Introduction to MQ:
Can MQ Really Make My Life Easier?

Monday 25th September 2017

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Agenda

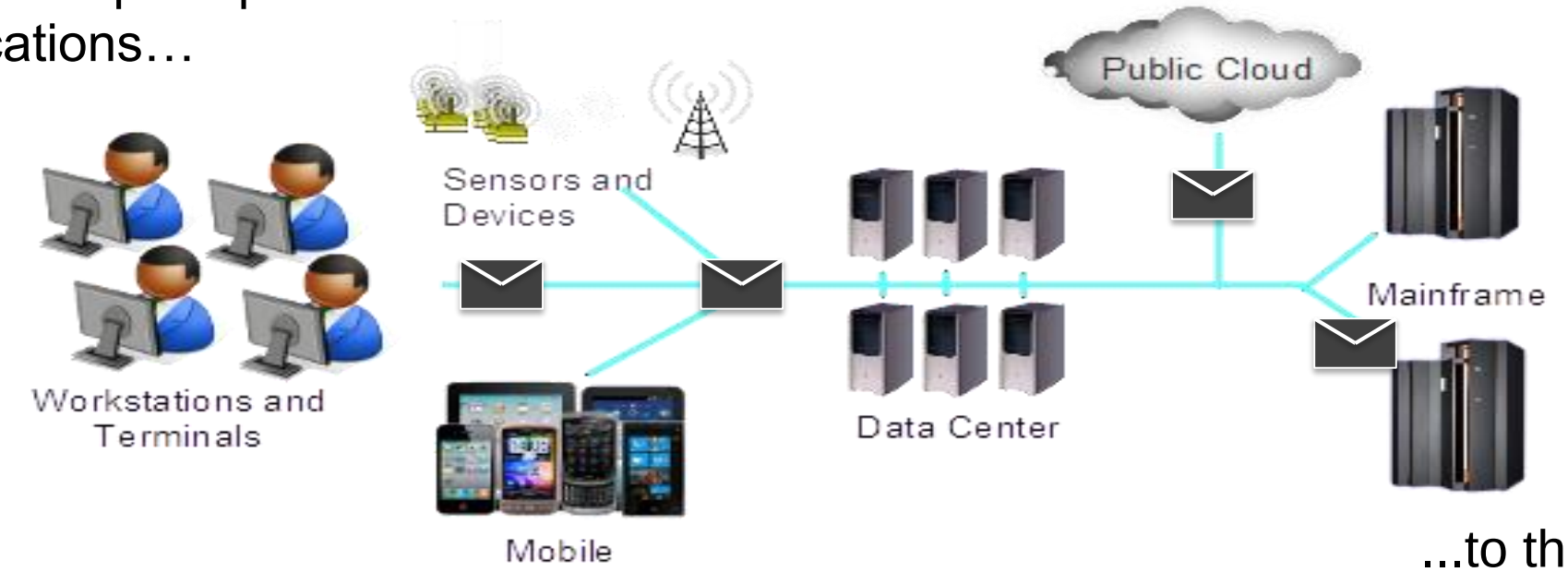
- **Messaging**
  - What is messaging and why use it?
  - What does MQ give you?

- **Fundamentals of IBM MQ**
  - Messaging models
  - Key components
  - Messaging applications
  - MQ Environments
  - Security
  - Reliability and availability
  - Administration
  - MQ Advanced

What is messaging?

- **It connects your applications!**

From the simplest pairs of applications…

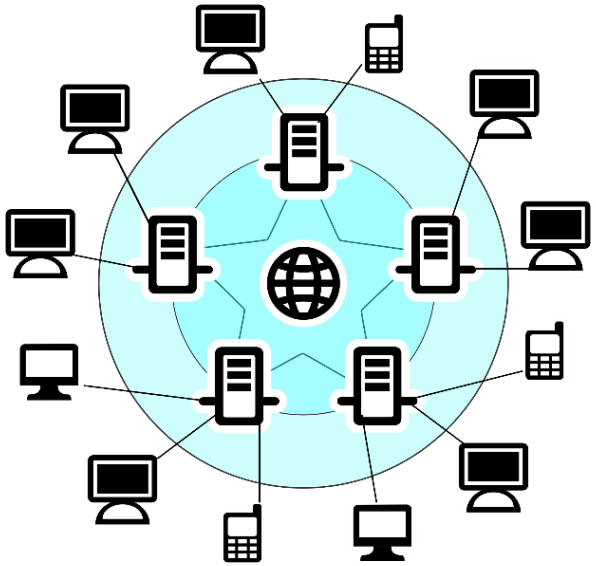


...to the most complex business processes.

- **and breaks the tight coupling…**

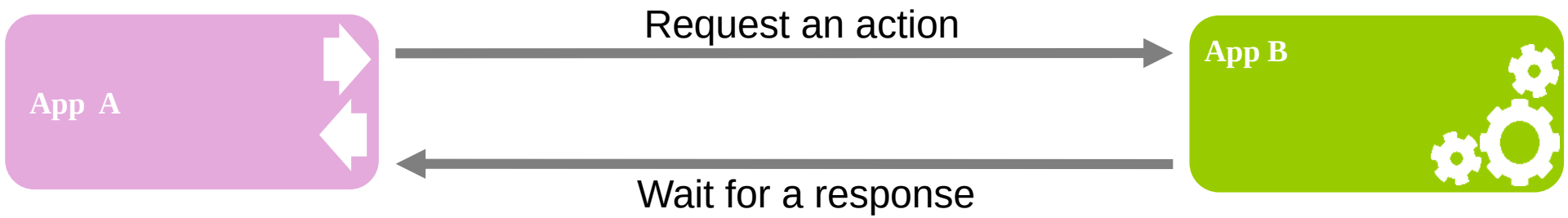
Why use it?

- **Extended reach**
- **Reliability**
- **Scalability**
- **Flexibility**



- **Provides for simplification of application development**
  - Ubiquity
  - Easy to change and scale
  - Focus on the business logic
- **Important regardless of the initial scale of deployment**

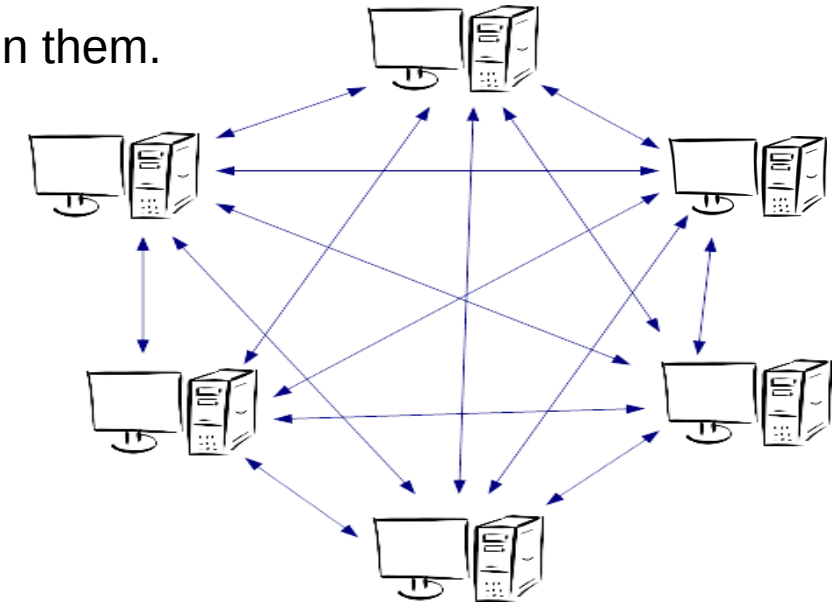
Direct communication between applications



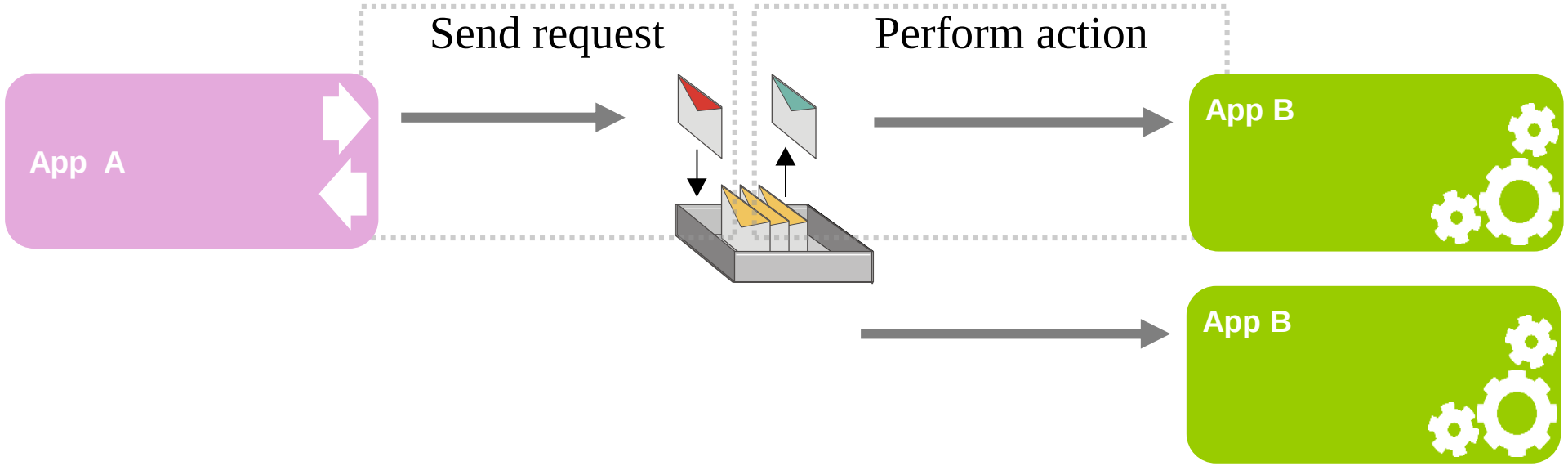
- **Issues with this ‘synchronous’ approach**
  - Both applications A and B **must always** be available for A to continue
  - A cannot do anything whilst B is processing A’s request
  - What is B fails whilst A is waiting for it to complete?
  - What is B needs to handle a high workload of different priority requests?

