

# Basic programming for WebSphere MQ

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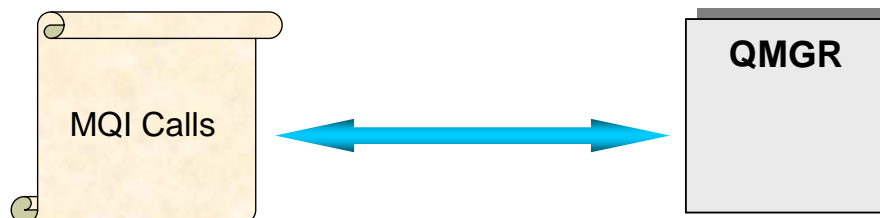
IBM Hursley - UK

**COBOL**

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## Agenda

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



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# Languages

## ■ Procedural (MQI)

- ▶ C
- ▶ COBOL
- ▶ Visual Basic
- ▶ RPG
- ▶ PL/1
- ▶ Assembler
- ▶ TAL

## ■ Object-Oriented (Classes)

- ▶ Java
- ▶ JMS/XMS
- ▶ C++
- ▶ .NET languages
- ▶ ActiveX (MQAX)
- ▶ Perl

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# Interface

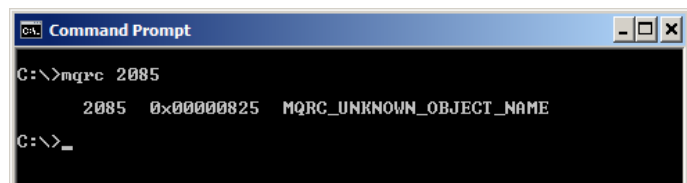
## ■ Simple 'handle' based interface

- ▶ Returned handle passed to subsequent call

## ■ Each verb returns

- ▶ Completion Code
  - MQCC-OK 0
  - MQCC-WARNING 1
  - MQCC-FAILED 2
- ▶ Reason Code
  - MQRC-xxxxxxx 2xxx
  - MQRC-NONE 0

## ■ Make sure you check the reason codes!



```
Command Prompt
C:\>mqrc 2085
      2085 0x00000825 MQRC_UNKNOWN_OBJECT_NAME
C:\>_
```

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# Data Structures

- **Programmers should be familiar with:**

| Name  | Description             | Purpose                               |
|-------|-------------------------|---------------------------------------|
| MQMD  | Message Descriptor      | Attributes associated with a message  |
| MQOD  | Object Descriptor       | Describes what object to open         |
| MQSD  | Subscription Descriptor | Describes what to subscribe to        |
| MQPMO | Put Message Options     | Describes how a message should be put |
| MQGMO | Get Message Options     | Describes how a message should be got |

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## Data Structure Tips

- **Use copybooks with value initialisers**
  - ▶ 01 MESSAGE-DESCRIPTOR.
  - ▶ 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

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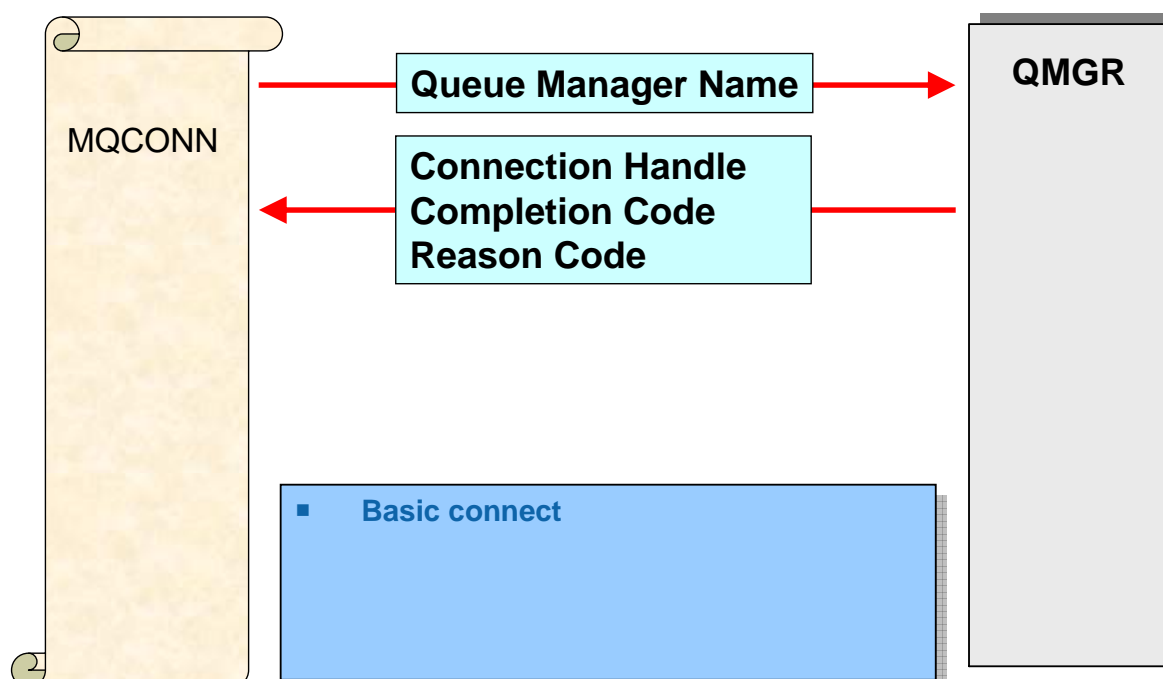
# MQ Elementary Data Types

- The main MQI data types

| Data Type | Purpose   |
|-----------|---|
| MQHCONN   | 4-byte Connection Handle                        |
| MQHOBJ    | 4-byte Object Handle                            |
| MLONG     | 4-byte binary integer                           |
| MQPTR     | Pointer   |
| MQCHARn   | A series of "n" bytes containing character data |
| MQBYTEn   | A series of "n" bytes containing binary data    |
| MQCHARV   | Variable length string                          |

