

**Chapter
2**

**WEBSPHERE MQ:
OBJECTS AND
ARCHITECTURE**

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Objectives

You will learn:

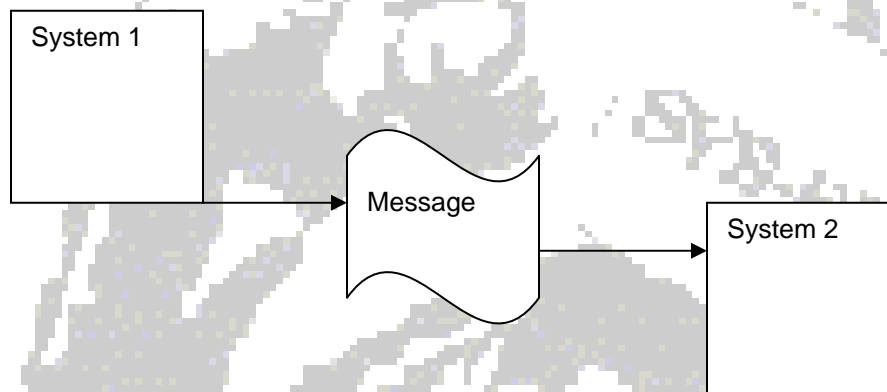
- WebSphere MQ and message queuing.
- Decoupling programs.
- Messages.
- Predefined queues and dynamic queues.
- Managing objects.
- Relationship between the objects.
- WebSphere MQ components.
- Two application programming interfaces: MQI and AMI.

1 WebSphere MQ and Message Queuing

WebSphere MQ, application programs can pass messages from one system to another and across different platforms. From an application programmer's perspective, it is not necessary to be aware of the mechanics of network communications.

MQ products use a common application programming interface known as the message queue interface - MQI.

WebSphere MQ provides a high level message handling API called the Application Messaging Interface - AMI.



2 Decoupling Programs

Sending and receiving application programs are decoupled.

The characteristics of decoupling are:

- The exchange of messages between the sending and receiving programs is independent of time.
- One program continues processing without waiting for the receiver.
- The target application does not have to be running when the message is sent.
- Triggers can be initiated when messages arrive on a queue.

It is possible to start or stop applications when messages have been processed.

3 Message

A message is a string of bytes; the meaning of the message is determined by the application.

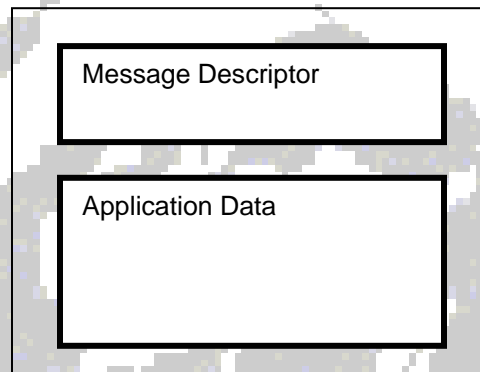
Messages are used to:

- transmit information between programs.
- transmit information between different parts of the same application; the applications can be running on the multiple platforms.

WebSphere MQ messages have two parts:

Application data	The application determines the content.
Message descriptor	This data identifies the message. It also contains control information and priority assigned to the message.

Message



4 Message Lengths

The default maximum message length is 4 MB; it can be increased to a maximum of 100 MB.

The limit of the message is determined by the:

- Maximum for the receiving queue.
- Maximum for the queue manager.
- Maximum defined by the queue.
- Maximum defined by either the sending or receiving application.
- Amount of storage.