Fragility of tight coupling

- **As systems become more tightly coupled, their reliance on each other increases.**
  - The cost of a failure of a process increases
- **Changing decoupled applications is cheaper/faster**
  - Only change the part that is changing, not the components that rely on them.
- **Scaling systems independently to respond to requirements becomes unmanageable**

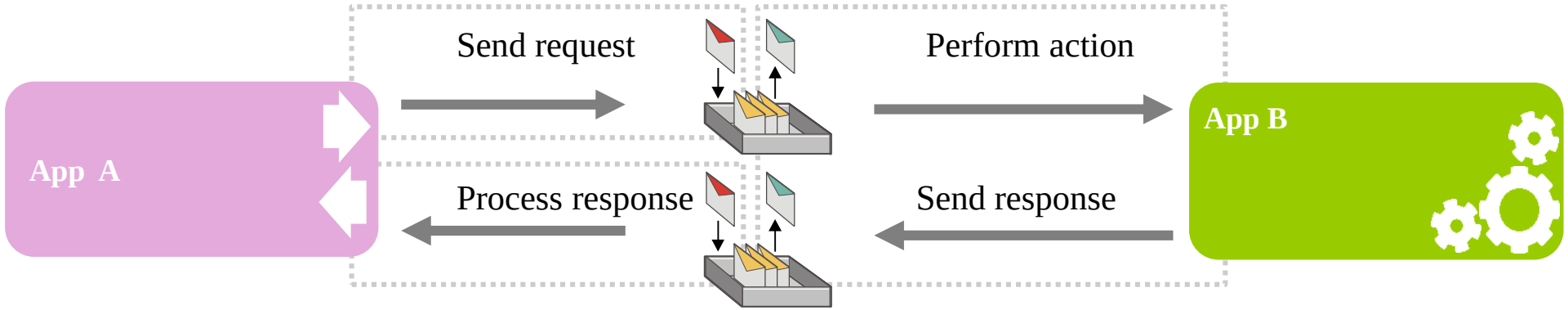


Adding flexibility with Messaging



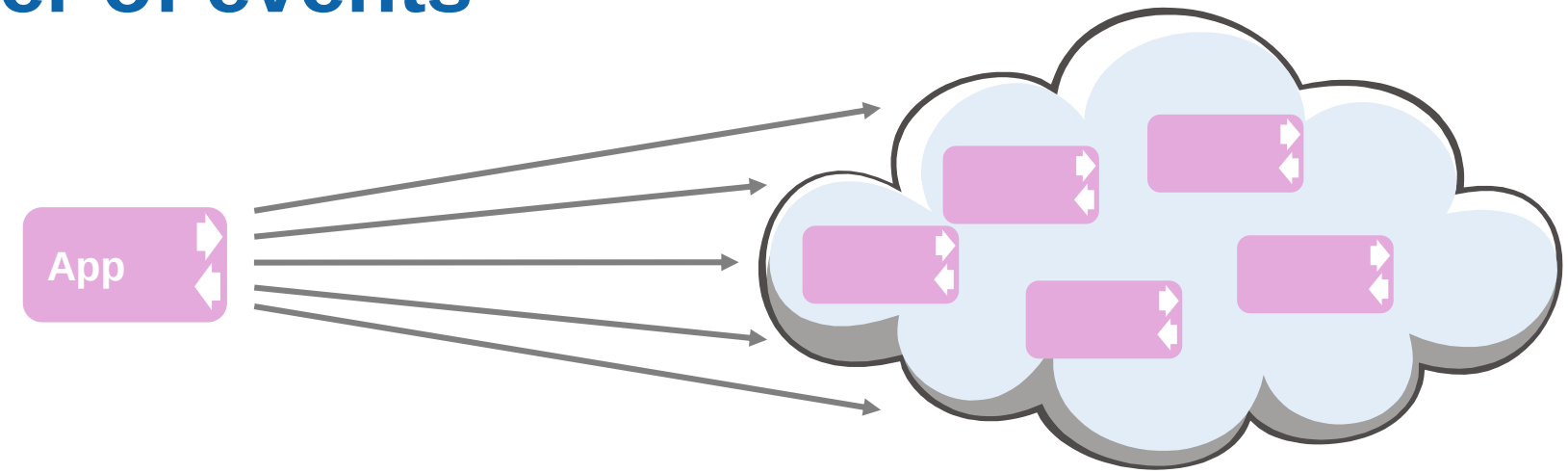
- **A ‘queue’ is placed between the two applications**
  - Allows A to continue immediately, without waiting for B
  - Allows B is efficiently process a queue of work
  - Overcomes availability of B versus A – “store and forward” of messages

What if I NEED a response?



- **Using messaging still adds value!**
  - Process the response whenever it becomes available
    - *No need for A to be idle whilst the request is performed*
  - Application B processes its workload efficiently and can handle spikes in load
  - Application, network and infrastructure failures are handled

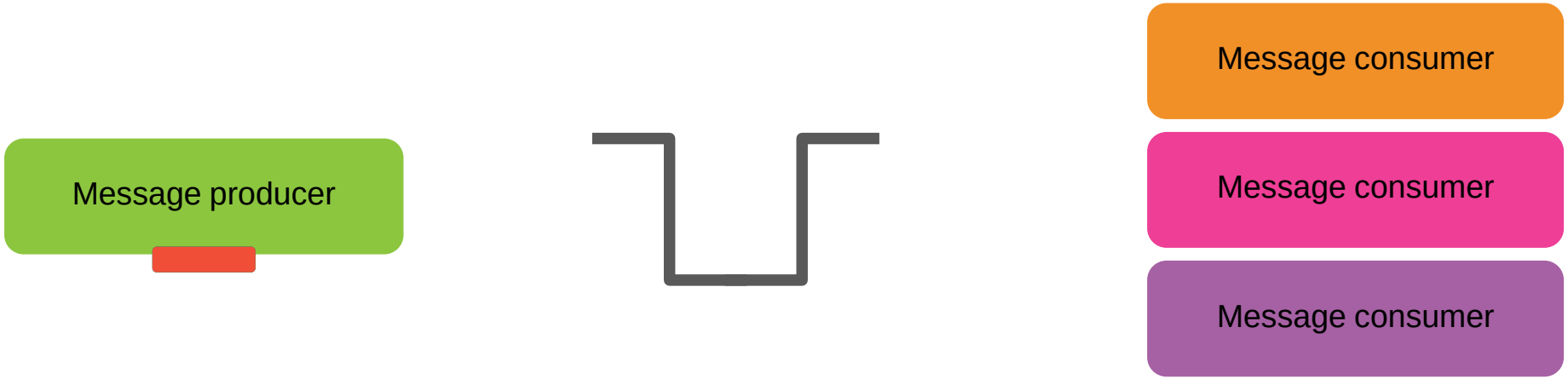
The power of events



- **Not all information is distributed on a one-to-one basis**
- **Think about streams of information**
  - Regularly updated information - such as stock prices or sensor data
  - Business events - such as ‘new customer’ or ‘purchase’
- **Publish / Subscribe messaging is the solution!**
  - The owner of the information simply ***publishes*** it on a ***topic***
  - Anybody who is interested simply ***subscribes*** to the ***topic***

