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# The MQ journey to date and what's new in MQ V9.1 LTS and MQ V9.1.n CD releases

Mayur Raja (mayur_raja@uk.ibm.com)
*MQ for z/OS Development*

**2019** IBM Systems Technical University
08:30-09:45 - Monday 7th October 2019
Veronese 2502-Level 2
Las Vegas

TechU

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# The MQ journey to date and what's new in MQ V9.1 LTS and MQ V9.1.n CD releases

Lyn Elkins – elkinsc@us.ibm.com

*MQ Technical Grunt*

**2019** IBM Systems Technical University

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# Agenda

- The business value of IBM MQ
- IBM MQ offerings
- IBM MQ for z/OS enhancements
- IBM MQ Advanced for z/OS VUE enhancements
- Migration
- Helping Developers
- IBM MQ and IBM Event Streams
- Fault Tolerance
- Cloud Native Messaging

# The business value of IBM MQ

# IBM MQ is *the* solution for business critical messaging

- The world depends on reliable, secure messaging and **85% of the fortune 100 depend on IBM MQ***
- Your bank transfers complete without losing your money, with **all of the worlds top 50 banks using IBM MQ***

IBM Messaging

1 + 1 = 2

Simple

Scalable

Precise

Connected

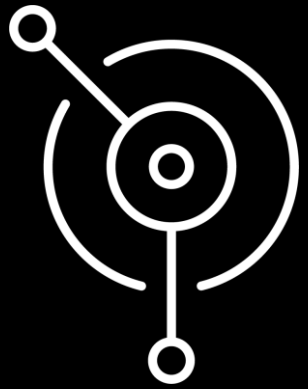
Reliable

Secure



*Correct as of end 2016 against http://www.relbanks.com/worlds-top-banks/assets and http://beta.fortune.com/fortune500/list/

# Run IBM MQ in any location or cloud, exactly as you need it



## On-premise, software and the MQ Appliance

Linux
AIX
IBM Z
Windows
Solaris
IBMi
HPE NonStop
zLinux
Appliance

## Run MQ yourself in public or private clouds

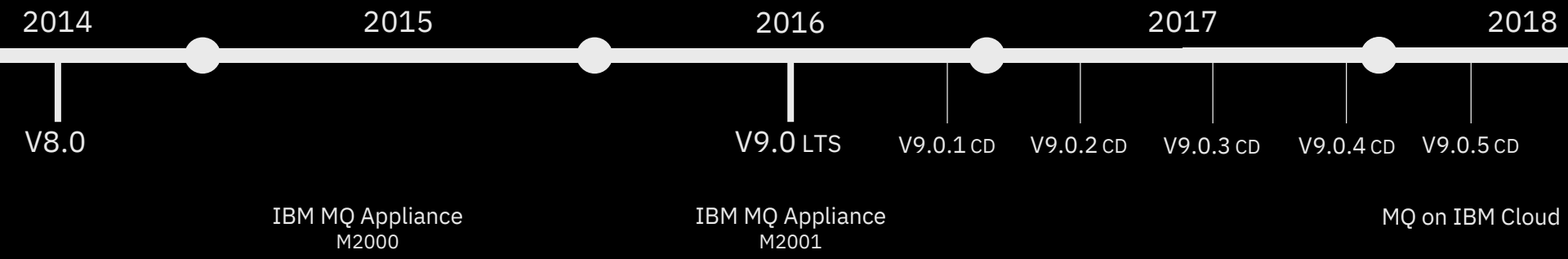
AWS
Azure
IBM Cloud
IBM Cloud Private
Red Hat OpenShift
Kubernetes

## Let IBM host MQ for you with its managed SaaS MQ service in public clouds, IBM Cloud and AWS

IBM Cloud
powered by aws

# IBM MQ offerings

# IBM MQ: long term support and continuous delivery




In 2016 MQ introduced a dual Long Term Support and a Continuous Delivery model

## Continuous Delivery

- New CD versions of MQ are released approximately every four months, incrementally introducing new product capabilities
- Intended for those that can continually integrate

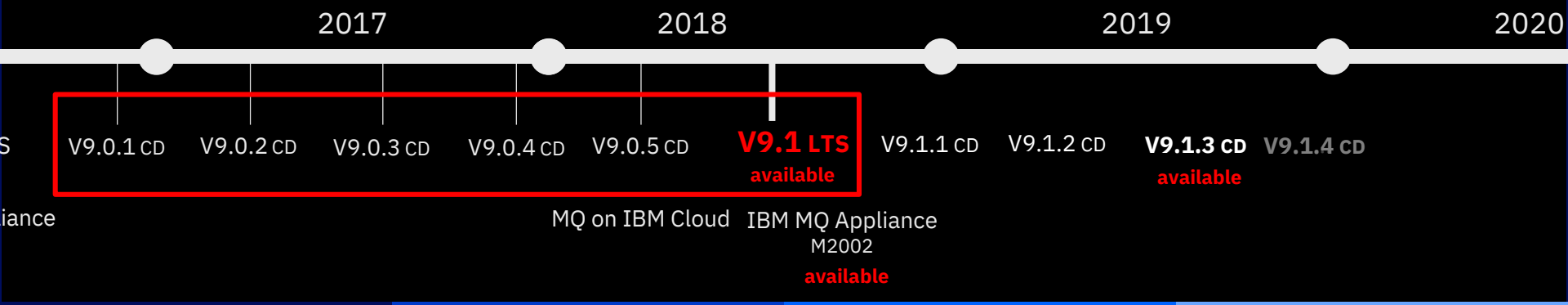
## Long Term Support

- Approximately every two years a new LTS version is released, rolling up many of the CD capabilities into a release with 5+3 support attached
- Required by those looking for fixed function

## Mix and Match

- Both are available under the same license
- Both can interoperate, just like any previous version of MQ

# IBM MQ: Long Term Support and Continuous Delivery

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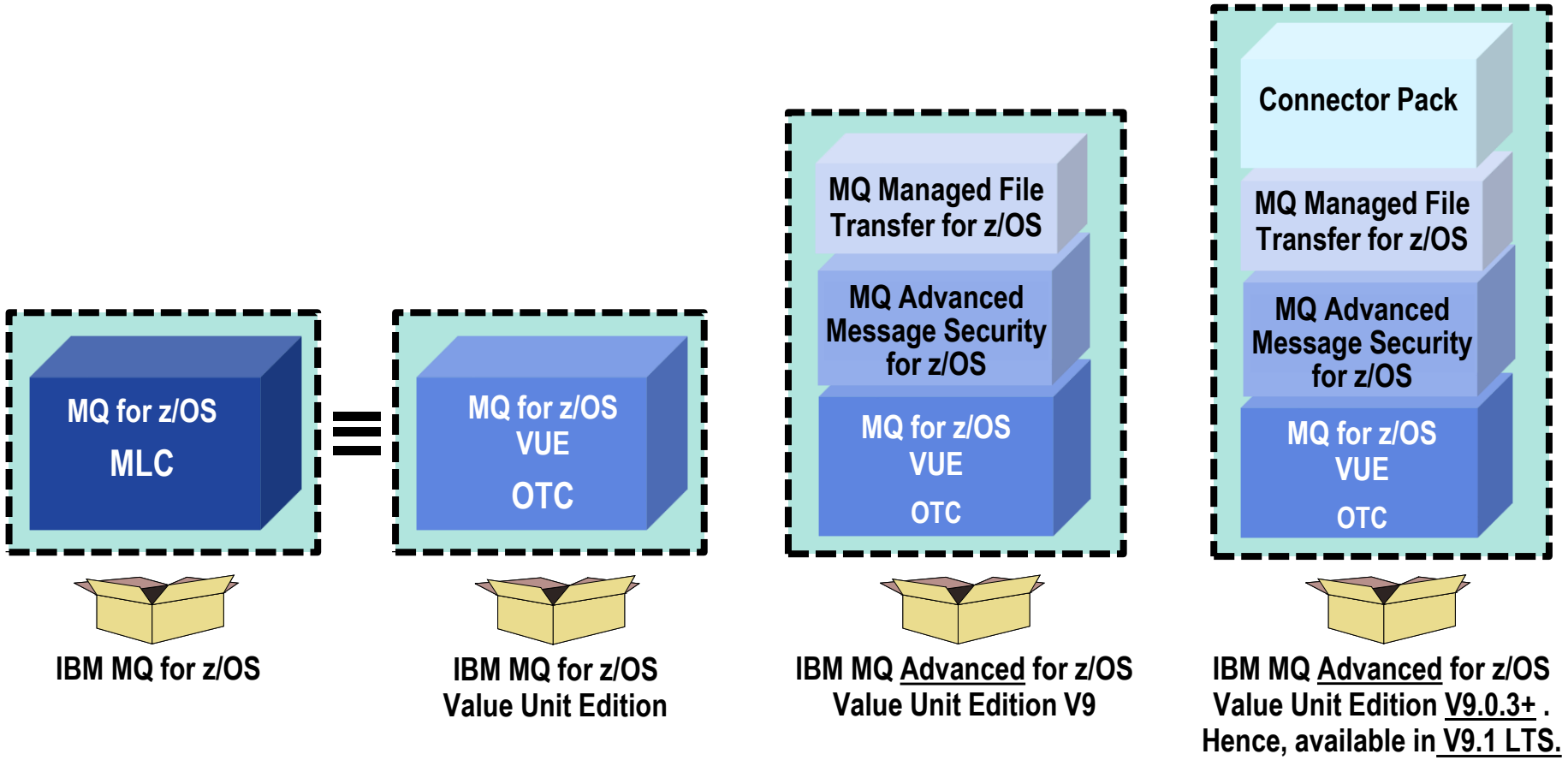
The function delivered in the 9.0.x CD releases is now available in the long term support release **V9.1 LTS**

# Value with added Connectivity in MQ Advanced for z/OS VUE




IBM MQ for z/OS

IBM MQ for z/OS Value Unit Edition

IBM MQ Advanced for z/OS Value Unit Edition V9

IBM MQ Advanced for z/OS Value Unit Edition V9.0.3+ . Hence, available in V9.1 LTS.





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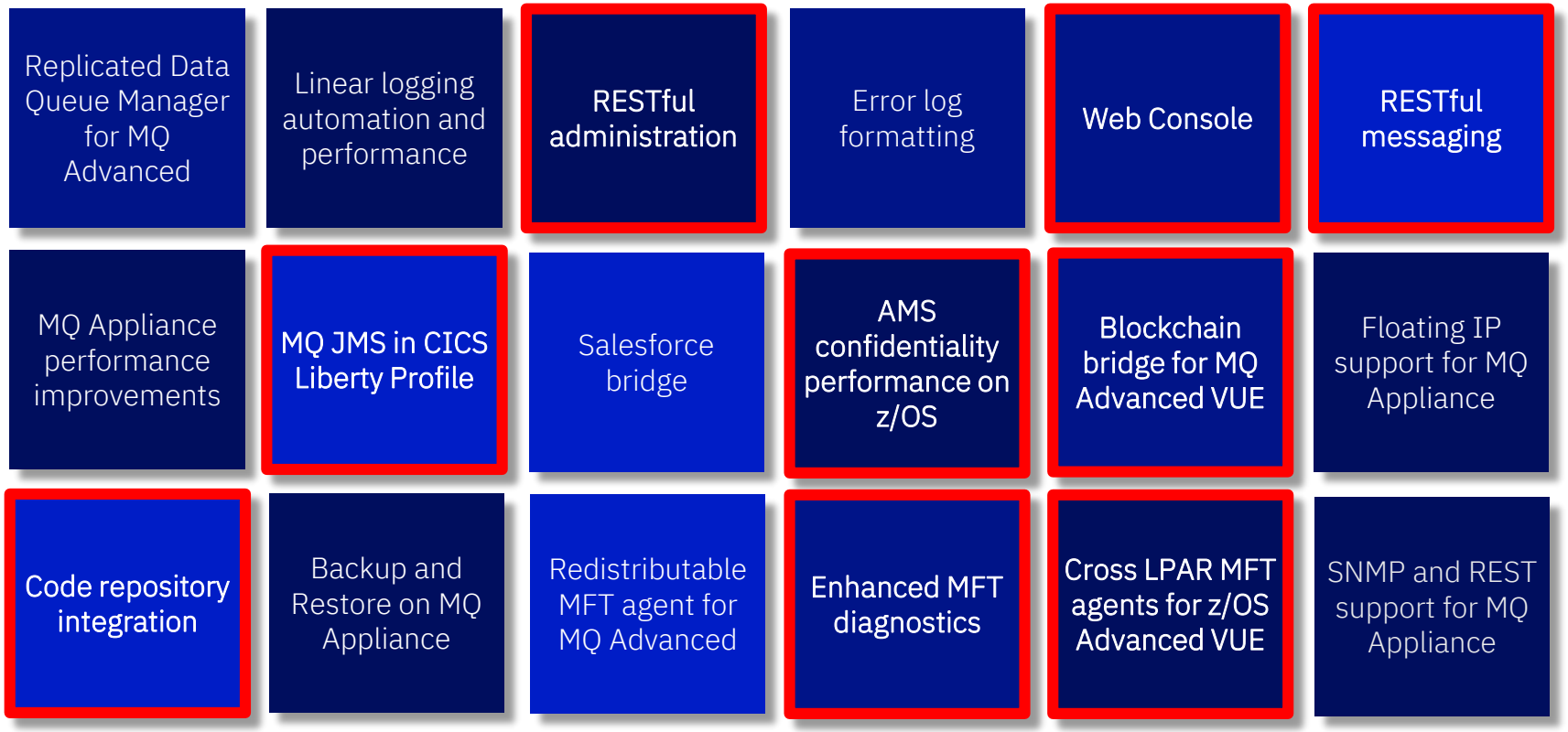
# IBM MQ for z/OS enhancements

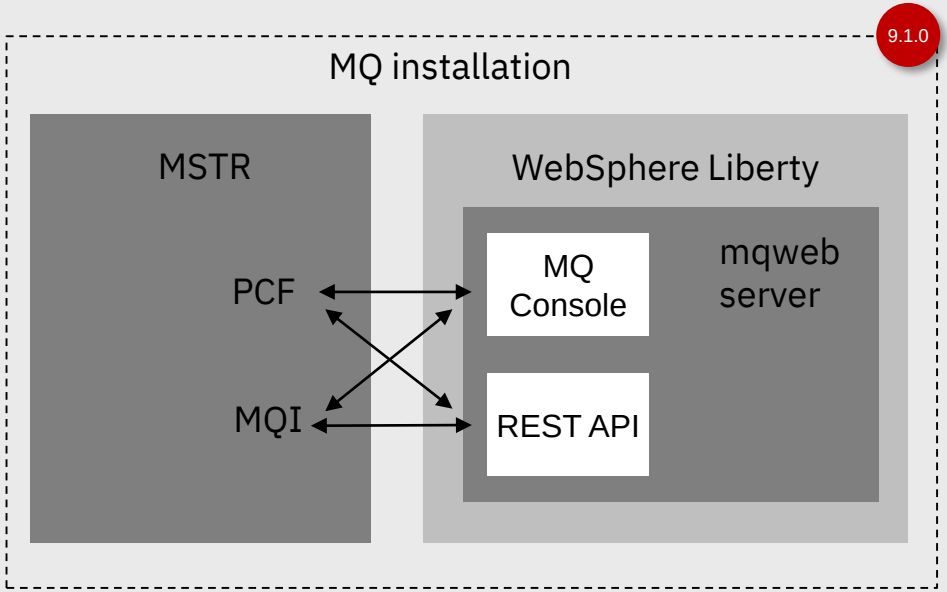
# MQ 9.0.x CD content, now available with V9.1 LTS




Items in red are available on z/OS

# New web server

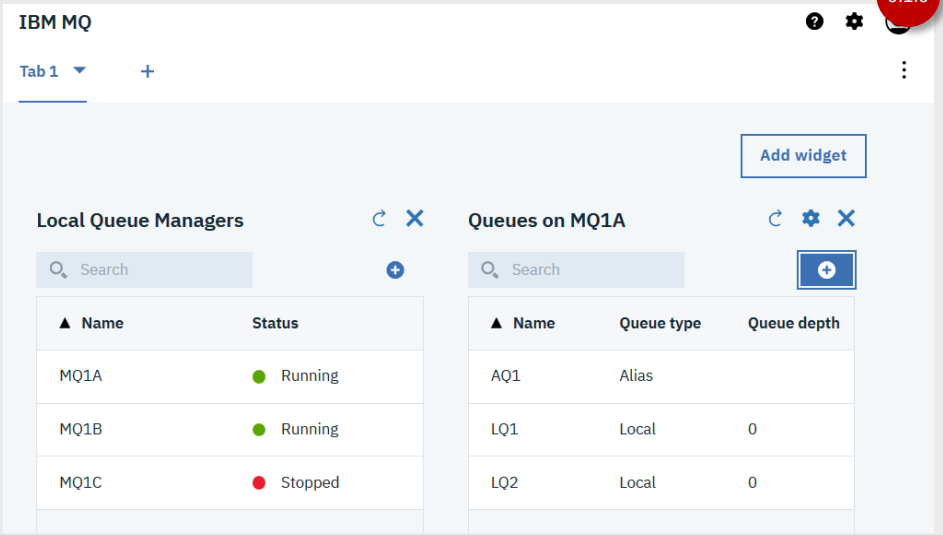
- Optional ZFS feature containing a web server (mqweb)
- Runs on a bundled version of WebSphere Liberty Profile
- Enables both the MQ Console and REST APIs
- Simple configuration using xml
- Samples provided to get started quickly
- Commands provided to simplify some configuration
- Flexible role based security, can reuse existing RACF configuration

