Basic programming for WebSphere MQ

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COBOL

Agenda

- MQI Concepts
- MQI Structures & Datatypes
- Basic MQI walkthrough
  - With Demonstrations
  - A number of verbs we do not cover
    - MQCMIT, MQBACK, MQINQ, MQSET etc
Languages

- Procedural (MQI)
  - C
  - COBOL
  - Visual Basic
  - RPG
  - PL/1
  - Assembler
  - TAL

- Object-Oriented (Classes)
  - Java
  - JMS/XMS
  - C++
  - .NET languages
  - ActiveX (MQAX)
  - Perl

Interface

- Simple ‘handle’ based interface
  - Returned handle passed to subsequent call

- Each verb returns
  - Completion Code
    - MQCC-OK 0
    - MQCC-WARNING 1
    - MQCC-FAILED 2
  - Reason Code
    - MQRC-xxxxxxxx 2xxx
    - MQRC-NONE 0

- Make sure you check the reason codes!
Data Structures

Programmers should be familiar with:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQMD</td>
<td>Message Descriptor</td>
<td>Attributes associated with a message</td>
</tr>
<tr>
<td>MQOD</td>
<td>Object Descriptor</td>
<td>Describes what object to open</td>
</tr>
<tr>
<td>MQSD</td>
<td>Subscription Descriptor</td>
<td>Describes what to subscribe to</td>
</tr>
<tr>
<td>MQPMO</td>
<td>Put Message Options</td>
<td>Describes how a message should be put</td>
</tr>
<tr>
<td>MQGMO</td>
<td>Get Message Options</td>
<td>Describes how a message should be got</td>
</tr>
</tbody>
</table>

Data Structure Tips

- Use copybooks with value initialisers
  - 01 MESSAGE-DESCRIPTION.
  - COPY CMQMDV.
  - Initialise to version 1

- Structures are versioned
  - Set the minimum version you need
    - MOVE MQMD-VERSION=2 to MQMD-VERSION.
  - Don't use current version
    - MOVE MQMD-CURRENT-VERSION to MQMD-VERSION.

- Bear in mind that some structures are input/output
  - May need to reset values for subsequent call
    - Eg. MsgId & CorrelId fields of MQMD on MQGET call
MQ Elementary Data Types

- The main MQI data types

<table>
<thead>
<tr>
<th>DataType</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQHCONN</td>
<td>4-byte Connection Handle</td>
</tr>
<tr>
<td>MQOBJ</td>
<td>4-byte Object Handle</td>
</tr>
<tr>
<td>MQCHARn</td>
<td>A series of “n” bytes containing character data</td>
</tr>
<tr>
<td>MQBYTEEn</td>
<td>A series of “n” bytes containing binary data</td>
</tr>
<tr>
<td>MQCHARV</td>
<td>Variable length string</td>
</tr>
<tr>
<td>MQPTR</td>
<td>Pointer</td>
</tr>
<tr>
<td>MQLONG</td>
<td>4-byte binary integer</td>
</tr>
</tbody>
</table>

Connect

- Basic connect

```
MQCONN
```

```
Queue Manager Name
```

```
Connection Handle
Completion Code
Reason Code
```

```
QMGR
```

```
Basic connect
```
Connect with extended options

- **MQCONNX**
  - Don’t hardcoded QM name
  - Always check reason codes

- **Connections options**
  - Connection not thread specific
  - Client reconnect

```sql
05 CONNECTION-OPTIONS.
COPY CMQCN0V.
ADD MQCNO-HANDLE-SHARE-BLOCK MQCNO-RECONNECT
GIVING CONNECT-OPTIONS.
```

Connecting

- **MQCONNX**
  ```sql
  CALL 'MQCONNX'
  USING QM-NAME, CONNECT-OPTIONS, HCONN, MQCC, REASON.
  IF MQCC IS NOT EQUAL TO MQCC-OK
  * report reason and
  * stop if it failed
  END-IF.
  ```

- **Connections options**
  ```sql
  CONNECTION-OPTIONS.
  COPY CMQCN0V.
  ADD MQCNO-HANDLE-SHARE-BLOCK MQCNO-RECONNECT
  GIVING CONNECT-OPTIONS.
  ```
MQCONN(X) Tips

- **Don’t hardcode Queue Manager names**
  - Pass as parameter or configure in INI file

- **Best to use MQCONNX**
  - Has options structure should it be needed

- **Most expensive verb**
  - Don’t issue it repeatedly for each request
  - Often problem for OO languages

- **If MQI handle need to be used on different threads**
  - Use connection options to indicate the MQI handle can be shared
  - Choose to block or reject any calls from another thread when handle is in use