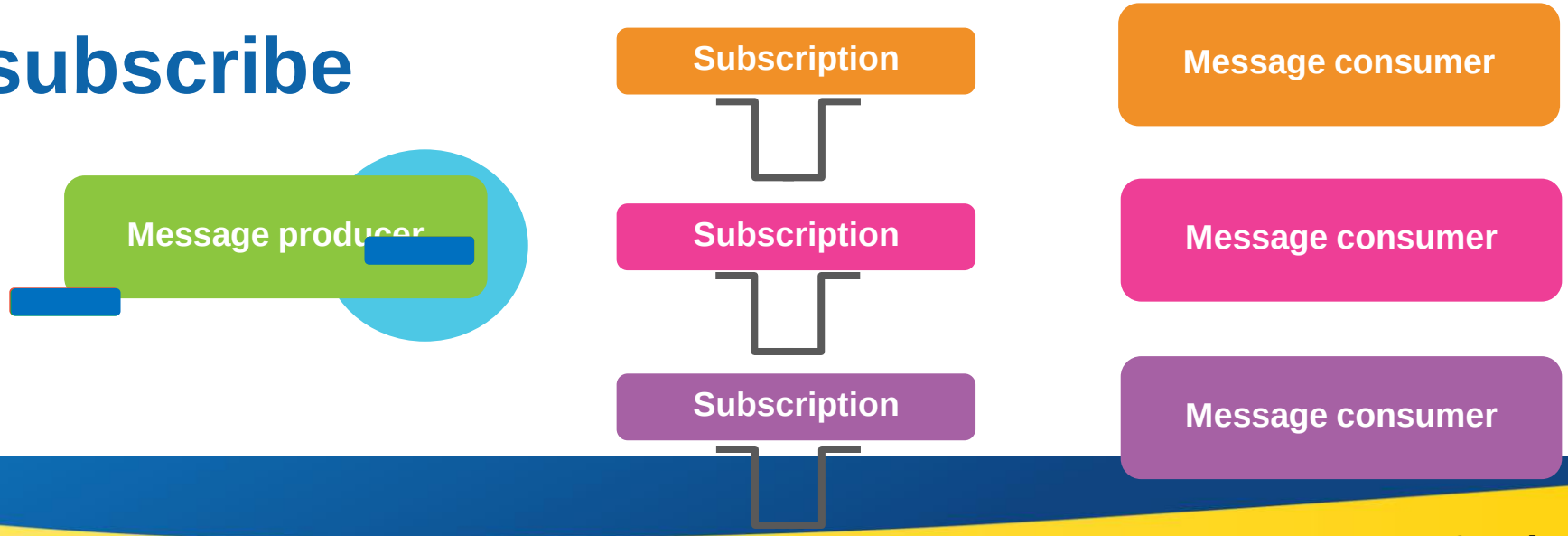
Messaging Models

Point-to-point



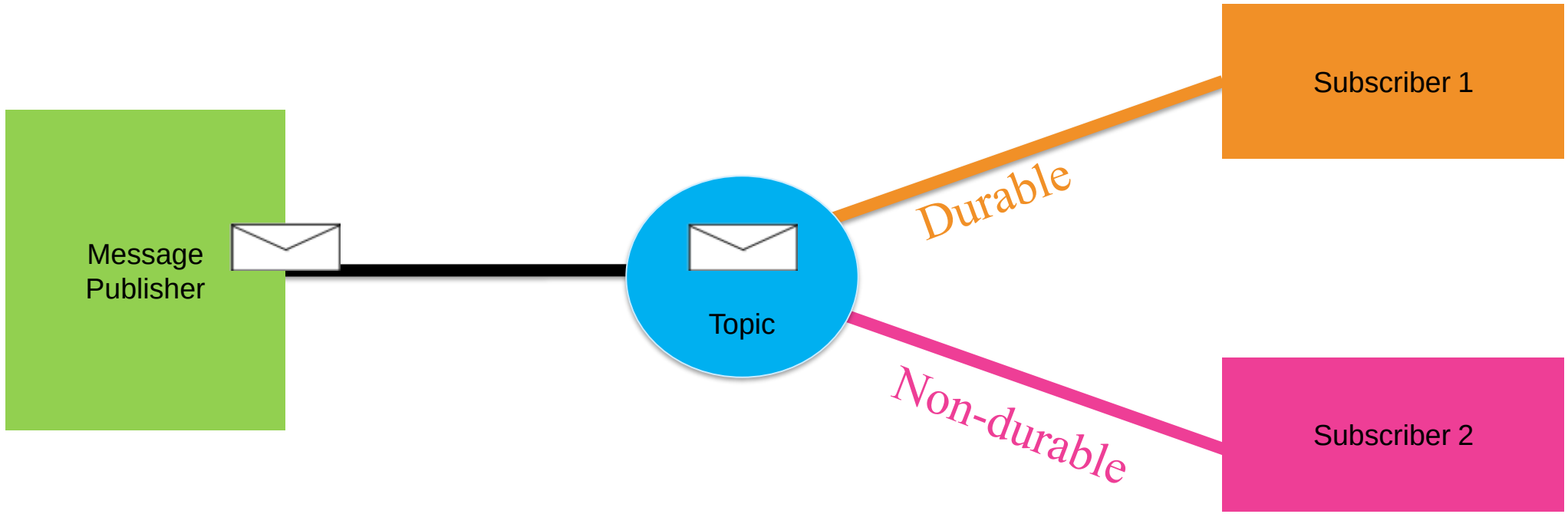
Point-to-point

Publish/subscribe



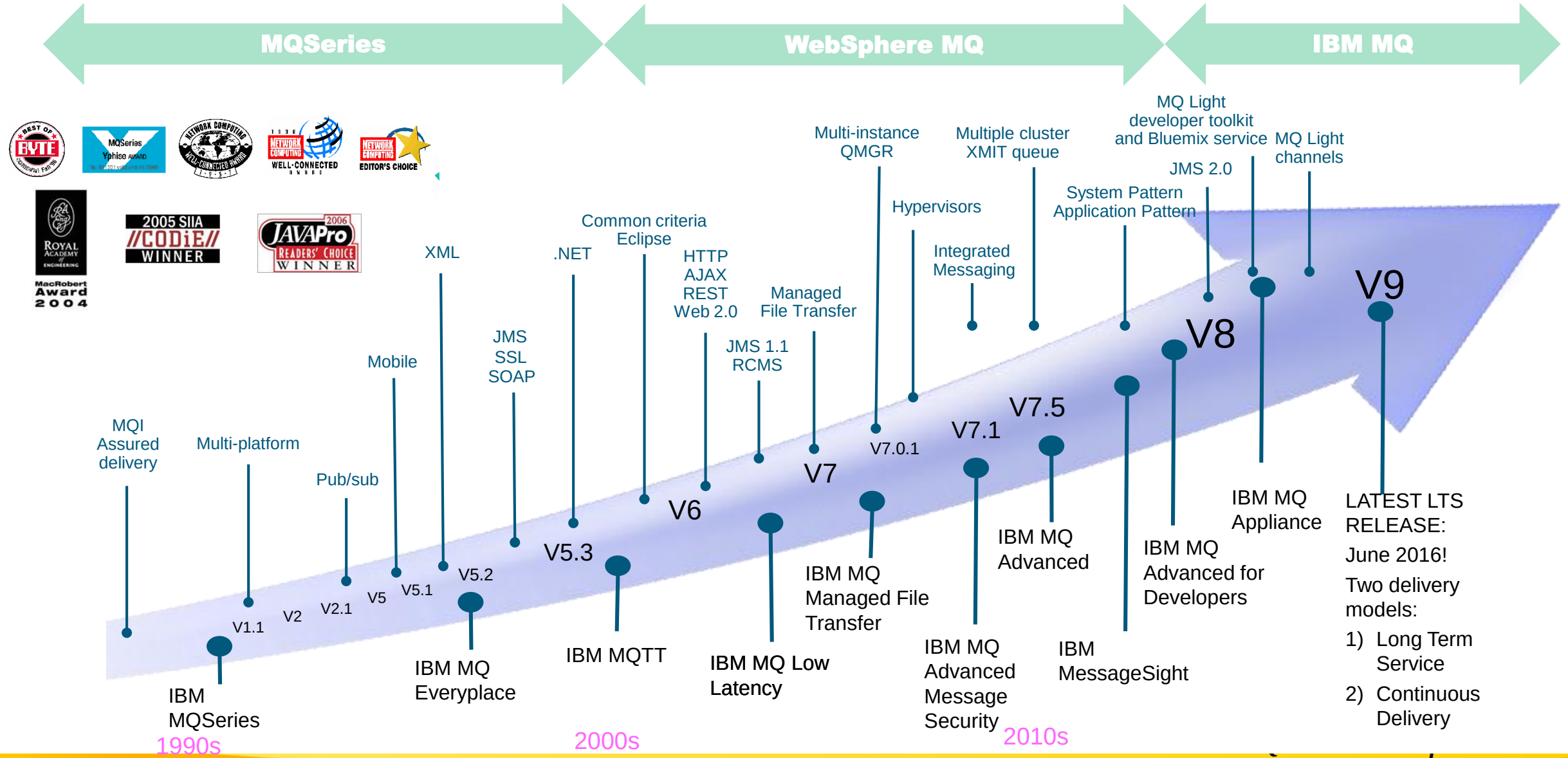
Durable publish/subscribe in action

- **Durable subscriptions result in published messages being retained when the subscriber is not connected to the messaging provider.**



IBM MQ

IBM MQ Timeline



What MQ adds to messaging

Enterprise messaging

Reliability

- Assured message delivery “Once and once only”
- Resiliency and high availability of the infrastructure
- Continued support and interoperability of systems for over twenty years

Scalability

- High performance solution
- Incremental growth of applications and infrastructure

Ubiquity

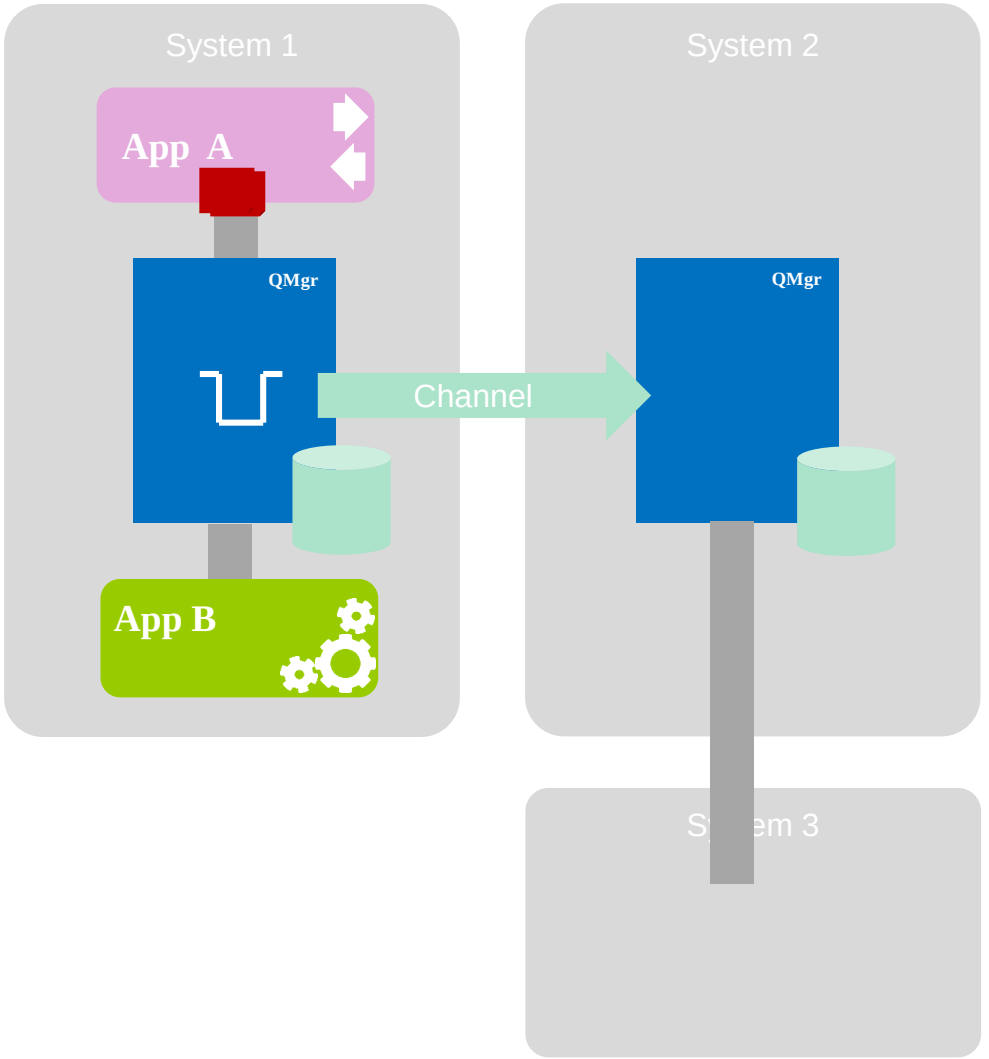
- Breadth of support for platforms and environments
- Multiple application environments and APIs to suit many styles

Security

- Data encryption and integrity
- End use authentication and authorisation
- Audit trails for configuration and data flows

Anatomy of an MQ system

- **Applications**
  - Applications use MQ clients to connect to an MQ **queue manager**
  - Applications can connect to queue managers either on the same system (*BINDINGS mode*) or remotely over a network (*CLIENT mode*)
- **Queue Managers**
  - A queue manager is a runtime that hosts messaging resources such as **queues** and their **messages**
  - A queue manager manages the flow and storage of messages
  - Each queue manager runs on a single system
  - Multiple queue managers can be connected together using **channels** and messages routed between them
- **Queues**
  - Queues are a named resource where messages sent to by applications, stored by the queue manager and retrieved by applications
- **Messages**
  - Are just chunks of data
  - Applications build messages to send and receive
- **Channels**
  - Channels define a way for one queue manager to connect to another queue manager
  - Channels can be manually configured or dynamically created as and when needed using **MQ Clusters**

