



# Introduction to WebSphere MQ

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IBM

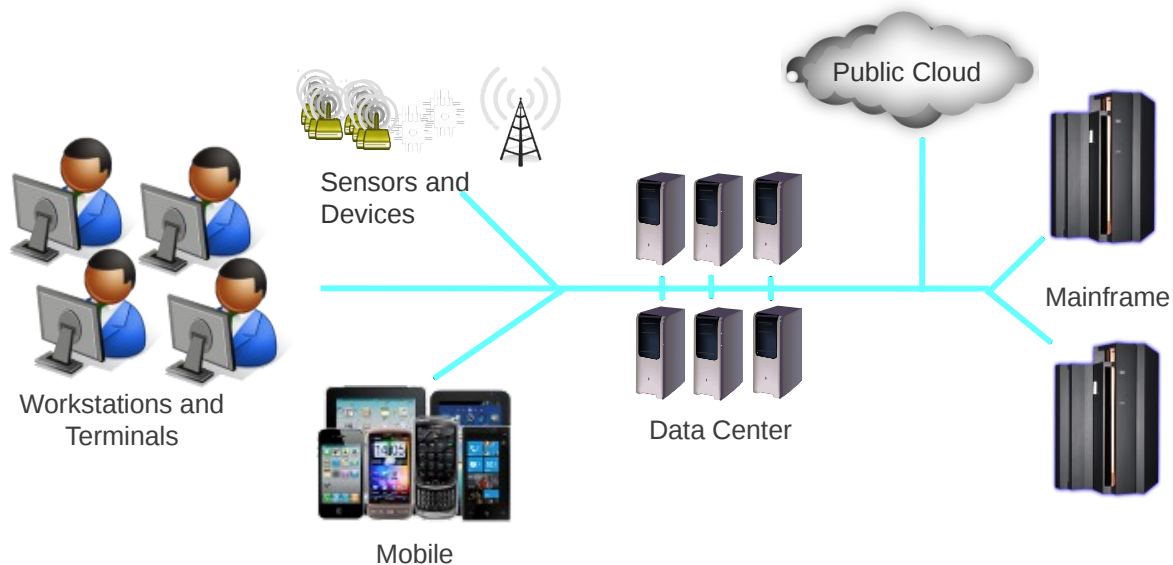
Monday 12th August, 2013  
Session 13787

# Agenda

- Introduction – why use messaging?
- Fundamentals of WebSphere MQ
- Using the WebSphere MQ API
- Example Architectures
- Other Key Features
- Related Products
- Summary

# Why use messaging...?

From the simplest pairs of applications...



...to the most complex business processes.

Messaging simplifies the challenges of connecting systems:

- **Extended Reach** – Connecting anywhere to anywhere
- **Reliability** – Assured delivery of data, securely and performant
- **Flexibility** – Ease of application change
- **Scalability** – Incremental growth of applications and capacity

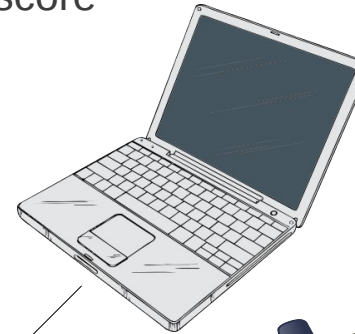
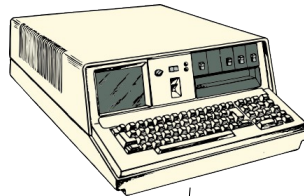
# Extended Reach - Universal Connectivity



Payroll have a program to run to add a one-time payment to an employee's pay packet

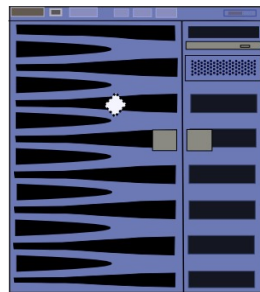


HR calculate employees performance bonus based on their annual review score



Sales have a program to calculate annual review scores

Research have a program to calculate annual review scores



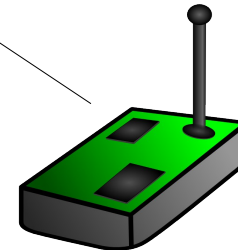
Tills report sales of goods



Engineers monitor problem reports



Sensors monitor stock temperature and ambient humidity



These applications run on different hardware and OS and be written in different programming languages. We want to connect the applications together in a time and cost efficient manner.

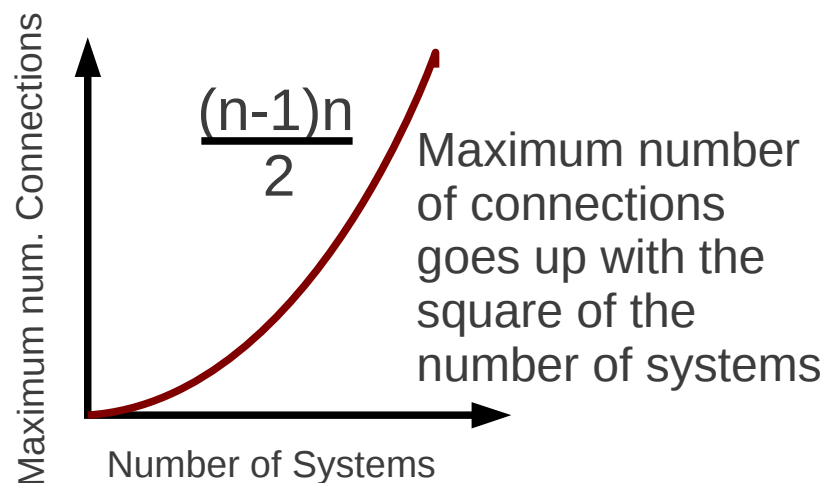
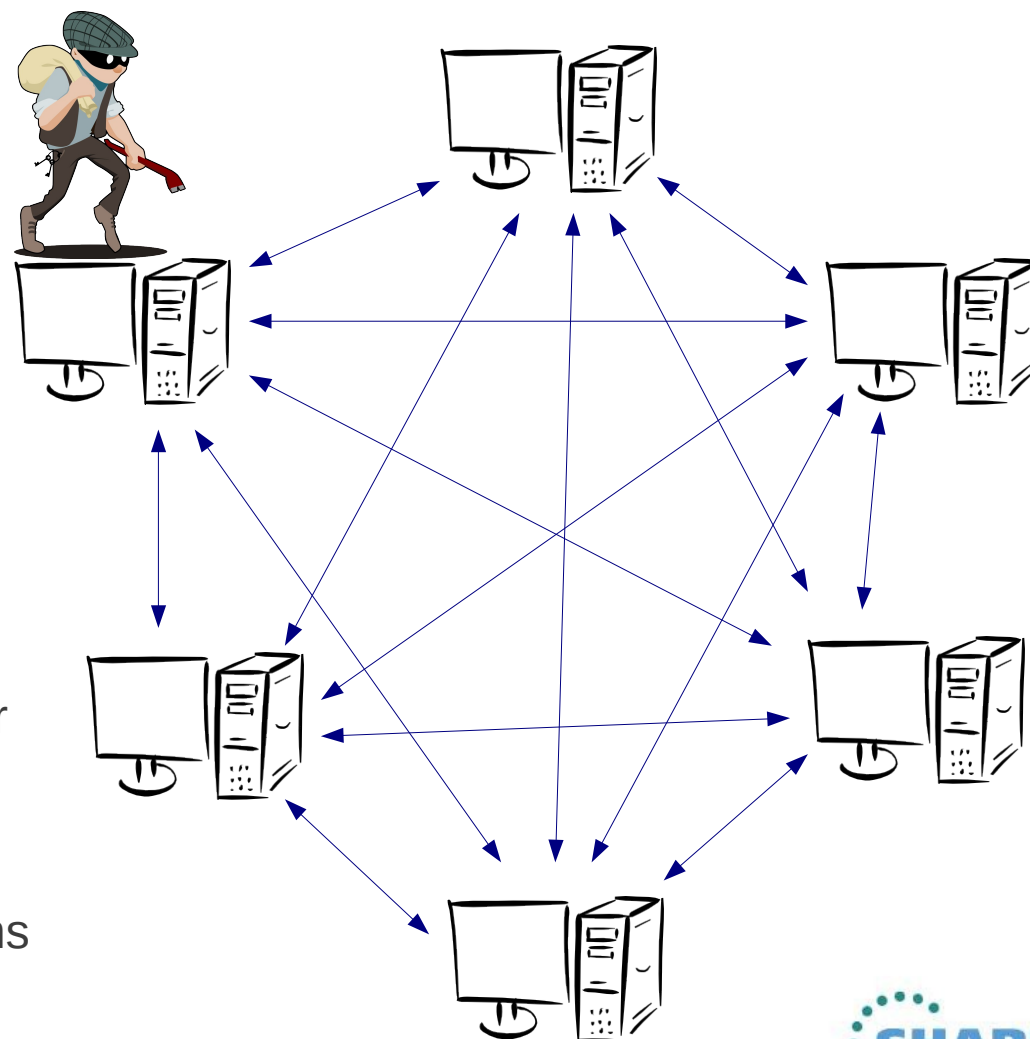
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# Reliability

As systems become more tightly coupled, their reliance on each other increases. The cost of failure of a process increases.

- **The risk of failure can be reduced by:**
  - Removing dependencies
  - Introducing redundancy
  - Assuring data delivery
  - Providing robust security



# Flexibility

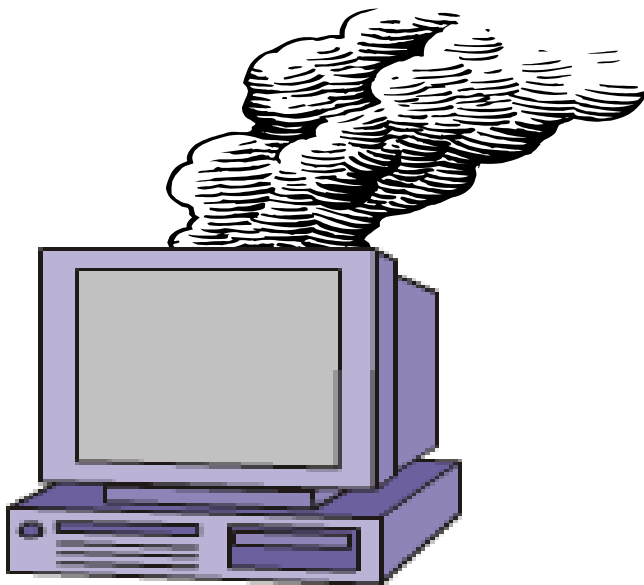
- A process was originally designed for one purpose...
- ... It then needed to change to meet new requirements



- Being able to respond rapidly to internal and external challenges by rapidly modifying existing services gives a competitive advantage.

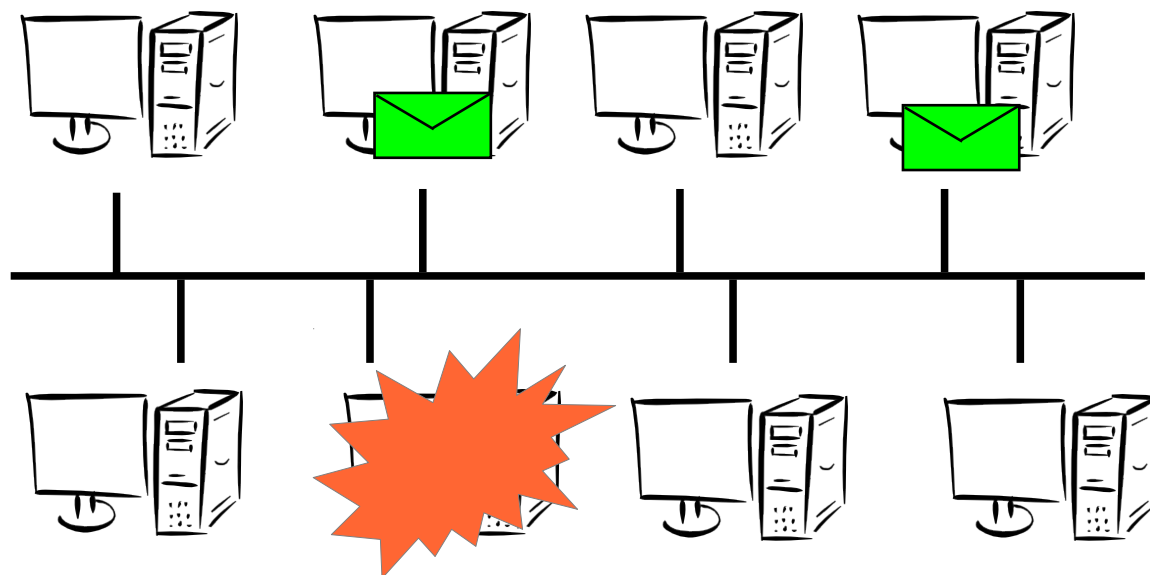
# Process Scalability

- Many applications and processes start out on a single system.
- The business grows, and the capacity of the system can no longer cope with the workload demand.



- A scalable architecture enables the capacity to be incrementally grown to meet increasing workloads

# Decoupling Systems



The interdependence between systems can be decoupled through the use of a common messaging system, providing a scalable environment which is more tolerant of individual system outage.

