WebSphere MQ Overview

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IBM CDL MQ L2 support , Feb 2012

Agenda

- WebSphere MQ Vision

- WebSphere MQ Product Status

- WebSphere MQ Core Concept

- WebSphere MQ Application Model

- WebSphere MQ API brief introduction

- WebSphere MQ Major feature

WebSphere MQ Vision

- ▶ Messaging backbone for business data delivery throughout the enterprise
- ▶ Comprehensive suite of transport protocol and Quality of Service options
- ▶ Extensive support and exploitation of individual platforms and environments
- ▶ The underpinning for ESB architectures and speedy adoption of SOA
- ▶ Critical aspects of the backbone are
  - First-class support for all appropriate messaging transport technologies
  - Range of "speeds and feeds"
  - Availability technologies supporting 24*7 application use of the backbone
  - Support for end-to-end transacton tracking
  - Support for end-to-end security
  - Exploitation of emerging and relevant technologies(eg Web Services, Event-Driven architecure) subsumed in appropriate standards-based interface

WebSphere MQ Product Status

Current WMQ product version

- V5.3 Distributed platforms now out of service (EOS on Sep 2007) except for MQ V5.3 for HP NSS and MQ V5.3 for HP OpenVMS.

- V6   GA , June 2005. EOS date has been announced, Sep 2012

- V7.0.0   GA ,June 2008

- V7.0.1 GA ,Sep 2009

- V7.1   GA , Nov 2011

WMQ Server Platforms

- AIX
- HP-UX on PA-RISC
- HP-UX on Itanium
- Solaris SPARC
- Solaris x64
- Linux on X86
- Linux on X86-64
- Linux on Power
- Linux on System Z
- Windows
- VSE
- Z/OS
- HP NSS (V5.3 only)
- HP Open VMS (V5.3 only)
- IBM I

System requirement:
See http://www-
    306.ibm.com/software/integration/wmq/requirements/index.html

WMQ Client Platforms

- AIX

- HP-UX on PA-RISC

- HP-UX on Itanium

- Linux on X86

- Linux on X86-64

- Linux on Power

- Linux on System Z

- Solaris SPARC

- Solaris x64

- Windows

✓ MQ client free Download website: http://www-01.ibm.com/software/integration/wmq/clients/

WMQ Family products

- WMQ File Transfer Edition

- WebSphere MQ Advanced Message Security Edition

- WebSphere MQ Low Latency Messaging

- WebSphere MQ Telemetry

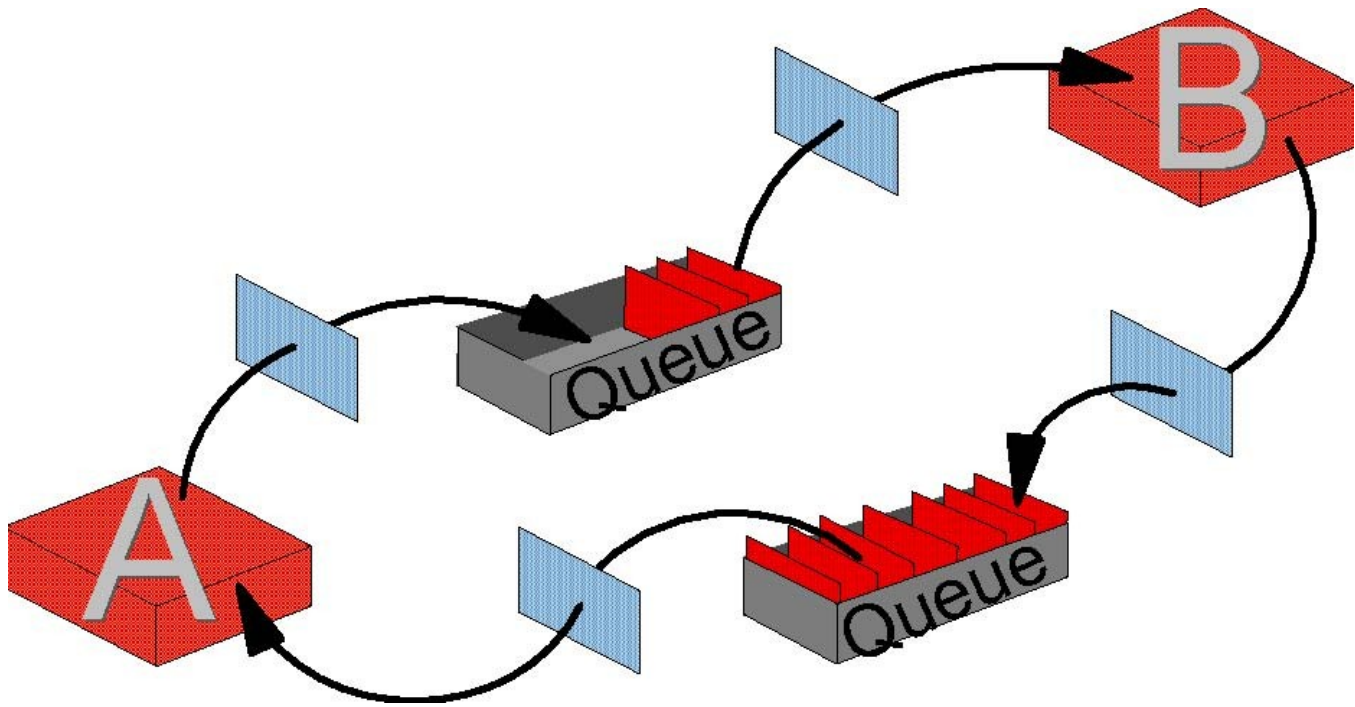- WebSphere MQ Hypervisor Edition

Website: http://www-01.ibm.com/software/integration/wmqfamily/

WebSphere MQ Core Concept

WMQ Core concept

Message and Queue

WMQ Core concept

Message and Queue Continued

- **Message**
  - ▶ Message Descriptor, Message Body, Message property(V7.0 later)
  - ▶ Persistent, Non-persistent
  - ▶ Logical message, physical message

- **Queue**
  - ▶ A container of messages
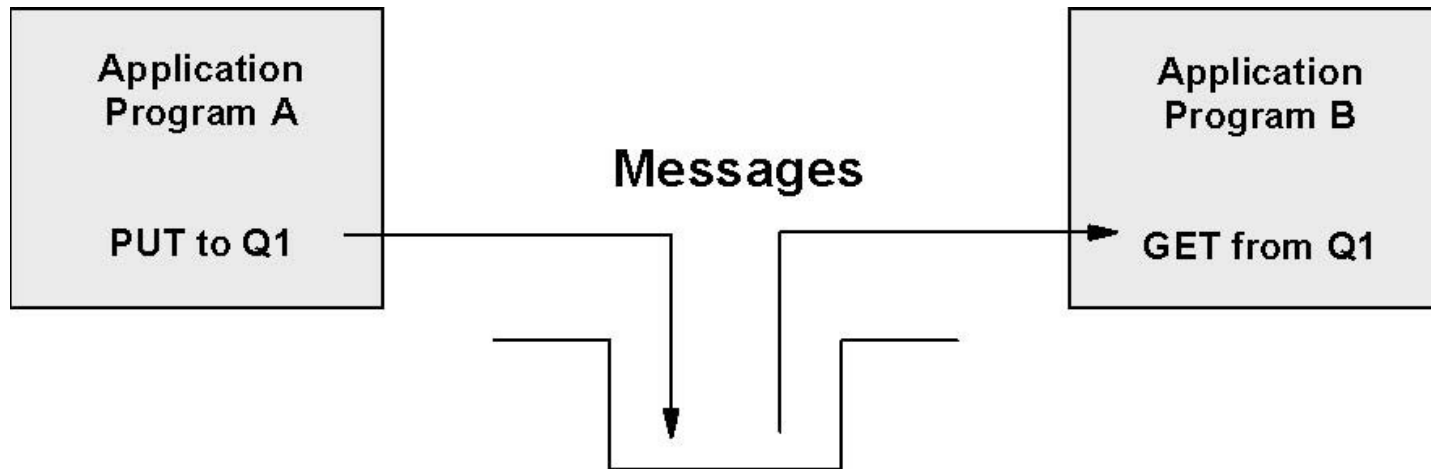 - ▶ Type:QALIAS | QLOCAL | QMODEL | QREMOTE

WMQ Core concept - Objects

Object

- **QMGR**
  - A basic execution unit of MQ
  - A container of object including queue, channel and etc.

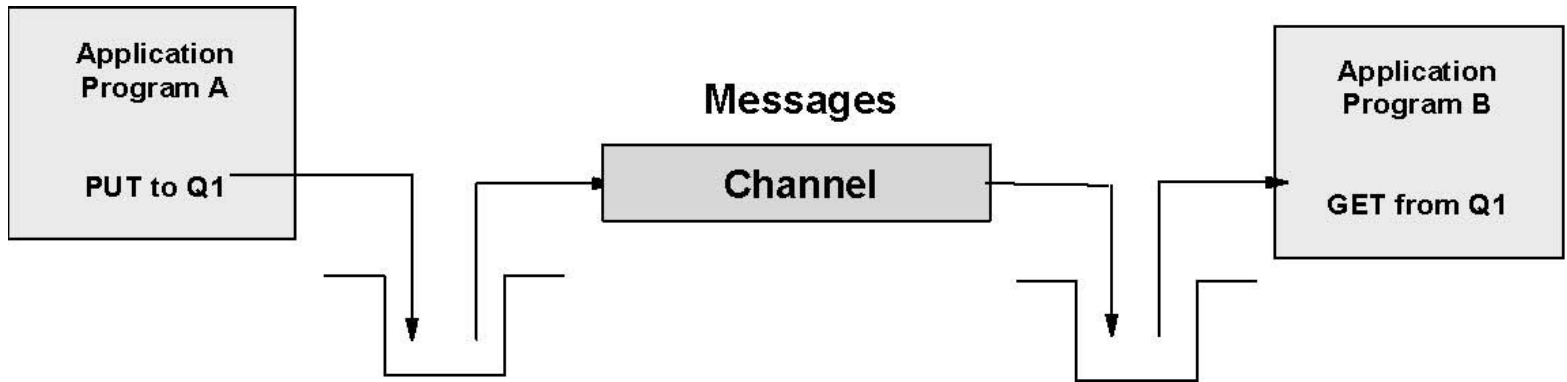- **Channel**
  - Channel type: MCA,MCI,Cluster

WMQ Core Concept – Communication(1)

Program-to-Program Communication - One System

WMQ Core Concept – Communication(2)

Program-to-Program Communication - Two Systems

Application Models for WebSphere MQ

- **Point to Point** : each application needs to be connected directly to any other application it needs to communicate with.

- **Publish & Subscribe** each application is connected to a central bus resulting in all application to application communication passing through the bus.)