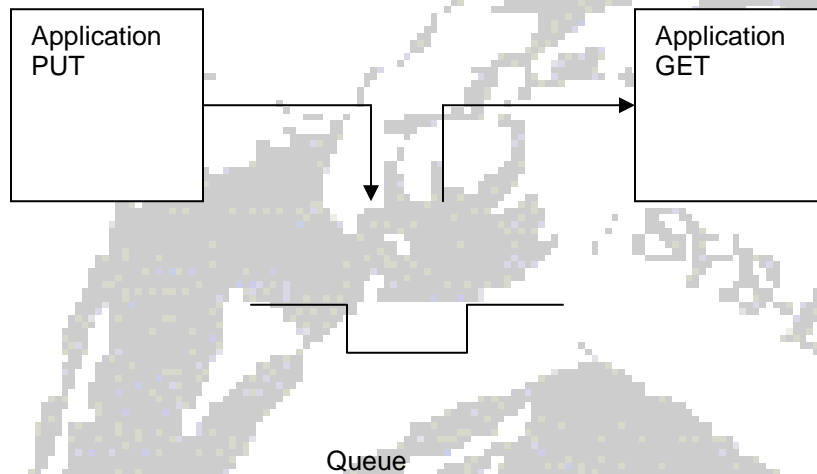
It might take several messages to send all the information that an application requires.

5 Queue: What is it

A queue is a data structure used for storing messages.

Objects are added and removed from the queue; each queue is owned by a queue manager. The queue manager maintains the queues it owns and for storing all the messages.

Messages are sent to a queue by an application programs. Messages are also sent to a queue by a queue manager as part of its normal operation.



6 Predefined Queues and Dynamic Queues

There are three major categories of queues:

1. Predefined queues which are created using MQSC or PCF commands. They are permanent queues that exist independent of the applications. If WebSphere MQ restarts, the message will remain.
2. Dynamic queues which are created by the application program. The queue attributes is based on a template, which is called a model queue. The attributes of a model queue are inherited by any dynamic queue that is created from it.
3. Model queues have an attribute that specifies whether the dynamic queue is to be permanent or temporary. Permanent queues survive restarts; temporary queues do not.

6.1 Queue Categories

There are three categories of queues:

• Predefined queues	• Dynamic queues	• Model queues
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7 Retrieving Messages from Queues

Messages can be retrieved from a queue using FIFO, which stands for first-in-first-out. It is an approach to handling program work requests from queues or stacks in order that the oldest request is handled next.

Message priority is specified in the message descriptor. Equal priority messages are retrieved FIFO.

An application will request a specific message. The method used to retrieve is determined by the MQGET request.

The priority for retrieving messages is:

- FIFO
- Message Priority
- Random/Keyed Access

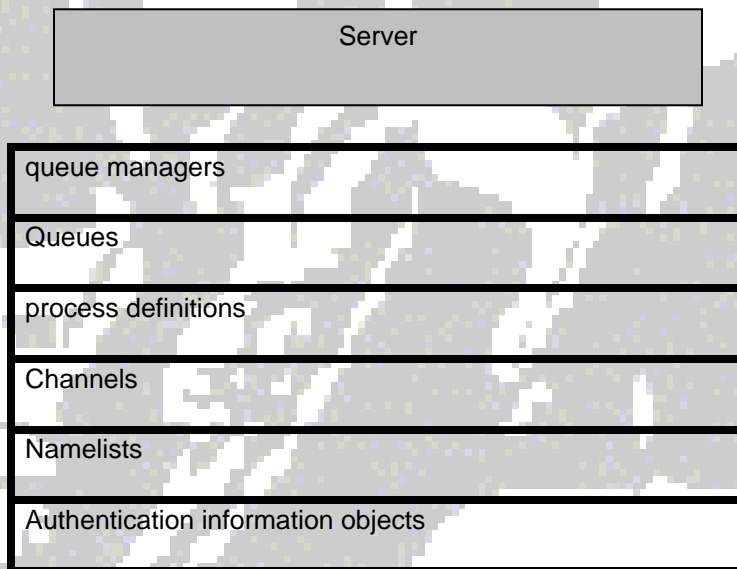
8 Objects

An administrator will typically perform tasks on objects which have been created, manipulated and deleted in WebSphere MQ.

The object types are:

- queue managers
- queues
- process definitions
- channels
- namelists
- authentication information objects.

8.1 Server Objects



9 Managing Objects

Objects can be created, altered, displayed, and deleted using:

- Control commands, which are typed in from a keyboard.
- MQSC commands, which can be typed in from a keyboard or read from a file.
- PCF: Programmable Command Format messages, which can be used in an automation program.
- WebSphere MQAI -MQ Administration Interface calls in a program.

