Session 18822: MQ Parallel Sysplex Exploitation, Getting the Best Availability from MQ on z/OS by using Shared Queues

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PLM for Messaging on z

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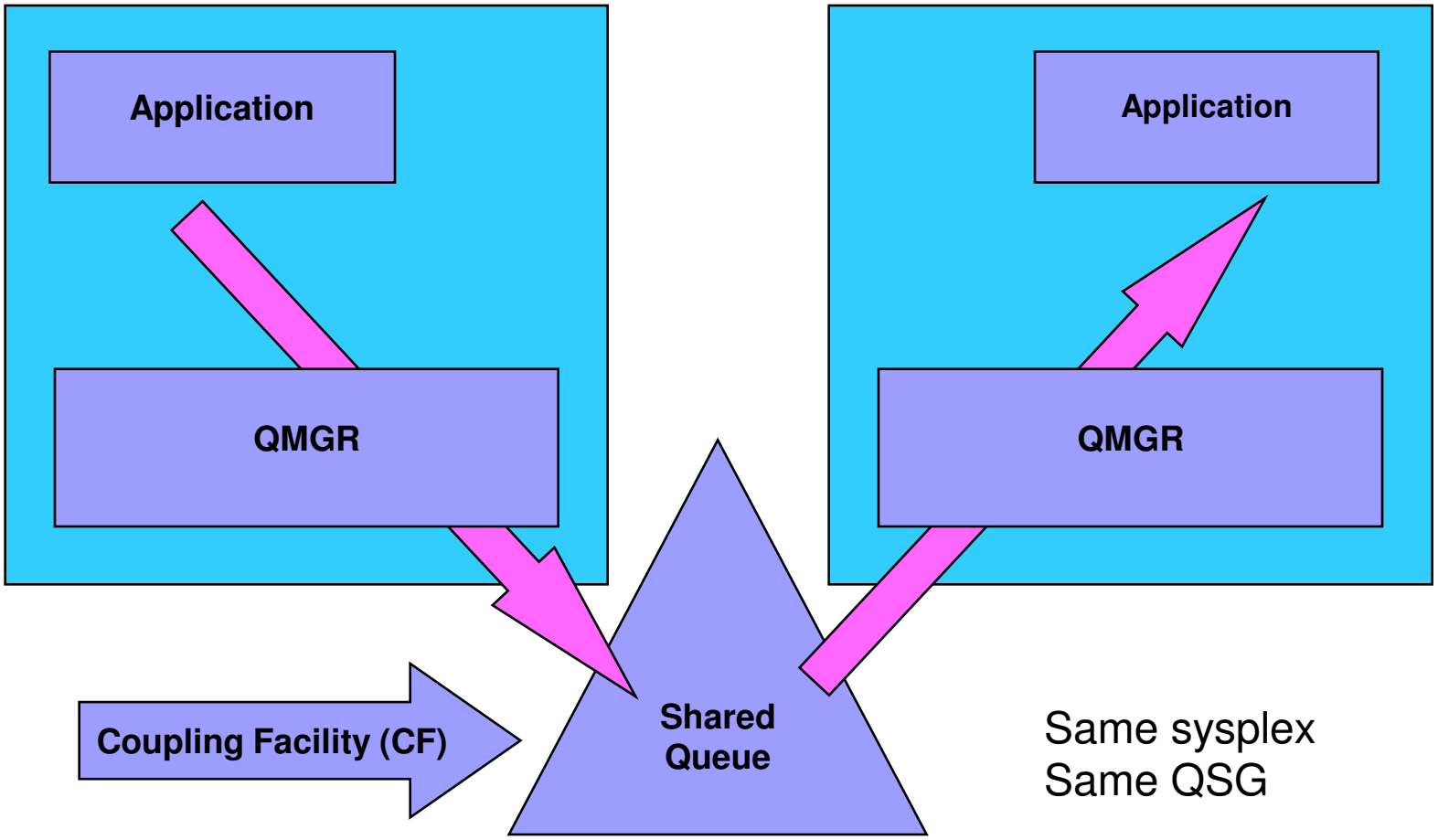
Agenda

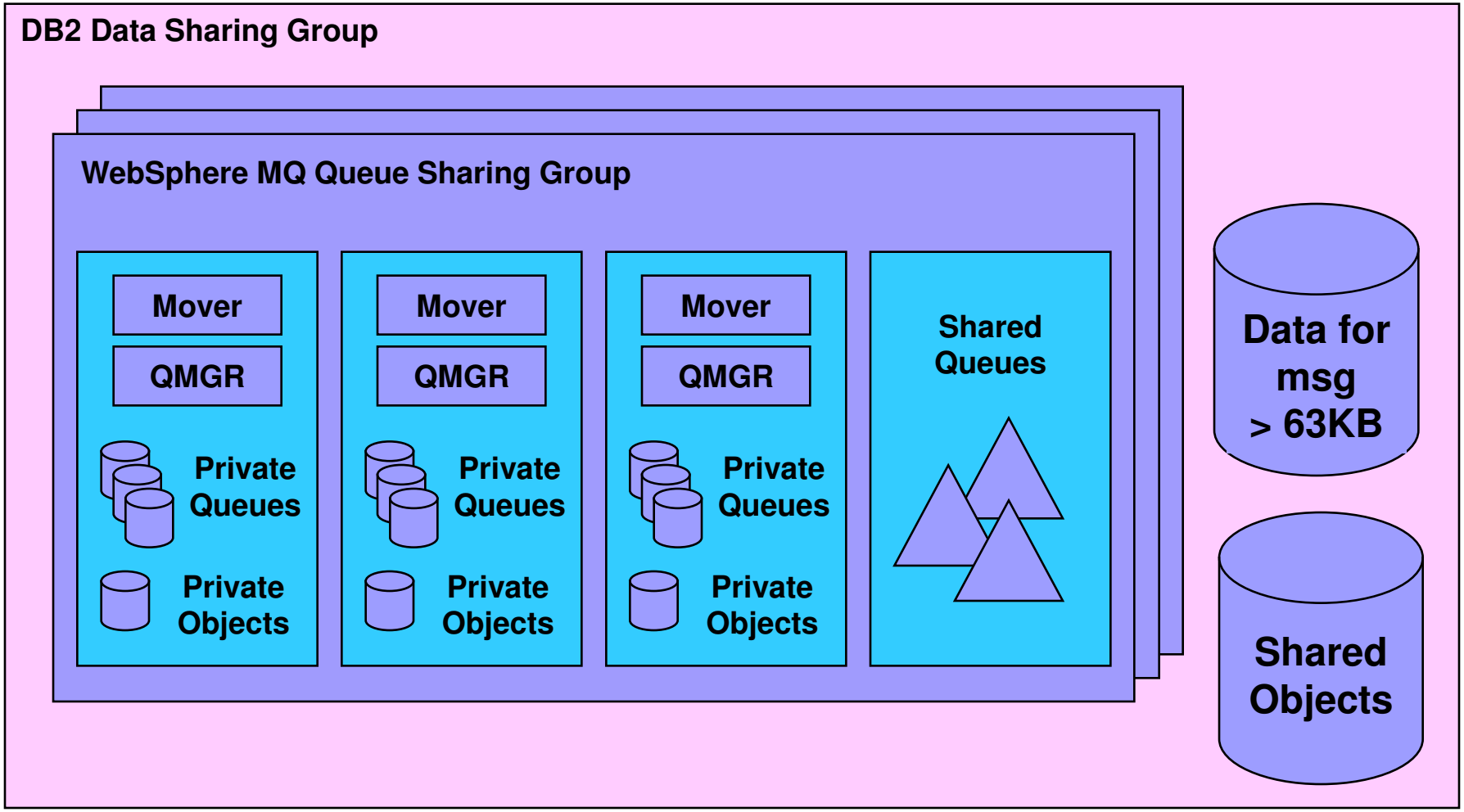
- Shared Queues
- Large messages with DB2
- SMDS
- Structures – Persistence and recovery
- Client Channels

