



WebSphere Software

WebSphere MQ for z/OS V7 as the messaging backbone for SOA, Web 2.0 and file transfer

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Agenda

- The role of WebSphere MQ in SOA
- WebSphere MQ for z/OS highlights
- What's new in WebSphere MQ V7 for z/OS
- WebSphere MQ and the Web
- WebSphere MQ and Files
- Summary



Universal Messaging Backbone with WebSphere MQ

- Extends the reach of your Enterprise to deliver Business data with a range of QoS for processing by CICS

Support for virtually every commercial IT System

80+ platform configurations

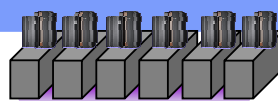
- AIX
- Linux x86, x86-64
- Linux POWER
- Linux for System z
- Windows x86, x64
- Solaris x86 / SPARC
- iSeries i5/OS
- HP-UX Itanium/PA-RISC
- HP NonStopServer
- HP OpenVMS



80+ platforms

Exploit System z for messaging powerhouse

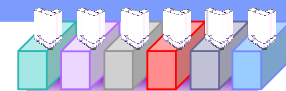
- Unique code-base designed natively for tight z/OS integration
- Runs as formal MVS sub-system
- Leverage Parallel Sysplex to provide Shared Queues for continuous availability, scalability and capacity
- Support for event-driven publish-subscribe delivery



z/OS

Enable popular applications and environments

- Built-in bridge for CICS, IMS, Batch/TSO
- JCA support to provide JMS services for JEE App Servers
- Support for Databases DB2, Oracle etc
- Support for External Transaction Coordinators
- Over 950 ISVs with enabled Packaged Applications



Applications

← UNIVERSAL MESSAGING BACKBONE →



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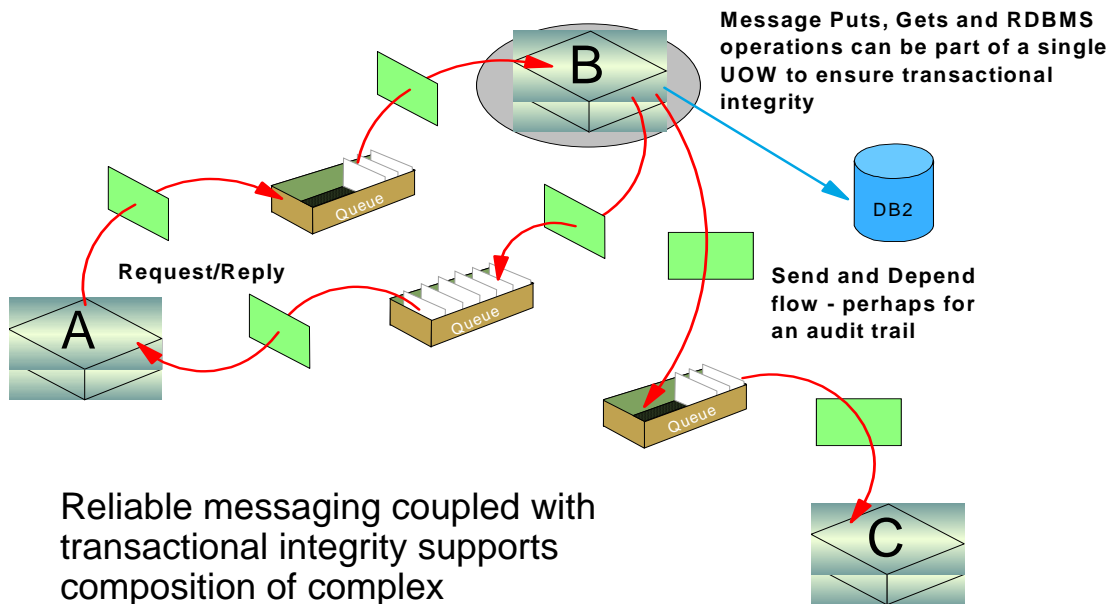
WebSphere MQ for z/OS highlights



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WebSphere MQ in a nutshell



Reliable messaging coupled with transactional integrity supports composition of complex applications to fully support parallel processing.

WebSphere MQ in a nutshell

In a nutshell it provides a simple, yet functionally rich application programming interface, known as the Message Queue Interface (or MQI for short), across all its supported platforms and it also fully implements the industry-standard Java Message Service (or JMS for short) interface. These interfaces support application-to-application communication through queues or topics and allow those applications to not be concerned with the location of those queues or topics or who processes them.

- N** Applications communicate with one another using PUT and GET verbs, and this allows great flexibility in creating application-interaction patterns ranging from pseudo-synchronous request-and-response styles, to fire-and-forget styles and mixtures of both.
- O** A request-response interaction pattern is just what its name suggests. To the requester, the application appears to be a completely synchronous invocation of a server application with a response from the server after execution. But it is in fact implemented by two distinct asynchronous, one-way message exchanges. The MQI provides a simple way in which these two flows can be combined to make a pseudo-synchronous pattern.
- T** Many customers use just such an interaction pattern to support customer-facing interactions and achieve satisfactory response times that meet or exceed their business requirements.
- E** Similarly, the fire-and-forget style applies to a one-way message exchange in which a response is not required. MQ provides reliable message delivery to help ensure that the message data is propagated to the target queue.
- S** Transactional support is provided by MQ — both as a resource manager coordinated by transaction coordinators like CICS or Resource Recovery Services (RRS), and as an XA programming-interface coordinator on distributed platforms. This helps to ensure that messages can be delivered with full transactional integrity, providing assured delivery in support of business-critical applications.

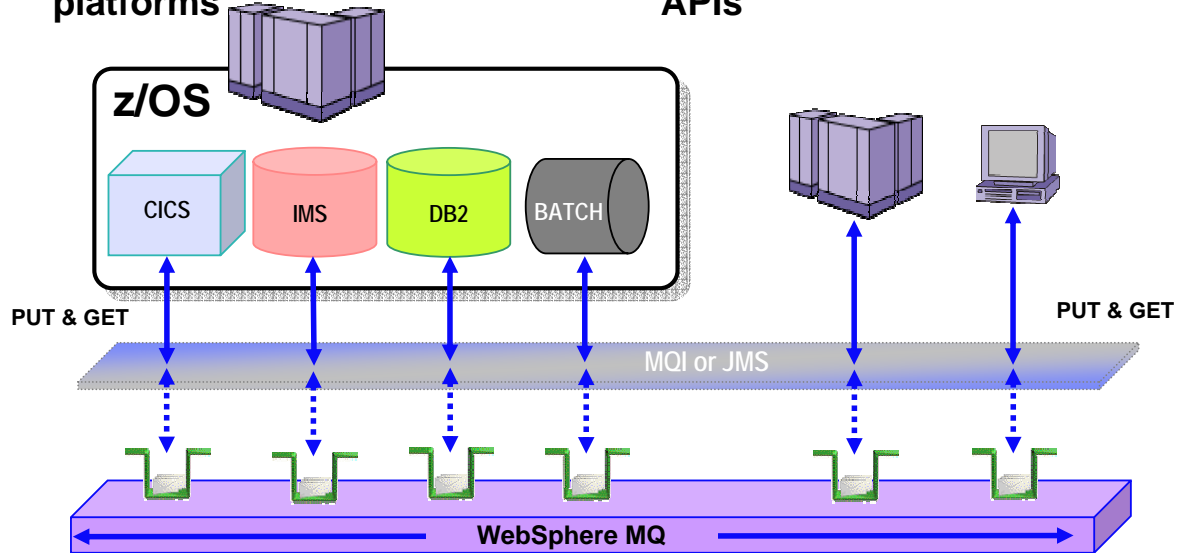
It can efficiently carry data of any type and of any size.

Message retrieval can be sequential, selective or subject to a message priority set at message creation time.

z/OS access to CICS, IMS, DB2 SPs and Batch/TSO

Explicitly – Using the MQI or JMS API

- Gives CICS and IMS access to messages from other z/OS regions and other non-z/OS platforms
- Allows other applications to access CICS and IMS without using CICS or IMS APIs



z/OS access to CICS, IMS, DB2 SPs and Batch/TSO

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The **CICS adapter** connects a CICS subsystem to a queue manager, enabling CICS application programs to use the MQI. You can start and stop CICS and WebSphere MQ independently, and you can establish or terminate a connection between them at any time. You can also allow CICS to connect to WebSphere MQ automatically. The CICS adapter provides two main facilities:

A set of control functions for use by system programmers and administrators to manage the adapter.

MQI support for CICS applications.

In a CICS multiregion operation or intersystem communication (ISC) environment, each CICS address space can have its own attachment to the queue manager subsystem. A single CICS address space can connect to only one queue manager at a time. However, multiple CICS address spaces can connect to the same queue manager.

You can use WebSphere MQ with the CICS Extended Recovery Facility (XRF) to aid recovery from a CICS error. The CICS adapter is supplied with WebSphere MQ and runs as a CICS External Resource Manager. WebSphere MQ also provides CICS transactions to manage the interface. The CICS adapter uses standard CICS command-level services where required, for

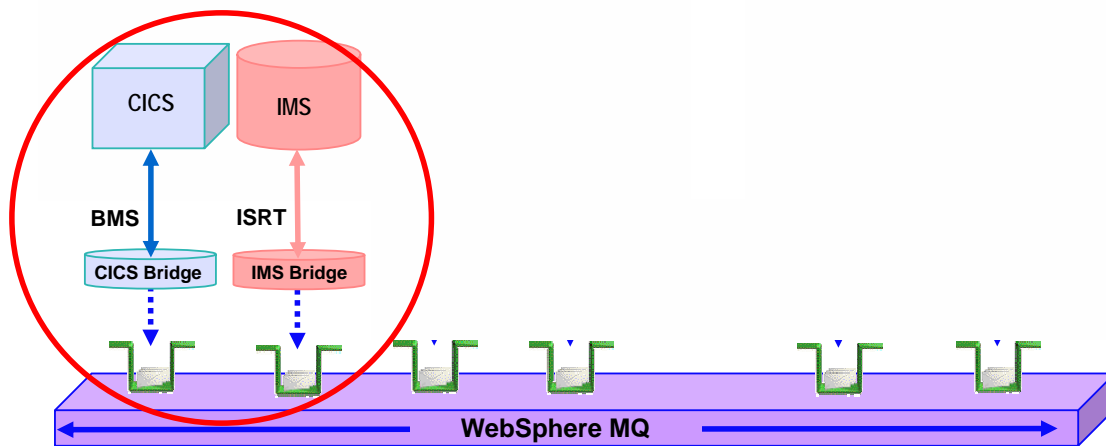
The **IMS adapter** is the interface between IMS application programs and a WebSphere MQ subsystem. It makes it possible for IMS application programs to use the MQI. The IMS adapter receives and interprets requests for access to WebSphere MQ using the External Subsystem Attach Facility (ESAF) provided by IMS. This facility is described in the *IMS Customization Guide*. Usually, IMS connects to WebSphere MQ automatically without operator intervention.