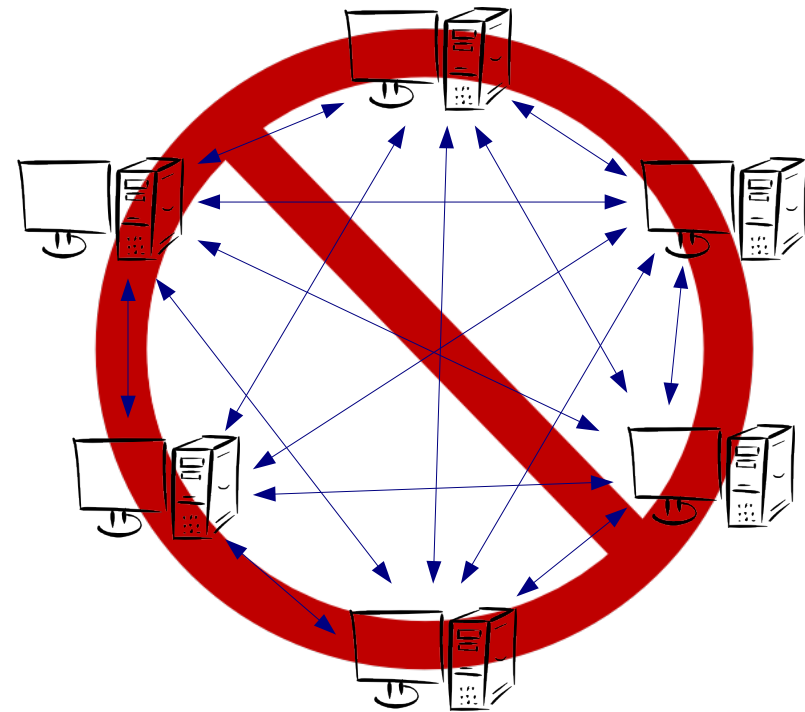


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- Using the WebSphere MQ API
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# Fundamentals of WebSphere MQ

- **Reliability**
  - Assured message delivery
  - Performance
- **Ubiquitous**
  - Breadth of support for platforms, programming languages and API
- **Loose application coupling**
  - Location transparency
  - Time independence
  - Data transparency (with WebSphere Message Broker)
  - Platform independence
- **Scalability**
  - Incremental growth
- **Rapid development**
  - Standards
  - Reduce Complexity
  - Ease of use



The vision for WebSphere MQ is that it provides a range of capabilities, making it suitable to be a transport backbone across all environments in an IT Infrastructure.



WebSphere MQ does not provide all these capabilities today. It evolves with new technologies as they develop and become widely adopted.



## WebSphere MQ is not a substitute for:

- Well written applications
- Robust network
- Good operational procedures
- Well managed systems



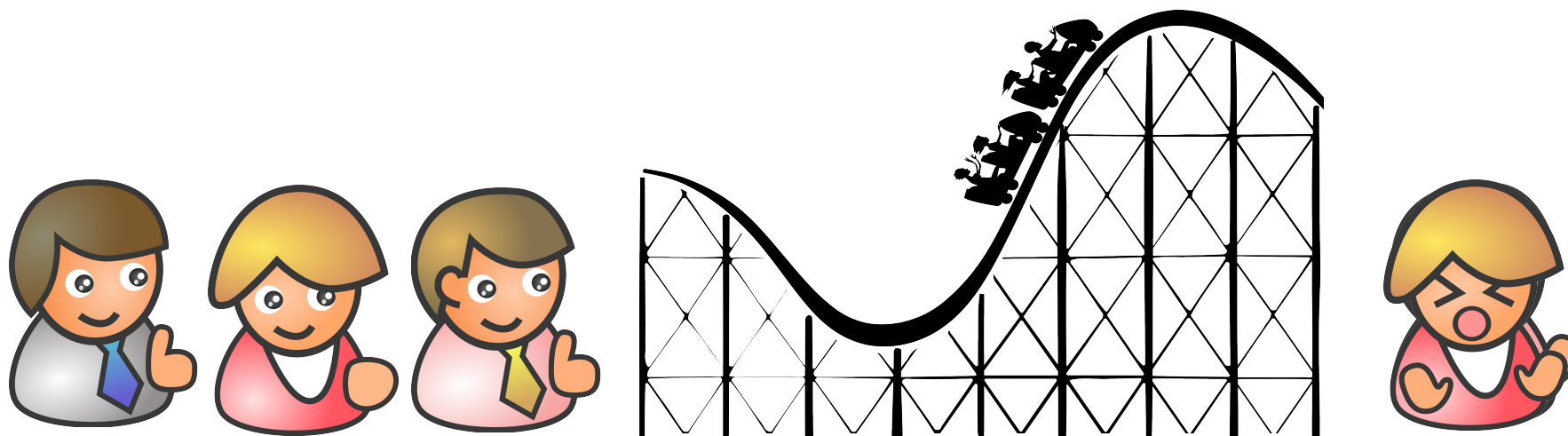
## What is Asynchronous Messaging?

- Paradigm 1: Point to Point
- Paradigm 2: Publish Subscribe

# Messaging Paradigm 1: Point to Point Messaging

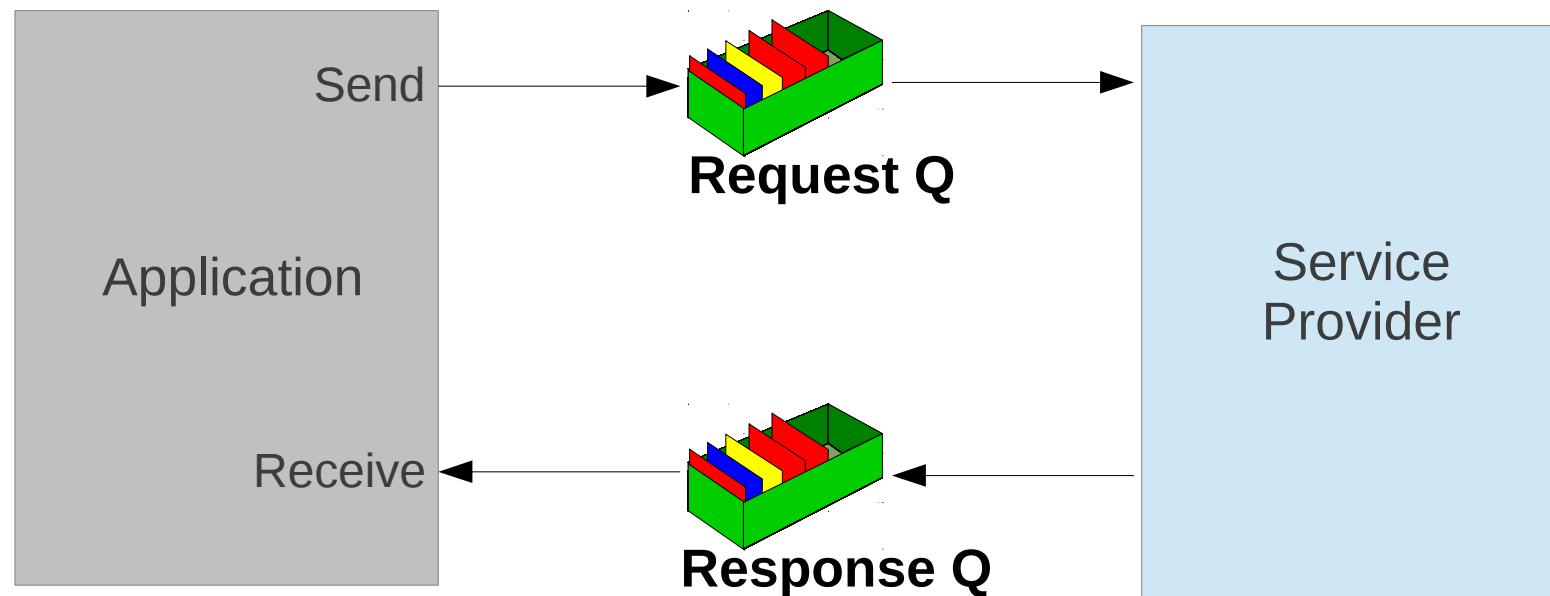
Most of us are familiar with the concept of queuing...

Consider a Roller Coaster ride:



- FIFO – First In, First Out
- One object in, one object out

## Asynchronous Messaging – Point to Point

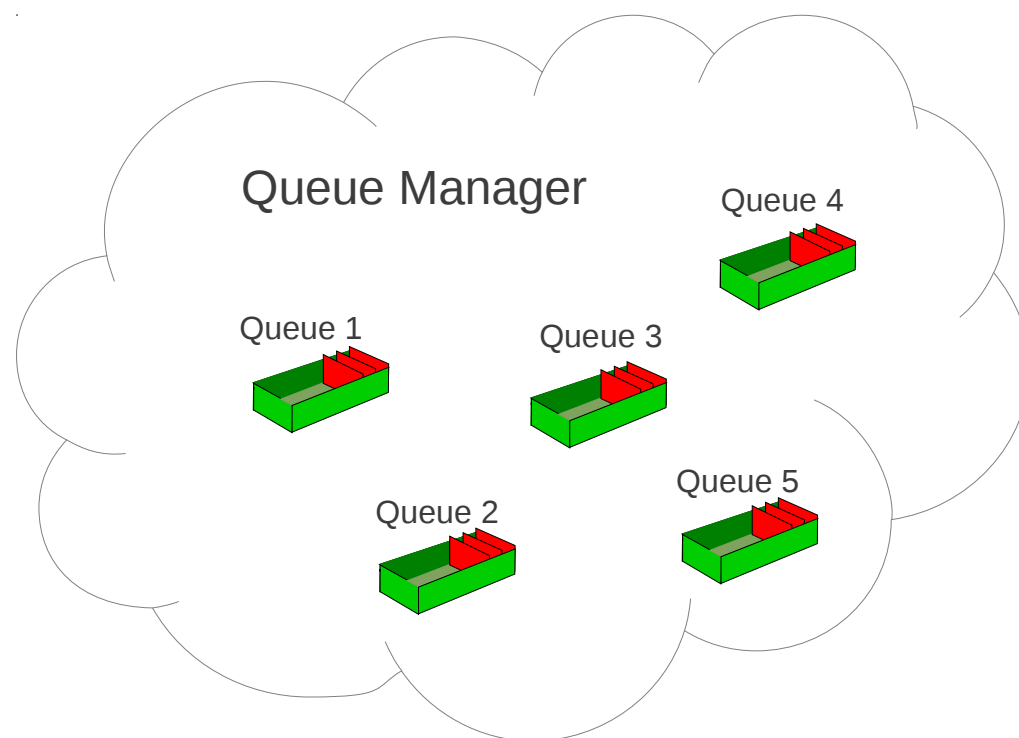


- Messages can be created from many sources:
  - Data, Messages, Events, Files, Web service requests / responses

# What is a Queue?

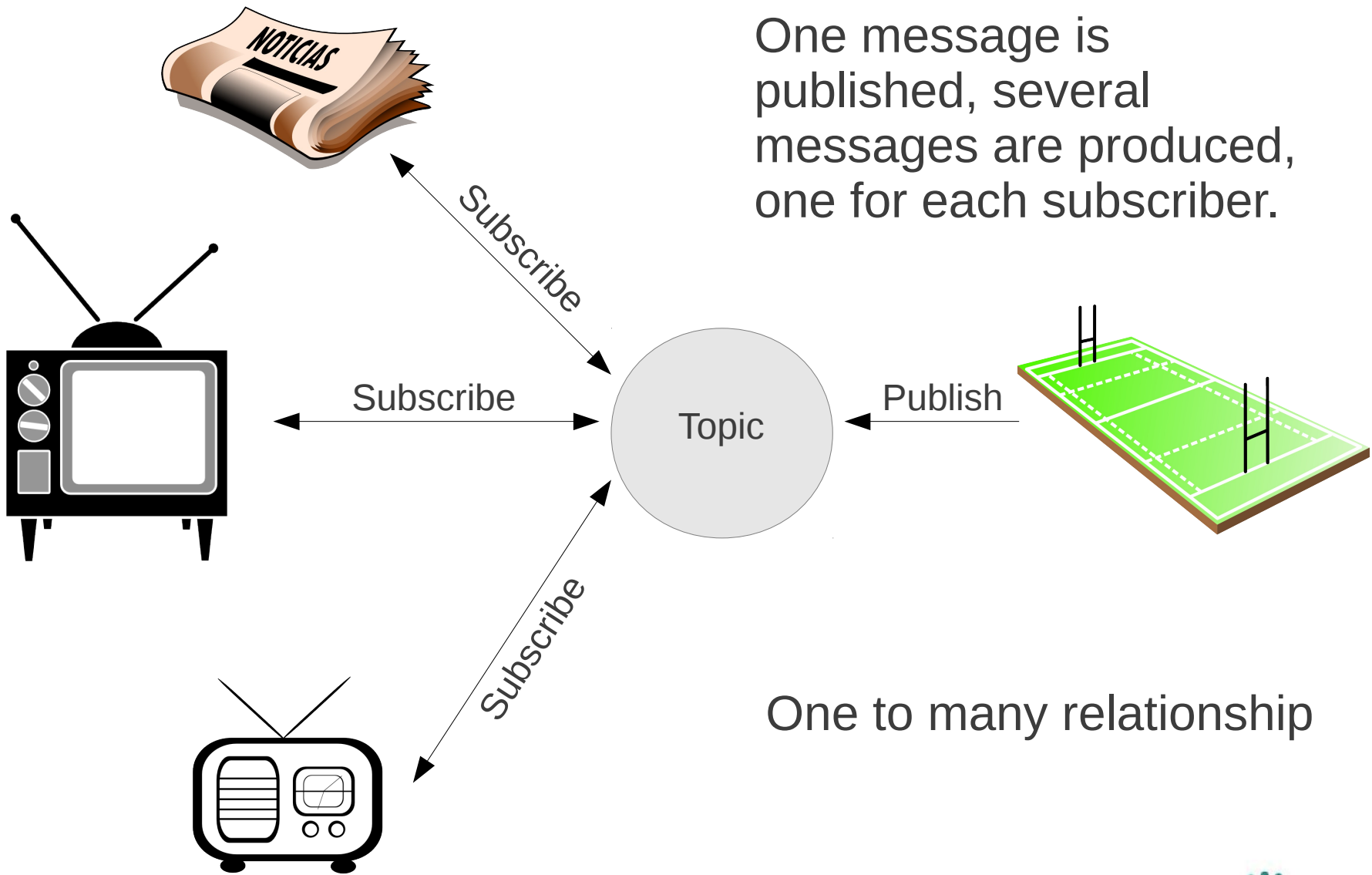
- **A queue holds messages**
  - Various Queue Types
    - Local, Alias, Remote, Model
- **Queue creation**
  - Predefined
  - Dynamically defined
- **Message Access**
  - FIFO
  - Priority
  - Direct
  - Selected by Property (V7+)
  - Destructive & non-destructive access
  - Transacted