Shared Queues

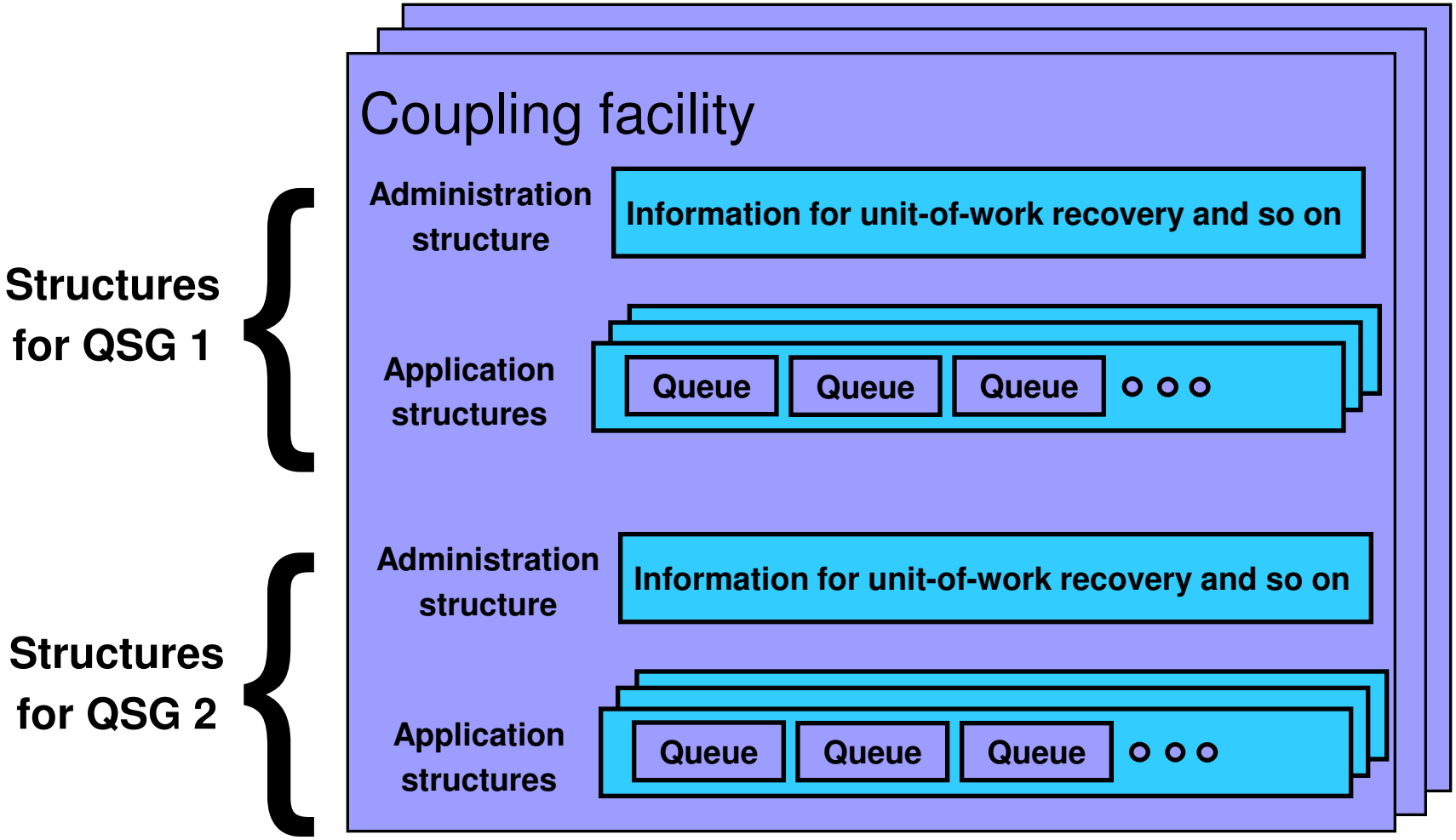
Shared Queues



Queue Sharing Groups (QSGs)



CF Structures for shared-queues

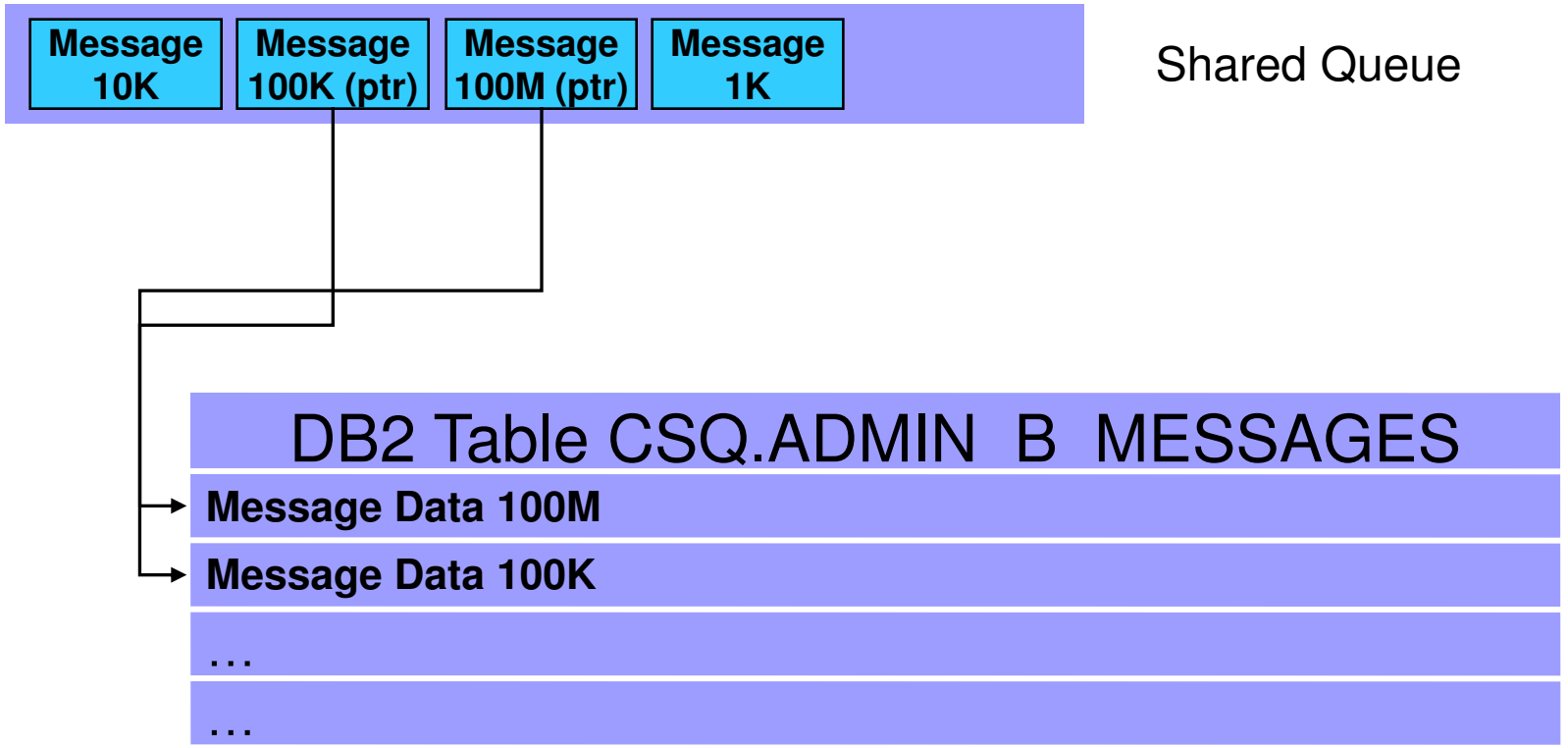


Creating CF structures and shared queues

- Define a structure to z/OS (not to WebSphere MQ) by updating the CFRM policy (see *System Setup Guide*):
  - Structure is known to WebSphere MQ by its 12-character *str-name*.
  - Structure is known to z/OS by the 16-character name formed by:
    - *qsg-name* || *str-name* (Application structures)
    - *qsg-name* || CSQ_ADMIN (Administration structure)
- Define a shared queue using the DEFINE QLOCAL command on any queue manager in the QSG**:**
  - DEFINE QLOCAL(*queue-name*) QSGDISP(SHARED) CFSTRUCT(*str-name*)
- z/OS creates the structure when required (first use).
- WebSphere MQ creates the queue when required (first use).

