Integration Technical Conference 2019

IBM MQ Appliance

Best Practices and Lessons Learned from the Field

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IBM **Cloud**

IBM

Introducing the MQ Appliance

The scalability and security of IBM MQ

Familiar administration model for administrators with MQ skills

The convenience, fast time-to-value and low total cost of ownership of an appliance

Ideal for use as a messaging hub running queue managers accessed by clients, or to extend MQ connectivity to a remote location

Familiar feel for existing MQ users – application interfaces, administration, networking and security

Easy integration

Integrates seamlessly into MQ networks and clusters

High availability

Built-in support for high availability and disaster recovery

M2002

Why an Appliance?

Fixed hardware specification allows IBM to simplify and tune the firmware

Fewer variables makes it easier to deploy and manage

Standardisation accelerates deployment

Repeatable and fast, less configuration or tuning required

Optionally lock down before deployment

Hub pattern separates messaging from applications

Improved availability, due to reduced downtime

Predictable performance, simpler capacity planning

Simplified ownership

Avoids dependencies on other resources and teams

Simpler licensing

Easier to assess for security compliance and audit

What do you want to do?

- Optimized solutions to meet the needs of these use cases
- Differentiation compared to MQ software deployment approaches
- 2 price points to meet different deployment-based business needs

Consolidate MQ infrastructure into an MQ hub for lower total cost of ownership (TCO)

Deploy to remote premises:

- Branch
- Factory
- Warehouse

Deploy to a business partner:

- Dealer
- Broker

Key differences with an appliance

IBM MQ Appliance

- Prebuilt for hub pattern – no apps on device
- No additional software installation
- No user exits in MQ
- Monitoring agents must be remote
- High availability out-of-the-box
- Pre-tuned
- Single firmware update for whole appliance (rollback as single unit)

IBM MQ on custom server

- DIY hub or generic server – apps + middleware
- Install any software
- Build & maintain custom extensions
- Can add local monitoring agents
- HA cluster SW or network storage for HA
- Custom tuning for OS and middleware
- Discrete maintenance (OS, MQ, etc.)

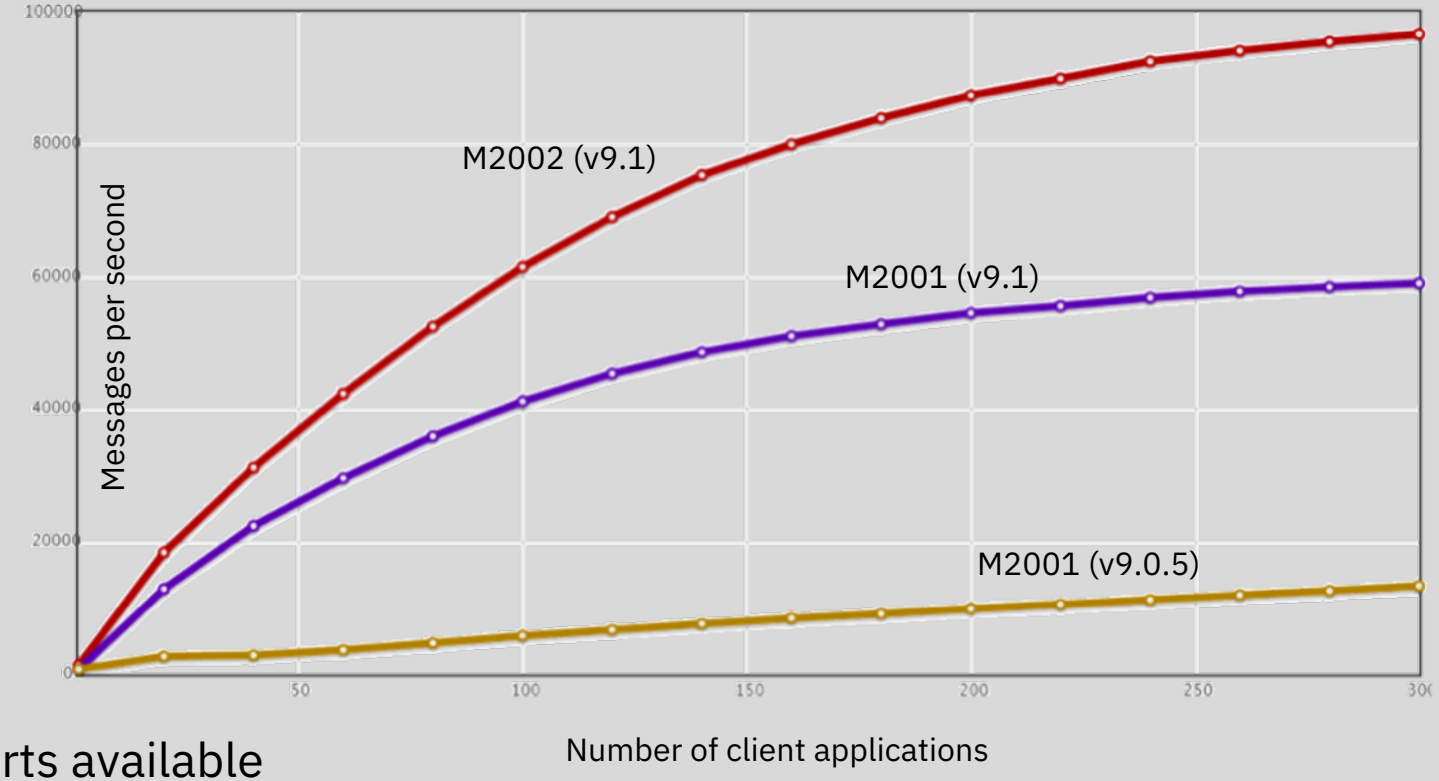
Hardware Features (M2002)

- ✓ 2 x 12 core Skylake processors (hyper-threaded, so seen as 48)
- ✓ 192 GB RAM
- ✓ 2 GB RAID cache

MQ Appliance performance

Comparison scenario:

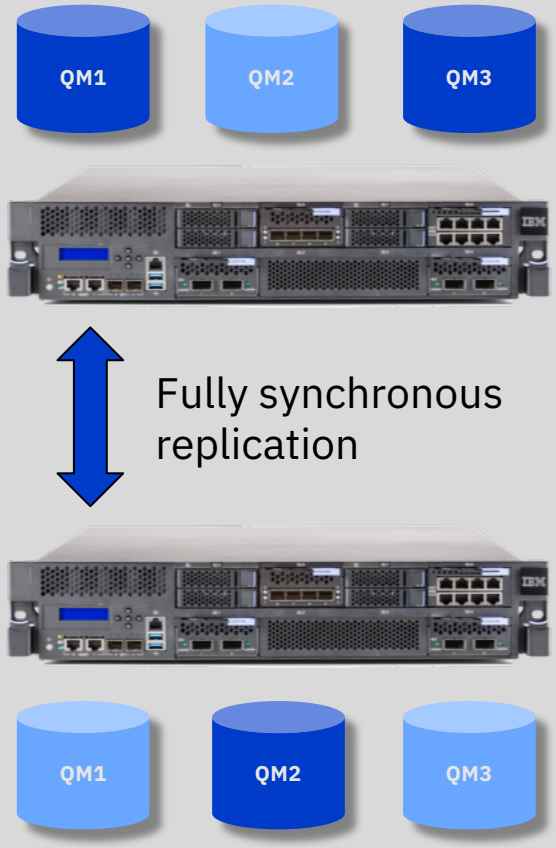
- ✓ Multiple queue managers
- ✓ High availability
- ✓ Many client applications



Performance reports available at https://ibm-messaging.github.io/mqperf/

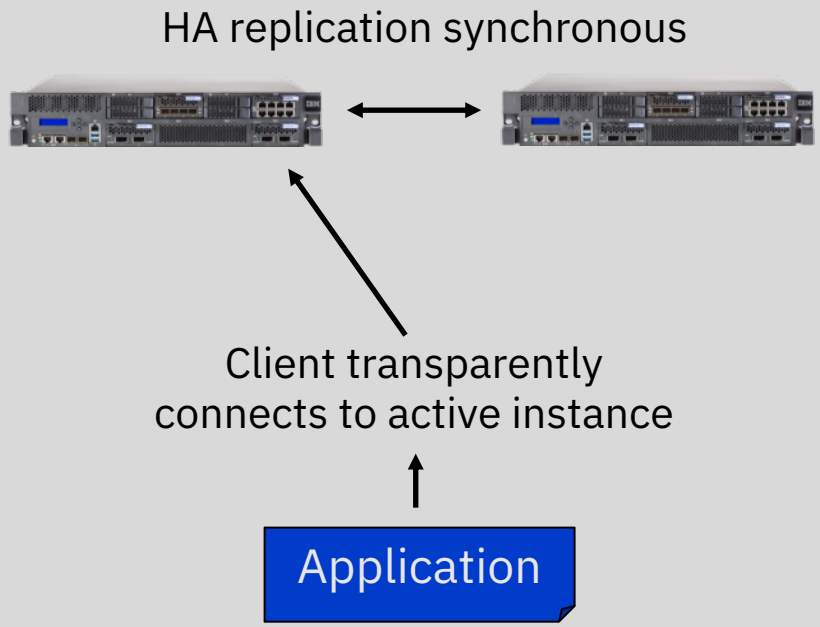
High availability

- ✓ Automatic failover, plus manual failover for migration or maintenance
- ✓ Independent failover for queue managers so both appliances can run workload
- ✗ No persistent data loss on failure
- ✗ No external storage
- ✗ No additional skills required



High availability floating IPs

- Optional IP address associated with an HA queue manager
- IP address automatically adopted by the active HA appliance
- Single logical end-point per queue manager for client applications
- No need for comma-separated list of IP addresses, CCDTs, or other routing
- Exploit aggregate interfaces for enhanced network availability

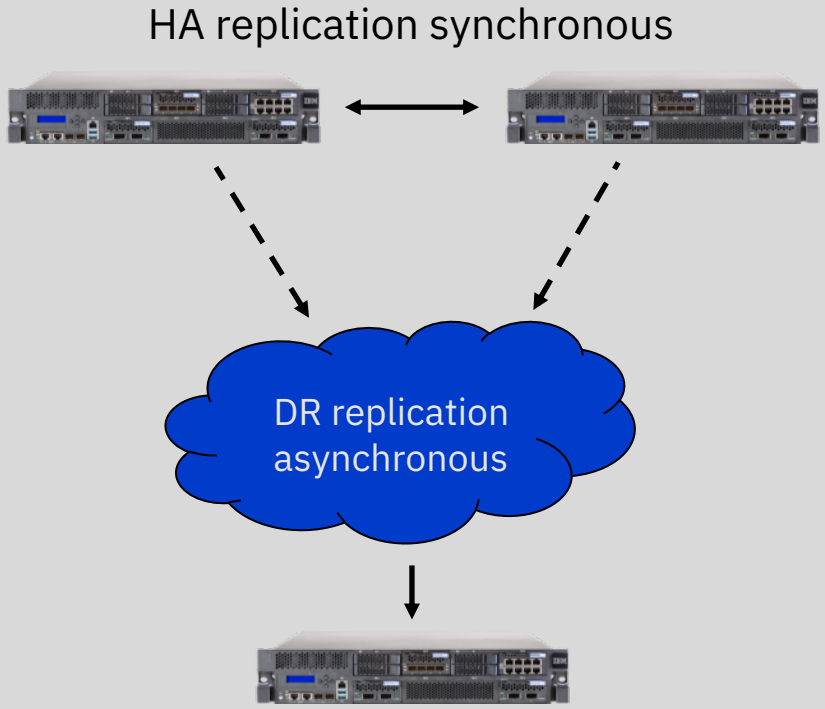


Disaster Recovery

- Provides for longer distance recovery than HA – e.g. out-of-region standby site
- High bandwidth connectivity required to mirror all persistent data
- Asynchronous replication, so better than HA for higher latency, ‘bursty’ or ‘lossy’ networks
  - → Most recent messages potentially lost on failover so application logic must consider this
- Manual failover