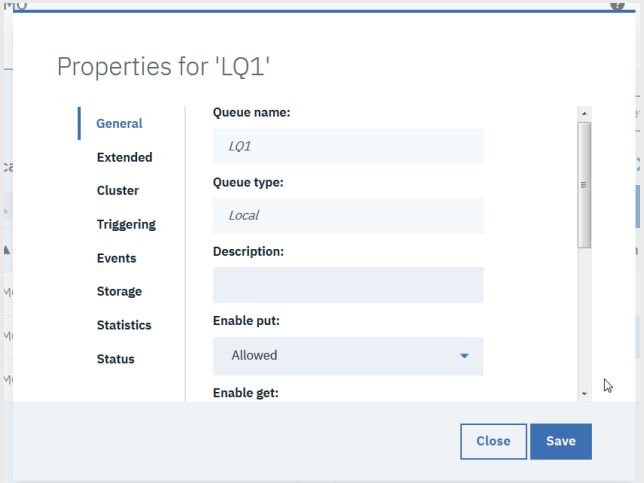



```
//*********************************************************************
//*
//         PROC
//*
//   SET INSTDIR='/u/mleming/mqm/V9R1M0/web'
//   SET USERDIR='/u/mleming/mqm_user/V9R1M0'
//*
//STEP1    EXEC PGM=BPXBATSL,REGION=0M,TIME=NOLIMIT,
//   PARM='PGM &INSTDIR./lib/native/zos/s390x/bbgzsrv mqweb --clean'
//WLPUDIR  DD PATH='&USERDIR.'
//STEPLIB  DD DSN=ANTZ.MQ.V910.DFCT.OUT.SCSQANLE,DISP=SHR
//         DD DSN=ANTZ.MQ.V910.DFCT.OUT.SCSQAUTH,DISP=SHR
//STDOUT   DD SYSOUT=*
//STDERR   DD SYSOUT=*
//STDIN    DD DUMMY
//STDENV   DD *
JAVA_HOME=/java/java80_64/J8.0_64
PATH=/u/mleming/mqm/V9R1M0/web/bin:/bin:/usr/sbin
LIBPATH=/u/mleming/mqm/V9R1M0/java/lib
//*
```

# MQ Console feature for web-based administration

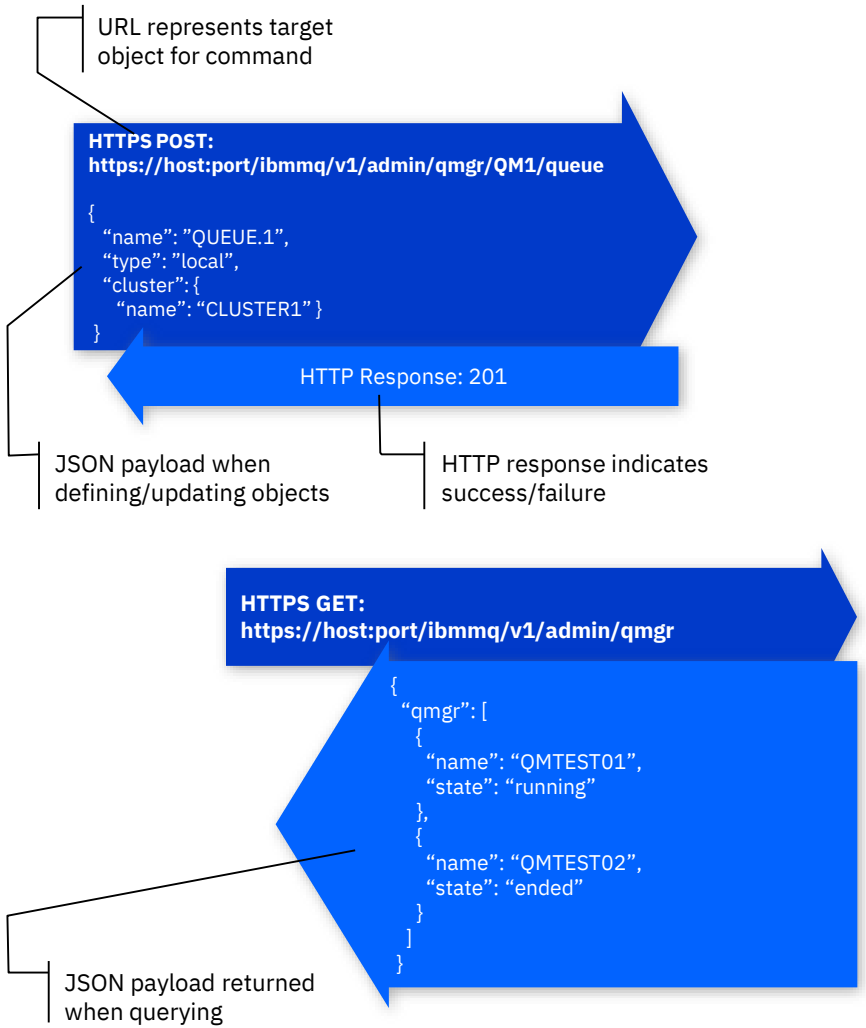
- Point a browser at an MQ installation to allow configuration of your MQ resources, as well as basic validation by sending/receiving messages
- No need to install MQ Explorer on multiple machines
- Easily share dashboard configuration between users, to allow you to get going quickly
- Currently provides a subset of the capabilities of MQ Explorer



# MQ REST API for administration

- MQ has supported scripting and programmatic administration for many years, but it requires MQ knowledge and tooling
- MQ has been increasing support for a RESTful administrative API to enable much of what's available today with MQSC and PCF. But in a more intuitive way to many, using the URL and structured JSON payloads to define the operations
- Being over HTTPS also enables the embedding of MQ administrative operations into many environments and tools that previously would not be possible
- Evolution of the REST API will continue in 9.1.x CD



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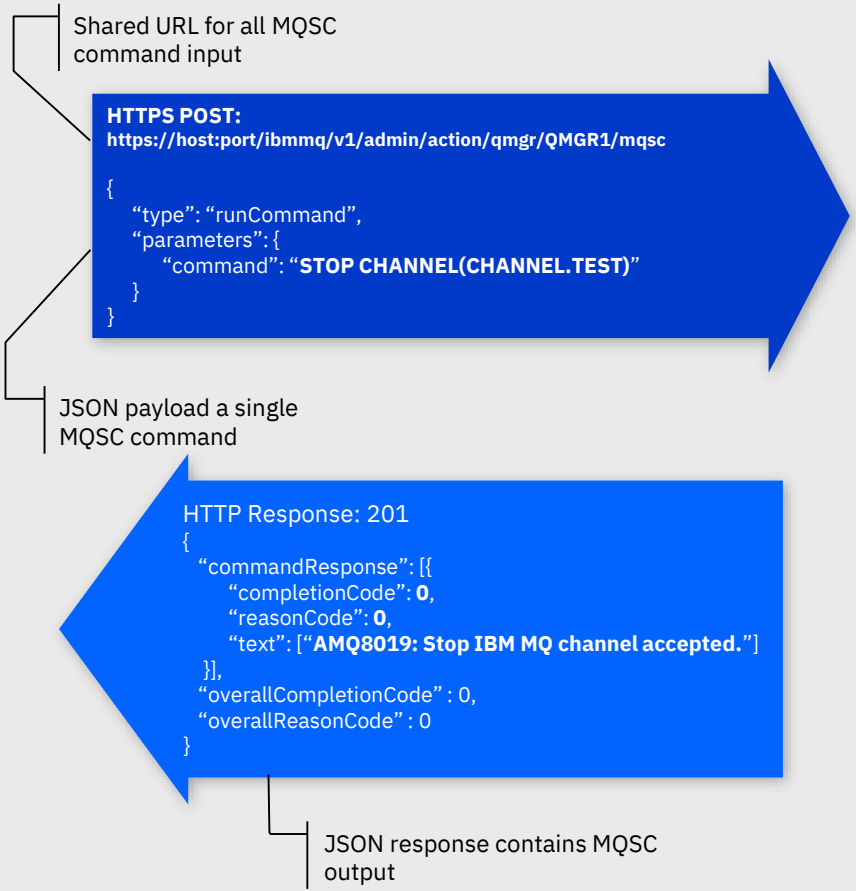
## MQSC over REST

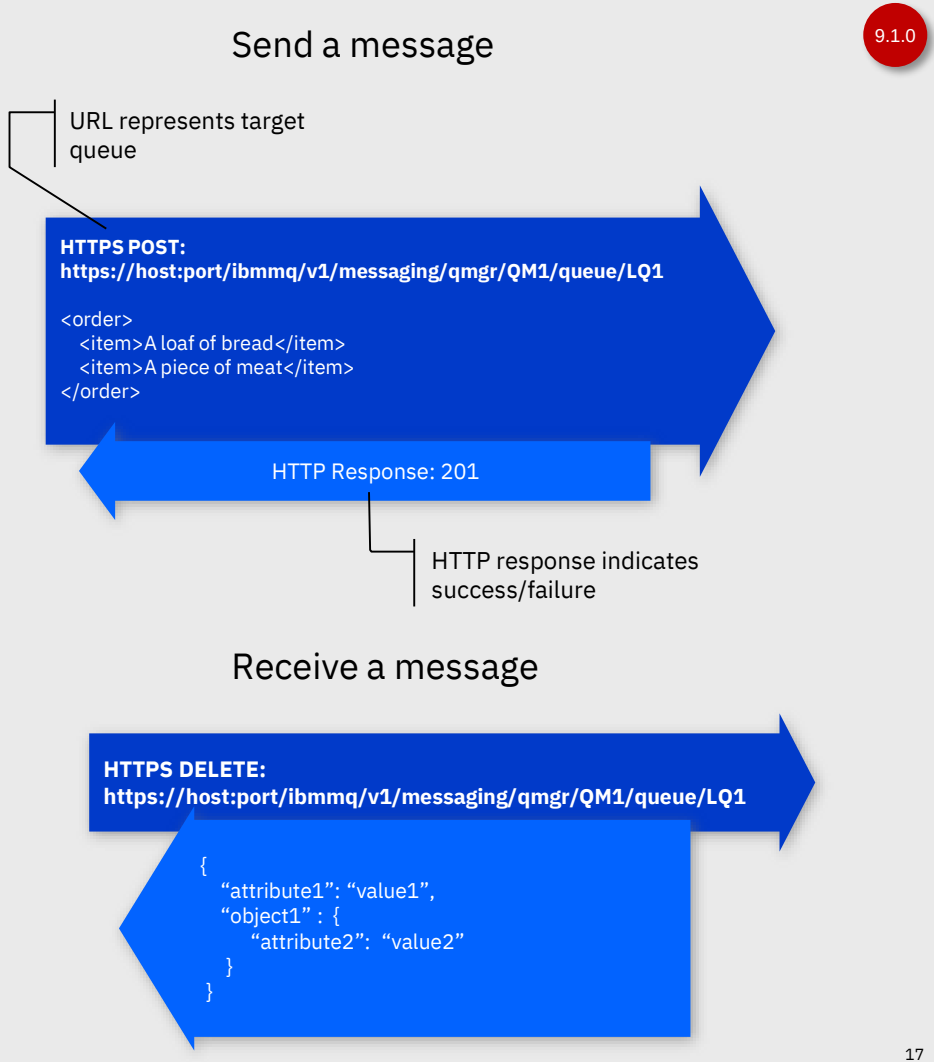
9.1.0




**Per object REST also available**

# MQ REST API for messaging

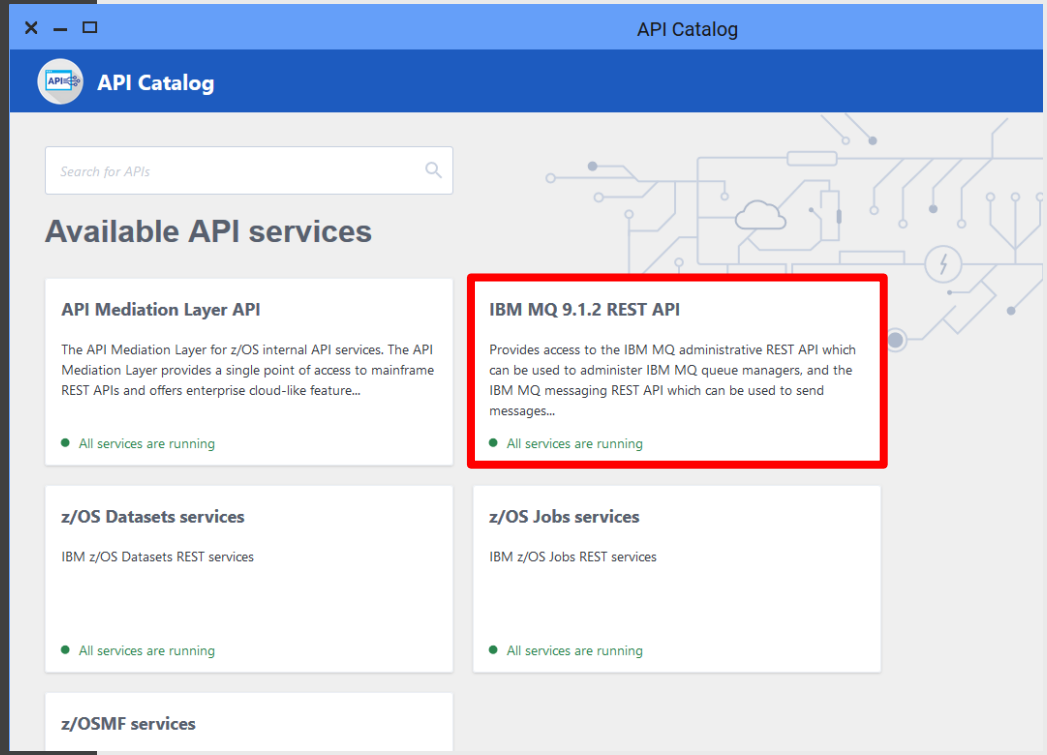
- A simple light-weight, built-in, REST API for messaging
- Doesn't require installation of an MQ client
- Allows you to build messaging into your applications regardless of where they run, or the language they are written in
- Currently supports point-to-point text based messaging
- Evolution of the messaging REST API will continue in 9.1.x CD
- Replaces the HTTP bridge which has now been removed



# Support for MQ with Zowe

- Zowe is an open source mainframe tools project based on a collaboration between IBM, CA and Rocket
- Provides tools to make it easier, and more natural, to administer z/OS from a laptop environment, by treating z/OS like any other cloud platform
- Includes a virtual desktop, API gateway, rich set of REST APIs, CLI
- MQ is starting to add support...

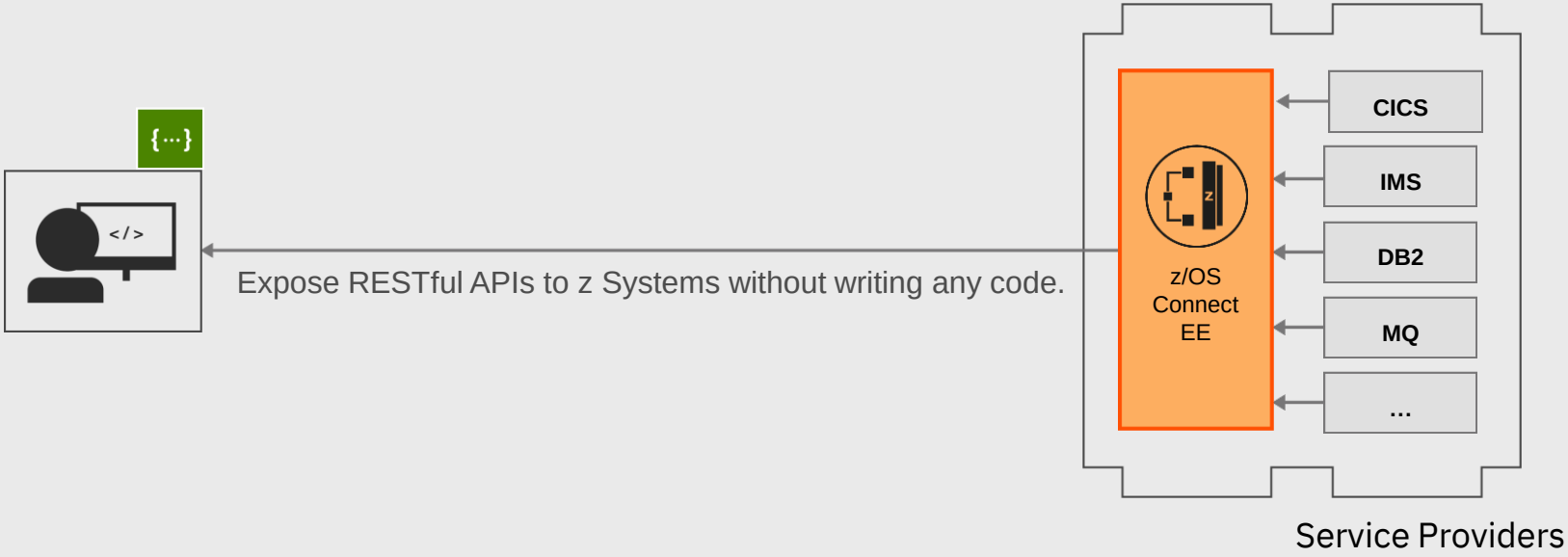
MQ REST API available in Zowe API Gateway




