

**Power
Week**



Université IBM i 2019

22 et 23 mai

IBM Client Center Paris



S33 – La nouvelle solution DB2 Mirror for i - Partie 1 : présentation

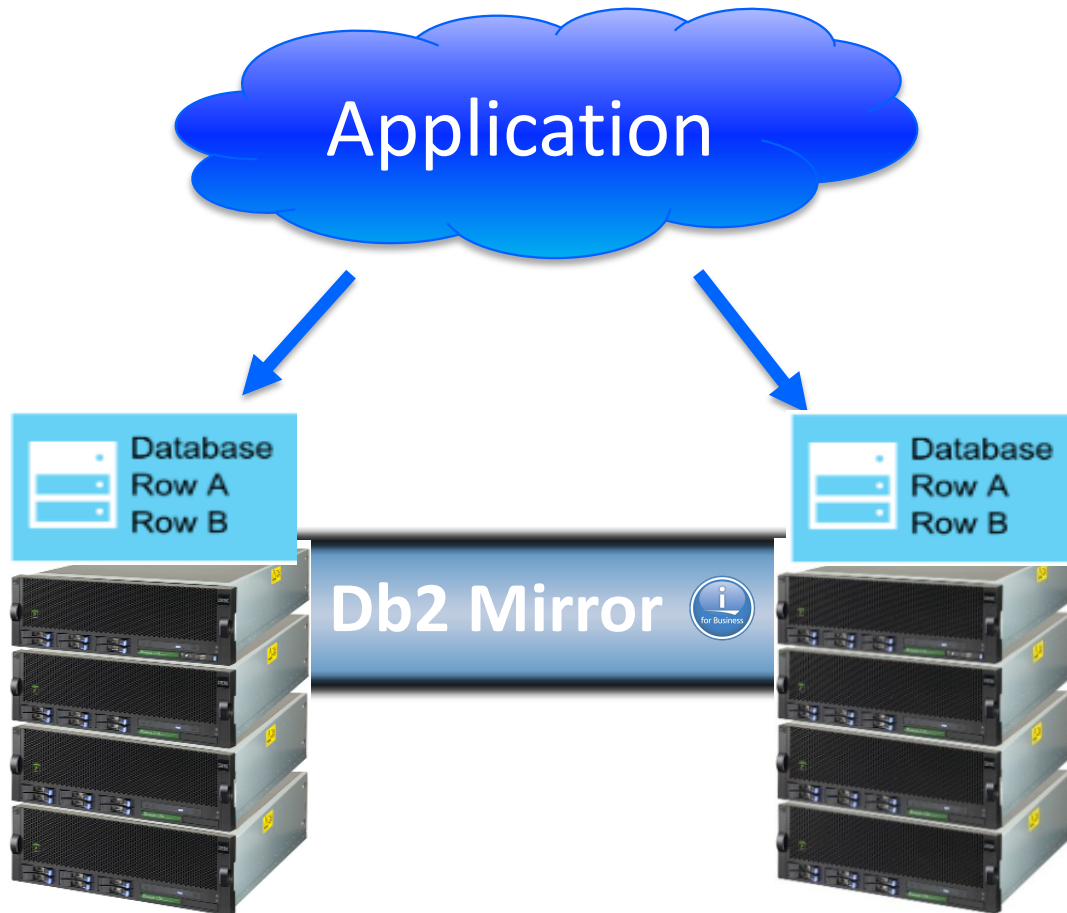
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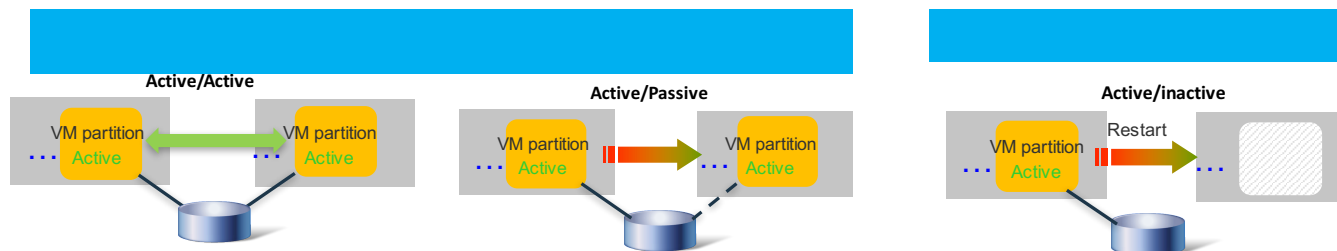
IBM Db2 Mirror for i



- **IBM Db2 Mirror for i: Enables Continuous Availability**
 - High speed synchronous replication of Db2 for i (Data Center Solution)
 - Access Db2 objects from either LPAR
- **Application Availability Enablement**
 - Two Nodes read and write to the same DB Files
 - Enables quickly moving all work to one node, for planned maintenance or node failure
- **Enables Business Continuity for Disruptive System Upgrades**
 - Nodes can be at different OS levels
 - Nodes can be on different Power Hardware Generations
 - Rolling upgrades for no downtime
 - Roll a node back a release with minimal impact if Active/Active applications are deployed

Requires POWER8 or later and IBM i 7.4
New IBM i LPP 5770DBM

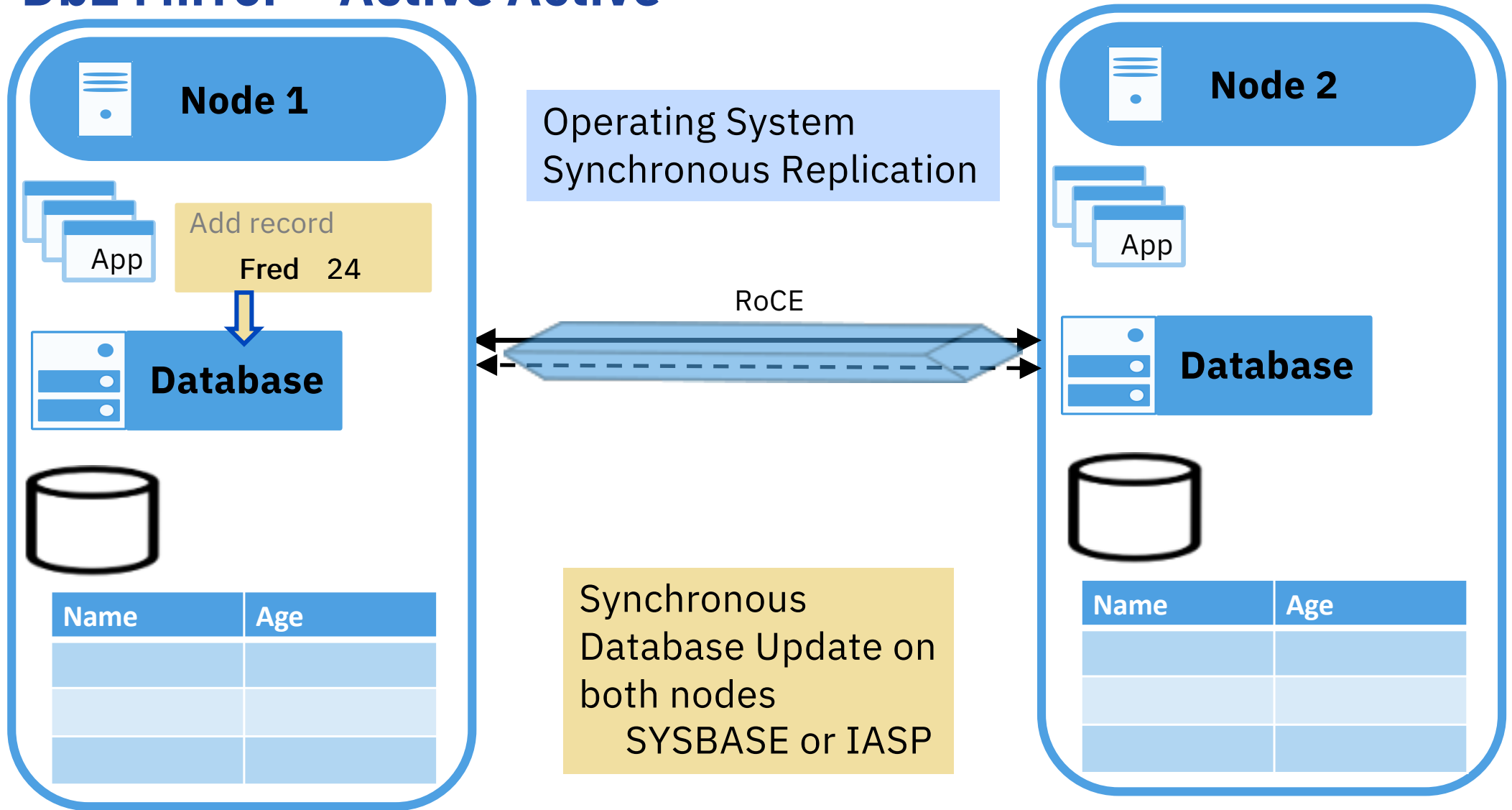
High Availability topology classification & positioning



