WMQ and JavaEE:
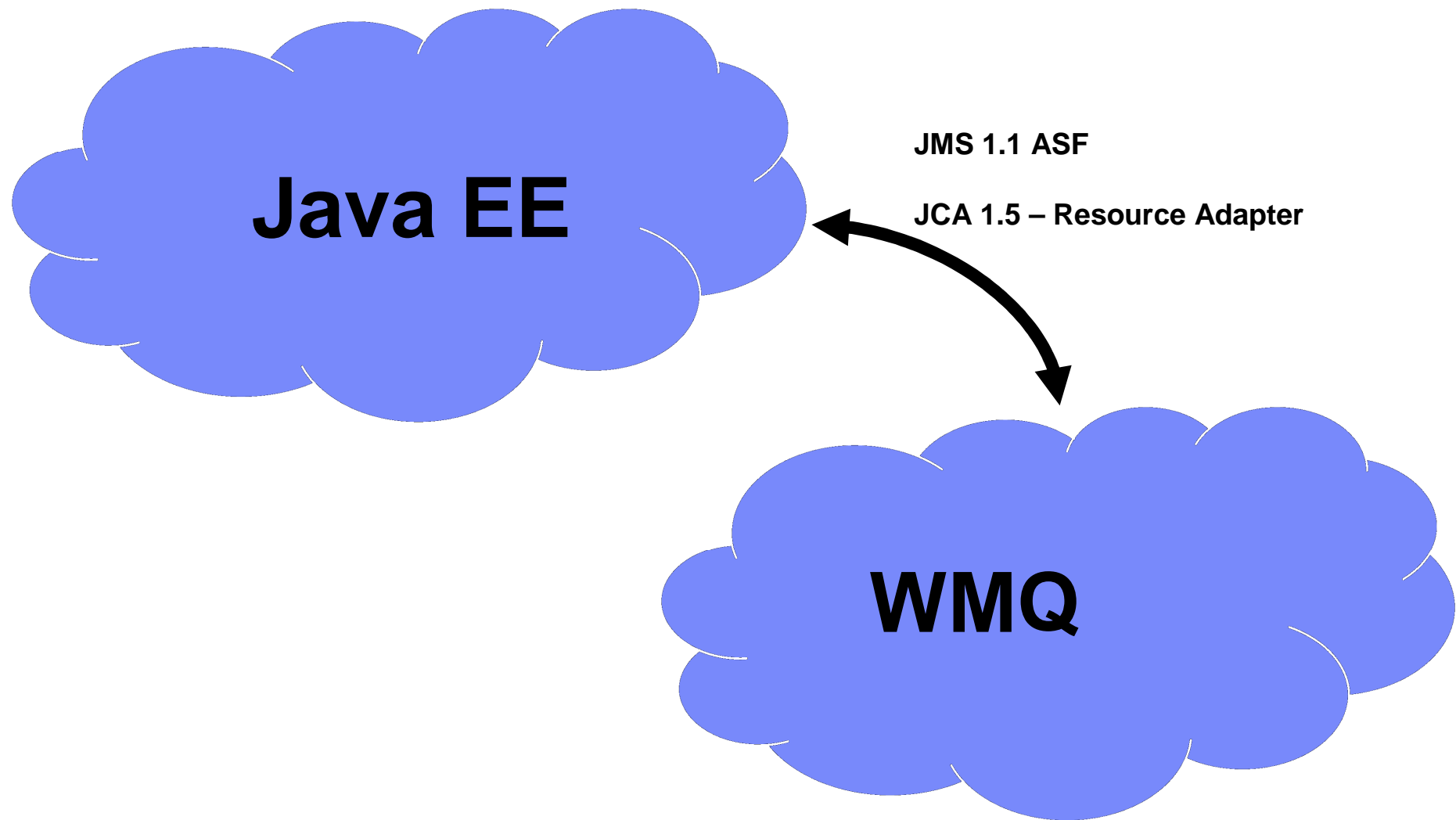# Living and Working with WAS and other Application Servers

Matthew B White & Graham Hopkins
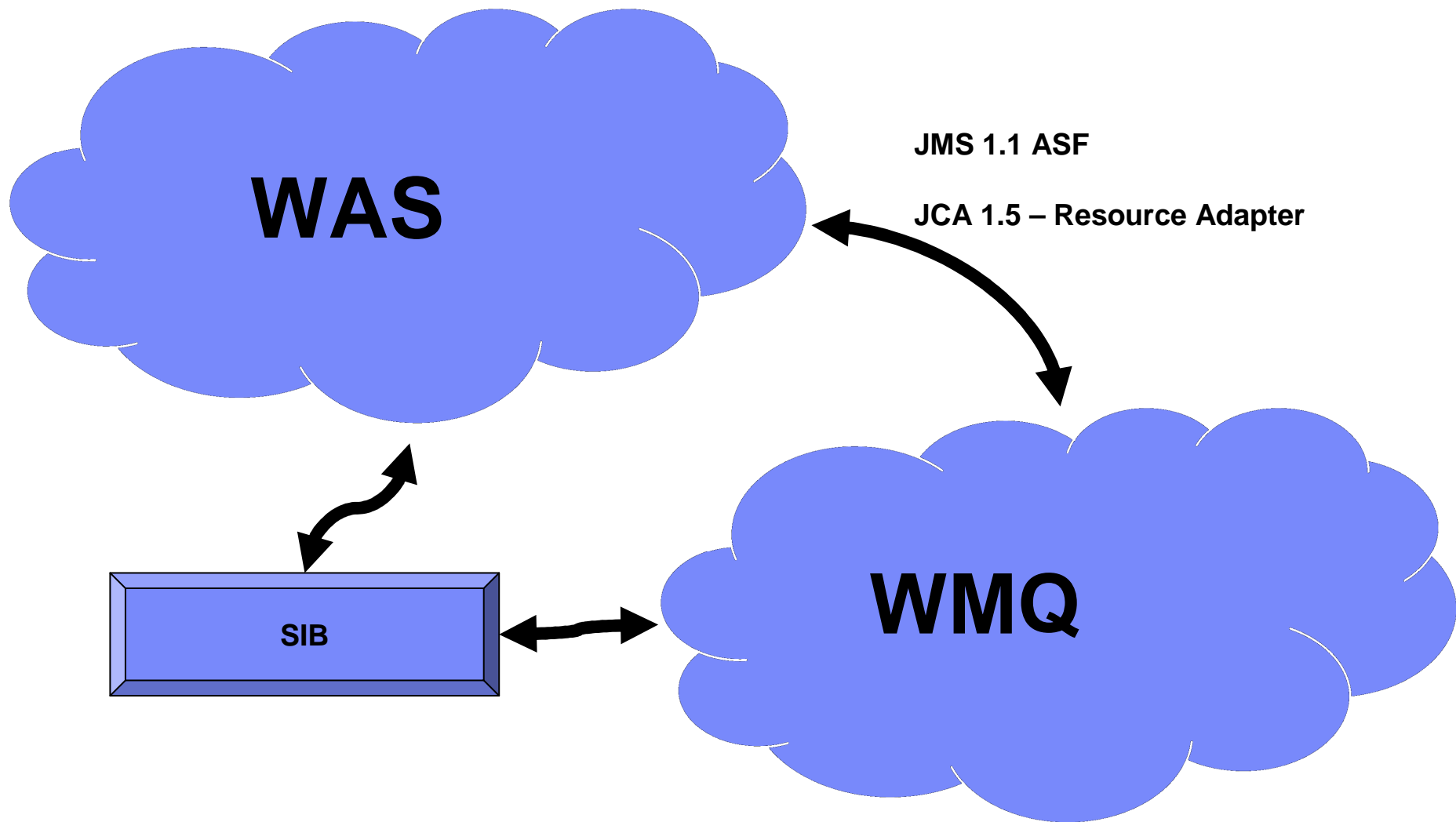IBM WebSphere MQ Platform Integration