The Batch/TSO adapter The WebSphere MQ Batch/TSO adapter provides WebSphere MQ support for z/OS Batch and TSO applications. All application programs that run under z/OS Batch or TSO must have the API stub program CSQBSTUB link-edited with them. The stub provides the application with access to all MQI calls. You use single-phase commit and backout for applications by issuing the MQI calls **MQCMIT** and **MQBACK**.

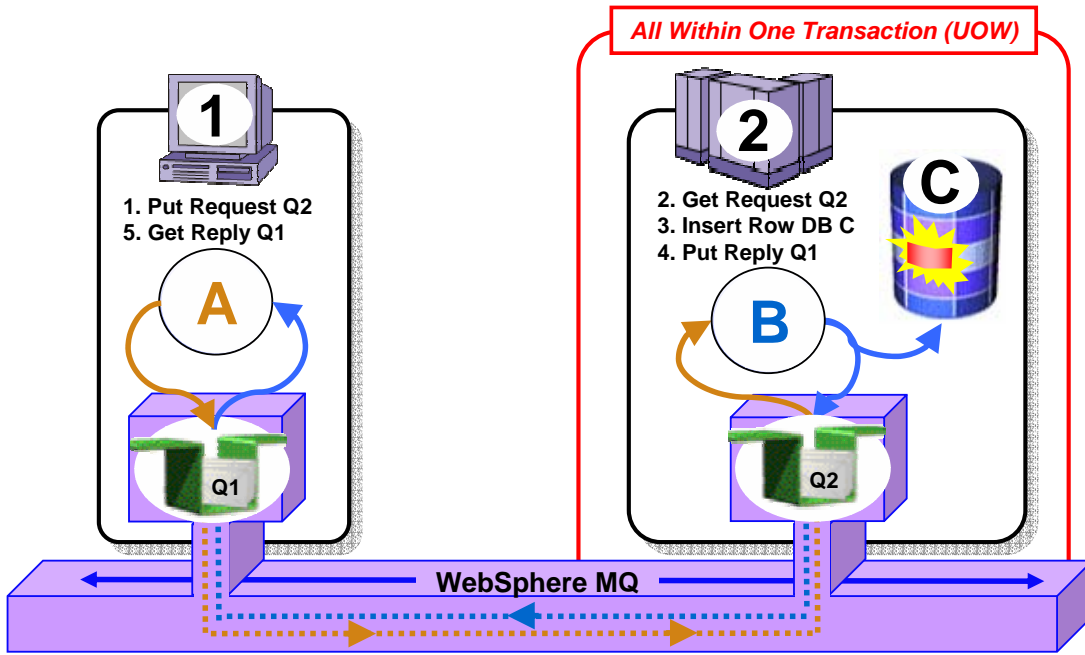
z/OS bridges to CICS and IMS

Implicitly – Using the Bridges supplied for CICS and IMS

- CICS and IMS applications use the native APIs:
 - EXEC CICS BMS. GU.
- Allows other applications to access CICS and IMS without using CICS or IMS APIs



Full support for transactional environments



- Full support for CICS, IMS, WAS, DB2 SPs & Batch RSS
- Reliable Two-Phase commit involving other Resource Managers e.g. DB2

Full support for transactional environments

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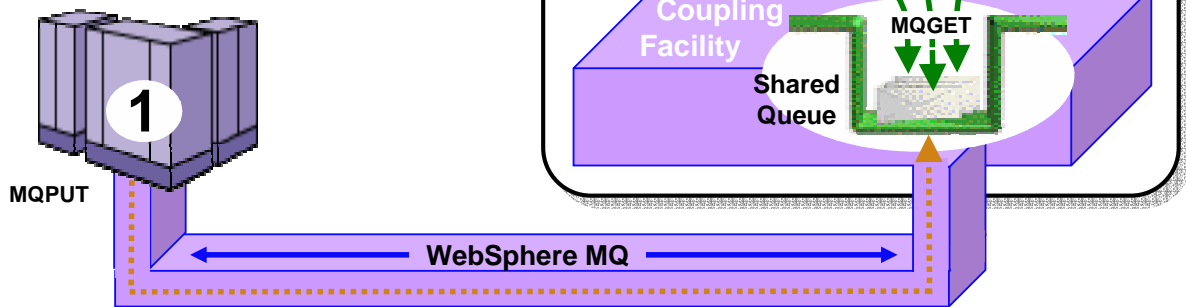
On z/OS MQ provides full support for CICS, IMS, WAS, DB2 Stored Procedures and Batch RRS environments to provide reliable 2-phase commit operations involving MQ and other resource managers – such as DB2

Reliable messaging coupled with transactional integrity supports composition of complex applications to fully support parallel processing.

And XA programming-interface coordinator on distributed platforms. This helps to ensure that messages can be delivered with full transactional integrity, providing assured delivery in support of business-critical applications.

Shared queues on z/OS

- Exploits Parallel Sysplex
- Automatic load balancing
- Scalable throughput
- Multiple processors can access the same queue
- Queue sharing groups
- VIPA support



Shared queues on z/OS

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WebSphere MQ for z/OS takes advantage of IBM Parallel Sysplex® technology, increasing availability, capacity and performance for persistent and nonpersistent messages, by enabling multiple queue managers to access the same queue.

If we look at the pull-model and triggering delivery style of MQ from an availability perspective, it can be seen that if there is any problem with the queues themselves, the Queue Managers hosting the AORs, or the AORs themselves, then we have a problem with the delivery of the message data into CICS. MQ provides two mechanisms to address this. One is a platform-wide facility called MQ clustering and the other is support of sysplex shared queues. .

MQ clustering provides two powerful facilities that can be used to reduce administration and provide workload distribution -

Automatic discovery of queues within a cluster and the auto-definition of resources to access them

Automatic push workload distribution to spread messages around a number of cloned cluster queues thus reducing the overall impact should there be a local failure

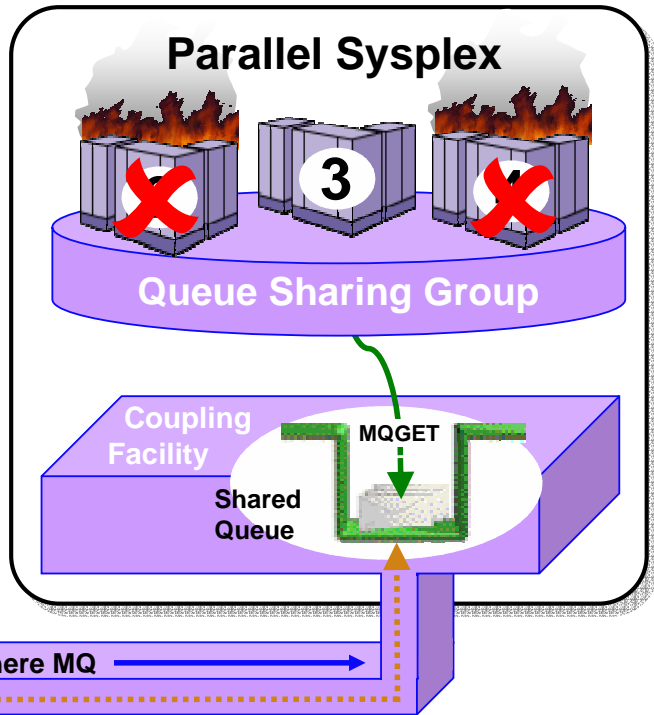
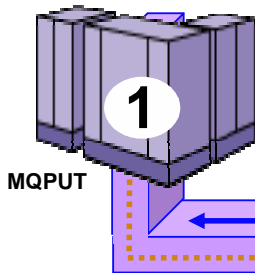
Complementing this, MQ provides support for Sysplex shared queues to provide the maximum possible availability of message data. A shared queue is not owned by any individual queue manager and, as a result, is isolated from an outage of an individual queue manager or logical partition (LPAR). Message data is accessible from anywhere in the Sysplex and Sysplex Distributor can be used to route connections around the sysplex under the control of z/OS Workload Manager.

Additionally, MQ maintains knowledge of the transactional state of all the shared-queue resources so it can provide support for dynamic backout of shared-queue messages within a unit of work in case a connected queue manager fails.

WebSphere MQ for z/OS also brings some very significant availability and performance benefits, including shared queue support and automated load balancing as well as isolation of server failures with automatic peer recovery of failing Queue Managers.

Highly Available with Failover for z/OS

- **Failure isolation**
 - Automatic peer recovery for failing Servers, Applications or Queue Managers
- **In-flight MQPUTs and MQGETs are rolled back**
 - Since messages are not hosted in any Queue Manager there are no marooned messages
- **24 x 7 availability**
- **Leverages ARM (Automatic Restart Manager)**



Highly Available with Failover for z/OS

NOTES

The clustering features of WebSphere MQ enable messages to be redirected around parts of the messaging backbone that have become isolated by network failure or otherwise unavailable without the applications. Clustering can help reduce administration of the messaging backbone. It enables many WebSphere MQ queue managers to be administered together as a group.

A queue-sharing group consists of a number of queue managers, running within a single z/OS sysplex, that can access the same WebSphere MQ object definitions and message data concurrently. Within a queue-sharing group, the shareable object definitions are stored in a shared DB2 database, and the messages are held inside one or more Coupling Facility structures (CF structures), and in the shared DB2 database.

Any queue manager in the queue-sharing group can access a shared queue. This means that you can put a message on to a shared queue on one queue manager, and get the same message from the queue from a different queue manager. This provides a rapid mechanism for communication within a queue-sharing group that does not require channels to be active between queue managers. Large messages (>63KB) have a placeholder stored in the Coupling Facility (4K), and their message data stored in DB2. Figure shows three queue managers and a Coupling Facility, forming a queue-sharing group. All three queue managers can access the shared queue in the Coupling Facility. An application can connect to any of the queue managers within the queue-sharing group. Because all the queue managers in the queue-sharing group can access all the shared queues, the application does not depend on the availability of a specific queue manager; any queue manager in the queue-sharing group can service the queue.

Shared queues

In the queue-sharing group environment, an application can connect to any of the queue managers within the queue-sharing group. Because all the queue managers in the queue-sharing group can access the same set of shared queues, the application does not depend on the availability of a particular queue manager; any queue manager in the queue-sharing group can service any queue. This gives greater availability if a queue manager stops because all the other queue managers in the queue-sharing group can continue processing the queue.

To further enhance the availability of messages in a queue-sharing group, WebSphere MQ detects if another queue manager in the group disconnects from the Coupling Facility abnormally, and completes units of work for that queue manager that are still pending, where possible. This is known as peer recovery

WebSphere MQ for z/OS also brings some very significant availability and performance benefits, including shared queue support and automated load balancing as well as isolation of server failures with automatic peer recovery of failing Queue Managers.

