



IBM Software Group

Q Replication: a Solution for Continuous DB2 Availability and Lots of Cool New Features!

IBM Information Management software



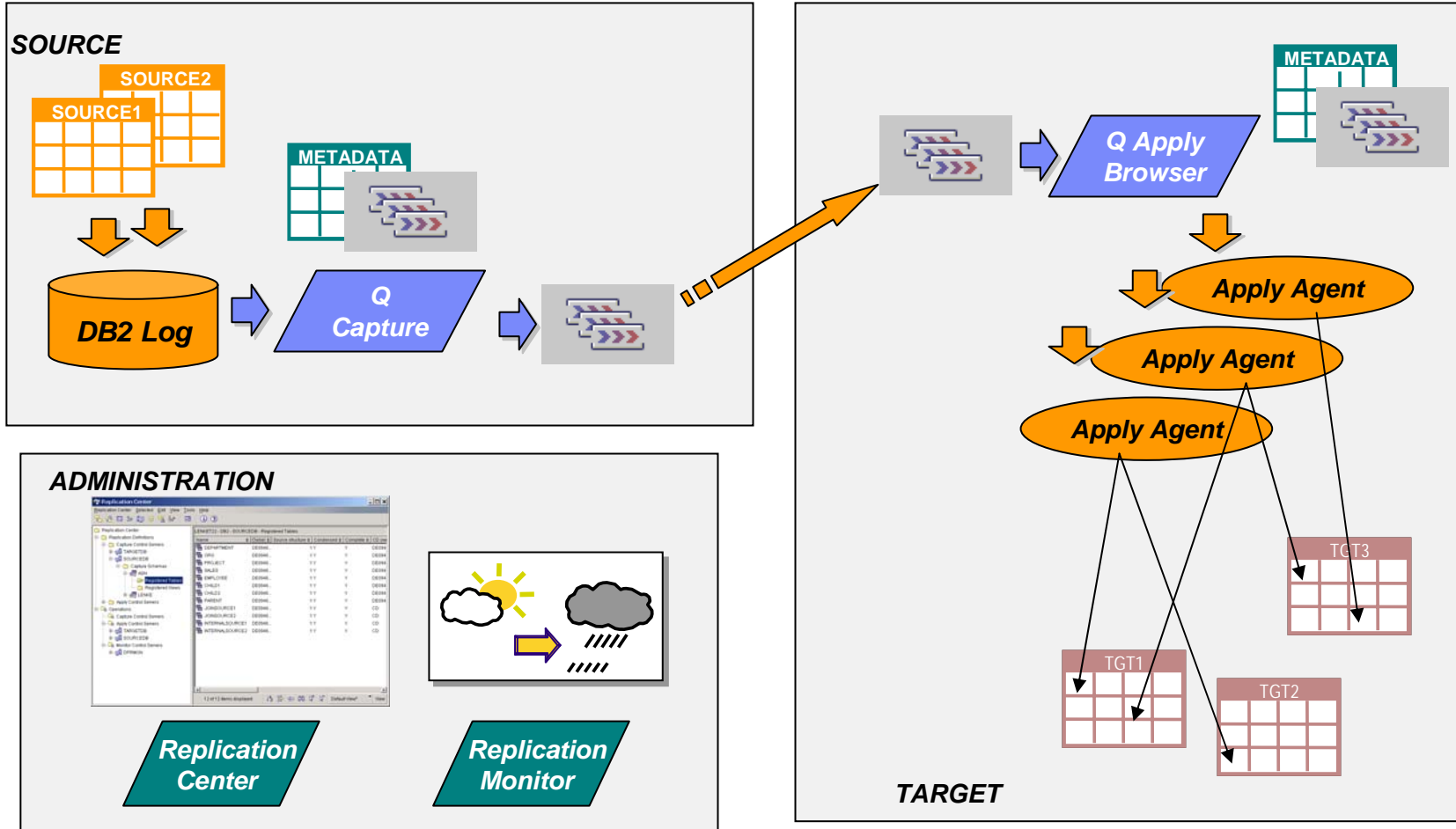
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ON DEMAND BUSINESS™

Agenda Topics

- A quick review of the basics
- Q Replication as a continuous availability solution
- New Product Features
- New Features on the Web

Q Replication Basics



Continuous Availability – What is your Scenario?



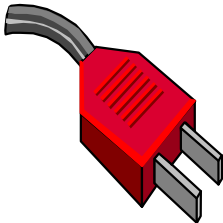
■ Planned Outage

- ▶ scheduled outages are still a necessity for most organizations
- ▶ includes application changes, software and hardware upgrades, and migrations in addition to utility operations
- ▶ typically handled with a local copy



■ Unplanned Outage - Failover or Hot Standby

- ▶ localized failure
- ▶ temporary or permanent outage of primary source
- ▶ typically handled with a local copy



■ Disaster Recovery

- ▶ widespread failure
- ▶ temporary or permanent outage of primary source
- ▶ typically handled with a remote copy



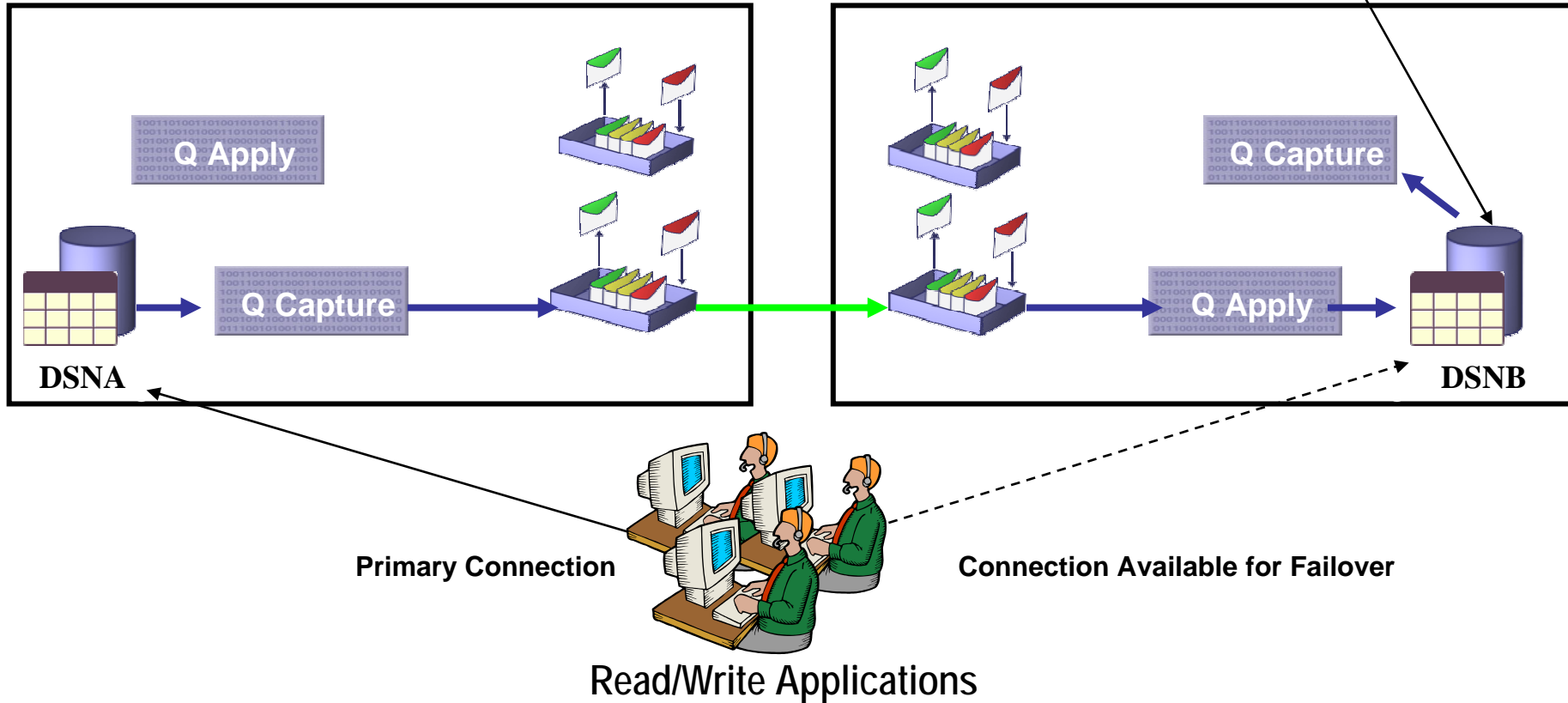
■ Global Distribution and Redundancy of Data

- ▶ geographical distribution of data for improved local access
- ▶ redundancy of data for continuity of business
- ▶ typically handled with multiple remote copies

Continuous Availability using Q Replication

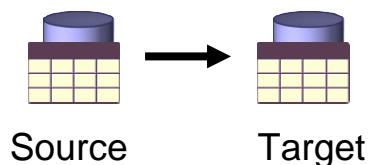


Read Only Applications



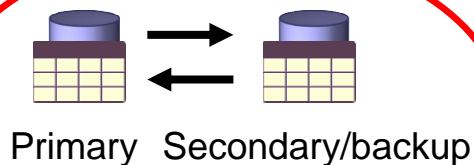
- Q Replication provides a solution for continuous availability where the active secondary system is also available for other applications