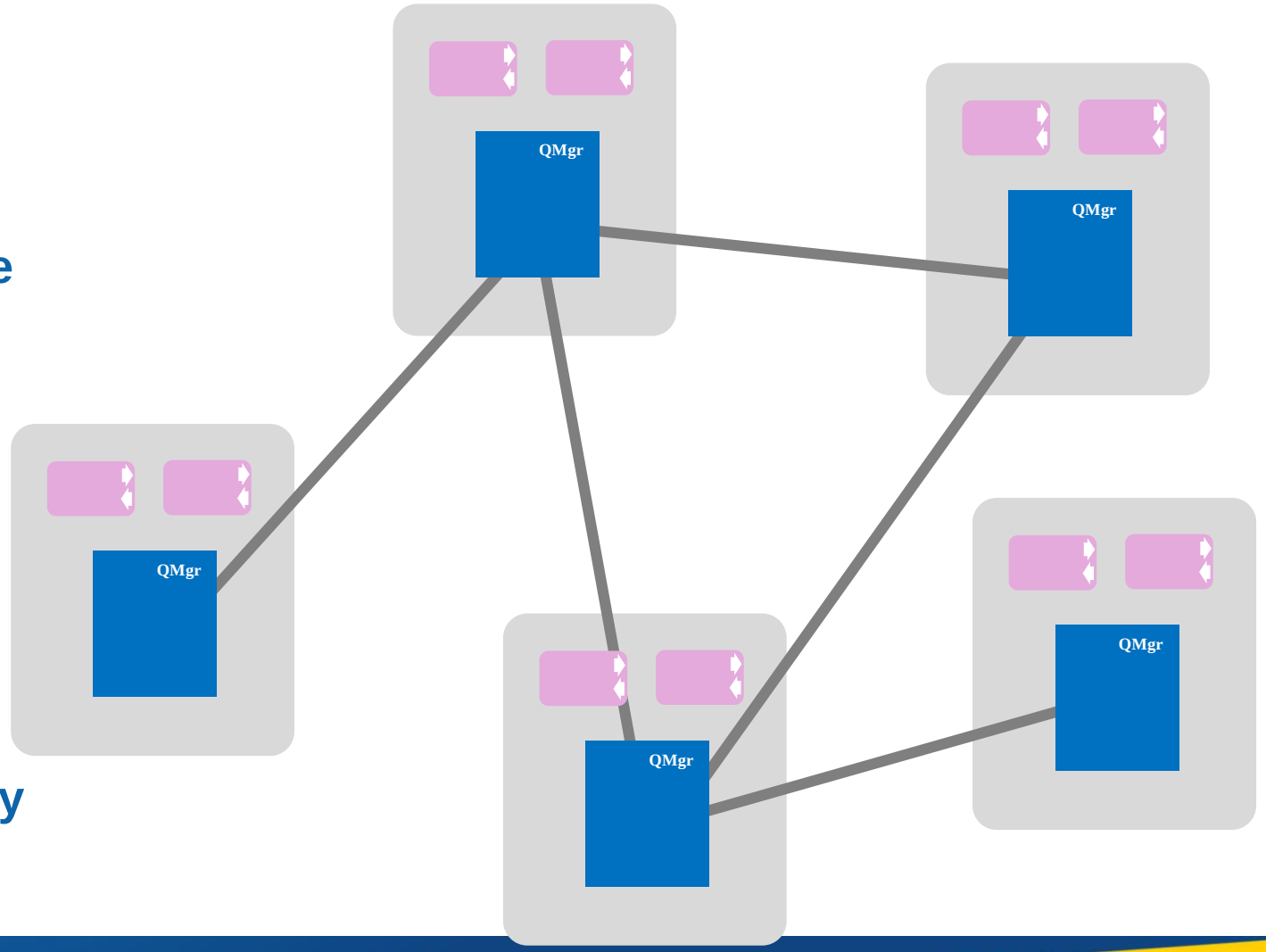


IBM MQ

IBM MQ Architecture

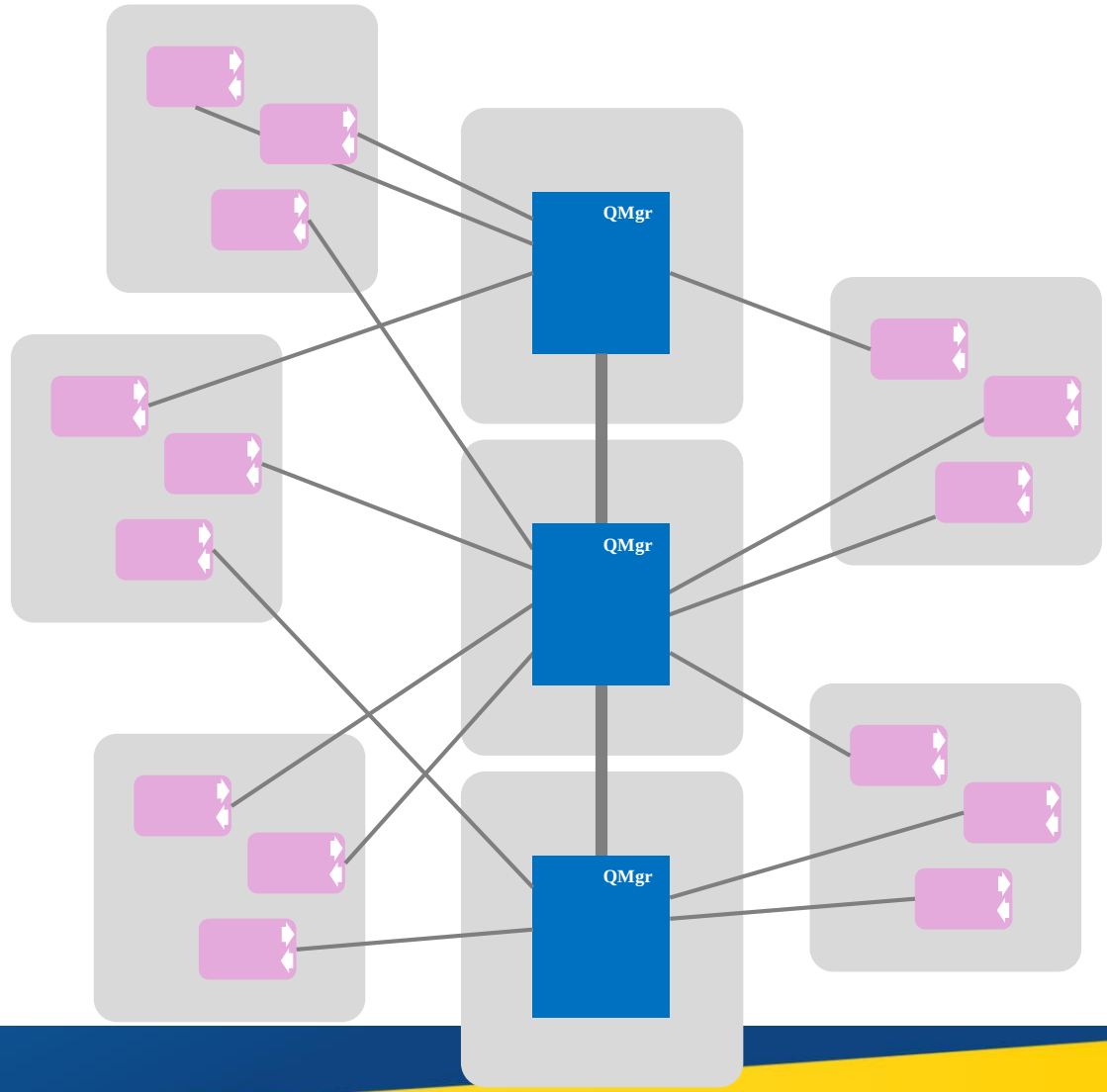
Distributed Architectures

- Used for connectivity of heterogeneous systems
- Provides *store and forward* to overcome system outages
- This is the ‘original’ deployment pattern MQ
- Queue managers will interoperate with other queue managers and clients at any other version of MQ



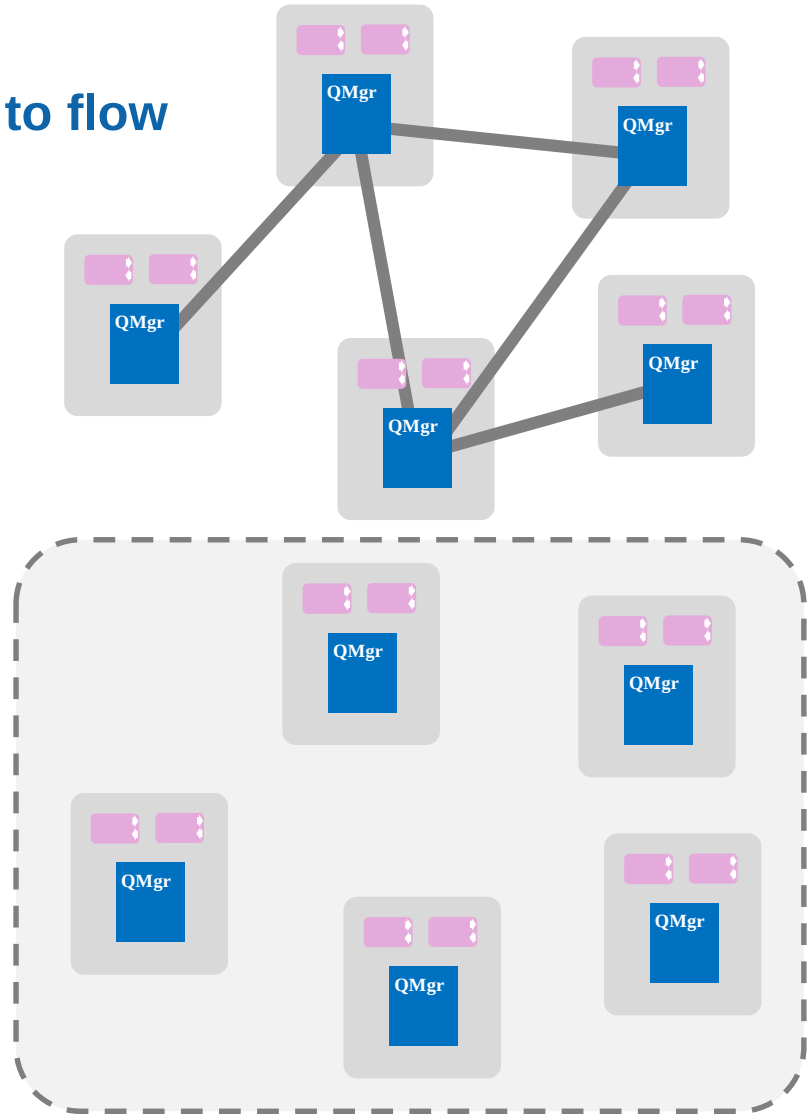
MQ hub architecture

- A ‘hub’ of systems running queue managers on a standard deployment
- Applications connect as clients from remote systems
- This pattern has gained popularity as networks improve and administration costs go up



Connecting queue managers together

- **Channels connect queue managers together, allowing messages to flow between them**



- **Two options:**
  - **Manual configuration of channels**
    - Each channel relationship must be defined on both ends
    - Additional resource also need to be defined (***transmission queues*** and ***remote queues***)
  - **MQ clusters**
    - Once queue managers join a cluster (a pair of special channels must be defined) they can route messages to any other clustered resource in the cluster without requiring further, per queue manager, configuration.
    - As queue manager networks grow, clusters become a benefit
    - Clusters also enable workload balancing and availability routing of messages

IBM MQ

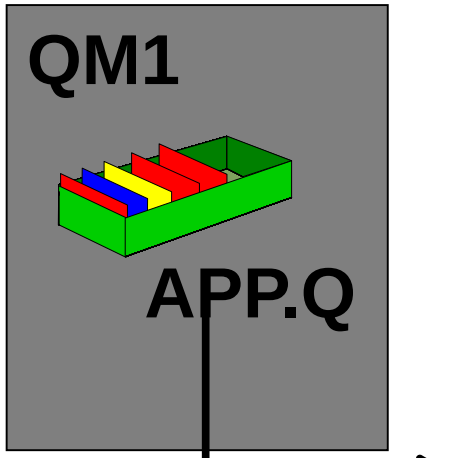
Applications

MQ APIs – How do I connect my apps to my queue manager?

- MQI
- JMS
- MQ Light API
- MQTT

MQ APIs - MQI (MQ Interface)

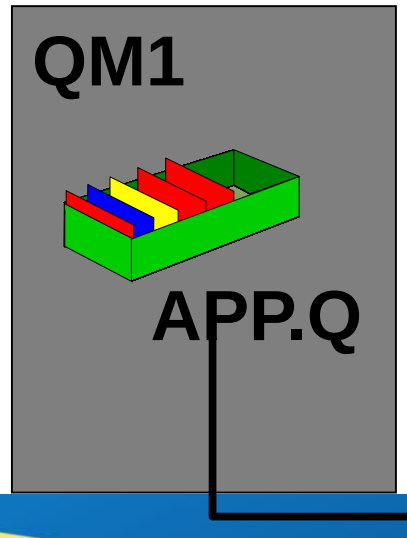
- C, COBOL, Java, Assembler
- MQ's proprietary API offering full access to MQ's capabilities




```
MQCONN(QM)
…
MQOPEN(Q)
…
MQPUT(Q)
…
MQGET(Q)
…
MQCLOSE(Q)
…
MQDISC(QM)
```

MQ APIs - Java Message Service (JMS/XMS)

- **JMS is part of the JEE specification.**
  - Fully supported in application servers such as WSAS, Liberty, WebLogic, Wildfly
- **Simplifies programming and supports both messaging domains**
- **No MQ coding knowledge needed!**
- **XMS syntactically the same as JMS V1.1 but for C, C++ and C#**




```
// Lookup the MQ specific objects in JNDI
Context jndiContext      = new InitialContext();
ConnectionFactory cf     = (ConnectionFactory) jndiContext.lookup("jms/QM1");
Destination dest         = (Destination) jndiContext.lookup("jms/APP.Q");

// Establish a connection with the queue manager & create JMS objects
JMSContext context       = cf.createContext();
JMSConsumer consumer     = context.createConsumer(dest);

// Get a message
Message msg = consumer.receive();
```