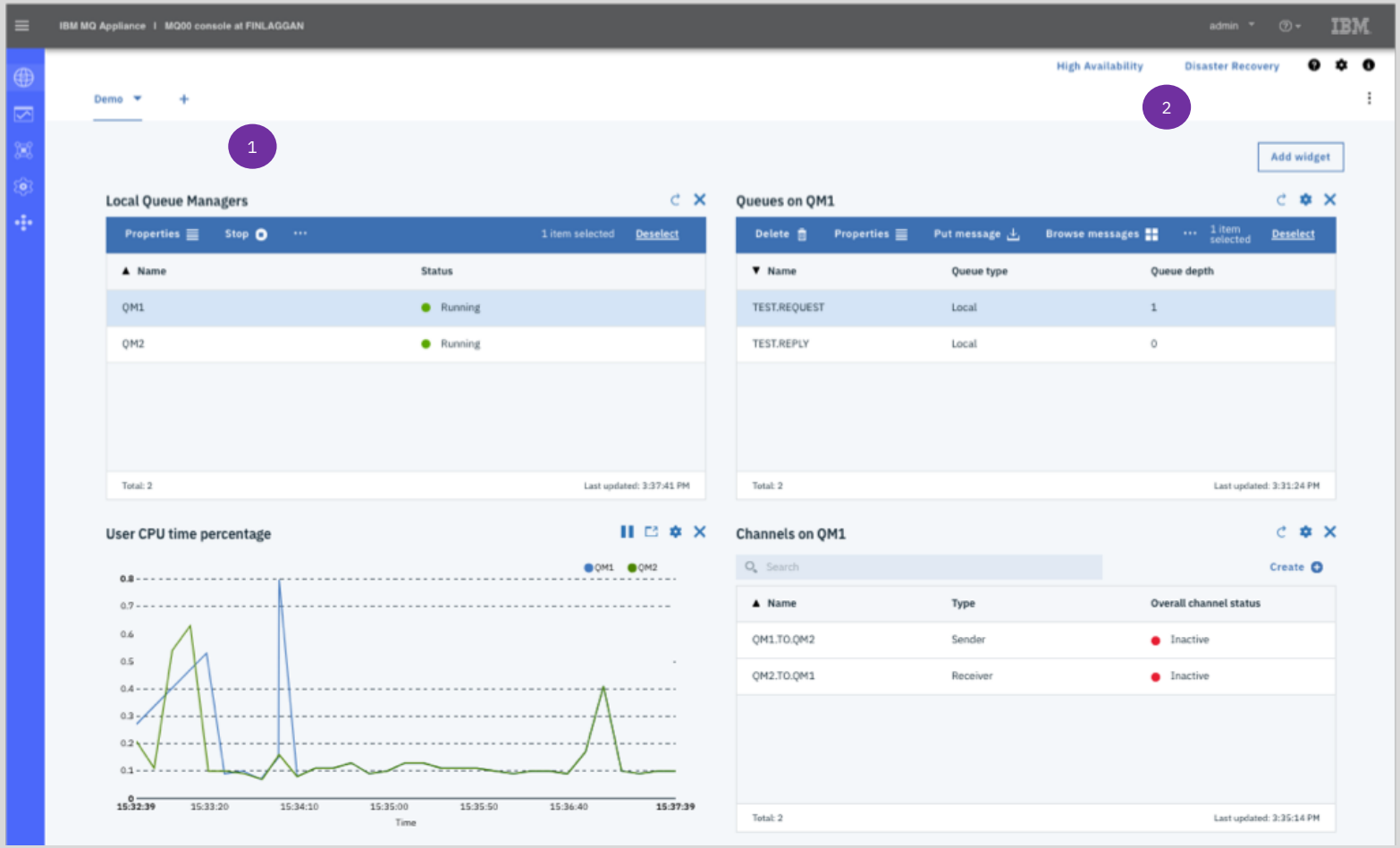
Disaster recovery for HA Groups

- Support for both HA and DR
- DR appliance asynchronously updated from whichever HA appliance is active
- DR configured independently for each queue manager
  - → One HA partner per appliance
  - → One DR recovery appliance per queue manager



Web administration

1. Embedded MQ Console
2. Easy access to configure high availability and disaster recovery
3. Quick navigation to system status and settings, including networking, security, file management



Administrative security

Two distinct types of user on the appliance

- Users who administer the system (appliance users)
- Users who perform messaging operations (messaging users)

Role-Based Management (RBM)

Security model for managing appliance users

Granular and flexible user and authority management

Authenticate using:

- Local users
- LDAP repository
- Users defined in an XML file

Password and account policy

Authorization

Assign authority to users, or local/LDAP groups

Quickly define simple rules or build granular definitions for complex policies

Integration with the MQ OAM for the MQ Console and REST API enables granular MQ admin authority

Restrict access to specific interfaces:

- Require local access for sensitive operations
- Independently grant access to the web UI, REST and SSH

Monitoring

SNMP support

Respond to hardware failures, temperature alerts, network errors and other system events

SNMP versions 1, 2c and 3

MQSC / PCF
MQ Explorer
MQ Console
SSH (expect)
Instrumentation events
Accounting and stats
Application activity trace

Most traditional MQ monitoring products will work in exactly the same way with an appliance queue manager (‘remote agent’ configuration)

- e.g. IBM Cloud Application Performance Management (APM)