- **If reconnecting use exponential back-off with random wait**
  - Try to avoid client storms

- **Can dynamically load MQ libraries if client or local binding**
  - Preferable to shipping two versions of the program

---

Open a Queue

- **MQCONNX**
  - Connection Handle
  - Open Options
  - Object Descriptor

- **MQOPEN**
  - Object Handle
  - Completion Code
  - Reason Code

- **Indicate type of open required**
  - input, output, inquire etc

- **Indicate object name to open**
  - Queue name
  - Topic
Open a queue

- **MQOPEN a queue**
- **OpenOptions**
  - MQOO- flags which are required
- **MQOD describes a object to open**
  - MQOD-OBJECTTYPE
    - MQOT-Q for point-to-point
    - MQOT-TOPIC for publish
  - MQOD-OBJECTSTRING
  - MQOD-OBJECTNAME

```
01 OBJECT-DESCRIPTOR.
COPY CMQODV.
MOVE MQOT-Q TO MQOD-OBJECTTYPE.
MOVE PARM-QNAME TO MQOD-OBJECTNAME.
```

Object Descriptor (MQOD)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>StrucId</td>
<td>Structure identifier</td>
<td></td>
</tr>
<tr>
<td>Version</td>
<td>Structure version number</td>
<td></td>
</tr>
<tr>
<td>ObjectType</td>
<td>Object type</td>
<td></td>
</tr>
<tr>
<td>ObjectName</td>
<td>Object name</td>
<td>1</td>
</tr>
<tr>
<td>ObjectQMgrName</td>
<td>Object queue manager name</td>
<td></td>
</tr>
<tr>
<td>ObjectQName</td>
<td>Object queue name</td>
<td></td>
</tr>
<tr>
<td>AlternateQName</td>
<td>Alternate object name</td>
<td></td>
</tr>
<tr>
<td>AlternateUserId</td>
<td>Alternate user identifier</td>
<td></td>
</tr>
<tr>
<td>RecsPresent</td>
<td>Number of object records present</td>
<td></td>
</tr>
<tr>
<td>KnownDestCount</td>
<td>Number of local queues opened successfully</td>
<td></td>
</tr>
<tr>
<td>UnknownDestCount</td>
<td>Number of remote queues opened successfully</td>
<td></td>
</tr>
<tr>
<td>InvalidDestCount</td>
<td>Number of queues that failed to open</td>
<td>2</td>
</tr>
<tr>
<td>ObjectRecOffset</td>
<td>Offset of first object record from start of MQOD</td>
<td></td>
</tr>
<tr>
<td>ResponseRecOffset</td>
<td>Offset of first response record from start of MQOD</td>
<td></td>
</tr>
<tr>
<td>ResponseRecPtr</td>
<td>Address of first object record</td>
<td></td>
</tr>
<tr>
<td>ObjectRecPtr</td>
<td>Address of first response record</td>
<td></td>
</tr>
<tr>
<td>AlternateSecurityId</td>
<td>Alternate security identifier</td>
<td></td>
</tr>
<tr>
<td>ResolvedQName</td>
<td>Resolved queue name</td>
<td></td>
</tr>
<tr>
<td>ResolvedQMgrName</td>
<td>Resolved queue manager name</td>
<td></td>
</tr>
<tr>
<td>ObjectString</td>
<td>Long object name</td>
<td>3</td>
</tr>
<tr>
<td>SelectionString</td>
<td>Selection string</td>
<td></td>
</tr>
<tr>
<td>ResObjectString</td>
<td>Resolved long object name</td>
<td></td>
</tr>
<tr>
<td>ResObjectType</td>
<td>Resolved object type</td>
<td>1</td>
</tr>
</tbody>
</table>
Open Options