- **Parallel access by applications**
  - Managed by the queue manager





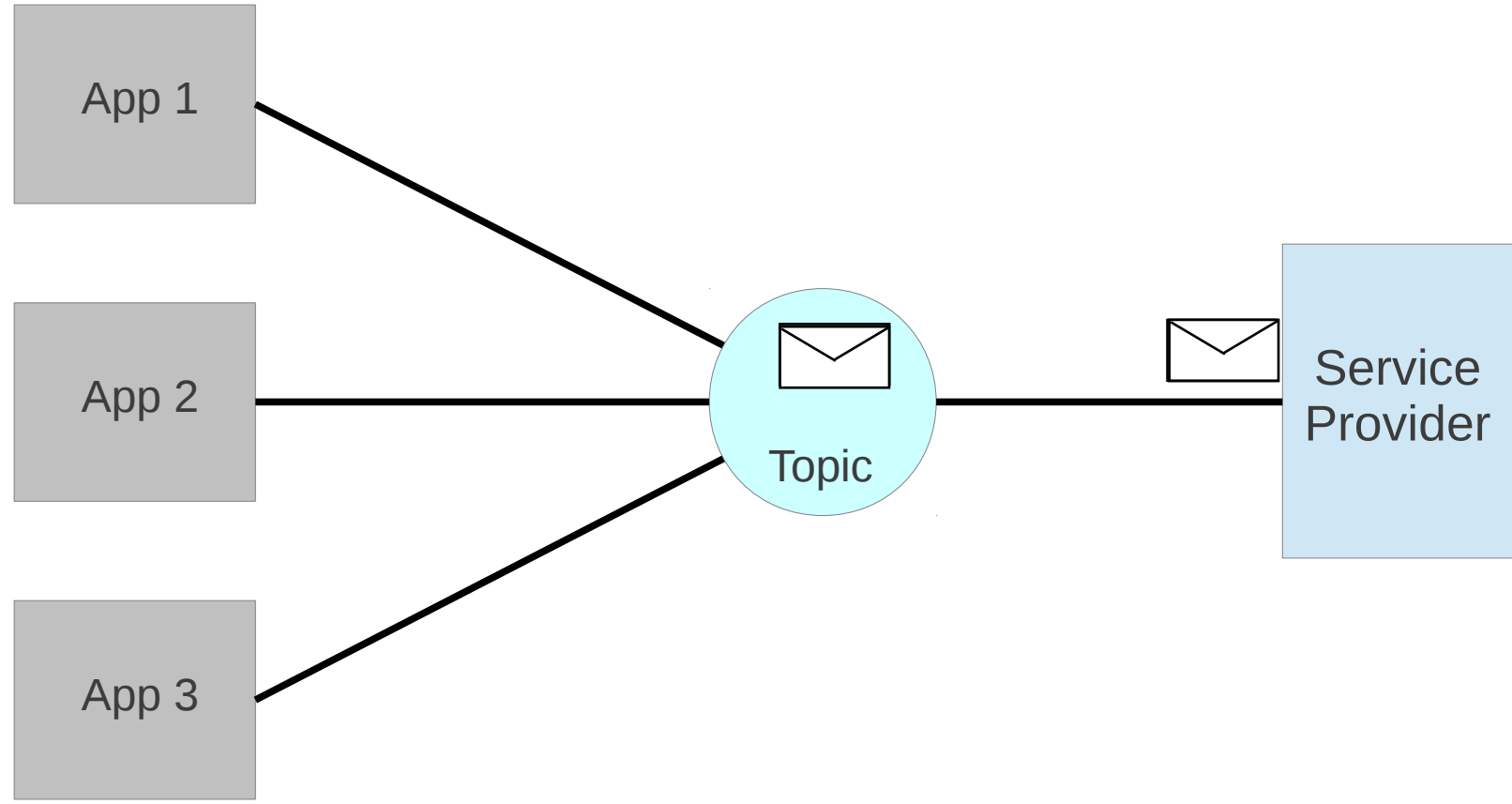
# Messaging Paradigm 2: Publish / Subscribe



One message is published, several messages are produced, one for each subscriber.

One to many relationship

# Asynchronous Messaging – Publish Subscribe



## What is a Topic?

- A Topic is defined by a “**Topic String**”. This is a case sensitive character string, where the following characters have a special meaning:
  - '/' The topic level separator – provides structure to topic trees
  - '#' The wildcard character
  - '+' The single-level wildcard character

Example:

Price/Fruit/Apple

The Topic can be defined in a number of ways:

- Predefined by the MQSC command
- Predefined by the PCF interface (as used by the WebSphere MQ Explorer)
- Subscribing or Publishing to the Topic object

# Topic Trees

By arranging Topic strings in a tree hierarchy, a 'Topic Tree' is created.

Every node in the tree is a Topic.

Topic Trees provide two benefits:

- Wildcard characters can be used to subscribe to multiple Topics.
- Security policies can be established

For example, to subscribe to both Topics:

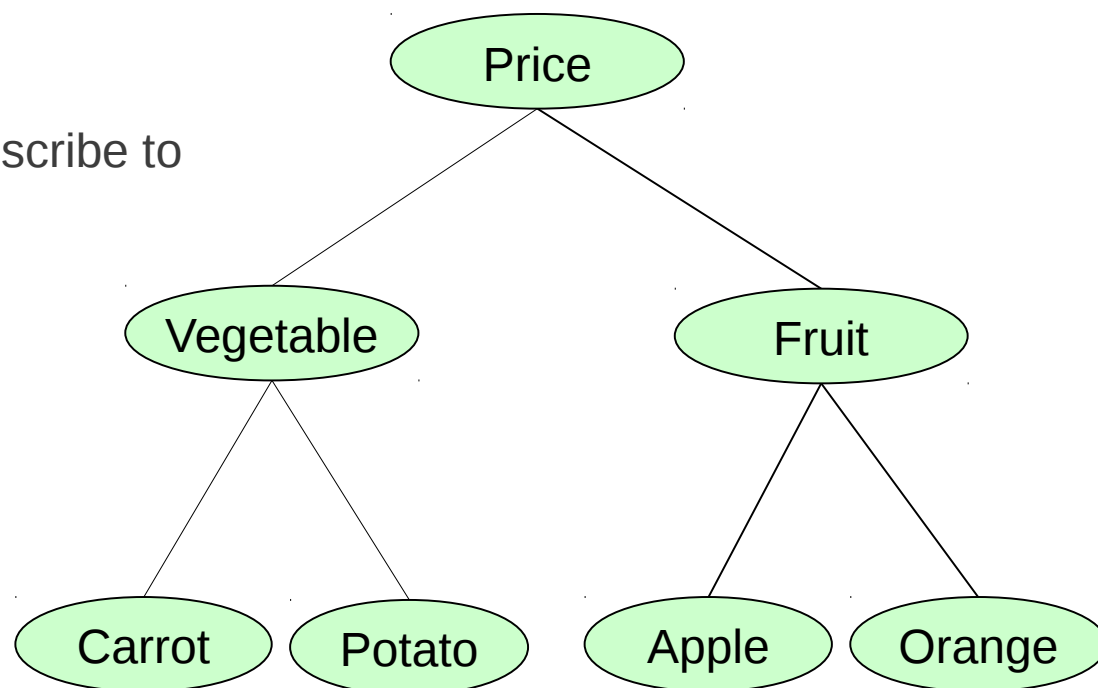
Price/Fruit/Apple  
Price/Fruit/Orange

The subscription string is:

Price/Fruit/+

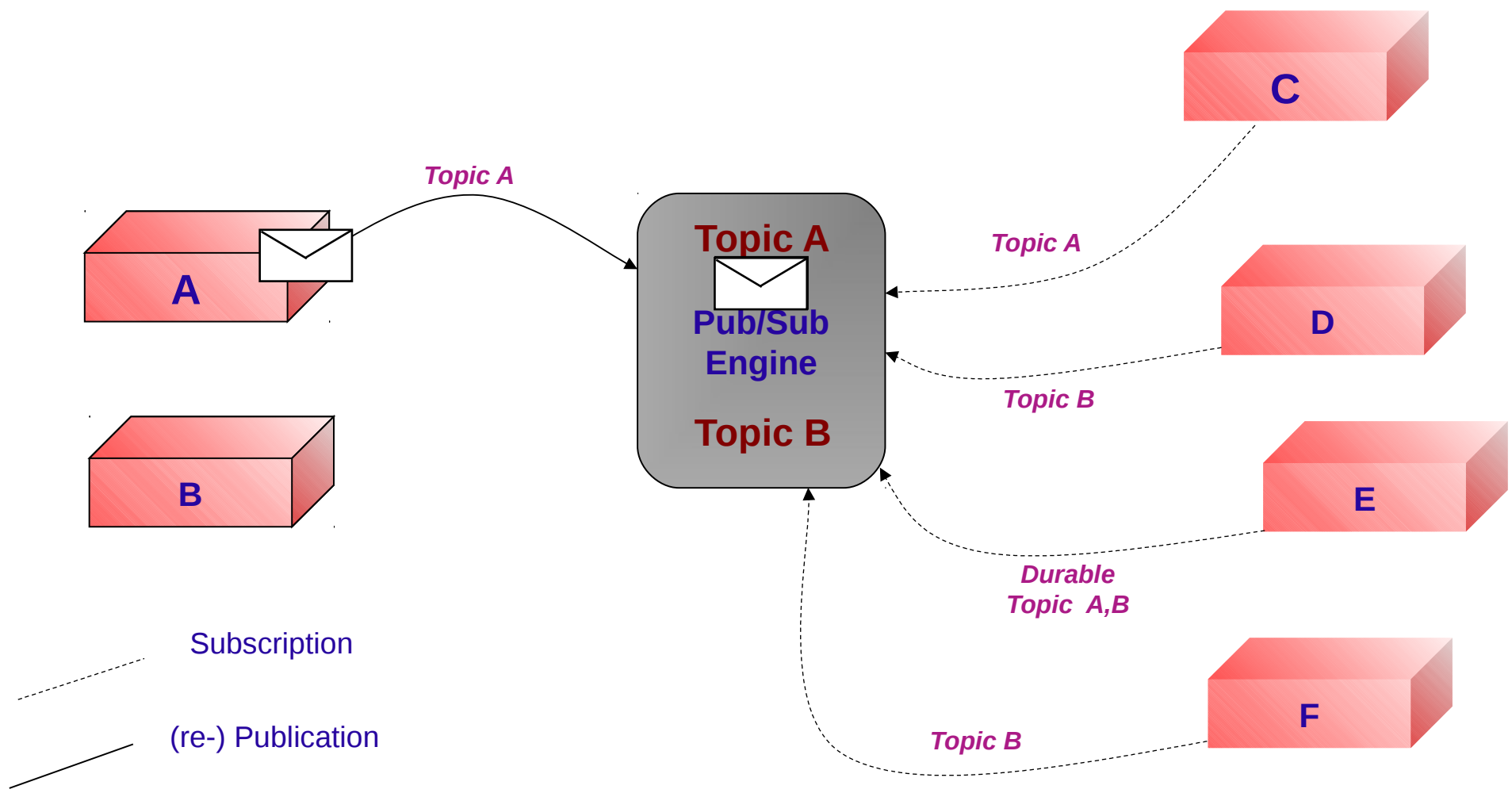
Note this is different to the subscription string:

Price/Fruit/#



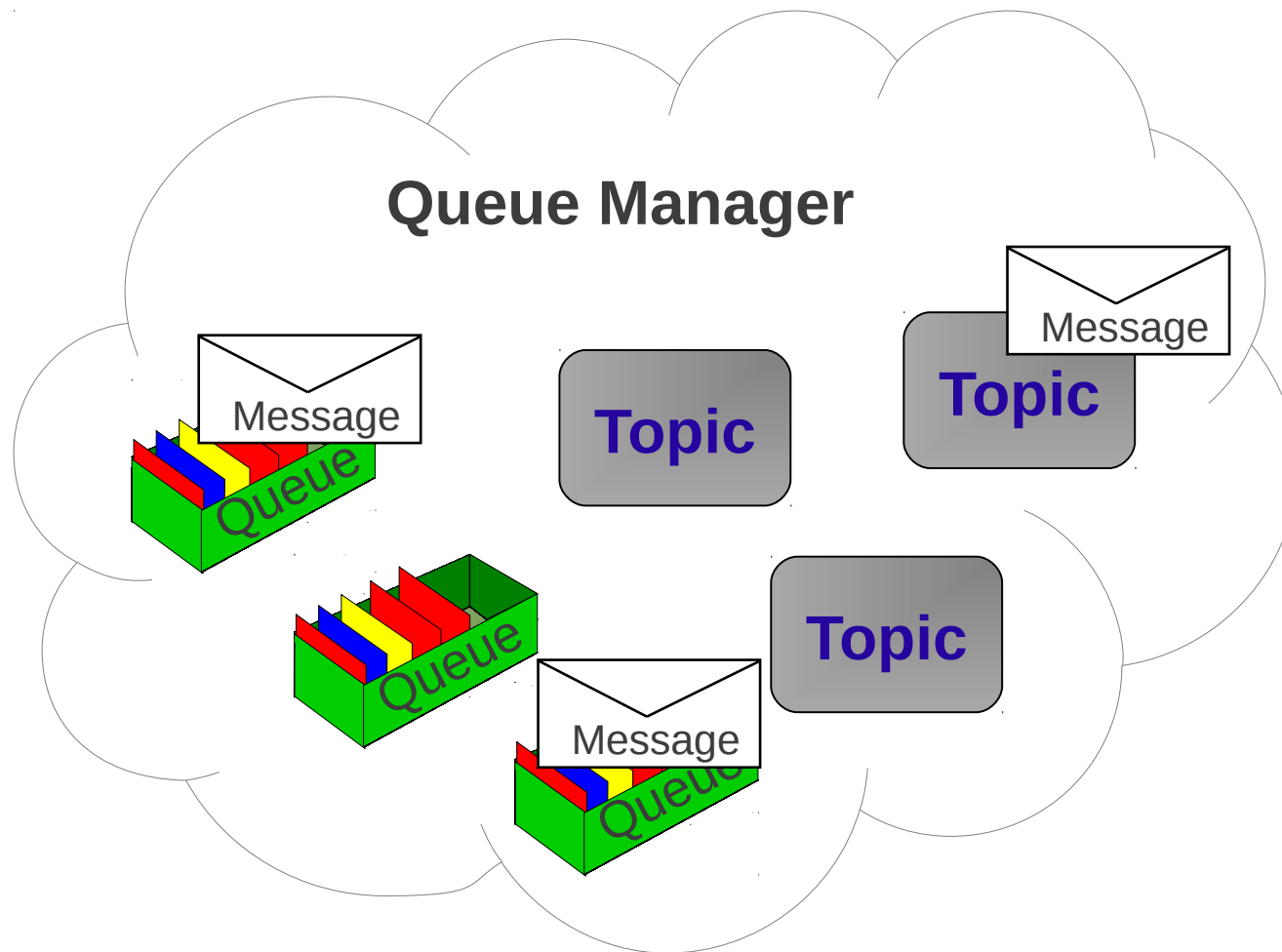
"Price/Vegetable/Potato"

# Durable Publish/Subscribe in Action



# WebSphere MQ Queue Manager

The Queue Manager is the process which controls the storage and flow of messages



# What is a Message?

Message = Header + User Properties + User Data



A Series of Message Attributes  
Understood and augmented by the Queue Manager

- Message Id
- Correlation Id
- Routing information
- Reply routing information
- Message priority
- Message codepage/encoding
- Message format
- ....etc.