Possible Q Replication Configurations for CA



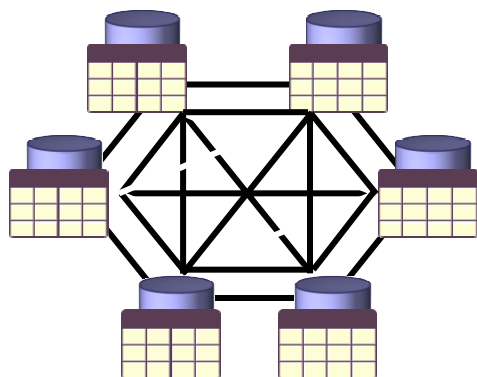
■ Unidirectional

- ▶ Changes are replicated in one direction between two servers (i.e. from source to target)
- ▶ Changes can be filtered and transformed



■ Bidirectional

- ▶ Changes are replicated in two directions between two servers
- ▶ Conflicts determined based on data values, one server designated as winner



■ Peer to peer

- ▶ Changes are replicated between 2 or more servers
- ▶ Conflicts determined by most recent timestamp, no master copy

Why Use Q Replication for Continuous Availability?

■ Advantages

- ▶ Allows the fastest switchover with transactionally consistent data
- ▶ Excellent solution for scheduled outage
 - Allows flexibility of OS level, DB level, application level, data format
 - Can be easily tested and monitored
- ▶ Allows for database read or write activity on secondary
 - secondary site may be used for other applications
 - is the only solution for geographically dispersed updateable databases
- ▶ Can supplement other HA solutions
 - eg hardware for local failover + Q Replication for long distance DR
- ▶ Allows for lower cost hardware or platform
- ▶ Low impact on source applications

■ Disadvantages

- ▶ Asynchronous
 - Data can be temporarily or permanently lost in a failure scenario
- ▶ Application awareness is required (triggers for example)



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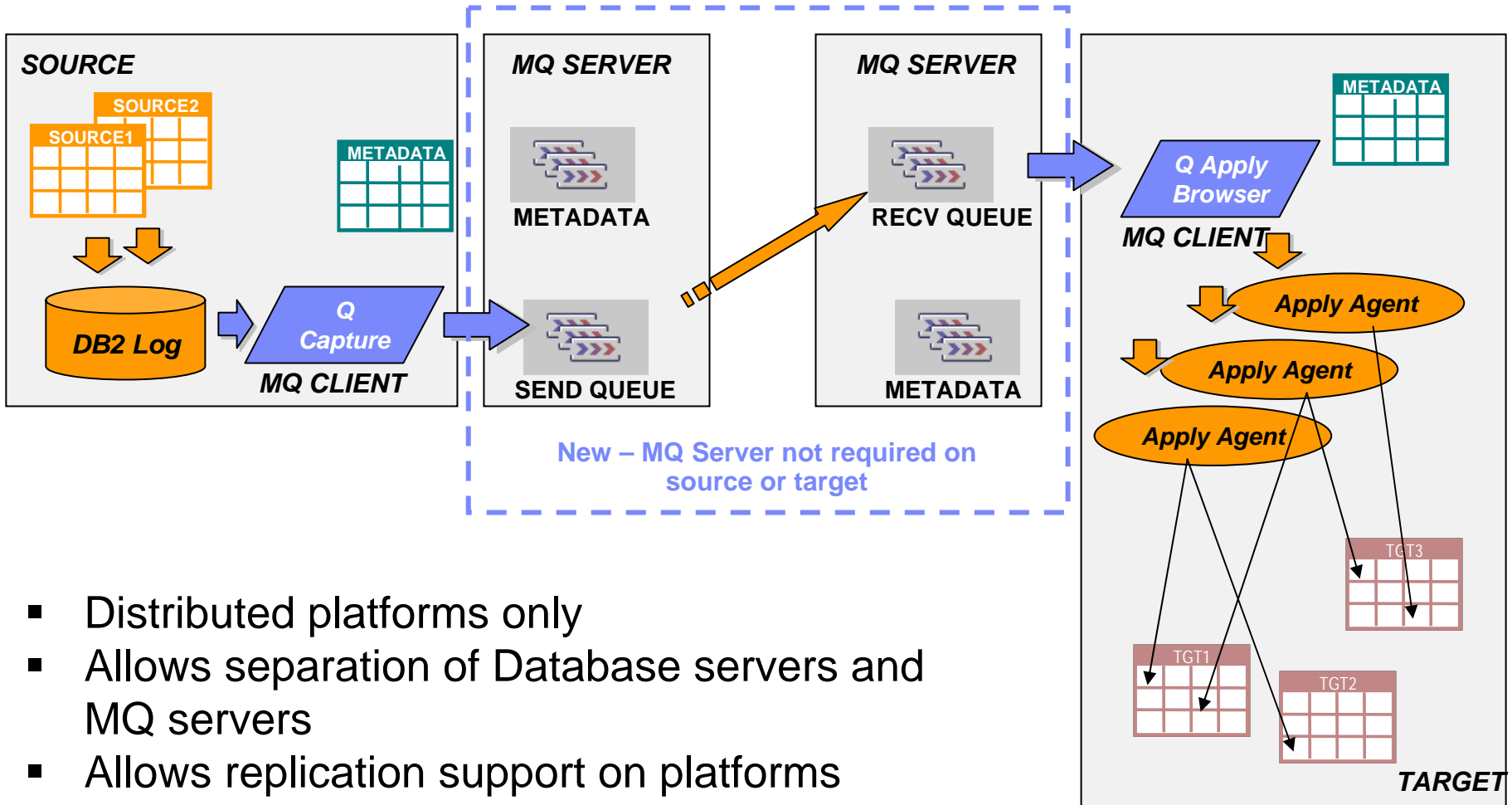
New Product Features

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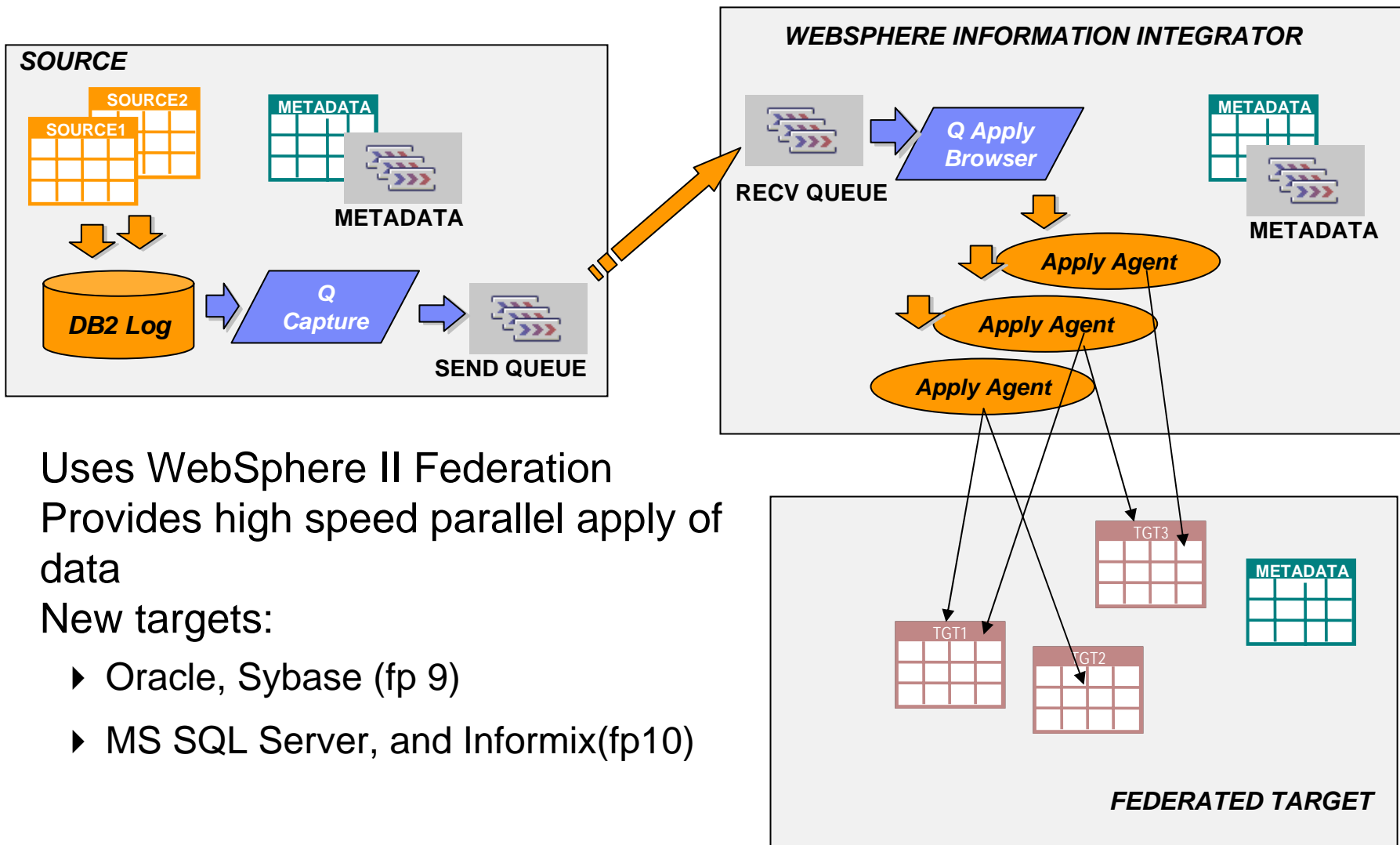
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New in 2005 – MQ Client Support