10 MQOO-BIND-AS-Q-DEF PIC S9(9) BINARY VALUE 0.
10 MQOO-READ-AHEAD-AS-Q-DEF PIC S9(9) BINARY VALUE 0.
10 MQOO-INPUT-AS-Q-DEF PIC S9(9) BINARY VALUE 1.
10 MQOO-INPUT-READ-AHEAD PIC S9(9) BINARY VALUE 2.
10 MQOO-INPUT-EXCLUSIVE PIC S9(9) BINARY VALUE 4.
10 MQOO-INPUT-SHARED PIC S9(9) BINARY VALUE 2.
10 MQOO-OUTPUT PIC S9(9) BINARY VALUE 16.
10 MQOO-INQUIRE PIC S9(9) BINARY VALUE 32.
10 MQOO-SET PIC S9(9) BINARY VALUE 64.
10 MQOO-SAVE-ALL-CONTEXT PIC S9(9) BINARY VALUE 128.
10 MQOO-PASS-IDENTITY-CONTEXT PIC S9(9) BINARY VALUE 256.
10 MQOO-PASS-ALL-CONTEXT PIC S9(9) BINARY VALUE 512.
10 MQOO-SET-IDENTITY-CONTEXT PIC S9(9) BINARY VALUE 1024.
10 MQOO-SET-ALL-CONTEXT PIC S9(9) BINARY VALUE 2048.
10 MQOO-ALTERNATE-USER-AUTHORITY PIC S9(9) BINARY VALUE 4096.
10 MQOO-FAIL-IF-QUIESCING PIC S9(9) BINARY VALUE 8192.
10 MQOO-BIND-ON-OPEN PIC S9(9) BINARY VALUE 16384.
10 MQOO-BIND-NOT-FIXED PIC S9(9) BINARY VALUE 32768.
10 MQOO-BIND-ON-OPEN PIC S9(9) BINARY VALUE 16384.
10 MQOO-SET-IDENTITY-CONTEXT PIC S9(9) BINARY VALUE 256.
10 MQOO-FILE-OPEN PIC S9(9) BINARY VALUE 512.
10 MQOO-NO-READ-AHEAD PIC S9(9) BINARY VALUE 1024.
10 MQOO-READ-AHEAD PIC S9(9) BINARY VALUE 2048.

Options can be added together as required

MQOPEN Tips

- Try not to hardcode queue/topic names
- Try not to open queues exclusively
  - Will reduce options for workload balancing
- Use MQPUT1 if only opening queue to put one message
- Consider queue cache for common used queues
  - MQOPEN is relatively expensive – load and security check
- Use read ahead for performance gain
  - If client and non-persistent messaging
- If opening model reply queues
  - Be aware of how many instances of queues you may be creating
  - Particularly large numbers of clients.
  - May be better to share reply queue
Put a message

- MQCONNX
- MQOPEN
- MQPUT

Connection Handle
Object Handle
Message Descriptor
Put Message Options
Message Data

Completion Code
Reason Code

Updates structure
- Message Descriptor
- Put Message Options

Putting Application

- MQOPEN a queue
- MQPUT a message
  - Simple Hello World message
  - Set message format to string
  - Put of syncpoint

```
01 MESSAGE-DESCRIPTION.
   COPY CMQMDD.
01 PMOPTIONS.
   COPY CMQPMOV.
   MOVE MQFMT-STRING TO MQMD-FORMAT.
   ADD MQPMO-FAIL-IF-QUIESCING MQPMO-NO-SYNCPPOINT GIVING MQPMO-OPTIONS.
   MOVE 'Hello World!' TO BUFFER.
   MOVE 12 TO BUFFER-LENGTH.
```
# Message Descriptor (MQMD)

<table>
<thead>
<tr>
<th>Field (V1)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>strucId</td>
<td>Structure identifier</td>
</tr>
<tr>
<td>Version</td>
<td>Structure version number</td>
</tr>
<tr>
<td>Report</td>
<td>Options for report messages</td>
</tr>
<tr>
<td>MsgType</td>
<td>Message Type</td>
</tr>
<tr>
<td>Expiry</td>
<td>Message lifetime</td>
</tr>
<tr>
<td>Feedback</td>
<td>Feedback or reason code</td>
</tr>
<tr>
<td>Encoding</td>
<td>Numeric encoding of message data</td>
</tr>
<tr>
<td>CodedCharSet</td>
<td>Character set identifier of message data</td>
</tr>
<tr>
<td>Format</td>
<td>Format name of message data</td>
</tr>
<tr>
<td>Priority</td>
<td>Message priority</td>
</tr>
<tr>
<td>Persistence</td>
<td>Message persistence</td>
</tr>
<tr>
<td>MsgId</td>
<td>Message identifier</td>
</tr>
<tr>
<td>CorrelId</td>
<td>Correlation identifier</td>
</tr>
<tr>
<td>BackoutCount</td>
<td>Backout counter</td>
</tr>
<tr>
<td>RespToQ</td>
<td>Name of reply queue</td>
</tr>
<tr>
<td>RespToQMgr</td>
<td>Name of reply queue manager</td>
</tr>
<tr>
<td>UserIdentifier</td>
<td>User identifier</td>
</tr>
<tr>
<td>AccountingToken</td>
<td>Accounting token</td>
</tr>
<tr>
<td>ApplianceData</td>
<td>Application data relating to identity</td>
</tr>
<tr>
<td>PutAppType</td>
<td>Type of application that put the message</td>
</tr>
<tr>
<td>PutAppName</td>
<td>Name of application that put the message</td>
</tr>
<tr>
<td>PutDate</td>
<td>Date when message was put</td>
</tr>
<tr>
<td>PutTime</td>
<td>Time when message was put</td>
</tr>
<tr>
<td>ApkOriginData</td>
<td>Application data relating to origin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field (V2)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GroupId</td>
<td>Group identifier</td>
</tr>
<tr>
<td>MsgSeqNumber</td>
<td>Sequence number of logical message within group</td>
</tr>
<tr>
<td>Offset</td>
<td>Offset of data in physical message from start of logical message</td>
</tr>
<tr>
<td>MsgFlags</td>
<td>Message flags</td>
</tr>
<tr>
<td>OriginalLength</td>
<td>Length of original message</td>
</tr>
</tbody>
</table>