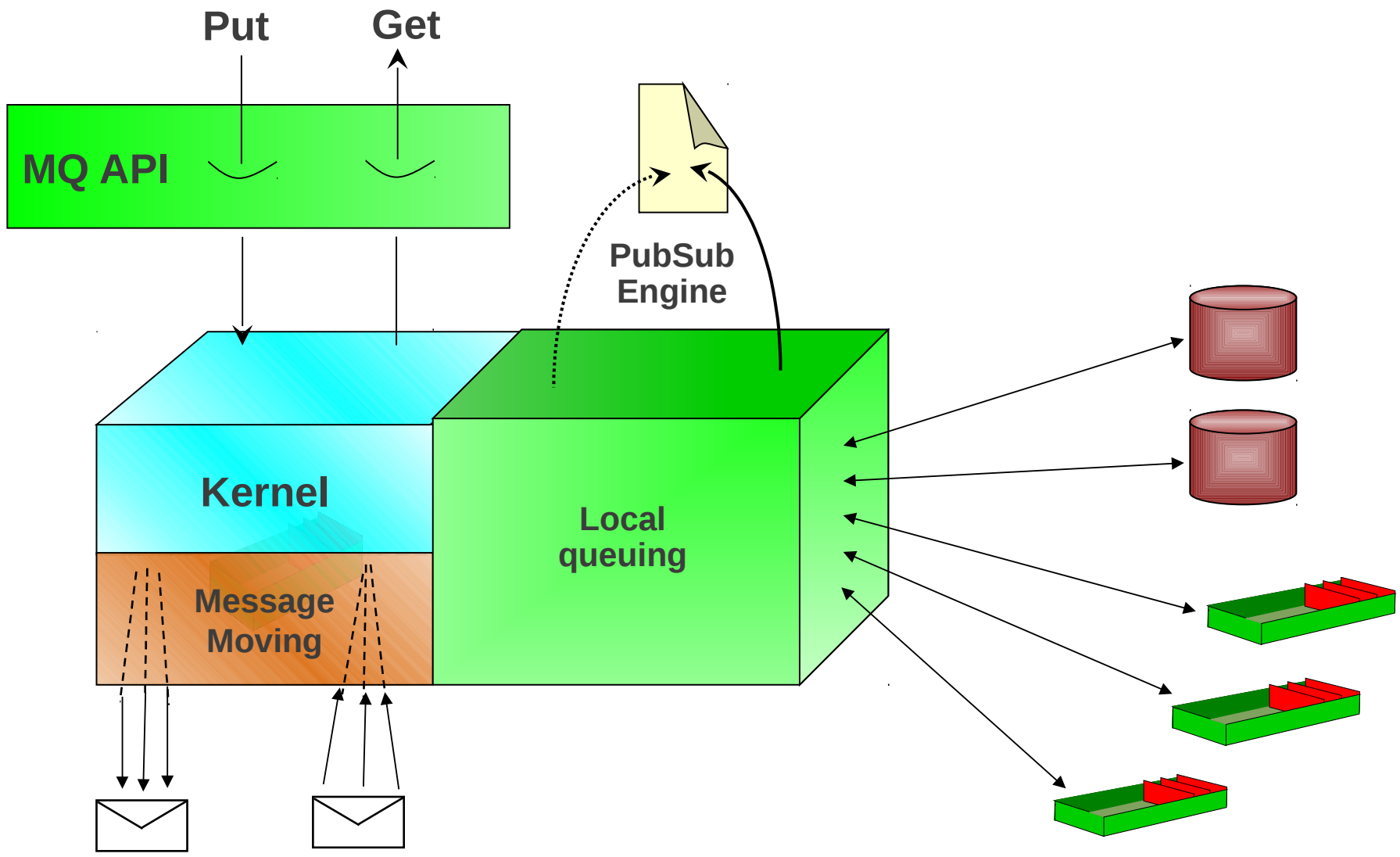


- User Properties require WMQ V7
  - Emulated for JMS in older versions of WMQ
- Arbitrary properties
  - For example, this is a “green” message

- Any sequence of bytes
- Private to the sending and receiving programs
- Not meaningful to the Queue Manager

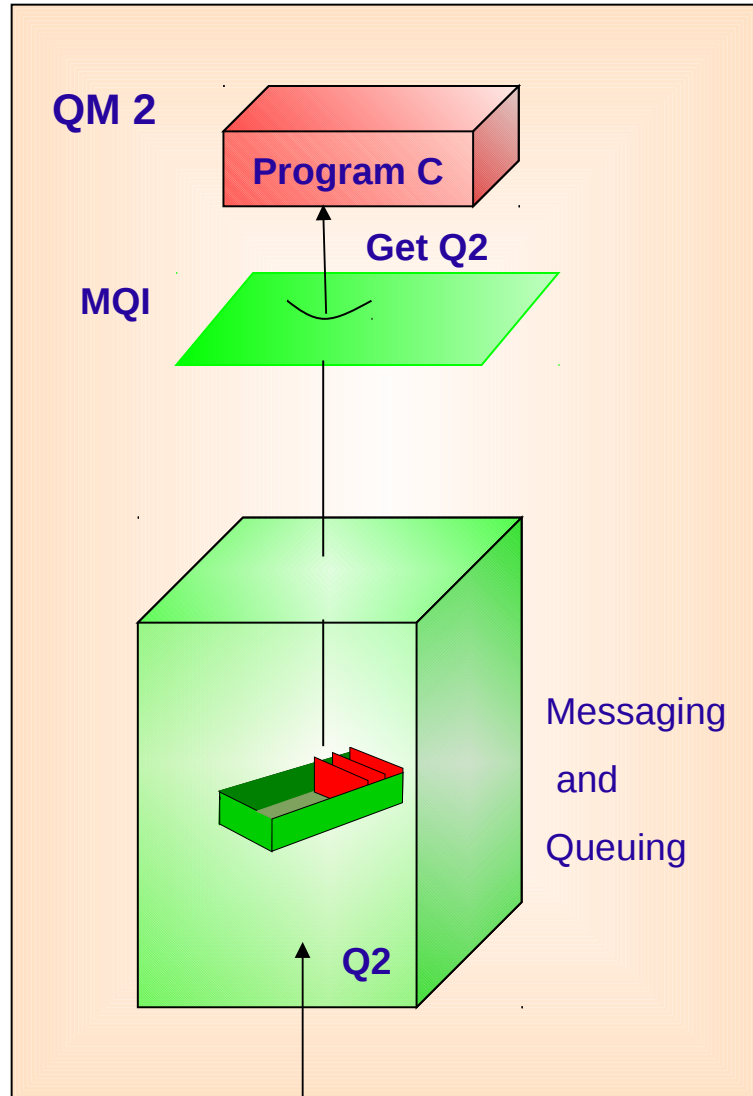
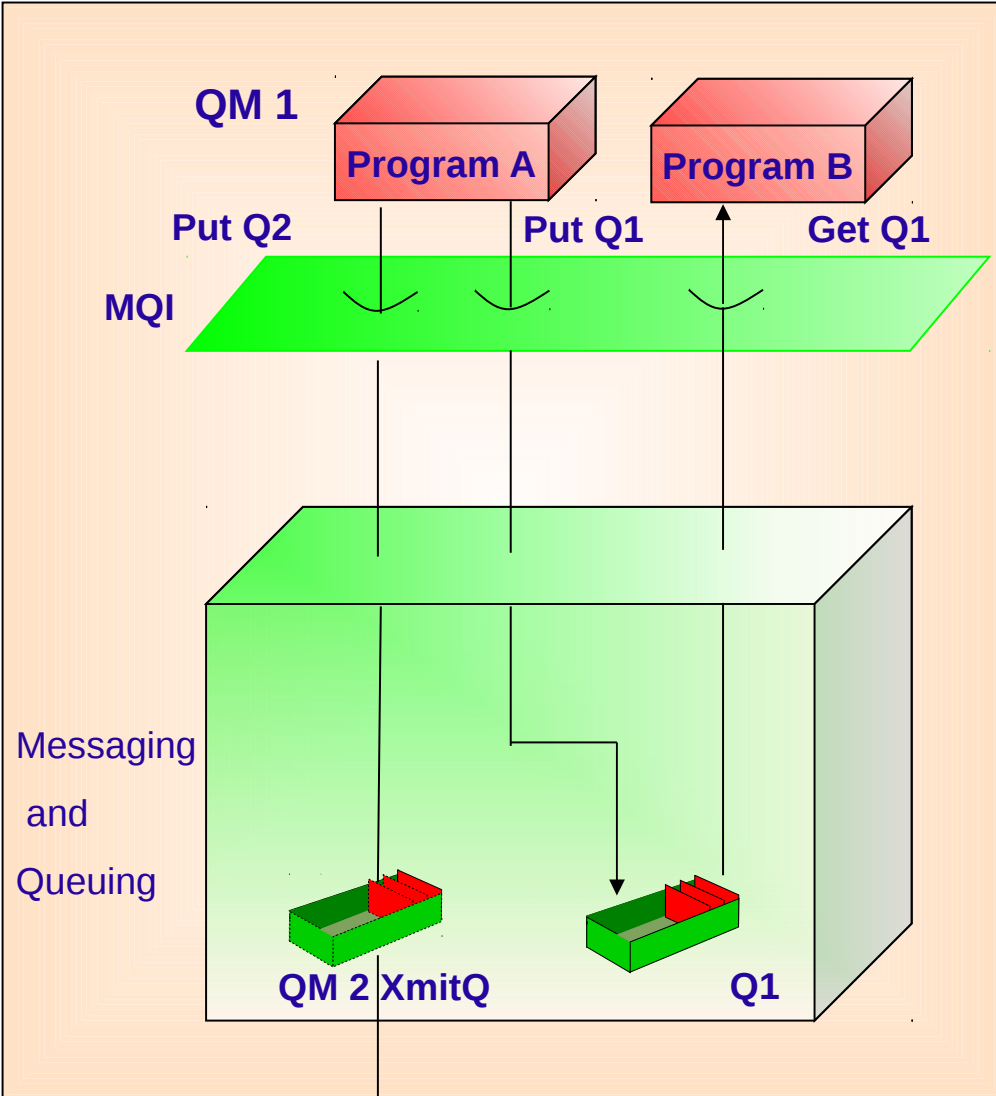
- **Message Types**
  - Persistent ... recoverable
  - Non Persistent
- **Up to 100MB message length**

