WebSphere MQ z/OS a-z
Proof of Technology

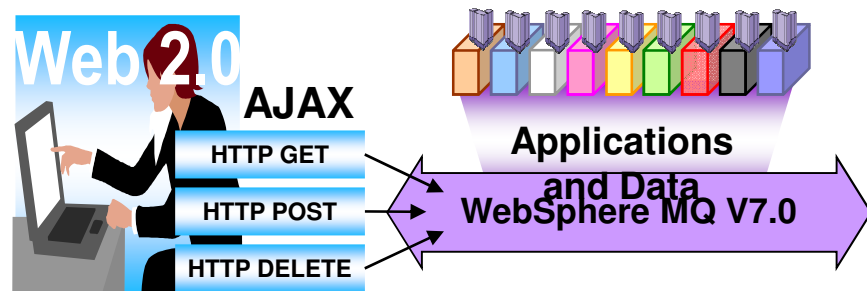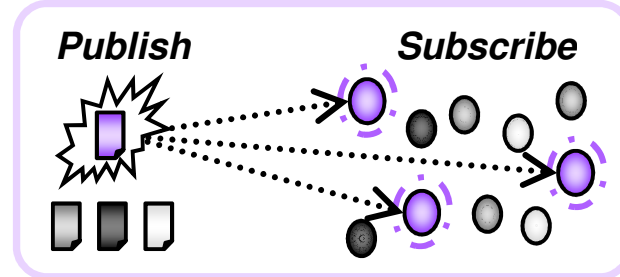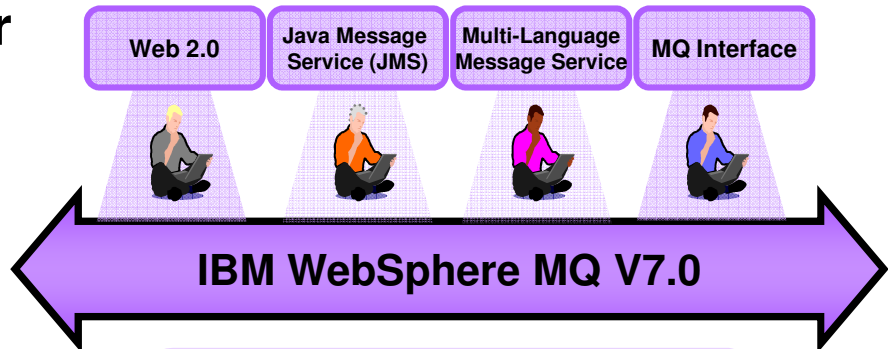WebSphere MQ z/OS Introduction

An IBM Educational Approach

WebSphere MQ z/OS Introduction

IBM WebSphere MQ V7.1

- **Universal Messaging Backbone for SOA and Web 2.0**

  ‣ Enhanced ease-of-use for publish-and-subscribe and Java Message Service (JMS) messaging

  ‣ Enhanced Publish-and-subscribe
    - Enhanced performance on Distributed
    - New support for z/OS

  ‣ Enhanced JMS performance

  ‣ Extended verbs and behaviors for MQI programming interface

  ‣ Enhanced WebSphere MQ clients for increased throughput resilience and availability

  ‣ Web 2.0 support to help create richer user experience
    - Bridges HTTP applications with Ajax and REST to the MQ messaging backbone

Web 2.0	Java Message Service (JMS)	Multi-Language Message Service	MQ Interface

IBM WebSphere MQ V7.0

Publish   **Subscribe**

Web 2.0

AJAX

HTTP GET

HTTP POST

HTTP DELETE

Applications and Data

WebSphere MQ V7.0

WebSphere MQ z/OS Introduction
IBM WebSphere MQ V7.1 Roadmap

WMQ Family Roadmap – continual delivery of customer value

(4Q/09)
MQ LLM V2.3
msg store

(2Q/10)
MQ LLM V2.4
late join

(4Q/10)
MQ LLM V2.5
self-managing

(2Q/11)
MQ LLM V2.6
improved perf.

( )
MQ LLM V2.x

(4Q/09)
MQ FTE V7.0.2
FTP Bridging

(4Q/10)
MQ FTE V7.0.3
end-to-end security

(2Q/11)
MQ FTE V7.0.4
C:D Integration

( )
MQ FTE V7.x

(1Q/11)
MQ V7.0.1.4
Pre-Connect Exit

(4Q/11)
MQ V7.1 with
Multi-version Install,
Out-of-the-box security,
Multicast capability,
Improved Performance,
z/OS Shared Q enhancements

(3Q/09)
MQ V7.0.1 with
Multi-Instance QMgrs,
Automatic Client Reconnect,
z/OS Availability, Capacity and
Performance improvements

(3Q/10)
MQ Telemetry V7.0.1

(2Q/11)
MQ WebSockets Tech Preview.
MQ HVE for RHEL ESX and
IBM Workload Deployer

(1Q/10)
Security SupportPacs and
Wizards

(4Q/10)
MQ Advanced Message Security
V7.0.1

( )
MQ AMS V7.x

2009   2010   2011   2012

**Early Access Programs**

WebSphere MQ z/OS Introduction

MQ General Information

- WebSphere MQ Industry DeFacto Standard

- Disparate interconnectivity

- Skills Reuse

- Ease of Implementation

- Tight architectural Implementation

- Reliable, scalable, transactional

WebSphere MQ z/OS Introduction

Business Value

- Reliability
  - ▶ Assured message delivery
  - ▶ Performance

- Ubiquitous
  - ▶ Breadth of support for platforms, programming languages and API

- Loose application coupling
  - ▶ Location transparency
  - ▶ Time independence
  - ▶ Data transparency (with WebSphere Message Broker)
  - ▶ Platform independence

- Scalability
  - ▶ Incremental growth

- Rapid development
  - ▶ Reduce Complexity
  - ▶ Ease of use

Message

Queue

Application A

Application Z

Q Manager   **Channels**   Q Manager
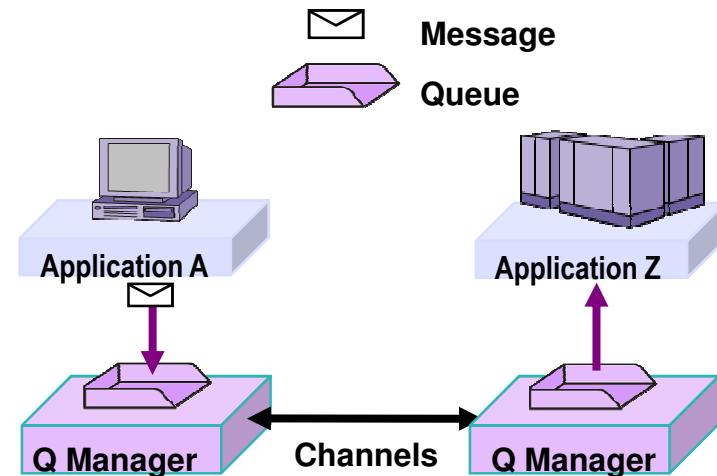
WebSphere MQ z/OS Introduction

What is WebSphere MQ?

- Communication Software

- Provides a Programmable Messaging Interface

- Messages are the data that is sent between programs

- Queues act as containers on file systems within MQ

- Channels are the TCP/IP conduits for Messages

- Supports Async message delivery

- Publish/Subscribe – sender unaware of receiver

- Telemetry provides connectivity to pervasive devices
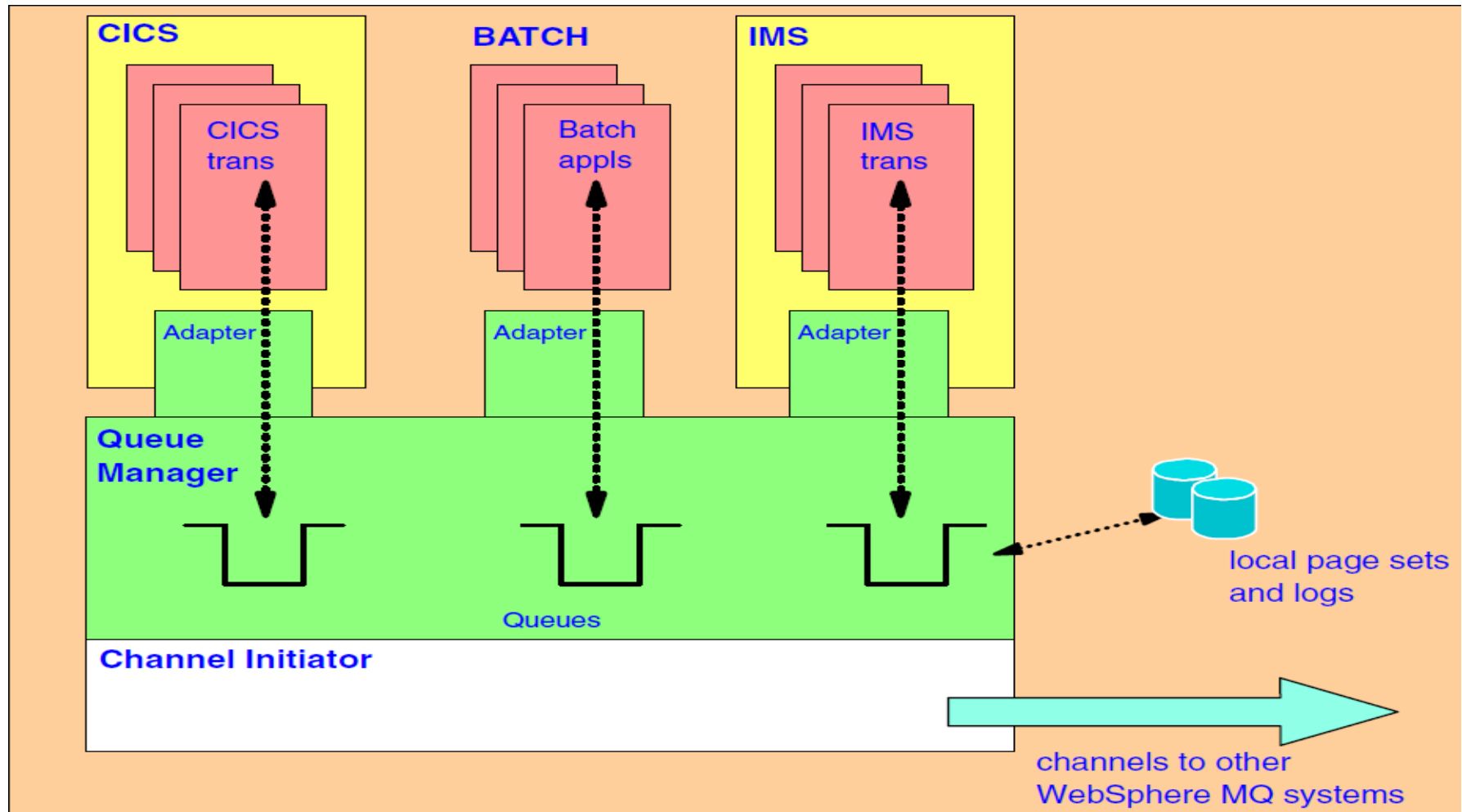
WebSphere MQ z/OS Introduction

What can it do for me?