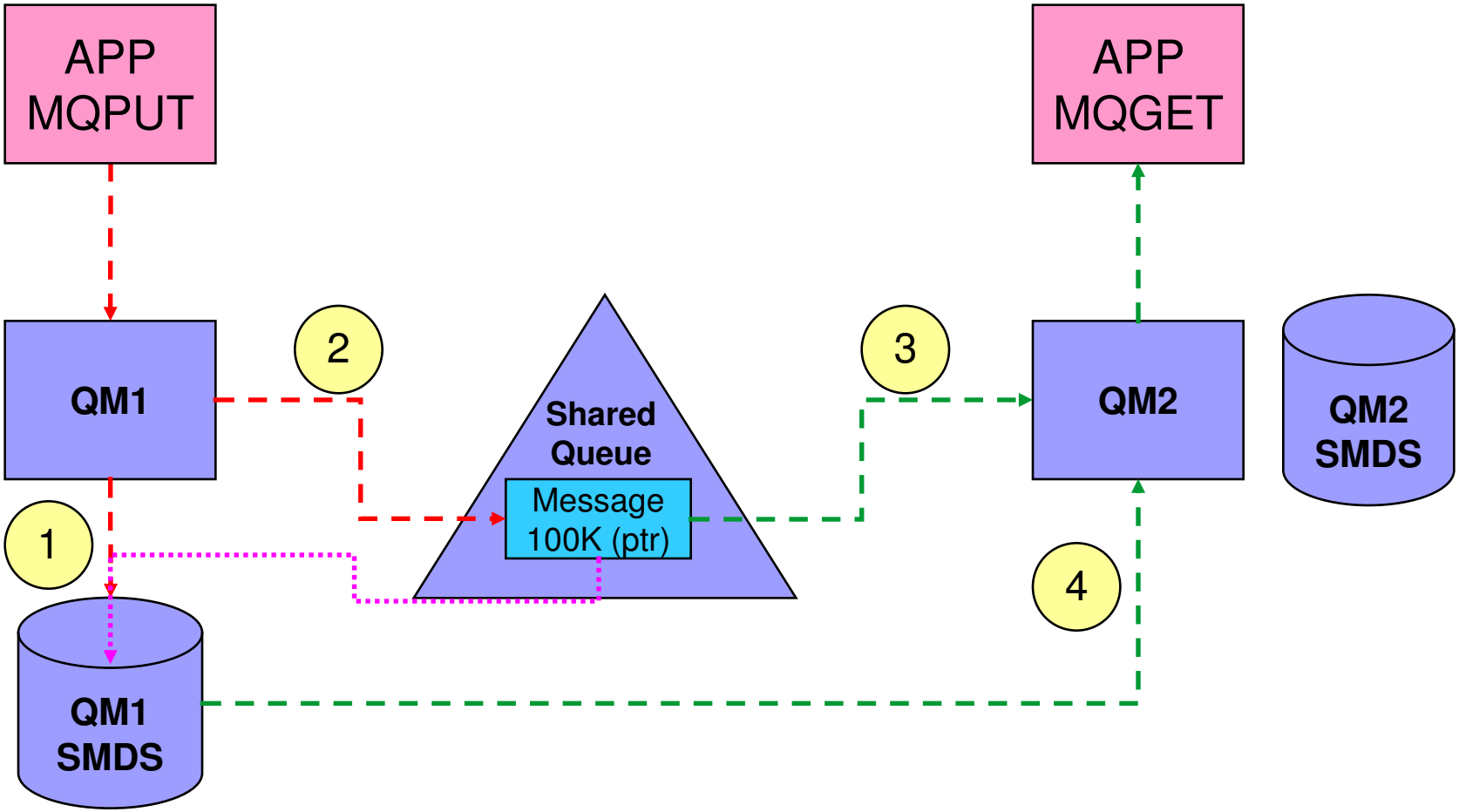
Large messages with DB2

Large Shared Queue Messages (using DB2)

