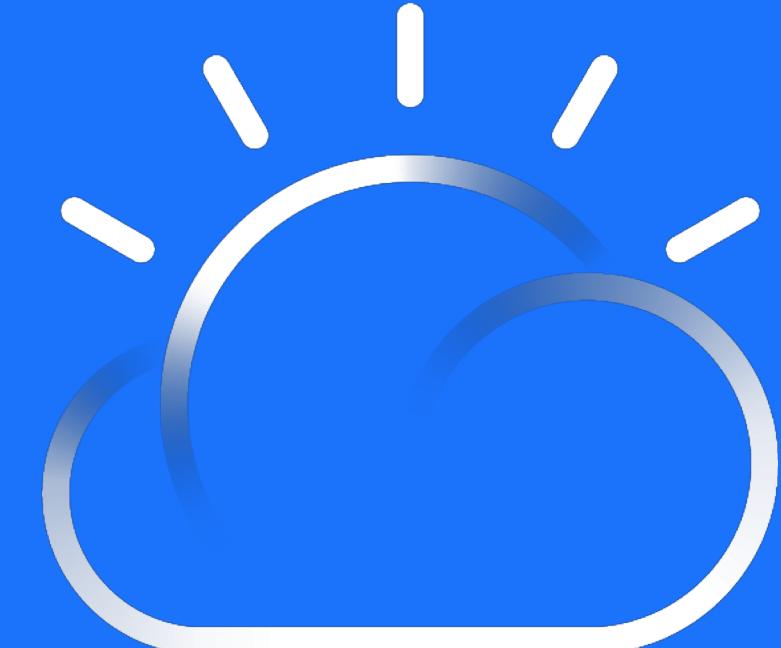


M10 – How to implement MQ in a containerized architecture

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Software Engineer, Security Focal
IBM MQ Development.
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IBM Cloud

IBM

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Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon many factors, including considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve results similar to those stated here.

Agenda

IBM®

- Containers Introduction
 - Containers
 - MQ in containers
 - Use Cases
- Considerations for IBM MQ in containers



Containers and MQ in containers

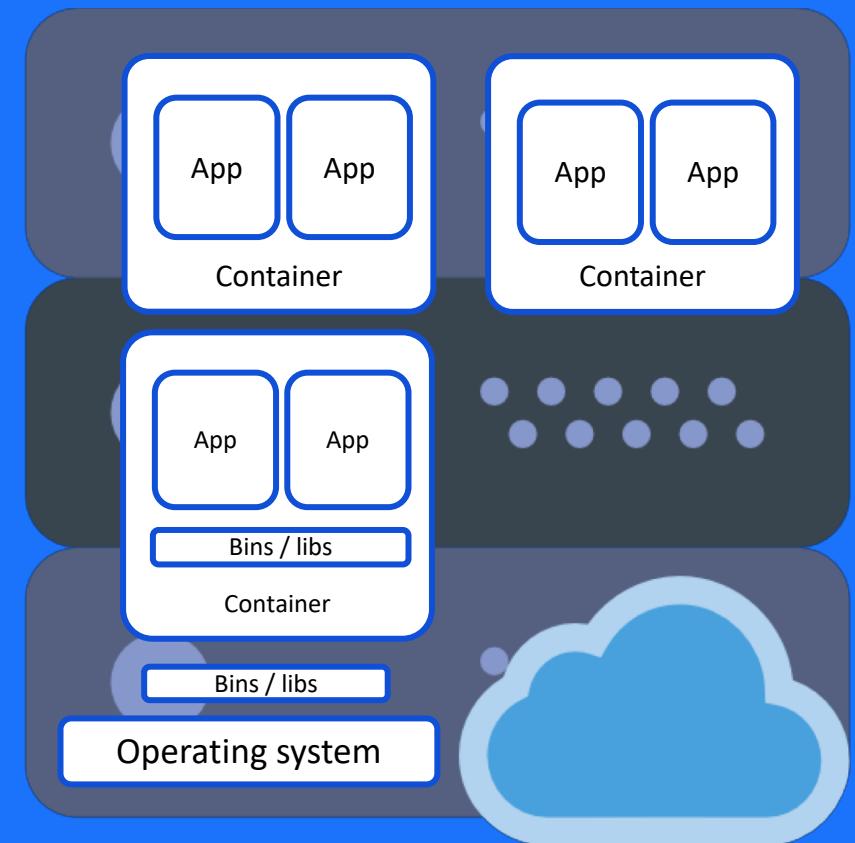


Containers Introduction



Containers

- Containers provide a similar environment to a VM but lighter in weight
 - A **virtual machine** provides an abstraction of the physical hardware
 - A **container** abstracts the OS level, typically at the user level
- Linux containers
 - Containers all share the same OS kernel
 - Images are constructed from layered filesystems
 - Containers isolate applications from each other and the underlying infrastructure



Containers Introduction



Containers

- Each container/process only sees its own process(es)
- Each container/process only sees its own filesystem
- Fast startup time – just the time to start a process, setup networks, etc
- Better resource utilization – can fit far more containers than VMs into a host

Containers Introduction



Containers

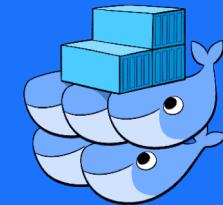
- Containers? Do you mean Docker?
- No. Linux containers have been around longer than Docker.
- Docker is tooling that allows you to easily create, run and manage Linux Containers.
 - There are many other container management programs you can use instead of Docker.
- Container images are now a OSCI Specification so can be ran by Docker, Podman or any other Container running software.

Containers Introduction



Containers

Orchestration tools



Docker Swarm

Public cloud container services



Containers Introduction



MQ in containers

- MQ is supported in containers
- IBM will support MQ issues, agnostic to the orchestration environment
 - The orchestration vendor will need to support and provide assistance for orchestration issues
- Applies to MQ V8.0.0.4 onwards
- IBM recommends using MQ V9 Continuous Delivery release
 - Adds web console
 - Adds REST APIs
 - Easier storage management (crtmqdir)
 - Quicker to receive new features

Containers Introduction



MQ in containers

	IBM Cloud Kubernetes Service	IBM Cloud Private				ICP on Red Hat OpenShift	Microsoft Azure Container Service	Amazon Elastic Container Service	Other
Component/ arch	x86_64	x86_64	ppc64le (POWER)	s390x (z/Linux)	x86_64	x86_64	x86_64	x86_64	*
MQ Server	●	●	●	●	●	▲	▲	▲	
MQ Advanced Server	●	★	★	★	★	▲	▲	▲	
MFT Agent	▲	▲	▲	▲	▲	▲	▲	▲	
Salesforce Bridge	▲	▲	▲	▲	▲	▲	▲	▲	

MQ and image supported
Supported image and Helm chart available

MQ supported with sample
Supported, and you need to build your own image (samples/blog available)