- Distributed platforms only
- Allows separation of Database servers and MQ servers
- Allows replication support on platforms which currently lack MQ Server support

New in 2005 – Federated Targets



- Uses WebSphere II Federation
- Provides high speed parallel apply of data
- New targets:
 - ▶ Oracle, Sybase (fp 9)
 - ▶ MS SQL Server, and Informix(fp10)

Other Improvements in 2005

- Allow user provided model queue name
 - ▶ For dynamic spill queues
- Replication Center – support for single sign on
- Replication center – queue map dialog “facelift”
 - ▶ We’ll take a look at that in the next section
- Alter Add Column Signal extended to P2P and Bidirectional
- Remove nuisance exceptions in applying cascade deletes
- Replication Center and Q Apply now support tables with no unique index defined



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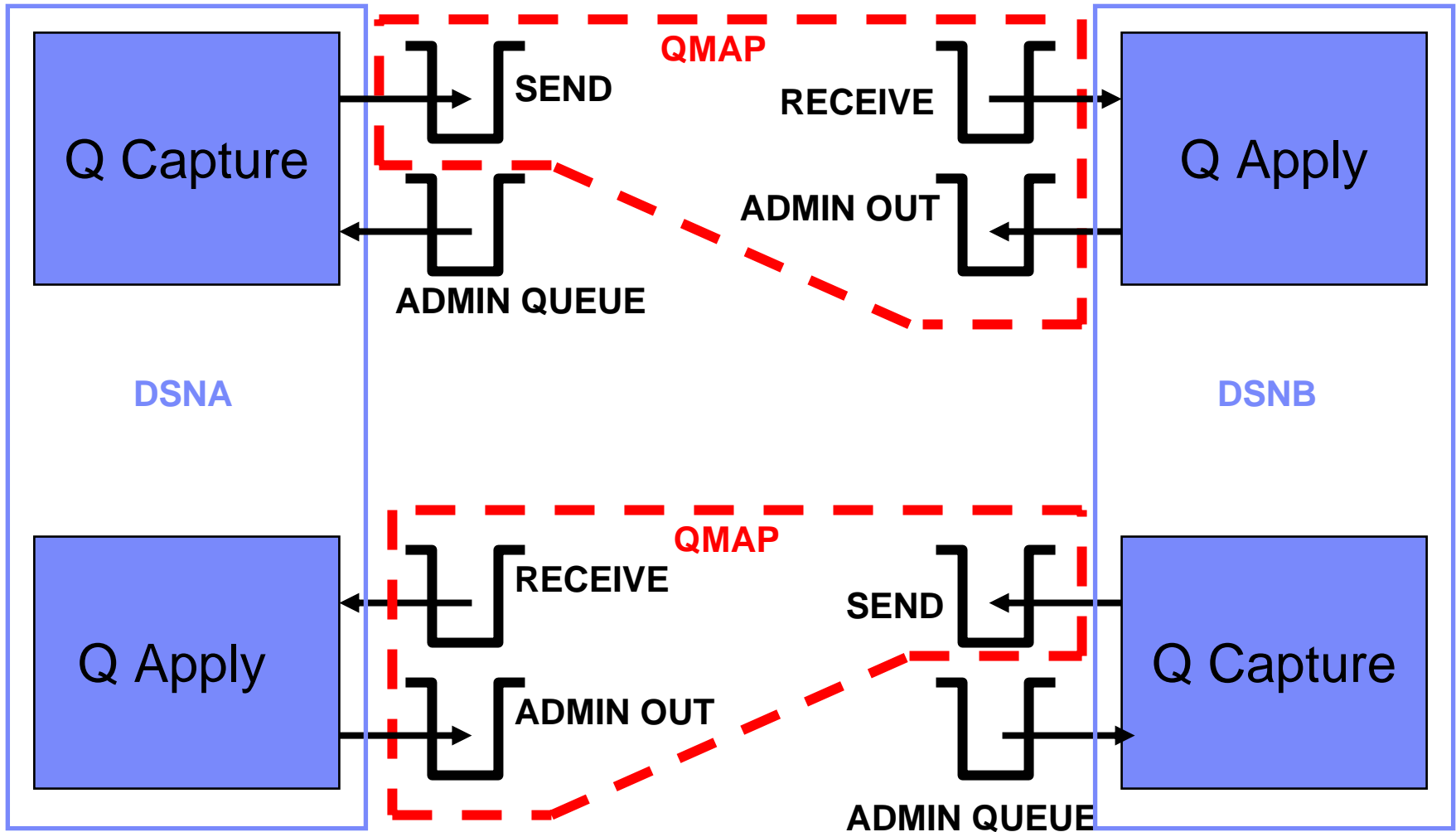
New Features on the Web

IBM **Information Management** software



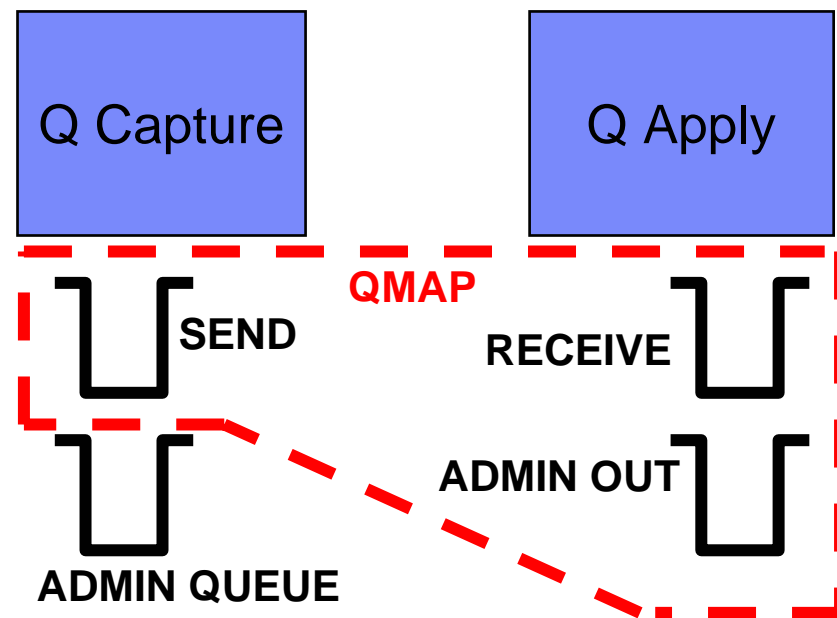
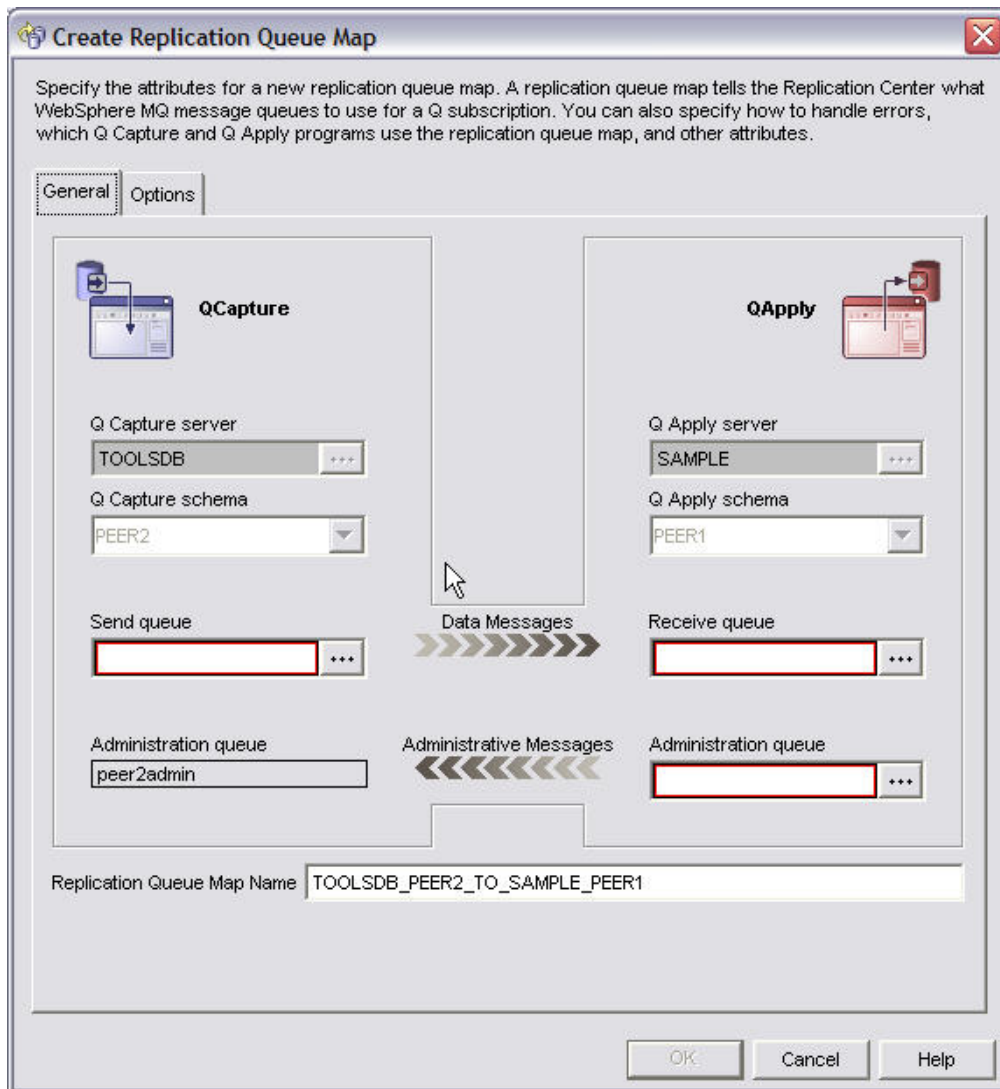
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Replication Queue Maps