Technology	Active/Active Clustering	Active/Passive Clustering	Active/Inactive
Definition	Application level clustering; applications in the cluster have simultaneous access to the production data therefore no app restart upon an app node outage. Certain types enable read-only access from secondary nodes	OS level clustering; one OS in the cluster has access to the production data, multiple active OS instances on all nodes in the cluster. Application is restarted on a secondary node upon outage of a production node.	VM level clustering, One VM in a cluster pair has access to the data, one logical OS, one or two physical copies. OS and applications must be restarted on a secondary node upon a primary node outage event. LPM enables the VM to be moved non-disruptively for a planned outage event.
Outage Types	SW,HW,HA, planned, unplanned RTO 0, limited distance	SW,HW,HA,DR, planned, unplanned, RTO>0, multi-site	HW,HA,DR, planned, unplanned, RTO>0, multi-site
OS integration	Inside the OS	Inside the OS	OS agnostic
RPO	Sync mode only	Sync/Async	Sync/Async
RTO	0	Fast (minutes)	Fast Enough (VM Reboot)
Licensing*	N+N licensing	N+1 licensing	N+0 licensing
Industry Examples	Oracle RAC, Db2 Mirror , pureScale	PowerHA, Redhat HA, Linux HA	VMware, VMR HA, LPM,

- N = number of licensed processor cores on each system in the cluster
- illustrations represent two-node shared-storage configurations for conceptual simplicity. There are many other topologies and data resiliency combinations

Db2 Mirror – Active Active



Db2 Mirror – Database Supported Objects

Database replication eligible objects

Native:

- Database Physical & Logical File

SQL:

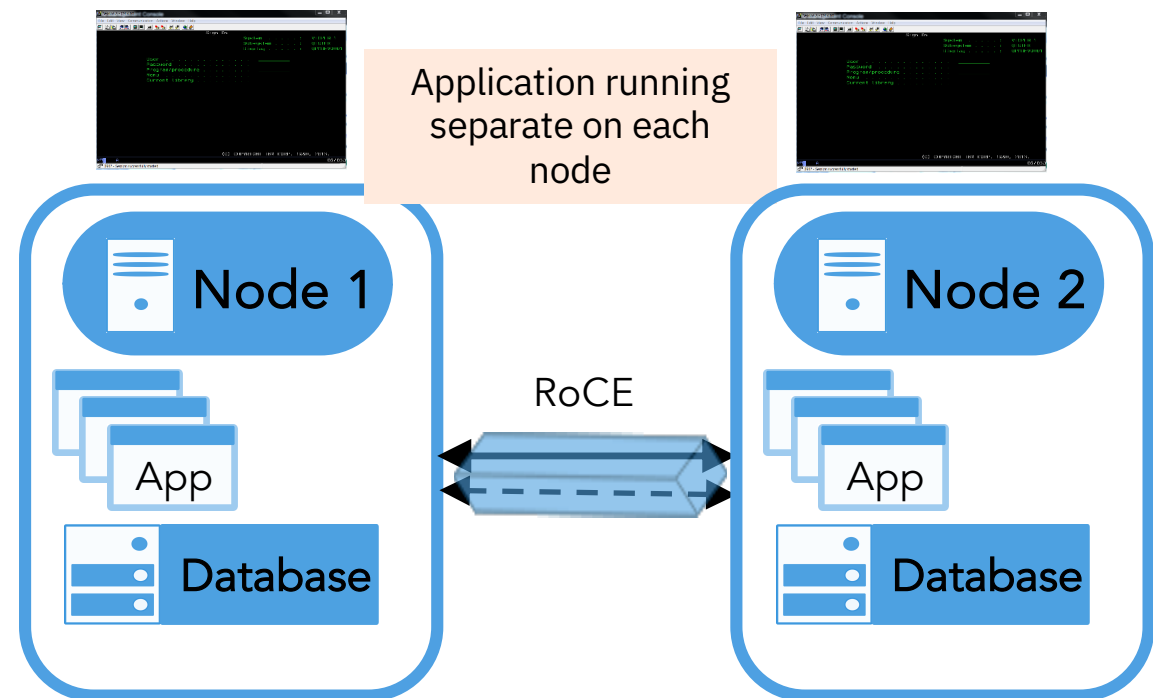
- Alias
- Function
- Global Variable
- Index
- Procedure
- Schema
- Sequence
- SQL Package
- Table
- Trigger
- User Defined Type
- View
- XML Schema Repository

Included with File support:

- Row Permission
- Column Mask
- Temporal Table
- Constraint
- Etc...



DDS / Record Level Access
SQL / Set Based Access



Db2 Mirror – Other Supported Objects

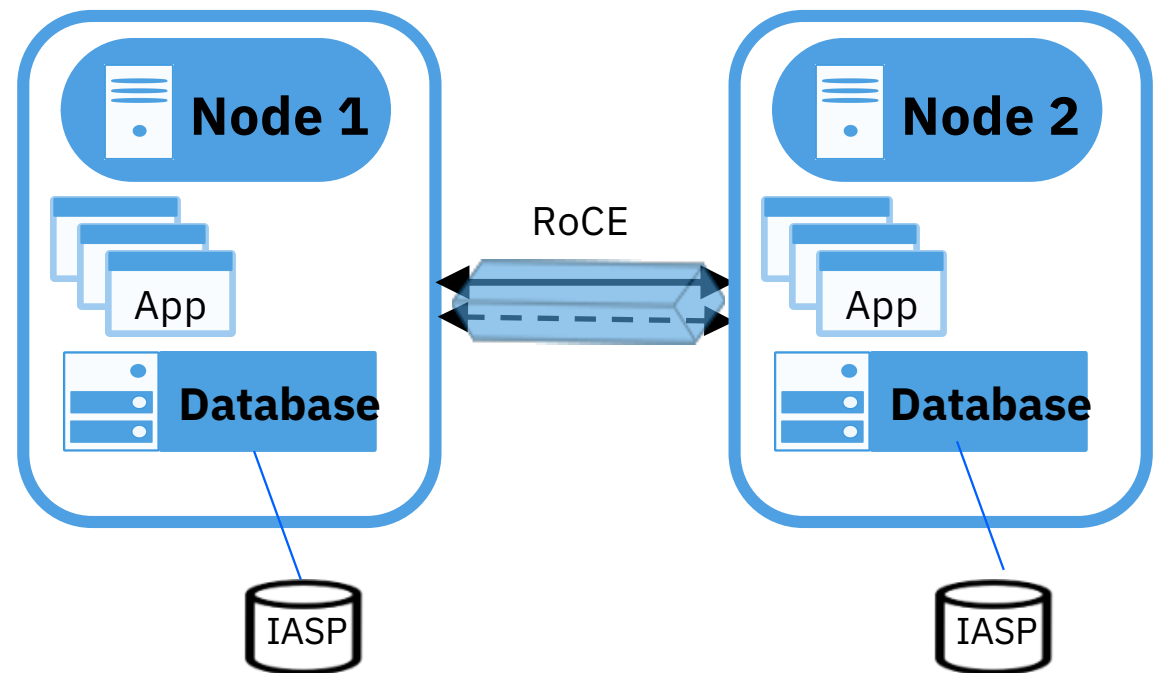
Other Objects

- User profiles
- Authority
- Ownership
- Security
- PGM/SRVPGM
- Data Areas
- Data Queues (DDL Only)
- SYSVALs
- ENVARs
- LIB
- JOBD
- Journals
- Files (also has DDL Only option)