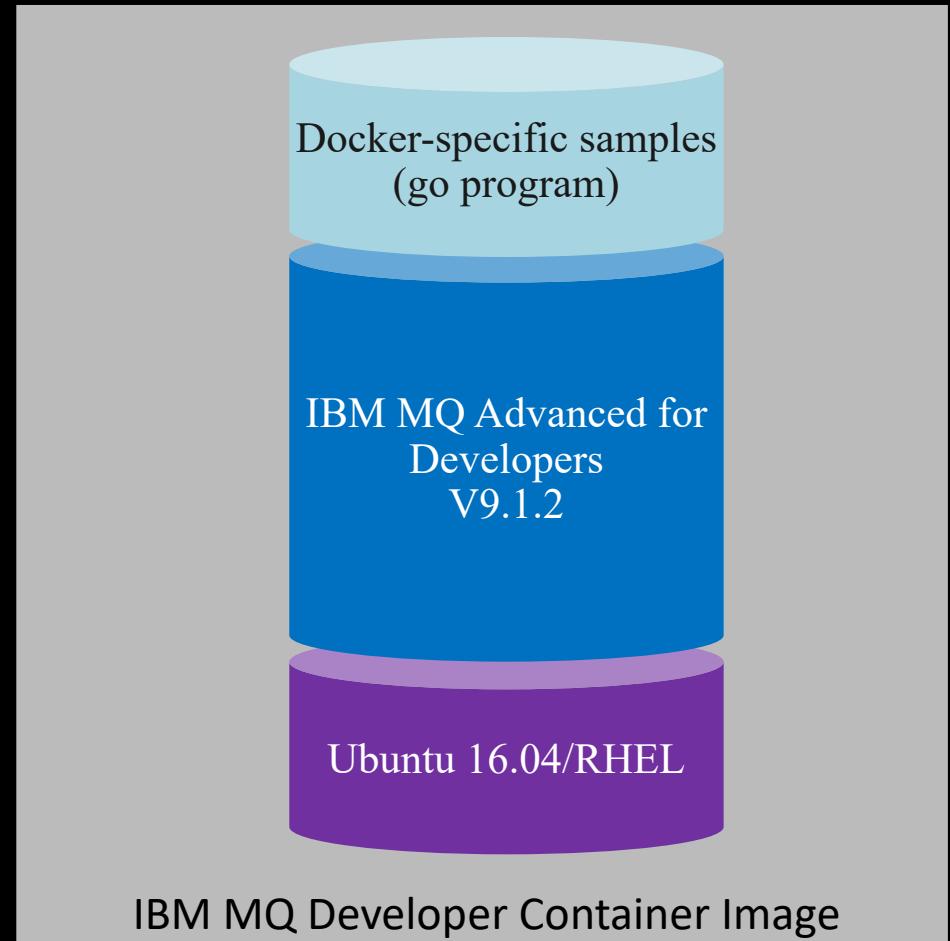
MQ supported with no sample
Supported, and you need to build your own image.

MQ in containers



Developer Image

- Based on IBM MQ Advanced for Developers, but can be re-built with your licensed copy of IBM MQ or IBM MQ Advanced
- Source code available from <https://github.com/ibm-messaging/mq-container>
- Pre-built image available from:
 - Docker Hub: <https://hub.docker.com/r/ibmcom/mq/>
 - Docker Store: <https://store.docker.com/images/ibm-mq-advanced>

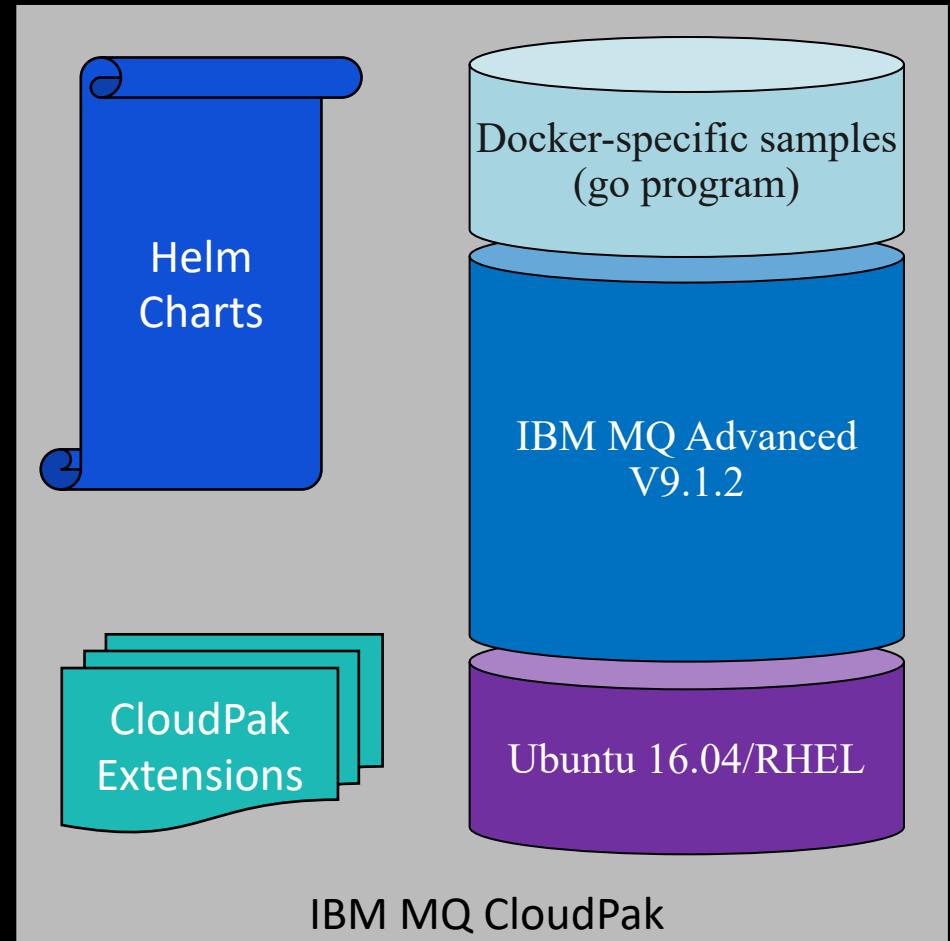


MQ in containers



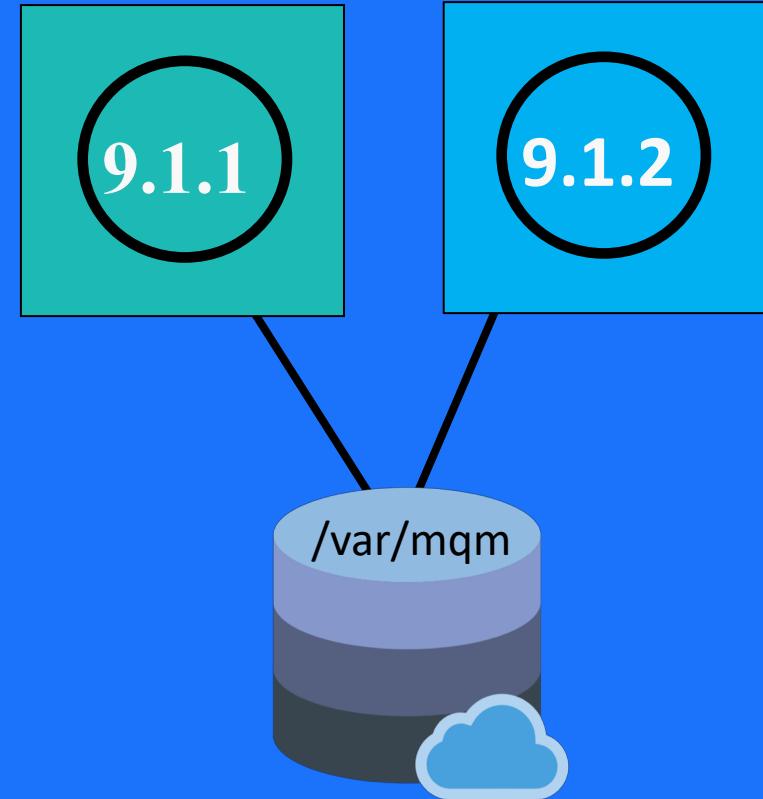
Production driver (CloudPak)

- Available from IBM Passport Advantage as a CloudPak for use in IBM Cloud Private
- Docker-specific tools supported by IBM for use in IBM Cloud Private
- Source code available from <https://github.com/ibm-messaging/mq-container>