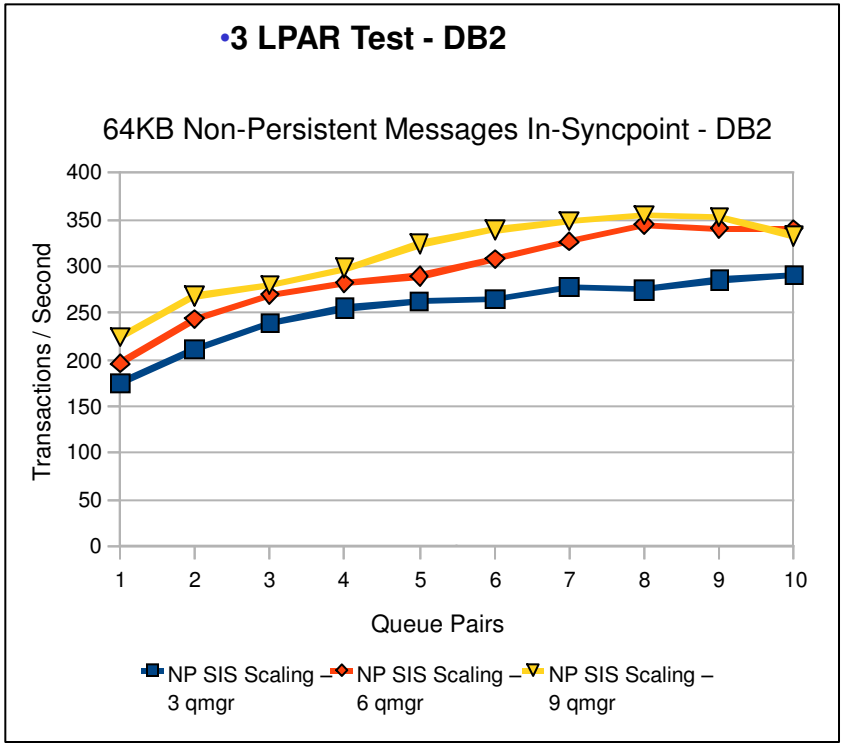


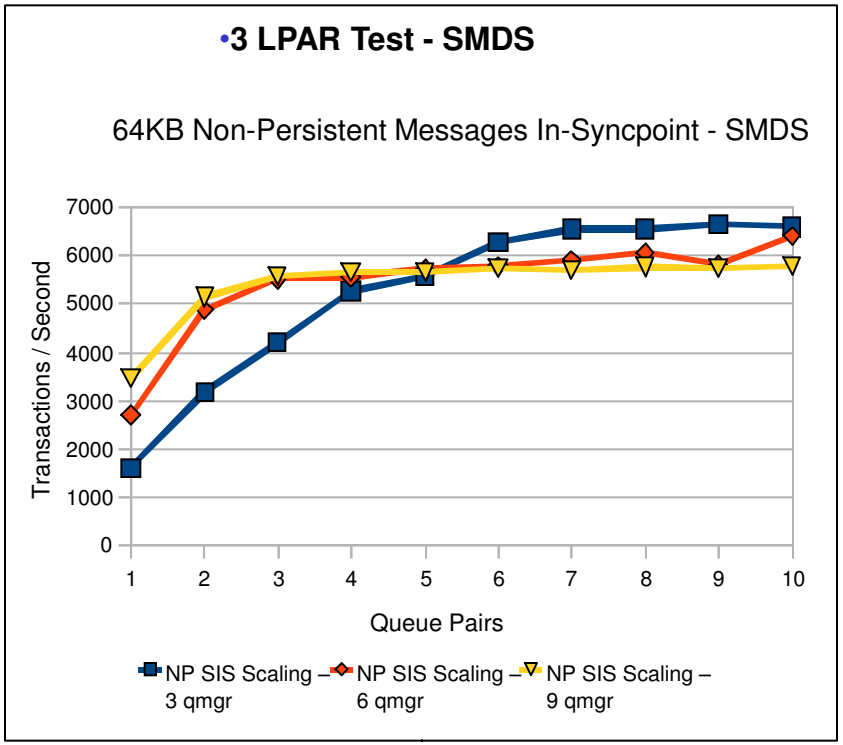
SMDS

Large Shared Queue Messages (using SMDS)



SMDS Performance Improvement





- Tests show comparable CPU savings making SMDS a more usable feature for managing your CF storage
- SMDS per CF structure provides better scaling than DB2 BLOB storage

Selecting which messages to offload

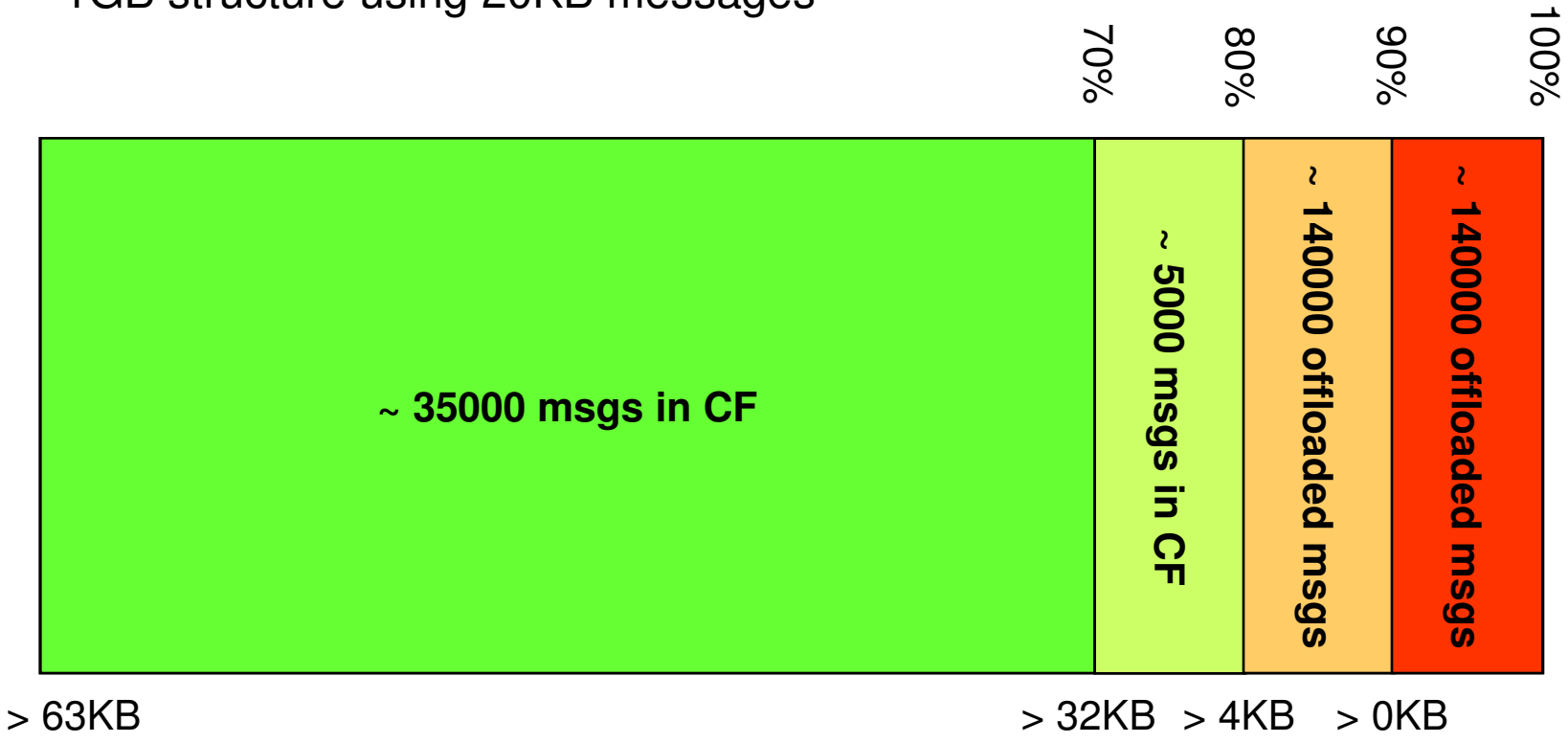
- Messages too large for CF entry (> 63K bytes) are always offloaded.
- Other messages may be selectively offloaded using offload rules.
  - Each structure has three offload rules, specified on the CFSTRUCT definition.
  - Each rule specifies message size in Kbytes and structure usage threshold, using two parameters:
    - OFFLDnSZ(size) and OFFLDnTH(percentage), where n = 1, 2, 3.
  - Data for new messages exceeding the specified size is offloaded (as for a large message) when structure usage exceeds the specified threshold.
  - Default rules are provided which should be useful in most cases.
  - Rules can be set to dummy values if not required.
- Without offloading data, it is possible to store 1.25M messages of 63KB on a 100GB structure
- When offloading all messages, possible to store approx 140M messages on the same structure, irrespective of message size

Typical use of offload rules

- The three offload rules have no fixed order but are typically intended to be used as follows:
  - Rule 1 is used to save space for fairly large messages by offloading them, with little performance impact, even when plenty of space left.
    - SMDS defaults: **OFFLD1SZ(32K)**, **OFFLD1TH(70)**
  - Rule 2 is used as an intermediate step between rules 1 and 3, to start saving more space as the structure usage increases, in exchange for a minor performance impact.
    - SMDS defaults: **OFFLD2SZ(4K)**, **OFFLD2TH(80)**
  - Rule 3 is used to maximize the remaining space when the structure is nearly full, by offloading everything possible.
    - SMDS defaults: **OFFLD3SZ(0K)**, **OFFLD3TH(90)**

Storage benefits of offloading

1GB structure using 20KB messages



~ 320000 msgs using offloading vs ~ 50000 without offloading

Creating a shared message data set

- SMDS is defined as a VSAM linear data set using IDCAMS **DEFINE CLUSTER**.
  - Requires **LINEAR** option.
  - Control interval size must be 4096, which is the default for linear.
  - Requires **SHAREOPTIONS(2 3)**, allowing one queue manager to write and other queue managers to read at the same time.
  - If maximum size may need to exceed 4GB, requires SMS data class which has VSAM extended addressability attribute.
  - If automatic expansion is to be supported, requires an appropriate secondary space allocation (although a default of 20% will be used if an expansion attempt fails because of no secondary allocation).
- Can optionally be pre-formatted, for example using CSQJUFMT.
  - Otherwise formatted automatically when first opened.