WebSphere MQ API Introduction

MQCONN (+ MQCONNX)	connect to a queue manager
MQOPEN	open an object (e.g. a queue or topic)
MQPUT (+ MQPUT1)	put a message on a queue or publish a topic
MQGET	get a message from a queue
MQSUB	Subscribe a Topic
MQCLOSE	close an object
MQDISC	disconnect from a queue manager
MQINQ	Inquire about attributes of object
MQSET	set attributes of a queue
MQBEGIN	start a unit of work
MQCMIT	commit changes
MQBACK	rollback changes

WebSphere MQ Major features

- WMQ Cluster

- WMQ PUB/SUB

- WMQ V7 Client Enhancement

- WMQ JMS

- WMQ High Availability solution

WebSphere MQ Cluster

- WMQ Cluster concept

- What make WMQ cluster work?

- How benefit from WMQ Clustering?

- WMQ Cluster design consideration

WMQ Clustering Concept

Clustering is a way to logically group WebSphere MQ queue managers so that you have:

- **Repository**

  - **SYSTEM.CLUSTER.REPOSITORY.QUEUE**

  - **Full repository and partial repository**

  - SYSTEM.CLUSTER.COMMAND.QUEUE

- **Repository queue manager**

- **Cluster-receiver channel/Cluster-sender channel**

- **Cluster queue**

- **Cluster transmission queue**

  - **SYSTEM.CLUSTER.TRANSMIT.QUEUE**
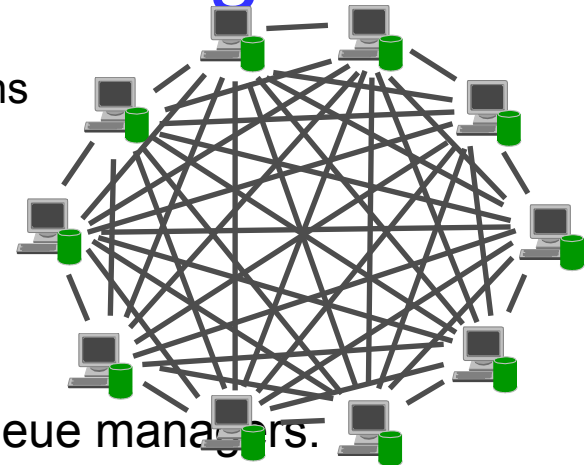
What make WMQ Cluster work
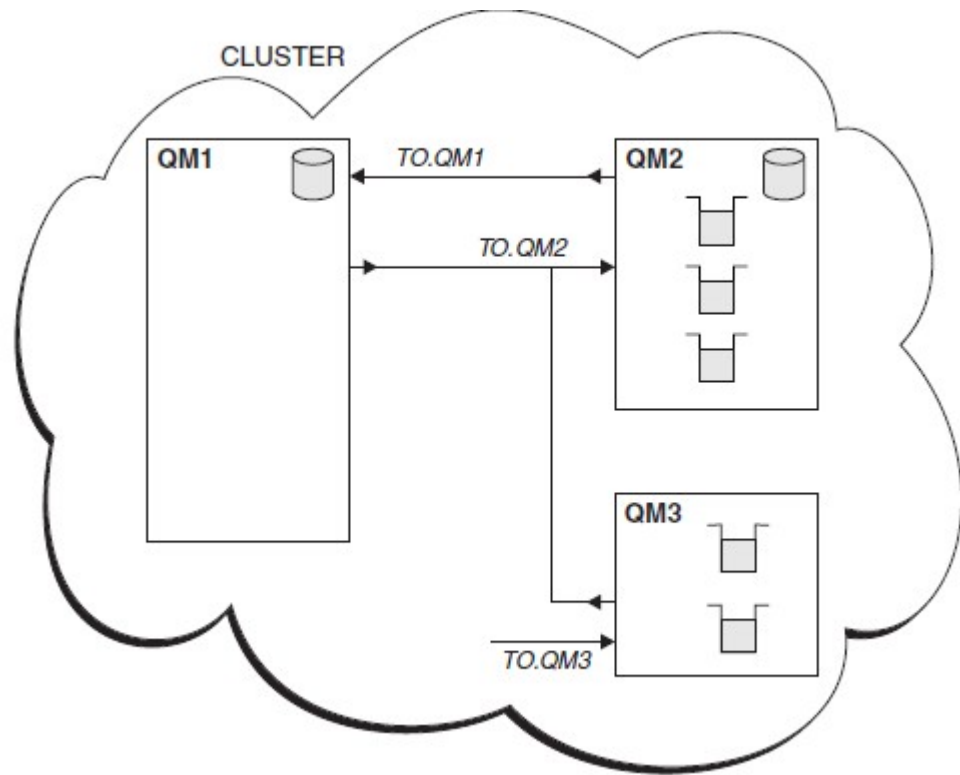
- ■ **Queue managers and repositories**
  - ▶ **Full Repos QMGR: QM1,QM2**
    ALTER QMGR REPOS(SALE)
  - ▶ **Partial Repos QMGR: QM3**

- ■ **Cluster channels**
  - ▶ **QM1: TO.QM1,TO.QM2**
  - ▶ **QM2: TO.QM2,TO.QM1**
  - ▶ **QM3: TO.QM2,TO.QM3**

- ■ **Queues**
  - ▶ On QM2,QM3:
    DEFINE QLOCAL(INPUTQ) CLUSTER(SALES)

- ■ **Auto-definition of channels**
  - ▶ **QM1: TO.QM3**

- ■ **Auto-definition of remote queues**
  - ▶ **QM1: remote queue definition**
    dis qc(inputq)

How benefit from MQ Clustering
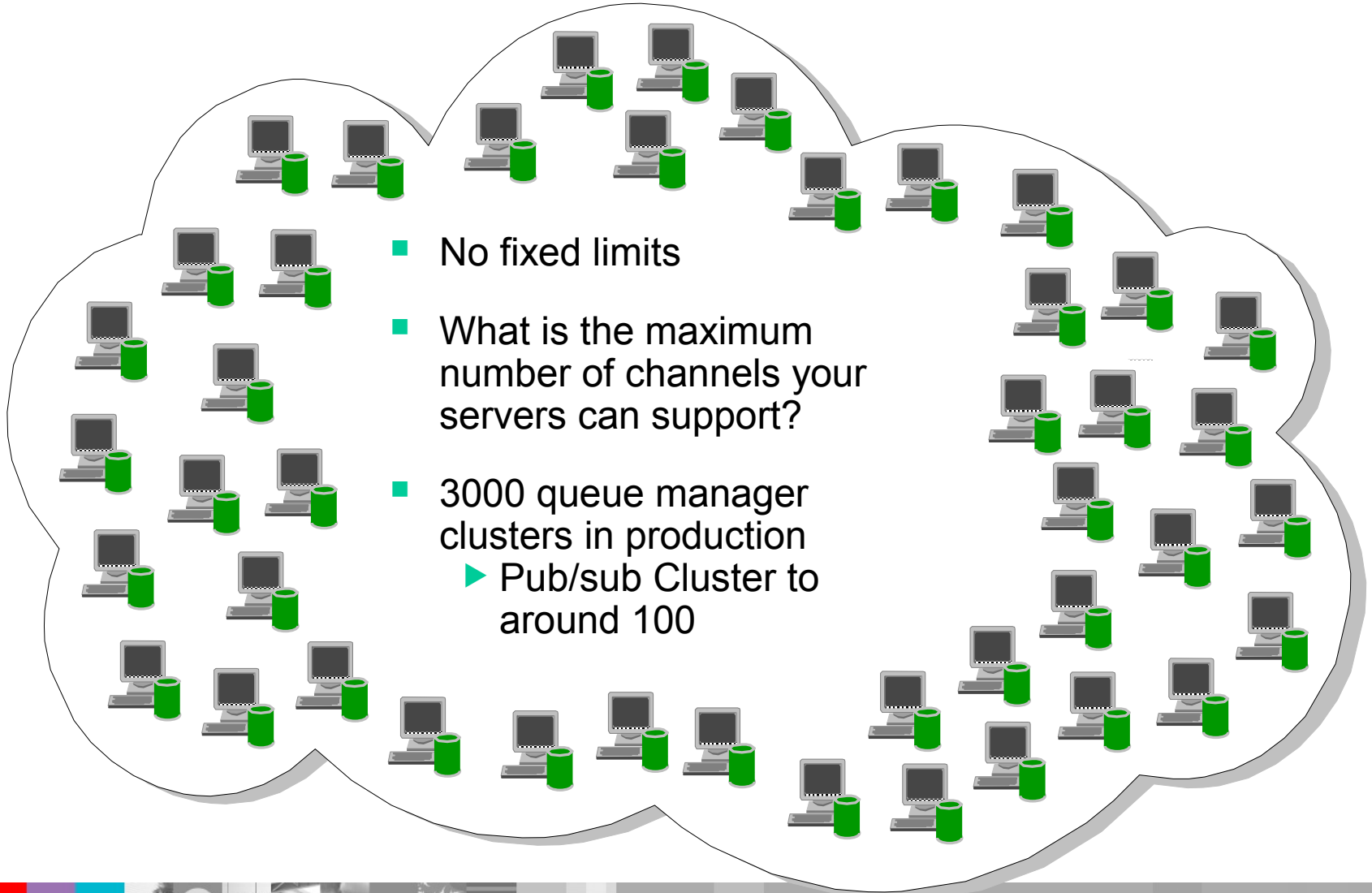
- Simplified administration
  - ▶ Large WMQ networks require many object definitions
    - Channels
    - Transmit queues
    - Remote queues

- Workload balancing
  - ▶ Multiple Local queue instances on different queue managers.
  - ▶ Always route message to local queue instance which local queue manager own
  - ▶ MQOO option:
    - ▪ MQOO_BIND_ON_OPEN or MQOO_BIND_NOT_FIXED
  - ▶ Message Affinity
  - ▶ Workload Exit

- Increased availability
  - ▶ Route around failures
  - ▶ Queue Redundancy

How big can a WMQ cluster be?

- No fixed limits

- What is the maximum number of channels your servers can support?