# The Queue Manager





# Local and Cross-System Communication with WMQ

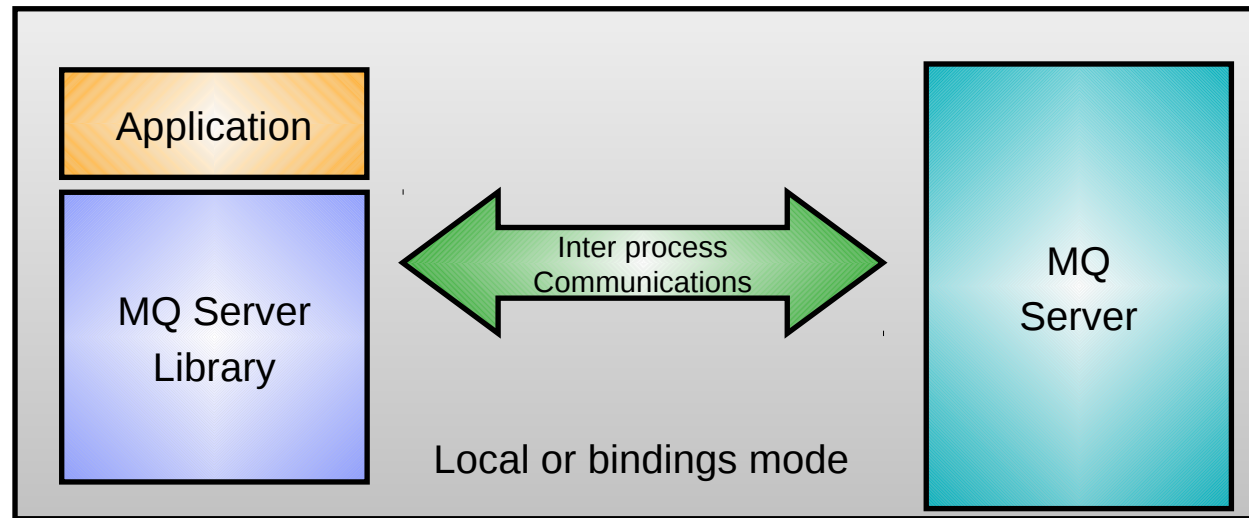


TCP/IP, APPC etc  
**Channel**



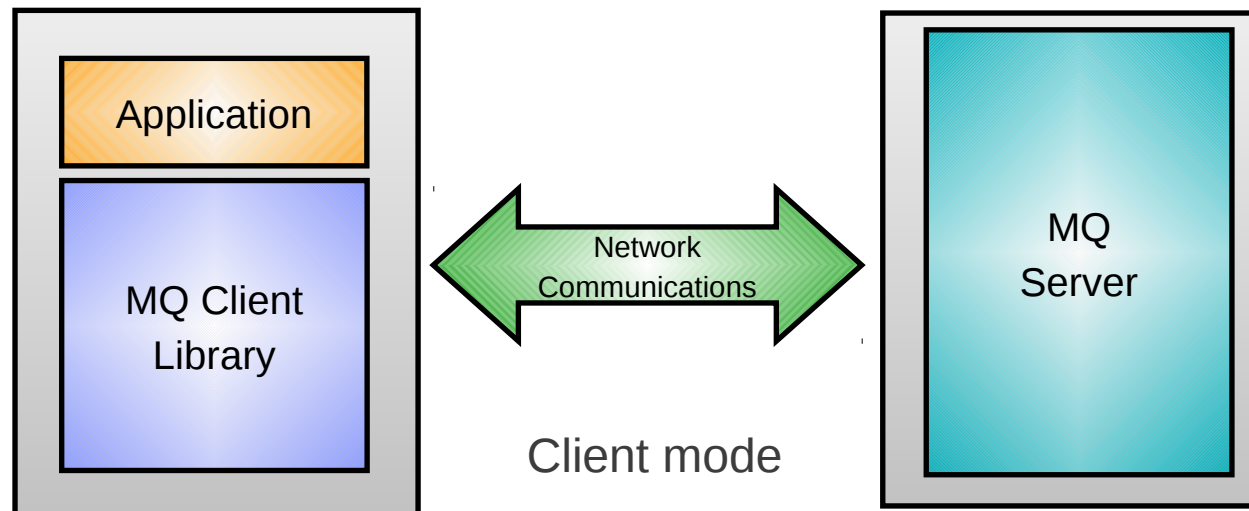
# Communicating with the Queue Manager

## Server Model



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## Client Model

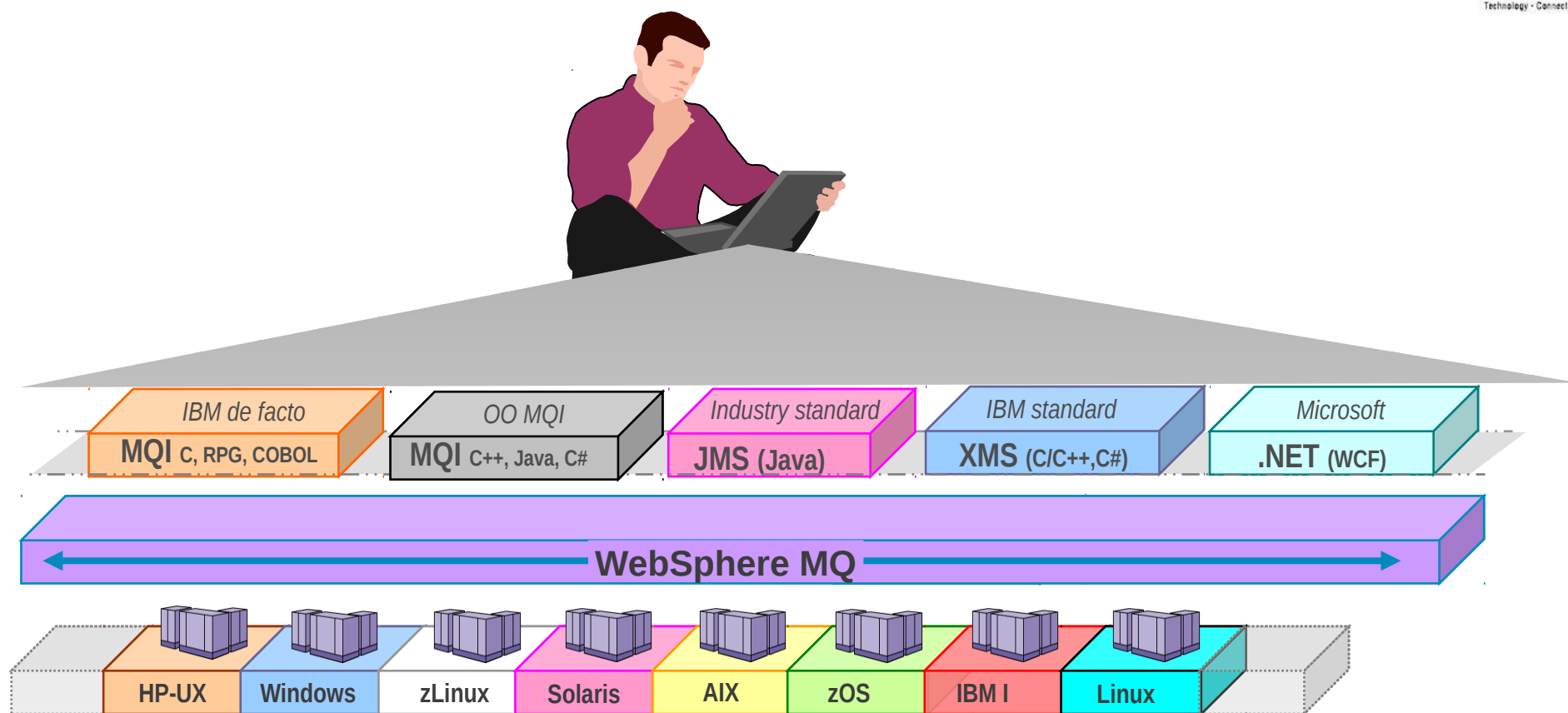


Application code is independent of the client to queue manager connection mode

# Agenda

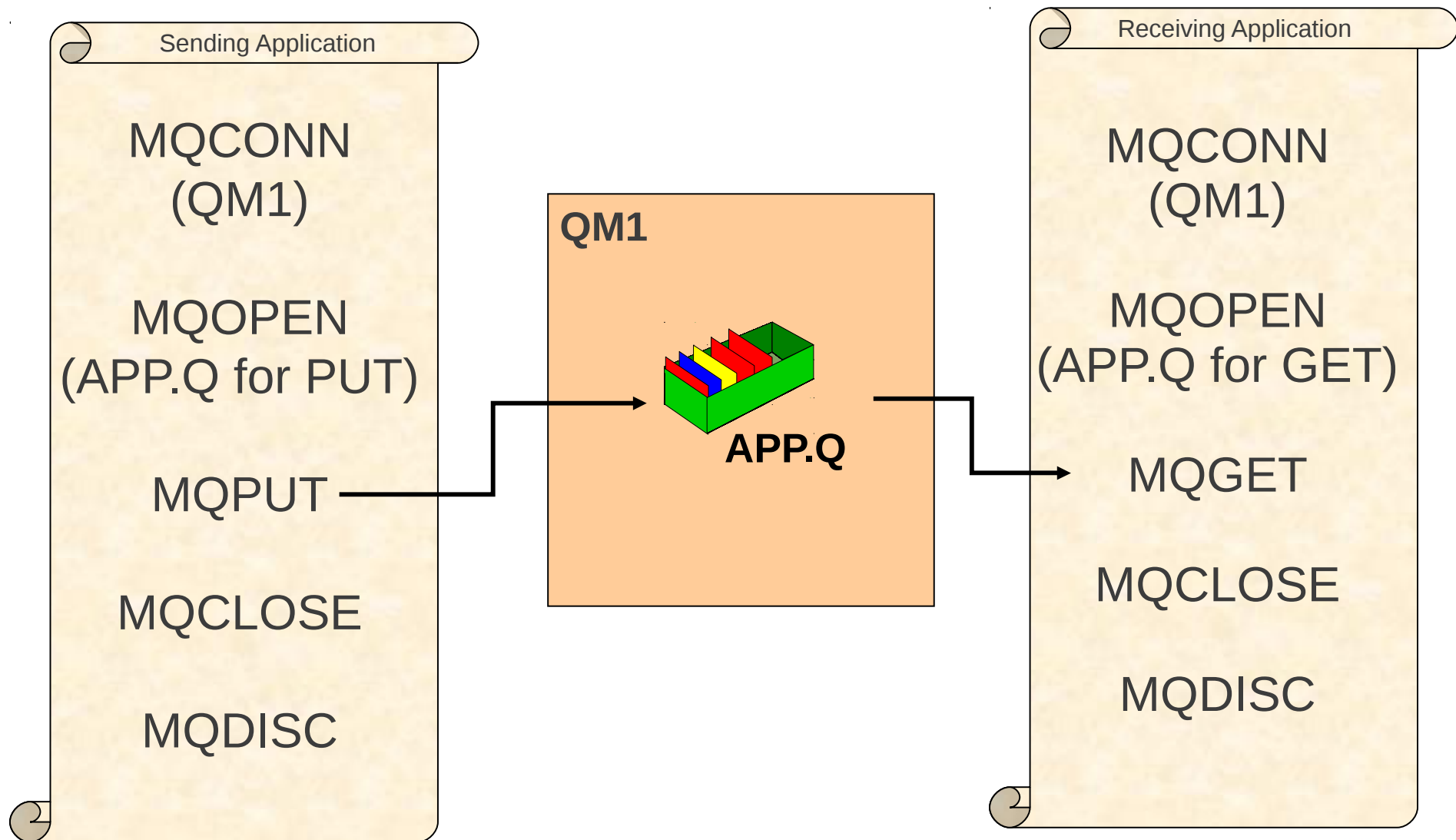
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# Programming API

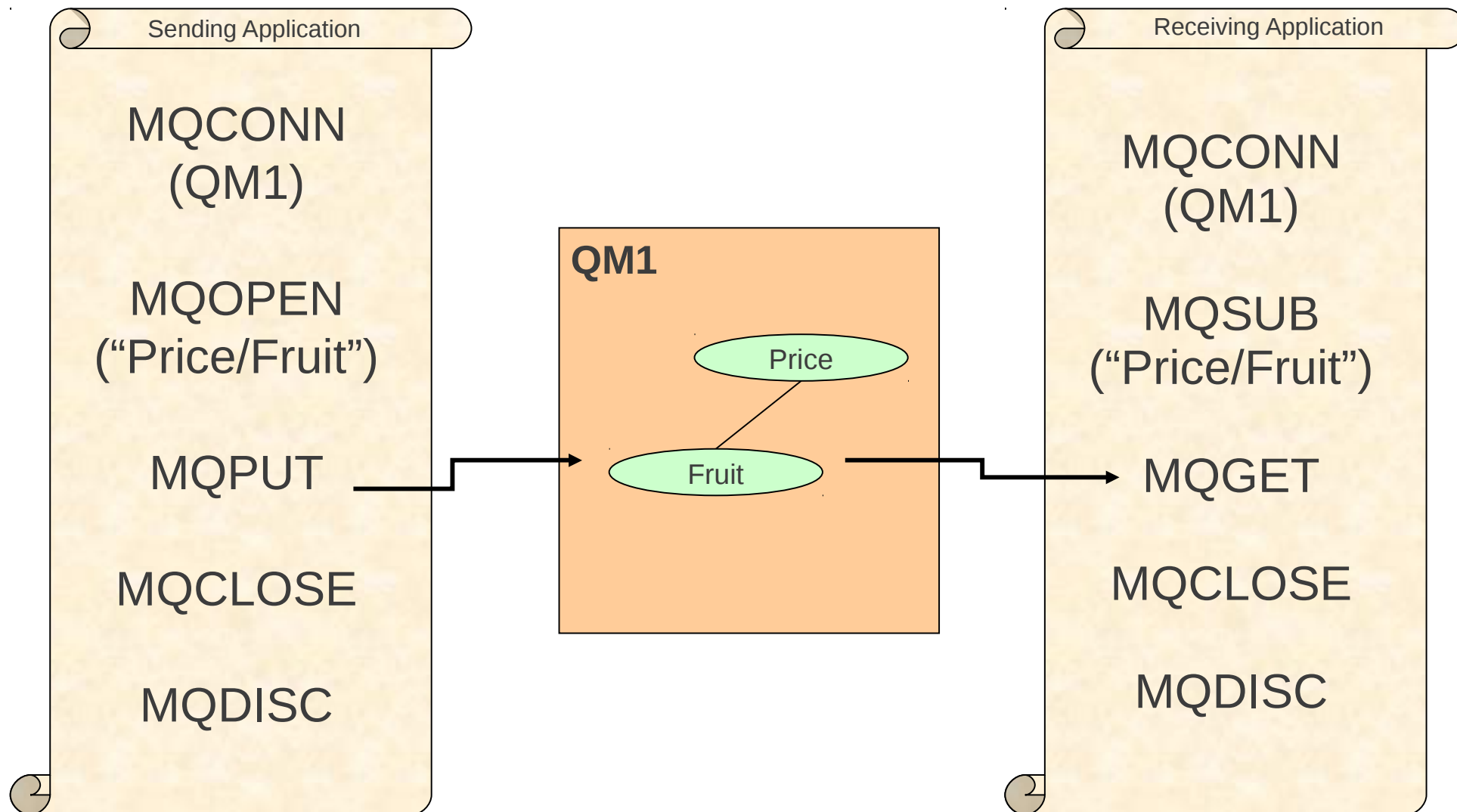


- **Broad support for:**
  - programming languages, messaging interfaces, application environments and OS platforms.