Creating a shared message data set

- The **DSGROUP** parameter on the **CFSTRUCT** definition specifies the group of data sets associated with the application structure.
  - It is specified as a generic data set name with a single asterisk as the point where the owning queue manager name is to be inserted.
  - It is required when the option **OFFLOAD**(**SMDS**) is specified.
- CSQ4SMDS in SCSQPROC provides JCL to define and format a single dataset

```
DEFINE CLUSTER                                          -
       (NAME(++HLQ++.++QMGR++.++CFSTRUCT++.SMDS)        -
        MEGABYTES(++PRI++ ++SEC++)                      -
        LINEAR                                          -
        DATACLAS(EXTENDED)                              -
        SHAREOPTIONS(2 3) )                             -
       DATA                                             -
       (NAME(++HLQ++.++QMGR++.++CFSTRUCT++.SMDS.DATA) )
```

Access to shared message data sets

- Shared message data sets must be on shared direct access storage accessible to all queue managers within the QSG.
- Normal running:
  - Queue manager opens own data set read/write.
    - Requires **UPDATE** access to own data set.
  - Queue manager opens other data sets read-only.
    - Requires **READ** access to all other data sets.
- Media recovery processing:
  - Queue manager performing recovery opens own data set and all other data sets for read/write access.
    - Requires **UPDATE** access to all data sets.

Shared message data set capacity considerations

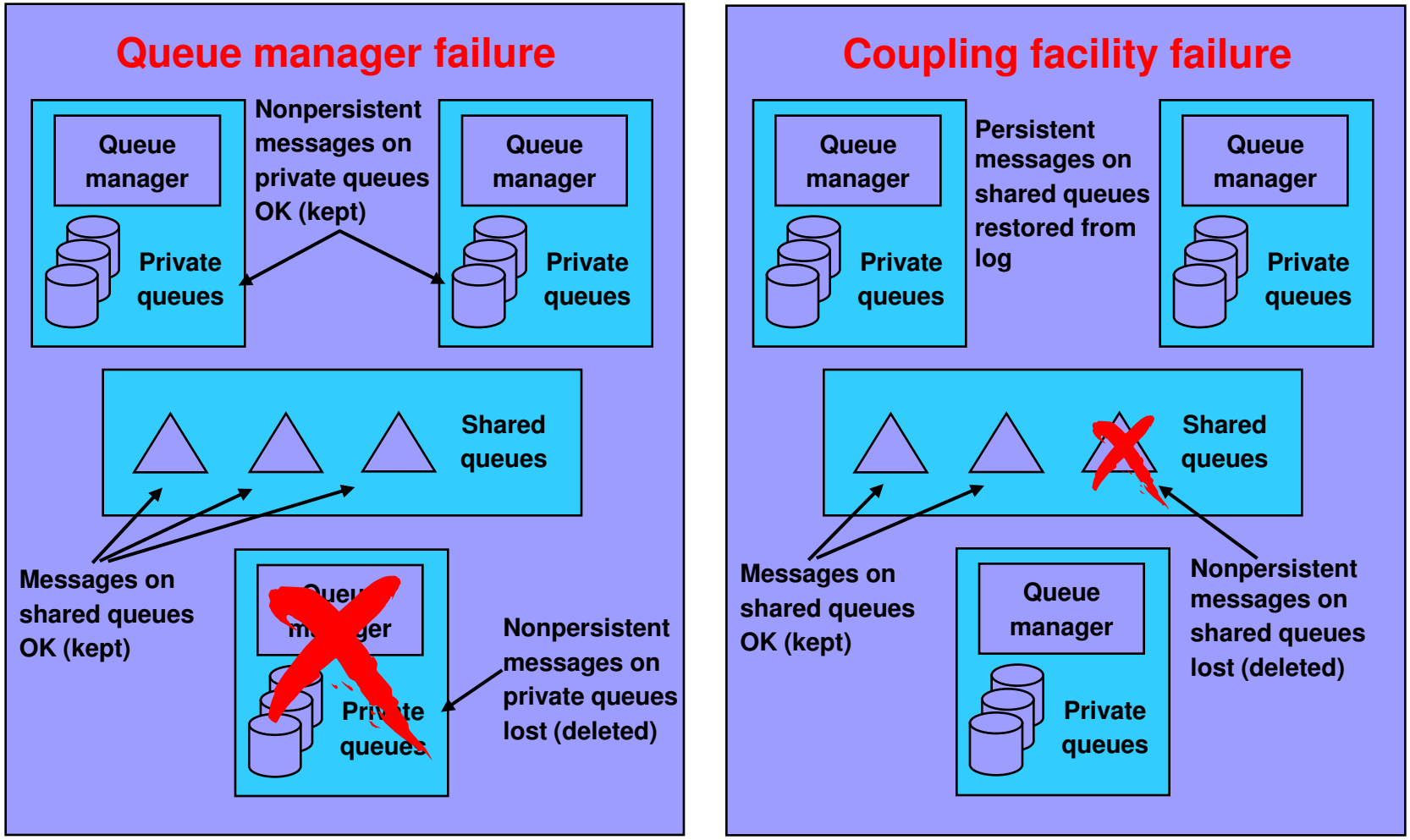
- Each shared message data set only contains data for large messages written via its owning queue manager.
- Message size calculation:
  - Each stored message includes standard headers (usually 352 bytes).
  - Each message is stored as one or more message blocks.
  - Each message block is stored in a range of consecutive 4K pages on the data set, with a very small header (32 bytes).
  - Approximate data set space required per large message, in bytes, is given by size of message plus header rounded up to next 4K.
- Multiply by maximum anticipated backlog of messages written via that queue manager (plus some safety margin) to estimate size needed for data set.

SMDS capacity considerations – expansion

- Data set can be automatically expanded when necessary.
  - Normally set by **DSEXPAND(YES|NO)** option on **CFSTRUCT**, which specifies default option for data set group.
  - Can also be overridden for individual data sets using **DSEXPAND** option on **ALTER SMDS**.
- Expansion attempt is automatically triggered when 90% full.
  - If no secondary allocation was specified, VSAM error message will appear, but queue manager will retry using a default secondary allocation of 20% of the existing size.
  - If expansion fails (not enough space available), queue manager sets **DSEXPAND(NO)** to prevent further attempts. Operator can use **ALTER SMDS** to set **DSEXPAND(YES)** again after problem is fixed.
  - If maximum extents are reached, data set cannot be expanded any further. (It could however be marked unavailable then copied to a larger data set which is then renamed back to the original name).