- 3000 queue manager clusters in production
  - ▶ Pub/sub Cluster to around 100
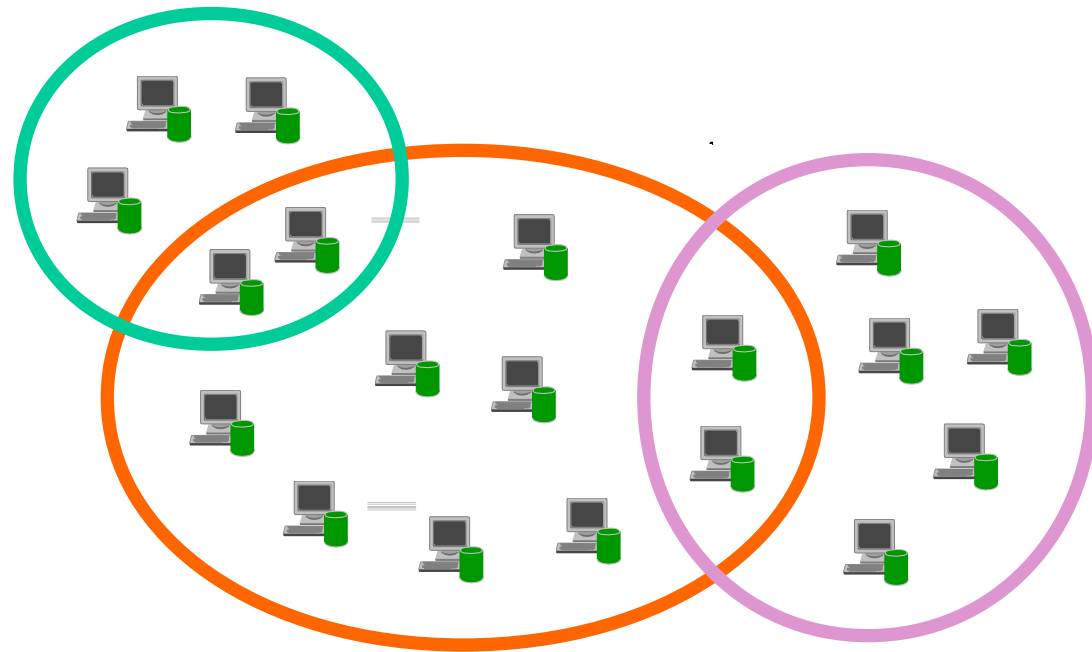
WMQ Clustering architectures

- Flexible connectivity
  - ▶ Overlapping clusters
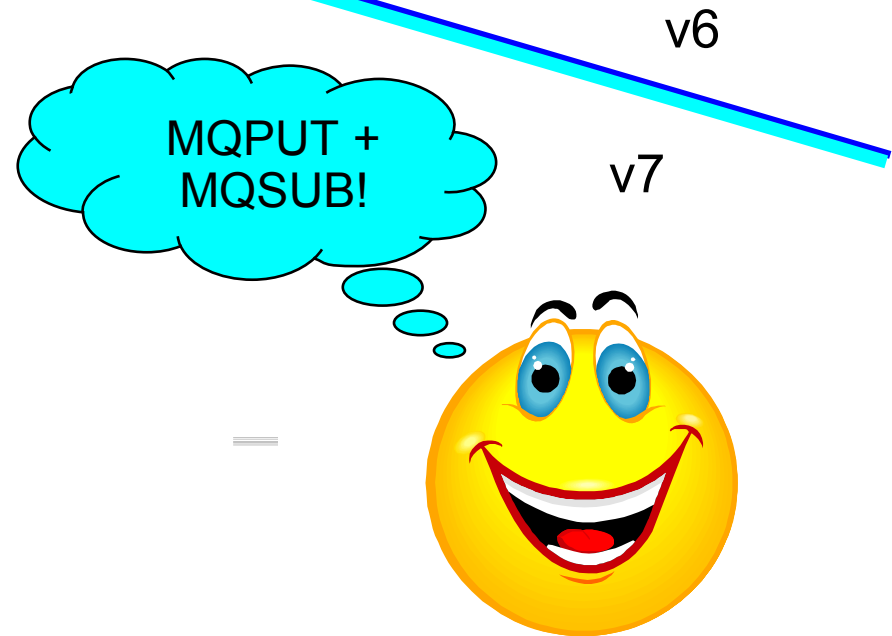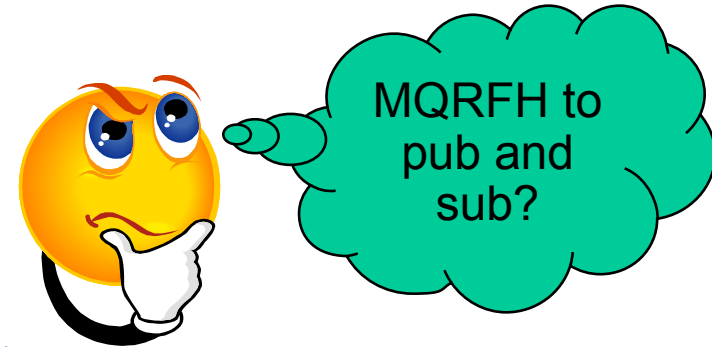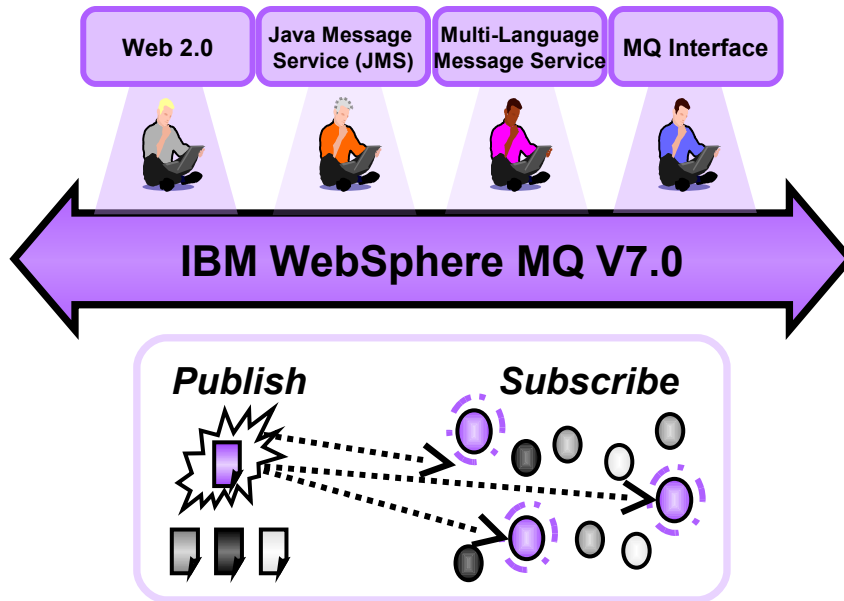 - ▶ Gateway Queue managers

WebSphere MQ V7 Publish/Subscribe

- WMQ V7 Pub/Sub new feature

- WMQ V7 Pub/Sub function overview

- WMQ V7 Pub/Sub Topologies

WebSphere MQ V7 Publish/Subscribe

- Compatibility mode available in V7,embedded pub/sub engine

- Now available on z/OS and better performance on distributed platforms

- Improved Pub/Sub adminstration

- 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

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

IBM WebSphere MQ V7.0

Publish   *Subscribe*

MQRFH to pub and sub?

v6

MQPUT + MQSUB!