Agenda

- How does WebSphere MQ really work when used as the messaging backbone in an Application Server environment?

- The WebSphere MQ Resource Adapter can also be used within other application servers; what considerations are there with deploying within these other environments?

- One important question is how to migrate to a new version of WAS and or WMQ?

- The last section of this session will cover the important issues surrounding integration of the new WebSphere MQ v7.0.1 multi-instance queue managers with the JavaEE world.

Java EE

JMS 1.1 ASF

JCA 1.5 – Resource Adapter

WMQ

WAS is a Java EE Application Server

WAS

JMS 1.1 ASF

JCA 1.5 – Resource Adapter

SIB

WMQ

Detail of the WMQ integration

WAS v6

WAS v7

WAS v6 : JMS Client

WAS v7 : JCA – RA

WMQ v6

WMQ v7
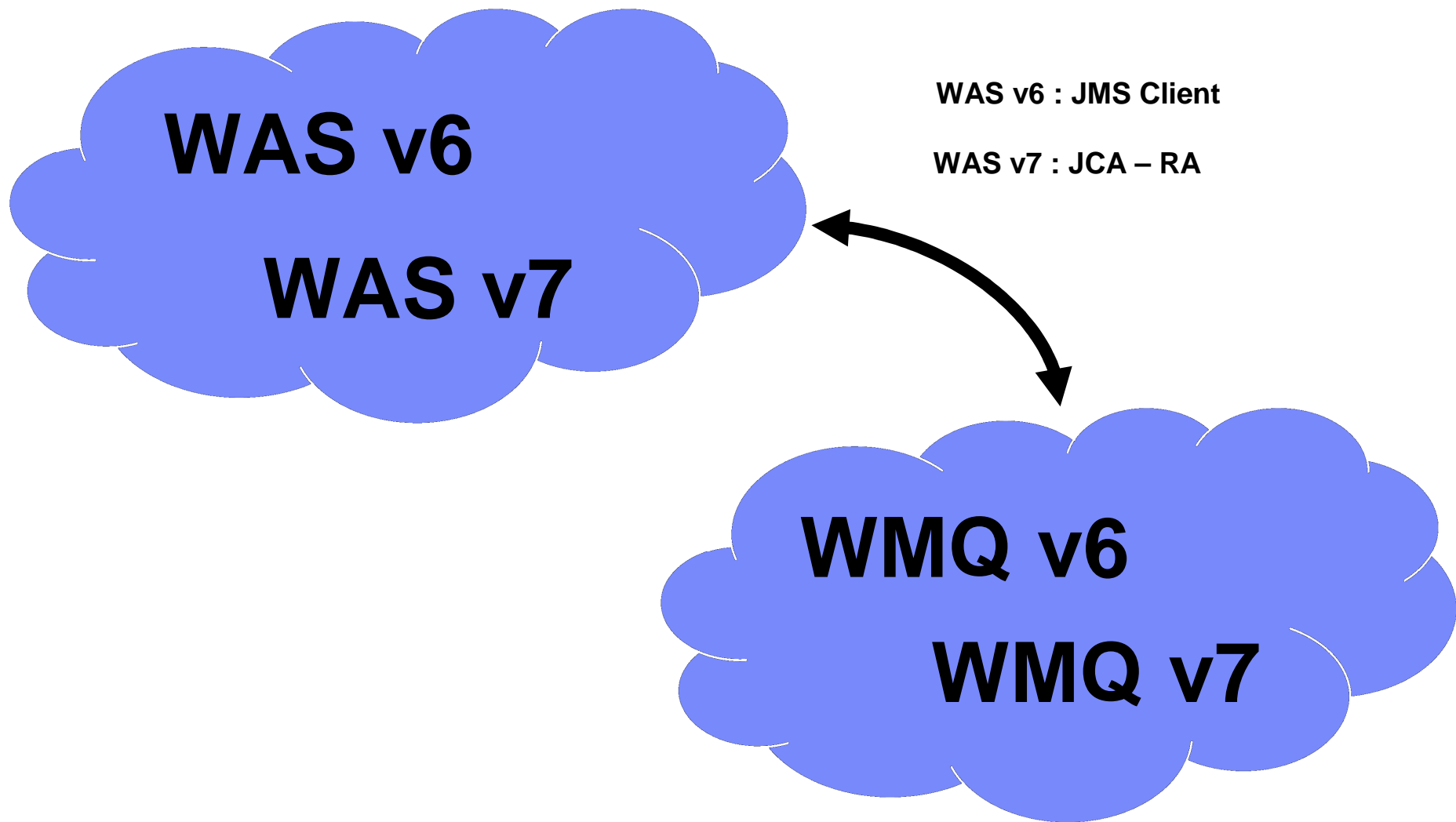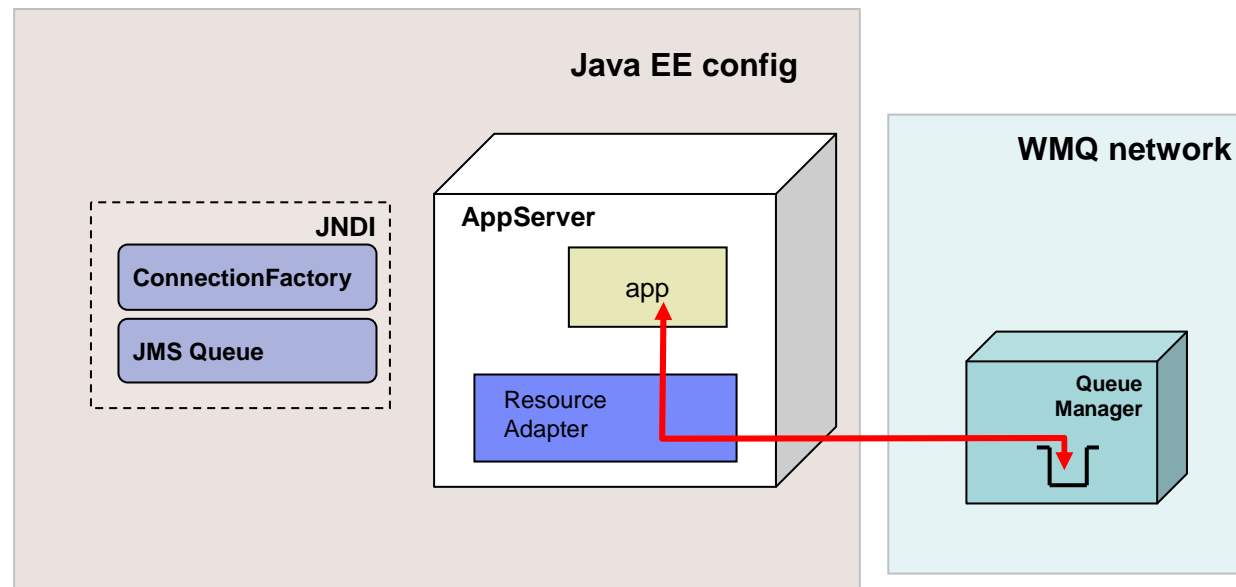
What is a 'Resource Adapter'?