For WebSphere MQ for Windows, the objects are created, altered, displayed, and deleted using:

- MQAI – COM - Component Object Model calls in a program.
- ADSI: Active Directory Service interface calls in a program.
- The WebSphere MQ Explorer snap-in and WebSphere MQ Services snap-in running under the Microsoft Management Console – MMC.

When viewing an object, the attributes are displayed.

10 Local/Remote Queue Object

A local queue object belongs to a specific queue manager. The application programs connect to the queue manager. Every queue is a local queue because each queue belongs to a queue manager.

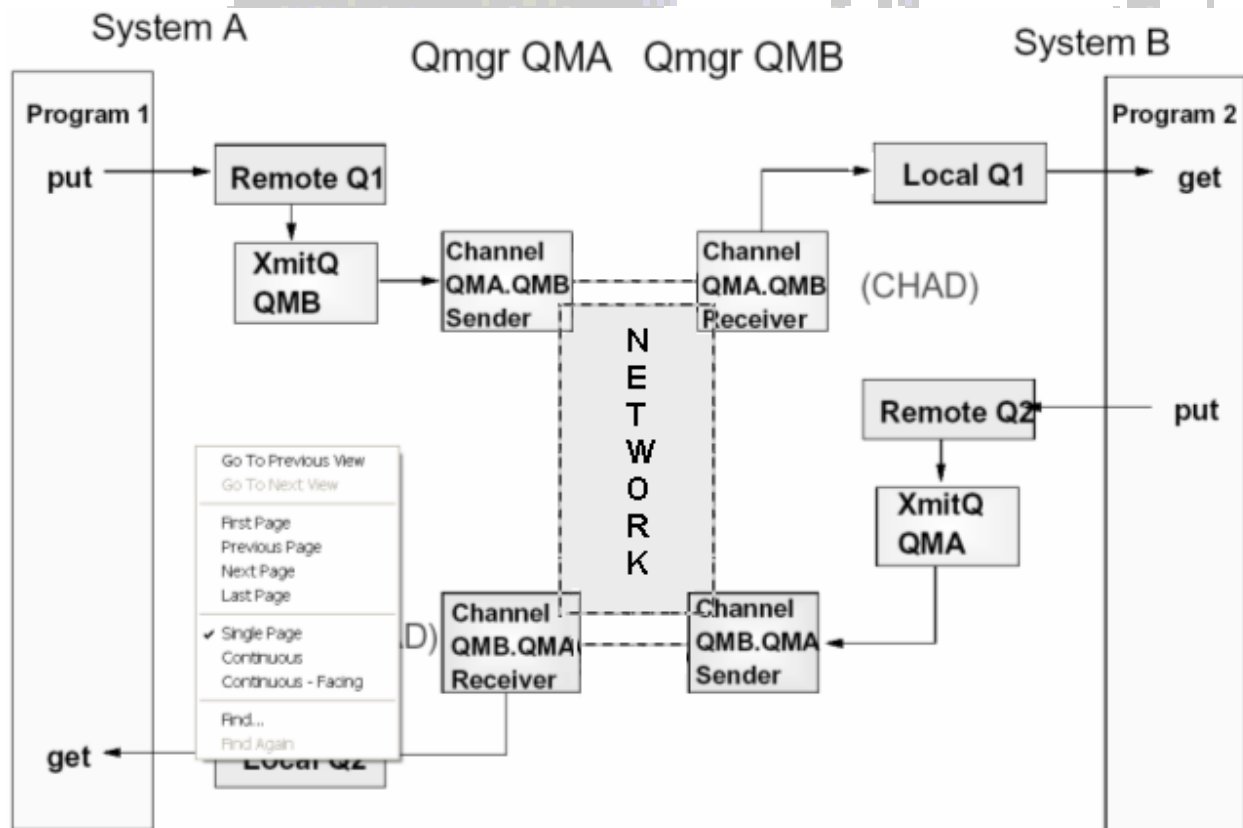
A remote queue object is a queue belonging to another queue manager under the local host or in a different computer/platform. The remote queue is a local queue to that queue manager.

