MQSeries Everyplace and does not require any specific action by the initiator or recipient of the message. Local and Message-level security must be initiated by an application.

MQSeries Everyplace also provides a mini-certificate server for enhanced security.

See “Chapter 8. Security” on page 169 for detailed information about MQSeries Everyplace security features.

Note: Throughout the world there are varying government regulations concerning levels and types of cryptography. You must always use a level and type of cryptography that complies with the appropriate local legislation. This is particularly relevant when using a mobile device that is moved from country to country. MQSeries Everyplace provides facilities for this, but it is the responsibility of the application programmer to implement it.

overview - security

Chapter 2. Getting Started

This section introduces Version 1.2.6 of the MQSeries Everyplace Development Kit. The Development Kit is a development environment for writing messaging and queuing applications based on Java 1.1.

Note: For information on the availability of development kits for environments other than Java, see the Websphere MQ Web site at <http://www.ibm.com/software/ts/mqseries/>

The code portion of the development kit comes in two sections:

Base MQSeries Everyplace classes

A set of Java classes that provide all the necessary function to build messaging and queuing applications.

Examples

A set of Java source code and classes that demonstrate how to use many features of MQSeries Everyplace.

Development Environment

To develop programs in Java using the MQSeries Everyplace development kit, you must set up the Java environment as follows:

- Set the `CLASSPATH` so that the Java Development Kit (JDK) can locate the MQSeries Everyplace classes.

Windows

In a Windows[®] environment, using a standard JDK, you can use the following:

```
Set CLASSPATH=<MQeInstallDir>\Java;%CLASSPATH%
```

UNIX In a UNIX environment you can use the following:

```
CLASSPATH=<MQeInstallDir>/Java:$CLASSPATH  
export CLASSPATH
```

- If you are developing code that uses or extends the Websphere MQ-bridge, the Websphere MQ Classes for Java must be installed and made available to the JDK. For details on setting up the environment for the Websphere MQ Classes for Java, see *MQSeries Using Java*.

You can use many different Java development environments and Java runtime environments with MQSeries Everyplace. The system configuration for both development and runtime is dependent on the environment used. MQSeries Everyplace includes a file that shows how to set up a development environment for different Java development kits. On Windows systems this is a batch file called `JavaEnv.bat`, for UNIX systems it is a shell script called `JavaEnv`. To use this file, copy the file and modify the copy to match the environment of the machine that you want to use it on.

A set of batch files and shell scripts that run some of the MQSeries Everyplace examples use the environment file described above, and, if you wish to use the example batch files, you must modify the environment file as follows:

- Set the `JDK` environment variable to the base directory of the JDK.

getting started

- Set the *JavaCmd* environment variable to the command used to run Java applications.
- If Websphere MQ Classes for Java is installed, set the *MQDIR* environment variable to the base directory of the Websphere MQ Classes for Java.

Note: Customized versions of JavaEnv.bat or JavaEnv may be overwritten if you reinstall MQSeries Everyplace.

When you invoke JavaEnv.bat on Windows you must pass a parameter that determines the type of Java development kit to use.

Possible values are:

Note: These parameters are case sensitive and must be entered exactly as shown.

Sun - Sun
JB -Borland JBuilder
MS - Microsoft
IBM - IBM

If you do not pass a parameter, the default is IBM.

The JavaEnv shell script on UNIX does not use a corresponding parameter.

On Windows, by default, you must run JavaEnv.bat from the <MQeInstallDir>\java\demo\Windows directory. On UNIX, by default, you must run JavaEnv from the <MQeInstallDir/Java/demo/UNIX directory. Both files can be modified to allow them to be run from other directories or to use other Java development kits.

Windows 2000 and NT security configuration

A sample Windows NT authenticator is supplied with MQSeries Everyplace, but the default MQSeries Everyplace installation does not make all the changes necessary for this authenticator to execute. If you wish to use the authenticator you should complete the following configuration.

Note: The Windows NT authenticator is used by the MQe_Explorer that is shipped in Supportpac ES02.

1. The file JavaNT.dll, which interfaces between MQSeries Everyplace and Windows security, must be placed in the search path or in the current directory. In a standard installation, this file is located in C:\MQe\Java. Put a copy of this file in the directory that contains your Windows .dll files (normally C:\WINNT\system32).

Note: This makes the sample authenticator available to all MQSeries Everyplace applications. If you only wish to make the authenticator available to the MQe_Explorer, put the copy of JavaNT.dll in the same directory as MQe_Explorer.exe.

2. Security permissions must be set correctly for the JavaNT.dll to be granted permission to access the Windows user/password database.

On Windows 2000:

- a. From the Start button click on Programs, then Administrative Tools, then Local Security Policy
- b. In the Local Security Settings panel click on Local Policies in the left hand pane, then User Rights Assignment. In the right hand pane check that your current *user ID* is assigned all of the following privileges:
 - Act as part of the operating system
 - Log on as a service
 - Log on locally

If all these privileges are not assigned to your ID, double click the relevant privilege and add your *user ID*.

On Windows NT:

- a. From the Start button click on Programs, then Administrative Tools, then User Manager.
- b. In the Policies menu click on User Rights
- c. In the User Rights Policy dialogue, check the box Show Advanced User Rights. Check the following rights in turn:
 - Act as part of the operating system
 - Log on as a service
 - Log on locally

Each right should be granted to the logged on *user ID*. If your ID, or a group to which your ID belongs, is not listed for any of these rights, click the Add button to add your ID to the Grant to list.

When all the privileges have been set you must then logoff Windows and logon again to get these privilege enabled for the current session (it is not necessary to reboot the machine).

Deploying applications

When deploying MQSeries Everyplace applications, you are recommended to pack the minimum set of classes required by the application into compressed jar files. This ensures that the application requires the minimum system resource. MQSeries Everyplace provides the following examples of how the MQSeries Everyplace classes can be packaged into jar files. These examples are in the <MQeInstallDir>\Java\Jars directory of a standard MQSeries Everyplace installation.

MQeDevice.jar

A full set of the base classes that can be used on a device

MQeGateway.jar

A full set of the base classes that can be used on a server platform

MQeMQBridge.jar

The classes that can be used to extend the MQeGateway.jar to build a server that interoperates with Websphere MQ

MQeHighSecurity.jar

A set of classes that can be used to extend both the MQeGateway.jar and MQeDevice.jar to provide enhanced security

MQeMiniCertificateServer.jar

A self contained jar file providing all the classes required to run the mini-certificate server

deploying application

MQeExamples.jar

A packaging of all the MQSeries Everyplace examples into one jar file

To run MQSeries Everyplace applications, you must set up the Java runtime environment to include the required MQSeries Everyplace and application classes. Using a standard Java runtime environment (JRE), you must set the CLASSPATH to include any required jar files.

Example statements are:

Windows

```
Set CLASSPATH=<MQeInstallDir>\Jars\MQeDevice.jar;%CLASSPATH%
```

UNIX

```
CLASSPATH=<MQeInstallDir>/Java/Jars/MQeDevice.jar:$CLASSPATH  
export CLASSPATH
```

Post install test

Once you have installed MQSeries Everyplace you can use the following procedures to run a set of examples that determine whether the installation of the development kit was successful.

- Ensure that the Java environment is set up as described in “Development Environment” on page 11. When running any of the Windows batch files described in this section, the first parameter of each is the name of the Java development kit to use, if you do not specify a name, the default is IBM.

Note: The UNIX shell scripts do not have a corresponding parameter.

- Move to the correct directory:

Windows

Change to the <MQeInstallDir>\Java\demo\Windows directory.

UNIX Change to the <MQeInstallDir>/Java/demo/UNIX directory.

- Create a queue manager as follows:

Windows

Run the batch file

```
CreateExampleQM.bat <JDK>
```

UNIX Run the shell script

```
CreateExampleQM
```

to create an example queue manager called ExampleQM.

Part of the creation process sets up directories to hold queue manager configuration information and queues. The example uses a directory called ExampleQM that is relative to the current directory. Within this directory are two other directories:

- Registry - holds files that contain queue manager configuration data.
 - Queues - for each queue there is a subdirectory to hold the queue’s messages. (The directory is not created until the queue is activated.)
- Run a simple application as follows:
Once you have created a queue manager you can start it and use it in applications. You can use the batch file ExamplesMQeClientTest.bat or the shell script ExamplesMQeClientTest to run some of the simple application examples.

deploying application

The batch file runs `examples.application.Example1` by default. This example puts a test message to queue manager `ExampleQM` and then gets the message from the same queue manager. If the two messages match, the application ran successfully.

There are a set of applications in the `examples.application` package that demonstrate different features of MQSeries Everyplace. You can run these examples as follows:

Windows

Pass parameters to the batch files:

```
ExamplesMQeClientTest <JDK> <ExampleNo>
```

UNIX Pass parameters to the shell scripts:

```
ExamplesMQeClientTest <ExampleNo>
```

where *ExampleNo* is the suffix of the example. This can range from 1 to 6.

- Delete a Queue manager.

When a queue manager is no longer required you can delete it. To delete the example queue manager `ExampleQM`:

Windows

Run the batch file

```
DeleteExampleQM.bat <JDK>
```

UNIX Run the shell script

```
DeleteExampleQM
```

.

Once you have deleted a queue manager you cannot start it.

Notes:

1. Deleting a queue manager does not delete any messages that are still on the queue, or configuration data that was not part of the base queue manager creation. Hence, if the queue manager is recreated with the same creation parameters, the remaining messages are available to the recreated queue manager.
2. The examples use relative directories for ease of set up. You are strongly recommended to use absolute directories for anything other than base development and demonstration. If the current directory is changed, and you are using relative directories, the queue manager can no longer locate its configuration information and queues.

Examples

The examples previously described form a small part of the set of examples provided with MQSeries Everyplace. Each example demonstrates how to use or extend a feature of MQSeries Everyplace. Most are described in the relevant sections of this Guide. They are all listed and briefly described in the following sections

examples.adapters

This package provides two example classes that conform to the MQSeries Everyplace adapters specification.

examples

MQeDiskFieldsAdapter

This example class is identical in functionality to the disk fields adapter found in `com.ibm.mqe.adapters`. It supports the reading and writing of data on the local file store.

WESAuthenticationGUIAdapter

Wrappers the `WESAuthenticationAdapter` found inside `com.ibm.mqe.adapters`. This example enhances the `WESAuthenticationAdapter` by displaying a dialog box that prompts the user for login information when connecting to a Websphere Everyplace proxy. See “The Websphere Everyplace Suite (WES) communications adapter” on page 227 for more information.

See “Chapter 10. MQSeries Everyplace adapters” on page 217 for more information on adapters in MQSeries Everyplace.

examples.administration.commandline package

This package contains a suite of example tools for creating base MQSeries Everyplace objects from the command line. Each program is a simple example of how to send administration messages and how to interpret the replies.

Using these tools and a script you can reliably set up exactly the same configuration on a number of machines.

See “Administration from the command line” on page 120 for details of the tools and examples of how to use them.

examples.administration.console package

This package contains a set of classes that implement a simple graphical user interface (GUI) for managing MQSeries Everyplace resources.

Admin

Front end to the example administration GUI.

Additionally there is a suite of classes that provides the graphical user interface for each MQSeries Everyplace managed resource.

The GUI can be invoked in any of the following ways:

- Using the batch file `ExamplesAdminConsole.bat`
- From the command line:

```
java examples.administration.console.Admin
```
- From a button on the example server `examples.awt.AwtMQeServer`

See “Chapter 6. Administering messaging resources” on page 85 for more details information about using the MQSeries Everyplace administration functions.

examples.administration.simple package

This package contains a set of examples that show how to use some of the administrative features of MQSeries Everyplace in your programs. As with the application examples, these examples can work with either a local or a remote queue manager.

Example1

Create and delete a queue

Example2

Add a connection definition for a remote queue manager

Example3

Inquire on the characteristics of a queue manager and the queues it owns

ExampleAdminBase

The base class that all administration examples inherit from.

For details of MQSeries Everyplace administration functions, see “Chapter 6. Administering messaging resources” on page 85.

examples.application package

This package contains a set of examples that demonstrate various ways to interact with a queue manager. These include putting a message to and getting a message from a queue. All the examples can be used with either a local queue manager or a remote queue manager. Before you can use any of these applications, the queue managers that are to be used must be created. You can use the CreateExampleQM.bat batch file on Windows, or the CreateExampleQM shell script on UNIX, to create queue managers ExampleQM (see “Post install test” on page 14).

Example1

Simple put and get of a message.

Example2

Put several messages and then get the second one using a match field.

Example3

Use a message listener to detect when new messages arrive.

Example4

Use the WaitForMessage method to get a message if it arrives within a specified interval.

Example5

Lock messages then get, unlock, and delete them.

Example6

Simple put and get of a message using assured message delivery.

Example7

Simple put and get of a message through a Websphere Everyplace proxy

ExampleBase

The base class that all application examples inherit from.

These examples can be run as follows:

Windows

Using batch file ExamplesMQeClientTest.bat

```
ExamplesMQeClientTest <JDK> <example no> <remoteQMgrName> <localQMgr ini file>
```

UNIX Using shell script ExamplesMQeClientTest

```
ExamplesMQeClientTest <example no> <remoteQMgrName> <localQMgr ini file>
```

where

<JDK> is the name of the Java environment (see “Development Environment” on page 11 for details). The default is IBM

examples

Note: This parameter is not used on UNIX.

<example no>

is the number of the example to run (suffix of the name of the example). The default is 1 (Example1).

<remoteQMgrName>

is the name of the queue manager that the application should work with. This can be the name of the local or a remote queue manager. If it is a remote queue manager, a connection must be configured that defines how the local queue manager can communicate with the remote queue manager.

By default the local queue manager is used (as defined in ExamplesMQeClient.ini)

<localQMgrIniFile>

is an ini file containing startup parameters for a local queue manager. By default ExamplesMQeClient.ini is used.

For more details on how to write applications that interact with a queue manager see "Chapter 4. Queue managers, messages, and queues" on page 27.

examples.attributes package

This package contains a set of classes that show how to write additional components to extend MQSeries Everyplace security.

NTAuthenticator

An authenticator that authenticates a user to the Windows NT security database. To authenticate correctly the user must have the following User Rights set on the target NT system:

- Act as part of the operating system
- Logon locally
- Logon as a service

The NT authenticator uses the Java native interface (JNI) to interact with Windows NT security. The code for this can be found in the examples.nativecode directory. The dll built from this code must be placed in the PATH of the NT machine that owns the target resource.

UnixAuthenticator

An authenticator that authenticates a user using the UNIX password or shadow password system. The UNIX authenticator uses the JNI to interact with the host system. The code for this can be found in the examples.nativecode directory. If your system supports the shadow password file, you must recompile this native code with the USE_SHADOW preprocessor flag defined. You must also ensure the code has sufficient privileges to read the shadow password file when it executes. This example does not work if your system uses a distributed logon service (such as Lightweight Directory Access Protocol (LDAP)).

LogonAuthenticator

Base logon authentication support.

UseridAuthenticator

Support for base *userID* authentication.

This example requires a UserIDS.txt file as input. This file must have the format:

```
[UserIDs]
User1Name=User1Password
...
UserNName=UserNPassword
```

TableCryptor

A very simple cryptor

See “Chapter 8. Security” on page 169 for more detailed information about the MQSeries Everyplace security features.

examples.awt package

This package provides a toolkit for building applications that require a small graphical interface. It also contains example applications that provide a graphical front end to MQSeries Everyplace functions.

AwtMQeServer

A graphical front end to the `examples.queuemanager.MQeServer` example. The `MQeTraceResourceGUI` class provides a resource bundle that contains internationalized strings for use by the GUI. `MQeTraceResourceGUI` is in package `examples.trace`.

You can use the batch file `ExamplesAwtMQeServer.bat` to run this application.

See “Server queue managers” on page 38 for more details about running a queue manager in a server environment.

AwtMQeTrace

A graphical front end to `examples.trace.MQeTrace`.

See “Chapter 9. Tracing in MQSeries Everyplace” on page 209 for more information about the MQSeries Everyplace trace facility.

Classes **AwtDialog**, **AwtEvent**, **AwtFormat**, **AwtFrame**, and **AwtOutputStream** provide a toolkit for building small footprint awt-based graphical applications. These classes are used by many of the graphical MQSeries Everyplace examples.

examples.certificates package

This package contains examples for managing mini-certificates (see “mini-certificate issuance service” on page 203) for more information on these examples, and using mini-certificates.

ListWTLSCertificates

This example uses methods in the class `com.ibm.mqe.attributes.MQeListCertificates` to implement a command line program which lists mini-certificates in a registry, to varying levels of detail.

RenewWTLSCertificates

This example uses methods in the class `com.ibm.mqe.registry.MQePrivateRegistryConfigure` to implement a command line program which renews mini-certificates in a registry. This should only be used on a private registry.

examples.eventlog package

This package contains some examples that demonstrate how to log events to different facilities.

LogToDiskFile

Write events to a disk file

LogToNTEventLog

Write events to the Windows NT event log. This class uses the JNI to interact with the Windows NT event log. The code for this is in the `examples.nativecode` directory

LogToUnixEventLog

Write events to the UNIX event log (which is normally `/var/adm/messages`). This class uses the JNI to interact with the UNIX event logging system. The code for this can be found in the `examples.nativecode` directory. The `syslog` daemon on your system should be configured to report the appropriate events.

examples.install package

This package contains a set of classes for creating and deleting queue managers.

DefineQueueManager

A GUI that allows the user to select options when creating a queue manager. When the options have been selected, this example creates an ini file containing the queue manager startup parameters, and then creates the queue manager.

CreateQueueManager

A GUI program that requests the name and directory of an ini file that contains queue manager startup parameters. When the name and directory are provided, a queue manager is created.

SimpleCreateQM

A command line program that takes a parameter that is the name of an ini file that contains queue manager startup parameters. It also optionally takes a parameter that is the root directory where queues are stored. Provided a valid ini file is found, a queue manager is created.

DeleteQueueManager

A GUI program that takes the name of an ini file that contains queue manager startup parameters. Provided a valid ini file is found, the queue manager is deleted.

SimpleDeleteQM

A command line program that takes a parameter that is the name of an ini file that contains queue manager startup parameters. Provided a valid ini file is found, the queue manager is deleted.

GetCredentials

A GUI program that takes the name of an ini file that contains queue manager startup parameters. Provided a valid ini file is found, new credentials (private/public key pair and public certificate) are obtained for the queue manager. The mini-certificate server must be running and the request for a new certificate must have been authorized for this to succeed (see "mini-certificate issuance service" on page 203).

All the configuration files use the resources and utilities provided in **ConfigResource**, and **ConfigUtils**.

For more details about creating and deleting queue managers, see “Chapter 4. Queue managers, messages, and queues” on page 27.

examples.mqbridge.awt package

This package contains a set of classes that show how to use and extend the Websphere MQ-bridge. Some of the examples extend other MQSeries Everyplace examples.

AwtMQBridgeServer

This is an example of a graphical interface for the underlying examples.mqbridge.queuemanager.MQBridgeServer class.

The MQBridgeServer class source code demonstrates how to add bridge functionality to your MQSeries Everyplace server program, following these guidelines.

To start the bridge enabled server:

1. Instantiate the base MQSeries Everyplace queue manager, and start it running.
2. Instantiate a com.ibm.mqe.mqbridge.MQeMQBridges object, and use its activate() method, passing the same .ini file information as you passed to the base MQSeries Everyplace queue manager.

The bridge function is then usable.

To stop the bridge-enabled server:

1. Disable the bridge function by calling the MQeMQBridges.close() method. This stops all the current Websphere MQ-bridge operations cleanly, and shuts down all the Websphere MQ-bridge function.
2. Remove your reference to the MQeMQBridges object, allowing it to be garbage-collected.
3. Stop and close the base MQSeries Everyplace queue manager.

ExamplesAwtMQBridgeServer.bat

This file provides an example of how to invoke the MQBridgeServer using the Awt server. It also shows how to control the initial settings of the AwtMQBridgeTrace module.

ExamplesAwtMQBridgeServer.ini

This file provides an example configuration file for a queue manager that supports Websphere MQ-bridge functionality.

See “Chapter 7. Websphere MQ-bridge” on page 129 for more details about the Websphere MQ-bridge.

examples.mqbridge.administration.commandline package

This package contains a suite of example tools, similar to those in the examples.administration.commandline package, designed to administer the objects required for an Websphere MQ-bridge.

See “Administration from the command line” on page 120 for details of the tools and examples of how to use them.

examples.mqbridge.application.GetFromMQ

The example programs in this package are useful for proving that MQSeries Everyplace and Websphere MQ can communicate with each other. These examples are Websphere MQ bindings programs that use the Java classes and are driven by a simple command-line syntax.

GetFromMQ

This class destructively reads any message appearing on a specified Websphere MQ queue, and provides timing statistics on when the message arrives. Optionally the message content can be dumped to the standard output screen.

This example is useful when testing a link between MQSeries Everyplace and Websphere MQ, to see what throughput is being achieved between the two systems. Scripts dealing with connectivity between MQSeries Everyplace and Websphere MQ can refer to and use this class.

PutFromMQ

This class puts a message to an Websphere MQ queue, such that the user can specify the target queue and the target queue manager. It specifically uses the long form of the `MQQueueManager.accessQueue()` method to make use of any MQSeries Everyplace queue manager alias definitions that might be defined on the Websphere MQ queue.

examples.nativecode package

Several of the examples require access to operating system facilities on Windows NT, or UNIX (AIX and Solaris). MQSeries Everyplace accesses these functions using the JNI. For Windows, the code in the `examples\native` directory provides the JNI implementation required by `examples.attributes.NTAuthenticator` and `examples.eventlog.LogToNTEventLog`. For UNIX, the code in the file `examples/native/JavaUnix.c` provides the JNI implementation required by the `examples.attributes.UnixAuthenticator` and `examples.eventlog.LogToUnixEventLog`.

examples.queuemanager package

A queue manager can run in many different types of environment. This package contains a set of examples that allow a queue manager to run as a client, server, or servlet:

MQeClient

A simple client typically used on a device

MQePrivateClient

A client that can be used with secure queues and secure messaging

MQeServer

A server that can connect concurrently to multiple queue managers (clients or servers). This is typically used on a server platform. Batch file `ExamplesAwtMQeServer.bat` can be used to run the `examples.awt.AwtMQeServer` example which provides a graphical front end to this server.

MQePrivateServer

Similar to `MQeServer` but allows the use of secure queues and secure messaging

MQeServlet

An example that shows how to run a queue manager in a servlet

MQeChannelTimer

An example that polls the channel manager so that it can time-out idle channels

MQeQueueManagerUtils

A set of helper methods that configure start various MQSeries Everyplace components

For more details about running queue managers in different environments see “Starting queue managers” on page 33. For details on queue managers that provide an environment for secure queues and messaging (MQePrivateClient and MQePrivateServer), see “Chapter 8. Security” on page 169.

examples.rules package

You can control and extend the base MQSeries Everyplace functionality using rules. Some components of MQSeries Everyplace allow rules classes to be applied to them. These rules provide a means of changing the functionality of the component. This package contains the following example rules classes:

ExamplesQueueManagerRules

Example queue manager rules class makes regular attempts to transmit any held messages.

See “Chapter 5. Rules” on page 75 for more details.

AttributeRule

Example attribute rule that controls the use of attributes.

examples.security package

This package contains an example that modifies MQSeries Everyplace security.

MQeSecurity

An example extension to the Java security manager that controls whether permission is granted to use certain features of MQSeries Everyplace.

examples.server package

This package contains classes that demonstrate how to support the mini-certificate server (com.ibm.mqe.server.MQeMiniCertificateServer). The main classes are a GUI that can be used to drive the server, and a resource bundle that can be used by the server. The other classes in this package support the GUI class.

MQeMiniCertificateServerGUI

This class provides a GUI to administer the mini-certificate server. It allows the user to add, update, display and delete the one-time use *PINs*, that authorize the mini-certificate server to issue certificates for entities. It also has a ‘server mode’ which launches the mini-certificate server itself.

MQeMiniCertificateServerActions

This class contains the action routines used by the MQeMiniCertificateServerGUI class.

MQeMCSAboutDialog

This class contains the ‘about’ dialog used by the MQeMiniCertificateServerGUI class.

examples

MQeMCSQuitDialog

This class contains the 'quit' dialog used by the MQeMiniCertificateServerGUI class.

MQeMCSMessageBundle

This class is a ResourceBundle that contains strings used by the MQeMiniCertificateServerGUI class and by the MQeMiniCertificateServer class. It can be used by the GUI and by the stand-alone server.

examples.trace package

This package contains an example trace handler that can be used for debugging an application during development, and for tracing a completed application.

MQeTrace

The base MQSeries Everyplace trace class.

AwtMQeTrace, which is in the examples.awt package, provides a graphical front end to the MQeTrace class.

MQeTraceResource

A resource bundle that contains trace messages that can be output by MQSeries Everyplace

MQeTraceResourceGUI

This class contains all the translatable text for the trace window controls

Chapter 3. MQeFields

MQeFields is the fundamental class used to hold data items for sending, receiving, or manipulating MQSeries Everyplace messages. An MQeFields object is constructed as follows:

```
/* create an MQeFields object */
MQeFields fields = new MQeFields( );
```

There are various **put** and **get** methods within the MQeFields object for storing and retrieving items. Items are held in a name, type and value form.

The name must conform to the following rules:

- It must be at least 1 character long.
- It must conform to the ASCII character set (characters with values $20 < \text{value} < 128$).
- It must *not* include any of the characters { } [] # () ; , ' " =
- It must be unique within the MQeFields object

The MQeFields object name is used to retrieve and update values. It is good practice to keep names short, because the names are included with the data when the MQeFields object is dumped.

The following examples shows how to store values in an MQeFields object:

```
/* Store integer values into a fields object */
fields.putInt( "Int1", 1234 );
fields.putInt( "Int2", 5678 );
fields.putInt( "Int3", 0 );
```

The following example shows how to retrieve values from an MQeFields object:

```
/* Retrieve an integer value from a fields object */
int Int2 = fields.getInt( "Int2" );
```

Methods are provided for storing and retrieving the value types shown in Table 1

Table 1. Store and retrieve methods

Value type	Store method	Retrieve method
byte	putByte	getByte
int	putInt	getInt
short	putShort	getShort
long	putLong	getLong
floating point	putFloat	getFloat
	putDouble	getDouble
boolean	putBoolean	getBoolean
string	putAscii	getAscii
	putUnicode	getUnicode

Arrays of values may be held within a fields object. There are two forms for holding arrays:

MQeFields

- Fixed length arrays are handled using the **putArrayOfType** and **getArrayOfType** methods. *type* can be Byte, Short, Int, Long, Float, or Double.
- Variable length arrays are handled using the **putTypeArray** and **getTypeArray**. *type* can be Byte, Short, Int, Long, Float, or Double.

Using this form, each element is stored as a series of single items. *.nn* is appended to the name of the item, where *nn* is the element number of the item within the array, starting at 0. A separate item contains the array length. This array length is an integer value and is handled using **putArrayLength** and **getArrayLength**.

An MQeFields object may be imbedded within another MQeFields object by using the **putFields** and **getFields** methods.

MQeMsgObject, or a descendant of this class, is used for normal MQSeries Everyplace messages. MQeMsgObject is a descendant of the MQeFields class, and hence has access to all the MQeFields methods. See "Messages" on page 56 for more information on MQeMsgObject.

The contents of an MQeFields object can be dumped in the following forms:

binary This is the form normally used to send an MQeFields or MQeMsgObject object through the network. The method used to convert the data to binary is **dump**. This method returns a binary byte array containing an encoded form of the contents of the object. (Note: this is not Java serialization.) The **dump** method has an optional boolean parameter that specifies if the dumped data is to be XOR'd with a previous copy of the object data. This is an attempt to increase the number of bytes in the output array that are "0x00" to help the compressor make the data stream smaller when it is sent over the network. This parameter is only useful when the application intends to write the byte array out to some other physical media.

When a fixed length array is dumped and the array does not contain any elements (its length is zero), its value is restored as null.

encoded string

There are various restrictions placed on the string form and it may not always be possible to restore the MQeFields object using the string. The string form uses the **dumpToString** method of the MQeFields object. It requires two parameters, a template and a title. The template is a pattern string showing how the MQeFields item data should be translated, as shown in the following example:

```
"(#0)#1=#2\r\n"
```

where

#0 is the data type (ascii, or short for example)

#1 is the field name

#2 is the string representation of the value

Any other characters are copied unchanged to the output string. The method successfully dumps imbedded MQeFields objects to a string, but there is no guarantee that the imbedded MQeFields data can be restored using the **restoreFromString** method.

Chapter 4. Queue managers, messages, and queues

“Chapter 1. Overview” on page 1 provides a high level description of the services provided by MQSeries Everyplace queue manager, and queues. This section provides detailed descriptions of the functions and use of queue managers and their associated resources, messages and queues.

Creating and deleting queue managers

A queue manager requires at least the following:

- A registry (see “MQeRegistry parameters for the queue manager” on page 35)
- A queue manager definition
- Local default queue definitions (see “Queues” on page 62)

Once these definitions are in place you can run the queue manager and use the administration interface to perform further configuration, such as adding more queues.

Methods to create these initial objects are supplied in the MQeQueueManagerConfigure class.

The example install programs `examples.install.SimpleCreateQM` and `examples.install.SimpleDeleteQM` use this class.

This section provides more information to help you to use the MQeQueueManagerConfigure class.

Queue manager names

MQSeries Everyplace queue manager names can contain the following characters:

- Numerics 0 to 9
- Lower case a to z
- Upper case A to Z
- Underscore _
- Period .
- Percent %

Queue manager names cannot have a leading or trailing ‘.’ character.

There are no inherent name length limitations in MQSeries Everyplace.

For additional naming recommendations when interacting with Websphere MQ networks, see “Naming recommendations for inter-operability with a Websphere MQ network” on page 130.

Creating a queue manager

The basic steps required to create a queue manager are:

1. Create and activate an instance of MQeQueueManagerConfigure
2. Set queue manager properties and create the queue manager definition
3. Create definitions for the default queues

creating a queue manager

4. Close the MQQueueManagerConfigure instance

1. Create and activate an instance of MQQueueManagerConfigure

You can activate the MQQueueManagerConfigure class in either of the following ways:

1. Call the empty constructor followed by `activate()`:

```
try
{
    MQQueueManagerConfigure qmConfig;
    MQeFields parms = new MQeFields();
    // initialize the parameters
    ...
    qmConfig = new MQQueueManagerConfigure( );
    qmConfig.activate( parms, "MsgLog:qmName\\Queues\\" );
}
catch (Exception e)
{ ... }
```

2. Call the constructor with parameters:

```
try
{
    MQQueueManagerConfigure qmConfig;
    MQeFields parms = new MQeFields();
    // initialize the parameters
    ...
    qmConfig = new MQQueueManagerConfigure( parms, "MsgLog:qmName\\Queues\\" );
}
catch (Exception e)
{ ... }
```

The first parameter is an MQeFields object that contains initialization parameters for the queue manager. These must contain at least the following:

- An imbedded MQeFields object (*Name*) that contains the name of the queue manager.
- An imbedded MQeFields object, that contains the location of the local queue store as the registry type (*LocalRegType*) and the registry directory name (*DirName*). If a base file registry is used these are the only parameters that are required. If a private registry is used, a *PIN* and *KeyRingPassword* are also required.

The directory name is stored as part of the queue manager definition and is used as a default value for the queue store in any future queue definitions. The directory does not have to exist and will be created when needed.

If you use an alias for any of the initialization parameters (see “Using queue manager aliases” on page 53), or if you wish to use an alias to set the channel attribute rule name (see “2. Set queue manager properties and create the queue manager definition” on page 29), the aliases should be defined before activating MQQueueManagerConfigure .

```
import com.ibm.mqe.*;
import com.ibm.mqe.registry.*;
import examples.queuemanager.MQQueueManagerUtils;
try
{
    MQQueueManagerConfigure qmConfig;
    MQeFields parms = new MQeFields();
    // initialize the parameters
```

```

MQeFields qmgrFields = new MQeFields();
MQeFields regFields = new MQeFields();

// Queue manager name is needed
qmgrFields.putAscii(MQeQueueManager.Name, "qmName");
// Registry information
regFields.putAscii(MQeRegistry.LocalRegType, "FileRegistry");
regFields.putAscii(MQeRegistry.DirName, "qmname\\Registry");

// add the imbedded MQeFields objects
parms.putFields(MQeQueueManager.QueueManager, qmgrFields);
parms.putFields(MQeQueueManager.Registry, regFields);
// set aliases
MQe.alias("FileRegistry", "com.ibm.mqe.registry.MQeFileSession");
MQe.alias("ChannelAttrRules", "examples.rules.AttributeRule");
// activate the configure object
qmConfig = new MQeQueueManagerConfigure( parms, "MsgLog:qmName\\Queues\\" );
}
catch (Exception e)
{ ... }

```

2. Set queue manager properties and create the queue manager definition

When you have activated `MQeQueueManagerConfigure`, but before you create the queue manager definition, you can set some or all of the following queue manager properties:

- You can add a description to the queue manager with `setDescription()`
- You can set a channel time-out value with `setChannelTimeout()`
- You can set the name of the channel attribute rule with `setChnlAttributeRuleName()`

Call `defineQueueManager()` to create the queue manager definition. This creates a registry definition for the queue manager that includes any of the properties that you set previously.

```

import com.ibm.mqe.*;
import com.ibm.mqe.registry.*;
import examples.queuemanager.MQeQueueManagerUtils;
try
{
    MQeQueueManagerConfigure qmConfig;
    MQeFields parms = new MQeFields();
    // initialize the parameters
    ...
    // set aliases
    MQe.alias("FileRegistry", "com.ibm.mqe.registry.MQeFileSession");
    MQe.alias("ChannelAttrRules", "examples.rules.AttributeRule");
    // activate the configure object
    qmConfig = new MQeQueueManagerConfigure( parms, "MsgLog:qmName\\Queues\\" );
    qmConfig.setDescription("a test queue manager");
    qmConfig.setChnlAttributeRuleName("ChannelAttrRules");
    qmConfig.defineQueueManager();
}
catch (Exception e)
{ ... }

```

At this point you can `close()` `MQeQueueManagerConfigure` and run the queue manager, however, it cannot do much because it has no queues. You cannot add queues using the administration interface, because the queue manager does not have an administration queue to service the administration messages.

creating a queue manager

The following sections show how to create queues and make the queue manager useful.

3. Create definitions for the default queues

`MQeQueueManagerConfigure` allows you to define the following four standard queues for the queue manager:

- An administration queue: `defineDefaultAdminQueue()`
- An administration reply queue: `defineDefaultAdminReplyQueue()`
- A dead letter queue: `defineDefaultDeadLetterQueue()`
- A default local queue: `defineDefaultSystemQueue()`

All these methods throw an exception if the queue already exists.

The administration queue and administration reply queue are needed to allow the queue manager to respond to administration messages, for example to create new connection definitions and queues.

The dead letter queue can be used (depending on the rules in force) to store messages that cannot be delivered to their correct destination.

The default local queue, `SYSTEM.DEFAULT.LOCAL.QUEUE`, has no special significance within `MQSeries Everyplace` itself, but it is useful when `MQSeries Everyplace` is used with `Websphere MQ` messaging because it exists on every `Websphere MQ` messaging queue manager.

```
import com.ibm.mqe.*;
import com.ibm.mqe.registry.*;
import examples.queuemanager.MQeQueueManagerUtils;
try
{
    MQeQueueManagerConfigure qmConfig;
    MQeFields parms = new MQeFields();
    // initialize the parameters
    ...
    qmConfig = new MQeQueueManagerConfigure( parms, "MsgLog:qmName\\Queues\\" );
    qmConfig.setDescription("a test queue manager");
    qmConfig.setChnlAttributeRuleName("ChannelAttrRules");
    qmconfig.defineDefaultAdminQueue();
    qmconfig.defineDefaultAdminReplyQueue();
    qmconfig.defineDefaultDeadLetterQueue();
    qmconfig.defineDefaultSystemQueue();
}
catch (Exception e)
{ ... }
```

4. Close the `MQeQueueManagerConfigure` instance

When you have defined the queue manager and the required queues, you can `close()` `MQeQueueManagerConfigure` and run the queue manager.

The complete example looks like this:

```
import com.ibm.mqe.*;
import com.ibm.mqe.registry.*;
import examples.queuemanager.MQeQueueManagerUtils;
try
{
    MQeQueueManagerConfigure qmConfig;
    MQeFields parms = new MQeFields();
    // initialize the parameters
    MQeFields qmgrFields = new MQeFields();
    MQeFields regFields = new MQeFields();
    // Queue manager name is needed
```

```

qmgrFields.putAscii(MQeQueueManager.Name, "qmName");

// Registry information
regFields.putAscii(MQeRegistry.LocalRegType, "FileRegistry");
regFields.putAscii(MQeRegistry.DirName, "qmname\\Registry");

// add the imbedded MQeFields objects
parms.putFields(MQeQueueManager.QueueManager, qmgrFields);
parms.putFields(MQeQueueManager.Registry, regFields);

// set aliases
MQe.alias("FileRegistry", "com.ibm.mqe.registry.MQeFileSession");
MQe.alias("ChannelAttrRules", "examples.rules.AttributeRule");

// activate the configure object
qmConfig = new MQeQueueManagerConfigure( parms, "MsgLog:qmName\\Queues\\" );
qmConfig.setDescription("a test queue manager");
qmConfig.setChnlAttributeName("ChannelAttrRules");
qmConfig.defineQueueManager();
qmconfig.defineDefaultAdminQueue();
qmconfig.defineDefaultAdminReplyQueue();
qmconfig.defineDefaultDeadLetterQueue();
qmconfig.defineDefaultSystemQueue();
qmconfig.close();
}
catch (Exception e)
{ ... }

```

The registry definitions for the queue manager and the required queues are created immediately. The queues are not created until they are activated.

Deleting a queue manager

The basic steps required to delete a queue manager are:

1. Use the administration interface to delete any definitions
2. Create and activate an instance of MQeQueueManagerConfigure
3. Delete the standard queue and queue manager definitions
4. Close the MQeQueueManagerConfigure instance

When these steps are complete, the queue manager is deleted and can no longer be run. The queue definitions are deleted, but the queues themselves are not deleted. Any messages remaining on the queues are inaccessible.

Note: If there are messages on the queues they are not automatically deleted. Your application programs should include code to check for, and handle, remaining messages before deleting the queue manager.

1. Delete any definitions

You can use MQeQueueManagerConfigure to delete the standard queues that you created with it. You should use the administration interface to delete any other queues before you call MQeQueueManagerConfigure.

2. Create and activate an instance of MQeQueueManagerConfigure

This process is the same as when creating a queue manager. See “1. Create and activate an instance of MQeQueueManagerConfigure” on page 28.

3. Delete the standard queue and queue manager definitions

Delete the default queues by calling:

- `deleteAdminQueueDefinition()` to delete the administration queue

deleting a queue manager

- **deleteAdminReplyQueueDefinition()** to delete the administration reply queue
- **deleteDeadLetterQueueDefinition()** to delete the dead letter queue
- **deleteSystemQueueDefinition()** to delete the default local queue

These methods work successfully even if the queues do not exist.

Delete the queue manager definition by calling **deleteQueueManagerDefinition()**

```
import com.ibm.mqe.*;
import examples.queuemanager.MQeQueueManagerUtils;
try
{
    MQeQueueManagerConfigure qmConfig;
    MQeFields parms = new MQeFields();
    // initialize the parameters
    ...
    // Establish any aliases defined by the .ini file
    MQeQueueManagerUtils.processAlias(parms);
    qmConfig = new MQeQueueManagerConfigure( parms );
    qmConfig.deleteAdminQueueDefinition();
    qmConfig.deleteAdminReplyQueueDefinition();
    qmConfig.deleteDeadLetterQueueDefinition();
    qmConfig.deleteSystemQueueDefinition();
    qmConfig.deleteQueueManagerDefinition();
    qmconfig.close();
}
catch (Exception e)
{ ... }
```

You can delete the default queue and queue manager definitions together by calling **deleteStandardQMDefinitions()**. This method is provided for convenience and is equivalent to:

```
deleteDeadLetterQueueDefinition();
deleteSystemQueueDefinition();
deleteAdminQueueDefinition();
deleteAdminReplyQueueDefinition();
deleteQueueManagerDefinition();
```

4. Close the MQeQueueManagerConfigure instance

When you have deleted the queue and queue manager definitions, you can **close** the MQeQueueManagerConfigure instance.

The complete example looks like this:

```
import com.ibm.mqe.*;
import examples.queuemanager.MQeQueueManagerUtils;
try
{
    MQeQueueManagerConfigure qmConfig;
    MQeFields parms = new MQeFields();
    // initialize the parameters
    ...
    // Establish any aliases defined by the .ini file
    MQeQueueManagerUtils.processAlias(parms);
    qmConfig = new MQeQueueManagerConfigure( parms );
    qmConfig.deleteStandardQMDefinitions();
    qmconfig.close();
}
catch (Exception e)
{ ... }
```

Starting queue managers

A queue manager can run:

- as a client
- in a server
- in a servlet

The following sections describe the example client, servers and servlet that are provided in the `examples.queuemanager` package. All queue managers are constructed from the same base MQSeries Everyplace components, with some additions that give each its unique properties. MQSeries Everyplace provides a class `MQeQueueManagerUtils` that encapsulates many of the common functions.

All the examples require parameters at startup. These parameters are stored in standard ini files. The ini files are read and the data is converted into an `MQeFields` object. This is described in “Chapter 3. MQeFields” on page 25. The `loadConfigFile()` method in the `MQeQueueManagerUtils` class performs this function.

Client queue managers

A client typically runs on a device platform, and provides a queue manager that can be used by applications on the device. It can open many connections to other queue managers and, if configured with a peer channel can accept incoming requests from other queue managers.

A server usually runs for long periods of time, but clients are started and stopped on demand by the application that use them. If multiple applications want to share a client, the applications must coordinate the starting and stopping of the client.

The following example shows a startup ini file for a typical client.

```
*
* ExamplesMQeClient.ini
*   An example ini file for a simple MQe client
*
[Alias]
*
*   Event log class
*
(ascii)EventLog=examples.log.LogToDiskFile
*
*   Network adapter class
*
(ascii)Network=com.ibm.mqe.adapters.MQeTcpipHttpAdapter
*
*   Queue Manager class
*
(ascii)QueueManager=com.ibm.mqe.MQeQueueManager
*
*   Trace handler (if any)
*
(ascii)Trace=examples.trace.MQeTrace
*
*   Message Log file interface
*
(ascii)MsgLog=com.ibm.mqe.adapters.MQeDiskFieldsAdapter
*
*   Class name for File registry
*
(ascii)FileRegistry=com.ibm.mqe.registry.MQeFileSession
```

client queue managers

```
*
*   Class name for Private registry
*
(ascii)PrivateRegistry=com.ibm.mqe.registry.MQePrivateSession
*
*   Class name for Registry Adapter
(ascii)RegistryAdapter=com.ibm.mqe.MQeDiskFieldsAdapter
*
*   Default Channel class
*
(ascii)DefaultChannel=com.ibm.mqe.MQeChannel
*
*   Default Transporter class
*
(ascii)DefaultTransporter=com.ibm.mqe.MQeTransporter
*
*   Channel Attribute Rules
*
(ascii)ChannelAttrRules=examples.rules.AttributeRule
*
*   Name of Base Key
*
(ascii)AttributeKey_1=com.ibm.mqe.MQeKey
*
*   Name of Shared Key
*
(ascii)AttributeKey_2=com.ibm.mqe.attributes.MQeSharedKey
*-----*
*
*   Registry ( configuration data store )
*
[Registry]
*
*   Type of registry for config data
*
(ascii)LocalRegType=FileRegistry
*
*   Location of the registry
*   (Only use relative directory for development/demo)
*
(ascii)DirName=.\ExampleQM\Registry\
*
*   Adapter on which registry sits
(ascii)Adapter=RegistryAdapter
*-----*
*
*   Queue manager details
*
[QueueManager]
*
*   Name for this Queue Manager
*
(ascii)Name=ExampleQM
```

Class Aliases

The [Alias] section provides a place where Class aliases can be set. Aliases are used by MQSeries Everyplace, to provide a level of indirection between the application and the real object. Hence the class that an alias relates to can be changed without the application needing to change.

The alias names are on the left of the equals sign, and the full class name is on the right. For example, the name "Trace" can now be used instead of examples.awt.AwtMQeTrace. The "(ascii)" before the alias names signifies the type of the entry, in this case as ascii string.

The alias list can include a solution's own classes.

The alias list is not processed by the queue manager itself. The queue manager requires this list to have been processed prior to its activation as several of these aliases are required to allow the queue manager to activate properly. For example, queues must have a queue store adapter defined so that they have a storage area in which to hold their messages. MsgLog is the default queue store adapter, if this is not present then a MsgLog not found exception is thrown.

MQeRegistry parameters for the queue manager

The [Registry] section of the ini file contain type and location information for the queue manager registry.

The registry is the primary store for queue manager-related information; one exists for each queue manager. Every queue manager uses the registry to hold its:

- Queue manager configuration data
- Queue definitions
- Remote queue definitions
- Remote queue manager definitions
- User data (including configuration-dependent security information)

Registry type:

MQeRegistry.LocalRegType (ascii)

The type of registry being opened. *file registry* and *private registry* are currently supported. A private registry is required for some of the security features. See "Chapter 8. Security" on page 169.

For a file registry this parameter should be set to:

`com.ibm.mqe.registry.MQeFileSession`

For a private registry it should be set to:

`com.ibm.mqe.registry.MQePrivateSession`

Aliases can be used to represent these values.

File registry parameters: The following parameter is needed for a file registry:

MQeRegistry.DirName (ascii)

The name of the directory holding the registry files.

Private registry parameters: The following parameters can be used for a private registry.

MQeRegistry.DirName (ascii)

The name of the directory holding the registry files

MQeRegistry.PIN (ascii)

The PIN for the private registry

MQeRegistry.KeyRingPassword (ascii)

The password or phrase used to protect the registry's private key

MQeRegistry.CAIPAddrPort (ascii)

The address and port number of a mini-certificate server

registry parameters

MQeRegistry.CertReqPIN (ascii)

The certificate request number preallocated by the mini-certificate administrator to allow the registry to obtain its credentials

The first three parameters are always needed. The last two parameters are needed for auto-registration of the registry if it wishes to obtain its credentials from the mini-certificate server.

Note: For security reasons, the *PIN* and *KeyRingPassword*, if supplied, are deleted from the startup parameters as soon as the queue manager has been activated.

For either type of registry *MQeRegistry.Separator (ascii)* is also needed if you want to use a non-default separator. The separator is the character that is used between the components of an entry name, for example:

<QueueManager><Separator><Queue>

This parameter is specified as a string but it should contain a *single* character. If it contains more than one only the first character is used.

You should use the same separator character every time a registry is opened. It should not be changed once a registry is in use.

If this parameter is not specified the separator defaults to "+".

RegistryAdapter:

MQeRegistry.RegistryAdapter (ascii)

The class, (or an alias that resolves to a class), of the adapter that the registry uses to store its data. This value should be included if you want the registry to use an adapter other than the default *MQeDiskFieldsAdapter*. Any valid adapter class can be used.

Starting a client queue manager

Starting a client queue manager involves:

1. Ensuring that there is no client already running. (Only one client is allowed per Java Virtual Machine.)
2. Adding any aliases to the system
3. Enabling trace if required
4. Starting the queue manager

The following code fragment starts a client queue manager:

```
/*-----*/
/* Init - first stage setup */
/*-----*/
public void init( MQeFields parms ) throws Exception
{
    if ( queueManager != null )          /* One queue manager at a time */
    {
        throw new Exception( "Client already running" );
    }
    sections = parms;                    /* Remember startup parms */
    MQeQueueManagerUtils.processAlias( sections ); /* set any alias names */

    // Uncomment the following line to start trace before the queue manager is started
    // MQeQueueManagerUtils.traceOn("MQeClient Trace", null); /* Turn trace on */

    /* Display the startup parameters */
}
```

registry parameters

```
System.out.println( sections.dumpToString( "#1\t=\t#2\r\n" ) );

/* Start the queue manager */
queueManager = MQeQueueManagerUtils.processQueueManager( sections, null );
}
```

Once you have started the client, you can obtain a reference to the queue manager object either from the static class variable *MQeClient.queueManager* or by using the static method **MQeQueueManager.getReference(queueManagerName)**.

The following code fragment loads aliases into the system:

```
public static void processAlias( MQeFields sections ) throws Exception
{
    if ( sections.contains( Section_Alias ) ) /* section present ? */
    { /* ... yes */
        MQeFields section = sections.getFields( Section_Alias );
        Enumeration keys = section.fields(); /* get all the keywords */
        while ( keys.hasMoreElements() ) /* as long as there are keywords*/
        {
            String key = (String) keys.nextElement(); /* get the Keyword */
            MQe.alias( key, section.getAscii( key ).trim( ) ); /* add */
        }
    }
}
```

Use the **processAlias** method to add each alias to the system. MQSeries Everyplace and applications can use the aliases once they have been loaded. Many of the aliases shown in the ini file on page 33 are required for MQSeries Everyplace to function correctly and should not be removed.

Starting a queue manager involves:

1. Instantiating a queue manager. The name of the queue manager class to load is specified in the alias QueueManager. Use the MQSeries Everyplace class loader to load the class and call the null constructor.
2. Activate the queue manager. Use the **activate** method, passing the MQeFields object representation of the ini file. The queue manager only makes use of the [QueueManager] and [Registry] sections from the startup parameters.

The following code fragment starts a queue manager:

```
public static MQeQueueManager processQueueManager( MQeFields sections,
    Hashtable ght ) throws Exception
{
    MQeQueueManager queueManager = null; /* work variable */
    if ( sections.contains( Section_QueueManager ) ) /* section present ? */
    { /* ... yes */
        queueManager = (MQeQueueManager) MQe.loader.loadObject(Section_QueueManager);
        if ( queueManager != null ) /* is there a Q manager ? */
        {
            queueManager.setGlobalHashTable( ght );
            queueManager.activate( sections ); /* ... yes, activate */
        }
    }
    return( queueManager ); /* return the allocated mgr */
}
```

Example MQePrivateClient

MQePrivateClient is an extension of MQeClient with the addition that it configures the queue manager and registry to allow for secure queues. For a secure client, the [Registry] section of the startup parameters is extended as follows:

registry parameters

```
* Extract from MQePrivateClient.ini
*
[Registry]
*
*   Type of registry for config data
*
(ascii)LocalRegType=PrivateRegistry
*
*   Location of the registry
*
(ascii)DirName=.\ExampleQM\PrivateRegistry
*
*   Adapter on which registry sits
(ascii)Adapter=RegistryAdapter
*
* PIN
*
(ascii)PIN=not set
*
* Certificate request pin
*
(ascii)CertReqPIN=not set
*
* Key ring password
*
(ascii)KeyRingPassword=not set
*
* Network address of certificate authority
*
(ascii)CAIPAddrPort=9.20.7.219:8082er
```

These fields are described in “MQeRegistry parameters for the queue manager” on page 35. See “Chapter 8. Security” on page 169 for more details on secure queues and MQePrivateClient.

For MQePrivateClient (and MQePrivateServer) to work, the startup parameters must *not* contain *CertReqPIN*, *KeyRingPassword* and *CAIPAddrPort*. Hence the registry section for an MQePrivateClient, looks like the following:

```
[Registry]
*
*   Type of registry for config data
*
(ascii)LocalRegType=PrivateRegistry
*
*   Location of the registry
*
(ascii)DirName=.\ExampleQM\PrivateRegistry
*
*   Adapter on which registry sits
(ascii)Adapter=RegistryAdapter
*
* PIN
*
(ascii)PIN=not set
```

Server queue managers

A server usually runs on a server platform. A server can run server-side applications but can also run client-side applications. As with clients, a server can open connections to many other queue managers on both servers and clients. One of the main characteristics that differentiate a server from a client is that it can handle many concurrent incoming requests. A server often acts as an entry point for many clients into an MQSeries Everyplace network . MQSeries Everyplace provides the following server examples:

MQeServer

A console based server

MQePrivateServer

A console based server with enhanced security

AwtMQeServer

A graphical front end to MQeServer

MQBridgeServer

In addition to the normal MQSeries Everyplace server functions, this server can send and receive messages to and from other members of the Websphere MQ family. This server is in package `examples.mqbridge.queuemanager` and is described in “Chapter 7. Websphere MQ-bridge” on page 129.

Example MQeServer

MQeServer is the simplest server implementation.

This server can be started with the following command:

```
<javaCommand> examples.queuemanager.awt.MQeServer <startupIniFile>
```

where:

javaCommand

is the command used to start Java applications (**java** for example)

startupIniFile

is an ini file that contains startup parameters for the queue manager and server (`.\ExamplesMQeServer.ini` for example)

For a server queue manager you must extend the standard client queue manager startup parameters. As with the client queue manager, ini files are used to hold the server startup parameters. The batch file `ExamplesMQeServer.bat` provides a shortcut for starting the server with the ini file `.\ExamplesMQeServer.ini`. A typical extension of the ini file to provide the server startup parameters follows:

```
* Extract from ExamplesMQeServer.ini
*
[ChannelManager]
*
*   Maximum number of channels allowed
*
(int)MaxChannels=0
*-----*
[Listener]
*
*   FileDescriptor for listening adapter
*
(ascii)Listen=Network::8082
*
*   FileDescriptor for Network read/write
*
(ascii)Network=Network:
*
*   Channel time-out interval in seconds
*
(int)TimeInterval=300
```

When two queue managers communicate with each other, MQSeries Everyplace opens a channel between the two queue managers. The channel is a logical entity that is used as a queue manager to queue manager pipe. Multiple channels may be open at any time.

server queue managers

The new parameters control channel usage. The *MaxChannels* parameter controls the maximum number of channels that can be open at any time. A special value of 0 means that the queue manager can handle an unlimited number of channels.

The following parameters control how incoming network requests are handled:

Listen The network adapter that handles incoming network requests. For example this could be an http adapter or a pure tcp/ip adapter. As well as the adapter name, you can pass parameters that dictate how the adapter should listen. For instance `Listen=Network::8082` means use the Network adapter where Network is an alias to listen on port 8082. (This assumes that the Network alias is set to either an http or a tcp/ip adapter.)

Network

This parameter is used to specify the adapter to use for network read and write requests, once the initial network request has been accepted. Usually this is the same as the adapter used on the *Listen* parameter.

TimeInterval

The time in seconds before idle channels are timed out. As channels are persistent logical entities that last longer than a single queue manager request, and can survive network breakages, it may be necessary to time out channels that have been inactive for a period of time.

The creation of MQeServer follows that of MQeClient..

1. Pass the server startup parameters to the **init** method
2. Check to ensure that only one server will run per JVM
3. Load any aliases, and, if necessary, enable trace

The following code shows the **init** method that is used to start the server:

```
public void init( MQeFields parms ) throws Exception
{
    if ( initialized )                /* Only one server at a time */
        throw new Exception( "Server already running" );

    sections = parms;                 /* Remeber startup parms */
    MQeQueueManagerUtils.processAlias( sections ); /* set any alias names */

    // Uncomment the following line to start trace before the queue manager is started
    // MQeQueueManagerUtils.traceOn("MQeServer Trace", null); /* Turn trace on */

    /* Display the startup parameters */
    System.out.println( sections.dumpToString( "#1\t=\t#2\r\n" ) );
}
```

Once the server has been initialized it must be activated. Activate it using the **activate** method with a parameter of *true*. Once activated you can deactivate the server by calling the **activate** method with a parameter of *false*.

When you activate a server the following occurs:

1. The channel manager is started
2. Any additional user specified classes are loaded and the null constructor is called
3. The queue manager is started
4. The channel listener is started.

This is shown in the following code:

server queue managers

```
public void activate( boolean Start ) throws Exception
{
    if ( Start )
        /* activate ? */
        {
            /* ... yes */
            if ( ! initialized )
                /* been here before */
                {
                    /* ... no */
                    /* allocate Chan Mgr */
                    channelManager = MQeQueueManagerUtils.processChannelManager( sections );

                    /* assign any class aliases */
                    MQeQueueManagerUtils.processAlias( sections );

                    /* check for any pre-loaded classes */
                    loadTable = MQeQueueManagerUtils.processPreLoad( sections );
                    initialized = true;
                    /* only once */
                }
                /*
                /* setup and activate the queue manager
                queueManager = MQeQueueManagerUtils.processQueueManager( sections,
                channelManager.getGlobalHashtable( ) );

                /* setup and activate the listener for incoming connections */
                channelListener = MQeQueueManagerUtils.processListener(
                sections, channelManager );
            }
        else
            /* ... no */
            {
                /*
                if ( channelListener != null ) channelListener.stop( );
                if ( queueManager != null ) queueManager.close( );
                channelListener = null;
                /* release object */
                queueManager = null;
                /* release object */
            }
    }
}
```

When the listener is started, the server is ready to accept network requests.

When the server is deactivated:

1. The channel listener is stopped, preventing any new incoming requests
2. The queue manager is closed.

The following sections of code from the MQeQueueManagerUtils class process each of the components.

The following section starts a channel manager:

```
public static MQeChannelManager processChannelManager( MQeFields sections )
throws Exception
{
    MQeChannelManager channelManager = null; /* work variable */
    if ( sections.contains( Section_ChannelManager ) ) /* section present ? */
        {
            /* ... yes */
            MQeFields section = sections.getFields( Section_ChannelManager );
            channelManager = new MQeChannelManager( ); /* load the manager */
            channelManager.numberOfChannels( section.getInt( "MaxChannels" ) );
        }
        /*
    return( channelManager );
    /* return the allocated mgr */
}
```

This method instantiates a channel manager and then uses the *MaxChannels* parameter from the startup parameters to set the maximum number of channels that are permitted.

It is also possible to specify a set of classes to load when the queue manager is loaded. These are added to a [PreLoad] section of the ini file. The entries must have the form (ascii)uniqueName=class, as shown in the following example:

server queue managers

```
[PreLoad]
*
*   Classes to load at server startup
*
(ascii)StartClass1=test.ServerTest1
(ascii)StartClass2=test.ServerTest2
```

The following section of code loads the preload classes:

```
public static Hashtable processPreLoad( MQeFields sections ) throws Exception
{
    Hashtable loadTable = new Hashtable();      /* allocate load table      */
    if ( sections.contains( Section_PreLoad ) ) /* section present ?      */
    {                                           /* ... yes                  */
        MQeFields section = sections.getFields( Section_PreLoad );
        Enumeration keys = section.fields();    /* get all the keywords    */
        while ( keys.hasMoreElements() )      /* as long as there are keywords*/
        try                                    /* incase of error        */
        {                                       /*                          */
            String key = section.getAscii( (String) keys.nextElement() ).trim( );
            loadTable.put( key, MQe.loader.loadObject( key ) );
        }
        catch ( Exception e )                  /* error occurred        */
        {                                       /*                          */
            e.printStackTrace();               /* show the error        */
        }
    }
    return( loadTable );                       /* return the table      */
}
```

For each class specified in the preload parameters:

1. The class is loaded using the MQeLoader. This calls the null constructor of the class, so any initialization or/startup code must be placed in this constructor
2. Once loaded, a reference to the class is placed in a hashtable. This table can then be used by other methods in the server. For instance, the **close** method of the server could be extended to execute the **close** method of every preloaded class, when the server closes.