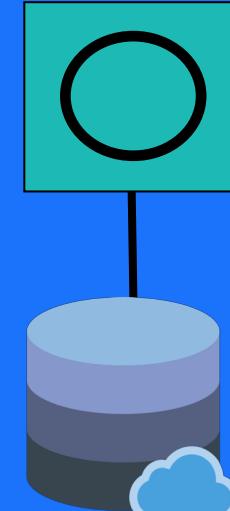
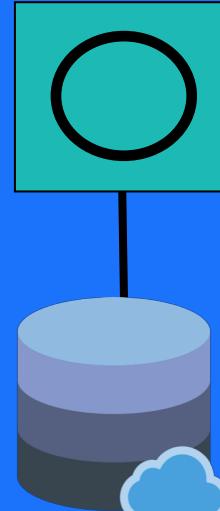
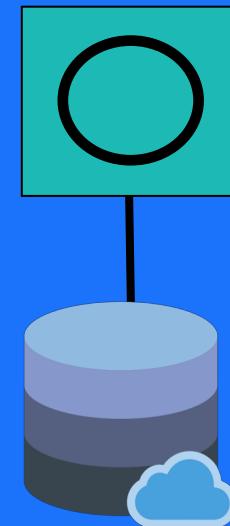
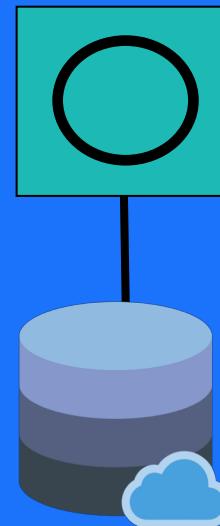
Use Case: Version Management

- Containers run from images which are prebuilt.
 - These images an entry program and all of its dependencies.
- You can create a container with a persistent volume (mounted file system) that stores data outside of a container's filesystem.
- You can update the MQ version by running a container with a new version of MQ and an existing persistent volume.



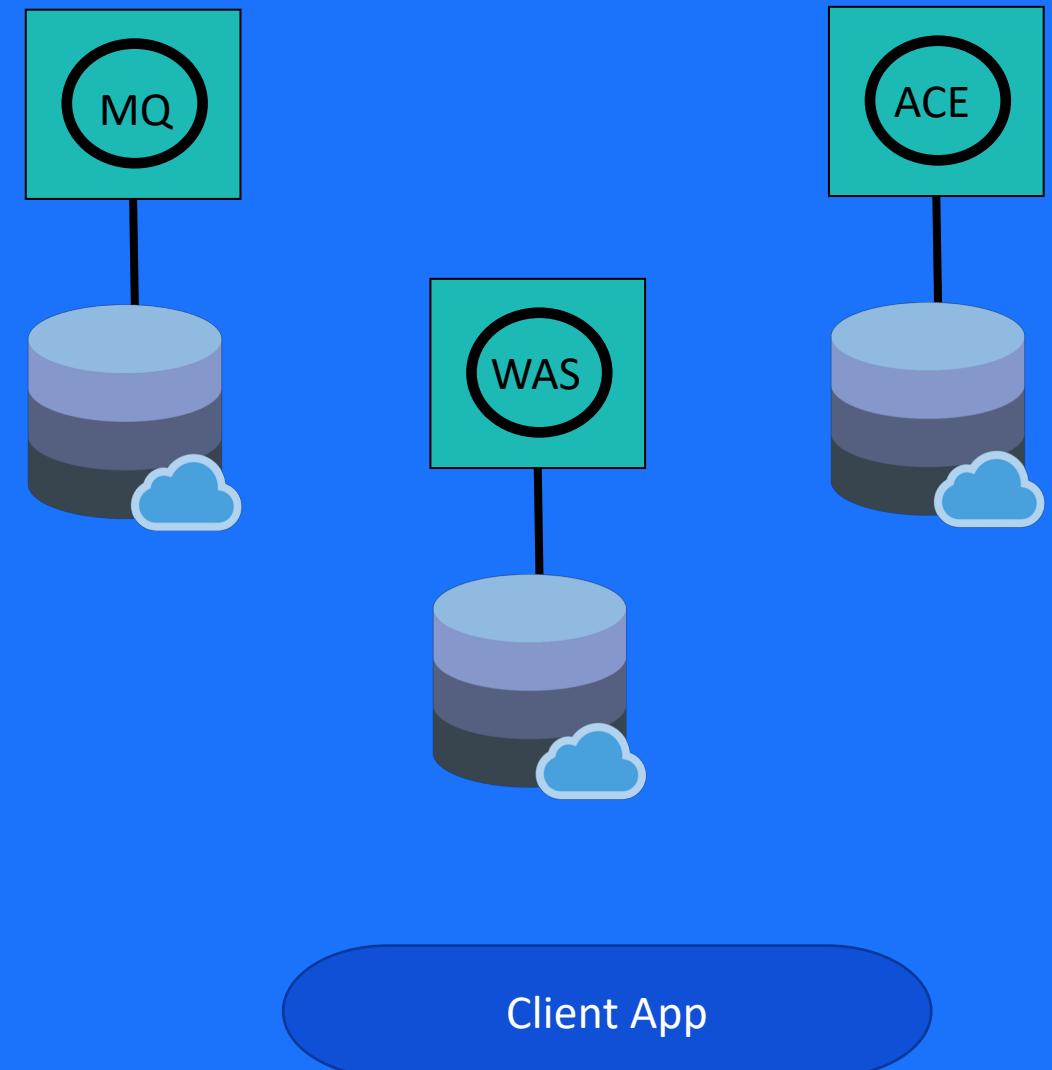
Use Case: Faster Deployments

- Containers are smaller than VMs giving them a faster start-up time.
- You can take advantage of this faster startup time in order to deploy single, resource isolated queue managers faster
- This allows:
 - Developers to quickly provision their own queue manager
 - Fast scaling up of queue managers.



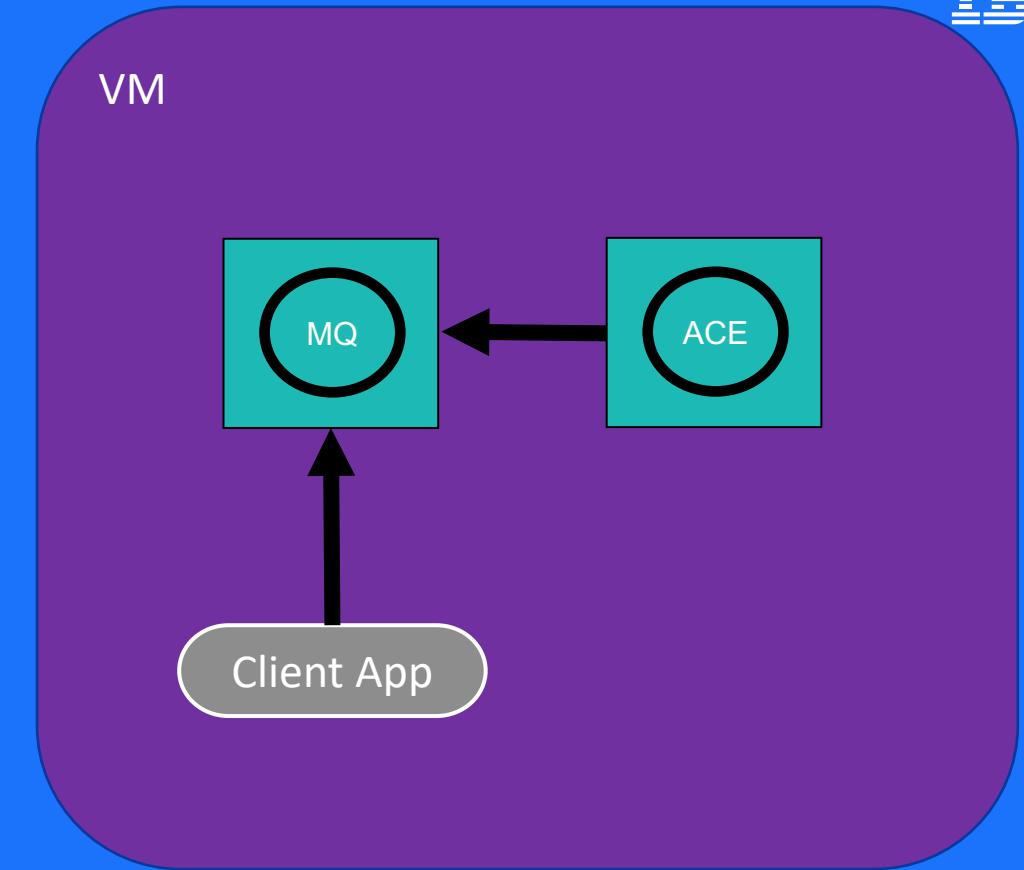
Use Case: Integration/Modernization

- IBM MQ is supported on a large number of container service and container orchestration services.
- The support statement for IBM MQ and container does not specify specific container technologies but does set some requirements.
- This flexibility allows you to place IBM MQ in containers alongside other IBM products and connect them.



