Weiterentwicklung von DB2 Server für VSE & VM

IBM Software Group

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GSE Herbsttagung, September 2004

DB2 Information Management Software

business on demand software

Agenda

- DB2 Server for VSE & VM Version 7 Release 4
- Datenreplikation in der DB2 Familie
- Implementierung der ‚Q Replication' im VM & VSE
- Quo Vadis - DB2 Server for VSE & VM ?
- Weiter Informationen
- Haben Sie Fragen?

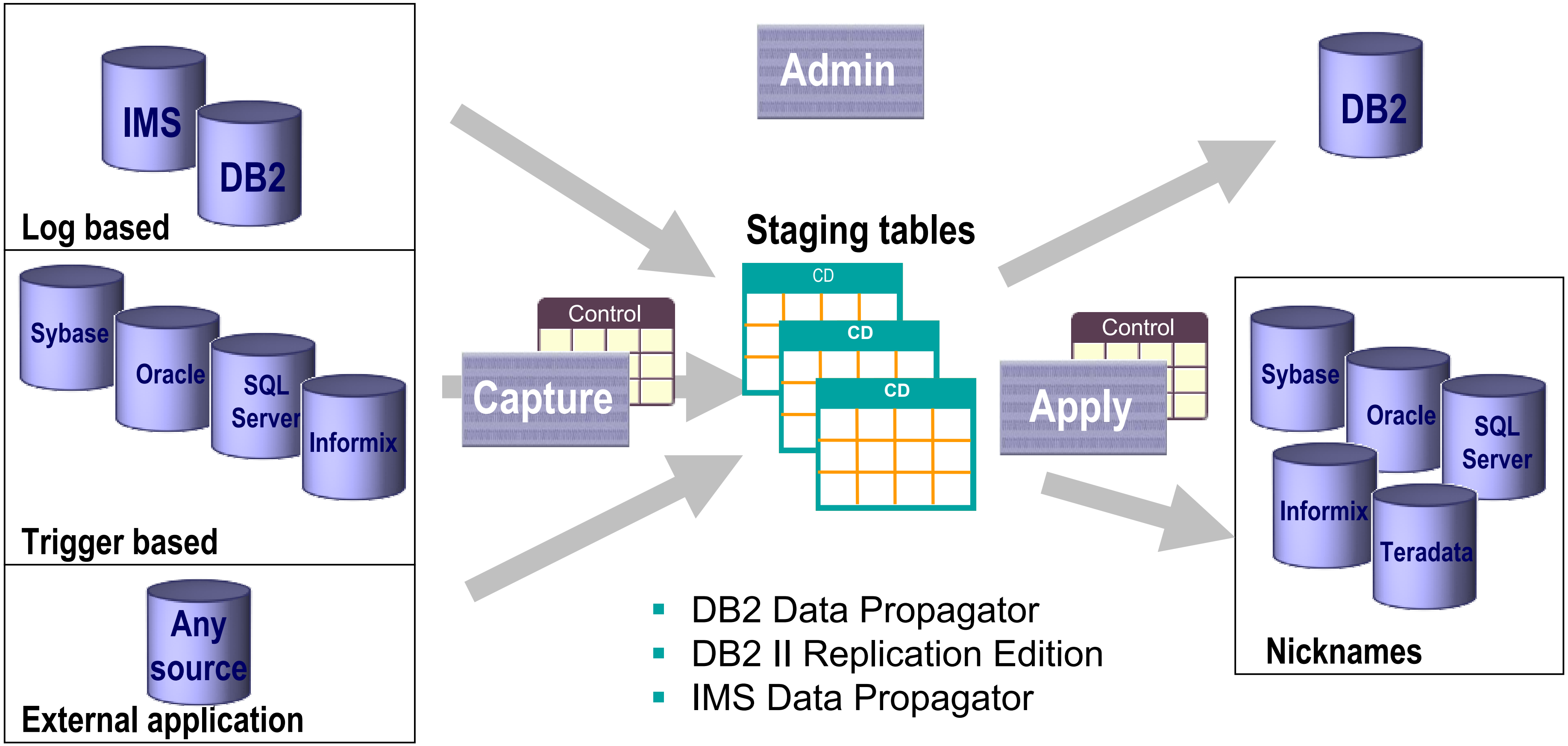
DB2 Server for VSE & VM Version 7 Release 4

- Verfügbar seit 17. September 2004
- Ein neues Kapitel der DB2 Datenreplikation
  - Transaktionsorientierte Replikation basierend auf MQSeries
  - Einschränkungen
    - Keine SQL-Replication mehr
    - VM nur MQ-Client
    - Kein Apply im VM & VSE

Replikation in der DB2 Familie

- Current SQL-Replication Architecture
- Why create another Replication Architecture?
- Q Replication
  - Q Subscription Process
  - Event Publication Process
  - Subscription Types
  - Q Apply Performance
  - Apply Load Options
  - Conflict Detection
  - Replication Administration

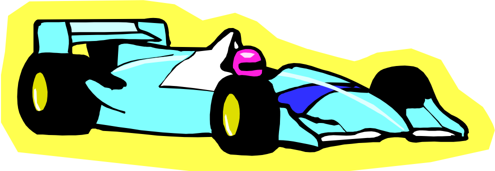
Current SQL Replication Architecture



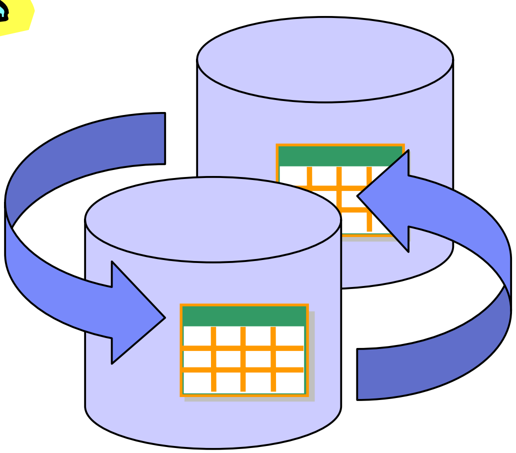
- DB2 Data Propagator
- DB2 II Replication Edition
- IMS Data Propagator

Why Create Another Replication Architecture?