- Early users found defining these was a bit tricky....

NEW!!! In Fixpak 10 – Replication Queue Map “Facelift”



- So we made it easier!!!

NEW!!! In Fixpak 10 – Replication Queue Map “Facelift”

Create Replication Queue Map

Specify the attributes for a new replication queue map. A replication queue map tells the Replication Center what WebSphere MQ message queues to use for a Q subscription. You can also specify how to handle errors, which Q Capture and Q Apply programs use the replication queue map, and other attributes.

General | Options

QCapture

Q Capture server:

Q Capture schema:

Send queue:

Administration queue:

QApply

Q Apply server:

Q Apply schema:

Receive queue:

Administration queue:

Data Messages →

← Administrative Messages

Replication Queue Map Name:

OK Cancel Help

Create Replication Queue Map - DSNAQREP

HAMELHOME - DB2 - DSNA - DSNAQREP

Specify the attributes for a new replication queue map that you can use with Q subscriptions. A replication queue map tells the Replication Center what WebSphere MQ message queues to use for a Q subscription. You can also specify how to handle errors, which Q Capture and Q Apply programs use the replication queue map, and other attributes.

General | Properties

Q Apply information

Q Apply server: (DSNB)

Q Apply schema:

WebSphere MQ queues

Send queue:

Receive queue:

Administration queue:

Replication queue map options

Maximum message length: KB

Options for handling queue errors:

Number of Q Apply agents:

Memory buffer for receive queue: MB

Allow the Q Capture program to send heartbeat messages

Interval between heartbeat messages: seconds

OK Cancel Help

New Improved Panel

Old Panel

NEW!!! Downloadable SP Provides Enhanced MQ Usability

Specify the attributes for a new replication queue map. A replication queue map tells the Replication Center what WebSphere MQ message queues to use for a Q subscription. You can also specify how to handle errors, which Q Capture and Q Apply programs use the replication queue map, and other attributes.

General Options

QCapture

Q Capture server
TOOLSDB

Q Capture schema
PEER2

Send queue
...

Administration queue
peer2admin

QApply

Q Apply server
SAMPLE

Q Apply schema
PEER1

Receive queue
...

Administration queue
...

Data Messages

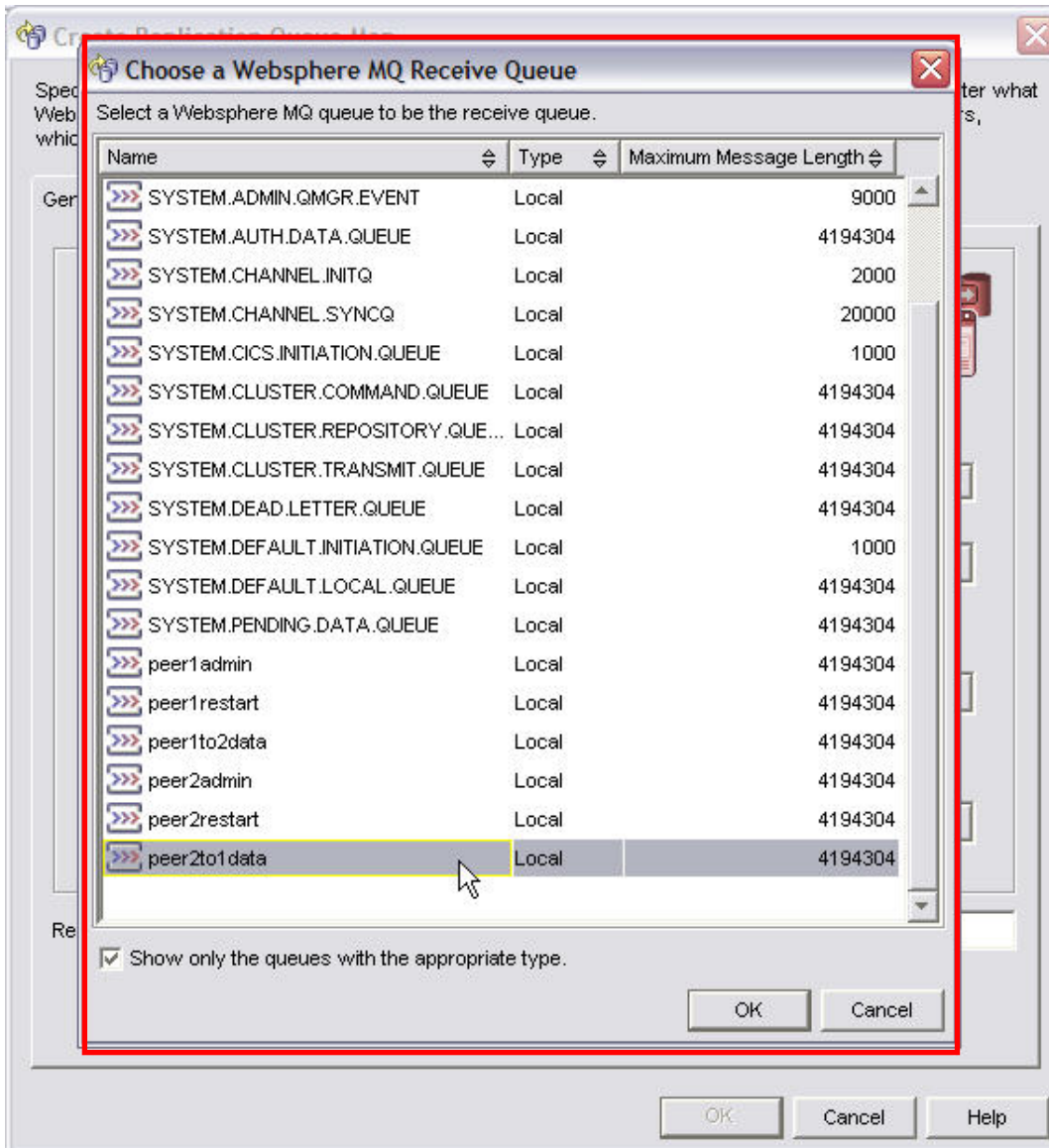
Administrative Messages

Replication Queue Map Name
TOOLSDB_PEER2_TO_SAMPLE_PEER1

OK Cancel Help

- When you have the stored procedure installed at the DB2 LUW server...
- ...The ellipsis allows you to choose existing queues

NEW!!! Downloadable SP Provides Enhanced MQ Usability



- Enhanced MQ Features available only when using MQ Servers – not supported at sites with MQ Client
- Available only on DB2 LUW servers
- Stored Procedure available via web download – requires fixpak 10

NEW!!! Downloadable SP Provides Enhanced MQ Usability

Specify the attributes for a new replication queue map. A replication queue map tells the Replication Center what WebSphere MQ message queues to use for a Q subscription. You can also specify how to handle errors, which Q Capture and Q Apply programs use the replication queue map, and other attributes.