Structures – Persistence and Recovery

Failure and persistence

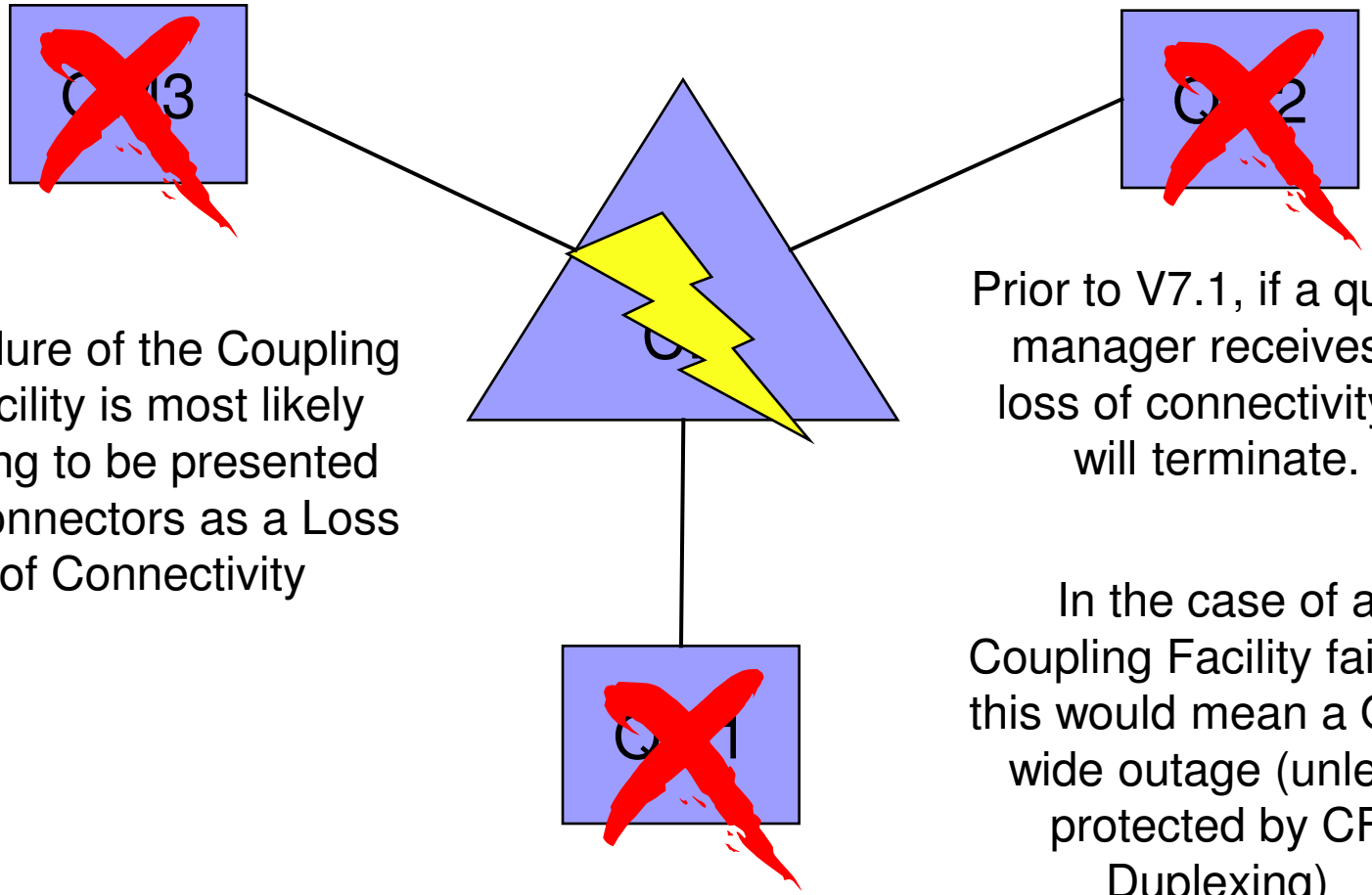


Admin Structure Recovery

- Prior to V7.0.1 each queue manager would rebuild own admin structure entries
  - Particularly an issue in a DR situation.
    - Need to start all queue managers to rebuild admin structure
    - Once recovered, application structures could be recovered
- At V7.0.1 active queue managers notice if other queue managers don’t have entries, and initiate rebuild on their behalf

CF Loss of Connectivity Tolerance

Pre V7.1 Queue Managers



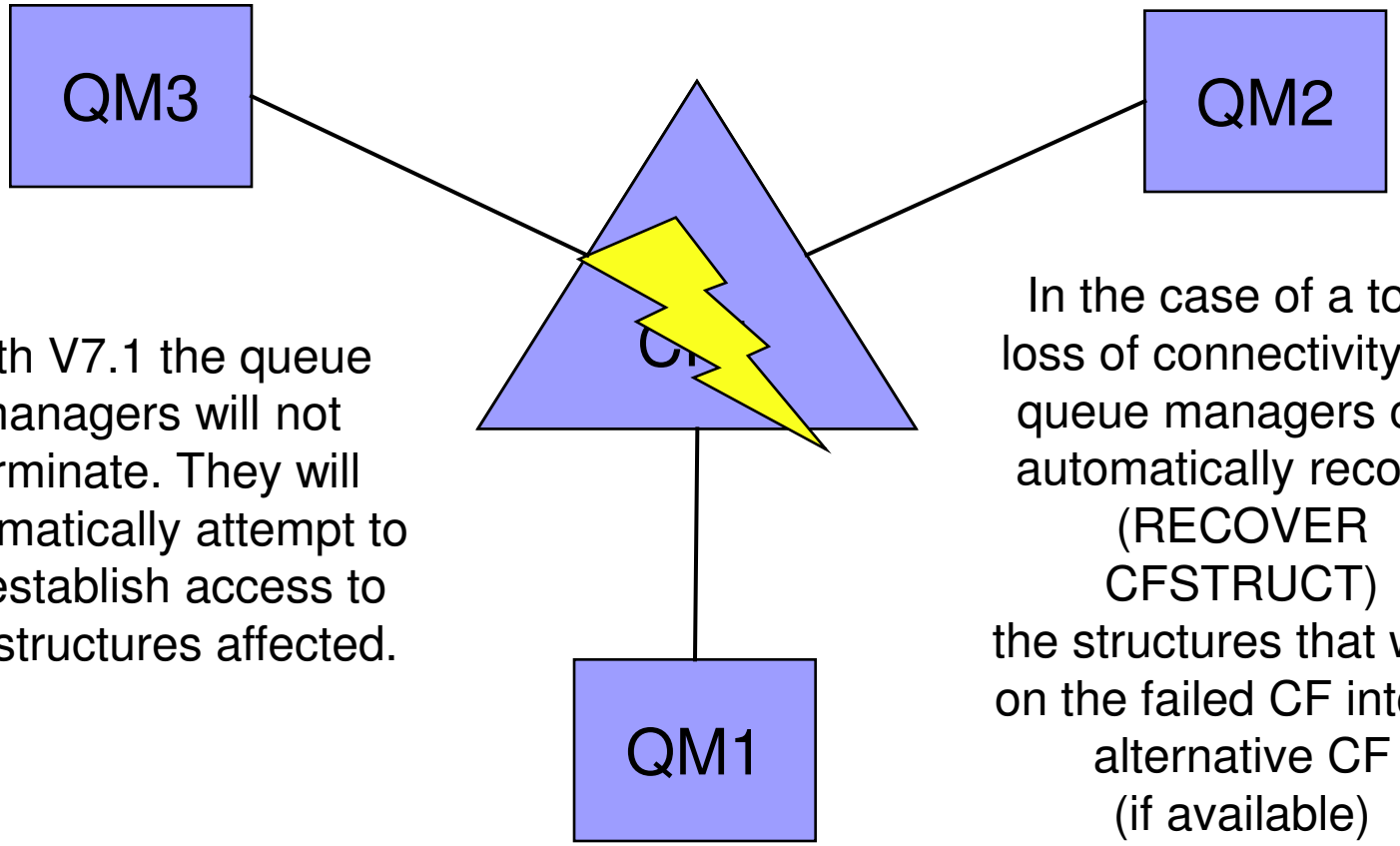
A failure of the Coupling Facility is most likely going to be presented to connectors as a Loss of Connectivity

Prior to V7.1, if a queue manager receives a loss of connectivity, it will terminate.

In the case of a Coupling Facility failure, this would mean a QSG wide outage (unless protected by CF Duplexing)

CF Loss of Connectivity Tolerance

V7.1+ Queue Managers



With V7.1 the queue managers will not terminate. They will automatically attempt to re-establish access to the structures affected.