The administrator supplies data for the local queue manager to find the remote queue manager. The message will go thru the local queue manager to access the remote queue in the remote queue manager.

A transmission queue and channels between the queue managers must be defined to allow applications to send messages to a queue on another queue manager.

One or more queue managers can be grouped together into a cluster.

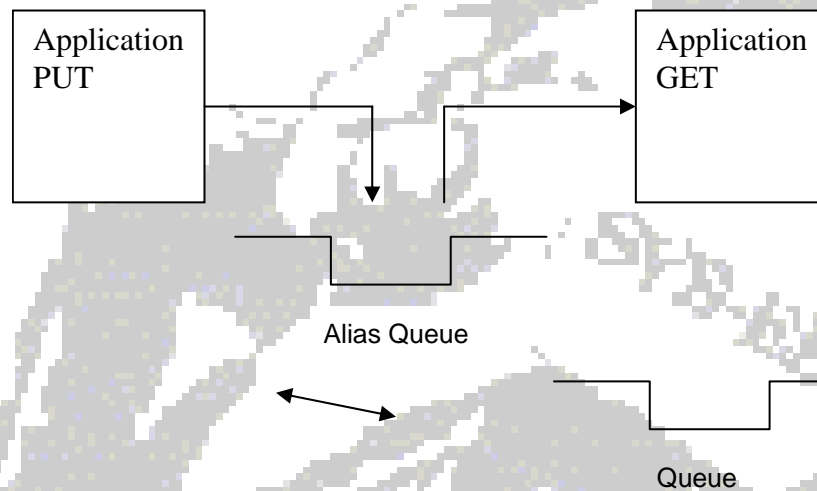
10.1 Local/Remote Queues



11 Alias Queue Object

An alias queue allows a program to refer to a queue indirectly. An alias queue is not a queue, but it is used to access another queue. At run time, WebSphere MQ resolves the alias name to a local or a remote queue.

This may well serve to simplify the job of administrators and programmers in that it will be possible to change the queues without changing the application in any way. The administrator can change the alias queue definition to reflect the name of the new queue to which the alias resolves.



12 Model Queue Object

A model queue is a template for creating a dynamic queue. The template contains a set of queue attributes.

Dynamic queues are created by the queue manager when requested by an application.

The dynamic queue which is created in this way is a local queue. The dynamic queue name can be specified by the application.

Queue manager can generate the name and return it to the application.

12.1 Model Queue

Characteristics of a model queue are that:

- The model queue is a template for creating a dynamic queue.
- They are created in a local queue.
- Applications can specify the queue name.
- Queue names can be generated.

13 Queues used by WebSphere MQ - Initiation Queues

These special purpose queues must be defined before WebSphere MQ can use them.:

- Initiation
- Transmission
- Cluster Transmission
- Dead-letter
- Command
- Reply To
- Event queues.

The Initiation queues are an integral part of triggering. The queue manager puts a special message (trigger message) on an initiation queue when a trigger event occurs. That message can be processed by an application program or invoked by an application program.

A trigger event is a logical combination of conditions that is detected by a queue manager. One type of trigger event is when the number of messages on a queue reaches a certain number of messages; this is known as predefined depth.

When a predefined depth is reached, the queue manager will place a trigger message on a specified initiation queue. This trigger message is retrieved by a trigger monitor; which is a special application that monitors an initiation queue.

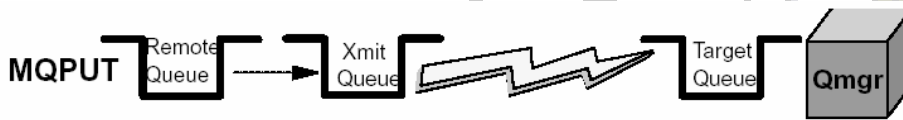
When using triggering, at least one initiation queue must be defined.

14 Transmission Queues

Transmission queues temporarily store messages that are destined for a remote queue manager. It will be necessary to define at least one transmission queue for each remote queue manager which the local queue manager will be sending messages to directly.