Special Handling

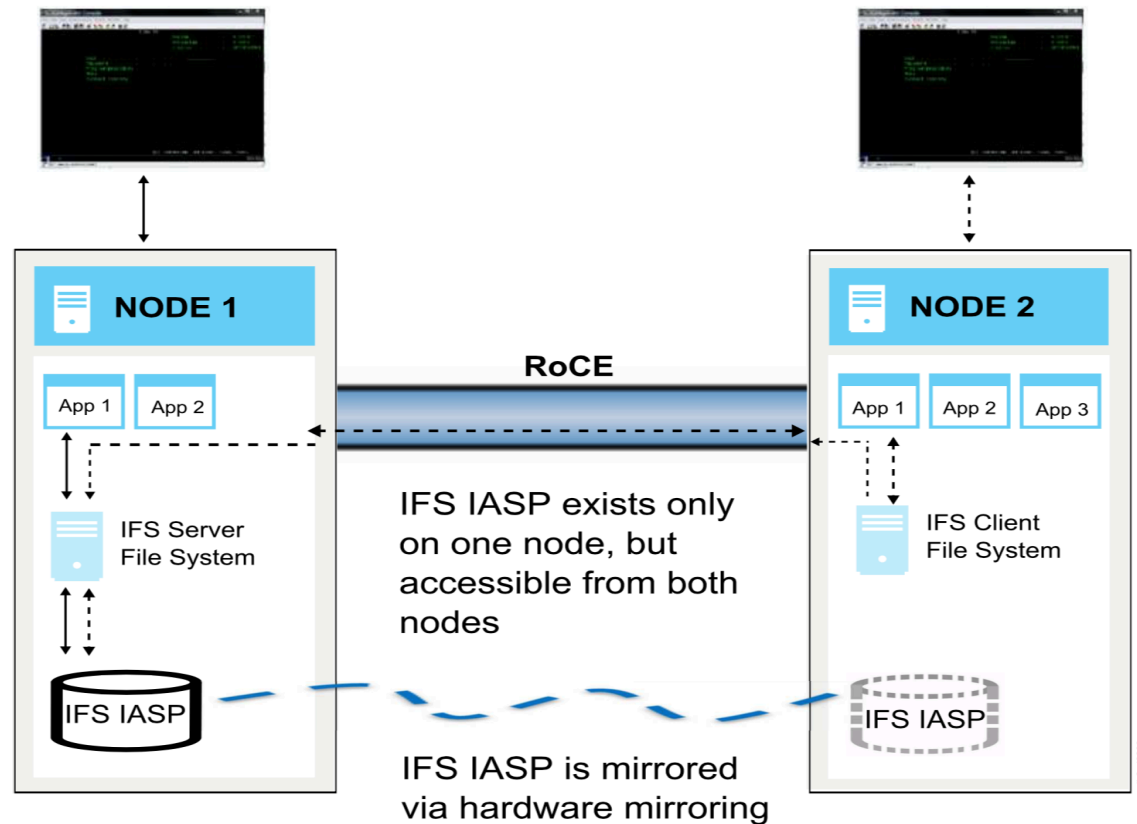
- OUTQ / Spool
- Job Queue

Objects can be in either **SYSBAS** or **IASPs**

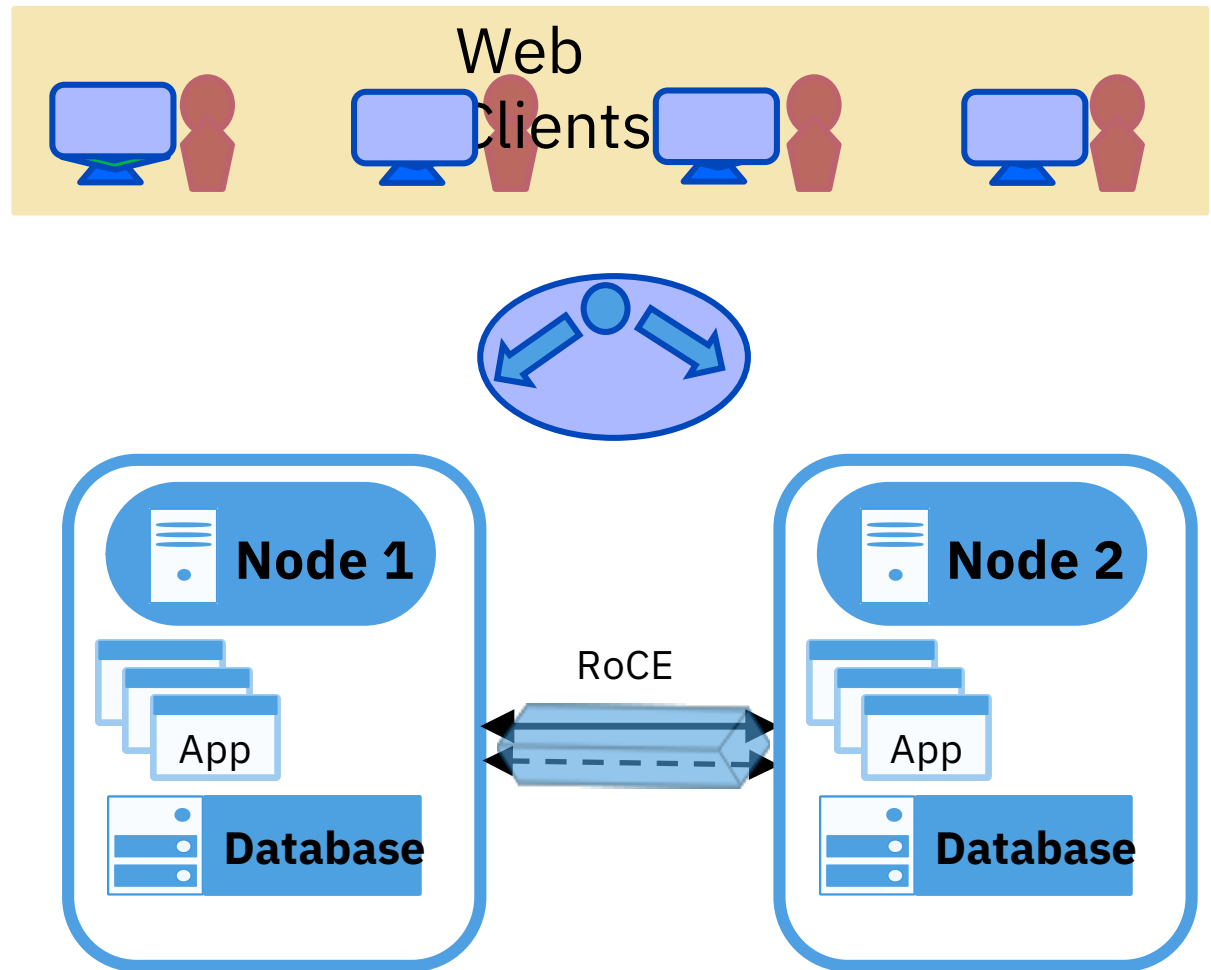


IFS Support

- Requires IASP
- IFS accessible on both Nodes (R/W)
- Requires PowerHA
- Filesystem automatically 'mutates' when the storage is switched