REST administration

Powerful REST API for system administration and monitoring

… plus an evolving API for MQ

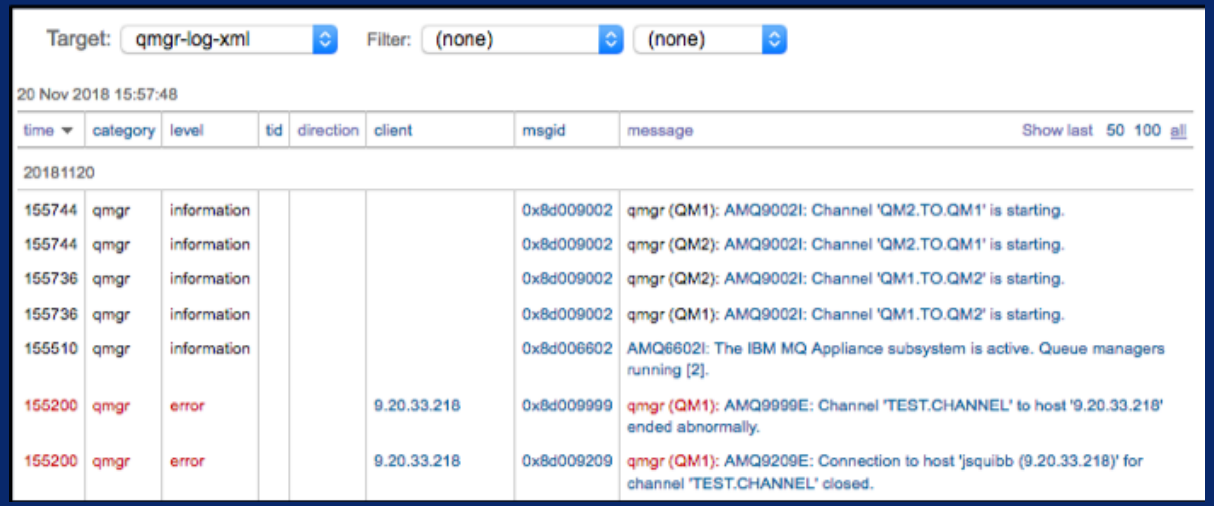
Logging

- ✓Flexible logging configuration
- ✓Traditional MQ error logs
- ✓Integrated MQ and system logs *
- ✓Variety of output formats
- ✓Filter log events
- ✓Stream logs to a remote syslog server for integration with centralized management tooling

```
01/31/19 14:35:19 - Process(156393.1) User(mqsystem)
                    Program(amqzxma0) Host(mqademo1)
                    Installation(MQAppliance)
                    VRMF(9.1.2.0)
                    QMgr(QM1)
                    Time(2019-01-31T14:35:19.201Z)
                    CommentInsert3(QM1)

AMQ8004I: IBM MQ Appliance queue manager 'QM1' ended.

EXPLANATION:
IBM MQ Appliance queue manager 'QM1' ended.
ACTION:
None.
```



* New in 9.1.2

Managing queue managers

- Integrated support for common queue manager management tasks
- Dynamically add or remove high availability and disaster recovery configuration

Configure queue managers to automatically start when the appliance boots

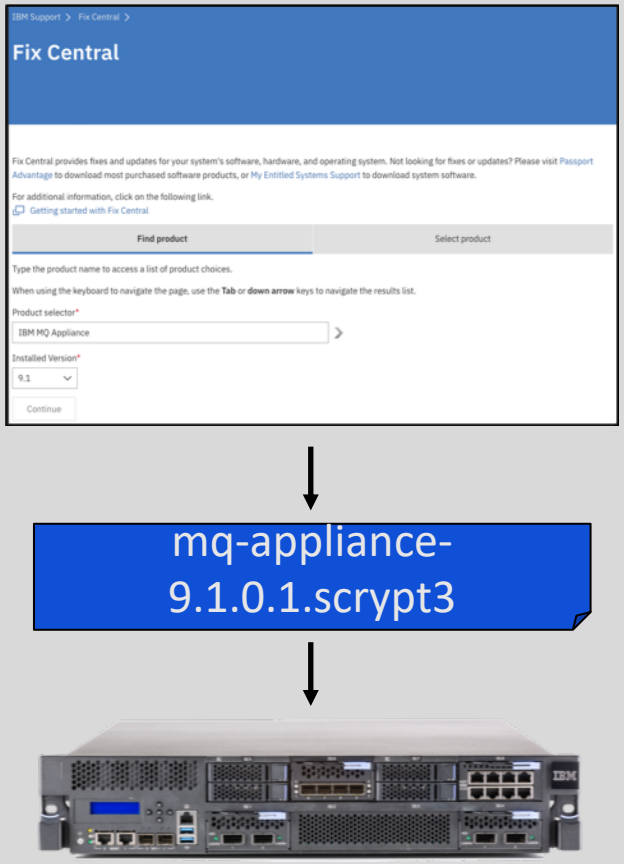
Expand the filesystem allocated for a queue manager to respond to growing workload patterns

Backup and restore queue managers

- Provides a fall back option when upgrading MQ versions
- Move a queue manager to an alternative appliance

Updates and maintenance

- Appliance updates supplied as a simple single file; signed and secure.
  - → Nothing else can be installed
- All system and MQ updates provided in one consumable package
- Rolling updates for HA and DR
- To install maintenance:
  1. Download updates from Fix Central
  2. Copy firmware image to the appliance
  3. Initiate update and reboot



Best Practices and Lessons Learned

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Migration and Consolidation

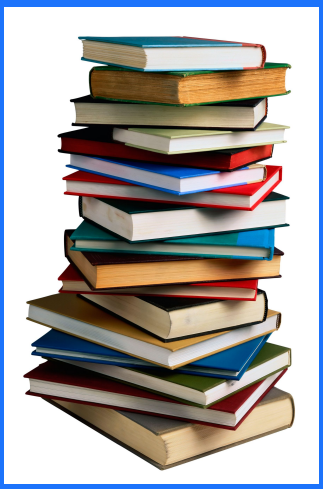
- You can consolidate your existing IBM MQ infrastructure by migrating existing queue manager configurations onto the IBM MQ Appliance.
- The IBM MQ Appliance is designed to be a good candidate for consolidation scenarios.
  - System performance tuning for client connectivity
  - High availability tooling
  - Segmentation available by using fixed storage allocations for queue managers
- A number of factors need consideration when you plan such a migration/consolidation exercise, depending on your previous IBM MQ configuration.

Moving Queue Managers

- Consolidation of your IBM MQ estate means moving your queue managers from their various platforms to your IBM MQ Appliance.
- You use the dmpmqcfg command on your source system to save the configuration of a queue manager.
- You create a new queue manager on your target appliance, and create a connection to it on your source system.
- You then use the runmqsc command on the source system to configure the remote queue manager.
- As part of moving a queue manager, you must carefully check the details that you are exporting. If there are features in the export that are not supported on IBM MQ Appliance, you must take action to remedy this.
- If you move queue managers that are part of a distributed configuration, you must update channel definitions on other queue managers in the configuration to point to the new location of the moved queue manager on the appliance.