- **Performance:** Combine high throughput with low latency

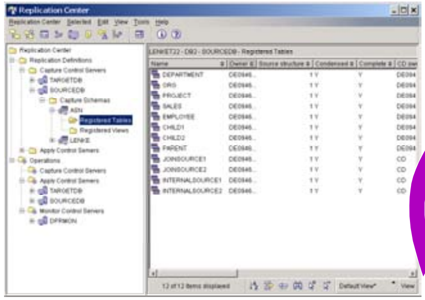


- **Capability:** Significantly improve multi-directional replication support



- **New function:** Event publishing, table difference utility

- **Manageability:** Reduce the number of replication objects to be defined and managed, ease the definition process with new Replication Center wizards

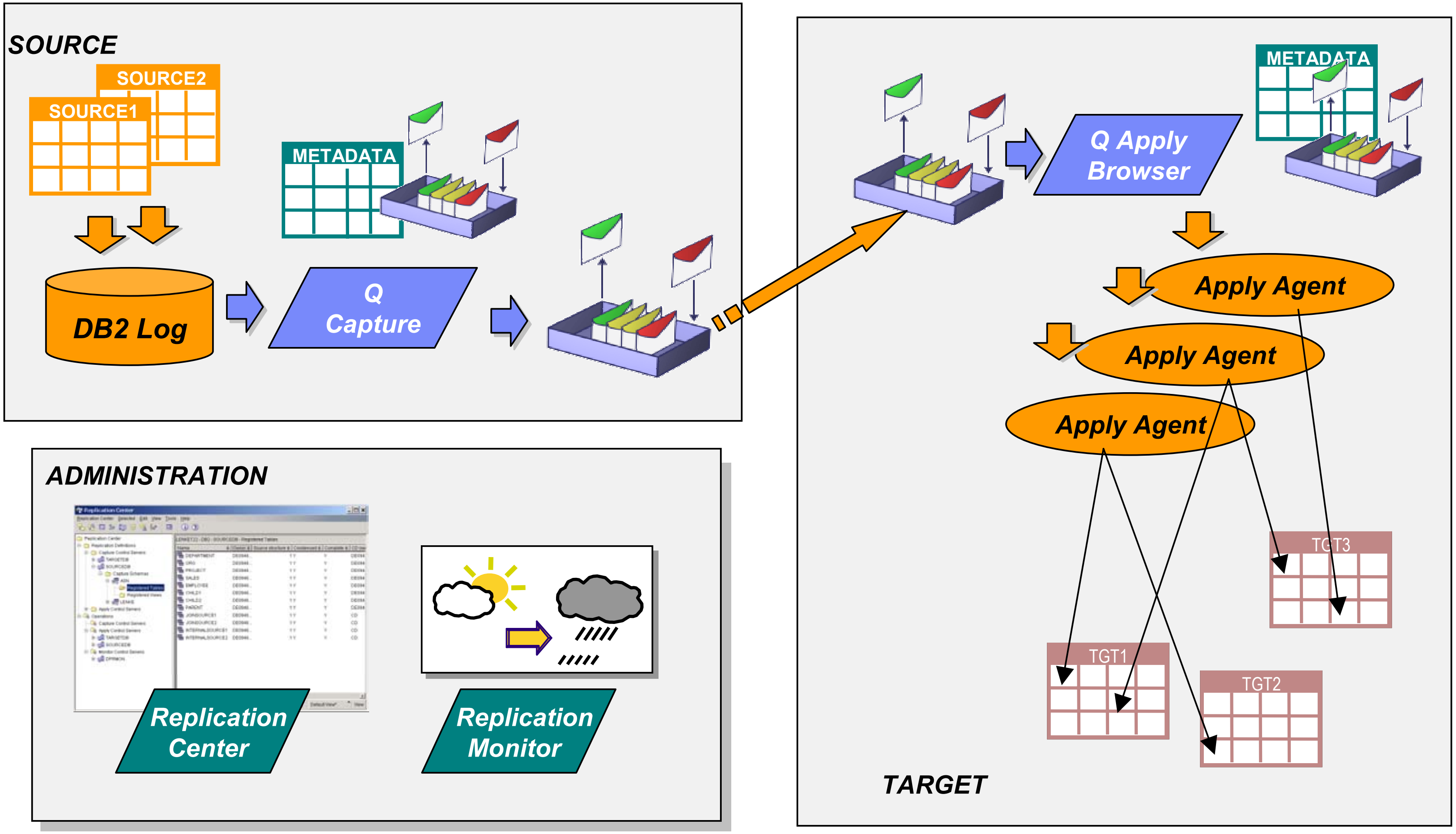


LENKET22 - DB2 - SOURCEDB - Registered Tables

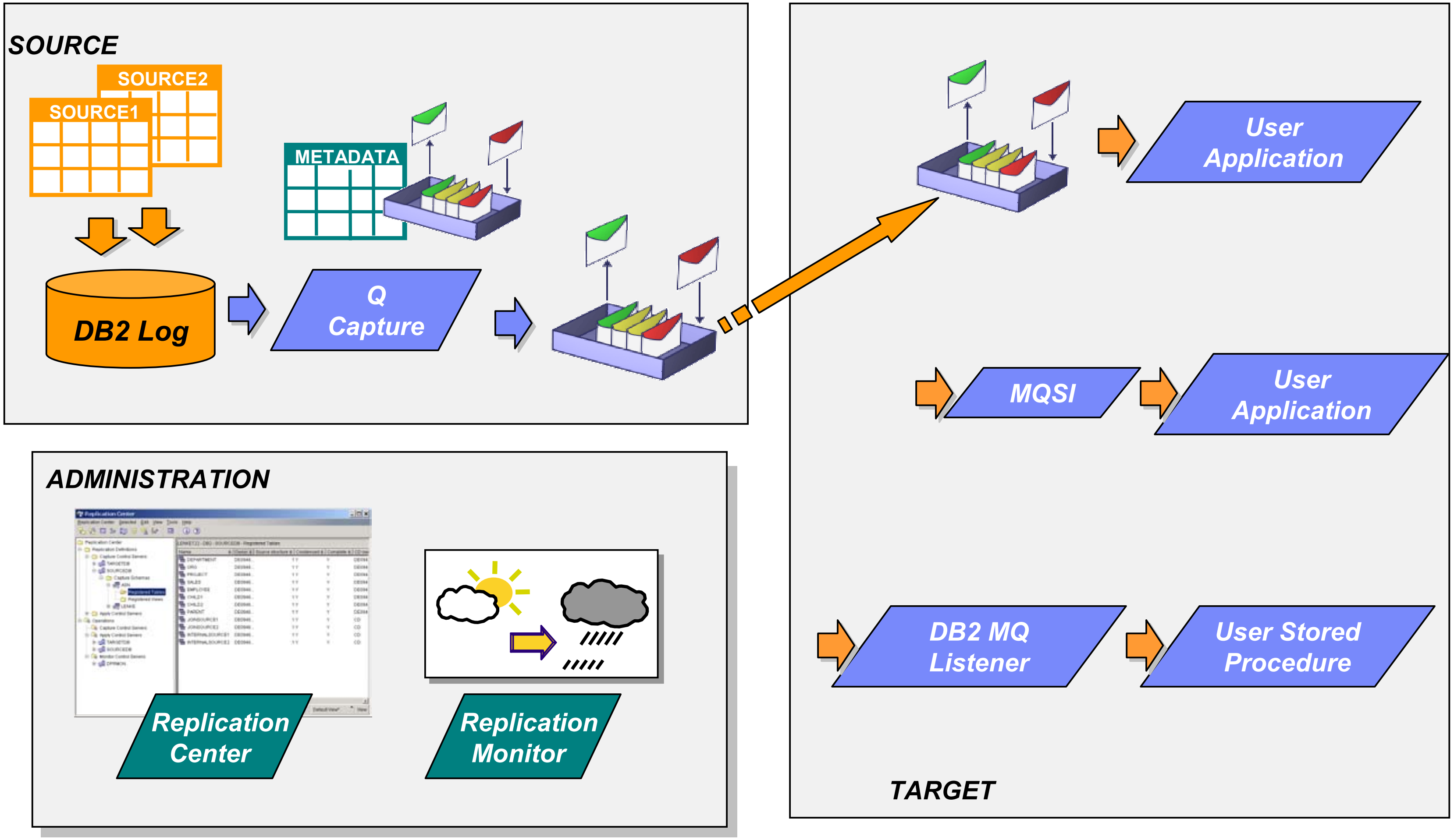
Name	Owner	Source structure	Condensed	Complete	CD ow
DEPARTMENT	DE0946...	1	Y	Y	DE094
ORG	DE0946...	1	Y	Y	DE094
PROJECT	DE0946...	1	Y	Y	DE094
SALES	DE0946...	1	Y	Y	DE094
EMPLOYEE	DE0946...	1	Y	Y	DE094
CHILD1	DE0946...	1	Y	Y	DE094
CHILD2	DE0946...	1	Y	Y	DE094
PARENT	DE0946...	1	Y	Y	DE094