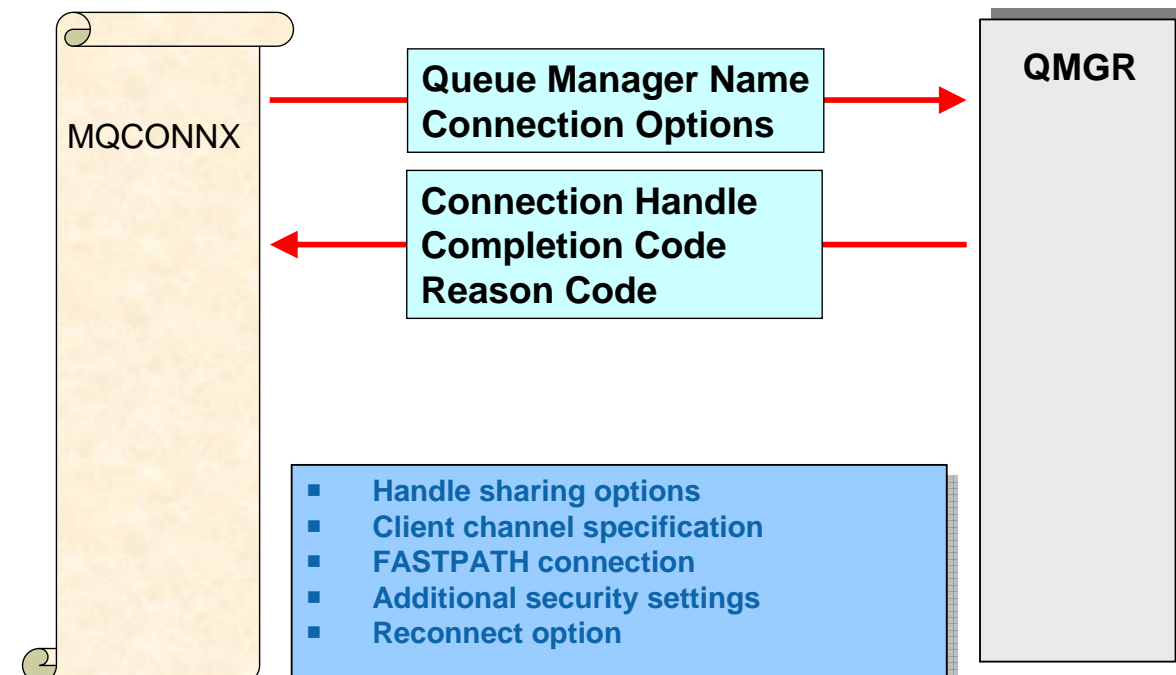
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## Connect



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# Connect with extended options



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## Connecting

- **MQCONNX**
  - ▶ Don't hardcode QM name
  - ▶ Always check reason codes
- **Connections options**
  - ▶ Connection not thread specific
  - ▶ Client reconnect

```
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.
```

```
05 CONNECTION-OPTIONS.  
  COPY CMQCNOV.
```

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

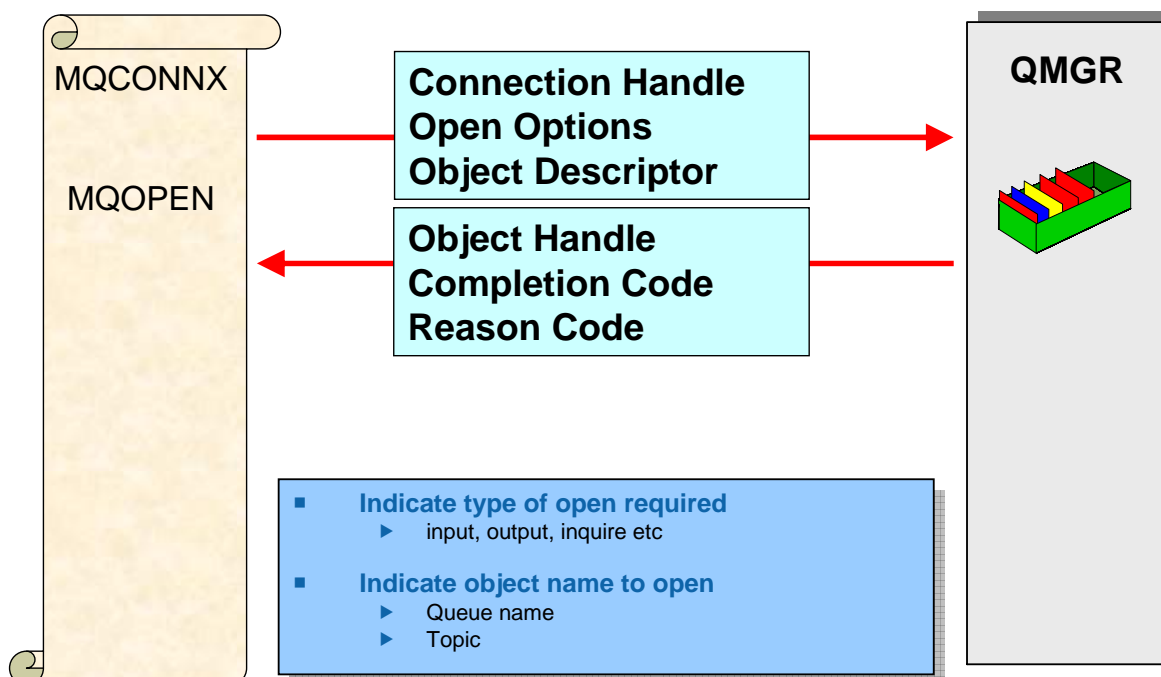
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# MQCONN(X) Tips

- **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

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## Open a Queue



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# 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

```

ADD MQOO-OUTPUT
MQOO-FAIL-IF-QUIESCING
GIVING OPTIONS.

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

IF MQCC IS NOT EQUAL TO MQCC-OK
* report reason and
* stop if it failed
END-IF.
  