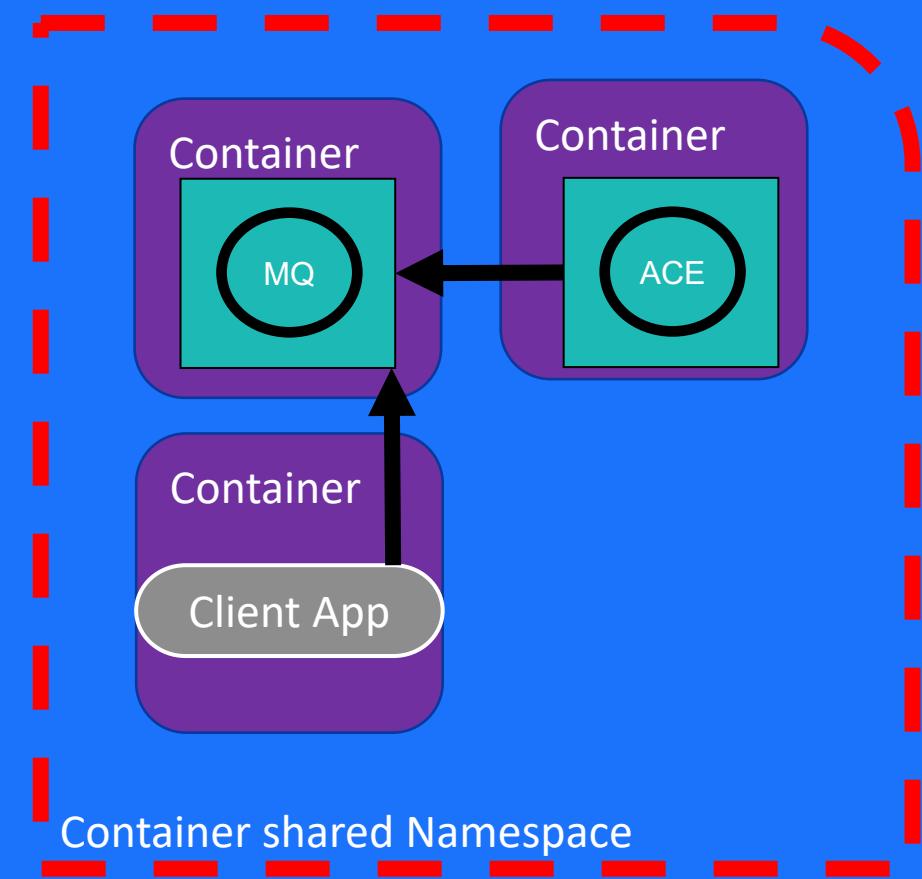
Use Case: Decoupling applications and MQ

- Move applications into separate containers for easy maintenance/upgrades.
 - With everything in separate containers you can minimize downtime.
- Even though containers are separate you can still use local bindings.
- Note limitations on this approach with container orchestration.



Use Case: Decoupling applications and MQ

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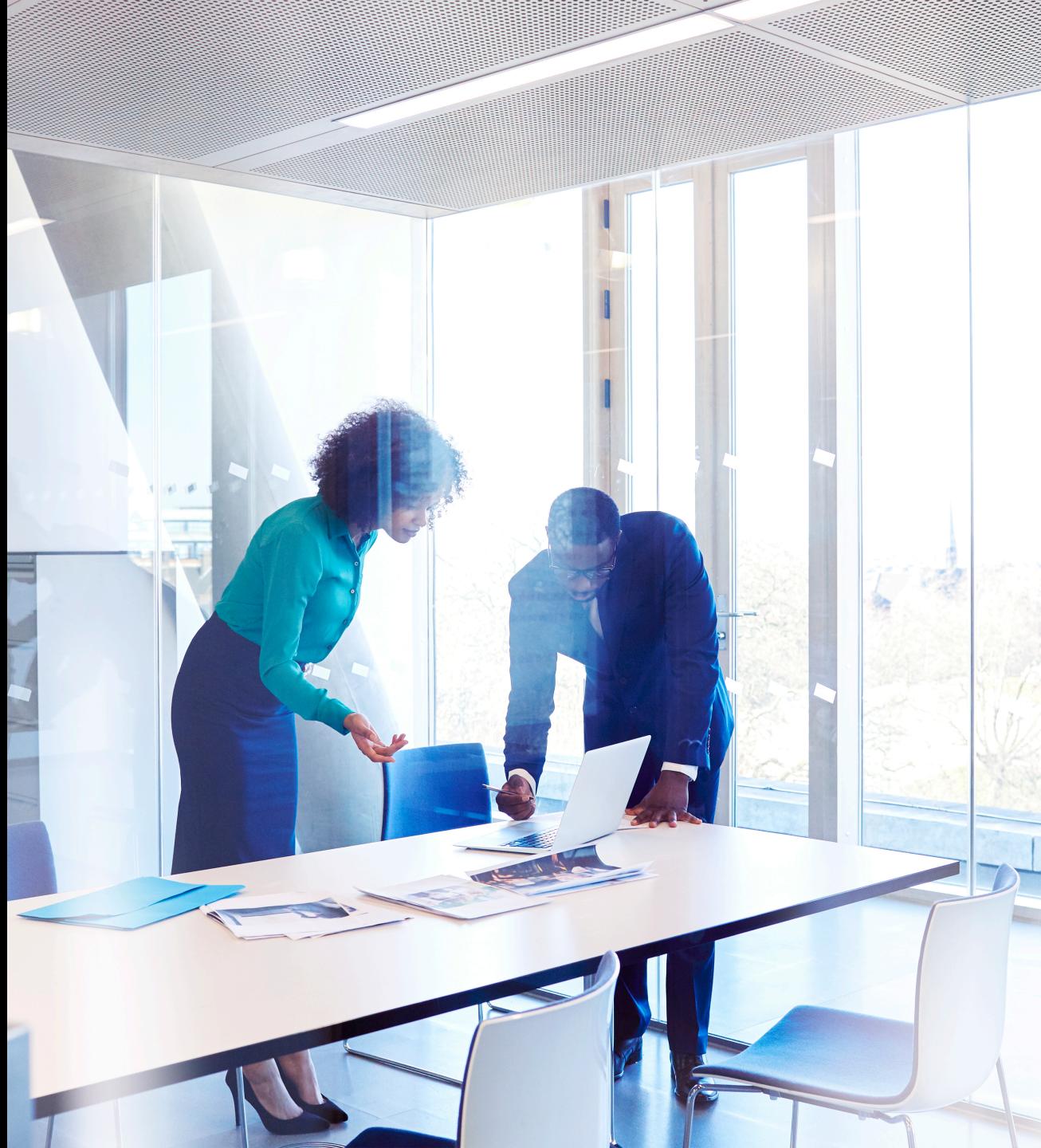
Containers Introduction



Are customers adopting MQ in containers?

- Yes!
- We have had many conversations with many customers who are in different stages of implementing MQ in Containers
- IBM is also investing in containers
 - IBM Cloud Kubernetes Service
 - MQ on IBM Cloud service

Considerations for IBM MQ in containers



MQ Modernization

Containerization facilitates the modernization of MQ deployments.