Lessons Learned - General

- Customers are using the appliance and interest is very strong
- Some new MQ customers starting with appliance
- With existing MQ customers, seen use two ways: one as a simple MQ refresh, and secondly as an addition to their existing MQ infrastructure
- Customers looking at the "small site with no skills" use case -- created centrally and then shipped out, and managed centrally
- Customers involved in ongoing Early Access (beta) Program – tell us if you would like to join!
- Redbook published -- Integrating the IBM MQ Appliance into Your Existing MQ Infrastructure (SG24-8283) -- http://www.redbooks.ibm.com/Redbooks.nsf/RedpieceAbstracts/sg248283.html?Open
- IBM MQ Appliance POT v9.1.2 available soon – at your own pace



Lessons Learned - General

- M2000 models go out of support 2020-04-30
- M2001 models, running firmware v9.1 or greater, go out of support 2023-07-10
- IBM Appliance Support Guide -- https://www01.ibm.com/support/docview.wss?uid=ibm10737691
  - Describes "Business Critical" and "Hard Drive Retention" options

Standard	Service upgrade	Service upgrade
Standard Appliance Service and Support You may contact IBM (24 hours x 7 days per week) for assistance	**Business Critical[1]** Upgrade to 24 hours x 7 days onsite for hardware issues	**Hard Drive Retention[1]** With HDR, you retain the replaced hard drive.
IBM targets remote response based on severity of the issue Severity 1: Within 2 hours. 24 hours per day x 7 days per week Severity 2-4: Within 2 business hours. 9 hours per day x 5 days per week.	**Same targets as Standard Appliance Service and Support**	
If IBM deems necessary, IBM targets onsite response for hardware issues[2] Any severity. next business day. 9 hours per day x 5 days per week.	**If IBM deems necessary, IBM targets onsite response for hardware** Any severity. Within 4 hours of dispatch.[3] 24 hours per day x 7 days per week.	**If IBM deems necessary, IBM will replace the hard drive. IBM normally retrieves the replaced hard drive.**

Lessons Learned - Migration

- Seeing consolidation of existing Queue Managers from several platforms on to the appliance
- Migrating existing queue managers, then decommissioning existing software based queue managers
- Some are moving licenses to IBM Cloud Integration Platform for new cloud native projects
- Migrating queue managers on aged versions of MQ to appliance
- In general, existing customers have looked at the appliance seriously and have generally found that existing exits can be scrapped (with additional savings in the long term from losing the ongoing maintenance), to be replaced by using channel authentication records and sometimes the application activity trace
- Also seen consolidation of all Queue Managers off z/OS platform (a banking customer), where z specific features not used (such as queue sharing groups)
  - It is not appropriate where you have native z/OS applications, CICS etc. involved, which **have** to have a local queue manager to function

Lessons Learned - Migration

- If you use the MS03 SupportPac to export the queue manager configuration, the output is slightly different than output from a dmpmqcfg command – you must look for the SCMDSERV attribute set to MANUAL on the ALTER QMGR command – this is not supported on the Appliance, where this must be set to QMGR
- Changing applications that used local bindings to client bindings to use a queue manager on the appliance, factors to consider:
  - Performance effects
    - What is the latency introduced going over the network and is it acceptable?
    - If using AMS remember the overhead is here
    - Use Asynchronous MQPUT and Read Ahead if appropriate
  - Potential need for client triggering

- V9 offers ability to backup and restore queue managers - to export and import queue manager data from/to MQ Appliance -- https://www.ibm.com/developerworks/community/blogs/messaging/entry/Migration_to_9_0_1_including_queue_manager_backup_restore?lang=en

Lessons Learned - Migration

- Migration to new appliances:
  - Do follow the link for more details, but in summary we suggest a simple 3 step approach to migrating queue managers: https://www.ibm.com/support/knowledgecenter/en/SS5K6E_9.1.0/com.ibm.mqa.doc/upgrading/up00055_.htm
    - Configure your new hardware.
    - Migrate queue managers one at a time using 'mqbackup' and 'mqrestore' (independently and at appropriate time for your applications).
    - Re-deploy each queue manager's HA and DR configuration (if applicable) in the new environment.
- Availability
  - Using a HA queue manger and configuring the CONNAME with multiple IP addresses? Or use CCDT (can be stored locally)? Or using floating IP?
  - If you have unreliable network links, is going client only a good idea?
  - Can use MAXINST and MAXINSTC to limit client connections on a channel, and use channel authentication records to secure its use
  - Consider SHARECNV value (0 for no sharing – V6 mode, 1 for full duplex V7 mode, > 1 sharing up to negotiated value)

Lessons Learned - Migration

- Transactionality (windows for in-doubt transactions, etc.)
  - If you don't want to lose messages, code MQ*_SYNCPOINT on MQGET and MQPUT calls then issue MQCMIT
  - Standard client - the MQ client can only commit a unit of work carried out on the queue manager it is connected to. The client cannot be used to manage work carried out on other resource managers. Therefore the MQBEGIN call is not available within MQ clients.
  - Extended Transactional Client - allows a client to participate in units of work coordinated by an XA transaction manager. Externally coordinated transactions can now work with queue managers located on different machines from where the transaction coordination takes place. Still does not support the MQBEGIN call as all units of work must be started using the XA interface by an external (non MQ) transaction manager.

Lessons Learned - Networking

- If needed, separate your applications at the network layer -- https://www.ibm.com/developerworks/community/blogs/messaging/entry/MQ_Appliance_Securely_separating_your_applications_at_the_network_layer?lang=en
- Recommend using NTP when you connect two appliances
- Understand your network layout, or make friends with the network team, before you plug your appliances in
- Customers using floating IP addresses for HA - Version 9.0.1 of MQ Appliance introduced support of floating IPs for queue managers configured for High Availability (HA). This simplified configuration of client applications – there is no need to specify IP addresses of both appliances in an HA pair. Instead, a single IP address is used, which floats between the two appliances when one of the appliances fails.

Lessons Learned - Networking

- Configuring network interfaces on the MQ Appliance (an article that looks at some basic best practices and TCP/IP networking tips) -- https://www.ibm.com/developerworks/community/blogs/messaging/entry/Configuring_LDAP_Role_Based_Management_RBM_on_the_IBM_MQ_Appliance?lang=en
  - Avoid ever having multiple IP addresses on a system on the same subnet
  - For HA or DR links which are direct connections, put them onto completely dedicated private subnets
  - If they are not direct, still give HA/DR interfaces dedicated/discrete subnets if possible. If not, define static routes to the equivalent interfaces on the partner appliance for each of the eth13/17/20/21 interfaces.
  - Consider defining static separate routes to hosts or subnets for specific MQ and management traffic
  - Avoid ever having multiple default gateways defined
    - Use static routes where necessary
  - The default gateway really should be just that

Lessons Learned - Networking

- Consider link aggregation and VLAN definitions
  - Floating IP address for HA now supported with link aggregation in 9.0.5 -- https://developer.ibm.com/messaging/2018/03/22/new-mq-appliance-combine-floating-ip-aggregated-links-maximum-availability/
- Can use custom DR & HA replication interfaces with 9.1 -- https://developer.ibm.com/messaging/2018/08/21/using-custom-dr-ha-replication-interfaces-9-1/
  - Previously the MQ Appliance restricted Disaster Recovery (DR) and High Availability (HA) Replication to eth20 and eth21 respectively. With the release of 9.1, this has been relaxed, users will now be able to configure DR and HA Replication links over interfaces of their choosing, including Aggregated Interfaces. This feature is even more desirable when combined with the new MQ Appliance M2002 as it allows use of new 4 x 40GB interfaces and additional 2 x 10GB interfaces.