JOINSOURCE1	DE0946...	1	Y	Y	CD
JOINSOURCE2	DE0946...	1	Y	Y	CD
INTERNALSOURCE1	DE0946...	1	Y	Y	CD
INTERNALSOURCE2	DE0946...	1	Y	Y	CD

12 of 12 items displayed

Q Replication – Q Subscription Process



Q Replication – Event Publication Process



SOURCE

SOURCE2

SOURCE1

METADATA

DB2 Log

Q Capture

ADMINISTRATION

Replication Center

Replication Monitor

User Application

MQSI

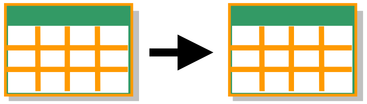
User Application

DB2 MQ Listener

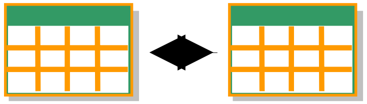
User Stored Procedure

TARGET

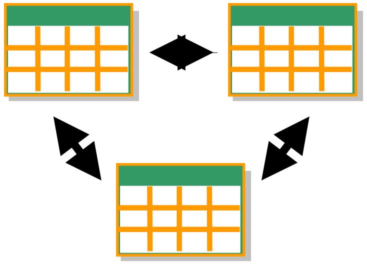
Subscription Types



- **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
  - Utilizes **VALUE** based conflict detection



- **Peer to peer**
  - Changes are replicated between 2 or more servers
  - Utilizes **VERSION** based conflict detection