Example MQePrivateServer

MQePrivateServer is an extension of MQeServer with the addition that it configures the queue manager and registry to allow for secure queues. See "Chapter 8. Security" on page 169.

Example AwtMQeServer

AwtMQeServer is in package examples.awt and provides a graphical front end to the console based servers.

Start the server with the following command:

```
<javaCommand> examples.awt.AwtMQeServer <startupIniFile>
```

Where:

javaCommand

is the command used to start Java applications (**java** for example)

startupIniFile

is an ini file that contains startup parameters for the queue manager and server (for example .\ExamplesAwtMQeServer.ini)

Batch file ExamplesAwtMQeServer.bat provides a shortcut to start the server with the file .\ExamplesAwtMQeServer.ini.

The AwtMQeServer uses the following additional aliases:

Server the server class for which this class provides a graphical front end

Admin the name of a class that provides an administration console

The example file `.\ExamplesAwtMQeServer.ini` sets the aliases as follow:

```
*
*   Admin console (if any)
*
(ascii)Admin=examples.administration.console.Admin
*
*   Base Server class
*
(ascii)Server=examples.queuemanager.MQeServer
```

When the private server is started the following window is displayed:



Figure 4. AWT MQSeries Everyplace server window

The buttons function as follows:

Exit Close the server and perform a `System.exit()`

Stop | Run

If the server is running then **Stop** stops it. If the server is stopped then the button displays **Run** to start the server.

Start is performed with the following code:

```
if ( running )                /* running ?          */
{
    setText( North, index, "Run" );          /* ... yes,          */
    server.activate( false );                /* stop server       */
}
else
{
    setText( North, index, "Stop" );         /* ... no, i.e start */
    if ( server == null )                    /* initialized before? */
    {
        /* Load the startup parms and setup class aliases          */
        MQeFields sections
            = MQeQueueManagerUtils.loadConfigFile( iniName );
        MQeQueueManagerUtils.processAlias( sections );
        /* Load the server and initialize if first pass              */
        server = (MQeServer)MQe.loader.loadObject( "Server" );
        server.init( sections );
    }
    server.activate( true );                 /* Activate the server */
}
running = ! running;                       /* change state       */
```

Trace Activates or deactivates trace. This is achieved with the following code:

server queue managers

```
/* Get current trace handler if any .. */
MQeTraceInterface trace = MQe.getTraceHandler( );
if ( trace == null ) /* If trace is not on,start it */
    MQeQueueManagerUtils.traceOn( this.getTitle() + " - Trace", null );
else /* otherwise stop it */
    MQeQueueManagerUtils.traceOff();
```

Admin

Starts or stops the administration console. The follow code implements this function:

```
if ( adminGUI != null && adminGUI.active )
{
    /* GUI active so */
    adminGUI.close(); /* close it */
    adminGUI = null;
}
else if ( adminGUI == null ||
    ( adminGUI != null && !adminGUI.active ) )
{
    /* GUI not running or not active*/
    adminGUI = (Admin)MQe.loader.loadObject( "Admin" );
    adminGUI.activate(); /* so load and actiate it */
}
```

Help Displays an about dialog

You can additionally turn event logging on and off and select the logger to use from the drop down list box. The following selections are possible:

- No logging,
- examples.eventlog.LogToDiskFile
- examples.eventlog.LogToNTEventLog

Servlet

As well as running as a standalone server, a queue manager can be encapsulated in a servlet to run inside a Web server . A servlet queue manager has nearly the same capabilities as a server queue manager. MQeServlet provides an example implementation of a servlet. As with the server, servlets use ini files to hold start up parameters. A servlet uses many of the same MQSeries Everyplace components as the server, and a servlet can use a server ini file.

The main component not required in a servlet is the channel listener, this function is handled by the Web server itself. Web servers only handle http data streams so any MQSeries Everyplace client that wishes to communicate with an MQSeries Everyplace servlet must use the http adapter (com.ibm.mqe.adapters.MQeTcpipHttpAdaper). When you configure connections to queue managers running in servlets, you must specify the name of the servlet in the parameters field of the connection. The following definitions configure a connection on servlet /servlet/MQSeries Everyplace with queue manager PayrollQM:

```
Connection name
    PayrollQM

Channel
    com.ibm.mqe.MQe

Channel Adapter
    com.ibm.mqe.adapters.MQe

TcpipHttpAdaper
    192.168.0.10:80
```

Parameters
/servlet/MQe

Options

Alternatively, if the relevant aliases have been set up, you can configure the connection as follows:

Connection name
PayrollQM

Channel
DefaultChannel

Adapter
Network:192.168.0.10:80

Parameters
/servlet/MQe

Options

Web servers can run multiple servlets. It is possible to run multiple different MQSeries Everyplace servlets within a Web server, with the following restrictions:

- Each servlet must have a unique name
- Only one queue manager is allowed per servlet
- Each MQSeries Everyplace servlet must run in a different Java Virtual Machine (JVM)

The MQSeries Everyplace sevlet extends `javax.servlet.http.HttpServlet` and overrides methods for starting, stopping and handling new requests. The following code fragment starts a servlet:

```
/**
 * Servlet Initialisation.....
 */
public void init(ServletConfig sc) throws ServletException
{
    // Ensure supers constructor is called.
    super.init(sc);

    try
    {
        // Get the the server startup ini file
        String startupIni;
        if ( ( startupIni = getInitParameter("Startup")) == null )
            startupIni = defaultStartupInifile;

        // Load it
        MQeFields sections = MQeQueueManagerUtils.loadConfigFile(startupIni);

        // assign any class aliases
        MQeQueueManagerUtils.processAlias( sections );

        // Uncomment the following line to start trace before the queue
        // manager is started
        //     MQeQueueManagerUtils.traceOn("MQeServlet Trace", null);

        // Start channel manager
        channelManager = MQeQueueManagerUtils.processChannelManager( sections );

        // check for any pre-loaded classes
        loadTable = MQeQueueManagerUtils.processPreLoad( sections );
    }
}
```

Servlet queue managers

```
// setup and activate the queue manager
queueManager = MQeQueueManagerUtils.processQueueManager( sections,
channelManager.getGlobalHashtable( ) );

// Start ChannelTimer (convert time-out from secs to millsecs)
int tI =
    sections.getFields(MQeQueueManagerUtils.Section_Listener).getInt( "TimeInterval" );
long timeInterval = 1000 * tI;
channelTimer = new MQeChannelTimer( channelManager, timeInterval );

// Servlet initialisation complete
mqe.trace( 1300, null );
}
catch (Exception e)
{
    mqe.trace( 1301, e.toString() );
    throw new ServletException( e.toString() );
}
}
```

The main differences compared to a server startup are:

- The servlet overrides the **init** method of the superclass. This method is called by the Web server to start the servlet. Typically this occurs when the first request for the servlet arrives.
- The name of the startup ini file cannot be passed in from the command line. The example expects to obtain the name using the servlet method **getInitParameter()** which takes the name of a parameter and returns a value. The MQSeries Everyplace servlet uses a *Startup* parameter that it expects to contain an ini file name. The mechanism for configuring parameters in a Web server is Web server dependant.
- A channel listener is not started as the Web server handles all network requests on behalf of the servlet.
- As there is no channel listener a mechanism is required to time-out channels that have been inactive for longer than the time-out period. A simple timer class MQeChannelTimer is instantiated to perform this function. The *TimeInterval* value is the only parameter used from the [Listener] section of the ini file.

A servlet relies on the Web server for accepting and handling incoming requests. Once the Web server has decided that the request is for an MQSeries Everyplace servlet, it passes the request to MQSeries Everyplace using the **doPost()** method. The following code handles this request:

```
/**
 * Handle POST.....
 */
public void doPost(HttpServletRequest request,
                  HttpServletResponse response) throws IOException
{
    // any request to process ?
    if (request == null)
        throw new IOException("Invalid request");
    try
    {
        int max_length_of_data = request.getContentLength(); // data length
        byte[] httpInData = new byte[max_length_of_data]; // allocate data area
        ServletOutputStream httpOut = response.getOutputStream(); // output stream
        ServletInputStream httpIn = request.getInputStream(); // input stream

        // get the request
        read( httpIn, httpInData, max_length_of_data);

        // process the request
    }
}
```

```

byte[] httpOutData = channelManager.process(null, httpInData);

// appears to be an error in that content-length is not being set
// so we will set it here
response.setContentLength(httpOutData.length);
response.setIntHeader("content-length", httpOutData.length);

// Pass back the response
httpOut.write(httpOutData);
}
catch (Exception e)
{
// pass it on ...
throw new IOException( "Request failed" + e );
}
}

```

This method:

1. Reads the http input data stream into a *byte array*. The input data stream may be buffered so the **read()** method is used to ensure that the entire data stream is read before continuing.

Note: MQSeries Everyplace only handles requests with the **doPost()** method, it does not accept requests using the **doGet()** method

2. The request is passed to MQSeries Everyplace through a channel manager. From this point, all processing of the request is handled by core MQSeries Everyplace classes such as the queue manager.
3. Once MQSeries Everyplace has completed processing the request, it returns the result wrapped in http headers as a byte array. The byte array is passed to the Web server and is transmitted back to the client that originated the request.

Configuring queue managers using base classes

Although the use of MQeQueueManagerConfigure is the recommended way to create and delete queue managers, this section describes how to create the same function from base classes.

Queue manager activation

To activate a queue manager you require:

- A pre-configured registry
- A set of activation parameters that inform the queue manager how to activate the registry

When the queue manager is activated the activation parameters are passed to it. These parameters consist of MQeFields objects imbedded inside another MQeFields object.

The names of the imbedded MQeFields objects to be used are defined in the MQeQueueManager class:

MQeQueueManager.QueueManager

The name of the queue manager being activated

MQeQueueManager.Registry

The location of the queue manager's predefined registry

MQeQueueManagerUtils.SectionAliases

MQSeries Everyplace aliases

configuring using base classes

The registry contains the definitions of the queues that the queue manager owns, the definitions of any other queue managers known , and some configurable queue manager setup data. This setup data is:

Queue manager description

A String containing a description for the queue manager

Queue manager rules

A String containing the name of the class to use as the queue manager's Rules (see "Queue manager rules" on page 75).

Default queue store

A path name that is the location of the default queue store (where queue stores its messages). This is only used if a queue without a queue store field is added to the queue manager . The name of the queue is appended to the default string to give the queue its own unique queue store path name.

Channel attribute rules

A String containing the name of the class to use as the channel attribute rules. These rules define how to behave when dealing with remote queues that have non-null attributes .

Channel Timeout

A long value that is the channel time-out (measured in milliseconds). If a channel between two queue managers is idle for longer than this period, the channel is closed.

You can update all these values using MQSeries Everyplace administration (see "Chapter 6. Administering messaging resources" on page 85) and they can also be configured when the queue manager is created.

MQSeries Everyplace provides two classes that start the queue manager in predefined configurations. (These classes are in the examples directory.)

MQeClient

Starts the queue manager as a client

MQeServer

Starts the queue manager as part of an MQSeries Everyplace server

All required processing is handled by these classes before the queue manager is started.

It is possible to process the alias list and activate the queue manager without using either of these classes. The alias list is processed using the **MQe.alias** method. In the example below, the alias name "Trace" is set to examples.awt.AwtMQeTrace.
`alias("Trace", "examples.awt.AwtMQeTrace");`

Both MQeClient and MQeServer accept an ini file containing the queue manager parameters. The entries in the ini file are converted to the required imbedded MQeFields object. This is done with the examples.queuemanager.MQeQueueManagerUtils class which makes use of the **MQe.alias** method to process the alias list.

The following code fragment shows these procedures:

```
public static void processAlias( MQeFields sections ) throws Exception
{
    if ( sections.contains( Section_Alias ) ) /* section present ?      */
    {                                         /* ... yes                    */
```


applications and the JVM

```
        System.err.println( "Exception on starting applications" );
        e.printStackTrace( System.err );
    }
}

public void startApplications( String args[] ) throws Exception
{
    boolean active = false; /* any active threads? */
    /* create an array of the thread references of the applications */
    /* being launched */
    threads = new Thread[ args.length ];
    appList = args; /* keep the list of the applications to be launched */
    /* loop through the list of apps being launched & start a new */
    /* thread for each one */
    for ( int i = 0; i < appList.length; i++ )
    {
        Thread th = new Thread( this ); /* create a new thread */
        threads[i] = th; /* keep reference */
        th.start(); /* start new thread */
        /* loop until queue manager is active then start rest of apps */
        if ( i == 0 )
            while( qmgr == null );
    }
    /* keep appLauncher thread alive until all other apps have finished */
    while( active )
    {
        active = false;
        /* loop through thread references, starting at element 1 */
        /* remember first element in appList is QMgr ini file path name */
        for( int j=1; j < appList.length; j++ )
            if ( threads[j] != null )
                active = true; /* thread still active */
    }
    if ( qmgr != null )
        qmgr.close(); /* close queue manager */
}

/* this method called for each application being launched, plus the */
/* queue manager */
public void run()
{
    int currentApp; /* which element in threads table */
    synchronized( lock )
    {
        currentApp = appCount;
        appCount++; /* update count */
    }
    try
    {
        /* first element is QMgr ini file path name */
        if ( currentApp == 0 ) /* start queue manager */
        {
            MQeClient client = new MQeClient( appList[0] );
            qmgr = client.queueManager; /* QMgr now active */
        }
        else /* load application */
            /* (this invokes default constructor) */
            loader.loadObject( appList[currentApp] );
    }
    catch ( Exception e )
    {
        e.printStackTrace( System.err );
    }
    finally
    { /* get thread reference for this app */
        Thread th = threads[currentApp];
        threads[currentApp] = null; /* nullify reference */
    }
}
```

```

        th.stop(); /* stop thread */
    }
}

```

The arguments supplied to this class are the path name of the queue manager's ini file, followed by a list of the MQSeries Everyplace applications launch. All the applications are invoked using their default constructor.

The application launcher is started with the command

```

java appLauncher
<ini file path name><application class name><application class name>...

```

For example:

```

java appLauncher
e:\MQe\TestQMGr\TestQMGr.ini examples.queueemanager.TestMQeApp

```

All the applications should use `MQeQueueManager.getReference()` to obtain the object reference to the queue manager that is already running inside the JVM.

Launching applications with RunList

An alternative way of launching MQSeries Everyplace applications is to use the RunList mechanism. You can supply two lists of MQSeries Everyplace applications (known as *run lists*) as part of the queue manager activation parameters. The first list contains applications that are launched after the queue manager has been activated. The second list contains applications that are launched once a queue manager has received a close request.

The applications contained in the run lists should implement `MQeRunListInterface`. The queue manager calls the `activate()` method defined in the interface to activate the applications and pass any available setup information to it.

If an applications does not implement `MQeRunListInterface`, the application is just invoked and no setup information is passed to it.

The [AppRunList] section in the ini file contains the names of the applications to launch at queue manager activation time. The symbolic name of the application is on the left-hand side of the equals sign, with the full class name of the application on the right , as shown in the queue manager ini file example.

Any setup data for the application can be provided in a section headed with [symbolic name of the application].

Example queue manager ini file

```

* Sample queue manager ini file

* queue manager setup info
[QueueManager]
* Name for this queue manager
(ascii)Name=ServerQMGr8082

* Registry setup info
[Registry]
* QueueManager Registry type (ascii)LocalRegType=com.ibm.mqe.registry.MQePrivateSession
* Location of the registry
(ascii)DirName=d:\development\Rename\Classes\ServerQMGr8082\Registry
* Registry access PIN

```

runlist

```
(ascii)PIN=12345678

* List of applications to launched at queue manager activation-time
[AppRunList]
(ascii)App1=examples.queuemanager.TestMQeApp
(ascii)App2=examples.administration.AdminApp

* Setup info for App1 - the data in this section is passed to the application
[App1]
(ascii)DefaultMsgPriority = 7
(long)Timeout = 30000

* Setup info for App2 - the data in this section is passed to the application
[App1]
(ascii)DefaultQueueName=AdminReplyQueue
```

The applications that are invoked when the queue manager is activated should return control to the queue manager as quickly as possible to allow the queue manager to continue its activation. If the application is a long running task it should initialize itself on a different thread from the one on which it was called. The application is responsible for the management of threads that it creates.

Applications that are invoked on queue manager **close** can block the queue manager from shutting down if they do not return.

Example of an application being launched at queue manager activation time

```
public class ExampleApp extends MQe implements MQeRunListInterface,
                                             Runnable,
                                             MQeMessageListenerInterface
{
    Thread th = null;
    MQeQueueManager qmgr = null;
    ...
    /*Called by the queue manager to activate the application */
    public Object activate( Object owner, Hashtable loadTable,
                           MQeFields setupData )
    {
        qmgr = (MQeQueueManager)owner; /*QMGr is owner of the application*/
        processSetupData( setupData ); /*Process the setup information*/
        th = new Thread( this );       /*Create a new thread to listen*/
        th.start();                    /*for incoming messages*/
        return (null);                /*return control to the QMgr*/
    }

    public void run()
    {
        try
        {
            /*Create a message listener for incoming messages*/
            qmgr.addMessageListener( this, "MyQueue", null );
            /* Loop indefinitely keeping application alive */
            while( true );
        }
        catch ( Exception e )
        {
            e.printStackTrace( System.err );
        }
    }
    ...
}
```

In this example, the application is invoked using the **activate()** method. This method processes its setup data, and creates a message listener on a separate

thread. The application returns control to the queue manager as soon as possible, to allow the queue manager to continue its activation process. The thread that the application created remains active.

Example of an application being launched when the queue manager receives a close request

```
public class ExampleCloseApp extends MQe implements MQeRunListInterface
{
    MQeQueueManager qmgr = null;
    ...
    /* Called by the queue manager to activate the application */
    public Object activate( Object owner, Hashtable loadTable,
                          MQeFields setupData )
    {
        qmgr = (MQeQueueManager)owner; /* QMgr is owner of the application */
        performAction(); /* Perform some action */
        /* don't return control to the QMgr until application has finished */
        return (null);
    }
}
```

In this example, the application is activated using its `activate()` method when the queue manager receives a close request. The application should not return control to the queue manager until the application has finished its processing because once the queue manager has control it continues its close-down process.

Using queue manager aliases

Aliases can be used for MQSeries Everyplace queue managers, and can be used by application programs, to provide a level of indirection between the application and the real object. Hence the attributes of a queue manager that an alias relates to can be changed without the application needing to change.

The following examples illustrate some of the ways that aliasing can be used with queue managers.

Examples of queue manager aliasing

Addressing a queue manager with several different names

Suppose you have a queue manager `SERVER23QM` on the server `SAMPLEHOST`, listening on port 8082. You have an application `SERVICEX` that accesses this queue manager, and wants to refer to the queue manager as `SERVICEXQM`. This can be achieved using an alias for the queue manager as follows:

- **Configure a connection on the `SERVER23QM` :**

Connection Name/Target queue manager:
SERVICEXQM

Description: Alias definition to enable `SERVER23QM` to receive messages sent to `SERVICEXQM`

Channel: "null"

Network Adapter: "null"

Network adapter options: "null"

- **Create a local queue on the `SERVER23QM` queue manager:**

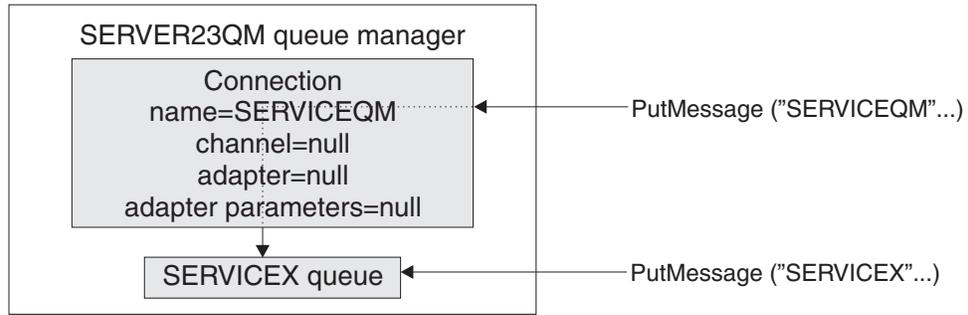
Queue Name: SERVICEXQ

Queue Manager: SERVER23QM

runlist

The server-side application takes messages from this queue, and process them, sending messages back to the client.

An MQSeries Everyplace application running within the server's JVM can now put messages to the SERVICEQ on either the SERVER23QM queue manager, or the SERVICEQM queue manager. In either case, the message will arrive on the SERVICEQ.



Both messages arrive at SERVICEQ queue

Figure 5. Addressing a queue manager with two different names

If the SERVICEQ queue is moved to another queue manager, the connection alias can be set up on the new queue manager, and the applications do not need to be changed.

Different routings from one queue manager to another

Using the scenario just described, an MQSeries Everyplace queue manager on a mobile device (MOBILE0058QM) can now access the SERVICEQ queue in a number of different ways. Two examples are described here:

- **Aliasing on the sending side**

Using this method of routing, the receiving queue manager does not know that the sending queue manager has given him an alias name. The aliasing is confined to the sending queue manager only.

On the mobile device:

- Create a connection from MOBILE0058QM to the SERVER23QM queue manager:

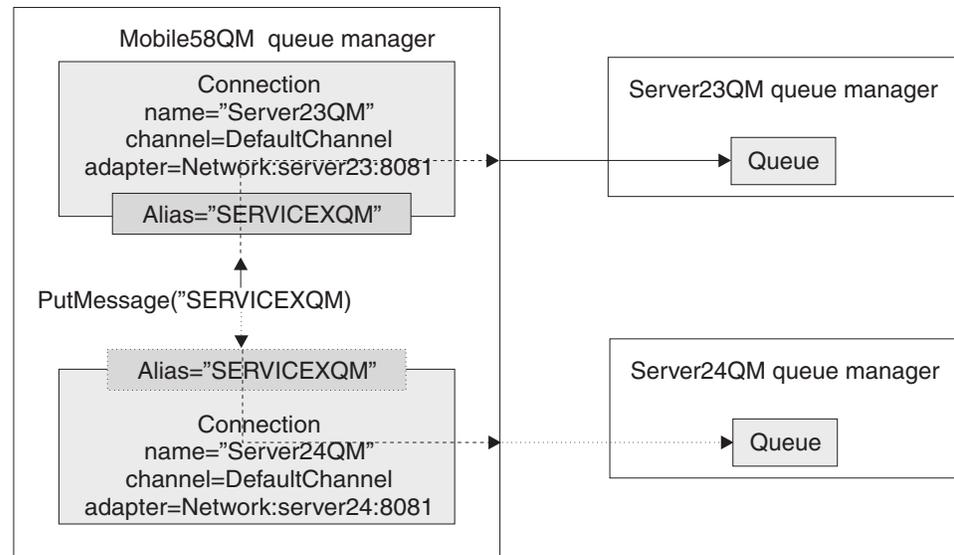
```
Connection name
  SERVER23QM
```

```
Network Adapter parameter
  Network: SAMPLEHOST: 8082
```

- Create an alias called SERVICEQM for queue manager SERVER23QM

When a message is sent from the mobile device application to the SERVICEQM queue manager, MQSeries Everyplace maps the SERVICEQM name to SERVER23QM in the connection, and sends the message to the SERVER23QM queue manager.

If the Mobile58QM then wished to send its messages to a different server queue manager, Server24QM, it would remove the alias SERVICEQM from the Server23QM connection, and add it to a Server24QM connection. This has no impact on the receiving queue managers, or the sending applications.



The message goes to either Server23QM or Server24QM depending on which connection the alias is attached to

Figure 6. Addressing a queue manager with two different names

- **Virtual queue manager on the receiving side**

Using this method, the sending queue managers think that its messages are routed through an intermediate queue manager before reaching the target queue manager. The target queue manager doesn't actually exist. The 'intermediate' queue manager captures all the message traffic for this virtual target queue manager.

On the mobile device:

- Create a connection from MOBILE0058QM to the SERVER23QM queue manager:

```

Connection name          SERVER23QM
Network Adapter parameter Network:SAMPLEHOST:8082

```

- Create a second connection to the SERVICEXQM that routes messages through the first connection:

```

Connection name
SERVICEXQM
Network Adapter parameter
SERVER23QM

```

Note: This is not an alias. It is a *via routing*, indicating that messages headed for SERVICEXQM are to be routed via the SERVER23QM queue manager on the receiving side.

The via routing on the mobile device causes any messages that are put to SERVICEXQM to be directed to Server23QM. Server23QM gets the messages and notes that they are destined for the SERVICEXQM queue manager. It resolves the SERVICEXQM name and finds that it is an alias which represents the Server23QM queue manager (itself). The Server23QM queue manager then accepts the messages and puts them onto the queue.

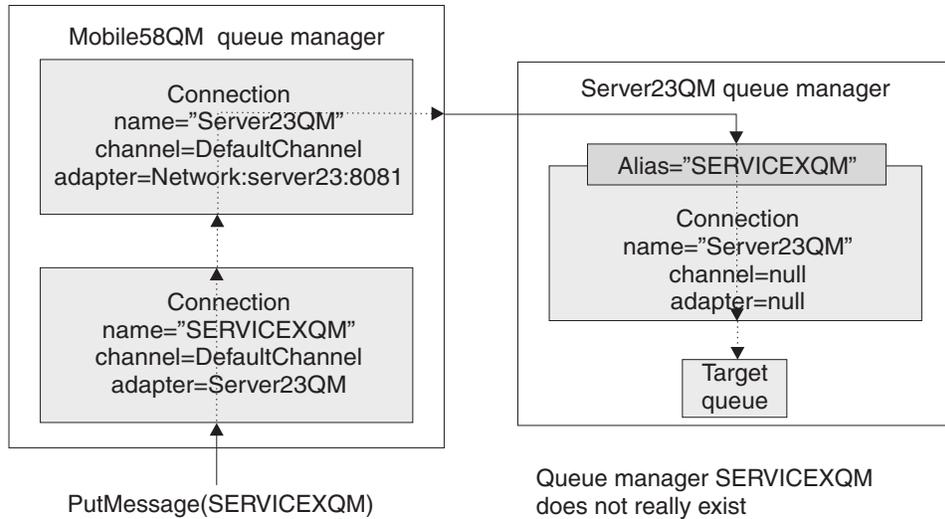


Figure 7. Addressing a queue manager with two different names

As an alternative to the above, you can keep the SERVICEXQM in existence, but move it from its original machine to the same machine (but a different JVM) as the Server23QM queue manager. SERVICEXQM needs to listen on a different port, so the connection from Server23QM to SERVICEXQM needs to be changed as well.

Messages

MQSeries Everyplace messages are descendant objects of MQeFields, as described in "Chapter 3. MQeFields" on page 25. Applications can put data into the message as a <name, data> pairing.

MQSeries Everyplace defines some constant field names that are useful to messaging applications. These are:

Unique ID

MQe.Msg_OriginQMgr + MQe.Msg_Time

Message ID

MQe.Msg_ID

Correlation ID

MQe.Msg_CorrelID

Priority

MQe.Msg_Priority

The *Unique ID* is a combination of a unique (per JVM) timestamp generated by the message object when it is created, and the name of the queue manager to which the message was first given. The *Unique ID* is used by applications to retrieve messages. It cannot be changed by an application.

The *Unique ID* uniquely identifies a message within an MQSeries Everyplace network so long as all queue managers within the MQSeries Everyplace network are named uniquely.

Note: MQSeries Everyplace does not check or enforce the uniqueness of queue manager names. It is the responsibility of an individual solution to ensure that its queue manager names are unique.

The `getMsgUIDFields()` method accesses the *Unique ID* of a message:

```
MQeFields msgUID = msgObj.getMsgUIDFields();
```

The `getMsgUIDFields()` method returns an `MQeFields` object that contains two fields,

- `MQe.Msg_OriginQMgr`
- `MQe.Msg_Time`

These fields can be individually retrieved as follows:

```
long timeStamp    = msgUID.getLong(MQe.Msg_Time);
String originQMgr = msgUID.getAscii(MQe.Msg_OriginQMgr);
```

The Websphere MQ *Message ID* and *Correlation ID* fields allow the application to provide an identity for a message. These two fields are also used in interactions with the rest of the Websphere MQ family.

```
MQeMsgObject msgObj = new MQeMsgObject();
msgObj.putArrayOfByte( MQe.Msg_ID, MQe.asciiToByte( "1234" ) );
```

The *Priority* field contains message priority values. Message priority is defined in the same way as in other members of the Websphere MQ family. It ranges from 9 (highest) to 0 (lowest). Applications use this field to deal with a message according to its priority.

```
MQeMsgObject msgObj = new MQeMsgObject();
msgObj.putByte( MQe.Msg_Priority, (byte)8 );
```

Applications can create fields for their own data within messages .

```
MQeMsgObject msgObj = new MQeMsgObject();
msgObj.putAscii( "PartNo", "Z301" );
msgObj.putAscii( "Colour", "Blue" );
msgObj.putInt( "Size", 350 );
```

An alternative approach is to extend `MQeMsgObject` to include some methods to assist with creating messages, as shown in the following example:

```
package messages.order;
import com.ibm.mqe.*;

/** This class defines the Order Request format */
public class OrderRequestMsg extends MQeMsgObject
{
    public OrderRequestMsg() throws Exception
    {
    }

    /** This method sets the client number */
    public void setClientNo(long aClientNo) throws Exception
    {
        putLong("ClientNo", aClientNo);
    }

    /** This method returns the client number */
    public long getClientNo() throws Exception
    {
        return getLong("ClientNo");
    }
}
```

messages

```
/** This method sets the name of the item to be ordered */
public void setItem(String anItem) throws Exception
{
    putUnicode("Item", anItem);
}

/** This method returns the name of the item to be ordered */
public String getItem() throws Exception
{
    return getUnicode("Item");
}

/** This method sets the quantity required */
public void setQuantity(int aQuantity) throws Exception
{
    putInt("Quantity", aQuantity);
}

/** This method returns the quantity required */
public int getQuantity() throws Exception
{
    return getInt("Quantity");
}

/** This method sets the name of the queue to which to send an order reply */
public void setReplyToQ(String aMyReplyToQ) throws Exception
{
    putAscii("Msg_ReplyToQ", aMyReplyToQ);
}

/** This method returns the name of the queue to which an order reply will be sent */
public String getReplyToQ() throws Exception
{
    return getAscii("Msg_ReplyToQ");
}

/** This method sets the name of the queue manager to which an order reply will be sent */
public void setReplyToQMgr(String aMyReplyToQMgr) throws Exception
{
    putAscii("Msg_ReplyToQMgr", aMyReplyToQMgr);
}

/** This method returns the name of the queue manager to which an order reply will be sent */
public String getReplyToQMgr() throws Exception
{
    return getAscii("Msg_ReplyToQMgr");
}
}
```

The additional methods handle the **puts** and **gets** of the data in and out of the message object. Application programmers do not need to be involved with either the type of the data being sent, or the field names being used inside the message, as shown in the following example:

```
OrderRequestMsg orderRequest = new OrderRequestMsg();
orderRequest.setClientNo( 1234 ); /* client ref. number */
orderRequest.setItem( " MQSeries Everyplace Programmers Guide" ); /* item being ordered */
orderRequest.setQuantity( 12 ); /* quantity */

/** send the order reply to QMgr1.OrderReplyQueue */
orderRequest.setReplyToQMgr( "QMgr1" );
orderRequest.setReplyToQ( "OrderReplyQueue" );
```

Storing messages

Most queue types hold messages in a persistent store. While in the store, the state of the message varies as it is transferred into and out of the store. As shown in Figure 8:

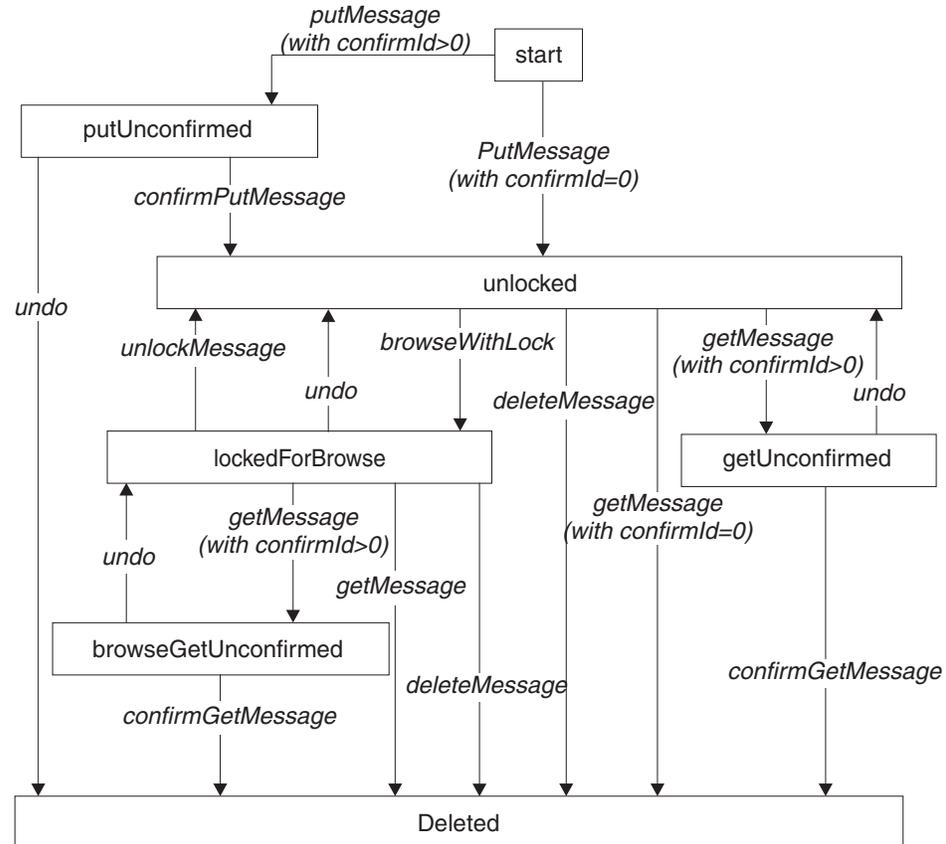


Figure 8. Stored message state flow

Message states

The possible message states are:

Start The initial state of a message before it is added to the message store.

Put Unconfirmed

A message has been placed in the message store under a *confirmID* but its addition has not been confirmed. The message is effectively hidden from all actions except **confirmPutMessage**, **confirm**, or **undo**.

Unlocked

A message has been added to the message store. There is no lock on it, and it is visible to all queries.

Locked for Browse

A browse with lock has retrieved the message. The message is now hidden from all queries except **getMessage**, **unlockMessage**, and **undo**.

Get Unconfirmed

A get message has been made with a *confirmID* but the get has not been confirmed. The message is invisible to all queries except **confirmGetMessage**, **confirm**, or **undo**. Each of these actions requires the matching *confirmID* to be included to confirm the get.

Storing messages

Browse Get Unconfirmed

A message has been got while it is locked for browse. This can only be done by passing the correct *lockID* to the **getMessage** function.

Deleted

The final state, after a message has been removed from the database.

Message events

Messages pass from one state to another as a result of an event. The possible message events (as shown in Figure 8 on page 59) are:

putMessage

Message placed on message store, no confirm required.

getMessage

Message retrieved from message store, no confirm required.

putMessage with confirmId>0

Message placed on message store, confirm required.

confirmPutMessage

A confirm for an earlier **putMessage** with confirmId>0

getMessage with confirmId>0

Message retrieved from message store, confirm required.

confirmGetMessage

A confirm for an earlier **getMessage** with confirmId>0

browseWithLock

Browse messages and lock those that match. Prevents messages changing while browse is in operation.

unlockMessage

Unlock a message locked with a **browsewithLock** command.

undo Unlock a message locked with a browse, or undo a **getMessage** with confirmId>0 or **putMessage** with confirmId>0

deleteMessage

Remove a message from the message store.

More detailed descriptions of message events and states are included in “Assured message delivery” on page 69, and “Browse and Lock” on page 63 and

Message index fields

Due to memory size constraints, complete messages are not held in memory, but, to enable faster message searching, MQSeries Everyplace holds specific fields from each message in a *message index*. The fields that are held in the index are:

Unique ID

MQe.Msg_OriginQMgr + MQe.Msg_Time

Message ID

MQe.Msg_ID

Correlation ID

MQe.Msg_CorrelID

Priority

MQe.Msg_Priority

Providing these fields in a filter makes searching more efficient, since MQSeries Everyplace may not have to load all the available messages into memory.

Filters

The concept of filters allows MQSeries Everyplace to perform powerful message searches. Most of the major queue manager operations support the use of filters. You can create filters by placing fields into MQeFields objects. For example, if a simple **get** message operation takes a "null" filter, the result of the operation is the return of the first available message on the queue.

```
qmgr.getMessage( "myQMgr", "myQueue", null, null, 0 );
```

The use of a filter causes an application to return the first available message that contains the same fields and values as the filter. For example, the following code creates a filter that obtains the first message with a message id of "1234":

```
MQeFields filter = new MQeFields();
filter.putArrayOfByte( MQe.Msg_MsgID, MQe.AsciiToByte( "1234" ) );
```

The filter is passed into the **get** message operation:

```
qmgr.getMessage( "myQMgr", "myQueue", filter, null, 0 );
```

When a filter is applied to a search, the fields in the filter are compared with each index entry in turn. If a field is common to both the index entry and the filter, and the values in the field are different, then the message cannot possibly match the filter and it is excluded from consideration. If a field is not common to both filter and index entry, or if the field is common and the values are the same, then the message is included in the search.

Message Expiry

Queues can be defined with an expiry interval. If a message has remained on a queue for a period of time longer than this interval then the message is marked as expired. The queue rules then decide what happens to the message once it has been marked as expired.

Messages can also have an expiry interval themselves. You can define this by adding an MQe.Msg_ExpireTime field to the message. The expiry time is either relative (expire 2 days after the message was created), or absolute (expire on November 25th 2000, at 08:00 hours).

In the example below, the message expires 60 seconds after it is created. (60000 milliseconds = 60 seconds).

```
/* create a new message */
MQeMsgObject msgObj = new MQeMsgObject();
msgObj.putAscii( "MsgData", getMsgData() );
/* expiry time of sixty seconds after message was created */
msgObj.putInt( MQe.Msg_ExpireTime, 60000 );
/* put message onto queue */
qmgr.putMessage( null, "MyQueue", msgObj, null, 0 );
```

In the example below, the message expires on 15th May 2001, at 15:25 hours.

```
/* create a new message */
MQeMsgObject msgObj = new MQeMsgObject();
msgObj.putAscii( "MsgData", getMsgData() );
/* create a Date object for 15th May 2001, 15:25 hours */
Calendar calendar = Calendar.getInstance();
calendar.set( 2001, 04, 15, 15, 25 );
Date expiryTime = calendar.getTime();
/* add expiry time to message */
```

Storing messages

```
msgObj.putLong( MQe.Msg_ExpireTime, expiryTime.getTime() );
/* put message onto queue */
qmgr.putMessage( null, "MyQueue", msgObj, null, 0 );
```

Queues

Queue managers manage queues and provide programming interface access to the queues. The queues are not directly visible to an application and all interactions with the queues take place through queue managers. Each queue manager can have queues that it manages and owns. These queues are known as *local* queues. MQSeries Everyplace also allows applications to access messages on queues that belong to another queue manager. These queues are known as *remote* queues. The same sets of operations are available on both local and remote queues, with the exception of defining message listeners (see “Message listeners” on page 64).

The messages on the queues are held in the queue’s persistent store (see “Storing messages” on page 59). A queue accesses its persistent store through a queue store adapter. (See “Chapter 10. MQSeries Everyplace adapters” on page 217). These adapters are interfaces between MQSeries Everyplace and hardware devices, such as disks or networks, or software stores such as a database. Adapters are designed to be pluggable components, allowing the protocols available to talk to the device to be easily changed. The backing store used by a queue can be changed using an MQSeries Everyplace administration message. Changing the backing store is not allowed while the queue is active or contains messages. If the backing store used by the queue allows the messages to be recovered in the event of a system failure, then this allows MQSeries Everyplace to assure the delivery of messages.

Queue names

MQSeries Everyplace queue names can contain the following characters:

- Numerics 0 to 9
- Lower case a to z
- Upper case A to Z
- Underscore _
- Period .
- Percent %

Queue names cannot have a leading or trailing ‘.’ character.

There are no inherent name length limitations in MQSeries Everyplace.

For additional naming recommendations when interacting with Websphere MQ networks, see “Naming recommendations for inter-operability with a Websphere MQ network” on page 130.

Queue types

The MQSeries Everyplace queue types are described briefly in “MQSeries Everyplace queues” on page 3, and information on setting up and administering the various types is provided in “Queues” on page 101.

Queue ordering

The order of messages on a queue is primarily determined by their priority. Message priority ranges from 9 (highest) to 0 (lowest). Messages with the same

priority value are ordered by the time at which they arrive on the queue, with messages that have been on the queue for the longest, being at the head of the priority group.

Reading all the messages on a queue

When a queue is empty, the queue throws an `Except_Q_NoMatchingMsg` exception if a `get` message command is issued. This allows you to create an application that reads all the available messages on a queue.

By encasing the `getMessage()` call inside a `try..catch` block, you can test the code of the resulting exception. This is done using the `code()` method of the `MQeException` class. You can compare the result from the `code()` method with a list of exception constants published by the `MQe` class. If the exception is not of type `Except_Q_NoMatchingMsg` throw the exception again.

The following code shows this technique:

```
try
{
    while( true )
    { /* keep getting messages until an exception is thrown */
        MQeMsgObject msg = qmgr.getMessage( "myQMgr", "myQueue", null, null, 0 );
        processMessage( msg );
    }
}
catch ( Exception e )
{
    if ( e.code() != MQe.Except_Q_NoMatchingMsg )
        throw e;
}
```

You can read all messages from a queue therefore by iteratively getting messages until the return code is 121.

Browse and Lock

Browsing a group of messages and locking them allows an application to assure that no other application is able to process the messages while they are locked. The messages remain locked until they are unlocked by the application. No other application can unlock the messages.

```
MQeEnumeration msgEnum = qmgr.browseMessagesAndLock( null, "MyQueue", null,
                                                    null, 0, false );
```

This command locks all the messages on the local queue `MyQueue` (`null` is an alias for the local queue manager). These messages can now only be accessed by the application that locked them. (Any messages arriving on the queue after the **Browse and Lock** operation will not be locked).

The `MQeEnumeration` object contains all the messages that match the filter supplied to the `browse`. `MQeEnumeration` can be used in the same manner as the standard Java `Enumeration`. You can enumerate all the browsed messages as follows:

```
while( msgEnum.hasMoreElements() )
{
    MQeMsgObject msg = (MQeMsgObject)msgEnum.nextElement();
    System.out.println( "Message from queue manager: " +
                       msg.getAscii( MQe.Msg_OriginQMgr ) );
}
```

queues

An application can perform either a **get** or a **delete** operation on the messages to remove them from the queue. To do this, the application must supply the *lock ID* that is returned with the enumeration of messages. Specifying the *lock ID* allows applications to work with locked messages without having to unlock them first. The following code performs a **delete** on all the messages returned in the enumeration. The message's *Unique ID* and *lock ID* are used as the filter on the **delete** operation.

```
while( msgEnum.hasMoreElements() )
{
    MQeMsgObject msg = (MQeMsgObject)msgEnum.getNextMessage( null,0 );

    processMessage( msg );

    MQeFields filter = msg.getMsgUIDFields();
    filter.putLong( MQe.Msg_LockID, msgEnum.getLockId() );

    qmgr.deleteMessage( null, "MyQueue", filter );
}
```

Instead of removing the messages from the queue, it is also possible just to unlock them, this makes them visible once again to all MQSeries Everyplace applications. You can achieve this by using the **unlockMessage()** method.

Note: See “Getting and browsing messages from the Websphere MQ-bridge queue” on page 157 for special considerations with Websphere MQ-bridge queues.

Message listeners

MQSeries Everyplace allows an application to *listen* for events occurring on queues. The notification takes the form of a standard Java event, and the listening application implements an interface that provides methods that are called when an event occurs. The application is able to specify message filters to identify the messages in which it is interested.

```
/* Create a filter for "Order" messages of priority 7 */
MQeFields filter = new MQeFields();
filter.putAscii( "MsgType", "Order" );
filter.putByte( MQe.Msg_Priority, (byte)7 );
/* activate a listener on "MyQueue" */
qmgr.addMessageListener( this, "MyQueue", filter );
```

The following parameters are passed to the **addMessageListener()** method:

- The name of the queue on which to listen for message events
- A *callback* object that implements MQeMessageListenerInterface
- An MQeFields object containing a message filter

When a message arrives on a queue with a listener attached, the queue manager calls the *callback* object that it was given when the message listener was created.

An example of the way in which an application would normally handle message events is given below.

```
public void messageArrived(MQeMessageEvent msgEvent )
{
    String queueName =msgEvent.getQueueName();
    if (queueName.equals("MyQueue"))
    {
        try
        {
            /*get message from queue */

```

```

MQeMsgObject msg =qmgr.getMessage(null,queueName,
msgEvent.getMsgFields(),null,0 );

processMessage(msg );
    }
    catch (MQeException e)
    {
        ...
    }
}
}

```

messageArrived() is a method implemented in MQeMessageListenerInterface. The *msgEvent* parameter contains information about the message, including:

- The name of the queue on which the message arrived
- The *UID* of the message
- The *message ID*
- The *correlation ID*
- *Message priority*

Message filters only work on local queues. A separate technique known as polling allows messages to be obtained as soon as they arrive on remote queues.

Message polling

Message polling uses the **waitForMessage()** method. This command issues a **getMessage()** command to the remote queue at regular intervals. As soon as a message that matches the supplied filter becomes available, it is returned to the calling application.

A wait for message call typically looks like this:

```
qmgr.waitForMessage( "RemoteQMGr", "RemoteQueue", filter, null, 0, 60000 );
```

The **waitForMessage()** method polls the remote queue for the length of time specified in its final parameter. The time is specified in milliseconds, so in the example above, the polling lasts for 6 seconds. The thread on which the command is executing is blocked for this length of time, unless a message is returned earlier.

Message polling works on both local and remote queues.

Note: Use of this technique results in multiple requests being sent over the network.

Messaging operations

Table 2 shows the operations that can be performed on messages on the various queue types.

Table 2. Messaging operations

Operation	Local queues	Remote queues	
		Synchronous	Asynchronous
browse(&lock)	yes	yes	
delete	yes	yes	
get	yes	yes	
listen	yes		
put	yes	yes	yes

Table 2. Messaging operations (continued)

Operation	Local queues	Remote queues	
		Synchronous	Asynchronous
wait	yes	yes	

Using queue aliases

Aliases can be assigned for MQSeries Everyplace queues to provide a level of indirection between the application and the real queues. Hence the attributes of a queue that an alias relates to can be changed without the application needing to change. For instance, a queue can be given a number of aliases and messages sent to any of these names will be accepted by the queue.

The following examples illustrate some of the ways that aliasing can be used with queues.

Examples of queue aliasing

Merging applications

Suppose you have the following configuration:

- A client application that puts data to queue Q1
- A server application that takes data from Q1 for processing
- A client application that puts data to queue Q2
- A server application which takes data from Q2 for processing

Some time later the two server applications are merged into one application supporting requests from both the client applications. It may now be appropriate for the two queues to be changed to one queue. For example, you may delete Q2, and add an alias of the Q1 queue, calling it Q2. Messages from the client application that previously used Q2 are automatically sent to Q1.

Upgrading applications

Suppose you have the following configuration:

- A queue Q1
- An application that gets messages from Q1
- An application that puts messages to Q1

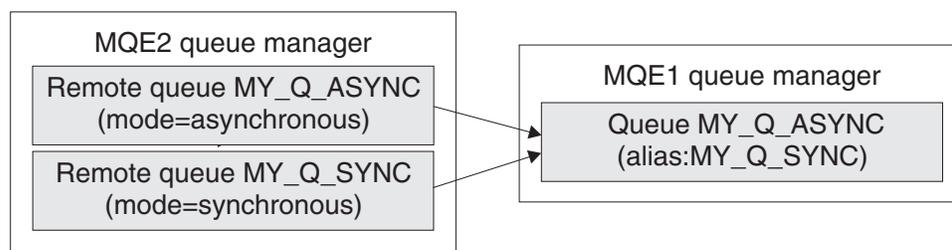
You then develop a new version of the application that gets the messages. You can make the new application work with a queue called Q2. You can define a queue called Q2 and use it to exercise the new application. When you want it to go live, you let the old version clear all traffic off the Q1 queue, and then create an alias of Q2 called Q1. The application that puts to Q1 will still work, but the messages will end up on Q2.

Using different transfer modes to a single queue

Suppose you have a queue MY_Q_ASYNC on queue manager MQE1. Messages are passed to MY_Q_ASYNC by a different queue manager MQE2, using a remote queue definition that is defined as an asynchronous queue. Now suppose your application periodically wants to get messages in a synchronous manner from the MY_Q_ASYNC queue.

The recommended way to achieve this is to add an alias to the MY_Q_ASYNC queue, perhaps called MY_Q_SYNC. Then define a remote queue definition on your MQE2 queue manager, that references the MY_Q_SYNC queue. This

provides you with two remote queue definitions. If you use the MY_Q_ASYNC definition, the messages are transported asynchronously. If you use the MY_Q_SYNC definition, synchronous message transfer is used.



Both remote queues reference the same queue, using different attributes and different names

Figure 9. Two modes of transfer to a single queue

Synchronous and asynchronous messaging

MQSeries Everyplace allows flexibility in the way that applications process their messages. Messages can be transmitted *synchronously* or *asynchronously*.

Synchronous messaging

An application does not need to know how or when its messages are transmitted, however it can take control of this process if it wishes, using synchronous messaging. Synchronous messaging means that the message is transmitted as soon as the **put** message command is issued. This type of messaging can only take place when both local and target queue managers are online simultaneously, and does not work if the queue manager is not connected to the network. Synchronous messaging offers the performance advantages of instant connection and the knowledge that a message has reached its destination.

Asynchronous messaging

Asynchronous messaging allows an application to continue processing messages, whether or not the device is connected to a network. The application puts a message to a remote queue definition, and the message is stored by the queue manager. The message is transmitted later when a connection is established to the remote queue manager. The application does not need to be aware of when the transmission takes place.

The typical example of asynchronous messaging is an application for a field engineer or salesman. The field personnel can send orders or inventories when it is convenient. The messages are stored locally until the device is physically connected to a network. When a connection is made, the messages can be transmitted.

For asynchronous transmission to occur, the queue manager must be *triggered*. The triggering is done either by an application calling the queue manager's **triggerTransmission()** method, or by using the queue manager's transmission rules (see "Transmission Rules" on page 77). The method of message transmission depends on how the remote queue is defined. A queue manager that is sending a message to a remote queue holds a definition of that queue. This definition is known as a *remote queue definition*. When a message is put to a remote queue, the

sync and async messaging

local queue manager determines how to transmit the message using the remote queue definition.

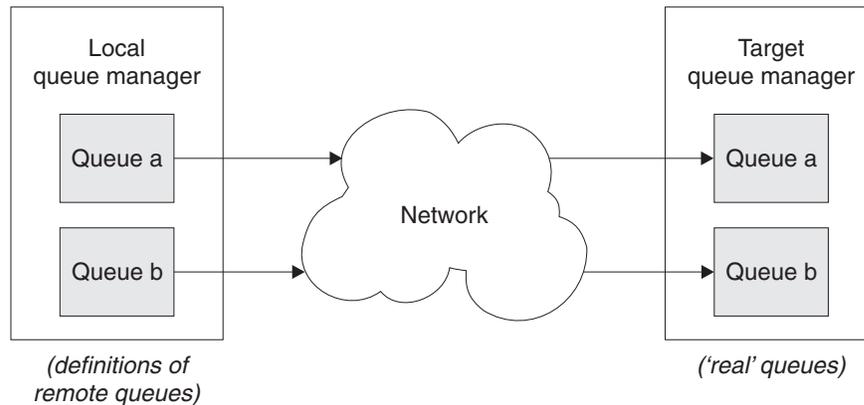


Figure 10. MQSeries Everyplace message flow

Messages are transmitted from the local queue manager to the remote queue manager using the authenticator, cryptor, and compressor that are defined on the remote queue. Before it can create a message channel between the two queue managers, the local queue manager needs to know the remote queue attributes. The local queue manager keeps this information as part of its remote queue definition.

The two transmission styles handle this differently.

If an application puts a message to a remote queue and a definition of the remote queue is held locally then the remote queue definition is used to determine characteristics of the queue. If a definition is not held locally, *queue discovery* occurs. This local queue manager synchronously contacts the remote queue manager in an attempt to ascertain characteristics of the queue. The following characteristics are discovered:

- Queue_Description
- Queue_Expiry
- Queue_MaxQSize
- Queue_MaxMsgSize
- Queue_Priority
- Queue_Cryptor
- Queue_Authenticator
- Queue_Compressor
- Queue_TargetRegistry
- Queue_AttrRule

After successful discovery of a queue, the definition of the queue is stored as a remote queue definition on the queue manager that initiated the discovery. This discovered queue definition is treated like a normal remote queue definition. The *Queue_Mode* is not discovered as all discovered queues are set for synchronous operation.

Asynchronous transmission is not able to request information from the target queue manager. Therefore, a remote queue definition must exist before asynchronous transmission can occur. Remote queue definitions can be created

using MQSeries Everyplace administration messages (see “Chapter 6. Administering messaging resources” on page 85).

The combination of synchronous and asynchronous messaging allows MQSeries Everyplace to cope with unreliable communications links. If a `putMessage` fails on a synchronous queue, then you have the opportunity to put the message to an asynchronous queue. An example of this is shown below. By defining two queues the application can handle a situation where synchronous transmission is not possible.

```
try
{
    qmgr.putMessage( "RemoteQMGr", "TransactionQueue", msgObj, null, 0 );
}
catch ( Exception e )
/* reset message UID */
msgObj.resetMsgUIDFields();
{ /* if connection cannot be made, put message on asynchronous queue */
    if ( e.getMessage().equals( "Connection Refused" )
        qmgr.putMessage( "RemoteQMGr", "AsynchTransactionQueue",
                        msgObj, null, 0 );
    }
}
```

Assured message delivery

Asynchronous transmission introduces the concept of *assured message delivery*. When delivering messages asynchronously, MQSeries Everyplace guarantees to deliver that message once, and once-only, to its destination queue. However, this assurance is only valid if the definition of the remote queue and remote queue manager match the current characteristics of the remote queue and remote queue manager. If a remote queue definition and the remote queue do not match, then it is possible that a message may become undeliverable. In this case the message is not lost, but remains stored on the local queue manager.

Synchronous assured message delivery

Put message

You can perform assured message delivery using synchronous message transmission, but the application must take responsibility for error handling.

Non-assured delivery of a message takes place in a single network flow. The queue manager sending the message creates or reuses a channel to the destination queue manager.

The message to be sent is dumped to create a byte-stream, and this byte stream is given to the channel for transmission. Once program control has returned from the channel the sender queue manager knows that the message has been successfully given to the target queue manager, that the target has logged the message on a queue, and that the message has been made visible to MQSeries Everyplace applications.

However, a problem can occur if the sender receives an exception over the channel from the target. The sender has no way of knowing if the exception occurred before or after the message was logged and made visible. If the exception occurred before the message was made visible it is safe for the sender to send the message again. However, if the exception occurred after the message was made visible, there is a danger of introducing duplicate messages into the system since an MQSeries Everyplace application could have processed the message before it was sent the second time.

assured message delivery

The solution to this problem involves transmitting an additional confirmation flow. If the sender application receives a successful response to this flow, then it knows that the message has been delivered once and once-only.

The *confirmId* parameter of the **putMessage** method dictates whether the confirm flow is sent or not. A value of zero means that message transmission occurs in one flow, while a nonzero value means that a confirm flow is expected. The target queue manager logs the message to the destination queue as usual, but the message is locked and invisible to MQSeries Everyplace applications, until the confirm flow is received.

An MQSeries Everyplace application can issue a **put** message confirmation using the **confirmPutMessage** method. Once the target queue manager receives the flow generated by this command, it unlocks the message, and makes it visible to MQSeries Everyplace applications. You can confirm only one message at a time, it is not possible to confirm a batch of messages.

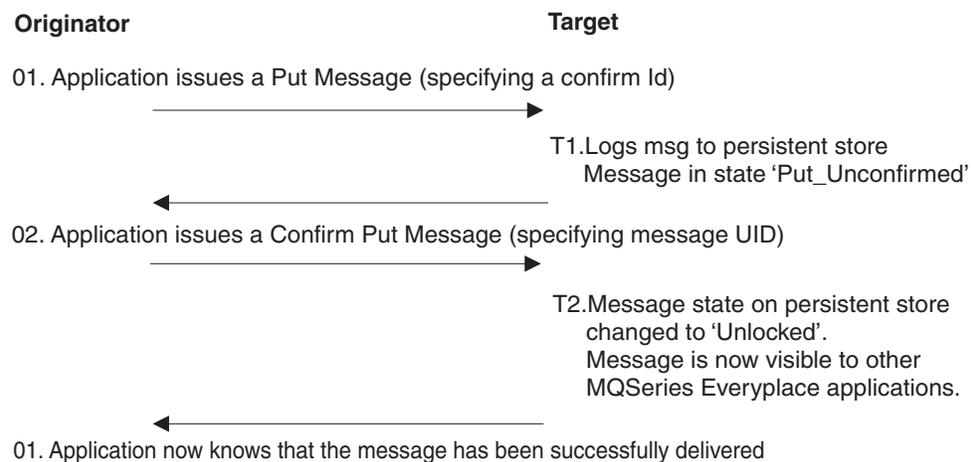


Figure 11. Assured put of synchronous messages

The **confirmPutMessage()** method requires you to specify the *UID* of the message, not the *Confirm ID* used in the prior put message command. (The *Confirm ID* is used to restore messages that remain locked after a transmission failure. This is explained in detail on page 73.)

A skeleton version of the code required for an assured **put** is shown below:

```
long confirmId = MQe.uniqueValue();

try
{
    qmgr.putMessage( "RemoteQMGr", "RemoteQueue", msg, null, confirmId );
}
catch( Exception e )
{
    /* handle any exceptions */
}

try
{
    qmgr.confirmPutMessage( "RemoteQMGr", "RemoteQueue",
        msg.getMsgUIDFields() );
}
```

```

catch ( Exception e )
{
    /* handle any exceptions */
}

```

If a failure occurs during step 1 in Figure 11 on page 70 the application should retransmit the message. There is no danger of introducing duplicate messages into the MQSeries Everyplace network since the message at the target queue manager is not made visible to applications until the confirm flow has been successfully processed.

If the MQSeries Everyplace application retransmits the message, it should also inform the target queue manager that this is happening. The target queue manager deletes any duplicate copy of the message that it already has. The application sets the MQe.Msg_Resend field to do this.