v7

Publish/Subscribe in WebSphere MQ

Monitor

Topic Status

Display Connections and handles

Configure

Create TOPIC objects

Configure attributes

Topic Tree

MQSUB
'Price/Fruit/+'
MQGET

MQOPEN
'Price/Fruit/Apples'
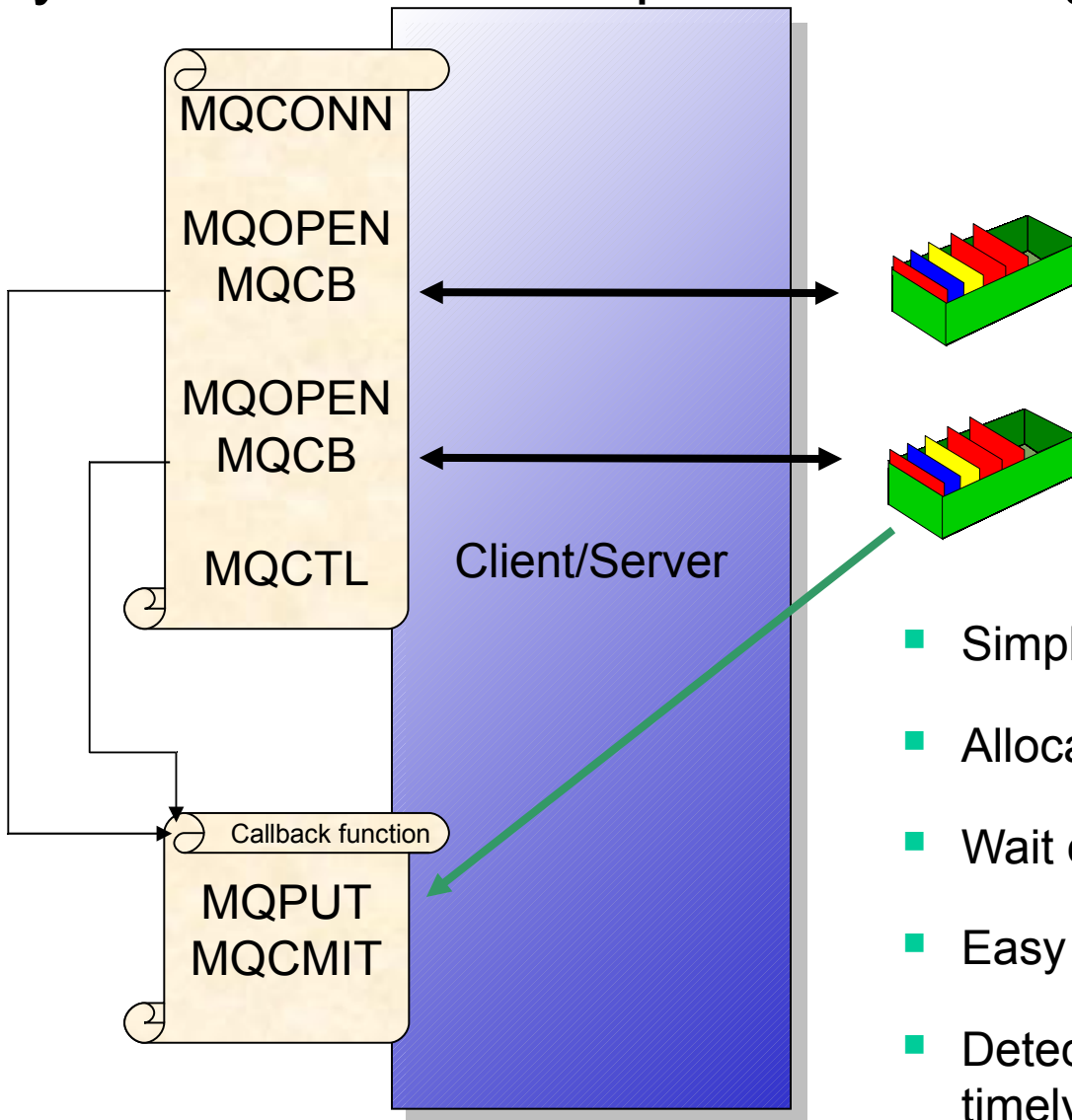MQPUT

Interface
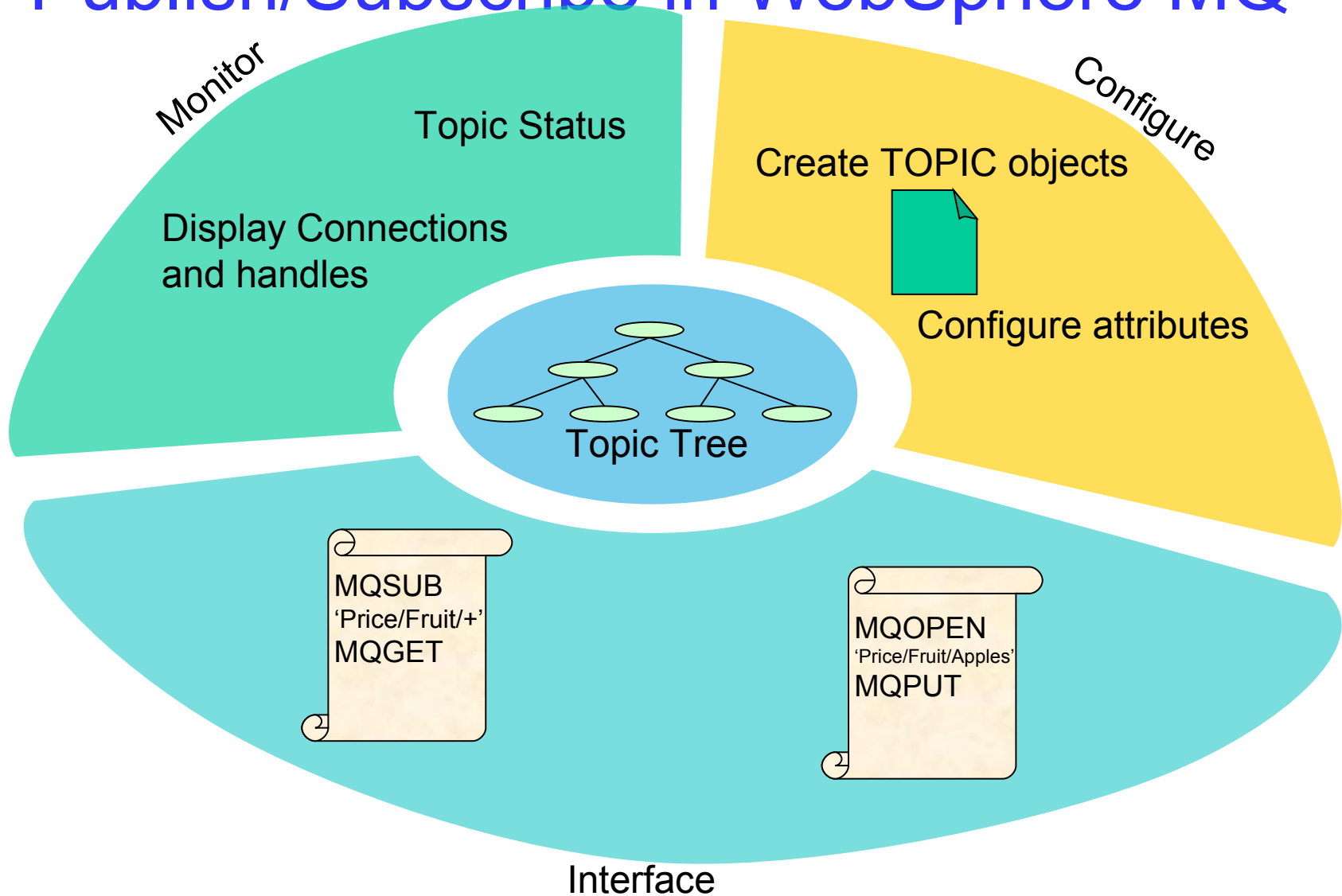
WMQ Publish/Subscribe Topologies

- WMQ V6 publish/subscribe networks based on hierarchies
  - ▶ All brokers linked in parent/child tree

- WMQ V7 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

WMQ V7 Client Enhancement

- Asynchronous Consumption of Messages

- Asynchronous Put Response

- Read-ahead of messages

- Conversation Sharing

Asynchronous Consumption of Messages

MQCONN

MQOPEN
MQCB

MQOPEN
MQCB

MQCTL

Client/Server

Callback function
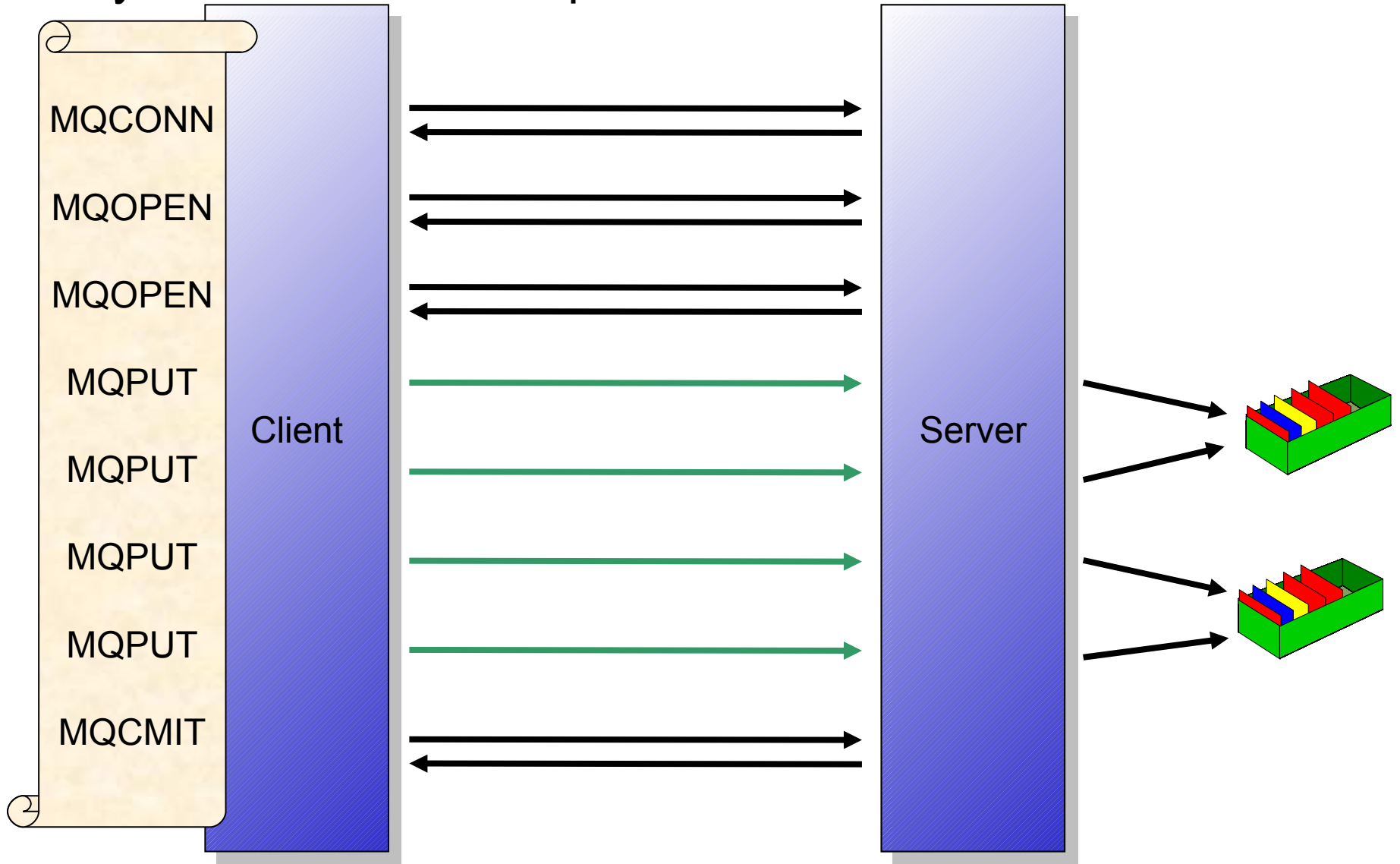
MQPUT
MQCMIT

- Simplifies programming

- Allocates message buffers

- Wait on multiple queues

- Easy to cancel

- Detect qmgr or network failures timely

Asynchronous Put Response

MQCONN

MQOPEN

MQOPEN

MQPUT

MQPUT

Client

MQPUT

MQPUT

MQCMIT

Server

Read-ahead of messages

MQCONN

MQOPEN

MQGET   Client

MQGET

MQGET

Server

Request for 'n' messages

Conversation Sharing (Multiplexing)

One socket for 'n' conversations
Socket is bi-directional
Heartbeats occur at all times
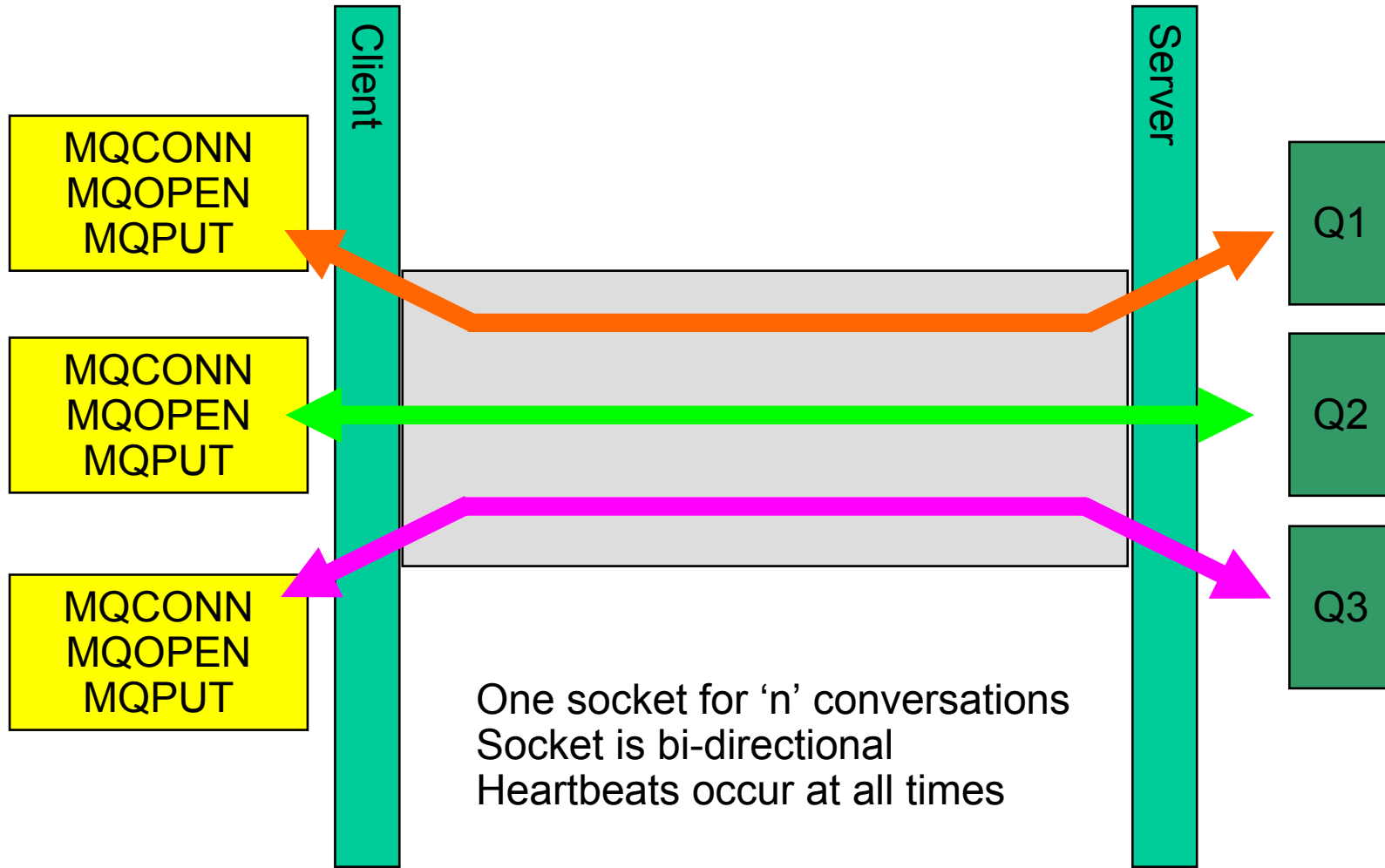
Conversation Sharing Administration