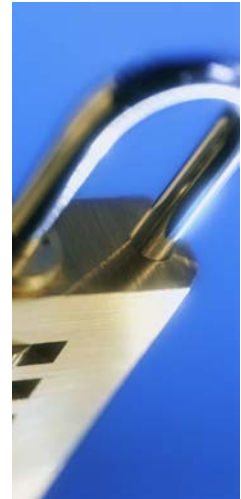
Security

- **Security is #1 concern of CIOs**

- **Secure Sockets Layer (SSL)**
 - Provides channel-level security
 - WebSphere MQ V5.3 introduced SSL support
 - Uses the z/OS Cryptographic Services System SSL function

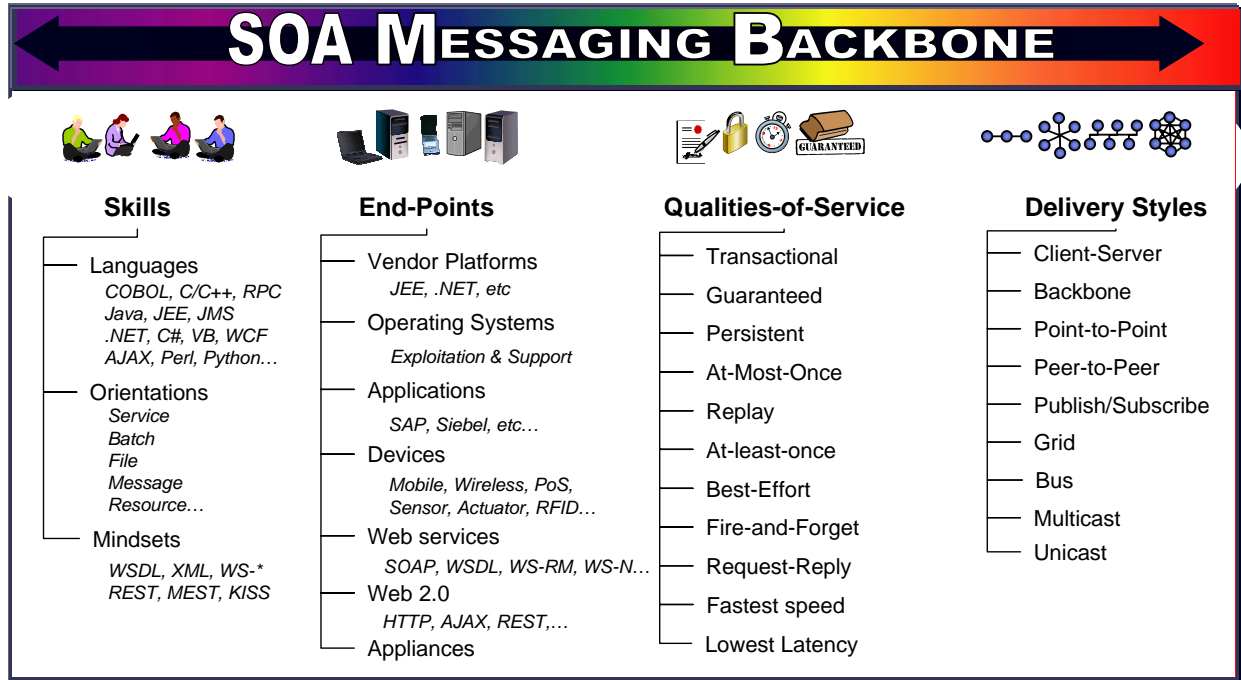
- **Security Server on z/OS (previously RACF)**
 - WebSphere MQ for z/OS has always provided close integration with RACF and 3rd-party alternatives
 - Security Server (RACF) can protect the resources that WebSphere MQ for z/OS owns and manages from access by unauthorized users

- **WebSphere MQ Extended Security Edition for z/OS**
 - Provides advanced security capabilities leveraging Tivoli security technology



IBM's Vision – SOA Messaging Backbone

- Addressing the full spectrum of transport requirements



IBM's Vision – SOA Messaging Backbone

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- Breadth addresses the broad spectrum of movement requirements
- Enabling connectivity to span entire organization without limits
- Increasing choice, lowering dependencies on specialist skills, Enabling synergies
- Support for a wide variety of qualities of service providing a business data highway that can connect all IT platforms, applications and services across the enterprise



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What's new in WebSphere MQ V7 for z/OS



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WebSphere MQ Version 7

- **Central requirement was to improve JMS implementation**
 - More applications being written to use this API
 - Underpins many SOA/ESB solutions needing access to messaging
- **Leads to designs involving features such as**
 - Ease-of-use
 - Performance
- **But it also leads to enhancements for ALL applications**
 - Not just JMS users
- **Extension of publish/subscribe capabilities**
 - Designed with Message Broker in mind
- **Easier programming in any environment**
 - Some features suggested by JMS requirements are useful in MQI
- **Administration model and APIs natural evolution of existing interfaces**

WebSphere MQ Version 7

N O T E S	<p>WebSphere MQ (WMQ) Version 7 takes its central theme from requirements to extend its support for JMS applications. WMQ has supported the JMS API for many years but recent growth in user applications written to use the JMS API, and growth in SOA solutions that need to exploit a JMS provider for access to messaging (for example as part of an Enterprise Service Bus), have increased the importance of this programming interface.</p> <p>This has led to incorporation of a number of JMS features into the core WebSphere MQ engine, and in turn has allowed these features to be easily accessible to applications using the native MQ API (MQI), not just those written to the JMS API.</p> <p>The publish/subscribe messaging pattern is one of the two patterns defined by the JMS API, the other being the point-to-point matter. WebSphere MQ V7 therefore extends its publish/subscribe provision. WebSphere MQ Version 7 provides publish/subscribe capabilities that exploit the natural high availability capabilities in WMQ including queue manager clustering. It incorporates a comprehensive range of qualities of service for message delivery, ranging from assured delivery to lightweight non persistent. It also permits a range of topologies, including support for very large numbers of subscribers.</p> <p>The pub/sub implementation in V7 has been designed to ensure that we can reach a simplified, and fully-integrated, relationship with Message Broker's pub/sub capabilities.</p> <p>WebSphere MQ Version 7 provides application programming interfaces that support the concepts required by JMS, including publish/subscribe, in the MQI, which JMS exploits.</p> <p>Enhancements to the programming and administrative interfaces are all modelled after existing WMQ interfaces, to deliver a familiar and easy-to-learn route towards the new features.</p> <p>This presentation is not an exhaustive list of all of the new features of WebSphere MQ Version 7, but gives an overview of major functions.</p>
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Publish/Subscribe

- **A natural part of the JMS API**
 - Combines both Publish/Subscribe and Point-to-Point patterns
 - Now also a natural part of the native MQI
- **Point-to-point asynchronous messaging decouples applications**
 - But still implies a one-one relationship between sender and receiver
- **Publish/subscribe is a further stage of decoupling**
 - Sender has no direct knowledge of how many (if any) apps will see a message
 - Link between applications is a **Topic**, not a **Queue**
- **WMQ V6 (Distributed) included a Publish/Subscribe broker (formerly MAOC)**
 - Compatibility mode available in V7
- **Implementation substantially improved with V7**
 - And is available for the first time on z/OS

Publish/Subscribe

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Point-to-point asynchronous messaging decouples applications from each other but still implies a one-one relationship between sender and receiver. Publish/subscribe is a further stage of decoupling since the sender has no direct knowledge of how many (if any) applications will see a message. In Publish/Subscribe, the link between applications is a Topic, not a Queue. In the JMS API, both Topics and Queues are referred to as Destinations.

Publish/Subscribe is a natural part of the JMS API and with WebSphere MQ Version 7 it is also a natural part of the native MQI. New verbs and options, that we see later, make it easy to use pub/sub from any environment.

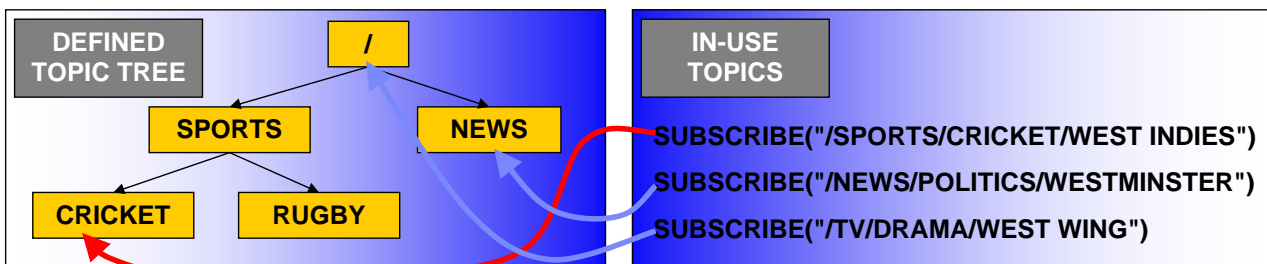
In WebSphere MQ Version 7 there is a publish/subscribe engine as part of the queue manager on all Distributed and z/OS systems. This is addressed directly through the MQI, replacing the queue-based interface available in WebSphere MQ V6, and previously as the MAOC SupportPac. The administration model for this uses the standard WMQ model, replacing the interfaces available in WebSphere MQ V6. Although these older interfaces are now deprecated, they are still supported to ensure coexistence with earlier versions of applications that may connect to a Version 7 queue manager.

This publish/subscribe engine is part of the queue manager and is always available. It does not have to be manually started. A queue-based publish/subscribe daemon task is provided to ensure coexistence of the V6 style Publish/Subscribe with V7 and to migrate the use of the V6 interface to V7.

WMQ on z/OS has not previously had a native pub/sub capability, and has had to rely on Message Broker or connecting to WMQ on a Distributed platform for access to pub/sub services. That limitation is removed in V7.