Benefit: Common URL for all z/OS REST APIS

# z/OS Connect EE

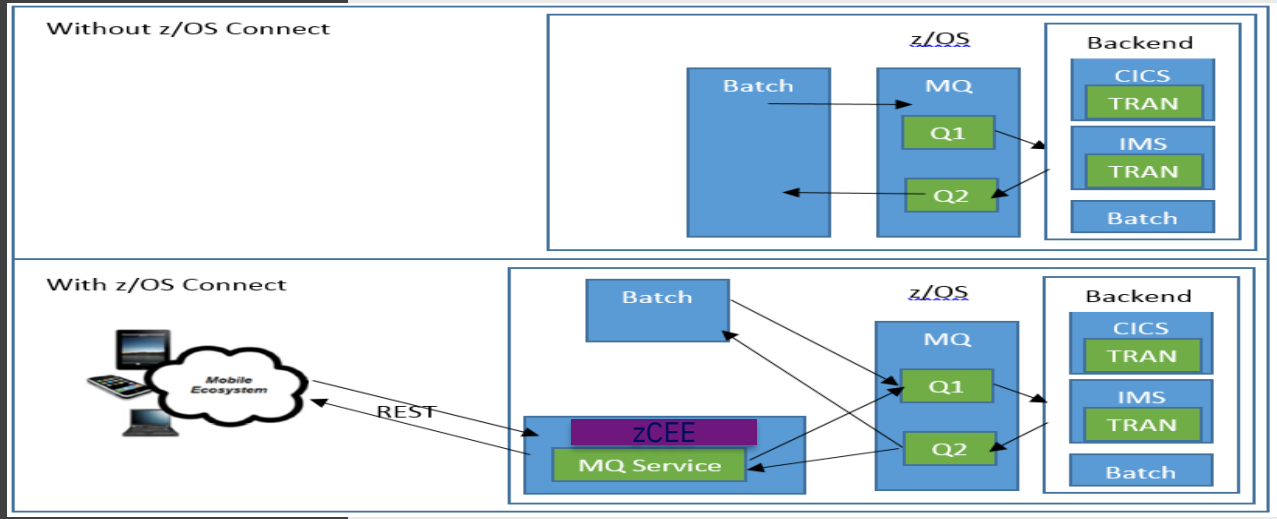
z/OS Connect EE provides a single, RESTful entry point to your z systems assets and data
Enables reuse of existing assets, exposing them to environments where it is natural to use REST
Those new consumers do not need to understand or be aware of the specifics of the subsystems
No changes to subsystems required, all handled via configuration



# MQ service provider for IBM z/OS Connect Enterprise Edition

- Free of charge z/OS Connect service provider that allows existing services that are fronted by MQ to be accessed via a RESTful front end
- Supported with MQ 8 and onwards
- Shipped as part of z/OS Connect EE 3.0.21 including build toolkit
- Clients need have no knowledge of MQ
- MQ information hidden by configuration, but advanced users can specify some MQ attributes using HTTP headers

Existing MQ environment, CICS and IMS consuming data via MQI, driven by batch or WAS environments



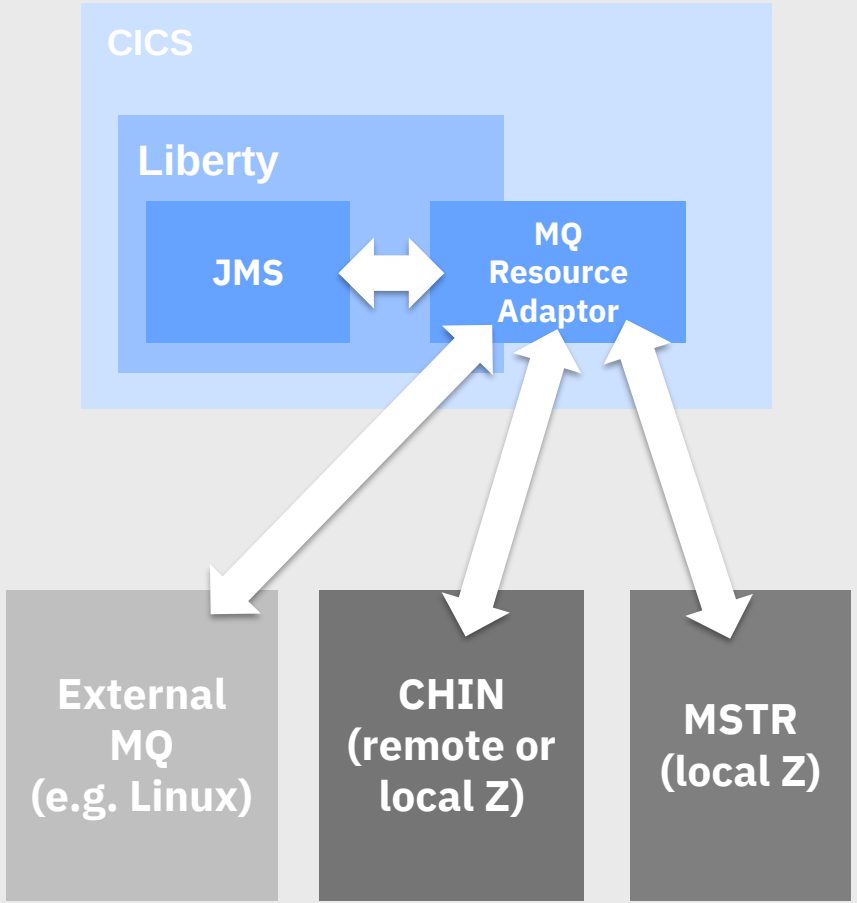

Expose **bespoke** REST APIs for particular MQ resources to new consumers, who don't understand COBOL copybooks / PL/I. Backend is hidden and invoked using JSON / HTTP. No changes to batch etc.

# Improving Java support within CICS

- MQ V8 added support for MQ JMS in CICS OSGi JVM Servers
- CICS now provides embedded Liberty server – JEE resources can exploit CICS resources
- Allows CICS Liberty to use MQ resource adapter just like normal Liberty
- Run existing Liberty messaging apps such as MDBs inside CICS
- Connections to MQ supported using either client or bindings mode
- Requires CICS 5.3 + PI58375 + MQ 9.1.0 resource adapter, or one from an earlier CD release (9.0.1 and later

9.1.0

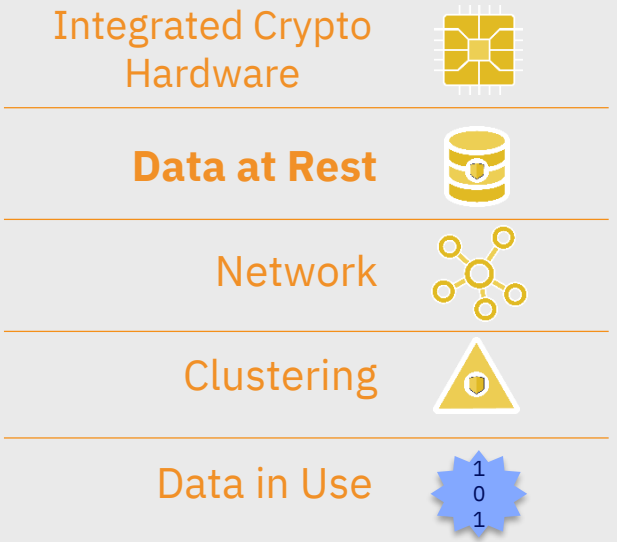
MQ JMS in CICS Liberty Profile



# Dataset encryption

- Last year z/OS added support for policy based dataset encryption in z/OS 2.2 and later
- Requires a CryptoExpress coprocessor to use!
- Dataset encryption can be used with a subset of MQ's datasets
- Supported datasets:
  - BSDS
  - CSQINP*
  - Archive logs
- Unsupported datasets (will get errors if policy defined and used):
  - Pagesets
  - Active Logs
  - SMDS
- If you want to ensure that your message data is protected at REST in all cases then we recommend you make use of AMS

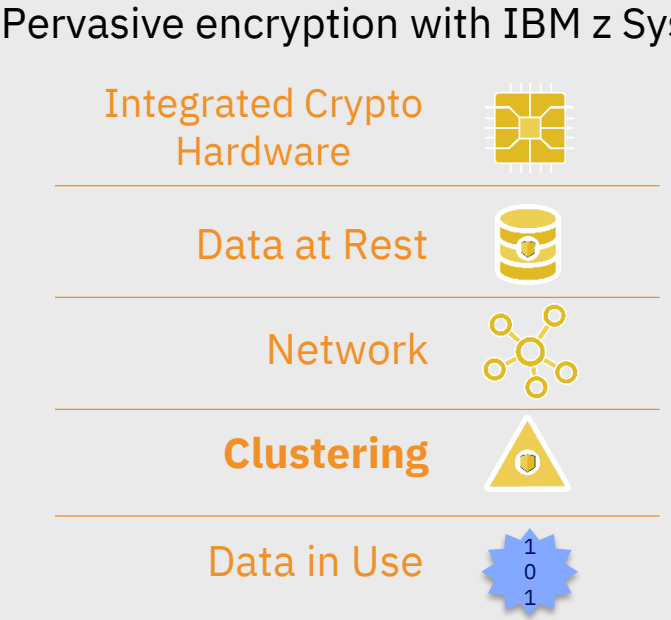
Pervasive encryption with IBM z Systems




https://developer.ibm.com/messaging/2017/08/30/mq-use-dataset-encryption-ibm-zos-v2-2/

# CF encryption

- z/OS 2.3 added support for encryption of data sent to CF list and cache structures
- Encryption protects data both inflight, and when at rest in the structure
- Encryption/decryption is performed by z/OS LPARs connected to the CF, not the CF itself
- Requires a CryptoExpress coprocessor to use!
- Entirely transparent to MQ, and fully supported
- Measurements in the lab have shown that using CF encryption with MQ has a low overhead, less than 6%



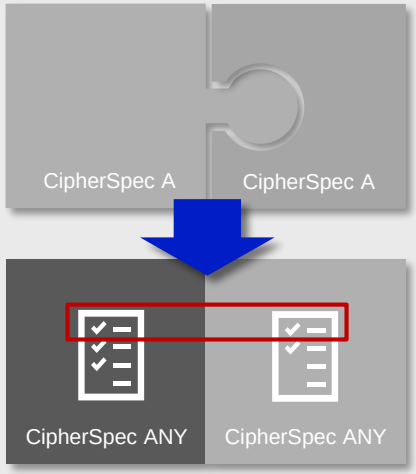
# Managing channel CipherSpecs

9.1.1

- Making it easier to keep up-to-date with ever changing ciphers, simplifying migration

- Rather than needing to match the CipherSpec on both ends of a channel, MQ 9.1.1 CD introduced ***ANY_TLS12*** and MQ will negotiate the strongest CipherSpec available to both ends

Also on z/OS the SECPROT attribute has been added to DIS CHSTATUS to indicate what security protocol is currently in use. SSLCIPH shows the actual cipher spec being used




SECPROT(**TLSV12**)

SSLCIPH(**ECDHE_RSA_AES_256_GCM_SHA384**)

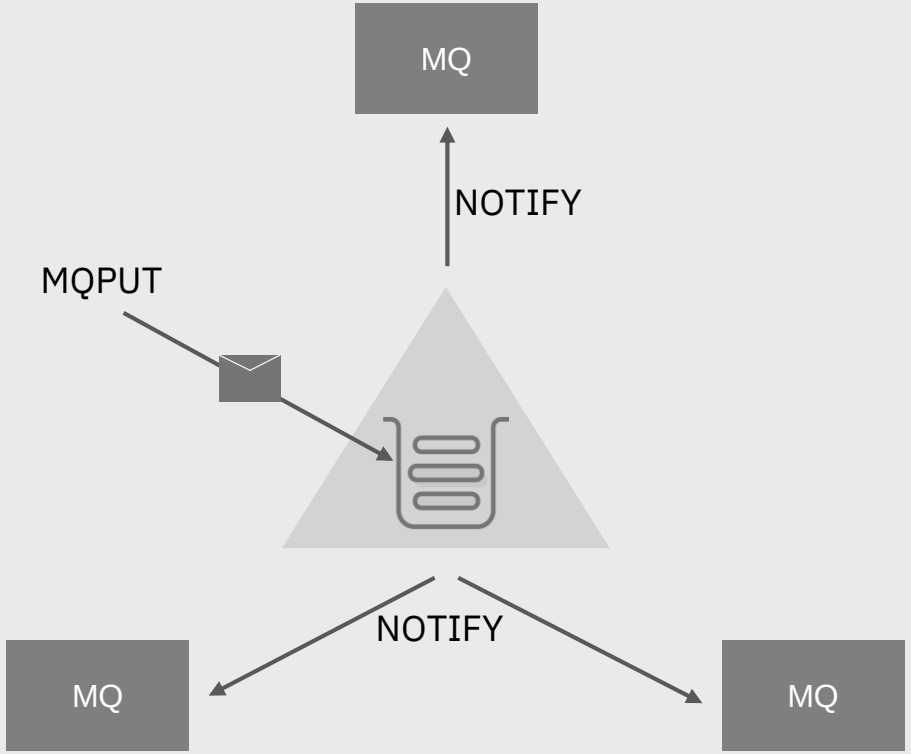
# Improved workload balancing options for shared queues

- CF list monitoring is used to monitor the state of list structures containing shared queues

  When a queue's depth transitions from zero to non-zero, the CF notifies queue managers in the queue sharing group

- The queue managers might perform a number of actions, including notifying trigger monitors that are using TRIGGER(FIRST), or applications which are performing a get-wait

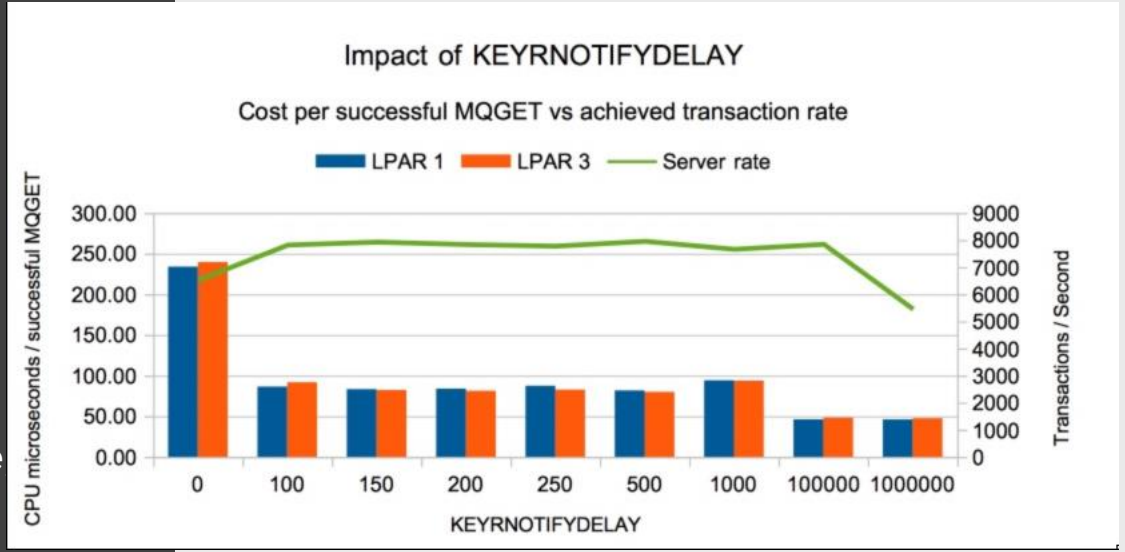
- All queue managers notified at the same time which causes a race for the messages and in some cases workload skewing or a large number of empty gets



# Improved workload balancing options for shared queues

- z/OS 2.3 introduces a new CFRM attribute: KEYRNOTIFYDELAY
- Can be used to notify one queue manager earlier than the others which **might** reduce skewing/empty gets
- If the target queue manager doesn't action the notify in the time period, in microseconds, specified by the attribute all other queue managers are notified

  Very dependent on environment and workload

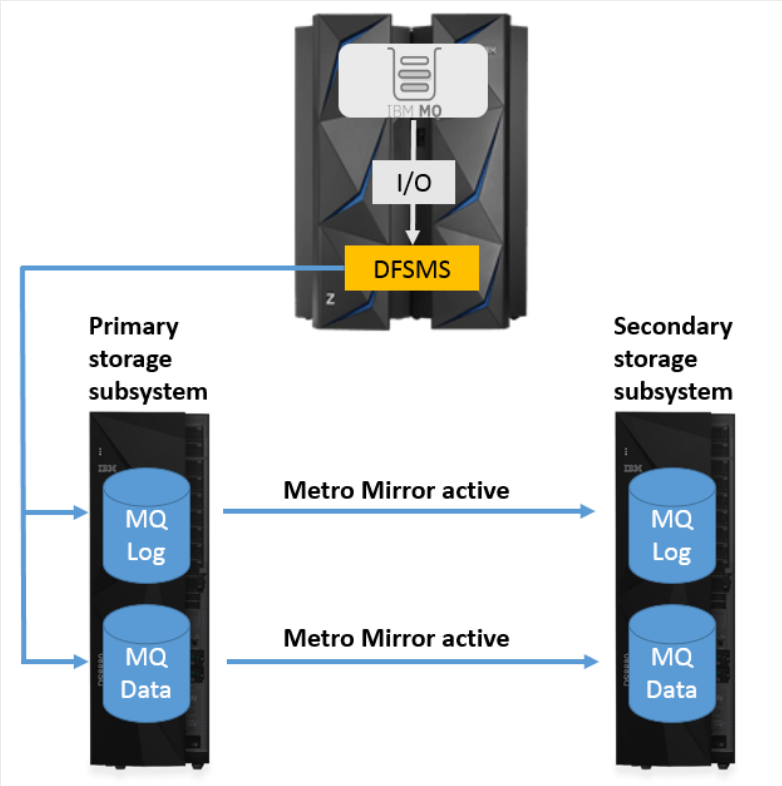



```
STRUCTURE
   NAME(QSG1STRUCT1)
   SIZE(1024M)
   KEYRNOTIFYDELAY(500)
   ...
```

https://developer.ibm.com/messaging/2018/06/22/z-os-v2r3-new-cfrm-policy-attributes-impact-mq/