Lessons Learned - Implementation

- Working on new applications to be used with appliance
- Creating 4-12 queue managers on appliance (M2002B)
- Sometimes seeing MQ software for development, sometimes doubling up development on another appliance
- Minimum firmware level for M2001 is MQ v8.0.5 / for M2002 is MQ v9.1
- In V9, take advantage of auto start of queue managers (non-HA and HA) -- https://www.ibm.com/developerworks/community/blogs/messaging/entry/Automatic_queue_manager_start_up?lang=en
- When planning space allocation for queue managers keep some 'spare' - e.g. for deciding to make a QM DR in future, or needing to take backups
  - Can now extend the size of the queue manager storage (see upcoming chart)

Lessons Learned - Implementation

- External SAN storage option available in M2000/M2001 with firmware v9.0.4, but **not supported on the M2002** – exploits the Host Bus Adapter included in the appliance specification since the GA of the M2000 model. It permits queue manager files (logs and data) to be placed on external SAN storage instead of internal storage. The design assumes each queue manager gets its own dedicated SAN partition (Logical Unit Number - LUN) – no two queue managers can co-exist on a single partition and no other files are allowed on it.
- Seriously consider AMS for at rest and in flight (including replication) encryption
- A paper featuring AMS and TLS Performance on the MQ Appliance has now been released, which show how a larger set of scenarios performs on the MQ Appliance and how to maximize AMS throughput (including Confidentiality policy) – https://ibm-messaging.github.io/mqperf/AMSMQAppliance.pdf

Lessons Learned - Implementation

- Assets to review:
  - MPA1: Performance report -- http://www-01.ibm.com/support/docview.wss?uid=swg24040125
    (Updated June 2016 for M2001 hardware – testing with solid state disks)
  - MPA2: IBM MQ Appliance HA/DR Performance Report –
    https://ibm-messaging.github.io/mqperf/MPA2-3.0.pdf
    (Updated September 2018 for updated firmware / 3rd revision for MQ v9.1)
  - **MPA3: IBM MQ Appliance Performance Report – M2002 --**
    https://ibm-messaging.github.io/mqperf/MPA3.pdf
  - AMS and SSL/TLS Performance on the IBM MQ Appliance --
    https://ibm-messaging.github.io/mqperf/AMSMQAppliance.pdf
  - YouTube video – Configuring a HA group -- https://www.youtube.com/watch?v=n5aeeF-4NCU
  - YouTube video – Using charts in the MQ Console -- https://www.youtube.com/watch?v=V2hIwQIelAo
  - Additional YouTube videos -- https://www.youtube.com/results?search_query=ibm+mq+appliance

Lessons Learned - Administration

- Can now resize queue managers on the appliance with *setmqsize* command - limited only to standalone queue managers created on local RAID storage -- https://developer.ibm.com/messaging/2017/12/12/resizing-queue-managers-mq-appliance/
- Resource utilization on the MQ Appliance - how you can monitor how resources are being utilized on the MQ Appliance and help determine how much capacity the MQ Appliance has for adding additional workload. -- https://developer.ibm.com/messaging/2017/07/03/resource-utilisation-mq-appliance/
- Look out for 'error reports', particularly e.g. following any issue is good practice. Basically equivalent of being aware of FDCs in MQ - worth checking if there is one (or generating one explicitly from the troubleshooting menu) e.g. if raising a PMR
- Worth setting up some 'permanent' system event logging (syslog, SNMP now it's available, etc.) in place of the default RAM only system log
- The general recommendation for now, and the future, is to use a secure private network for appliance management network interfaces, which is only accessible to security administrators
- Significant performance impact if the total size of active log files exceeds approximately 600MB, so you need to look at the workload of the queue managers and the expected maximum size of the active log file for each queue maork for appliance management network interfaces, which is only accessible to security administrators.

Lessons Learned - Administration

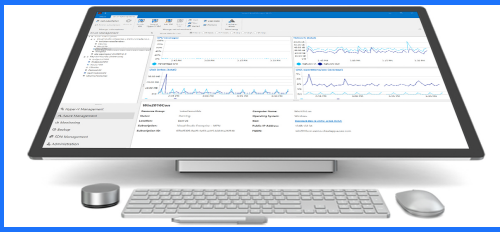
- There are significant error log enhancements in v9.1.2 -- see https://developer.ibm.com/messaging/2019/03/22/mq-appliance-error-log-enhancements-in-9-1-2/

  "Diagnostic Message Services" that support:

  - Generation of custom queue manager and system error logs in text or JSON format
  - Customization of error log sizes
  - Suppression and/or exclusion of specific messages from error logs
  - Filtering content written to error logs by message severity, for example to only include warnings or errors
  - Integrates MQ error logs with system log targets. This capability provides a single logging framework for both MQ and system activity on an appliance. It is enabled by default for new queue managers. The logging framework :
    - Is configured in mqs.ini and qm.ini using dspmqini and setmqini
    - Can exploit existing log target output formats, including files, SMTP, SNMP and remote syslog servers for MQ error log events
    - Using a syslog log target it is now possible to stream MQ diagnostic messages from an appliance to a remote syslog server, including tools such as Splunk or Elastic Stack.
    - A sample Logstash pipeline and Elasticsearch index mapping template are available at https://github.com/ibm-messaging/mq-appliance/tree/master/elastic