```

```

01 OBJECT-DESCRIPTOR.
COPY CMQODV.

MOVE MQOT-Q TO MQOD-OBJECTTYPE.
MOVE PARM-QNAME TO MQOD-OBJECTNAME.
  
```

# Object Descriptor (MQOD)

| Field               | Description  | Version |
|---------------------|--|---------|
| StrucId             | Structure identifier                               | 1       |
| Version             | Structure version number                           |         |
| ObjectType          | Object type  |         |
| ObjectName          | Object name  |         |
| ObjectQMgrName      | Object queue manager name                          | 2       |
| DynamicQName        | Dynamic queue name                                 |         |
| AlternateUserId     | Alternate user identifier                          |         |
| RecsPresent         | Number of object records present                   |         |
| KnownDestCount      | Number of local queues opened successfully         | 3       |
| UnknownDestCount    | Number of remote queues opened successfully        |         |
| InvalidDestCount    | Number of queues that failed to open               |         |
| ObjectRecOffset     | Offset of first object record from start of MQOD   |         |
| ResponseRecOffset   | Offset of first response record from start of MQOD | 4       |
| ObjectRecPtr        | Address of first object record                     |         |
| ResponseRecPtr      | Address of first response record                   |         |
| AlternateSecurityId | Alternate security identifier                      |         |
| ResolvedQName       | Resolved queue name                                | 3       |
| ResolvedQMgrName    | Resolved queue manager name                        |         |
| ObjectString        | Long object name                                   | 4       |
| SelectionString     | Selection string                                   |         |
| ResObjectString     | Resolved long object name                          |         |
| ResolvedType        | Resolved object type                               |         |

# 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-SHARED             | PIC S9(9) BINARY VALUE 2.       |
| 10 | MQOO-INPUT-EXCLUSIVE          | PIC S9(9) BINARY VALUE 4.       |
| 10 | MQOO-BROWSE                   | PIC S9(9) BINARY VALUE 8.       |
| 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-CO-OP                    | PIC S9(9) BINARY VALUE 131072.  |
| 10 | MQOO-NO-READ-AHEAD            | PIC S9(9) BINARY VALUE 524288.  |
| 10 | MQOO-READ-AHEAD               | PIC S9(9) BINARY VALUE 1048576. |

- Options can be added together as required

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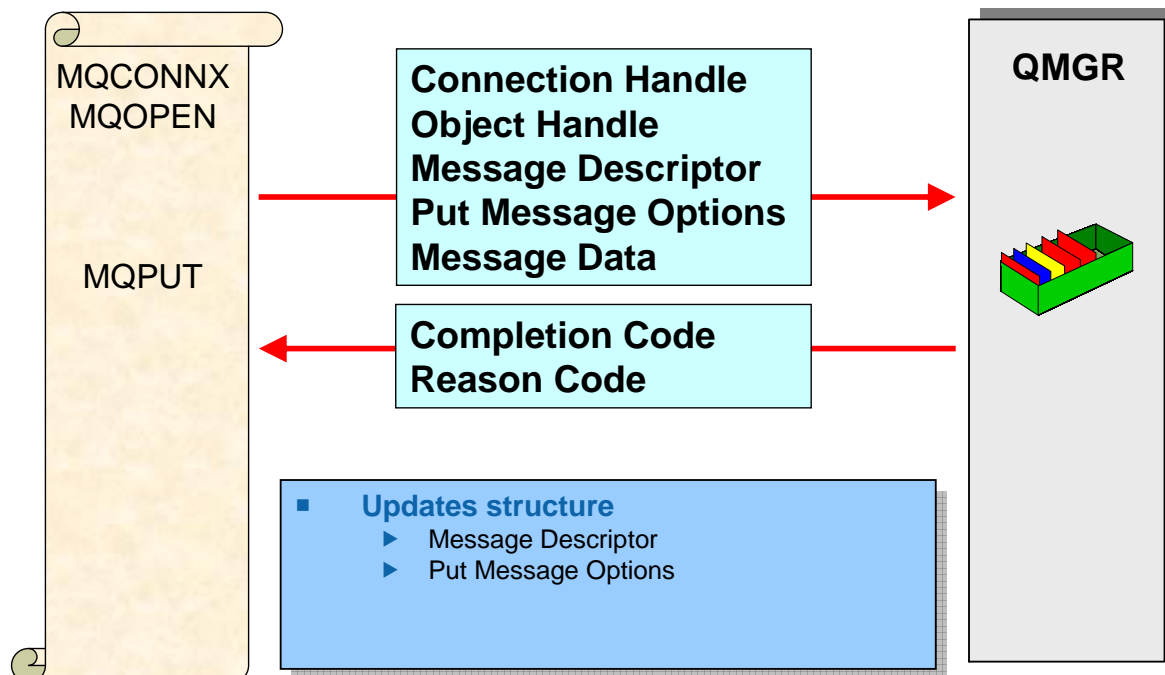
## MQOPEN Tips

- 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

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# Put a message



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## Putting Application

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

```
ADD MQOO-OUTPUT  
MQOO-FAIL-IF-QUIESCING  
GIVING OPTIONS.  
CALL 'MQOPEN'  
USING HCONN,  
OBJECT-DESCRIPTOR,  
OPTIONS,  
Q-HANDLE,  
MQCC,  
REASON.  
CALL 'MQPUT'  
USING HCONN,  
Q-HANDLE,  
MESSAGE-DESCRIPTOR,  
PMOPTIONS,  
BUFFER-LENGTH,  
BUFFER,  
MQCC,  
REASON.
```

```
01 MESSAGE-DESCRIPTOR.  
COPY CMQMDV.  
01 PMOPTIONS.  
COPY CMQPMOV.  
MOVE MQFMT-STRING TO MQMD-FORMAT.  
ADD MQPMO-FAIL-IF-QUIESCING MQPMO-NO-SYNCPOINT GIVING MQPMO-OPTIONS.  
MOVE 'Hello World!' TO BUFFER.  
MOVE 12 TO BUFFER-LENGTH.
```