# Put Message Options (MQPMO)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>strucId</td>
<td>Structure identifier</td>
</tr>
<tr>
<td>Version</td>
<td>Structure version number</td>
</tr>
<tr>
<td>Options</td>
<td>Options that control the action of MQPUT and MQPUT1</td>
</tr>
<tr>
<td>Context</td>
<td>Object handle of local queue</td>
</tr>
<tr>
<td>KnownDestCount</td>
<td>Number of messages sent successfully to local queues</td>
</tr>
<tr>
<td>UnknownDestCount</td>
<td>Number of messages sent successfully to remote queue</td>
</tr>
<tr>
<td>InvalidDestCount</td>
<td>Number of messages that could not be sent</td>
</tr>
<tr>
<td>ResolvedQName</td>
<td>Resolved name of destination queue</td>
</tr>
<tr>
<td>ResolvedQMgrName</td>
<td>Resolved name of destination queue manager</td>
</tr>
<tr>
<td>RecsPresent</td>
<td>Number of put messages records or response records present</td>
</tr>
<tr>
<td>PutMsgRecFields</td>
<td>Flags indicating which MQPMR fields are present</td>
</tr>
<tr>
<td>PutMsgRecOffset</td>
<td>Offset of first put-message records from start of MQPMRO</td>
</tr>
<tr>
<td>ResponseRecOffset</td>
<td>Offset of first response record from start of MQPMRO</td>
</tr>
<tr>
<td>PutMsgRecPtr</td>
<td>Address of first put-message record</td>
</tr>
<tr>
<td>ResponseRecPtr</td>
<td>Address of first response record</td>
</tr>
<tr>
<td>OriginalMsgHandle</td>
<td>Original message handle</td>
</tr>
<tr>
<td>NewMsgHandle</td>
<td>New message handle</td>
</tr>
<tr>
<td>Action</td>
<td>Type of put being performed and the relationship between the original message and the new message</td>
</tr>
<tr>
<td>PutLevel</td>
<td>Level of subscription targeted by the publication</td>
</tr>
</tbody>
</table>
### Put Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQPMO-SYNCPOINT</td>
<td>2</td>
</tr>
<tr>
<td>MQPMO-NO-SYNCPOINT</td>
<td>4</td>
</tr>
<tr>
<td>MQPMO-DEFAULT-CONTEXT</td>
<td>32</td>
</tr>
<tr>
<td>MQPMO-NEW-MSG-ID</td>
<td>64</td>
</tr>
<tr>
<td>MQPMO-NEW-CORREL-ID</td>
<td>128</td>
</tr>
<tr>
<td>MQPMO-FAIL-IDENTITY-CONTEXT</td>
<td>256</td>
</tr>
<tr>
<td>MQPMO-NO-CONTEXT</td>
<td>1024</td>
</tr>
<tr>
<td>MQPMO-LOGICAL-ORDER</td>
<td>2048</td>
</tr>
<tr>
<td>MQPMO-ASYNC-RESPONSE</td>
<td>4096</td>
</tr>
<tr>
<td>MQPMO-SYNC-RESPONSE</td>
<td>8192</td>
</tr>
<tr>
<td>MQPMO-RESOLVE-LOCAL-Q</td>
<td>16384</td>
</tr>
<tr>
<td>MQPMO-WARN-IF-NO-SUBS-MATCHED</td>
<td>32768</td>
</tr>
<tr>
<td>MQPMO-RETAIN</td>
<td>65536</td>
</tr>
<tr>
<td>MQPMO-MD-FOR-OUTPUT-ONLY</td>
<td>131072</td>
</tr>
<tr>
<td>MQPMO-SCOPE-QMGR</td>
<td>262144</td>
</tr>
<tr>
<td>MQPMO-SUPPRESS-REPLYTO</td>
<td>524288</td>
</tr>
<tr>
<td>MQPMO-NOT-OWN-SUBS</td>
<td>1024</td>
</tr>
<tr>
<td>MQPMO-RESPONSE-AS-Q-DEF</td>
<td>2097152</td>
</tr>
<tr>
<td>MQPMO-RESPONSE-AS-TOPIC-DEF</td>
<td>8388608</td>
</tr>
<tr>
<td>MQPMO-SCOPE-QMGR</td>
<td>67108864</td>
</tr>
<tr>
<td>MQPMO-SUPPRESS-REPLYTO</td>
<td>134217728</td>
</tr>
<tr>
<td>MQPMO-HOT-OWN-SUBS</td>
<td>268435456</td>
</tr>
<tr>
<td>MQPMO-RESPONSE-AS-Q-DEF</td>
<td>0</td>
</tr>
<tr>
<td>MQPMO-RESPONSE-AS-TOPIC-DEF</td>
<td>0</td>
</tr>
</tbody>
</table>