If a failure occurs during step 2 in Figure 11 on page 70 the application should send the confirm flow again. There is no danger in doing this since the target queue manager ignores any confirm flows it receives for messages that it has already confirmed. This is shown in the following example (taken from examples.application.example6).

```

boolean msgPut      = false; /* put successful? */
boolean msgConfirm = false; /* confirm successful? */
int maxRetry       = 5; /* maximum number of retries */

long confirmId = MQe.uniqueValue();

int retry = 0;
while( !msgPut && retry < maxRetry )
{
    try
    {
        qmgr.putMessage( "RemoteQMgr", "RemoteQueue", msg, null, confirmId );
        msgPut = true; /* message put successful */
    }
    catch( Exception e )
    {
        /* handle any exceptions */
        /* set resend flag for retransmission of message */
        msg.putBoolean( MQe.Msg_Resend, true );
        retry ++;
    }
}

if ( !msgPut ) /* was put message successful? */
    /* Number of retries has exceeded the maximum allowed, so abort the put*/
    /* message attempt */
    return;

retry = 0;
while( !msgConfirm && retry < maxRetry )
{
    try
    {
        qmgr.confirmPutMessage( "RemoteQMgr", "RemoteQueue",
                                msg.getMsgUIDFields() );
        msgConfirm = true; /* message confirm successful */
    }
    catch ( Exception e )
    {
        /* handle any exceptions */
        /* An Except_NotFound exception means that the message has already */
        /* been confirmed */
    }
}

```

assured message delivery

```
    if ( e instanceof MQException &&
        ((MQException)e).code() == Except_NotFound )
        putConfirmed = true;          /* confirm successful          */
    /* another type of exception - need to reconfirm message      */
    retry ++;
}
}
```

Get message

Assured message **get** works in a similar way to **put**. If a **get** message command is issued with a *confirmId* parameter greater than zero, the message is left locked on the queue on which it resides until a confirm flow is processed by the target queue manager. When a confirm flow is received, the message is deleted from the queue.

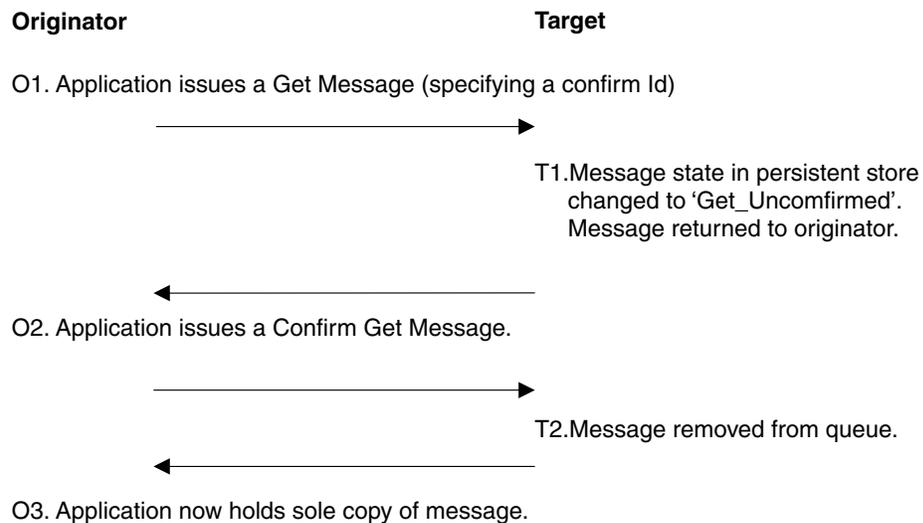


Figure 12. Assured get of synchronous messages

The following code is taken from `examples.application.example6`

```
boolean msgGet      = false; /* get successful? */
boolean msgConfirm = false; /* confirm successful? */
MQeMsgObject msg   = null;
int maxRetry       = 5; /* maximum number of retries */

long confirmId = MQe.uniqueValue();
int retry = 0;
while( !msgGet && retry < maxRetry )
{
    try
    {
        msg = qmgr.getMessage( "RemoteQMGr", "RemoteQueue", filter, null,
                               confirmId );
        msgGet = true; /* get succeeded */
    }
    catch ( Exception e )
    {
        /* handle any exceptions */
        /* if the exception is of type Except_Q_NoMatchingMsg, meaning that */
        /* the message is unavailable then throw the exception */
        if ( e instanceof MQException )
            if ( ((MQException)e).code() == Except_Q_NoMatchingMsg )
                throw e;
        retry ++; /* increment retry count */
    }
}
```

assured message delivery

```
if ( !msgGet ) /* was the get successful? */
    /* Number of retry attempts has exceeded the maximum allowed, so abort */
    /* get message operation */
    return;

while( !msgConfirm && retry < maxRetry )
{
    try
    {
        qmgr.confirmGetMessage( "RemoteQMgr", "RemoteQueue",
                               msg.getMsgUIDFields() );
        msgConfirm = true; /* confirm succeeded */
    }
    catch ( Exception e )
    {
        /* handle any exceptions */
        retry ++; /* increment retry count */
    }
}
```

The value passed as the *confirmId* parameter also has another use. The value is used to identify the message while it is locked and awaiting confirmation. If an error occurs during the **get** operation, it can potentially leave the message locked on the queue. This happens if the message is locked in response to the **get** command, but an error occurs before the application receives the message. If the application reissues the **get** in response to the exception, then it will be unable to obtain the same message because it is locked and invisible to MQSeries Everyplace applications.

However, the application that issued the **get** command can restore the messages using the **undo** method. The application must supply the *confirmId* value that it supplied to the **get** message command. The **undo** command restores messages to the state they were in before the **get** command.

```
boolean msgGet      = false; /* get successful? */
boolean msgConfirm  = false; /* confirm successful? */
MQeMsgObject msg    = null;
int maxRetry        = 5; /* maximum number of retries */

long confirmId = MQe.uniqueValue();
int retry = 0;
while( !msgGet && retry < maxRetry )
{
    try
    {
        msg = qmgr.getMessage( "RemoteQMgr", "RemoteQueue", filter, null,
                               confirmId );
        msgGet = true; /* get succeeded */
    }
    catch ( Exception e )
    {
        /* handle any exceptions */
        /* if the exception is of type Except_Q_NoMatchingMsg, meaning that */
        /* the message is unavailable then throw the exception */
        if ( e instanceof MQeException )
            if ( ((MQeException)e).code() == Except_Q_NoMatchingMsg )
                throw e;
        retry ++; /* increment retry count */
        /* As a precaution, undo the message on the queue. This will remove */
        /* any lock that may have been put on the message prior to the */
        /* exception occurring */
        myQM.undo( qMgrName, queueName, confirmId );
    }
}
```

assured message delivery

```
if ( !msgGet ) /* was the get successful? */
  /* Number of retry attempts has exceeded the maximum allowed, so abort */
  /* get message operation */
  return;

while( !msgConfirm && retry < maxRetry )
{
  try
  {
    qmgr.confirmGetMessage( "RemoteQMGr", "RemoteQueue",
                          msg.getMsgUIDFields() );
    msgConfirm = true; /* confirm succeeded */
  }
  catch ( Exception e )
  {
    /* handle any exceptions */
    retry ++; /* increment retry count */
  }
}
```

The **undo** command also has relevance for the **putMessage** and **browseMessagesAndLock** commands. As with **get** message, the **undo** command restores any messages locked by the **browseMessagesandLock** command to their previous state.

If an application issues an **undo** command after a failed **putMessage** command, then any message locked on the target queue awaiting confirmation is deleted.

The **undo** command works for operations on both local and remote queues.

Security

The queue manager fully supports the security functions supplied with MQSeries Everyplace. Any messages stored in a queue defined with security characteristics are encoded using those characteristics. Any communication channels set up between a queue manager and a secure queue use the security characteristics of the queue, or an existing channel with equal or higher security.

Messages can be individually protected by attaching security characteristics to them directly. The correct characteristics must be presented whenever dealing with a message protected in this manner.

See “Chapter 8. Security” on page 169 for a detailed discussion of MQSeries Everyplace security.

Chapter 5. Rules

MQSeries Everyplace uses the concept of *rules* to govern the behavior of its major components. Rules allow a solution to have some control over the internal workings of MQSeries Everyplace. Rules take the form of Java classes that are loaded by MQSeries Everyplace components when they are initialized.

A component's rules are called at certain points during the component's execution cycle. The component expects a method with a particular signature to be available, so when producing an extension of the base rules, care must be taken to use the correct method signatures.

Default or example rules are provided for all MQSeries Everyplace components, however it is expected that a solution would provide its own rules to customize MQSeries Everyplace behavior to fit the solution requirements.

Queue manager rules

Queue manager Rules are used when:

- The queue manager is activated
- The queue manager is closed
- A queue is added to the queue manager
- A queue is removed from the queue manager
- A put message operation occurs
- A get message operation occurs
- A delete message operation occurs
- An undo message operation occurs
- The queue manager is triggered to transmit any pending messages (Transmission Rules)
- An incoming peer connection is established

Loading and activating queue manager rules

Queue manager rules are loaded, or changed, and activated whenever a queue manager administration message, containing a request to update the queue manager rule class, is received

If a queue manager rule has already been applied to the queue manager, it is asked whether the current rule may be replaced with a different rule. If the answer is yes, the new rule is loaded and activated. (A restart of the queue manager is not required.)

The QueueManagerUpdater command-line tool in the package `examples.administration.commandline` shows how to create such an administration message.

Using queue manager rules

This section describes some examples of the use of the queue manager rules.

queue manager rules

The first example shows a **put message** rule that insists that any message being put to a queue using this queue manager must contain an MQSeries Everyplace *message ID* field.

```
/* Only allow msgs containing an ID field to be placed on the Queue */
public void putMessage( String destQMgr, String destQ, MQeMsgObject msg,
                      MQeAttribute attribute, long confirmId )
{
    if ( !(msg.Contains( MQe.Msg_MsgId )) )
        throw new MQeException( Except_Rule, "Msg must contain an ID" );
}
```

The next example rule is a **get message** rule that insists that a password must be supplied before allowing a get message request to be processed on the queue called OutboundQueue. The password is included as a field in the message filter passed into the **getMessage()** method.

```
/* This rule only allows GETs from 'OutboundQueue', if a password is */
/* supplied as part of the filter */
public void getMessage( String destQMgr, String destQ, MQeFields filter,
                      MQeAttribute attr, long confirmId )
{
    super.getMessage( destQMgr, destQ, filter, attr, confirmId );
    if ( destQMgr.equals( Owner.GetName() ) && destQ.equals( "OutboundQueue" ) )
    {
        if ( !(filter.Contains( "Password" ) ) )
            throw new MQeException( Except_Rule, "Password not supplied" );
        else
        {
            String pwd = filter.getAscii( "Password" );
            if ( !(pwd.equals( "1234" ) ) )
                throw new MQeException( Except_Rule, "Incorrect password" );
        }
    }
}
```

This previous rule is a simple example of protecting a queue. However, for more comprehensive security, you are recommended to use an *authenticator*. An authenticator allows an application to create access control lists, and to manage who is able to get messages from queues.

The next example rule is called when a queue manager administration request tries to remove a queue. The rule is passed an object reference to the queue in question. In the following example, the rule checks the name of the queue that is passed, and if the queue is named PayrollQueue, the request to remove the queue is refused.

```
/* This rule prevents the removal of the Payroll Queue */
public void removeQueue( MQeQueue queue ) throws Exception
{
    if ( queue.getQueueName().equals( "PayrollQueue" ) )
        throw new MQeException( Except_Rule, "Can't delete this queue" );
}
```

A queue manager can define its own peer channel listener. The listener detects incoming connection attempt from other queue managers made through a peer channel. The following rule is called whenever a connection request is detected. The rule is passed the name of the queue manager that is trying to connect.

```
public void peerConnection( String qmgrName )
{
    /* block any connection attempt from 'RogueQMgr' */
    if ( qmgrName.equals( "RogueQMgr" ) )
        throw new MQeException( Except_Rule, "Connection not allowed" );
}
```

Transmission Rules

A message that is put to a remote queue and is defined as synchronous is transmitted immediately. Messages put to remote queues defined as asynchronous are stored within the local queue manager, until the queue manager is triggered into transmitting them. The queue manager can be triggered directly by an application, but the process can also be controlled by the queue manager's transmission rules.

The transmission rules are a subset of the queue manager rules.

There are two methods within the rules class that allow control over message transmission:

triggerTransmission()

Determines whether to allow message transmission at the time when the rule is called

transmit()

Makes a decision to allow transmission for each individual queue. For example, this makes it possible only to transmit the messages from queues deemed to be high priority. The **transmit()** rule is only called if the **triggerTransmission()** rule returns successfully

Trigger Transmission Rule

MQSeries Everywhere calls the **triggerTransmission** rule when a message is put onto a remote asynchronous queue. The queue manager **triggerTransmission** method overrides this rule and causes an attempt to transmit any pending messages

```
/* default transmission rule - always allow transmission */
public boolean triggerTransmission( int noOfMsgs, MQeFields msgFields )
{
    return true;
}
```

The return code from this rule tells the queue manager whether or not to transmit any pending messages. A return code of true means "transmit", while a return code of false means "do not transmit at this time". So, the above rule attempts to transmit all messages immediately. This is the default **triggerTransmission()** rule contained in the base queue manager rules class `com.ibm.mqe.MQeQueueManagerRule`. The rule attempts to transmit a message as soon as it is put onto a queue. This near-synchronous mode of operation is inefficient, since it sends all messages individually. It is usually advantageous to send groups of messages to utilize the network more efficiently.

A more complex rule could decide whether or not to transmit immediately based on the priority of the message. The following example shows a rule that triggers the queue manager if a message arrives that has a priority greater than 5.

```
/* Decide to transmit based on priority of message */
public boolean triggerTransmission( int noOfMsgs, MQeFields msgFields )
{
    if ( msgFields == null ) /* msg fields may be null */
        return false;
    if ( !(msgFields.contains( MQe.Msg_Priority )) )
        return false; /* no priority field in message */
    byte priority = msg.GetByte( MQe.Msg_Priority );
    if ( priority > 5 ) /* if message priority greater than 5 */

```

queue manager rules

```
        return true; /* then transmit */
    else
        return false; /* else do not transmit */
}
```

The *msgFields* parameter contains selected fields from the message. These fields are:

- *Unique ID*
- *Message ID*
- *Correlation ID*
- *Priority*

If the rule decides to allow transmission, then all pending messages are transmitted, not just the message that was put to the asynchronous remote queue.

The *noOfMsgs* parameter contains the number of messages that are awaiting transmission. A solution may decide to implement a rule that blocks transmission until a certain number of messages are pending. Such a rule helps to make more efficient use of the network connection.

The rule below blocks until at least 10 messages are awaiting transmission.

```
public void triggerTransmission( int noOfMsgs, MQeFields msgFields )
{
    if ( noOfMsgs >= 10 ) /* if more than 10 msgs are waiting */
        return true; /* then transmit */
    else
        return false;
}
```

Transmit rule

The **transmit()** rule is only called if the **triggerTransmission()** rule allows transmission, (returns a value of true). The **transmit()** rule is called for every remote queue definition that holds messages awaiting transmission. This means that the rule can decide which messages to transmit from each queue.

The rule below only allows message transmission from a queue if the queue has a default priority greater than 5. (If a message has not been assigned a priority before being placed on a queue, it is given the queue's default priority).

```
public boolean transmit( MQeQueue queue )
{
    if ( queue.getDefaultPriority() > 5 )
        return (true);
    else
        return (false);
}
```

A sensible extension to this rule would be to allow all messages to be transmitted at 'off-peak' time. This would cause only messages from high-priority queues to be transmitted during peak periods. The following examples, show rules that implement similar ideas.

The following example only allows messages to be transmitted if the queue contains more than 10 messages.

```
public boolean transmit( MQeQueue queue )
{
    if ( queue.getNumberOfMessages() >= 10 )
```

```

        return (true);
    else
        return (false);
}

```

The following more complex example assumes that the transmission of the messages takes place over a communications network that charges for the time taken for transmission. It also assumes that there is a *cheap-rate* period when the unit-time cost is lower. The rules block any transmission of messages until the cheap-rate period. During the cheap-rate period, the queue manager is triggered at regular intervals.

```

import com.ibm.mqe.*;
import java.util.*;

/**
 * Example set of queue manager Rules which trigger the transmission
 * of any messages waiting to be sent.
 *
 * These rules only trigger the transmission of messages if the current
 * time is between the values defined in the variables cheapRatePeriodStart
 * and cheapRatePeriodEnd
 *
 * (This example assumes that transmission will take place over a
 * communication network which charges for the time taken to transmit)
 */

public class ExampleQueueManagerRules extends MQQueueManagerRule
    implements Runnable
{
    /* default interval between triggers is 10 minutes */
    public final int triggerInterval = 600000;
    /* cheap rate transmission period start and end times */
    public final int cheapRatePeriodStart = 18; /* 18:00 hrs */
    public final int cheapRatePeriodEnd = 9; /* 09:00 hrs */

    /* background thread reference */
    protected Thread th = null;
}

```

The constants `cheapRatePeriodStart` and `cheapRatePeriodEnd` define the extent of this cheap rate period. In this example, the cheap-rate period is defined as being between 18:00 hours in the evening until 09:00 hours the following morning.

```

/* cheap rate transmission period start and end times */
public final int cheapRatePeriodStart = 18; /* 18:00 hrs */
public final int cheapRatePeriodEnd = 9; /* 09:00 hrs */

```

The constant `triggerInterval` defines the period of time (in milliseconds) between each triggering of the queue manager.

```
public final int triggerInterval = 600000;
```

In this example, the trigger interval is defined to be 600,000 milliseconds, which is equivalent to 600 seconds, or 10 minutes.

The triggering of the queue manager is handled by a background thread that *wakes up* at the end of the `triggerInterval` period. If the current time is inside the cheap rate period, it calls the `MQQueueManager.triggerTransmission()` rule to initiate an attempt to transmit all messages awaiting transmission.

The background thread is created in the `queueManagerActivate()` rule and stopped in the `queueManagerClose()` rule. The queue manager calls these rules when it is activated and closed respectively.

queue manager rules

```
/**
 * Overrides MQeQueueManagerRule.queueManagerActivate()
 * Starts a timer thread
 */
public void queueManagerActivate()
{
    /* background thread which triggers XmitQ */
    th = new Thread( this );
    th.start();          /* start timer thread */
}
/**
 * Overrides MQeQueueManagerRule.queueManagerClose()
 * Stops the timer thread
 */
public void queueManagerClose()
{
    th.stop();          /* stop timer thread */
}
```

The code to handle the background thread looks like this:

```
/**
 * Timer thread
 * Triggers queue manager every interval until thread is stopped
 */
public void run()
{
    try
    {
        while ( true )
        { /* sleep for specified interval */
            Thread.sleep( triggerInterval );
            /* if cheap rate period call queue manager to trigger transmission */
            if ( timeToTransmit() )
                ((MQeQueueManager)owner).triggerTransmission();
        }
    }
    catch ( Exception e )
    {
        e.printStackTrace( System.err );
    }
}
```

The variable `owner` is defined by the class `MQeRule`, which is the ancestor of `MQeQueueManagerRule`. As part of its startup process, the queue manager activates the queue manager rules and passes a reference to itself to the rules object. This reference is stored in the variable `owner`.

The thread loops indefinitely (remember it is stopped by the `queueManagerClose()` rule), and it sleeps until the end of the trigger interval period. At the end of the trigger interval, it calls the `timeToTransmit()` method to check if the current time is in the cheap-rate transmission period. If this method succeeds, the queue manager's `triggerTransmission()` rule is called.

The `timeToTransmit` method is shown in the following code:

```
protected boolean timeToTransmit()
{
    /* get current time */
    long currentTimeLong = System.currentTimeMillis();

    Date date = new Date( currentTimeLong );
    Calendar calendar = Calendar.getInstance();
    calendar.setTime( date );

    /* get hour */
```

```

int hour = calendar.get( Calendar.HOUR_OF_DAY );

if ( hour >= cheapRatePeriodStart || hour < cheapRatePeriodEnd )
    return true; /* cheap rate */
else
    return false; /* not cheap rate */
}

```

Activating asynchronous remote queue definitions

The queue manager can activate its asynchronous remote queue definitions at startup time. Activating the queues means that an attempt is made to transmit any messages they contain. This behavior is configurable with the **activateQueues()** rule.

The basic rule just returns true or false.

```

public boolean activateQueues()
{
    return true; /* always transmit on activate */
}

```

Like other rules, a check can be made to see if the current time is inside the cheap-rate transmission period.

```

public boolean activateQueues()
{
    if ( timeToTransmit() )
        return true;
    else
        return false;
}

```

This rule also determines whether home-server and store-and-forward queues are activated at startup time.

If **activateQueues()** returns false, the remote queue definitions are only activated when a message is put onto them. home-server queues can be activated by calling the queue manager's **triggerTransmission()** rule.

Queue rules

Each queue has its own set of rules. A solution can extend the behavior of these rules. All queue rules should descend from class `com.ibm.mqe.MQeQueueRule`.

Queue rules are called when:

- The queue is activated
- The queue is closed
- A message is placed on the queue (put)
- A message is removed from the queue (get)
- A message is deleted from the queue (delete)
- The queue is browsed
- An undo operation is performed on a message on the queue
- A message listener is added to the queue
- A message listener is removed from the queue
- A message expires
- When the queue's use count changes

queue rules

- When an attempt is made to change a queue's attributes (authenticator, cryptor, compressor)
- An index entry is created for a message

Index entry rule

The queue does not hold all its messages in memory. They are saved into the queue store, and restored to memory when required. The queue maintains an index entry for each message held in its queue store. The index entry contains state information for the message, such as whether it is locked or unlocked. Also, certain fields from the message, known as *index fields* are stored in the index entry. The default index fields are message *Unique ID*, *Message ID*, *Correlation ID*, and message *priority*. These fields are stored because they are present in most messages, and storing them in memory allows for faster message searching.

The **indexEntry()** rule is called whenever an index entry is created. This occurs whenever a new message is put onto the queue, or at queue activation time, when the queue reads any messages left in its queue store from a previous session. The rule allows a solution to alter the index entry when it is created. A use for this would be to add commonly-used fields into the index, to improve message search times.

```
/* if the message contains a customer number field - then add this field */
/* to the message's index entry. */
/* This will enable faster message searching */
public void indexEntry( MQeFields entry,
                      MQeMsgObject msg ) throws Exception
{
    if ( msg.contains( "Cust_No" ) )
        entry.copy( msg, true, "Cust_No" );
}
```

The parameter, *entry* contains a blank index entry for the message. The default index fields are added by the queue, after the **indexEntry** rule returns. In the previous example, if the message contains a field named *Cust_No* this is added to the message's index entry.

In subsequent messaging operations, such as get or browse, the application can use the *Cust_No* field as part of the filter supplied to the operation. Imagine that the application wants to find a message containing a *Cust_No* field with a value of "75", and an *Order_No* field with a value of "115". The queue can check the index entries and load only messages containing a *Cust_No* field with a value of "75" into memory, to see if they contain an *Order_No* field with the correct value. If the *Cust_no* field is not part of the index, every message is loaded into memory to check if it contains fields that match the filter.

Of course, the use of index fields is a compromise. They can be used to speed message search times, but they are held in memory, which may be at a premium on a pervasive device.

Message Expired rule

Both queues and message can have an expiry interval set. If this interval is exceeded the message is flagged as being *expired*. At this point the **messageExpired()** rule is called. This rule determines what happens to the message. Typically the message is either deleted, or placed on a dead-letter queue. However, the rule can decide to do something different. For example it can leave the message intact on the queue so that it remains visible to MQSeries Everyplace applications.

```

/* This rule puts a copy of any expired messages to a Dead Letter Queue */
public boolean messageExpired( MQeFields entry,
                               MQeMsgObject msg ) throws Exception
{
    /* Get the reference to the Queue Manager */
    MQeQueueManager qmgr = MQeQueueManager.getReference(
        ((MQeQueue)owner).getQueueManagerName() );
    /* need to set re-send flag so that put of message to new queue isn't */
    /* rejected */
    msg.putBoolean( MQe.Msg_Resend, true );
    /* if the message contains an expiry interval field - remove it */
    if ( msg.contains( MQe.Msg_ExpireTime )
        msg.delete( MQe.Msg_ExpireTime );
    /* put message onto dead letter queue */
    qmgr.putMessage( null, MQe.DeadLetter_Queue_Name, msg, null, 0 );
    /* return true & the message will be deleted from the queue */
    return (true);
}

```

The previous example sends any expired messages to the queue manager's dead-letter queue, the name of which is defined by the constant, `MQe.DeadLetter_Queue_Name`. It is worth noting that the queue manager rejects a put of a message that has previously been put onto another queue. This protects against a duplicate message being introduced into the MQSeries Everyplace network. So, before moving the message to the dead-letter queue, the rule must set the resend flag. This is done by adding the `MQe.Msg_Resend` field to the message. The message expiry time field must be deleted before moving the message to the dead-letter queue.

Returning a value of true informs the queue that the rule has determined that the message has expired.

Logging an add message listener event

The following example shows how to log an event that occurs on the queue. In the example the event that occurs is the creation of a message listener, but the principal can be used for any other queue event such as a put message, or browse message request.

In the example, the queue has its own log file, but it is equally as valid to have a central log file that is used by all queues. The queue needs to open the log file when it is activated, and close the log file when the queue is closed. The queue rules, **queueActivate** and **queueClose** can be used to do this. The variable *logFile* needs to be a class variable so that both rules can access the log file

```

/* This rule logs the activation of the queue */
public void queueActivate()
{
    try
    {
        logFile = new LogToDiskFile( "\\log.txt );
        log( MQe_Log_Information, Event_Activate, "Queue " +
            ((MQeQueue)owner).getQueueManagerName() + " + " +
            ((MQeQueue)owner).getQueueName() + " active" );
    }
    catch( Exception e )
    {
        e.printStackTrace( System.err );
    }
}
/* This rule logs the closure of the queue */
public void queueClose()
{
    try

```

queue rules

```
{
  log( MQe_Log_Information, Event_Closed, "Queue " +
      ((MQeQueue)owner).getQueueManagerName() + " + " +
      ((MQeQueue)owner).getQueueName() + " closed" );
  /* close log file */
  logFile.close();
}
catch ( Exception e )
{
  e.printStackTrace( System.err );
}
}
```

The **addListener** rule is shown in the following code. It uses the **MQe.log** method to add an **Event_Queue_AddMsgListener** event.

```
/* This rule logs the addition of a message listener */
public void addListener( MQeMessageListenerInterface listener,
                        MQeFields filter ) throws Exception
{
  log( MQe_Log_Information, Event_Queue_AddMsgListener,
      "Added listener on queue " +
      ((MQeQueue)owner).getQueueManagerName() + "+" +
      ((MQeQueue)owner).getQueueName() );
}
}
```

Chapter 6. Administering messaging resources

The administration of MQSeries Everyplace resources such as queue managers and queues is performed using specialized MQSeries Everyplace messages. Using messages allows administration to be performed locally or remotely.

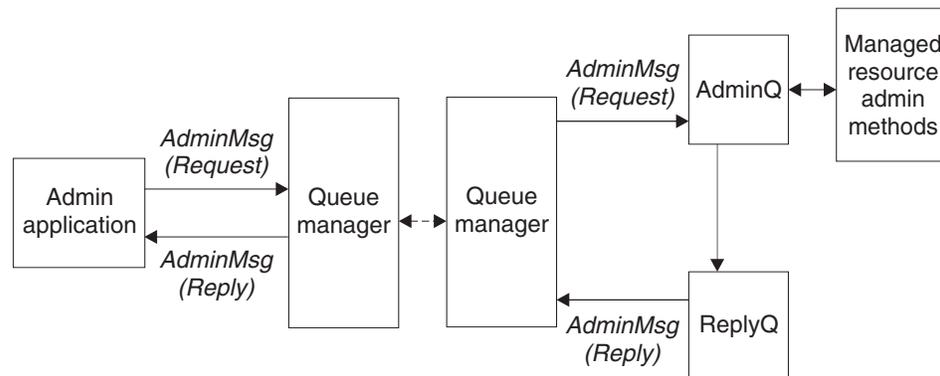


Figure 13. MQSeries Everyplace administration

Before you can administer a queue manager or its resources, you must start the queue manager and configure an administration queue on it. The administration queue's role is to process administration messages in the sequence that they arrive on the queue. Only one request is processed at a time. The queue can be created using the `defineDefaultAdminQueue()` method of the `MQeQueueManagerConfigure` class. The name of the queue is `AdminQ` and applications can refer to it using the constant `MQe.Admin_Queue_Name`.

A typical administration application instantiates a subclass of `MQeAdminMsg`, configures it with the required administration request, and passes it to the `AdminQ` on the target queue manager. If the application wishes to know the outcome of the action, a reply can be requested. When the request has been processed the result of the request is returned in a message to the reply-to queue and queue manager specified in the request message.

The reply can be sent to any queue manager or queue but you can configure a default reply-to that is used solely for administration reply messages. This default queue is created using the `defineDefaultAdminReplyQueue()` method of the `MQeQueueManagerConfigure` class. The name of the queue is `AdminReplyQ` and applications can refer to it using the constant `MQe.Admin_Reply_Queue_Name`.

The administration queue does not understand how to perform administration of individual resources. This knowledge is encapsulated in each resource and its corresponding administration message. The following messages are provided for administration of MQSeries Everyplace resources:

administration

Table 3. Administration messages

Message name	purpose
MQeAdminMsg	an abstract class that acts as the base class for all administration messages
MQeAdminQueueAdminMsg	provides support for administering the administration queue
MQeConnectionAdminMsg	provides support for administering connections between queue managers
MQeHomeServerQueueAdminMsg	provides support for administering home-server queues
MQeQueueAdminMsg	provides support for administering local queues
MQeQueueMangerAdminMsg	provides support for administering queue managers
MQeRemoteQueueAdminMsg	provides support for administering remote queues
MQeStoreAndForwardQueueAdminMsg	provides support for administering store-and-forward queues

These base administration messages are provided in the `com.ibm.mqe.administration` package. Other types or resource can be managed by subclassing either `MQeAdminMsg` or one of the existing administration messages. For instance, an additional administration messages for managing the Websphere MQ-bridge, are provided in the `com.ibm.mqe.mqbridge` package.

The basic administration request message

Every request to administer an MQSeries Everyplace resource takes the same basic form. Figure 14 on page 87 shows the basic structure for all administration request messages:

A request is made up of:

1. Base administration fields, that are common to all administration requests
2. Administration fields, that are specific to the resource being managed
3. Optional fields to assist with the processing of administration messages

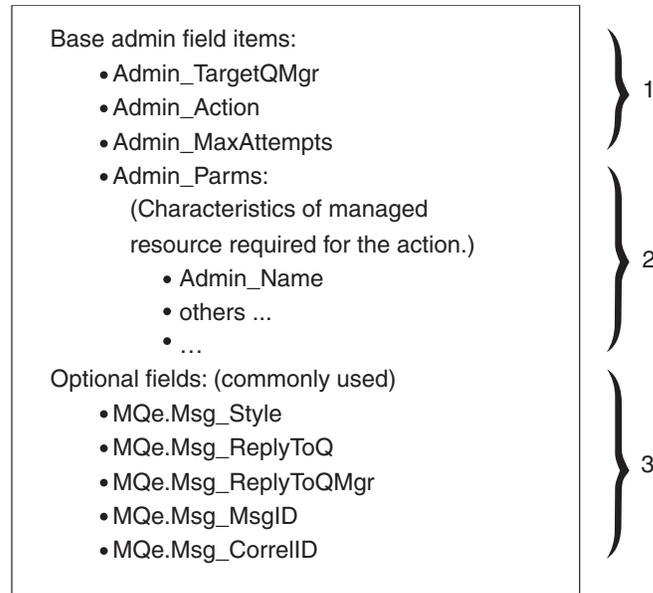


Figure 14. Administration request message

Base administration fields

The base administration fields, that are common to all administration messages, are:

Admin_Target_QMgr

This field provides the name of the queue manager on which the requested action is to take place (target queue manager). The target queue manager can be either a local or a remote queue manager. As only one queue manager can be active at a time in a Java Virtual Machine, the target queue manager, and the one to which the message is put, are the same.

Admin_Action

This field contains the administration action that is to be performed. Each managed resource provides a set of administrative actions that it can perform. A single administration message can only request that one action be performed. the following common actions are defined:

Table 4. Administration actions

Administration action	Purpose
Action_Create	Create a new instance of a managed resource.
Action_Delete	Delete an existing managed resource
Action_Inquire	Inquire on one or more characteristics of a managed resource
Action_InquireAll	Inquire on all characteristics of a managed resource
Action_Update	Update one or more characteristics of a managed resource

All resources do not necessarily implement these actions. For instance, it is not possible to create a queue manager using an administration message.

administration request message

Specific administration messages can extend the base set to provide additional actions that are specific to a resource.

Each common action provides a method that sets the *Admin_Action* field:

Table 5. Setting the administration action field

Administration action	Setting method
Action_Create	create (MQeFields parms)
Action_Delete	delete(MQeFields parms)
Action_Inquire	inquire(MQeFields parms)
Action_InquireAll	inquireAll(MQeFields parms)
Action_Update	update(MQeFields parms)

Admin_MaxAttempts

This field determines how many times an action can be retried if the initial action fails. The retry occurs either the next time that the queue manager restarts or at the next interval set on the administration queue.

Other fields

For most failures further information is available in the reply message. It is the responsibility of the requesting application to read and handle failure information. See “The basic administration reply message” on page 91 for more details on using the reply data.

A set of methods are available for setting some of the request fields:

Table 6. Setting administration request fields

Administration action	field type	set and get methods
Admin_Parms	MQeFields	MQeFields getInputFields()
Admin_Action	int	setAction (int action)
Admin_TargetQMgr	ascii	setTargetQMgr(String qmgr)
Admin_MaxAttempts	int	setMaxAttempts(int attempts)

Fields specific to the managed resource

Admin_Parms

This field contains the resource characteristics that are required for the action.

Every resource has a set of unique characteristics. Each characteristic has a name, type and value, and the name of each is defined by a constant in the administration message. The name of the resource is a characteristic that is common to all managed resources. The name of the resource is held in the *Admin_Name*, and it has a type of ascii.

The full set of characteristics of a resource can be determined by using the **characteristics()** method against an instance of an administration message. This method returns an MQeFields object that contains one field for each characteristic. MQeFields methods can be used for enumerating over the set of characteristics to obtain the name, type and default value of each characteristic.

administration request message

The action requested determines the set of characteristics that can be passed to the action. In all cases, at least the name of the resource, *Admin_Name*, must be passed. In the case of **Action_InquireAll** this is the only parameter that is required.

The following code could be used to set the name of the resource to be managed in an administration message:

```
SetResourceName( MQeAdminMsg msg, String name )
{
    MQeFields parms;
    if ( msg.contains( Admin_Parms ) )
        parms = msg.getFields( Admin_Parms );
    else
        parms = new MQeFields();

    parms.putAscii( Admin_Name, name );
    msg.putFields( Admin_Parms, name );
}
```

Alternatively, the code can be simplified by using the **getInputFields()** method to return the *Admin_Parms* field from the message, or **setName()** to set the *Admin_Name* field into the message. This is shown in the following code:

```
SetResourceName( MQeAdminMsg msg, String name )
{
    msg.SetName( name );
}
```

Other useful fields

By default, no reply is generated, when an administration request is processed. If a reply is required, then the request message must be setup to ask for a reply message. The following fields are defined in the MQe class and are used to request a reply.

Msg_Style

A field of type int that can take one of three values:

Msg_Style_Datagram

A command not requiring a reply

Msg_Style_Request

A request that would like a reply

Msg_Style_Reply

A reply to a request

If *Msg_Style* is set to *Msg_Style_Request* (a reply is required) then the location that the reply is to be sent to must be set into the request message. The two fields used to set the location are:

Msg_ReplyToQ

An ascii field used to hold the name of the queue for the reply

Msg_ReplyToQMgr

An ascii field used to hold the name of the queue manager for the reply

If the reply-to queue manager is not the queue manager that processes the request then the queue manager that processes the request must have a connection defined to the reply-to queue manager.

administration request message

For an administration request message to be correlated to its reply message the request message needs to contain fields that uniquely identify the request, and that can then be copied into the reply message. MQSeries Everyplace provides two fields that can be used for this purpose:

Msg_MsgID

A byte array containing the message ID

Msg_CorrelID

A byte array containing the Correl ID of the message

Any other fields can be used but these two have the added benefit that they are used by the queue manager to optimize searching of queues and message retrieval. The following code fragment provides an example of how to prime a request message:

```
public class LocalQueueAdmin extends MQe
{
    public String    targetQMgr = "ExampleQM";    // target queue manager

    public MQeFields primeAdminMsg(MQeAdminMsg msg) throws Exception
    {
        /*
         * Set the target queue manager that will process this message
         */
        msg.setTargetQMgr( targetQMgr );

        /*
         * Ask for a reply message to be sent to the queue
         * manager that processes the admin request
         */
        msg.putInt (MQe.Msg_Style,      MQe.Msg_Style_Request);
        msg.putAscii(MQe.Msg_ReplyToQ,  MQe.Admin_Reply_Queue_Name);
        msg.putAscii(MQe.Msg_ReplyToQMgr, targetQMgr);

        /*
         * Setup the correl id so we can match the reply to the request.
         * - Use a value that is unique to the this queue manager.
         */
        byte[] correlID = Long.toHexString( (MQe.uniqueValue()).getBytes() );
        msg.putArrayOfByte( MQe.Msg_CorrelID, correlID );

        /*
         * Ensure matching response message is retrieved
         * - set up a fields object that can be used as a match parameter
         * when searching and retrieving messages.
         */
        MQeFields msgTest = new MQeFields();
        msgTest.putArrayOfByte( MQe.Msg_CorrelID, correlID );

        /*
         * Return the unique filter for this message
         */
        return msgTest;
    }
}
```

When the administration request message has been created, it is sent to the target queue manager using standard MQSeries Everyplace message processing APIs. Depending on how the destination administration queue is defined, delivery of the message can be either synchronous or asynchronous.

Standard MQSeries Everyplace message processing APIs are also used to wait for a reply, or notification of a reply. There is a time lag between sending the request and receiving the reply message. The time lag may be small if the request is being

administration request message

processed locally or may be long if both the request and reply messages are delivered asynchronously. The following code fragment could be used to send a request message and wait for a reply:

```
public class LocalQueueAdmin extends MQe
{
    public String    targetQMgr = "ExampleQM"; // target queue manager
    public int      waitFor    = 10000;      // millsecs to wait for reply

    /*
     * Send a completed admin message.
     * Uses the simple putMessage method which is not assured if the
     * the queue is defined for synchronous operation.
     */
    public void sendRequest( MQeAdminMsg msg ) throws Exception
    {
        myQM.putMessage( targetQMgr,
                        MQe.Admin_Queue_Name,
                        msg,
                        null,
                        0 );
    }

    /*
     * Wait a while for a reply message. This method will wait for
     * a limited time on either a local or a remote reply to queue.
     * Parameters:
     *   msgTest: a filter for the reply message to wait for
     * Returns:
     *   respMsg: a reply message matching the msgTest filter.
     */
    public MQeAdminMsg waitForReply( MQeFields msgTest ) throws Exception
    {
        MQeAdminMsg respMsg = null;
        respMsg = (MQeAdminMsg)myQM.waitForMessage(targetQMgr,
                                                  MQe.Admin_Reply_Queue_Name,
                                                  msgTest,
                                                  null,
                                                  0,
                                                  waitFor);

        return respMsg;
    }
}
```

The basic administration reply message

Once an administration request has been processed, a reply, if requested, is sent to the reply-to queue manager queue. The reply message has the same basic format as the request message with some additional fields.

administration reply message

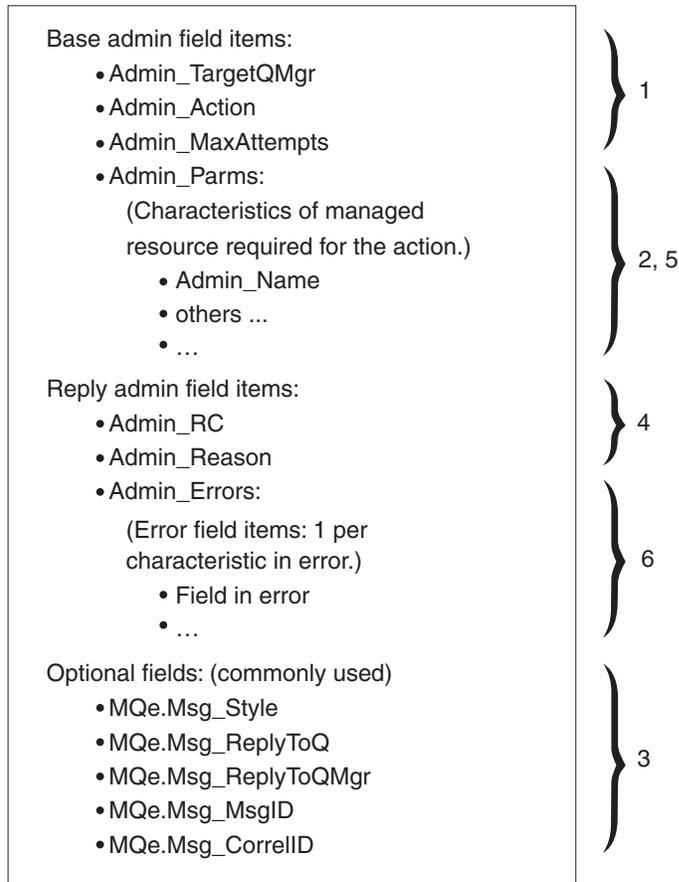


Figure 15. Administration reply message

A reply is made up of:

1. Base administration fields. These are copied from the request message
2. Administration fields that are specific to the resource being managed
3. Optional fields to assist with the processing of administration messages. These are copied from the request message
4. Administration fields detailing outcome of request
5. Administration fields providing detailed results of the request that are specific to the resource being managed
6. Administration fields detailing errors that are specific to the resource being managed

The first three items are describe in “The basic administration request message” on page 86. The reply specific fields are described in the following sections.

Outcome of request fields

Admin_RC field

This byte field contains the overall outcome of the request. This is a field of type `int` that is set to one of:

MQeAdminMsg.RC_Success

The action completed successfully

MQeAdminMsg.RC_Failed

The request failed completely.

MQeAdminMsg.RC_Mixed

The request was partially successful. A mixed return code could result if a request is made to update four attributes of a queue and three succeed and one fails.

Admin_Reason

A unicode field containing the overall reason for the failure in the case of Mixed and Failed.

Admin_Parms

An MQeFields object containing a field for each characteristics of the managed resource

Admin_Errors

An MQeFields object containing one field for each update that failed. Each entry contained in the *Admin_Errors* field is of type `ascii` or `asciiArray`.

The following methods are available for getting some of the reply fields:

Table 7. Getting administration reply fields

Administration field	Field type	get method
Admin_RC	int	int getAction()
Admin_Reason	unicode	String getReason()
Admin_Parms	MQeFields	MQeFields getOutputFields()
Admin_Errors	MQeFields	MQeFields getErrorFields()

Depending on the action performed, the only fields of interest may be the return code and reason. This is the case for **delete**. For other actions such as **inquire**, more details may be required in the reply message. For instance, if an **inquire** request is made for fields *Queue_Description* and *Queue_FileDesc*, the resultant MQeFields object would contain the values for the actual queue in these two fields.

The following table shows the *Admin_Parms* fields of a request message and a reply message for an inquire on several parameters of a queue:

Table 8. Enquiring on queue parameters

Admin_Parms field name	Request message		Reply message	
	Type	Value	Type	Value
Admin_Name	ascii	"TestQ"	ascii	"TestQ"
Queue_QMgrName	ascii	"ExampleQM"	ascii	"ExampleQM"
Queue_Description	Unicode	null	Unicode	"A test queue"
Queue_FileDesc	ascii	null	ascii	"c:\queues\"

For actions where no additional data is expected on the reply, the *Admin_Parms* field in the reply matches that of the request message. This is the case for the **create** and **update** actions.

Some actions, such as **create** and **update**, may request that several characteristic of a managed resource be set or updated. In this case, it is possible for a return code of `RC_Mixed` to be received. Additional details indicating why each update failed

administration reply message

are available from the *Admin_Errors* field. The following table shows an example of the *Admin_Parms* field for a request to update a queue and the resultant *Admin_Errors* field:

Table 9. Request and reply message to update a queue

Field name	Request message		Reply message	
	Type	Value	Type	Value
Admin_Parms field				
Admin_Name	ascii	"TestQ"	ascii	"TestQ"
Queue_QMgrName	ascii	"ExampleQM"	ascii	"ExampleQM"
Queue_Description	Unicode	null	Unicode	"ExampleQM" "A new description"
Queue_FileDesc	ascii	null	Unicode	"D:\queues"
Admin_Errors field				
Queue_FileDesc	n/a	n/a	ascii	"Code=4;com.ibm.mqe.MQeException: wrong field type"

For fields where the update or set is successful there is no entry in the *Admin_Errors* field.

A detailed description of each error is returned in an ascii string. The value of the error string is the exception that occurred when the set or update was attempted. If the exception was an MQeException, the actual exception code is returned along with the *toString* representation of the exception. So, for an MQeException, the format of the value is:

"Code=nnnn;toString representation of the exception"

The following code fragment shows how to check the outcome of an administration request and to send any errors to System.out.

```
/**
 * Check to see if a good reply was received.
 * If not detail the error(s) that occurred
 * @return boolean true if good
 * @param replyMsg reply message to check
 * Throws an Exception if the request failed.
 */
public boolean checkReply( MQeAdminMsg replyMsg ) throws Exception
{
    // Was a reply received ?
    if (replyMsg == null)
    {
        System.out.println("..No response received to the request");
        throw new Exception("No response message received");
    }
    // If the reply was not successful output details for failure
    if ( replyMsg.getRC() != MQeAdminMsg.RC_Success)
    {
        System.out.println("..Action Failed: "+replyMsg.getReason());

        // If mixed then detail each error that occurred
        if ( replyMsg.getRC() == MQeAdminMsg.RC_Mixed)
        {
            MQeFields errors = replyMsg.getErrorFields();
            Enumeration en = errors.fields();
            // process each error
            while( en.hasMoreElements() )
```

```

    {
        String value[];
        String name = (String)en.nextElement();
        // Field in error may be an array
        if ( errors.dataType( name ) == MQeField.TypeArrayElements )
            value = errors.getAsciiArray( name );
        else
            value = new String[] { errors.getAscii( name ) };
        for (int j=0; j<value.length; j++)
            System.out.println("Field in error: "+name+" "+value[j]);
    }
}
// Request failed so throw exception
throw new MQeException(replyMsg.getReason());
}
return true;    // All is OK
}

```

Administration of managed resources

As described in previous sections, MQSeries Everyplace has a set of resources that can be administered with administration messages. These resources are known as *managed resources*. The following sections provide information on how to manage some of these resources. For detailed description of the application programming interface for each resource see the *MQSeries Everyplace for Multiplatforms Programming Reference*.

Queue managers

The complete management life-cycle for most managed resources can be controlled with administration messages. This means that the managed resource can be brought into existence, managed and then deleted with administration messages. This is not the case for queue managers. Before a queue manager can be managed it must be created and started. See “Creating and deleting queue managers” on page 27 for information on creating and starting a queue manager.

The queue manager has very few characteristics itself, but it controls other MQSeries Everyplace resources. When you inquire on a queue manager, you can obtain a list of connections to other queue managers and a list of queues that the queue manager can work with. Each list item is the name of either a connection or a queue. Once you know the name of a resource, you can use the appropriate message to manage the resource. For instance you use an MQeConnectionAdminMessage to manage connections.

Connections

Connections define how to connect one queue manager to another queue manager. Once a connection has been defined, it is possible for a queue manager to put messages to queues on the remote queue manager. The following diagram shows the constituent parts that are required for a remote queue on one queue manager to communicate with a queue on a different queue manager:

administration of connections

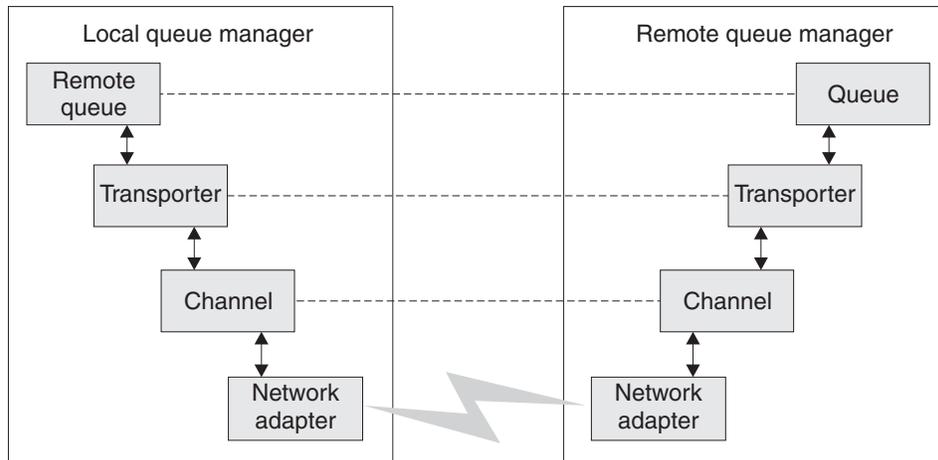


Figure 16. Queue manager connections

Communication happens at different levels:

Transporter:

Logical connection between two queues

Channel:

Logical connection between two systems

Adapter:

Protocol specific communication

The channel and adapter are specified as part of a connection definition. The transporter is specified as part of a remote queue definition. The following example code shows a method that instantiates and primes an MQeConnectionAdminMsg ready to create a connection:

```
/**
 * Setup an admin msg to create a connection definition
 */
public MQeConnectionAdminMsg addConnection( remoteQMGr
    adapter,
        parms,
        options,
        channel,
        desc ) throws Exception
{
    String remoteQMGr = "ServerQM";
    /*
     * Create an empty queue manager admin message and parameters field
     */
    MQeConnectionAdminMsg msg = new MQeConnectionAdminMsg();

    /*
     * Prime message with who to reply to and a unique identifier
     */
    MQeFields msgTest = primeAdminMsg( msg );

    /*
     * Set name of queue manager to add routes to
     */
    msg.setName( remoteQMGr );

    /*
     * Set the admin action to create a new queue
     * The connection is setup to use a default channel. This is an alias

```

```

* which must have be setup on the queue manager for the connection to
* work.
*/
msg.create( adapter,
            parms,
            options,
            channel,
            desc );

return msg;
}

```

MQSeries Everyplace provides a choice of channel and adapter types. Depending on the selection, queue managers can be connected in the following ways:

- Client to server
- Peer to peer

Client to server

In a client to server configuration, one queue manager acts as a client and the other runs in a server environment. A server allows multiple simultaneous incoming connections (channels). To accomplish this the server must have components that can handle multiple incoming requests. See “Server queue managers” on page 38 for a description of how to run a queue manager in a server environment.

Figure 17 shows the typical connection components in a client to server configuration.

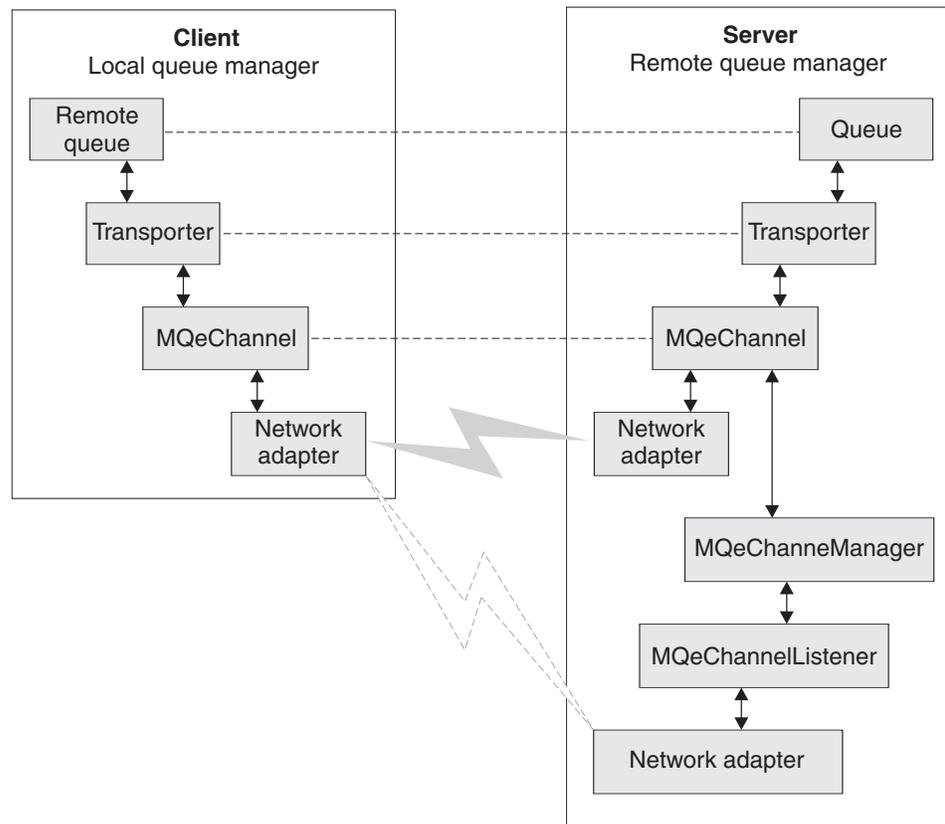


Figure 17. Client to server connections

administration of connections

You use `MQeConnectionAdminMsg` to configure the client portion of a connection. The channel type is `com.ibm.mqe.MQeChannel`. Normally an alias of `DefaultChannel` is configured for `MQeChannel`. The following code fragment shows how to configure a connection on a client to communicate with a server using the http protocol.

```
/**
 * Create a connection admin message that creates a connection
 * definition to a remote queue manager using the HTTP protocol. Then
 * send the message to the client queue manager.
 */
public addClientConnection( MQeQueueManager myQM,
    String targetQMgr ) throws Exception
{
    String remoteQMgr = "ServerQM";
    String adapter    = "Network:127.0.0.1:80";
    // This assumes that an alias called Network has been setup for
    // network adapter com.ibm.mqe.adapters.MQeTcpipHttpAdapter
    String parameters = null;
    String options    = null;
    String channel    = "DefaultChannel";
    String description = "client connection to ServerQM";

    /*
     * Setup the admin msg
     */
    MQeConnectionAdminMsg msg = addConnection( remoteQMgr,
                                                adapter,
                                                parameters,
                                                options,
                                                channel,
                                                desc );

    /*
     * Put the admin message to the admin queue (not using assured flows)
     */
    myQM.putMessage(targetQMgr,
        MQe.Admin_Queue_Name,
        msg,
        null,
        0 );
}
```

Peer to peer

In a peer to peer configuration, a queue manager running as a peer can talk to many other peers simultaneously but can only have one other peer talk to it at any time. One peer is configured as a master or initiator, the other as a slave or receiver.

You configure the master in much the same way as a client connection definition, the only difference being the type of channel to use. The channel type must be set to `com.ibm.mqe.adapters.MQePeerChannel` (or an alias).

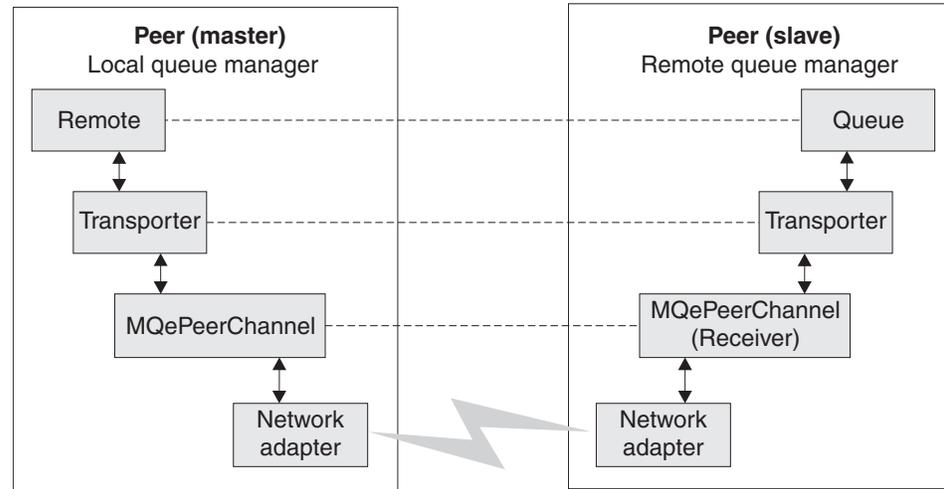


Figure 18. Peer to peer connections

You configure the slave or receiver in a similar way but with the following differences:

- The connection definition must have the same name as the queue manager it is defined on
- The channel type must be `com.ibm.mqe.adapters.MQePeerChannel`
- The adapter must be configured as a listener

The following code fragment configures a queue manager called PeerQM1 as a peer receiver, listening on port 8082 using the HTTP protocol.

```
/**
 * Create a connection admin message which will create a connection
 * definition to a remote queue manager using the HTTP protocol. Then
 * send the message to the client queue manager.
 */
public addClientConnection( MQeQueueManager myQM,
    String targetQMgr ) throws Exception
{
    String remoteQMgr = "PeerQM1";
    // To be a receiver the connection definition called "PeerQM1" must
    // be configured on queue manager "PeerQM1"
    String adapter = "Network::8082";
    // This assumes that an alias called Network has been setup for
    // network adapter com.ibm.mqe.adapters.MQeTcpipHttpAdapter
    String parameters = null;
    String options = null;
    String channel = "com.ibm.mqe.adapters.MQePeerChannel";
    String description = "peer receiver on PeerQM";

    /*
     * Setup the admin msg
     */
    MQeConnectionAdminMsg msg = addConnection( remoteQMgr,
        adapter,
            parameters,
            options,
            channel,
            desc );

    /*
     * Put the admin message to the admin queue (not using assured flows)
     */
    myQM.putMessage(targetQMgr,
```

administration of connections

```
MQe.Admin_Queue_Name,  
msg,  
null,  
0 );  
}
```

The following table shows the connection definition parameters for a receiver on PeerQM1 and for any other peer queue manager that would like to communicate with it.

Table 10. Peer-to-peer connection definitions

	Master (Initiator)	Slave (Receiver)
Queue Manager	Any	"PeerQM1"
Connection name	"PeerQM1"	"PeerQM1"
Channel	com.ibm.mqe.MQePeerChannel	com.ibm.mqe.MQePeerChannel
Adapter	Network:192.168.0.10:8082	Network::8082

Adapters

For details of the adapters supplied with MQSeries Everyplace see the "Chapter 10. MQSeries Everyplace adapters" on page 217 and Chapter 9 in the MQSeries Everyplace for Multiplatforms Programming Reference.