When using clusters, each queue manager cluster transmission queue is named `SYSTEM.CLUSTER.TRANSMIT.QUEUE`. This queue is automatically created when a queue manager is defined.

A queue manager in the cluster can send messages on the cluster transmission queue to any other transmission in the same cluster.



15 Dead-letter Queues

When a message cannot be routed to an appropriate queue a dead-letter queue can be used. The dead letter queue is a queue that stores messages that cannot be routed to their correct destinations.

A common cause for an undeliverable message is when the destination queue is full.

Dead-letter Queues:

- Capture undeliverable messages.
- Use utilities to extract the messages and process them.
- `SYSTEM.DEAD.LETTER.QUEUE` is the default name.

16 Command Queues

The command queue is named SYSTEM.ADMIN.COMMAND.QUEUE. It is a local queue to which MQSC commands is sent for processing. The commands are then retrieved by the command server.

The command server:

- Validates the commands.
- Passes the valid ones on for processing.
- Returns any responses to the appropriate reply-to queue.

A command queue is created automatically when that queue manager is created.

Command Queues:

- Are local queues.
- Are processed by the command server.
- Have the commands validated by the command server, passing valid commands, and returning responses.

17 Reply-to Queues

A request message sends a request to the server and expects responses. When a request message is sent, the server that gets the message can send back a reply message.

This reply message is put on a reply-to queue. The reply-to queue is normally a local queue to the sending application.

The program that sends the message supplies the name of the reply-to queue in the message descriptor.

18 Event Queues

Events are a special message that occur within the system. These events can be used to monitor queue managers.

When an event occurs, the queue manager puts an event message on an event queue. This message can then be read by a monitoring application. The monitoring program can invoke a program, send a message to an administrator or perform some action to rectify the problem.

19 Queue Manager Functions

When a program must perform an action with MQ, the program invokes the queue manager to perform the function. A queue manager manages the queues that belong to it.

The principle functions of the queue manager are:

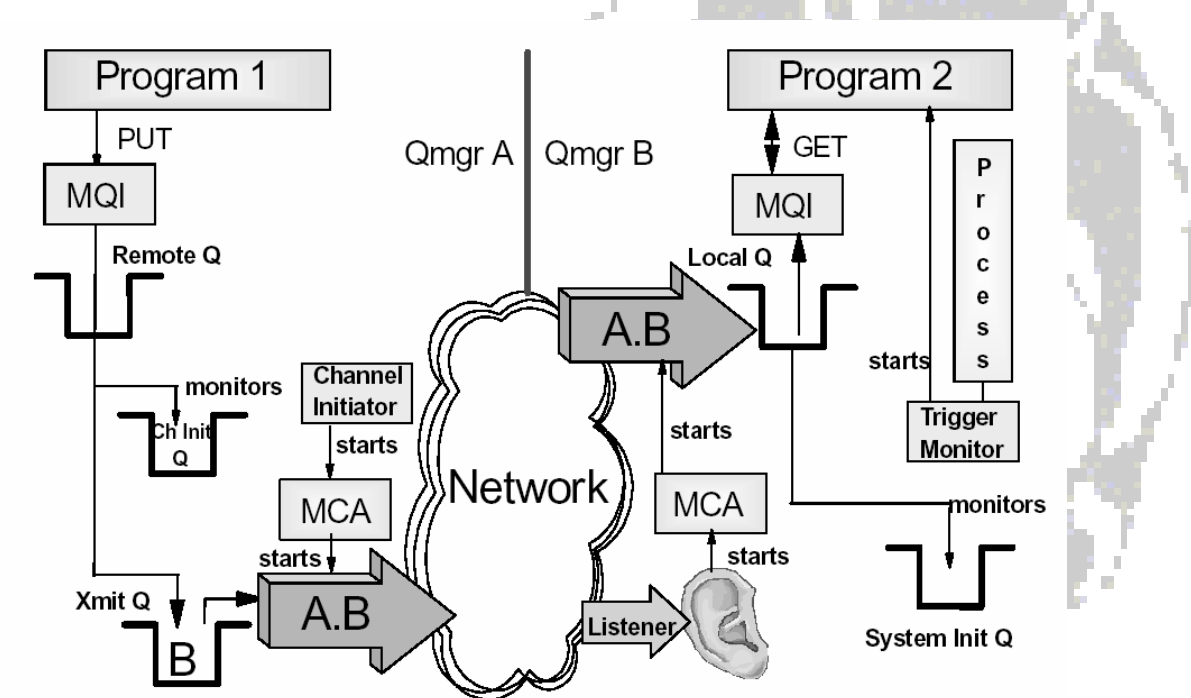
- Changing object attributes.
- Handling special events.
- Exception processing.