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# Message Descriptor (MQMD)

| Field (V1)      | Description                              |
|-----------------|--|
| StrucId         | Structure identifier                     |
| Version         | Structure version number                 |
| Report          | Options for report messages              |
| MsgType         | Message Type                             |
| Expiry          | Message lifetime                         |
| Feedback        | Feedback or reason code                  |
| Encoding        | Numeric encoding of message data         |
| CodedCharSetId  | Character set identifier of message data |
| Format          | Format name of message data              |
| Priority        | Message priority                         |
| Persistence     | Message persistence                      |
| MsgId           | Message identifier                       |
| CorrelId        | Correlation identifier                   |
| BackoutCount    | Backout counter                          |
| ReplyToQ        | Name of reply queue                      |
| ReplyToQMGr     | Name of reply queue manager              |
| UserIdentifier  | User identifier                          |
| AccountingToken | Accounting token                         |
| AppIdentityData | Application data relating to identity    |
| PutAppType      | Type of application that put the message |
| PutAppName      | Name of application that put the message |
| PutDate         | Date when message was put                |
| PutTime         | Time when message was put                |
| AppOriginData   | Application data relating to origin      |

| Field (V2)     | Description  |
|----------------|--|
| GroupId        | Group identifier   |
| MsgSeqNumber   | Sequence number of logical message within group                  |
| Offset         | Offset of data in physical message from start of logical message |
| MsgFlags       | Message flags  |
| OriginalLength | Length of original message                                       |

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# Put Message Options (MQPMO)

| Field             | Description   | Version |
|-------------------|---|---------|
| StrucId           | Structure identifier  | 1       |
| Version           | Structure version number  |         |
| Options           | Options that control the action of MQPUT and MQPUT1   |         |
| Context           | Object handle of input queue  |         |
| KnownDestCount    | Number of messages sent successfully to local queues  |         |
| UnknownDestCount  | Number of messages sent successfully to remote queue  |         |
| InvalidDestCount  | Number of messages that could not be sent   |         |
| ResolvedQName     | Resolved name of destination queue  |         |
| ResolvedQMGrName  | Resolved name of destination queue manager  |         |
| RecsPresent       | Number of put messages records or response records present  |         |
| PutMsgRecFields   | Flags indicating which MQPMR fields are present   |         |
| PutMsgRecOffset   | Offset of first put-message records from start of MQPMO   |         |
| ResponseRecOffset | Offset of first response record from start of MQPMO   |         |
| PutMsgRecPtr      | Address of first put message record   |         |
| ResponseRecPtr    | Address of first response record  | 3       |
| OriginalMsgHandle | Original message handle   |         |
| NewMsgHandle      | New message handle  |         |
| Action            | Type of put being performed and the relationship between the original message and the new message |         |
| PubLevel          | Level of subscription targeted by the publication   |         |

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# Put Options

|    |                                |           |                         |
|----|--------------------------------|-----------|-------------------------|
| 10 | MQPMO-SYNCPPOINT               | PIC S9(9) | BINARY VALUE 2.         |
| 10 | MQPMO-NO-SYNCPPOINT            | PIC S9(9) | BINARY VALUE 4.         |
| 10 | MQPMO-DEFAULT-CONTEXT          | PIC S9(9) | BINARY VALUE 32.        |
| 10 | MQPMO-NEW-MSG-ID               | PIC S9(9) | BINARY VALUE 64.        |
| 10 | MQPMO-NEW-CORREL-ID            | PIC S9(9) | BINARY VALUE 128.       |
| 10 | MQPMO-PASS-IDENTITY-CONTEXT    | PIC S9(9) | BINARY VALUE 256.       |
| 10 | MQPMO-PASS-ALL-CONTEXT         | PIC S9(9) | BINARY VALUE 512.       |
| 10 | MQPMO-SET-IDENTITY-CONTEXT     | PIC S9(9) | BINARY VALUE 1024.      |
| 10 | MQPMO-SET-ALL-CONTEXT          | PIC S9(9) | BINARY VALUE 2048.      |
| 10 | MQPMO-ALTERNATE-USER-AUTHORITY | PIC S9(9) | BINARY VALUE 4096.      |
| 10 | MQPMO-FAIL-IF-QUIESCING        | PIC S9(9) | BINARY VALUE 8192.      |
| 10 | MQPMO-NO-CONTEXT               | PIC S9(9) | BINARY VALUE 16384.     |
| 10 | MQPMO-LOGICAL-ORDER            | PIC S9(9) | BINARY VALUE 32768.     |
| 10 | MQPMO-ASYNC-RESPONSE           | PIC S9(9) | BINARY VALUE 65536.     |
| 10 | MQPMO-SYNC-RESPONSE            | PIC S9(9) | BINARY VALUE 131072.    |
| 10 | MQPMO-RESOLVE-LOCAL-Q          | PIC S9(9) | BINARY VALUE 262144.    |
| 10 | MQPMO-WARN-IF-NO-SUBS-MATCHED  | PIC S9(9) | BINARY VALUE 524288.    |
| 10 | MQPMO-RETAIN                   | PIC S9(9) | BINARY VALUE 2097152.   |
| 10 | MQPMO-MD-FOR-OUTPUT-ONLY       | PIC S9(9) | BINARY VALUE 8388608.   |
| 10 | MQPMO-SCOPE-QMGR               | PIC S9(9) | BINARY VALUE 67108864.  |
| 10 | MQPMO-SUPPRESS-REPLYTO         | PIC S9(9) | BINARY VALUE 134217728. |
| 10 | MQPMO-NOT-OWN-SUBS             | PIC S9(9) | BINARY VALUE 268435456. |
| 10 | MQPMO-RESPONSE-AS-Q-DEF        | PIC S9(9) | BINARY VALUE 0.         |
| 10 | MQPMO-RESPONSE-AS-TOPIC-DEF    | PIC S9(9) | BINARY VALUE 0.         |