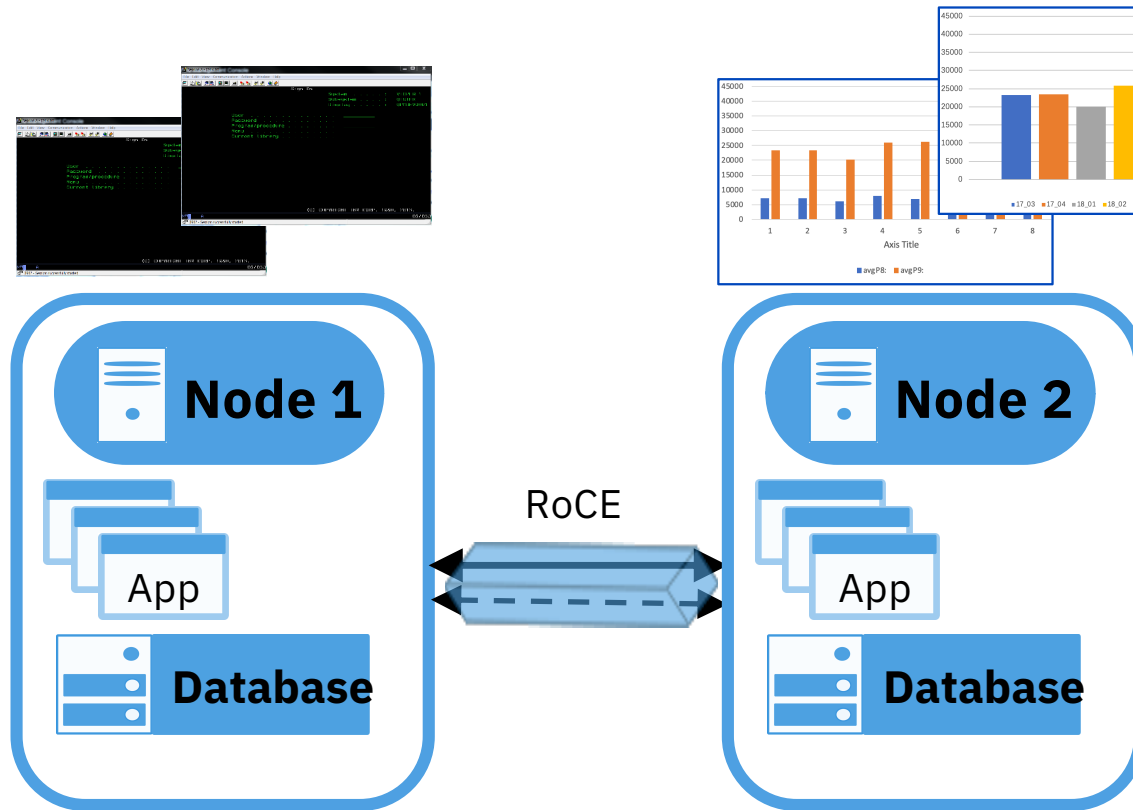
Db2 Mirror – Active Active, Web Clients



Application layer connects with either JDBC or Load Balancer

Db2 Mirror – Active Passive

Run Production Workloads on this node

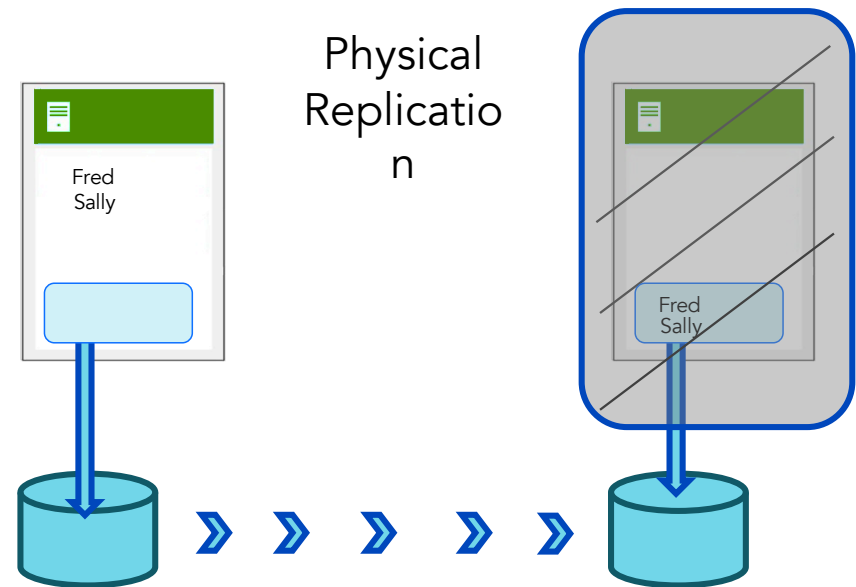
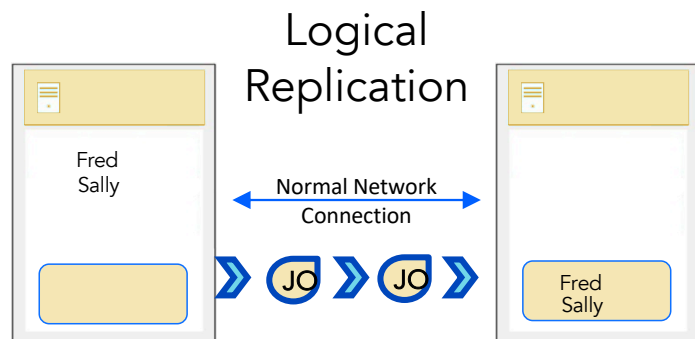