- The resource adapter allows applications running in an application server to access WebSphere MQ resources. It supports inbound and outbound communication.

- The Java Platform, Enterprise Edition (Java EE) Connector Architecture (JCA) provides a standard way of connecting applications running in a Java EE environment to an Enterprise Information System (EIS) such as WebSphere® MQ or DB2®. The WebSphere MQ resource adapter implements the JCA 1.5 interface

What is WMQ's Resource Adapter?

- WMQ RA Outbound and Inbound (JCA 1.5) Communication types supported

- All of the WMQ JMS jar files required to connect in Client mode to WMQ now come packaged as the WMQ RA
  - This can be considered as a super set of WMQ JMS Client tailored specifically for the JavaEE Connector Architecture

- Native code for WMQ Bindings mode still needs configuring

- Same RA deployable into any JavaEE 1.4 Application Server
  - Already deployed into WAS – please don't redeploy it ☺

- Supplied with IVT to ensure deployment is good

WAS: Using the WMQ Resource Adapter in WAS7

- Activation Specifications are now the preferred method for delivering messages to a MDB
  - The use of message listener ports has been deprecated in WAS v7

- Reduces the complexity of integration
  - Fewer 'moving parts' when choosing what is supported with what
  - The 3 WMQ JMS client jars used in WAS v6 are not required at WAS v7 for <u>any</u> migration scenario.

- Allows IBM to focus testing at combined levels

- Fixes applied by WAS APARs
  - MQ_INSTALL_ROOT not usable to allow update to the JMS client

- Manual update possible but only on advice from IBM Service
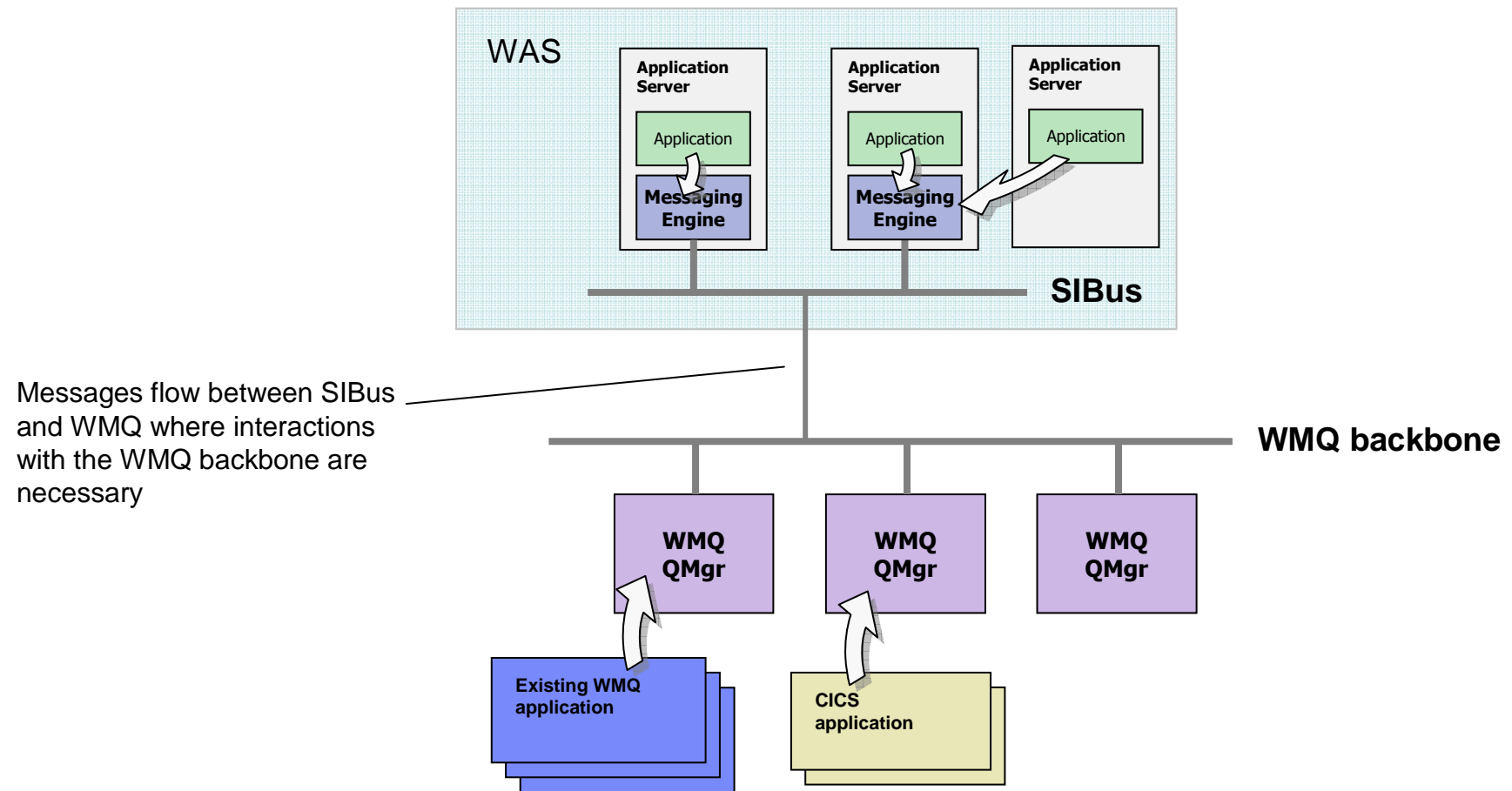 - Pushes RA code outside of normal update route

WMQ Resource Adapter – 'Statement of Environment'

- WMQ RA available from WMQ 6.0.2.1 – provides a JCA 1.5 RA

- Useable in a certified JavaEE 1.4 Application Server (or later)