# Optimize by exploiting zHyperWrite

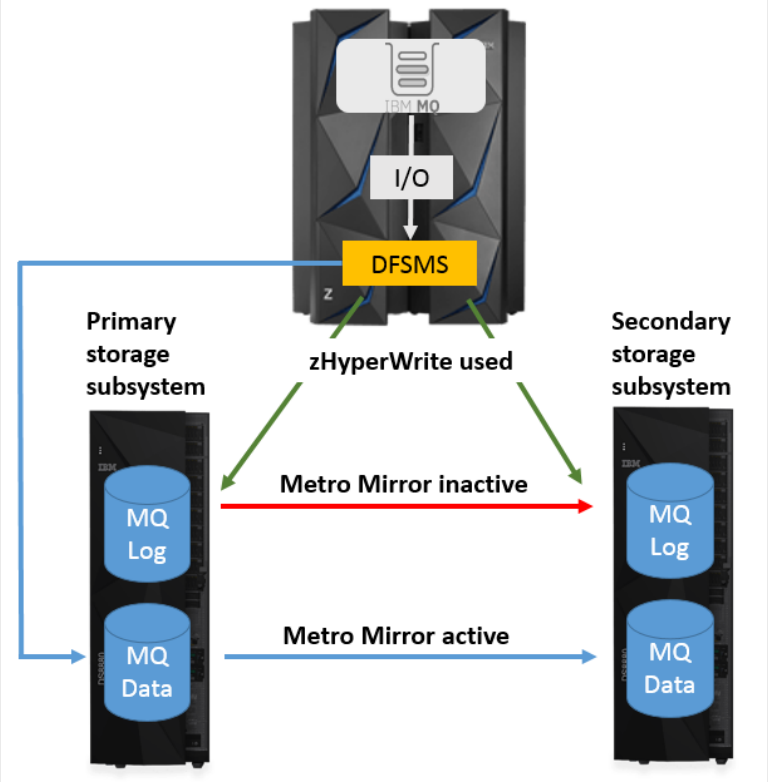
- Many customers use Metro Mirror (Synchronous PPRC) with MQ to mirror their datasets
- This protects against storage subsystem failure, and can be part of an HA/DR strategy
- Mirroring has a performance impact, even at zero distance because the write from MQ doesn't complete until the writes to both primary and secondary complete, and these happen in series



# Optimize by exploiting zHyperWrite

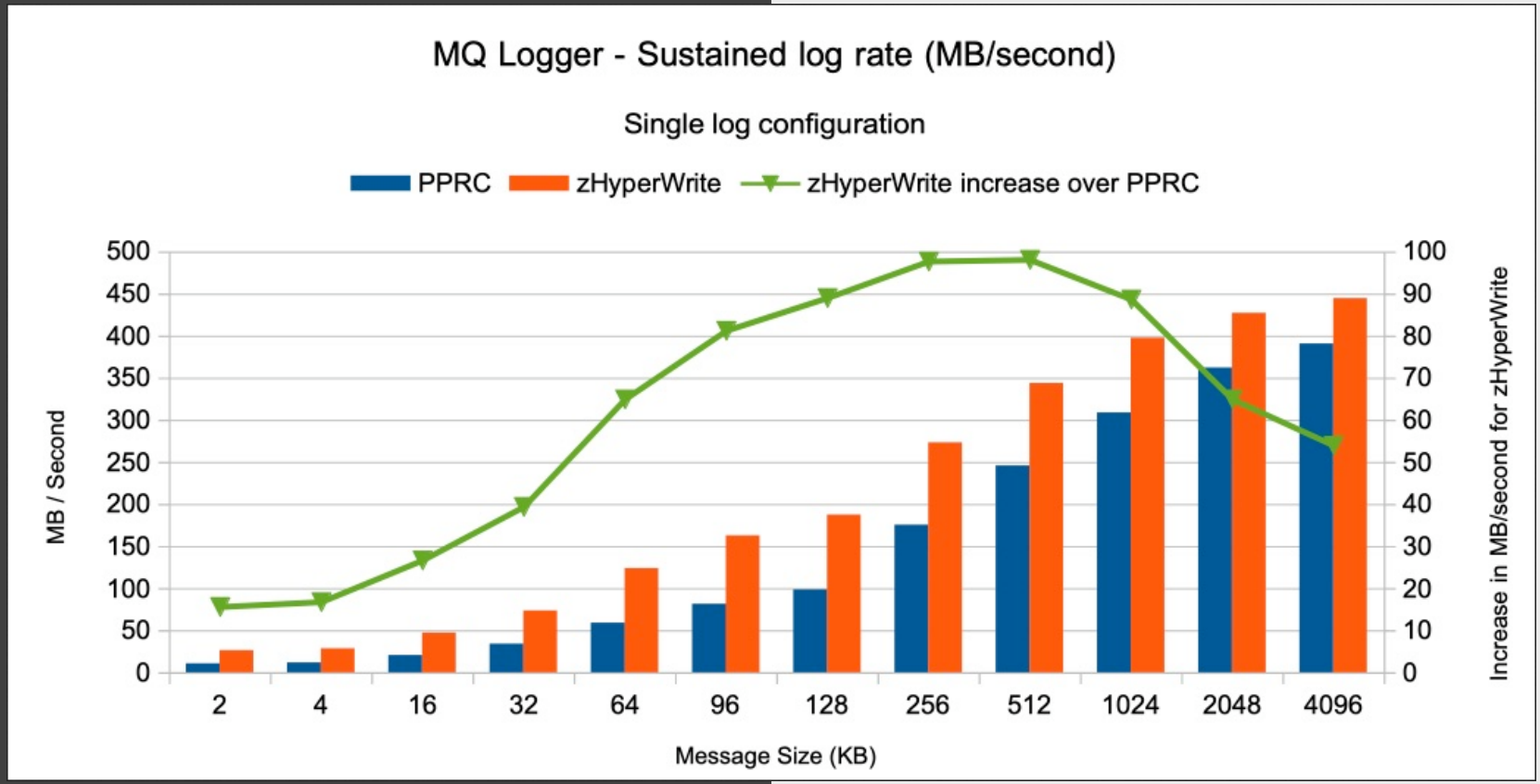


- zHyperWrite was introduced to minimize the performance impact of Metro Mirror
- Collaboration between DS8K and DFSMS, originally done for Db2
- With zHyperWrite the writes to primary and secondary are issued in parallel at the DFSMS level, meaning the write can complete earlier
- If a zHyperWrite write fails then it falls-back transparently to Metro Mirror
- In 9.1.2 MQ has added support for zHyperWrite for active log datasets



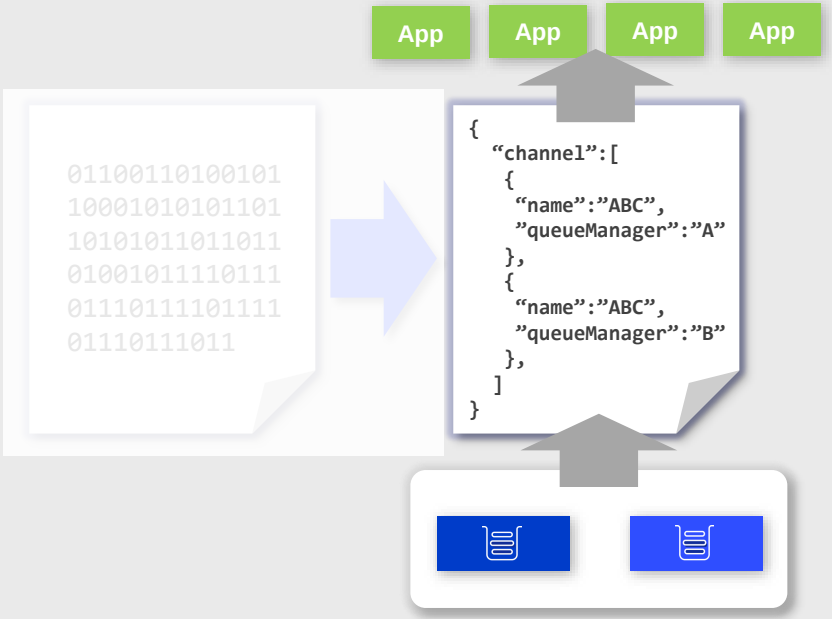
# Optimize by exploiting zHyperWrite





# Building scalable and available solutions

- JSON CCDT
- Build your own JSON format CCDTs
  - Supports multiple channels of the same name on different queue managers (to simplify the building of uniform clusters)
  - Available with all 9.1.2 clients
    - C, JMS, .NET, Node.js, Golang client
- Handy for z/OS where there is no native tooling for creating CCDTs

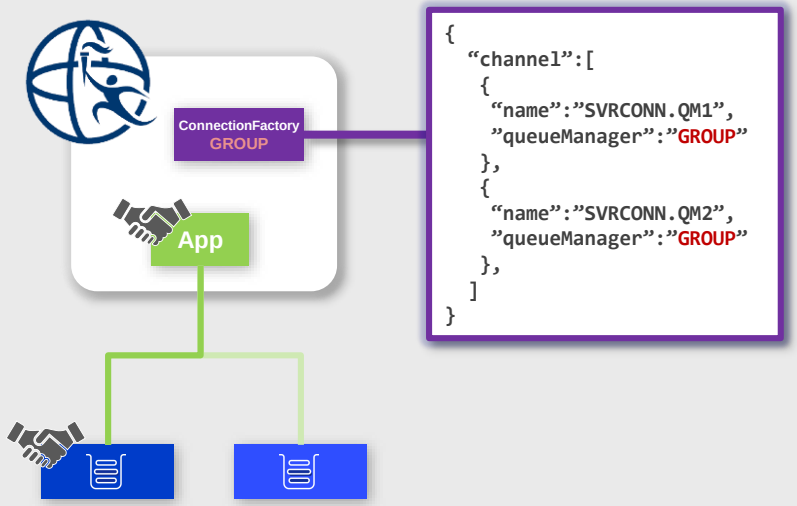


# Building scalable and available solutions

9.1.2

- WebSphere Liberty Transactions
  - Global transactions currently require a single queue manager to be named when connecting, complicating deployment and introducing single points of failure
  - WebSphere Liberty 18.0.0.2 and MQ 9.1.2 support the use of CCDT queue manager groups when connecting





# IBM MQ Advanced for z/OS VUE enhancements

# IBM MQ Advanced for z/OS Value Unit Edition

9.1.0

## *The Richest Set of z/OS Messaging Capabilities in a Single, Simple to Deploy Offering*


Enables applications and systems to participate in a Blockchain network via MQ, performing CRUD operations on Hyperledger Fabric Blockchain running in IBM Cloud or running locally

Provides reliable, secure and auditable file transfer that reduces the need for manual processes, and management tools that help reduce wasted time when dealing with failure analysis

Provides end-to-end encryption of message contents to protect sensitive data from all forms of intrusion, attack or accidental disclosure, and with no need for application change

Enables the secure, reliable exchange of business data across applications, systems and services on-premises, in the Cloud, or in Hybrid environments

# How do you address data protection and compliance?

***"It's no longer a matter of if, but when …"***

**26%**
Likelihood of an organization having a data breach in the next 24 months [1]

European Union General Data Protection Regulation (GDPR)



Payment Card Industry Data Security Standard (PCI-DSS)

**$4M**

Average cost of a data breach in 2016 [2]

Of the **9 Billion** records breached since 2013 only **4%** were encrypted [3]

Health Insurance Portability and Accountability Act (HIPAA)

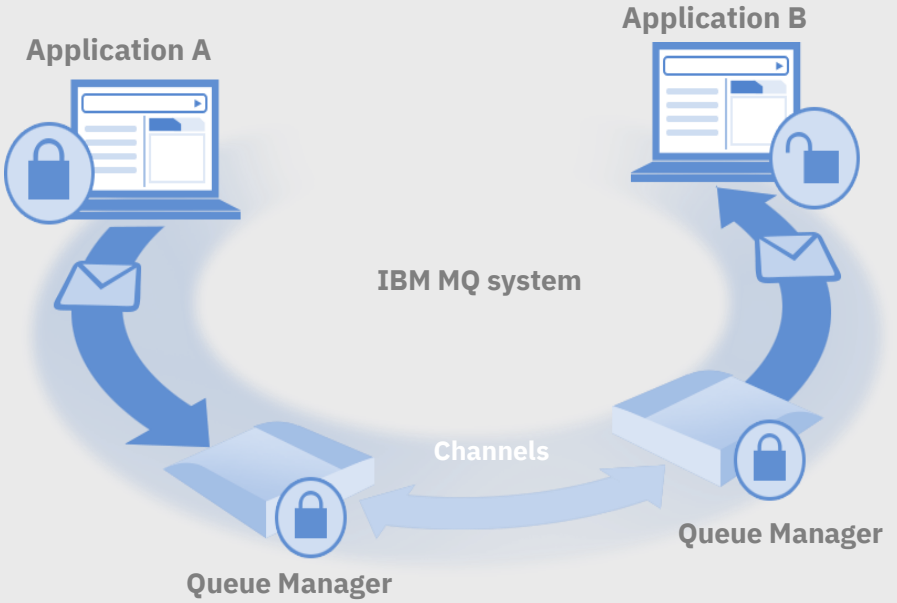

1, 2 Source: 2016 Ponemon Cost of Data Breach Study: Global Analysis -- http://www.ibm.com/security/data-breach/
3 Source: Breach Level Index -- http://breachlevelindex.com/

# MQ Advanced for z/OS VUE delivers pervasive encryption

9.1.0

- Apply end-to-end encryption to existing messaging infrastructure easily and with no application changes
- Authenticate and protect messages across the enterprise making audit simple
- Reduce time and skills needed to comply with aspects of common security standards
- Detect and remove rogue messages
- New Confidentiality option for encryption has minimal performance impact

Advanced Message Security (AMS) protects data at rest, in-flight and in-memory to guarantee privacy of message contents



# Significant improvement in performance when applying AMS policies

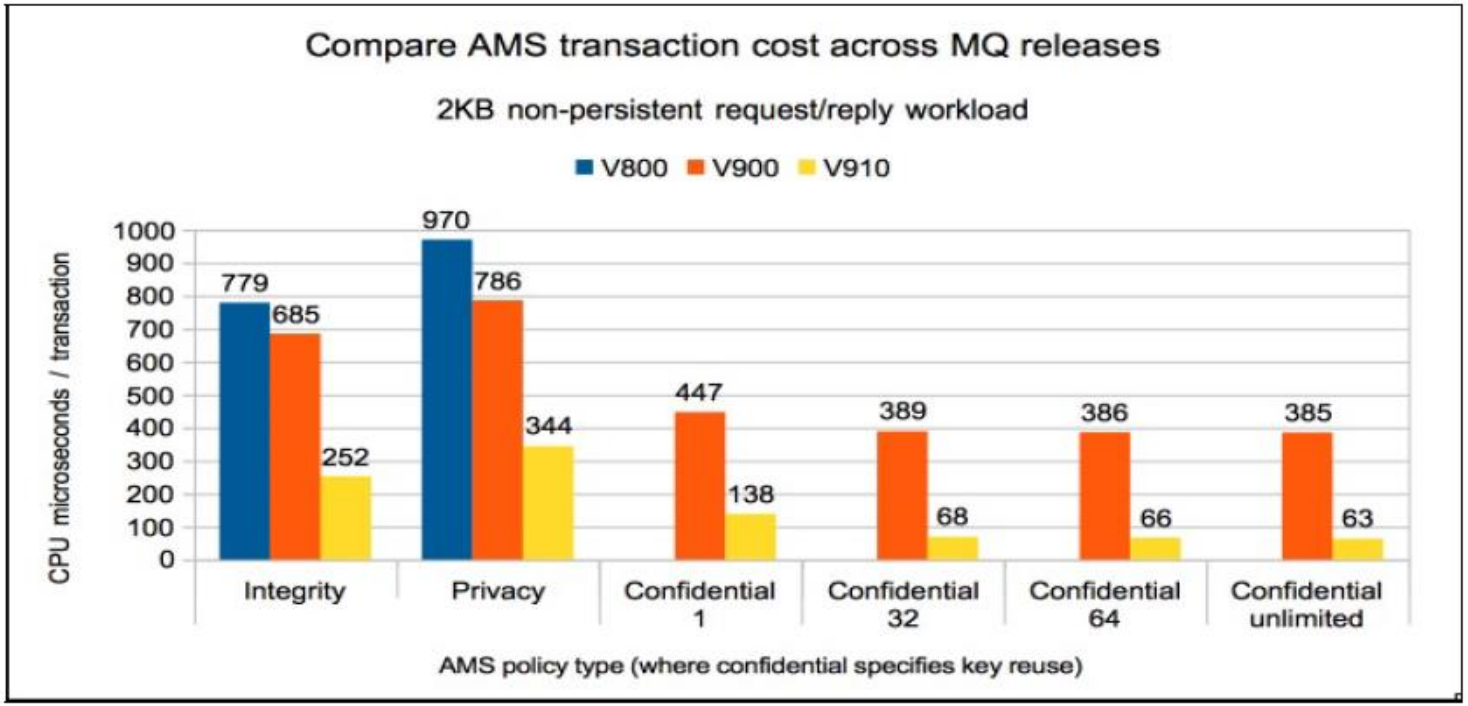
9.1.0

A cost comparison between version 9.1.0 and 9.0.0 shows:

**Integrity:** 37% of the equivalent version 9.0.0 measurement

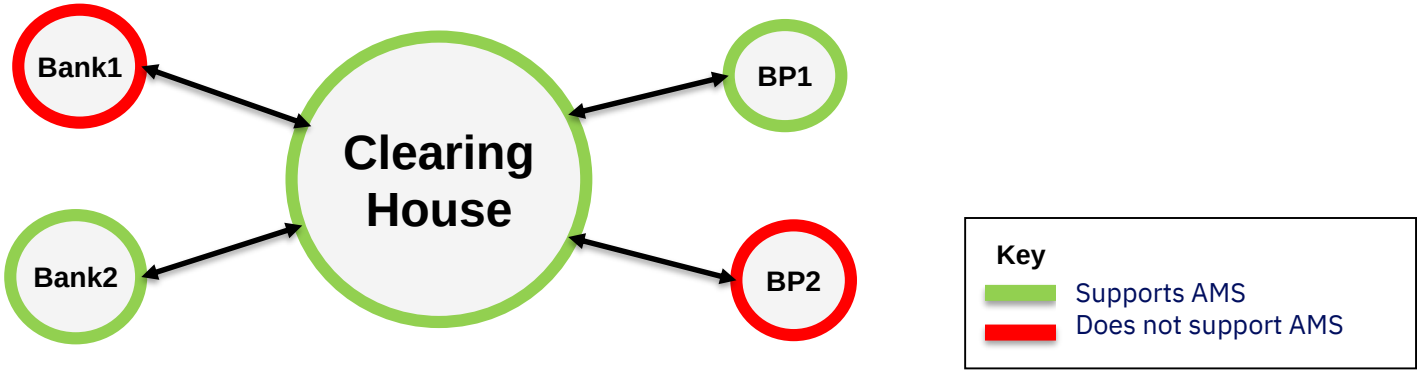
**Privacy:** 44% of the equivalent version 9.0.0 measurement

**Confidentiality:** 17-32% of the equivalent version 9.0.0 measurements (depending on the key reuse value)



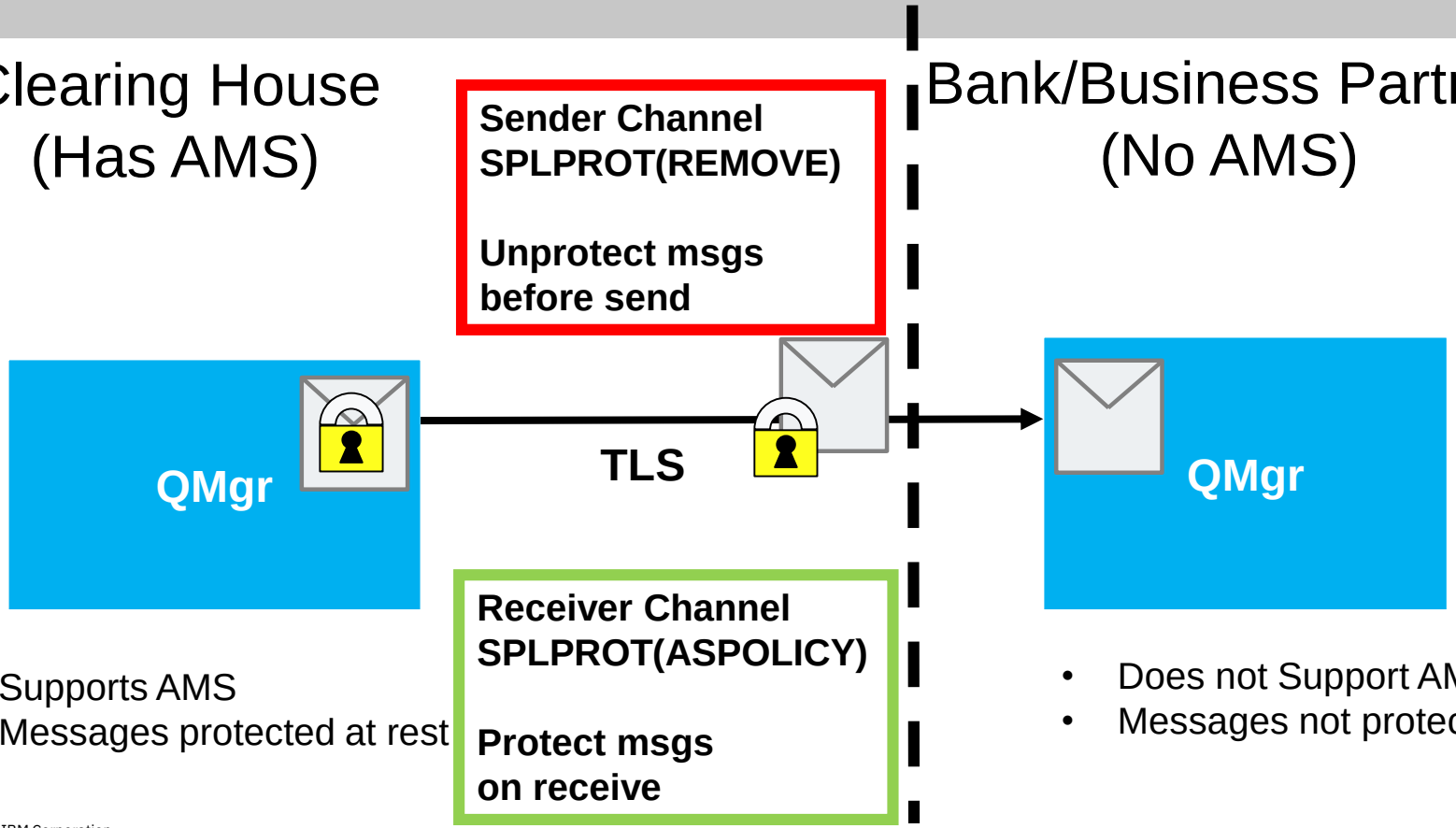
# However, the reality is that …

- Clearing house has AMS
  - Requires all in-house messages to be protected at rest
- Some banks/partners have AMS, some do not
  - Need to be able to exchange messages with all banks and business partners !



# Remove/Apply AMS Protection between QMgrs

MQ for z/OS V9.1.3




- Supports AMS
- Messages protected at rest

- Does not Support AMS
- Messages not protected at rest

# Move Data and Files with MQ Advanced for z/OS VUE

9.1.0

## How:

- ⇨ File-to-file
- ⇨ File-to-message
- ⇨ Message-to-file

## Benefits:

Reliability of delivery
Increased security of system and data
Integrated management and recovery

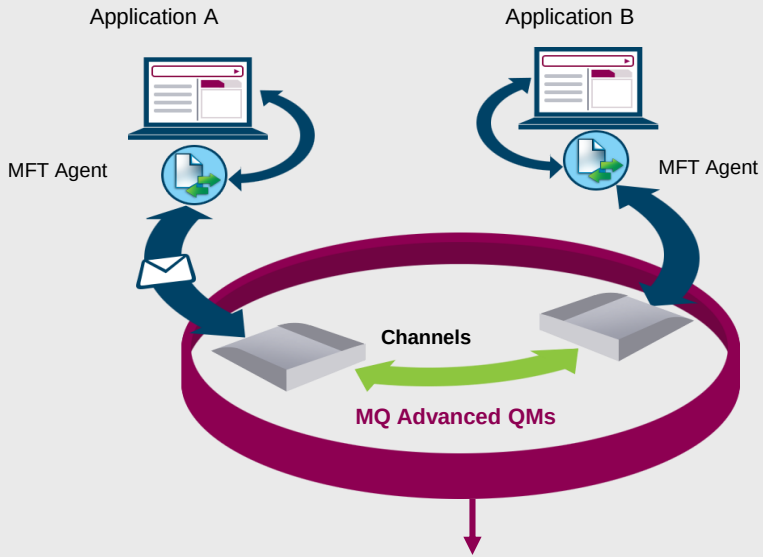
**MFT Agent:**

Performs the fundamental file transfer function of sending and receiving files from the local system

**MFT Service:**

Installs a file transfer agent on MQ server with additional capabilities

Managed File Transfer (MFT) enables a consistent approach to transporting application data and file data as messages




**Unlimited deployments** of MQ MFT Agents when connecting them to MQ Advanced Queue Managers

# Managed File Transfer Enhancements

9.1.0

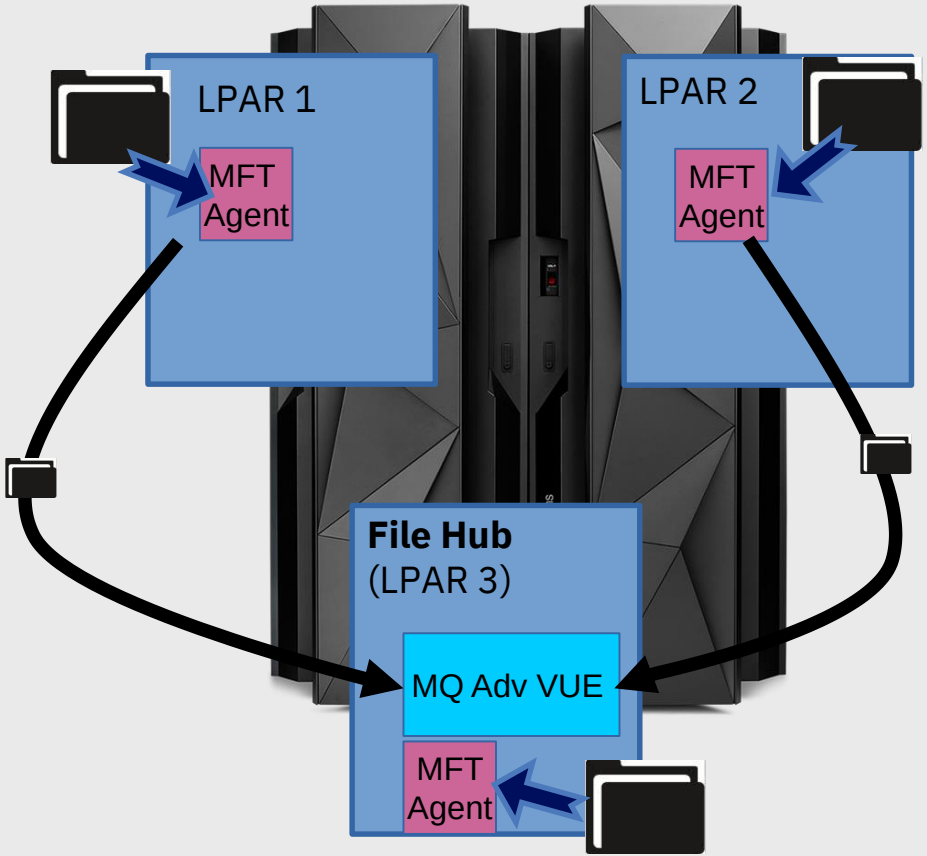
**Create a “File Hub” using simplified MFT Agent connectivity**

MFT agents deployed wherever files are to be sourced or delivered

No requirement for a local z/OS queue manager - choose where to handle file workload

Files transferred across the MQ network between local and remote agents

Reduce the number of queue managers required - simplified topology for easier administration




**MFT file logger can now use client mode to connect to the coordination queue manager**

**Monitor current MFT transfers via the MQ REST API and query the status of MFT agents**

# Managed File Transfer Enhancements



MFT manages your file transfers, and now it's even easier for you to manage MFT…

Simplified MFT Agent licensing
No need to track individual agents with MQ Advanced queue managers

Failed transfer timeout
Automatically stop transfers after repeated failures

Resource monitor backups
Simple, single command to backup and restore resource monitors

MFT agent, transfer and resource monitor monitoring through REST — 9.1.1

File transfer initiation through simple REST call — 9.1.2

# Blockchain requires connectivity for data sharing

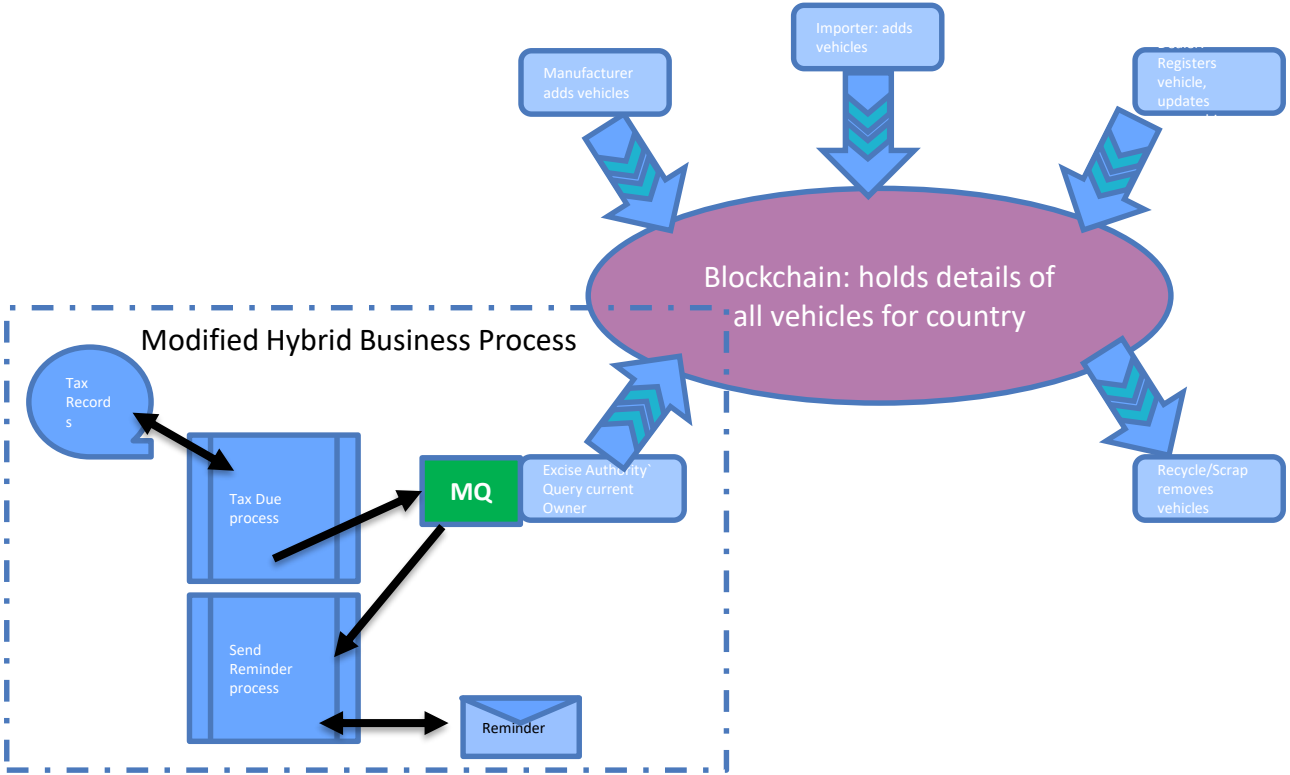
Parties in the business network need to exchange data often held in Systems of Record

## *Requirements…*

Enable a range of different applications and systems to send updates to a Blockchain network

Ensure data integrity following changes to shared assets

Transport critical business data securely and reliably



# Connect to Blockchain with MQ Advanced for z/OS VUE

## Deploy IBM MQ Bridge to Blockchain to enable applications and systems to participate

Bridge allows an MQ application to connect to Hyperledger Composer Blockchain running in IBM Cloud or running locally

Utilise request-reply MQ messages to query information from Blockchain (e.g. what is the value of the balance on this account)

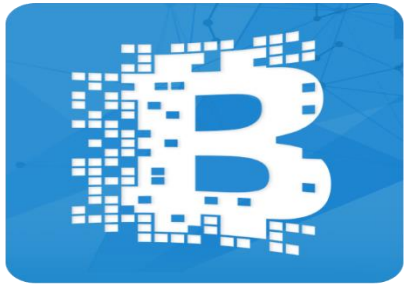
Use MQ to drive create, read, update and delete operations on Blockchain-managed assets

No need to understand the ledger-specific APIs, configuration or controls

```
Connection to Queue Manager
---------------------------
Queue Manager                       : []MQ21
Bridge Input Queue                  :
[SYSTEM.BLOCKCHAIN.INPUT.QUEUE]
MQ Channel                          : []
MQ Conname                          : []
MQ CCDT URL                         : []
JNDI implementation class           :
[com.sun.jndi.fscontext.RefFSContextFactory]
JNDI provider URL                   : []
MQ Userid                           : []MLEMING
MQ Password                         : []


User Identification
-------------------
Userid                              : []MLEMING
Password                            : []

API path for login                  : [auth/users/login]
```



# Run the IBM MQ bridge to Blockchain on z/OS

The bridge can be run on USS and connect via bindings to your z/OS queue manager

No need to install in an x86 Linux environment

Three step process to set up

1) Define necessary queues using CSQ4BCBQ

2) Generate configuration file in USS: runmqbcb -o config.json

3) Run the bridge either in USS or using JCL: CSQ4BCB sample provided

```
//CSQ4BCB  JOB MSGCLASS=H,NOTIFY=&SYSUID
//*
//   SET INSTDIR='/u/mleming/mqm/V9R1M0/mqbc'
//*
//STEP1   EXEC PGM=BPXBATSL,REGION=0M,TIME=NOLIMIT,MEMLIMIT=NOLIMIT,
//   PARM='PGM &INSTDIR./bin/runmqbc -f /u/mleming/bcb/config.json -d 2'
//STEPLIB  DD DSN=ANTZ.MQ.V910.DFCT.OUT.SCSQANLE,DISP=SHR
//         DD DSN=ANTZ.MQ.V910.DFCT.OUT.SCSQAUTH,DISP=SHR
//STDOUT   DD SYSOUT=*
//STDERR   DD SYSOUT=*
//STDIN    DD DUMMY
//STDENV   DD PATH='/u/mleming/bcb/stdenv.txt',PATHOPTS=ORDONLY
```