(These pattern also apply outside of containers)

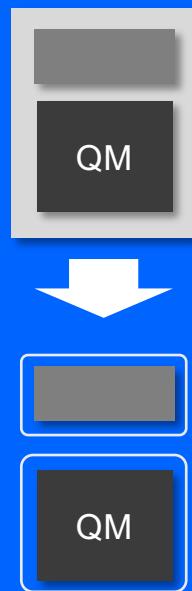
IBM Cloud Transformation Advisor

Analyses your queue managers and JEE applications for suitability for moving to IBM containers



Replatform

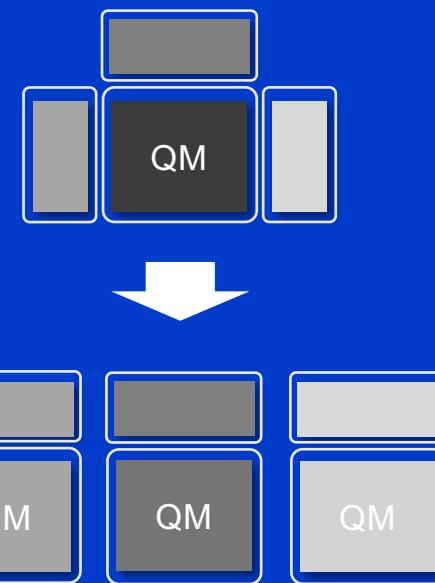
establishing the container orchestration platform, services and capabilities to succeed, and move to a runtime topology that is native to the platform



Containerize MQ queue managers, with applications connected as clients

Repackage

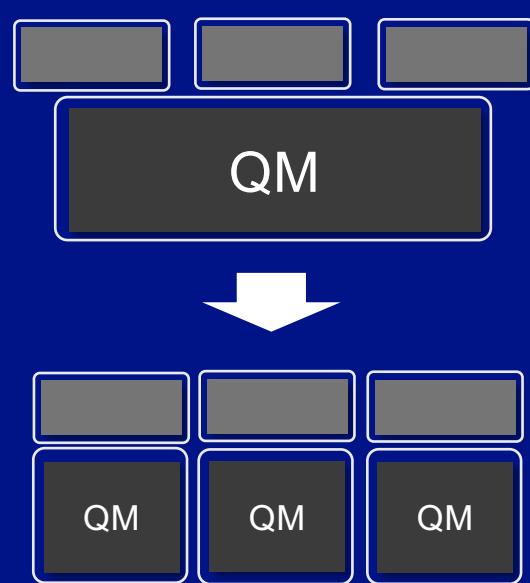
break down the existing artefacts so that they are bounded along line of business and development teams to improve the agility of the organization



Queue managers are dedicated to an application

Refactor

re-work the artefacts that are hard to maintain or prevent the organization from realising the full benefits of their modernization journey



Deploy MQ patterns that provide horizontal scaling and continuous availability

Considerations for IBM MQ in containers



Storage



- Container storage is ephemeral. If the container is deleted then the storage is lost (even though it did exist on the host)
 - To prevent data loss you should use a persistent volume.
 - You can mount a portion of the host filesystem as a volume
 - Cloud container systems provide interfaces to use other storages.
- Reliability of storage
 - Replicated across failure domains / availability zones?
 - Are disk writes cached?
 - What's the failure rate of disks?
- Connecting to the right persistent storage
 - When a queue manager's is moved (e.g. run a container in a different VM), then something needs to re-connect the queue manager to the correct storage.

Considerations for IBM MQ in containers



Log Management/Monitoring



- Containers only run as long as their control program runs
 - If you have tied this in to the life of the queue manager a container will stop with the queue manager
- If there is a problem you may not be able to log into the container to get error logs
 - Although you should be avoiding this as much as possible.
 - You may also only know where the problem is later and so now you can't identify the failing container.
- Containers could also be running anywhere which makes locating a particular container troublesome
- You should be centralizing your logs and monitoring data so you can quickly see your full infrastructure and debug even if a container is failing.

Considerations for IBM MQ in containers



Security/User Management



- What will you use as a user repository?
- IBM MQ supports many different user repositories
 - OS
 - LDAP
 - PAM
- OS may not work effectively in a container.
 - OS uses user details stored in /etc/passwd
 - If this isn't stored in a persistent volume it will be reset.

Considerations for IBM MQ in containers



Certificate Management

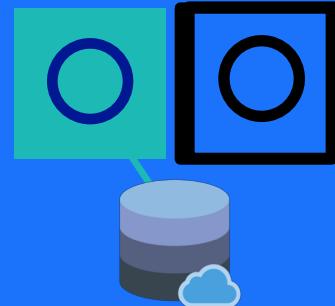
- Certificate management has similar problems as User management.
- Keystore should be stored under /var/mqm which should be on a persistent volume.
- But how can you quickly and effectively update certificates if needed?



Considerations for IBM MQ in containers



HA Availability



Single resilient queue manager

- Cloud manages fail-over to somewhere with spare capacity
- Networked storage (block or filesystem), managed by separate subsystem



Multi-instance queue manager

- MQ manages fail-over
- Networked storage (filesystem), managed by separate subsystem



Replicated data queue manager

- MQ manages fail-over
- Local block storage, synchronously replicated by MQ

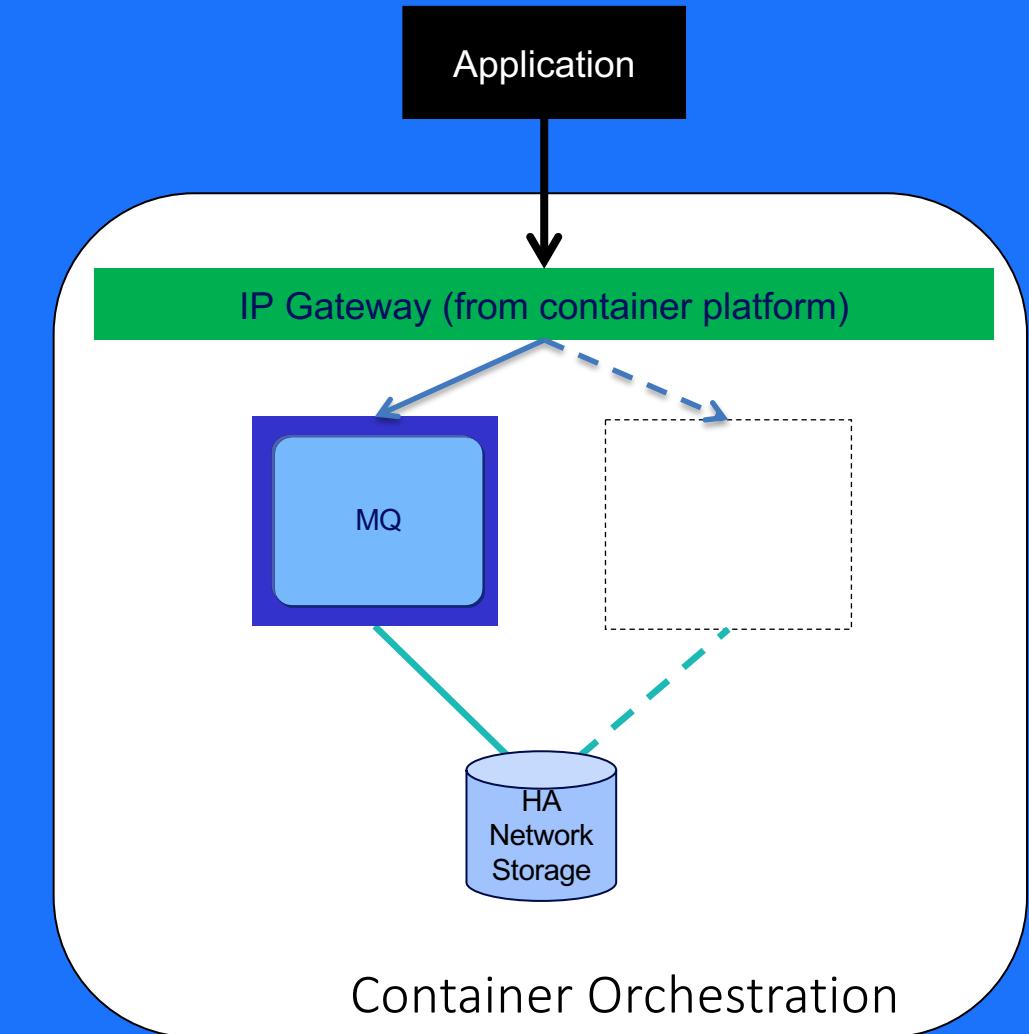


Single Resilient Queue Manager on Kubernetes



- Container restarted by Kubernetes*
- Data persisted to external storage
- Restarted container connects to existing storage
- IP Gateway routes traffic to the active instance
- Implemented as Kubernetes Stateful set of 1
- **Implications:** Both the service and the messages stored in the single queue manager are unavailable during failover