Options can be added together as required

### MQPUT Tips

- **Always use explicit syncpoint setting**
  - Defaults are not the same on z/OS and Distributed
  - Generally
    - Syncpoint when persistent
    - No syncpoint when non-persistent

- **Try not to use extreme message sizes**
  - QM optimized for message 4K – 1MB

- **Consider async put response for performance gain**
  - If on client and sending many non-persistent messages
Get a message

MQCONNX
MQOPEN
MQPUT
MQOPEN
MQGET

Connection Handle
Object Handle
Message Descriptor
Get Message Options
Buffer Size

Message Data
Message Length
Completion Code
Reason Code

Updates structure
- Message Descriptor
- Get Message Options

Getting Application

- MQOPEN a queue

- MQGET a message
  - Syncpoint if persistent
  - Always ask for convert
  - Wait for message
    - up to one minute

ADD MQOO-INPUT-SHARED
MQOO-FAIL-IF-QUIESCING
GIVING OPTIONS.

CALL 'MQOPEN'
USING HCONN,
OBJECT-_DESCRIPTOR,
OPTIONS,
Q-HANDLE,
MQCC,
REASON.

CALL 'MQGET'
USING HCONN,
Q-HANDLE,
MESSAGE-Descriptor,
GMOPTIONS,
BUFFER-LENGTH,
BUFFER,
DATA-LENGTH,
MQCC,
REASON.

01 MESSAGE-DESCRIPTOR.
COPY CMQMDV.
01 GMOPTIONS.
COPY CMQGMOV.
MOVE 60000 TO MQGMO-WAITINTERVAL.
ADD MQGMO-SYNCPPOINT-IF-PERSISTENT MQGMO-CONVERT
MQGMO-FAIL-IF-QUIESCING MQGMO-WAIT GIVING MQGMO-OPTIONS.
## Get Message Options (MQGMO)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>StructId</td>
<td>Structure identifier</td>
<td></td>
</tr>
<tr>
<td>Version</td>
<td>Structure version number</td>
<td></td>
</tr>
<tr>
<td>Options</td>
<td>Options that control the action of MQGET</td>
<td></td>
</tr>
<tr>
<td>WaitInterval</td>
<td>Wait Interval</td>
<td>1</td>
</tr>
<tr>
<td>Signal1</td>
<td>Signal</td>
<td></td>
</tr>
<tr>
<td>Signal2</td>
<td>Signal identifier</td>
<td></td>
</tr>
<tr>
<td>ResolvedQName</td>
<td>Resolved name of destination queue</td>
<td></td>
</tr>
<tr>
<td>MatchOptions</td>
<td>Options controlling selection criteria used for MQGET</td>
<td></td>
</tr>
<tr>
<td>GroupStatus</td>
<td>Flag indicating whether message retrieved is in a group</td>
<td>2</td>
</tr>
<tr>
<td>SegmentationStatus</td>
<td>Flag indicating whether message retrieved is a segment of a logical message</td>
<td></td>
</tr>
<tr>
<td>Generated</td>
<td>Flag indicating whether further segmentation is allowed for the message retrieved</td>
<td></td>
</tr>
<tr>
<td>MsgToken</td>
<td>Message token</td>
<td></td>
</tr>
<tr>
<td>ReturnedLength</td>
<td>Length of message data returned (bytes)</td>
<td>3</td>
</tr>
<tr>
<td>MsgHandle</td>
<td>The handle to a message that is to be populated with the properties of the message being retrieved from the queue.</td>
<td>4</td>
</tr>
</tbody>
</table>