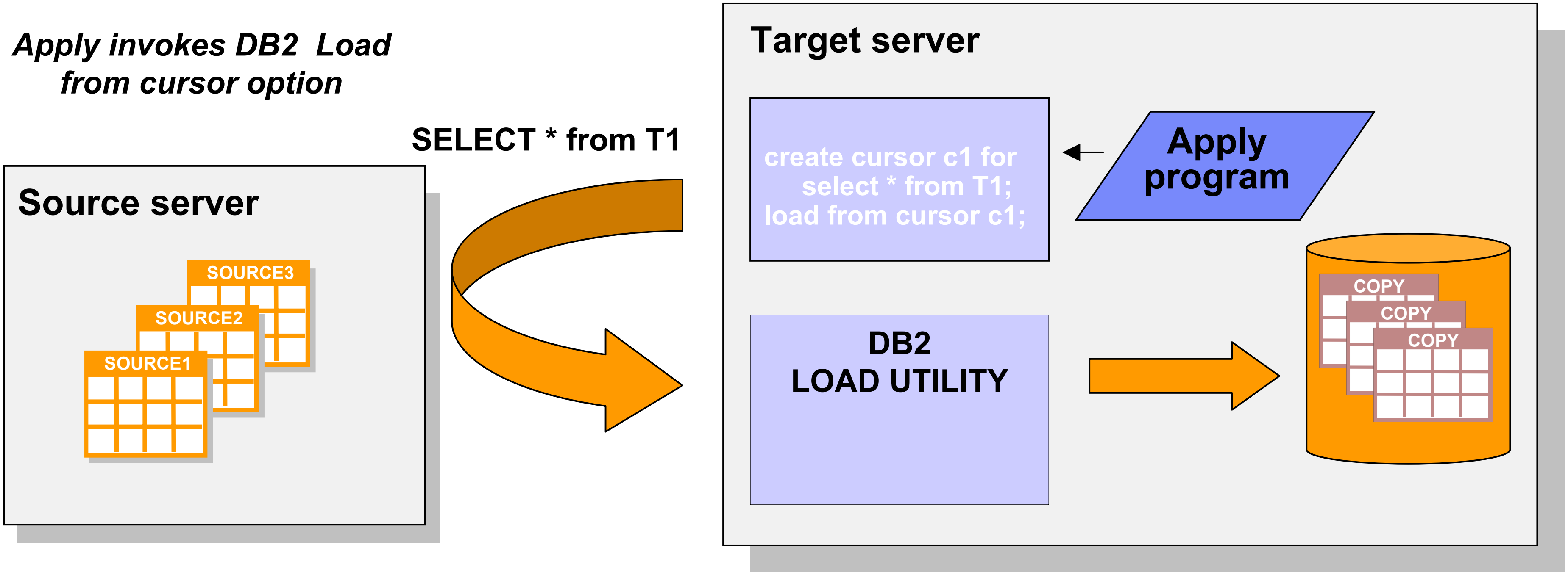
Q Apply Performance

- A Q Apply program will start one Apply browser for each receive queue defined
- Each Apply browser will read from its receive queue and apply transactions in parallel
  - Using as many agents as the user has defined
  - Performing dependency analysis and serializing transactions as necessary to preserve data integrity
  - Also possible to observe strict transactional order without parallelism
- It is the user’s choice regarding how many queues to define
  - A high degree of parallelism can be reached using one queue
  - All related tables should be subscribed to on the same queue (using the same replication queue map)
  - In some ways, a receive queue is similar to the SQL Replication subscription set

Apply Load Options

- A subscription is defined as either: automatic load, manual load, no load required
- Automatic load:
  - Load is performed by Apply, with automatic coordination of the simultaneous capture of changes, loading of the new table, and apply of changes to other tables.
- Manual load:
  - Load is performed by user, coordination is required, and will be handled by user (with some help from our administration).
- No load:
  - No loading required, no coordination required, can immediately capture and apply changes
  - Example: target system is built through backup/restore, with replication started from an inactive source

Apply - Load Processing Example



Apply invokes DB2 Load from cursor option

SELECT * from T1

Source server

Target server

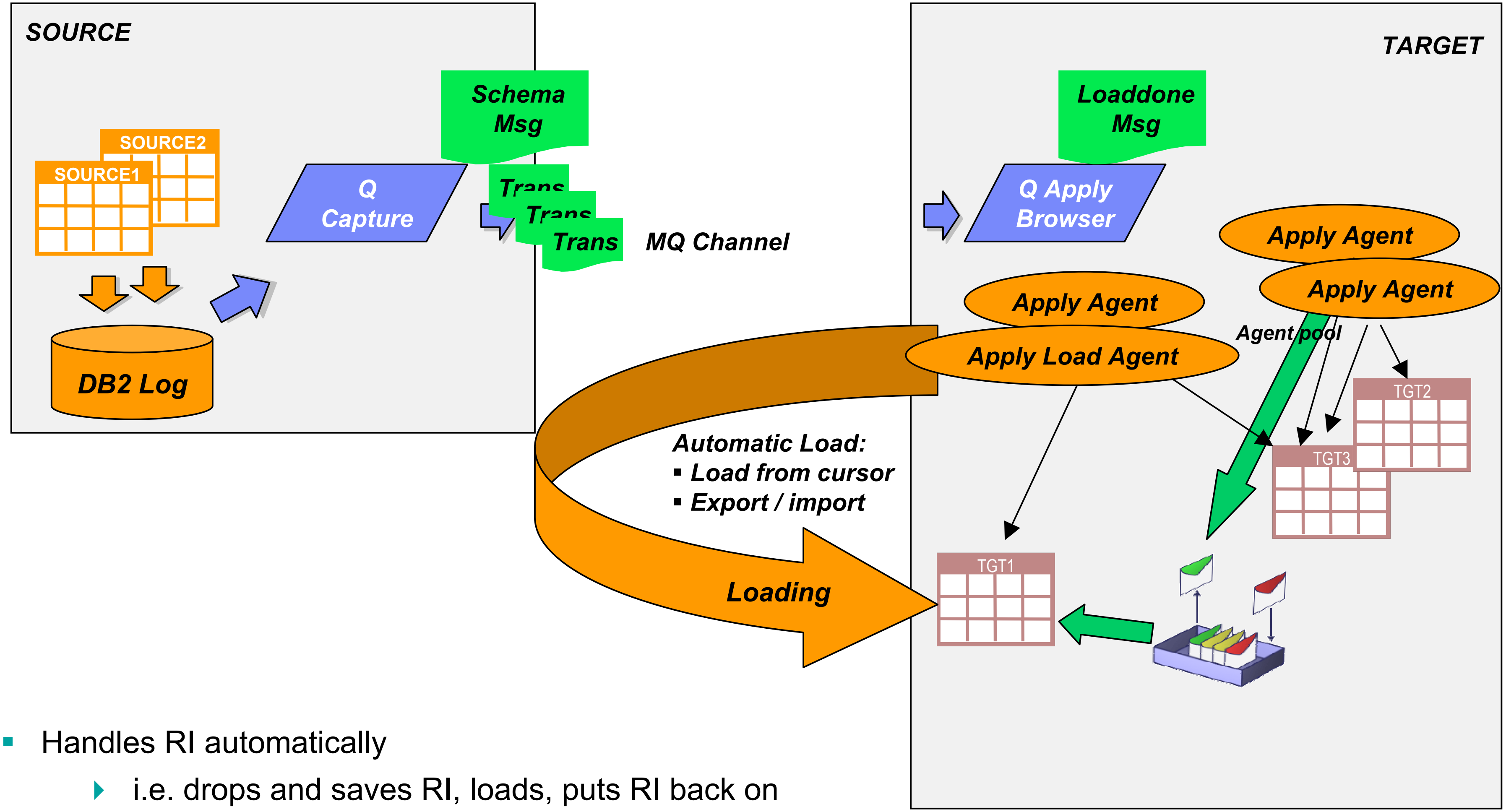
create cursor c1 for
select * from T1;
load from cursor c1;