* Total Kubernetes node failure considerations described in
<https://developer.ibm.com/messaging/2018/05/02/availability-scalability-ibm-mq-containers/>



Considerations for IBM MQ in containers

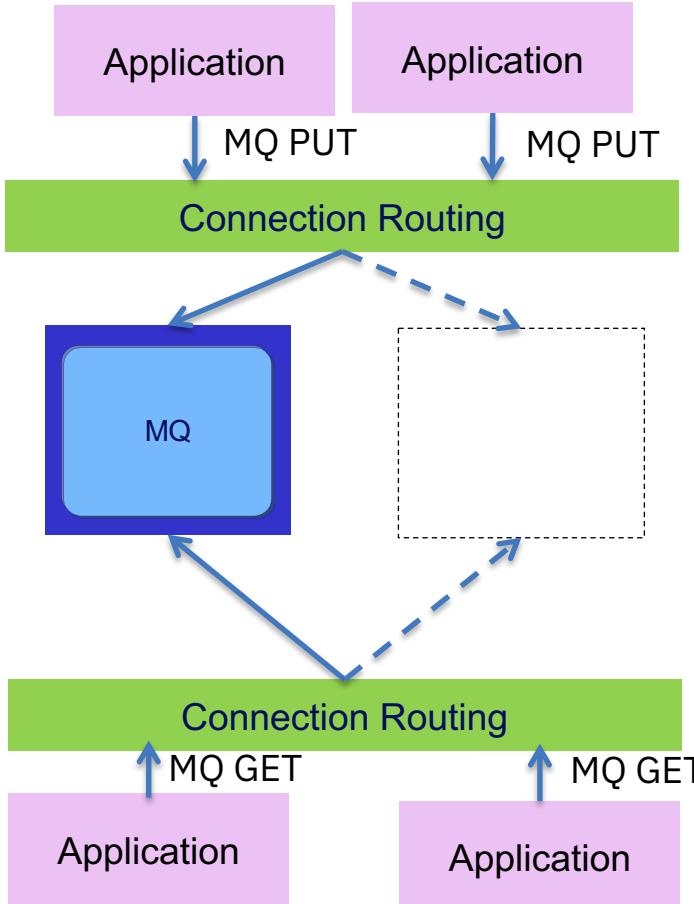


Scaling/Workload Balancing

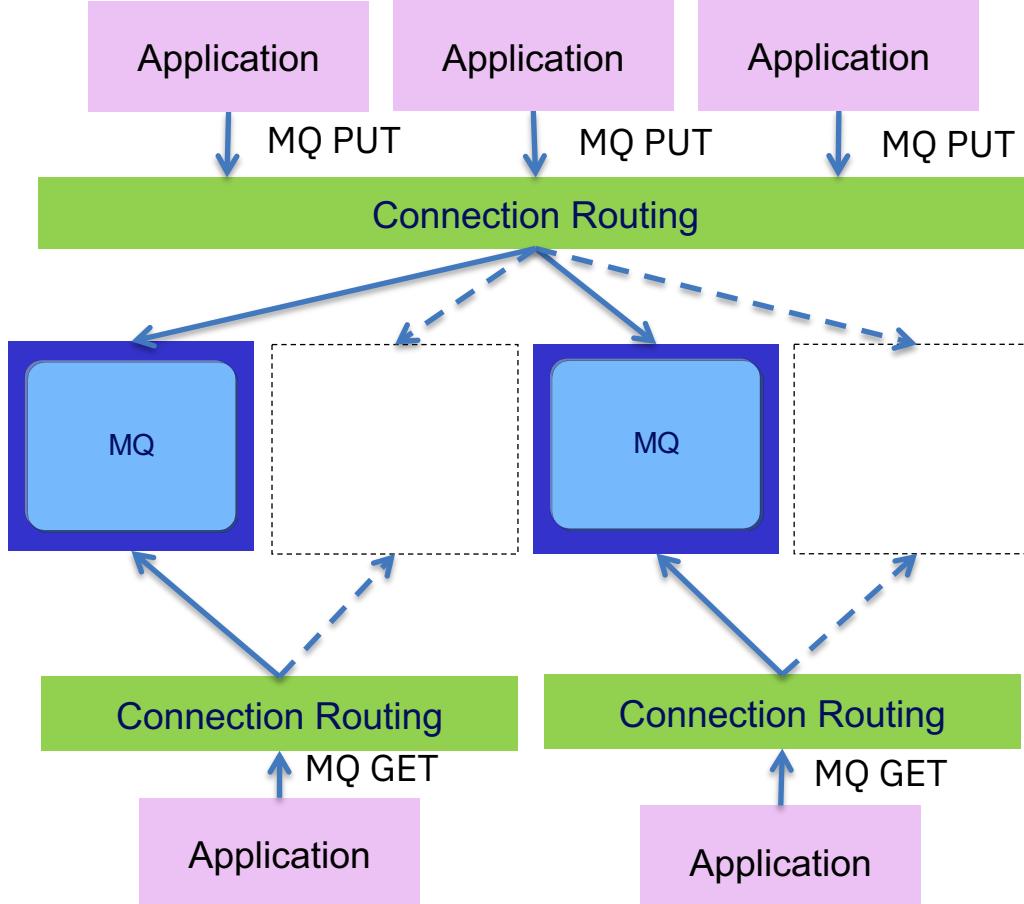


- How will you handle the need to scale up/down?
 - How quickly do you need to scale?
 - Do you require automatic scaling or will manual be ok?
- Scaling up is generally easy, but scaling down has risks
 - Scaling down could lose messages.
 - If using clustering then you need to leave the cluster before scaling down.
- How will you also do workload balancing?
 - MQ Clustering can do this but has its requirements/complexities
 - Using outside load balancing, but this has limitations.