- IBM have tested on

  - WebSphere Application Server Community Edition V1.0.0 and V1.1.0
  - JBoss Application Server V4.0.4 and V4.0.5

- For the rest
  - If you can get the IVT to deploy…
  - … problems can be reported to IBM for diagnosis

- Please don't
  - … deploy in WAS 6 – this needs the JMS Client to work
  - … deploy in WAS 7 – it already has the RA

- *Formal Support Statement can be found at http://www-01.ibm.com/support/docview.wss?rs=171&uid=swg27009524*

Running in other Application Servers

- Get the IVT working first – **wmq.jmsra.ivt.ear**

- Deployment is usually via copying the **wmq.jmsra.rar**

- For XA functionality the WMQ Extended Transactional Client is required running in client mode
  - Running in Bindings mode to a local Queue Manager doesn't need this

- Trace is best enabled via the Resource Adapter XML

- Check the WMQ RA Support Statement for release notes on a per application server basis

WAS to WMQ – Indirect Integration

WAS

Application Server — Application → Messaging Engine

Application Server — Application → Messaging Engine

Application Server — Application

SIBus

Messages flow between SIBus and WMQ where interactions with the WMQ backbone are necessary

WMQ backbone

WMQ QMgr

WMQ QMgr

WMQ QMgr

Existing WMQ application

CICS application

**When flowing messages to or from a WMQ backbone:**

- **Pros**
  - Messaging runtime is embedded into the same runtime as the applications
    - Best way to get messages produced by WAS applications into other WAS applications
  - Ability to asynchronously queue messages in WAS if the WMQ backbone is unavailable
  - JMS resource configuration relates to WAS-defined SIBus configuration objects
    - WMQ-aware configuration in WAS is minimised
  - Applications can be unaware of actual queue locations

- **Cons**
  - Two messaging systems to configure and maintain
  - Additional complexity in configuring interactions between SIBus and WMQ
    - Additional problem determination may be required to resolve issues
  - Performance overhead when passing from one messaging system to another

Migration of WAS and WMQ Stack

WAS v6 → **WAS v7**

WMQ v6 → **WMQ v7**
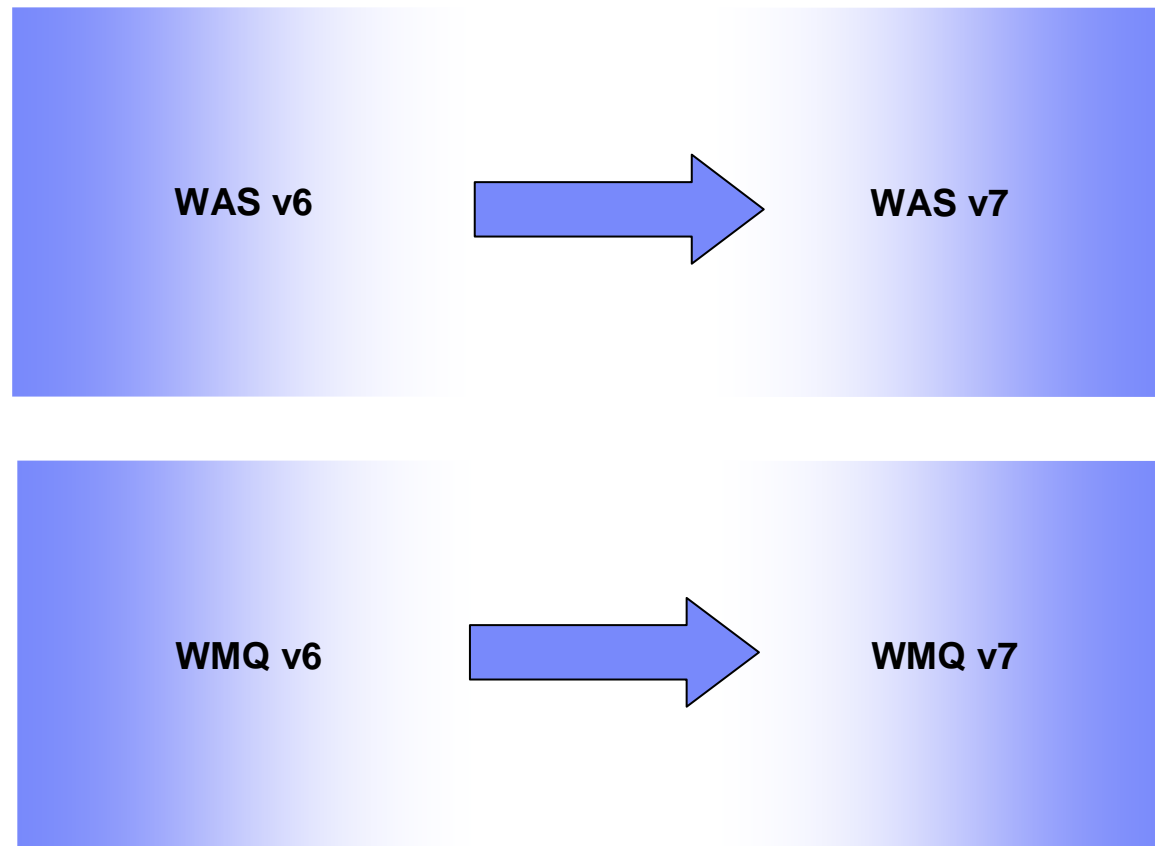
Migration Roadmap

- Two routes for migration

- **Option 1**

    - Upgrade WAS to v7 before upgrading WMQ to v7

- **Option 2**

    - Upgrade WMQ to v7 before upgrading WAS to v7

Option 1 : Upgrade WAS to v7 before upgrading WMQ to v7 (WAS 7.0.0.13 with WMQ 6.0.2.10)

- Do check pre-requisite APAR levels etc. for WMQ in provided documentation

  - Specifically WMQ APAR IC64098 is required to run with WAS v7

  - Details of recommended fixes and supported combinations are described via the WAS supported software pages (for example http://www-01.ibm.com/support/docview.wss?rs=171&context=SSFKSJ&dc=DB540&uid=swg21316899&loc=en_US&cs=UTF-8&lang=en&rss=ct171websphere)

- WAS v7 connects to WMQ using the WMQ RA as above.
  - The WMQ classes for JMS will be running in WAS in "migration mode", which has a performance and functional cost

  - MP07 JMS Performance evaluation SupportPac documents this:
    - "When connected to a v6 Queue Manager a less optimised codepath is used, which facilitates migration from v6 to v7 but which should not be considered as a long term solution if performance is important."
  - WAS v7 does not support Bindings mode connections to or before MQ 6.0.2.4
    - (see http://www-01.ibm.com/support/docview.wss?rs=171&uid=swg21316899)

- Migration mode is a simple but short-term expedient only if performance cost has been confirmed to be acceptable by a business.