Publish/Subscribe Administration

- **Based on Topic Strings**
- **Topic Objects**
 - New object type, like queue or channel definitions
 - A 48-character name which has a longer attribute for full **topic string**
 - Defines major points in a topic tree
 - No additional definitions needed before applications can start using pub/sub
- **In-use topics**
 - The topic strings that applications are publishing or subscribing on
 - Inherit attributes (eg security) from the "closest" defined topic object
 - Not defined administratively, but can be viewed



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Publish/Subscribe Administration

N O T E S	<p>The construct that couples a publishing application with subscribing applications is the topic string. A topic string can be very long, and has a structure implied by the separator character '/'. Topic strings can be used directly from publishing and subscribing applications without any need to define them administratively.</p>
	<p>However, there may sometimes be a need to tune certain attributes of topic strings or to apply security to topic strings and as such an administrative point is required in order to do this. This administrative point is a new object type called a topic object. It is envisaged that the top layer, or the top few layers, of a topic string hierarchy is defined administratively, setting any appropriate attributes for use in that environment, and then the remaining layers of the hierarchy are defined by use, inheriting attributes from their parents in the hierarchy.</p>
	<p>Managing topics administratively is done by means of commands in MQSC or PCF as per the standard WMQ administration model allowing creation, alteration, deletion and display of topic objects (which contain topic string).</p> <p>In either case, whether a topic string is defined administratively or automatically created when an application uses it, status can be interrogated from the queue manager. Similarly, statistics can be gathered on the use of a topic string regardless of its creation mechanism.</p>

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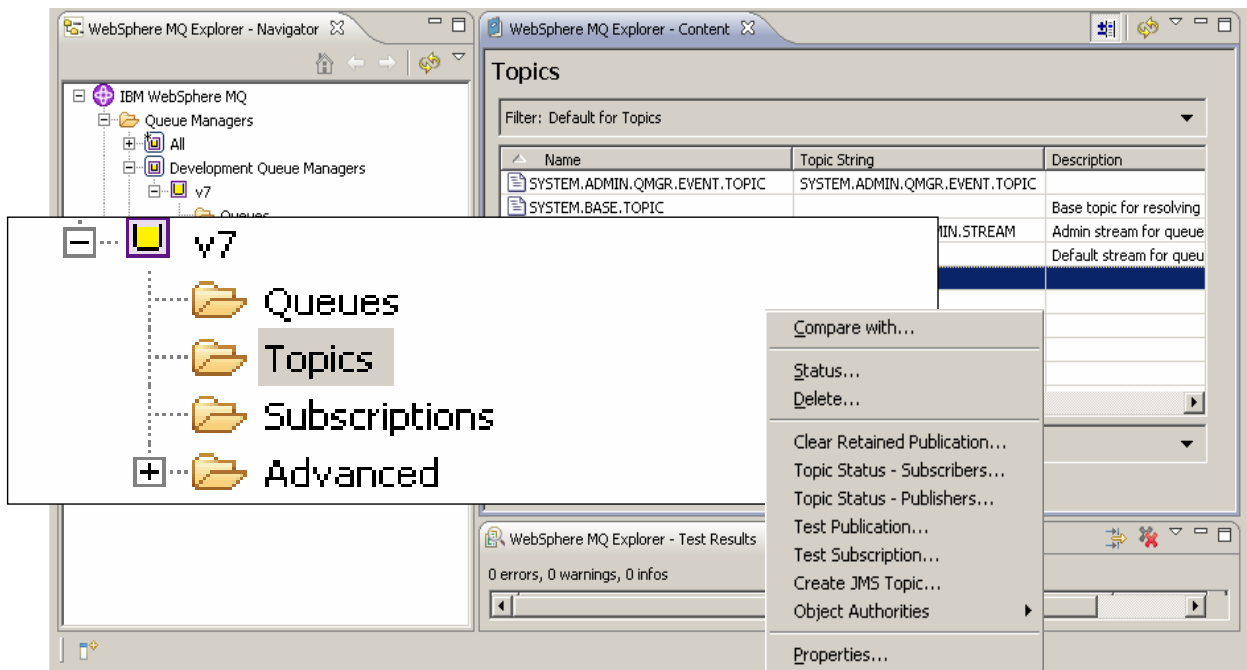
Publish/Subscribe Administration (2)

- **Support for durable and non-durable subscriptions**
 - With durable, a client can go away and come back later without missing messages
 - Durable can cause queues to fill – generating configured depth events as warning
 - Non-durable exist only for the lifetime of the application
 - No manual "cleanup" task needed when applications end unexpectedly
- **Subscriptions**
 - Able to see who is subscribing to topics: DISPLAY SBSTATUS
 - Able to create subscriptions on behalf of a third party DEFINE SUB
- **Security**
 - Use of a topic is restricted by permissions on the associated topic object
 - On z/OS drives need for mixed-case support in RACF
 - Follows existing WMQ model for security configuration (SAF or OAM)
- **Conversion of point-to-point applications without code changes**
 - Administrative changes to objects
 - A queue alias can point to a topic, not just a local queue

Publish/Subscribe Administration (2)

N O T E S	<p>When applications have subscribed to a topic, or are publishing on a topic, the queue manager can be interrogated to show the details of these applications. This interrogation is by means of MQSC or PCF commands as per the standard WMQ administration model. The details displayed are specific to publishers or subscribers and are in addition to that shown via the DISPLAY CONN command since subscribers may remain registered while they are not connected to the queue manager.</p> <p>No management or cleanup is required when subscriptions are made non-durably since the queue manager recognises when applications disconnect and cleans up any non-durable subscriptions. Queues do not continue to fill up with messages.</p> <p>The security of who can use a particular topic string is something that is restricted by permissions on the associated topic object. In the same way that attributes can be inherited from parent topics in a topic hierarchy, security settings can also be inherited from parent topics. It follows the existing WebSphere MQ model for security configuration (SAF on z/OS and the OAM on distributed). The z/OS security interface has been enhanced to permit use of mixed-case support in RACF to give more flexibility in the naming of topic objects.</p> <p>Topic security will be checked for publishing applications before they are allowed to publish, and subscribing applications before they are allowed to subscribe to a topic. Different permissions exist for creation of a new subscription against resumption of an existing durable subscription</p> <p>Applications which currently put to or get from a queue and cannot have their source code changed, can still publish messages through an alias queue which references a topic object set up on their behalf by administrative commands and receive through administratively-created subscriptions</p>
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Publish/Subscribe in the WMQ Explorer



Publish/Subscribe in the WMQ Explorer

NOTES

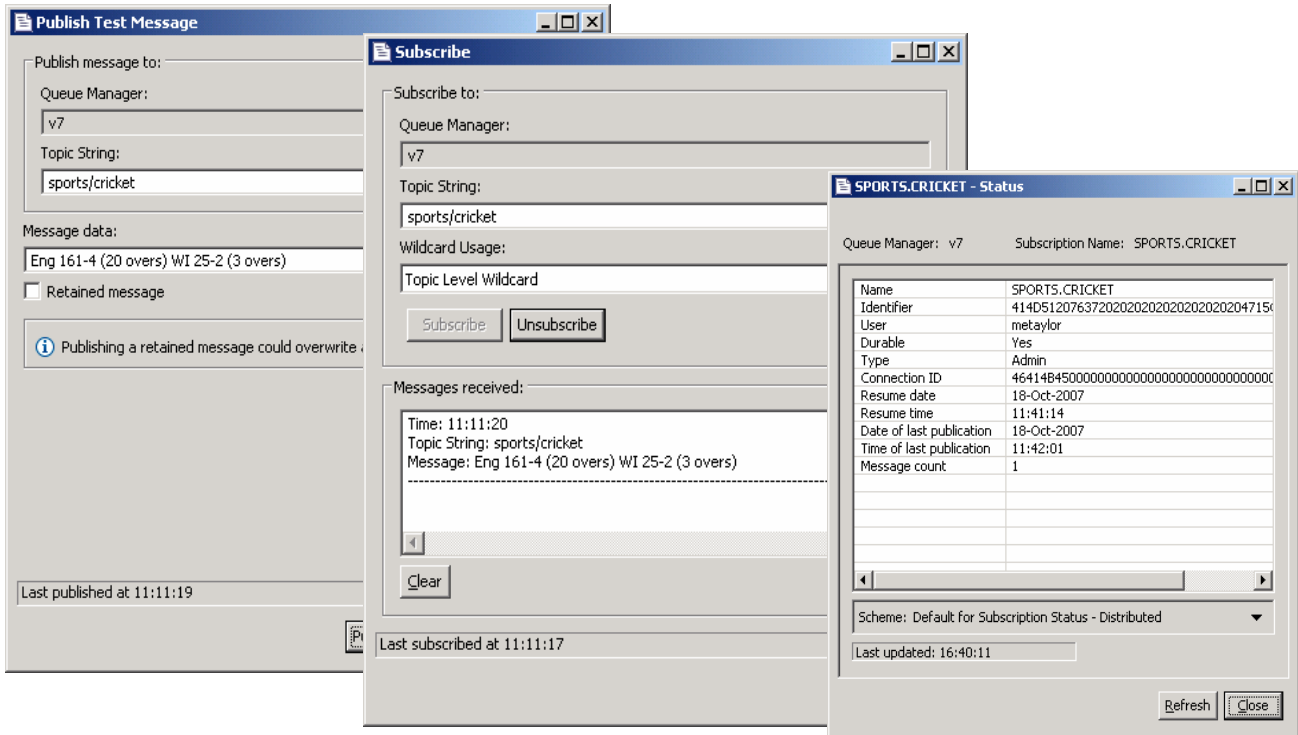
The WMQ Explorer has been enhanced to show pub/sub-related operations.

Topic objects and the subscription table can be displayed, created and modified from here.

The same functions are available from MQSC and PCF interfaces, but this is the easy-to-use mechanism.

When connected to older levels of WMQ, the Explorer fully supports administration of the publish/subscribe services found there. This is the equivalent of SupportPac MS0Q, the publish/subscribe plug-in for WMQ V6.

Testing Publish and Subscribe



Testing Publish and Subscribe

NOTES

As part of the pub/sub operations, there are simple interfaces in the Explorer to demonstrate and check the behaviour.