- WebSphere MQ sends and receives data between your applications, and over networks.
- Message delivery is *assured* and *decoupled* from the application.
- Your application programmers do not need to have communications programming knowledge.
- Connects disparate computer systems with each other
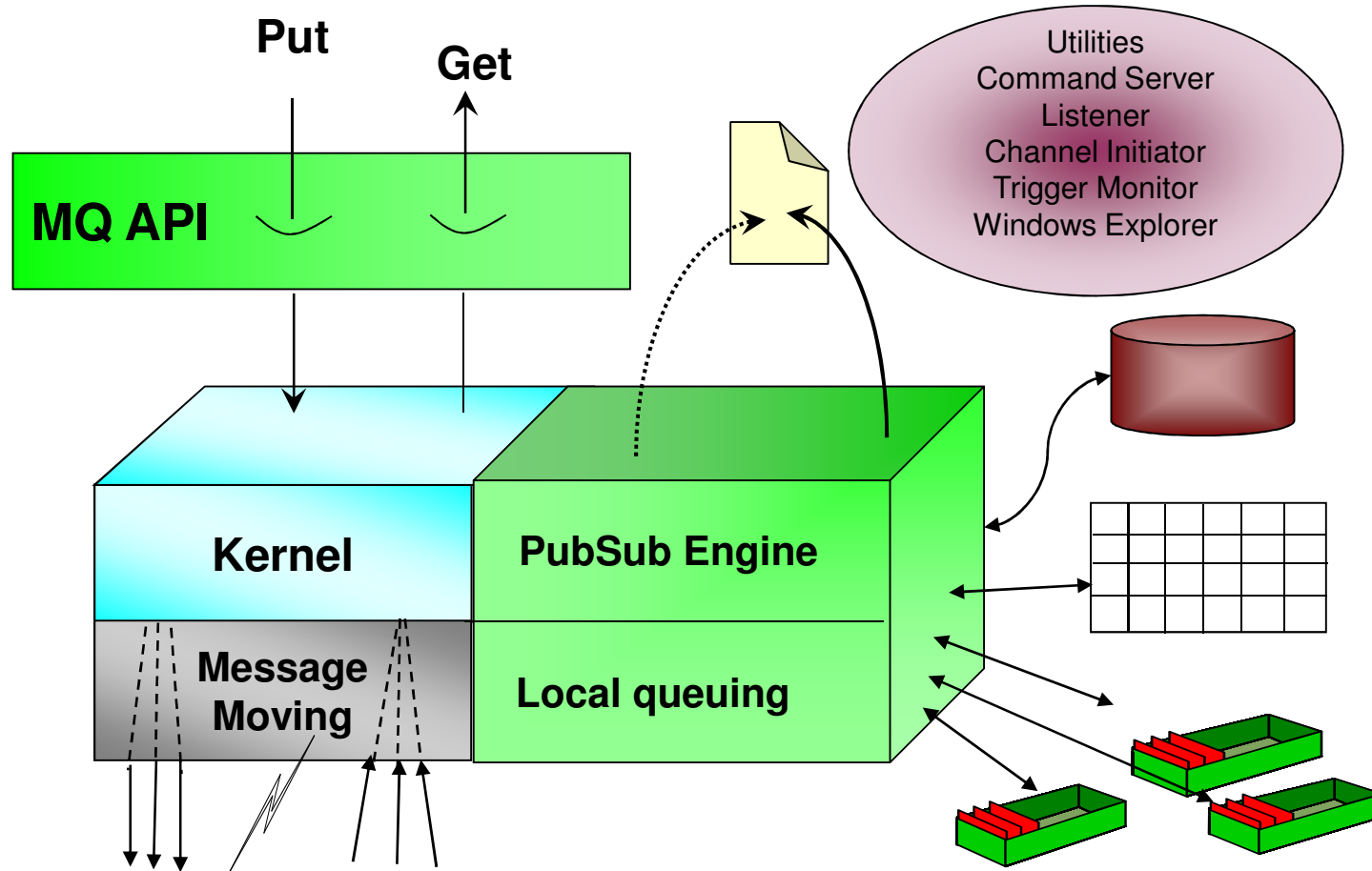- Removes the low level communication requirements
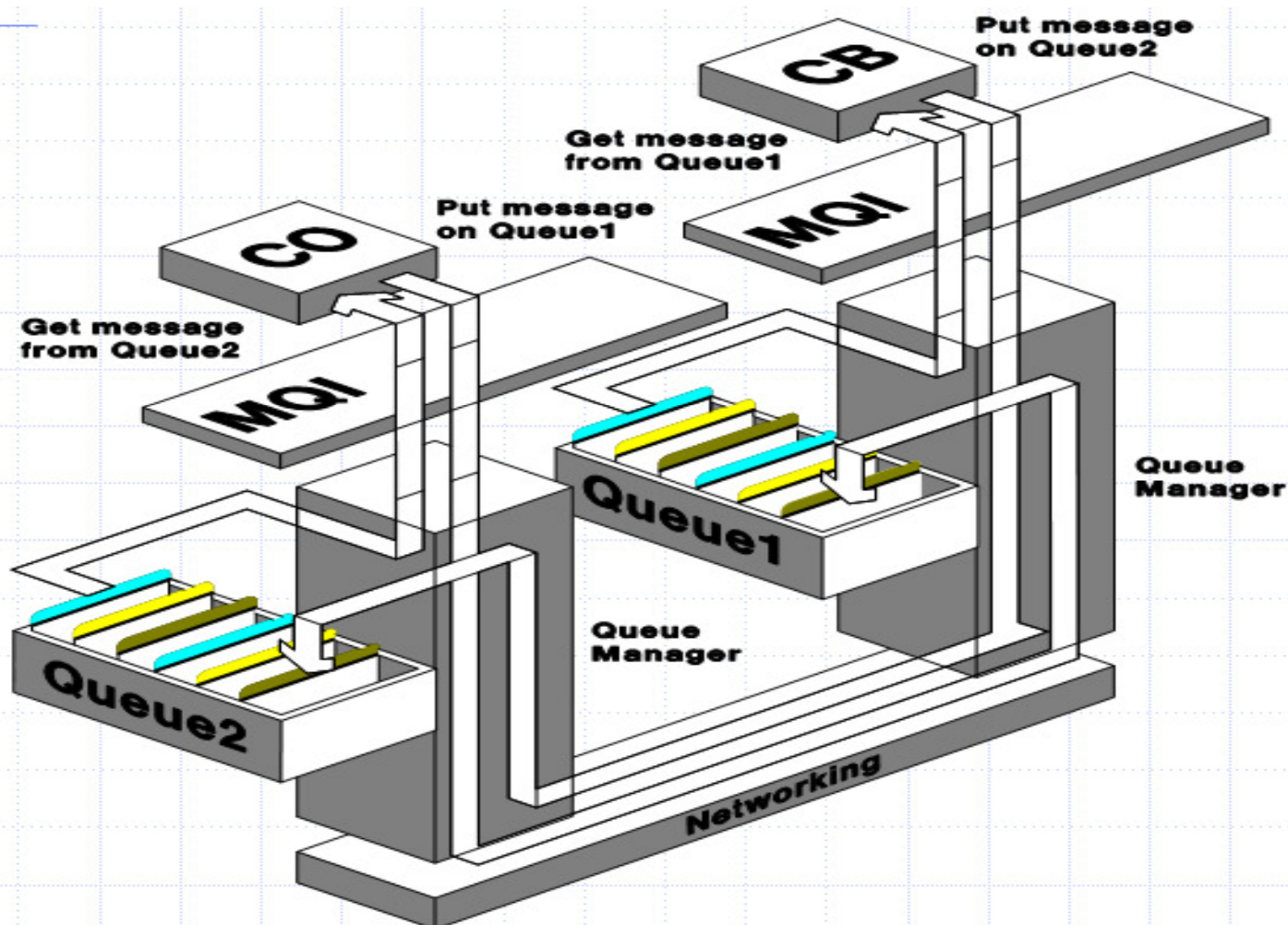
WebSphere MQ z/OS Introduction

MQ z/OS Architecture

WebSphere MQ z/OS Introduction

What is a Queue Manager?

Put

Get

MQ API

Utilities
Command Server
Listener
Channel Initiator
Trigger Monitor
Windows Explorer

Kernel

PubSub Engine

Message Moving

Local queuing

WebSphere MQ z/OS Introduction

MQ Messaging

WebSphere MQ z/OS Introduction

What tools/resources come with MQ?

- *WebSphere MQ Explorer (MS0T)*
- *InfoCenter*
- *Control* Commands
- *MQSC Commands*
- *PCF Commands*
- Sample Programs
- Free Support Packs
- Utilities

WebSphere MQ z/OS Introduction

How do I use it?

- Use the WebSphere MQ Explorer and its associated tools to create your initial configuration.
- Use the MQ API (*MQI*) in your application to *connect* to a queue manager, *open* queues and topics, and *put* and *get* messages.
- CICS Adapter
- IMS Adapter
- MQ Web Service

WebSphere MQ z/OS Introduction

How does it work?

- Queue Managers manage internal resources
- Normal operational procedures start Queue Managers with commands
- Queue Managers and Channel Initiators are usually STC's
- Applications interact with Queue Managers using MQ API's
- Application PUT and GET messages from '**Named queues**' (i.e. Objects)
- Channels connect Queue Managers
- Queue Managers on z/OS can share Objects using Queue sharing

WebSphere MQ z/OS Introduction

MQ Queuing
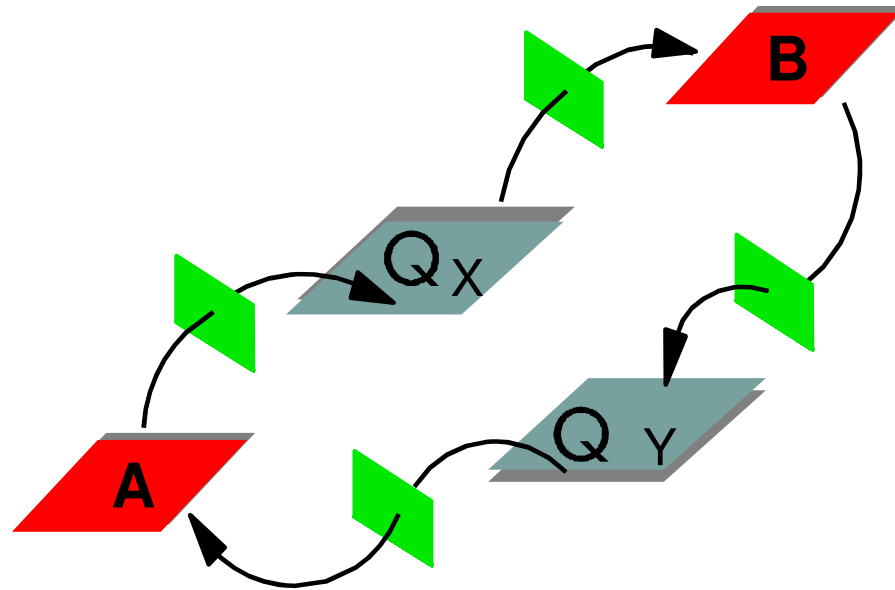
- **Messages** can be created from any source:
  - ▸ *Data, Messages, Events, Files, Web service requests / responses*

- Messages are moved asynchronously using **Queues**

WebSphere MQ z/OS Introduction

What is a Queue?

- **A queue holds messages**
  - ▶ Various Queue Types
    - ▪ Local, Alias, Remote, Model

- **Queue creation**
  - ▶ Predefined
  - ▶ Dynamically defined

- **Message Access**
  - ▶ FIFO
  - ▶ Priority
  - ▶ Direct
  - ▶ Selected by Property (V7)
  - ▶ Destructive & non-destructive access
  - ▶ Transacted

- **Parallel access by applications**
  - ▶ Managed by the queue manager

- **File Based Storage**
  - ▶ Pagesets
  - ▶ Logs
  - ▶ VSAM
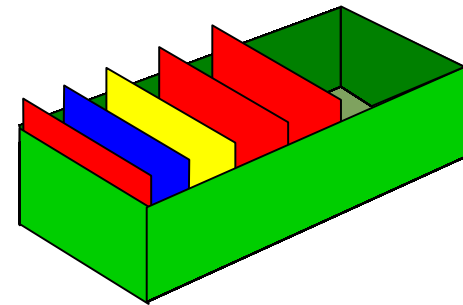
WebSphere MQ z/OS Introduction

What is a Message?

Message = Header + User Properties + User Data

Header	User Properties	User Data

•Any sequence of bytes
•Private to the sending and receiving programs
•Not meaningful to the Queue Manager

A Series of Message Attributes
Understood and augmented by the Queue Manager
•Message Id
•Correlation Id
•Routing information
•Reply routing information
•Message priority
•Message codepage/encoding
•Message format
....etc.

•User Properties require WMQ V7
      •Emulated for JMS in older versions of WMQ
•Arbitrary properties
      •For example, this is a "green" message

•Message Types
   -Persistent ... recoverable
   -Non Persistent
•Up to 100MB message length

WebSphere MQ z/OS Introduction

MQ Clustering

Clustering is one of the IBM WebSphere MQ key features to achieve Work Load Balancing , Availability and Reduced Administration.