Run Queries and reports on this node

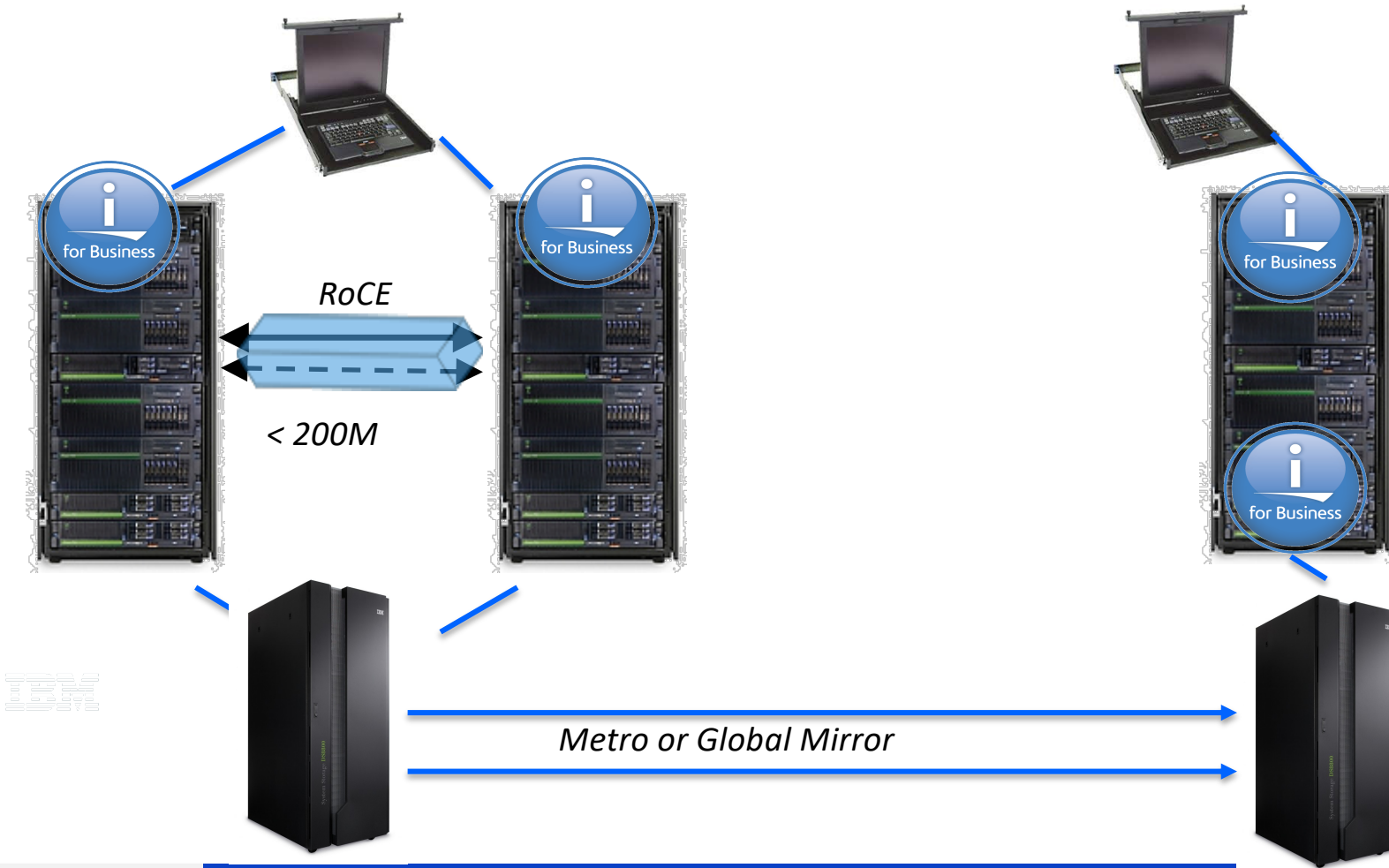


Db2 Mirror – What makes it different

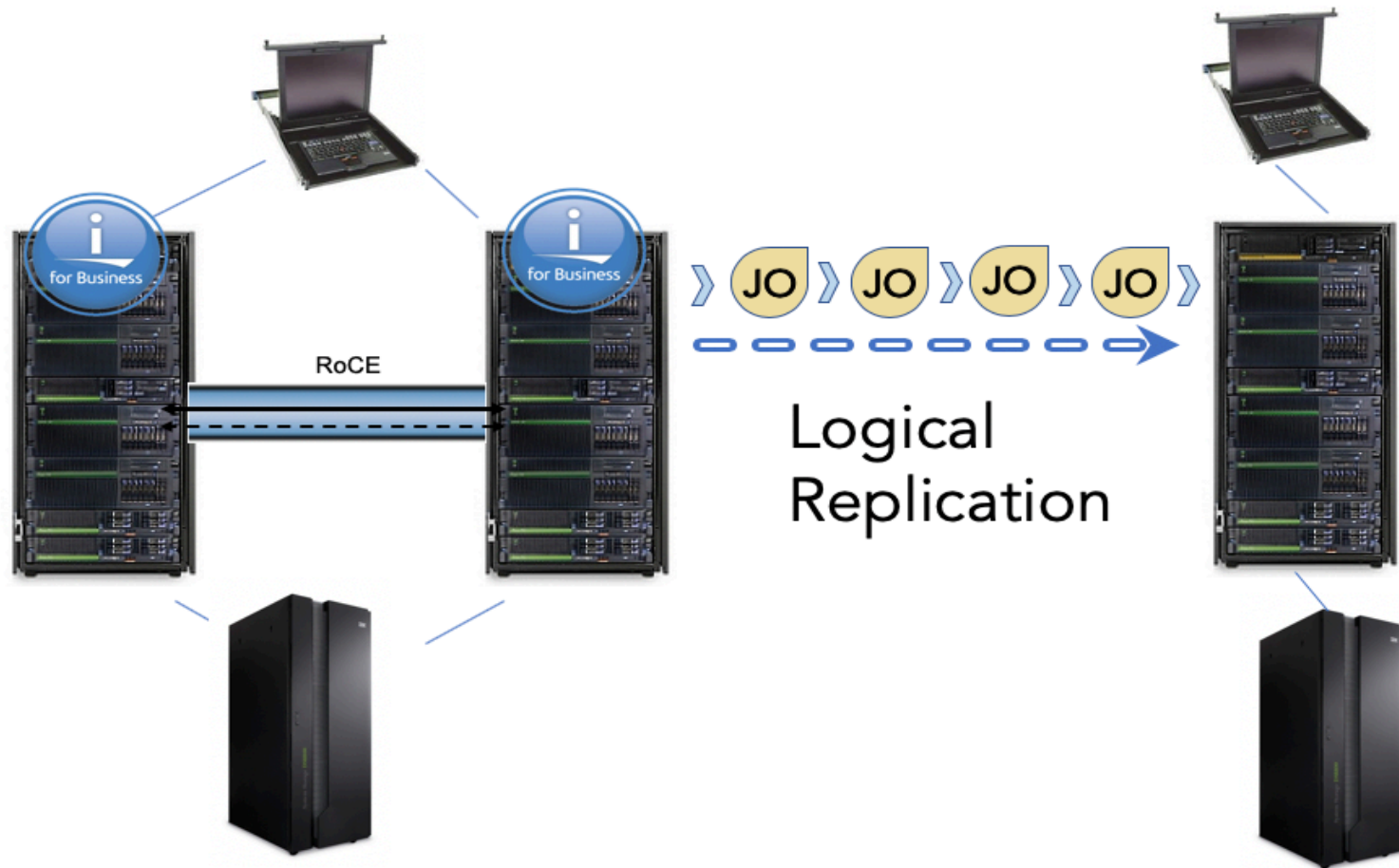
- New integrated IBM i synchronization technology
- Does not leverage any existing availability technology to provide continuous availability
 - But does work with existing technology



DR Solutions Built on Top of Db2 Mirror for IBM i



DR Solutions Built on Top of Db2 Mirror for IBM i



IBM
i

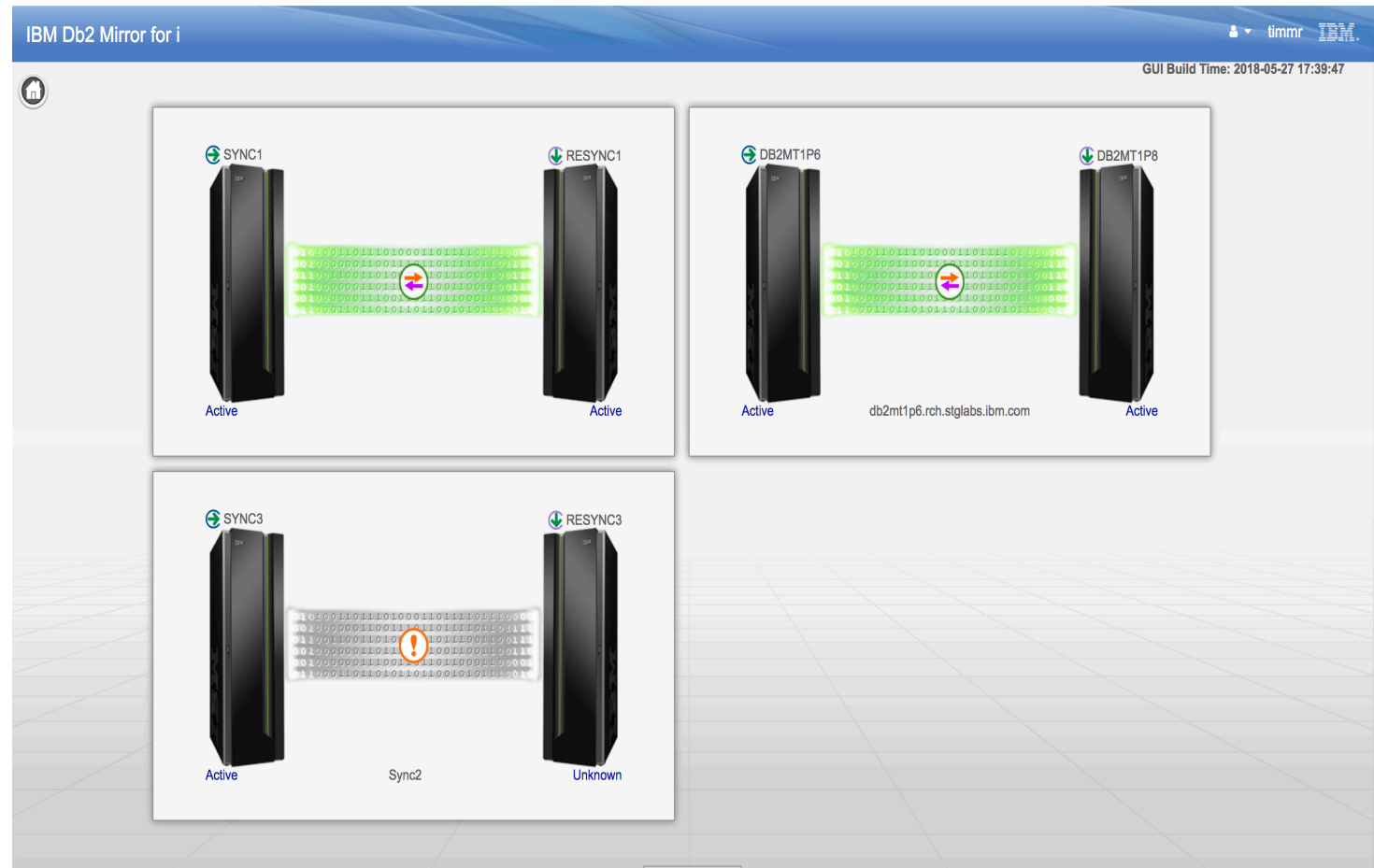
Db2 Mirror GUI

GUI runs on IBM i

GUI can run on the Db2 Mirror nodes

GUI can run outside of the Db2 Mirror nodes and manage multiple pairs

<http://systemname:2006/Db2Mirror>



SQL Services

Db2 Mirror - SQL Services - Septemb...