Option 2 : Upgrade WMQ to v7 before upgrading WAS to v7

- Starting point is WAS v6.1 with WMQ v6 JMS Classes

- Intermediate point is WAS v6.1 with WMQ v7 JMS Classes
  - This is a valid 'end-point' if it meets business requirements
  - It is stable and supported

- The MQ_INSTALL_ROOT will by default point to the WAS directory with the WAS installed WMQ JMS libraries.

- Some of WMQ v7's new functionality and improved performance levels are both unobtainable with this combination.

- The WMQ RA <u>CAN NOT</u> be installed on WAS v6.1.

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Connecting WAS v6.1 applications to WMQ

- For bindings connection the following configuration steps are required:
    - WMQ v7 must be installed on the same machine as the application server
    - MQ_INSTALL_ROOT must be configured to point to the WMQ v7 installation directory

- For client mode applications, everything is the same as for the starting environment (WAS v6 & WMQ v6).
    - i.e. the cutdown version of WMQ JMS Client in WAS v6 is supplied by means of:
        - com.ibm.mqjms.jar
        - com.ibm.mq.jar
        - dhbcore.jar
    - Which reside by default in WAS_install_root\lib\WMQ\java\lib

WAS v7 – Important Considerations

- Messaging provider fixes come via WAS v7 Fix Packs ONLY.

- To have a WAS v7 application connect in bindings mode, WMQ must minimally be at v6.0.2.5 on Distributed platforms and v6.0.2.7 on z/OS (any WMQ v6 level can be used in client mode).

- If WAS profiles were created at v7.0.0.0 level, then a manual step is required so that future WMQ JMS updates are applied
  - (See http://publib.boulder.ibm.com/infocenter/wasinfo/v7r0/index.jsp?topic=/com.ibm.websphere.base.doc/info/aes/ae/tmm_mig.html for details)

WAS general considerations

- "Target client" field is not displayed in the WAS Administration Console v7.
  - "Target client" field for a JMS Destination in the WAS Admin. Console is not deleted in v7, it was renamed and the format was changed.
    - *Documentation at http://www-01.ibm.com/support/docview.wss?uid=swg21421492*

- A number of JMS issues are resolved between release of WAS v7.0 and current date: It is recommended that the latest WAS level is targeted at the start of the migration project
  - Note that WAS v7 release (7.0.0.13) contains latest WMQ RA (7.0.1.3)

- If migrating in place ensure WAS v7 cell names match the existing and DMgr node names match existing, or are completely new (unused)

- Prerequisite fixes are documented for WAS v6.1.*, not for WAS v6.0.*, but migration fixes are documented as late as 6.0.2.37 (Sept. 2009) and we are currently on fp41 (April 2010)

WAS 7- what's new..

- Use of Activation Specs with WMQ

- Tighter integration with Application Server SSL support

- Automatic selection of transport types

- Support for CCDT

- Channel Compression

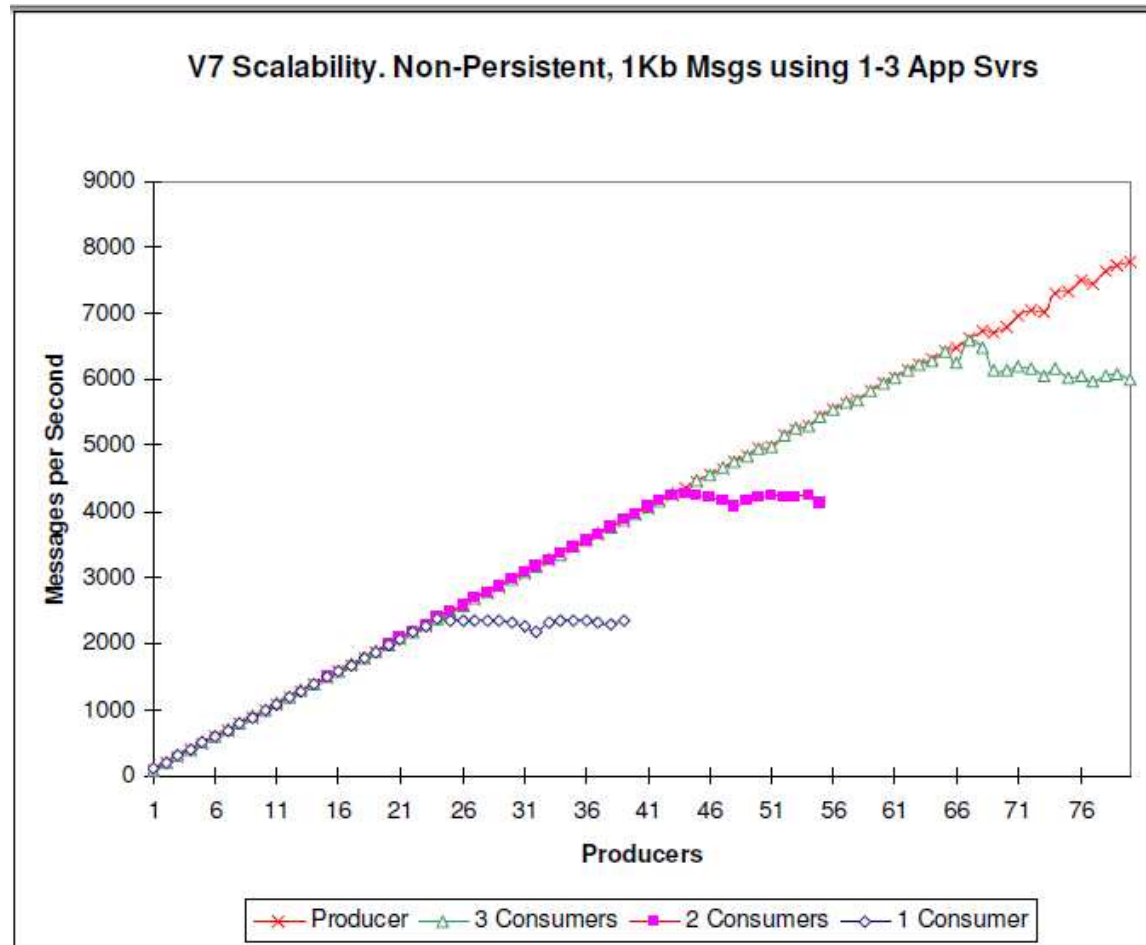- Improved scripting

- Channel Exits

WMQ v7 JMS Client – Important Considerations

- JMS is completely re-written to improve performance.

  - Jar file differences, no changes to existing apps required (apart from installing new jar).

- MQException moves to com.ibm.wmq.jmqi.jar.

  - Applications compiled with Java 1.5 will automatically pick up com.ibm.mq.jmqi.jar.

  - Applications compiled with Java 1.4.2 must have the following added to their class path:
    - jms.jar
    - com.ibm.mq.jms.jar

- The format for JMS errors has changed e.g. JMSWMQxxxx

- By default when messages are retrieved by the classes for Java at v7 they don't contain the RFH2 Header, this has been moved to the message properties.
  - To preserve the WMQ v6 behaviour (propagate RFH2 to caller), change queue attribute PROPCTL from COMPAT to FORCE

- The JMSAdmin.config file will be overwritten when upgrading to WMQ v7. Save the file to another location before performing the upgrade.