Clustering allow you to define logical groups of Queue Managers.
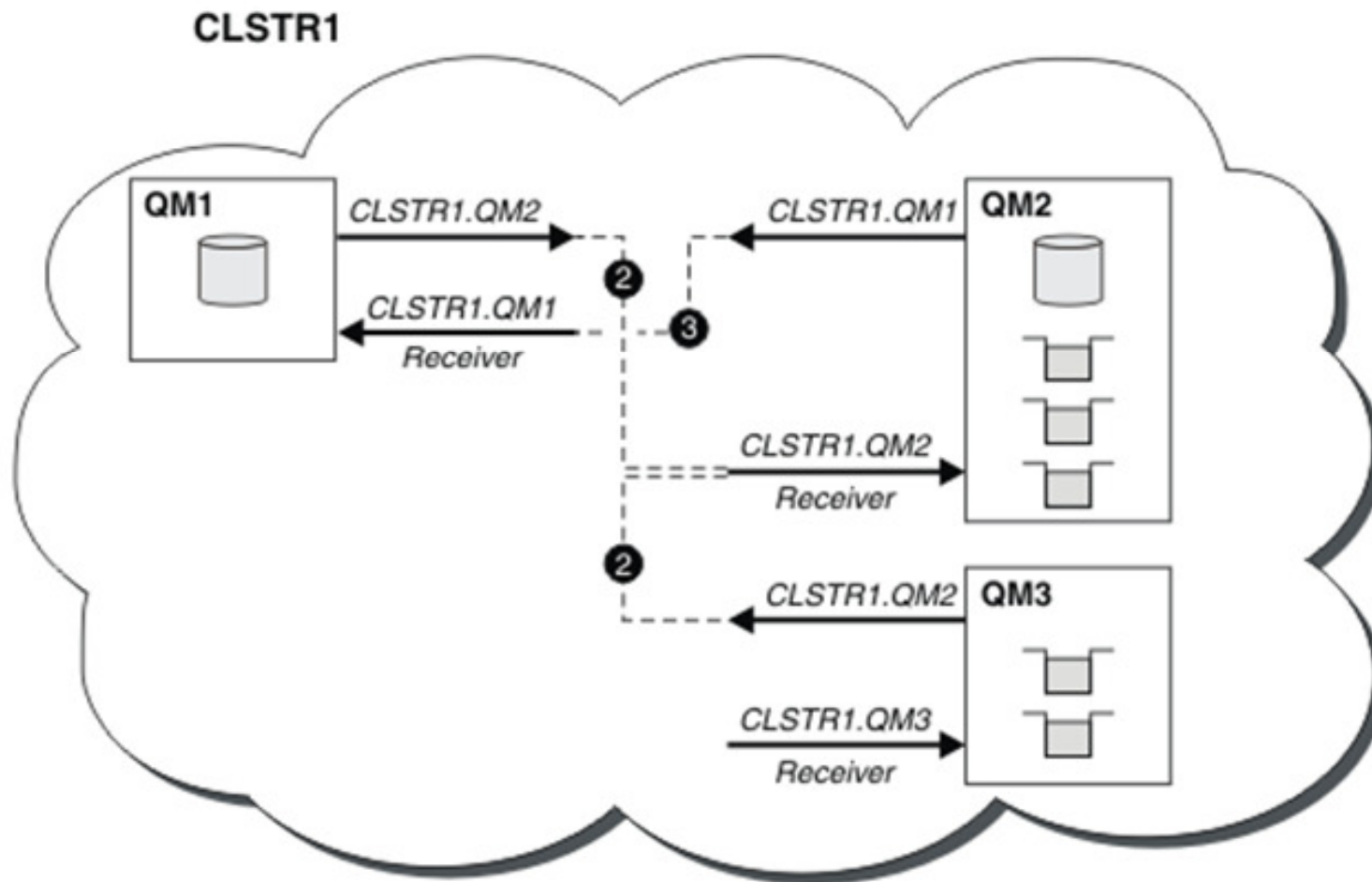
It provides:
- Automatic connectivity
- Object Awareness
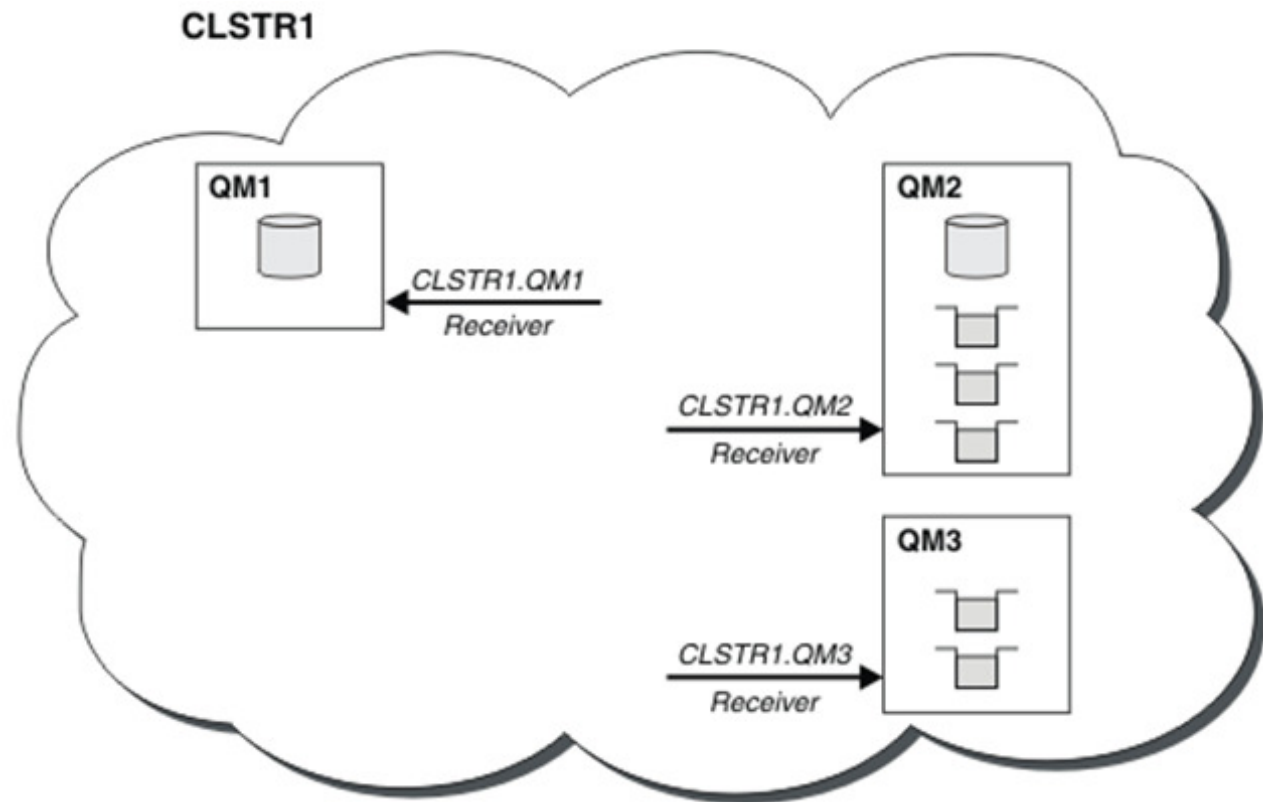- Load balancing
- High availability
- Work Load Balancing

WebSphere MQ z/OS Introduction
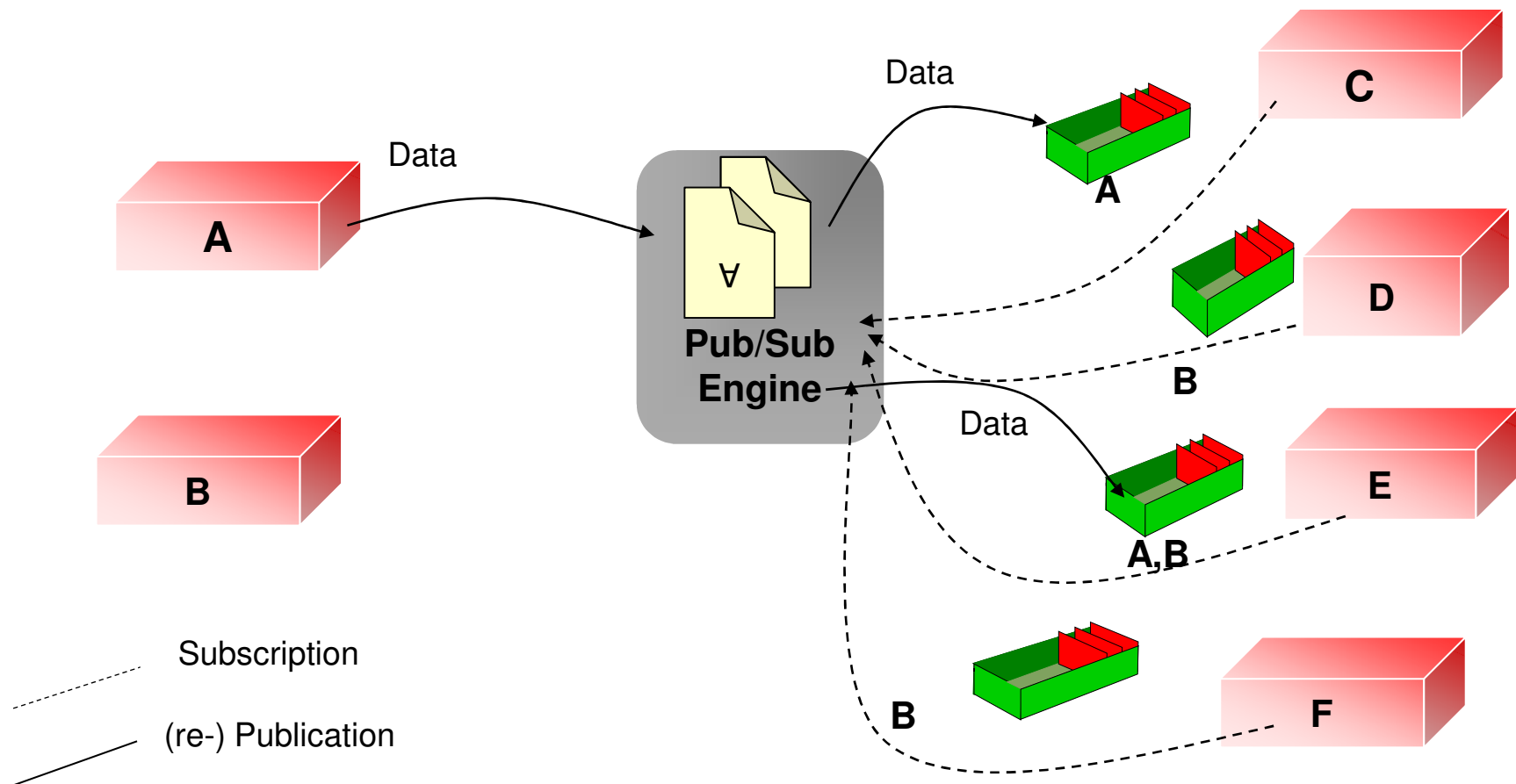## What makes clustering work

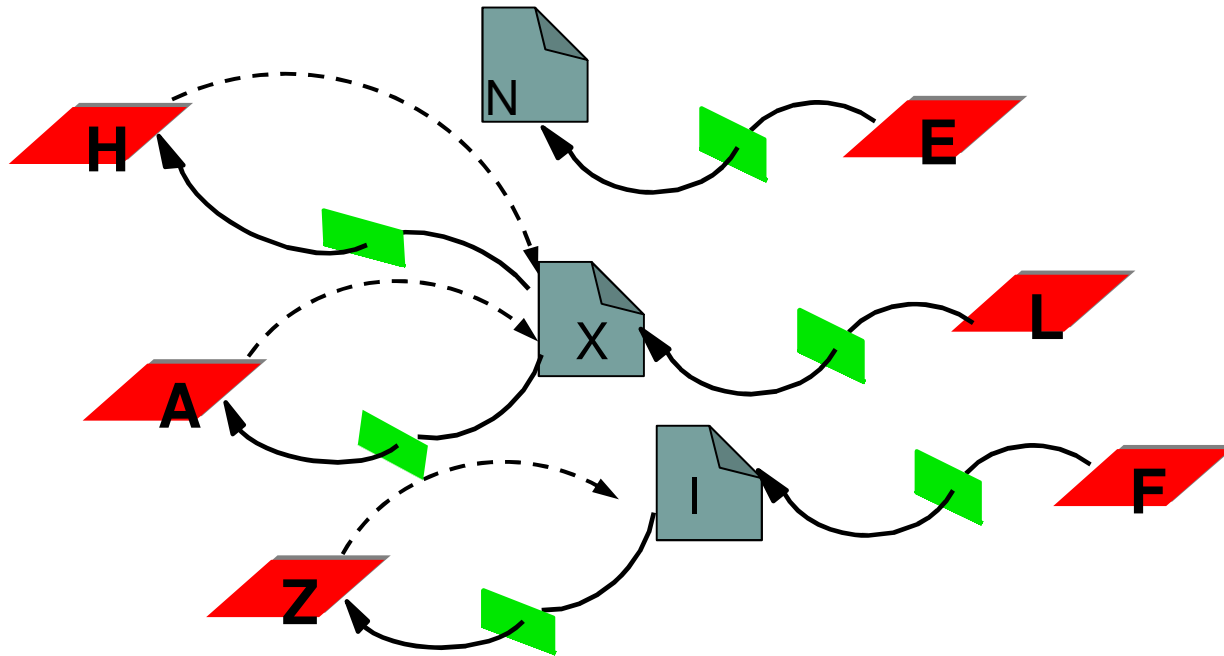# WebSphere MQ z/OS Introduction

How clusters work

WebSphere MQ z/OS Introduction

What is a Publish/Subscribe?