Publish/Subscribe Topologies

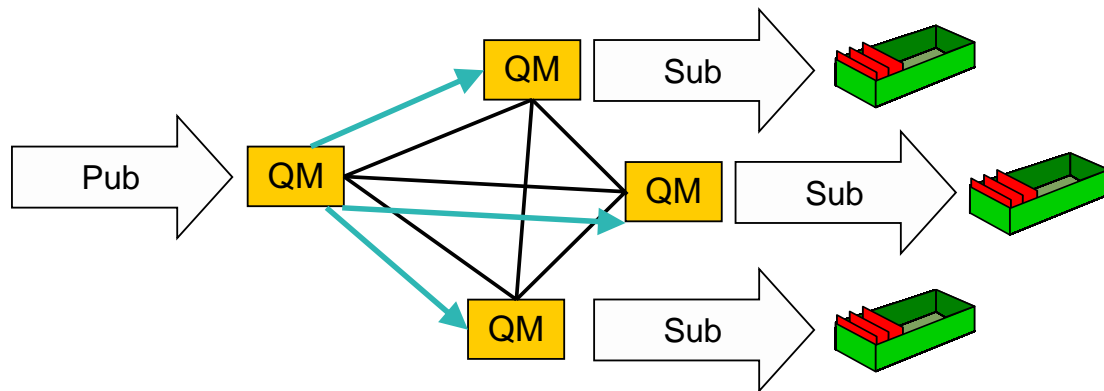
- **WMQ V6 publish/subscribe networks based on hierarchies**
 - All brokers linked in parent/child tree
- **WMB publish/subscribe networks based on hierarchies of collectives**
 - All systems in a collective are connected to each other (mesh)
 - Also has "clones"
- **New product built on hierarchies and clusters**
 - With interoperability to other pub/sub systems through hierarchies
- **Clusters are built on existing WMQ cluster technology**
 - Cluster can be defined independently of any existing cluster used for queuing
 - Behaves in a similar way to WMB collective
- **Design gives**
 - Scalability
 - Availability
 - Ease of administration

Publish/Subscribe Topologies

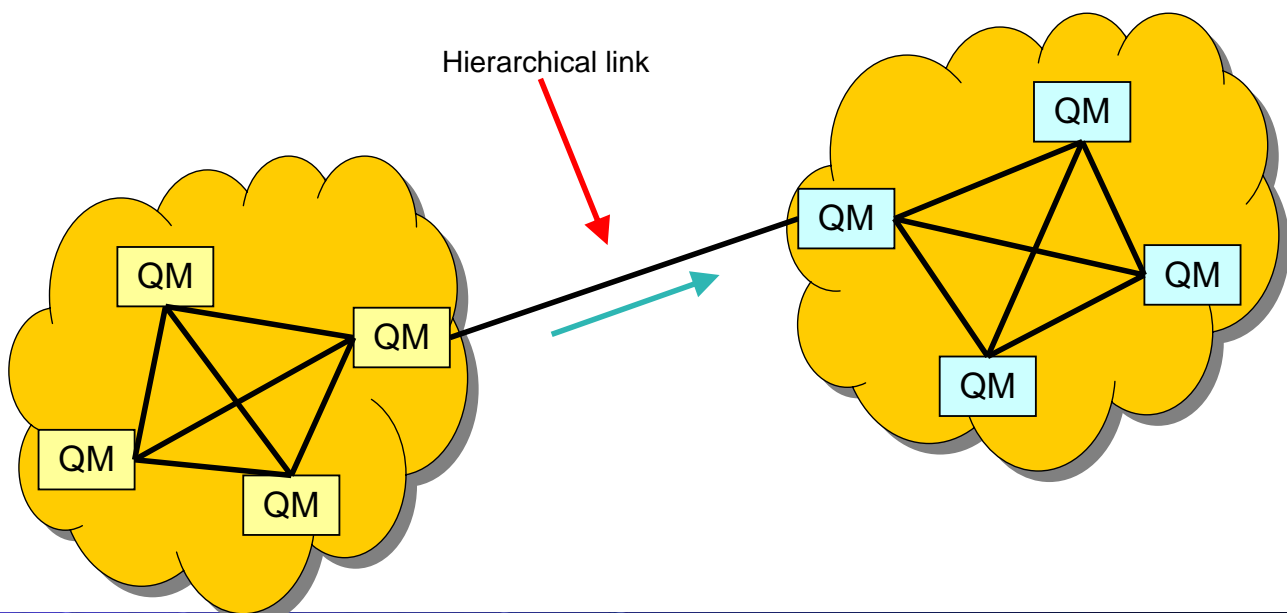
N O T E S	<p>WebSphere MQ Version 7 provides a range of topologies, including support for very large numbers of subscribers. It does this with two complementary topology designs: queue manager hierarchies, continuing support for the connection model used by WebSphere MQ V6 publish/subscribe, and publish/subscribe clusters, similar to the collectives used by WebSphere Message Broker V6.</p> <p>Queue manager hierarchies link together queue managers in a parent/child tree. Publications are delivered across these channel links to satisfy subscriptions existing on other queue managers. The availability of this topology is reliant on the links being available as there is only one route through the queue manager hierarchy from one queue manager to another.</p> <p>Publish/Subscribe queue manager clusters link together queue managers using WMQ queue manager clustering technology. A publish/subscribe cluster can be defined independently of any existing cluster used for queuing. This topology has all the availability characteristics of WMQ clusters with no reliance on any single route between two queue managers. Publications are delivered across cluster channels to satisfy subscriptions existing on other queue managers.</p> <p>WebSphere MQ Version 7 provides interoperability to other publish/subscribe systems through hierarchies, including allowing the linkage of separate publish/subscribe clusters with hierarchical links, analogous to joining up clusters with gateway queue managers for queuing. A number of attributes are available to control how much traffic is shared with other clusters; when publications are to be shared, the queue managers will attempt to minimise the traffic, allowing the destination cluster to do the fan-out as close as possible to the subscriber.</p> <p>The next two slides show some typical topologies.</p>
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Publish/Subscribe in a Cluster

- Consistent topic definitions in cluster
- Multiple routes across cluster



Publish/Subscribe in Combined Hierarchy & Clusters



Publish/Subscribe Application Programming

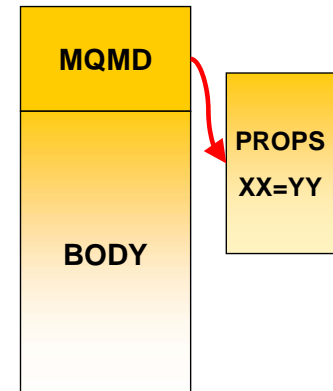
- **Cannot significantly change the JMS API**
 - But we want some of its facilities more easily available in the MQI
 - To improve MQI programming and improve (make thinner) the JMS layer
 - JMS implementation exploits new MQI functions
- **New verb for subscribing**
 - So you do not need to build RFH or RFH2 headers in the application
 - **MQSUB** registers a subscription
 - Includes information about where messages will be read from
 - Do not need to specify a queue – can be automatically assigned
 - Retained publications delivered immediately after subscribing
- **New options on existing verbs**
 - MQOPEN to get access to a topic
 - MQCLOSE deregisters a subscription
 - MQPUT, MQGET to publish and to receive publications
- **Sample programs included to demonstrate use**

Publish/Subscribe Application Programming

N	<p>Publish/Subscribe is part of the JMS API. We cannot change the JMS API but we want to make some of its facilities more easily available in the MQI. This has the effect of improving MQI programming and shrinks the JMS layer that is built on the MQI.</p>
O	<p>Publishing to a topic and subscribing for publications on a topic are now part of the MQI. Subscribing to a topic object registers that applications interest in publications to that topic. This is done by means of a new verb, MQSUB. Reading from the returned object handle gives the application any publications made to that topic.</p>
T	<p>Opening a topic for output registers that application as a publisher to that topic for the duration of the open. Putting messages to the returned object handle sends them to the subscribers of that topic.</p>
E	<p>Options are available on the MQI to indicate whether a subscription is durable or non-durable. Those subscriptions that are made durably continue to have publications sent to their indicated target whether the application is connected or not. Those subscriptions that are made non-durably cease to exist when the application disconnects and no further publications will be sent to their indicated target.</p>
S	<p>The indicated target for publications used by a subscriber could be a nominated queue, or a managed queue. If a queue is nominated by the subscriber then it is the responsibility of the application to tidy up that queue and remove all messages from it, even if it is using a non-durable subscription (only durable subscriptions can be made via the administrative command). If the subscriber requests a managed queue, then this queue is guaranteed to be local to this queue manager and will be tidied up after the disconnection of a non-durably subscribed application, or after the explicit removal of a durable subscription.</p> <p>If a subscription is made durably, it remains in place when the subscribing application disconnects and can be resumed by the subscribing application when it reconnects and requests the subscription again. When an application no longer needs a durable subscription it can be removed cleanly using MQCLOSE options.</p>

Message Properties

- **Arbitrary values associated with the message but not part of the body**
 - Like a user-extendable MQMD
 - Already part of JMS
- **New verbs including MQSETMP and MQINQMP**
 - Properties can be integers, strings, boolean, etc.
- **Easier to use than RFH2 folders**
 - Receiving apps do not see them unless they want
 - No need to parse and skip over message headers
- **Configuration options for compatibility**
 - Queue and channel attributes define behaviour
 - Defaults will create RFH2 folders
- **Permits explicit statement of relationships between messages**
 - eg Message X is a **REPLY** to Message Y
 - Messages referred to by handles



Message Properties

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Message properties are arbitrary values associated with the message but not part of the body of the message. You can think of them rather like a user-extendable message descriptor (MQMD). This concept is already part of the JMS API. Properties can be any of any basic type, for example integers, strings, or Booleans, as expressed in the appropriate programming language.

Setting and Inquiring of message properties in a message is part of the MQI with the introduction of new verbs to allow this. Message handles are introduced to allow references to be made to a message within which message properties are to be manipulated.

For applications whose source cannot be changed, the decision to discard message properties can be made based on the consumer of messages at consumption time rather than by the producer of the messages who doesn't necessarily know whether the consumer will be able to accept message properties.

Message properties are exposed as MQRFH2 headers when they are sent to older queue managers, as they are today. Configuration attributes also allow removal of these properties as they are transferred.

The introduction of a message handle also permits the application to state an explicit relationship between messages. For example, Message X is a REPLY to Message Y. This then potentially allows monitoring products to tie messages together, where previously they could only guess or have external configuration.

Other MQI Enhancements

- **Asynchronous Message Reception**
 - New verb **MQCB** defines a callback function
 - Automatically Invoked when a message arrives
 - No need for MQGET(WAIT) or MQGET(SIGNAL)
 - A thread can receive messages from multiple queues
 - New verb **MQCTL** to start and stop message delivery to callback
- **Selectors**
 - Use a SQL92 clause to select messages by properties including MQMD fields
 - Can be specified on **MQOPEN**, **MQSUB** for filtering messages
 - Selection is done inside queue manager
 - Not looking inside message body
 - Message Broker still required for content filtering
- **Cooperative Browsing and Message Tokens**
 - Efficient interface for applications reading from the same queue
 - Example: "master" program browses a queue telling "slaves" which message to work with, based on elements within the message
 - No races – messages locked but available to any cooperating process

Other MQI Enhancements

NOTES

The MQI is enhanced to provide asynchronous consumption of messages removing the need for the JMS interface to build the onMessage() method on top of polling MQGET calls. This allows applications to be called back when a message becomes available, meeting their message selection criteria on one of their named queues. The callback function is also invoked when something happens that requires the application to end, for example when the connection to the queue manager is being quiesced.

Functions to be driven are defined using a new verb, MQCB. This links a function with an object handle previously obtained by opening a queue or subscribing to a topic. The same function may be linked to many different object handles allowing the consumption of messages from a number of queues at the same time. Once all objects have been opened and all functions have been linked with object handles, another new verb is called to indicate that asynchronous consumption can start, MQCTL. The connection handle used for this call cannot be used for any other MQI verb, outside of the callback function, except for stopping asynchronous consumption.