Routing connections

You can set up a connection so that a queue manager routes messages through an intermediate queue manager. This requires two connections:

1. A connection to the intermediate queue manager
2. A connection to the target queue manager

The first connection is created by the methods described earlier in this section, either as a client or as a peer connection. For the second connection, the name of the intermediate queue manager is specified in place of the network adapter name. With this configuration an application can put messages to the target queue manager but route them through one or more intermediate queue managers.

Aliases

You can assign multiple names or aliases to a connection (see "Class Aliases" on page 34). When an application calls methods on the MQeQueueManager class that require a queue manager name be specified, it can also use an alias.

You can alias both local and remote queue managers. To alias a local queue manager, you must first establish a connection definition with the same name as the local queue manager. This is a logical connection that can have all parameters set to null.

To add and remove aliases use the **Action_AddAlias** and **Action_RemoveAlias** actions of the MQeConnectionAdminMsg class. You can add or remove multiple aliases in one message. Put the aliases that you want to manipulated directly into the message by setting the ascii array field *Con_Aliases*. Alternatively you can use the two methods **addAlias()** or **removeAlias()**. Each of these methods takes one alias name but you can call the method repeatedly to add multiple aliases to a message.

The following snippet of code shows how to add connection aliases to a message:

```
/**  
 * Setup an admin msg to add aliases to a queue manager (connection)  
 */
```

administration of connections

```
public MQeConnectionAdminMsg addAliases( String queueManagerName
                                         String aliases[] ) throws Exception
{
    /*
     * Create an empty connection admin message
     */
    MQeConnectionAdminMsg msg = new MQeConnectionAdminMsg();

    /*
     * Prime message with who to reply to and a unique identifier
     */
    MQeFields msgTest = primeAdminMsg( msg );

    /*
     * Set name of the connection to add aliases to
     */
    msg.setName( queueManagerName );

    /*
     * Use the addAlias method to add aliases to the message.
     */
    for ( int i=0; i<aliases.length; i++ )
    {
        msg.addAlias( aliases[i] );
    }

    return msg;
}
```

Queues

The queue types provided by MQSeries Everyplace are described briefly in “MQSeries Everyplace queues” on page 3. The simplest of these is a local queue that is implemented in class MQeQueue and is managed by class MQeQueueAdminMsg. All other types of queue inherit from MQeQueue. For each type of queue there is a corresponding administration message that inherits from MQeQueueAdminMsg. The following sections describe the administration of the various types of queues.

Local queue

You can create, update, delete and inquire on local queues and their descendents using administration actions provided in MQSeries Everyplace. The basic administration mechanism is inherited from MQeAdminMsg.

The name of a queue is formed from the target queue manager name (for a local queue this is the name of the queue manager that owns the queue) and a unique name for the queue on that queue manager. Two fields in the administration message are used to uniquely identify the queue, these are the ascii fields *Admin_Name* and *Queue_QMgrName*. You can use the **setName(queueManagerName, queueName)** method to set these two fields in the administration message.

The diagram below shows an example of a queue manager configured with a local queue. Queue manager qm1 has a local queue named invQ. The queue manager name characteristic of the queue is qm1, which matches the queue manager name.

administration of queues

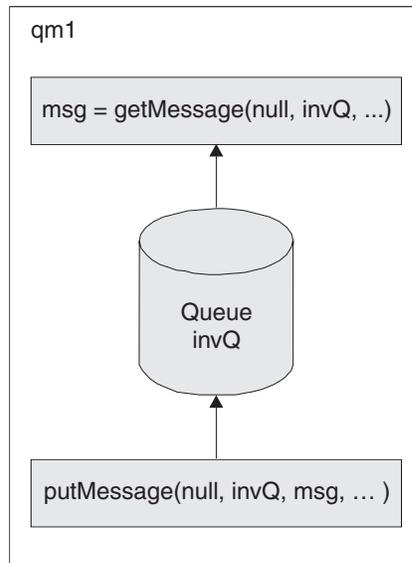


Figure 19. Local queue

Message Store: Local queues require a message store to store their messages. Each queue can specify what type of store to use, and where it is located. Use the queue characteristic *Queue_FileDesc* to specify the type of message store and to provide parameters for it. The field type is *ascii* and the value must be a file descriptor of the form:

```
adapter class:adapter parameters
or
adapter alias:adapter parameters
```

For example:

```
MsgLog:d:\QueueManager\ServerQM12\Queues
```

MQSeries Everyplace Version 1.2.6 provides two adapters, one for writing messages to disk and one for storing them in memory. By creating an appropriate adapter, messages can be stored in any suitable place or medium (such as DB2 data base or writable CDs).

The choice of adapter determines the persistence and resilience of messages. For instance if a memory adapter is used then the messages are only as resilient as the memory. Memory may be a much faster medium than disk but is highly volatile compared to disk. Hence the choice of adapter is an important one.

If you do not provide message store information when creating a queue, it defaults to the message store that was specified when the queue manager was created. See "Chapter 4. Queue managers, messages, and queues" on page 27 for more details.

The following should be taken into consideration when setting the *Queue_FileDesc* field:

- Ensure that the correct syntax is used for the system that the queue resides on. For instance, on a windows system use "\" as a file separator on UNIX® systems use "/" as a file separator. In some cases it may be possible to use either but this is dependent on the support provided by the JVM (Java Virtual Machine) that the queue manager runs in. As well as file separator differences, some systems use drive letters like Windows NT whereas others like UNIX do not.

- On some systems it is possible to specify relative directories (".\") on others it is not. Even on those where relative directories can be specified, they should be used with great caution as the current directory can be changed during the lifetime of the JVM. Such a change causes problems when interacting with queues using relative directories.

Creating a local queue: The following code fragment demonstrates how to create a local queue:

```

/**
 * Create a new local queue
 */
protected void createQueue(MQeQueueManager localQM,
                           String          qMgrName,
                           String          queueName,
                           String          description,
                           String          queueStore
                           ) throws Exception
{
    /*
     * Create an empty queue admin message and parameters field
     */
    MQeQueueAdminMsg msg = new MQeQueueAdminMsg();
    MQeFields parms = new MQeFields();

    /*
     * Prime message with who to reply to and a unique identifier
     */
    MQeFields msgTest = primeAdminMsg( msg );

    /*
     * Set name of queue to manage
     */
    msg.setName( qMgrName, queueName );

    /*
     * Add any characteristics of queue here, otherwise
     * characteristics will be left to default values.
     */
    if ( description != null ) // set the description ?
        parms.putUnicode( MQeQueueAdminMsg.Queue_Description,
                          description);

    if ( queueStore != null ) // Set the queue store ?
        // If queue store includes directory and file info then it
        // must be set to the correct style for the system that the
        // queue will reside on e.g \ or /
        parms.putAscii(MQeQueueAdminMsg.Queue_FileDesc,
                       queueStore );

    /*
     * Other queue characteristics like queue depth, message expiry
     * can be set here ...
     */

    /*
     * Set the admin action to create a new queue
     */
    msg.create( parms );

    /*
     * Put the admin message to the admin queue (not assured delivery)
     */
    localQM.putMessage( qMgrName,
                        MQe.Admin_Queue_Name,
                        msg,

```

administration of queues

```
        null,  
        0);  
    }
```

Queue security: Access and security are owned by the queue and may be granted for use by a remote queue manager (when connected to a network), allowing these other queue managers to send or receive messages to the queue. The following characteristics are used in setting up queue security:

- *Queue_Cryptor*
- *Queue_Authenticator*
- *Queue_Compressor*
- *Queue_TargetRegistry*
- *Queue_AttrRule*

For more detailed information on setting up queue based security see “Chapter 8. Security” on page 169.

Other queue characteristics: You can configure queues with many other characteristics such as the maximum number of messages that are permitted on the queue. For a description of these, see the *MQeQueueAdminMsg* section of the *MQSeries Everyplace for Multiplatforms Programming Reference*.

Aliases: Queue names can have aliases similar to those described for connections in “Aliases” on page 100. The code fragment in the connections section alias example shows how to setup aliases on a connection, setting up aliases on a queue is the same except that an *MQeQueueAdminMsg* is used instead of an *MQeConnectionAdminMsg*.

Action restrictions: Certain administrative actions can only be performed when the queue is in a predefined state, as follows:

Action_Update

- If the queue is in use, characteristics of the queue cannot be changed
- The security characteristics of the queue cannot be changed if there are messages on the queue
- The queue message store cannot be changed once it has been set

Action_Delete

The queue cannot be deleted if the queue is in use or if there are messages on the queue

If the request requires that the queue is not in use, or that it has zero messages, the administration request can be retried, either when the queue manager restarts or at regular time intervals. See “The basic administration request message” on page 86 for details on setting up an administration request retry.

Remote queue

Remote queues are implemented by the *MQeRemoteQueue* class and are managed with the *MQeRemoteQueueAdminMsg* class which is a subclass of *MQeAdminMsg*.

The name of a queue is formed from the target queue manager name (for a remote queue this is the name of the queue manager where the queue is local) and the real name of the queue on that queue manager. Two fields in the administration message are used to uniquely identify the queue, these are the ascii fields *Admin_Name* and *Queue_QMgrName*. You can use the `setName(queueManagerName,`

`queueName`) method to set these two fields in the administration message. For a remote queue definition, the queue manager name of the queue never matches the name of the queue manager where the definition resides.

The remote definition of the queue should, in most cases, match that of the real queue. If this is not the case different results may be seen when interacting with the queue. For instance:

- For asynchronous queues if *max message size* on the remote definition is greater than that on the real queue, the message is accepted for storage on the remote queue but may be rejected when moved to the real queue. The message is not lost, it remains on the remote queue but cannot be delivered.
- If the security characteristics for a synchronous queue do not match, MQSeries Everyplace negotiates with the real queue to decide what security characteristics should be used. In some cases the message put is successful, in others an attribute mismatch exception is returned.

Setting the operation mode: To set a queue for synchronous operation, set the *Queue_Mode* field to *Queue_Synchronous*.

Asynchronous queues require a message store to temporarily store messages. Definition of this message store is the same as for local queues (see “Message Store” on page 102).

To set a queue for asynchronous operation, set the *Queue_Mode* field to *Queue_Asynchronous*.

Figure 20 on page 106 shows an example of a remote queue set up for synchronous operation and a remote queue setup for asynchronous operation.

administration of queues

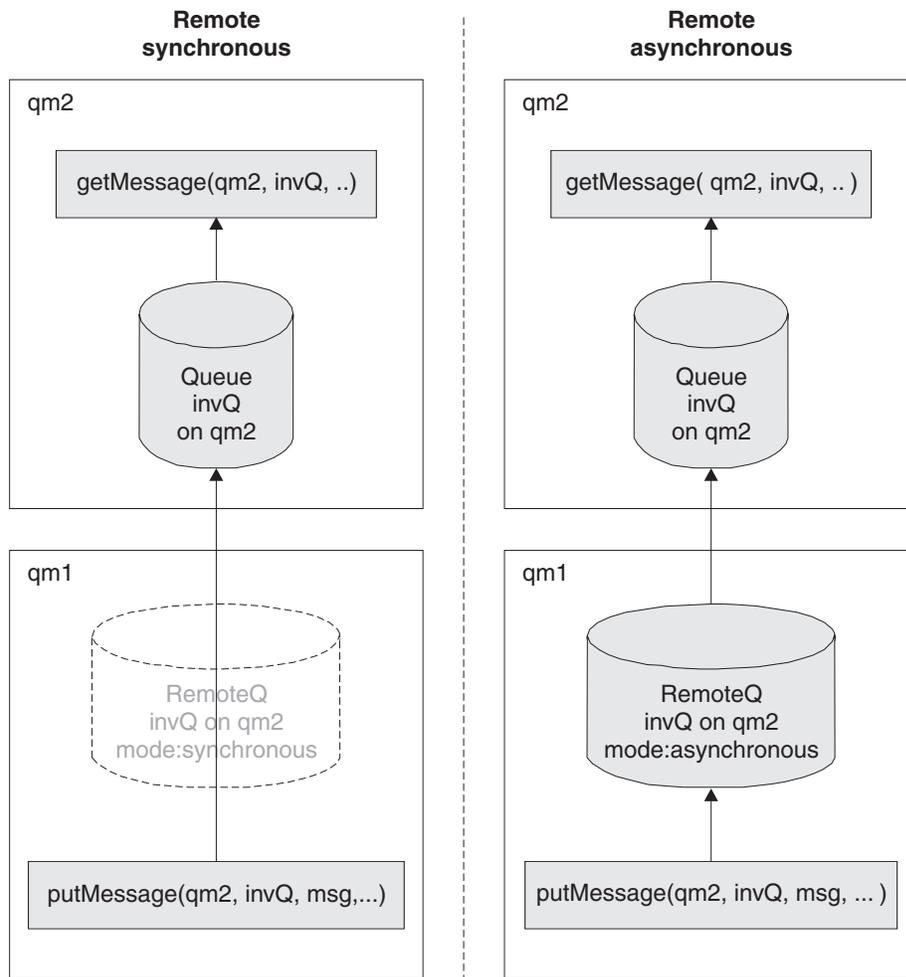


Figure 20. Remote queue

- In both the synchronous and asynchronous examples queue manager qm2 has a local queue invQ
- In the synchronous example, queue manager qm1 has a remote queue definition of queue invQ. invQ resides on queue manager qm2. The mode of operation is set to synchronous.

An application using queue manager qm1 and putting messages to queue qm2.invQ establishes a network connection to queue manager qm2 (if it does not already exist) and the message is immediately put on the real queue. If the network connection cannot be established then the application receives an exception that it must handle.

- In the asynchronous example, queue manager qm1 has a remote queue definition of queue invQ. invQ resides on queue manager qm2. The mode of operation is set to asynchronous.

An application using queue manager qm1 and putting messages to queue qm2.invQ stores messages temporarily on the remote queue on qm1. When the transmission rules allow, the message is moved to the real queue on queue manager qm2. The message remains on the remote queue until the transmission is successful.

Creating a remote queue: The following code fragment shows how to setup an administration message to create a remote queue.

```

/**
 * Create a remote queue
 */
protected void createQueue(MQeQueueManager localQM,
                           String          targetQMgr,
                           String          qMgrName,
                           String          queueName,
                           String          description,
                           String          queueStore,
                           byte            queueMode
) throws Exception
{
    /*
     * Create an empty queue admin message and parameters field
     */
    MQeRemoteQueueAdminMsg msg = new MQeRemoteQueueAdminMsg();
    MQeFields parms = new MQeFields();

    /*
     * Prime message with who to reply to and a unique identifier
     */
    MQeFields msgTest = primeAdminMsg( msg );

    /*
     * Set name of queue to manage
     */
    msg.setName( qMgrName, queueName );

    /*
     * Add any characteristics of queue here, otherwise
     * characteristics will be left to default values.
     /
    if ( description != null ) // set the description ?
        parms.putUnicode( MQeQueueAdminMsg.Queue_Description,
                          description);

    // set the queue access mode if mode is valid
    if ( queueStore != MQeQueueAdminMsg.Queue_Asynchronous &&
        queueStore != MQeQueueAdminMsg.Queue_Synchronous )
        throw new Exception ("Invalid queue store");

    parms.putByte( MQeQueueAdminMsg.Queue_Mode,
                   queueMode);

    if ( queueStore != null ) // Set the queue store ?
        // If queue store includes directory and file info then it
        // must be set to the correct style for the system that the
        // queue will reside on e.g \ or /
        parms.putAscii( MQeQueueAdminMsg.Queue_FileDesc,
                       queueStore );

    /*
     * Other queue characteristics like queue depth, message expiry
     * can be set here ...
     */

    /*
     * Set the admin action to create a new queue
     */
    msg.create( parms );

    /*
     * Put the admin message to the admin queue (not assured delivery)
     * on the target queue manager
     */
    localQM.putMessage( targetQMgr,
                        MQe.Admin_Queue_Name,

```

administration of queues

```
        msg,  
        null,  
        0);  
    }
```

For synchronous operation, the queue characteristics for inclusion in the remote queue definition can be obtained using *queue discovery* which is explained on page 68.

Store-and-forward queue

This type of queue is normally defined on a server and can be configured in the following ways:

- Forward messages either to the target queue manager, or to another queue manager between the sending and the target queue managers. In this case the store-and-forward queue pushes messages either to the next hop or to the target queue manager
- Hold messages until the target queue manager can collect the messages from the store-and-forward queue. This can be accomplished using a *home-server* queue (see “Home-server queue” on page 111). Using this approach messages are *pulled* from the store-and-forward queue.

Store-and-forward queues are implemented by the `MQeStoreAndForwardQueue` class. They are managed with the `MQeStoreAndForwardQueueAdminMsg` class, which is a subclass of `MQeRemoteQueueAdminMsg`. The main addition in the subclass is the ability to add and remove the names of queue managers for which the store-and-forward queue can hold messages. You can add and delete queue manager names with the **Action_AddQueueManager** and **Action_RemoveQueueManager** actions. You can add or remove multiple queue manager names with one administration message. You can put the names directly into the message by setting the ascii array field `Queue_QMgrNameList`. Alternatively you can use the **addQueueManager()** and **removeQueueManager()** methods. Each of these methods takes one queue manager name but you can call the method repeatedly to add multiple queue managers to a message.

The following code fragment shows how to add target queue manager names to a message:

```
/**  
 * Setup an admin msg to add target queue managers to  
 * a store and forward queue.  
 */  
public MQeStoreAndForwardQueueAdminMsg addQueueManager( String queueName  
                                                         String queueManagerName  
                                                         String qMgrNames[] )  
                                                         throws Exception  
{  
    /*  
     * Create an empty admin message  
     */  
    MQeStoreAndForwardQueueAdminMsg msg =  
        new MQeStoreAndForwardQueueAdminMsg();  
  
    /*  
     * Prime message with who to reply to and a unique identifier  
     */  
    MQeFields msgTest = primeAdminMsg( msg );  
  
    /*  
     * Set name of the store and forward queue  
     */  
    msg.setName( queueManagerName, queueName );  
}
```

```

/*
 * Use the addAlias method to add aliases to the message.
 */
for ( int i=0; i<qMgrNames.length; i++ )
{
    msg.addQueueManager(qMgrNames[i] );
}

return msg;
}

```

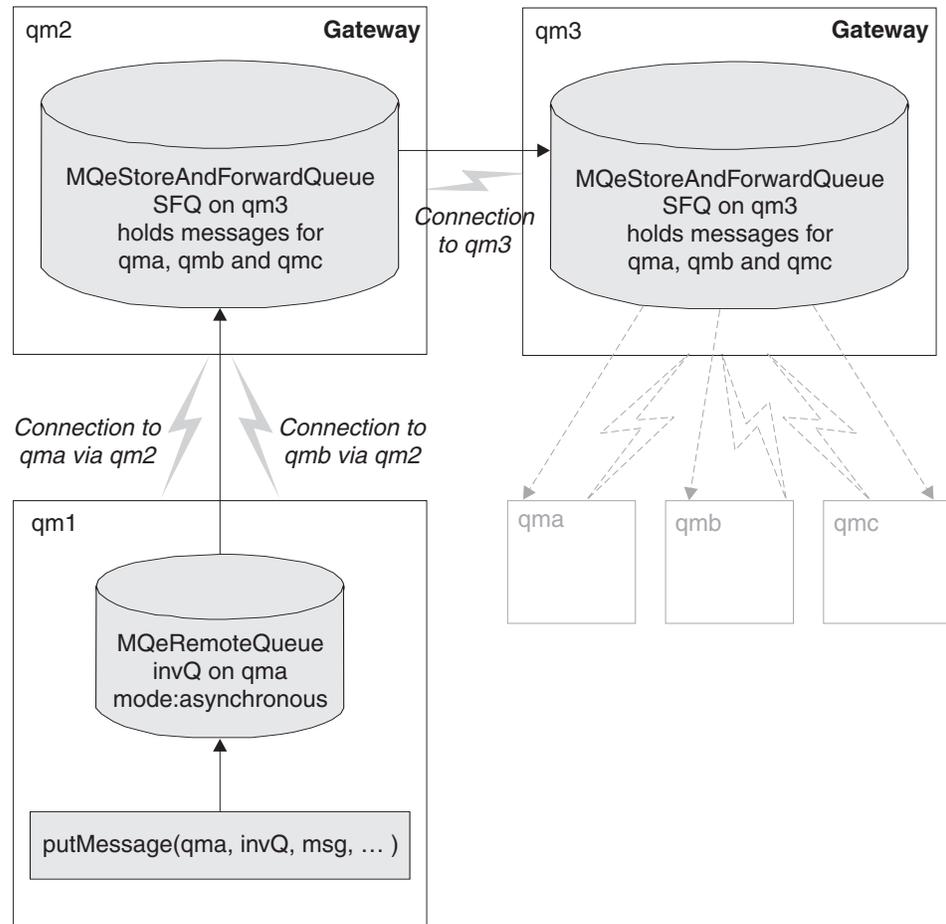


Figure 21. Store-and-forward queue

Each store-and-forward queue has to be configured to handle messages for any queue managers for which it can hold messages. Use the **Action_AddQueueManager** action, described earlier in this section, to add the queue manager information to each queue.

If you want the store-and-forward queue to push messages to the next queue manager, the queue manager name attribute of the store-and-forward queue must be the name of the next queue manager. A connection with the same name as the next queue manager must also be configured. The store-and-forward queue uses this connection as the transport mechanism for pushing messages to the next hop.

administration of queues

If you want the store-and-forward queue to wait for messages to be collected (pulled), the queue manager name attribute of the store-and-forward queue has no meaning (but it must still be configured). The only restriction on the queue manager attribute of the queue name is that there must not be a connection with the same name. If there is such a connection, the queue tries use the connection to forward messages.

Figure 21 on page 109 shows an example of two store and forward queues on different queue managers, one setup to push messages to the next queue manager, the other setup to wait for messages to be collected:

- Queue manager qm2 has a connection configured to queue manager qm3
- Queue manager qm2 has a store-and-forward queue configuration that pushes messages using connection qm3, to queue manager qm3. Note that the queue manager name portion of the store-and-forward queue is qm3 which matches the connection name. Store-and-forward queue qm3.SFQ on qm2 temporarily holds messages on behalf of qma, qmb and qmc, (but not qm3).
- Queue manager qm3 has a store-and-forward queue qm3.SFQ. The queue manager name portion of the queue name qm3 does not have a corresponding connection called qm3, so all messages are stored on the queue until they are collected.
- Store-and-forward queue qm3.SFQ on qm3 holds messages on behalf of queue managers qma, qmb and qmc. Messages are stored until they are collected or they expire.

If a queue manager wants to send a message to another queue manager using a store-and-forward queue on an intermediate queue manager, the initiating queue manager must have:

- A connection configured to the intermediate queue manager
- A connection configured to the target queue manager routed through the intermediate queue manager
- A remote queue definition for the target queue

When these conditions are fulfilled, an application can put a message to the target queue on the target queue manager without having any knowledge of the layout of the queue manager network. This means that changes to the underlying queue manager network do not affect application programs.

In Figure 21 on page 109 queue manager qm1 has been configured to allow messages to be put to queue invQ on queue manager qma. The configuration consists of:

- A connection to the intermediate queue manager qm2
- A connection to the target queue manager qma
- A remote asynchronous queue invQ on qma

If an application program uses queue manager qm1 to put a message to queue invQ on queue manager qma the message flows as follows:

1. The application puts the message to asynchronous queue qma.invQ. The message is stored locally on qm1 until transmission rules allow the message to be moved to the next hop
2. When transmission rules allow, the message is moved. Based on the connection definition for qma, the message is routed to queue manager qm2
3. The only queue configured to handle messages for queue invQ on queue manager qma is store-and-forward queue qm3.SFQ on qm2. The message is temporarily stored in this queue

4. The stored and forward queue has a connection that allows it to push messages to its next hop which is queue manager qm3
5. Queue manager qm3 has a store-and-forward queue qm3.SFQ that can hold messages destined for queue manager qma so the message is stored on that queue
6. Messages for qma remain on the store-and-forward queue until they are collected by queue manager qma. See “Home-server queue” for how to set this up.

Home-server queue

Home-server queues are implemented by the MQeHomeServerQueue class. They are managed with the MQeHomeServerQueueAdminMsg class which is a subclass of MQeRemoteQueueAdminMsg. The only addition in the subclass is the *Queue_QTimerInterval* characteristic. This field is of type int and is set to a millisecond timer interval. If you set this field to a value greater than zero, the home-server queue checks the home server every n milliseconds to see if there are any messages waiting for collection. Any messages that are waiting are delivered to the target queue. A value of 0 for this field means that the home-server is only polled when the **MQeQueueManager.triggertransmission** method is called

Note: If a home-server queue fails to connect to its store-and-forward queue (for instance if the store-and-forward queue is unavailable when the home server queue starts) it will stop trying until a trigger transmit call is made.

administration of queues

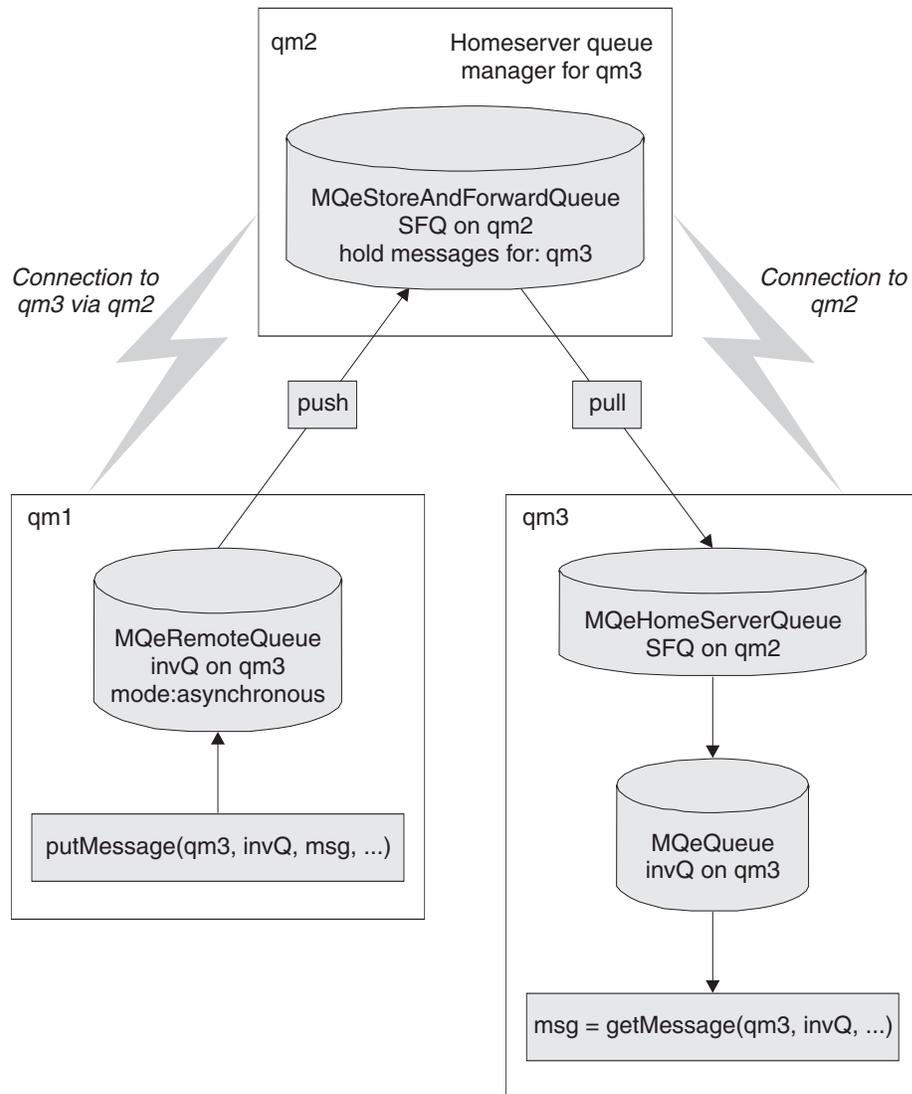


Figure 22. Home-server queue

The name of the home-server queue is set as follows:

- The queue name must match the name of the store-and-forward queue
- The queue manager attribute of the queue name must be the name of the home-server queue manager

The queue manager where the home-server queue resides must have a connection configured to the home-server queue manager.

Figure 22 shows an example of a queue manager qm3 that has a home-server queue SFQ configured to collect messages from its home-server queue manager qm2.

The configuration consists of:

- A home server queue manager qm2
- A store and forward queue SFQ on queue manager qm2 that holds messages for queue manager qm3
- A queue manager qm3 that normally runs disconnected and cannot accept connections from queue manager qm2

- Queue manager qm3 has a connection configured to qm2
- A home server queue SFQ that uses queue manager qm2 as its home server

Any messages that are directed to queue manager qm3 through qm2 are stored on the store-and-forward queue SFQ on qm2 until the home-server queue on qm3 collects them.

Websphere MQ-bridge queue

An Websphere MQ-bridge queue is a remote queue definition that refers to a queue residing on a Websphere MQ queue manager. The queue holding the messages resides on the Websphere MQ queue manager, not on the local queue manager.

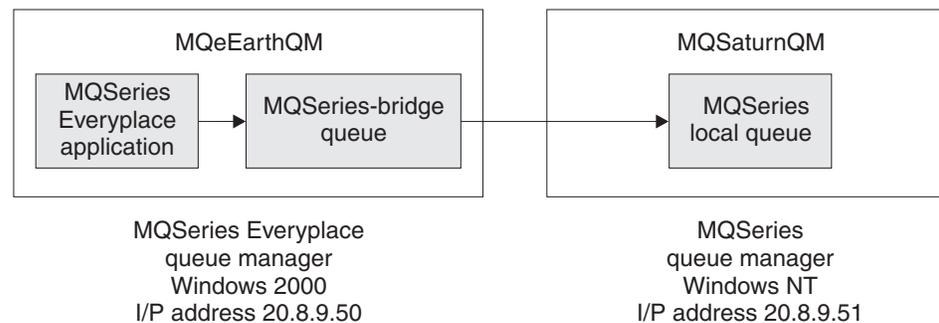


Figure 23. Websphere MQ-bridge queue

- The MQSaturnQM Websphere MQ queue manager has a local queue MQSaturnQ defined .
- The MQeEarthQM must have an Websphere MQ-bridge queue defined called MQSaturnQ on the MQSaturnQM queue manager.
- Applications attached to the MQeEarthQM queue manager put messages to the MQSaturnQ Websphere MQ-bridge queue, and the bridge queue delivers the message to the MQSaturnQ on the MQSaturnQM queue manager.

The definition of the bridge queue requires that bridge, Websphere MQ queue manager proxy, and client connection names are specified to uniquely identify a client connection object in the bridge object hierarchy (see Figure 33 on page 130). This information identifies how the Websphere MQ-bridge accesses the Websphere MQ queue manager, to manipulate a Websphere MQ queue.

The Websphere MQ-bridge queue provides the facility to put to a queue on a queue manager that is not directly connected to the Websphere MQ-bridge. This allows a message to be sent to a Websphere MQ queue manager (the target) routed through another Websphere MQ queue manager. The Websphere MQ-bridge queue takes the name of the target queue manager and the intermediate queue manager is named by the Websphere MQ queue manager proxy.

For a complete list of the characteristics used by the Websphere MQ-bridge queue, see *MQeMQBridgeQueueAdminMsg* in the *com.ibm.mqe.bridge* section of *MQSeries Everyplace for Multiplatforms Programming Reference*.

Table 11 on page 114 details the list of operations supported by the Websphere MQ-bridge queue, once it has been configured:

administration of queues

Table 11. Message operations supported by Websphere MQ—bridge queue

Type of operation	Supported by Websphere MQ-bridge queue
getMessage()	yes*
putMessage()	yes
browseMessage()	Yes*
browseAndLockMessage	no
Note: * These functions have restrictions on their use. See “Getting and browsing messages from the Websphere MQ-bridge queue” on page 157	

If an application attempts to use one of the unsupported operations, an MQException of Except_NotSupported is returned.

When an application puts a message to the bridge queue, the bridge queue takes a logical connection to the Websphere MQ queue manager from the pool of connections maintained by the bridge’s client connection object. The logical connection to Websphere MQ is supplied by either the Websphere MQ Java Bindings classes, or the Websphere MQ Classes for Java. The choice of classes depends on the value of the *hostname* field in the Websphere MQ queue manager proxy settings. Once the Websphere MQ-bridge queue has a connection to the Websphere MQ queue manager, it attempts to put the message to the Websphere MQ queue.

An Websphere MQ-bridge queue must always have an access mode of synchronous and cannot be configured as an asynchronous queue. This means that, if your put operation is directly manipulating an Websphere MQ-bridge queue and returns success, your message has passed to the Websphere MQ system while your process was waiting for the put operation to complete.

If you do not wish to use synchronous operations against the Websphere MQ-bridge queue, you may set up an asynchronous remote queue definition (see “Asynchronous messaging” on page 67) that refers to the Websphere MQ-bridge queue. Alternatively you can set up a store-and-forward queue, and home-server queue. These two alternative configurations provide the application with an asynchronous queue to which it can put messages. With these configurations, when your **putMessage()** method returns, the message may not necessarily have passed to the Websphere MQ queue manager.

An example of Websphere MQ-bridge queue usage is described in “Configuration example” on page 134.

Administration queue

The administration queue is implemented in class MQAdminQueue and is a subclass of MQQueue so it has the same features as a local queue. It is managed using administration class MQAdminQueueAdminMsg.

If a message fails because the resource to be administered is in use, it is possible to request that the message be retried. “The basic administration request message” on page 86 provides details on setting up the maximum number attempts count. If the message fails due to the managed resource not being available and the maximum number of attempts has not been reached, the message is left on the queue for processing at a later date. If the maximum number of attempts has been reached, the request fails with an MQException. By default the message is retried the next

time the queue manager is started. Alternatively a timer can be set on the queue that processes messages on the queue at specified intervals. The timer interval is specified by setting the long field `Queue_QTimerInterval` field in the administration message. The interval value is specified in milliseconds.

Security and administration

By default, any MQSeries Everyplace application can administer managed resources. The application can be running as a local application to the queue manager that is being managed, or it can be running on a different queue manager. It is important that the administration actions are secure, otherwise there is potential for the system to be misused. MQSeries Everyplace provides the basic facilities for securing administration using queue-based security which is described in “Chapter 8. Security” on page 169.

If you use synchronous security, you can secure the administration queue by setting security characteristics on the queue. For example you can set an authenticator so that the user must be authenticated to the operating system (Windows NT or UNIX) before they can perform administration actions. This can be extended so that only a specific user can perform administration.

The administration queue does not allow applications direct access to messages on the queue, the messages are processed internally. This means that messages put to the queue that have been secured with message level security cannot be unwrapped using the normal mechanism of providing an attribute on a get or browse request. However, a queue rule class can be applied to the administration queue to unwrap any secured messages so that they can be processed by the administration queue. The queue rule `browseMessage()` must be coded to perform this unwrap and allow administration to take place.

Additional information on implementing queue rules can be found in “Queue rules” on page 81.

Example administration console

One of the examples provided with MQSeries Everyplace is an administration graphical user interface (GUI). This example uses many of the administration techniques and features described in previous sections of this manual. All the classes for this example are contained in package `examples.administration.console`.

This example demonstrates the following MQSeries Everyplace administration features:

- Management of both local and remote queue managers
- Administration of all MQSeries Everyplace managed resources
- Access to all actions of each managed resource
- Use of most of the base `MQAdminMsg` features
- A queue browser
- A customized version of the queue browser for the administration reply queue.

This is provided solely as a programming example, *it is not expected to be used outside a development and test environment*. It should be noted that this example works with other examples such as trace, and the client queue manager, and it is also subclassed to provide an administration example for the Websphere MQ-bridge (see “The example administration GUI application” on page 140).

example administration console

The main console window

To start the console use the command:
`java examples.administration.console.Admin`

This displays the following window:

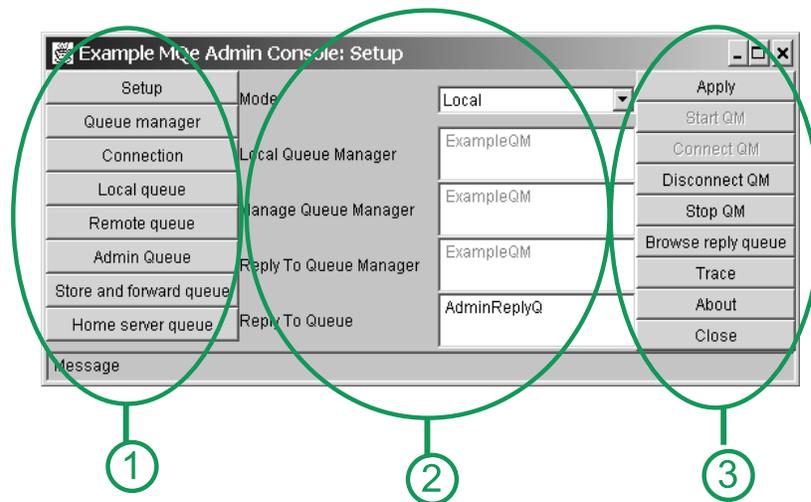


Figure 24. Administration console window

This is the central window from which all other interactions are initiated. The window has three sections:

1. Type of resource to manage

The set of buttons on the left side of the window control the selection of the resource that is to be managed. There is one button for each type of MQSeries Everyplace managed resource and one special button called **Setup**. The **Setup** button provides access to a set of base administration functions such as browsing the reply-to queue and turning trace on and off.

2. Base administration parameters

The central section of the window allows base administration parameters to be altered.

Mode: Whether the queue manager to be managed is local or remote.

Local queue manager:

The name of the local queue manager that is initiating the administration actions. This is set automatically when a queue manager is started with the **Start QM** button.

Managed queue manager:

If the mode is set to remote, this is the name of the queue manager to be managed. If the mode is set to local, this is always the same as the local queue manager.

Reply-to queue manager:

The name of the queue manager to which administration reply messages are to be sent.

Reply-to queue:

The name of the queue to which administration reply messages are to be sent.

3. Managed resource specific action

Each managed resource has a set of actions that can be performed on it. The buttons on the right of the main window show the actions for the resource that is selected on the left of the window. Selecting one of an action button starts the function for that action. Normally this causes the display of another window related to the action.

The selected local queue manager must be running in the JVM that the console is executing in. If it is not already running, it needs to be started using the **Start QM** button. This displays a dialog that requests the name and path of the ini file that contains the queue manager startup parameters. If the queue manager is already running, the **Connect QM** button can be selected (this is the case if administration is started from the example server ExampleAwtMQeServer).

Once the queue manager has been started, any of the resources in area 1 can be selected and managed.

Queue browser

An example queue browser, AdminQueueBrowser is provided with MQSeries Everyplace. This example shows how to browse a queue and how to display the contents of messages on the queue. The example can only browse queues that can be accessed synchronously and that the user has the necessary authority to access. The example code is not able to show the messages that are secured using message level security.

AdminQueueBrowser has been subclassed to provide a queue browser with enhanced function for browsing the administration reply-to queue. This is implemented in class AdminLogBrowser. This subclass can be accessed by selecting the **Setup** button followed by the **Browse reply queue** button.

The following figure shows the administration reply-to queue window.

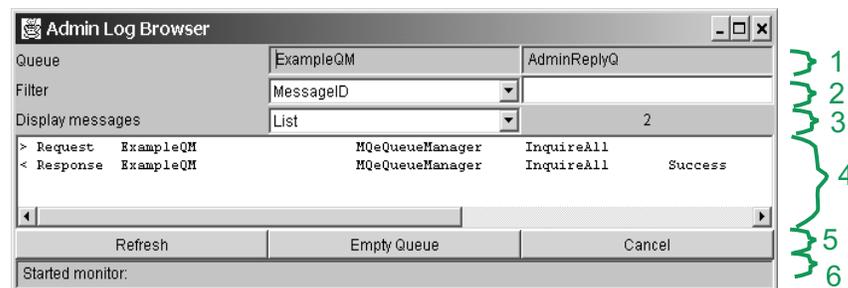


Figure 25. Reply-to queue window

This window has several sections:

1. The name of the administration reply to queue manager and queue

2. Message filter

You can provide a filter to limit the set of messages displayed. This example allows a filter on the *MsgID* and *CorrelID* fields of a message. The example also makes the assumption that the fields contain strings that have been encoded in a byte array.

example administration console

When administration messages are sent from the example console, the *MsgID* is set to the name of the queue manager to be managed. It is therefore possible to display administration messages only for a specific queue manager.

3. Message view type

You can view messages in the message display panel in the following ways:

List: A one line summary of each message on the queue.

Full: The contents of all messages on the queue.

Both: Two panels, one panel displays a list with a summary line for each message, the other panel displays the contents of a message that has been selected in the message panel.

The number of messages currently being viewed is also displayed.

4. Message display panel

As described in 3, this panel displays messages in various forms. To display a detailed view of a message in a new window, double click the message in the list view.

5. Actions

Several buttons provide actions that are specific to the queue browser:

Refresh

Clears the display and then displays the current contents of the queue. If the queue being browsed is a local queue, a monitor is automatically started. This monitor refreshes the display when new messages are added to the queue. If the queue being browsed is remote then it is not possible to automatically refresh the window when new messages are added. In this case, the **Refresh** button can be used to get the latest contents of the queue.

Empty Queue

Deletes all messages from the queue.

Cancel

Closes the queue browser window.

6. Message

Error and status messages are displayed here.

Action windows

Once you have selected a managed resource type, and you have clicked an action button, a window opens that displays a list of possible parameters for the action. Some parameters are mandatory, others are optional. The following figure shows an example of selecting the add action on a connection:

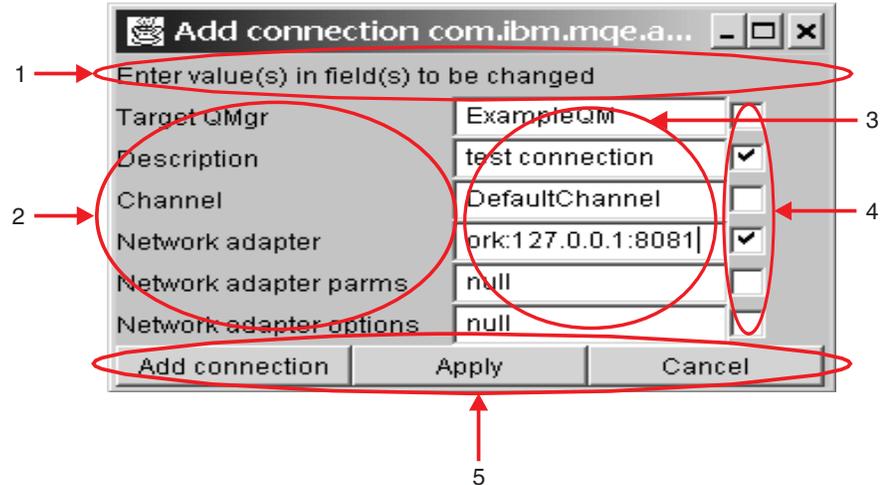
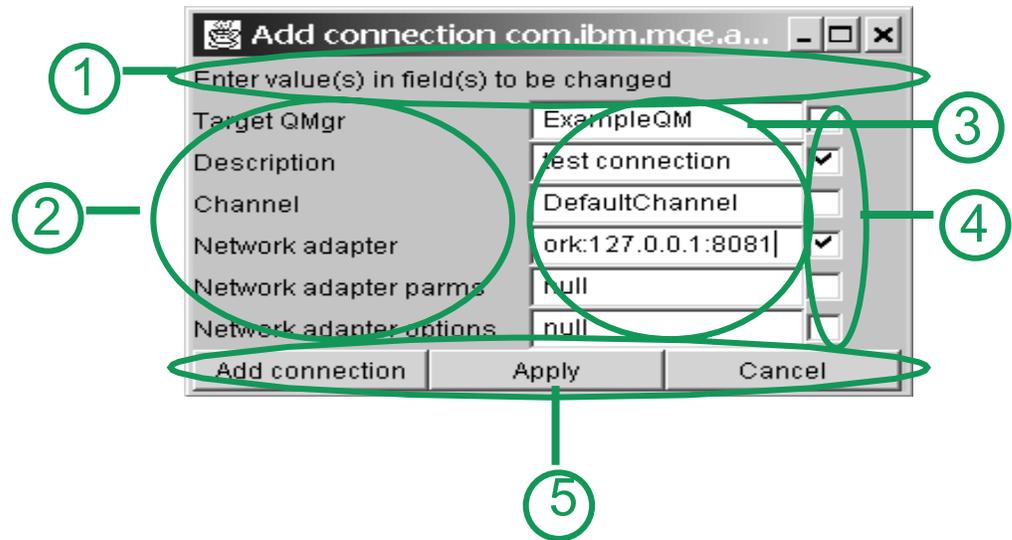


Figure 26. Action window

The action window is the same for most actions. It consists of the following parts:

1. Message area

Error and status messages are displayed here.

2. Names of parameter

Action parameter names.

3. Value of parameter

An input field where you can change the parameter values. The initial value displayed is the default value for the parameter.

4. Send field

The check box for each field is automatically selected when a value is changed. When this field is selected, the field is included in the administration message. By default the administration message only contains values that have changed, it does not contain default values. Default values are understood by the administration message and are not included in the message to ensure that the message size is kept as small as possible. If you change a value back to its default, then you must select the send field check box yourself.

example administration console

5. Action buttons

For each administration action there are three buttons:

Action The name on this button depends on the administration action (in this example it is **Add connection**). The action is always to create the administration message and send it to the destination queue manager. The action window is closed.

Apply Create the administration message and send it to the destination queue manager. The action window remains open allowing the same message to be sent multiple times or it can be modified and then sent.

Cancel

Close the action window without sending the administration message.

Reply windows

You can view the outcome of an administration request with the administration log browser as described in “Queue browser” on page 117. To see the details of the result of the request, double click on the reply message in the list view.

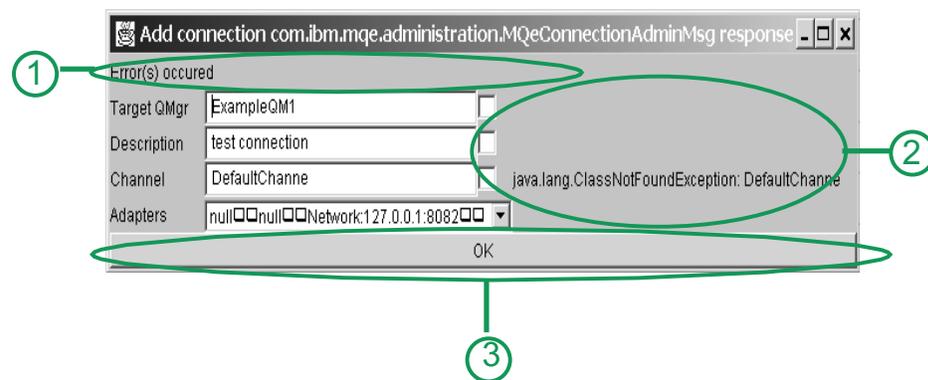


Figure 27. Reply window

The window has the same basic structure as an administration request action window but has the following differences:

1. Message

Displays the return code and result of the action

2. Detailed errors

If the return code was RC_Mixed, any errors relating to a particular field are displayed alongside the field.

3. Action buttons

OK Close the action reply window

Administration from the command line

MQSeries Everyplace includes some tools that enable the administration of MQSeries Everyplace objects from the command line, using simple scripts. The following tools are provided:

QueueManagerUpdater

Creates a device queue manager from an ini file, and sends an administration message to update the characteristics of a queue manager.

IniFileCreator

Creates an ini file with the necessary content for a client queue manager.

LocalQueueCreator

Opens a client queue manager, adds a local queue definition to it, and closes the queue manager.

HomeServerCreator

Open a server queue manager, adds a home-server queue, and closesg the queue manager.

ConnectionCreator

Allow a connection to be added to an MQSeries Everyplace queue manager without programming anything in Java.

RemoteQueueCreator

Opens a device queue manager for use, sends it an administration message to cause a remote queue definition to be created, then closes the queue manager.

MQBridgeCreator

Creates an Websphere MQ-bridge on an MQSeries Everyplace queue manager.

MQQMgrProxyCreator

Creates a Websphere MQ queue manager proxy for a bridge.

MQConnectionCreator

Creates a connection definition for a Websphere MQ system on a proxy object.

MQListenerCreator

Creates a Websphere MQ transmit queue listener to pull messages from Websphere MQ

MQBridgeQueueCreator

Creates an MQSeries Everyplace queue that can reference messages on a Websphere MQ queue.

StoreAndForwardQueueCreator

Creates a store-and-forward queue.

StoreAndForwardQueueQMGrAdder

Adds a queue manager name to the list of queue managers for which the store-and-forward queue accepts messages.

The following files are also provided:

Example script files

Two example .bat files, and a runmqsc script to demonstrate setting up a fictitious network configuration, involving a branch, a gateway, and a Websphere MQ system.

Rolled-up Java example

An example of how a batch file can be rolled-up into a Java file for batch-language independence.

example administration console

Example of use of command-line tools

The command-line tools can be used to create an initial queue manager configuration using a script, and without needing to know how to program in the Java programming language.

The following example demonstrate how to use these tools to configure the network topology shown in the following figure.

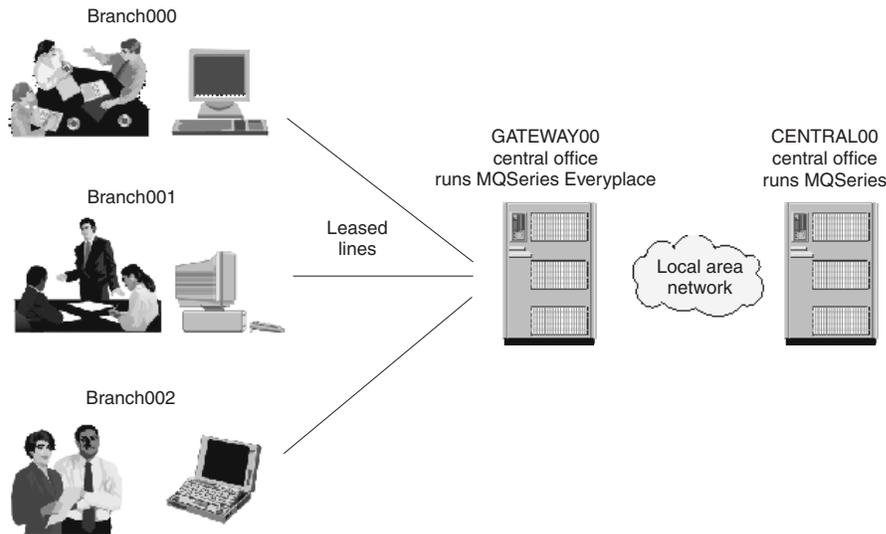


Figure 28. MQSeries Everyplace administration scenario

In this scenario:

- The branch offices need to send sales information to the central site for processing by applications on the Websphere MQ server
- Each branch has a single machine with DNS names BRANCH000, BRANCH001, and BRANCH002 respectively. These machines all run MQSeries Everyplace each having a single queue manager names BRANCH000QM, BRANCH001QM, and BRANCH002QM respectively.
- The central office machine GATEWAY00 runs a single gateway queue manager GATEWAY00QM
- The central office machine CENTRAL00 runs Websphere MQ with a single queue manager CENTRAL00QM
- When a sale occurs, a message is sent to the Websphere MQ queue manager CENTRAL00QM, into a queue called BRANCH.SALES.QUEUE.
- The messages are encoded in a byte array at the branch, and sent inside an MQeMQMsgObject.
- The Websphere MQ system must be able to send messages back to each branch queue manager.
- The topology must also be able to cope with the addition of a firewall later between the branches and the gateway.
- The Websphere MQ-bound queue traffic should use the 56-bit DES cryptor.

Script files required

The following scripts are needed to configure this network topology.

Central.tst

Used with the runmqsc script to create relevant objects on CENTRAL00QM

CentralQMDetails.bat

Used to describe the CENTRAL00QM to other scripts

GatewayQMDetails.bat

Used to describe the GATEWAY00QM to other scripts

CreateGatewayQM.bat

Used to create the gateway queue manager

CreateBranchQM.bat

Used to create a branch queue manager

These .bat files can all be found in the installed product, in MQE\Java\Demo\Windows.

Note: Although the example scripts provided are in the Windows .bat file format, they could be converted to work equally well in any scripting language available on your system.

MQSeries Everyplace and Websphere MQ objects defined by the scripts

The following objects are created by the scripts, to provide the branch-to-central routing:

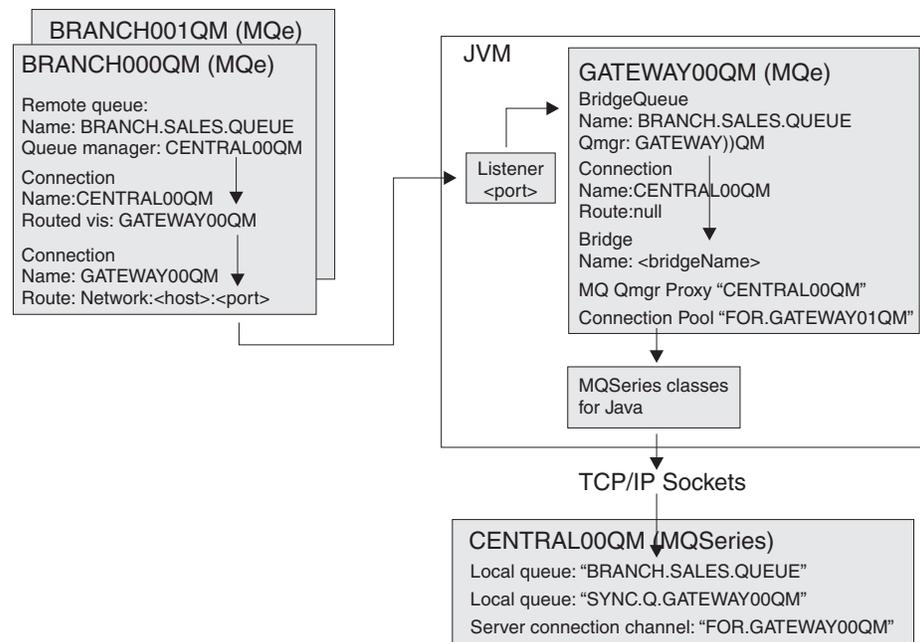


Figure 29. Branch to central routing

The following objects are created by the scripts to provide the central-to-branch routing:

example administration console

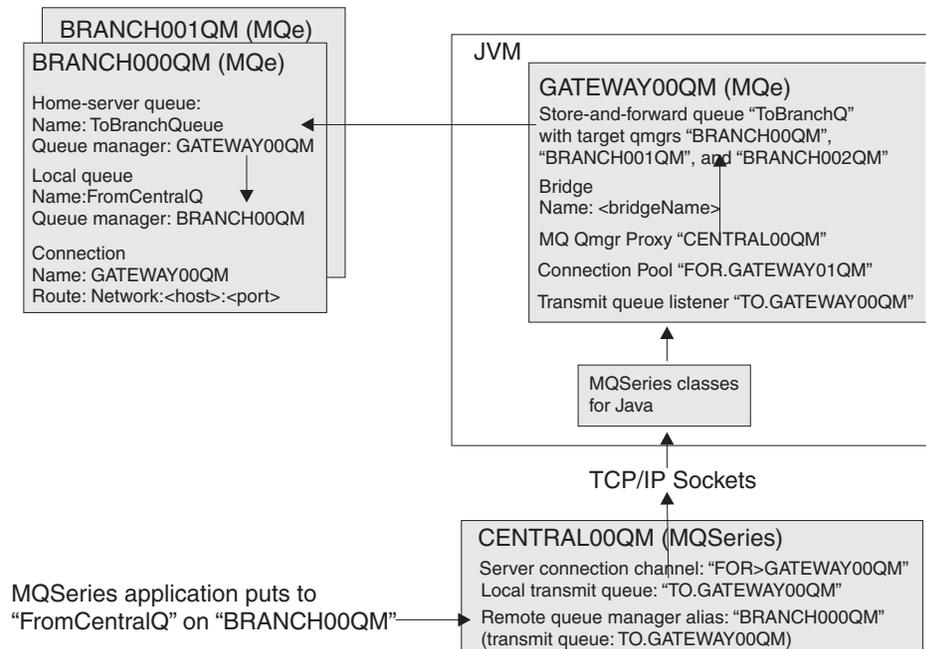


Figure 30. Central to branch routing

How to use the script files

Follow these procedures to create the required objects and operate the example scenario, using the supplied script files.

Edit the JavaEnv.bat .

Make sure you have edited the JavaEnv.bat file to set your required working environment.

Create a command-line session

Create a command-line session, and invoke the JavaEnv.bat to make the settings available in the current environment.

Gather hardware required

Locate all the hardware on which you will be installing the network topology.

Gather the machine names of those machines available to you, and note them down. If you have only one machine available, you can still use the scripts to deploy the example network topology, as you can specify the same hostname for each queue manager.

Create a Websphere MQ queue manager

By default, the scripts assume this is called CENTRAL00QM listening on port 1414 for client channel connections.

Describe the MQSeries queue manager

Edit and review the CentralQMDetails.bat file to make sure that its details match those of the Websphere MQ queue manager you have just created. All values, except the name of the machine on which the Websphere MQ queue manager sits, are defaulted in the script file.

Describe the gateway queue manager

Edit and review the GatewayQMDetails.bat file to make sure that details of the gateway queue manager are decided on, and available for the other .bat files to use.

The default name of the gateway queue manager created by the scripts is GATEWAY00QM. You will need to set the machine name, and port number it will listen on. This port must be available for use.

Tip: On Windows machines, use the command **netstat -a** to get a list of ports currently in-use.

Review the central.tst file

Read the central.tst file, make sure it won't create any Websphere MQ objects you are unhappy with on your Websphere MQ queue manager.

Distribute all the scripts to all machines

Copy all of the scripts to all of the machines on which you will be running MQSeries Everyplace queue managers.

This step spreads knowledge to all the machines in your network, of the host names, port numbers, and queue manager names that you have decided to use. If any of these files are changed, delete all MQSeries Everyplace queue managers and restart from this point in the instructions.

Run the central.tst script on your new Websphere MQ queue manger

The central.tst script is in a format used by the **runmqsc** sample program supplied with MQSeries.

Pipe the central.tst file into **runmqsc** to configure your Websphere MQ queue manger For example:

```
runmqsc CENTRAL00QM < Central.tst
```

Use the Websphere MQ Explorer to view the resultant Websphere MQ objects that are created.

Milestone: You have now set up your Websphere MQ system.

Run the CreateGatewayQM script

The CreateGatewayQM script uses the details in the CentralQMDetails and GatewayQMDetails scripts to create a gateway queue manager.

The script needs no parameters.

Check for the test message

The script that creates the queue manager sends a test message to the Websphere MQ system.

Use the Websphere MQ Explorer tool to look at the target queue (BRANCH.SALES.QUEUE by default) to make sure a test message arrived. The body of the test message contains the string ABCD

Milestone: You have now set up your MQSeries Everyplace gateway queue manager.

Keep the gateway queue manager running

During the running of the CreateGatewayQM script, an example server program is invoked to start the gateway queue manager, and keep it running. The following window is displayed:

example administration console



Figure 31. Gateway queue manager window

Do not close this window.