### Get Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Binary Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQGMO-WAIT</td>
<td>Wait for response</td>
<td>1</td>
</tr>
<tr>
<td>MQGMO-NO-WAIT</td>
<td>Do not wait for response</td>
<td>0</td>
</tr>
<tr>
<td>MQGMO-SET-SIGNAL</td>
<td>Set output signal</td>
<td>8</td>
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<tr>
<td>MQGMO-FAIL-IF-QUIESCING</td>
<td>Fail if queue is in QUIESCING state</td>
<td>8192</td>
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<tr>
<td>MQGMO-SYNCPOINT</td>
<td>Synchronize message</td>
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<tr>
<td>MQGMO-SYNCPOINT-IF-PERSISTENT</td>
<td>Synchronize message with persistent flag</td>
<td>4096</td>
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<tr>
<td>MQGMO-NO-SYNCPOINT</td>
<td>Do not synchronize message</td>
<td>4</td>
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<tr>
<td>MQGMO-MARK-SKIP-BACKOUT</td>
<td>Mark and skip message</td>
<td>128</td>
</tr>
<tr>
<td>MQGMO-BROWSE-FIRST</td>
<td>Browse to first message</td>
<td>16</td>
</tr>
<tr>
<td>MQGMO-BROWSE-NEXT</td>
<td>Browse to next message</td>
<td>32</td>
</tr>
<tr>
<td>MQGMO-BROWSE-MSG-UNDER-CURSOR</td>
<td>Browse to message under cursor with cursor flag</td>
<td>2048</td>
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<tr>
<td>MQGMO-MSG-UNDER-CURSOR</td>
<td>Underscore cursor</td>
<td>256</td>
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<tr>
<td>MQGMO-LOCK</td>
<td>Lock</td>
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<tr>
<td>MQGMO-UNLOCK</td>
<td>Unlock</td>
<td>1024</td>
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<tr>
<td>MQGMO-ACCEPT-TRUNCATED-MSG</td>
<td>Accept message with truncated length</td>
<td>64</td>
</tr>
<tr>
<td>MQGMO-CONVERT</td>
<td>Convert</td>
<td>16384</td>
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<tr>
<td>MQGMO-LOGICAL-ORDER</td>
<td>Logical order</td>
<td>32768</td>
</tr>
<tr>
<td>MQGMO-COMPLETE-MSG</td>
<td>Complete message</td>
<td>65536</td>
</tr>
<tr>
<td>MQGMO-ALL-MSGS-AVAILABLE</td>
<td>All messages available</td>
<td>131072</td>
</tr>
<tr>
<td>MQGMO-ALL-SEGMENTS-AVAILABLE</td>
<td>All segments available</td>
<td>262144</td>
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<tr>
<td>MQGMO-MARK-BROWSE-HANDLE</td>
<td>Mark browse handle</td>
<td>1048576</td>
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<tr>
<td>MQGMO-MARK-BROWSE-CO-OP</td>
<td>Mark browse with CO-OP</td>
<td>2097152</td>
</tr>
<tr>
<td>MQGMO-UNMARK-BROWSE-CO-OP</td>
<td>Unmark browse with CO-OP</td>
<td>4194304</td>
</tr>
<tr>
<td>MQGMO-UNMARK-BROWSE-HANDLE</td>
<td>Unmark browse handle</td>
<td>8388608</td>
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<tr>
<td>MQGMO-UNMARKED-BROWSE-MSG</td>
<td>Unmark message with CO-OP</td>
<td>16777216</td>
</tr>
<tr>
<td>MQGMO-PROPERTIES-FORCE-MQRFH2</td>
<td>Properties force MQRFH2</td>
<td>33554432</td>
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<tr>
<td>MQGMO-NO-PROPERTIES</td>
<td>No properties</td>
<td>67108864</td>
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<tr>
<td>MQGMO-PROPERTIES-IN-HANDLE</td>
<td>Properties in handle</td>
<td>134217728</td>
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<tr>
<td>MQGMO-PROPERTIES-COMPATIBILITY</td>
<td>Properties compatibility</td>
<td>268435456</td>
</tr>
</tbody>
</table>
MQGET Tips

- **Avoid using default syncpoint setting**
  - Defaults are not the same on z/OS and Distributed
  - Generally
    - MQGMO_SYNCPOINT_IF_PERSISTENT

- **Use MQGMO_FAIL_IF QUIESCING**
  - Ensure your application ends promptly

- **Generally use MQGMO_CONVERT**
  - Even if you ‘think’ you don’t need it

- **Remember to reset MsgId & Correlld fields**
  - These fields are used for selection and are returned