Contents

▼ DB2 Mirror Services

▶ Communication Services

▶ Product Services

▼ Replication Services

ADD_REPLICATION_CRITERIA pr...

CHECK_REPLICATION_CRITERIA...

INSPECT_REPLICATION_CRITERI...

PROCESS_PENDING_REPLICATI...

REMOVE_REPLICATION_CRITERI...

REPLICATION_CRITERIA_INFO vi...

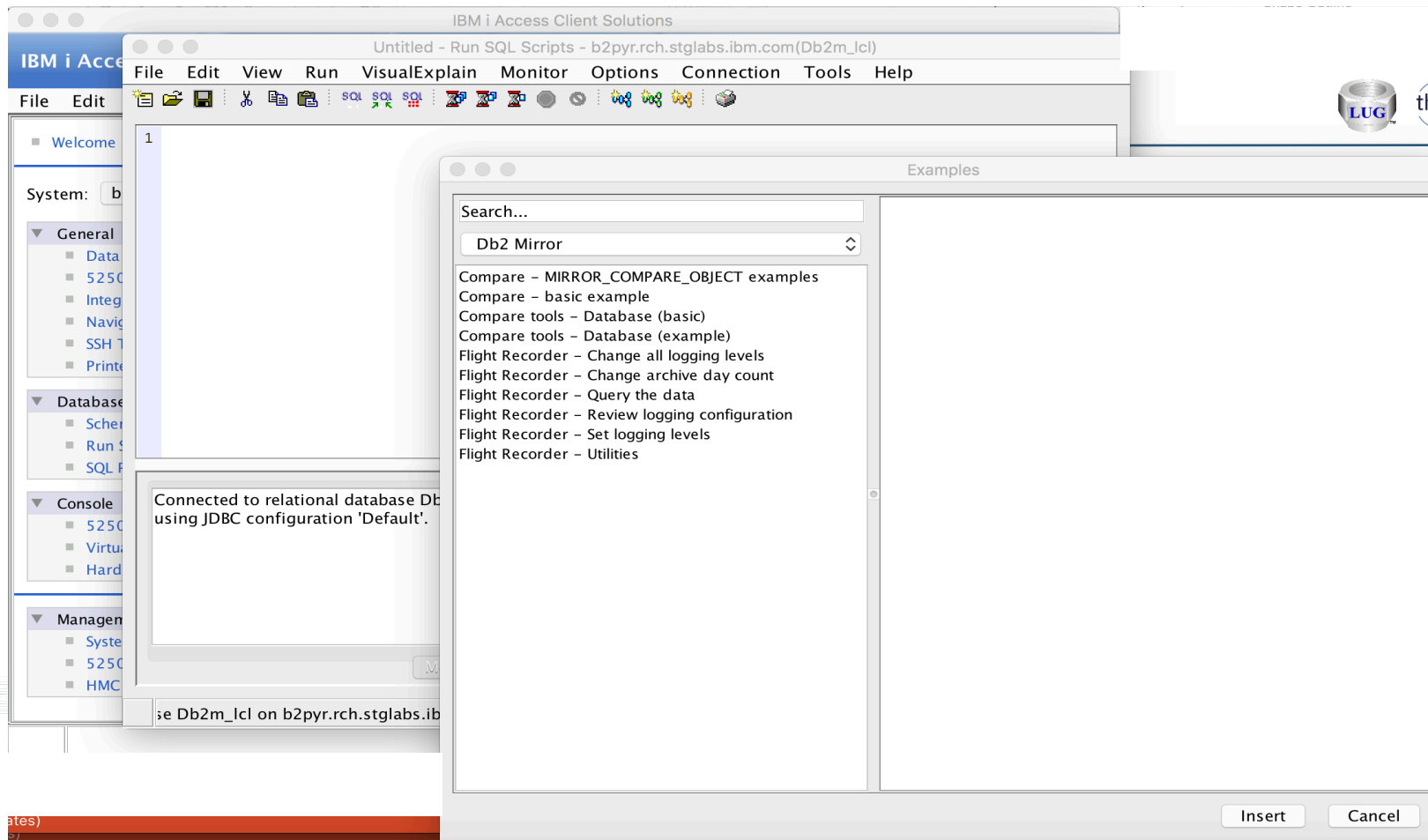
▶ Resynchronization Services

- EXECUTE SQL privilege on this procedure
- *USE authority on the QSYS/QMRDBSSDBA *SRVPGM.

```
▶—ADD_REPLICATION_CRITERIA—(—  
    [INCLUSION_STATE— => ] inclusion-state—, —  
    , [IASP_NAME— => ] iasp-name—, [LIBRARY_NAME— => ] library-name—  
    , [OBJECT_TYPE— => ] object-type—  
    , [OBJECT_NAME— => ] object-name—, [APPLY— => ] apply—  
    , [APPLY_LABEL— => ] apply-label— )
```