All the time this window is active, the MQSeries Everyplace gateway queue manager it represents is also active. Closing the window closes the MQSeries Everyplace gateway queue manager and breaks the path from the branch queue managers to the Websphere MQ queue manager.

Create a branch queue manager

If your branch queue manager needs to run on a different machine, you may need to edit the JavaEnv.bat file to set up your local environment.

Create a command-line session, and call JavaEnv.bat as before to set up your environment.

Use the CreateBranchQM script to create a branch queue manager. The syntax of the command is :

```
CreateBranchQM.bat branchNumber portListeningOn
```

Where:

branchNumber

Is a 3-digit number, padded with leading zeros, indicating which branch the queue manager is being created for. For example, 000, 001, 002...

portListeningOn

Is a port on which the device branch queue manager listens on for administration requests. For example, 8082, 8083...

Note: The port must not already be in use

Hint: On Windows machines, use the **netstat -a** command to view the list of ports in-use.

During the script, a test message is sent to your Websphere MQ system. Use the Websphere MQ Explorer to make sure the test message arrived successfully. The body of the test message contains the string ABCD.

At the end of the script, an example program is used to start the MQSeries Everyplace queue manager. The following window is displayed:



Figure 32. Branch queue manager window

example administration console

As with the gateway queue manager, *do not close this window* until you wish to close the queue manager.

Explore the branch queue manager

The branch queue manager is set up with a channel manager and listener, on the port you specified when you created it, and the Primary Network connection is HttpTcipAdapter. As a result, you can use the MQE_Explorer to view the queue managers. (see “How to use the MQE_Explorer to view the configurations”).

Milestone: You now have a branch queue manager set up.

Note: An MQSeries Everyplace queue manager should be named uniquely. Never create two queue managers with the same name.

Start the MQE_Explorer.exe program. Stop one of the branch queue managers, say BRANCH002QM Open the BRANCH002QM.ini file, and navigate from there.

How to use the MQE_Explorer to view the configurations

To use the MQE_Explorer to view your configuration:

1. Start the MQE_Explorer.exe program.
2. Stop one of the branch queue managers, say BRANCH002QM
3. Open the BRANCH002QM.ini file, and navigate from there.

example administration console

Chapter 7. Websphere MQ-bridge

The Websphere MQ-bridge is a piece of software that allows an MQSeries Everyplace network to exchange messages intelligently with a Websphere MQ network . Because each system aims to satisfy different requirements, there are differences in the way the two systems pass messages. The bridge resolves these differences and enables messages to flow between the various systems.

Installation

Make sure that the following configuration is complete before trying to use an Websphere MQ-bridge.

The bridge code is packaged into the MQeMQBridge.jar file. The class files are also available in the com\ibm\mqe\mqbridge directory. The classpath must be set to make the bridge classes accessible when the MQSeries Everyplace server is started. The Websphere MQ-bridge code runs only on the MQSeries Everyplace gateway platform, not on a device platform.

Websphere MQ Classes for Java

To use the Websphere MQ-bridge you must have the Websphere MQ Classes for Java (version 5.1 or greater) installed on your MQSeries Everyplace system. Websphere MQ Classes for Java is available for free download from the Web as supportpac MA88. The Web address for the download is: <http://www.ibm.com/software/mqseries/txppacs/ma88.html>. (The Websphere MQ classes for Java for NT is shipped with Websphere MQ Version 5.1 for NT.)

Configuring the Websphere MQ-bridge

The configuration of the Websphere MQ-bridge requires you to perform some actions on the Websphere MQ queue manager, and some on the MQSeries Everyplace queue manager. The bridge is logically broken into two pieces, one for each direction of the message (MQSeries Everyplace to Websphere MQ and Websphere MQ to MQSeries Everyplace)

The bridge objects are defined in a hierarchy as shown in Figure 33 on page 130

The following rules govern the relationship between the various objects:

- An MQSeries Everyplace bridges object is associated with a single MQSeries Everyplace queue manager.
- A single MQSeries Everyplace bridges object may have more than one bridge object associated with it. You may wish to configure several Websphere MQ-bridge instances with different routings.
- Each bridge can have a number of Websphere MQ queue manager proxy definitions.
- Each Websphere MQ queue manager proxy definition can have a number of client connections that allow communication with MQSeries Everyplace.
- Each client connection connects to a single Websphere MQ queue manager. Each connection may use a different *server connection* on the Websphere MQ queue manager , or a different set of security, send, and receive exits, ports or other parameters.

bridge configuration

- An Websphere MQ-bridge client connection may have a number of transmission queue listeners that use that bridge service to connect to the Websphere MQ queue manager.
- A listener uses only one client connection to establish its connection.
- Each listener connects to a single transmission queue on the Websphere MQ system.
- Each listener moves messages from a single Websphere MQ transmission queue to anywhere on the MQSeries Everyplace network, (through the MQSeries Everyplace queue manager its bridge is associated with). So an Websphere MQ-bridge can funnel multiple Websphere MQ message sources through one MQSeries Everyplace queue manager onto the MQSeries Everyplace network.
- When moving MQSeries Everyplace messages to the Websphere MQ network, the MQSeries Everyplace queue manager creates a number of *adapter* objects. Each adapter object can connect to any Websphere MQ queue manager (providing it is configured) and can send its messages to any queue. So an Websphere MQ-bridge can dispatch MQSeries Everyplace messages routed through a single MQSeries Everyplace queue manager to any Websphere MQ queue manager.

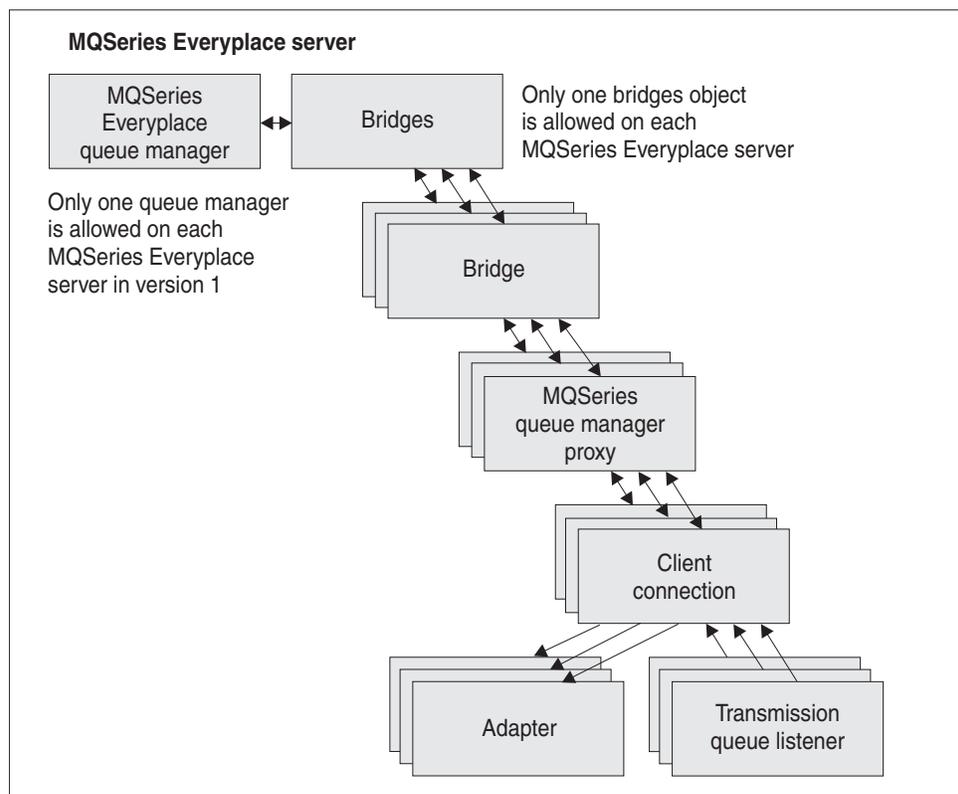


Figure 33. Bridge object hierarchy

Naming recommendations for inter-operability with a Websphere MQ network

To create an MQSeries Everyplace network that can interoperate with a Websphere MQ network, it is necessary to adopt the same limitations in naming convention for both systems. It is therefore important to understand the differences between valid queue names in both systems:

- In Websphere MQ, the forward-slash '/' character is allowed in queue and queue manager names. This character is not valid in MQSeries Everyplace object names.

We strongly recommend that you do not use this character in the name of any Websphere MQ queue or queue manager.

- Websphere MQ queue and queue manager names have a limit of 48 characters but MQSeries Everyplace names have no length restrictions.

We strongly recommend that you do not define MQSeries Everyplace queues or queue managers with names that contain more than 48 characters.

- Websphere MQ queue names can have leading or trailing '.' characters. This is not allowed in MQSeries Everyplace

We strongly recommend that you do not defined any Websphere MQ queue or queue manager with a name that starts or ends with a '.' character.

- Queue managers should be named uniquely, such that a queue manager with the same name does not exist on either the MQSeries Everyplace network, or the Websphere MQ network.

If you choose not to follow these guideline, then you may experience problems when trying to address an MQSeries Everyplace queue from a Websphere MQ application.

Configuring a basic installation

To configure a very basic installation of the Websphere MQ-bridge you need to complete the following steps:

1. Make sure you have a Websphere MQ system installed and that you understand local routing conventions, and how to configure the system.
2. Install MQSeries Everyplace on a system (It can be the same system as your Websphere MQ system is located on if you wish)
3. If Websphere MQ Classes for Java is not already installed, download it from the Web and install it. (See "Websphere MQ Classes for Java" on page 129.)
4. Set up your MQSeries Everyplace system and verify that it is working properly before you try to connect it to Websphere MQ.
5. Update the MQe_java\Classes\JavaEnv.bat file so that it points to the Java classes that are part of the Websphere MQ Classes for Java, and to the classpath for your JRE (Java Runtime Environment). You need to make sure the com.ibm.mqbind.jar and the com.ibm.mq.jar classes are in the classpath, and that the java\lib and \bin directories are in your path.
6. Plan the routing you intend to implement. You need to decide which Websphere MQ queue managers are going to talk to which MQSeries Everyplace queue managers.
7. Decide on a naming convention for MQSeries Everyplace objects and Websphere MQ objects and document it for future use.
8. Modify your MQSeries Everyplace system to define an Websphere MQ-bridge on your chosen MQSeries Everyplace server. See "The example administration GUI application" on page 140 for information on using examples.mqbridge.awt.AwtMQBridgeServer to define a bridge.
9. Connect the chosen Websphere MQ queue manager to the bridge on the MQSeries Everyplace server as follows:
 - On the Websphere MQ queue manager:

bridge configuration

Define one or more Java server connection channels so that MQSeries Everyplace can use the Websphere MQ Classes for Java to talk to this queue manager. This involves the following steps:

- a. Define the server connection channels
 - b. Define a sync queue for MQSeries Everyplace to use to provide assured delivery to the Websphere MQ system. You need one of these for each server connection channel that the MQSeries Everyplace system can use.
- On the MQSeries Everyplace server:
 - a. Define a Websphere MQ queue manager proxy object which holds information about the Websphere MQ queue manager. This involves the following steps:
 - 1) Collect the Hostname of the Websphere MQ queue manager.
 - 2) Put the name in the Websphere MQ queue manager proxy object.
 - b. Define a Client Connection object that holds information about how to use the Websphere MQ Classes for Java to connect to the server connection channel on the Websphere MQ system. This involves the following steps:
 - 1) Collect the Port number, and all other server connection channel parameters.
 - 2) Use these values to define the client connection object so that they match the definition on the Websphere MQ queue manager.
10. Modify your configuration on both MQSeries Everyplace and Websphere MQ to allow messages to pass from Websphere MQ to MQSeries Everyplace.
 - a. Decide on the number of routes from Websphere MQ to your MQSeries Everyplace network. The number of routes you need depends on the amount of message traffic (load) you will be using across each route. If your message load is high you may wish to split your traffic into multiple routes.
 - b. Define your routes as follows:
 - 1) For each route define a transmission queue on your Websphere MQ system. DO NOT define a channel for these transmission queues.
 - 2) For each route create a matching transmission queue listener on your MQSeries Everyplace system.
 - 3) Define a number of remote queue definitions, (such as remote queue manager aliases and queue aliases) to allow Websphere MQ messages to be routed onto the various MQSeries Everyplace-bound transmission queues that you defined in step 10b1.
 11. Modify your configuration on MQSeries Everyplace to allow messages to pass from MQSeries Everyplace to Websphere MQ:
 - a. Publish details about all the queue managers on your Websphere MQ network you want to send messages to from the MQSeries Everyplace network. Each Websphere MQ queue manager requires a Connections definition on your MQSeries Everyplace server. All fields except the Queue manager name should be null, to indicate that the normal MQSeries Everyplace communications channels should not be used to talk to this queue manager.
 - b. Publish details about all the queues on your Websphere MQ network you want to send messages to from the MQSeries Everyplace network. Each Websphere MQ queue requires an Websphere MQ-bridge queue definition

on your MQSeries Everyplace server. (This is the MQSeries Everyplace equivalent of a DEFINE QREMOTE in Websphere MQ).

- The queue name is the name of the Websphere MQ queue to which the bridge should send any messages arriving on this Websphere MQ-bridge queue.
 - The queue manager name is the name of the Websphere MQ queue manager on which the queue is located.
 - The bridge name indicates which bridge should be used to send messages to the Websphere MQ network.
 - The Websphere MQ queue manager proxy name is the name of the Websphere MQ queue manager proxy object, in the MQSeries Everyplace configuration, that can connect to a Websphere MQ queue manager.
 - The Websphere MQ queue manager should have a route defined to allow messages to be posted to the Queue Name on Queue Manager Name to deliver the message to its final destination.
12. Start your Websphere MQ and MQSeries Everyplace systems to allow messages to flow. The Websphere MQ system client channel listener must be started. All the objects you have defined on the MQSeries Everyplace must be started. These objects can be started in any of the following ways:
- Explicitly using the Administration GUI described in “The example administration GUI application” on page 140
 - By configuring the rules class (described in “Websphere MQ-bridge rules” on page 162) to indicate the startup state (running or stopped) and restarting the MQSeries Everyplace server
 - A mixture of the two previous methods

The simplest way to start objects manually, is to send a **start** command to the relevant bridge object. This command should indicate that all the children of the bridge, and children’s children should be started as well.

- To allow messages to pass from MQSeries Everyplace to Websphere MQ, start the client connection objects in MQSeries Everyplace.
 - To allow messages to pass from Websphere MQ to MQSeries Everyplace, start both the client connection objects, and the relevant transmission queue listeners.
13. Create transformer classes, and modify your MQSeries Everyplace configuration to use them. A transformer class converts messages from Websphere MQ message formats into an MQSeries Everyplace message format, and vice-versa. These format-converters must be written in Java and configured in several places in the Websphere MQ-bridge configuration.
- a. Create transformer classes
 - Determine the message formats of the Websphere MQ messages that need to pass over the bridge.
 - Write a transformer class, or a set of transformer classes to convert each Websphere MQ message format into an MQSeries Everyplace message. See “Transformers” on page 158.
 - b. You can replace the default transformer class. Use the administration GUI to **update** the default transformer class parameter in the bridge object’s configuration.
 - c. You can specify a non-default transformer for each Websphere MQ-bridge queue definition. Use the administration GUI to **update** the *transformer* field of each Websphere MQ-bridge queue in the configuration

bridge configuration

- d. You can specify a non-default transformer for each Websphere MQ transmission queue listener. Use the administration GUI to **update** the *transformer* field of each listener in the configuration
- e. Restart the bridge, and listeners.

Sample configuration tool

MQSeries Everyplace systems and the Websphere MQ-bridge are complex environments. A sample configuration tool that helps to create an initial configuration is included with the Websphere MQ-bridge. The source code for the tool is provided and you can subclass it, modify it, and change its behavior to suite your needs.

This documentation explains what this sample tool does and how to use it.

Limitations

The sample configuration tool cannot be used on a server that has a large number of MQSeries Everyplace queue manager connections defined. For instance, if you have a large number of mobile phones, each with a separate queue manager, and the server had a connection defined for each, then the tool would not work. This is because the tool sometimes queries the list of connections and, in such situations, the JVM that the tool runs in fails due to a lack of memory. If you are trying to administer a server that has many connections to other MQSeries Everyplace queue managers, we recommend you use the `examples.mqbridge.administration.console.AdminGateway` application instead.

Steps required to configure the bridge

To configure a very basic installation of the Websphere MQ-bridge you need to complete the steps in “Configuring a basic installation” on page 131. The sample tool aims to provide a simple way of doing the steps 8-12 in this list.

Configuration example

This section describes an example configuration of 4 systems.

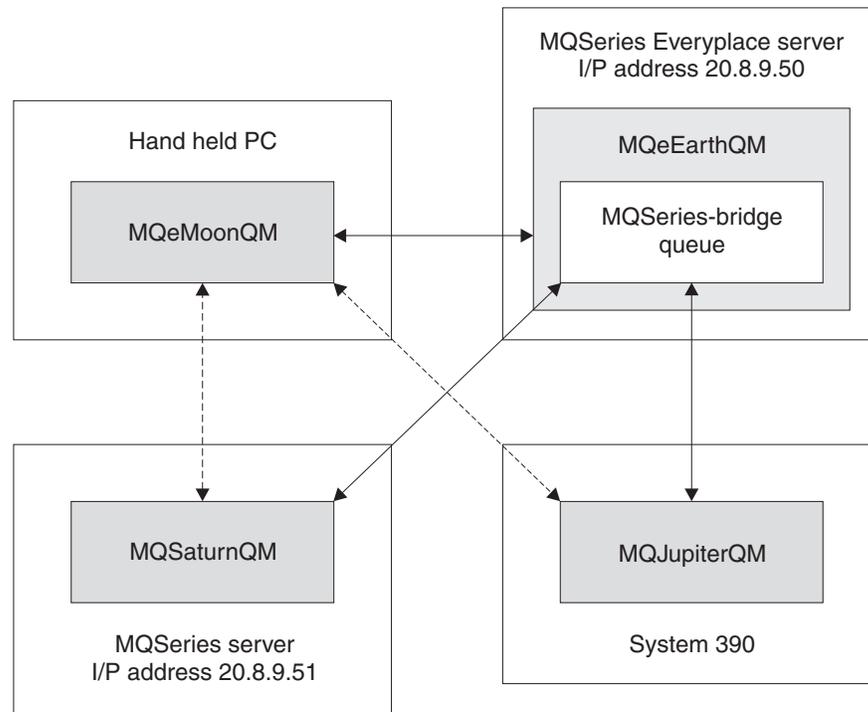


Figure 34. Configuration example

The four systems are:

MQeMoonQM

This is an MQSeries Everyplace client queue manager, sited on a handheld PC. The user periodically attaches the handheld PC to the network, to communicate with the MQeEarthQM MQSeries Everyplace gateway.

MQeEarthQM

This is on a Windows/2000 machine, with an I/P address of 20.8.9.50 This is an MQSeries Everyplace gateway (server) queue manager.

MQSaturnQM

This is a Websphere MQ queue manager, installed on a Windows/NT platform. The I/P address is 20.8.9.51

MQJupiterQM

This is a Websphere MQ queue manager, installed on a System/390 platform.

Requirement

The requirement for this example is that all machines are able to post a message to a queue on any of the other machines.

It is assumed that all machines are permanently connected to the network, except the MQeMoonQM machine, which is only occasionally connected.

Initial setup

For this example, it is assumed that there are local queues, to which messages can be put, on all the queue managers. These queues are called:

- MQeMoonQ on the MQeMoonQM
- MQeEarthQ on the MQeEarthQM
- MQSaturnQ on the MQSaturnQM

sample configuration tool

- MQJupiterQ on the MQJupiterQM

Enabling MQeMoonQM to put and get messages to and from the MQeEarthQM queue manager

On MQeMoonQM:

1. Define a **connection** with the following parameters:

Target queue manager name: MQeEarthQM
Adapter: FastNetwork:20.8.9.50

Note: Check that the adapter you specify when you define the connection matches the adapter used by the Listener on the MQeEarthQM queue manager.

Applications can now connect directly to any queue defined on the MQeEarthQM queue manager directly, when the MQeMoonQM is connected to the network. The requirement states that applications on MQeMoonQM must be able to send messages to MQeEarthQ in an asynchronous manner. This requires a remote queue definition to set up the asynchronous linkage to the MQeEarthQ queue.

2. Define a **remote queue** with the following parameters:

Queue name: MQeEarthQ
Queue manager name: MQeEarthQM
Access mode: Asynchronous

Applications on MQeMoonQM now have access to the MQeMoonQ (a local queue) in a synchronous manner, and the MQeEarthQ in an asynchronous manner.

Enabling the MQeEarthQM to send messages to the MQeMoonQM queue manager

Since the MQeMoonQM is not attached to the network for most of the time, use a store-and-forward queue on the MQeEarthQM to collect messages destined for the MQeMoonQM queue manager.

On MQeEarthQM:

1. Define a **store-and-forward-queue** with the following parameters:

Queue name: TO.HANDHELDS
Queue Manager Name: MQeEarthQM

2. Add a **queue manager** to the **store-and-forward queue** using the following parameters:

Queue Name: TO.HANDHELDS
Queue manager: MQeMoonQM

A (similarly named) home-server queue is needed on the MQeMoonQM queue manager. This queue pulls messages out of the store-and-forward queue and puts them to a queue on the MQeMoonQM queue manager.

On MQeMoonQM:

1. Define a **home-server queue** with the following parameters:

Queue Name: TO.HANDHELDS
Queue manager name: MQeEarthQM

Any messages arriving at MQeEarthQM that are destined for MQeMoonQM are stored temporarily in the store-and-forward queue TO.HANDHELDS. When MQeMoonQM next connects to the network, it's home-server queue TO.HANDHELDS gets any messages currently on the store-and-forward queue, and delivers them to the MQeMoonQM queue manager, for storage on local queues.

Applications on MQeEarthQM can now send messages to MQeMoonQ in an asynchronous manner.

Enabling MQeEarthQM to send a message to MQSaturnQ

On MQeEarthQM:

1. Define a **bridge** with the following parameters:

Bridge name: MQeEarthQMBridge

2. Define an **Websphere MQ queue manager proxy** with the following parameters:

Bridge Name: MQeEarthQMBridge

MQ QMgr Proxy Name: MQSaturnQM

Hostname: 20.8.9.51

3. Define a **client connection** with the following parameters:

Bridge Name: MQeEarthQMBridge

MQ QMgr Proxy Name: MQSaturnQM

ClientConnectionName: MQeEarth.CHANNEL

SyncQName: MQeEarth.SYNC.QUEUE

4. Define a **connection** with the following parameters:

ConnectionName: MQSaturnQM

Channel: null

Adapter: null

5. Define an **Websphere MQ-bridge queue** with the following parameters:

Queue Name: MQSaturnQ

MQ Queue manager name: MQSaturnQM

Bridge name: MQeEarthQMBridge

MQ QMgr Proxy Name: MQSaturnQM

ClientConnectionName: MQeEarth.CHANNEL

On MQSaturnQM:

1. Define a **server connection channel** with the following parameters:

Name: MQeEarth.CHANNEL

2. Define a **local sync queue** with the following parameters:

Name: MQeEarth.SYNC.QUEUE

The sync queue is needed for assured delivery.

Applications on MQeEarthQM can now send messages to the MQSaturnQ on MQSaturnQM.

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Enabling MQeEarthQM to send a message to MQJupiterQ

On MQeEarthQM:

1. Define a **connection** with the following parameters:

```
ConnectionName: MQJupiterQM
Channel: null
Adapter: null
```

2. Define an **Websphere MQ-bridge queue** with the following parameters:

```
Queue Name: MQJupiterQ
MQ Queue manager name: MQJupiterQM
Bridge name: MQeEarthQMBridge
MQ QMgr Proxy Name: MQSaturnQM
ClientConnectionName: MQeEarth.CHANNEL
```

On MQSaturnQM:

1. Define a **remote queue definition** with the following parameters:

```
Queue Name: MQJupiterQ
Transmission Queue: MQJupiterQM.XMITQ
```

On both MQSaturnQM and MQJupiterQM:

1. Define a **channel** to move the message from the MQJupiterQM.XMITQ on MQSaturnQM to MQJupiterQM.

Now applications on MQeEarthQM can send a message to MQJupiterQ on MQJupiterQM, through MQSaturnQM.

Enabling MQeMoonQM to send a message to MQJupiterQ and MQSaturnQ

On MQeMoonQM:

1. Define a **connection** with the following parameters:

```
Target Queue manager name: MQSaturnQM
Adapter: MQeEarthQM
```

The connection indicates that any message bound for the MQSaturnQM queue manager should go through the MQeEarthQM queue manager.

2. Define a **remote queue definition** with the following parameters:

```
Queue name: MQSaturnQ
Queue manager name: MQSaturnQM
Access mode: Asynchronous
```

3. Define a **connection** with the following parameters:

```
Target Queue manager name: MQJupiterQM
Adapter: MQeEarthQM
```

4. Define a **remote queue definition** with the following parameters:

```
Queue name: MQJupiterQ
Queue manager name: MQJupiterQM
Access mode: Asynchronous
```

Applications connected to MQeMoonQM can now issue messages to MQeMoonQ, MQeEarthQ, MQSaturnQ, and MQJupiterQ, even when the handheld PC is disconnected from the network.

Enabling MQSaturnQM to send messages to the MQeEarthQ

On MQSaturnQM:

1. Define a **local queue** with the following parameters:

Queue name: MQeEarth.XMITQ
Queue type: transmission queue

2. Define a **queue manager alias** (remote queue definition) with the following parameters:

Queue name: MQeEarthQM
Remote queue manager name: MQeEarthQM
Transmission queue: MQeEarth.XMITQ

On MQeEarthQM:

1. Define a **Transmission queue listener** with the following parameters:

Bridge name: MQeEarthQMBridge
MQ QMgr Proxy Name: MQSaturnQM
ClientConnectionName: MQeEarth.CHANNEL
Listener Name: MQeEarth.XMITQ

Applications on MQSaturnQM can now send messages to MQeEarthQ using the MQeEarthQM queue manager alias . This routes each message onto the MQeEarth.XMITQ, where the MQSeries Everyplace transmission queue listener MQeEarth.XMITQ gets them, and moves them onto the MQSeries Everyplace network.

Enabling MQSaturnQM to send messages to the MQeMoonQ

On MQSaturnQM:

1. Define a **queue manager alias** (remote queue definition) with the following parameters:

Queue name: MQeMoonQM
Remote queue manager name: MQeMoonQM
Transmission queue: MQeEarth.XMITQ

Applications on MQSaturnQM can now send messages to MQeMoonQ using the MQeMoonQM queue manager alias . This routes each message to the MQeEarth.XMITQ, where the MQSeries Everyplace transmission queue listener MQeEarth.XMITQ gets them, and posts them onto the MQSeries Everyplace network.

The store-and-forward queue T0.HANDHELDS collects the message, and when the MQeMoonQM next connects to the network, the home-server queue retrieves the message from the store-and-forward queue, and delivers the message to the MQeMoonQ.

Enabling the MQJupiterQM to send messages to the MQeMoonQ

On MQJupiterQM:

Set up **remote queue manager aliases** for the MQeEarthQM and MQeMoonQM to route messages to MQSaturnQM using normal Websphere MQ routing techniques.

sample configuration tool

Now any application connected to any of the queue managers can post a message to any of the queues MQeMoonQ, MQeEarthQ, MQSaturnQ or MQJupiterQ.

Additional bridge configuration

A trace of the base Websphere MQ Classes for Java is not usually needed, and so is disabled by default. However it is the responsibility of the active trace handler class to initialize Websphere MQ trace. An example of how to do this is shipped with the MQSeries Everyplace classes. The example bridge trace class is `examples.mqbridge.awt.AwtBridgeTrace`. This class is automatically instantiated by the bridge administration GUI (see “The example administration GUI application”). Websphere MQ-bridge trace messages are supplied in several languages in `examples.mqbridge.trace`.

In addition, MQExceptions are logged to the `OutputStreamWriter` defined in `com.ibm.mq.MQException.log`. (System.err by default). Consult *MQSeries Using Java* for more information on initializing and configuring base Websphere MQ trace.

Administration of the Websphere MQ-bridge

This section contains information on the tasks associated with the administration of the Websphere MQ-bridge

The example administration GUI application

An example administration GUI is provided with the Websphere MQ-bridge. It is a subclass of the `examples.administration.console.Admin` example described in “Example administration console” on page 115.

The subclass is called `examples.mqbridge.administration.console.AdminGateway`.

Websphere MQ-bridge function cannot execute on a client queue manager, so using this class in conjunction with a client queue manager does not allow the administration of bridge objects on that client queue manager, but it does enable administration of a remote Websphere MQ-bridge-enabled server queue manager.

To administer an Websphere MQ-bridge that is attached to a local queue manager, use the example server program `<java> examples.mqbridge.awt.AwtMQBridgeServer <server_ini_file>` to start an MQSeries Everyplace server.

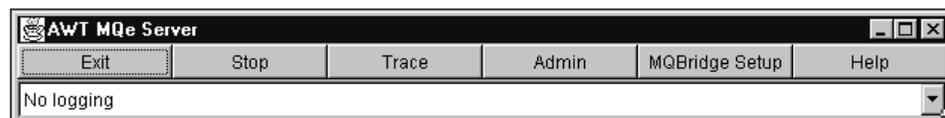


Figure 35. Websphere MQ-bridge administration GUI server window

From the server window either of the following options can be used:

- Click the **Admin** button to use the `examples.mqbridge.administration.console.AdminGateway` class to administer the local server queue manager, and its bridge objects.

- Click the **MQBridge Setup** button to invoke the `examples.mqbridge.setup.MQBridgeWizard` example class, as described in “Sample configuration tool” on page 134.

Both examples demonstrate how to programmatically manipulate Websphere MQ-bridge configuration objects using the bridge-specific administration message subclasses, `MQeMQBridgesAdminMsg`, `MQeMQBridgeAdminMsg`, `MQeMQMgrProxyAdminMsg`, `MQeClientConnectionAdminMsg`, `MQeListenerAdminMsg`, and `MQeMQBridgeQueueAdminMsg`.

Websphere MQ-bridge administration actions

Run state

Each administered object has a *run state*. This can be ‘running’ or ‘stopped’ indicating whether the administered object is active or not.

When an administered object is ‘stopped’, it cannot be used, but its configuration parameters can be queried or updated.

If the Websphere MQ-bridge queue references a bridge administered object that is ‘stopped’, it is unable to convey an MQSeries Everyplace message onto the Websphere MQ network until the bridge, Websphere MQ queue manager proxy, and client connection objects are all ‘started’.

The run state of administered objects can be changed using the **start** and **stop** actions from the `MQeMQBridgeAdminMsg`, `MQeMQMgrProxyAdminMsg`, `MQeClientConnectionAdminMsg` or `MQeListenerAdminMsg` administration message classes.

The actions supported by the Websphere MQ-bridge administration objects are described in the following sections.

Start action

An administrator can send a **start** action to any of the administered objects.

The *affect children* boolean flag affects the results of this action. The **start** action starts the administered object and all its children (and children’s children) if the *affect children* boolean field is in the message and is set to true. If the flag is not in the message or is set to false, only the administered object receiving the start action changes its run-state. For example, sending **start** to a bridge object with *affect children* as true causes all proxy, client connection, and listeners that are ancestors, to start. If *affect children* is not specified, only the bridge is started. An object cannot be started unless its parent object has already been started. Sending a start event to an administered object attempts to start all the objects higher in the hierarchy that are not already running.

Stop action

An administered object can be stopped by sending it a **stop** action. The receiving administered object always makes sure all the objects below it in the hierarchy are stopped before it is stopped itself.

Inquire action

The **inquire** action queries values from an administered object.

If the administered object is running, the values returned on the inquire are those that are currently in use. The values returned from a stopped object reflect any recent changes to values made by an **update** action. Thus, a sequence of **start**,

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update, **inquire**, returns the values configured *before* the update, while **start**, **update**, **stop**, **inquire**, returns the values configured *after* the update.

You may find it less confusing if you stop any administered object before updating variable values.

Update action

The **update** action changes one or more values for characteristics for an administered object. The values set by an **update** action do not become current until the administered object is next stopped. (See “Inquire action” on page 141.)

Delete action

The **delete** action permanently removes all current and persistent information about the administered object. The *affect children* boolean flag affects the outcome of this action. If the *affect children* flag is present and set to true the administered object receiving this action issues a **stop** action, and then a **delete** action to all the objects below it in the hierarchy, removing a whole piece of the hierarchy with one action. If the flag is not present, or it is set to false, the administered object deletes only itself, but this action cannot take place unless all the objects in the hierarchy below the current one have already been deleted.

Create action

The **create** action creates an administered object. The run state of the administered object created is initially set to stopped.

Websphere MQ-bridge considerations when shutting down a Websphere MQ queue manager

We recommend that before you stop a Websphere MQ queue manager, you issue a **stop** administration message to all the Websphere MQ queue-manager-proxy bridge objects. This stops the MQSeries Everyplace network from trying to use the Websphere MQ queue manager and possibly interfering with the shutdown of the Websphere MQ queue manager. (This can also be achieved by issuing a single **stop** administration message to the MQEbridges object.)

If you choose not to stop the Websphere MQ queue-manager-proxy bridge object before you shut the Websphere MQ queue manager, the behavior of the Websphere MQ shutdown and the Websphere MQ-bridge depends on the type of Websphere MQ queue manager shutdown you choose, immediate shutdown or controlled shutdown.

Immediate shutdown

Stopping a Websphere MQ queue manager using immediate shutdown severs any connections that the Websphere MQ-bridge has to the Websphere MQ queue manager (this applies to connections formed using the MQSeries Classes for Java in either the bindings or client mode). The Websphere MQ system shuts down as normal.

This causes all the Websphere MQ-bridge transmission queue listeners to stop immediately, each one warning that it has shut down due to the Websphere MQ queue manager stop.

Any Websphere MQ-bridge queues that are active retain a (broken) connection to the Websphere MQ queue manager until:

- The connection times-out, after being idle for an idle time-out period (as specified on the client-connection bridge object), at which point the broken connection is closed.

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- The WebSphere MQ-bridge queue is told to perform some action, such as put a message to WebSphere MQ, that attempts to use the broken connection. The `putMessage` operation fails and the broken connection is closed.

When an WebSphere MQ-bridge queue has no connection, the next operation on that queue causes a new connection to be obtained. If the WebSphere MQ queue manager is not available, the operation on the queue fails synchronously. If the WebSphere MQ queue manager has been restarted after the shutdown, and a queue operation, such as `putMessage`, acts on the bridge queue, then a new connection to the active WebSphere MQ queue manager is established, and the operation executes as expected.

Controlled shutdown

Stopping a WebSphere MQ queue manager using the controlled shutdown does not sever any connections immediately, but waits until all connections are closed (this applies to connections formed using the MQSeries Classes for Java in either the bindings or client mode). Any active WebSphere MQ-bridge transmission queue listeners notice that the WebSphere MQ system is quiescing, and stop with a relevant warning.

Any WebSphere MQ-bridge queues that are active retain a connection to the WebSphere MQ queue manager until:

- The connection times-out, after being idle for an idle time-out period (as specified on the client connection bridge object), at which point the broken connection is closed, and the controlled shutdown of the WebSphere MQ queue manager completes.
- The WebSphere MQ-bridge queue is told to perform some action, such as put a message to WebSphere MQ, that attempts to use the (broken) connection. The `putMessage` operation fails, the broken connection is closed, and the controlled shutdown of the WebSphere MQ queue manager completes.

The bridge client-connection object maintains a pool of connections, that are awaiting use. If there is no bridge activity, the pool retains WebSphere MQ client channel connections until the connection idle time exceeds the idle time-out period (as specified on the client connection object configuration), at which point the channels in the pool are closed.

When the last client channel connection to the WebSphere MQ queue manager is closed, the WebSphere MQ controlled shutdown completes.

Administered objects and their characteristics

This section describes the characteristics of the different types of administered objects associated with the MQSeries Everyplace WebSphere MQ-bridge. Characteristics are object attributes that can be queried using an `inquireAll()` administration message. The results can be read and used by the application, or they can be sent in an update or create administration message to set the values of the characteristics. Some characteristics can also be set using the create and update administration messages. Each characteristic has a unique label associated with it and this label is used to set and get the characteristic value.

The following lists show the attributes that apply to each administered object. The attributes are described in detail in alphabetical order in “Attribute details” on page 145. The label constants are defined in the class `com.ibm.mq.mqbridge.MQCharacteristicLabels`.

Characteristics of bridges objects

bridge administered objects

- Run-state
- Children
- Child

Characteristics of bridge objects

- Run-state
- Children
- Child
- AdministerObjectClass
- StartupRuleClass
- BridgeName
- HeartBeatInterval
- DefaultTransformer

Characteristics of Websphere MQ queue manager proxy objects

- Run-state
- Children
- Child
- AdministerObjectClass
- StartupRuleClass
- BridgeName
- MQQMgrProxyName
- HostName

Characteristics of client connection objects

- Run-state
- Children
- Child
- AdministerObjectClass
- StartupRuleClass
- BridgeName
- MQQMgrProxyName
- ClientConnectionName
- Port
- AdapterClass
- MQUserID
- MQPassword
- SendExit
- ReceiveExit
- SecurityExit
- CCSID
- SyncQName
- SyncQPurgerRulesClass
- MaxConnectionIdleTime
- SyncQPurgeInterval

Characteristics of Websphere MQ transmission queue listener objects

- Run-state

- Children
- Child
- AdministerObjectClass
- StartupRuleClass
- BridgeName
- MQMGrProxyName
- ClientConnectionName
- ListenerName
- DeadLetterQName
- ListenerStateStoreAdapter
- UndeliveredMessageRuleClass
- TransformerClass

Attribute details

AdapterClass

Type: Unicode

Label:

`com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_ADAPTER`

Valid actions

Inquire, create, update

Description

Either a Java class name, or an alias that can be resolved into a Java class name. The client connection uses this attribute to determine which class to use to manipulate the Websphere MQ system. Different versions of Websphere MQ may recognize different adapter classes.

If this attribute is not specified, a default value of `com.ibm.mqe.mqbridge.MQeMQAdapter` is used.

This parameter is not validated

AdministeredObjectClass

Type: Unicode

Label:

`com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_ADMINISTERED_OBJECT`

Valid actions

Inquire, create, update

Description

The name of a Java class, or an alias that resolves into a Java class name using the MQSeries Everyplaceclass aliasing technique. The '.class' extension is not required.

This attribute describes the Java class that is used to provide the function for the bridge administered object. The value set depends on the type of administered object being configured.

This field should not be set, or changed without detailed instructions from IBM staff.

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If this parameter is not specified when the object is created, it defaults to the following allowable values:

Object being configured	Value
A bridge object	com.ibm.mqe.mqbridge.MQeMQBridge
Websphere MQ queue manager proxy object	com.ibm.mqe.mqbridge.MQeMQQMGrProxy
Websphere MQ client connection object	com.ibm.mqe.mqbridge.MQeClientConnection
Websphere MQ transmission queue listener object	com.ibm.mqe.mqbridge.MQeListener

Valid characters are: "0-9" "A-Z" "a-z" - . % /

BridgeName

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_BRIDGE_NAME

Valid actions

Inquire, create, update, delete, start, stop

Description

If you use a symbolic name, it may take longer to detect that this machine is not switched on, or that the name server is not working. If this causes a problem, you can use the actual I/P address in this field instead.

Note: This characteristic can be set only once, with the **create** administration message. Thereafter it is used to identify which bridge administered object should be inquired on, updated, deleted, started, or stopped.

CCSID

Type: Int

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_CCSID

Valid actions

Inquire, create, update

Description

See the Websphere MQ Using Java documentation for a description of this parameter.

Valid values are: 0 to MAXINT. The default is 0.

Child

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_CHILD

Valid actions

Inquire

Description

A field containing the name of an Websphere MQ-bridge administered object.

Children

Type: MQeFields array

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_CHILDREN

Valid actions

Inquire

Description

An array of Child fields, each element containing a Child attribute.

ClientConnectionName

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_CLIENT_CONNECTION_NAME

Valid actions

Inquire, create, update, delete, start, stop

Description

Note: This characteristic can be set only once, with the **create** administration message. Thereafter it is used to identify which bridge administered object should be inquired on, updated, deleted, started, or stopped.

DeadLetterQName

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_DEAD_LETTER_Q_NAME

Valid actions

Inquire, create, update

Description

If the gateway finds it cannot deliver a message from Websphere MQ to MQSeries Everyplace, the message cannot be processed by the gateway, and it is placed on a dead letter queue on the Websphere MQ system. This parameter defines which queue the erroneous message is delivered to.

The default value is SYSTEM.DEAD.LETTER.QUEUE.

DefaultTransformer

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_DEFAULT_TRANSFORMER

Valid actions

Inquire, create, update

Description

The classname specified here is used as the default transformer

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class. When a message is sent from Websphere MQ to MQSeries Everyplace, the target queue may have a transformer class defined. If a transformer is not defined, this class is used to transform the Websphere MQ message into the MQSeries Everyplace format.

When a message is sent from MQSeries Everyplace to Websphere MQ, the transmission queue listener moving the message onto MQSeries Everyplace may have a transformer class defined. If a transformer is not defined, this class is used to transform the MQSeries Everyplace message into the Websphere MQ format.

No validation of the value in this field is performed.

The default value is `com.ibm.mqbridge.MQeBaseTransformer`

HeartBeatInterval

Type: Int

Label:

`com.ibm.mq.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_HEARTBEAT_INTERVAL`

Valid actions

Inquire, create, update

Description

A time interval, expressed in units of 1 minute, with values between 1 and 60. The bridge uses a *heartbeat* internally to provide a regular stimulus to other administered objects. The administered objects perform small tasks when the heartbeat event arrives, such as 'The client connection will reap old or stale Websphere MQ connections' or 'the sync queue will be purged'. The heartbeat provides an interval for the timers that is indivisible. The lower this value is set, the more accurate any timer related actions will be. For instance, if you say 'reap all Websphere MQ connections if they have been idle for more than 10 minutes', but set the heartbeat interval to 3 minutes, then an idle Websphere MQ connection is checked after 3,6,9 and 12 minutes, but is only reaped on the 12th minute. Setting this value lower increases the accuracy of the timer-related heartbeat events, but does so at the cost of efficiency. The more heartbeat events created, the more work is done.

The default value is 5 minutes.

Hostname

Type: Unicode

Label:

`com.ibm.mq.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_HOST_NAME`

Valid actions

Inquire, create, update

Description

Used to create connections to this Websphere MQ queue manager using the Websphere MQ Classes for Java. If this characteristic is not specified, the Websphere MQ queue manager is assumed to be on the same machine as the JVM, so the Java bindings mode is used to communicate with the Websphere MQ system.

Note: A blank value is *not* the same as specifying localhost. If a blank value is used, then the Websphere MQ-bridge uses the Websphere MQ Classes for Java in bindings mode which communicates directly with Websphere MQ. If you specify localhost, the Websphere MQ-bridge uses the Websphere MQ Classes for Java in client mode. This means that all communication with Websphere MQ is through the network (TCP/IP) stack.

The value specified here is not validated. If you use a symbolic name, it may take longer to detect that this machine is not switched on, or if the name server is not working. You can use the I/P address notation in this field if a symbolic name causes problems.

ListenerName

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQCharacteristicLabels.MQE_FIELD_LABEL_LISTENER_NAME

Valid actions

Inquire, create, update, delete, start, stop

Description

The name of this listener. The listener name is the name of the transmission queue on Websphere MQ that the listener takes messages from. The combination of *MQ_queue_manager_name* and *MQ_transmission_queue_name* pair must be unique across all the gateways that exist.

Note: This characteristic can be set only once, with the **create** administration message. Thereafter it is used to identify which Websphere MQ-bridge administered object should be inquired on, updated, deleted, started, or stopped.

ListenerStateStoreAdapter

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQCharacteristicLabels.MQE_FIELD_LABEL_LISTENER_STATE_STORE_ADAPTER

Valid actions

Inquire, create, update

Description

In order to provide assured message delivery of persistent messages, the listener class uses an adapter to store state information. This is the class name (or alias of the classname) of the adapter that is loaded to manage the storing and recovery of the state information to and from disk. Two adapters are currently supported- `com.ibm.mqe.adapters.MQeDiskFieldsAdapter` (which stores state information on the local file system) and `com.ibm.mqe.mqbridge.MQeMQAdapter` (which stores state information on the Websphere MQ server). The disk adapter is generally quicker than using the Websphere MQ-based adapter. The classname can be followed by a colon separated list of arguments, although only the `MQeDiskFieldsAdapter` uses them. In this case the `MQeDiskFieldsAdapter` can be followed by a colon

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and a fully qualified path name to a file that contains the state information. For example, in order to use the disk fields adapter to store the listener's state information in the file `c:\folder\state.sta`, the `listener-state-store-adapter` field should contain the value `com.ibm.mqe.Adapters.MQeDiskFieldsAdapter:c:\folder\state.sta`. A file specified by this parameter need not currently exist. If the supplied path name ends in a folder separator (for example. "\" in DOS) it is assumed that the supplied parameter is a directory, and a state file called `<ListenerName>-listener.sta` is created inside it (where `<ListenerName>` is the name of the listener, from the registry entry). If no path name is supplied, the listener uses a file called `<ListenerName>-listener.sta` inside the current Java working directory. If the `MQeMQAdapter` is being used, no additional arguments are required.

The default value of the `ListenerStateStoreAdapter` field is `com.ibm.mqe.Adapters.MQeDiskFieldsAdapter`.

MaxConnectionIdleTime

Type: Int

Label:

`com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_MAX_CONNECTION_IDLE_TIME`

Valid actions

Inquire, create, update

Description

Each client connection object in the bridge maintains a pool of Websphere MQ Java client connections to its Websphere MQ system.

When a Websphere MQ connection becomes idle through lack of use, a timer is started. If the timer reaches the current value of this parameter, then the idle connection is thrown away. This is known as *reaping* the connection. This saves resources when the connection is idle. The connection pool is an efficiency device that is used within the Websphere MQ-bridge. The creation of new Websphere MQ client connections is a resource intensive operation. If there are idle connections in the pool, one of these is reused, thus avoiding a creation operation. The higher the *MaxConnectionIdleTime* value, the more likely it is that an idle connection will be waiting in the pool, but idle client connections consume resources in the JVM. Setting this value lower, decreases the likelihood of an idle connection being available, but also decreases the number of idle connections, so less resources are consumed.

The time is expressed in units of 1 minute.

The Valid range: Between 0 and 720 (12 hours). The default is 5 (minutes).

Setting this value to 0 is not recommended as it effectively means 'don't use a connection pool', and whenever a Websphere MQ client connection is idle, it is reaped or discarded.

This time-out is only checked at the interval set by the *heartbeatInterval* parameter.

MaxConnectionIdleTime can have a direct effect on the length of time it takes to shut down an MQSeries Everyplace system. See

“Websphere MQ-bridge considerations when shutting down a Websphere MQ queue manager” on page 142 for more details.

MQPassword

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_PASSWORD

Valid actions

Inquire, create, update

Description

Used by the MQSeries Classes for Java. If this attribute is not specified, the password field on the Websphere MQ calls is set to "" . The value you specify here overrides any defaults. This parameter is not validated.

MQMgrProxyName

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_MQ_Q_MGR_PROXY_NAME

Valid actions

Inquire, create, update, delete, start, stop

Description

The name of the queue manager proxy object. (In other words, the name of the target Websphere MQ queue manager.)

Note: This characteristic can be set only once, with the **create** administration message. Thereafter it is used to identify which bridge administered object should be inquired on, updated, deleted, started, or stopped.

MQUserID

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_USER_ID

Valid actions

Inquire, create, update

Description

Used by the MQSeries Classes for Java. If this parameter is not specified, the user-id field on the Websphere MQ calls is set to "" . The value you specify here overrides any defaults. This parameter is not validated.

Port

Type: Int

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_PORT

Valid actions

Inquire, create, update

bridge administered objects

Description

Used to create connections to this Websphere MQ queue manager using the Websphere MQ Classes for Java. If this parameter is not specified, the Websphere MQ queue manager is assumed to be on the same machine as the JVM. In this case, the bindings mode of the Websphere MQ Classes for Java is used to communicate with the Websphere MQ system.

Valid range 0 to MAXINT.

ReceiveExit

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_RECEIVE_EXIT

Valid actions

Inquire, create, update

Description

Used to match the exit used at the other end of the Client channel.

This parameter is not validated.

Run-state

Type: Int

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_RUN_STATE

Valid actions

Inquire

Description

Indicates whether the administered object is running (value=1), or stopped (value=0). When an object is stopped it can have its properties changed.

SecurityExit

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_SECURITY_EXIT

Valid actions

Inquire, create, update

Description

Used to match the exit used at the other end of the Client channel.

This parameter is not validated.

SendExit

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_SEND_EXIT

Valid actions

Inquire, create, update

Description

Used to match the exit used at the other end of the Client channel.
This parameter is not validated.

StartupRuleClass

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_STARTUP_RULE_CLASS

Valid actions

Inquire, create, update

Description

This is a rule class that is used when the administered object is loaded at system startup, or when the object is created. The rule class name is not validated.

The rule class dictates whether the administered object is started, and whether or not its children are started. The default rule is com.ibm.mqe.mqbridge.MQeStartupRule This default causes the administered object and all its parents to start. If this field is set to "" (blank) , the administered object is not started. See "MQeStartupRule" on page 164

SyncQName

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_SYNC_Q_NAME

Valid actions

Inquire, create, update

Description

The name of the sync queue on the Websphere MQ queue manager that is used by the Websphere MQ-bridge . Valid characters forming the name are: "0-9" "A-Z" "a-z" _ . % / .The sync queue is a Websphere MQ queue that is used to keep track of which messages are in the process of moving from MQSeries Everyplace to Websphere MQ. If a message is part way through the logic that assures the once-only delivery of a message, there is another message on the sync queue, indicating how far through the logic the message has progressed. If the MQSeries Everyplace system is shut down cleanly, the sync queue should be empty. If the connection between the systems is broken, some persistent state information is left in the sync queue. The MQSeries Everyplace system uses this information when it restarts and continues from where the process failed. The name of the sync queue can be the same for client connections on the same bridge, or on different bridges, providing the send, receive and security exits used when talking to that sync queue are the same. The sync queues must exist on the Websphere MQ queue manager for MQSeries Everyplace to Websphere MQ message transfer to work. If the listener state class is the MQeMQAdapter, this sync queue is also used for storing persistent state information about the listeners. The listener does not use this parameter if the state information is being stored by an MQeDiskFieldsAdapter. We recommended a

bridge administered objects

naming scheme of: MQE.SYNCQ.<ClientConnectionName> so that you know which client connection is using which sync queue.

The default is MQE.SYNCQ.DEFAULT.

SyncQPurgeInterval

Type: int

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_SYNC_Q_PURGE_INTERVAL

Valid actions

Inquire, create, update

Description

The time interval between successive purges of the sync queue, expressed in minutes.

When this interval elapses, the sync queue is scanned. If a message that has not been confirmed is found on the Sync queue, then the SyncQPurgerRules class is invoked to deal with this situation.

Zero indicates that the sync queue should never be purged.

The default is 60 minutes.

The actual granularity of the purging operation is dictated by the heartbeat-interval of the owning bridge definition. For example: If the heartbeat interval is set to 10 minutes, but the purge interval is set to 9 minutes, then the purge operation occurs after 10 minutes. If, however, the purge interval is changed to 11 minutes, the purge operation still occurs after 10 minutes.

SyncQPurgerRulesClass

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_SYNC_Q_PURGER_RULES_CLASS

Valid actions

Inquire, create, update

Description

The name of the rules class used when a message on the sync queue indicates a failure of MQSeries Everyplace to confirm a message.

The default is a classname that just reports the condition in the MQSeries Everyplace trace.

This parameter is not validated.

TransformerClass

Type: Unicode

Label:

com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_TRANSFORMER

Valid actions

Inquire, create, update

Description

This is the name of the Java class that is used to convert the

Websphere MQ message into an MQSeries Everyplace message. When a message is taken from Websphere MQ by the listener, it is transformed into an MQSeries Everyplace format message using the specified transformer. If the transformer class is specified as null or a blank string, then the *DefaultTransformer* parameter provided on the bridge configuration parameters is used as the transformer. If the default is also set to null or blank, messages cannot be transferred.

The default value is ""

See "Transformers" on page 158 for more details.

UndeliveredMessageRuleClass

Type: Unicode

Label:

`com.ibm.mqe.mqbridge.MQeCharacteristicLabels.MQE_FIELD_LABEL_UNDELIVERED_MESSAGE_RULE_class`

Valid actions

Inquire, create, update

Description

The name of the MQeUndeliveredMessageRule class. When a message moving from Websphere MQ to MQSeries Everyplace cannot be delivered, this rule class is consulted to decide what action the listener should take. The rule tells the listener to wait and retry, shut down, or deal with the message as defined in the MQMessage report options.

The default value is:

`com.ibm.mqe.mqbridge.MQeUndeliveredMessageRule`. See "MQeUndeliveredMessageRule" on page 163.

How to send a message from Websphere MQ to MQSeries Everyplace

There are many ways of arranging your routing on the Websphere MQ system to test the transmission of a message. One method is to use the bridge setup wizard (as described in "The example administration GUI application" on page 140) to define queue manager aliases for each MQSeries Everyplace queue manager that the bridge knows about. This document describes how to use the resultant configuration to send a message to the MQSeries Everyplace queue.

1. Select the Websphere MQ First Steps program from the Websphere MQ Client v 5.1
2. Select the **API exerciser** from the 'First Steps' screen
3. In the 'API Exerciser Queue Managers' screen:
 - Select the Websphere MQ queue manager to which the bridge is connected. (The example is called MQA)
 - Check the **Advanced mode** checkbox
 - Click the **MQCONN** button
 - Select the **Queues** tab to display the 'Queues' screen
 - Select **MQOPEN** to display the 'MQOPEN Selectable Options' screen
4. In the 'MQOPEN Selectable Options' screen:
 - Make sure that **MQOO_INPUT_AS_Q_DEF** is *not* selected
 - Make sure that **MQO_OUTPUT** is selected

sending a message across the bridge

- Fill in the **ObjectName** field with the name of the queue that you wish the message to go to on the MQSeries Everyplace queue manager. (The example is called Q1)
 - Fill in the **ObjectQMGrName** field with the name of the MQSeries Everyplace queue manager that you wish the message to go to. (The example is called ExampleQM)
 - Click **OK** to open a route to the queue.
5. In the 'API Exerciser Queues' screen:
 - Click the **MQPUT** button to display the 'MQPUT -Argument Options' screen
 6. In the 'MQPUT - Argument Options' screen:
 - Type in your message
 - Click **OK** to send the message to Q1 on ExampleQM on the MQSeries Everyplace system

Handling undeliverable messages

The Websphere MQ-bridge's transmission queue listener acts in a similar way to a Websphere MQ channel, pulling messages from a Websphere MQ transmission queue, and delivering them to the MQSeries Everyplace network. It follows the MQSeries Everyplace convention in that if a message cannot be delivered, an *undelivered message rule* is consulted to determine how the transmission queue listener should react. If the rule indicates the report options in the message header, and these indicate that the message should be put onto a dead-letter queue, the message is placed on the Websphere MQ queue (on the *sending* queue manager).

Putting messages to the Websphere MQ-bridge queue

If an application uses **putMessage()**, specifying that a **confirmputMessage()** should not be used to confirm this message, the Websphere MQ-bridge does not use assured delivery logic to pass the message to Websphere MQ. It does a simple **MQPut** to the target Websphere MQ queue. If there is a failure anywhere along the message route, the application is unable to determine whether the message has been sent or not. If the application decides to resend the message, it is possible for two identical messages to arrive on the Websphere MQ queue.

To avoid this problem, the application programmer should use a combination of **putMessage()** and **confirmputMessage()** calls. Using **putMessage()** with the *confirm* parameter set to true causes the Websphere MQ-bridge to use assured delivery logic to put the message to the Websphere MQ system.

If any component of the path between the Websphere MQ system and the sending application fails, the application is unable to determine whether the message got to its destination or not. In this case, the application should put the original message again, with a boolean MQeField added. For example:

```
msg.putBoolean( MQe.Qos_Retry)
```

This indicates that this message has been sent in the past. The Websphere MQ-bridge uses its assured delivery logic to assure that only one of the two **putMessage()** calls actually put a message to Websphere MQ.

If the **putMessage()** is used, with or without the *confirm* flag set, and a successful return code is received, the application can be sure that the message has been passed to the Websphere MQ queue.

bridge - putMessage considerations

If the **putMessage()** is used, with the *confirm* flag set, the Websphere MQ-bridge retains some information about the message (on its sync queue) that enables it to prevent duplicate messages being sent by the application. The Websphere MQ-bridge can only prevent duplicate messages being sent if the *Qos_Retry* parameter is set. The **confirmputMessage()** removes the message history from the Websphere MQ-bridge sync queue.

The following procedure causes four messages to arrive on the target Websphere MQ queue.

- | | | |
|-----|---------------------------------------|--|
| | create a new message | |
| (1) | <code>putMessage(Confirm=Yes)</code> | - Causes the message to be delivered to Websphere MQ, but some note made on the sync queue. |
| | set the retry bit on the message | |
| | <code>putMessage(Confirm=Yes)</code> | - Suppressed, as the message is already noted in the sync queue. |
| | <code>putMessage(Confirm=Yes)</code> | - Suppressed, as the message is already noted in the sync queue. |
| (2) | <code>putMessage(Confirm=No)</code> | - <i>not</i> suppressed. The message is delivered to the Websphere MQ queue. |
| | remove the retry bit from the message | |
| (3) | <code>putMessage(Confirm=Yes)</code> | - Causes the message to be sent to Websphere MQ. The retry bit was not set, so the Websphere MQ-bridge did not look at its sync queue. |
| | <code>ConfirmputMessage()</code> | - Causes the Websphere MQ-bridge to clear its memory of the message. |
| | set the retry bit on the message | |
| (4) | <code>putMessage()</code> | - Causes the message to be sent. |

Getting and browsing messages from the Websphere MQ-bridge queue

As with other MQSeries Everyplace queues, it is possible to get and browse messages from Websphere MQ-bridge queues. It is also possible to specify an MQFields filter on these operations. If a filter is used, the first message matching the filter is returned by **getMessage()** and all messages matching the filter are returned by **browseMessages**.

When browsing messages, if the filter field is blank or null, all messages are collected from the Websphere MQ queue and are placed in the returning enumeration. If the filter is non-blank and non-null, all messages collected from the Websphere MQ queue are passed through the queue's message transformer before being matched against the filter. Matching messages are placed in the returning enumeration.