20 Local/Remote Queue

Each queue belongs to a single queue manager and is said to be a local queue to that queue manager. Each application is connect to a queue manager. A remote queue is a queue that belongs to another queue manager.

Every queue is a remote queue manager except for the one that the programmer is attached.

WebSphere MQ supports multiple queue managers on the same machine. Therefore, there can be a local and remote queue on the same machine.

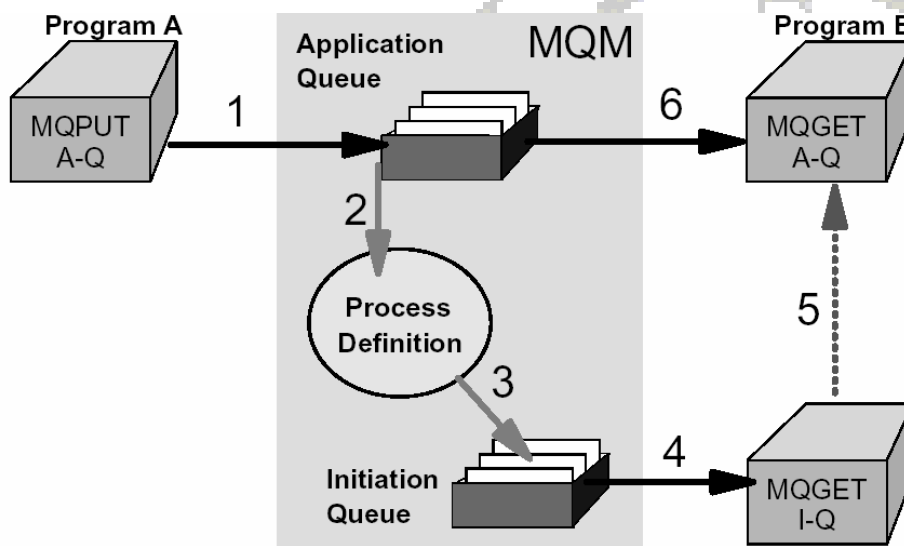


21 Process Definitions

When a trigger event occurs, an application can be started. The application to be started is defined in a process definition object.

The process definition attributes includes:

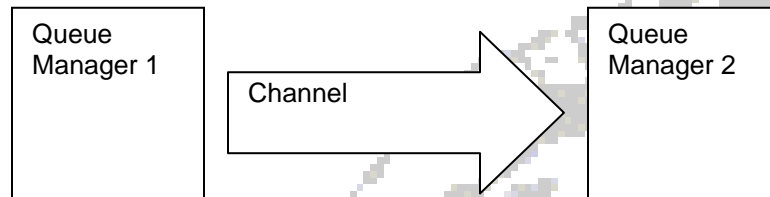
- Application ID
- Application type
- Data specific to the application.



22 Channels

Channels provide a communication path from one queue manager to another.

Channels are used move messages between queue managers. Multiple queue managers are supported. Each of the queue managers must have a channel defined.