New SHARECNV channel attribute

- many
  Default:10

- 0
  All sharing is off ; channel operates in MQ V6 mode

- 1
  Sharing is off but channel still operates in MQ V7 mode

Conversation Sharing Connect

- Can be overridden at MQCONNX time:

- MQCNO_NO_CONV_SHARING
  - equivalent to SHARECNV(1)

- MQCNO_ALL_CONVS_SHARE (default)

Queue Manager
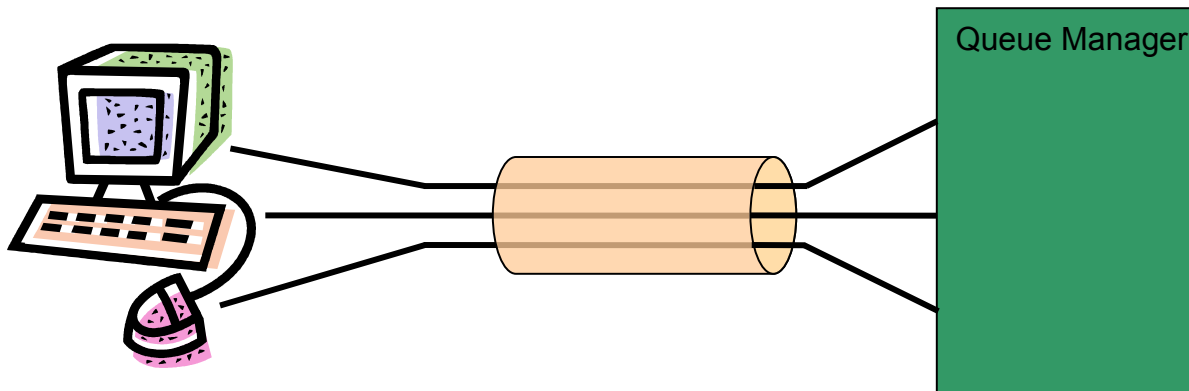
WMQ JMS Introduction

- JMS to MQ – the translation gap

- WMQ JMS/Base Java Architectures changes between V6 and V7.

- WMQ V7 JMS Enhancements

JMS to MQ – the translation gap

- Prior to MQ V7, a gap existed between the functionality specified in JMS and that provided in the MQI, e.g. selectors in JMS, not in MQ API requiring WMQ Classes for JMS to perform the work.

- Native WMQ API now supplies functionality such as Asynchronous Consumers and Selectors. Now WMQ JMS Classes are simpler and more efficient.
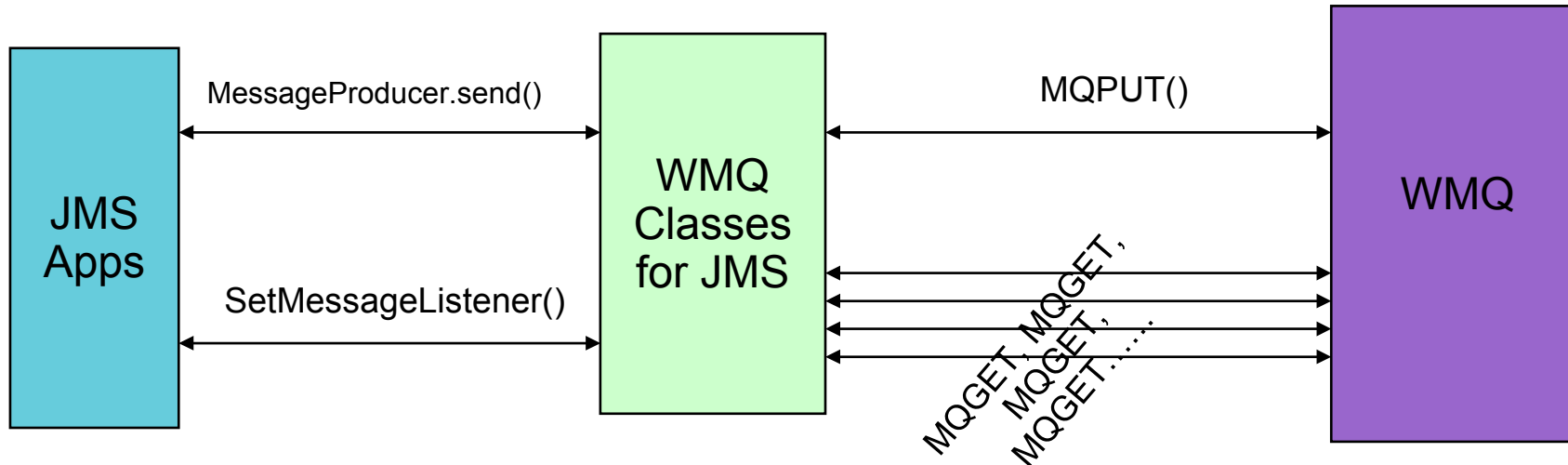
JMS Apps		WMQ Classes for JMS		WMQ

MessageProducer.send()

MQPUT()

SetMessageListener()

MQGET, MQGET, MQGET, MQGET......

WMQ V6 JMS/Base Java Architectures

JMS

Base Java

com.ibm.mqjms.jar;
com.ibm.mq.jar

WMQ V7 JMS/Base Java Architectures

com.ibm.mqjms.jar

com.ibm.mq.jar

JMS

JMQI

Remote

com.ibm.mq.jmqi.jar

Local

(tcp/ip)

mqjbnd
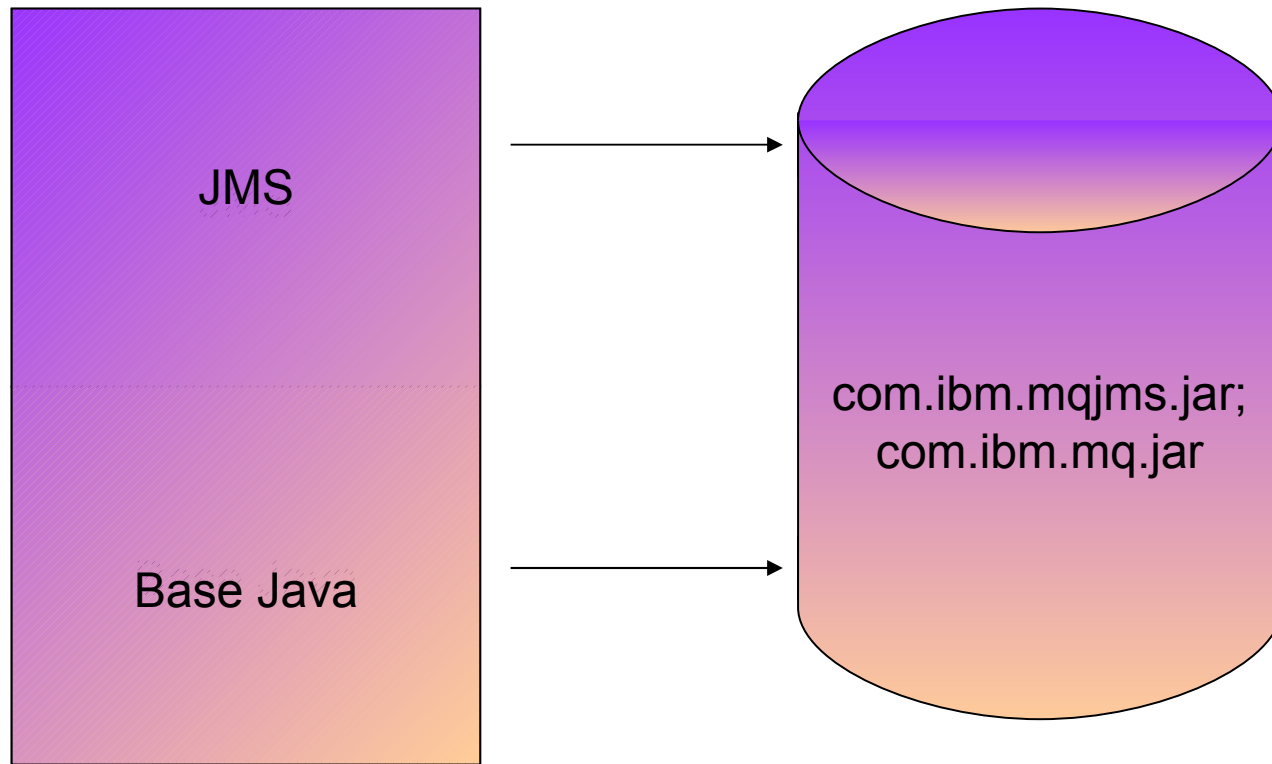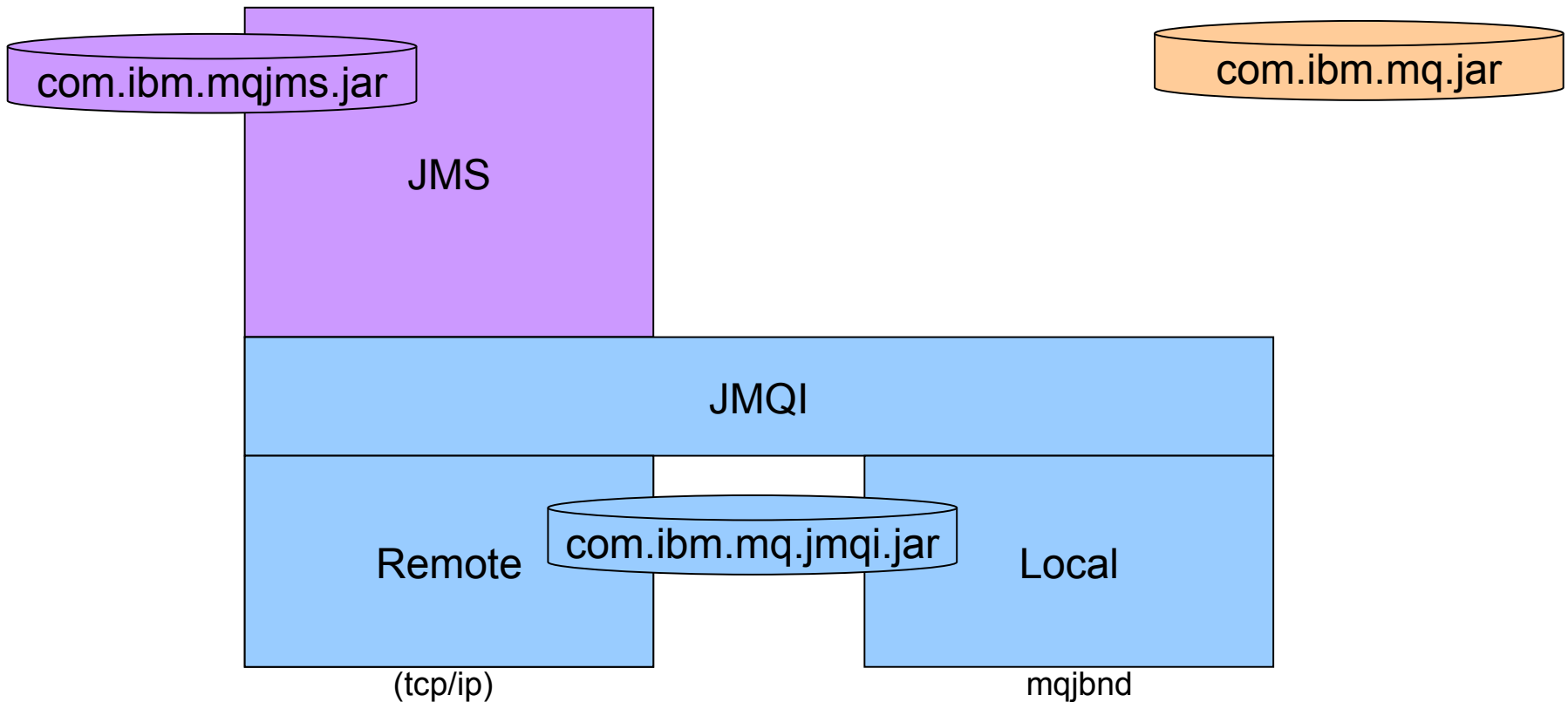
WMQ V7 JMS Enhancements