Impact of new WMQ v7 Features

- Post-migration options:
  - Full-Duplex Channels (conversation sharing)
  - Asynchronous Consumers (callback)
  - Read-Ahead (streaming)
  - Message Selectors
  - Asynchronous Put (fire and forget)
  - Message Properties

- Post-migration considerations:
  - Using PROVIDERVERSION
  - MQ bindings library location

- Actions when compiling applications, post-migration
  - MQC is replaced by MQConstants
    - *http://www-01.ibm.com/support/docview.wss?uid=swg21423244&myns=swgws&mynp=OCSSFKSJ&mync=R*
  - CLASSPATH settings when recompiling MQ JMS applications

Some graphs…

V7 Scalability. Non-Persistent, 1Kb Msgs using 1-3 App Svrs

- Source WebSphere MQ JMS v7 Performance Evaluation
  ftp://public.dhe.ibm.com/software/integration/support/supportpacs/individual/mp07.pdf
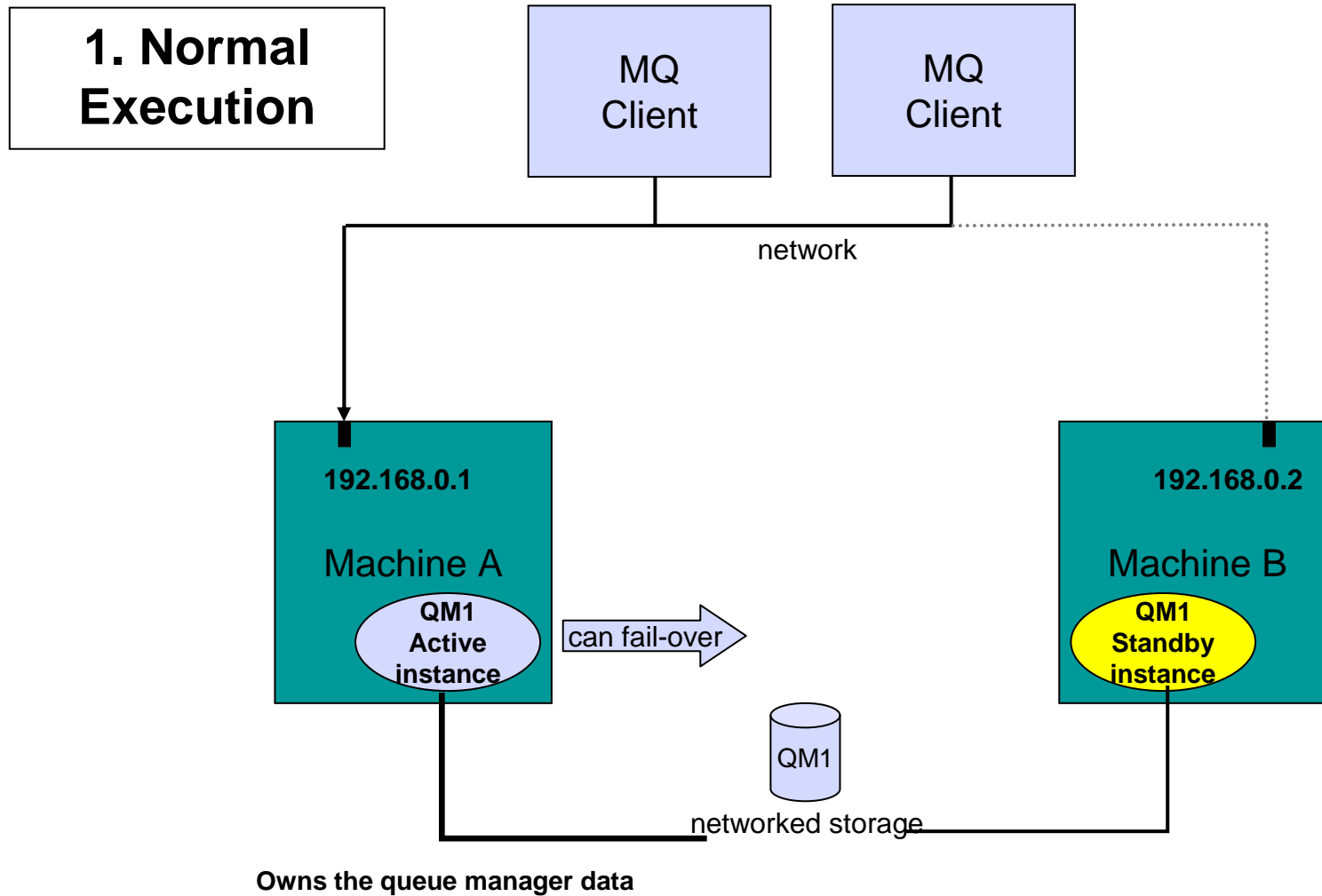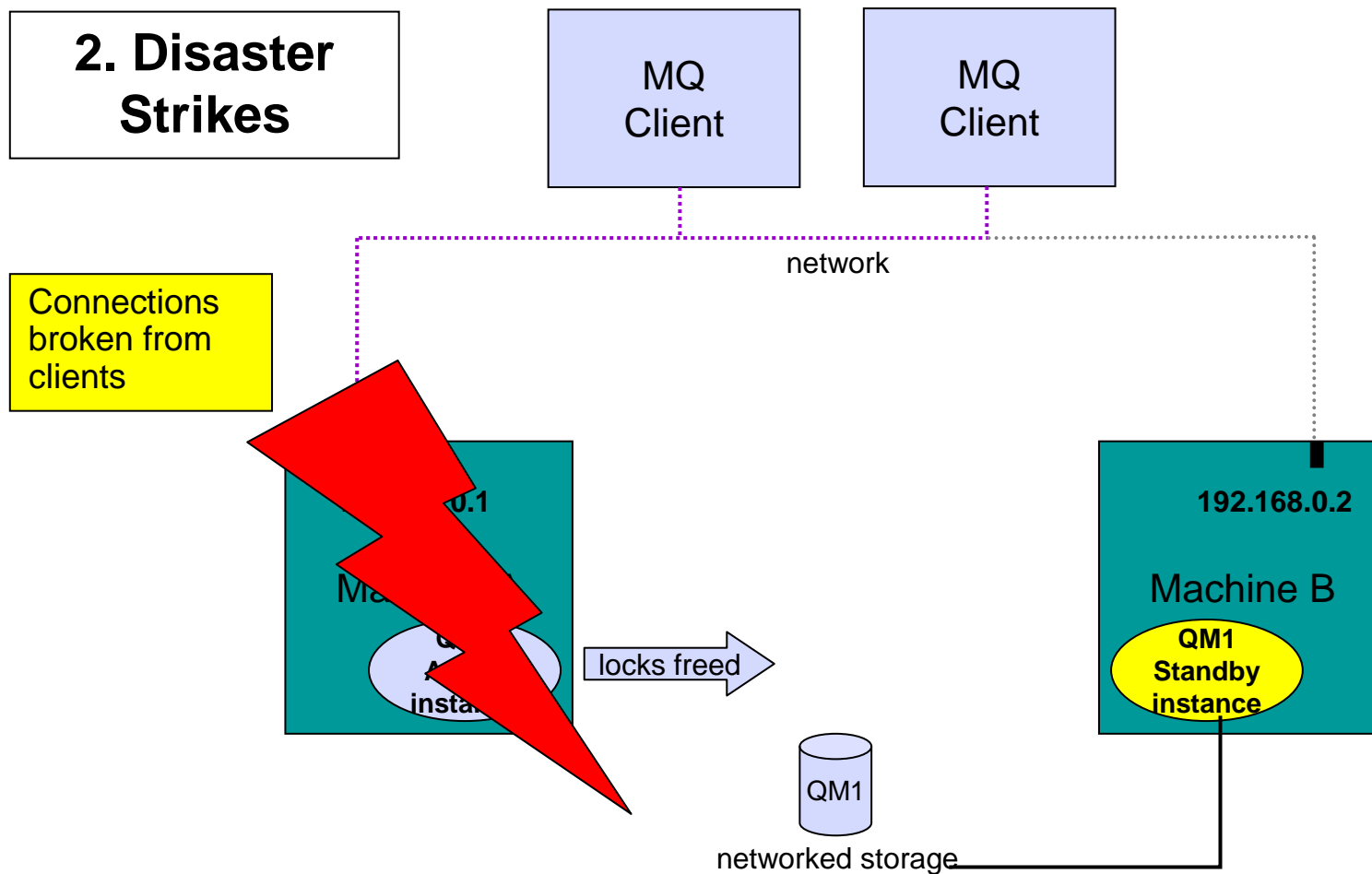
Multi Instance QueueManagers