If the filter field contains one or both of *Msg_MsgID* and *Msg_CorrelId*, messages are collected from the Websphere MQ queue using one or both of the Websphere MQ *Msg_MsgID* and *Msg_CorrelId* as filter elements. The results are then transformed into MQSeries Everyplace messages which are filtered as follows:

1. The original filter is applied as the default match criteria and any matching messages are placed in the returning enumeration.

bridge - getMessage considerations

2. If any transformed MQSeries Everyplace messages do not contain the *Msg_MsgID* field, the *Msg_MsgID* field is removed from the filter.
3. If any transformed MQSeries Everyplace message do not contain the *Msg_CorrelId* field, the *Msg_CorrelId* field is removed from the filter.
4. The unmatched *MQSeries Everyplace* messages are then filtered using the new filter, and matching messages are placed into the returning enumeration.

Note that using a blank or null filter, or a filter that contains neither the *Msg_MsgID* field nor the *Msg_CorrelId* field causes all messages on the Websphere MQ queue to be browsed. To optimize performance, try to include in the filter one or both of the expected *Message Id* or *CorrelId* as it exists in Websphere MQ format.

Filters on **getMessage** work in a similar way to filters on **browseMessages**, except that only the first match is removed from the Websphere MQ queue and returned to the application.

Usage restrictions

There are some restrictions on the use of **getMessage** and **browseMessages** with Websphere MQ-bridge queues:

- It is not possible to get or browse messages from Websphere MQ-bridge queues that point to Websphere MQ remote queue definitions.
- You cannot use a nonzero *Confirm ID* on Websphere MQ-bridge queue gets. This means that the **getMessage** operation on Websphere MQ-bridge queues does not provide assured delivery. If you need a get operation to be assured, you should use transmission-queue listeners to transfer messages from Websphere MQ.
- Because messages originating from Websphere MQ do not contain unique identifiers, it is not possible to browse messages using the *justUID* flag set to true (this would normally return a list of the unique message identifiers that matched the browse).
- The **browseMessagesAndLock()** method is not supported.

Transformers

A transformer is a Java class that is capable of converting between the different message formats used by MQSeries Everyplace and Websphere MQ. Transformers are derived from the *MQeBaseTransformer* class.

The transformer can be specified in several ways during the Websphere MQ-bridge configuration.

- A Default transformer can be specified for each Websphere MQ-bridge
- A transformer can be specified for each Websphere MQ-bridge queue
- A transformer can be specified for each Websphere MQ transmission queue listener

The transformer is responsible for all aspects of message conversion and must provide a method of converting between the Websphere MQ and MQSeries Everyplace message format that you want to use. This means that whenever you create a new format for messages that flow between Websphere MQ and MQSeries Everyplace, you need to create or modify a transformer class for the new message format.

These changes can be handled in a variety of ways:

- Write a single transformer that can convert all your message formats.

This could be implemented using the inheritance model of Java, where one transformer inherits from another, which inherits from another thus forming a chain of transformers. Alternatively, it could be implemented as a single Java class.

Positive aspects of this approach are:

- This transformer can be specified as the default for the Websphere MQ-bridge. This requires only one point of configuration to determine the transformer to use for all operations. (Leave the transformer name blank or null on the Websphere MQ-transmission-queue-listener and the Websphere MQ-bridge queue definitions.)
- This a very simple approach

Negative aspects of this approach are:

- When formats of an application change, or when a new format is invented, this large transformer has to be changed and redeployed everywhere.
- It may not be possible to create one transformer that understands all the message formats in your system.
- Write a series of medium-sized transformers, each being capable of understanding and transforming various groups of message formats. Each transformer may be responsible for working with a specific application and the MQSeries Everyplace routing may be set up such that each application has exclusive use of a set of Websphere MQ bridge queues, and Websphere MQ-transmission-queue-listeners. The transformer name on the Websphere MQ-bridge queues and transmission-queue-listeners are then set to be application-specific.

Positive aspects of this approach are:

- The programmer has complete control of where messages are routed, and can make sure that the correct transformer is used.
- The approach is simple
- If you add or change a message format the transformer only need to be changed along the path that the changed or new message formats can flow
- Write a separate transformer for every message format in your system. This requires that a higher-level transformer is created that uses a list of these very small transformers, invoking each in turn until the a transformer that can use the message is found.(See "The examples.mqbridge.transformers.MQeListTransformer example transformer class" on page 160.)

Each transformer has knowledge of a single message format.

Care must be taken with each message format, and transformer to make sure each small transformer is able to uniquely identify the format of the messages that it transforms. Do not allow an instance of a message to be transformable by more than one transformer. Each transformer must be able to examine each message to determine whether the message is in the format that the transformer was designed to work on.

Various list transformers may be used at different points in the Websphere MQ-bridge configuration. At the most basic level, create a list transformer with a list of all the small transformers available, and set this to be the default. At the most complex level, create a list transformer with a very small list of transformers, and set the Websphere MQ-bridge queue and Websphere MQ-transmission-queue-listener transformer parameters.

The list transformer may obtain its list from any of the following:

transformers

- A hard-coded literal string constants within the Java source code itself
- The system environment variables of the JVM
- The underlying operating system environment
- An ASCII data file that is loaded when the list transformer class is loaded
- By looking at which transformer classes are available in the file system when it is loaded

The choice of methods is left to the application programmer. The example list transformer uses the method of hard-coding the transformer list in its Java source code.

Positive aspects of this approach

- This approach is more object oriented, allowing the knowledge about a particular message format to be completely encapsulated within a single small transformer, while the list transformer only understands which transformers are available.
- Adding a new small transformer need not cause a list transformer to change. For example, if the list transformer looks at the file system to see which transformers are available, then simply adding the transformer to the correct location in the file system may be enough to cause the transformer to be used.
- Use a mixture of all of the above methods.

Note: If the transformer returns an MQSeries Everyplace-format message containing either the *Msg_CorrelID* or *Msg_MsgID* fields, their contents must be an exact match with the original Websphere MQ-style message. This rule is enforced by the Websphere MQ-bridge queue. Failure to comply with this guideline results in the returned MQSeries Everyplace messages being invisible to the browsing application.

The examples.mqbridge.transformers.MQeListTransformer example transformer class

This example transformer demonstrates how a higher-level transformer class can use a list of transformers to perform message transformation, without itself having any knowledge of the format of the message.

The source file is `examples\mqbridge\transformers\MQeListTransformer.java` and is a simple Websphere MQ to MQSeries Everyplace transformer class.

This transformer does not understand the format of any messages that are passed to it. It contains an ordered list of small transformers. When a message needs to be transformed, this class works through its list of transformers one by one, presenting the message to each transformer. The results of the first transformer to successfully return a converted message are returned to the user of this class.

This style of transformer can be used in conjunctions with a collection of small transformers, each of which understands a limited number of message formats.

This class keeps its list of transformers in a static ordered list (array).

To use the example, write a series of small transformers, and put their class names into the static list at the top of the example file. Compile, and set the modified example transformer into the required places in the Websphere MQ-bridge configuration (see “Configuring a basic installation” on page 131).

If the transformer develops an MQSeries Everyplace format message containing either the *Msg_CorrelID* or *Msg_MsgID* fields, their contents should match with the *Message ID* and *Correlation ID* of the original Websphere MQ-style message. Failure to follow this guideline means that when an application browses a bridge queue with a filter containing either the *Msg_CorrelID* or *Msg_MsgID*, the transformed message is not visible to the browsing application.

Websphere MQ-style messages

MQeMQMMsgObject is a subclass of MQeMsgObject that supports Websphere MQ-style messages within MQSeries Everyplace. It is typically used to exchange messages with Websphere MQ applications using the default transformer in the Websphere MQ-bridge. The default transformer generates an MQeMQMMsgObject when it receives a standard Websphere MQ message. Similarly, if an MQSeries Everyplace application generates an MQeMQMMsgObject and sends it to Websphere MQ, the default transformer in the bridge knows how to transform it into a standard Websphere MQ message.

If the MQeMQMMsgObject class does not meet your requirements, you can write a transformer for the bridge that uses another type of message object more suited to your application.

Reading a Websphere MQ -style message

When an application receives a message, it can check whether the message belongs to the MQeMQMMsgObject class as follows:

```
import com.ibm.mqe.mqemqmessage.MQeMQMMsgObject;
...
MQeMsgObject msg = MyQM.getMessage(qmgr, queue, null, null, 0);
if (msg instanceof MQeMQMMsgObject)
{
    MQeMQMMsgObject mqeMsg = (MQeMQMMsgObject) msg;
    ...
}
```

If the message does belong to this class, by using the appropriate **get** methods on the message object, all the information from the Websphere MQ message header can be accessed as well as the message data . The header information can be obtained using methods of the form **getxxx()** where *xxx* is the name of the header field. For consistency, the names and types of the header fields follow those of the Websphere MQ Classes for Java. The application data is obtained using the **getData()** method.

```
import com.ibm.mqe.mqemqmessage.MQeMQMMsgObject;
...
if (msg instanceof MQeMQMMsgObject)
{
    MQeMQMMsgObject mqeMsg = (MQeMQMMsgObject) msg;
    String replyQMgr = mqeMsg.getReplyToQueueManagerName();
    String replyQueue = mqeMsg.getReplyToQueueName();
    byte [] correlId = mqeMsg.getCorrelationId();
    String msgFormat = mqeMsg.getFormat();
    ...
    byte [] data = mqeMsg.getData();
    ...
}
```

The data can then be processed by the application. The MQeMQMMsgObject returns the data as a byte array, and the application must understand the structure of the data within the byte array. If the data is required in a more structured format, you can write your own transformer that understands the application data and transforms it into the required format.

Websphere MQ-style messages

Creating a Websphere MQ -style message

To create a Websphere MQ -style message that is understood by the default transformer, create a new MQeMQMsgObject and set the required values for the header fields and data. Send the message in the normal way.

To create a new message object invoke the constructor, which has no parameters.

```
import com.ibm.mqe.mqemqmessage.MQeMQMsgObject;
...
try
{
    MQeMQMsgObject mqeMsg = new MQeMQMsgObject()
    ...
}
```

Set the Websphere MQ header information in the message using methods of the form **setxxx()** where *xxx* is the name of the header field. For consistency, the names and types of the header fields follow those of the Websphere MQ Classes for Java. Any header fields that are not set explicitly assume their Websphere MQ default values.

The application data is set using the **setData()** method.

```
import com.ibm.mqe.mqemqmessage.MQeMQMsgObject;
...
try
{
    MQeMQMsgObject mqeMsg = new MQeMQMsgObject()
    mqeMsg.setPutApplicationName("myApp");
    mqeMsg.setFormat(...);
    mqeMsg.setData(...);
    MyQM.putMessage(qmgr, queue, mqeMsg, null, 0);
}
```

Before it is passed to **setData()**, the data must be formatted into a byte array that the receiving application understands.

Transformers and expiry time considerations

Special care needs to be taken when converting the expiry times between Websphere MQ and MQSeries Everyplace.

MQSeries Everyplace expiry times are specified as either an explicit time after which the message expires, or a delta in units of 1 millisecond of how long after the message creation time the message will expire.

Websphere MQ units are in tenths of a second.

Failure to convert these expiry times in your transformer can result in messages expiring, and apparently being "lost".

Websphere MQ-bridge rules

The Websphere MQ-bridge uses the following rule classes which can be used to alter the behavior of the bridge.

MQeLoadBridgeRule

This rule class decides which bridges can be loaded when the server starts up.

MQeUndeliveredMessageRule

This rule class decides how to handle a Websphere MQ message that cannot be put to MQSeries Everyplace

MQeSyncQueuePurgerRule

This rule class decides on the action to take against old unconfirmed MQSeries Everyplace to Websphere MQ messages

MQeStartupRule

This rule class decides whether an administered object should be started when it is first loaded

These classes are described in more detail in the following sections. As a programmer, you can subclass these rules classes to create rules to alter the behavior of MQSeries Everyplace. You can then change your MQSeries Everyplace configuration to use your rule classes instead of the default rule classes.

MQeLoadBridgeRule

This class defines which bridge objects can be loaded when the server starts up. When the server uses the **MQeMQBridge.activate()** method, the bridge loader starts up. The bridge loader reads all entries in the registry and for each name of a bridge in the registry, it asks this rules class whether that bridge name should be loaded or not. The basic MQeLoadBridgeRule class allows all bridges in the registry to be loaded. This is acceptable as long as the registry is used by a single MQSeries Everyplace queue manager.

If the registry is shared by two or more MQSeries Everyplace queue managers they could each try to load the same bridge object, which is not valid. The first server to start up is given access to all the bridges and their queue managers and queues, locking out all subsequent servers. For this reason, it is desirable to select the bridges that should be loaded by each server, by writing a customized version of the MQeLoadBridgeRule. Using a naming convention for the bridges that has some correspondence to the servers that need to load them, simplifies the writing of the customized rule.

The class `examples.mqbridge.rules.ExampleLoadBridgeRule` demonstrates how a naming convention can be applied to bridge objects, and used in conjunction with a LoadBridgeRule, can be used to dictate which bridges may be loaded by the server.

MQeUndeliveredMessageRule

MQeUndeliveredMessageRule

A bridge may have a number of Websphere MQ transmission queue listener objects defined, and running, each moving a series of messages from a Websphere MQ transmission queue onto the MQSeries Everyplace network.

When a Websphere MQ message cannot be delivered to the MQSeries Everyplace network, the transmission queue listener thread invokes the **permit** method to consult the UndeliveredMessageRule class in the listener's configuration parameters. The return value from this method determines what action should be taken.

- If the result is the `MQeUndeliveredMessageRule.STOP_LISTENER` value, the listener should stop if the message is undeliverable. The message remains on the transmission queue on the Websphere MQ system.

bridge rules

- If the result is the `MQeUndeliveredMessageRule.USE_MQ_REPORT_OPTIONS` value, the *report* field of the original Websphere MQ message determines whether the message should be discarded or moved to the dead letter queue on the MQSeries Everyplace system. The name of the Websphere MQ queue managers' dead-letter-queue is a configuration parameter on the transmission queue listener of the Websphere MQ-bridge. If this value is returned, and the message *report* options contain `MQRO_DISCARD`, the undelivered message is discarded.
- If the result is an integer, with a value greater than "0", the value returned is number of seconds for which the listener should wait before retrying the Websphere MQ to MQSeries Everyplace transfer operation.

If the value returned is none of the above, or if the rule throws an exception, then the listener acts as if the `STOP_LISTENER` result was returned.

The `examples.mqbridge.rules.MQeUndeliveredMessageRule` class shows the behavior of the default rule used by the Websphere MQ-bridge configuration: When called, it returns values on successive failures to create the following behavior:

- Waits 5 second between retries for the first minute
- Waits 10 seconds between retries for the second minute
- Waits 60 seconds between retries for the third to ninth minute inclusive
- `STOP_LISTENER` is applied after retries have failed for 10 minutes

`examples.mqbridge.rules.UndeliveredMQMessageToDLQRule` is another example class used to tailor the transmission queue listener behavior. The value of `MQeUndeliveredMessageRule.USE_MQ_REPORT_OPTIONS` is always returned by the `permit()` method.

MQeSyncQueuePurgerRule

The *sync queue* is a locally defined queue on the Websphere MQ queue manager. This queue is used exclusively by the Websphere MQ-bridge and is used to assist assured message delivery. For MQSeries Everyplace messages bound for Websphere MQ it contains one record for each unconfirmed message. Over time, on an unstable system, unconfirmed message records can build up on the sync queue resulting in a degradation of Websphere MQ-bridge performance.

At an interval specified by the client-connection's *sync queue purge interval* parameter, the client connection's defined sync queue purger rule class is invoked for each old unconfirmed message record. This rule is asked to return a Boolean `true` if the supplied message can be deleted or `false` if it should remain. The administrator can also use this rule to perform other actions, such as issue an alert and take appropriate action if a message has not been confirmed after a certain length of time.

See the `examples.mqbridge.rules.MQeSyncQueuePurgerRules` for more information.

Note: If the sync queue is being used to store the Websphere MQ transmission queue listener state messages, these messages are not affected by this rule.

MQeStartupRule

When a bridge, proxy, client connection, or listener object is loaded, at server startup, this rule class is consulted for each administered object to see whether it should be started, or left in the stopped state. This rule also determines whether the administered object's children should be started or not.

The return value from the `MQStartupRule.permit(...)` method dictates whether the administered object is started or not. Possible return values, and their effects are :

START_NOTHING

Do not start this administered object. This has the same effect as sending the administered object a **stop** administration message.

START_PARENTS_AND_ME

Start this administered object, and all its parents. This has the same effect as sending the administered object a **start** message, with the *affect-children* flag value of false.

START_PARENTS_AND_ME_AND_CHILDREN

Start this administered objects, all its parents, and all its children. This has the same effect as sending the administered object a **start** message, with the *affect-children* flag value of true.

As the returned value can be controlled by applications, you could, implement an intelligent rule. Such a rule could, for example, only starts a Websphere MQ transmission queue listener if the Websphere MQ system it wants to connect to is active.

The `com.ibm.mqe.mqbridge.MQStartupRule` used in the default configuration for all administered objects, is similar to the `examples.mqbridge.rules.MQStartupRule` class (for which the source code is provided). These classes always return the `START_PARENTS_AND_ME` value.

National language support implications

This section describes how the Websphere MQ-bridge handles messages flowing between MQSeries systems that use different national languages. The diagram in Figure 36 is used to describe the flow of a message from an MQSeries Everyplace client application to a Websphere MQ application.

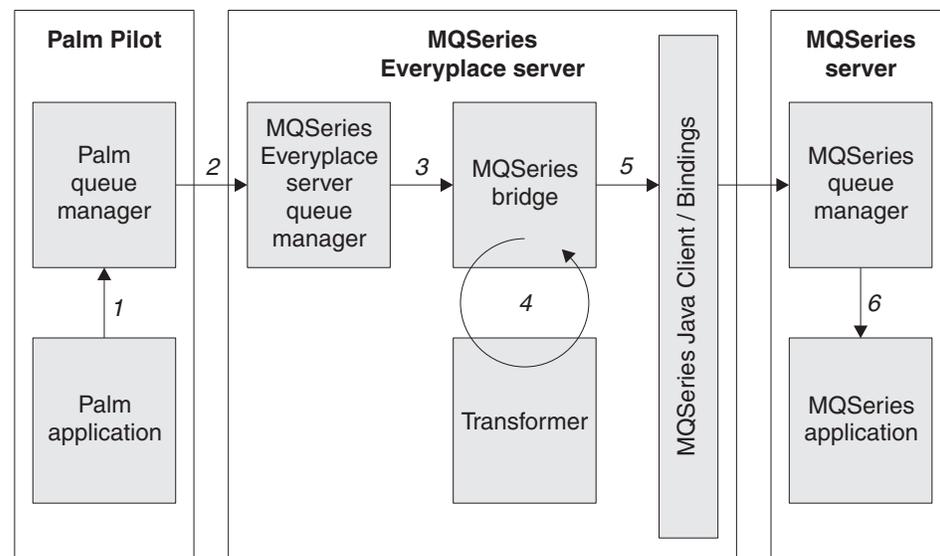


Figure 36. Message flow from MQSeries Everyplace to Websphere MQ

1. Client application

bridge - national language considerations

- a. The client application builds an MQSeries Everyplace message object containing the following data:

A Unicode field

This string is generated using appropriate libraries available on the client machine (if C/C++ is being used).

A byte field

This field should never be translated

An ascii field

This string has a very limited range of valid characters, conforming to the ASCII standard. The only valid characters are those that are invariant over all ASCII codepages.

- b. The message is put to the Palm queue manager. No translation is done during this put.

2. Client queue manager puts to the server queue manager

The message is not translated at all through this step.

3. MQSeries Everyplace server puts the message onto the Websphere MQ-bridge queue

The message is not translated at all through this step.

4. Websphere MQ-bridge passes the MQSeries Everyplace message to the user-written transformer

The transformer creates a Websphere MQ message as follows:

- The Unicode field in the MQSeries Everyplace message is retrieved using:
`String value = MQemsg.GetUnicode(fieldName)`
- The retrieved value is copied to the Websphere MQ message using **MQmsg.writeChars(value)**
- The byte field in the MQSeries Everyplace message is retrieved using:
`Byte value = MQemsg.getByte(fieldName)`
- The retrieved value is copied to the Websphere MQ message using **MQmsg.writeByte(value)**
- The ascii field in the MQSeries Everyplace message is retrieved using either **MQmsg.writeChars(value)** to create a unicode value, or **MQmsg.writeString(value)** to create a code-set-dependent value, in the Websphere MQ message.

If using **writeString()**, the character set of the string may also be set. The transformer returns the resultant Websphere MQ message to the calling Websphere MQ-bridge code.

5. The Websphere MQ-bridge passes the message to Websphere MQ using the Websphere MQ Classes for Java

Unicode values in the Websphere MQ message are translated from big-endian to little-endian, and vice-versa, as required. Byte values in the Websphere MQ message are translated from big-endian to little-endian, and vice-versa, as required. The field that was created using **writeString()** is translated as the message is put to Websphere MQ, using conversion routines inside the Websphere MQ Classes for Java. ASCII data should remain ASCII data regardless of the character set conversions performed. The translations done during this step depend on the code page of the message, the CCSID of the sending Websphere MQ Classes for Java client connection, and the CCSID of the receiving Websphere MQ server connection channel.

6. The message is got by a Websphere MQ application

bridge - national language considerations

If the message contains a unicode string, the application must deal with that string as a unicode string, or else convert it into some other format (UTF8 for example). If the message contains a byte string, the application may use the bytes as-is. (raw data). If the message contains a string, it is read from the message, and may be converted to a different data format as required by the application. This conversion is dependent on the codeset value in the *characterSet* header field. Java classes provide this automatically.

Conclusion

If you have an MQSeries Everyplace application, and wish to convey character-related data from MQSeries Everyplace to Websphere MQ, your choice of method is determined largely by the data you wish to convey:

- **If your data contains characters in the variant ranges of the ASCII character codepages**, (the character for a codepoint changes as you change between the various ASCII codepages) then you can use either **putUnicode** (which is never subject to translation between codepages), or **putArrayOfByte** (in which case you have to handle the translation between the sender's codepage and the receiver's codepage).

Note: *DO NOT USE putAscii()* as the characters in the variant parts of the ASCII codepages are subject to translation.

- **If your data contains only characters in the invariant ranges of the ASCII character codepages**, then you can use **putUnicode** (which is never subject to translation between codepages) or **putAscii** (which is never subject to translation between codepages, as all your data lies within the invariant range of the ASCII codepages).

Example files

See "Chapter 2. Getting Started" on page 11 for information about example files that show how to write and use MQSeries Everyplace programs that support Websphere MQ-bridge functionality.

Chapter 8. Security

This section contains information about the security function provided by MQSeries Everyplace. The different levels of security are described together with typical usage scenarios and usage guidance.

Security features

MQSeries Everyplace provides an integrated set of security features that enable the protection of data when held locally and when it is being transferred. There are three different categories of security:

Local security

Local security provides protection for any MQSeries Everyplace data.

Queue-based security

Queue-based security automatically protects MQSeries Everyplace message data between the initiating queue manager and queue, on the queue, and between the queue and the receiving queue manager. This protection is independent of whether the target queue is owned by a local or a remote queue manager.

Message-level security

Message-level security provides protection for message data between an initiating and receiving MQSeries Everyplace application.

Queue based security is handled internally by MQSeries Everyplace and does not require any specific action by the initiator or recipient of the message. Local and Message-level security must be initiated by an application.

All three categories protect Message data by the application of an MQeAttribute (or a descendent). Depending on the category, the attribute is either explicitly or implicitly applied.

Every attribute can contain any or all of the following objects:

- Authenticator
- Cryptor
- Compressor
- Key
- Target Entity Name

The way these objects are used depends on the category of MQSeries Everyplace security. Each category of security is described in detail later in this chapter.

MQSeries Everyplace also provides the following services to assist with security:

Private registry services

MQSeries Everyplace private registry provides a repository in which public and private objects can be stored. It provides (login) PIN protected access so that access to a private registry is restricted to the authorized user. It also provides additional services so that functions can use the entity's private key, (for digital signature, and RSA decryption) without the private credentials leaving the PrivateRegistry instance.

These services are used by queue-based security and message-level security using MQeTrustAttribute.

security features

Public registry services

MQSeries Everyplace public registry provides a publicly accessible repository for mini-certificates.

These services can be used by queue-based and message-level security.

Mini-certificate issuance service

MQSeries Everyplace includes a default *mini-certificate issuance service* that can be configured to issue mini-certificates to a carefully controlled set of entity names.

These services can be used by queue-based and message-level security.

These services are described in more detail later in the chapter.

Local security

Local security provides protection for MQSeries Everyplace data (MQeFields) objects, including message (MQeMsgObject) objects. The protected data is returned in a byte array. To apply local security to a data object you must:

1. Create an attribute with an appropriate authenticator, cryptor, and compressor
2. Set up an appropriate *key* (by providing a password or passphrase seed)
3. Explicitly attach the key to the attribute, the attribute to the data (MQeFields) object, and invoke the **dump()** method on the data object

The authenticator determines how access to the data is controlled. The cryptor determines the cryptographic strength protecting the data confidentiality. The compressor determines the storage required by the message.

MQSeries Everyplace provides the MQeLocalSecure class to assist with the use of local security. However, it is the responsibility of the local security user to setup an appropriate attribute and provide the password or passphrase key. MQeLocalSecure provides the function to protect the data and to save and restore it from backing storage. If an application chooses to attach an attribute to a message without using MQeLocalSecure, it also needs to save the data after using **dump** and must retrieve the data before using **restore**.

Usage scenario

Consider a scenario where mobile agents working on many different customer sites want to ensure that the confidential data of one customer is not accidentally shared with another. Local security features, using different keys, and possibly different cryptographic strengths, provide a simple method for protecting different customer data held on a single machine .

A simple extension of this scenario could be that the protected local data is accessed using a key that is pulled from a secure queue on an MQSeries Everyplace server node. The agents client has to authenticate itself to access the server queue and pull the local key data, but never knows the actual key.

One of the advantages of taking this approach is that an audit trail is easily accumulated for all access to customer specific data.

Secure feature choices

When using MQeLocalSecure, the following attribute choices are available:

Authenticator

Example NTAAuthenticator or UserIdAuthenticator

Cryptor

One of the symmetric cryptors MQeDESCryptor, MQe3DESCryptor, MQeRC4Cryptor, MQeRC6Cryptor or MQeMARSCryptor

Compressor

MQeLZWCompressor, MQeRleCompressor, or MQeGZIPCompressor

Selection criteria

You should use an authenticator if you need to provide additional controls to prevent access to the local data by unauthorized users. In some ways using an authenticator is unnecessary since providing the key password or passphrase automatically limits access to those who know this secret.

The choice of cryptor is driven by the strength of protection required. The stronger the encryption, the more difficulty an attacker would face when trying to get illegal access to the data. Data protected with symmetric ciphers that use 128 bit keys is acknowledged as more difficult to attack than data protected using ciphers that use shorter keys. However, in addition to cryptographic strength, the selection of a cryptor may also be driven by many other factors. An example is that some financial solutions require the use of triple DES in order to get audit approval.

You should use a compressor if you need to optimize the size of the protected data. However, the effectiveness of the compressor depends on the content of the data. The MQeRleCompressor performs run length encoding . This means that the compressor routines compress or expand repeated bytes. Hence it is effective in compressing and decompressing data with many repeated bytes. MQeLZWCompressor uses the LZW scheme. The simplest form of the LZW algorithm uses a dictionary data structure in which various words (data patterns) are stored against different codes. This compressor is likely to be most effective where the data has a significant number of repeating words (data patterns). The MQeGZIPCompressor uses the same compression algorithm as the **gzip** command on UNIX. This searches for repeating patterns in the data and replaces subsequent occurrences of a pattern with a reference back to the first occurrence of the pattern.

Usage guide

1. The following code protects an MQeFields object using MQeLocalSecure

```
try
{
.../*SIMPLE PROTECT FRAGMENT */
.../*instantiate a DES cryptor */
MQeDESCryptor desC =new MQeDESCryptor();
.../*instantiate an Attribute using the DES cryptor */
MQeAttribute attr =new MQeAttribute(null,desC,null);
.../*instantiate a base Key object */
MQeKey localkey =new MQeKey();
.../*set the base Key object local key */
localkey.setLocalKey("my secret key");
.../*attach the key to the attribute */
attr.setKey(localkey);
/*instantiate a MQeFields object */
MQeFields myData =new MQeFields();
/*attach the attribute to the data object */
myData.setAttribute(attr);
/*add some test data */
myData.putAscii("testdata","0123456789abcdef...");
trace ("i:test data in =" +myData.getAscii("testdata"));
/*encode the data */
byte []protectedData =myData.dump();
trace ("i:protected test data =" +MQe.byteToAscii(protectedData));
}
```

local security

```
catch (Exception e )
{
    e.printStackTrace();/*show exception */
}
try
{
    .../* SIMPLE UNPROTECT FRAGMENT */
    .../* instantiate a DES cryptor */
    MQeDESCryptor des2C = new MQeDESCryptor( );
    .../* instantiate an attribute using the DES cryptor */
    MQeAttribute des2A = new MQeAttribute( null, des2C, null);
    .../* instantiate a (a helper) LocalSecure object */
    MQeLocalSecure ls2 = new MQeLocalSecure( );
    .../* open LocalSecure obj identifying target file and directory */
    ls2.open( ".\\", "TestSecureData.txt" );
    .../* use LocalSecure read to restore from target and decode data*/
    String outData = MQe.byteToAscii( ls2.read( desA2,
                                           "It_is_a_secret" ) );
    .../* show results.... */
    trace ( "i: test data out = " + outData);
    ...
}
catch ( Exception e )
{
    e.printStackTrace(); /* show exception */
}
```

2. The following code protects an MQeMsgObject locally without using MQeLocalSecure.

```
try
{
    .../*SIMPLE PROTECT FRAGMENT */
    .../*instantiate a DES cryptor */
    MQeDESCryptor desC = new MQeDESCryptor();
    .../*instantiate an Attribute using the DES cryptor */
    MQeAttribute attr = new MQeAttribute(null,desC,null);
    .../*instantiate a base Key object */
    MQeKey localkey = new MQeKey();
    .../*set the base Key object local key */
    localkey.setLocalKey("my secret key");
    .../*attach the key to the attribute */
    attr.setKey(localkey);
    /*instantiate an MQeFields object */
    MQeFields myData = new MQeFields();
    /*attach the attribute to the data object */
    myData.setAttribute(attr);
    /*add some test data */
    myData.putAscii("testdata", "0123456789abcdef....");
    trace ("i:test data in = " + myData.getAscii("testdata"));
    /*encode the data */
    byte [] protectedData = myData.dump();
    trace ("i:protected test data = " + MQe.byteToAscii(protectedData));
}
catch (Exception e )
{
    e.printStackTrace(); /*show exception */
}

try
{
    .../*SIMPLE UNPROTECT FRAGMENT */
    .../*instantiate a DES cryptor */
    MQeDESCryptor desC2 = new MQeDESCryptor();
    .../*instantiate an Attribute using the DES cryptor */
    MQeAttribute attr2 = new MQeAttribute(null,desC2,null);
    .../*instantiate a base Key object */
```

```

MQeKey localkey2 = new MQeKey();
.../*set the base Key object local key */
localkey2.setLocalKey("my secret key");
.../*attach the key to the attribute */
attr2.setKey(localkey2 );
/*instantiate a new data object */
MQeFields myData2 = new MQeFields();
/*attach the attribute to the data object */
myData2.setAttribute(attr2 );
/*decode the data */
myData2.restore(protectedData );
/*show the unprotected test data */
trace ("i:test data out = " + myData2.getAscii("testdata"));
}
catch (Exception e )
{
    e.printStackTrace(); /*show exception */
}

```

Queue-based security

Queue-based security automatically protects MQSeries Everyplace message data between the initiating queue manager and the queue, on the queue itself, and between the queue and the receiving queue manager. This form of protection requires the target queue to be defined with an attribute. This protection is independent of whether the queue is owned by a local or a remote queue manager.

A simple example of this is a target queue defined with an attribute that has an NTAAuthenticator, an MQe3DESCryptor and an MQeRleCompressor. When such a target queue is accessed (either locally or remotely), using **putMessage**, **getMessage** or **browseMessages**, the queue attribute is automatically applied. In this example the application initiating the access has to satisfy the requirements of the NTAAuthenticator before the operation is permitted. If the operation is permitted, the message data is automatically encoded and decoded using the attribute's MQe3DESCryptor and MQeRleCompressor. When the example target queue is remotely accessed, for example using **putMessage**, queue-based security automatically ensures that the message data is protected at the level defined by the queue attribute. This protection applies during transfer between the initiating queue manager and the queue, while the message is stored on the queue, and during transfer between the queue and the receiving queue manager.

Queue-based security and asynchronous queues

With synchronous queues, queue-based security is relatively simple. In this case a message is put to a synchronous remote queue definition that has the same security attributes as the destination queue. The message is transmitted over a channel with appropriate security attributes and is stored on the secure queue.

With asynchronous queues, especially Store-and-forward queues and Home-server queues, the transmitting and receiving queues are more likely to have different security attributes. These differences have to be managed during message transfer.

Once a message has been put to an asynchronous queue it is transmitted from one queue to another until it reaches its destination. A queue manager is responsible for requesting the transfer of the message between a pair of queues and another queue manager is responsible for responding to the request.

If queue based security is used, the requesting queue manager tries to establish a channel with security attributes that match the queue that it owns. The queue

queue-based security

manager receiving the request checks that the existing attributes are sufficient for its queue. For example, suppose a client queue manager has a queue with a DES cryptor on it and messages are routed from this to a server's Store-and-forward queue that has a MARS cryptor. When the client is triggered to send a message it tries to establish a DES encrypted channel to the server; the server asks the Store-and-forward queue whether it will accept messages over a DES encrypted channel.

If a queue doesn't have any attribute rules, it only accepts a channel that has exactly the same cryptor as itself. This behavior can be overridden by attribute rules and by default queues use `examples.rules.AttributeRules`. These default rules group cryptors into four strengths:

1. No cryptor
2. XOR cryptor
3. DES cryptor
4. All the other cryptors (triple DES, MARS, RC4, RC6)

Using these rules, a queue accepts messages from a channel if the cryptor on the channel is at least as strong as its own cryptor:

- A queue with no cryptor accepts messages from any channel
- A queue with an XOR cryptor accepts messages from a channel with any cryptor (but not a channel with no cryptor)
- A queue with a DES cryptor accepts messages from a channel with a DES, triple DES, MARS, RC4 or RC6 cryptor
- A queue with a triple DES, MARS, RC4 or RC6 cryptor accepts messages from a channel with any of triple DES, MARS, RC4 or RC6 cryptor

In the previous example, if the Store-and-forward queue used these rules it would not accept a DES encrypted channel because DES is not as strong as its own MARS cryptor, it would throw an "attribute mismatch" exception.

A Home-server queue trying to pull messages from a Store-and-forward queue needs a cryptor that is at least as strong as that on the Store-and-forward queue, because the Home-server queue is at the initiating end of the request. Once the Home-server queue has received the message it can store it on a local queue that has any level of protection.

This behavior can be changed by using different attribute rules on the queues. The `equals()` method is used to compare the cryptors, so if the attribute rule has an `equals()` method that always returns true, the queue accepts channels with any cryptor.

Trying to send a message from a queue with a weaker cryptor to a queue with a stronger cryptor usually results in an "attribute mismatch" exception. However if a channel with a strong cryptor already exists between the queue managers, this can be reused (depending on the attribute rules on the channel) and result in the message being delivered.

Usage scenario

MQSeries Everyplace queue-based security can be used whenever you need to protect the confidentiality of message data being transferred between queue managers.

A typical scenario could be a service that is delivered over an open network, like the internet, where an initiating application makes requests, using a queue manager on a client, to access a service provided by a server queue manager application.

This can be implemented as follows:

1. The initiating client queue manager application encapsulates the request in an MQSeries Everyplace message
2. **putMessage** is used to transfer the message to a queue called XXX_service_request on a remote server
3. A queue manager application on the server is setup to listen for messages on the XXX_service_request queue
4. When a message event occurs, a **getMessage** is performed, to get the service request message
5. The request is processed (for example by invocation of a CICS transaction on a back-end system)
6. The response (transaction result) is encapsulated in a message
7. **putMessage** is used to return the response to a queue called XXX_service_reply on the initiating client queue manager.
8. **waitForMessage** is used on the initiating queue manager to wait for a reply message to arrive in the local queue called XXX_service_reply

One way to support this simple example would be to define the following queues:

Owned by the initiating client queue manager (ClientQMgr for example)

- TestClient_HomeServerQ
- XXX_service_reply

While a number of choices exist, setting the TestClient_HomeServerQ *TimerInterval* option, to 5000 for example, sets a 5sec poll interval and triggers the client queue manager to poll the server queue manager. This poll 'pulls' any messages on the server queue manager's store-and-forward queue that have been directed to the client queue manager. Also, before running any client queue manager application, the *AddQueueManager* option must be used to add a reference to the server queue manager.

Owned by the server queue manager (ServerQMgr for example)

- TestServer_StoreAndForwardQ
- XXX_service_request

Defining the TestServer_StoreAndForwardQ for use in this scenario requires two steps.

1. Create the queue
2. setAction *MqStoreAndForwardQueueAdminMsg.Action_AddQueueManager*, with name ClientQMgr

Secure feature choices

When using queue-based security all the choices for attribute are available:

Authenticator

NTAuthenticator or UserIdAuthenticator (or other descendant of examples.attributes.LogonAuthenticator), or MQeWTLSCertAuthenticator

queue-based security

Cryptor

MQeXORCryptor or one of the symmetric cryptors MQeDESCryptor, MQe3DESCryptor, MQeRC4Cryptor, MQeRC6Cryptor, or MQeMARSCryptor

Compressor

MQeLZWCompressor, MQeRleCompressor, or MQeGZIPCompressor

Selection criteria

Queue-based security is appropriate for solutions designed to use synchronous queues. In this case, the selection criteria is really concerned with the selection of the (synchronous) queue attribute's authenticator, cryptor and compressor.

The option to use an Authenticator is driven by the need to provide additional controls to prevent access to the local data by unauthorized users. This is equally relevant when the queue data is accessed locally or remotely.

Using a descendant of LogonAuthenticator (NTAuthenticator or UserIdAuthenticator), when the attribute is activated, for example when an application is performing a **putMessage()**, **getMessage()** or **browseMessages()** of data on the queue, the requirements of the authenticator have to be satisfied before the operation is permitted. In the queue-based "Usage scenario" on page 174, if the `XXX_service_request` queue is defined with an attribute including the NTAuthenticator, then access to the server `XXX_service_request` queue (for example when attempting to **putMessage()** requests to this queue from a client queue manager), is restricted to the set of users defined as valid NT users in the target server's domain. The NTAuthenticator is provided as an example, enabling descendants that enable a finer granularity of control to smaller sets of users to be easily created.

Using MQeWTLSCertAuthenticator ensures that all remote accesses to a queue protected with an attribute using this authenticator have completed mutual authentication before the operation can be executed. The mutual authentication of the mini-certificates exchanged consists of each participant validating the mini-certificate it receives. This validation checks the mini-certificate received is a valid signed entity, signed by the same mini-certificate server as the requestor's own mini-certificate, and that it is valid with respect to date, that is the current date is not prior to its from-date or after its to-date. An administration option enables the solution creator to choose whether a target queue manager queue has its own credentials (that it is an authenticatable entity in its own right, with its own mini-certificate and associated private key) or shares the credentials of its owning queue manager. In the queue-based "Usage scenario" on page 174, if the `XXX_service_request` queue is defined with an attribute containing the MQeWTLSCertAuthenticator, then access to the server `XXX_service_request` queue, for example when the initiating client queue manager application performs a remote **putMessage()**, depends on the credentials of the initiating client queue manager and the target `XXX_service_request` queue being successfully mutually authenticated.

The choice of cryptor is driven by the strength of protection required, that is, the degree of difficulty that an attacker would face when cryptographically attacking the protected data to get illegal access. Data protected with symmetric ciphers which use 128 bit keys is acknowledged as being more difficult to attack than data protected using ciphers that use shorter keys. But in addition to cryptographic strength, the selection of a cipher may also be driven by many other factors. An example of this is some financial solutions require the use of triple DES in order to get audit approval.

The option to use a compressor is driven by the need to optimize the size of the protected data. However, the effectiveness of the compressor depends on the content of the data. The MQeRleCompressor performs run length encoding ; that is, the compressor routines compress and/or expand repeated bytes. Hence it is effective in compressing/decompressing data with many repeated bytes. MQeLZWCompressor uses the LZW scheme. The simplest form of the LZW algorithm uses a dictionary data structure in which various words (data patterns) are stored against different codes. This compressor is likely to be most effective where the data has a significant number of repeating words (data patterns).

Usage guide

To use queue base security, the queue manager that owns the queue must have a private registry. If the MQeWTLSAuthenticator is used, the registry must also have its own credentials, which it obtains by auto-registering with the mini-certificate server. In the following example the credentials process is enabled by adding information to the Registry Section of the queue manager's configuration (.ini) file. If the MQeWTLSAuthenticator is not used, a private registry is still required but it does not have to register with the mini-certificate server to obtain credentials

The following code fragments provide an example of how to create queue manager instances and define the queues identified for the queue-based scenario described in "Usage scenario" on page 174. Fragments for the client queue manager initiating application and server queue manager AppRunList started application are also provided.

Using SimpleCreateQM to create ClientQMgr and ServerQMgr instances

Note: This example program requires the *PIN*, the *Certificate-request PIN*, and the *Key Ring Password* to be stored in the configuration file. This is convenient for an example but is not recommended for a production system. Care should be taken to prevent the unauthorized disclosure of PINs and passwords.

SimpleCreateQM assists users to create queue manager instances that have private registries. The class uses parameters found in the Registry Section of MQePrivateClient1.ini and MQePrivateServer1.ini.

The particular instances can be created as follows:

1. Reset the private registry related parameters in the registry section of MQePrivateClient1.ini and MQePrivateServer1.ini from their defaults to a desired setting:

```
(ascii)LocalRegType=PrivateRegistry
(ascii)DirName=.\MQeNode_PrivateRegistry
(ascii)PIN=12345678
  < change PIN from '12345678' to the PIN to be provided subsequently at
    queue manager start-up time to enable the queue manager to access its
    own private registry >
```

Include the next three keywords (*CertReqPIN*, *KeyRingPassword* and *CAIPAddrPort* only if MQeWTLSAuthenticator is to be used:

```
(ascii)CertReqPIN=12345678
  < change CertReqPIN from '12345678' to a new value that matches the value set by
    Mini Certificate Server's Administrator when the queuemanager instance is defined >
(ascii)KeyRingPassword=It_is_a_secret
  < change the KeyRingPassword from 'It_is_a_secret' to the password that
```

queue-based security

```
to be subsequently provided at queuemanager start-up time to enable
the queuemanager instance to access its protected private credentials
within its Private Registry. >
(ascii)CAIPAddrPort=9.20.X.YYY:8082
< change this to the IP address and port of the solution's
MiniCertificateServer.>
```

2. If the last three keywords are supplied auto-registration is triggered, so, before adding the queue manager instances it is necessary to start the MiniCertificateServerGUI, and, using 'administration' mode, to define the queue manager instances (ClientQMgr and ServerQMgr) as valid authenticatable entities with their certificate request PIN set to the same value as that defined in the registry section CertReqPIN= line in the MQePrivateClient1.ini and MQePrivateServer1.in files in the previous step.
3. Start a MiniCertificateServerGUI instance and select 'server' mode.
4. Run the TestCreate program (shown in the following code fragment) to create the queue manager instances.

```
import com.ibm.mqe.*;
import examples.trace.*;
import examples.install.*;

public class TestCreate extends MQe
{
    public void createQMs()
    {
        try
        {
            /* start trace */
            MQeTrace trace = new MQeTrace("TestCreate...", null );

            /* create the client queue manager */
            String fs = java.io.File.separator;
            String INI_FileName = "MQePrivateClient1.ini";
            String QueueDir = "." + fs + "ClientQMgr" + fs + "Queues";
            SimpleCreateQM c_QMgr = new SimpleCreateQM();
            if ( c_QMgr.createQMgr(INI_FileName, QueueDir) )
                trace (">>>>ClientQMgr created OK...");
            else
                trace (">>>>error creating ClientQMgr...");

            /* create the server queue manager */
            INI_FileName = "MQePrivateServer1.ini";
            QueueDir = "." + fs + "ServerQMgr" + fs + "Queues";
            SimpleCreateQM s_QMgr = new SimpleCreateQM();
            if ( s_QMgr.createQMgr(INI_FileName, QueueDir) )
                trace (">>>>ServerQMgr created OK...");
            else
                trace (">>>>error creating ServerQMgr...");
        }
        catch (Exception e)
        {
            trace (">>>>SimpleCreateQM exception = " + e.getMessage());
            e.printStackTrace();
        }
    }

    public static void main(String args [])
    {
        TestCreate testc = new TestCreate();
        testc.createQMs();
    }
}
```

Defining the queues identified for the queue-based scenario described above

There are several ways to add queue definitions to a queue manager instance. The method described here starts the queue manager instance locally, adds the new queue definitions by creating the relevant administration messages and sending them to the queue manager's own administration queue, and then waits for confirmation of success in an AdminReply queue.

ClientQMGr queues -adding TestClient_HomeServerQ:

Start the ClientQMGr locally using the MQePrivateClient class, (using a different version, MQePrivateClient2.ini, that deliberately does not hold hard coded values for *PIN*, *KeyRingPassword*, and *CertReqPIN*) then create and use administration messages to add the queue and set the poll interval.

```
{
    try
    {
        /* start the ClientQMGr */
        MQePrivateClient newC = new MQePrivateClient("../MQePrivateClient2.ini",
"12345678", /* PIN */
"It_is_a_secret", /* KeyRingPwd */
null );
        MQeQueueManager newQM = newC.queueManager;
        String QMgrName = newQM.getName(); /* should be "ClientQMGr" */

        /* before we can add the Home Server Queue we must have a
        * connection definition for the target queue manager
        */

        /* define some of the values we need for the connection ... */
        /* ... the name of the connection */
        String ConName = "ServerQMGr";
        /* ... the channel type */
        String channel = "DefaultChannel";

        /* create an Admin msg to add the connection */
        MQeConnectionAdminMsg conMsg = new MQeConnectionAdminMsg();
        conMsg.setName(ConName);
        conMsg.setTargetQMGr(QMgrName);
        conMsg.putInt(MQe.Msg_Style, MQe.Msg_Style_Request);
        conMsg.putAscii(MQe.Msg_ReplyToQ, MQe.Admin_Reply_Queue_Name);
        conMsg.putAscii(MQe.Msg_ReplyToQMGr, QMgrName );
        conMsg.putArrayOfByte(MQe.Msg_CorrelID,
Long.toHexString(newQM.uniqueValue()).getBytes());

        conMsg.create("FastNetwork:localhost:8082", /* adapter */
            null, /* parameters */
            null, /* options */
            channel, /* channel */
            "Connection to ServerQMGr"); /* description */

        /* use the CorrelID to create a filter for the reply message */
        MQeFields replyFilter = new MQeFields();
        replyFilter.putArrayOfByte(MQe.Msg_CorrelID,
conMsg.getArrayOfByte(MQe.Msg_CorrelID ));

        /* send the Admin msg */
        trace(">>>putting Admin Msg to QM/queue:" + QMgrName + "/" +
MQe.Admin_Queue_Name);
        newQM.putMessage(QMgrName, MQe.Admin_Queue_Name, conMsg, null, 0);

        /* get the Admin Reply msg */
        MQeAdminMsg respMsg = null;
        trace(">>>Waiting for a response to create connection Admin Msg...");
    }
}
```

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```
    respMsg = (MQeAdminMsg)newQM.waitForMessage(QMgrName,
MQe.Admin_Reply_Queue_Name,
replyFilter, null, 0, 3000);
    trace(">>>Admin Msg processed OK...");

    /* process Admin Reply msg ...*/
    if (respMsg == null)
        trace ("i:create Connection failed,no response message received");
    else
    {
        if (respMsg.getRC() == MQeAdminMsg.RC_Success)
            trace("i:create added Connection OK...");
        else
            trace("i:create Connection failed: " + respMsg.getReason());
    }

    /* add the Home Server Queue
    */

    /* define some of the values we need for the Home Server queue ... */
    /* ... the name of the queue */
    String QName = "TestClient_HomeServerQ";
    /* ... the name of the queue manager it will collect messages from */
    String targetQMName = "ServerQMGr";
    /* ... the cryptor to protect the queue */
    String cryptorType = new MQe3DESCryptor().type();
    /* ... the file descriptor */
    String FileDesc = "MsgLog.";

    /* create an Admin msg to add HomeServerQ */
    MQeHomeServerQueueAdminMsg msg =
    new MQeHomeServerQueueAdminMsg(targetQMName, QName);
    msg.setTargetQMGr(QMgrName);
    msg.putInt(MQe.Msg_Style, MQe.Msg_Style_Request);
    msg.putAscii(MQe.Msg_ReplyToQ, MQe.Admin_Reply_Queue_Name);
    msg.putAscii(MQe.Msg_ReplyToQMGr, QMgrName );
    msg.putArrayOfByte(MQe.Msg_CorrelID,
Long.toHexString(newQM.uniqueValue()).getBytes());
    /* ... define parameter values for the queue */
    MQeFields parms = new MQeFields();
    parms.putUnicode(msg.Queue_Description, "Q-based scenario Q");
    parms.putLong(msg.Queue_QTimerInterval, 5000 );
    parms.putAscii(msg.Queue_FileDesc, FileDesc );
    parms.putAscii(msg.Queue_Cryptor, cryptorType);
    parms.putAscii(msg.Queue_AttrRule, "examples.rules.AttributeRule");

    msg.create(parms );

    /* use the CorrelID to create a filter for the reply message */
    replyFilter = new MQeFields();
    replyFilter.putArrayOfByte(MQe.Msg_CorrelID,
msg.getArrayOfByte(MQe.Msg_CorrelID ));

    /* send the Admin msg */
    trace(">>>putting Admin Msg to QM/queue:" + QMgrName + "/" +
MQe.Admin_Queue_Name);
    newQM.putMessage(QMgrName, MQe.Admin_Queue_Name, msg, null, 0);

    /* get the Admin Reply msg */
    trace(">>>Waiting for a response to create Admin Msg...");
    respMsg = (MQeAdminMsg)newQM.waitForMessage(QMgrName,
MQe.Admin_Reply_Queue_Name,
replyFilter, null, 0, 3000);
    trace(">>>Admin Msg processed OK...");

    /* process Admin Reply msg */
    if (respMsg == null )
```

```

        trace ("i:create Queue failed,no response message received");
    else
    {
        if (respMsg.getRC() == MqeAdminMsg.RC_Success)
            trace("i:create Queue added queue OK...");
        else
            trace("i:create Queue failed:"+respMsg.getReason());
    }
    newQM.close();
}
catch (Exception e )
{
    trace (">>>>add HomeServerQ exception = " + e.getMessage());
    e.printStackTrace();
}
}
}

```

ClientQMgr queues -adding XXX_service_reply queue: Start the ClientQMgr locally using the MqePrivateClient class, (using a different version, MqePrivateClient2.ini, that deliberately does not hold hard coded values for *PIN*, *KeyRingPassword* and *CertReqPIN*) then create and use an administration messages to add the queue.

```

{
    try
    {
        /* start the ClientQMgr */
        MqePrivateClient newC = new MqePrivateClient("../MqePrivateClient2.ini",
"12345678", /* PIN */
"It_is_a_secret", /* KeyRingPwd */
null );
        MqeQueueManager newQM = newC.queueManager();
        String QMgrName = newQM.getName(); /* should be "ClientQMgr" */

        /* define some of the values we need for the queue ... */
        /* ... the name of the queue */
        String QName = "XXX_service_reply";
        /* ... the cryptor to protect the queue */
        String cryptorType = new Mqe3DESCryptor().type();
        /* ... the file descriptor */
        String FileDesc = "MsgLog:.";

        /* create an Admin msg to add XXX_service_reply queue */
        MqeQueueAdminMsg msg = new MqeQueueAdminMsg();
        msg.setTargetQMgr(QMgrName );
        msg.setName(QMgrName, QName );
        msg.putInt(Mqe.Msg_Style, Mqe.Msg_Style_Request );
        msg.putAscii(Mqe.Msg_ReplyToQ, Mqe.Admin_Reply_Queue_Name);
        msg.putAscii(Mqe.Msg_ReplyToQMgr, QMgrName );
        msg.putArrayOfByte(Mqe.Msg_CorrelID,
Long.toHexString(newQM.uniqueValue()).getBytes());

        /* ... define parameter values for the queue */
        MqeFields parms =new MqeFields();
        parms.putUnicode(msg.Queue_Description,"Q-based scenario Q");
        parms.putAscii(msg.Queue_FileDesc, FileDesc );
        parms.putAscii(msg.Queue_Cryptor, cryptorType);
        parms.putAscii(msg.Queue_AttrRule, "examples.rules.AttributeRule");

        msg.create(parms );

        /* use the CorrelID to create a filter for the reply message */
        MqeFields replyFilter = new MqeFields();
        replyFilter.putArrayOfByte(Mqe.Msg_CorrelID,
msg.getArrayOfByte(Mqe.Msg_CorrelID ));

        /* send the Admin msg */
    }
}

```

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```
        trace(">>>putting Admin Msg to QM/queue:" + QMgrName + "/" +
MQe.Admin_Queue_Name);
        newQM.putMessage(QMgrName, MQe.Admin_Queue_Name, msg, null, 0);

        /* get the Admin Reply msg */
        MQeAdminMsg respMsg = null;
        trace(">>>Waiting for a response to create Admin Msg...");
        respMsg = (MQeAdminMsg)newQM.waitForMessage(QMgrName,
MQe.Admin_Reply_Queue_Name,
replyFilter, null, 0, 3000);
        trace(">>>Admin Msg processed OK...");

        /* process Admin Reply msg */
        if (respMsg == null )
            trace ("i:create Queue failed,no response message received");
        else
        {
            if (respMsg.getRC() == MQeAdminMsg.RC_Success)
                trace("i:create Queue added queue OK...");
            else
                trace("i:create Queue failed: " + respMsg.getReason());
        }
        newQM.close();
    }
    catch (Exception e )
    {
        trace (">>>add XXX_service_reply Q excep = " + e.getMessage());
        e.printStackTrace();
    }
}
```

ServerQMgr queues -adding TestServer_StoreAndForwardQ: Start the ServerQMgr locally using the MQePrivateClient class, (using a different version, MQePrivateServer2.ini, that deliberately does not hold hard coded values for *PIN*, *KeyRingPassword* and *CertReqPIN*), create and use an administration messages to add the queue, and then add a remote queue manager reference.

```
{
    try
    {
        /* start ServerQMgr locally as a client */
        MQePrivateClient newC = new MQePrivateClient("./MQePrivateServer2.ini",
"12345678", /* PIN */
"It_is_a_secret", /* KeyRingPwd */
null );
        MQeQueueManager newQM = newC.queueManager;
        String QMgrName = newQM.getName(); /* should be "ServerQMgr" */

        /* define some of the values we need for the Store and Forward queue ... */
        /* ... the name of the queue */
        String QName = "TestServer_StoreAndForwardQ";
        /* ... the cryptor to protect the queue */
        String cryptorType = new MQe3DESCryptor().type();
        /* ... the file descriptor */
        String FileDesc = "MsgLog.";

        /* create an Admin msg to add StoreAndForwardQ */
        MQeStoreAndForwardQueueAdminMsg msg =
new MQeStoreAndForwardQueueAdminMsg();
        msg.setTargetQMgr(QMgrName );
        msg.setName(QMgrName, QName );
        msg.putInt(MQe.Msg_Style, MQe.Msg_Style_Request );
        msg.putAscii(MQe.Msg_ReplyToQ, MQe.Admin_Reply_Queue_Name);
        msg.putAscii(MQe.Msg_ReplyToQMgr, QMgrName );
        msg.putArrayOfByte(MQe.Msg_CorrelID,
Long.toHexString(newQM.uniqueValue()).getBytes());
    }
}
```

```

/* ... define parameter values for the queue */
MQeFields parms =new MQeFields();
parms.putUnicode(msg.Queue_Description,"Q-based scenario Q");
parms.putAscii(msg.Queue_QMgrName, QMgrName );
parms.putAscii(msg.Queue_FileDesc, FileDesc );
parms.putAscii(msg.Queue_Cryptor, cryptorType);
parms.putAscii(msg.Queue_AttrRule, "examples.rules.AttributeRule");

msg.create(parms );

/* use the CorrelID to create a filter for the reply message */
MQeFields replyFilter = new MQeFields();
replyFilter.putArrayOfByte(MQe.Msg_CorrelID,
msg.getArrayOfByte(MQe.Msg_CorrelID ));

/* send the Admin msg */
trace(">>>putting Admin Msg to QM/queue:" + QMgrName + "/" +
MQe.Admin_Queue_Name);
newQM.putMessage(QMgrName, MQe.Admin_Queue_Name, msg, null, 0);

/* get the Admin Reply msg */
MQeAdminMsg respMsg = null;
trace(">>>Waiting for a response to create Admin Msg...");
respMsg = (MQeAdminMsg)newQM.waitForMessage(QMgrName,
MQe.Admin_Reply_Queue_Name,
replyFilter, null, 0, 3000);
trace(">>>Admin Msg processed OK...");

/* process Admin Reply msg */
if (respMsg == null )
    trace ("i:create Queue failed, no response message received");
else
{
    if ( respMsg.getRC() == MQeAdminMsg.RC_Success )
        trace("i:create Queue added queue OK...");
    else
        trace("i:create Queue failed: " + respMsg.getReason());
}

/* use Admin msg to AddQueueManager reference */
msg = new MQeStoreAndForwardQueueAdminMsg();
msg.addQueueManager("ClientQMgr");
msg.setTargetQMgr(QMgrName);
msg.setName(QMgrName, QName);
msg.putInt(MQe.Msg_Style,MQe.Msg_Style_Request );
msg.putAscii(MQe.Msg_ReplyToQ, MQe.Admin_Reply_Queue_Name);
msg.putAscii(MQe.Msg_ReplyToQMgr, QMgrName );
msg.putArrayOfByte(MQe.Msg_CorrelID,
Long.toHexString(newQM.uniqueValue()).getBytes());

msg.setAction(msg.Action_AddQueueManager );

/* use the CorrelID to create a filter for the reply message */
replyFilter = new MQeFields();
replyFilter.putArrayOfByte(MQe.Msg_CorrelID,
msg.getArrayOfByte(MQe.Msg_CorrelID ));

/* send the Admin msg */
trace(">>>putting Admin Msg to QM/queue:" + QMgrName + "/" +
MQe.Admin_Queue_Name);
newQM.putMessage(QMgrName, MQe.Admin_Queue_Name, msg, null, 0);

/* get the Admin Reply msg */
trace(">>>Waiting for a response to create Admin Msg...");
respMsg = (MQeAdminMsg)newQM.waitForMessage(QMgrName,
MQe.Admin_Reply_Queue_Name,

```

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```
replyFilter, null, 0, 3000);
    trace(">>>Admin Msg processed OK...");

    /* process Admin Reply msg */
    if (respMsg == null )
        trace ("i:create Queue failed,no response message received");
    else
    {
        if (respMsg.getRC() == MQeAdminMsg.RC_Success)
            trace("i:QueueManager reference added queue OK...");
        else
            trace("i:create Queue failed: " + respMsg.getReason());
    }
    newQM.close();
}
catch ( Exception e )
{
    trace (">>>add StoreAndForwardQ exception = " + e.getMessage());
    e.printStackTrace();
}
}
```

ServerQMgr queues -adding XXX_service_request queue: Start the ServerQMgr locally using the MQePrivateClient class, (using a different version, MQePrivateServer2.ini, that deliberately does not hold hard coded values for *PIN*, *KeyRingPassword* and *CertReqPIN*) then create and use an administration messages to add the queue.