Lessons Learned - Administration

- Now two REST APIs exposed by the MQ Appliance: the MQ administrative REST API for managing the 'MQ' aspects of the MQ Appliance, and the 'System management' REST API which will provide access to typically 'OS' concerns, such as hardware, networking, user management, etc.
- Now that it's available, use REST where appropriate for remote management. Probably a better option than e.g. 'expect' scripts in most cases. Support libs for REST calls to make it easy are available in basically any 'scripting' languages nowadays (perl, python, node.js etc.) -- https://www.ibm.com/developerworks/community/blogs/messaging/entry/Scripting_using_the_MQ_REST_API?lang=en
  and
  https://www.ibm.com/developerworks/community/blogs/messaging/entry/The_MQ_Administrative_REST_API_is_now_available_on_the_MQ_Appliance?lang=en and https://www.ibm.com/developerworks/community/blogs/messaging/entry/Monitoring_an_IBM_MQ_Appliance_s_Resources_using_the_REST_API?lang=en
- Monitoring an IBM MQ Appliance using the RESTful API in Node.js – https://github.com/ibm-messaging/mq-appliance/tree/master/rest
- Scripting system management operations on the IBM MQ Appliance using the REST API -- https://www.ibm.com/developerworks/community/blogs/messaging/entry/Scripting_system_management_operations_on_the_IBM_MQ_Appliance_using_the_REST_API?lang=en



Lessons Learned - Security

- In V9, make use of role based management:
  - Adding new authentication mechanisms such as LDAP
  - Allowing configuration of security ‘policies’ (e.g. minimum password length)
  - Enabling meaningful ‘Roles’ to be defined for users, including coarse grained MQ Authorities

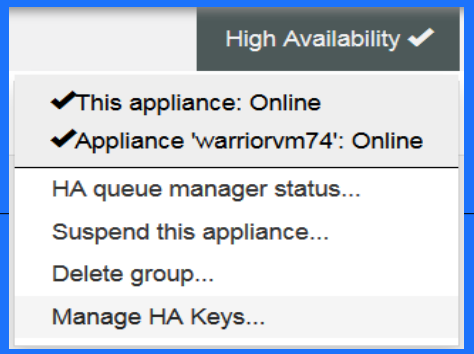
    https://www.ibm.com/developerworks/community/blogs/messaging/entry/Introducing_Role_Based_Management_RBM_for_the_IBM_MQ_Appliance?lang=en and https://www.ibm.com/developerworks/community/blogs/messaging/entry/Configuring_access_to_the_MQ_Console_and_CLI_on_the_IBM_MQ_Appliance?lang=en
- Use LDAP for messaging users https://www.ibm.com/developerworks/community/blogs/messaging/entry/An_Example_for_how_to_configure_Role_Based_Management_on_MQ_Appliance_to_allow_access_to_LDAP_users?lang=en and https://www.ibm.com/developerworks/community/blogs/messaging/entry/Configuring_LDAP_Role_Based_Management_RBM_on_the_IBM_MQ_Appliance?lang=en

Lessons Learned - Security

- Can now renew appliance HA keys
  - The feature introduces a mechanism to renew SSH keys used for communication between two MQ appliances when configured in high availability (HA). As security best practices recommend, secret keys should not exist in perpetuity, but should be regenerated and exchanged on a regular basis. To meet this need, this feature provides MQ CLI command, which allows regenerating SSH keys on both appliances of an HA pair and exchange their public parts.
- MCA intercept for AMS
  - This feature delegates the work of encrypting messages for AMS to the Queue Manager, and eliminates the need for clients to manage their own certificates. The intention of this feature is to remove the need for clients to encrypt their own messages in AMS and instead delegates that role to the Queue Manager. Note of caution, as keys are stored on device in plain text.
- Configuring access to the MQ Console and CLI on the IBM MQ Appliance -- https://www.ibm.com/developerworks/community/blogs/messaging/entry/Configuring_access_to_the_MQ_Console_and_CLI_on_the_IBM_MQ_Appliance?lang=en

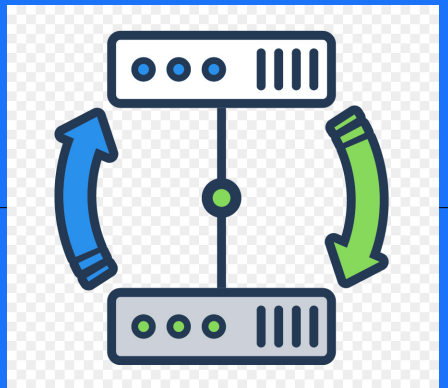
```
mqa(mqcli)# crthakeys
The crthakeys command succeeded.

mqa(mqcli)# dsphakeys
SSH key generation time: 2017-02-13
16:47:55
```



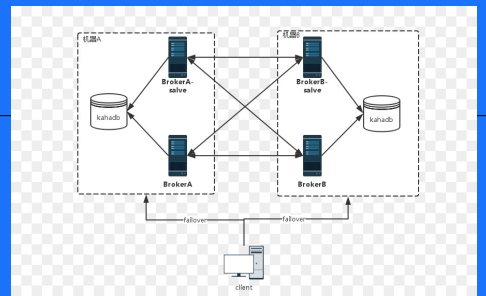
Lessons Learned - HA

- Using HA within a data center – typically two data centers
- Several customers considered and are using HA across two nearby data centers, where latency was < 5ms
- You should use unique subnets for the links between eth13, eth17 and eth21
- Initial limitation of 16 HA queue managers per appliance (HA Group) (documented in the README – ***lifted in 8.0.0.5***)
- It is important to thoroughly understand the testing tools that will be used for demonstrating HA
- Some customers use a solution, such as F5, in front of pair of appliances to provide virtual IP for appliance access from clients
- Now customers (in V9) implementing floating IP addresses for HA -- https://www.ibm.com/developerworks/community/blogs/messaging/entry/Floating_IP_support_for_the_IBM_MQ_Appliance?lang=en



Lessons Learned - HA

- We strongly recommend that the firmware version is consistent on appliances in HA and DR configurations, especially when administrative/configuration changes are made
- Remember queue managers cannot be started at a lower command level (i.e. VRM).
  - This means that if one appliance is at 9.1.0 and another appliance is at 9.1.1, then once a queue manager has been started at 9.1.1 it cannot be started at 9.1.0 (fix packs are fine though so 9.1.0.2 back to 9.1.0.1 would be ok).
  - To avoid HA/DR fail over problems we recommend that all appliances in these configurations are kept at the same firmware level as much as possible, subject to rolling upgrades.
- Upgrade the secondary appliances first (i.e. DR recovery appliance -> HA secondary appliance -> HA primary appliance) to ensure queue managers can be readily started should a fail over be necessary.
- Firmware v9.1.2 has support for the Uniform Cluster pattern, to assist in automatic application rebalancing -- https://developer.ibm.com/messaging/2019/03/21/building-scalable-fault-tolerant-ibm-mq-systems/

