MQ Hybrid Cloud Architectures

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Agenda

• Topologies
• Connectivity
• Clients & Applications
IBM Cloud Hybrid Messaging – Joining the 2 worlds together

- Systems of record
- Enterprise data
- 24 x 7 x 365 applications

On Premise

- Systems of engagement
- Mobile
- Social
- Analytics & Watson
- Rapid development

IBM Cloud
But first – parish notices

NEW

• **MQ on Cloud** service now available
• Your queue managers running in the IBM Cloud
• Hosted solution removes hassle of platform and OS maintenance from you
• See session on Wednesday (1pm) this week

• **Hourly Container-Based Pricing** now available
• Requires you to run your queue managers in containers
• Uses IBM Cloud Private (ICP) metering solution to track usage
Why Hybrid Messaging?

“All the benefits of cloud, with access to your enterprise data”

- Doing more with less
- Being more ready to change
- Making the development process less heavyweight
- Paying for what you use
- Integrating with other cloud services
- Rapidly scaling up and down with demand

- Customer profiles
- Purchases (online orders)
- Data requests (e.g. insurance quotes)
- Website comments
Why Hybrid Messaging?

Is it to…

• run you apps, unchanged, in a cheaper environment?

• stage the migration of applications to cloud-native runtimes?

• move to micro-services model?

• enable developers?

• be able to say you’re “in the cloud”? 
Typical MQ Architectures

- **Classic**
- **Hub**
- **Decentralized**

More suited to cloud scenarios
Used for connectivity of heterogeneous systems, providing store and forward to overcome system and network outages

Isolation through dedicated queue managers, tightly bound to the application runtimes

This is one of the ‘original’ deployment patterns for MQ and has often ended up as bespoke, tuned deployments for individual components

Leads to hard to deploy, manage and maintain systems over time
A ‘hub’ (or backbone) of systems running multiple queue managers, based on a standard deployment

Applications connecting as clients from remote systems. Loser coupling enables simpler deployments and independent scaling and maintenance

This pattern has gained popularity as networks improve and administration costs go up
Decentralise the MQ system completely. Each line of business or application has its own infrastructure and therefore own queue managers. Client connections to separate applications from the infrastructure.

Remove the central administration as much as possible to reduce bureaucracy and speed up application deployments.

Has popularity as a way to satisfy greater autonomy for lines of business.
It’s best practice to adopt a consistent queue manager configuration and usage pattern to enable full automation and deployment of your system.

It’s hard to treat the queue managers as true cattle, the message state associated with each is typically critical. But it is possible to architect your system to minimise any single point of failure through high availability and active/active patterns.

And it’s definitely possible to separate the messaging state from the physical/virtual system it is currently running on.

Pets: Each system is unique and indispensable. Hand-built and customised. Lovingly nurtured.

Cattle: Uniform systems, built using automation. Built for failure. If they go wrong it doesn’t matter if another takes its place.
Tenancy

Multi tenant
Potentially lower runtime overheads
More care needed in configuring to achieve isolation
Isolation of machine resources not possible
Harder/simpler to monitor
Depends on your view of more queue managers
Fine grain security required

Single tenant
Simple to configure, maintain and monitor
Very good isolation
A proliferation of queue managers
Harder when integration is required

Best suited to scalable, cloud deployments
Hybrid Architectures

Today

• Run MQ clients in the cloud
• Connect to on-premise hub
• Applications running in container, Cloud Foundry, serverless environment (e.g. Lambda/OpenWhisk), etc…

Hybrid Cloud
Hybrid Architectures

Today

- Single queue manager run in the cloud
- Gateway QM connects to on-premise hub
- Not multi-tenancy - apps are scaled instances
- Allows some communication between cloud apps without going back to on-premise

Hybrid Cloud
Hybrid Architectures

Today

- Queue managers run in the cloud alongside apps
- Connect to on-premise hub
- Run in **VMs** or **containers**
- Unless you have a good reason to run QMs along side apps this may not be the best architecture for cloud

Hybrid Cloud
Hybrid Architectures

**Clients**
- Easier to scale ✓
- Stateless ✓
- Less administration ✓

- Need to discover a QM ✗
- Can’t operate during network partition ✗

**Clients & Gateway QM**
- Client service discovery simpler ✓
- QM manages discovery and routing ✓
- Single place to configure connectivity back to the enterprise ✓