# The WebSphere MQ API (MQI)



# The WMQ API (MQI) – Publish/Subscribe

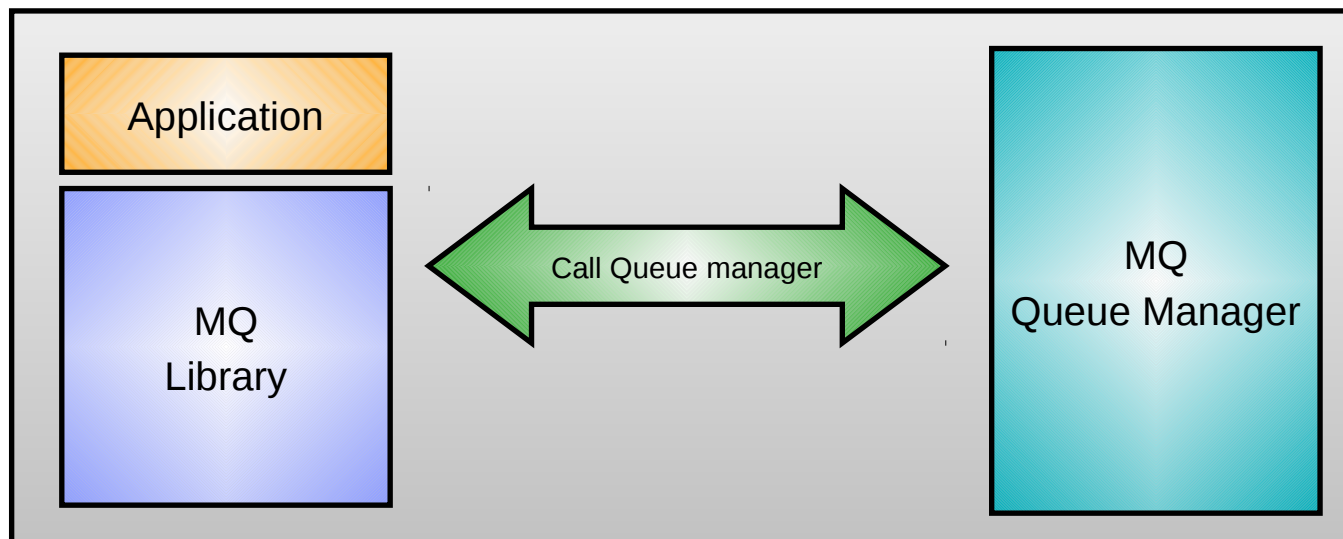


# The WebSphere MQ API (MQI) – Summary of all verbs

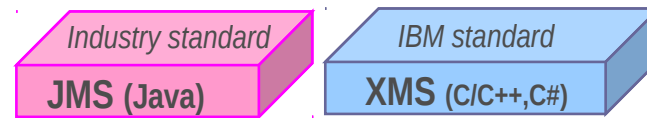
IBM de facto

MQI C, RPG, COBOL

Connection	Resource Use	Messages	Object attributes	Transactions	Message Properties
MQCONN	MQOPEN	MQPUT	MQINQ	MQBEGIN	MQCRTMH
MQCONNX	MQSUB	MQPUT1	MQSET	MQCMIT	MQCLTMH
MQCTL	MQSUBRQ	MQGET		MQBACK	MQSETMP
MQDISC	MQCLOSE	MQCB			MQINQMP
					MQDLTMP
					MQMHBUF/MQBUFMH



# Java Message Service (JMS) and XMS

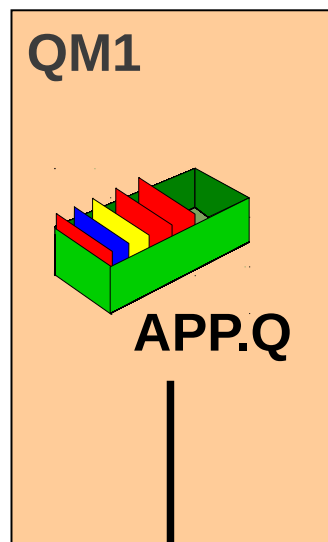


- JMS is the standard Java API for messaging
  - Point-to-point and Publish/subscribe messaging (application can be agnostic)
  - Enables greater portability between messaging providers
    - *Vendor-independent messaging API in Java*
    - *Managed by The Java Community Process*
    - *Expert Group includes IBM*
  - WMQ supports all Java Enterprise Edition (JEE) 1.4+ application servers
  - Features such as message-driven beans greatly simplify creation of messaging applications
- IBM Message Service Clients (XMS) renders a JMS-like API in non-Java languages
  - (Almost) full compatibility with JMS 1.1 API
  - Full interoperability with IBM JMS implementations on WMQ and WPM
  - Shared administered objects in JNDI with JMS
  - Current implementations include: C, C++ and .NET



## Example JMS receiving application

Some client APIs need no MQI programming knowledge!



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

// Establish a connection with the queue manager
Connection conn = cf.createConnection();
conn.start();
Session session =
    conn.createSession(false, Session.AUTO_ACKNOWLEDGE);

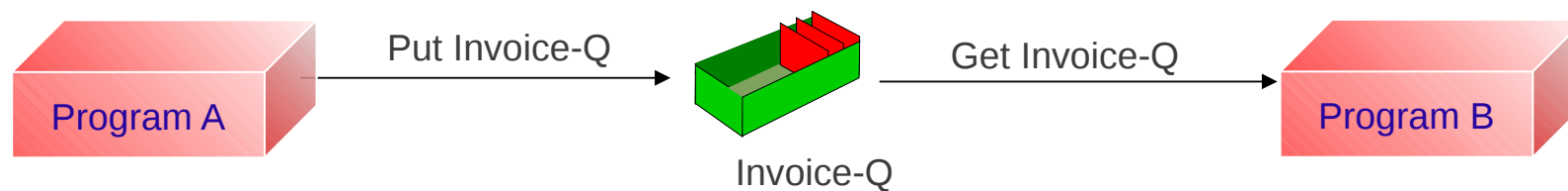
// Get a message
MessageConsumer consumer = session.createConsumer(dest);
consumer.receive();
```

## Agenda

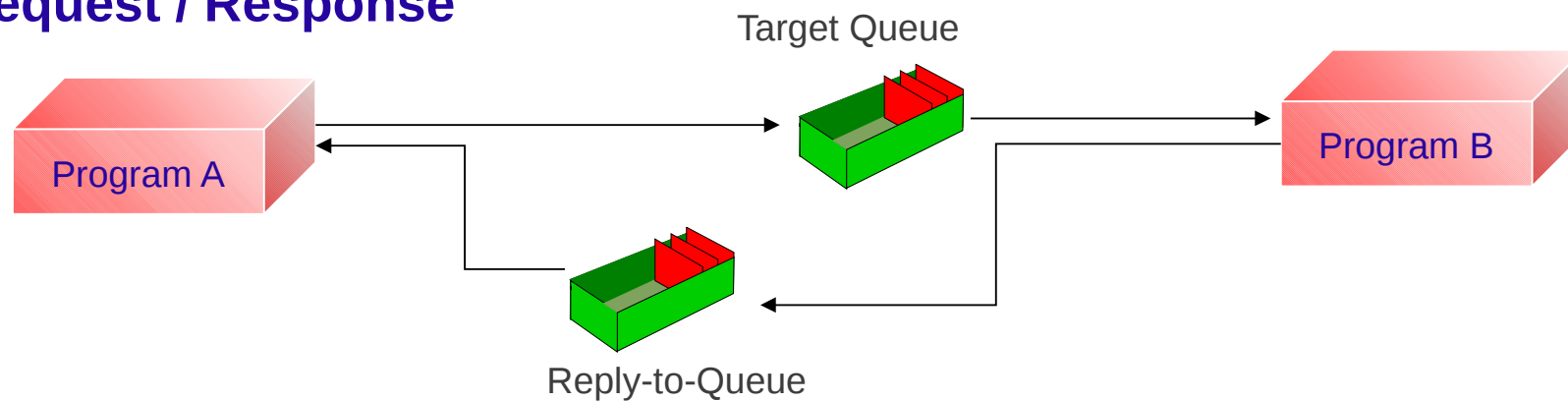
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# Example application architectures (1)

## 'Send and Forget'

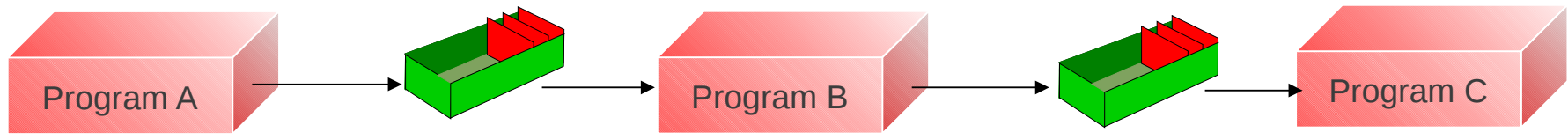


## Request / Response

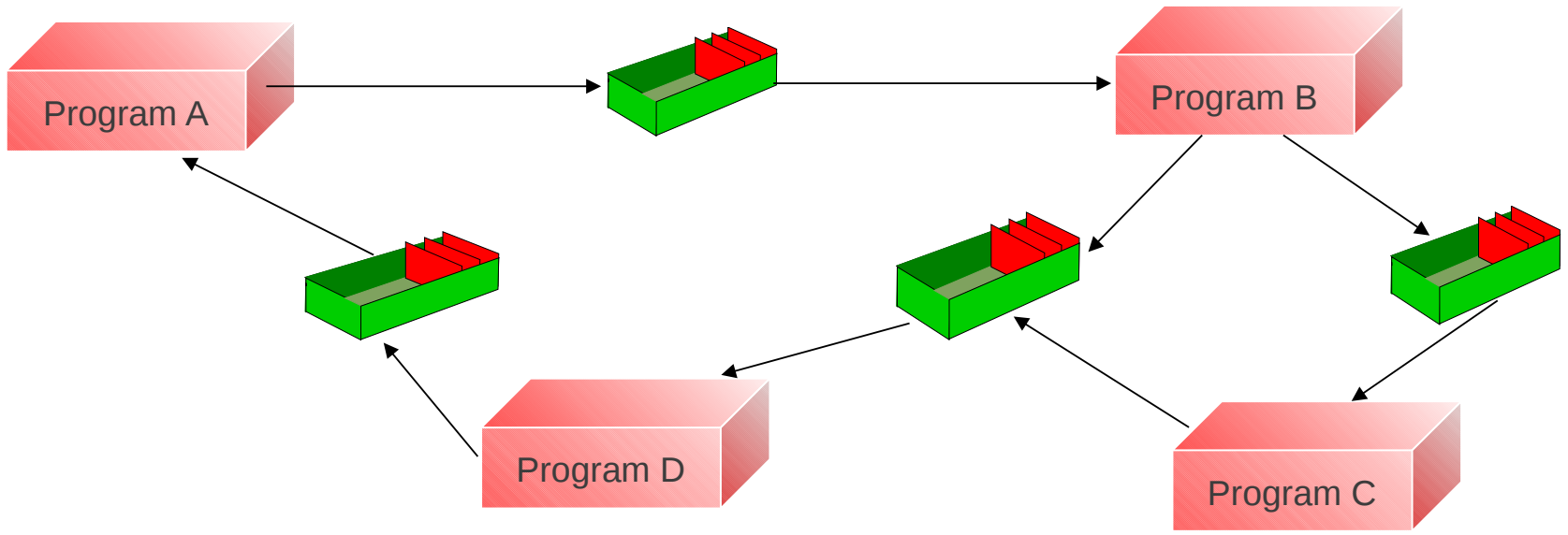


# Example application architectures (2)

## Chain



## Workflow

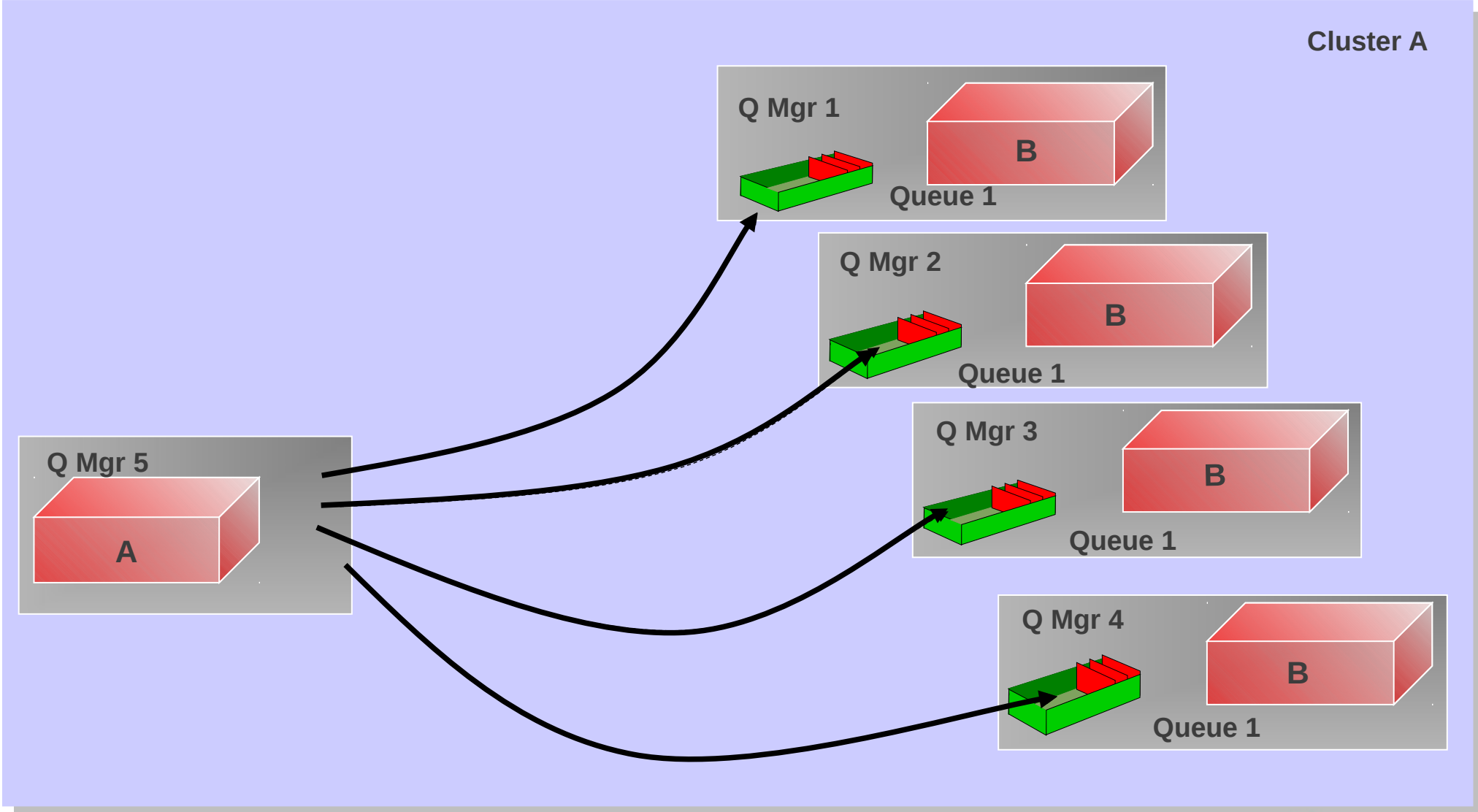


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# Example application architectures – Clustering



# WebSphere MQ Transactions



- Message level inclusion/exclusion in unit of work
- Single UoW active per connection at any one time
- WebSphere MQ local units of work
  - MQCMIT and MQBACK control the unit of work
- Messages and other resources in a global unit of work
  - Managed by a Transaction Manager
    - *WebSphere Application Server, CICS, IMS, z/OS RRS*
    - *Microsoft Transaction Server*
    - *Any XA or JEE App Server Transaction Manager*
  - Managed by WebSphere MQ
    - *WebSphere MQ is an XA Transaction Manager*
    - *MQBEGIN, MQCMIT and MQBACK control the unit of work*

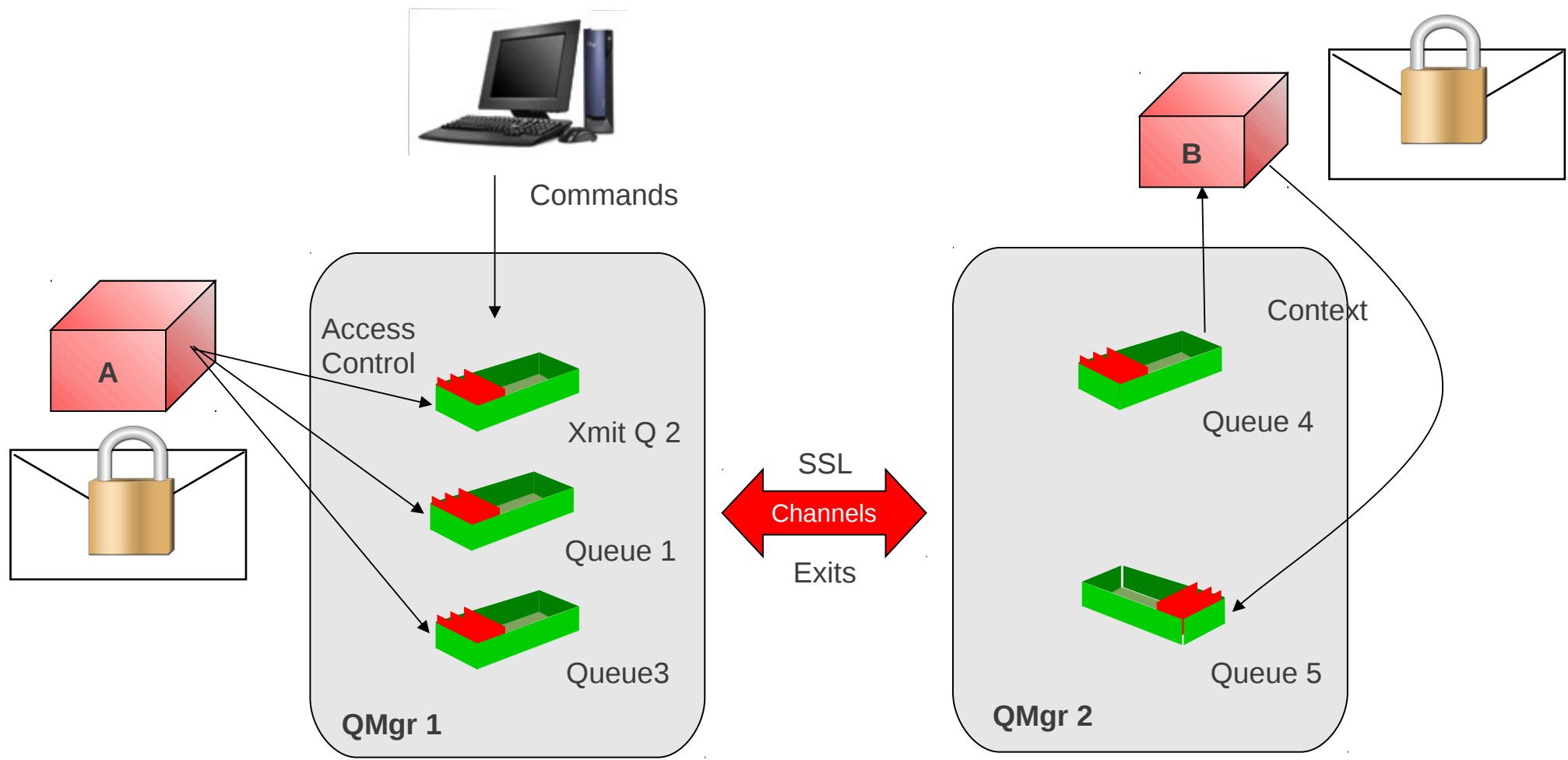
IBM de facto

MQI C, RPG, COBOL

## Transactions

MQBEGIN  
MQCMIT  
MQBACK

# WebSphere MQ Security





# Data Conversion



When receiving messages, WebSphere MQ can convert the message payload data. This is most commonly used to convert character data so that it is in a format which is consumable by the receiving application.