WebSphere MQ z/OS Introduction

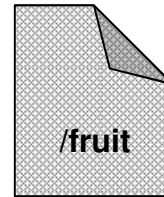## Publish Subscribe

▶ Essentially....

- - - - - -   requesting information on a given **topic**

_____   providing information on a given **topic**

WebSphere MQ z/OS Introduction

What is a TOPIC?

- A Topic can be

  /fruit

- a) Topic Object

  - is predefined

  - allows you to assign specific non default information to a topics

  - is an access control point

- b) Topic String

  - is a character string

  - can be made up of any characters

  - is case sensitive

    - /fruit/apples

  - describes the information to be associated with it

New in V7 fo z/OS
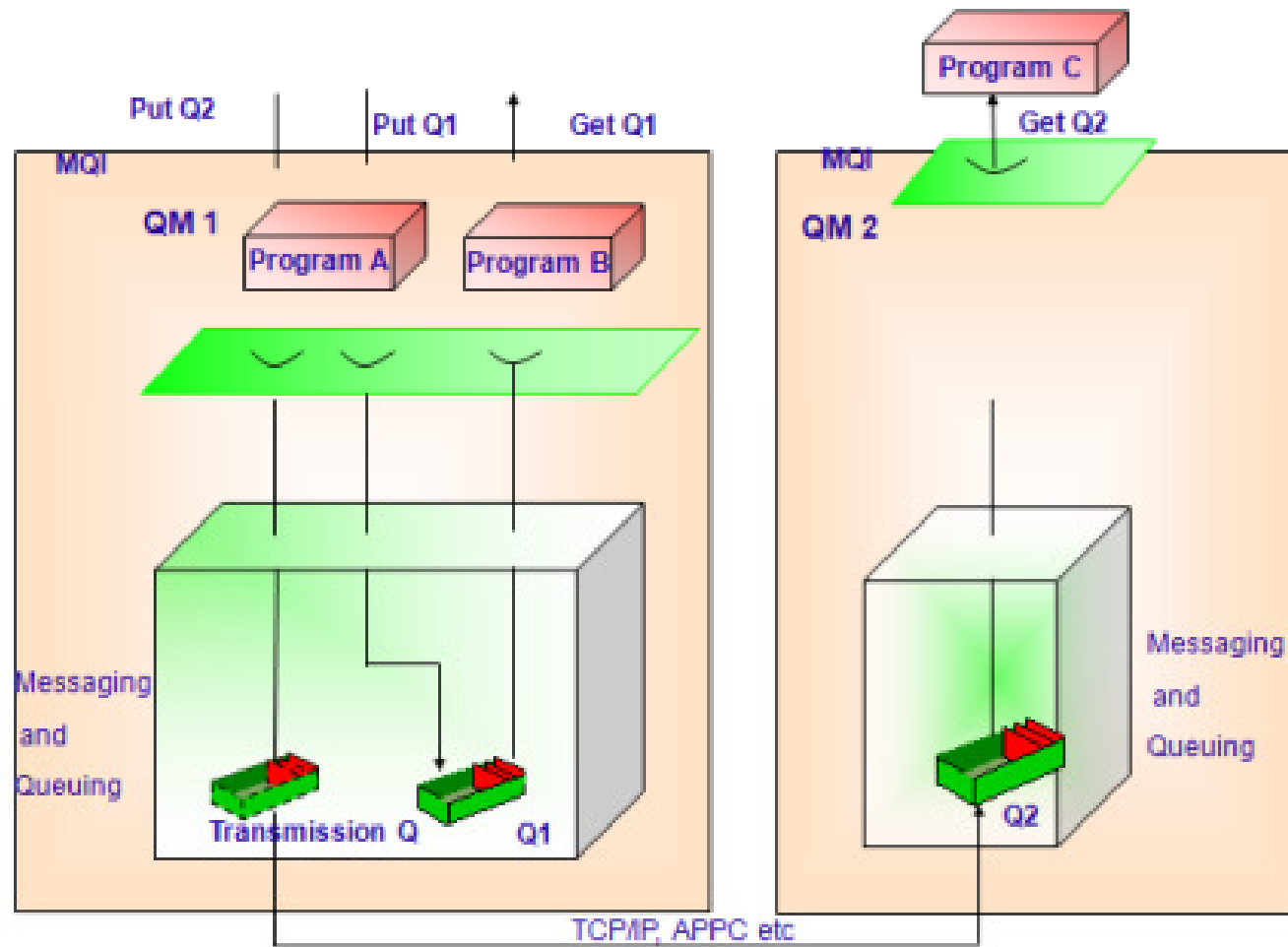
/fruit/apples

WebSphere MQ z/OS Introduction

What is a TOPIC TREE?

- Each topic defined is a node in a topic tree

- Topic Nodes in the topic tree can be

  ▸ A topic object defined by administrators

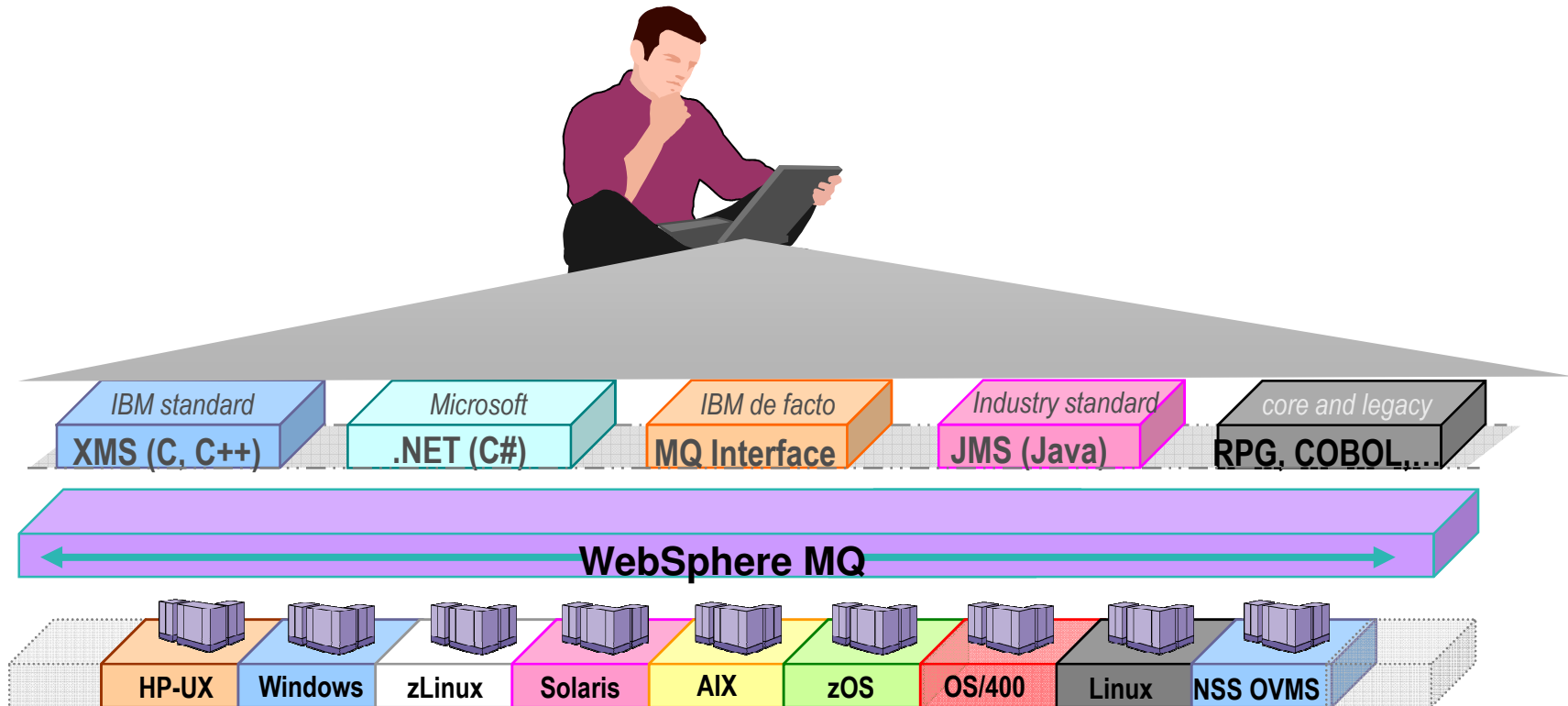 ▸ created dynamically

- Topic Nodes contain Topic Strings

New in V7

/fruit/apples

/fruit

/fruit

/fruit/bananas

/fruit/oranges
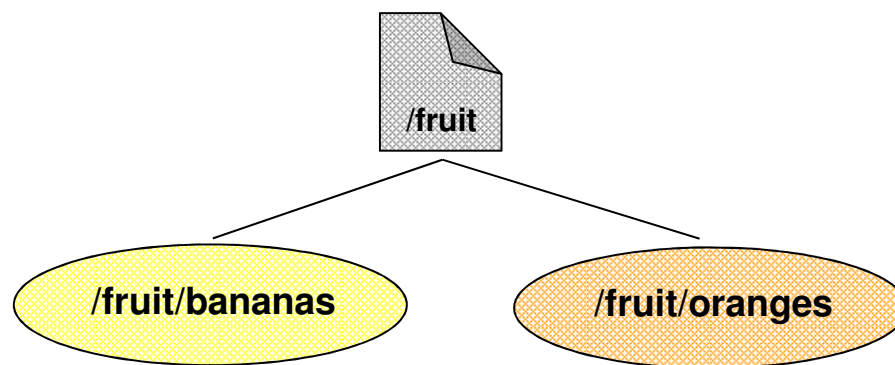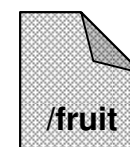
WebSphere MQ z/OS Introduction
Cross-System Communication

WebSphere MQ z/OS Introduction

Programming API

IBM standard	Microsoft	IBM de facto	Industry standard	core and legacy
XMS (C, C++)	.NET (C#)	MQ Interface	JMS (Java)	RPG, COBOL,…