- Options can be added together as required

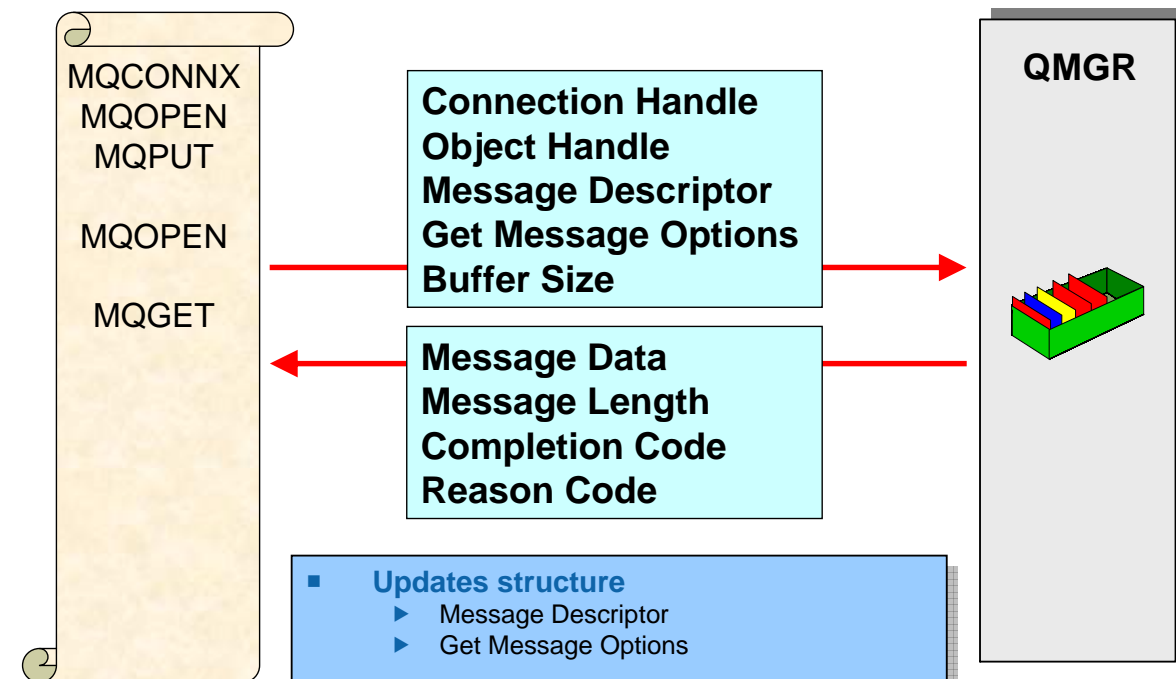
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## MQPUT Tips