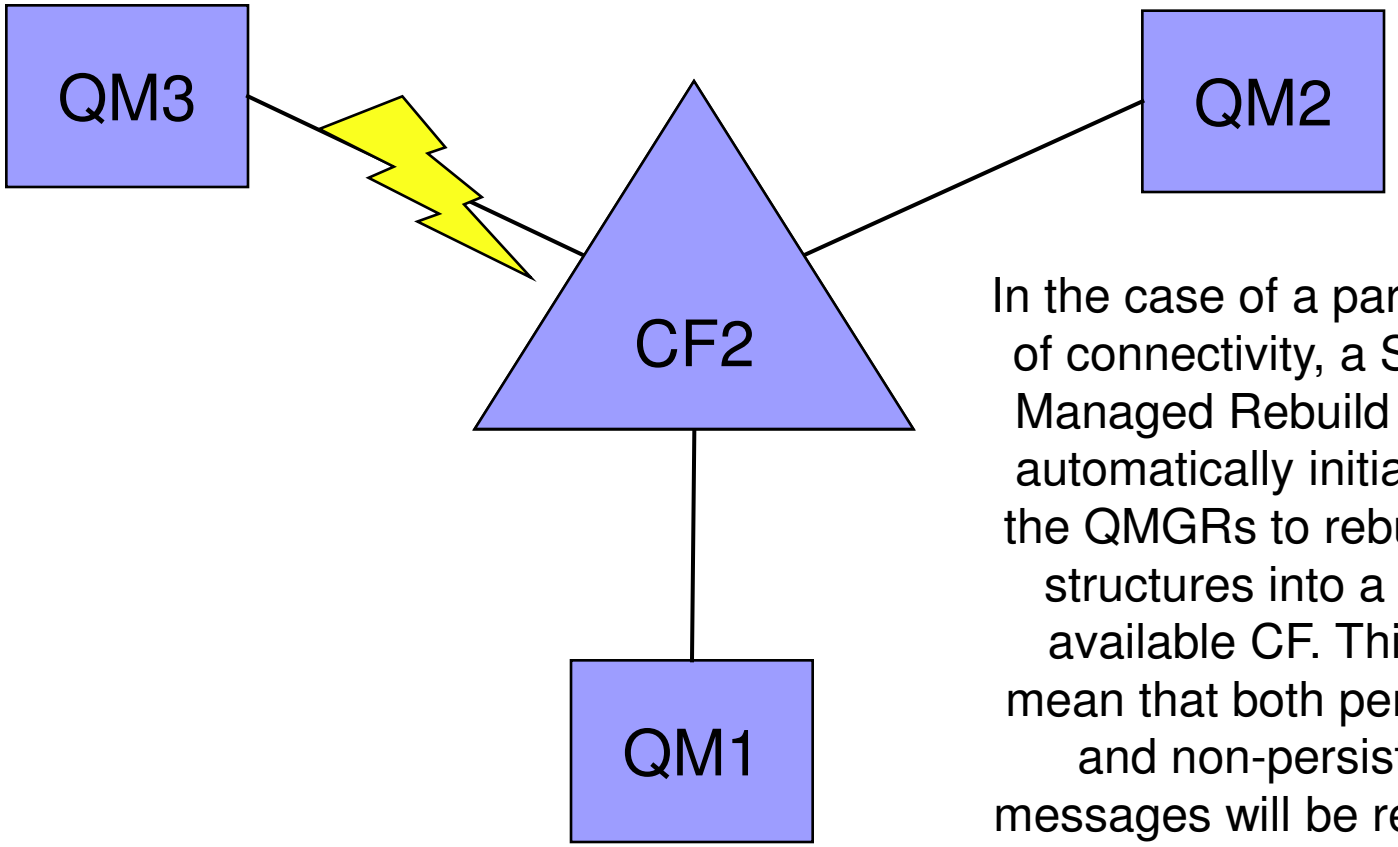
In the case of a total loss of connectivity the queue managers can automatically recover (RECOVER CFSTRUCT) the structures that were on the failed CF into an alternative CF (if available)

Total loss of connectivity - CFCONLOS(TOLERATE)

- Administration structure
  - The queue manager will not terminate and try and reconnect and rebuild its admin structure data
  - If the structure remains unavailable, some shared queue operations will be unavailable
  - Failure to connect to the admin structure during start up is not tolerated
- Application structures
  - Connection loss is partial if at least one system in the QSG still has connectivity to the CF the structure is allocated in
  - If total loss of connectivity, the structure is rebuild on an alternative CF if available
    - The structure is likely to be in a failed state and requires recovery

CF Loss of Connectivity Tolerance

V7.1+ Queue Managers



In the case of a partial loss of connectivity, a System Managed Rebuild will be automatically initiated by the QMGRs to rebuild the structures into a more available CF. This will mean that both persistent and non-persistent messages will be retained.

CF Loss of Connectivity Tolerance

- QMGR CFCONLOS(TERMINATE|TOLERATE)
  - Specifies whether loss of connectivity to the admin structure should be tolerated
  - Default is TERMINATE
  - Can only be altered to TOLERATE when all QSG members are at 7.1
- CFSTRUCT CFCONLOS(TERMINATE|TOLERATE|ASQMGR)
  - Specifies whether loss of connectivity to application structures should be tolerated
  - Only available at CFLEVEL(5)
  - Default is ASQMGR for new CFLEVEL(5) structures, and TERMINATE for structures altered to CFLEVEL(5)
- CFSTRUCT RECAUTO(YES|NO)
  - Specifies whether application structures should be automatically recovered
  - Only available at CFLEVEL(5)
  - Default is YES for new CFLEVEL(5) structure, and NO for structures altered to CFLEVEL(5)

CFRM Policy Considerations

```
•CFSTRUCT(TEST1)
    CFLEVEL(5)
    CFCONLOS(TOLERATE)
    RECAUTO(YES)
    OFFLOAD(SMDS)
ALLOWAUTOALT(YES)
PREFLIST(P5CF01,P5CF02)
```

```
STRUCTURE NAME(SQ27TEST1)
          SIZE(50000)
 INITSIZE(20000)
 DUPLEX(ALLOWED)
```

- If using CFCONLOS(TOLERATE) also need to consider multiple CFs in PREFLIST
- ALLOWAUTOALT(YES) enables CF to adjust entry/element ratio, and also automatically resize structure up to SIZE value (can also adjust down to MINSIZE!!)
- MQ structures can be duplexed… this will make most types of failures transparent to MQ