WebSphere MQ

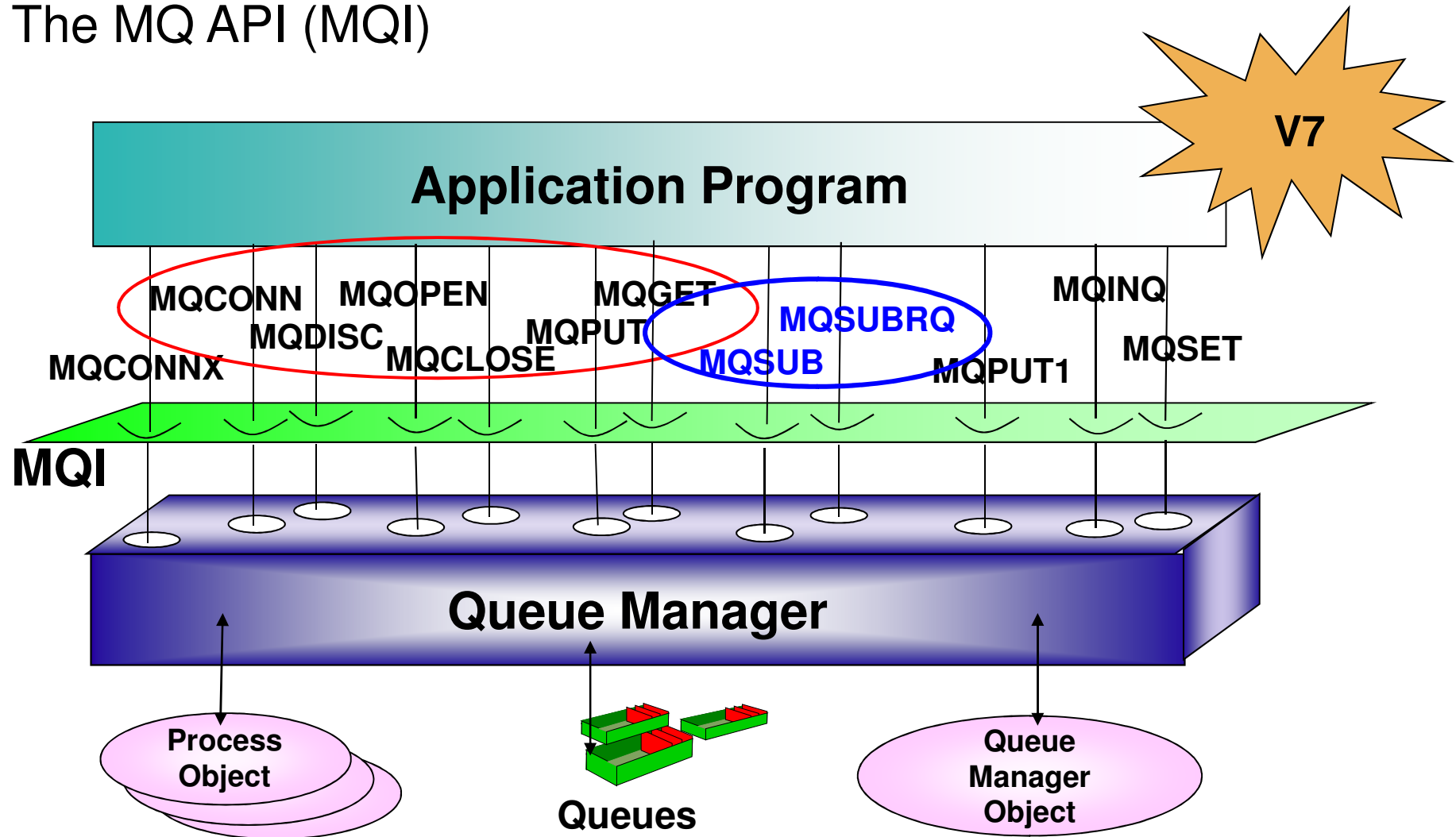| HP-UX	Windows	zLinux	Solaris	AIX	zOS	OS/400	Linux	NSS OVMS

- ## Broad support for:
  - programming languages, messaging interfaces, application environments and OS platforms.

WebSphere MQ z/OS Introduction
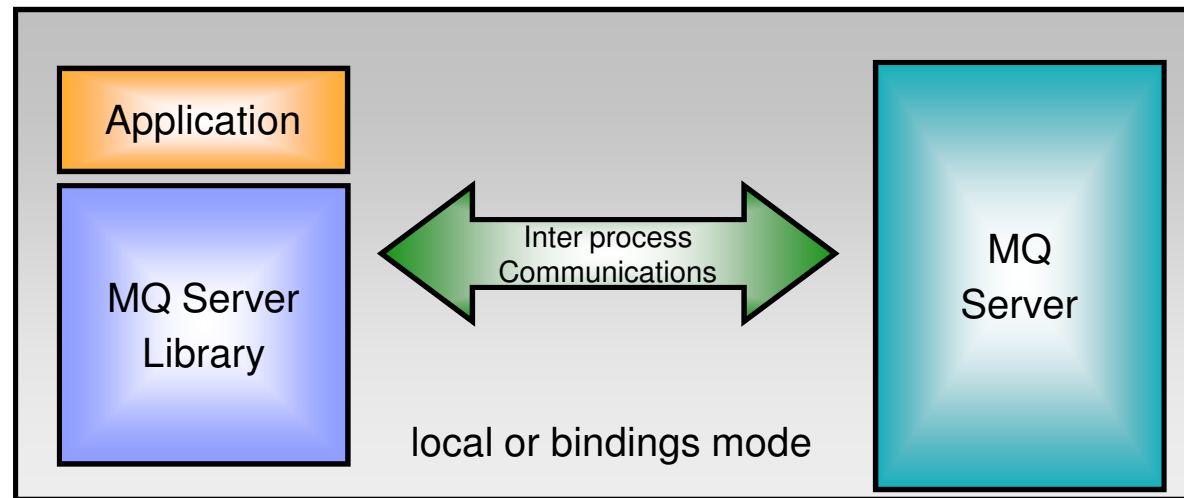
The MQ API (MQI)

V7

Application Program

MQCONN MQOPEN MQGET

MQDISC MQPUT MQSUBRQ MQINQ

MQCONNX MQCLOSE MQSUB MQPUT1 MQSET

MQI

Queue Manager

Process Object

Queues

Queue Manager Object

C, C++, C# (.NET), RPG, COBOL, PL/1, Java, Assembler (z/OS), Visual Basic, COM

WebSphere MQ z/OS Introduction
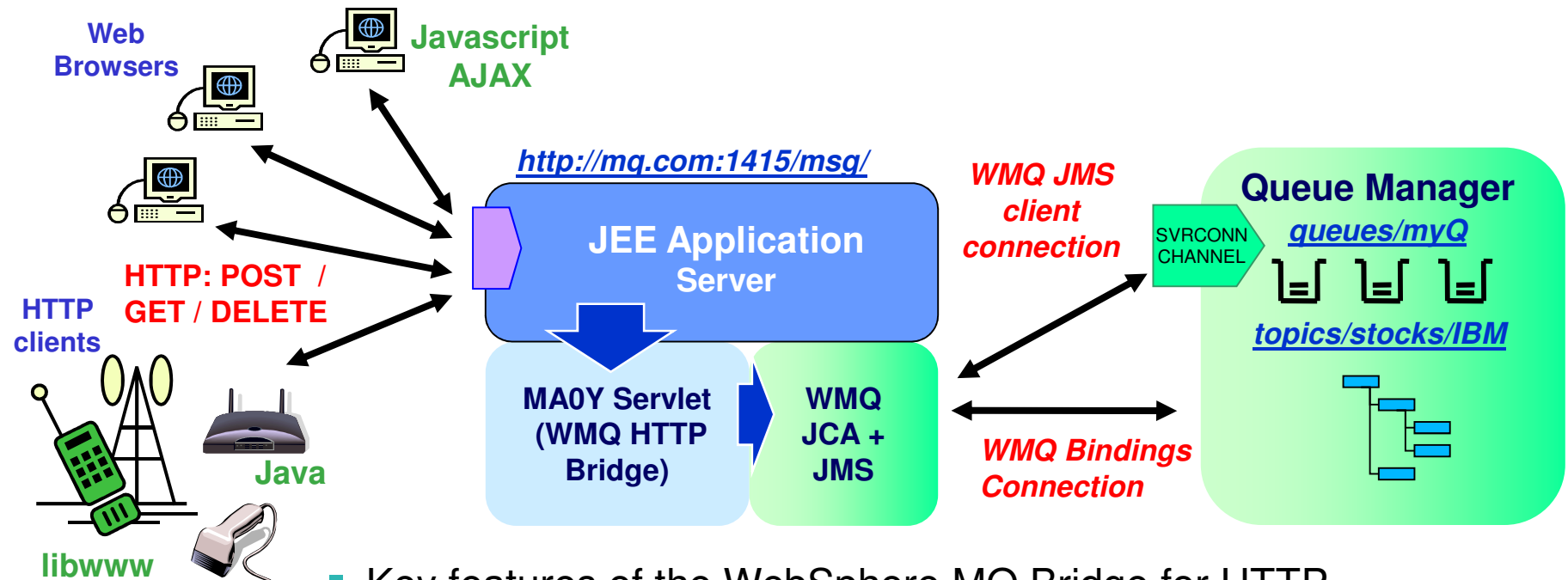
What is an MQ Client?

Server Model

Application
MQ Server Library

Inter process Communications

MQ Server

local or bindings mode

Client Model

Application
MQ Client Library

Network Communications

MQ Server
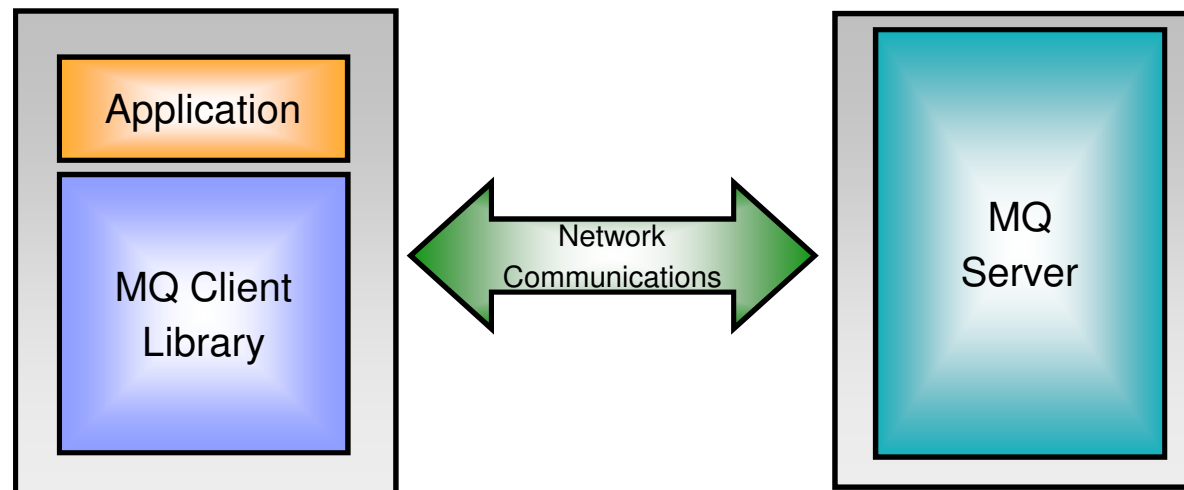
WebSphere MQ z/OS Introduction

HTTP Connectivity to WMQ

- 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 implementation as SupportPac MA94

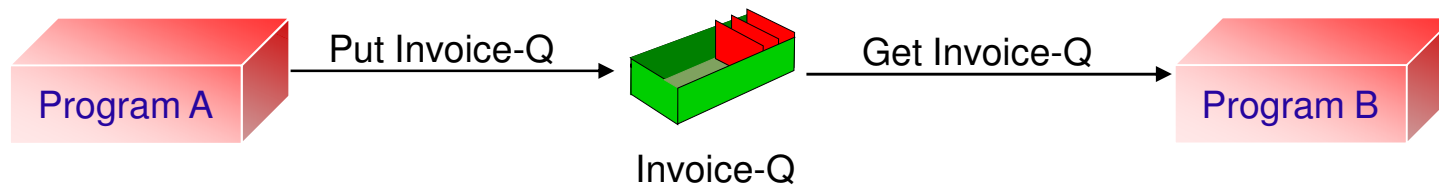# WebSphere MQ z/OS Introduction

HTTP-MQI Verb / Resource

- ## 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/*qname*/ http://**host**/msg/topic/*topic_path*/	MQGET w. browse	MQPUT	-	MQGET

WebSphere MQ z/OS Introduction
Example application architectures (1)