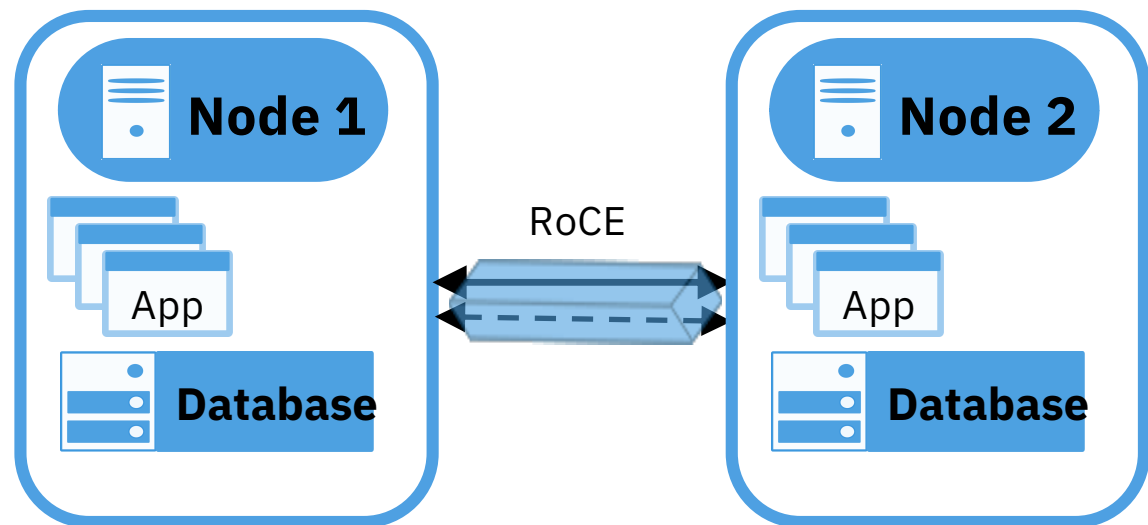


ACS Insert from Examples



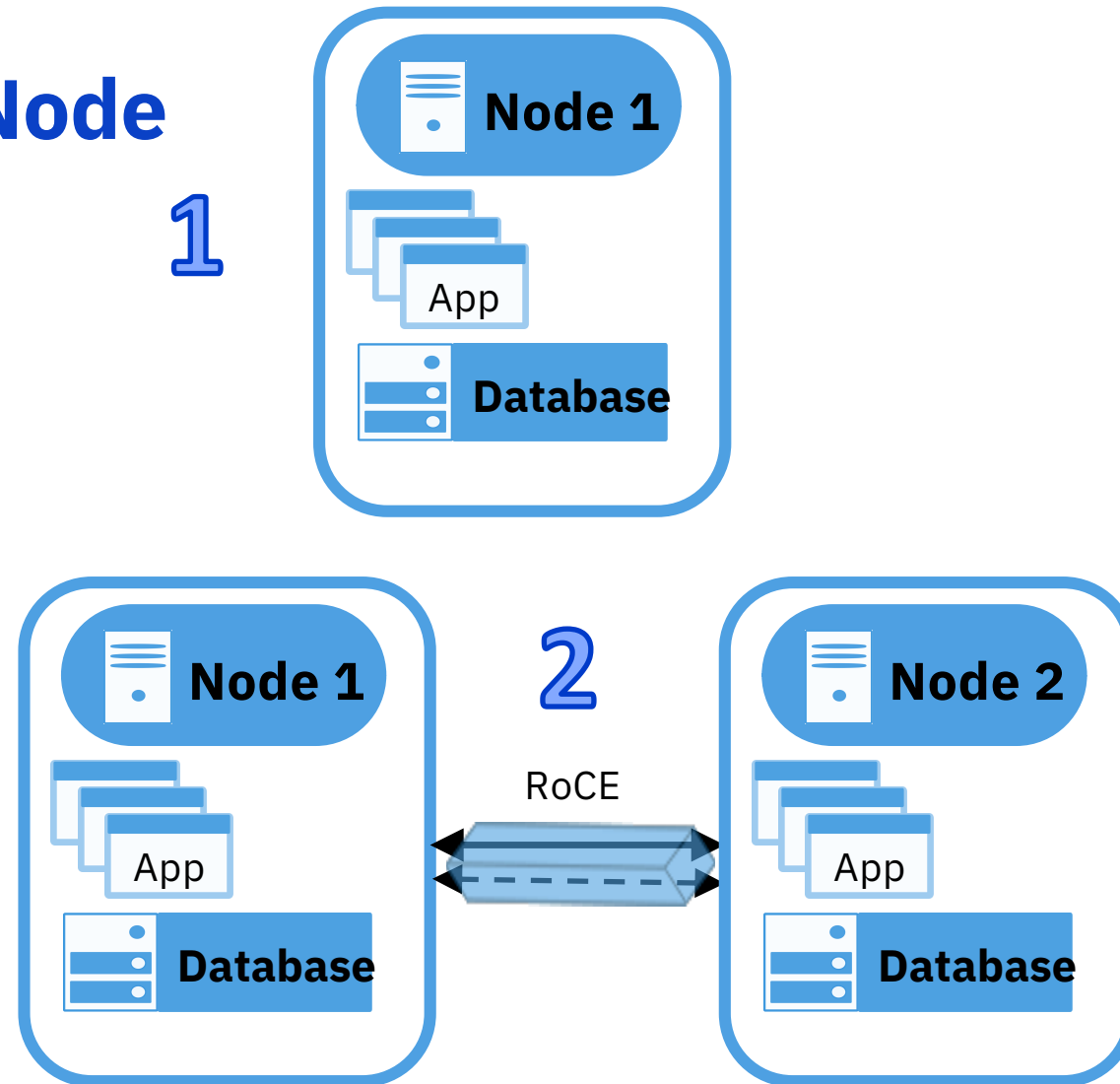
Performance Expectations

- With synchronous replication the complete path length will increase since the action may drive I/O on both nodes in order to finish. This could increase by up to $\sim(2-3)X$
- The ability to run transactions on both nodes will mitigate per transaction overhead and with a target of achieving equal to or greater transactional throughput
- Read workloads will not be impacted since they do not have to be replicated
- Single threaded or serial I/O workloads will be the most impacted.



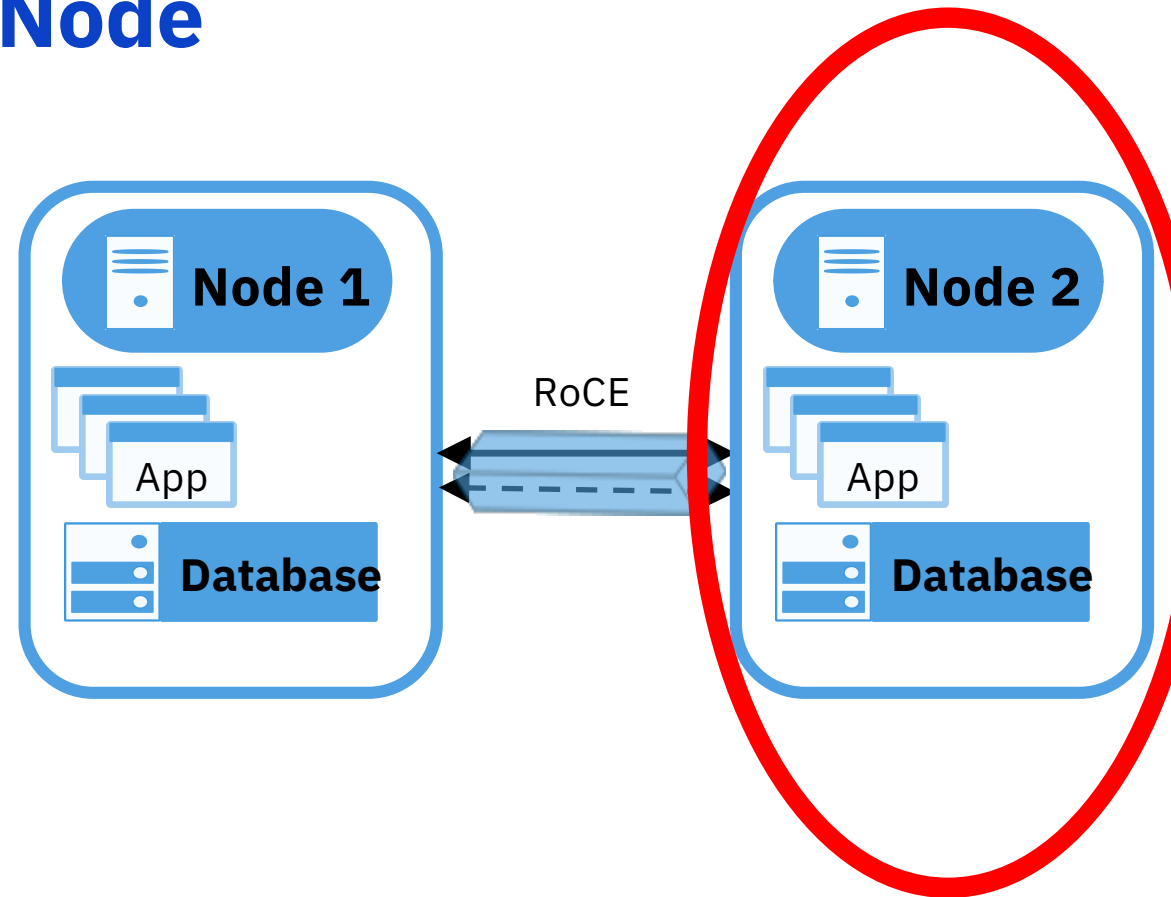
Setup of Db2 Mirror 2nd Node

- Guided wizard to setup
 - Input secondary config information
 - Start DB2Mirror
 - Clone original lpar
- On the clone lpar initial IPL, the config information will be set. ie IP addresses and system name.
- The Source and Clone will connect and form a cluster.
- The Source will sync any new changes that have happened after the clone and before the cluster formation.



Setup of Db2 Mirror 2nd Node

- Before starting setup
1. Define a second lpar at the HMC
 - CPU/MEM should be similar to the the source lpar
 2. Zone/Connect Storage Controller to the Node 2 lpar
 3. Create LUNs the same number and size as Node1.
 4. Assign LUNs to Node 2



Setup of Db2 Mirror 2nd Node

- Input HMC info:
- Source and Target don't have to be on the same HMC
- Select the LPARs from the List

IBM Db2 Mirror for i

Setup Db2 Mirror

Source and Copy Node Configuration ?

HMC Information Are source and copy managed on the same HMC?

HMC Information:

HMC Address:

User:

Password:

Select from the HMC LPARs list:

Db2 Mirror 2nd Node Setup

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr

GUI Build Time: 2019-04-14 10:34:3

Setup Db2 Mirror



Source and Copy Node Configuration

HMC Information

Specify the system information for each node in this Db2 Mirror pair.

Node Information

Source zz2p28 - Primary

Host Name:

IP Address:

Communication Port:

Line Description:

Subnet Mask:

Gateway:

System Name:

Domain Name:

DNS Servers:

Previous

Copy zz2p29 - Secondary

The copy node will be powered off during the cloning process.