9.1.0

```
/u/mleming/mqm/V9R1M0/mqbc/bin:>./runmqbcb -o ~config.json
2018-06-21 09:56:05.970 BST IBM MQ Bridge to Blockchain
5724-H72 (C) Copyright IBM Corp. 2017, 2018
Level : V910-DFCT6-L180619

Enter new values for the configuration attributes.
Current values are shown in square brackets.

Press ENTER to accept current values; use SPACE+ENTER
to clear values; use <new value>ENTER to set a new value.

If lists of values are required these may be separated by commas
or entered on multiple lines. A blank line terminates the list.

NOTE: You cannot edit existing values - you can only keep, replace or

Connection to Queue Manager
---------------------------
Queue Manager                          : []MQ21
Bridge Input Queue                     : [SYSTEM.BLOCKCHAIN.INPUT.QUEUE]
MQ Channel                             : []
MQ Conname                             : []
```

```
/u/mleming/mqm/V9R1M0/mqbc:>ls -1
bin
lib
prereqs
samp
/u/mleming/mqm/V9R1M0/mqbc:>ls bin
runmqbcb
```

# Client connection flexibility

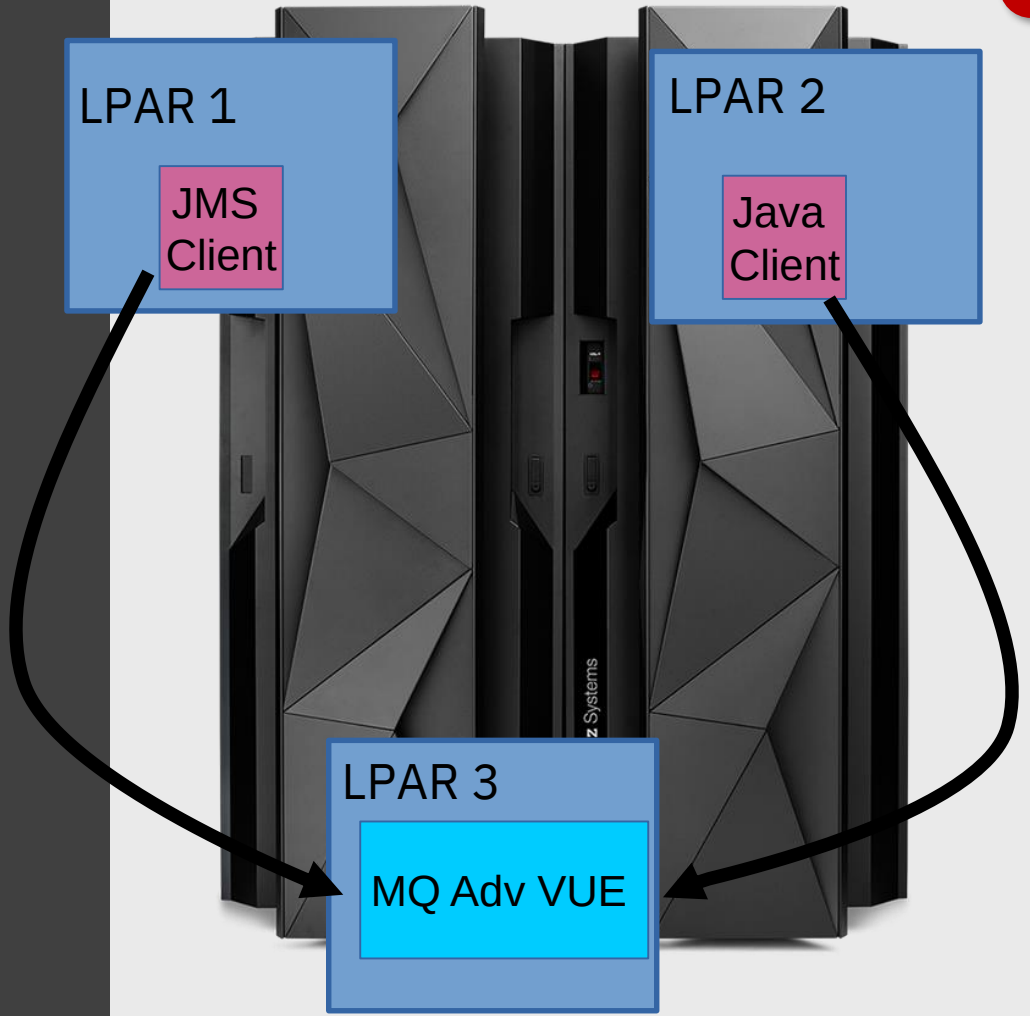
9.1.0

Traditionally we have supported Java client connections in JEE environments only (tWAS, Liberty, and now CICS Liberty)

Support now added for client connections from Java applications to MQ Advanced for z/OS VUE queue managers running on other LPARs

Including AMS support for Java applications using client connections

Allows you to have more flexibility when setting up your MQ topologies



# Migration

# Simplified migration experience

9.1.0

OPMODE removed at 9.1.0

Recompiling ZPARM at 9.1.0 with OPMODE specified will generate a warning. But old ZPARM modules can be used

OPMODE output removed from the DIS SYSTEM command

New message indicates whether backwards migration is support or not, and if it is where you can migrate back to

Backwards migration always supported to 8.0.0 or 9.0.0 if migration PTFs applied

PI95928 for 8.0.0
PI95939 for 9.0.0

CSQY039I !MQ21 Backwards migration is supported to Version 9.0.0

CSQY040I !MQ21 Backwards migration not supported

Reminder: backwards migration is not supported in continuous delivery.

I.e. you can go from 9.0.5 to 9.1.0 but you can’t go back

Similarly you can go from 9.0.0 to 9.0.5 but you can’t go back

# Migrating to IBM MQ Advanced for z/OS VUE: FMIDS

IBM MQ Advanced for z/OS VUE consists of 5 FMIDS:

**HMS9100**: Core queue manager

**IBM MQ for z/OS**

**Core**

**HAMS910**: AMS enablement module

**IBM MQ Advanced Message Security for z/OS**

**HMF9910** : Managed File Transfer

**IBM MQ Managed File Transfer for z/OS**

**HAV9100**: Connector Pack

**Connector Pack**

**Optional**

**HUE9100**: VUE Enablement module. Replaced by simpler alternatives. See following slides

**Not needed**

# Migrating to IBM MQ Advanced for z/OS VUE: recommended migration path

Assumes migrating from an existing MQ V8.0.0 or V9.0.0 installation

1) Install HMS9100 (base product) on same LPAR as existing installation

2) Apply relevant migration and coexistence PTFs to existing installation plus qTypes to new 9.1.0 installation

3) Switch existing queue managers' started tasks to use new installation

4) Start queue managers and validate that applications are running fine

**At this point you are not using IBM MQ Advanced for z/OS VUE**

CSQY036I !MQ21 CSQYASCP QMGRPROD=, recording product usage for **MQM MVS/ESA**
**product id 5655-MQ9**

# Migrating to IBM MQ Advanced for z/OS VUE: enabling Advanced VUE

The QMGRPROD attribute affects which product ID MQ registers with SCRT when it starts

Replaces the VUE enablement module

Three possible values:
- MQ – the default
- VUE – IBM MQ for z/OS VUE
- ADVANCEDVUE – IBM MQ Advanced for z/OS, VUE

QMGRPROD can be set in a number of ways, shown on the right, all have the same effect

To apply, make the necessary change and then stop and restart the queue manager

START QMGR command

```
                    System Command Extension

!MQ21 START QMGR PARM(MQ21ZPRM)
QMGRPROD(ADVANCEDVUE)
```

Useful the first time Advanced VUE is enabled

MSTR JCL

```
//PROCSTEP EXEC PGM=CSQYASCP,REGION=0M,MEMLIMIT=1G,
//         PARM='ZPARM(MQ21ZPRM),QMGRPROD(ADVANCEDVUE)'
```

Useful for temporary enablement, or if you don't want to adjust ZPARMs

ZPARM: CSQ6USGP

```
//SYSIN     DD *
          CSQ6USGP
                QMGRPROD=ADVANCEDVUE
                AMSPROD=
          END
/*
```

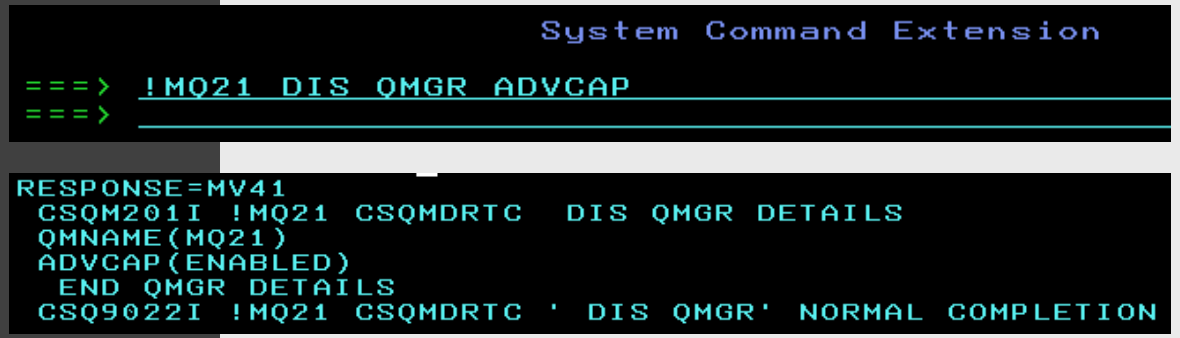
Used for permanent enablement

# Migrating to IBM MQ Advanced for z/OS VUE: validating Advanced VUE

At queue manager start up look for the CSQY036I message

CSQY036I !MQ21 CSQYASCP QMGRPROD=ADVANCEDVUE, recording product usage for **MQ z/OS Adv VUE product id 5655-AV1**

Or look at ADVCAP attribute on response from DISPLAY QMGR command




At start up the queue manager will have registered that it is using Advanced VUE with SCRT

# Migrating to IBM MQ Advanced for z/OS VUE: exploit new function!

Having migrated queue managers to IBM MQ Advanced for z/OS VUE consider installing and exploiting some of the capabilities described earlier

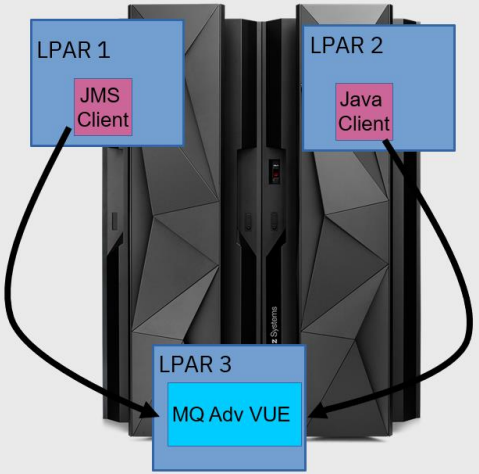
For example

- Transparently protecting message data with AMS
- Reliably and repeatedly transferring your files with MFT
- Flexible deployment options for Java applications by connecting to queue managers running on remote z/OS LPARs
- Using a simple API for interacting with your block chain assets

**IBM MQ Advanced Message Security for z/OS**

**IBM MQ Managed File Transfer for z/OS**

**Connector Pack**



# Helping Developers

Making it easy to build MQ into your applications

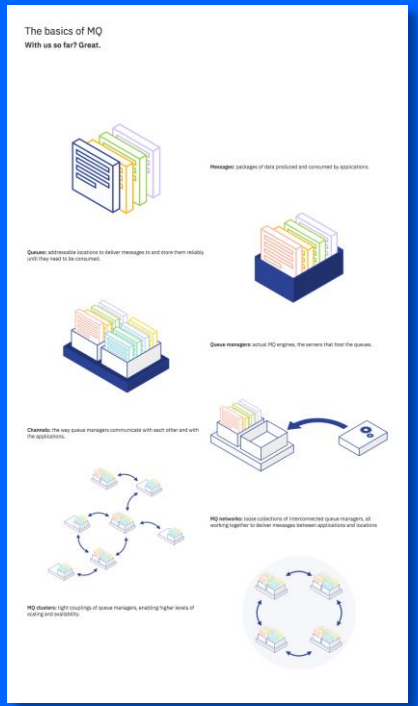
# LearnMQ

Finding it hard to get developers started with MQ?

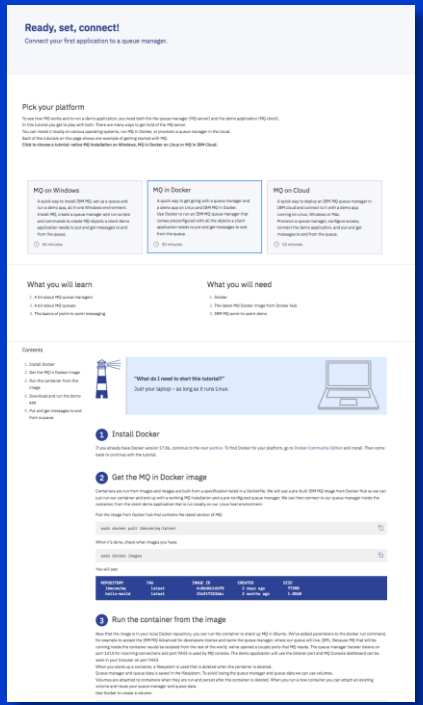
Point them to:

**ibm.biz/learn-mq**

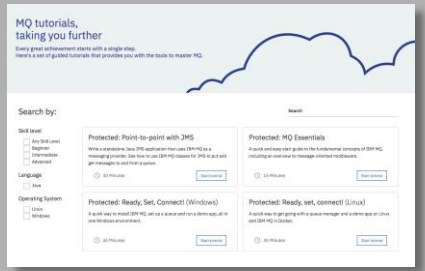

## Totally new to MQ? Learn the basics

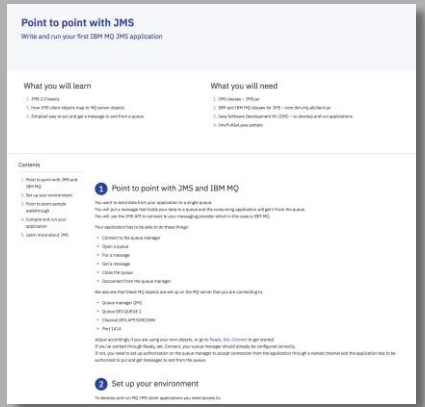



## Step-by-step guide to getting up and running with MQ




## Tutorials on building your applications



# Developing applications

9.1.1

- Build your applications simply, with no need for an MQ installation
  - Pull Java directly from the Maven repository since MQ 9.0.4 CD
  - MQ 9.1.1 CD added the **SDK** to the MQ redistributable client
  - The redistributable client is now available directly, no need to log into IBM
    - **ibm.biz/mqclientdownload**


- Develop your applications on the platform of your choice with the addition of the MacOS version of the 9.1.1 MQ client and SDK for Developers

**ibm.biz/mqmacos**

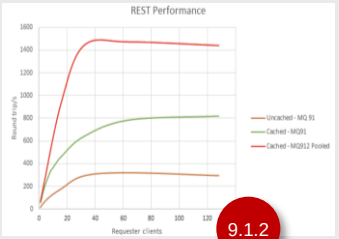
*(The MQ for MacOS toolkit includes runmqsc)*

# Writing new applications

## REST Messaging

- Providing a very simple way to get messages in and out of your MQ system
- 9.1.2 CD will boost the performance capability

REST




9.1.2

## NET Core

- 9.1.1 CD brought support for .NET Core on Windows
- 9.1.2 CD will add Linux support

.NET Core

Windows 9.1.1

Linux 9.1.2

## Open Source language bindings

- Write MQI applications in Node.js and Golang
- New simpler JMS style API for Golang

**github.com/ibm-messaging**

Node.js MQI

Golang MQI

Golang JMS NEW

# IBM MQ and IBM Event Streams

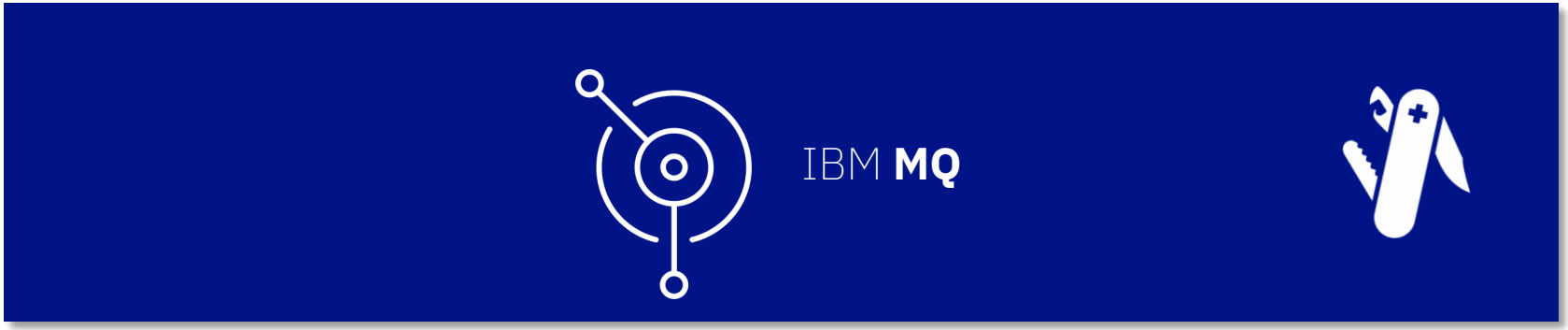
† also known as ***commands*** or ***operations***