'Send and Forget'

Program A → Put Invoice-Q → Invoice-Q → Get Invoice-Q → Program B

Invoice-Q

Request / Response
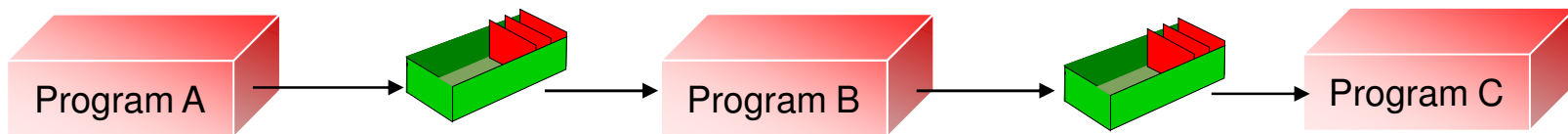
Target Queue

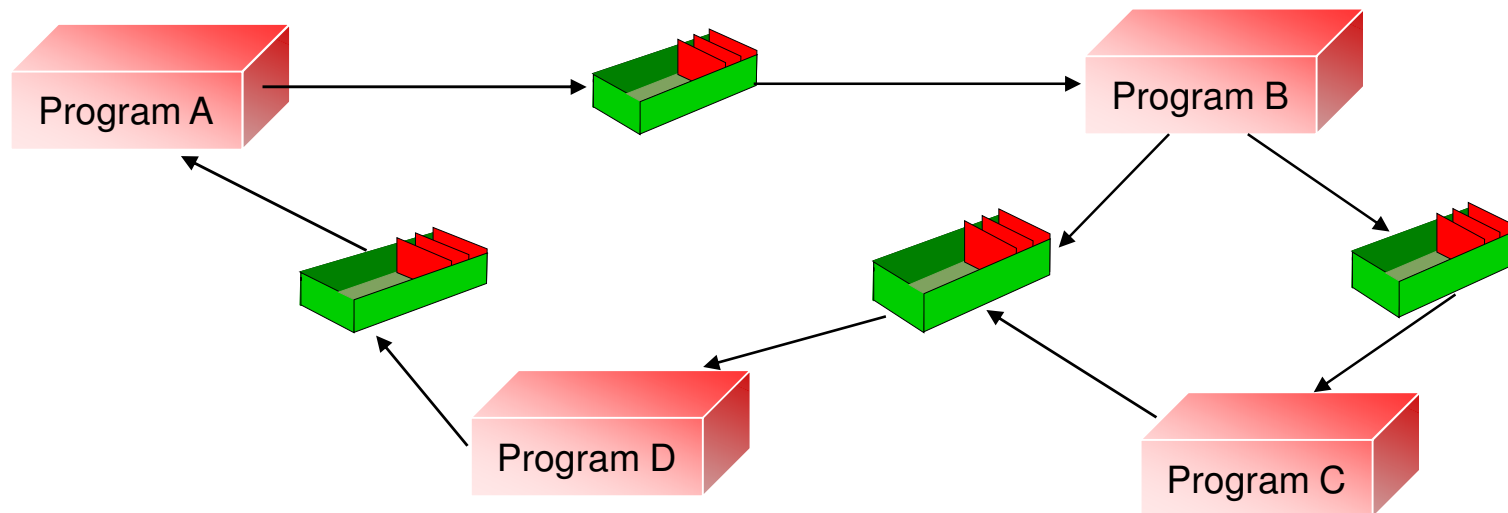Program A → → Target Queue → → Program B

Reply-to-Queue
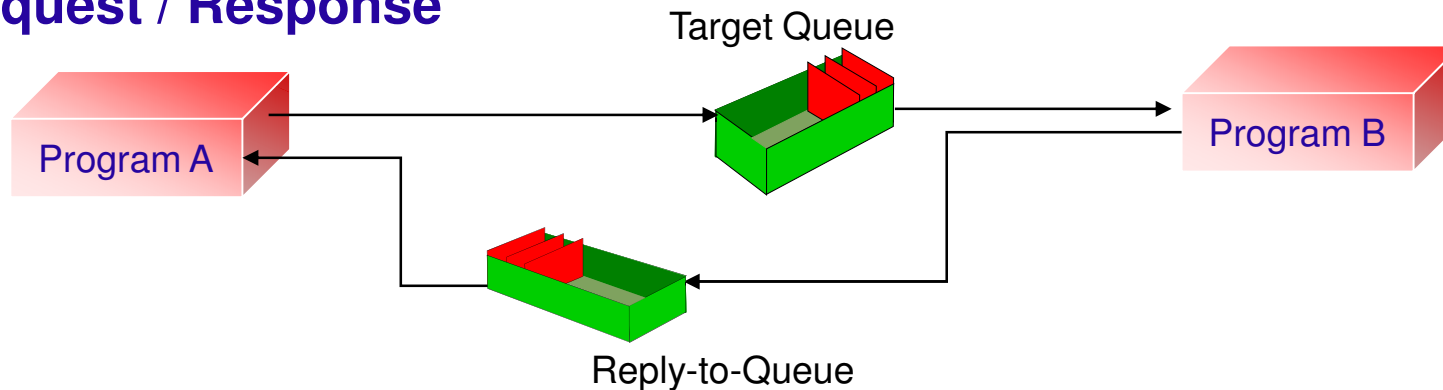
WebSphere MQ z/OS Introduction

Example application architectures (2)
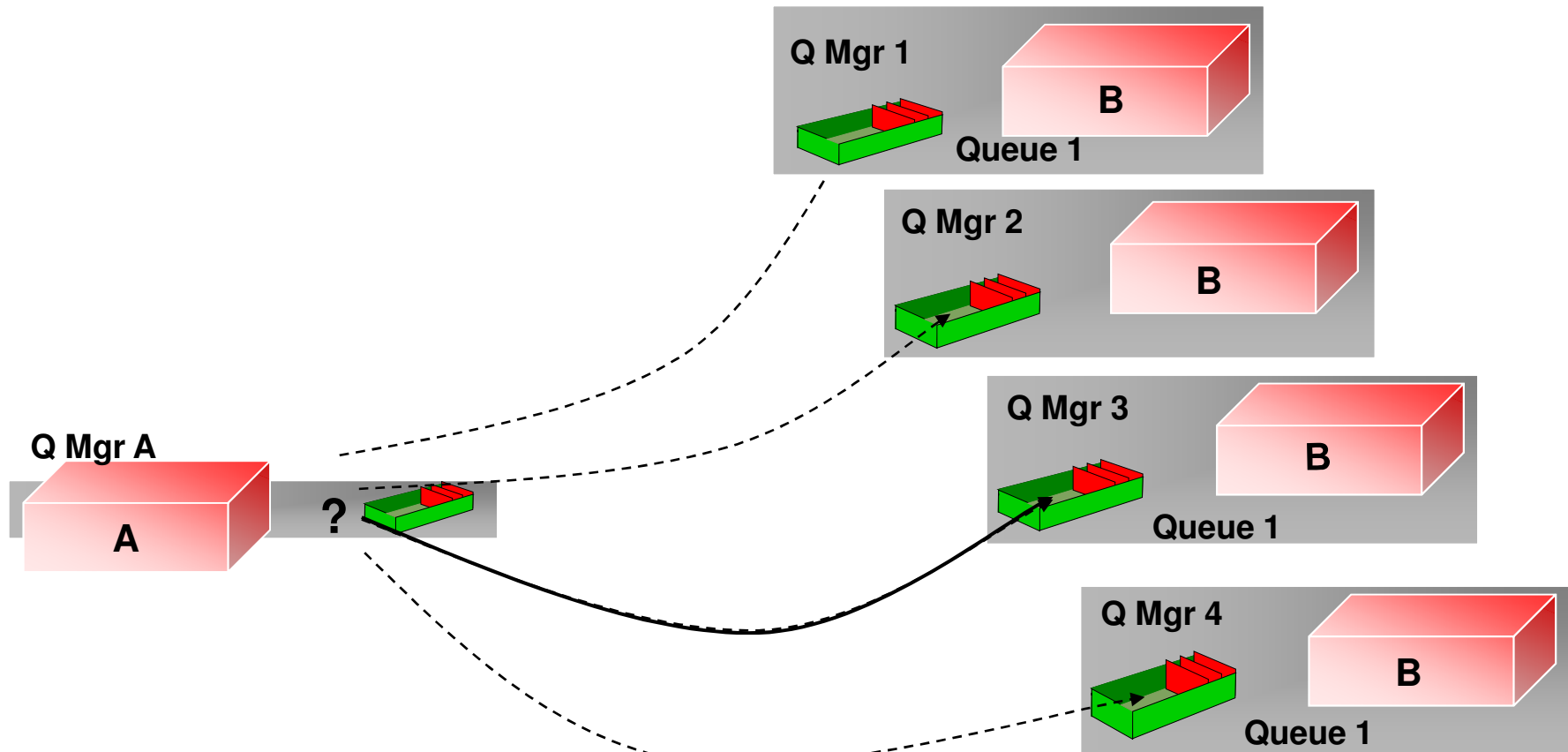
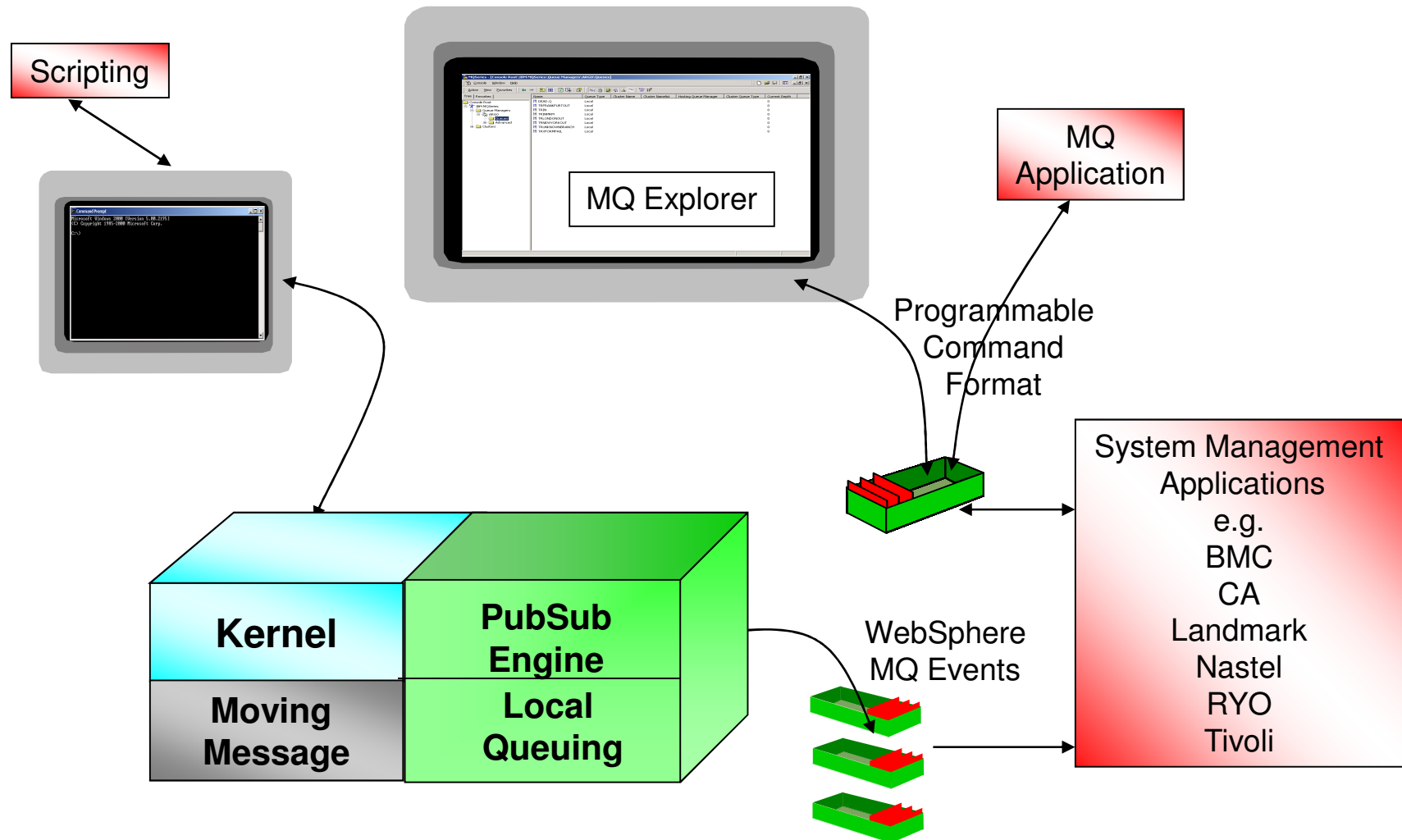### Chain