Distributed Platforms: 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 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

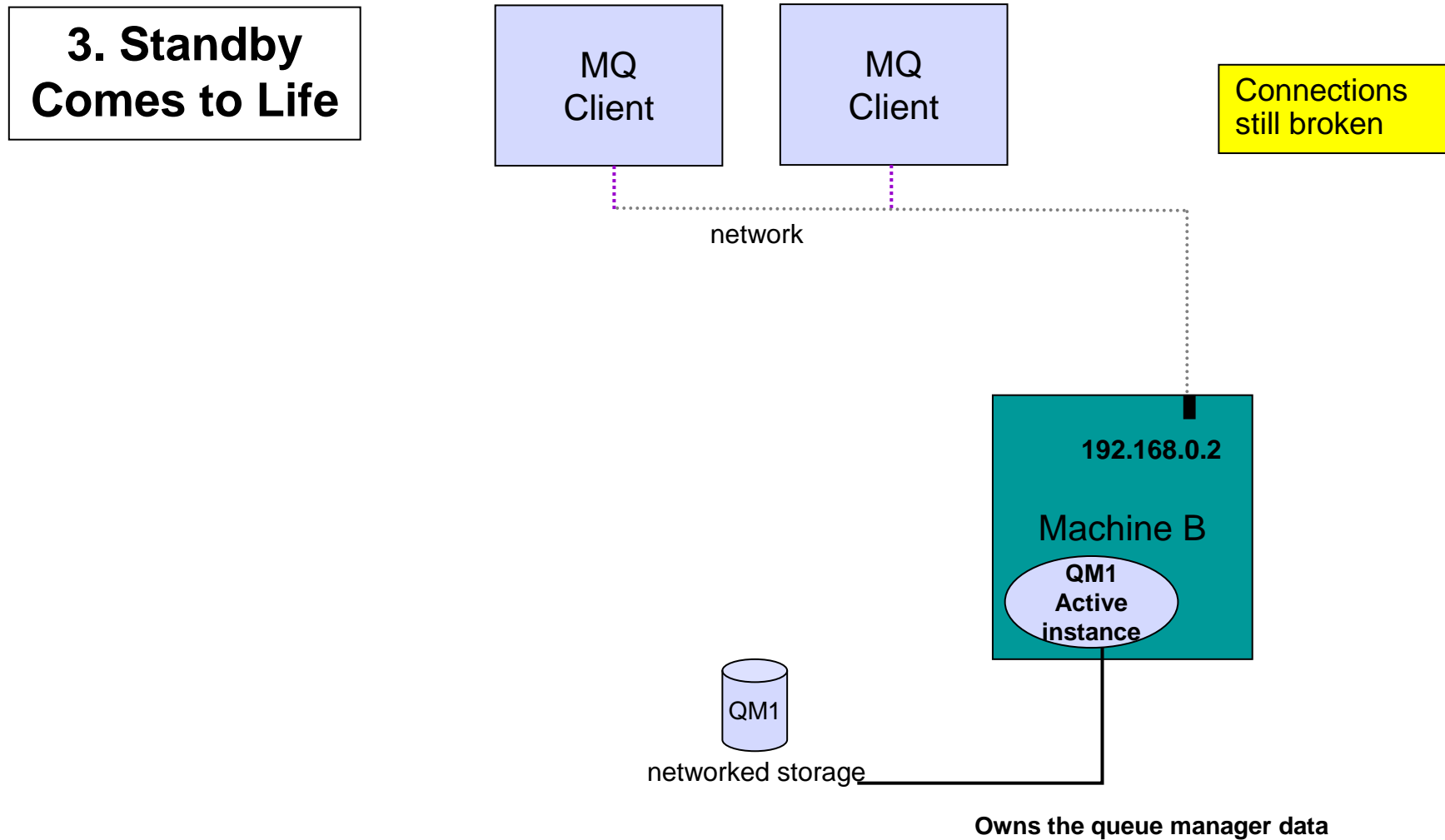# Multi-instance Queue Managers

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. Disaster Strikes

MQ Client

MQ Client

network

Connections broken from clients

192.168.0.1

Machine A

QM1 Active instance

locks freed

192.168.0.2

Machine B

QM1 Standby instance

QM1

networked storage

Multi-instance Queue Managers

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. Recovery Complete

MQ Client

MQ Client

Clients reconnected. Processing continues.