- **Asynchronous Consumers**
  - ▶ By adding asynchronous consumer support into the MQI, the JMS implementation can be hugely simplified and optimised.

- **Selector**
  - ▶ A JMS Consumer can be registered to only receive messages meeting specific criteria, based on message headers and properties.

- **Message Driven Beans**
  - ▶ By adding asynchronous consumer and selector support, as well as client read-ahead, optimisations can be made.
  - ▶ **Benefits**:
    - • Improved message throughput for MDBs.
    - • Reduced CPU and memory usage within the application server.

- **Publish/Subscribe**
  - ▶ By adding native publish/subscribe support into WMQ V7, topics are treated as first-class objects like queues, thus simplifying administration and subscription.
  - ▶ Messages are published to topics rather than being put to publication queues for a broker to then send to subscribers.

- **Integration with MQ Explorer**
  - ▶ Improved administrative view of WMQ as a JMS provider

- **Improved problem determination and serviceability**
  - ▶ e.g. Enhanced JMS trace facilities allow better support

WMQ High Availability Solution
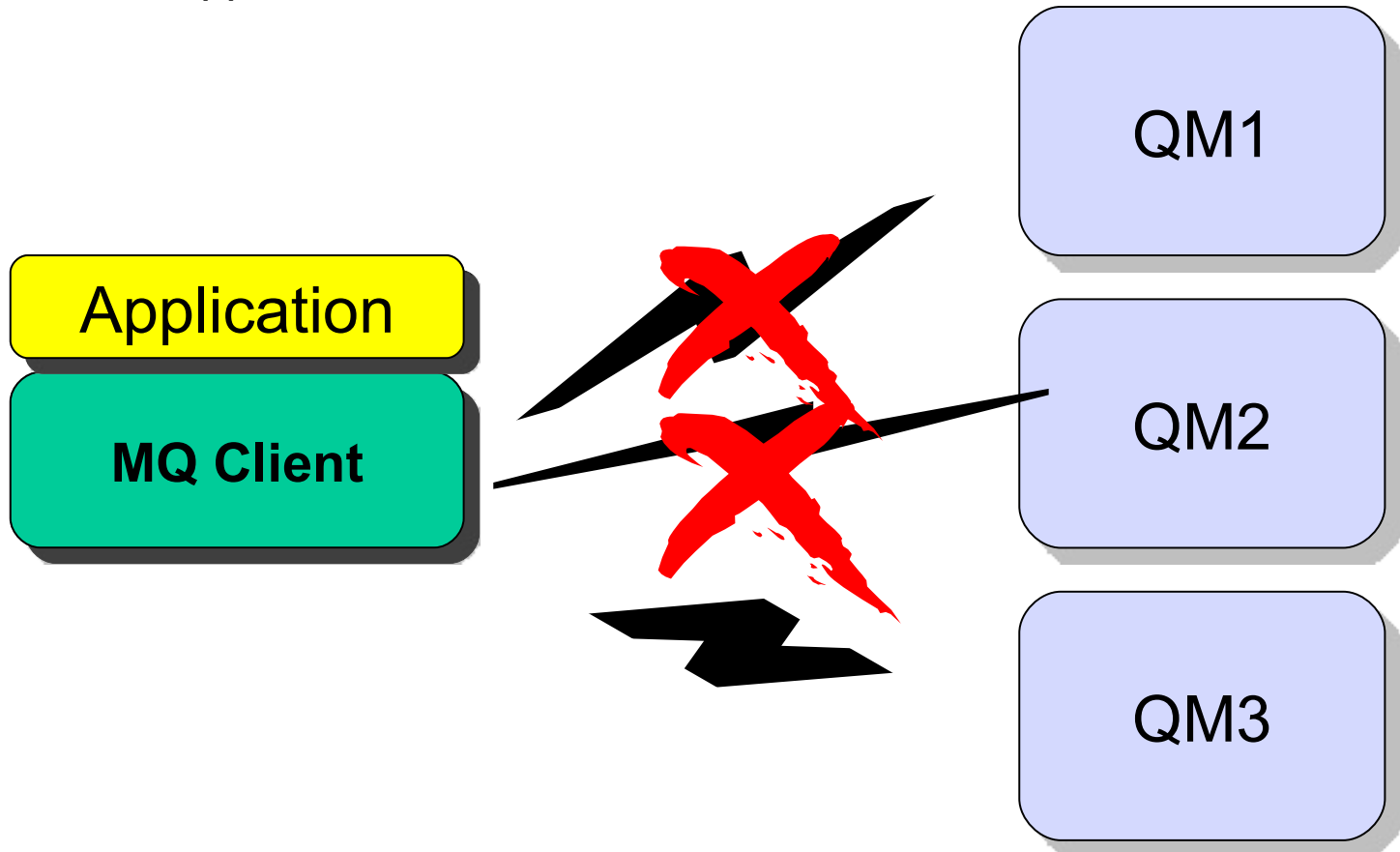
WMQ High Availability Solution

- Redundancy
  - ▶ MQ Cluster
  - ▶ MQ Client Reconnect *

- Failover
  - ▶ HA Cluster
  - ▶ MQ Multi-instance *

  :

Automatic Client Reconnection

- Client library provides necessary reconnection logic on detection of a failure

- Hides failure from application code

Automatic Client Reconnection

- Tries to hide queue manager failures by restoring current state automatically
  - ▶ For example, if MQPUT returns error, client reruns MQCONN/MQOPEN/MQPUT internally

- Uses the list of addresses in CONNAME to find queue manager
  - ▶ MQSERVER environment variable also understands list
  - ▶ MQSERVER=SYSTEM.DEF.SVRCONN/TCP/host1(1414),host2(1414)

- Can reconnect to the same or different Queue Manager

- Re-opens queues and other qmgr objects, re-establishes subscriptions

- Reconnection interval is backed off exponentially on each unsuccessful retry
  - ▶ Total timeout is configurable – default 30 minutes.

- MQ Java client doesn't support

- Supported Client details

http://publib.boulder.ibm.com/infocenter/wmqv7/v7r0/topic/com.ibm.mq.csqzaf.doc/cs70190_.htm

Multi-instance Queue Managers

- **Basic failover support without HA coordinator**
  - ▶ Faster takeover: fewer moving parts
  - ▶ Cheaper: no specialised software or administration skills needed
  - ▶ Windows, Unix, Linux platforms

- **Queue manager data is held in networked storage**
  - ▶ NAS, NFS, GPFS etc so more than one machine sees the queue manager data
  - ▶ Improves storage management options: formal support for these even without failover config

- **Multiple (2) instances of a queue manager on different machines**
  - ▶ One is "active" instance; other is "standby" instance
  - ▶ Active instance "owns" the queue manager's files and will accept app connections
  - ▶ Standby instance does not "own" the queue manager's files and apps cannot connect
    - • If active instance fails, standby performs queue manager restart and becomes active

- **Instances share data, so it's the SAME queue manager**

- **Combine with Client reconnect feature**

http://www.ibm.com/developerworks/cn/websphere/library/techarticles/1104_murthy/1104_murthy.html

Multi-instance queue managers: How it looks

- Enhanced dspmq

- New option for dspmq to output English-only text
  - Useful for programmable parsing

```
$ hostname
rockall
$ dspmq -x
QMNAME(V7)         STATUS(Running)
    INSTANCE(rockall)    MODE(Active)
QMNAME(V7B)        STATUS(Running)
    INSTANCE(rockall)    MODE(Active)
QMNAME(V7C)        STATUS(Running as standby)
    INSTANCE(llareggub) MODE(Active)
    INSTANCE(rockall)    MODE(Standby)
```

Multi-instance Queue Managers (1)