Workflow

WebSphere MQ z/OS Introduction
Example application architectures (3) – Clustering

WebSphere MQ z/OS Introduction

WebSphere MQ systems management

Scripting

MQ Explorer

MQ Application

Programmable
Command
Format

System Management
Applications
e.g.
BMC
CA
Landmark
Nastel
RYO
Tivoli

Kernel

PubSub
Engine

Moving
Message

Local
Queuing

WebSphere
MQ Events

WebSphere MQ z/OS Introduction

WebSphere MQ Transactions

- Message level inclusion/exclusion in unit of work

- Single UoW active per connection at any one time

- WebSphere MQ local units of work

  ▶ MQCMIT and MQBACK control the unit of work

- Messages and other resources in a global unit of work

  ▶ Managed by a Transaction Manager
    - WebSphere Application Server, CICS, IMS, z/OS RRS
    - Microsoft Transaction Server
    - Any XA or JEE App Server Transaction Manager

  ▶ Managed by WebSphere MQ
    - WebSphere MQ is an XA Transaction Manager
    - MQBEGIN, MQCMIT and MQBACK control the unit of work

WebSphere MQ z/OS Introduction
## WebSphere MQ Security
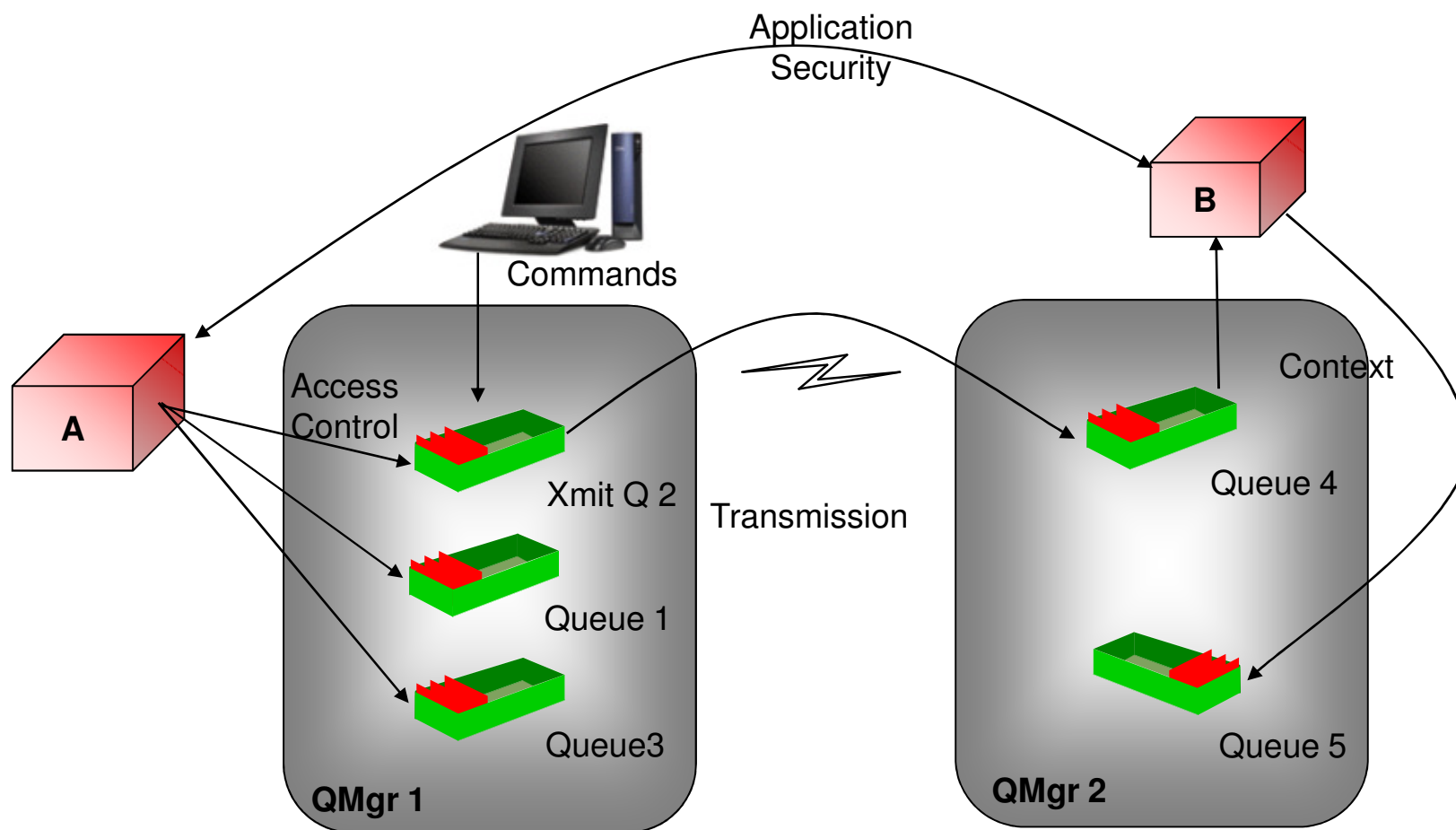
WebSphere MQ z/OS Introduction

WebSphere MQ Security (contd)

- Channel Security (Authentication)

- Channel Authoraxation

- WebSphere MQ 7.1 provides built-in SSL link level security

- MQ also provides a number of exit points during the transfer of messages between systems. The key exits concerned with security are :
  Security Exit : This exit allows for (mutual) authentication of partner systems when they connect to one another.
  Message Exit: This exit allows for customisation at the message level, allowing individual messages to be protected, in terms of message integrity, message privacy and non-repudiation

- Application Security
  This level of security is not implemented directly by the Queue Manager but such facilities may be implemented at the application level, outside of the direct control of WebSphere MQ.

- MQ Advanced Messaging Security (MQAMS)
  Provides end to end security, enabling messages to be encrypted from the time they are PUT by the sending application to when they are GET by the receiving application, so messages are help encrypted when at rest on queues as well as when in transit.

WebSphere MQ z/OS Introduction

SOAP and Web Services over MQ
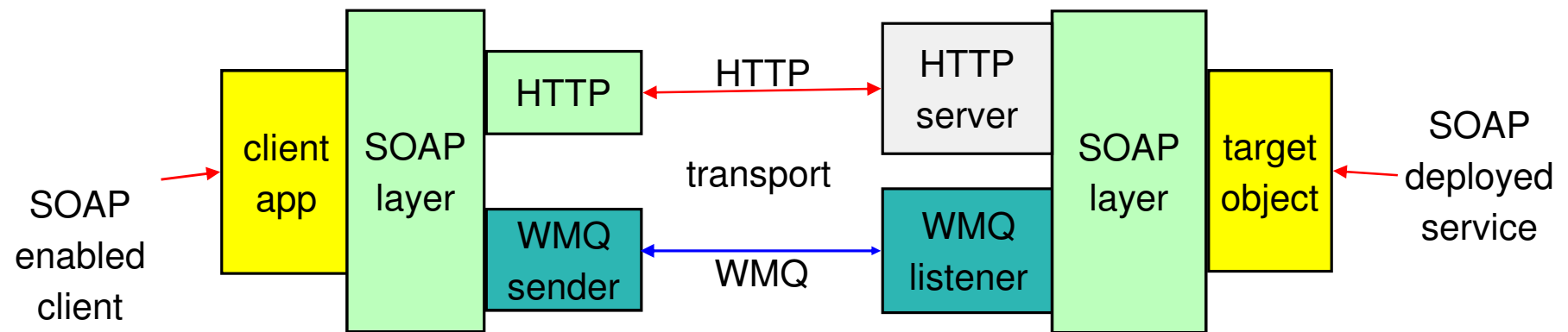
- **Transport SOAP messages over a reliable transport instead of http**

- **Integrates directly into:**
  - Axis Web Services environment
  - .NET Web Services environment
  - WebSphere Application Server Services environment
  - CICS Services environment

- **Heterogeneous**
  - if services interoperate using HTTP, they will interoperate using WMQ

- **SOAP / JMS Message Format**
  - Soon to be standardized at API level across Vendors
  - Sonic, TIBCO, BEA, Axis

WebSphere MQ z/OS Introduction
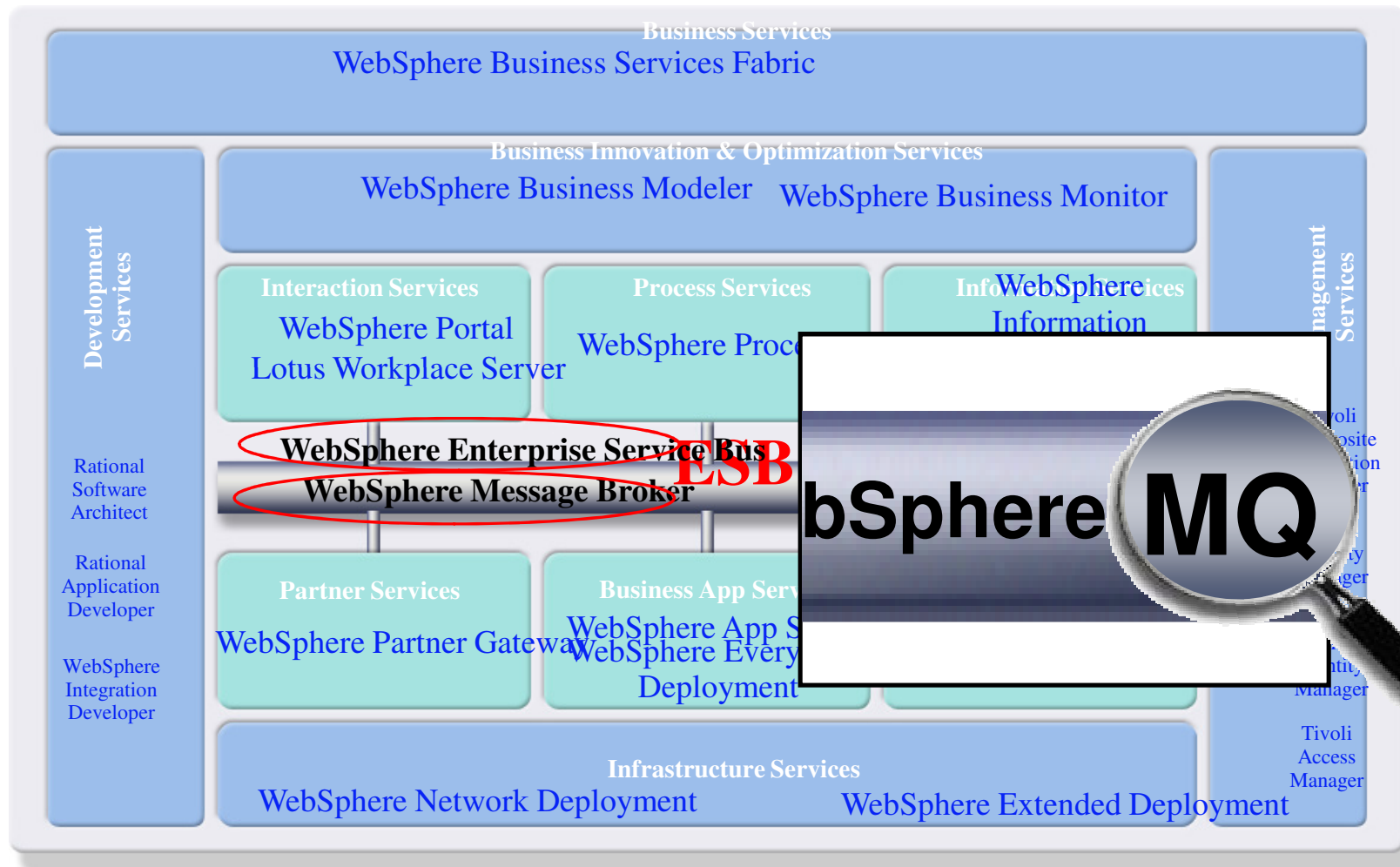
Related Products

For a messaging engine to be really useful it should allow access to the messages from many different environments. We have already discussed MQs programming language and API support but what about the environments.