# Messages or Events?

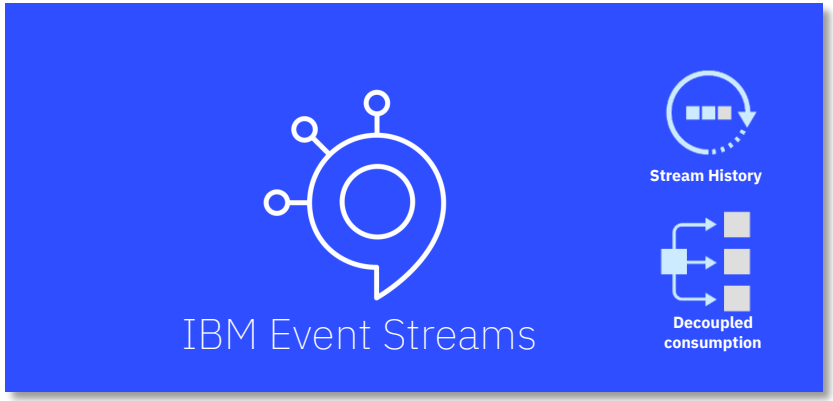
**Messages**† are *"work that needs to be done"*

**Events** are *"things that have happened"*

Generalised solution




Specialised technology


Specialised for **message exchange** and **transactions**

Specialised for **streaming** of **events**

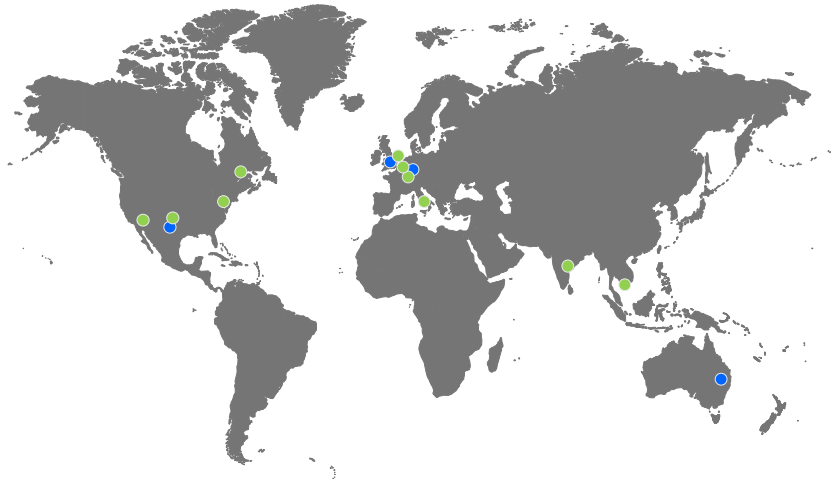
**Apache Kafka®** is the de-facto standard for event-driven applications

APACHE kafka®
A distributed streaming platform

**IBM Event Streams** is fully supported Apache Kafka, with **value-add capabilities**

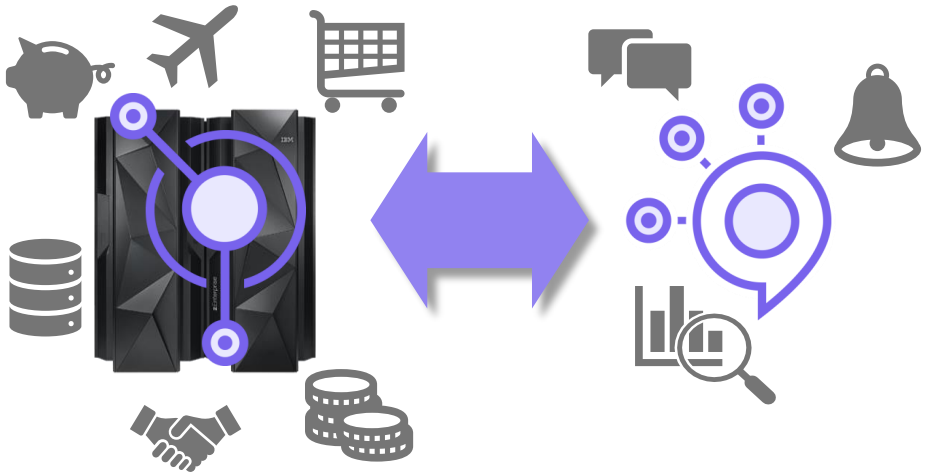
# Benefit from IBM’s Kafka Expertise

- IBM has years of experience running Apache Kafka across the globe
- In 2015 IBM was the **first vendor** to offer a fully managed, Apache Kafka cloud service



# IBM MQ with IBM Event Streams

- **IBM MQ** connects mission-critical systems, requiring **transactional**, **once-only delivery**
- **Event Streams** distributes and processes streams of events in real-time to intelligently engage with customers
- Connecting the two together, flowing messages and events between then, with the **supported connectors** enables you to unlock the potential of your data



# Run IBM MQ in any location or cloud, exactly as you need it

IBM Z
Linux
AIX
Windows
Solaris
IBMi
HPE NonStop
zLinux
Appliance

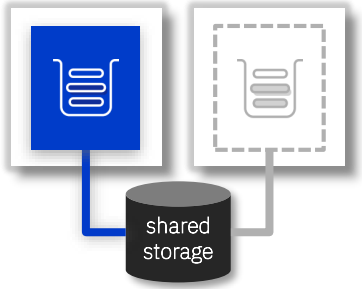
AWS
Azure
IBM Cloud
IBM Cloud
IBM Cloud Private
powered by aws
Red Hat OpenShift
Kubernetes
IBM Event Streams
IBM Cloud
IBM Event Streams

# Fault tolerance

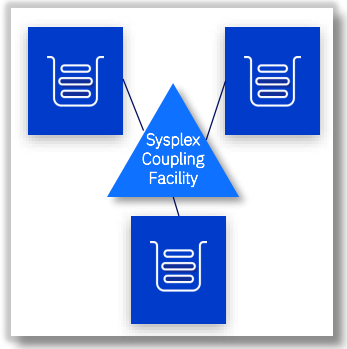
Protecting your critical data

# Fault tolerance

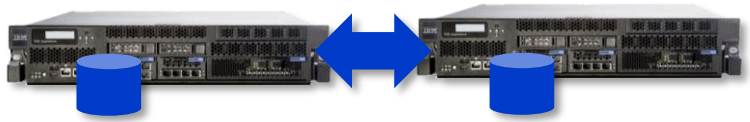
- MQ delivers HA through the ability to build horizontally scaled, active-active systems and typically **active-passive HA** of the data itself, the messages
- Traditionally active-passive HA has been achieved through **HA clusters** or **multi instance** queue managers. Both rely on highly available infrastructure to be setup and relied on
- The **MQ Appliance** changed this with a fully integrated HA solution, providing built in machine to machine data replication and failover
- On z/OS, Shared Queues provide active-active HA of the message data




Multi-instance queue managers and HA Cluster




z/OS Queue Sharing Groups



MQ Appliance

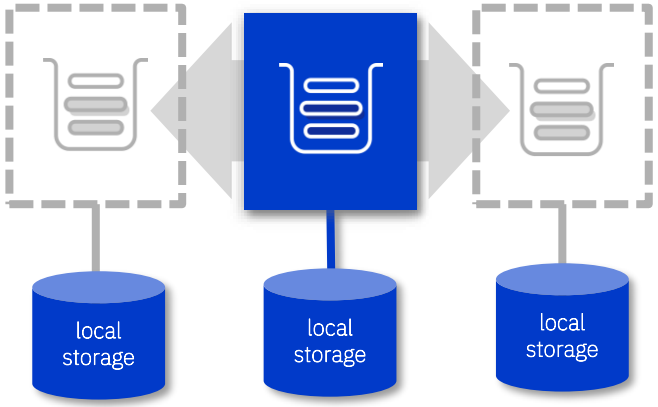




65

# Fault tolerance

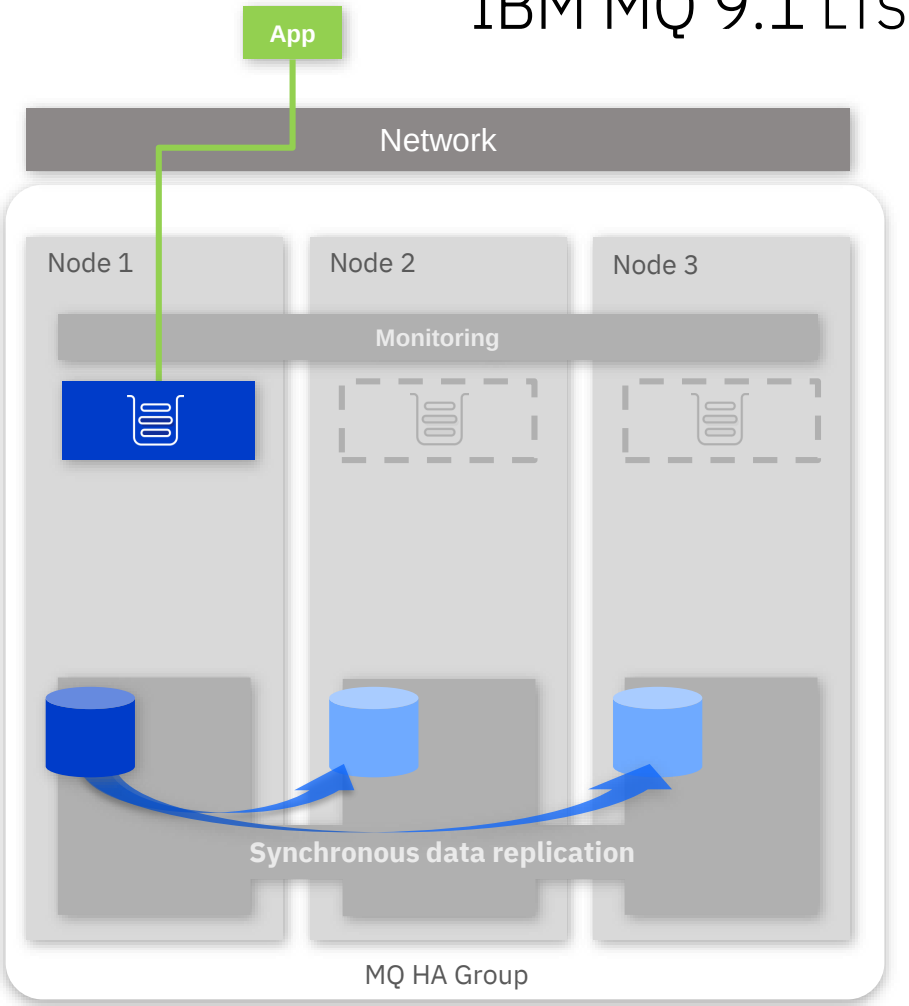
- MQ delivers HA through the ability to build horizontally scaled, active-active systems and typically **active-passive HA** of the data itself*, the messages.
- Traditionally active-passive HA has been achieved through **HA clusters** or **multi instance** queue managers. Both rely on highly available infrastructure to be setup and relied on.
- The **MQ Appliance** changed this with a fully integrated HA solution, providing built in machine to machine data replication and failover.
- On z/OS, Shared Queues provide active-active HA of the message data
- **2018 saw a fully integrated, data replication and failover solution arrive on Red Hat x86…**



# Replicated Data Queue Managers

- **Linux only, MQ Advanced** HA solution
- No need for a shared file system or HA cluster
- Three-way replication and monitoring for quorum support
- **Synchronous** data replication for once and once only transactional delivery of messages
- Active/passive queue managers with **automatic takeover**

MQ Advanced for RHEL x86-64



# Replicated Data Queue Managers

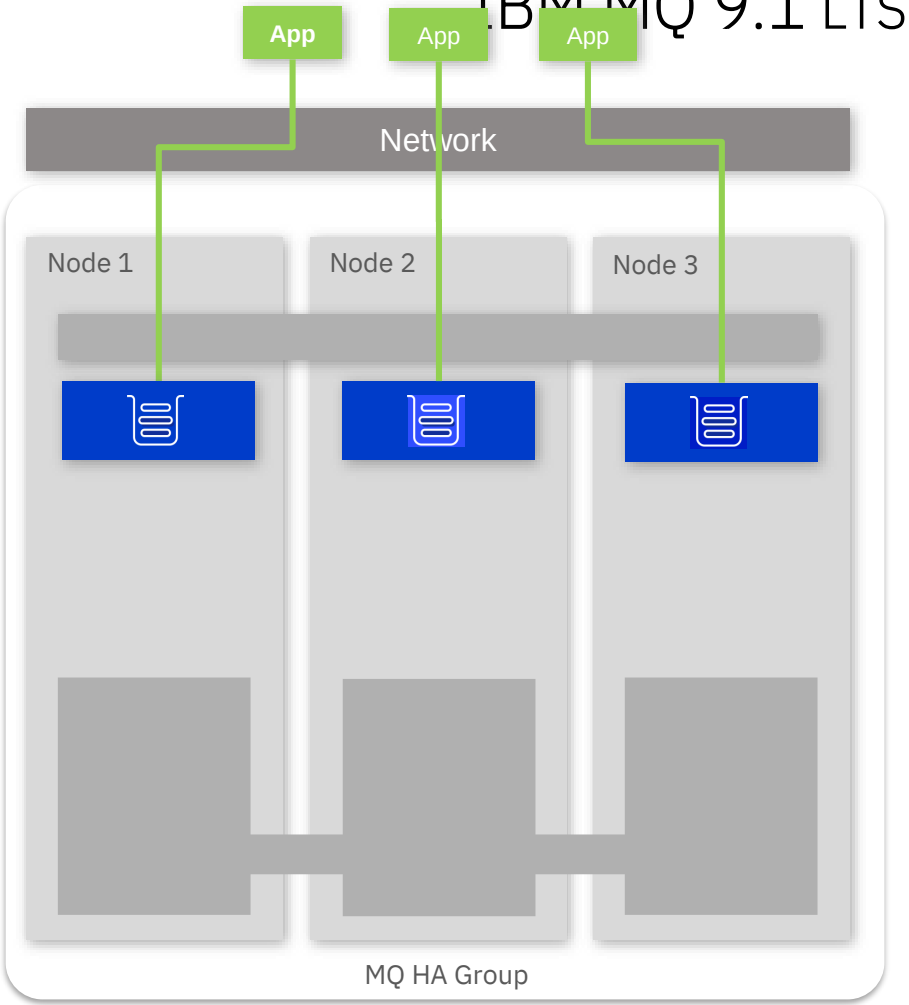
- **Linux only, MQ Advanced** HA solution

  No need for a shared file system or HA cluster
- Three-way replication and monitoring for quorum support
- **Synchronous** data replication for once and once only transactional delivery of messages
- Active/passive queue managers with **automatic takeover**
- Per queue manager control to support active/active utilisation of nodes
- MQ **licensing** is aligned to maximise benefits

Improvements in queue manager restart times

9.1.1 9.1.2

MQ Advanced for RHEL x86-64



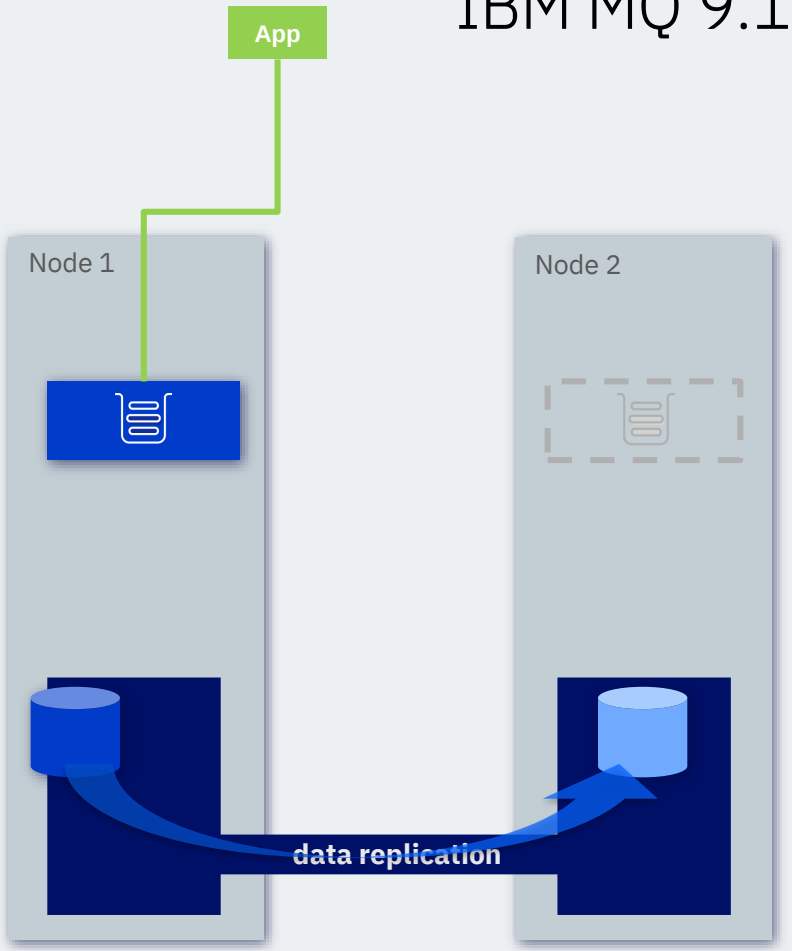
# Replicated Data Queue Managers

## Manual failover

RDQM also supports a looser coupled pair of nodes for data replication but with no automatic failover, often for **Disaster Recovery**