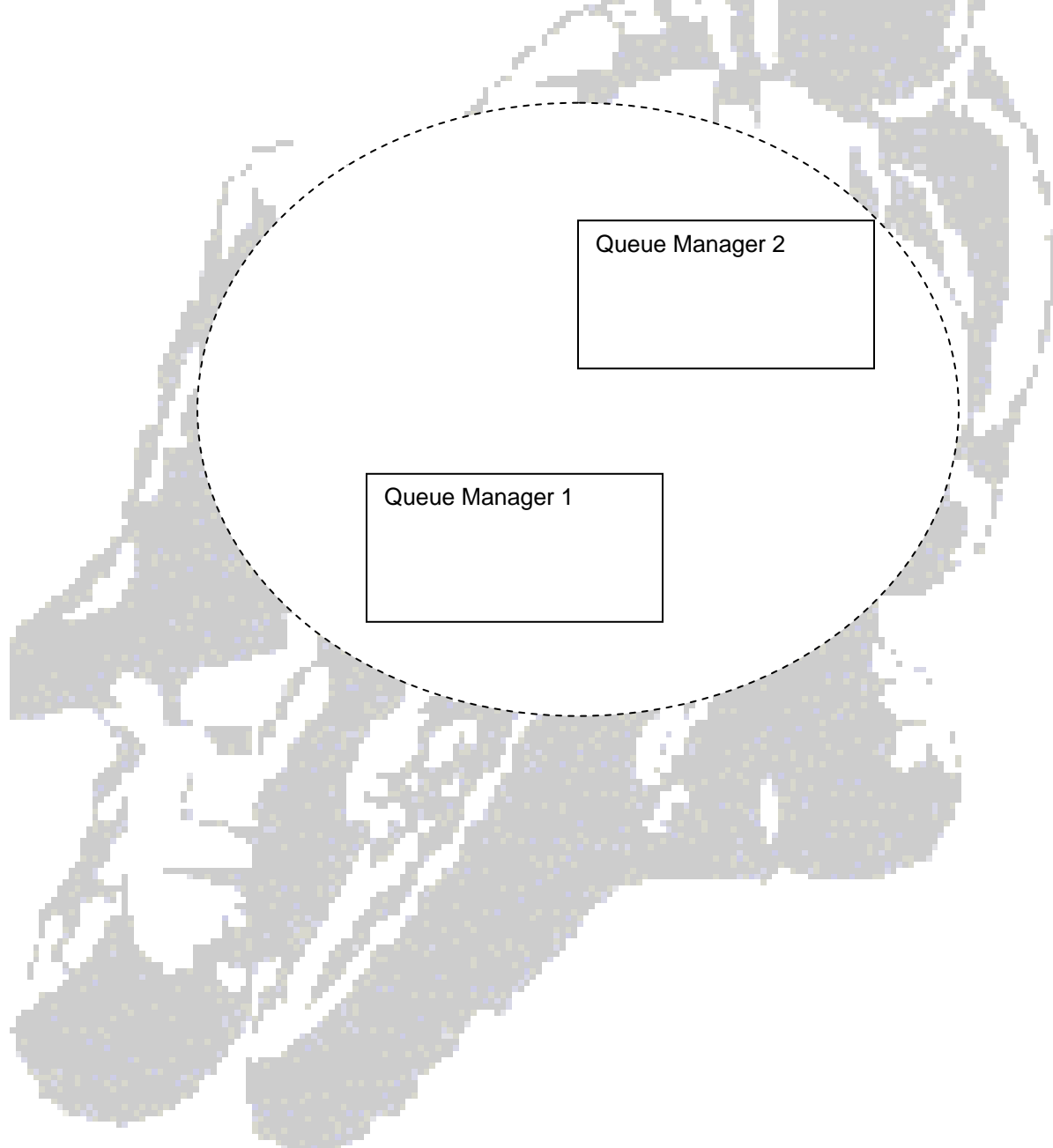


23 Clusters

In most configurations which use distributed queuing, every queue manager is independent.

If one queue manager needs to send messages to another queue manager, it must define a transmission queue, a channel to the remote queue manager, and a remote queue definition for every queue to which it wants to send messages.

A cluster is a group of queue managers set up in such a way that the queue managers can communicate directly with one another over a single network, without the need for transmission queue, channel, and remote queue definitions.



24 Namelists

A namelist is a list of WebSphere MQ objects. Typically, namelists are used by applications such as trigger monitors, where they are used to identify a group of queues. Namelist can be updated without stopping any of the applications that use it.