```

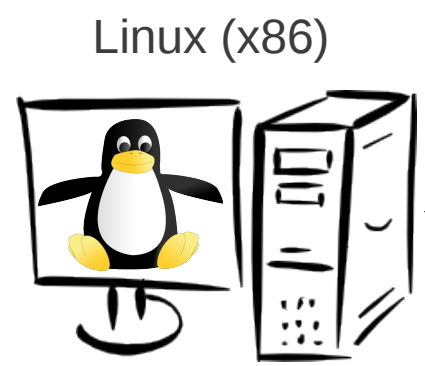
CCSID 500 (EBCDIC Latin-1-charset)
Data: H e l l o      w o r l d !
Hex:  C8 85 93 93 96 40 A6 96 99 93 84 4F

```

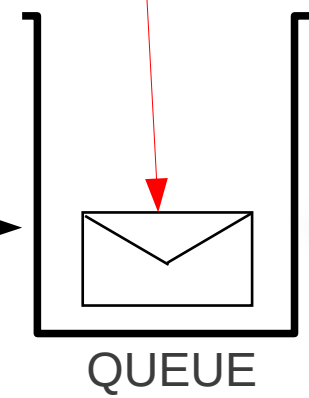
```

CCSID 1208 (UTF-8)
Data: H e l l o      w o r l d !
Hex:  48 65 6C 6C 6F 20 77 6F 72 6C 64 21

```



MQGET  
MQGMO\_CONVERT



# WebSphere MQ Systems Management



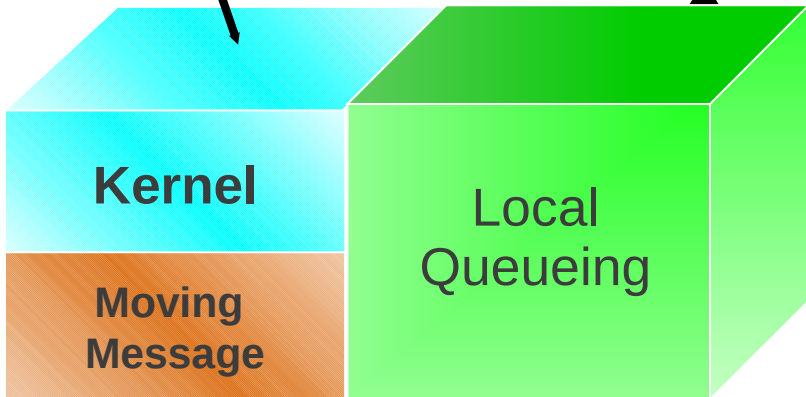
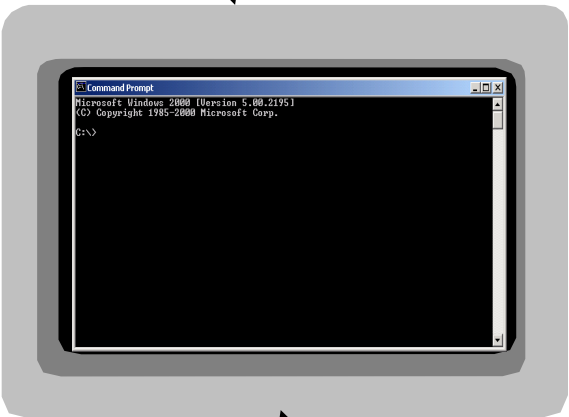
## MQ Explorer

Scripting

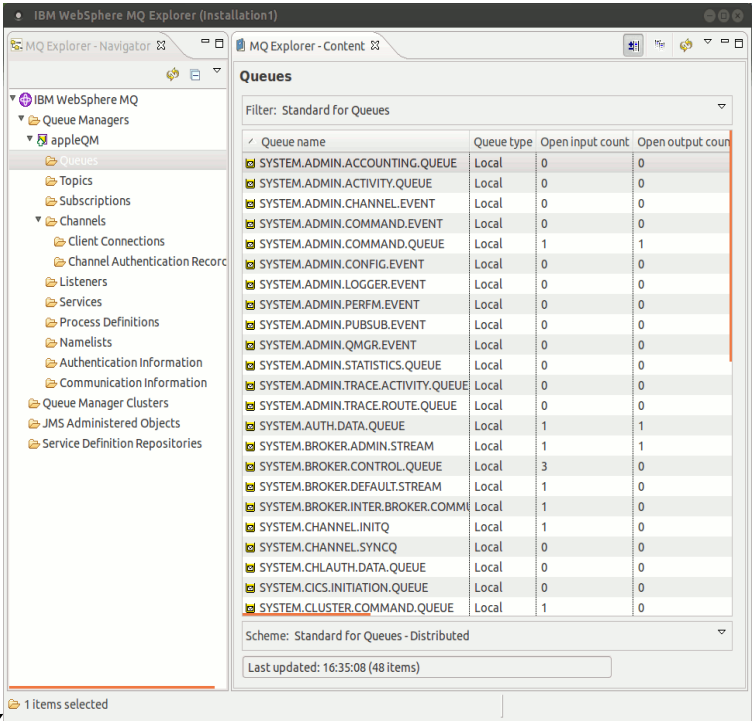
MQSC

MQ Application

Programmable Command Format (PCF)



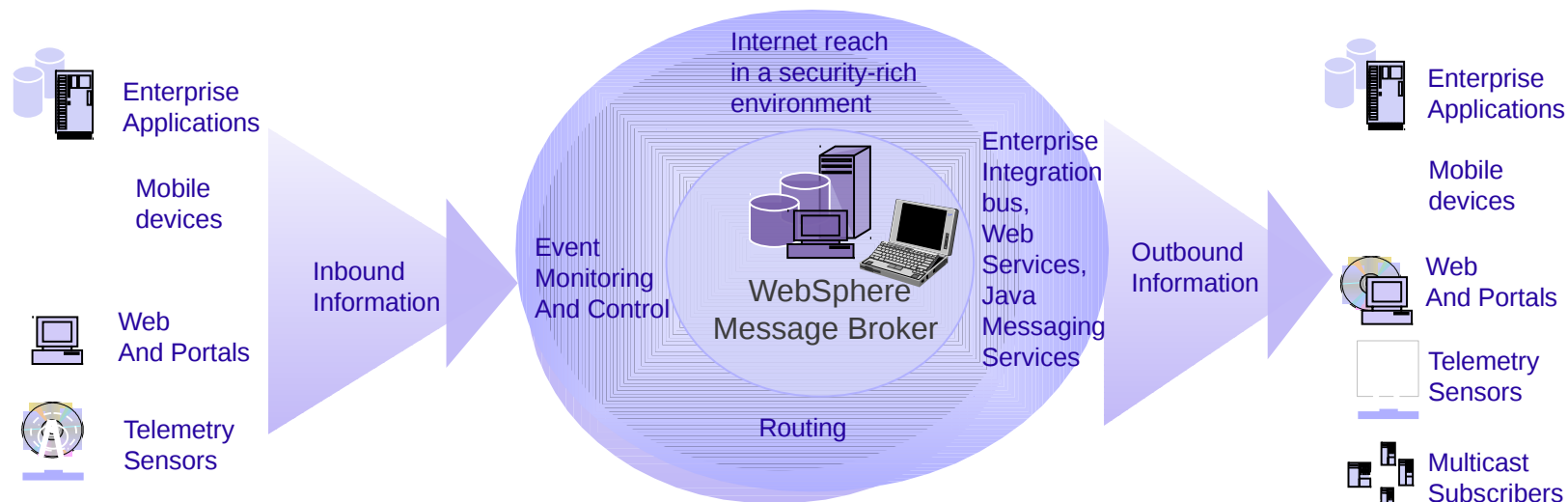
System Management Applications:  
BMC, CA, Landmark, RYO, Tivoli



# Agenda

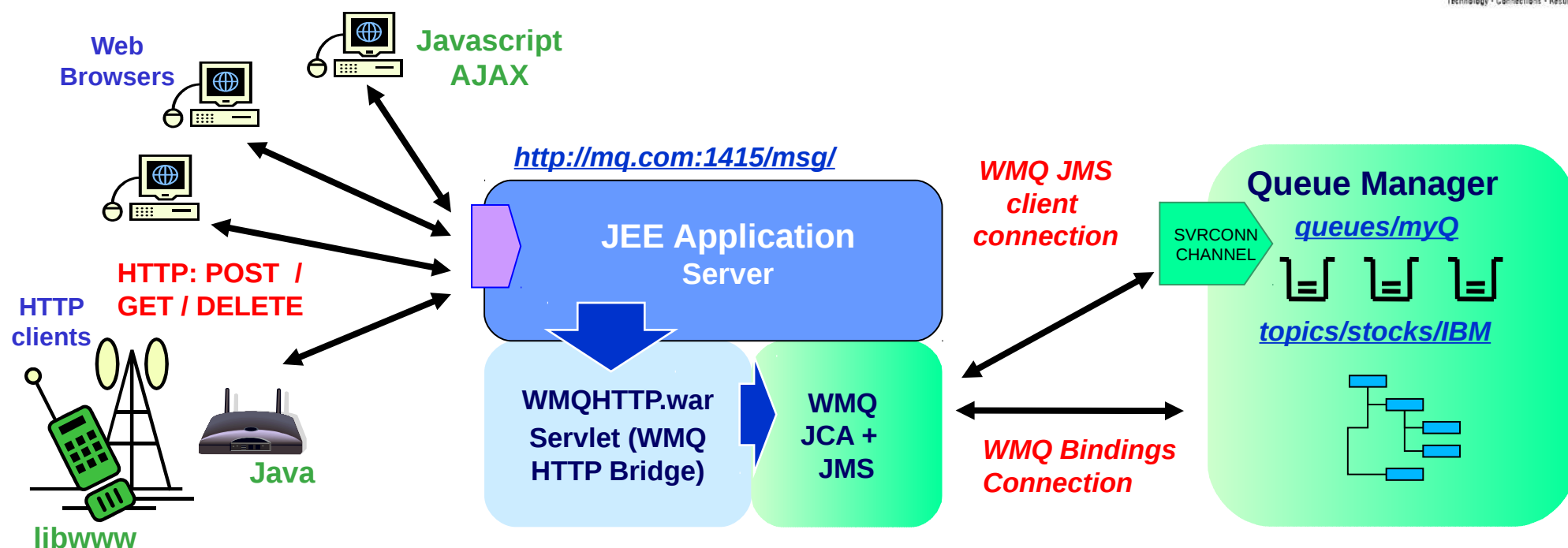
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# WebSphere Message Broker



- **WebSphere Message Broker**
  - Message transformation (mediations)
    - *Combine data sources: databases, files, etc.*
    - *Update other data stores: databases, files, etc.*
  - Content based filtering and routing
  - Adapters - SAP, PeopleSoft, ORACLE, Files, e-mail...
  - WebSphere Transformation Extender

# HTTP Connectivity to WMQ



- Key features of the WebSphere MQ Bridge for HTTP
  - Maps URIs to queues and topics
  - Enables MQPUT and MQGET from
    - *Web Browser*
    - *Lightweight client*
- Can be used as a SOAP Web Services entry point

# WebSphere MQ Advanced Message Security

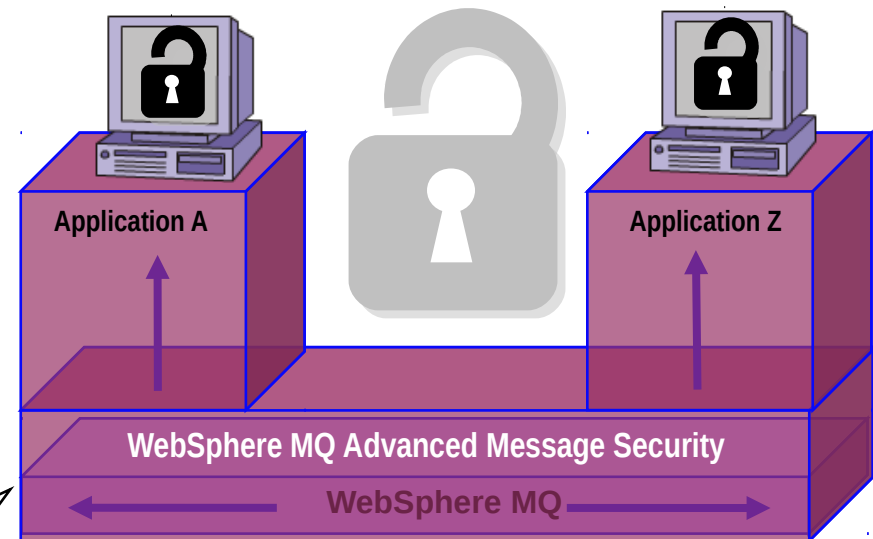
- Secures application data even before it is passed to MQ
- Upgrade from base WMQ – No changes to existing applications or network required

## WebSphere MQ standard security:

- Industry standard SSL 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

## WebSphere 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

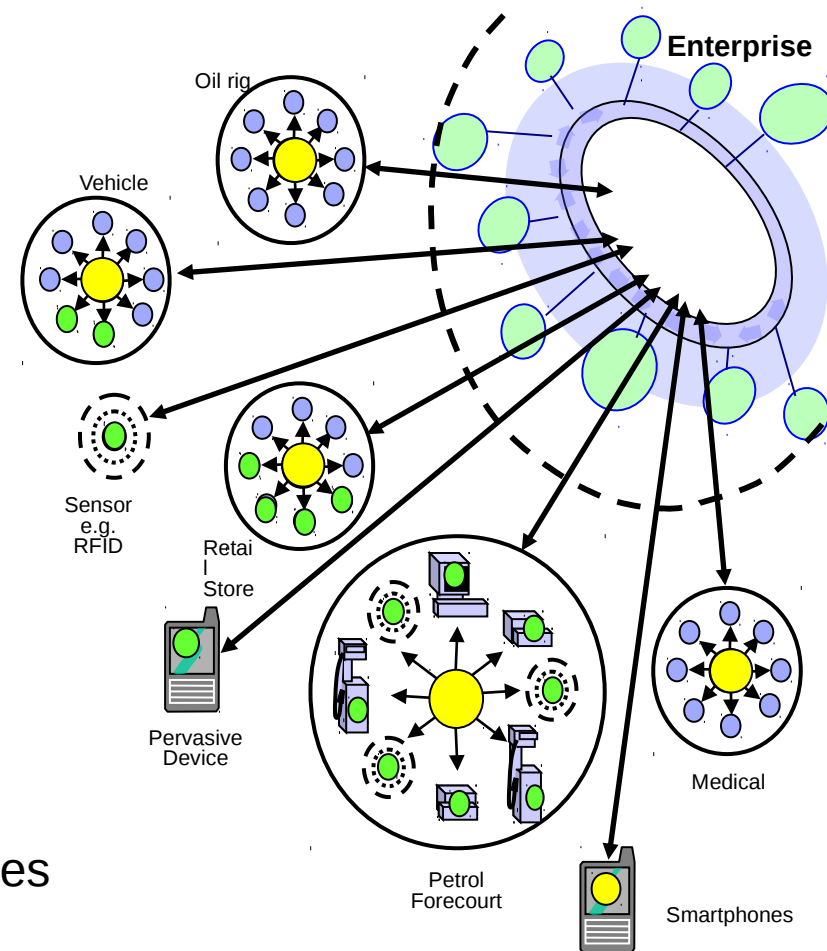


*Securing the data  
and the applications*

# WebSphere MQ Telemetry



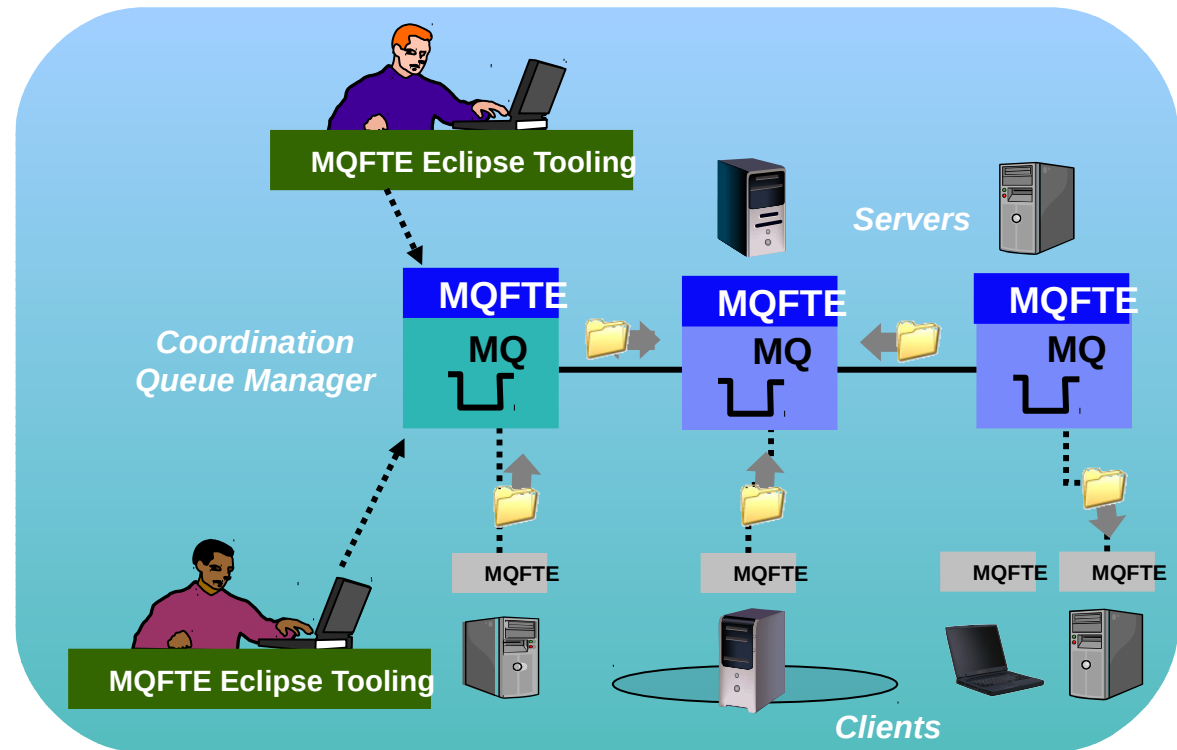
- Product extension included in WMQ 7.1 (MQXR) supporting mass connectivity for smart devices to the enterprise
- Utilises MQTT protocol
  - a lightweight, public, low bandwidth messaging protocol for scenarios where enterprise messaging clients are too big or bandwidth intensive.
  - Established for >10 years
- Java and C API provided, but you can “roll your own”
- Ideally suited to:
  - Fragile / Expensive networks such as “sometimes connected” devices / satellite phones
  - Niche platforms such as tiny sensors, personal devices, edge/small servers
  - Mass Scalability (> 50,000 clients per queue manager)



# WMQ Managed File Transfer



- MQ MFT/FTE solves problems of auditing, monitoring, scheduling, security ...
  - Automated bulk data transfer between distributed heterogeneous systems.
  - Capabilities for integrating, managing, and controlling data movement.
  
- Built on WebSphere MQ
  - Assured delivery of data over MQ backbone
  
- Simplicity and ease-of-use
  - GUI Driven
  - WMQ Explorer Integration
  - Scheduled, or Triggered transfers
  - Scriptable
  
- Complements MB File Nodes



Product page:

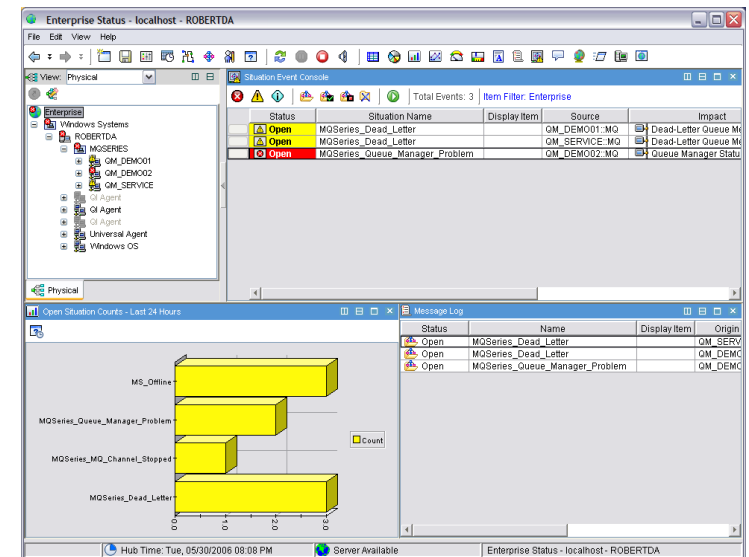
- <http://www.ibm.com/software/integration/wmq/filetransfer/v7/>