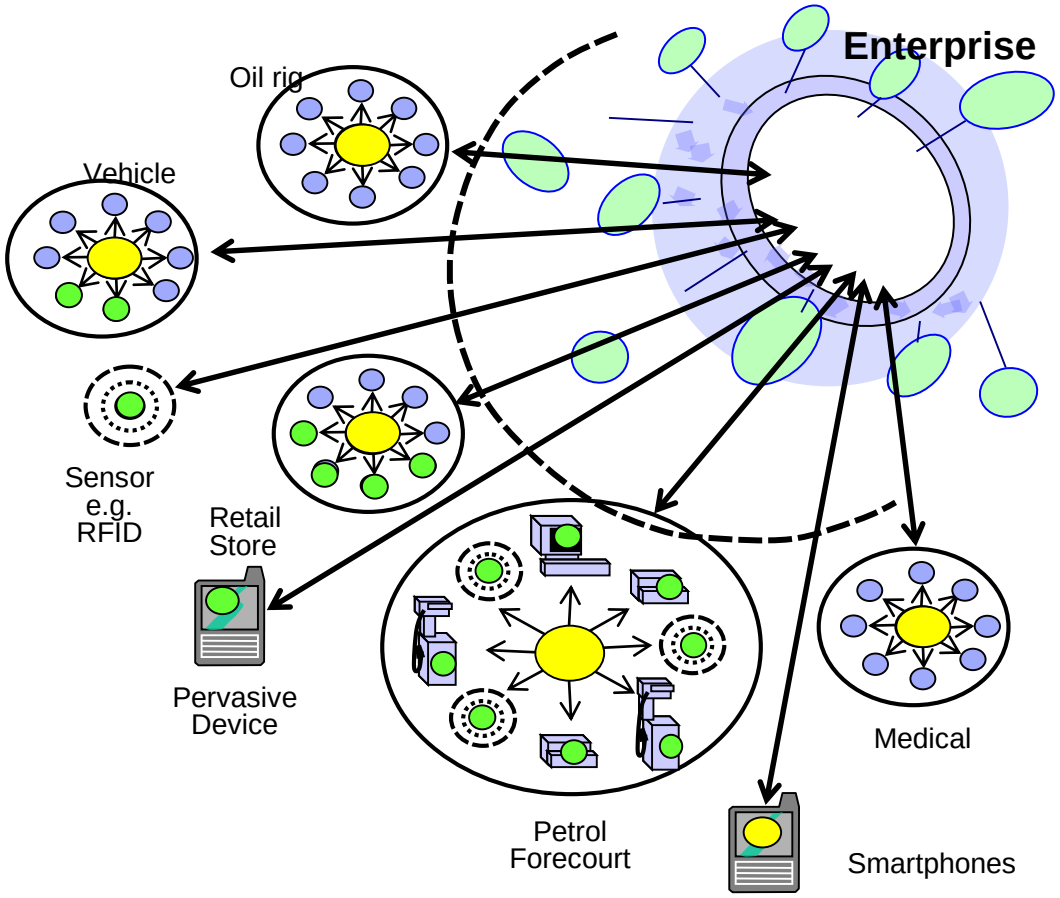
MQ APIs - MQ Light

- AMQP based API
- Node.js, Java, Ruby
- Connects cloud applications to MQ!


```
# Receive:
var mqlight = require('mqlight');
var recvClient = mqlight.createClient({service: 'amqp://localhost'});
recvClient.on('started', function() {
recvClient.subscribe('news/technology');
recvClient.on('message', function(data, delivery) {
          console.log(data);
     });
});
```

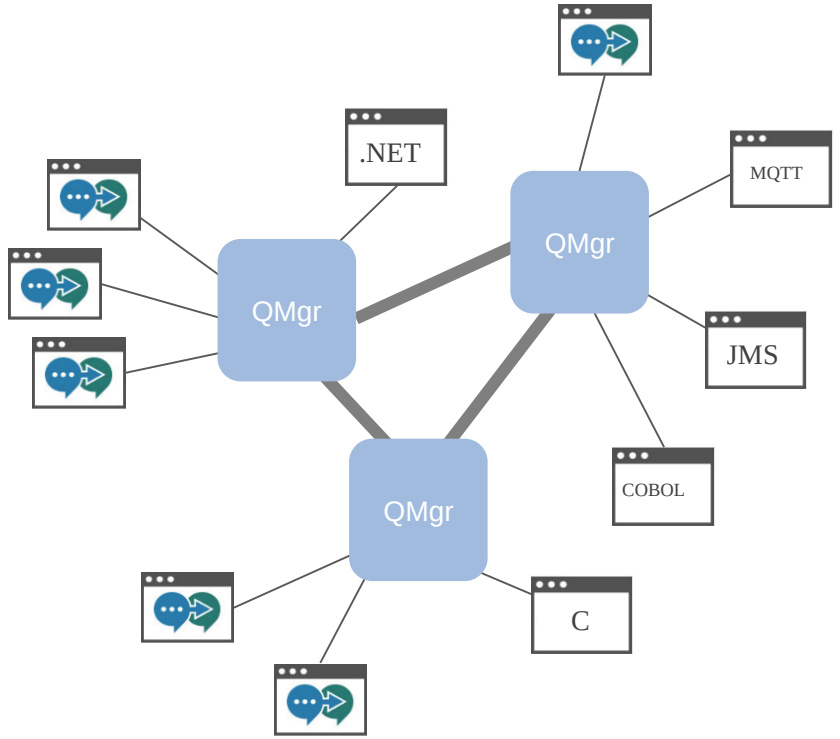
MQ APIs - MQ Telemetry (MQTT)

- Product extension supports connectivity for smart devices to the enterprise
- Utilises the open standard MQTT protocol
  - a lightweight, public, low bandwidth messaging protocol for scenarios where enterprise messaging clients are too big or bandwidth intensive.
- Java, C and JavaScript libraries provided, but you can “roll your own” that implement the MQTT v3 spec



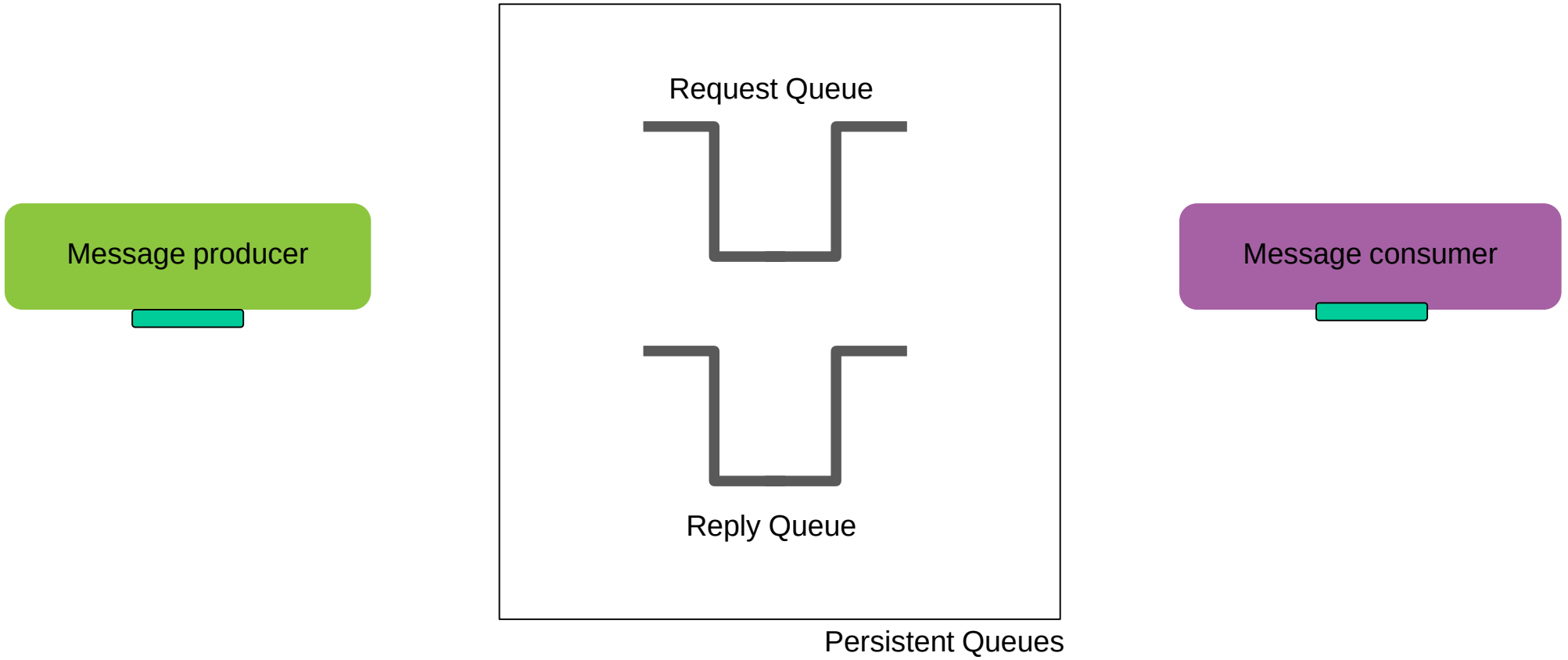
Messaging APIs

- All interoperate with each other!
  - Any application can receive messages from any other application

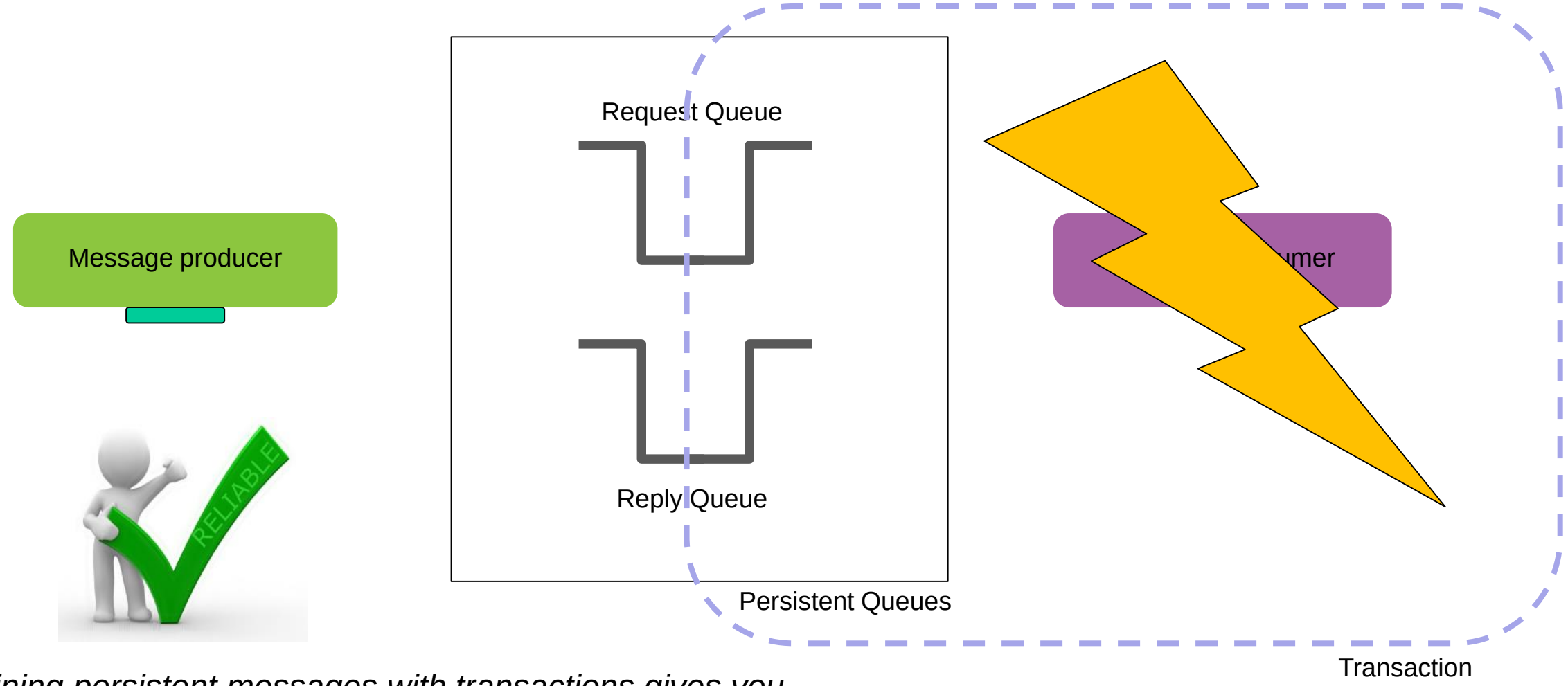


Transactional Messaging

- Non Persistent
- Persistent



Transactional Messaging



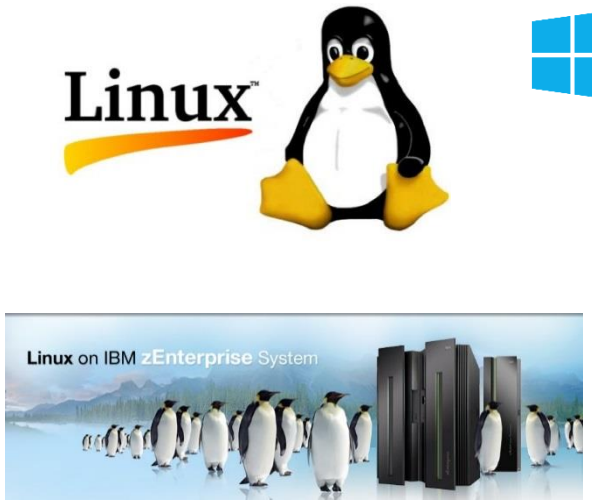
Combining persistent messages with transactions gives you
once and once only delivery of messages from an application's point of view