network

192.168.0.2

Machine B

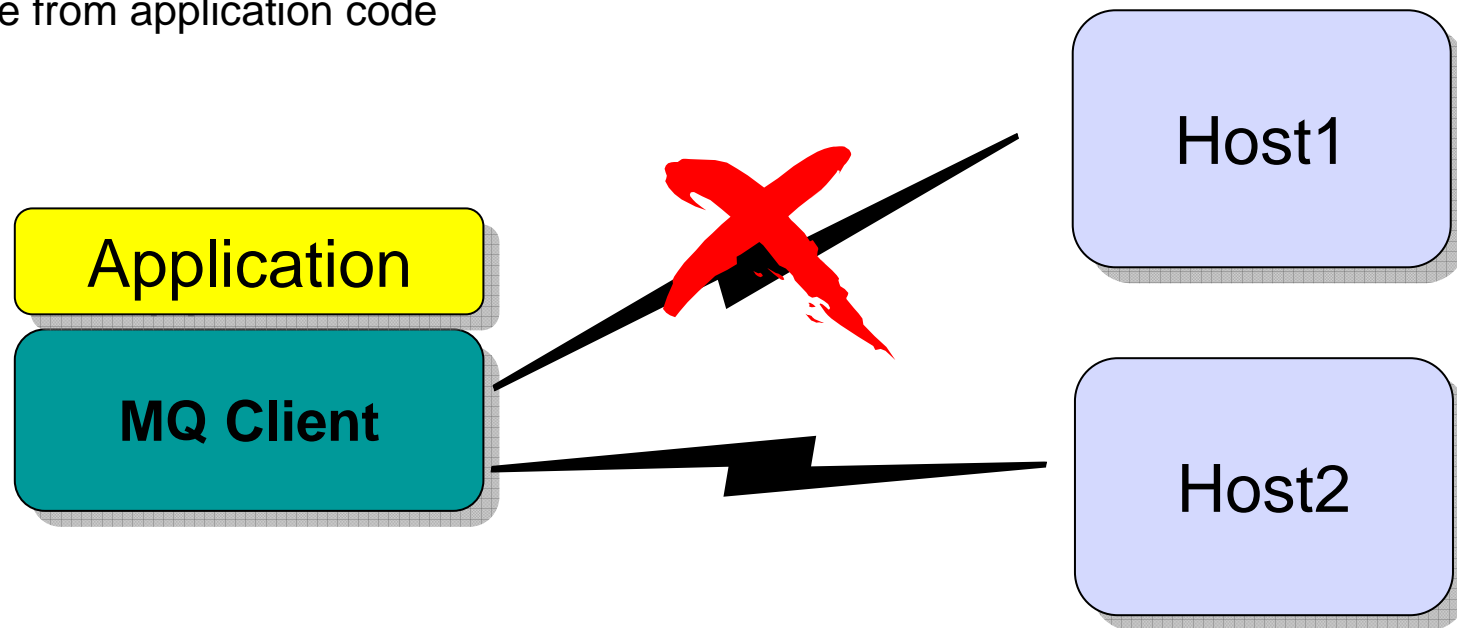**QM1 Active instance**

QM1

networked storage

Owns the queue manager data

Automatic Client Reconnection

- Client library provides necessary reconnection logic on detection of a failure
- Hides failure from application code

Application

MQ Client

Host1

Host2

Within an Application Server

- Connection to Multi-Instance Queue Managers is supported
    - Minimum of WAS 7.0.0.13 required (contains WMQ 7.0.1.3)
    - Can be configured using CCDT
    - Can be configured using custom properties
        - Connection Factories:
        - Set a custom property called XMSC_WMQ_CONNECTION_NAME_LIST to the list of host/port names that you wish to connect to. For example: host1(port1),host2(port2)
        - Activation Specs:
        Set a custom property called connectionNameList on the activation spec with the same format as above: host1(port1),host2(port2)

- Automatic Client Reconnect *is not supported* (in EJB/WEB container)
    - MDB based applications use ListenerPort/Activation Specification based reconnection
    - Automatic Client Reconnect can be used in unmanaged/client environments

Product Connectivity Information Center

- Existing documentation often very product centred – not ideal when trying to integrate two products

- This new InfoCenter is "scenario based", guiding the reader through a set of tasks and steps for scenario based designs.

- With the rich complexity of WMQ and WAS, there are often choices to be made at each step, giving excellent flexibility but often leading to confusion

- The first scenario provided is a basic scenario to allow a JMS client running on WAS to connect to WMQ; everything required to implement this scenario on Windows is provided.

- *http://publib.boulder.ibm.com/infocenter/prodconn/v1r0m0/index.jsp.*

SOA Sandbox

- IBM Dedicated host environment

- Pre-configured software
  – Allowing uses to trial IBM Software without downloading / installing / configuring

- Guided tutorials to get you up and running in minutes

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Newest sandbox exercise
Learn how to use WebSphere MQ Explorer to simplify the configuration of a point-to-point scenario for sending message data, as well as how to verify that your messages transited the queues successfully. More >

We love our users!

- Dedicated "WebSphere Messaging Community Lead" to actively monitor and engage in community activities

- developerWorks
  - IBMer's blog on messaging

- MQSeries.net
  - www.mqseries.net

- Twitter
  - @IBM_WMQ @IBM_Broker

- Store and Forward – T.Rob's WMQ Security Blog
  - www.t-rob.net

- Open and vibrant ecosystem
  - E.g. PyMQI, mosquito
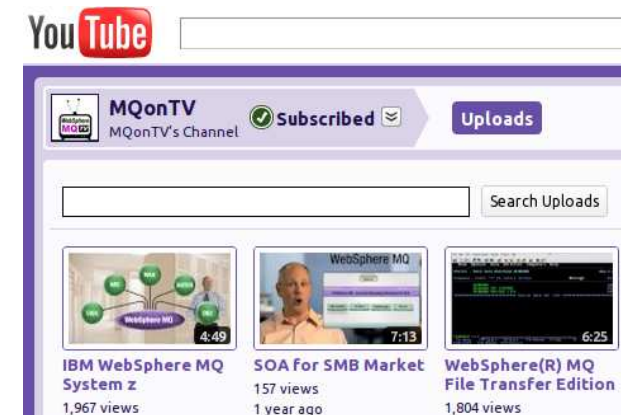
Further Information

- WebSphere MQ Resource Adapter Support Statement
  - http://www-01.ibm.com/support/docview.wss?rs=171&uid=swg27009524

- WMQ Info Center
  - http://publib.boulder.ibm.com/infocenter/wmqv7/v7r0/index.jsp

- WAS product information
  - http://www-306.ibm.com/software/webservers/appserv/was/

- WAS Info Center
  - http://publib.boulder.ibm.com/infocenter/wasinfo/v6r0/index.jsp
  - http://publib.boulder.ibm.com/infocenter/wasinfo/v6r1/index.jsp
  - http://publib.boulder.ibm.com/infocenter/wasinfo/v7r0/index.jsp

- Using WebSphere MQ Java Interfaces in J2EE/JEE Environments
  - http://www-01.ibm.com/support/docview.wss?rs=171&context=SSFKSJ&dc=DB520&uid=swg21266535&loc=en_US&cs=UTF-8&lang=en&rss=ct171websphere

- Evaluating Open Source Application Servers
  - https://www14.software.ibm.com/webapp/iwm/web/signup.do?source=sw-app&S_PKG=ossred&S_TACT=109J63DW&S_CMP=web_ibm_ws_appinfra_bot_wascefeat

Thank you!

… questions?