1. Normal Execution

MQ Client

MQ Client

network

192.168.0.1

Machine A

QM1 Active instance

can fail-over

192.168.0.2

Machine B

QM1 Standby instance

QM1

networked storage
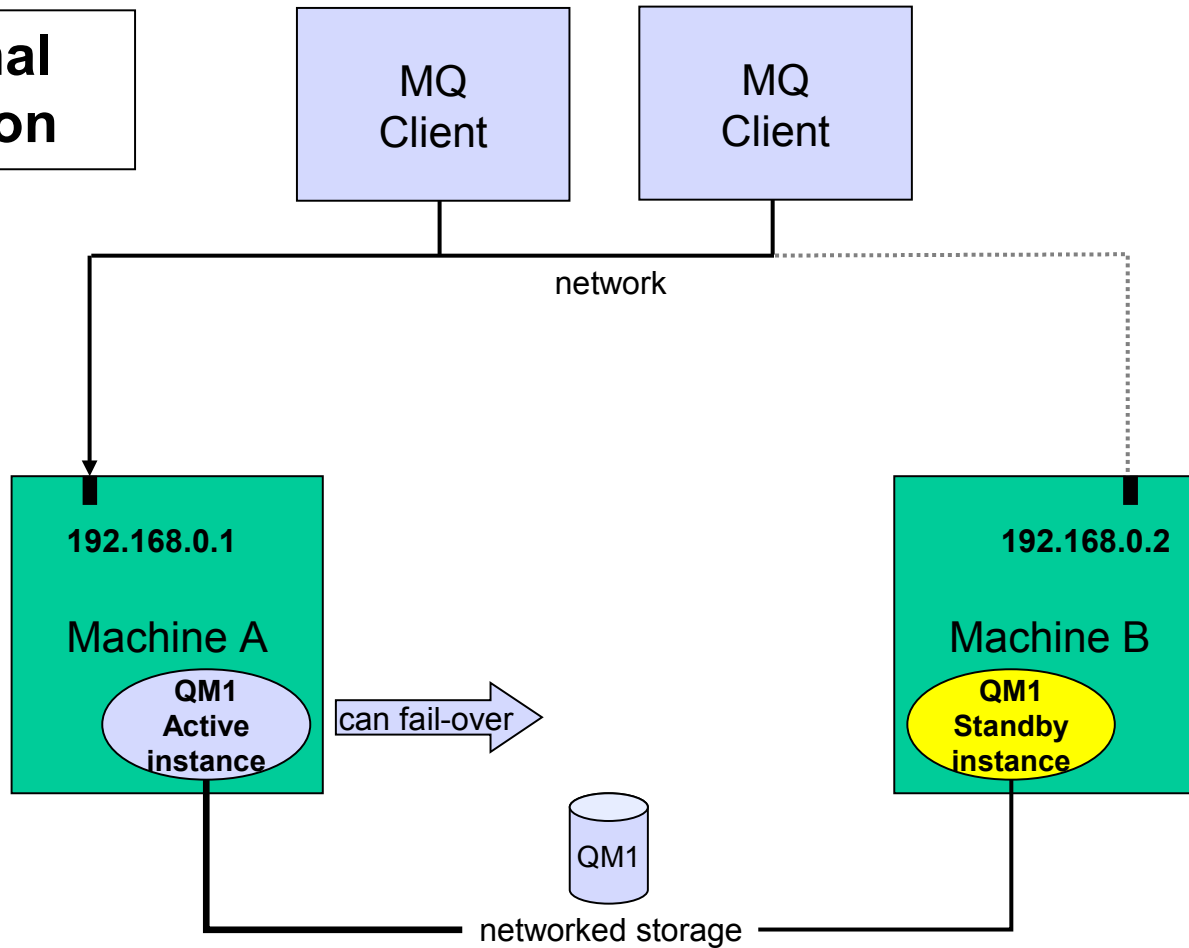
Owns the queue manager data

Multi-instance Queue Managers (2)

2. Disaster
Strikes

MQ
Client

MQ
Client

network

Connections
broken from
clients

0.1

192.168.0.2

Ma...

Machine B

instance

locks freed

QM1
Standby
instance

QM1

networked storage
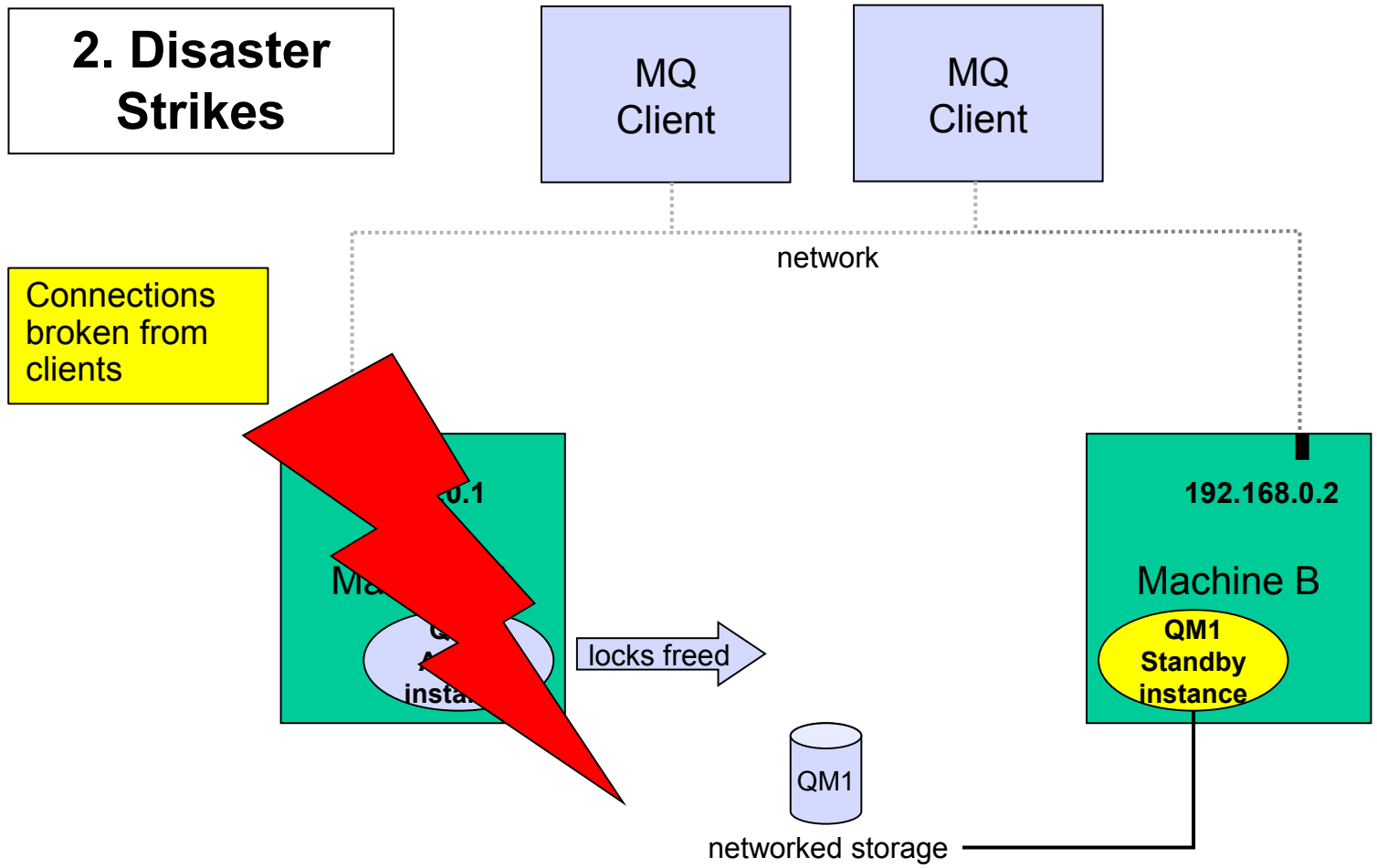
Multi-instance Queue Managers (3)

3. Standby Comes to Life

MQ Client

MQ Client

Connections still broken

network

192.168.0.2

Machine B

QM1 Active instance

QM1

networked storage

Owns the queue manager data
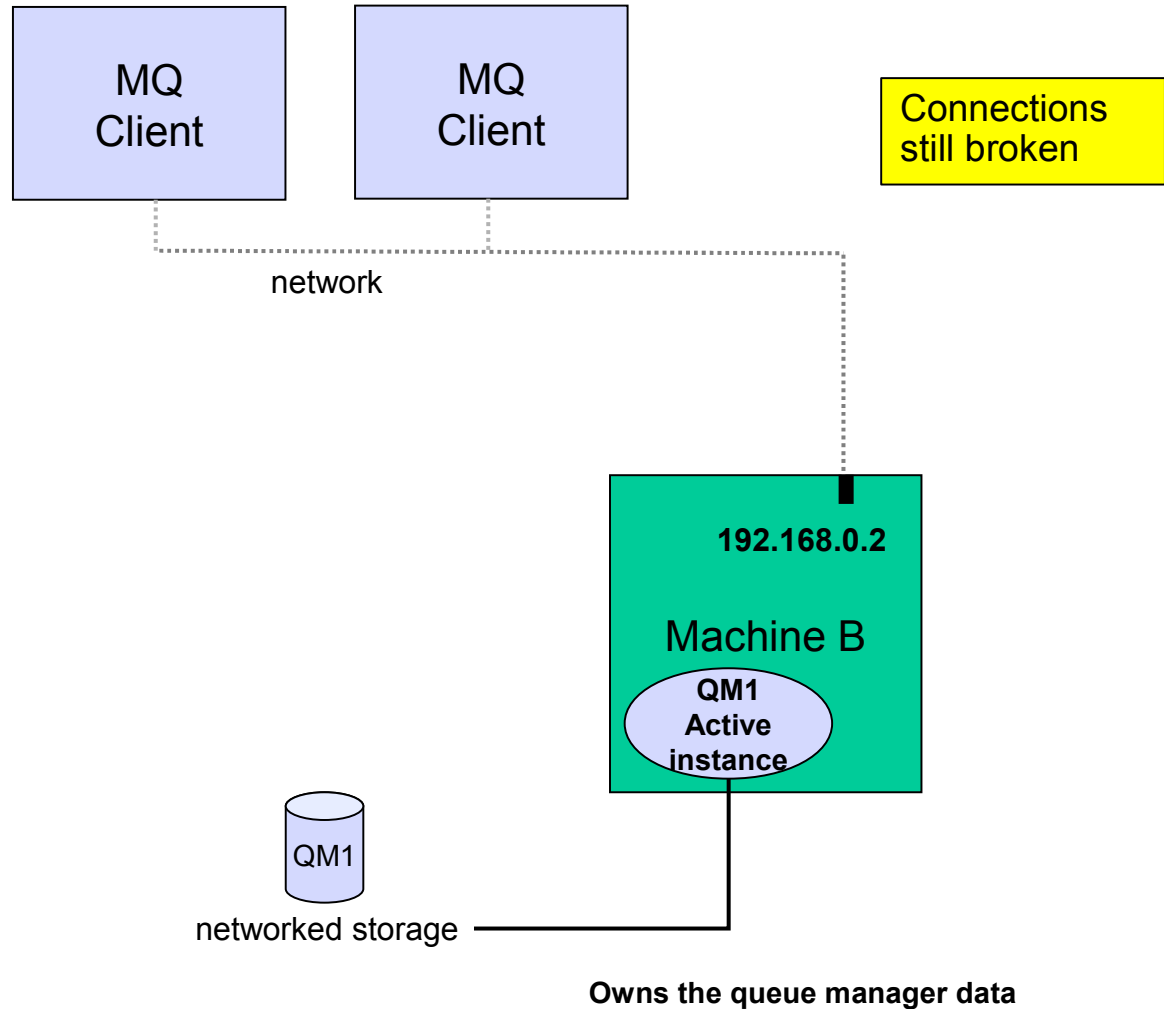
Multi-instance Queue Managers (4)