IBM MQ

Environments
On-premise & Cloud

MQ systems

- **MQ servers and clients can run on many different operating systems and architectures**
  - *Linux, Windows, z/OS, zLinux, AIX, HP-UX, Solaris, IBM i and HP NonStop*



- And a physical appliance
  - M2001: IBM MQ Appliance

The IBM MQ Appliance

- **The scalability, security and reliability of IBM MQ**
- **The convenience, fast time-to-value and low total cost of ownership of an appliance**
- **Built in high availability and disaster recovery capabilities**
- **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/clustering, security….**

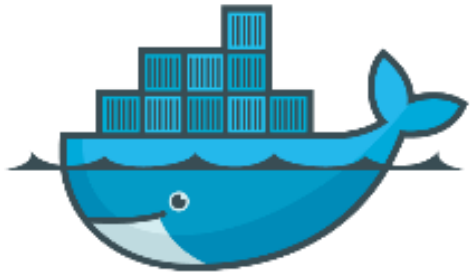
Come to my other sessions!

Introducing the MQ Appliance
Room: Zebrawood
September 25th 15:50 – 17:00 &
September 27th 09:50 – 11:00

MQ Appliance – HA & DR Deep Dive
Room: Zebrawood
September 26th 08:30 – 09:40 &
September 27th 15:50 – 17:00

Virtual Environments

- **MQ can be run in many different virtual and cloud environments**



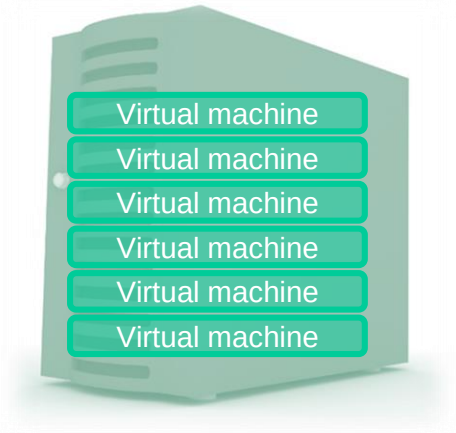
MQ In Containers
Rob Parker
Room: Leopardwood
September 27th 14:30 – 15:40

IBM MQ supported to run in Docker

Windows Azure

amazon web services™

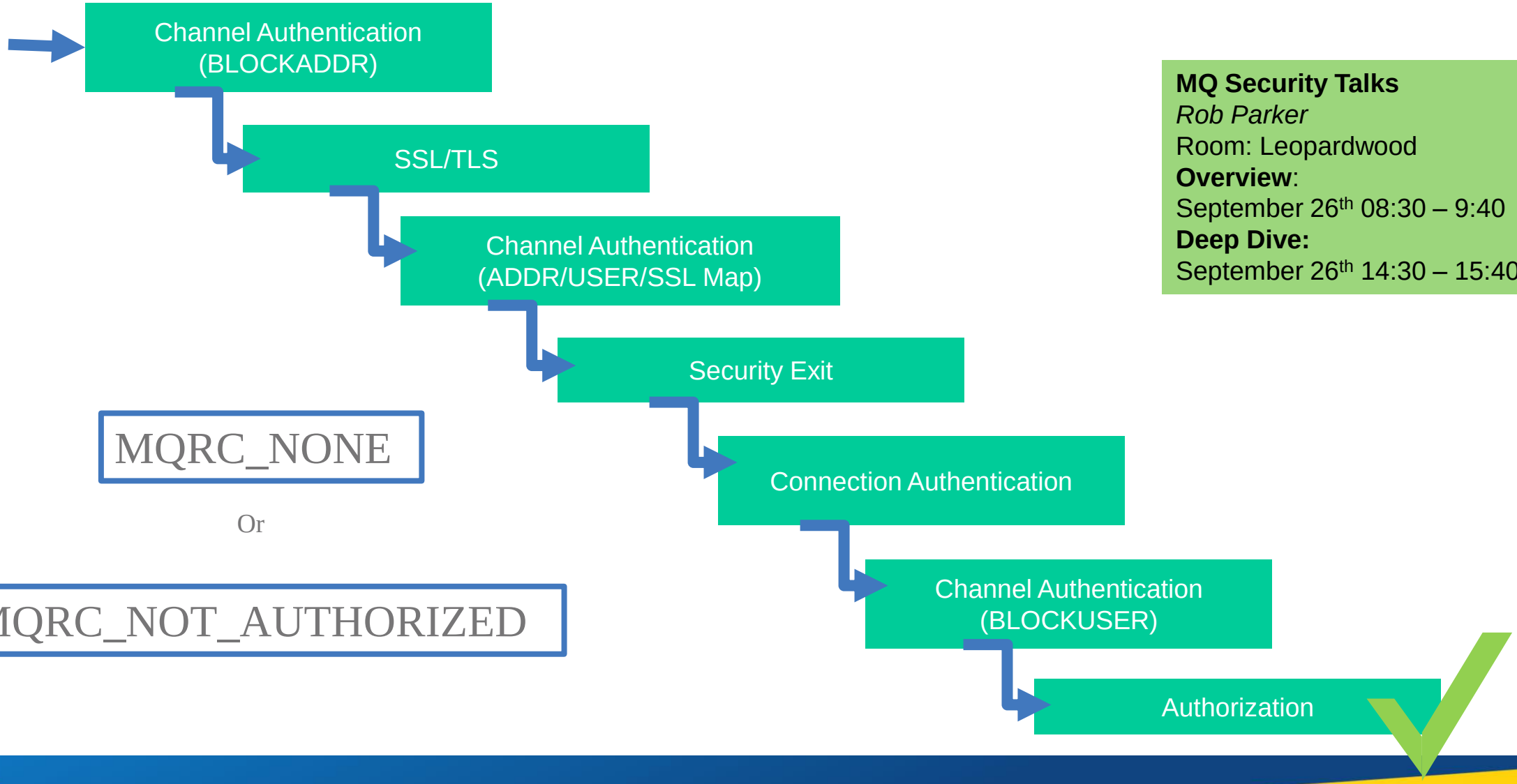
MQ available on public cloud platforms



IBM MQ is run by customers in many virtualised environments

IBM MQ
Security

Security provided on Client to Queue Manager connections



MQ Security Talks
Rob Parker
Room: Leopardwood
Overview:
September 26th 08:30 – 9:40
Deep Dive:
September 26th 14:30 – 15:40

Security

- **Integrity & Privacy**
  - Digital signing & Data Encipherment / Encryption supporting latest protocols and algorithms
  - Builds on Public key infrastructure technologies
    - X.509 Certificates
  - Transport level (in-flight)
    - TLS 1.0 & 1.2
    - FIPS 140-2 (Federal Information Processing Standards) compliance
  - Message level (data at rest)
    - Advanced Message Security (AMS) provides signing and encryption capabilities for message lifetime
    - From MQ V9:
      - AMS supported on non-IBM JREs
      - Fast encrypted messages with “Confidentiality policies”

IBM MQ

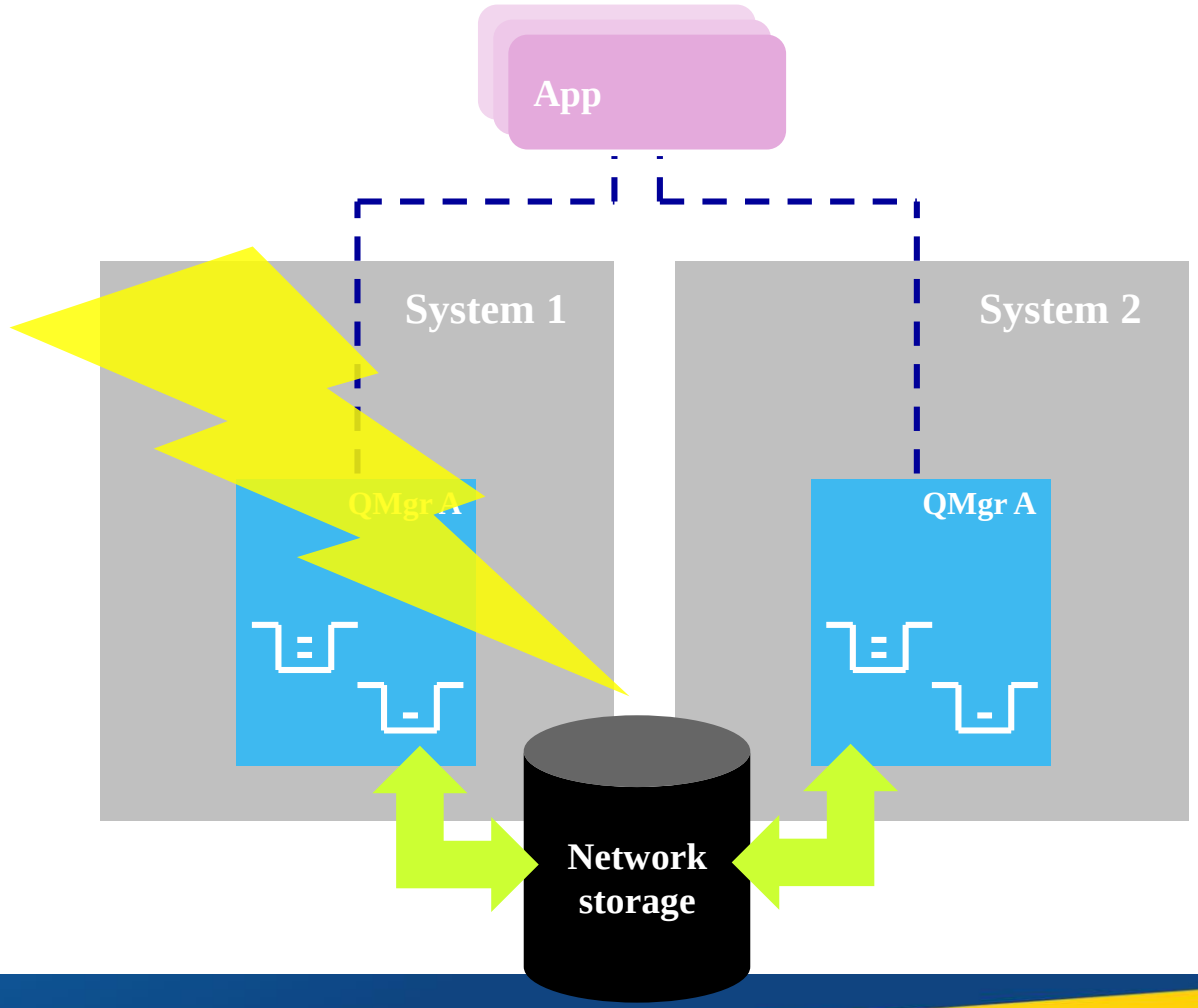
High Availibility

IBM MQ HA Technologies

- **Many MQ technologies are tagged with “high availability”**
  - Queue manager clusters
  - z/OS Queue-sharing groups
  - Multi instance queue managers
  - HA cluster support
  - MQ Appliance HA groups
  - Client reconnection