The complexity of overall business applications is increasing every year as more and more applications are linked together in some way. WebSphere MQ dramatically reduces an individual applications complexity by providing a consistent, reliable and transactional method of communicating between applications from hundreds of different environments.

We are now going to look briefly at some of the other WebSphere Business Integration products that make up the portfolio, and how WebSphere MQ fits in
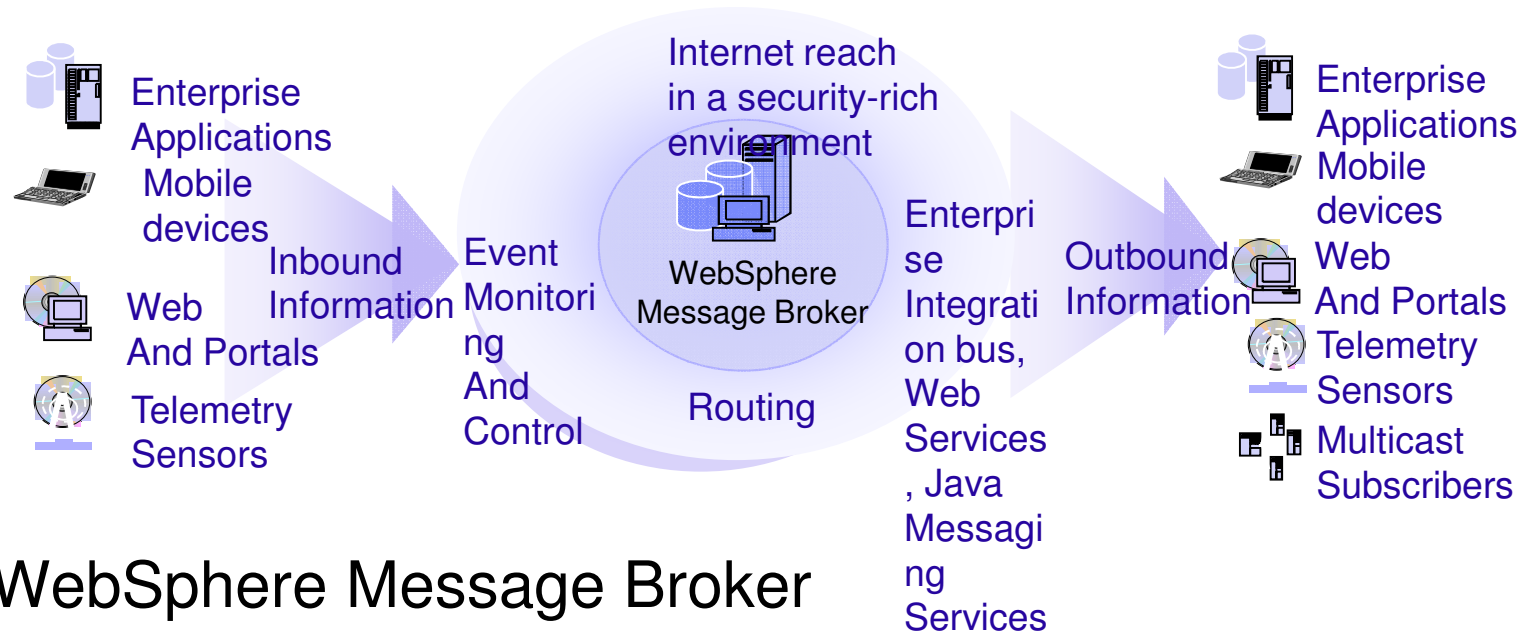
WebSphere MQ z/OS Introduction

SOA - Reference Architecture

Business Services

WebSphere Business Services Fabric

Business Innovation & Optimization Services

WebSphere Business Modeler   WebSphere Business Monitor

Development Services

Rational Software Architect

Rational Application Developer

WebSphere Integration Developer

Interaction Services

WebSphere Portal
Lotus Workplace Server

Process Services

WebSphere Proce...

Info WebSphere Information

WebSphere Enterprise Service Bus   **ESB**
WebSphere Message Broker

bSphere MQ

Partner Services

WebSphere Partner Gateway

Business App Serv...

WebSphere App S...
WebSphere Every...
Deployment

Tivoli ...osite ...tion ...r

...tity Manager

Tivoli Access Manager

Management Services

Infrastructure Services

WebSphere Network Deployment   WebSphere Extended Deployment

WebSphere MQ z/OS Introduction

WebSphere Message Broker

Enterprise Applications

Mobile devices

Web And Portals

Telemetry Sensors

Inbound Information

Event Monitoring And Control

Internet reach in a security-rich environment

WebSphere Message Broker

Routing

Enterprise Integration bus, Web Services, Java Messaging Services

Outbound Information

Enterprise Applications

Mobile devices

Web And Portals

Telemetry Sensors

Multicast Subscribers

- ● **WebSphere Message Broker**

  ▸ Message transformation (mediations)

  - ▪ Combine data sources: databases, files, etc.

  - ▪ Update other data stores: databases, files, etc.

  ▸ Content based filtering and routing

  ▸ Adapters - SAP, PeopleSoft, ORACLE, Files, e-mail…

  ▸ WebSphere Transformation Extender (Mercator)

WebSphere MQ z/OS Introduction

WebSphere ESB and Process Server

- ## WebSphere ESB
  - Built on WebSphere Application Server
  - Standards based Mediation, Routing and Adapters for J2EE environments

  - ## WebSphere Process Server
    - Seamless upgrade from WebSphere ESB
    - Process choreography

WebSphere MQ z/OS Introduction

What's New in v7.1

Multi-Version Installation

- MQ on Unix and Windows can install multiple levels on a system
    - Relocatable to user-chosen directories
    - Can have multiple copies even at the same fixpack level
- Simplifies migration
    - Can move applications as needed, not all at once
    - No need for parallel hardware
- Easier for ISVs to imbed MQ in solutions
    - Can install in "private" locations without worrying about other copies
    - Reduces support concerns
- Permits a single copy of V7.0.1 to remain on system
    - So existing systems can be migrated
    - Must be 7.0.1.6 or later
- Main concept is an installation
    - Refers to the directory containing the binaries from a particular version of MQ
    - Can have a descriptive name
- One installation can be designated as primary
    - Required on Windows where some OS-specific elements have to be registered
    - Optional on Unix, creates symlinks to commands and libraries in /usr
    - Not created by default so your PATH will not always find MQ commands
- Queue Managers are owned by a specific installation
    - Governs the level of function available when the queue manager is running
    - Ownership can be changed to a newer installation for migration

WebSphere MQ z/OS Introduction

What's New in v7.1

Security: Channel Access Control

- Simplifying configuration for channel access
  - Clients and queue managers
- Rules are based on
  - Partner IP address
  - Partner Queue Manager name
  - SSL Distinguished Name mapping
  - Asserted identity (including *MQADMIN option)
- Easy to test rules that you define
  - DISPLAY CHLAUTH can "execute" rules
- Rules can be applied in WARNING mode
  - Not actually blocked, but errors generated
- **MIGRATION NOTE: Standard rules block clients on new queue managers**
  - "Secure by default"
  - Migrated queue managers behave as before until you enable the rules
  - Queue manager attribute CHLAUTH(ENABLED|DISABLED) provides overall control

WebSphere MQ z/OS Introduction

What's New in v7.1

Channel Blocking and Mapping from the Explorer

WebSphere MQ z/OS Introduction

What's New in v7.1

Security: SSL

- More crypto algorithms supported for SSL
    - Stronger algorithms are now available and recommended
    - MQ V7.0.1 added some SHA-2
    - MQ V7.1 adds more, with support for the NSA "Suite B" standard which includes Elliptic Curve cryptography
- Some older algorithms (eg SHA-1) should be considered deprecated
    - No plans to withdraw older algorithms immediately
    - But expect them to be removed in a future version of MQ
- Newer algorithms supported by gskit8 on Distributed platforms
    - Waiting for z/OS and iSeries SSL implementations before MQ can support them there
- The gskit toolkit is now provided inside the MQ installation
    - Will not clash with alternative levels from other MQ installations or other products

WebSphere MQ z/OS Introduction

What's New in v7.1

Security: Authorizations for Non-Local (Clustered) Queues

- Distributed platforms now have authorizations for non-local queues
  - Including clustered queues
  - Making it consistent with z/OS
  - Also consistent with Topic authorizations
- So there is no longer a need to authorize access to the cluster transmit queue
- Grant authorization to the remote queue manager instead
  - A new pseudo-object known to the OAM

```
setmqaut -m QM1 -t queue -n SYSTEM.CLUSTER.TRANSMIT.QUEUE -p mquser +put

                              BECOMES

setmqaut -m QM1 -t rqmname -n QM2 -p mquser +put
```

WebSphere MQ z/OS Introduction

What's New in v7.1

Application Activity Reports

- New set of events to report on MQI operations by applications
  - One PCF event may contain multiple MQI operations
- Configurable in granularity
  - Amount of data
  - Which applications
- Enables scenarios such as
  - Application audit trail
  - Message duplication
  - Resource usage: which queues or topics are actually being used
  - Problem Determination: most recent MQI calls by applications
  - Application Coding Standards: does everyone use the MQI in the recommended way
  - And more …
- On all Distributed platforms
- Forthcoming MS0P release

WebSphere MQ z/OS Introduction
What's New in v7.1

Clustering

- "Bind on group"
    - All messages within a logical group are routed to the same queue manager
    - Workload balancing is done for each group
    - Simpler for applications that use message groups
    - Previously would have had to close and reopen the queue
- New option in the MQI and DEFBIND attribute for queues
- Once a group has started its path to a selected queue manager, messages in that group will not be reallocated in the event of a failure
- New sample **amqsclm to monitor queues and redistribute delivered messages**
    - If a queue has no getters, block further deliveries and redistribute existing messages
    - Includes source code, so easy to modify

WebSphere MQ z/OS Introduction

What's New in v7.1

MQ Clients

- Client now available on iSeries
  - Connectivity from C and RPG programs without needing a local queue manager
  - Platform already had a Java client
- MQI libraries like libmqm connect to local and remote queue managers
  - Smart switching for clients, as well as handling multi-version systems
- API Exits available in C clients
  - Same interface as available for local binding applications

WebSphere MQ z/OS Introduction

What's New in v7.1

Channels

- See the MQ version of connecting partner
  - Level of clients and queue managers available in channel status
  - For example a V7.0.0.1 client shows as RVERSION(07000001)
  - Can distinguish Java, C, .Net client programs
  - Helps administrator determine whether partner needs upgrading
- Distributed platforms now use DISCINT to disconnect idle clients
  - ClientIdle qm.ini parameter ignored
  - Consistent with z/OS
- Alternative channel batch control based on byte counts
  - BATCHLIM attribute
  - Useful when a transmission queue holds mix of large and small messages
  - Can make batch time (latency) more consistent
  - Batch is ended when first of either bytes or messages transferred reach configured limit
- Per-channel control of Dead Letter Queue
  - New channel attribute USEDLQ(YES|NO)\
- DEFRECON added to client channels
- Any pending sequence number reset is shown on DIS CHL

WebSphere MQ z/OS Introduction

What's New in v7.1

z/OS Performance and Availability

- Performance
    - z196 Scaling improvements for both non-shared and shared queues
        - Have successfully processed more than ONE MILLION non-shared messages/sec through a single queue manager
        - Have also successfully processed 150K shared msgs/sec with 3 queue managers
    - Improved performance by using SMDS for large messages on shared queues
- Availability
    - Structure rebuild when connectivity to CF is lost improves availability of Shared Queues
    - GroupUR function from MQ V7.0.1 for Distributed QSG connections available for CICS usage
        - CICS 4.2 can use this to enhance the MQ Group Attach originally provided in CICS 4.1

WebSphere MQ z/OS Introduction