```
{
    try
    {
        /* start ServerQMgr locally as a client */
        MQePrivateClient newC = new MQePrivateClient("./MQePrivateServer2.ini",
"12345678", /* PIN */
"It_is_a_secret", /* KeyRingPwd */
null );
        MQeQueueManager newQM = newC.queueManager;
        String QMgrName = newQM.getName(); /* should be "ServerQMgr" */

        /* define some of the values we need for the queue ... */
        /* ... the name of the queue */
        String QName = "XXX_service_request";
        /* ... the cryptor to protect the queue */
        String cryptorType = new MQe3DESCryptor().type();
        /* ... the file descriptor */
        String FileDesc = "MsgLog.";

        /* create an Admin msg to add XXX_service_request queue */
        MQeQueueAdminMsg msg = new MQeQueueAdminMsg();
        msg.setTargetQMgr(QMgrName);
        msg.setName(QMgrName, QName);
        msg.putInt(MQe.Msg_Style, MQe.Msg_Style_Request );
        msg.putAscii(MQe.Msg_ReplyToQ, MQe.Admin_Reply_Queue_Name);
        msg.putAscii(MQe.Msg_ReplyToQMgr, QMgrName );
        msg.putArrayOfByte(MQe.Msg_CorrelID,
Long.toHexString(newQM.uniqueValue()).getBytes());

        /* ... define parameter values for the queue */
        MQeFields parms =new MQeFields();
        parms.putUnicode(msg.Queue_Description,"Q-based scenario Q");
        parms.putAscii(msg.Queue_QMgrName, QMgrName );
        parms.putAscii(msg.Queue_FileDesc, FileDesc );
        parms.putAscii(msg.Queue_Cryptor, cryptorType);
        parms.putAscii(msg.Queue_AttrRule, "examples.rules.AttributeRule");

        msg.create(parms );
    }
}
```

```

        /* use the CorrelID to create a filter for the reply message */
        MQeFields replyFilter = new MQeFields();
        replyFilter.putArrayOfByte(MQe.Msg_CorrelID,
msg.getArrayOfByte(MQe.Msg_CorrelID ));

        /* send the Admin msg */
        trace(">>>putting Admin Msg to QM/queue:" + QMgrName + "/" +
MQe.Admin_Queue_Name);
        newQM.putMessage(QMgrName, MQe.Admin_Queue_Name, msg, null, 0);

        /* get the Admin Reply msg */
        MQeAdminMsg respMsg = null;
        trace(">>>Waiting for a response to create Admin Msg...");
        respMsg = (MQeAdminMsg)newQM.waitForMessage(QMgrName,
MQe.Admin_Reply_Queue_Name,
replyFilter, null, 0, 3000);
        trace(">>>Admin Msg processed OK...");

        /* process Admin msg response ...*/
        if (respMsg == null)
            trace ("i:create Queue failed, no response message received");
        else
        {
            if (respMsg.getRC() == MQeAdminMsg.RC_Success)
                trace("i:create Queue added queue OK...");
            else
                trace("i:create Queue failed: " + respMsg.getReason());
        }
        newQM.close();
    }
    catch (Exception e)
    {
        trace (">>>add XXX_service_request excep = " + e.getMessage());
        e.printStackTrace();
    }
}

```

Server queue manager AppRunList started application: This section provides an example extension to MQePrivateServer2.ini showing how to add an AppRunList application that is automatically started when the ServerQMgr starts. It also provides an example TestService application.

Example MQePrivateServer2.ini

MQePrivateServer2.ini - with AppRunList extension...

```

[Alias]
(ascii)EventLog=examples.log.LogToDiskFile
(ascii)Network=com.ibm.mqe.adapters.MqeTcpipHttpAdapter
(ascii)QueueManager=com.ibm.mqe.MqeQueueManager
(ascii)Trace=examples.awt.AwtMQeTrace
(ascii)MsgLog=com.ibm.mqe.adapters.MqeDiskFieldsAdapter
(ascii)FileRegistry=com.ibm.mqe.registry.MqeFileSession
(ascii)PrivateRegistry=com.ibm.mqe.registry.MqePrivateSession
(ascii)ChannelAttrRules=examples.rules.AttributeRule
(ascii)AttributeKey_1=com.ibm.mqe.MQeKey
(ascii)AttributeKey_2=com.ibm.mqe.attributes.MqeSharedKey
[ChannelManager]
(int)MaxChannels=0
[Listener]
(ascii)Listen=Network::8082
(ascii)Network=Network:
(int)TimeInterval=300
[QueueManager]
(ascii)Name=ServerQMgr
(ascii)QueueStore=MsgLog:\MQeNode_PrivateRegistry
[Registry]

```

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```
(ascii)LocalRegType=PrivateRegistry
(ascii)DirName=.\MQeNode_PrivateRegistry
(ascii)PIN=not set
(ascii)CertReqPIN=not set
(ascii)KeyRingPassword=not set
(ascii)CAIPAddrPort=9.20.X.YYY:8082
[AppRunList]
(ascii)App1=test.TestService
```

Example Server TestService application

```
package test;
import com.ibm.mqe.*;
import com.ibm.mqe.attributes.*;
import java.util.*;
public class TestService extends MQe
    implements MQeRunListInterface, MQeMessageListenerInterface, Runnable
    {
    protected Thread applicationThread = null;
    protected MQeQueueManager thisQMgr = null;

    /* constructor */
    public TestService( ) throws Exception
    {
    }

    /* activate method */
    public Object activate( Object owner,
                           Hashtable loadTable,
                           MQeFields setupData ) throws Exception
    {
        System.out.println(" TestService, activate, owner objref = " + owner);
        thisQMgr = (MQeQueueManager)owner; /* save QMgr objref */
        applicationThread = new Thread(
            this, "applicationThread" ); /* create svr app thread */
        System.out.println(" TestService, activate no of active threads = " +
            Thread.activeCount( ) );
        Thread t[] = new Thread[Thread.activeCount( )];
        int i = Thread.enumerate( t );
        for ( int j = 0; j < i; j++ ) /* look at svr threads */
            System.out.println("TestService activate, active thread name = "
                + t[j].getName( ) );
        applicationThread.start( ); /* start appl'n Thread. */
        return this;
    }

    /* run method */
    public void run( )
    {
        System.out.println("TestService, Run...");
        /* add listener for XXX_service_request queue */
        try {
            thisQMgr.addMessageListener( this, "XXX_service_request",
                new MQeFields( ) );
        }
        catch( Exception e)
        {
            e.printStackTrace( );
        }
    }

    /* MessageArrived event handler */
    /* MsgArrived event is generated when a message arrives on a queue */
    public void messageArrived( MQeMessageEvent msgEvent )
```

```

{
try {
    System.out.println(" TestService, msgEvent, messageArrived ");
    System.out.println(" TestService, msgEvent getQueueManagerName = " +
        msgEvent.getQueueManagerName() );
    System.out.println(" TestService, msgEvent getQueueName = " +
        msgEvent.getQueueName( ) );
    /* get XXX service request message */
    MQeMsgObject reqmsg = thisQMgr.getMessage(
        msgEvent.getQueueManagerName( ),
        msgEvent.getQueueName( ),
        msgEvent.getMsgFields( ),
        null,
        0);
    /* process service request here */
    String reqdata = reqmsg.getAscii("XXX_service_request_data");
    String replydata = reqdata + "_reply";
    /* build XXX_service reply message here */
    MQeMsgObject replymsg = new MQeMsgObject( );
    replymsg.putArrayOfByte( MQe.Msg_CorrelID,
        reqmsg.getArrayOfByte(MQe.Msg_CorrelID ) );
    replymsg.putAscii("XXX_service_reply_data", replydata );
    System.out.println(" TestService, msgEvent putting service reply " +
        "to ClientQMgr XXX_service_reply queue");
    /* put reply to ClientQMgr XXX_service_reply queue */
    thisQMgr.putMessage( "ClientQMgr", "XXX_service_reply",
        replymsg, null, 1 );
}
catch( Exception e )
{
    e.printStackTrace( );
}
}
/* finalize method */
protected void finalize()
{
    System.out.println("TestService, finalize...");
    applicationThread.stop( );
    applicationThread.destroy( );
}
}

```

Client queue manager application initiating XXX_service_request.:

The example queue-based security scenario in “Usage scenario” on page 174 describes a client queue manager application that initiates XXX_service_request messages by encapsulating the request in a MQeMsgObject and using **putMessage()** to reliably deliver the request to the server queue manager’s XXX_service_request queue. It then waits for the reply to the service request by using **waitForReply()** on its own XXX_service_reply queue.

In the scenario, the TestService application on the server processes the service request by using **getMessage()** to get the service request from the XXX_service_request queue, processes the request (for example by invocation of a backend transaction), builds the reply MQeMsgObject, and uses the server queue manager **putMessage()** to return the reply to the (remote) initiating client queue manager.

The server queue manager internally puts the message onto its TestServer_StoreAndForwardQ. The client queue manager pulls the message from the TestServer_StoreAndForwardQ and receives it in its ClientTest_HomeServerQ before putting it on the intended target XXX_service_reply queue.

queue-based security

The client application below provides a simple example of invoking a service request and processing the resulting reply.

```
package test;
import com.ibm.mqe.*;
import examples.queuemanager.*;
public class UseTestService extends MQe
{
    protected MQeQueueManager thisQMgr = null;
    /* serviceRequest method */
    public void serviceRequest( )
    {
        /* start trace... */
        try{
            MQeTraceInterface trace =
                (MQeTraceInterface) MQe.loader.loadObject(
                    "examples.awt.AwtMQeTrace" );
            trace.activate( "UseTestService...", null );
        }
        catch(Exception e) {e.printStackTrace();}
        /* start and use Client queuemanager to put request & process reply */
        try {
            /* start Client queue manager */
            MQePrivateClient newC = new MQePrivateClient(
                "../MQePrivateClient2.ini",
                "12345678",
                "It_is_a_secret",
                null );
            MQeQueueManager newQM = newC.queueManager;
            /* build svc request and use putMessage to put it to server */
            MQeMsgObject msgreq = new MQeMsgObject( );
            long thisReq_CorrelID = newQM.uniqueValue();
            msgreq.putArrayOfByte( MQe.Msg_CorrelID,
                longToByte( thisReq_CorrelID) );
            String reqdata = "0123456789abcdef";
            msgreq.putArrayOfByte("XXX_service_request_data",
                asciiToByte(reqdata) );
            newQM.putMessage("ServerQMgr","XXX_service_request",msgreq,null,1);
            trace( " >>> request put to ClientQMgr,XXX_service_request q OK");
            /* field and process reply to service request */
            trace( " >>> waiting for reply message...");
            MQeFields msgreq_filter = new MQeFields();
            msgreq_filter.putArrayOfByte( MQe.Msg_CorrelID,
                longToByte( thisReq_CorrelID) );
            MQeMsgObject msgreply = newQM.waitForMessage( newQM.getName( ),
                "XXX_service_reply", msgreq_filter, null, 0, 3000 );
            trace(" >>> service request reply = " +
                byteToAscii(msgreply.getArrayOfByte("XXX_service_reply_data")));
        }
        catch(Exception e2) { e2.printStackTrace();}
    }
}
public static void main(String args[])
{
    UseTestService testsvc = new UseTestService( );
    testsvc.serviceRequest();
}
}
```

Queue-based security and triggering auto-registration

When a queue manager accesses a remote queue or any local queue that is defined with an attribute including the MQeWTLSAuthenticator, then the queue manager and queues are authenticatable entities and require their own credentials.

A queue manager's credentials are created by triggering auto-registration. The simplest way of triggering auto-registration is to include the relevant keywords in the registry section of the ini file used when the queue manager is created. The keywords needed in the registry section of the ini file are:

```
(ascii)CertReqPIN=12345678
  < change CertReqPIN '12345678' to a new value that matches the value set by
    Mini Certificate Server's Administrator when the Queue Manager instance is defined >
(ascii)KeyRingPassword=It_is_a_secret
  < change the default KeyRingPassword from 'It_is_a_secret' to the password that
    is to be subsequently provided at Queue Manager start-up time to enable
    the Queue Manager instance to access its protected private credentials
    within its Private Registry. >
(ascii)CAIPAddrPort=9.20.X.YYY:8082
  < change this to the IP address and port of the solution's MiniCertificateServer.>
```

The credentials of queues (with an attribute including MQeWTLS CertAuthenticator) are also created by triggering auto-registration. This happens automatically when an administration message adding the queue is processed providing that:

- The owning queue manager has already auto-registered, and been started with parameters necessary to access its own credentials and the solution's mini-certificate server
- The owning queue manager name and queue name have been predefined by the mini-certificate server administrator, with the mini-certificate request PIN set to the same value as the *CertReqPIN* value used to start the owning queue manager
- The mini-certificate server is available, started, and is in 'server' mode

When adding a queue (with an attribute including MQeWTLS CertAuthenticator) the queue can have its own credentials or it can share its owning queue manager's credentials. This choice is determined when the 'create queue' administration message is constructed. The following code fragment shows the relevant parameters and their meaning.

ServerQMgr queues -adding ServerTestQWTLS2: The following code fragment:

- Assumes that the mini-certificate server administrator has added ServerQMgr+ServerTestQWTLS2 with *Certificate Request PIN* equal to 12345678, and has started the mini-certificate server in 'server' mode
- Starts the ServerQMgr locally using the MQePrivateClient class, (using the different version, MQePrivateServer2.ini, that deliberately does not hold hard coded values for *PIN*, *KeyRingPassword*, and *CertReqPIN*) then create and use an administration message to add the ServerTestQWTLS2 queue

```
{
  try
  {
    /* start ServerQMgr locally as a client */
    MQePrivateClient newC = new MQePrivateClient("./MQePrivateServer2.ini",
"12345678", /* PIN */
"It_is_a_secret", /* KeyRingPwd */
null );
    MQeQueueManager newQM = newC.queueManager;
    String QMgrName = newQM.getName(); /* should be "ServerQMgr" */

    /* define some of the values we need for the queue ... */
    /* ... the name of the queue */
    String QName = "ServerTestQWTLS2";
    /* ... the authenticator to control access to the queue */
    String authenticatorType = new MQeWTLS CertAuthenticator().type();
    /* ... the cryptor to protect the queue */
    String cryptorType = new MQe3DESCryptor().type();
```

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```
/* ... the file descriptor */
String FileDesc = "MsgLog:.";

/* create an Admin msg to add ServerTestQWTL2 queue */
MQeQueueAdminMsg msg = new MQeQueueAdminMsg();
msg.setTargetQMgr(QMgrName);
msg.setName(QMgrName, QName);
msg.putInt(MQe.Msg_Style, MQe.Msg_Style_Request);
msg.putAscii(MQe.Msg_ReplyToQ, MQe.Admin_Reply_Queue_Name);
msg.putAscii(MQe.Msg_ReplyToQMgr, QMgrName );
msg.putArrayOfByte(MQe.Msg_CorrelID,
Long.toHexString(newQM.uniqueValue()).getBytes());

/* ... define parameter values for the queue */
MQeFields parms =new MQeFields();
parms.putUnicode(msg.Queue_Description,"Q-based scenario Q");
parms.putAscii(msg.Queue_QMgrName, QMgrName);
parms.putAscii(msg.Queue_FileDesc, FileDesc);
parms.putAscii(msg.Queue_Authenticator, authenticatorType);
parms.putAscii(msg.Queue_AttrRule, "examples.rules.AttributeRule");
/* ... for the Queue to have its own credentials */
parms.putByte(msg.Queue_TargetRegistry, msg.Queue_RegistryQueue );
// /* ... for the Queue to share its host QMgr's credentials */
// parms.putByte(msg.Queue_TargetRegistry, msg.Queue_RegistryQMgr );
parms.putAscii(msg.Queue_Cryptor, cryptorType);
parms.putAscii(msg.Queue_AttrRule, "examples.rules.AttributeRule");

msg.create(parms );

/* use the CorrelID to create a filter for the reply message */
MQeFields replyFilter = new MQeFields();
replyFilter.putArrayOfByte(MQe.Msg_CorrelID,
msg.getArrayOfByte(MQe.Msg_CorrelID ));

/* send the Admin msg */
trace(">>>putting Admin Msg to QM/queue:" + QMgrName + "/" +
MQe.Admin_Queue_Name);
newQM.putMessage(QMgrName, MQe.Admin_Queue_Name, msg, null, 0);

/* get the Admin Reply msg */
MQeAdminMsg respMsg = null;
trace(">>>Waiting for a response to create Admin Msg...");
respMsg = (MQeAdminMsg)newQM.waitForMessage(QMgrName,
MQe.Admin_Reply_Queue_Name,
replyFilter, null, 0, 3000);
trace(">>>Admin Msg processed OK...");

/* process Admin Reply msg ...*/
if (respMsg == null)
    trace ("i:create Queue failed,no response message received");
else
{
    if (respMsg.getRC() == MQeAdminMsg.RC_Success)
        trace("i:create Queue added queue OK...");
    else
        trace("i:create Queue failed: " + respMsg.getReason());
}
newQM.close();
}
catch (Exception e) {e.printStackTrace();}
}
```

Queue-based security, starting queue managers with private registries

Whenever a queue manager and any of its queues are authenticatable entities, that is, have their own credentials, then, in order to access these credentials, the appropriate parameters are needed when the queue manager is started.

While hard coding these parameters in the registry section of the appropriate `ini` file is a convenient mechanism during solution development, it is inappropriate for a production system. Whenever possible, these parameters should be collected interactively and used to start a queue manager instance without storing them in a file.

An example of starting an MQSeries Everyplace client queue manager using the `MQePrivateClient` class, and passing the parameters (instead of hard coding them in keywords of the `MQePrivateClient2.ini` file) is found in the example "ClientQMgr queues -adding XXX_service_reply queue" on page 181.

Queue-based security - channel reuse

When data is sent between a queue manager and a remote queue, the queue manager opens a channel to the remote queue manager that owns the queue. By default, if the remote queue is protected, for example with a cryptor, the channel is given exactly the same level of protection as the queue. To reduce the number of channels open concurrently, the queue manager can reuse an existing channel if its level of protection is adequate. If none of the channels has a suitable level of protection, the queue manager can also change the level of protection on an existing channel to match that required for the queue. The default behavior can be changed by using attribute rules on both the queue and the channel. These rules apply to the attribute on the queue (and channel), they are not the same as queue rules.

If attribute rules are defined for the queue, the queue manager uses the rules to decide whether an existing channel has sufficient protection for the queue. If the `equals()` method in the rules returns `true`, the channel can be used. MQSeries Everyplace provides an example rule, `examples.rules.AttributeRule`, that can be used on the queue. This rule allows a channel to be used for a queue if the following conditions are met:

- If the queue has an authenticator, the channel must have the same authenticator. If the queue does not have an authenticator, it does not matter whether the channel has one or not.
- If the queue has a cryptor, the channel must have a cryptor that is the same as or better than that on the queue. If the queue does not have a cryptor it does not matter whether the channel has one or not.
- It does not matter what compressors are defined for the queue or channel

The example rules define "better" for a cryptor to mean:

- Any cryptor is the same as or better than XOR
- Any cryptor, except XOR, is the same as or better then DES
- The remaining cryptors (Triple DES, RC4, RC6, and MARS) are considered equal to each other and all better than XOR and DES.

If none of the existing channels has sufficient protection for the queue, the queue manager checks if any of the channels can be upgraded to the required level. If attribute rules are defined for the channel, the `permit()` method is used to determine this. The `examples.rules.AttributeRule` uses the following criteria:

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- If the channel has been authenticated it cannot be upgraded, but if it does not have one, an authenticator can be added to a channel.
- A cryptor can be added to a channel or strengthened (using the criteria for "better" described above). A cryptor cannot be removed from the channel or replaced with a weaker cryptor.
- A compressor can be changed, added to, or removed from the channel.

Before allowing channel reuse, the target queue uses its current `AttributeRule equals()` method to determine if the channel attribute can provide an appropriate level of protection for the target queue. This provides protection against inconsistency in the queue attribute rules on the local and target queue managers.

Attribute rules are set on a queue when it is created or modified using administration messages. Attribute rules are set on channels using the `ChannelAttrRules` keyword in the configuration file used at queue manager creation time.

While the `examples.rules.AttributeRule` provides practical defaults, there may be a solution specific reason why different behavior is required. You can modify the way channels are reused by extending or replacing the default `examples.rules.AttributeRule` with rules that define the desired behavior.

It is possible to run without setting `ChannelAttrRules`, but this mode of operation is not recommended.

Message-level security

Message-level security facilitates the protection of message data between an initiating and receiving MQSeries Everyplace application. Message-level security is an application layer service. It requires the initiating MQSeries Everyplace application to create a message-level attribute and provide it when using `putMessage()` to put a message to a target queue. The receiving application must setup an appropriate, 'matching', message-level attribute and pass it to the receiving queue manager so that the attribute is available when `getMessage` is used to get the message from the target queue.

Like local security, message-level security exploits the application of an attribute on a message (MQeFields object descendent). The initiating application's queue manager handles the application's `putMessage()` with the message dump method, which invokes the (attached) attribute's `encodeData()` method to protect the message data. The receiving application's queue manager handles the application's `getMessage()` with the message's 'restore' method which in turn uses the supplied attribute's `decodeData()` method to recover the original message data.

Usage scenario

Message-level security is typically most useful for:

- Solutions that are designed to use predominantly asynchronous queues
- Solutions for which application level security is important, that is solutions whose normal message paths include flows over multiple nodes perhaps connected with different protocols. Message-level security manages trust at the application level, which means security in other layers becomes unnecessary.

A typical scenario is a solution service that is delivered over multiple open networks. For example over a mobile network and the internet, where, from outset asynchronous operation is anticipated. In this scenario, it is also likely that

message data is flowed over multiple links that may have different security features, but whose security features are not necessarily controlled or trusted by the solution owner. In this case it is very likely the solution owner does not wish to delegate trust for the confidentiality of message data to any intermediate, but would prefer to manage and control trust management directly.

MQSeries Everyplace message-level security provides solution designers with the features that enable the strong protection of message data in a way that is under the direct control of the initiating and recipient applications, and that ensures the confidentiality of the message data throughout its transfer, end to end, application to application.

Secure feature choices

MQSeries Everyplace supplies two alternative attributes for message-level security.

MQeMAttribute

This suits business-to-business communications where mutual trust is tightly managed in the application layer and requires no trusted third party. It allows use of all available MQSeries Everyplace symmetric cryptor and compressor choices. Like local security it requires the attribute's key to be preset before it is supplied as a parameter on **putMessage()** and **getMessage()**. This provides a simple and powerful method for message-level protection that enables use of strong encryption to protect message confidentiality, without the overhead of any public key infrastructure (PKI).

MQeMTrustAttribute

This provides a more advanced solution using digital signatures and exploiting the default public key infrastructure to provide a digital envelope style of protection. It uses ISO9796 digital signature/validation so the receiving application can establish proof that the message came from the purported sender. The supplied attribute's cryptor protects message confidentiality. SHA1 digest guarantees message integrity and RSA encryption/decryption ensures that the message can only be restored by the intended recipient. As with MQeMAttribute, it allows use of all available MQSeries Everyplace symmetric cryptor and compressor choices. Chosen for size optimization, the certificates used are mini-certificates which conform to the WTLS Specification approved by the WAP forum. MQSeries Everyplace provides a default public key infrastructure to distribute the certificates as required to encrypt and authenticate the messages.

A typical MQeMTrustAttribute protected message has the format:

```
RSA-enc{SymKey}, SymKey-enc {Data, DataDigest, DataSignature}
```

where:

RSA-enc:

RSA encrypted with the intended recipient's public key, from his mini-certificate

SymKey:

Generated pseudo-random symmetric key

SymKey-enc:

Symmetrically encrypted with the *SymKey*

Data: Message data

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DataDigest:

Digest of message data

DigSignature:

Initiator's digital signature of message data

Selection Criteria

MQeMAttribute relies totally on the solution owner to manage the content of the key seed that is used to derive the symmetric key used to protect the confidentiality of the data. This key seed must be provided to both the initiating and recipient applications. While it provides a simple mechanism for the strong protection of message data without the need of any PKI, it clearly depends of the effective operational management of the key seed.

MQeMTrustAttribute exploits the advantages of the MQSeries Everyplace default PKI to provide a digital envelope style of message-level protection. This not only protects the confidentiality of the message data flowed, but checks its integrity and enables the initiator to ensure that only the intended recipient can access the data. It also enables the recipient to validate the originator of the data, and ensures that the signer cannot later deny initiating the transaction. This is known as *non-repudiation*.

Solutions that wish to simply protect the end-to-end confidentiality of message data will probably decide that MQeMAttribute suits their needs, while solutions for which one to one (authenticatable entity to authenticatable entity) transfer and non-repudiation of the message originator are important may find MQeMTrustAttribute is the correct choice.

Usage guide

The following code fragments provide examples of how to protect and unprotect a message using MQeMAttribute and MQeMTrustAttribute

MQSeries Everyplace message-level security using MAttribute

```
/*SIMPLE PROTECT FRAGMENT */
{
    MQeMsgObject msgObj = null;
    MQeMAttribute attr = null;
    long confirmId = MQe.uniqueValue();
    try{
        trace(">>>putMessage to target Q using MQeMAttribute"
            +" with 3DES Cryptor and key=my secret key");
        /* create the cryptor */
        MQe3DESCryptor tdes = new MQe3DESCryptor();
        /* create an attribute using the cryptor */
        attr = new MQeMAttribute(null,tdes,null );
        /* create a local key */
        MQeKey localkey = new MQeKey();
        /* give it the key seed */
        localkey.setLocalKey("my secret key");
        /* set the key in the attribute */
        attr.setKey(localkey );
        /* create the message */
        msgObj = new MQeMsgObject();
        msgObj.putAscii("MsgData","0123456789abcdef...");
        /* put the message using the attribute */
        newQM.putMessage(targetQMgrName, targetQName,
            msgObj, attr, confirmId );
        trace(">>>MAttribute protected msg put OK...");
    }
    catch (Exception e)
    {
```

```

        trace(">>>on exception try resend exactly once...");
        msgObj.putBoolean(MQe.Msg_Resend, true );
        newQM.putMessage(targetQMgrName, targetQName,
            msgObj, attr, confirmId );
    }
}

/*SIMPLE UNPROTECT FRAGMENT */
{
    MQeMsgObject msgObj2 = null;
    MQeMAttribute attr2 = null;
    long confirmId2 = MQe.uniqueValue();
    try{
        trace(">>>getMessage from target Q using MQeMAttribute"+
            " with 3DES Cryptor and key=my secret key");
        /* create the attribute - we do not have to specify the cryptor, */
        /* the attribute can get this from the message itself */
        attr2 = new MQeMAttribute(null,null,null );
        /* create a local key */
        MQeKey localkey = new MQeKey();
        /* give it the key seed */
        localkey.setLocalKey("my secret key");
        /* set the key in the attribute */
        attr2.setKey(localkey );
        /* get the message using the attribute */
        msgObj2 = newQM.getMessage(targetQMgrName, targetQName,
            null, attr2, confirmId2 );
        trace(">>>unprotected MsgData = "
            + msgObj2.getAscii("MsgData"));
    }
    catch (Exception e)
    {
        /*exception may have left */
        newQM.undo(targetQMgrName, /*message locked on queue */
            targetQName, confirmId2 ); /*undo just in case */
        e.printStackTrace(); /*show exception reason */
    }
    ...
}

```

MQSeries Everyplace message-level security using MTustAttribute

```

/*SIMPLE PROTECT FRAGMENT */
{
    MQeMsgObject msgObj = null;
    MQeMTrustAttribute attr = null;
    long confirmId = MQe.uniqueValue();
    try {
        trace(">>>putMessage from Bruce1 intended for Bruce8"
            + " to target Q using MQeMTrustAttribute with MARSCryptor ");
        /* create the cryptor */
        MQeMARSCryptor mars = new MQeMARSCryptor();
        /* create an attribute using the cryptor */
        attr = new MQeMTrustAttribute(null, mars, null);
        /* open the private registry belonging to the sender */
        String EntityName = "Bruce1";
        String PIN = "12345678";
        Object Passwd = "It_is_a_secret";
        MQePrivateRegistry sendreg = new MQePrivateRegistry();
        sendreg.activate(EntityName, "./MQeNode_PrivateRegistry",
            PIN, Passwd, null, null );
        /* set the private registry in the attribute */
        attr.setPrivateRegistry(sendreg );
        /* set the target (recipient) name in the attribute */
        attr.setTarget("Bruce8");
        /* open a public registry to get the target's certificate */
    }
}

```

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```
MQePublicRegistry pr = new MQePublicRegistry();
pr.activate("MQeNode_PublicRegistry", ".//");
/* set the public registry in the attribute */
attr.setPublicRegistry(pr);
/* set a home server, which is used to find the certificate*/
/* if it is not already in the public registry */
attr.setHomeServer(MyHomeServer +":8082");
/* create the message */
msgObj =new MQeMsgObject();
msgObj.putAscii("MsgData","0123456789abcdef...");
/* put the message using the attribute */
newQM.putMessage(targetQMgrName, targetQName,
                msgObj, attr, confirmId );
trace(">>>MTrustAttribute protected msg put OK...");
}
catch (Exception e)
{
trace(">>>on exception try resend exactly once...");
msgObj.putBoolean(MQe.Msg_Resend, true);
newQM.putMessage(targetQMgrName, targetQName,
                msgObj, attr, confirmId );
}
}

/*SIMPLE UNPROTECT FRAGMENT */
{
MQeMsgObject msgObj2 = null;
MQeMTrustAttribute attr2 = null;
long confirmId2 = MQe.uniqueValue();
try {
trace(">>>getMessage from Bruce1 intended for Bruce8"
    + " from target Q using MQeMTrustAttribute with MARSCryptor ");
/* create the cryptor */
MQeMARSCryptor mars = new MQeMARSCryptor();
/* create an attribute using the cryptor */
attr2 = new MQeMTrustAttribute(null, mars, null);
/* open the private registry belonging to the target */
String EntityName = "Bruce8";
String PIN = "12345678";
Object Passwd = "It_is_a_secret";
MQePrivateRegistry getreg = new MQePrivateRegistry();
getreg.activate(EntityName, ".//MQeNode_PrivateRegistry",
                PIN, Passwd, null, null);
/* set the private registry in the attribute */
attr2.setPrivateRegistry(getreg);
/* open a public registry to get the sender's certificate */
MQePublicRegistry pr = new MQePublicRegistry();
pr.activate("MQeNode_PublicRegistry", ".//");
/* set the public registry in the attribute */
attr2.setPublicRegistry(pr);
/* set a home server, which is used to find the certificate*/
/* if it is not already in the public registry */
attr2.setHomeServer(MyHomeServer +":8082");
/* get the message using the attribute */
msgObj2 = newQM.getMessage(targetQMgrName,
                targetQName, null, attr2, confirmId2 );
trace(">>>MTrustAttribute protected msg = "
    + msgObj2.getAscii("MsgData"));
}
catch (Exception e)
{
/*exception may have left */
newQM.undo(targetQMgrName, /*message locked on queue */
```

```

        targetQName, confirmId2 ); /*undo just in case */
    e.printStackTrace();          /*show exception reason */
    }
}

```

Non-repudiation

The MQEmTrustAttribute digitally signs the message. This enables the recipient to validate the creator of the message, and ensures that the creator cannot later deny creating the message. This is known as *non-repudiation*. This process depends on the fact that only one public key (certificate) can validate the signature successfully, and this proves that the signature was created with the corresponding private key. The only way the alleged creator can deny creating the message is to claim that someone else had access to the private key.

When a message is created with the MQEmTrustAttribute, it uses the private key from the sender's private registry to create the digital signature and it stores the sender's name in the message. When the message is read (with the queue manager's `getMessage()` method), it uses the sender's public certificate to validate the digital signature. The message is read successfully only if the signature validates successfully, proving that the message was created by the entity whose name was stored in the message as the sender.

When the MQEmTrustAttribute is specified as a parameter to the queue manager's `getMessage()` method, the attribute validates the digital signature but by the time the message is returned to the user's application all the information relating to the signature has been discarded. If non-repudiation is important to you, you must keep a record of this information. The simplest way to do this is to keep a copy of the encrypted message, because that includes the digital signature. You can do this by using the `getMessage()` method without an attribute. This returns the encrypted message which you can then save, for example in a local queue. You can decrypt the message by applying the attribute to access the contents of the message.

The following code fragment provides an example of how to save an encrypted message.

Saving a copy of an encrypted message

```

/*SIMPLE FRAGMENT TO SAVE ENCRYPTED MESSAGE*/
{
MQEMsgObject msgObj2 = null;
MQEmTrustAttribute attr2 = null;
long confirmId2 = MQE.uniqueValue();
long confirmId3 = MQE.uniqueValue();
try {
    trace(">>>getMessage from Bruce1 intended for Bruce8"
    + " from target Q using MQEmTrustAttribute with MARSCryptor ");
    /* read the encrypted message without an attribute */
    MQEMsgObject tmpMsg1 = newQM.getMessage(targetQMGrName,
    targetQName, null, null, confirmId2 );
    /* save the encrypted message - we cannot put it directly */
    /* to another queue because of the origin queue manager */
    /* data. Embed it in another message */
    MQEMsgObject tmpMsg2 = new MQEMsgObject();
    tmpMsg2.putFields("encryptedMsg", tmpMsg1);
    newQM.putMessage(localQMGrName, archiveQName, tmpMsg2, null, confirmId3);
    trace(">>>encrypted message saved locally");
    /* now decrypt and read the message ... */
    /* create the cryptor */
    MQEMARSCryptor mars = new MQEMARSCryptor();
    /* create an attribute using the cryptor */
    attr2 = new MQEmTrustAttribute(null, mars, null);
    /* open the private registry belonging to the target */

```

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```
String EntityName = "Bruce8";
String PIN = "12345678";
Object Passwd = "It_is_a_secret";
MQePrivateRegistry getreg = new MQePrivateRegistry();
getreg.activate(EntityName, "./MQeNode_PrivateRegistry",
PIN, Passwd, null, null );
/* set the private registry in the attribute */
attr2.setPrivateRegistry(getreg);
/* open a public registry to get the sender's certificate */
MQePublicRegistry pr = new MQePublicRegistry();
pr.activate("MQeNode_PublicRegistry", "./");
/* set the public registry in the attribute */
attr2.setPublicRegistry(pr);
/* set a home server, which is used to find the certificate*/
/* if it is not already in the public registry */
attr2.setHomeServer(MyHomeServer + ":8082");
/* decrypt the message by unwrapping it */
msgObj2 = tmpMsg1.unwrapMsgObject(attr2);
trace(">>>MTrustAttribute protected msg = "
+ msgObj2.getAscii("MsgData"));

catch (Exception e)
{ /*exception may have left */
newQM.undo(targetQMGrName, /*message locked on queue */
targetQName, confirmId2 ); /*undo just in case */
e.printStackTrace(); /*show exception reason */
}
}
```

```
P187
private registry service
2nd paragraph, 2nd line, remove "an" from the end:
" ... dependent services as"
```

Private registry service

This section describes the private registry service provided by MQSeries Everyplace.

Private registry and the concept of authenticatable entity

Queue-based security, that uses mini-certificate based mutual authentication and message-level security, that uses digital signature, have triggered the concept of authenticatable entity. In the case of mutual authentication it is normal to think about the authentication between two users but, messaging generally has no concept of users. The normal users of messaging services are applications and they handle the user concept.

MQSeries Everyplace abstracts the concept of target of authentication from user (person) to authenticatable entity. This does not exclude the possibility of authenticatable entities being people, but this would be application selected mapping.

Internally, MQSeries Everyplace defines all queue managers that can either originate or be the target of mini-certificate dependent services as authenticatable entities. MQSeries Everyplace also defines queues defined to use mini-certificate based authenticators as authenticatable entities. So queue managers that support these services can have one (the queue manager only), or a set (the queue manager and every queue that uses certificate based authenticator) of authenticatable entities.

MQSeries Everyplace provides configurable options to enable queue managers and queues to auto-register as an authenticatable entity. MQSeries Everyplace private registry service (MQePrivateRegistry) provides services that enable an MQSeries Everyplace application to auto-register authenticatable entities and manage the resulting credentials.

All application registered authenticatable entities can be used as the initiator or recipient of message-level services protected using MQeMTrustAttribute.

Private registry and authenticatable entity credentials

To be useful every authenticatable entity needs its own credentials. This provides two challenges, firstly how to execute registration to get the credentials, and secondly where to manage the credentials in a secure manner. MQSeries Everyplace private registry services help to solve these two problems. These services can be used to trigger auto-registration of an authenticatable entity creating its credentials in a secure manner and they can also be used to provide a secure repository.

Private registry (a descendent of base registry) adds to base registry many of the qualities of a secure or cryptographic token. For example, it can be a secure repository for public objects (mini-certificates) and private objects (private keys). It provides a mechanism to limit access to the private objects to the authorized user. It provides support for services (for example digital signature, RSA decryption) in such a way that the private objects never leave the private registry. Also, by providing a common interface, it hides the underlying device support.

Auto-registration

MQSeries Everyplace provides default services that support auto-registration. These services are automatically triggered when an authenticatable entity is configured; for example when a queue manager is started, or when a new queue is defined, or when an MQSeries Everyplace application uses MQePrivateRegistry directly to create a new authenticatable entity. When registration is triggered, new credentials are created and stored in the authenticatable entity's private registry. Auto-registration steps include generating a new RSA key pair, protecting and saving the private key in the private registry; and packaging the public key in a new-certificate request to the default mini-certificate server. Assuming the mini-certificate server is configured and available, and the authenticatable entity has been pre-registered by the mini-certificate server (is authorized to have a certificate), the mini-certificate server returns the authenticatable entity's new mini-certificate, along with its own mini-certificate and these, together with the protected private key, are stored in the authenticatable entity's private registry as the entity's new credentials.

While auto-registration provides a simple mechanism to establish an authenticatable entity's credentials, in order to support message-level protection, the entity requires access to its own credentials (facilitating digital signature) and to the intended recipient's public key (mini-certificate).

Usage scenario

The primary purpose of MQSeries Everyplace's private registry is to provide a private repository for MQSeries Everyplace authenticatable entity credentials. An authenticatable entity's credentials consist of the entity's mini-certificate (encapsulating the entity's public key), and the entity's (keyring protected) private key.

private registry service

Typical usage scenarios need to be considered in relation to other MQSeries Everyplace security features:

Queue-based security with MQeWTLSCertAuthenticator

Whenever queue-based security is used, where a queue attribute is defined with MQeWTLSCertAuthenticator, (mini-certificate based mutual authentication) the authenticatable entities involved are MQSeries Everyplace owned. Any queue manager that is to be used to access messages in such a queue, any queue manager that owns such a queue and the queue itself are all authenticatable entities and need to have their own credentials. By using the correct configuration options and setting up and using an instance of MQSeries Everyplace mini-certificate issuance service, auto-registration can be triggered when the queue managers and queues are created, creating new credentials and saving them in the entities' own private registries.

Message-level security with MQeMTrustAttribute

Whenever message-level security is used with MQeMTrustAttribute, the initiator and recipient of the MQeMTrustAttribute protected message are application owned authenticatable entities that must have their own credentials. In this case, the application must use the services of MQePrivateRegistry (and an instance of MQSeries Everyplace mini-certificate issuance service) to trigger auto-registration to create the entities' credentials and to save them in the entities' own private registries.

Secure feature choices

MQSeries Everyplace Version 1 provides no support for any alternative secure repository for an authenticatable entity's credentials. If queue-based security with MQeWTLSCertAuthenticator or message-level security using MQeMTrustAttribute are used, private registry services must be used.

Selection criteria

The selection criteria for private registry are the same as those for queue-based and message-level security.

Usage guide

Prior to using queue-based security, MQSeries Everyplace owned authenticatable entities must have credentials. This is achieved by completing the correct configuration so that auto-registration of queue managers is triggered. This requires the following steps:

1. Setup and start an instance of MQSeries Everyplace mini-certificate issuance service.
2. In administration mode, add the name of the queue manager as a valid authenticatable entity, and the entity's one-time-use certificate request PIN.
3. Start the mini-certificate server in server mode.
4. Configure MQePrivateClient1.ini and MQePrivateServer1.ini as described in "Using SimpleCreateQM to create ClientQMgr and ServerQMgr instances" on page 177 so that when queue managers are created using SimpleCreateQM, auto-registration is triggered. This section explains which keywords are required in the registry section of the ini files, and where to use the entity's one-time-use certificate request PIN. .

Prior to using message-level security to protect messages using MQeMTrustAttribute, the application must use private registry services to ensure that the initiating and recipient entities have credentials. This requires the following steps:

1. Setup and start an instance of MQSeries Everyplace mini-certificate issuance service.
2. In administration mode, add the name of the application entity, and allocate the entity a one-time-use certificate request PIN.
3. Start the mini-certificate server in server Mode.
4. Use a program similar to the pseudo-code fragment below to trigger auto-registration of the application entity . This creates the entity's credentials and saves them in its private registry.

```

/* SIMPLE MQePrivateRegistry FRAGMENT */
try
{
  /* setup PrivateRegistry parameters */
  String EntityName      = "Bruce";
  String EntityPIN       = "11111111";
  Object KeyRingPassword = "It_is_a_secret";
  Object CertReqPIN      = "12345678";
  Object CAIPAddrPort    = "9.20.X.YYY:8082";
  /* instantiate and activate a Private Registry. */
  MQePrivateRegistry preg = new MQePrivateRegistry( );
  preg.activate( EntityName, /* entity name */
                "./MQeNode_PrivateRegistry", /* directory root */
                EntityPIN, /* private reg access PIN */
                KeyRingPassword, /* private credential keyseed */
                CertReqPIN, /* on-time-use Cert Req PIN */
                CAIPAddrPort ); /* addr and port MiniCertSvr */
  trace(">>> PrivateRegistry activated OK ...");
}
catch (Exception e)
{
  e.printStackTrace( );
}

```

Public registry service

This section describes the public registry service provided by MQSeries Everyplace.

MQSeries Everyplace provides default services facilitating the sharing of authenticatable entity *public credentials* (mini-certificates) between MQSeries Everyplace nodes. Access to these mini-certificates is a prerequisite for message-level security. MQSeries Everyplace public registry (also a descendent of base registry) provides a publicly accessible repository for mini-certificates. This is analogous to the personal telephone directory service on a mobile phone, the difference being that it is a set of mini-certificates of the authenticatable entities instead of phone numbers. MQSeries Everyplace public registry is not a purely passive service. If accessed to provide a mini-certificate that it does not hold, and if the public registry is configured with a valid home server, the public registry automatically attempts to get the requested mini-certificate from the public registry of the home server. It also provides a mechanism to share a mini-certificate with the public registry of other MQSeries Everyplace nodes. Together these services provide the building blocks for an intelligent automated mini-certificate replication service that can facilitate the availability of the right mini-certificate at the right time.

Usage scenario

A typical scenario for the use of the public registry would be to use these services so that the public registry of a particular MQSeries Everyplace node builds up a store of the most frequently needed mini-certificates as they are used.

public registry service

A simple example of this is to setup an MQSeries Everyplace client to automatically get the mini-certificates of other authenticatable entities that it needs, from its MQSeries Everyplace home server, and then save them in its public registry.

Secure feature choices

It is the Solution creator's choice whether to use the public registry active features for sharing and getting mini-certificates between the public registries of different MQSeries Everyplace nodes.

The alternative to this intelligent replication may be to have an out-of-band utility to initialize an MQSeries Everyplace node's public registry with all required mini-certificates before enabling any secure services that uses them.

Selection criteria

Out-of-band initialization of the set of mini-certificates available in an MQSeries Everyplace node's public registry may have advantages over using the public registry active features in the case where the solution is predominantly asynchronous and the synchronous connection to the MQSeries Everyplace node's home server may be difficult. But in the case where this connection is more likely to be available, the public registry's active mini-certificate replication services are useful tools to automatically maintain the most useful set of mini-certificates on any MQSeries Everyplace node public registry.

Usage guide

```
/*SIMPLE MQePublicRegistry shareCertificate FRAGMENT */
try {
    String EntityName = "Bruce";
    String EntityPIN = "12345678";
    Object KeyRingPassword = "It_is_a_secret";
    Object CertReqPIN = "12345678";
    Object CAIPAddrPort = "9.20.X.YYY:8082";
/*instantiate and activate PublicReg */
    MQePublicRegistry pubreg = new MQePublicRegistry();
    pubreg.activate("MQeNode_PublicRegistry",".");
/* auto-register Bruce1,Bruce2...Bruce8 */
/* ... note that the mini-certificate issuance service must */
/* have been configured to allow the auto-registration */
    for (int i = 1; i < 9; i++)
    {
        EntityName = "Bruce"+(new Integer(i)).toString();
        MQePrivateRegistry preg = new MQePrivateRegistry();
/* activate() will initiate auto-registration */
        preg.activate(EntityName, ".\MQeNode_PrivateRegistry",
            EntityPIN, KeyRingPassword, CertReqPIN, CAIPAddrPort);
/* save MiniCert from PrivReg in PubReg*/
        pubreg.putCertificate(EntityName,
            preg.getCertificate(EntityName ));
/*before share of MiniCert */
        pubreg.shareCertificate(EntityName,
            preg.getCertificate(EntityName ),"9.20.X.YYY:8082");
        preg.close();
    }
    pubreg.close();
}
catch (Exception e)
{
    e.printStackTrace();
}
```

Notes:

1. It is not possible to activate a registry instance more than once, hence the example above demonstrates the recommended practice of accessing a private registry by creating a new instance of `MQePrivateRegistry`, activating the instance, performing the required operations and closing the instance.
2. If you want to share certificates using a public registry on the home-server, the public registry must be called `MQeNode_PublicRegistry`.

mini-certificate issuance service

MQSeries Everyplace includes a default *mini-certificate issuance service* that can be configured to satisfy private registry auto-registration requests. With the tools provided, a solution can setup and manage a mini-certificate issuance service so that it issues mini-certificates to a carefully controlled set of entity names. The characteristics of this issuance service are:

- Management of the set of registered authenticatable entities
- Issuance of mini-certificates (the mini-certificate conforms to the WAP WTLS specification)
- Management of the mini-certificate repository

The tools provided enable a mini-certificate issuance service administrator to authorize mini-certificate issuance to an entity by registering its entity name and registered address and defining a one-time-use *certificate request PIN*. This would normally be done after off line checking to validate the authenticity of the requestor. The certificate request PIN can be posted to the intended user (as bank card PINs are posted when a new card is issued). The user of the private registry (for example the MQSeries Everyplace application or MQSeries Everyplace queue manager) can then be configured to provide this certificate request PIN at startup time. When the private registry triggers auto-registration, the mini-certificate issuance service validates the resulting new certificate request, issues the new mini-certificate and then resets the registered certificate request PIN so it cannot be reused. All auto-registration of new mini-certificate requests is processed on a secure channel.

The mini-certificates that have been issued by a mini-certificate issuance service are held in the issuance service's own registry. When a mini-certificate is reissued (for example as the result of expiry), the expired mini-certificate is archived.

The issuance service comprises a server and a registry class. The server, `com.ibm.mqe.server.MQeMiniCertificateServer`, can either be launched from another program or run as a stand-alone application from the command line, see `MQeMiniCertificateServer` in the *MQSeries Everyplace for Multiplatforms Programming Reference*. The registry class, `com.ibm.mqe.server.MQeMiniCertSvrRegistry`, provides methods to add, update, retrieve and delete details of entities and their request PINs. The request PINs are used to authorize the server to issue mini-certificates, see `MQeMiniCertSvrRegistry` in the *MQSeries Everyplace for Multiplatforms Programming Reference*. The registry class can be built into administrative tools to control the issue of certificates.

An example mini-certificate server program, `examples.server.MQeMiniCertificateServerGUI`, is provided to show how these classes can be used. This can be run in either 'admin' or 'server' mode. In admin mode, the GUI can be used to enter, update, display, or delete details of an entity and its request PIN. In server mode, the program launches the mini-certificate server to listen for requests and issue certificates.

Operation

Running the example mini-certificate issuance service

The example program can be run by executing the batch file MQeMiniCertificateServerGUI.bat on Windows, or the script MQeMiniCertificateServerGUI on UNIX. This is a simple example startup file which can easily be modified. It uses the command:

```
java examples.server.MQeMiniCertificateServerGUI <resource> <trace>
```

Where:

<resource>

is a Java resource bundle that contains translatable strings, and is set to examples.server.MQeMCSMessageBundle

<trace>

is a Java resource file that contains trace strings, and is set to examples.trace.MQeTraceResource

When the GUI program starts, it displays the configuration file that it will use for the server. By default this is MQeMiniCertificateServer.ini, which is described in the MQeMiniCertificateServer in the *MQSeries Everyplace for Multiplatforms Programming Reference*. The configuration file to use can be changed by overtyping the text.

Before starting admin mode, the Server Administrator's PIN (InitialPIN) must be entered in the GUI. Before starting server mode, both the Server Administrator's PIN and the Server Key Ring Password must be entered.

Note: The very first time the program is used, both the Administrator's PIN and the Key Ring Password are needed even for admin mode.

When the appropriate values have been entered, you may click either the 'Start Server' or 'Start Admin' button. In server mode, the mini-certificate server is launched and requests received by the server are logged to the GUI. In admin mode, you may add, update, display and delete information about entities. You cannot change between admin and server modes while the example program is running, you must stop the program and restart it to change modes.

Renewing mini-certificates

The certificates issued for an entity by the mini-certificate issuance service are valid for one year from the date of issue and it is advisable to renew them before they expire. Renewed certificates are obtained from the same mini-certificate issuance service. Before requesting a renewal, the request must be authorized with the issuance service and a one-time-use certificate request PIN obtained, in just the same way as for the initial certificate issuance. When you use the server to obtain the PIN for renewal, remember that you are updating the entity, not adding it.

When a certificate is issued for an entity, a copy of the mini-certificate server's own certificate is issued with it. This is needed to check the validity of other certificates. With versions of MQSeries Everyplace earlier than 1.2, the certificate server's certificate could expire before the entity's certificate. If this happens you can renew the server's certificate by requesting a renewal of the entity's certificate; a new copy of the mini-certificate server's certificate will be returned along with the entity's certificate. From mini-certificate server Version 1.2, the mini-certificate server's certificate will expire later than the entity's certificate.

mini-certificate issuance service

The class `com.ibm.mqe.registry.MQePrivateRegistryConfigure` contains a method **renewCertificates()** which can be used to request renewed certificates. This is used in the example program `examples.certificates.RenewWTLSCertificates`, which implements a command-line program that requests renewed certificates from the issuance service

The program has four compulsory parameters:

```
RenewWTLSCertificates <entity> <ini file> <MCS addr> <MCS Pin>
```

where:

entity is the name of the entity for which a renewed certificate is required. This should be either a queue manager, a queue or other authenticatable entity. The name of a queue should be specified as `<queue manager>+<queue>`, for example `myQM+myQueue`.

ini file

is the name of a configuration file that contains a section for the registry. This is typically the same configuration file that is used for the queue manager. For a queue, this typically the configuration file for the queue manager that owns the queue.

MCS addr

is the host name and port address of the mini-certificate server (for example: `myServer:8085`)

MCS Pin

is the one-time use PIN issued by the mini-certificate server administrator to authorize this renewal request.

Obtaining new credentials (private and public keys)

When you renew a certificate, you get an updated certificate for your existing public key, (this allows you to continue to use your existing private/public key pair). If you want to change your private/public key pair, you must request new credentials. This includes a request to the mini-certificate issuance service for a new public certificate embodying the new public key. Before requesting a certificate for the new credentials, the request must be authorized with the issuance service and a one-time-use certificate request PIN must be obtained, in the same way as for the initial certificate issuance. (When you use the server to obtain the PIN for the new certificate, remember that you are updating the entity, not adding it.)

The class `com.ibm.mqe.registry.MQePrivateRegistryConfigure` contains a method **getCredentials()** which can be used to request new credentials. This is used in the example program `examples.install.GetCredentials`, which implements a GUI program that requests new credentials from the issuance service.

Note: When new credentials are issued, the existing ones are archived in the registry. You will no longer be able to decrypt messages created using your earlier credentials. The new certificate will not validate a digital signature (used with `MQeMTrustAttribute`) created with your earlier credentials.

Listing mini-certificates

It can be useful to list the certificates in a registry, for example to check on their expiry dates. You can do this using methods in the class `com.ibm.mqe.attributes.MQeListCertificates`. These are used in the example program `examples.certificates.ListWTLSCertificates`, which implements a command-line program that lists certificates.

mini-certificate issuance service

The program has one compulsory and three optional parameters:
ListWTLSCertificates <reg Name>[<ini file>] [<level>] [<cert names>]

where:

regName

is the name of the registry whose certificates are to be listed. It can be a private registry belonging to a queue manager, a queue or another entity; it can be a public registry, or (for the administrator) it can be the mini-certificate server's registry. If you want to list the certificates in a queue's registry, you must specify its name as <queue manager>+<queue>, for example myQM+myQueue. If you want to list the certificates in a public registry, it must have the name MQeNode_PublicRegistry, it will not work for a public registry with any other name. The name of the mini-certificate server's registry is MiniCertificateServer.

ini file

is the name of a configuration file that contains a section for the registry. This is typically the same configuration file that is used for the queue manager or mini-certificate server. For a queue, this is typically the configuration file for the queue manager that owns the queue. This parameter should be specified for all registries except public registries, for which it can be omitted.

level is the level of detail for the listing. This can be:

- b or -brief** prints the names of the certificate, one name per line
- n or -normal** prints the names of the certificates, one per line, followed by their type (old or new format)
- f or -full** prints the names of the certificates, their type, and some of the contents

This parameter is optional and if omitted the "normal" level of detail is used.

cert names

is a list of names of the certificates to be listed. It starts with the flag -cn followed by names of the certificates, for example: -cn ExampleQM putQM. If this parameter is used, only the named certificates are listed. If this parameter is omitted, all the certificates in the registry are listed.

Updated mini-certificate format for MQSeries Everyplace Version 1.2.6

The mini-certificates used by MQSeries Everyplace are based on the WTLS certificates used by WAP. The certificates used by MQSeries Everyplace Versions 1.0 and 1.1 were based on the latest draft of the WTLS specification that was available at the time of development. A standard for the certificates has since been approved. In MQSeries Everyplace Version 1.2.6, updated mini-certificates that conform to the approved standard have been introduced.

MQSeries Everyplace Version 1.2.6 supports both the earlier and the updated format mini-certificates, so if you are successfully using the earlier format mini-certificate you can continue to use them. However, we recommend that you migrate to the updated certificates as soon as possible. Support for the earlier format will be discontinued in MQSeries Everyplace Version 2.

You can upgrade your certificates to the new format by running the mini-certificate server from MQSeries Everyplace Version 1.2.6 and renewing the certificates (see “Running the example mini-certificate issuance service” on page 204). The renewed certificates will be in the new format.

Compatibility Mode

By default, the mini-certificate server in MQSeries Everyplace Version 1.2.6 issues certificates in the new format. These will not work with earlier versions of MQSeries Everyplace. If you are already using certificates and have not upgraded all the relevant queue manager software to Version 1.2.6, you may wish to continue using the original format certificates until all the software has been upgraded. You can configure the mini-certificate server to run in a *compatibility mode* and issue certificates in the original format. To do this, add a new section, [Mode], to the configuration file. This section should contain one entry, Mode=old, as in the following example:

Example configuration file for issuing original format certificates

```
[Alias]
*
*      Event log class
*
(ascii)EventLog=examples.log.LogToDiskFile
*
*      Network adapter class
*
(ascii)Network=com.ibm.mqe.adapters.MQeTcpipHttpAdapter
*
*      Queue Manager class
*
(ascii)QueueManager=com.ibm.mqe.MQeQueueManager
*
*      Trace handler (if any)
*
(ascii)Trace=examples.awt.AwtMQeTrace
*
*      Message Log file interface
*
(ascii)MsgLog=com.ibm.mqe.adapters.MQeDiskFieldsAdapter
*
*      Mini Certificate Server Registry class
*
(ascii)MiniCertSvrRegistry=com.ibm.mqe.registry.MQeMiniCertSvrRegistry
*
*      Mini Certificate Server Issuance Manager class
*
(ascii)MiniCertIssuanceManager=com.ibm.mqe.server.MQeMiniCertIssuanceManager
*-----*
[ChannelManager]
*
*      Maximum number of channels allowed
*
(int)MaxChannels=0
*-----*
[Listener]
*
*      FileDescriptor for listening adapter
*
(ascii)Listen=Network::8085
*
*      FileDescriptor for Network read/write
*
(ascii)Network=Network:
```

mini-certificate issuance service

```
*
*      Channel timeout interval in seconds
*
(int)TimeInterval=300
*
*      Mini Certificate Server Registry class
*
*-----*
[MiniCertSvrRegistry]
*
*      Mini-Certificate-Server Registry's Root User InitialPIN
*
(ascii)InitialPIN=12345678
*
*      Mini Certificate Server Registry's KeyRingPassword
*
(ascii)KeyRingPassword=It_is_a_secret
*-----*
[Mode]
*
*      Issue certificates in the old format
*
(ascii)Mode=old
*
```

When all the relevant queue manager software has been upgraded to MQSeries Everyplace Version 1.2.6, you can start issuing certificates in the updated format by changing `Mode=old` to `Mode=new`, or by omitting the `[Mode]` section.

Note: If you are setting up a new mini-certificate issuance service, (running the mini-certificate server for the first time), the server issues itself with new credentials and a new certificate. The server's own certificate is always in the new format, even when running in compatibility mode. If you are setting up a new service, you should not use compatibility mode.

Chapter 9. Tracing in MQSeries Everyplace

This section provides assistance with using and customizing the MQSeries Everyplace trace program.

MQSeries Everyplace provides a simple, but useful, tracing facility. This facility can be used to follow the course of execution of a program either when it is running, or later by inspecting the trail of execution recorded in a file. Trace messages are sent from the running code to a trace window, where they are displayed.

The trace facility is just a trace, it does not contain some features found in debuggers, such as the ability to set and release break points.

Example trace classes can be found in the `examples.trace` subdirectory. For brief details of these classes see “`examples.trace` package” on page 24. These classes can be used to handle and display trace from a running MQSeries Everyplace environment. “MQeTrace example” on page 211 shows how to use the example files.

Tracing would not normally be used in a production environment, except for diagnosis of problems, as any form of tracing affects the performance of MQSeries Everyplace.

Using trace

To trace the execution of an application program you must put a statement in an appropriate place in the code using the `MQe.trace` method as shown in the following example:

```
...
/* */
trace( "We got here" );
...
```

When executed, this results in the text “We got here” being displayed in the MQSeries Everyplace Trace window.

Trace message formats

There are several types of message (information, warning, error, security and debug) and the type is denoted by the first characters as shown in Table 12.

Table 12. Trace message types

Initial character	Meaning
I or i	Information
W or w	Warning
E or e	Error
S or s	Security
D or d	Debug

Upper case prefixes are used for application trace messages and lower case prefixes are used for system trace messages. System trace messages are usually only generated from within MQSeries Everyplace.

trace message formats

The message is sent to the MQSeries Everyplace trace facility, which checks the level of the message and, if required, outputs it to the trace window. Trace messages that have a recognizable prefix are written to System.err, others are written to System.out

The examples.trace.MQeTrace file in the examples.trace directory contains the various message templates for the messages issued by MQSeries Everyplace internal routines. The messages are of the form:

```
/* common messages */
{ "1", "d:[00001]:Created" },
{ "2", "d:[00002]:Destroyed" },
{ "3", "d:[00003]:Close" },
{ "4", "w:[00004]:Warning:#0" },
{ "5", "e:[00005]:Error:#0" },
{ "6", "i:[00006]:Command:#0" },
{ "7", "i:[00007]:Waiting" },
{ "8", "i:[00008]:#0 input byte count=#1" },
... ,
```

where the first character string is the message number and the second string is the message template.

examples.trace.MQeTraceResource contains the message strings in English. Various other language versions are also provided in this directory.

The template has the following format:

- The message type as described in Table 12 on page 209
- A modifier character, this modifier has the following meanings:

Table 13. Trace message modifiers

Modifier	Meaning
:	no modification applied
;	RESERVED for create/destroy object
+	log this message via the Log interface
¬	ignore - Do not display this message

- The message number in the format '[nnnnn]:'
- The message text. This can include inserts of the form '#n' where 'n' is an integer from 0 to 9

By modifying this source file you can change the classification of a message. For example, you can change from a Warning to an Error, or by changing the modifier character from ':' to '+', you can cause the message to be copied to the Event log.

New trace messages can be added at runtime using the addMessage or addMessageBundle calls. For example, to add a single new message :

```
...
MQeTraceInterface MyTrace = MQe.GetTraceHandler();
myTrace.addMessage(" :[11111]:My Application - #0 = #1" );
...
trace( 11111, new String[] { "Magic word", "xyzy" } );
...

```

Activating trace

Trace, which is not active by default, can be activated using the MQe.setTraceHandler as shown in the following code:

```

...
/* give the trace object to MQe */
setTraceHandler( new myTraceHandler() );
trace( "I:Starting..." );
...

```

The example trace handler that is shipped as part of the MQSeries Everyplace toolkit, includes the trace activation code.

Customizing trace

The trace classes provided in the examples directory can be used as a basis for custom trace handlers.

MQeTrace example

The MQeTrace example class provides a simple, tracing facility that by default outputs the trace messages to System.out and/or to System.err.

To activate the trace window specify the following code:

```

...
/* Start the example version of MQeTrace */
new examples.trace.MQeTrace( "Trace", null );
...
trace( "I:Starting..." );
trace( 123456, "Insert" );
...

```

The second parameter on the constructor is the language to be used for the trace messages, if null is specified, the default language is used. Alternatively a different resource file may be specified that changes the classification of the messages, for example:

```

...
/* Start the example version of MQeTrace */
new examples.trace.MQeTrace( "Trace", "MyMessageResourceFile" );
...
trace( "I:Starting..." );
trace( 123456, "Insert" );
...

```

The currently active trace handler object can be found by issuing an MQe.getTraceHandler method call. Using this reference the behavior of the trace can be modified, that is selecting or deselecting the types of trace messages to be written.