Improving the MQ Service availability



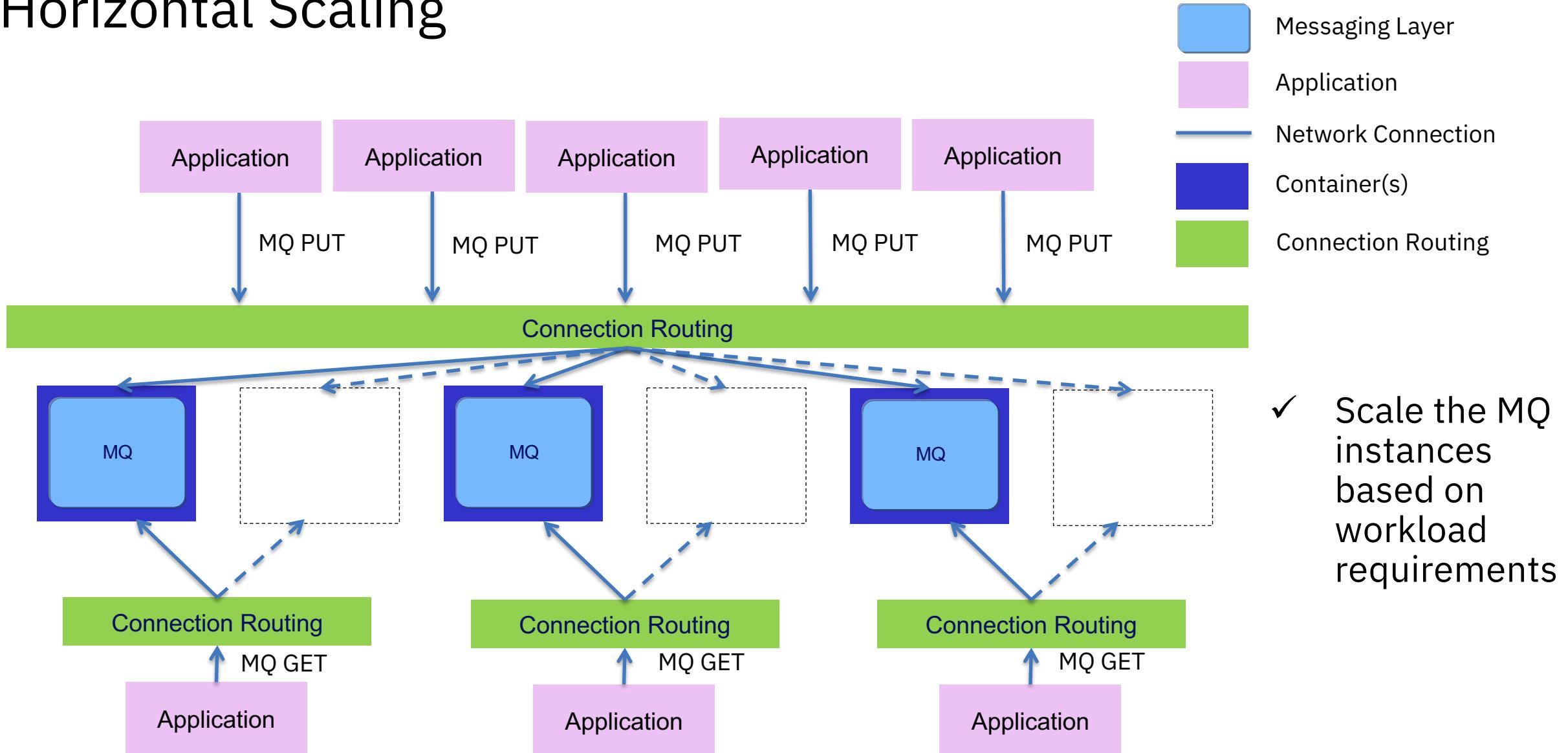
Single resilient container



Multiple resilient containers

- ✓ Provide access to store messages, even in failover situations. Connection Routing provided to distribute the traffic across the available instances.
- ✓ Applications retrieving messages attach to the individual Queue Manager. Connection Routing provided to route traffic to container location.

Horizontal Scaling



Considerations for IBM MQ in containers



Applying Configuration



- How do you apply configuration?
 - Manually?
 - Automatically
- If you want to apply configuration automatically how will you update/verify it?
 - Do you need a tool/program to apply and monitor configuration?
 - Will you bake the configuration into the image?

Considerations for IBM MQ in containers



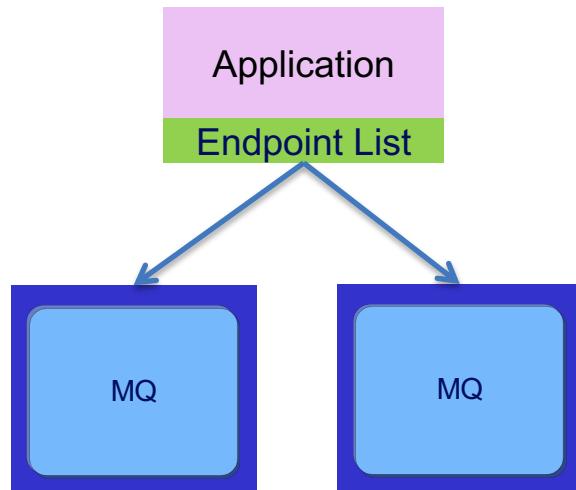
Applications



- Can you use your existing applications as-is?
 - Will they handle moving queue managers?
 - Are they local binding?
 - How do they connect to the queue manager?
- How will you route connections to where they need to go?
- Do you have a static connection option?
 - Required if using clustering
 - Required to ensure you can get 1 consumer to each queue manager

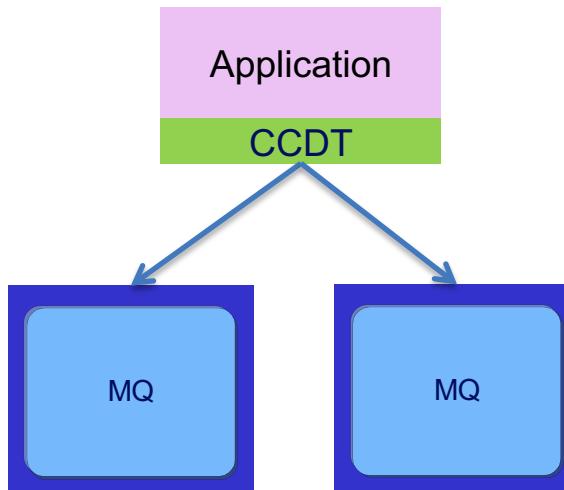
Connection Routing

Static Routing



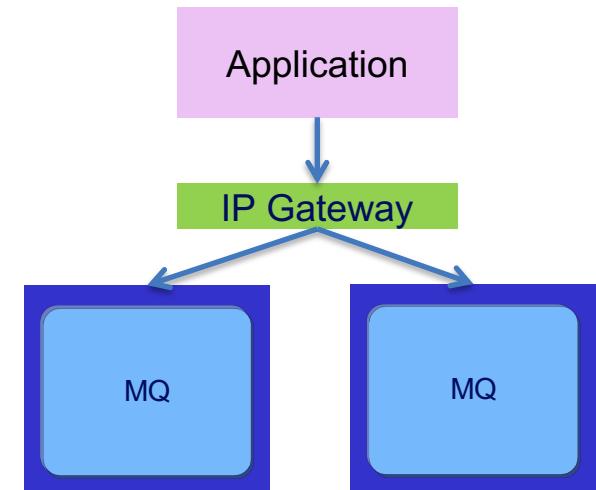
Client embeds endpoints
Performance impact when primary unavailable
Brittle configuration
No load balancing