Apply program

DB2
LOAD UTILITY

Selected data blocks feed <u>directly into load</u> utility

Subscription Start with Load Processing



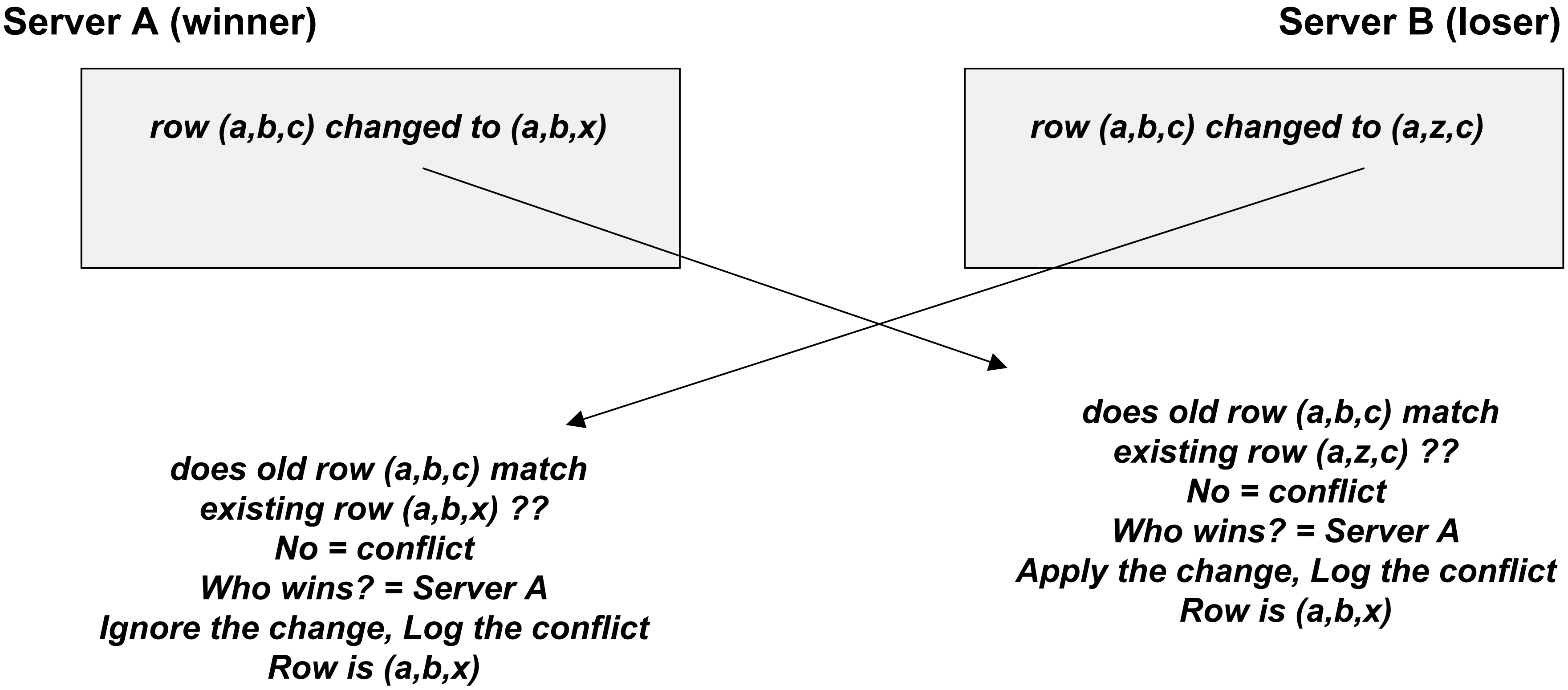
- Handles RI automatically
  - i.e. drops and saves RI, loads, puts RI back on
- Can handle Peer to Peer loading of n peers
  - Includes starting a new peer into an existing active configuration

Conflict Detection and Resolution

- Enables multi-directional replication that may result in conflicts
- Important for
  - “Active” standby systems
  - Workload balancing
- Value based conflict resolution
  - 2 participating nodes
  - Minimal overhead
- Version based conflict resolution
  - 2 or more participating nodes (practical limit around 6)
  - Requires extra columns and triggers
  - Most robust conflict detection and resolution (with some restrictions)

Value Based Conflict Detection

- Do the current row values at the apply target match the old row (before values) carried over from the source update?
- Designated site wins.



Server A (winner)

row (a,b,c) changed to (a,b,x)

Server B (loser)

row (a,b,c) changed to (a,z,c)

does old row (a,b,c) match
existing row (a,b,x) ??
No = conflict
Who wins? = Server A
Ignore the change, Log the conflict
Row is (a,b,x)

does old row (a,b,c) match
existing row (a,z,c) ??
No = conflict
Who wins? = Server A
Apply the change, Log the conflict
Row is (a,b,x)

Value Based Conflict Detection and Resolution

- Conflict level options offered:
  - Check all columns on update requires capture/transmit/apply of all old values
    - ✓ update target table where key values = < > and all current target values = all old source values
  - Check only changed columns on update - allows for merge
    - ✓ update target table where key values = < > and current target values = old source values for columns changed at source
  - No conflict checking