```

...
/* Start the example version of MQeTrace */
MQeTraceInterface trace = MQe.getTraceHandler( );
if ( trace instanceof MQeTrace )
{
    ((MQeTrace) trace).MsgInf = true;
    ((MQeTrace) trace).MsgDebug = true;
    ((MQeTrace) trace).MsgTime = true;
}
...
trace( "I:Starting..." );
...

```

The variables (and their defaults) in MQeTrace that may be modified are :

```

public boolean MsgInf      = false;    /* Informaton msgs */
public boolean MsgWarn     = true;     /* warning msgs */
public boolean MsgErr      = true;     /* error msgs */

```

customizing trace

```
public boolean MsgSecurity = false;    /* Security msgs    */
public boolean MsgSys      = true;     /* System modifier  */
public boolean MsgDebug    = false;    /* Debug modifier   */
public boolean MsgLog      = false;    /* Trace message to log */
public boolean MsgTime     = false;    /* add Time stamp   */
public boolean MsgPrefix   = false;    /* add object prefix */
public boolean MsgThread   = false;    /* add Thread ID    */
```

More details can be found by examining the source code for MQeTrace in the `examples.trace` directory:

This trace example can be used as the basis for a more sophisticated trace program or a completely new one could be created.

The application program could even be the trace handler as well as its normal function just by implementing the MQeTraceInterface and issuing the MQe.setTraceHandler method call.

Graphical user interface for trace

The basic trace function provided in the `examples.trace` directory just displays the trace messages on `System.out` and `System.err` in the console window associated with the application.

There is another trace handler supplied in the `examples.awt` directory that uses a subset of the Java AWT to provide a graphical user interface to the trace. This enables the various tracing options to be modified dynamically.

```
...
/* Start the example GUI version of MQeTrace */
new examples.awt.AwtMQeTrace( "My Trace title", null );
...
trace( "I:Starting..." );
```

This code starts the trace window with the title 'My Trace' and displays the information message "I:Starting". The trace window has pull-down menus that enable the user to modify the level of tracing, the format of the messages, and other properties, as shown in Figure 37 on page 213. Note that an MQSeries Everyplace object is required to perform tracing. The examples above assumed that the code is part of a class that extends the base MQSeries Everyplace class. It is possible to output MQSeries Everyplace trace messages from objects that do not themselves extend MQSeries Everyplace. In this case, you need to create an MQSeries Everyplace object, and then specify the tracing by using the methods of this object. For example:

```
...
/* create a MQe object */
MQe dbg = new MQe( );
dbg.Message( "D:We got here" );
...
```

MQSeries Everyplace tracing is Java virtual machine wide, so that all messages from MQSeries Everyplace objects executed on any thread in the current Java Virtual Machine are handled by the same trace facility, and displayed in the same trace window. This can be a big advantage as it shows the order in which events actually occurred. However it can be a disadvantage if you wish to separate out totally independent events occurring on different threads.

Note: Terminating the MQSeries Everyplace Trace window does not terminate the Java program.

Example AWT trace window layout

Note that you need a `MyMessageResourceFileGUI` file that specifies the text to be used in any graphical user interface components associated with trace.

The example trace program in `examples.awt` produces a window with the layout shown in Figure 37.

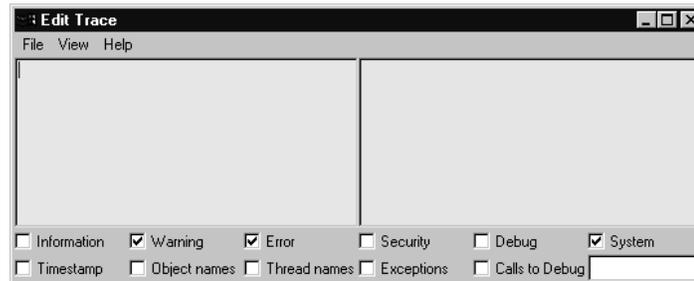


Figure 37. Example trace GUI window

The Menu items are:

- File Menu:

Clear clears the trace window

Save As...

Save the contents of the trace window to a disk file

Trace to Log

Copy Trace messages to the event log

Trap I/O

Output to `System.out` and `System.err` is displayed in the window. If this option is unchecked output goes to the Java console

Kill

Terminate both trace and the owning application. Clicking on the window frame exit button only terminates the Trace

- View Menu:

View Options

Show the trace message display options

System.out

Show the `System.out` window

System.err

Show the `System.err` window

The various trace message display options control how, and which, trace messages are to be displayed in the `System.err.println` window:

Information

Display information messages

Warning

Display warning messages

Error Display error messages

trace GUI

Security

Display security messages

Debug

Display debugging information messages

System

Controls whether messages with the System characteristics are displayed. This affects Information, Warning, Error, Security and Debug style messages

Timestamp

Prefixes the messages with the current time stamp

Object names

Prefixes the messages with the object type and instance that originated the message

Thread names

Prefixes the messages with the name of the thread that is running at the time

Exceptions

Causes a stack trace to be displayed whenever an MQException is thrown

Calls to Debug

Causes a stack trace to be displayed whenever an application or MQSeries Everyplace issues the MQE.Debug call

The 'System.err.println and Trace message filter' is a string that is used to match anything within the output. If the match is successful the output is displayed, if the match was unsuccessful the output is not displayed.

Using this feature it is possible to selectively display messages from a specific thread (assuming that the Thread name checkbox is checked).

Setting trace options

The various trace options can be preset on start-up of the AwtMQETrace program by creating a new GUI resource file that prechecks any of the checkable components for example:

```
public class MQETraceResourceGUI extends java.util.ListResourceBundle
{
    static final Object[][] contents = {
        /* Check items can be pre-checked by replacing the blank with an "!" */
        { "File", "File" },
        { "Clear", "Clear" },
        { "Save", "Save As..." },
        { "Log", "Trace to Log" }, /* check item */
        { "Trap", "Trap I/O" }, /* check item */
        { "Halt", "Kill" },
        { "View", "View" },
        { "Options", "View Options" }, /* check item */
        { "SystemOut", "System.out" }, /* check item */
        { "SystemErr", "System.err" }, /* check item */
        { "Help", "Help" },
        { "About", "About..." },
        /* checkbox labels */
        { "Information", "Information" }, /* check item */
        { "Warning", "Warning" }, /* check item */
        { "Error", "Error" }, /* check item */
        { "Debug", "Debug" }, /* check item */
        { "Security", "Security" }, /* check item */
        { "System", "System" }, /* check item */
    }
}
```

```

        { "Timestamp",      " Timestamp"    }, /* check item */
        { "Objects",       " Object names" }, /* check item */
        { "Threads",       " Thread names" }, /* check item */
        { "Exceptions",    " Exceptions"   }, /* check item */
        { "CallStack",     " Calls to Debug" }, /* check item */

/* About dialog */
{ "AboutTitle",      "About MQe Trace" },
{ "AboutVersion",    "MQe version"     },
{ "AboutProduct",    "Product number 5639-I47" },
{ "AboutCopyright", "(C) Copyright IBM Corp. 1999 All Rights Reserved" },
{ "AboutCopyright2", "Licensed Materials - Property of IBM" },
{ "AboutTrace",      "Trace version"   },
{ "AboutComments",   " "                },
{ "OK",              "OK"              },

};

public Object[][] getContents( )
{
    return( contents );
}

```

Note: If trace options are modified programmatically for MQeTrace, as shown in the following code, the corresponding components on the AwtMQeTrace window WILL NOT be updated

```

...
/* Start the example version of MQeTrace */
MQeTraceInterface trace = MQe.getTraceHandler( );
if ( trace instanceof MQeTrace )
    ((MQeTrace) trace).MsgDebug = true;
...

```

trace GUI

Chapter 10. MQSeries Everyplace adapters

MQSeries Everyplace adapters are used to map MQSeries Everyplace to device interfaces. Adapters are usually associated with transmission protocols, but they can also be used with other interfaces such as storage devices.

The following adapters are provided with MQSeries Everyplace and are described in detail in *MQSeries Everyplace for Multiplatforms Programming Guide*.

MQeDiskFieldsAdapter

Provides support for reading and writing MQeFields information to a local disk.

MQeMemoryFieldsAdapter

Provides a non-persistent store for MQeFields information

MQeReducedDiskFieldsAdapter

Provides support for high speed writing of MQeFields information to a local disk.

MQeTcpipAdapter

Provides support for reading and writing data over TCP/IP streams.

MQeTcpipHttpAdapter

Extends the MQeTcpipAdapter to provide basic support for the HTTP 1.0 protocol.

MQeTcpipLengthAdapter

Extends the MQeTcpipAdapter to provide a simple, byte efficient protocol.

MQeTcpipHistoryAdapter

Extends the MQeTcpipLengthAdapter to provide a more efficient protocol that caches recently used data.

MQeUdpipeAdapter

Provides support for assured data transfer over UDP/IP datagrams.

MQeWESAuthenticationAdapter

Provides support for tunnelling HTTP requests through Websphere Everyplace authentication proxies and transparent proxies.

You can also write your own adapters to tailor MQSeries Everyplace for your own environment. The next section describes some adapter examples that are supplied to help you with this task.

Adapter examples

This section provides information on the creation of MQSeries Everyplace adapters. The following adapters are described:

A simple communications adapter

This example uses the standard Java classes to manipulate TCPIP and adds an extra protocol.

A simple message store adapter

This example creates an adapter for use as an interface to a message store.

adapters

Please refer to Chapter 9 in the MQSeries Everyplace for Multiplatforms Programming Reference for details of the adapter classes that are supplied with MQSeries Everyplace.

An example of a simple communications adapter

This example uses the standard Java classes to manipulate TCPIP and adds a protocol of its own on top. This protocol has a header consisting of a four byte length of the data in the data packet followed by the actual data. This is so that the receiving end knows how much data to expect.

This example is not meant as a replacement for the adapters that are supplied with MQSeries Everyplace but rather as a simple introduction into how to create communications adapters. In reality, much more care should be taken with error handling, recovery, and parameter checking. Depending on the MQSeries Everyplace configuration used, the supplied adapters may be sufficient.

A new class file is constructed, inheriting from MQeAdapter. Some variables are defined to hold this adapter's instance information, that is the name of the host, port number and the output stream objects.

The MQeAdapter constructor is used for the object, so no additional code needs to be added for the constructor.

```
public class MyTcpipAdapter extends MQeAdapter
{
    protected    String          host          = "";
    protected    int             port         = 80;
    protected    Object          readLock    = new Object( );
    protected    ServerSocket    serversocket = null;
    protected    Socket          socket      = null;
    protected    BufferedInputStream stream_in = null;
    protected    BufferedOutputStream stream_out = null;
    protected    Object          writeLock   = new Object( );
}
```

Next the activate method is coded. This is the method that extracts from the file descriptor the name of the target network address if a connector, or the listening port if a listener. The fileDesc parameter contains the adapter class name or alias name, and any network address data for the adapter for example MyTcpipAdapter:127.0.0.1:80. The thisParam parameter contains any parameter data that was set when the connection was defined by administration, the normal value would be "?Channel". The thisOpt parameter contains the adapter setup options that were set by administration, for example MQe_Adapter_LISTEN if this adapter is to listen for incoming connections.

```
public void activate( String      fileDesc,
                    Object      thisParam,
                    Object      thisOpt,
                    int         thisValue1,
                    int         thisValue2 ) throws Exception
{
    super.activate( fileDesc,
                  thisParam,
                  thisOpt,
                  thisValue1,
                  thisValue2 );
    /* isolate the TCP/IP address - "MyTcpipAdapter:127.0.0.1:80" */
    host = fileId.substring( fileId.indexOf( ':' ) + 1 );
    i    = host.indexOf( ':' ); /* find delimiter */
    if ( i > -1 ) /* find it ? */
    {

```

```

        port = (new Integer( host.substring( i + 1 ) )).intValue( );
        host = host.substring( 0, i );
    }
}

```

The close method needs to be defined to close the output streams and flush any remaining data from the stream buffers. Close is called many time during a session between a client and a server, however, when the channel has completely finished with the adapter it calls MQSeries Everyplace with the option MQe_Adapter_FINAL. If the adapter is to have one socket connection for the life of the channel then the call with MQe_Adapter_FINAL set, is the one to use to actually close the socket, other calls should just flush the buffers. If however a new socket is to be used on each request, then each call to MQSeries Everyplace should close the socket, subsequent open calls should allocate a new socket:

```

public void    close( Object opt ) throws Exception
{
    if ( stream_out  != null )                /* output stream ?    */
    {
        stream_out.flush();                  /* empty the buffers */
        stream_out.close();                  /* close it           */
        stream_out = null;                   /* clear              */
    }
    if ( stream_in   != null )                /* input stream ?    */
    {
        stream_in.close();                   /* close it           */
        stream_in = null;                    /* clear              */
    }
    if ( socket      != null )                /* socket ?          */
    {
        socket.close();                      /* close it           */
        socket = null;                       /* clear              */
    }
    if ( serversocket != null )               /* serversocket ?    */
    {
        serversocket.close();                /* close it           */
        serversocket = null;                 /* clear              */
    }
    host = "";
    port = 80;
}

```

The control method needs to be coded to handle an MQe_Adapter_ACCEPT request, to accept an incoming connect request. This is only allowed if the socket is a listener (a server socket). Any options that were specified for the listen socket (excluding MQe_Adapter_LISTEN) are copied to the socket created as a result of the accept. This is accomplished by the use of another control option MQe_Adapter_SETSOCKET this allows a socket object to be passed to the adapter that was just instantiated.

```

public Object control( Object opt, Object ctrlObj ) throws Exception
{
    if ( checkOption( opt, MQe.MQe_Adapter_LISTEN      ) &&
        checkOption( opt, MQe.MQe_Adapter_ACCEPT ) )
    {
        /* CtrlObj - is a string representing the file descriptor of the */
        /*           MQeAdapter object to be returned e.g. "MyTcpip:"    */
        Socket ClientSocket = serversocket.accept(); /* wait connect */
        String Destination = (String) ctrlObj;      /* re-type object*/
        int i = Destination.indexOf( ':' );
        if ( i < 0 )
            throw new MQeException( MQe.Except_Syntax,
                                     "Syntax:" + Destination );
        /* remove the Listen option */
        String NewOpt = (String) options;          /* re-type to string */
    }
}

```

adapters

```
int j = NewOpt.indexOf( MQe.MQe_Adapter_LISTEN );
NewOpt = NewOpt.substring( 0, j ) +
        NewOpt.substring( j + MQe.MQe_Adapter_LISTEN.length( ) );
MQeAdapter Adapter = MQe.newAdapter( Destination.substring( 0,i+1 ),
                                     parameter,
                                     NewOpt + MQe_Adapter_ACCEPT,
                                     -1,
                                     -1 );

/* assign the new socket to this new adapter */
Adapter.control( MQe.MQe_Adapter_SETSOCKET, ClientSocket );
return( Adapter );
}
else
if ( checkOption( opt, MQe.MQe_Adapter_SETSOCKET ) )
{
    if ( stream_out != null ) stream_out.close();
    if ( stream_in != null ) stream_in.close();
    if ( ctrlObj != null ) /* socket supplied ? */
    {
        socket = (Socket) ctrlObj; /* save the socket */
        stream_in = new BufferedInputStream ( socket.getInputStream ( ) );
        stream_out = new BufferedOutputStream( socket.getOutputStream( ) );
    }
    else
        return( super.control( opt, ctrlObj ) );
}
}
```

The open method needs to check for a listening socket or a connector socket and create the appropriate socket object. Reinitialization of the input and output streams is achieved by using the control method, passing it a new socket object. The opt parameter may be set to MQe_Adapter_RESET, this means that any previous operations are now complete any new reads or writes constitute a new request.

```
public void open( Object opt ) throws Exception
{
    if ( checkOption( MQe.MQe_Adapter_LISTEN ) )
        serversocket = new ServerSocket( port, 32 );
    else
        control( MQe.MQe_Adapter_SETSOCKET, new Socket( host, port ) );
}
```

The read method can take a parameter specifying the maximum record size to be read.

This examples calls internal routines to read the data bytes and do error recovery (if appropriate) then return the correct length byte array for the number of bytes read. Care needs to be taken to ensure that only one read at a time occurs on this socket. The opt parameter may be set to:

MQe_Adapter_CONTENT

read any message content

MQe_Adapter_HEADER

read any header information

```
{ public byte[] read( Object opt, int recordSize ) throws Exception

    int Count = 0; /* number bytes read */
    synchronized ( readLock ) /* only one at a time */
    {
        if ( checkOption( opt, MQe.MQe_Adapter_HEADER ) )
        {
            byte lreclBytes[] = new byte[4]; /* for the data length */
            readBytes( lreclBytes, 0, 4 ); /* read the length */
            int recordSize = byteToInt( lreclBytes, 0, 4 );
        }
    }
```

```

if ( checkOption( opt, MQe.MQe_Adapter_CONTENT ) )
{
    byte Temp[] = new byte[recordSize];    /* allocate work array */
    Count = readBytes( Temp, 0, recordSize);/* read data          */
}
}
if ( Count < Temp.length )                /* read all length ? */
    Temp = MQe.sliceByteArray( Temp, 0, Count );
return ( Temp );                          /* Return the data   */
}

```

The readByte method is an internal routine designed to read a single byte of data from the socket and to attempt to retry any errors a specific number of times, or throw an end of file exception if there is no more data to be read.

```

protected int readByte( ) throws Exception
{
    int intChar = -1;                       /* input character */
    int RetryValue = 3;                     /* error retry count */
    int Retry = RetryValue + 1;             /* reset retry count */
    do{                                     /* possible retry */
        try                                 /* catch io errors */
        {
            intChar = stream_in.read();     /* read a character */
            Retry = 0;                      /* dont retry      */
        }
        catch ( IOException e )             /* IO error occured */
        {
            Retry = Retry - 1;              /* decrement      */
            if ( Retry == 0 ) throw e;      /* more attempts ? */
        }
    } while ( Retry != 0 );                 /* more attempts ? */
    if ( intChar == -1 )                    /* end of file ?   */
        throw new EOFException();         /* ... yes, EOF    */
    return( intChar );                      /* return the byte */
}

```

The readBytes method is an internal routine designed to read a number of bytes of data from the socket and to attempt to retry any errors a specific number of times, or throw an end of file exception if there is no more data to be read.

```

protected int readBytes( byte buffer[], int offset, int recordSize )
throws Exception
{
    int RetryValue = 3;
    int i = 0;                               /* start index */
    while ( i < recordSize )                 /* got it all in yet ? */
    {                                         /* ... no */
        int NumBytes = 0;                    /* read count */
        /* retry any errors based on the QoS Retry value */
        int Retry = RetryValue + 1;         /* error retry count */
        do{                                  /* possible retry */
            try                               /* catch io errors */
            {
                NumBytes = stream_in.read( buffer, offset + i, recordSize - i );
                Retry = 0;                    /* no retry      */
            }
            catch ( IOException e )           /* IO error occured */
            {
                Retry = Retry - 1;           /* decrement      */
                if ( Retry == 0 ) throw e;   /* more attempts ? */
            }
        } while ( Retry != 0 );              /* more attempts ? */
        /* check for possible end of file */
        if ( NumBytes < 0 )                  /* errors ? */

```

adapters

```
        throw new EOFException( );           /* ... yes          */
        i = i + NumBytes;                    /* accumulate       */
    }    return ( i );                       /* Return the count */
}
```

The readln method reads a string of bytes terminated by a 0x0A character it will ignore 0x0D characters.

```
{
synchronized ( readLock )                  /* only one at a time */
{
    /* ignore the 4 byte length              */
    byte lrc1Bytes[] = new byte[4];        /* for the data length */
    readBytes( lrc1Bytes, 0, 4 );         /* read the length    */

    int intChar = -1;                      /* input characater   */
    StringBuffer Result = new StringBuffer( 256 );
    /* read Header from input stream        */
    while ( true )                         /* until "newline"    */
    {
        intChar = readByte( );             /* read a single byte */
        switch ( intChar )                 /* what character     */
        {
            /*
            case -1:                        /* ... no character   */
                throw new EOFException(); /* ... yes, EOF      */
            case 10:                        /* eod of line        */
                return( Result.toString() ); /* all done          */
            case 13:                        /* ignore             */
                break;
            default:                        /* real data          */
                Result.append( (char) intChar ); /* append to string  */
        }
    }
}
}
```

The status method returns status information about the adapter. In this example it returns for the option MQe_Adapter_NETWORK the network type (TCPIP), for the option MQe_Adapter_LOCALHOST it returns the tcpip local host address.

```
public String status( Object opt ) throws Exception
{
    if ( checkOption( opt, MQe.MQe_Adapter_NETWORK ) )
        return( "TCPIP" );
    else
        if ( checkOption( opt, MQe.MQe_Adapter_LOCALHOST ) )
            return( InetAddress.getLocalHost( ).toString() );
        else
            return( super.status( opt ) );
}
```

The write method writes a block of data to the socket. It needs to ensure that only one write at a time can be issued to the socket. In this example it calls an internal routine writeBytes to write the actual data and perform any appropriate error recovery.

The opt parameter may be set to:

MQe_Adapter_FLUSH
flush any data in the buffers

MQe_Adapter_HEADER
write any header records

MQe_Adapter_HEADERRSP
write any header response records

```

public void write( Object opt, int recordSize, byte data[] )
throws Exception
{
    synchronized ( writeLock )           /* only one at a time */
    {
        if ( checkOption( opt, MQe.MQe_Adapter_HEADER ) ||
              checkOption( opt, MQe.MQe_Adapter_HEADERRSP ) )
            writeBytes( intToByte( recordSize ), 0, 4 ); /* write length*/
        writeBytes( data, 0, recordSize ); /* write the data */
        if ( checkOption( opt, MQe.MQe_Adapter_FLUSH ) )
            stream_out.flush( ); /* make sure it is sent */
    }
}

```

The writeBytes is an internal method that writes an array (or partial array) of bytes to a socket, and attempt a simple error recovery if errors occur.

```

protected void writeBytes( byte buffer[], int offset, int recordSize )
throws Exception
{
    if ( buffer != null ) /* any data ? */
    {
        /* break the data up into manageable chunks */
        int i = 0; /* Data index */
        int j = recordSize; /* Data length */
        int MaxSize = 4096; /* small buffer */
        int RetryValue = 3; /* error retry count */
        do{ /* as long as data */
            if ( j < MaxSize ) /* smallbuffer ? */
                MaxSize = j;
            int Retry = RetryValue + 1; /* error retry count */
            do{ /* possible retry */
                try /* catch io errors */
                {
                    stream_out.write( buffer, offset + i, MaxSize );
                    Retry = 0; /* don't retry */
                }
                catch ( IOException e ) /* IO error occurred */
                {
                    Retry = Retry - 1; /* decrement */
                    if ( Retry == 0 ) throw e; /* more attempts ? */
                }
            } while ( Retry != 0 ); /* more attempts ? */

            i = i + MaxSize; /* update index */
            j = j - MaxSize; /* data left */
        } while ( j > 0 ); /* till all data sent */
    }
}

```

The writeLn method writes a string of characters to the socket, terminating with 0x0A and 0x0D characters.

The opt parameter may be set to:

MQe_Adapter_FLUSH
flush any data in the buffers

MQe_Adapter_HEADER
write any header records

MQe_Adapter_HEADERRSP
write any header response records

adapters

```
public void writeLn( Object opt, String data ) throws Exception
{
    if ( data == null )                /* any data ?      */
        data = "";
    write( opt, -1, MQe.asciiToByte( data + "\r\n" ) ); /* write data */
}
```

This is now a complete (though very simple) tcpip adapter that will communicate to another copy of itself one of which was started as a listener and the other started as a connector.

An example of a simple message store adapter

This example creates an adapter for use as an interface to a message store. It uses the standard Java i/o classes to manipulate files in the store.

This example is not meant as a replacement for the adapters that are supplied with MQSeries Everyplace but rather as a simple introduction into how to create a message store adapter.

A new class file is constructed, inheriting from MQeAdapter. Some variables are defined to hold this adapter's instance information, such as the name of the file/message and the location of the message store.

The MQeAdapter constructor is used for the object, so no additional code needs to be added for the constructor.

```
public class MyMsgStoreAdapter extends MQeAdapter
    implements FilenameFilter
{
    protected String filter = "";          /* file type filter */
    protected String fileName = "";       /* disk file name   */
    protected String filePath = "";       /* drive and directory */
    protected boolean reading = false;    /* open'd for reading */
    protected boolean writing = false;
}
```

Because this adapter implements FilenameFilter the following method must be coded. This is the flittering mechanism that is used to select files of a certain type within the message store.

```
public boolean accept( File dir, String name )
{
    return( name.endsWith( filter ) );
}
```

Next the activate method is coded. This is the method that extracts, from the file descriptor, the name of the directory to be used to hold all the messages.

The Object parameter on the method call may be an attribute object. If it is, this is the attribute that is used to encode and/or decode the messages in the message store.

The Object options for this adapter are:

- MQe_Adapter_READ
- MQe_Adapter_WRITE
- MQe_Adapter_UPDATE

Any other options should be ignored.

```
public void activate( String fileDesc,
                    Object param,
                    Object options,
```

```

        int    value1,
        int    value2 ) throws Exception
    {
    super.activate( fileDesc, param, options, lrec1, noRec );
    filePath = fileId.substring( fileId.indexOf( ':' ) + 1 );
    String Temp = filePath; /* copy the path data */
    if ( filePath.endsWith( File.separator ) ) /* ending separator ? */
        Temp = Temp.substring( 0, Temp.length() -
                               File.separator.length() );
    else
        filePath = filePath + File.separator; /* add separator */
    File diskFile = new File( Temp );
    if ( ! diskFile.isDirectory( ) ) /* directory ? */
        if ( ! diskFile.mkdirs( ) ) /* does mkDirs work ? */
            throw new MQeException( MQe.Except_NotAllowed,
                                     "mkdirs '" + filePath + "' failed" );
    filePath = diskFile.getAbsolutePath( ) + File.separator;
    this.open( null );
    }

```

The close method disallows reading or writing.

```

public void close( Object opt ) throws Exception
    {
    reading = false; /* not open for reading*/
    writing = false; /* not open for writing*/
    }

```

The control method needs to be coded to handle an MQe_Adapter_LIST that is, a request to list all the files in the directory that satisfy the filter. Also to handle an MQe_Adapter_FILTER that is a request to set a filter to control how the files are listed.

```

public Object control( Object opt, Object ctrlObj ) throws Exception
    {
    if ( checkOption( opt, MQe.MQe_Adapter_LIST ) )
        return( new File( filePath ).list( this ) );
    else
        if ( checkOption( opt, MQe.MQe_Adapter_FILTER ) )
            {
            filter = (String) ctrlObj; /* set the filter */
            return( null ); /* nothing to return */
            }
        else
            return( super.control( opt, ctrlObj ) ); /* try ancestor */
    }

```

The erase method is used to remove a message from the message store.

```

public void erase( Object opt ) throws Exception
    {
    if ( opt instanceof String ) /* select file ? */
        {
        String FN = (String) opt; /* re-type the option */
        if ( FN.indexOf( File.separator ) > -1 ) /* directory ? */
            throw new MQeException( MQe.Except_Syntax, "Not allowed" );
        if ( ! new File( filePath + FN ).delete( ) )
            throw new MQeException( MQe.Except_NotAllowed, "Erase failed" );
        }
    else
        throw new MQeException( MQe.Except_NotSupported, "Not supported" );
    }

```

The open method sets the Boolean values that permit either reading of messages or writing of messages.

adapters

```
public void open( Object opt ) throws Exception
{
    this.close( null );           /* close any open file */
    fileName = null;             /* clear the filename */
    if ( opt instanceof String ) /* select new file ? */
        fileName = (String) opt; /* retype the name */
    reading = checkOption( opt, MQe.MQe_Adapter_READ ) ||
              checkOption( opt, MQe.MQe_Adapter_UPDATE );
    writing = checkOption( opt, MQe.MQe_Adapter_WRITE ) ||
             checkOption( opt, MQe.MQe_Adapter_UPDATE );
}
```

The readObject method reads a message from the message store and recreates an object of the correct type. It also decrypts and decompresses the data if an attribute is supplied on the activate call. This is a special function in that a request to read a file that satisfies the matching criteria specified in the parameter of the read, returns the first message it encounters that satisfies the match.

```
public Object readObject( Object opt ) throws Exception
{
    if ( reading )
    {
        if ( opt instanceof MQeFields )
        {
            /* 1. list all files in the directory */
            /* 2. read each file in turn and restore as a Fields object */
            /* 3. try an equality check - if equal then return that object */
            String List[] = new File( filePath ).list( this );
            MQeFields Fields = null;
            for ( int i = 0; i < List.length; i = i + 1 )
                try
                {
                    fileName = List[i];           /* remember the name */
                    open( fileName );           /* try this file */
                    Fields = (MQeFields) readObject( null );
                    if ( Fields.equals( (MQeFields) opt ) ) /* match ? */
                        return( Fields );
                }
                catch ( Exception e )           /* error occurred */
                {
                    /* ignore error */
                }
            throw new MQeException( Except_NotFound, "No match" );
        }
        /* read the bytes from disk */
        File diskFile = new File( filePath + fileName );
        byte data[] = new byte[(int) diskFile.length()];
        FileInputStream InputFile = new FileInputStream( diskFile );
        InputFile.read( data );                /* read the file data */
        InputFile.close( );                   /* finish with file */
        /* possible Attribute decode of the data */
        if ( parameter instanceof MQeAttribute ) /* Attribute encoding ? */
            data = ((MQeAttribute) parameter).decodeData( null,
                                                         data,
                                                         0,
                                                         data.length );
        MQeFields FieldsObject = MQeFields.reMake( data, null );
        return( FieldsObject );
    }
    else
        throw new MQeException( MQe.Except_NotSupported, "Not supported" );
}
```

The status method returns status information about the adapter. In this examples it can return the filter type or the file name.

```

public String status( Object opt ) throws Exception
{
    if ( checkOption( opt, MQe.MQe_Adapter_FILTER ) )
        return( filter );
    if ( checkOption( opt, MQe.MQe_Adapter_FILENAME ) )
        return( fileName );
    return( super.status( opt ) );
}

```

The writeObject method writes a message to the message store. It compresses and encrypts the message object if an attribute is supplied on the activate method call.

```

public void writeObject( Object opt,
                        Object data ) throws Exception
{
    if ( writing && (data instanceof MQeFields) )
    {
        byte dump[] = ((MQeFields) data).dump( );           /* dump object */
        /* possible Attribute encode of the data           */
        if ( parameter instanceof MQeAttribute )
            dump = ((MQeAttribute) parameter).encodeData( null,
                                                            dump,
                                                            0,
                                                            dump.length );

        /* write out the object bytes                       */
        File diskFile = new File( filePath + fileName );
        FileOutputStream OutputFile = new FileOutputStream( diskFile );
        OutputFile.write( dump );                          /* write the data */
        OutputFile.getFD().sync( );                       /* synchronize disk */
        OutputFile.close();                               /* finish with file */
    }
    else
        throw new MQeException( MQe.Except_NotSupported, "Not supported" );
}

```

This is now a complete (though very simple) message store adapter that reads and writes message objects to a message store.

Variations of this adapter could be coded for example to store messages in a database or in nonvolatile memory.

The Websphere Everyplace Suite (WES) communications adapter

MQSeries Everyplace provides sophisticated security that allows applications to run over HTTP, through the protection of an Internet firewall. The purpose of the Websphere Everyplace communications adapter is to allow MQSeries Everyplace applications to authenticate themselves with the Websphere Everyplace authentication proxy and thus allow messages to flow through it. Figure 38 shows a basic scenario with two applications communicating over the Internet through the Websphere Everyplace authentication proxy.

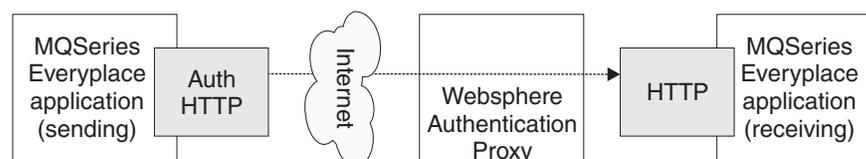


Figure 38. Applications communicating through the Websphere authentication proxy

The Websphere Everyplace adapter acts as the Auth HTTP adapter on the sending application. The receiving application could use either the same adapter or the standard HTTP adapter provided with MQSeries Everyplace.

Websphere adapter

However, the real value of MQSeries Everyplace is that it allows asynchronous messaging to occur in a typically synchronous environment. It is possible to gather enqueued requests from the receiving application and deal with them time-independently. Figure 39 shows how incoming requests could be made to reach Websphere MQ servers asynchronously.

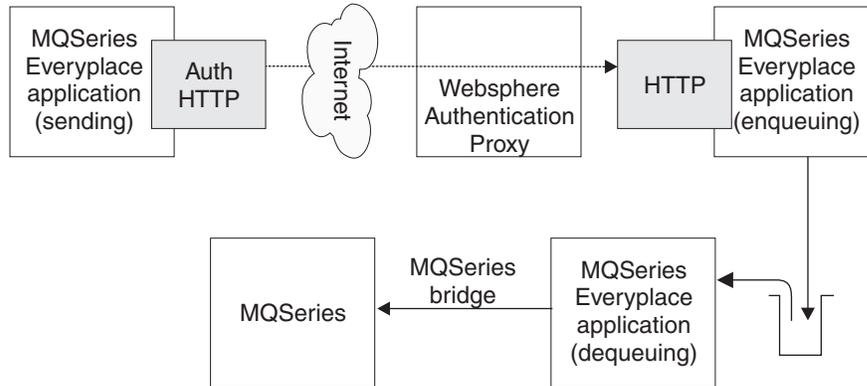


Figure 39. Applications communicating asynchronously through the Websphere Authentication Proxy

In each of these environments the Websphere authentication proxy is adding the ability to control access to the receiving applications. The adapter code supports this by adding (application-supplied) user ID and password information to each outgoing HTTP request. The Websphere authentication proxy accepts these requests and verifies that the supplied credentials are valid for the current environment. If the credentials are valid the proxy forwards the request to the receiving application.

The Websphere Everyplace adapter files

In a standard MQSeries Everyplace installation the Websphere Everyplace adapter consists of, and is supported by the following files:

...\`Java\com\ibm\mqe\adapters\MQeWESAAuthenticationAdapter.class`
- The Websphere Everyplace adapter class.

...\`Java\examples\application\Example7.class`
- Compiled example application that uses the adapter

...\`Java\examples\application\Example7.java`
- Source for the example application

...\`Java\examples\adapters\WESAAuthenticationGUIAdapter.class`
- Compiled example adapter that adds a user interface to the Websphere Everyplace adapter. As with other example classes, this class is not meant as a replacement for the base WES adapter class, but rather as a demonstration of how to tailor the WES adapter to suit your requirements.

...\`Java\examples\adapters\WESAAuthenticationGUIAdapter.java`
- Source for the example adapter

If your environment `CLASSPATH` variable is set to find all classes within the MQSeries Everyplace Java folder, the Websphere Everyplace adapter class files should be accessible from within the Java environment. If the files are not accessible, issue a command such as:

```
set CLASSPATH=%CLASSPATH%;c:\mqe\java
```

This will make the new classes visible to Java. (The exact format of this command may vary from system to system.) Once this is complete you should be able to use the WebSphere Everyplace adapter classes in the same way as any other MQSeries Everyplace classes.

Using the WebSphere Everyplace adapter

This section provides information on how to use the WebSphere Everyplace adapter. The information is divided into three parts:

General operation

This describes in detail, how to use the adapter in your applications

Using the Authentication Dialog Example

This describes how to use an example class, `examples.adapters.WESAuthenticationGUIAdapter`. This class is derived from the base WES adapter class and provides a small user interface to collect the ID and password of the user.

Using the Application Example

This describes how to use the supplied example file `examples.application.Example7` which is configured to use the base WES adapter.

The information in this section assumes that both the WebSphere Everyplace authentication proxy and MQSeries Everyplace have been installed and configured correctly. It is also assumed that an MQSeries Everyplace server queue manager and an MQSeries Everyplace client queue manager have been configured.

General Operation

1. Configure the client queue manager to send messages using the new adapter by modifying the client queue manager's configuration `.ini` file so that the `Network` alias points to `com.ibm.mqe.adapters.MQeWESAuthenticationAdapter`. Use the following command:

```
(ascii)Network=com.ibm.mqe.adapters.MQeWESAuthenticationAdapter
```
2. Configure the server queue manager to decode the stream of data that the Client Adapter supplies using either the new adapter or the standard HTTP adapter. Do this by changing the line in the server queue manager's configuration `.ini` file so that the `Network` alias points to either `com.ibm.mqe.adapters.MQeWESAuthenticationAdapter` or `com.ibm.mqe.adapters.MQeTcpipHttpAdapter`. Use one of the following commands:

```
(ascii)Network=com.ibm.mqe.adapters.MQeWESAuthenticationAdapter  
(ascii)Network=com.ibm.mqe.adapters.MQeTcpipHttpAdapter
```
3. Modify the client queue manager code so that the required user ID and password are set before the first network operation is started. For example, insert the following line near the top of your code:

```
com.ibm.mqe.adapters.MQeWESAuthenticationAdapter.setBasicAuthorization("myUserId@myRealm",  
                                                                    "myPassword");
```

Replace the parameters with a valid WES Server user ID and password.

You also need to add code to catch the new `MQeException` `Except_Authenticate` after each network operation, in case the supplied credentials were invalid.

4. Check that the client queue manager can still send messages to the server queue manager without going through the proxy.

Websphere adapter

5. Configure the client machine to send HTTP requests through the proxy. Depending on how WES has been configured, the adapter will need to work with either a *transparent proxy* or an *authentication proxy*.

As a *transparent proxy*

In this mode, the WES server acts as a simple HTTP proxy. In this case, the Java application needs to set system properties that relate to proxy information;

http.proxyHost

Must be set to the host name of the WES proxy

http.proxyPort

Must be set to the name of the port that the proxy is listening on

http.proxySet

Must be set to true, which tells the adapter to use transparent proxy mode

These parameters can be set by adding the following to your Java application:

```
System.getProperties( ).put( "http.proxySet", "true" );
System.getProperties( ).put( "http.proxyHost", "wes.hursley.ibm.com" );
System.getProperties( ).put( "http.proxyPort", "8082" );
```

The client queue manager's connection to the target MQSeries Everyplace server is similar to a connection that doesn't use the WES proxy.

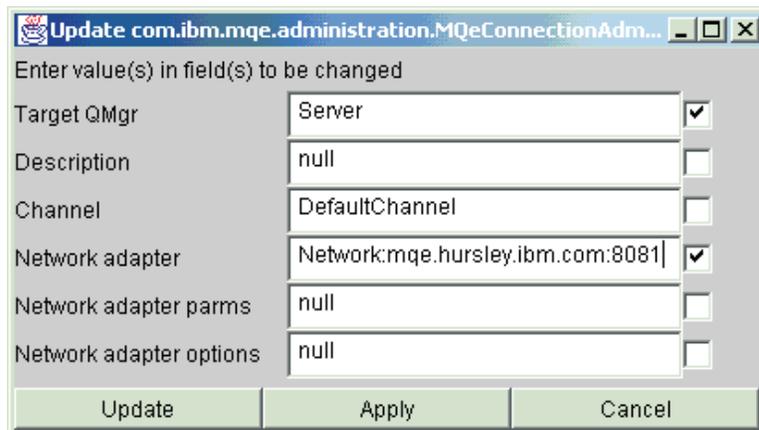


Figure 40. Administration interface panel

You need to restart the server and client queue managers for the new settings to take effect. The client should then be able to send messages to the server through the proxy.

As an *Authentication Proxy*

In this mode, the WES server forwards requests to services, based on the URL that you supply. For example, you may want requests for `http://wes.hursley.ibm.com/mqe` to be forwarded to an MQSeries Everyplace queue manager running on `mqe.hursley.ibm.com:8082`.

To set this up from MQSeries Everyplace you need to update the client's *connection* reference to the server.

Target network adapter

Should point to the Authentication Proxy machine and port

Network adapter parameters

Should contain the pathname to the required service

If you are using the MQSeries Everyplace Example Administration tool, select **Connection** and then **Update** to configure this.

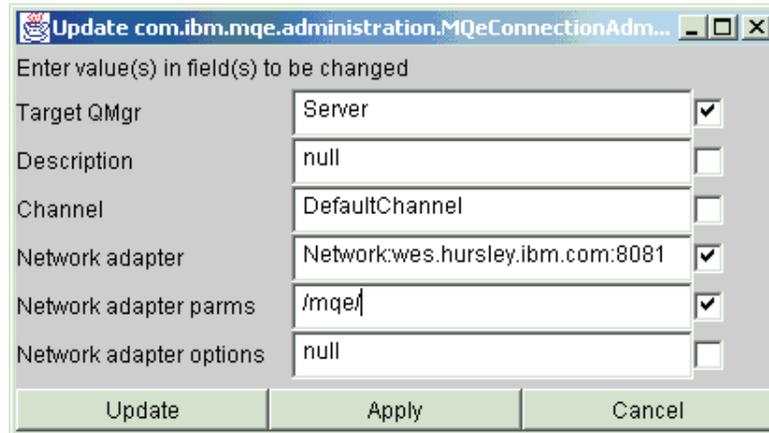


Figure 41. Administration interface panel

Note: The reference to the WES Server is entered in the **Network adapter** field, and the pathname is entered in the **Network adapter parms** field.

You need to restart the server and client queue managers for the new settings to take effect. The client should then be able to send messages to the server through the proxy.

Using the Authentication Dialog Example

The following information describes the use of the example class file, examples.adapters.WESAuthenticationGUIAdapter. This class adds a small user interface to the base WES adapter function.

1. Follow steps (1) and (2) of the 'General operation' procedures, but substitute 'WESAuthenticationGUIAdapter' for 'WESAuthenticationAdapter' in step (1).
2. Configure the client's TCP/IP settings as in step (5) of 'General operation'.

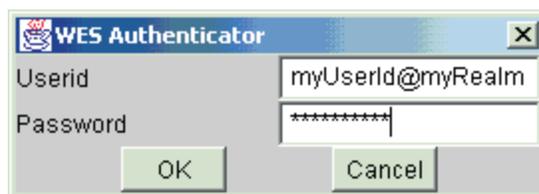


Figure 42. WebSphere Everyplace Suite adapter user dialog

The client should now be able to send messages to the server using the WESAuthenticationGUIAdapter. This adapter intercepts write calls to the WES adapter, and on the first request it pops up a dialog box that prompts for user ID and password information.

Websphere adapter

When the user clicks on **OK** or presses the **Enter** key, the `setBasicAuthorization()` method is called with the values from the `userid` and `password` fields. The `write()` is then forwarded on to the underlying WES adapter. The dialog box also has a **Cancel** button which, when selected, cancels the current write operation by not forwarding the request to the WES adapter. This causes an `MQException` (`Except_Stopped`) to be thrown.

If authentication fails, the dialog box is redisplayed on the next `write()` along with any information provided by the server. In order to learn of an authentication failure, the example adapter intercepts `read()` calls and catches any `Except_Authenticate` `MQExceptions` coming from the adapter.

Note: Web browsers do not generally send authentication information on the first flow. This typically results in a 401 or 407 response that contains the realm information. Only then does the browser send the authenticated request. User clients may wish to follow this convention.

Using the Application Example

The following information describes the use of the example application file, `examples.application.Example7`. This example behaves in a similar way to the MQSeries Everyplace programming example `examples.application.Example1` and uses the basic WES adapter for communications.

1. Follow steps (1) and (2) of the 'General operation' procedures.
2. Configure the client's TCP/IP settings as in step (5) of 'General operation'.
3. Edit the example file `...\Java\examples\application\Example7.java` inserting a valid user ID and password, and then recompile the application.
4. Restart the server.
5. Run the `Example7` program using the following command:

```
java examples.application.Example7 Server client.ini
```

where

Server

is the name of the remote queue manager (that the client already knows how to reach)

client.ini

points to the client's .ini configuration file.

The application starts the client queue manager, authenticates with the proxy, puts a message to server and then get a message from the server.

Appendix A. MQSeries Everyplace diagnostic tool

MQSeries Everyplace includes a small diagnostic tool that can be used to gather the information required by technical support personnel to assist with problem determination. The tool collects information about the local MQSeries Everyplace environment. In particular:

- CLASSPATH and PATH information
- Java system variables
- Version information of the MQSeries Everyplace classes

No personal information or MQSeries Everyplace message data is collected by this program, and it should normally only be used at the request of IBM technical support personnel.

This tool should not be confused with the trace facility, which is used to gather debugging information on a running MQSeries Everyplace system.

Invoking the MQeDiagnostics Tool

If you need to use this tool it can be invoked as follows.

On Windows NT/2000

1. From a command prompt change to the ...\`mqe\Java\demo\Windows\` folder.
2. Edit the `MQeDiagnostics.bat` file to suit your environment. The file makes use of the `JavaEnv.bat` script, so either ensure that `JavaEnv.bat` correctly sets up your `CLASSPATH` and `PATH` environment variables, or configure them directly from within the `MQeDiagnostics.bat` script.
3. Run the `MQeDiagnostics.bat` file and follow the on screen prompts.
4. Once the tool has completed, look through the `MQeDiagnostics.out` file for any errors. Common errors include:

"`.\MQeDiagnostics.properties could not be found`"

The tool requires the `MQeDiagnostics.properties` file to be supplied as input. Edit `MQeDiagnostics.bat` so that it points to the correct location for this file and rerun the tool.

"`com.ibm.mqe.support.MQeDiagnostics is not recognized as an internal or external command...`"

`JavaEnv.bat` is not configured correctly. Edit `MQeDiagnostics.bat` and `JavaEnv.bat` if necessary and rerun the tool.

"`java.lang.NoClassDefFoundError: com/ibm/mqe/support/MQeDiagnostics`"

Edit `JavaEnv.bat` and `MQeDiagnostics.bat` if necessary so that the ...\`MQe\Java\Jars\MQeDiagnostics.jar` can be found in the `CLASSPATH` environment variable.

Note: Not all MQSeries Everyplace classes can supply version information, so the `MQeDiagnostics.out` file may include some "Unknown version!" messages.

- 5) Send `MQeDiagnostics.out` to the MQSeries Everyplace support personnel.

diagnostic tool

On UNIX systems

1. From a command prompt change to the ...\`mqe\Java\demo\UNIX\` folder.
2. Edit the `MQeDiagnostics` script to suit your environment. The file makes use of the `JavaEnv` script, so either ensure that `JavaEnv` correctly sets up your `CLASSPATH` and `PATH` environment variables, or configure them directly from within the `MQeDiagnostics` script.
3. Run the `MQeDiagnostics` script and follow the on screen prompts.
4. Once the tool has completed, look through the `MQeDiagnostics.out` file for any errors. Common errors include:

"`.\MQeDiagnostics.properties could not be found`"

The tool requires the `MQeDiagnostics.properties` file to be supplied as input. Edit `MQeDiagnostics.bat` so that it points to the correct location of this file and rerun the tool.

"`com.ibm.mqe.support.MQeDiagnostics : command not found`"

`JavaEnv` is not configured correctly. Edit `MQeDiagnostics` and `JavaEnv` if necessary and rerun the tool.

"`java.lang.NoClassDefFoundError: com/ibm/mqe/support/MQeDiagnostics`"

Edit `JavaEnv` and `MQeDiagnostics` if necessary so that the ...\`MQe\Java\Jars\MQeDiagnostics.jar` file can be found in the `CLASSPATH` environment variable.

Note: Not all MQSeries Everyplace classes can supply version information, so the `MQeDiagnostics.out` file may include some "Unknown version!" messages.

5. Send `MQeDiagnostics.out` to the MQSeries Everyplace support personnel.

Other systems

On other systems, the `MQeDiagnostics` tool should be invoked directly.

1. Add the `MQeDiagnostics.jar` file to your classpath.
2. Invoke the `com.ibm.mqe.support.MQeDiagnostics` class from the Java runtime environment. For example:

```
java com.ibm.mqe.support.MQeDiagnostics MQeDiagnostics.properties > MQeDiagnostics.out
```

The program takes the `MQeDiagnostics.properties` file as an argument.

3. Send the output from the tool to the MQSeries Everyplace support personnel.

Appendix B. Applying maintenance to MQSeries Everyplace

Maintenance updates for MQSeries Everyplace are always shipped as a complete new release. There are two options when upgrading from one release to another:

Completely uninstall the current level, and install the new level in same directory

When doing this it is recommended you keep the install package for the current level to allow it to be restored later if necessary.

Keep the existing level and install the new level into a new directory

After installation, check your classpath to ensure that the latest level of MQSeries Everyplace is being invoked. If installing on Windows, make sure that you give the shortcuts folder for the new install a different name to the existing one.

For more general information on maintenance updates and their availability see the Websphere MQ family Web page at <http://www.software.ibm.com/mqseries/>.

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Glossary

This glossary describes terms used in this book and words used with other than their everyday meaning. In some cases, a definition may not be the only one applicable to a term, but it gives the particular sense in which the word is used in this book.

If you do not find the term you are looking for, see the index or the *IBM Dictionary of Computing*, New York: McGraw-Hill, 1994.

Application Programming Interface (API). An Application Programming Interface consists of the functions and variables that programmers are allowed to use in their applications.

asynchronous messaging. A method of communicating between programs in which the programs place messages on message queues. With asynchronous messaging, the sending program proceeds with its own processing without waiting for a reply to its message. Contrast with *synchronous messaging*.

authenticator. A program that checks that verifies the senders and receivers of messages.

bridge. An MQSeries Everyplace object that allows messages to flow between MQSeries Everyplace and other messaging systems, including Websphere MQ.

channel. See *dynamic channel*, *client/server channel*, *peer channel*, and *MQI channel*.

channel manager. An MQSeries Everyplace object that supports logical multiple concurrent communication pipes between end points.

class. A class is an encapsulated collection of data and methods to operate on the data. A class may be instantiated to produce an object that is an instance of the class.

client. (1) In MQSeries Everyplace, a client is MQSeries Everyplace code running without a channel manager or channel listener. Contrast with *server (1)*. (2) In Websphere MQ, a client is a run-time component that provides access to queuing services on a server for local user applications.

client/server channel. An MQSeries Everyplace a unidirectional channel between a client and a server that can only be established from the client side. Contrast with *peer channel*.

compressor. A program that compacts a message to reduce the volume of data to be transmitted.

cryptor. A program that encrypts a message to provide security during transmission.

device. A small portable machine running MQSeries Everyplace as a client. Contrast with *server(1)*.

dynamic channel. This is a name given to MQSeries Everyplace channels that connect clients and servers to enable the transfer of messages. They are called *dynamic* because they are created on demand. See *client/server* and *peer* channels. Contrast with *MQI channel*.

encapsulation. Encapsulation is an object-oriented programming technique that makes an object's data private or protected and allows programmers to access and manipulate the data only through method calls.

gateway. An MQSeries Everyplace gateway is a computer running the MQSeries Everyplace Websphere MQ-bridge code.

Hypertext Markup Language (HTML). A language used to define information that is to be displayed on the World Wide Web.

instance. An instance is an object. When a class is instantiated to produce an object, we say that the object is an instance of the class.

interface. An interface is a class that contains only abstract methods and no instance variables. An interface provides a common set of methods that can be implemented by subclasses of a number of different classes.

Internet. The Internet is a cooperative public network of shared information. Physically, the Internet uses a subset of the total resources of all the currently existing public telecommunication networks. Technically, what distinguishes the Internet as a cooperative public network is its use of a set of protocols called TCP/IP (Transport Control Protocol/Internet Protocol).

Java Developers Kit (JDK). A package of software distributed by Sun Microsystems for Java developers. It includes the Java interpreter, Java classes and Java development tools: compiler, debugger, disassembler, appletviewer, stub file generator, and documentation generator.

Java Naming and Directory Service (JNDI). An API specified in the Java programming language. It provides naming and directory functions to applications written in the Java programming language.

Lightweight Directory Access Protocol (LDAP). LDAP is a client-server protocol for accessing a directory service.

Local area network (LAN). A computer network located on a user's premises within a limited geographical area.

message. In message queuing applications, a message is a communication sent between programs.

message queue. See queue

message queuing. A programming technique in which each program within an application communicates with the other programs by putting messages on queues.

method. Method is the object-oriented programming term for a function or procedure.

MQI channel. An MQI channel connects a Websphere MQ client to a queue manager on a server system and transfers MQI calls and responses in a bidirectional manner. MQI channels must be explicitly created. Contrast with *dynamic channels*.

Websphere MQ. Websphere MQ is a family of IBM licensed programs that provide message queuing services.

object. (1) In Java, an object is an instance of a class. A class models a group of things; an object models a particular member of that group. (2) In Websphere MQ, an object is a queue manager, a queue, or a channel.

package. A package in Java is a way of giving a piece of Java code access to a specific set of classes. Java code that is part of a particular package has access to all the classes in the package and to all non-private methods and fields in the classes.

peer channel. A bidirectional MQSeries Everyplace channel, normally used between clients. The connection can be established from either end.

personal digital assistant (PDA). A pocket sized personal computer.

private. A private field is not visible outside its own class.

protected. A protected field is visible only within its own class, within a subclass, or within packages of which the class is a part

public. A public class or interface is visible everywhere. A public method or variable is visible everywhere that its class is visible

queue. A queue is a Websphere MQ object. Message queuing applications can put messages on, and get messages from, a queue

queue manager. A queue manager is a system program that provides message queuing services to applications.

server. (1) An MQSeries Everyplace server is MQSeries Everyplace code with an MQSeries Everyplace channel manager, and MQSeries Everyplace channel listener, configured. This provides the ability to receive from multiple devices and servers concurrently. Contrast with *client* (1). (2) A computer running MQSeries Everyplace server code. Contrast with *device*. (3) A Websphere MQ server is a queue manager that provides message queuing services to client applications running on a remote workstation. (4) More generally, a server is a program that responds to requests for information in the particular two-program information flow model of client/server, or the computer on which a server program runs.

servlet. A Java program which is designed to run only on a web server.

subclass. A subclass is a class that extends another. The subclass inherits the public and protected methods and variables of its superclass.

superclass. A superclass is a class that is extended by some other class. The superclass's public and protected methods and variables are available to the subclass.

synchronous messaging. A method of communicating between programs in which programs place messages on message queues. With synchronous messaging, the sending program waits for a reply to its message before resuming its own processing. Contrast with *asynchronous messaging*.

Transmission Control Protocol/Internet Protocol (TCP/IP). A set of communication protocols that support peer-to-peer connectivity functions for both local and wide area networks.

Web. See World Wide Web.

Web browser. A program that formats and displays information that is distributed on the World Wide Web.

World Wide Web (Web). The World Wide Web is an Internet service, based on a common set of protocols, which allows a particularly configured server computer to distribute documents across the Internet in a standard way.

Bibliography

Related publications:

- *MQSeries Everyplace for Multiplatforms Read Me First*, GC34-5862
- *MQSeries Everyplace for Multiplatforms Introduction*, GC34-5843
- *MQSeries Everyplace for Multiplatforms Programming Reference*, SC34-5846
- *MQSeries Everyplace for Multiplatforms C Programming Guide*, SC34-5980
- *MQSeries Everyplace for Multiplatforms C Programming Reference*, SC34-5981
- *MQSeries Everyplace for Multiplatforms Native Client Information*, GC34-5883
- *Websphere MQ An Introduction to Messaging and Queuing*, GC33-0805

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