- **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

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# Get a message



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# 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 CMQGMV.
MOVE 60000 TO MQGMO-WAITINTERVAL.
ADD MQGMO-SYNCPPOINT-IF-PERSISTENT MQGMO-CONVERT
    MQGMO-FAIL-IF-QUIESCING MQGMO-WAIT GIVING MQGMO-OPTIONS.
```

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# Get Message Options (MQGMO)

| Field          | Description  | Version |
|----------------|--|---------|
| StrucId        | Structure Identifier   | 1       |
| Version        | Structure version number   |         |
| Options        | Options that control the action of MQGET   |         |
| WaitInterval   | Wait Interval  |         |
| Signal1        | Signal   |         |
| Signal2        | Signal identifier  |         |
| ResolvedQName  | Resolved name of destination queue   | 2       |
| MatchOptions   | Options controlling selection criteria used for MQGET  |         |
| GroupStatus    | Flag indicating whether message retrieved is in a group  |         |
| SegmentStatus  | Flag indicating whether message retrieved is a segment of a logical message  |         |
| Sementation    | Flag indicating whether further segmentation is allowed for the message retrieved                                  | 3       |
| MsgToken       | Message token  |         |
| ReturnedLength | Length of message data returned (bytes)  | 4       |
| MsgHandle      | The handle to a message that is to be populated with the properties of the message being retrieved from the queue. |         |

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# Get Options

|                                   |                              |                                   |                                   |
|-----------------------------------|------------------------------|-----------------------------------|-----------------------------------|
| 10 MQGMO-WAIT                     | PIC S9(9) BINARY VALUE 1.    | 10 MQGMO-CONVERT                  | PIC S9(9) BINARY VALUE 16384.     |
| 10 MQGMO-NO-WAIT                  | PIC S9(9) BINARY VALUE 0.    | 10 MQGMO-LOGICAL-ORDER            | PIC S9(9) BINARY VALUE 32768.     |
| 10 MQGMO-SET-SIGNAL               | PIC S9(9) BINARY VALUE 8.    | 10 MQGMO-COMPLETE-MSG             | PIC S9(9) BINARY VALUE 65536.     |
| 10 MQGMO-FAIL-IF-QUIESCING        | PIC S9(9) BINARY VALUE 8192. | 10 MQGMO-ALL-MSGS-AVAILABLE       | PIC S9(9) BINARY VALUE 131072.    |
| 10 MQGMO-SYNCPPOINT               | PIC S9(9) BINARY VALUE 2.    | 10 MQGMO-ALL-SEGMENTS-AVAILABLE   | PIC S9(9) BINARY VALUE 262144.    |
| 10 MQGMO-SYNCPPOINT-IF-PERSISTENT | PIC S9(9) BINARY VALUE 4096. | 10 MQGMO-MARK-BROWSE-HANDLE       | PIC S9(9) BINARY VALUE 1048576.   |
| 10 MQGMO-NO-SYNCPPOINT            | PIC S9(9) BINARY VALUE 4.    | 10 MQGMO-MARK-BROWSE-CO-OP        | PIC S9(9) BINARY VALUE 2097152.   |
| 10 MQGMO-MARK-SKIP-BACKOUT        | PIC S9(9) BINARY VALUE 128.  | 10 MQGMO-UNMARK-BROWSE-CO-OP      | PIC S9(9) BINARY VALUE 4194304.   |
| 10 MQGMO-BROWSE-FIRST             | PIC S9(9) BINARY VALUE 16.   | 10 MQGMO-UNMARK-BROWSE-HANDLE     | PIC S9(9) BINARY VALUE 8388608.   |
| 10 MQGMO-BROWSE-NEXT              | PIC S9(9) BINARY VALUE 32.   | 10 MQGMO-UNMARKED-BROWSE-MSG      | PIC S9(9) BINARY VALUE 16777216.  |
| 10 MQGMO-BROWSE-MSG-UNDER-CURSOR  | PIC S9(9) BINARY VALUE 2048. | 10 MQGMO-PROPERTIES-FORCE-MQRFH2  | PIC S9(9) BINARY VALUE 33554432.  |
| 10 MQGMO-MSG-UNDER-CURSOR         | PIC S9(9) BINARY VALUE 256.  | 10 MQGMO-NO-PROPERTIES            | PIC S9(9) BINARY VALUE 67108864.  |
| 10 MQGMO-LOCK                     | PIC S9(9) BINARY VALUE 512.  | 10 MQGMO-PROPERTIES-IN-HANDLE     | PIC S9(9) BINARY VALUE 134217728. |
| 10 MQGMO-UNLOCK                   | PIC S9(9) BINARY VALUE 1024. | 10 MQGMO-PROPERTIES-COMPATIBILITY | PIC S9(9) BINARY VALUE 268435456. |
| 10 MQGMO-ACCEPT-TRUNCATED-MSG     | PIC S9(9) BINARY VALUE 64.   | 10 MQGMO-PROPERTIES-AS-Q-DEF      | PIC S9(9) BINARY VALUE 0.         |

Options can be used together as required

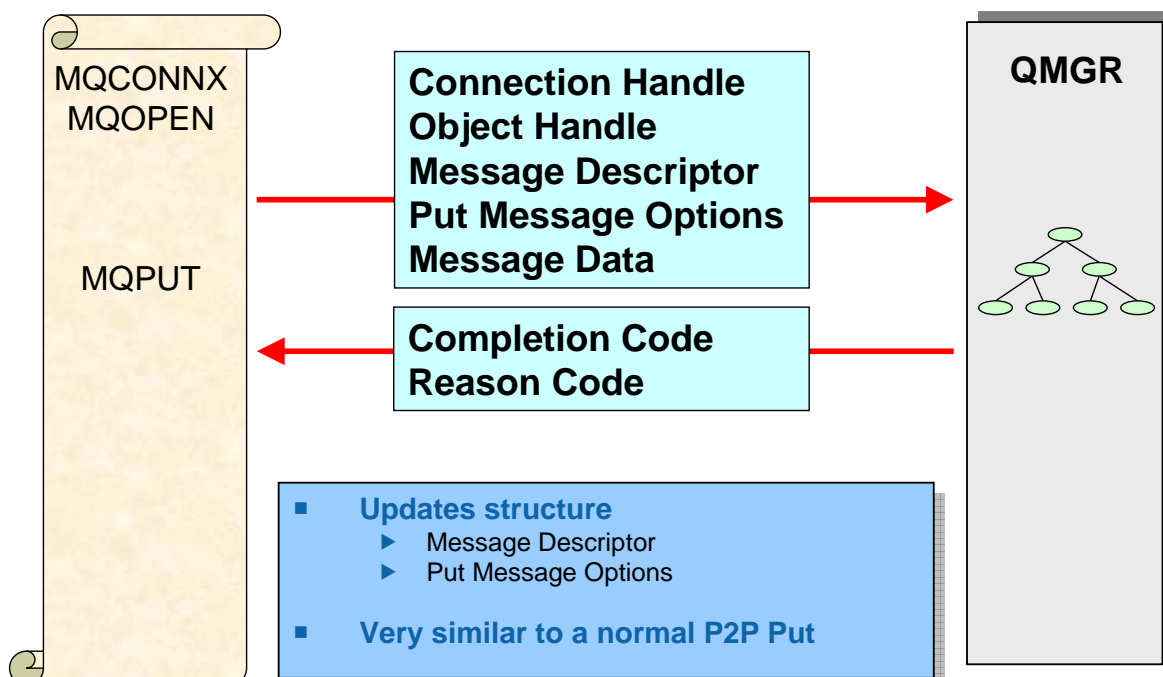
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# MQGET Tips

- **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 Msgld & 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

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# Publish a message



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# 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

```
ADD MQOO-OUTPUT
MQOO-FAIL-IF-QUIESCING
GIVING OPTIONS.
CALL 'MQOPEN'
  USING HCONN,
  OBJECT-DESCRIPTOR,
  OPTIONS,
  Q-HANDLE,
  MQCC,
  REASON.
CALL 'MQPUT'
  USING HCONN,
  Q-HANDLE,
  MESSAGE-DESCRIPTOR,
  PMOPTIONS,
  BUFFER-LENGTH,
  BUFFER,
  MQCC,
  REASON.
```