SQL92 selector strings are used on the JMS API to pick out specific messages to be consumed by the application. Selectors are now also available for use in the MQI both when opening a queue for input and when subscribing to a topic. Since these selectors are understood by the queue manager, it reduces the number of messages sent to the JMS interface that are discarded because they don't match the selection criteria for the application. Reducing this number of non-matching messages is especially critical when the JMS application is connected as a client, because it reduces the CPU and bandwidth used to deliver unneeded messages.

Selection can be made based on fields in the message descriptor (MQMD) and properties. WebSphere Message Broker is still required for filtering based on the content, or body, of the message.

Enhancements have also been made to the Browse options to allow one process to tell another which message to retrieve from a queue, removing contention that exists in some architectures today. This was used in WMQ V6 to drive CICS transactions reading from a shared queue; that interface has now been publicly exposed.

Programming in Java

- **JMS read/write access to all MQMD fields as properties**
 - Have to explicitly enable this in the application program
 - Allows the application to go beyond the JMS specification
- **JMS access to the raw message content**
 - Can treat the whole body as a byte array property
 - Can see RFH2 folders that would normally be stripped
- **Message Header Classes for Java**
 - Updated and supported version of MS0B SupportPac
 - Makes it easy to build and parse PCF structures
 - Extended to handle other MQI message header formats
 - eg MQCIH, MQDLH classes

Programming in Java

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WebSphere MQ Version 7 does include new interfaces for the Java programmer. One group of these are intended to make it easier to create and parse MQI structures such as the PCF elements. The MS0B SupportPac has been enhanced and incorporated into the product as a fully-supported component.

There are also options to simplify the interoperation of JMS programs with other programming languages, allowing more direct manipulation of fields in the MQMD and giving access to the raw message body. Because modifying some of these attributes is not permitted within the JMS specification, the program has to "acknowledge" that it is prepared to do this by setting another virtual property on the message or destination.

Client Performance

- **Traditional WMQ non-persistent messages more reliable than some need**

- **"Read Ahead" for Receiving Messages/Publications:**
 - Messages sent to a client in advance of MQGET, queued internally
 - Administrative choice – no application changes needed
 - Higher performance in client

- **"Asynchronous Put" for Sending/Publishing Messages:**
 - Application can indicate it doesn't want to wait for the real return code
 - Maybe look for return code later – MQSTAT verb
 - Maintains transactional semantics
 - Higher performance in client

Client Performance – Notes

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While WebSphere MQ non-persistent messages do not have assured delivery, they traditionally have still been more reliable than is necessary for some application scenarios. With V7 it is possible to have additional trade-off options for performance versus reliability. WMQ provides a comprehensive range of qualities of service for message delivery, ranging from assured delivery to lightweight non persistent.

Client Performance – Read ahead – Notes

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Message read ahead is supported between clients and servers removing the need for the WMQ client to specifically request every message that is sent to it by the server. Certain profiles of applications can benefit from providing the message criteria that they wish to consume and having these messages sent to the client without the need for the client to repeatedly tell the server the same message criteria.

Read ahead works best when you are fairly certain that the messages really are intended for this client, you are fairly certain they will be consumed by the client, and you know ahead of time in what manner they will be consumed. The ideal scenario is a non-durable subscribe of non-persistent messages using an asynchronous consumer. By contrast, a point to point get of a persistent message in a transaction is not suitable for read ahead. As another example, a queue that has the messages processed by many cloned applications all opening the same queue at the same time is not a suitable application to use read ahead.

Read ahead provides a significant performance improvement to an application requiring a lower Quality of Service by removing many of the network replies. The messages are stored in memory in the client process and so if the application is not ended gracefully these messages are lost. Read ahead is a negotiated option between the client and the server and therefore does not provide any support to a back level client as it will be negotiated to off. It is set by a configuration option on an individual queue level; application code does not need changes.

Read ahead only applies to non-persistent messages, so the class of service for persistent messages is not being changed in any way. When there is a mixture of persistent and non-persistent messages on a queue, read ahead stops until the persistent message is explicitly requested by the application.

Client Performance – Asynchronous Put – Notes

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This is an option that allows an application to indicate that it is not immediately interested in the return code from a put of a message (although it may be interested enough to ask for the return code later). It allows unacknowledged messages to be sent removing the expense of the line turnaround on a client.

An application can indicate that it is willing to have unacknowledged, or asynchronous, communication with the server when it is producing messages either to be placed on a named queue, or published to a topic, by supplying the put message option indicating this. Using this option does not guarantee that no line turnarounds will occur, but simply that the application does not require any synchronization with the server. For example, in the case of persistent messages outside of sync-point, this option has no effect, since a line turnaround is still required. For this case, however an error will not be given with the use of this option. This behaviour can also be configured by administrative means so that application code does not have to be changed.

Messages that are given to the server using this option may be within a transaction. The commit of the transaction always does a line turn-around and still provides a return code, which may indicate that a previous put had failed and that the transaction has not been committed. In this case the application can request the last asynchronous return code using a verb to get the last asynchronous error to determine what the problem was. The error returned to this verb is only the error from an asynchronous call. Any subsequent synchronous calls which experience an error do not have any impact on the result provided when using this verb.

In order for this option to be used, both the client and the server must understand it, and therefore it does not provide any advantage to a back level client. It is however applicable to both point-to-point and publish/subscribe applications and is available in the MQI. JMS applications get a benefit from this without any application code changes at all.

Client Connection Management

- **Shared Client Conversations**
 - Several connections from the same process can be handled on the same socket
 - Faster startup for the second and subsequent connections
- **Implementation also gives us more heartbeat opportunities**
 - Faster failure notification for clients

- **Client Connections**
 - Automatic workload distribution via CCDT
 - Control number of connected clients at a queue manager

- **Free connections to z/OS for administration programs like WMQ Explorer**
 - Limited number of clients permitted by V7 license without CAF

Client Connection Management (1)

NOTES

There is a reduction in the network resources required when an application connects several times to the same queue manager by allowing all connections to be shared over the same socket. This is especially useful for JMS applications that create several JMS sessions. In order to implement these features, client channels have been changed to use a full-duplex protocol (TCP/IP only) and this implementation gives us more heartbeat opportunities allowing for faster failure notification for clients and faster tidy-up of orphaned server-connection channels.

In order to implement conversation sharing we allow a single TCP/IP socket to carry multiple connections provided the two ends of the connection are the same process. Sharing the conversation requires a full duplex connection.

It is not expected that large numbers of JMS sessions are created on a single JMS connection, even by larger entities such as the WebSphere Application Server. They can still benefit by having many JMS connections shared across a single socket, although of course it is not guaranteed that all their JMS connections will use the same socket, just that they could do where it is possible.

Administrative users of the product will be aware of conversation sharing since the number of server-connection channels will be reduced compared to previous releases although they see the same number of details when displaying connections. Displaying channel status details will indicate that there are a number of connections going across a specific channel instance and there are administrative means to set limits on this behaviour, including removing it altogether.

Client Connection Management (2)

NOTES

The Client Connection Definition Table (CCDT) has always allowed a client to connect to one of a number of queue managers, but the list was always searched sequentially for the first available system. With WMQ V7 the selection can be configured to be made randomly from the list, assisting with workload distribution. Where multiple connections might be made from the same process, an affinity attribute tells the client to attempt to connect to the same queue manager as previously – this can then exploit the multiplexing capabilities of the channel.

The number of inbound client channels can now be restricted with WMQ SVRCONN channel attributes. You can specify independently the maximum number of instances of a channel, and the maximum number of instances from a specific partner. This is designed to prevent rogue applications from using all the system resources by continuing to connect. Existing attributes can still restrict the total number of channels across the queue manager.

With V7, the license for WMQ on z/OS has been modified to permit a small number of client connections to the SYSTEM.ADMIN.SVRCONN without requiring purchase of the Client Attach Facility. This has been done to make it easier for customers without the CAF to use the WMQ Explorer configuration program. System messages have been extended to make it obvious when you are using one of these connections. If you want to use other named SVRCONN channels, or to have more connections, then the CAF is still required.

WMQ Explorer Enhancements

- **Sets**
 - Queue Managers can be partitioned into sets within the Navigator
 - For example "Test", "Production"
- **Security Configuration**
 - Easy to define channel exits, userid/password configurations
 - Configured for each queue manager or for all queue managers in a set
 - Password manager included
 - Still recommend security exit or service for authentication at the server
- **Tighter JMS integration**
 - Creating an queue/topic can define a JMS destination at the same time
- **Message browser configuration**
 - Number, size of messages
- **Plug-in Migration**
 - Explorer now based on Eclipse 3.3 – compatibility not guaranteed
 - Major change is availability of supported PCF classes
- **Using MQ Explorer with WebSphere MQ for z/OS**
 - you can use the MQ Explorer, which runs on the Windows and Linux on x86 platforms, to manage the z/OS parts of your WebSphere MQ network without having to buy the Client Attach Feature

WMQ Explorer Enhancements

NOTES

Along with support for new features such as the publish/subscribe objects and their corresponding status displays, the Explorer has been enhanced with more general capabilities.

One of the most frequently requested features has been the ability to partition the list of queue managers into sets, for example to show test and production systems separately in the navigation tree. This version of the Explorer allows sets to be defined, with queue managers assigned to sets manually or automatically based on some attribute such as the CommandLevel value. Queue managers can appear in more than one set. There are some operations that can be applied at the set level, such as connecting to all of them with a single click.

The security controls allow configuration of not just a userid and password, but SSL and channel exit parameters. These can be defined globally or for each queue manager. A password manager component stores information securely, so that you do not need to re-enter passwords on each restart of the Explorer.

When a queue or topic is created, the wizard can optionally also drive the corresponding JMS operation. This assist with integration of JMS configuration objects with the WMQ configuration.