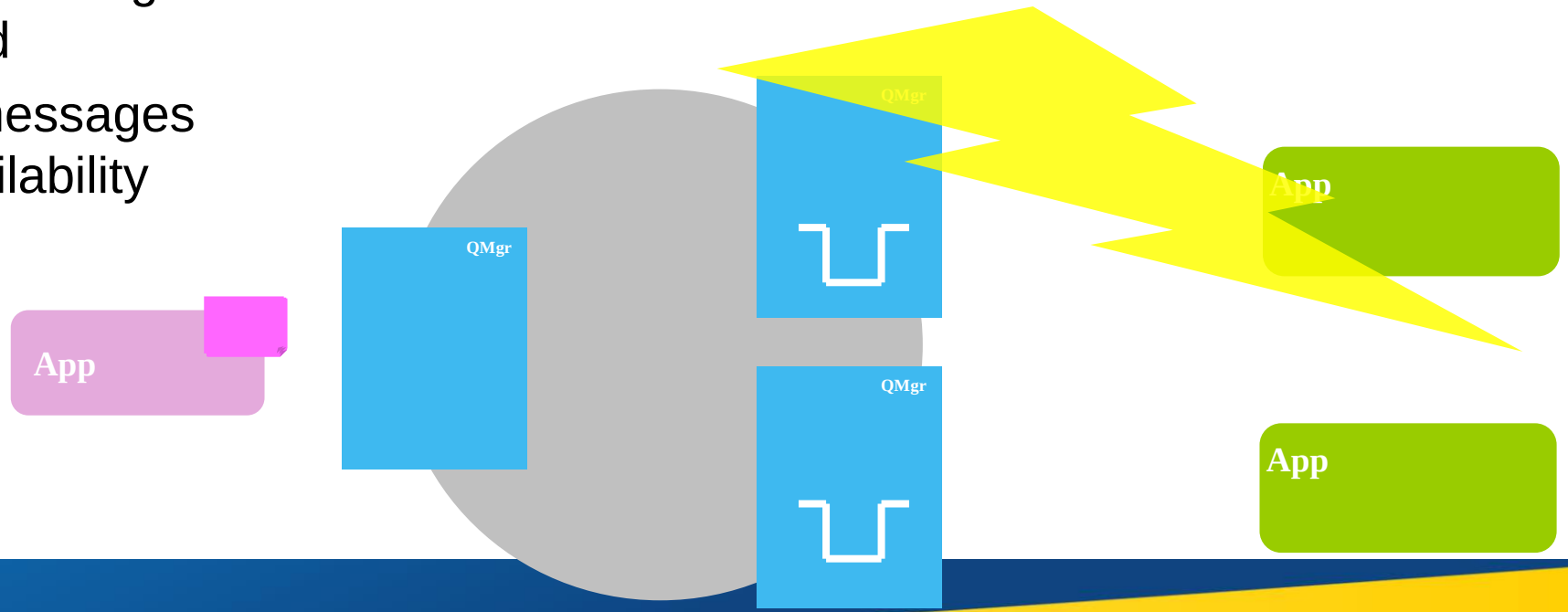
Multi-instance queue managers

- Automatic detection and take over of terminated queue managers, recovering persistent messages.
- MQ clients can detect the failover and automatically reconnect an application to an alternative location without the application being aware of it.



MQ queue manager clusters

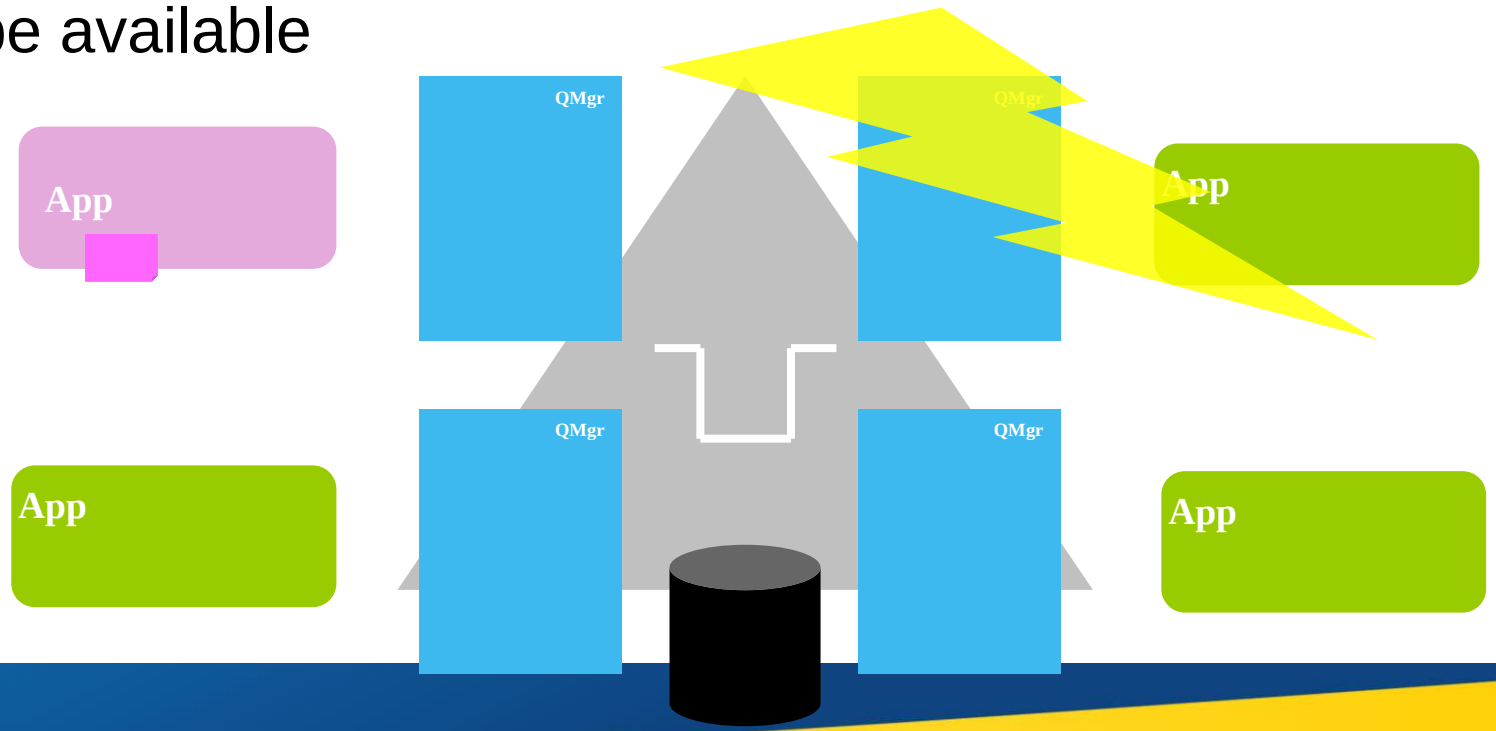
- The *same* queue is defined on multiple queue managers in an MQ cluster
- Messages are workload balanced across them or sent to a primary location
  - This gives you great horizontal scaling potential or high availability
- In the event of a failure, messages continue to be routed to the available locations to be processed
- Also the ability to route messages based on application availability



Shared queues on z/OS

- Shared queues are hosted centrally within a *queue sharing group*
- A application connected to any queue manager in the group can consume the messages from the shared queues
- A failure of one queue manager is recovered by the others in the group and messages continue to be available

Introduction to z/OS Shared Queues
Matt Leming
Room: Rosewood
September 25th 14:30 – 15:40



MQ Appliance high availability

- No external storage
- No additional skills required

Fully synchronous replication

MQ Appliance – HA & DR Deep Dive
Room: Zebrawood
September 26th 08:30 – 09:40 &
September 27th 15:50 – 17:00

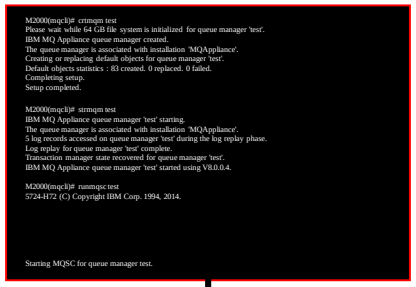
- All recoverable data replicated immediately
- Manual control of failover for migration/maintenance
- Queue manager level active/passive (i.e. both appliances can run workload)

https://www.ibm.com/support/knowledgecenter/SS5K6E_1.0.0/com.ibm.mqa.doc/overview/ov00020_.htm

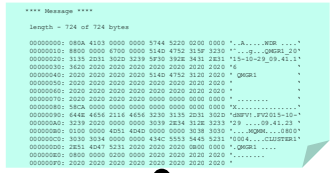
IBM MQ
Administration

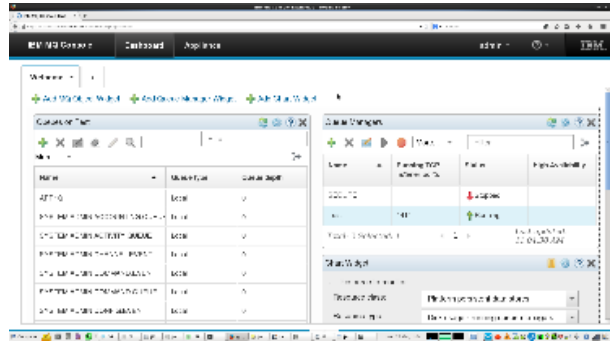
Administering MQ

Interactive command line and scripting - *runmqsc* tool



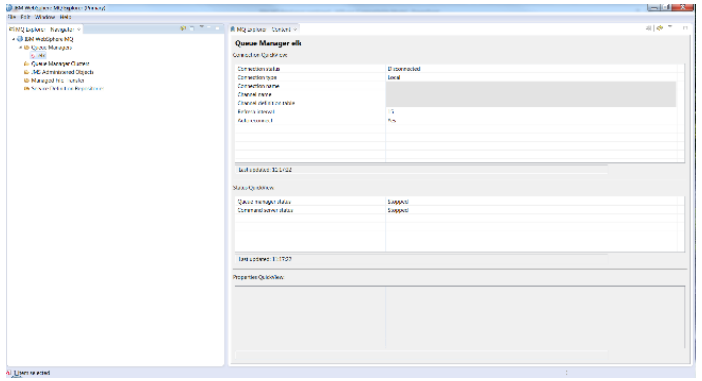
Programmatically
Message based configuration commands