```
01 OBJECT-DESCRIPTOR.
COPY CMQODV.
MOVE MQOT-TOPIC TO MQOD-OBJECTTYPE.
MOVE MQOD-VERSION-4 TO MQOD-VERSION.
MOVE 'Price/Fruit/Apples' TO TARGET-TOPIC.
SET MQOD-OBJECTSTRING-VSPTR TO ADDRESS OF TARGET-TOPIC.
MOVE 18 TO MQOD-OBJECTSTRING-VSLENGTH.
```

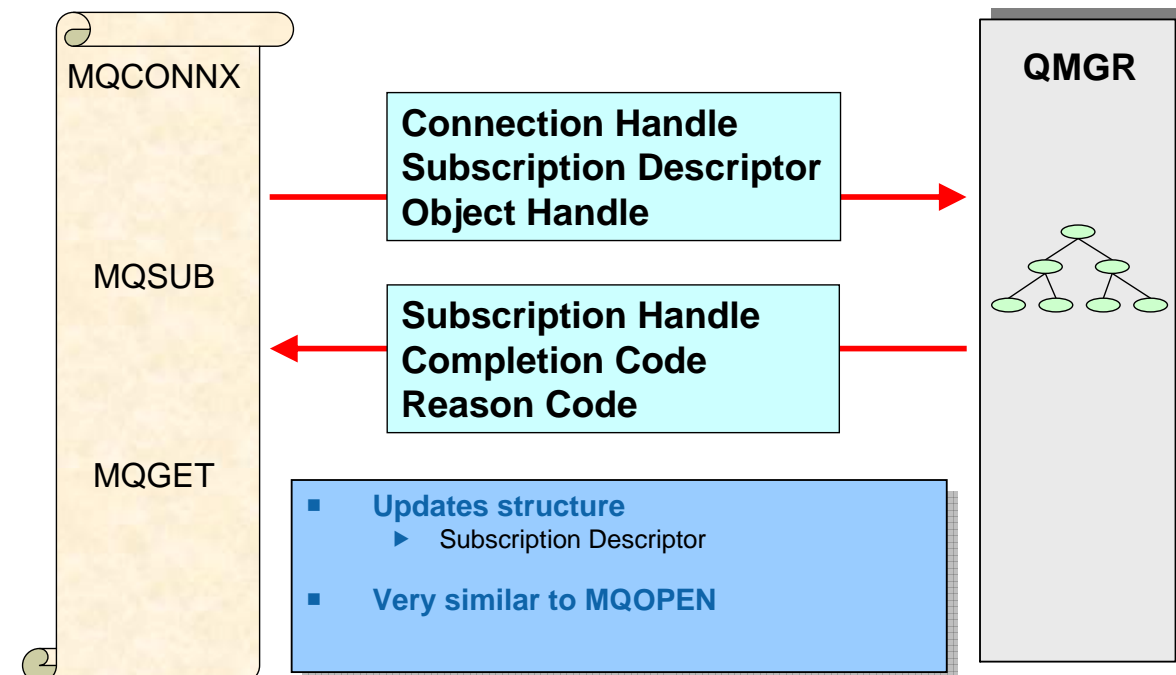
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## Publishing Tips

- **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'

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# Subscribe to a topic



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## 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-VSLLENGTH.
```

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# Subscription Descriptor (MQSD)

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

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## Subscribe Options

```

10 MQSO-NON-DURABLE          PIC S9(9) BINARY VALUE 0.
10 MQSO-READ-AHEAD-AS-Q-DEF  PIC S9(9) BINARY VALUE 0.
10 MQSO-ALTER                PIC S9(9) BINARY VALUE 1.
10 MQSO-CREATE               PIC S9(9) BINARY VALUE 2.
10 MQSO-RESUME               PIC S9(9) BINARY VALUE 4.
10 MQSO-DURABLE              PIC S9(9) BINARY VALUE 8.
10 MQSO-GROUP-SUB           PIC S9(9) BINARY VALUE 16.
10 MQSO-MANAGED              PIC S9(9) BINARY VALUE 32.
10 MQSO-SET-IDENTITY-CONTEXT PIC S9(9) BINARY VALUE 64.
10 MQSO-FIXED-USERID        PIC S9(9) BINARY VALUE 256.
10 MQSO-ANY-USERID          PIC S9(9) BINARY VALUE 512.
10 MQSO-PUBLICATIONS-ON-REQUEST PIC S9(9) BINARY VALUE 2048.
10 MQSO-NEW-PUBLICATIONS-ONLY PIC S9(9) BINARY VALUE 4096.
10 MQSO-FAIL-IF-QUIESCING   PIC S9(9) BINARY VALUE 8192.
10 MQSO-ALTERNATE-USER-AUTHORITY PIC S9(9) BINARY VALUE 262144.
10 MQSO-WILDCARD-CHAR       PIC S9(9) BINARY VALUE 1048576.
10 MQSO-WILDCARD-TOPIC      PIC S9(9) BINARY VALUE 2097152.
10 MQSO-SET-CORREL-ID       PIC S9(9) BINARY VALUE 4194304.
10 MQSO-SCOPE-QMGR          PIC S9(9) BINARY VALUE 67108864.
10 MQSO-NO-READ-AHEAD      PIC S9(9) BINARY VALUE 134217728.