Data replication can be

- **Asynchronous** for systems separated by a high latency network
- **Synchronous** for systems on a low latency network



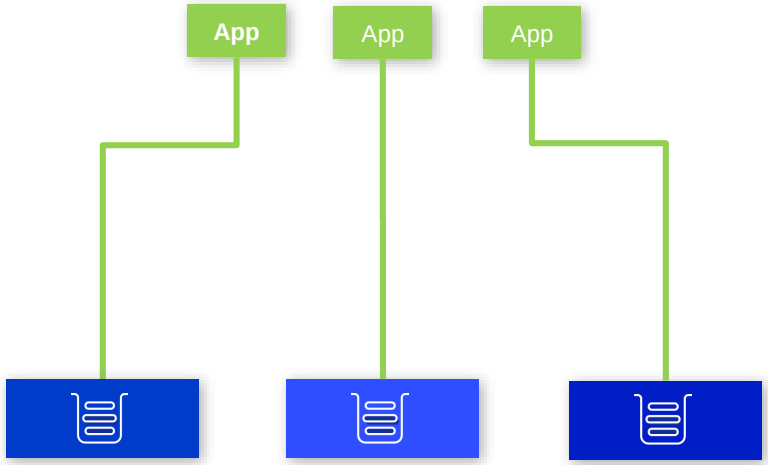

MQ Advanced for RHEL x86-64

# Cloud Native Messaging

Building scalable, fault tolerant, solutions

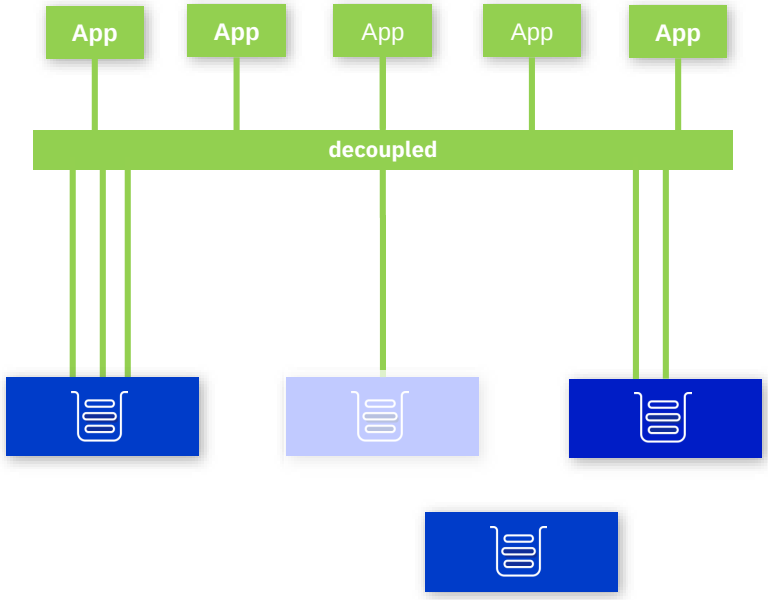
# Building scalable, fault tolerant, solutions

- Many of you have built your own continuously available and horizontally scalable solutions over the years
- Let's call this the *"**uniform cluster**"* pattern



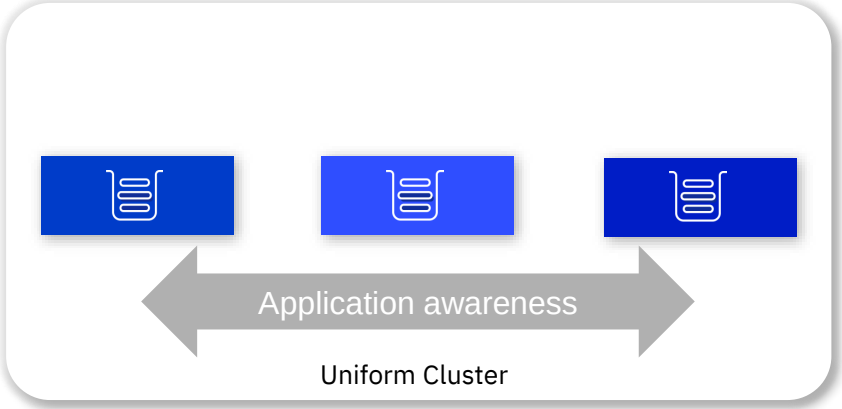
# Building scalable, fault tolerant, solutions

- Many of you have built your own continuously available and horizontally scalable solutions over the years
- Let's call this the *"**uniform cluster**"* pattern
- MQ has provided you many of the building blocks -
  - Client auto-reconnect
    CCDT queue manager groups
- But you're left to solve some of the problems, particularly with long running applications -
  - Efficiently distributing your applications
    Ensuring all messages are processed
    Maintaining availability during maintenance
    Handling growth and contraction of scale



# MQ 9.1.2 is starting to make that easier

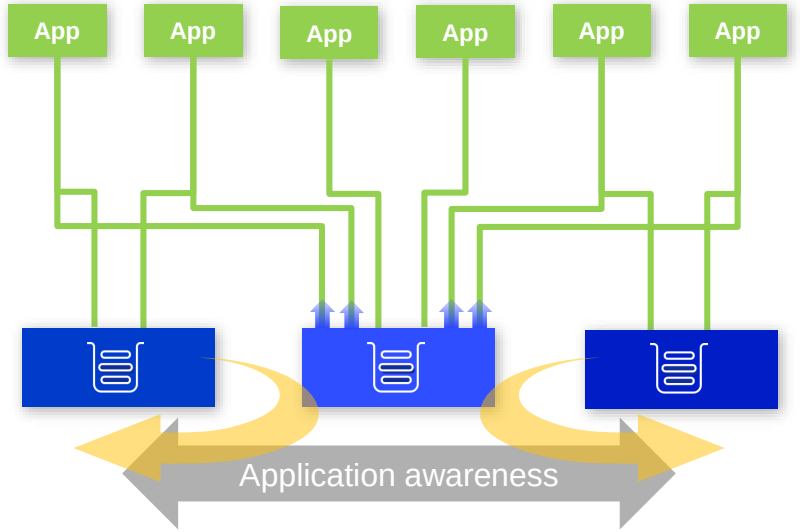
- For the distributed platforms, declare a set of matching queue managers to be following the ***uniform cluster pattern***
  - All members of an MQ Cluster
  - Matching queues are defined on every queue manager
  - Applications can connect as clients to every queue manager
- MQ will automatically share application connectivity knowledge between queue managers
- The group will use this knowledge to automatically keep matching application instances balanced across the queue managers
  - Matching applications are based on *application name* (new abilities to programmatically define this)
- MQ 9.1.2 is starting to roll out the client support for this



# Automatic Application balancing



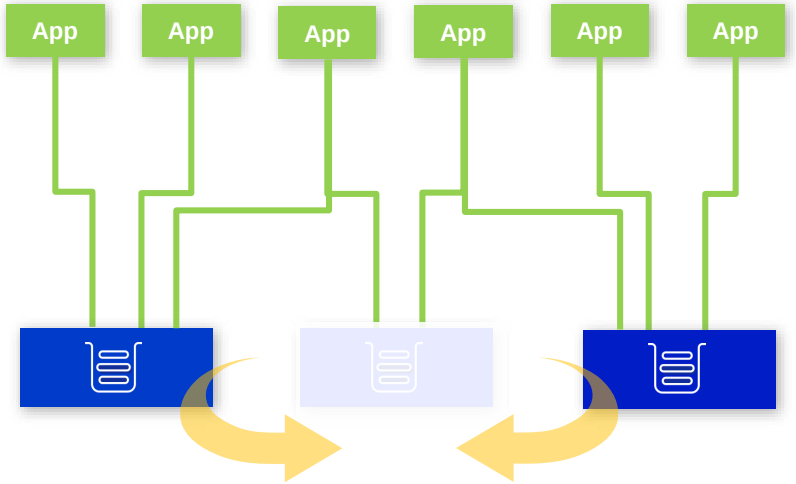
- Application instances can initially connect to any member of the group
  - We recommend you use a queue manager group and CCDT to remove any SPoF
- Every member of the uniform cluster will detect an imbalance and request other queue managers to donate their applications
- Hosting queue managers will instigate a client *auto-reconnect* with instructions of where to reconnect to
- Applications that have enabled *auto-reconnect* will automatically move their connection to the indicated queue manager
  - 9.1.2 CD has started with support for C-based applications
  - …



# Automatic Application balancing

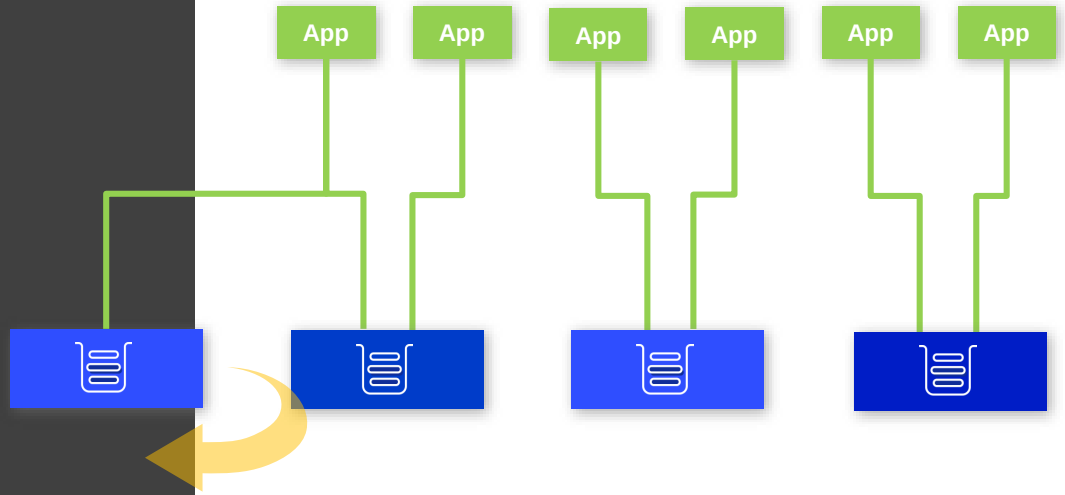
IBM MQ 9.1.2 CD

- Automatically handle rebalancing following planned and unplanned queue manager outages
  - Existing client auto-reconnect and CCDT queue manager groups will enable initial re-connection on failure
  - Uniform Cluster rebalancing will enable automatic rebalancing on recovery



# Automatic Application balancing

- Even to horizontally scale out a queue manager deployment
  - Simply add a new queue manager to the uniform cluster
  - The new queue manager will detect an imbalance of applications and request its fair share




MQ 9.1.2 CD is the *start* of the Uniform Cluster journey

Join the MQ Beta program to see how the Uniform Cluster pattern and client support will evolve

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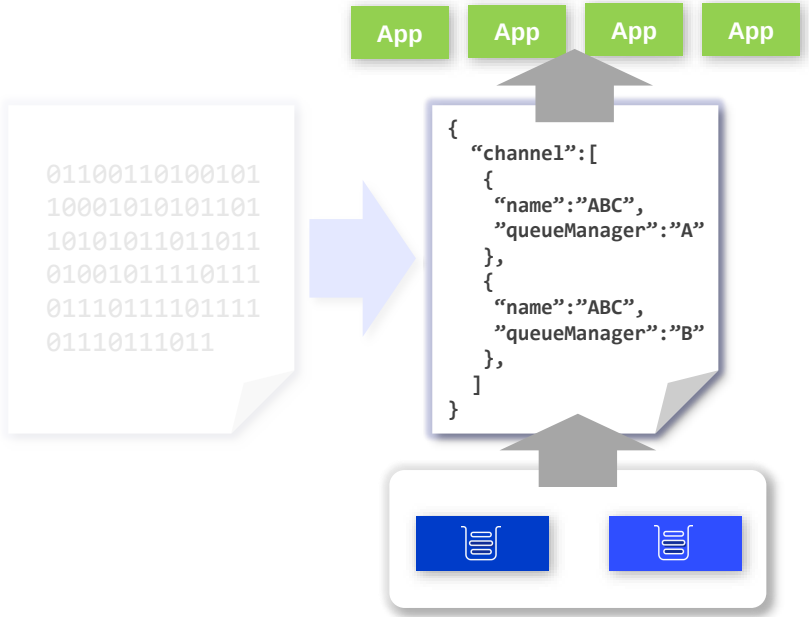
# Building scalable and available solutions



## JSON CCDT

- Build your own JSON format CCDTs
- Supports multiple channels of the same name on different queue managers to simplify the building of uniform clusters
- Available with all 9.1.2 clients
  - C, JMS, .NET, Node.js, Golang clients



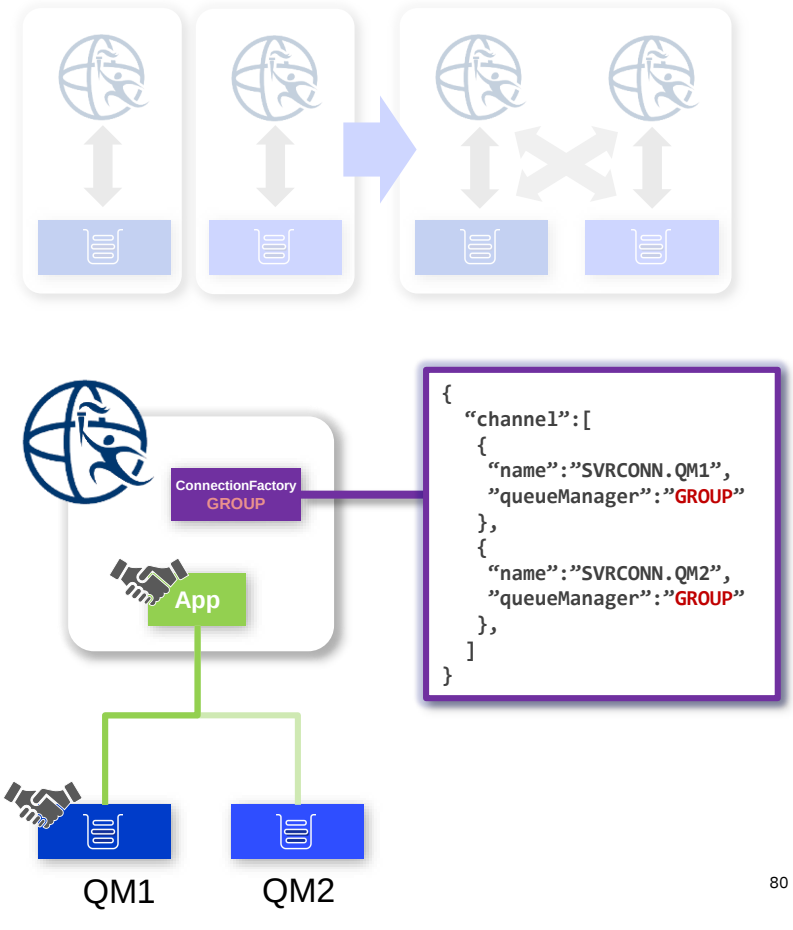
# Building scalable and available solutions



## WebSphere Liberty Transactions

- Global transactions currently require a single queue manager to be named when connecting, complicating deployment and introducing single points of failure

- WebSphere Liberty 18.0.0.2 and MQ 9.1.2 support the use of CCDT queue manager groups when connecting



# Summary

- The business value of IBM MQ
- IBM MQ offerings
- IBM MQ for z/OS enhancements
- IBM MQ Advanced for z/OS VUE enhancements
- Migration
- Helping Developers
- IBM MQ and IBM Event Streams
- Fault Tolerance
- Cloud Native Messaging

# IBM MQ and IBM Event Streams sessions this week

| Day | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| 8:30<br>9:00 | **z109525 - The MQ journey to date and what's new in MQ V9.1 LTS and MQ V9.1.n CD releases**<br>Veronese 2502-Level 2<br>Mayur Raja | | **z110367 – MQ Advanced Message Security**<br>Veronese 2502-Level 2<br>Mayur Raja | **z109588 - IBM MQ for z/OS - Security and REST hands-on lab - Part 1**<br>Casanova 602-Level 1<br>Mitch Johnson / Carolyn Elkins | |
| 10:15 | | | | **z109589 - IBM MQ for z/OS - Security and REST hands-on lab - Part 2**<br>Casanova 602-Level 1<br>Mitch Johnson / Carolyn Elkins | |
| 11:30 | | | | **z109526 – MQ clustering deep dive**<br>Veronese 2506-Level 2<br>John Waldron | |
| 1:45 PM | | **z109590 – MQ for z/OS – SMF, what we've learnt since we last spoke**<br>Veronese 2406-Level 2<br>Carolyn Elkins / Mitch Johnson | | | |
| 3:15 PM | | **z110366 – MQ for z/OS – Where's my message ?**<br>Veronese 2402-Level 2<br>John Waldron | | | |
| 4:30 PM | | | | **I110031 - Making sense of queues and event streams / Apache Kafka**<br>Veronese 2403-Level 2<br>Subhajit Maitra / Bernard Kufluk | |
| 5:30 PM | | | | **z109529 – Introducing the MQ Appliance (M2002) - Poster Session**<br>Venetian Ballroom Level 2<br>John Waldron / Mayur Raja | |

# Thank you!


Mayur Raja

MQ for z/OS Development

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**Please complete the Session Evaluation!**