# Tivoli Omegamon and ITCAM



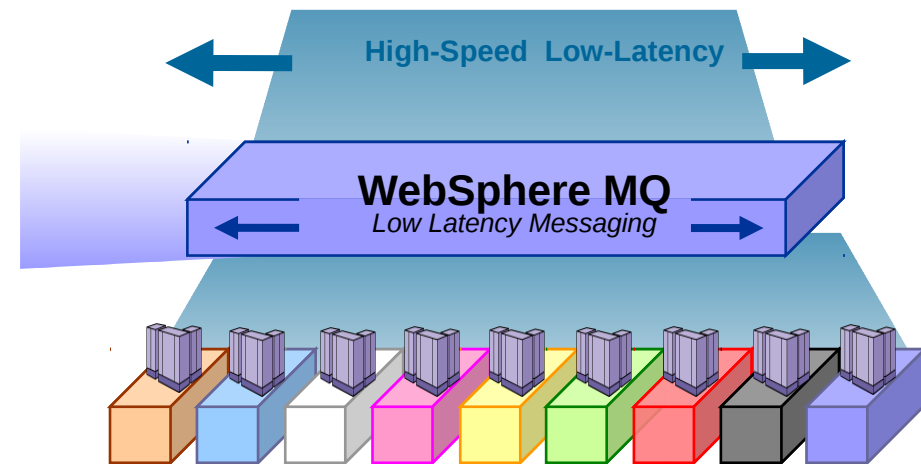
- Range of IBM products for monitoring and managing
  - Common core technologies with product-specific integration
  - eg Omegamon for Messaging deals with WMQ and Message Broker
- Enterprise-scale Management with Omegamon
  - Much larger environments than the MQ Explorer will handle
  - Allows joining of multiple products into single views
    - *eg there might be a situation only if both WMQ and DB2 show specific issues*
- Part of the "extended" WMQ development team
  - Make sure Tivoli can support new features
  - WMQ V7 support available
- Monitor SLAs
  - Drill down to appropriate product/OS levels



# WebSphere MQ Low Latency Messaging



- Extends the WebSphere MQ messaging family
  - New product that provides a messaging transport optimized for low latency, high-throughput delivery
- Provides low Latency, high-throughput messaging
  - Capable of 91 million messages per second
  - Less than 30μs latency at high throughput rates
  - Traffic control with static & dynamic rate control
- Delivers semi-reliable delivery
  - Choice of Multicast and Unicast transport with range of topology, speed and reliability characteristics
  - Ordered (FIFO) delivery
  - Stream failover for high availability
- Filters messages flexibly
  - Coarse-grained, topic-based and fine-grained filtering
- Included in WebSphere Front Office for Financial Markets



# Getting WebSphere MQ : Free Trial

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## Summary

- WebSphere MQ - World leader in messaging technology
- Runs everywhere your applications do
- Simplifies application communication
  - From simple connectivity.....
  - ..... to complex workload balancing, transformation and routing
- Provides secure, reliable and high-speed infrastructure

# This was session 13787 - The rest of the week .....



	Monday	Tuesday	Wednesday	Thursday	Friday
08:00				Extending IBM WebSphere MQ and WebSphere Message Broker to the Cloud	CICS and WMQ - The Resurrection of Useful
09:30	<b>Introduction to MQ</b>				Can I Consolidate My Queue Managers and Brokers?
11:00		MQ on z/OS - Vivisection	Hands-on Lab for MQ - take your pick!	MOBILE connectivity with Broker	Migration and Maintenance, the Necessary Evil. Into the Dark for MQ and Message Broker
12:15					
1:30	MQ Parallel Sysplex Exploitation, Getting the Best Availability From MQ on z/OS by Using Shared Queues	What's New in the MQ Family	MQ Clustering - The basics, advances and what's new	Using IBM WebSphere Application Server and IBM WebSphere MQ Together	
3:00	First Steps With Message Broker: Application Integration for the Messy	What's New in Message Broker	BIG Connectivity with mobile MQ	WebSphere MQ CHINIT Internals	
4:30	What's available in MQ and Broker for high availability and disaster recovery?	The Dark Side of Monitoring MQ - SMF 115 and 116 Record Reading and Interpretation	MQ & DB2 – MQ Verbs in DB2 & Q-Replication performance	Big Data Sharing with the Cloud - WebSphere eXtreme Scale and IBM Integration Bus Integration	
6:00				WebSphere MQ Channel Authentication Records	



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