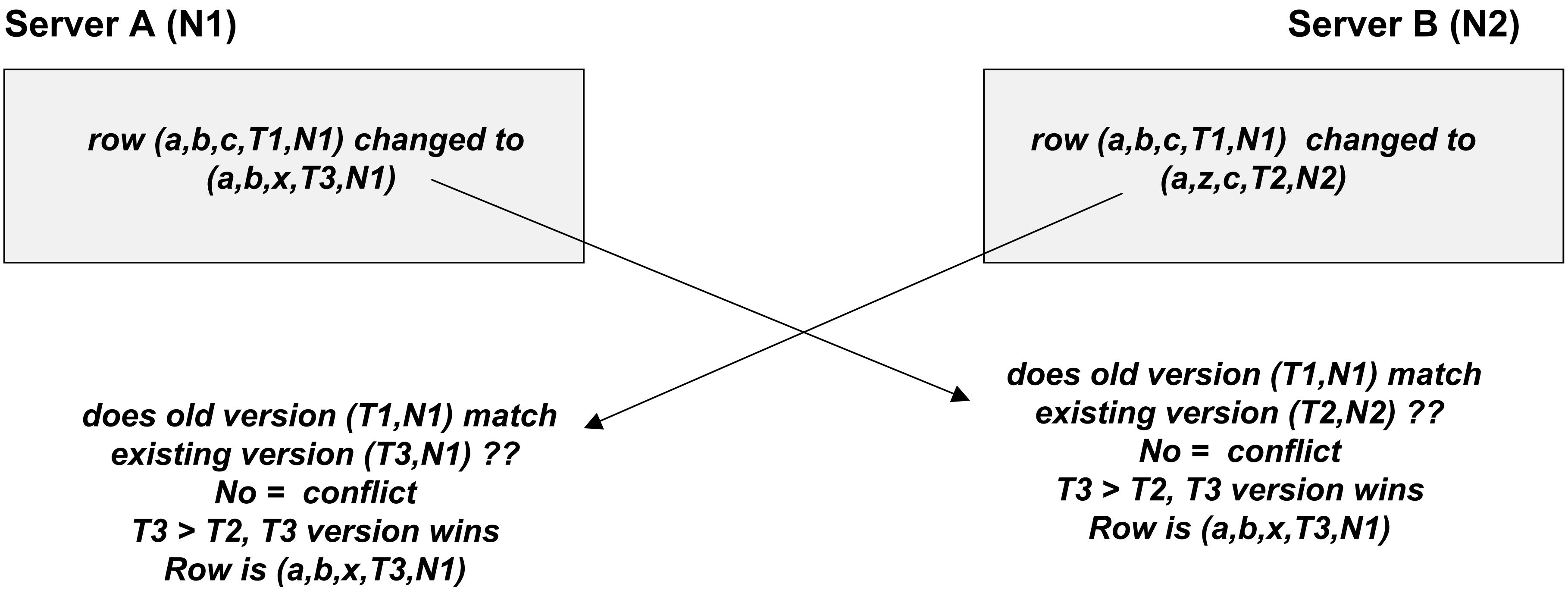
- Resolution choices offered: Force or Ignore
  - Force Action requires capture/transmit/apply of all new values
    - ✓ force convergence on conflicts
    - ✓ log the conflict
  - Ignore Action
    - ✓ log the conflict
  - Force/Ignore used together in a pair provides "very good" convergence

Value Based Conflict Detection and Resolution

- Disadvantage: Does not detect all possible forms of conflict
  - Does not detect insert/insert+delete conflicts
  - Does not detect other fairly academic conflict cases
  - Is not offered for more than 2 participating database nodes
- Advantage: Requires less overhead
  - No extra columns or triggers
  - No effect to source updating applications
  - Problematic conflict cases may not be applicable to user applications
  - Can supplement with reconciliation utility (Tdiff/Trepair)
  - Might be appropriate for planned outage/failover/DR

Version Based Conflict Detection

- All rows are augmented with a “Version” = timestamp Tx and smallint Nx, indicating when and by which server the row was last updated
- Do the current values of Tx and Nx at the apply target match the old values of Tx and Nx carried over from the source update?
- Most current timestamp Tx wins.



Server A (N1)

row (a,b,c,T1,N1) changed to (a,b,x,T3,N1)

Server B (N2)

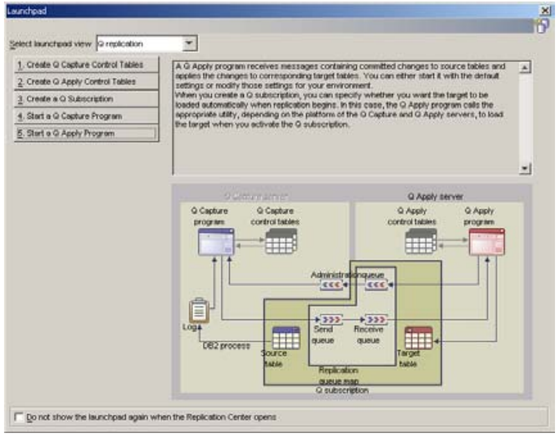
row (a,b,c,T1,N1) changed to (a,z,c,T2,N2)

does old version (T1,N1) match existing version (T3,N1) ??
No = conflict
T3 > T2, T3 version wins
Row is (a,b,x,T3,N1)

does old version (T1,N1) match existing version (T2,N2) ??
No = conflict
T3 > T2, T3 version wins
Row is (a,b,x,T3,N1)

Replication Administration

- Replication Center GUI
  - Launchpads, Wizards, Online Help
  - Definitions, Operations, Monitoring



Select launchpad view: Q replication

A Q Apply program receives messages containing committed changes to source tables and applies the changes to corresponding target tables. You can either start it with the default settings or modify those settings for your environment.
When you create a Q subscription, you can specify whether you want the target to be loaded automatically when replication begins. In this case, the Q Apply program calls the appropriate utility, depending on the platform of the Q Capture and Q Apply servers, to load the target when you activate the Q subscription.