Client Connection Definition Table



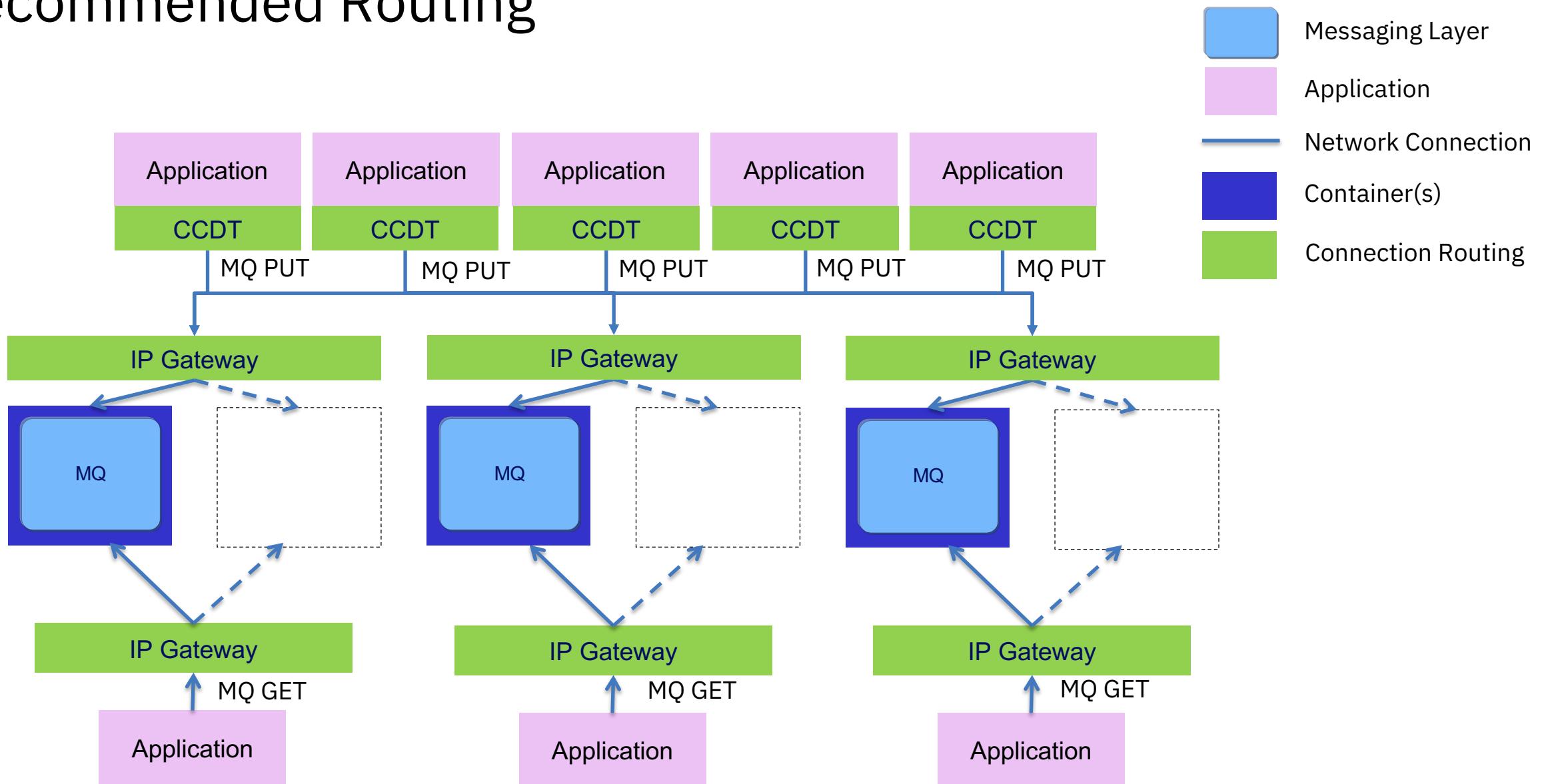
Client references endpoints
Enhanced Workload Management Strategies
Central configuration management

Load Balancer



Client references endpoints
Enhanced Workload Management Strategies
Central configuration management
Not recommended for JMS

Recommended Routing



More information?

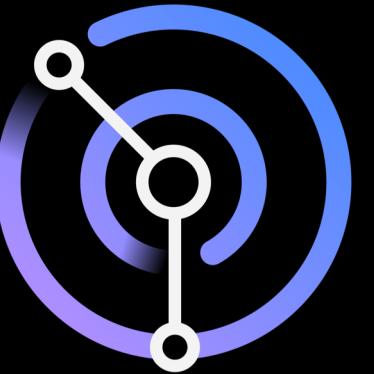
IBM Messaging developerWorks
developer.ibm.com/messaging

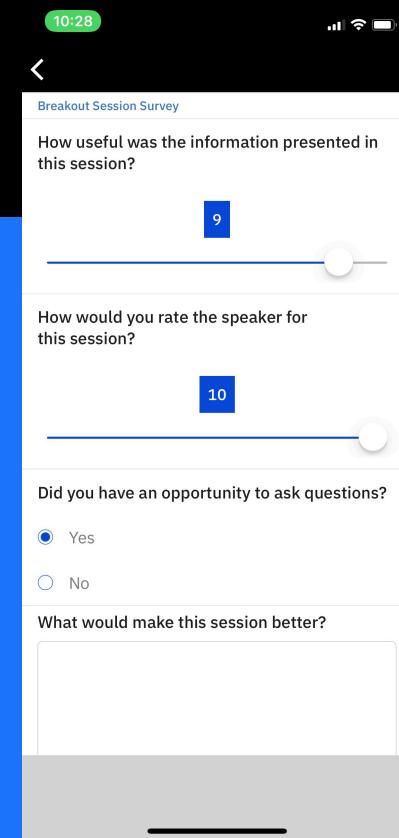
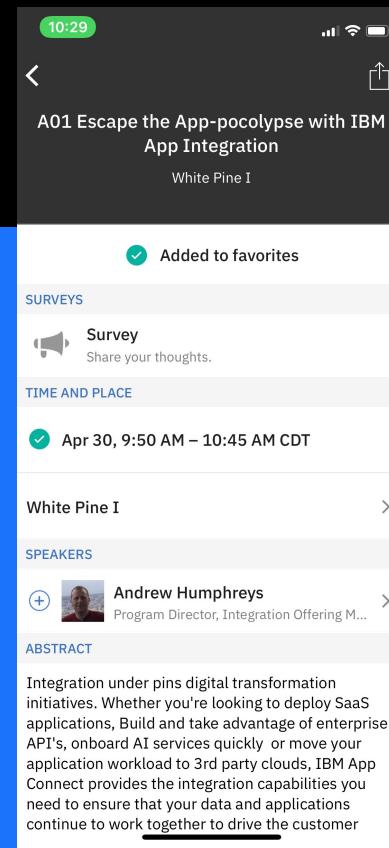
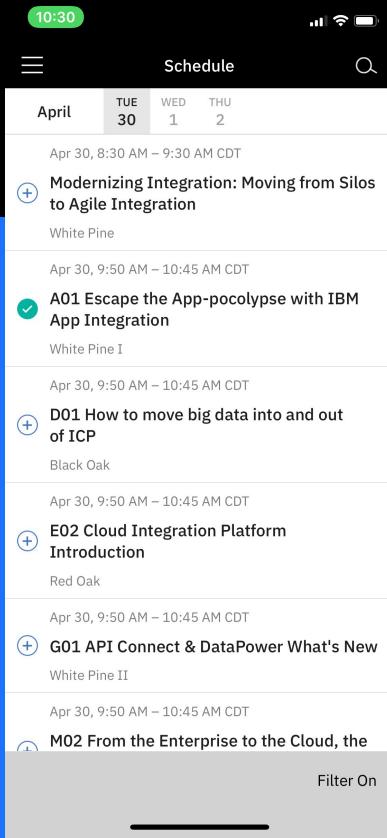
IBM Messaging Youtube
<https://ibm.biz/MQplaylist>

LinkedIn
<https://ibm.biz/ibmmessaging>



Questions?



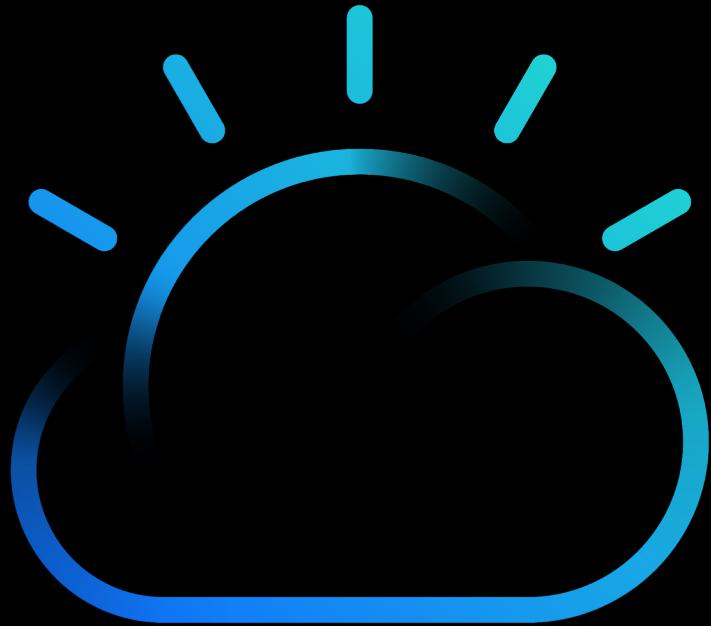


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Select your session, select survey, rate the session and submit!

Thank You



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