General Options

QCapture

Q Capture server
TOOLSDB

Q Capture schema
PEER2

Send queue
peer2to1 data

Administration queue
peer2admin

QApply

Q Apply server
SAMPLE

Q Apply schema
PEER1

Receive queue
peer2to1 data

Administration queue
peer2admin

Data Messages

Administrative Messages

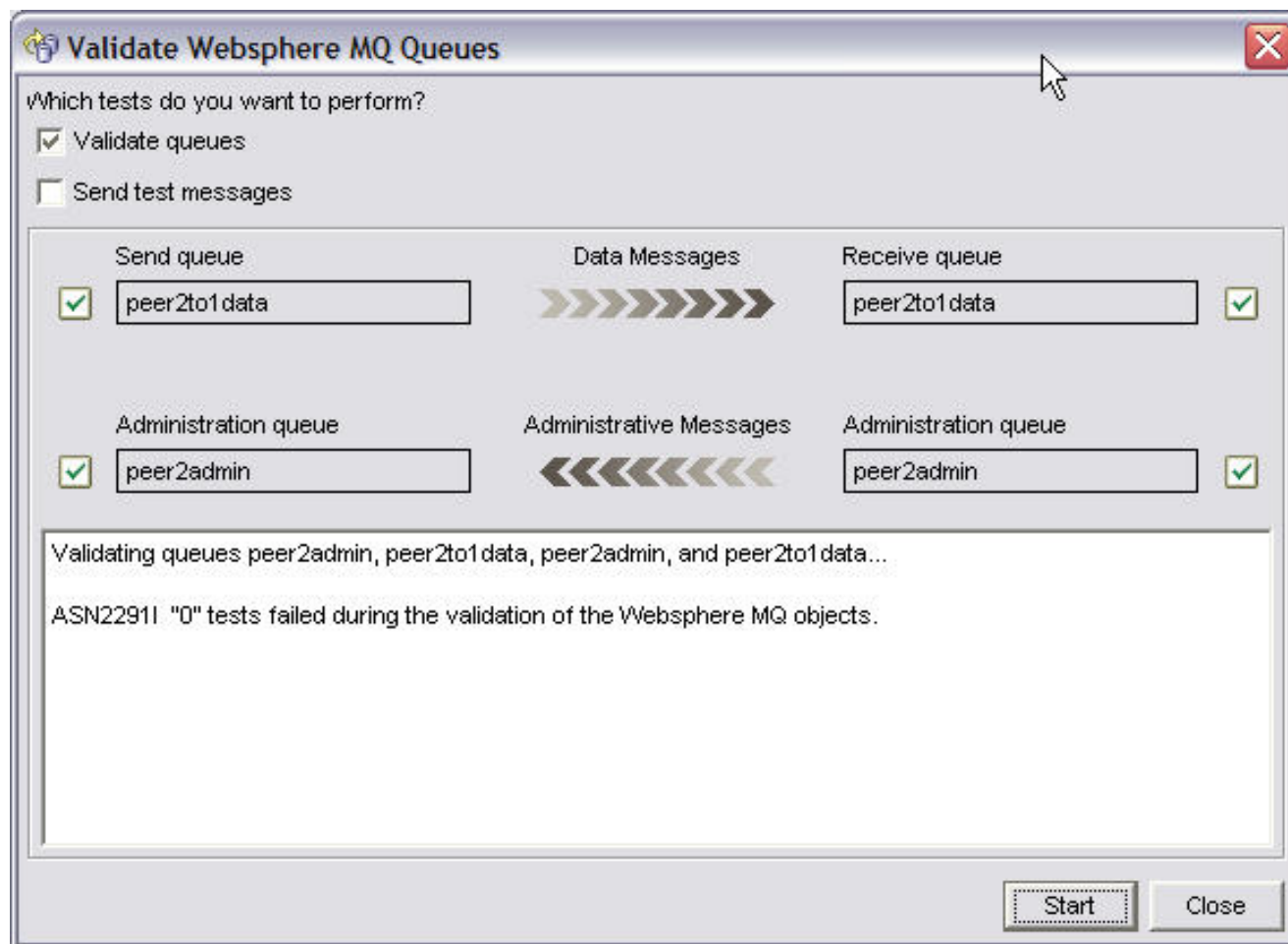
Replication Queue Map Name
TOOLSDB_PEER2_TO_SAMPLE_PEER1

[Validate queues](#)

OK Cancel Help

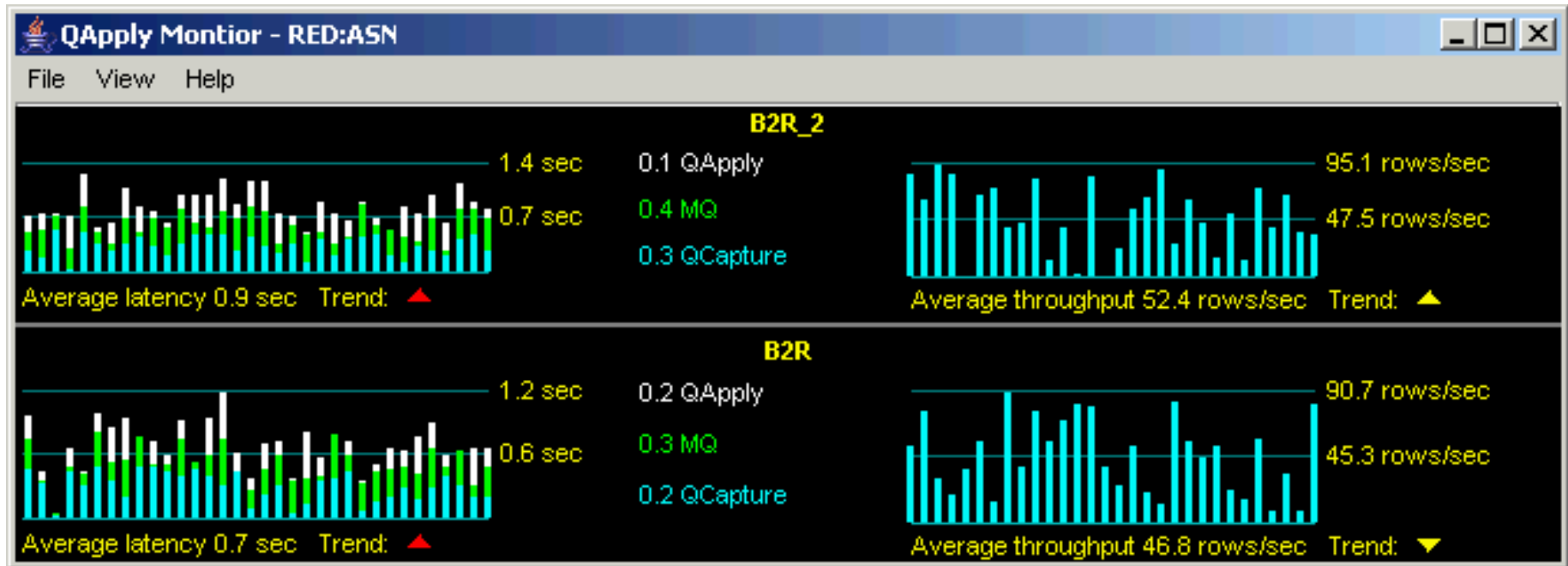
- When you have filled in the queue names on the page...
- The stored procedure enhancement allows you to validate existing queues

NEW!!! Downloadable SP Provides Enhanced MQ Usability



Reducing chances of configuration failures...

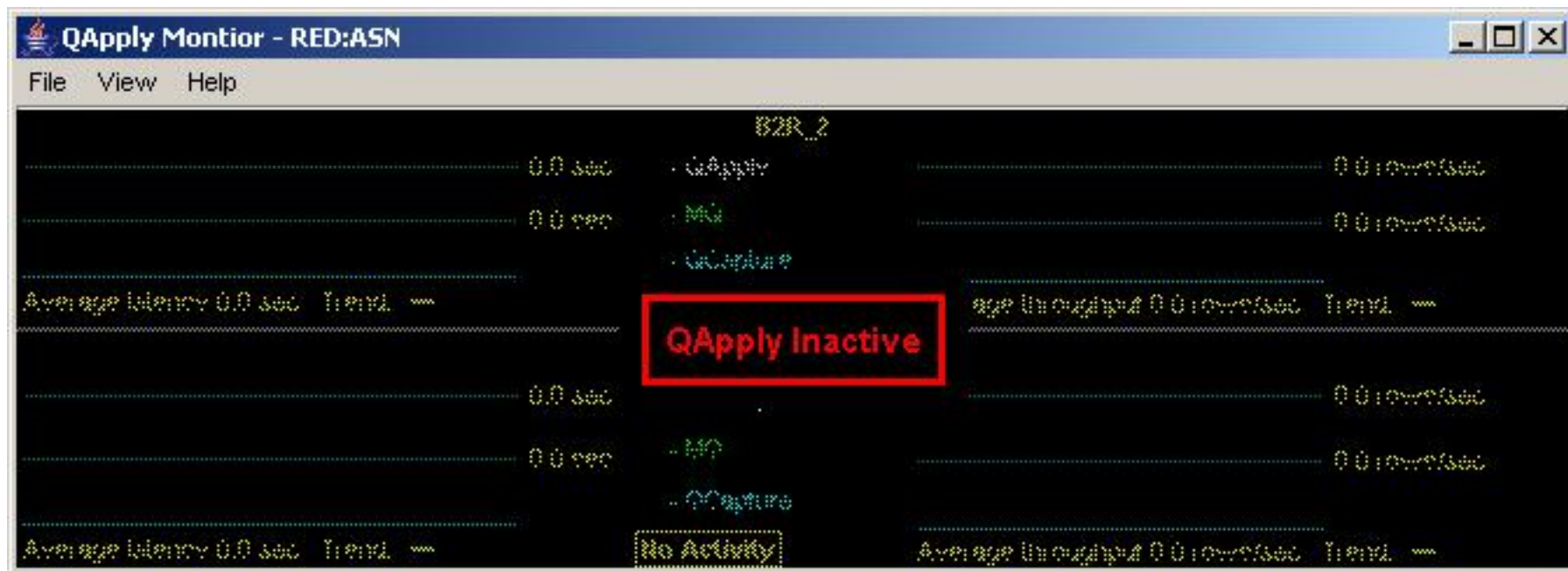
NEW!!! Live Monitor – Q Apply



From the Q Apply side of the replication, we have an end to end view and a breakdown of where time is spent:

- End-to-end latency information per Queue (on left)
 - Color coded for different components of latency
- Throughput information per Queue (on right)
- Each bar represents one MONITOR_INTERVAL of time

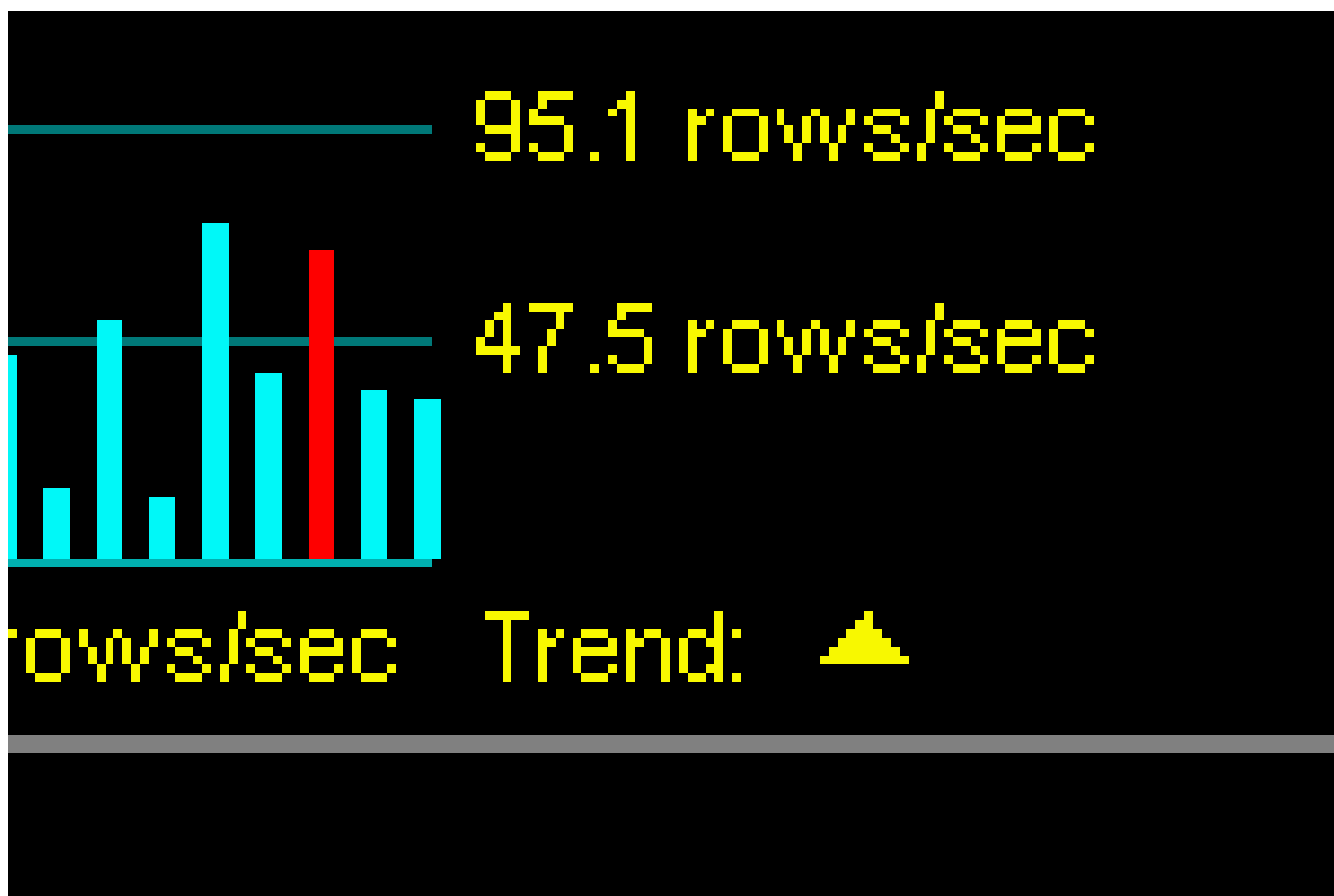
NEW!!! Live Monitor – Q Apply



If the Q Apply becomes inactive, the live monitor will display this behavior

Identifying Exceptions

- The Live Monitor displays exception rows with a red bar



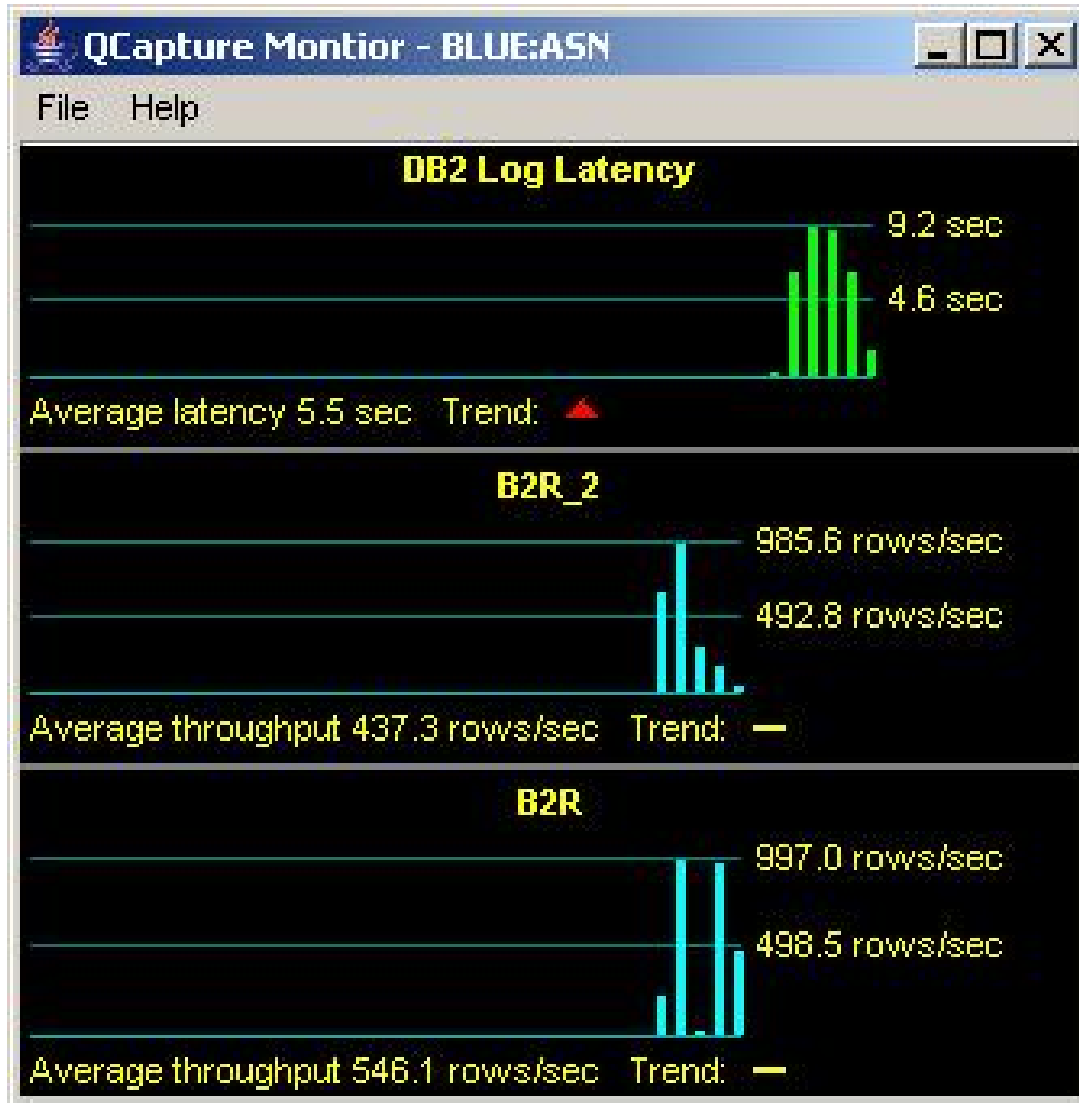
Exceptions Table Formatter

- Exceptions are viewable as text in a web browser.