Web UI
Web based graphical interface

MQ



GUI tooling
MQ Explorer, Eclipse based graphical interface

REST API

System management tools
Tivoli and many third party products

IBM MQ

MQ Advanced

MQ Advanced Message Security

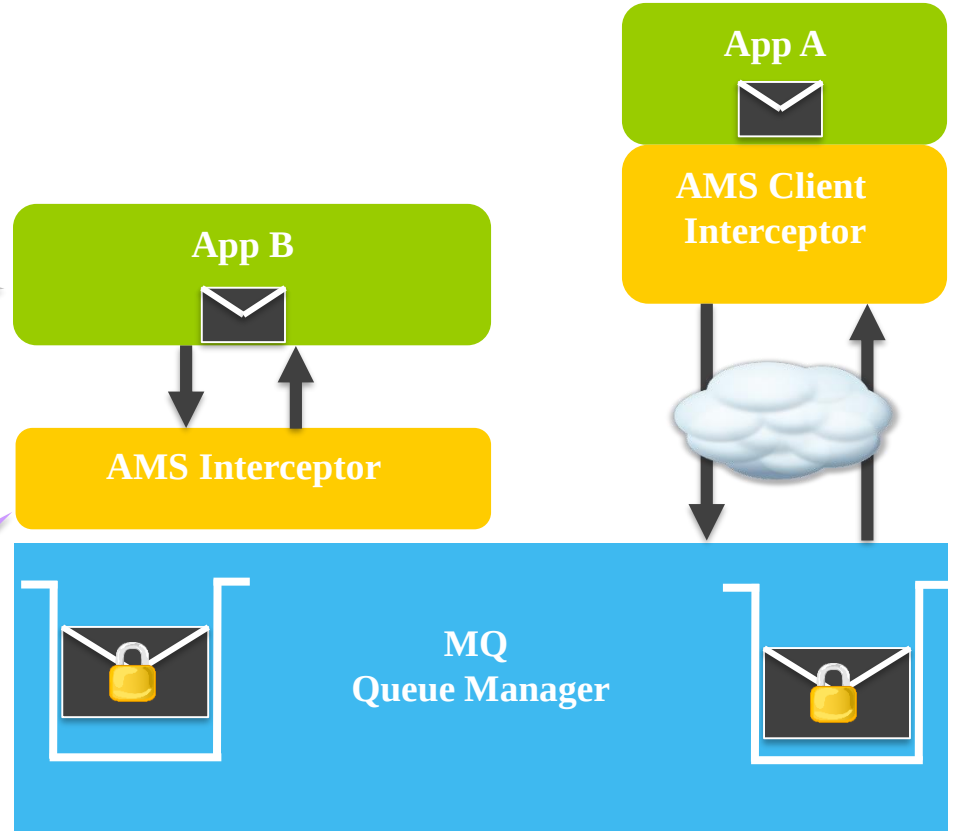
- **Secures application data even before it is passed to MQ**
- **Upgrade from base MQ**
  - No changes to existing applications or network required

MQ standard security:

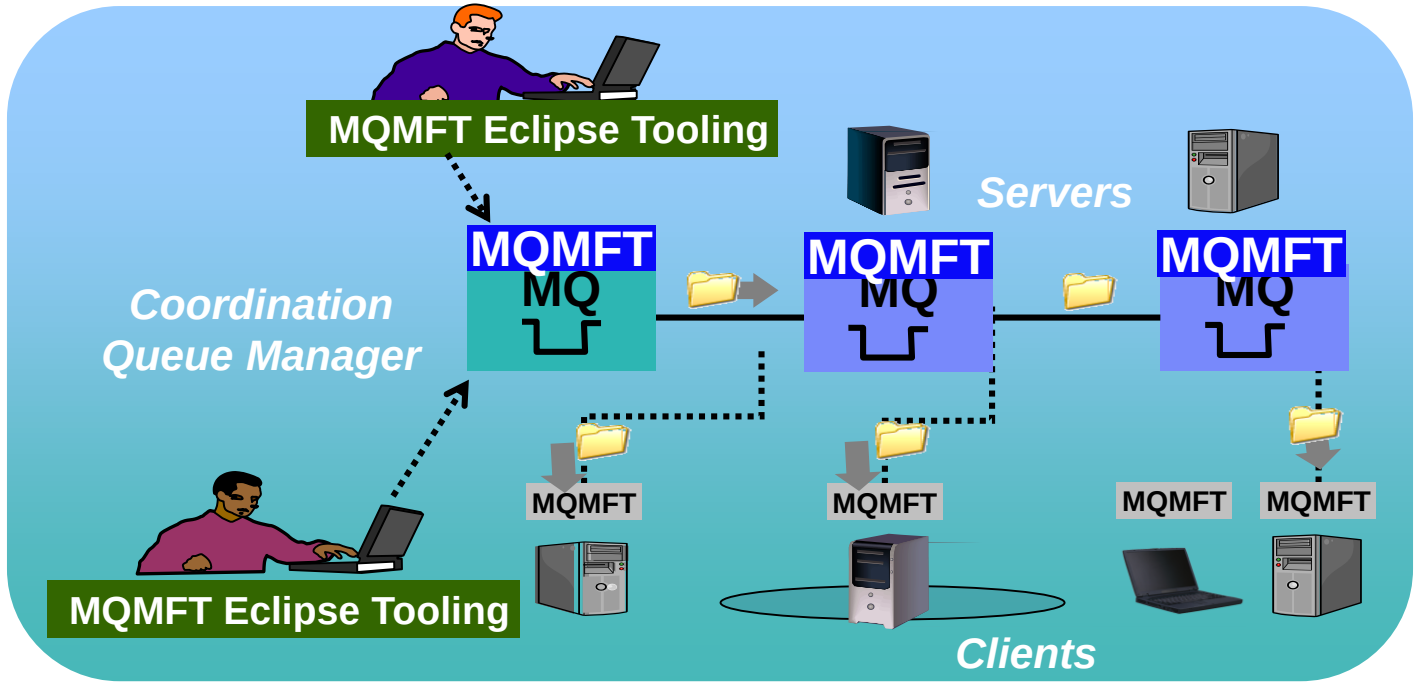
- Industry standard TLS channels (256-bit)
- Certified for Common Criteria
- Authentication is based on Operating System identifier of local process
- Message data can be encrypted in transport but not when it resides in the queues

MQ Advanced Message Security adds:

- Authentication policies are based on certificates associated with each application
- Message data is protected end-to-end – including when it resides in queues
- Much finer granularity in security policies
- No changes needed to applications or queues



MQ Managed File Transfer

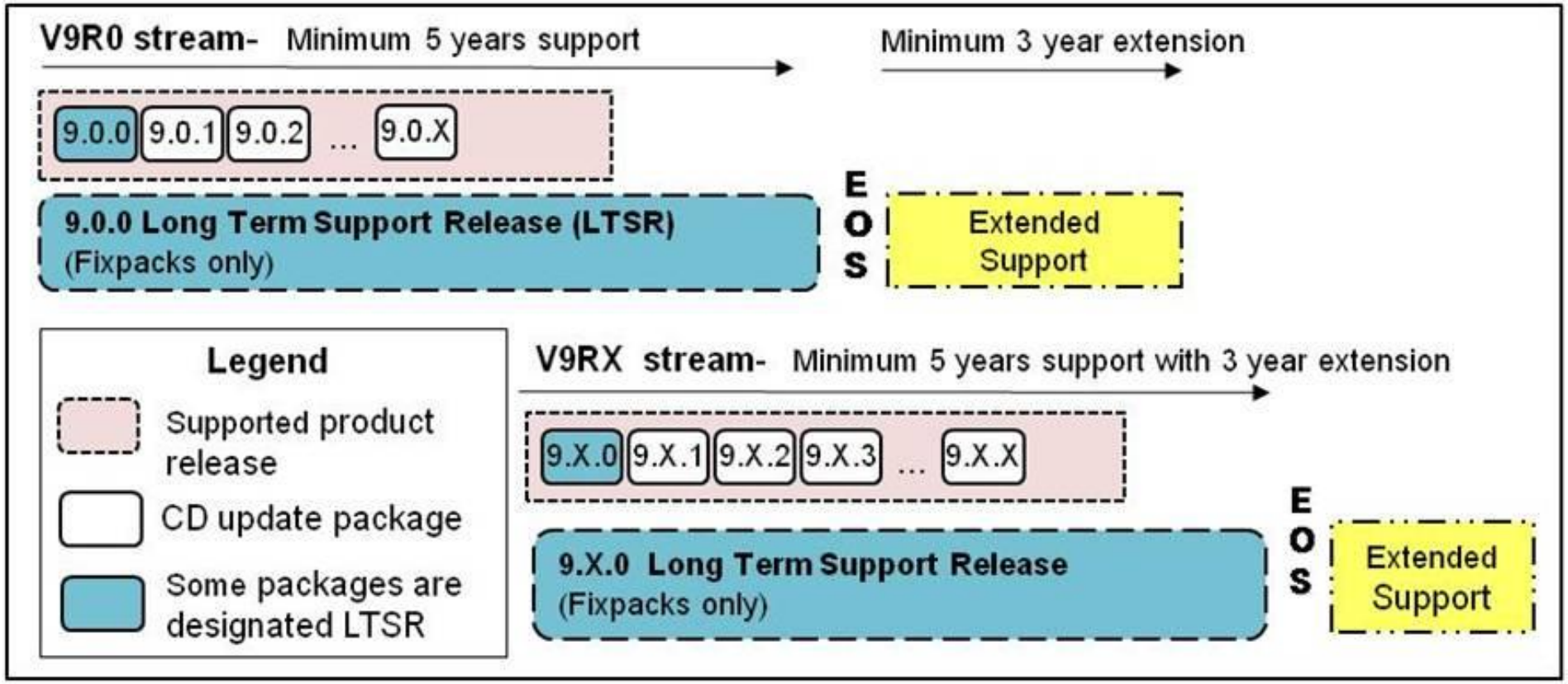


MQ V9

http://www-01.ibm.com/support/docview.wss?uid=swg27047919

MQ V9

- **Released 2 Jun 2016 for Distributed, 17 June z/OS**
- **Main "feature" is the two-stream delivery model!**



Where to go now?

How to get started

Get hold of IBM MQ

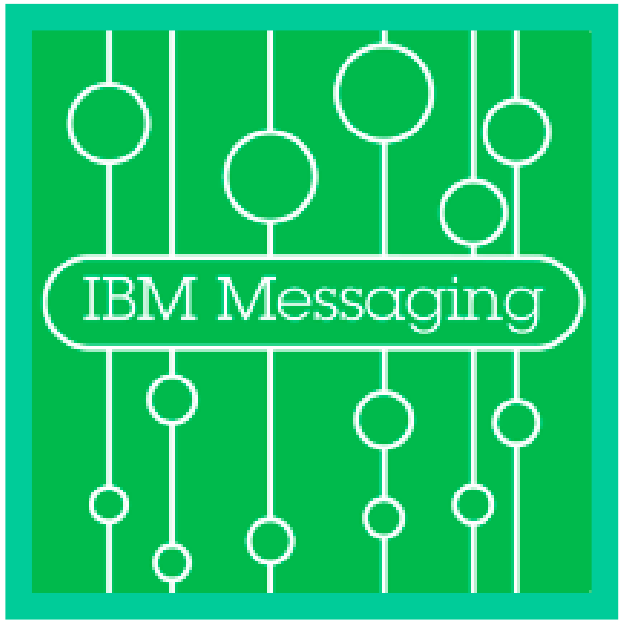
- IBM MQ Advanced for developers
  - Free to download and use for development purposes
    - Gives you a full MQ installation including all *advanced* function
    - Exactly the same as a production MQ installation
    - **http://www.ibm.com/software/products/en/ibm-mq**

Where do I get more information?

IBM MQ Knowledge Center
http://www.ibm.com/software/integration/wmq/library/

IBM Messaging developerWorks
developer.ibm.com/messaging

Youtube
https://www.youtube.com/user/IBMmessagingMedia



Would you like to take part in IBM MQ Design Research?

- **The IBM MQ team is currently conducting some long term research with our MQ customer base.**
- **With this survey we would like to understand:**
  - Who is interreacting with MQ and what are their responsibilities?
  - Which customers are interested in moving IBM MQ into the cloud?
  - Which customers would like to take part in future research?
- **We estimate the survey should take 4 minutes to complete.**
- **Please note: This survey is for distributed users only.**
- **If you're interested, go to ibm.biz/MQ-Customer-Survey**

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Thanks for listening

Questions?

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