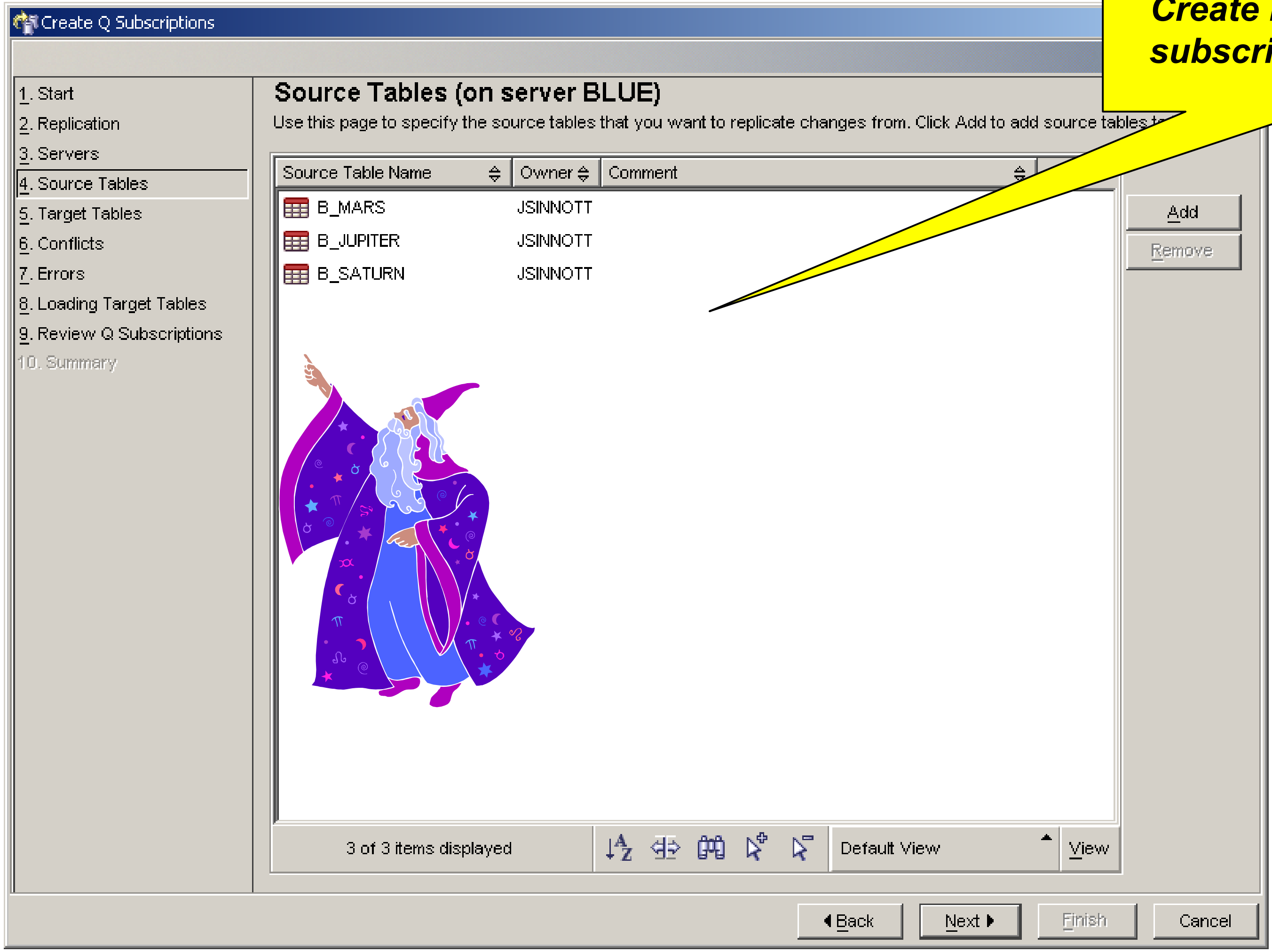
☐ Do not show the launchpad again when the Replication Center opens

- Command Line Interface
  - Scripts or interactive mode
  - Example:

```
C:\asnclp
REPL > CREATE QSUB USING REPLQMAP ...
REPL > CREATE SUBSCRIPTION SET SETNAME ...
REPL > CREATE MEMBER IN SETNAME ...
```

- Java API’s
  - Typically used when replication is embedded

Q Create Subscription Wizard



Create Q Subscriptions

1. Start
2. Replication
3. Servers
4. Source Tables
5. Target Tables
6. Conflicts
7. Errors
8. Loading Target Tables
9. Review Q Subscriptions
10. Summary

Source Tables (on server BLUE)

Use this page to specify the source tables that you want to replicate changes from. Click Add to add source tables to

Source Table Name	Owner	Comment
B_MARS	JSINNOTT	
B_JUPITER	JSINNOTT	
B_SATURN	JSINNOTT	