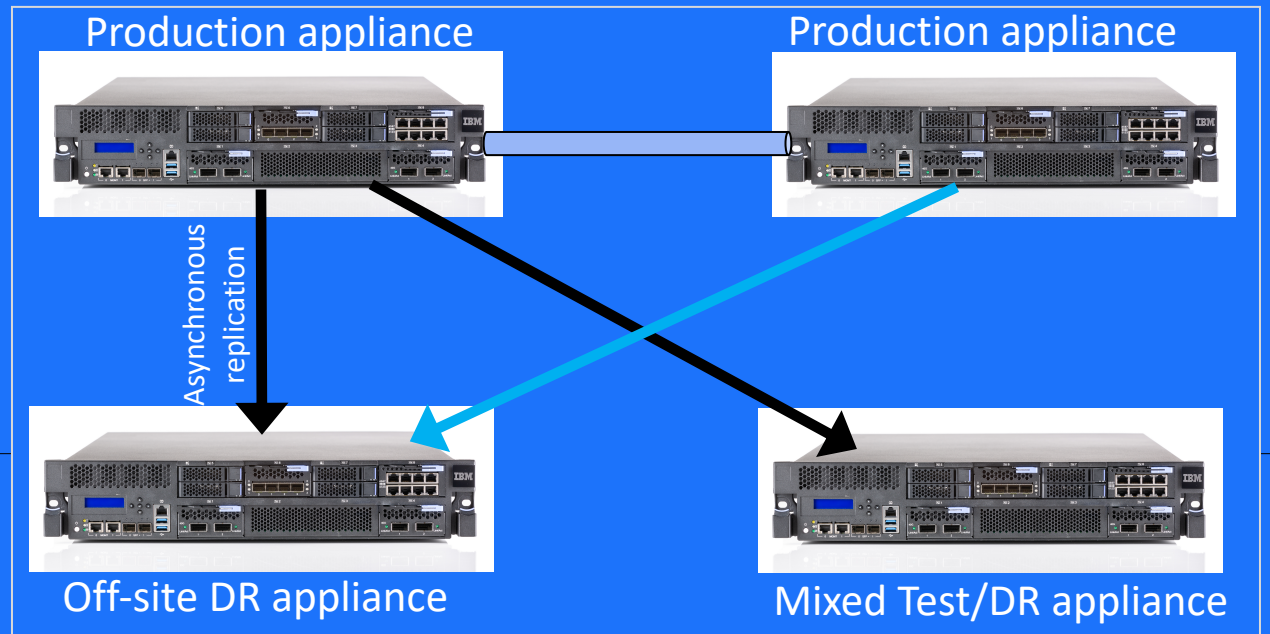


Lessons Learned - HA

- Failover time needs to be considered from two perspectives:
  - The time that it takes for the MQ appliance to successfully fail over the queue manager. There's been a lot of discussion on this topic in reference to the MQ Appliance and Multi-Instance Queue Manager configurations. Suffice it to say there's a number of variables that can lead to different failover times depending on a customer's environment and applications.
  - The time that it takes for the MQ Client to sense that a Queue Manager is no longer available, then initiate automatic recovery. (If automatic recovery is supported and enabled!) That is what the HBINT parameter addresses.
- When not using floating IPs, as part of configuring automatic recovery for client connections, it is necessary to specify multiple servers for the CONNAME parameter. The MQ client code will always attempt to connect to the first server before it attempts to connect to the second server. In a failover situation, the first server won't be available, so the MQ client code will have to wait for the TCP connection to fail before it attempts to connect to the second server. *The time that it takes for the TCP connection to fail is approximately 20 seconds for most platforms.* This time will most likely be in addition to the overall queue manager takeover time.

Lessons Learned - DR

- Customers using DR appliance to host active queue managers or for dev/QA, so it is not sitting idle
- Like HA, configured per QM – can provide HA & DR – though no concept of a ‘group’
  - Still ultimately requires high bandwidth
- Flexible DR topologies -- replicate each QM to 1 ‘DR’ appliance, or multiple ‘DR’ appliances
- Appliance disaster recovery – managing client reconnection – https://developer.ibm.com/messaging/2017/10/23/dr_client_reconnection/



Lessons Learned - DR

- The expected sequence of steps to fail back to PROD is:
  1. Ensure that network connectivity between PROD and DR is available (it might be unavailable in a real life 'disaster')
  2. Stop the queue manager on the DR appliance
  3. Make the DR appliance the DR secondary using either makedrsecondary or the MQ Console
  4. Make the PROD appliance the DR primary using either makedrprimary of the MQ Console
  5. Verify the queue manager state has been correctly replicated back to the PROD appliance using either the status command or the MQ Console
  6. Start the queue manager on the PROD appliance

Concerns

- Not model for putting appliance in DMZ
- Want HA Group to HA Group disaster recovery
- No concept of “domains” (as in DataPower) to allow true isolated multi-environment/tenancy

Cost of messaging when using the MQ Appliance?

$0

- Performance ‘out of the box’ with new M2002A MQ Appliance
  - 200,000 persistent messages per second in a HA configuration
- Imagine a scenario with typical traffic of 100,000 messages per second
  - In 1 hour = 360 million messages
  - In 1 day = 8,640 million messages
  - In 1 year = 3,153,600 million messages
  - In 5 year typical appliance life = 15,768,000 million messages
- M2002A Appliance cost
  - Purchase cost (@20% discount) = approx. $195K
  - 4 years S&S total: $156K
  - Total cost for 5 years = $351K
- Cost per message = $0.00000002

Cost of not having the MQ Appliance

- Financial trading platform using open source goes down for 2 hours. Appliance offers seamless failover.
- Manufacturing site halts work for 8 hours. No need for skills in location with MQ Appliance
- Bank hit by security breach due to malware installed. MQ Appliances are locked down.
- Distribution company hits identified problem as it hasn’t installed fix. HA Appliance pair can be updated in 15 minutes

Thank You