- Limits app scalability ✗
- Not very cloudy ✗

**Clients & QMs**
- QM buffers messages between outages ✓
- Client service discovery easier ✓

- More admin required ✗
- Need access to each QMs logs ✗
- Harder to scale down ✗
- Can apps really do anything during an outage anyway? ✗
Agenda

• Topologies

• Connectivity

• Clients & Applications
• Enterprise network behind firewall
• Cloud queue manager on public facing IP address
• Cloud can’t connect directly to enterprise QM
Connectivity

- Like connecting from any other external network, need to route connectivity through firewall/DMZ
- All cloud platforms provide ways to connect on-premise and cloud networks (e.g. IBM SecureGateway, DirectConnect, VPN)
Connectivity – IBM Secure Gateway

Secure Gateway client runs on-premise
- Native Mac/Linux/Win app
- Docker
- DataPower

Connects to IBM Cloud Secure Gateway
Connectivity – IBM Secure Gateway

- Secure Gateway sets up a tunnel to on-premise client
You configure valid routes from Secure Gateway client to on-premise network interfaces.

Cloud application connects to virtual address in cloud e.g. `cap-sg-prd-1.integration.ibmcloud.com:17036`

Secure gateway client routes packets to/from on-premise network

Connectivity from app to tunnel secured with TLS and/or restricted IP ranges.
Secure Gateway Destinations

Add Destination

- **On-Premises Destination**: On Prem MQ Gateway (QM123)
  - **Host/Port**: 192.168.5.12
  - **TCP Port**: 1414

**Network security**

- **Restrict network access to cloud destination**: Select the checkbox to restrict network access.

**IP Addresses**:

- **IP or IP Range**: Enter the IP address or range of IPs.
- **Port or Port Range**: Enter the port or range of ports.

**TLS options**

- **Destination Authentication**: None
- **User Authentication**: Select the checkbox to auto-generate certificate and private key.

**Destination Wizard**
Secure Gateway Destinations

- Once an on-premise destination IP address has been defined, the secure gateway allocates a host name and port.
- Your cloud application connects to this virtual host name.
- The secure gateway routes traffic to the on-premise address 192.168.5.12:1414.
• Avoids the need for a direct TCP connection from cloud to on-prem
• Tunnel MQ traffic over HTTP(S)
• Avoids requirement for more complicated VPN configuration
• Re-use on-prem IPT if you’re already using it
• Cloud agnostic
Initiating channels **TO** the cloud is easy

- **SENDER** channel defined on-premise, **RECEIVER** channel defined in the cloud
Server/Requester channels

- Initiating channels **FROM** the cloud is more difficult
- Typically sender channels won’t be able to connect through the firewall to on-premise listener/receiver channel
• Instead, a **REQUESTER** channel defined on-premise initiates a connection to a **SERVER** channel running the cloud
• Once the connection has been established, it works much like a sender/receiver pair, sending messages from cloud to on-prem
Agenda

• Topologies

• Connectivity

• Clients & Applications
Client Runtimes

- MQ offers a lot of different application runtime options
  - C, C++, JEE, CICS…
- Putting existing applications into cloud-hosted VMs is certainly possible
  - but - are there better runtimes for your new cloud-era applications?
- New concepts like serverless programming suit some runtimes over others
- E.g. AWS Lambda™
  - Node.js
  - Java™
  - Python
  - .NET® C#
Client Runtimes

- **Cloud Foundry™** supported buildpacks
  - Java
  - .NET Core
  - Node.js
  - PHP
  - Python
  - Ruby
  - Go

- but you can still push native MQ apps to Cloud runtimes as we’ll see later…
Native applications in Cloud Foundry™

You’re responsible for this part

Cloud Foundry runtime

- Application
- Buildpack
- OS Layer

Built-in buildpacks
Liberty, Node.js, ASP.NET, Swift, Java, PHP, Ruby, Python, Go

Community buildpacks
Binary, Clojure, Haskell, Python, …
Cloudifying native apps

- You can still deploy native applications to cloud platforms
  - See binary buildpack for cloudfoundry…
Native applications in Cloud Foundry™

Running an MQ C client in Cloud Foundry™, and connecting it to on-premise MQ

Matthew Whitehead
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Application Code
- amqsgetc
- MQ C redist libs