The screenshot shows the QApply Monitor application interface. On the left, there are two bar charts showing average latency (0.9 sec and 0.7 sec) and a menu for 'Exceptions' with options: Last Minute, Last 10 Minutes, Last Hour, Last Day, and All. The main display area shows performance metrics for 'B2R_2' and 'B2', including QApply, MQ, and QCapture counts, and throughput graphs (95.1, 47.5, and 52.4 rows/sec). An inset window titled 'RED:ASN QApply Exceptions' shows a table of exception records.

Time	Exception
2005-12-14 13:42:47.622002	<pre> RECVQ = B2R SRC_COMMIT_LSN = x'0000000000000890332F' SRC_TRANS_TIME = 2005-12-14 21:42:45.000002 SUBNAME = TOM10001 REASON = NOTFOUND SQLCODE = 100 SQLSTATE = 02000 SQLERRMC (EB CDC) = ??? (ASCII) = (HEX) = 202020202020...20 IS_APPLIED = N CONFLICT_RULE = K Database name = RED Source Table Owner = null Source Table Name = null Row Operation = Delete Columns : Column Name = C1 Is Key = true Value = 255 </pre>
2005-12-14 13:42:47.622001	<pre> RECVQ = B2R SRC_COMMIT_LSN = x'0000000000000890332F' SRC_TRANS_TIME = 2005-12-14 21:42:45.000002 SUBNAME = TOM10001 REASON = NOTFOUND </pre>

NEW!!! Live Monitor – Q Capture



- Overall QCapture log latency displayed
- Queue by queue capture throughput

Q Replication dashboard

- A new graphical tool.
- Gives a dashboard view of your replication setup.

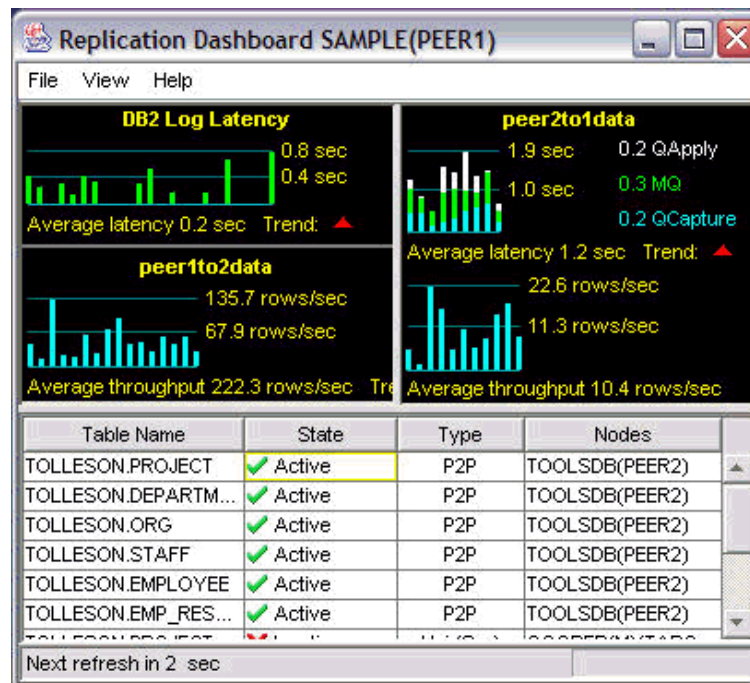
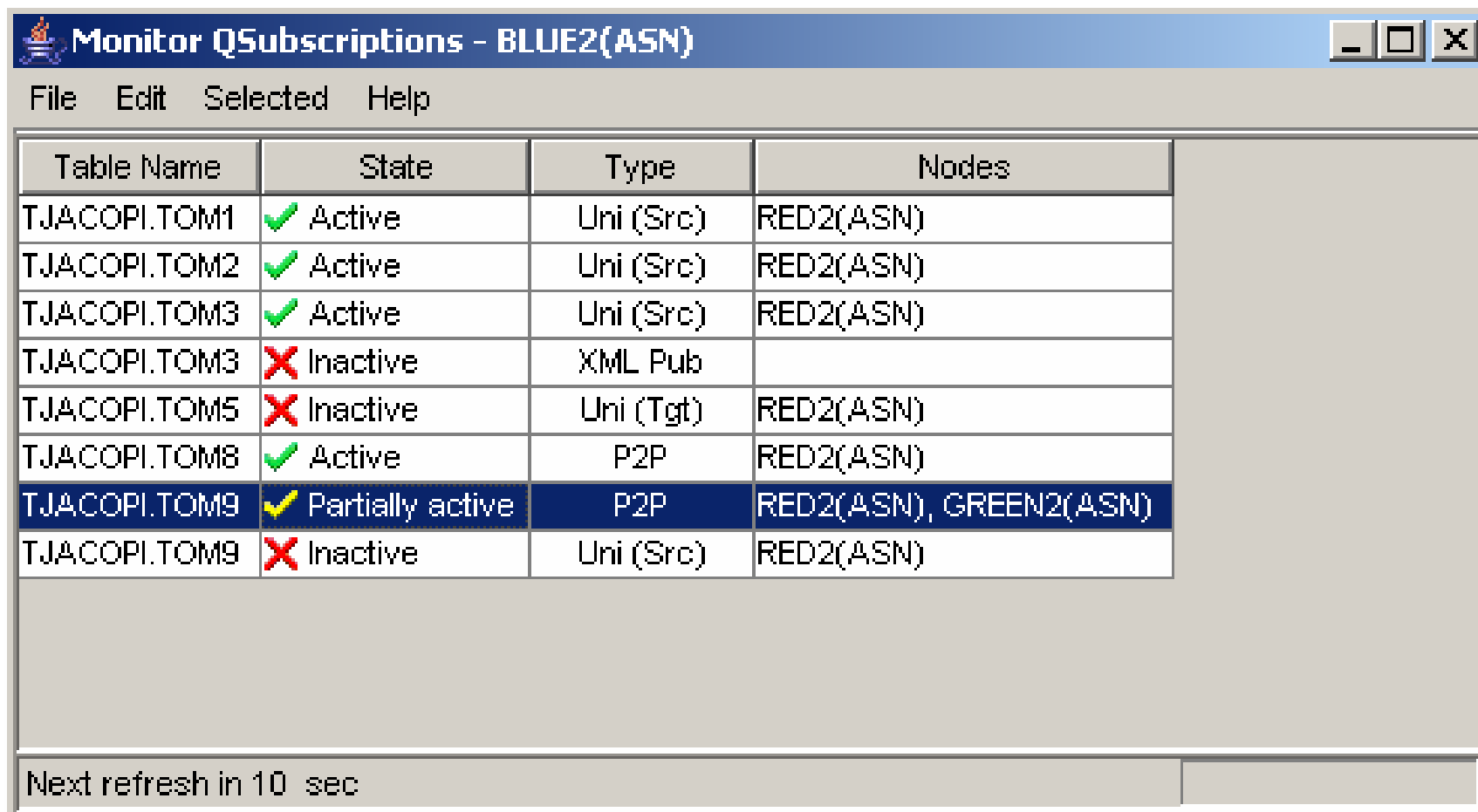


Table Level Information

- Dashboard can drill down to the table level:



The screenshot shows a window titled "Monitor QSubscriptions - BLUE2(ASN)" with a menu bar (File, Edit, Selected, Help) and a table of subscription data. The table has four columns: Table Name, State, Type, and Nodes. The row for T.JACOPI.TOM9 is highlighted in blue, indicating it is the selected item. Below the table, a status bar indicates "Next refresh in 10 sec".

Table Name	State	Type	Nodes
T.JACOPI.TOM1	✓ Active	Uni (Src)	RED2(ASN)
T.JACOPI.TOM2	✓ Active	Uni (Src)	RED2(ASN)
T.JACOPI.TOM3	✓ Active	Uni (Src)	RED2(ASN)
T.JACOPI.TOM3	✗ Inactive	XML Pub	
T.JACOPI.TOM5	✗ Inactive	Uni (Tgt)	RED2(ASN)
T.JACOPI.TOM8	✓ Active	P2P	RED2(ASN)
T.JACOPI.TOM9	✓ Partially active	P2P	RED2(ASN), GREEN2(ASN)
T.JACOPI.TOM9	✗ Inactive	Uni (Src)	RED2(ASN)

Next refresh in 10 sec

Tools web site.

- The URL for the tools web site is:

<http://www.ibm.com/support/docview.wss?&uid=swg27007070>

- All of the tools run on windows machines and come as zip files.