- **Handle ‘poison message’**
  - Look at BackoutCount in MQMD

- **Consider using MQCB to consume messages instead**
  - Callback semantics, often easier to code

---

Publish a message

- **Updates structure**
  - Message Descriptor
  - Put Message Options

- **Very similar to a normal P2P Put**
Publishing Application

- **MQOPEN** a topic
  - **MQOD** describes a topic to publish to
    - MQOD-OBJECTTYPE
      - MQOT-Q for point-to-point
      - MQOT-TOPIC for publish
    - MQOD-OBJECTSTRING
    - MQOD-OBJECTNAME

- **MQPUT** a message

Publishing Tips

- **Choose topic string carefully**
  - Use sensible topic hierarchy
    - Based on context of published data
  - Don’t use different topic for each publish
    - This is probably meta data, use message property
  - Topic strings can be up to 10K bytes
    - But don’t use long topics unless necessary

- **Consider using Topic object and Topic string**
  - Administer can set point in topic tree
    - Known as ‘topic tree isolation’
Subscribe to a topic

- Connection Handle
- Subscription Descriptor
- Object Handle

Subscription Handle
- Completion Code
- Reason Code

Updates structure
- Subscription Descriptor
- Very similar to MQOPEN

Subscribing Application

- MQSUB verb
- Subscription Descriptor (MQSD) describes the topic
  - MQSD-OBJECTSTRING
  - MQSD-OBJECTNAME
- Consume publications from the returned Q-HANDLE
  - when MQSO-MANAGED used

CALL 'MQSUB' USING HCONN, SUB-DESCRIPTOR, Q-HANDLE, SUB-HANDLE, MQCC, REASON.
CALL 'MQGET' USING HCONN, Q-HANDLE, MESSAGE-DESCRIPTOR, GMOPTIONS, BUFFER-LENGTH, BUFFER, DATA-LENGTH, MQCC, REASON.

01 SUB-DESCRIPTOR.
COPY CMQSDV.
ADD MQSO-CREATE MQSO-MANAGED MQSO-FAIL-IF-QUIESCING GIVING MQSD-OPTIONS.
MOVE 'Price/Fruit/Apples' TO TARGET-TOPIC.
SET MQSD-OBJECTSTRING-VSPTR TO ADDRESS OF TARGET-TOPIC.
MOVE 18 TO MQSD-OBJECTSTRING-VSLENGTH.
Subscription Descriptor (MQSD)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>StructId</td>
<td>Structure identifier</td>
</tr>
<tr>
<td>Version</td>
<td>Structure version number</td>
</tr>
<tr>
<td>Options</td>
<td>Options that control the action of MQSUB</td>
</tr>
<tr>
<td>ObjectName</td>
<td>Object Name</td>
</tr>
<tr>
<td>AlternateUserId</td>
<td>Alternate User Id</td>
</tr>
<tr>
<td>AlternateSecurityId</td>
<td>Alternate Security Id</td>
</tr>
<tr>
<td>SubExpiry</td>
<td>Subscription expiry</td>
</tr>
<tr>
<td>ObjectString</td>
<td>Object string</td>
</tr>
<tr>
<td>SubName</td>
<td>Subscription name</td>
</tr>
<tr>
<td>SubUserData</td>
<td>Subscription user data</td>
</tr>
<tr>
<td>PubPriority</td>
<td>Publication priority</td>
</tr>
<tr>
<td>PubAccountingToken</td>
<td>Publication accounting token</td>
</tr>
<tr>
<td>PubAppIdentityData</td>
<td>Publication application identity data</td>
</tr>
<tr>
<td>SelectionString</td>
<td>String providing selection criteria</td>
</tr>
<tr>
<td>SubLevel</td>
<td>Subscription Level</td>
</tr>
<tr>
<td>ResObjectString</td>
<td>Resolved object string</td>
</tr>
</tbody>
</table>