If an application fails, the namelist is not affected and other applications can continue using it.

Namelists are also used with queue manager clusters to maintain a list of clusters referred to by more than one WebSphere MQ object.

25 System Default Objects

The system default objects are created automatically whenever a queue manager is created. These object definitions can be copied and modified.

The default object names have the stem SYSTEM.DEFAULT. These objects cannot be renamed; default objects of these names are required.

System Default Objects:

- Are created automatically.
- Copy and modify the default objects.
- The default object names have the stem SYSTEM.DEFAULT.
- Cannot be renamed.

26 Security

There are three methods for providing security:

Method	Description
OAM: Object Authority Manager facility	<p>Authorization for using MQI calls, commands, and access to objects is provided by the Object Authority Manager; by default it is enabled.</p> <p>Access to WebSphere MQ entities is controlled through WebSphere MQ user groups and the OAM.</p> <p>There is a command line interface for enabling administrators to grant or revoke authorizations as required.</p>
DCE Security	Channel exits that use the DCE Generic Security Service (GSS) are provided by WebSphere MQ.
Channel Security using SSL	The Secure Sockets Layer protocol provides industry-standard channel security, with protection against eavesdropping, tampering, and impersonation. SSL uses public key and symmetric techniques to provide message privacy and integrity and mutual authentication.

27 WebSphere MQ Administration

Local Administration

Local administration means carrying out administration tasks on any queue managers that have been defined on a local system.

Remote Administration – Single Point of Contact

Other systems can be accessed and administration tasks carried out. In WebSphere MQ, this is a form of local administration because no channels are involved. The communication is managed by the operating system.

WebSphere MQ supports administration from a single point of contact; this is known as remote administration. This allows commands to be issued from a local system that are processed on another system.

- It is not necessary to log on to that system, although the appropriate channels have to be defined.
- The queue manager and command server on the target system must be running.
- Performing administration tasks using commands

There are three sets of commands that can be used for administering WebSphere MQ:

• Control commands	• MQSC commands	• PCF commands
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27.1 Control Commands

Control commands allow administrative tasks to be performed on queue managers themselves.

WebSphere MQ Script - MQSC commands can be used for managing queue manager objects, including the queue manager itself, channels, queues, and process definitions.

MQSC commands are issued to a queue manager using the runmqsc command. This can be done interactively by issuing commands from a keyboard, or redirected from the standard input device (stdin) to run a sequence of commands from an ASCII text file.

Depending on the flags set on the command, the runmqsc command can be run in three modes.

Verification	Where the MQSC commands are verified on a local queue manager, but are not actually run.
Direct	Where the MQSC commands are run on a local queue manager.
Indirect	Where the MQSC commands are run on a remote queue manager.

27.2 PCF Commands

WebSphere MQ PCF - programmable command format commands allow administration tasks to be programmed into an administration program. This provides the capability for creating queues and process definitions, and changing queue managers, from a program.

PCF commands cover the same range of functions provided by the MQSC commands.

27.3 WebSphere MQ File Names

Each WebSphere MQ queue, queue manager, namelist, and process object is represented by a file.

Since object names are not necessarily valid file names, the queue manager converts the object name into a valid file name where necessary.

The default path to a queue manager directory is a prefix, which is defined in the WebSphere MQ configuration information:

- In WebSphere MQ for Windows, the default prefix is C:\Program\Files\IBM\WebSphere MQ.
- In WebSphere MQ for UNIX systems, the default prefix is /var/mqm.

It can be changed in the DefaultPrefix stanza of the mqs.ini configuration file.

The queue manager name is transformed into a valid directory name. This process is referred to as name transformation.

28 Queue Manager Name Transformation

In WebSphere MQ, a queue manager can be given a name containing up to 48 characters.

Each queue manager is represented by a file and there are limitations on the maximum length of a file name, and on the characters that can be used in the name. As a result, the names of files representing objects are automatically transformed to meet the requirements of the file system.

The transformation algorithm also distinguishes between names that differ only in case on file systems that are not case sensitive.