```

- Options can be added together as required

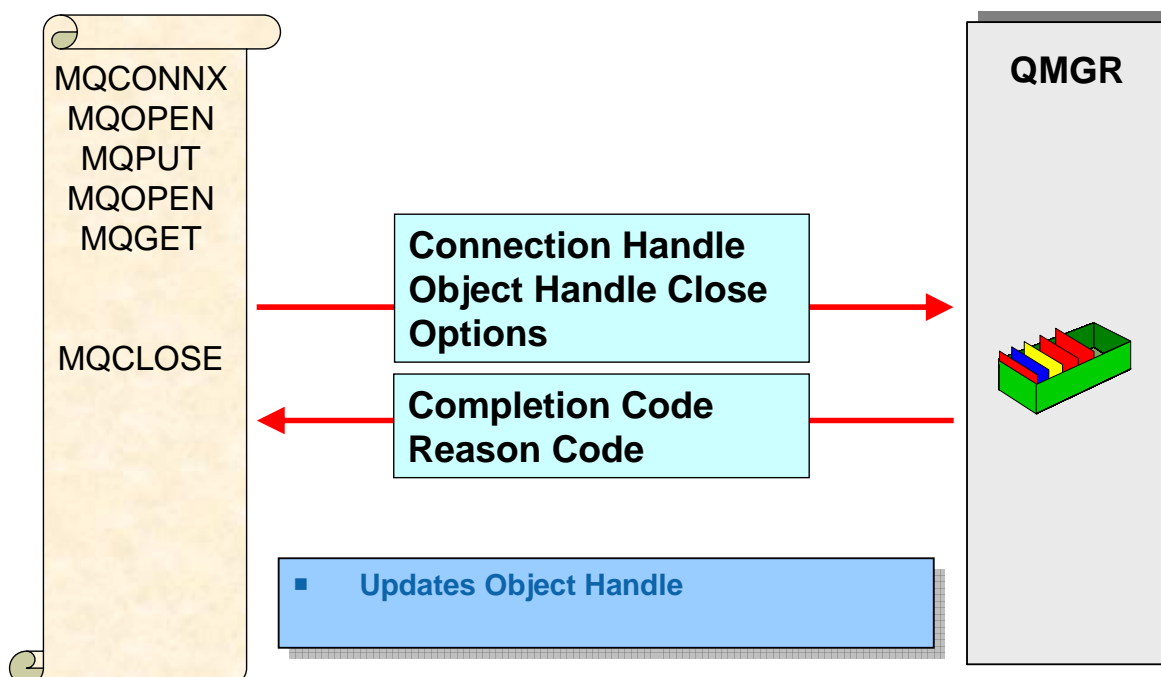
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# Subscribing Tips

- **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

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## Close a handle



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# Closing Application

- MQOPEN a queue
- MQCLOSE a queue
  - ▶ Normally we'd do something !

```
ADD MQOO-INPUT_SHARED
MQOO-FAIL-IF-QUIESCING
GIVING OPTIONS.
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.
```

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

MOVE MQCO-NONE TO OPTIONS.
```

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# Close Options

- Options available depending on object type

|                   |    |                         |
|-------------------|----|-------------------------|
| MQCO-DELETE       | 1  | Permanent Dynamic Queue |
| MQCO-DELETE-PURGE | 2  | Permanent Dynamic Queue |
| MQCO-KEEP-SUB     | 4  | Durable Subscription    |
| MQCO-REMOVE-SUB   | 8  | Durable Subscription    |
| MQCO-QUIESCE      | 32 | Read Ahead input handle |

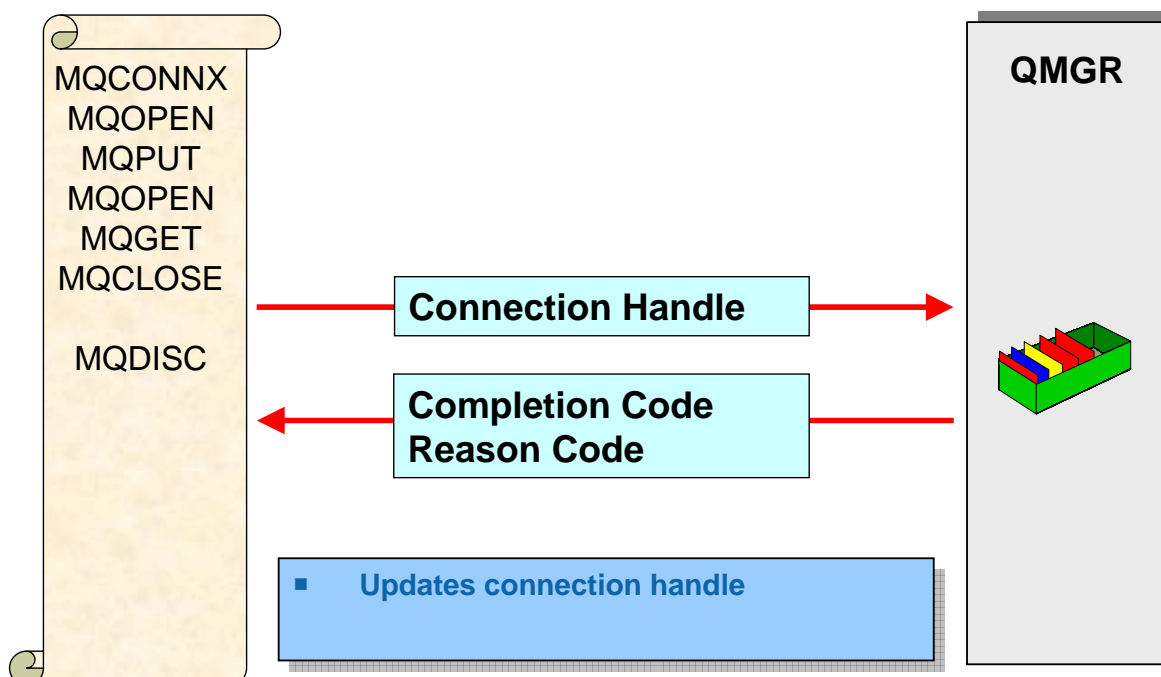
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# MQCLOSE Tips

- **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

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# Disconnect from Queue Manager



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# Disconnecting Application

- **MQCONN to Queue Manager**
- **MQDISC from Queue Manager**
  - ▶ Normally we'd do something !

```
CALL 'MQCONN'  
  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.
```

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## 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

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# 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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