4. Recovery Complete

MQ Client

MQ Client

Clients reconnected. Processing continues.

network

192.168.0.2

Machine B

QM1 Active instance

QM1

networked storage

Owns the queue manager data
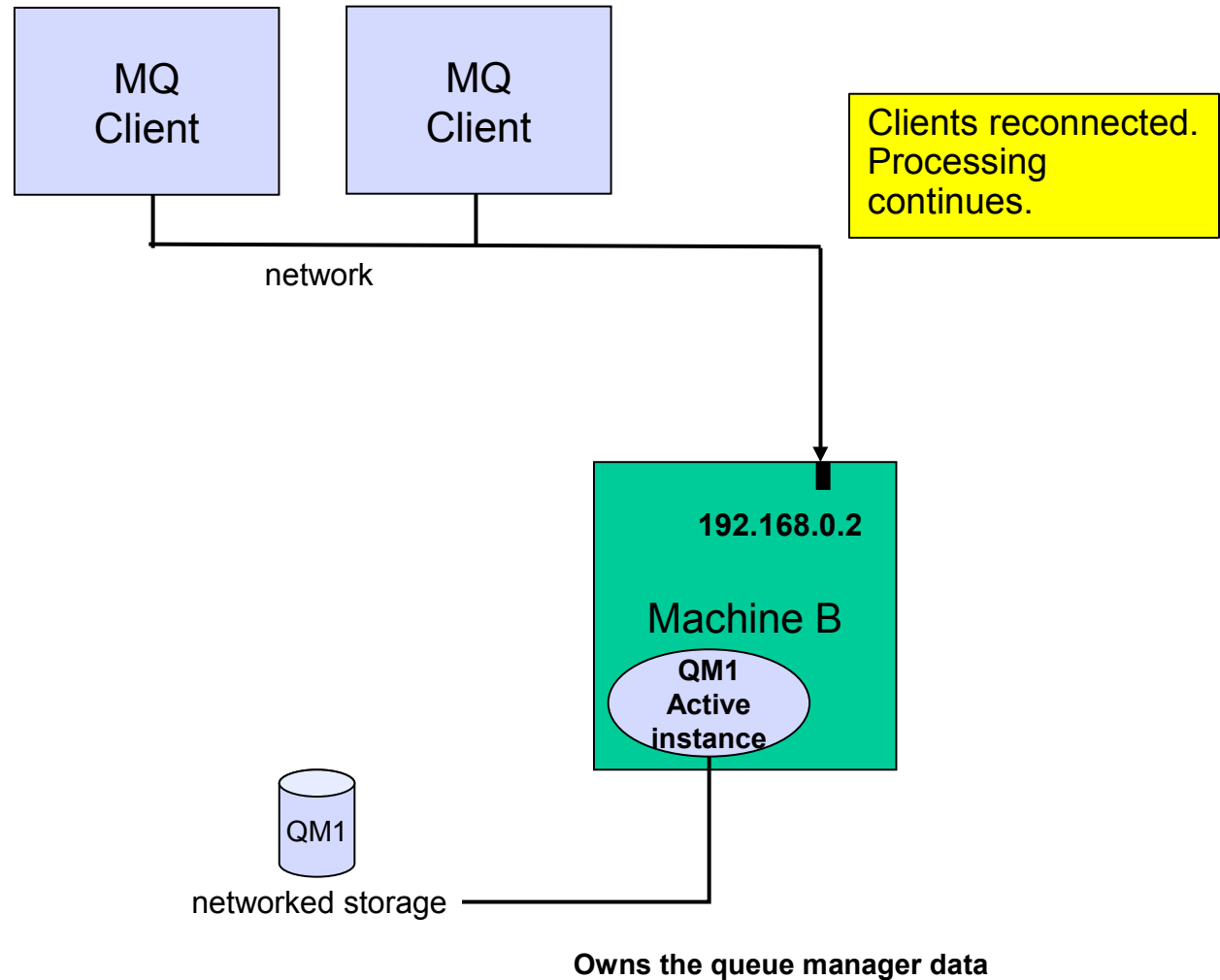
Multi-instance queue managers: Details

- **MQ is NOT becoming an HA coordinator**
  - Generally, if other resources also required, use an HA coordinator such as HACMP
  - Service objects can restart applications with qmgr but limited control
  - Message Broker will integrate with and exploit this MQ function

- **The IP address is not taken over**
  - Channel config needs all possible addresses unless you use external IPAT or intelligent router
  - CONNAME('host1(port1),host2(port2)') syntax extension on all platforms including z/OS

- **Support for networked storage over modern network file system protocols**
  - For example, NFS v4 (not v3)
  - Tool (amqmfsck) shipped to validate configuration

- **New options for crtmqm/strmqm/endmqm to control operations**
  - Cannot guarantee which instance becomes the primary

- **Removes need for MC91, which will be withdrawn**
  - crtmqm now does equivalent of MC91's hacrtmqm

Summary –WebSphere MQ Overview

- WMQ Product Vision

- WMQ Core Concept
  - Message and Queue
  - MQ Object introduction
  - MQ intercommunication

- WMQ API brief introduction

- WMQ Product Status
  - Product Version
  - WMQ Family Product
  - Supported Platform

- WMQ Application Model

  - Point to Point
  - Publish/Subscribe

- WMQ Major Feature

  - Cluster
  - Pub/Sub
  - V7 Client Enhancement
  - JMS
  - MQ High Availability Solution

MQ 中英文技术专题讲座

- ## CDL MQ L2 中英文技术交流会
  - ### 已举办讲座 (可下载录音和材料）
    - **WMQ** 发布订阅功能介绍 **2011** 年 **4** 月 **19** 日
    - **WMQ** 集群技术 **2011** 年 **7** 月 **27** 日

http://www01.ibm.com/software/cn/passportadvantage/support/seminars/websphere.html

- ## WW MQ L2 英文技术专题讲座： (可下载录音和材料)

Support Technical Exchange for WebSphere MQ, WebSphere Message Broker and related products

http://www-01.ibm.com/support/docview.wss?uid=swg27007786

Related WMQ Technical Exchange Link (1)

- **What is new in WebSphere MQ Version 7**

  ➢ **http://www-01.ibm.com/support/docview.wss?uid=swg27012921**

- **Considerations in Designing and Maintaining a WebSphere MQ Clustering Environment**

  ➢ http://www-01.ibm.com/support/docview.wss?uid=swg27017264

- **WebSphere MQ V7 Publish/Subscribe Troubleshooting Tools & Techniques**

  ✓ http://www-01.ibm.com/support/docview.wss?uid=swg27014870

- Installation and Migration of WebSphere MQ V7 including Publish/Subscribe Configuration

  ➢ http://www-01.ibm.com/support/docview.wss?uid=swg27016064

Related WMQ Technical Exchange Link (2)

- **WebSphere MQ V7.0 Client Enhancements**

  ➤ http://www-01.ibm.com/support/docview.wss?uid=swg27016801

- **Understanding the WebSphere MQ Java Message Service Classes**

  ➤ http://www-01.ibm.com/support/docview.wss?uid=swg27015559

- Using WebSphere MQ V7 as JMS Provider for WebSphere Application Server V7

  ➤ http://www-01.ibm.com/support/docview.wss?uid=swg27016595

- **Understanding High Availability Options on Unix Platforms**

  ➤ http://www-01.ibm.com/support/docview.wss?uid=swg27019872

- **An Introduction to WebSphere MQ Multi-Instance Queue Managers**

  ➤ http://www-01.ibm.com/support/docview.wss?uid=swg27017382

Related WMQ Technical Exchange Link (3)

- **High Availability for WebSphere MQ**

  ➤ http://www-01.ibm.com/support/docview.wss?uid=swg27009125

- **Ask the Experts Replay: WebSphere MQ Failover on Distributed Platforms**

  ➤ **http://www-01.ibm.com/support/docview.wss?uid=swg27020934**

- Using Custom Property and CCDT File to Connect to WebSphere MQ Multi-Instance Queue Managers from WebSphere Application Server V7

  ➤ http://www-01.ibm.com/support/docview.wss?uid=swg27020901

- **Implementation Considerations for Multi-Instance Queue Managers in WebSphere MQ Cluster Environment**

  ➤ http://www-01.ibm.com/support/docview.wss?uid=swg27018127

WebSphere MQ Reference URL

- **WebSphere MQ Library**

  ➢ http://www.ibm.com/software/integration/wmq/library

- **WebSphere MQ Support Page**

  ➢ http://www-947.ibm.com/support/entry/portal/Overview/Software/WebSphere/WebSphere_MQ

- **WebSphere MQ SupportPacs** http://www.ibm.com/support/docview.wss?rs=977&uid=swg27007205

- **DeveloperWork for WebSphere MQ product:**

  ➢ http://www.ibm.com/developerworks/websphere/zones/businessintegration/wmq.html

Chinese http://www.ibm.com/developerworks/cn/websphere/zones/businessintegration/wmq.html

- **WebSphere MQ redbook**

http://www.redbooks.ibm.com/cgi-bin/searchsite.cgi?query=websphere+AND+MQ

WebSphere MQ Reference URL

- **WebSphere MQ Library**

  http://www.ibm.com/software/integration/wmq/library

- **WebSphere MQ Support Page**

  http://www-947.ibm.com/support/entry/portal/Overview/Software/WebSphere/WebSphere_MQ

- **WebSphere MQ SupportPacs**

  http://www.ibm.com/support/docview.wss?rs=977&uid=swg27007205

- **DeveloperWork for WebSphere MQ topic:**

  http://www.ibm.com/developerworks/websphere/zones/businessintegration/wmq.html (English)

  http://www.ibm.com/developerworks/cn/websphere/zones/businessintegration/wmq.html(Chinese)

- **WebSphere MQ redbook**

  http://www.redbooks.ibm.com/cgi-bin/searchsite.cgi?query=websphere+AND+MQ

Additional WebSphere Product Resources

- Learn about upcoming WebSphere Support Technical Exchange webcasts, and access previously recorded presentations at:
  http://www.ibm.com/software/websphere/support/supp_tech.html

- Discover the latest trends in WebSphere Technology and implementation, participate in technically-focused briefings, webcasts and podcasts at:
  http://www.ibm.com/developerworks/websphere/community/

- Join the Global WebSphere Community:
  http://www.webspherusergroup.org

- Access key product show-me demos and tutorials by visiting IBM Education Assistant:
  http://www.ibm.com/software/info/education/assistant

- View a webcast replay with step-by-step instructions for using the Service Request (SR) tool for submitting problems electronically:
  http://www.ibm.com/software/websphere/support/d2w.html

- Sign up to receive weekly technical My Notifications emails:
  http://www.ibm.com/software/support/einfo.html

Q & A