NEW - Interactive PDF MQ Checklist

Adobe Reader - [uni_remote.pdf]

File Edit View Document Tools Window Help

You cannot save data typed into this form. Please print your completed form if you would like a copy for your records. [Print Form](#) Highlight fields

Q Replication
WebSphere MQ configuration: unidirectional, two queue managers

Click in each field below, type the names of your objects, and then proceed to pages 2 and 3 to view your customized scripts. [Sample entries](#) [Clear form](#)

Source system IP address (S8) _____ Target system IP address (T8) _____

Q Capture server _____ Q Apply server _____

Q Capture schema _____ Q Apply schema _____

Queue manager (S1) _____ Queue manager (T1) _____
 Q Capture control tables Q Apply control tables

Restart queue (S2) (GLOCAL) _____ Spill queue (T7) (QMODEL) _____
 IBMQREP.SPILL.MODELQ

Administration queue (S3) (GLOCAL) _____ Transmission queue (T4) (GLOCAL) _____

Receiver channel (S7) Sender channel (T5)
 Source IP address (S8) (1414) Port (S9) _____

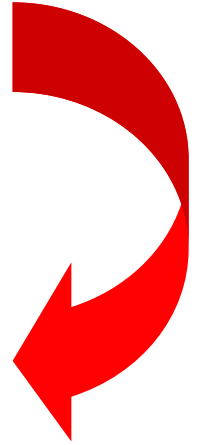
Send queue (S4) (QREMOTE) _____ Administration queue (T3) (QREMOTE) _____

Transmission queue (S5) (GLOCAL) _____ Sender channel (S6) Receiver channel (T6) _____
 Target IP address (T8) (1414) Port (T9) _____ Receive queue (T2) (GLOCAL) _____

Replication queue map

1 of 3

Interactive PDF MQ Checklist – clicked “sample entries”



Adobe Reader - [uni_remote.pdf]

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Print Form Highlight fields

Q Replication

WebSphere MQ configuration: unidirectional, two queue managers

Click in each field below, type the names of your objects, and then proceed to pages 2 and 3 to view your customized scripts.

Source system IP address (S4) Target system IP address (T8)

Q Apply server

Q Apply schema

Queue manager (T1)

Q Apply control tables

IBMQRREP.SPILL.MODELQ

Spill queue (T7) (GLOBAL)

Transmission queue (T4) (GLOBAL)

Administration queue (T3) (REMOTE)

Send queue (S4) (REMOTE)

Transmission queue (S5) (GLOBAL)

Sender channel (S6) Receiver channel (T6)

{ 1414 } Port (T9)

Target IP address (T8)

Receive queue (T2) (LOCAL)

Cannot Save Form Information

Cannot Save Form Information

Please Note: You cannot save a completed copy of this form on your computer. If you would like a copy for your records, please fill it in and print it.

Don't show again

Close

Interactive PDF MQ Checklist – Sample Entries filled in

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File Edit View Document Tools Window Help

You cannot save data typed into this form. Please print your completed form if you would like a copy for your records. [Print Form](#) Highlight fields

Q Replication
WebSphere MQ configuration: unidirectional, two queue managers [Sample entries](#) [Clear form](#)

Click in each field below, type the names of your objects, and then proceed to pages 2 and 3 to view your customized scripts.

Source system IP address (S1)	192.168.0.2	Target system IP address (T8)	192.168.0.3
-------------------------------	-------------	-------------------------------	-------------

SAMPLE

Q Capture server
ASN

Q Capture schema

QM1
Queue manager (S1)

ASN.QM1.RESTARTQ
Restart queue (S2) (QLOCAL)

ASN.QM1.ADMINQ
Administration queue (S3) (QLOCAL)

Q Capture control tables

TARGET

Q Apply server
ASN

Q Apply schema

QM2
Queue manager (T1)

Q Apply control tables

IBMQREP.SPILL.MODELQ
Spill queue (T7) (QMODEL)

QM1
Transmission queue (T4) (QLOCAL)

QM2_TO_QM1 **QM2_TO_QM1**

Receiver channel (S7) Sender channel (T5)

Source IP address (S8) 192.168.0.2 Port (S9) (1414)

ASN.QM1_TO_QM2.DATAQ **SAMPLE_ASN_TO_TARGET_ASN** **ASN.QM1.ADMINQ**

Send queue (S4) (QREMOTE) Replication queue map Administration queue (T3) (QREMOTE)

QM2
Transmission queue (S5) (QLOCAL)

QM1_TO_QM2 **QM1_TO_QM2**

Sender channel (S6) Receiver channel (T6)

192.168.0.3 (1414) Port (T9)

Target IP address (T8)

ASN.QM1_TO_QM2.DATAQ
Receive queue (T2) (QLOCAL)

1 of 3

Interactive PDF MQ Checklist: Page 2 = source script

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File Edit View Document Tools Window Help

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Setting up WebSphere MQ objects on the source system

- On the source system, open a new command window and use the following command to create the queue manager:


```
crtmqm QM1
```
- Open a text editor such as Notepad. Copy and paste the following code into a new file:


```
*S2. Restart queue
DEFINE QLOCAL('ASN.QM1.RESTARTQ') DEFPSIST(YES)
*S3. Administration queue
DEFINE QLOCAL('ASN.QM1.ADMINQ') DEFPSIST(YES)
*S4. Send queue
DEFINE QREMOTE('ASN.QM1_TO_QM2.DATAQ') RNAME('ASN.QM1_TO_QM2.DATAQ') RQMNAME('QM2') XMITQ('QM2') DEFPSIST(YES)
*S5. Transmission queue
DEFINE QLOCAL('QM2') USAGE(XMITQ) DEFPSIST(YES)
*S6. Sender channel
DEFINE CHL ('QM1_TO_QM2') CHLTYPE(SDR) TRPTYPE(TCP) CONNAME('192.168.0.3(1414)') XMITQ('QM2') DISCNT(0)
*S7. Receiver channel
DEFINE CHL ('QM2_TO_QM1') CHLTYPE(RCVR) TRPTYPE(TCP)
*Start the channel:
START CHL ('QM1_TO_QM2')
```
- Save the file as uni_source.txt
- Start the source queue manager:


```
strmqm QM1
```
- Run the uni_source.txt script by issuing the following command:

Linux or UNIX:	<code>runmqsc QM1 < filepath/uni_source.txt</code>	<code>runmqsc QM1</code>
Windows:	<code>< filepath\uni_source.txt</code>	
- Start the listener:

Linux or UNIX:	<code>runmqslr -t tcp -m QM1 -p 1414 &</code>
----------------	---

(Runs in the background)

Next >>

Interactive PDF MQ Checklist: Page 3 = target script

Adobe Reader - [uni_remote.pdf]

File Edit View Document Tools Window Help

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Please print your completed form if you would like a copy for your records.

Print Form Highlight fields

Setting up WebSphere MQ objects on the target system

- On the target system, open a new command window and use the following command to create the queue manager:


```
crtmqm QM2
```
- Open a text editor such as Notepad. Copy and paste the following code into a new file:


```
*T2. Receive queue
DEFINE QLOCAL('ASN.QM1_TO_QM2.DATAQ') DEFPSIST(YES)
*T3. Administration queue
DEFINE QREMOTE('ASN.QM1.ADMINQ') RNAME('ASN.QM1.ADMINQ') RQMNAME('QM1') XMITQ('QM1') DEFPSIST(YES)
*T4. Transmission queue
DEFINE QLOCAL('QM1') USAGE(XMITQ) DEFPSIST(YES)
*T5. Sender channel
DEFINE CHL ('QM2_TO_QM1') CHLTYPE(SDR) TRPTYPE(TCP) CONNAME('192.168.0.2(1414)') XMITQ('QM1') DISCONT (0)
*T8. Receiver channel
DEFINE CHL ('QM1_TO_QM2') CHLTYPE(RCVR) TRPTYPE(TCP)
*T7. Spill queue
DEFINE QMODEL('IBMQREP.SPILL.MODELQ') DEFPSOFT(SHARED) MAXDEPTH(500000) MSGDLVSOQ(FIFO) DEFTYPE(PERMDYN)
*Start the channel:
START CHL ('QM2_TO_QM1')
```
- Save the file as uni_target.txt
- Start the target queue manager:


```
strmqm QM2
```
- Run the uni_target.txt script by issuing the following command:


```
Linux or UNIX: runmqsc QM2 < filepath/uni_target.txt
Windows: < filepath/uni_target.txt runmqsc QM2
```
- Start the listener:


```
Linux or UNIX: runmqslr -t top -m QM2 -p 1414 &
```

(Runs in the background)

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Important Sources of Information/Education

- The Replication roadmaps:
 - ▶ Simply the best place to start any search for replication info - downloads, tutorials, JMS appl toolkit, performance paper, and pointers to all available documentation
 - ▶ <http://www-128.ibm.com/developerworks/db2/roadmaps/qrepl-roadmap-v8.2.html>
 - ▶ <http://www-128.ibm.com/developerworks/db2/roadmaps/sqlrepl-roadmap-v8.2.html>

- IBM Education for Q Replication:
 - ▶ DW240: 3 day course without MQ basics
 - ▶ DW241: 4 day course with MQ basics included

- Redbooks available for Q Replication , Event Publishing – new redbook this year on using Q Replication for High Availability

- Consider IBM Services as part of your implementation plan