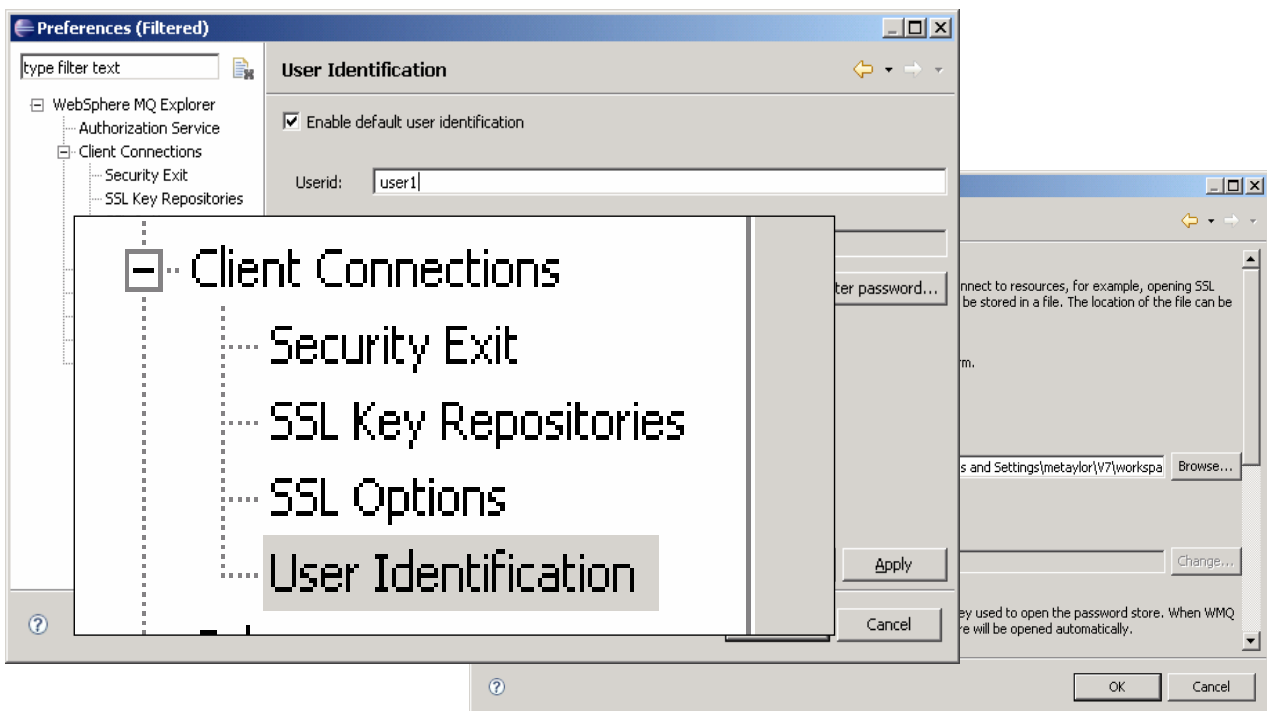
The message browser now has preferences that say how many messages to read from the queue instead of the previously hard-coded 500; similarly the length of messages can be configured.

The Explorer has been updated to use the current version of the Eclipse runtime, V3.3. User-written plug-ins ought to work unchanged, but Eclipse has deprecated some interfaces that existed in the previous version, so compatibility cannot be guaranteed. One major change is that PCF classes are now officially available and supported; plug-ins should be changed to use those interfaces.

Queue Manager Sets



WMQ Explorer Preferences



Benefits of V7 on z/OS Summary

1. Premier ease-of-use for improved developer productivity
 - Graphical configuration of JMS and Publish/Subscribe
 - New MQI verbs providing greater flexibility in retrieving messages, adding custom properties to messages and automatically notifying applications when messages arrive
 - **you can use the MQ Explorer, which runs on the Windows and Linux on x86 platforms, to manage the z/OS parts of your WebSphere MQ network without having to buy the Client Attach Feature**
2. Enhanced performance and usability for JMS and MQI users
 - Increases in JMS and Publish/Subscribe performance - **Increasing JMS listener throughput by up to 220%* on z/OS – spending less MIPS!**
 - Increase throughput and resilience of MQ client connections
3. New Publish-and-subscribe for z/OS users
 - **Enables event driven delivery of messages increasing flexibility of messaging to help reduce time, effort and costs of introducing new applications and making changes to existing**
 - WebSphere MQ V5.3 for z/OS End of Service effective 30 Apr 2008
4. Enhanced connectivity for Web 2.0 developers
 - Enables developers to use Ajax to build Web 2.0 applications that connect to the backend business applications and data
 - Provides Bridge for HTTP enabling simple, REST-style access to WebSphere MQ
 - **Helps simplify deployment and maintenance of large scale distributed applications**
 - **Enables simple access to MQ without need to install MQ clients**



WebSphere Software

WebSphere MQ and the Web



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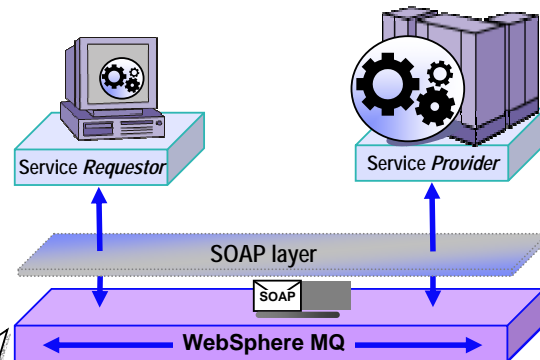
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WebSphere MQ makes Reliable Web services possible

- **Many developers today connect Web services using HTTP**
 - May seem “good-enough” to start with but doesn’t address reliability and auditability and locks-up the services whilst they are communicating

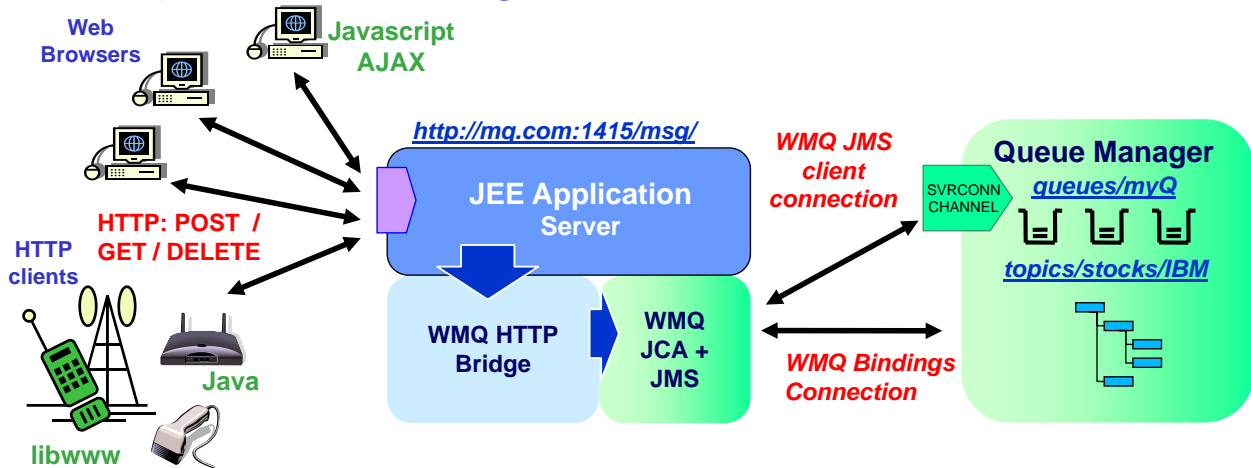
WebSphere MQ provides a **layer** of messaging services to help make SOAP exchanges:

- ✓ *More reliable than those sent over HTTP*
- ✓ *Transactional – allowing service resources to be updated atomically so they retain integrity and failures can be recovered and retried*
- ✓ *Arrive in the same order as they were sent*
- ✓ *Decoupled in time – so that they can handle other requests whilst waiting for responses*
- ✓ *Buffered so that SOAP requests can be throttled for batch-style Web services*
- ✓ *Clustered so that SOAP requests can be processed in parallel by multiple service providers*
- ✓ *Easily integrated with applications that are not enabled for SOA*
- ✓ *More auditable*



- **Web services that interoperate with HTTP will also with WebSphere MQ**
- **Sender and listener support for**
 - Axis host Web services environment
 - .NET host Web services environment

WebSphere MQ Bridge for HTTP



- Key features of the WebSphere MQ Bridge for HTTP
 - Maps URIs to queues and topics
 - Enables MQPUT and MQGET from
 - Web Browser
 - Lightweight client
- Alternative non-servlet implementation available as MA94

HTTP Connectivity to WMQ

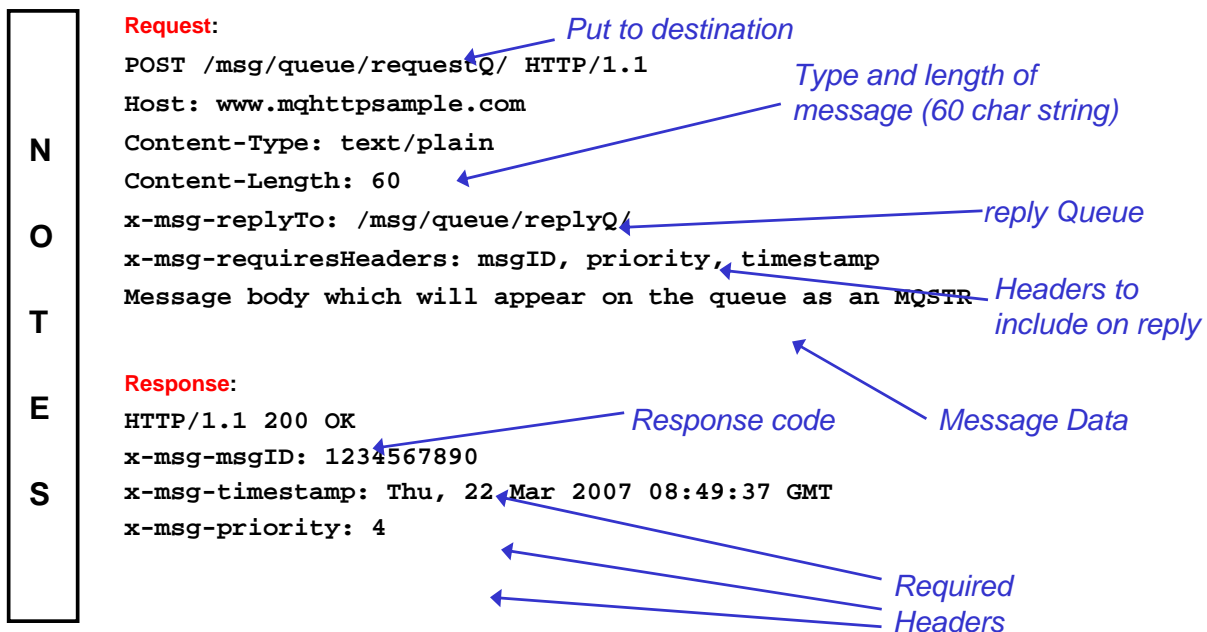
N O T E S	<p>The first goal of the HTTP feature is to extend the reach of WMQ applications to more environments such as web browsers. This will give Rich Internet Applications simplified access to the Enterprise. Eliminating the WMQ client reduces the cost of application deployment, though this is not a complete replacement for the WMQ client</p> <p>It is missing many MQI features and does not offer transactionality, assured delivery etc.</p> <p>But in many cases where applications have resend logic and check for duplicates it will be good enough</p>
	<p>Shipped with WMQ V7 is the J2EE/JCA-based implementation, previously SupportPac MA0Y. An alternative native implementation, SupportPac MA94 is also available as a separate download.</p>
	<p>The API is modelled after REST ("Representational State Transfer") principles. REST offers a different integration style to WS-* standards based web services. Qualities of service are sacrificed for simplicity and scalability to keep barriers-to-entry low. REST APIs are typically simple and can be used spontaneously and incrementally – for example in Web 2.0 mash-ups. The HTTP/WMQ API is largely based on REST, though it has quirks. For example the bridge transfers message representations, but messages are not ideal REST resources</p> <p>They do not necessarily have a unique identifier, and so cannot be addressed individually</p> <p>Not generally amenable to caching etc. because they must be delivered only once</p> <p>They are very transient</p>
	<p>It is a stateless / connectionless API with one HTTP verb corresponding to one WMQ operation</p> <p>HTTP headers = Message headers</p> <p>request headers (get and put options) – wait, requires-headers</p> <p>entity headers (MQMD options) – priority, expiry, timestamp, persistence, msgId, correId, replyTo</p> <p>HTTP request payload = Message body as either text or binary</p>
	<p>No client libraries are provided – apps code directly to HTTP verbs using whatever APIs are in the environment.</p> <p>REST was described by Roy Fielding in http://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm</p>