Client Channels

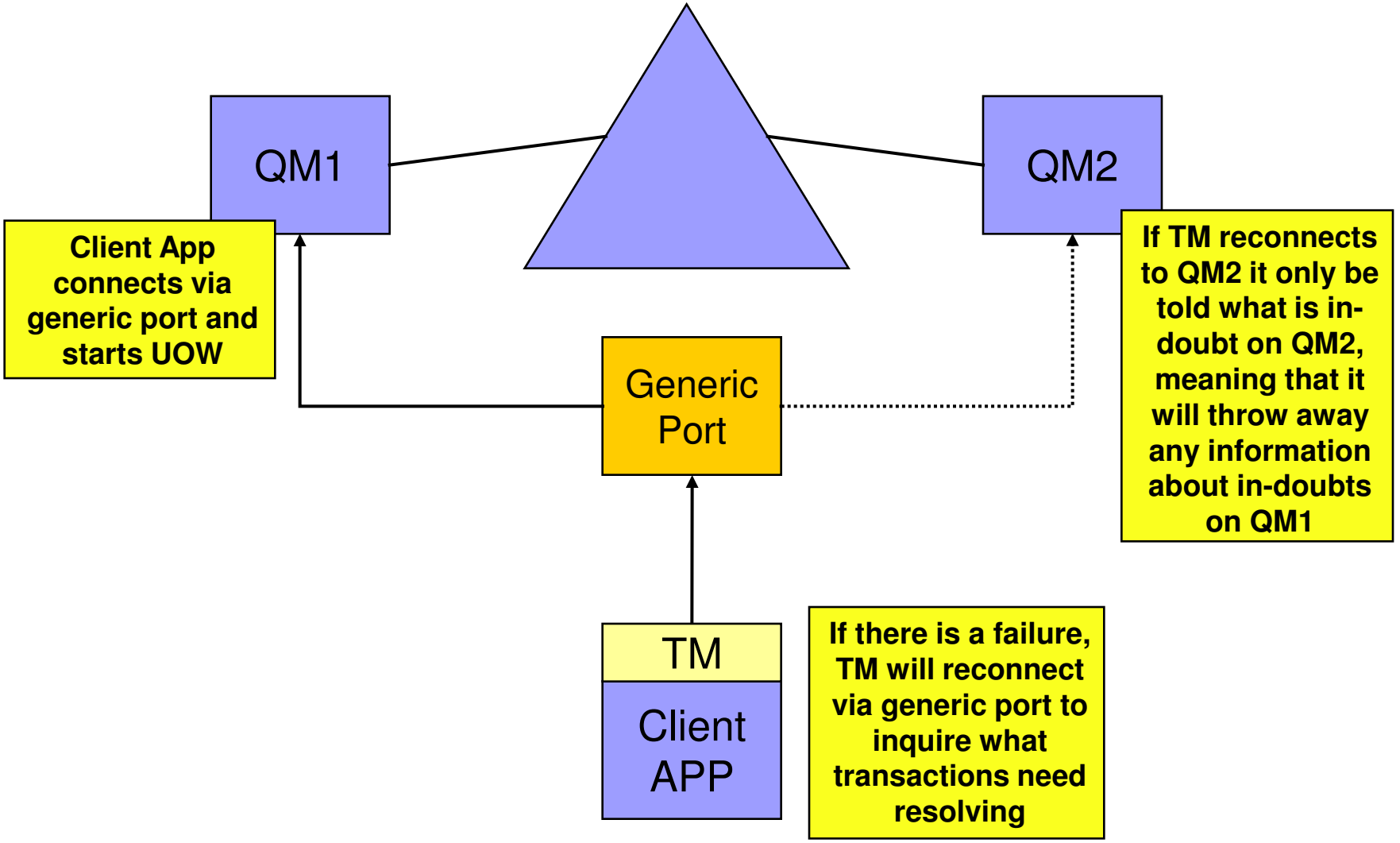
Client Channels

- Regular client channels are stateless, so don't use synchronization queues
  - Only benefit of using a shared channel is the shared status
  - Can cause performance issues if using shared channel
    - Needs to update DB2 status for each connect/disconnect
- Can configure a generic port to point at INDISP(QMGR) listener on each queue manager
  - Can still benefit from failover and balancing of client connections without using a shared channel, and can still use QSG name on the MQCONN
- Will not work for Extended Transactional Client (including WAS 2-Phase Commit over client conn) until at V7.0.1

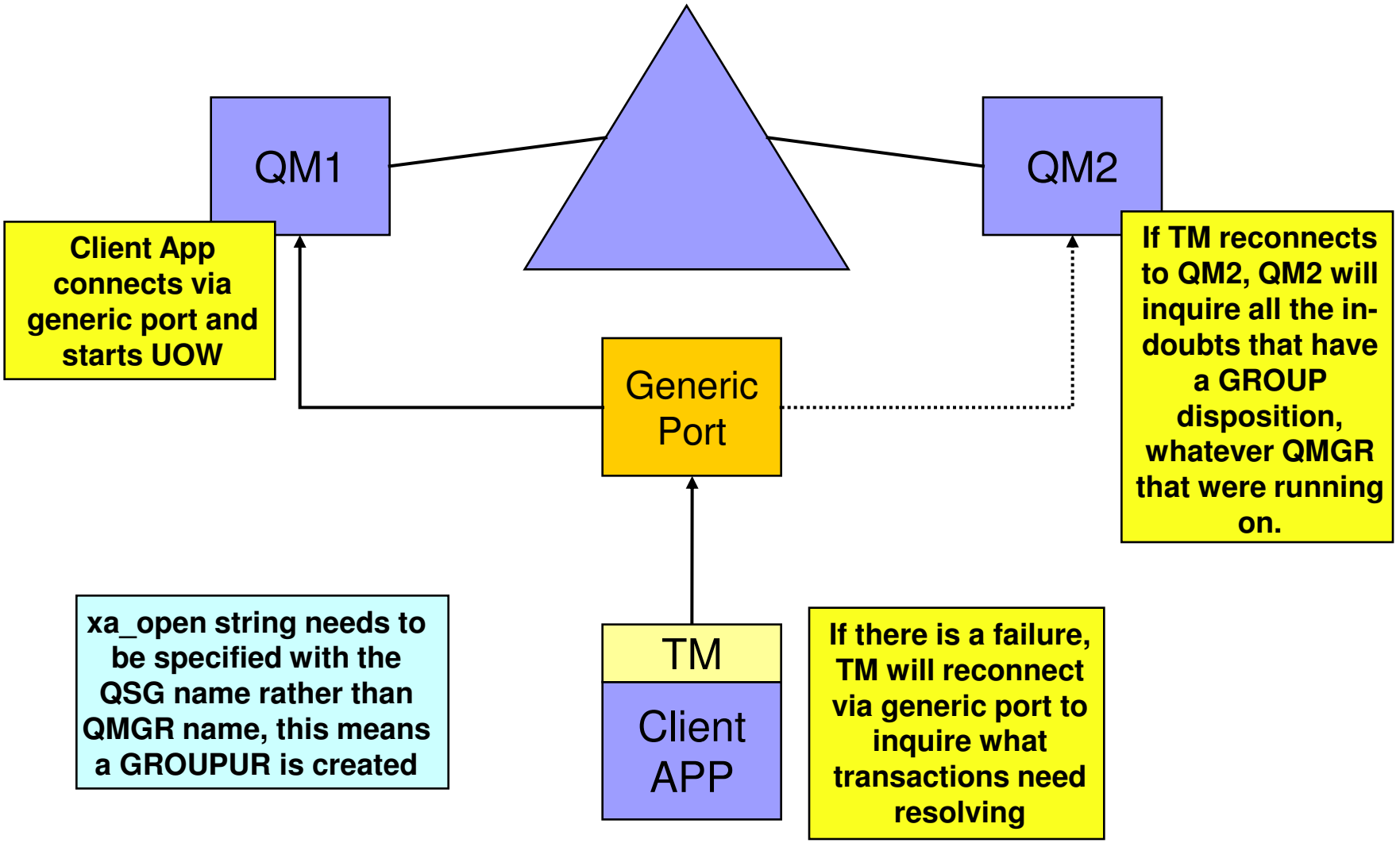
2-Phase Commit Client Connections

- When setting up the connection, specify the QSG name rather than QMGR name
  - In MQConnectionFactory if using JMS under WAS, you must ensure that you are only using shared resources
  - This causes a UR with GROUP disposition to be created, rather than QMGR
  - A GROUP UR can be inquired and resolved via any member of the QSG
    - If there is a failure, the transaction manager will reconnect to the QSG and request a list of in-doubt transactions. GROUP URs will be reported back no matter what QMGR they were started on

GROUPUR – The Problem (Pre V7.0.1)



GROUPUR – The Solution (V7.0.1)



More Information

- WebSphere MQ for z/OS Concepts and Planning Guide
- SupportPacs MP16, MP1E, MP1F, MQ1G
  - www.ibm.com/software/integration/support/supportpacs/perfreppacs.html
- RedPaper 3636 – WebSphere MQ Queue Sharing Group in a Parallel Sysplex environment
  - www.redbooks.ibm.com/redpieces/pdfs/redp3636.pdf

Any questions?

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