Cloud Foundry runtime

Built-in buildpacks
- Liberty, Node.js, ASP.NET, Swift, Java, PHP, Ruby, Python, Go

Community buildpacks
- Binary, Clojure, Haskell, Python, …
A Side Note – MQ Redistributable Clients

- **Windows C & .Net**
  - fix pack: 9.0.0.0-IBM-MQC-Redist-Win64
  - IBM MQ C and .NET redistributable client

- **Linux C**
  - fix pack: 9.0.0.0-IBM-MQC-Redist-LinuxX64
  - IBM MQ C redistributable client

- **Java/JMS**
  - fix pack: 9.0.0.0-IBM-MQC-Redist-Java
  - IBM MQ JMS and Java redistributable client

- Also available for MFT client libraries (create transfers, query agents etc)
- Create your own redistributable packages by stripping out unused libraries
  - See *genmqpkg.sh*
A Side Note – MQ Redistributable Clients

Choose packages to include

Does the runtime require 32-bit application support [Y/N]? n
Does the runtime require support for languages other than English [Y/N]? n
Does the runtime require C++ libraries [Y/N]? n
Does the runtime require COBOL libraries [Y/N]? n
Does the runtime require SSL/TLS support [Y/N]? n
Does the runtime require AMS support [Y/N]? n
Does the runtime require CICS support [Y/N]? n
Does the runtime require any administration tools [Y/N]? n
Does the runtime require any RAS tools [Y/N]? n
Does the runtime require any sample applications [Y/N]? y

Please provide a target directory for the runtime package to be created
/home/mwhitehead/my-redist-client

The redistributable image will be created in
/home/mwhitehead/my-redist-client

Are you sure you want to continue [Y/N]? y

Generation complete!
Redistributable client image copied to '/home/mwhitehead/my-redist-client'

Specify a directory to create the package
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Native applications in Cloud Foundry™

Cloud Foundry runtime

Application Code
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Built-in buildpacks
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Native applications in Cloud Foundry™

Cloud Foundry runtime

- OS Layer
- Buildpack
- Application

secure tunnel
Client Runtimes

- IBM Cloud Functions based on Apache OpenWhisk™
  - Java
  - Node.js
  - Python
  - PHP
  - Docker®
Serverless Functions

- Ideal for short-lived application logic
- Only pay for the time functions are executing
- Like PaaS, you don’t worry about the OS environment or the application runtime (JVM, nodejs runtime, Python interpreter etc.)
- Just write your function and AWS will invoke it when a defined action occurs
- Scalability and availability is an inherent part of the architecture
  - 1 event = 1 function invocation
  - 10 concurrent events = 10 concurrent function invocations
How can you drive MQ serverless applications?

It is difficult since serverless functions don’t generally support long-lived connections.

One option - use timer events to invoke functions, e.g.

```javascript
lambdaFunction(...) {
    // Connect to MQ
    // Retrieve & process msgs
    // return
}
```
Service Discovery

• Clients need to discover where to connect

• Can be done a number of different ways

  • MQSERVER env
  • CCDT (MQCHLLIB & MQCHLTAB, MQCCDTURL)
  • mqclient.ini
  • JNDI

• But also…

  • MQ Light client service lookup (JSON)
  • DNS
  • Key/value store
CCDT retrieval over HTTP

MQ on OpenStack, part three: Automated client connection PoC using MQ v9 CCDT URL feature.

1. HTTP lookup
2. MQCONN
CCDT retrieval over HTTP

MQ on OpenStack, part three: Automated client connection PoC using MQ v9 CCDT URL feature.
CCDT retrieval over HTTP

MQ on OpenStack, part three: Automated client connection PoC using MQ v9 CCDT URL feature.

RebiParker | Aug 17 2016 | Comment (1) | Visits (274) |
Like
CCDT retrieval over HTTP

- When you need to change your architecture, push changes to AMQCHL.TAB
- Clients pickup changes on reconnect

MQ on OpenStack, part three: Automated client connection PoC using MQ v9 CCDT URL feature.
Thank You - Questions?

Related sessions:

• Running MQ in Containers
  • Tuesday 1.00pm (Leopardwood)

• The MQ on Cloud Service
  • Wednesday 1.00pm (Sagewood)
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