HTTP-MQI Verb / Resource Mapping

- **Define URI to identify queue (or topic)**
- **Modelled on REST principles**
 - Simple translation of HTTP to MQI
- **Message Format:**
 - Header fields (MQMD) conveyed in HTTP headers
 - Body is passed in HTTP entity body
 - Message type is conveyed in HTTP Content-Type
 - “text/plain” or “text/html” equate to WMQ string messages (MQFMT_STRING)
 - All other media types map to WMQ binary messages (MQFMT_NONE)

Resource	Sample URIs	HTTP verb mapping			
		GET	POST	PUT	DELETE
Messages	http://host/msg/queue/ <i>qname</i> / http://host/msg/topic/ <i>topic_path</i> /	MQGET w. browse	MQPUT	-	MQGET

Example HTTP Flow - POST (= MQPUT)



WMQ as an SOA Asset - Service Descriptions

- **A standard way to describe all WMQ apps as SOA assets (services)**
 - To be inventoried, and catalogued in Service Registry
 - To be re-used as services in composite SOA applications
 - To be managed and traced with SOA tools
- **IBM has created the WMQ Service Definition and SOAP binding**
 - IRI for WMQ addresses (“wmq:”)
 - Message destinations - Queues or Topics
 - Other resources - Qmgrs, channels, channel status etc.
 - WSDL bindings to define application properties
 - Also defines the Message Exchange Pattern; Request queue; Response queue; Correlation style; Message format; Message persistence, priority etc.
- **Published as SupportPac MA93**

WMQ as an SOA Asset - Service Descriptions

N O T E S	<p>WMQ users have requested guidance from IBM on how they should describe their WMQ applications as services for use in service oriented architectures. There has been particular interest in applying this to unmanaged (ie not hosted in environments such as CICS or WAS) native WMQ applications</p>
	<p>This will allow applications to:</p> <ul style="list-style-type: none"> Be inventoried, and catalogued. For example, the WSDL description of an app can be stored in WSRR Be managed and traced with SOA tools. which could monitor the queues associated with a service Be re-used in composite applications. For example, once the service definition has been implemented by web services tools, it will be possible to drop a WMQ application into a composite Web services application, and the tools will generate the code required to invoke the application
	<p>IBM is creating the WMQ service definition specification consisting of two documents.</p> <ul style="list-style-type: none"> An IRI specification defining the address of WMQ message destinations (Queues or Topics) and the address of other resources such as Qmgrs, Queues, channels, channel status etc. for use by admin tools A Bindings Specification, which defines: <ul style="list-style-type: none"> Properties which may be used to describe and connect to a WMQ app. The mapping of properties to message headers for the construction and interpretation of SOAP and non-SOAP messages Supported message exchange patterns A WSDL binding for SOAP/WMQ and non-SOAP/WMQ
	<p>Initially this has been published as a SupportPac, without immediate plans to add tooling support in the base WMQ product, but it provides a standard to be implemented by IBM and vendor tooling products.</p>



WebSphere Software

WebSphere MQ and Linux for System z

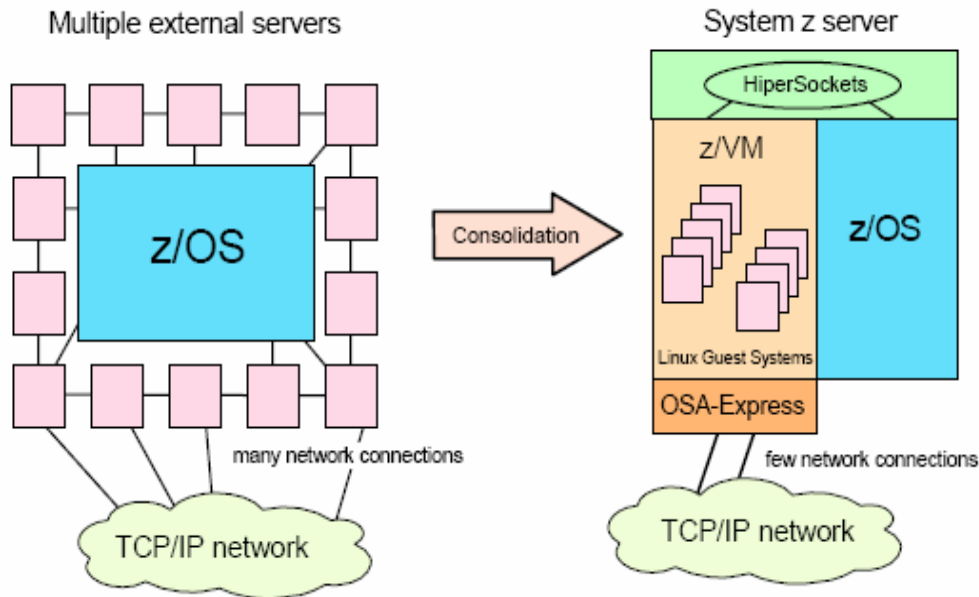


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Why Linux for System z?

Why WebSphere MQ on Linux for System z



Why WebSphere MQ on Linux for System z?

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A very popular configuration is one that uses a Linux for System z queue manager as a gateway into the z/OS queue manager cluster and shared queues. This configuration is often used for queue manager and client connection concentration. It can take advantage of hipersockets – speeding messages to their final destination, while reducing the number of connections to the z/OS queue managers to a manageable level.

Queue Manager consolidation

One customer reported replacing 10 queue managers on distributed servers with 1 queue manager on Linux for System z with no degradation in throughput. Others have reported replacing multiple instances, though not usually with quite such dramatic results. Best results are for consolidation of client connections, where the back end processing is on z/OS.

Stability

Customer reported replacing 8 Windows servers running WebSphere MQ and applications with two Linux for System z instances running the same stack. Their downtime has been dramatically reduced and they gained the added benefit of reducing software licensing.



WebSphere Software

WebSphere MQ and Files



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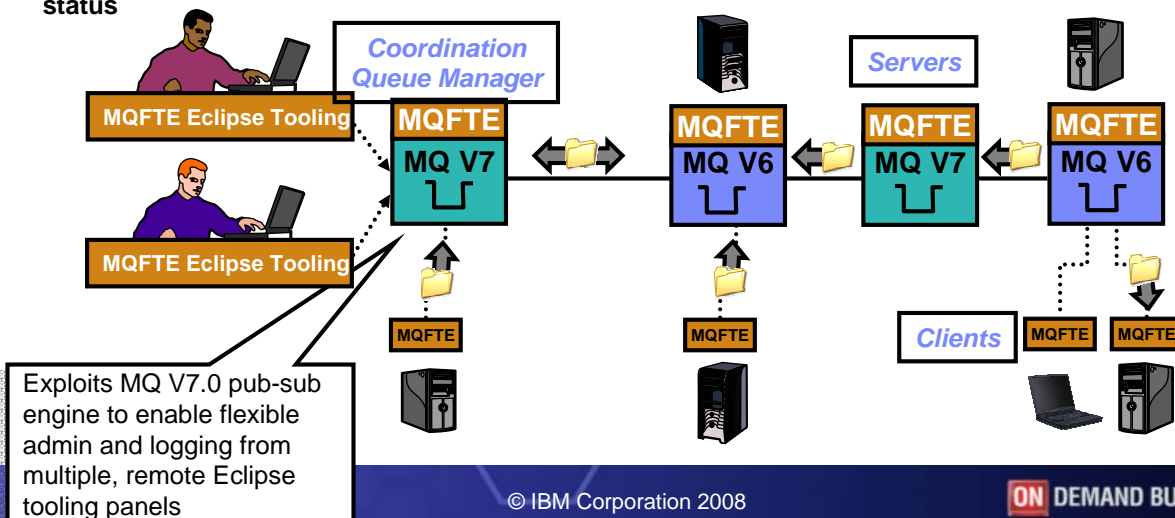
Introducing WebSphere MQ File Transfer Edition for z/OS V7.0

- **The newest member of the WebSphere MQ family**
 - Builds upon WebSphere MQ's proven transport backbone
 - Licensed as a trade-up from WebSphere MQ on distributed platforms
- **Will deliver robust solution for Managed File Transfer**
 - Enable control of all aspects of file movement between IT systems
 - Provide file delivery reliability
 - Optimized for both small and massive files
 - Provides audit trail of transfers
- **Designed to integrate with IBM's SOA portfolio**
 - Enables files to be delivered to WebSphere Message Broker for File Processing



Architecture

- Enables remote GUI configuration and admin using same tooling as MQ
- Tooling publishes transfer requests to Backbone
- “Agents” running alongside Queues managers publish audit trail to Coordination Center
- “Agents” monitor file directories, load/unload files & perform pre- & post-transfer activities
- Coordination Queue manager publishes transfer status, process and audit trail
- Coordination Queue manager requires MQ V7.0
- Multiple Coordination Queue manager could control transfers, capture audit log and publish status



Next Steps and more information

- **Talk with your IBM representative and IBM Business Partners to identify ways to help achieve your business goals with WebSphere MQ**

- **More information about WebSphere MQ can be found here**
 - <http://www.ibm.com/webspheremq>
 - <http://www.ibm.com/software/integration/wmq/zos/>
- **WebSphere MQ File Transfer Edition**
 - <http://www.ibm.com/software/integration/wmq/filetransfer/>

- **Additional materials**
 - White paper: The Value of WebSphere MQ for z/OS for the CICS customers
<ftp://ftp.software.ibm.com/software/integration/wmq/WSW11355-USEN-00.pdf>
 - Article: Connecting System z applications with IBM WebSphere MQ on z/OS
<http://www.ibm.com/software/tivoli/features/ccr2/ccr2-2007-12/connecting.html>
 - Introducing reliable, Managed File Transfer for z/OS
<http://www.ibm.com/software/os/systemz/telecon/27aug/index.html>

Thank
YOU