Subscribe Options

10 MQSO-NON-DURABLE PIC 99 BINARY VALUE 0.
10 MQSO-READ-AHEAD AS-Q-DEF PIC 99 BINARY VALUE 0.
10 MQSO-ALTER PIC 99 BINARY VALUE 1.
10 MQSO-CREATE PIC 99 BINARY VALUE 2.
10 MQSO-RESUME PIC 99 BINARY VALUE 4.
10 MQSO-DURABLE PIC 99 BINARY VALUE 8.
10 MQSO-GROUP-SUB PIC 99 BINARY VALUE 16.
10 MQSO-MANAGED PIC 99 BINARY VALUE 32.
10 MQSO-SET-IDENTITY-CONTEXT PIC 99 BINARY VALUE 64.
10 MQSO-FIXED-USERID PIC 99 BINARY VALUE 256.
10 MQSO-ANY-USERID PIC 99 BINARY VALUE 512.
10 MQSO-PUBLICATIONS-ON-REQUEST PIC 99 BINARY VALUE 1024.
10 MQSO-NEW-PUBLICATIONS-ONLY PIC 99 BINARY VALUE 2048.
10 MQSO-FAIL-IF-QUIESCING PIC 99 BINARY VALUE 4096.
10 MQSO-ALTERNATE-USER-AUTHORITY PIC 99 BINARY VALUE 8192.
10 MQSO-WILDCARD-CHAR PIC 99 BINARY VALUE 16384.
10 MQSO-WILDCARD-TOPIC PIC 99 BINARY VALUE 32768.
10 MQSO-SET-CORREL-ID PIC 99 BINARY VALUE 65536.
10 MQSO-SCOPE-QMGR PIC 99 BINARY VALUE 131072.
10 MQSO-NO-READ-AHEAD PIC 99 BINARY VALUE 262144.

- Options can be added together as required
Subscribing Tips

- Managed handles make things simpler

- Only use durable subscriptions when necessary
  - Avoid build up of messages

- For durable subscriptions
  - Combine the create and resume options to make it simpler

Close a handle
Closing Application

- **MQOPEN a queue**
  - Normally we’d do something!

- **MQCLOSE a queue**
  - Normally we’d do something!

```
CALL 'MQOPEN'
  USING HCONN,
    OBJECT-DESCRIPTOR,
    OPTIONS,
    Q-HANDLE,
    MQCC,
    REASON.

< Issue some MQI calls here >

CALL 'MQCLOSE'
  USING HCONN,
    Q-HANDLE,
    OPTIONS,
    MQCC,
    REASON.
```

Close Options

- Options available depending on object type

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MQCO-DELETE</td>
<td>1</td>
<td>Permanent Dynamic Queue</td>
</tr>
<tr>
<td>MQCO-DELETE-PURGE</td>
<td>2</td>
<td>Permanent Dynamic Queue</td>
</tr>
<tr>
<td>MQCO-KEEP-SUB</td>
<td>4</td>
<td>Durable Subscription</td>
</tr>
<tr>
<td>MQCO-REMOVE-SUB</td>
<td>8</td>
<td>Durable Subscription</td>
</tr>
<tr>
<td>MQCO-QUIESCE</td>
<td>32</td>
<td>Read Ahead input handle</td>
</tr>
</tbody>
</table>
MQCLOSE Tips

- In triggered applications
  - Only close triggered queue if application ending

- If implementing queue cache
  - Close ‘rarely used’ queues in a timely fashion
    - Open queues can not be deleted/purged and use memory

- For read ahead queues
  - Use the quiesce close option to avoid message loss

Disconnect from Queue Manager

MQCONNX  MQOPEN  MQPUT  MQOPEN  MQGET  MQCLOSE  MQDISC

QMGR

Connection Handle

Completion Code  Reason Code

- Updates connection handle
Disconnecting Application

- MQCONN to Queue Manager
- MQDISC from Queue Manager
  - Normally we’d do something!

CALL 'MQCONNX'
USING QM-NAME,
CONNECT-OPTIONS,
HCONN,
MQCC,
REASON.

< Issue some MQI calls here >

CALL 'MQDISC'
USING HCONN,
MQCC,
REASON.

05 CONNECTION-OPTIONS.
COPY CMQCNOV.

ADD MQCNO-HANDLE-SHARE-BLOCK MQCNO-RECONNECT
GIVING CONNECT-OPTIONS.

MQDISC Tips

- Ensure application disconnects if QM quiescing
  - Will prevent Queue Manager from ending

- MQDISC will close all queues/topics and subscriptions
  - May wish to close some queues individually

- MQDISC is an implicit commit
  - May want to consider issuing MQBACK() first

- Still call MQDISC
  - If MQI call returns with a connection broken reason code

- Application ending without MQDISC
  - Will backout on Distributed
  - Will commit or backout depending on exit reason on z/OS
  - Try to always do explicit MQDISC if possible
Summary

- **Simple MQI – very easy to get started**
  - Let most fields have default values
  - Keep things simple if you can
    - do not try and monitor channels for example

- **Plenty of samples to help you along**
  - In a variety of languages
    - eg. `<install dir>\Tools\cobol\Samples`
    - `<hlq>.SCSQCOBS`

- **Check reason codes and log failures**
  - MQ trace can be useful
Questions & Answers

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IBM Hursley - UK