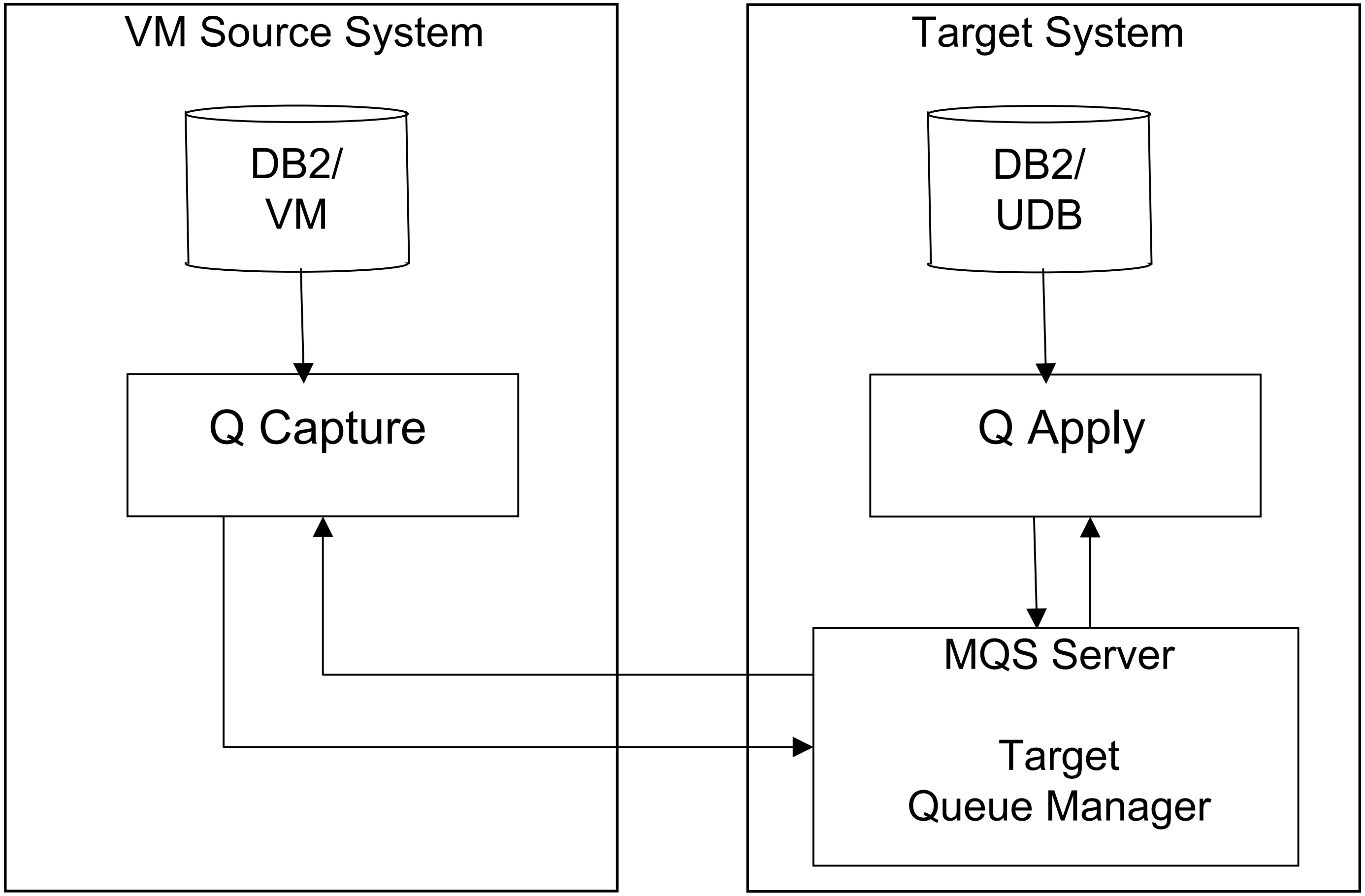
3 of 3 items displayed

Create large numbers of subscriptions at a time!!

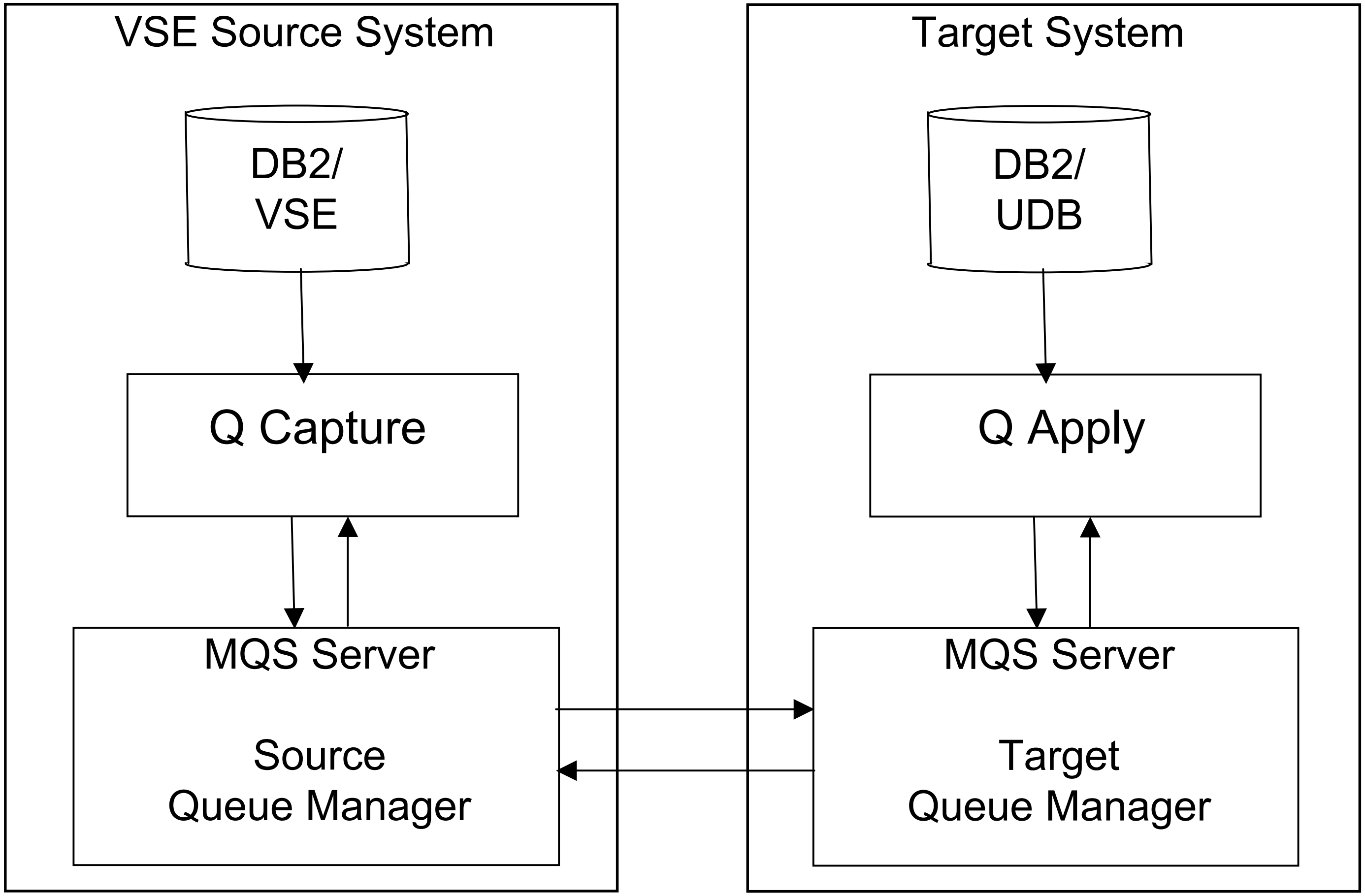
Implementierung der ‚Q Replication' im VM & VSE

- Nur Q Capture, kein Q Apply
- VM hat keinen MQ Server
- Replikation ins VSE nur über ‚Federated Database Support'
- Keine ‚Event Publication'
- Keine SQL-Replikation mehr!

Implementierung der ‚Q Replication‘ im VM



Implementierung der ‚Q Replication‘ im VSE



Quo Vadis - DB2 Server for VSE & VM

- Zukunft: DB2 VM & VSE ‚Client only‘?
  - DRDA Performance!
  - UDB-Funktionalität für VSE Anwendungen?
    - Unterstützung aller rein Server-basierenden Funktionen
      - z.B. CASE - Funktion
    - Kein Support für Funktionen die erweiterte Funktionalität des ‚Clients‘ erfordern
      - z.B. CURSOR WITH HOLD

DB2 Server for VSE & VM – weitere Informationen

- Dokumentation: Q Capture Supplement
  - Verfügbar über die DB2 VM/VSE Homepage

    http://www.ibm.com/software/data/db2/vse-vm/

- End of Service für DB2 Server for VM & VSE V **7.1**

  2. Mai 2005

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Haben Sie Fragen?