Host Name:

IP Address: <<

Communication Port:

Line Description:

Subnet Mask:

Gateway:

System Name:

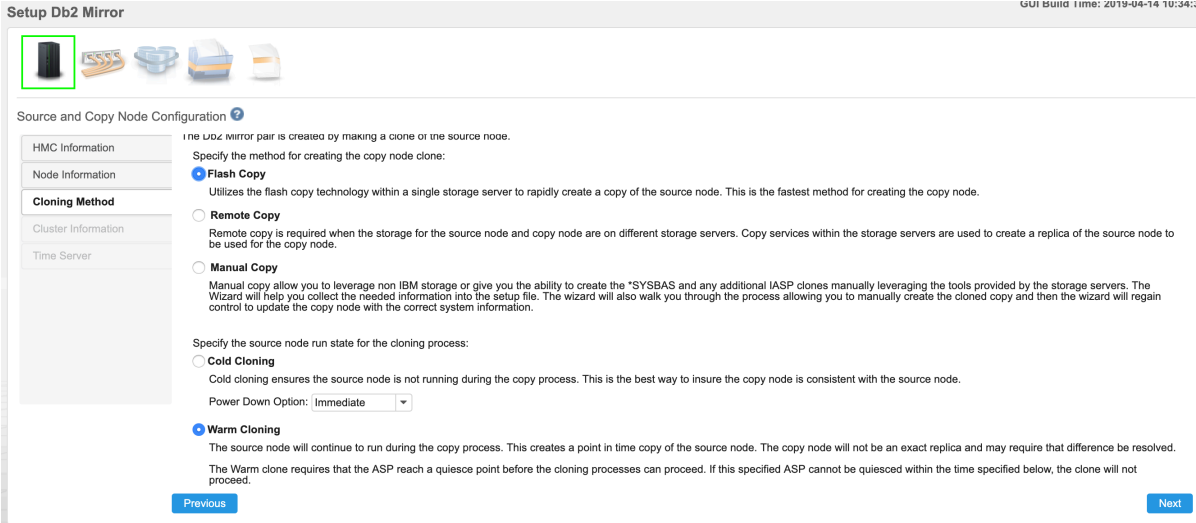
Domain Name:

Next

Input IP information for the Copy LPAR

External Storage Options

- If a single storage controller is used Flash Copy can be used with the system running (Warm) or shutdown (Cold).
- If you use Warm cloning, the system will be quiesced to a transaction commitment control boundary.
- If you have 2 storage controllers you can use a combination of metro/global mirroring and global copy.
- If you have DS8000 or Spectrum Virtualize storage, the process will be automated. If you any other storage you can select the manual option and issue the copy commands yourself.



Setup Db2 Mirror GUI Build Time: 2019-04-14 10:34:3

Cloning Method

Source and Copy Node Configuration ⓘ

HMC Information

Node Information

Cloning Method

Cluster Information

Time Server

The Db2 mirror pair is created by making a clone of the source node.

Specify the method for creating the copy node clone:

- Flash Copy**
Utilizes the flash copy technology within a single storage server to rapidly create a copy of the source node. This is the fastest method for creating the copy node.
- Remote Copy**
Remote copy is required when the storage for the source node and copy node are on different storage servers. Copy services within the storage servers are used to create a replica of the source node to be used for the copy node.
- Manual Copy**
Manual copy allow you to leverage non IBM storage or give you the ability to create the *SYSBAS and any additional IASP clones manually leveraging the tools provided by the storage servers. The Wizard will help you collect the needed information into the setup file. The wizard will also walk you through the process allowing you to manually create the cloned copy and then the wizard will regain control to update the copy node with the correct system information.

Specify the source node run state for the cloning process:

- Cold Cloning**
Cold cloning ensures the source node is not running during the copy process. This is the best way to insure the copy node is consistent with the source node.
Power Down Option: Immediate
- Warm Cloning**
The source node will continue to run during the copy process. This creates a point in time copy of the source node. The copy node will not be an exact replica and may require that difference be resolved.
The Warm clone requires that the ASP reach a quiesce point before the cloning processes can proceed. If this specified ASP cannot be quiesced within the time specified below, the clone will not proceed.

[Previous](#) [Next](#)

Time Servers

Setup Db2 Mirror



Source and Copy Node Configuration ?

HMC Information

Node Information

Cloning Method

Cluster Information

Time Server

Note: For a newly added time server, it may take several minutes after starting for the time server to become active and adjusting the time.

Specify Network Time Protocol (NTP) server information for source node:

Time Server Address	Preferred
tick.rchland.ibm.com	YES
tock.rchland.ibm.com	NO

Add

Specify NTP server information for copy node:

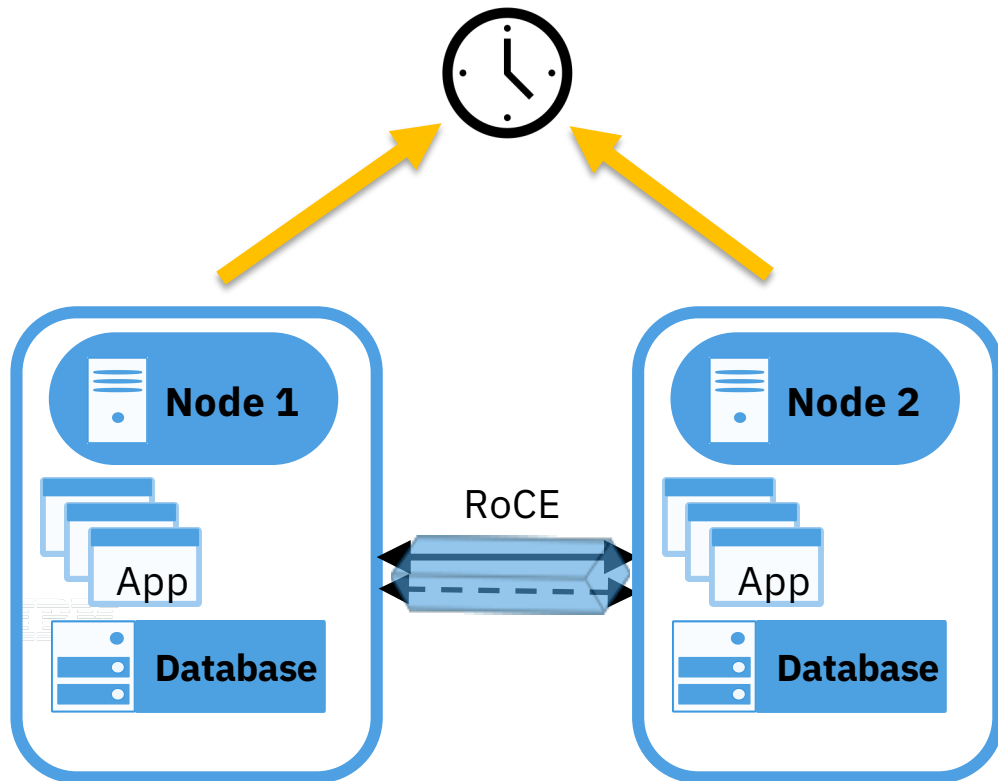
- Use the same external time server as the source node
- Use source node as the chained time server

Previous

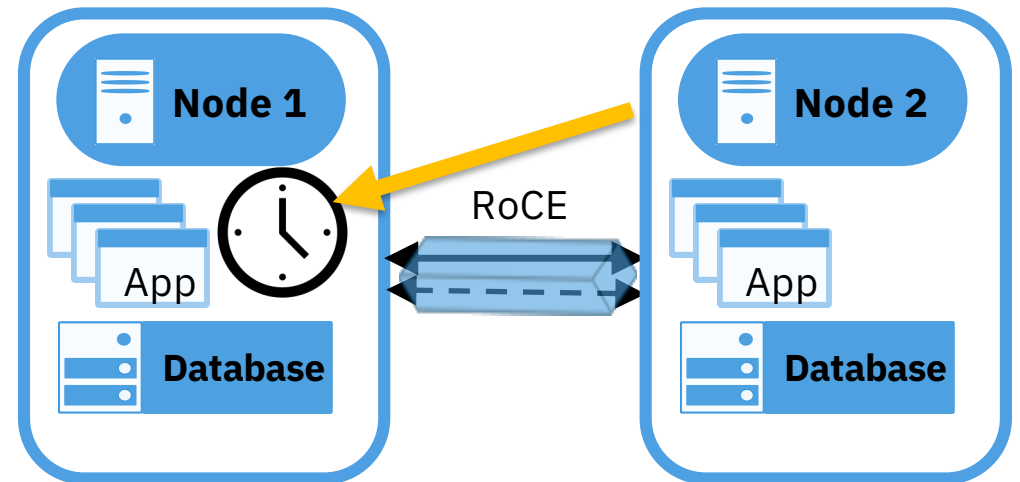
Save and Continue

Time Server Topology

- External Time Server



- Internal Time Server



Communication Hardware

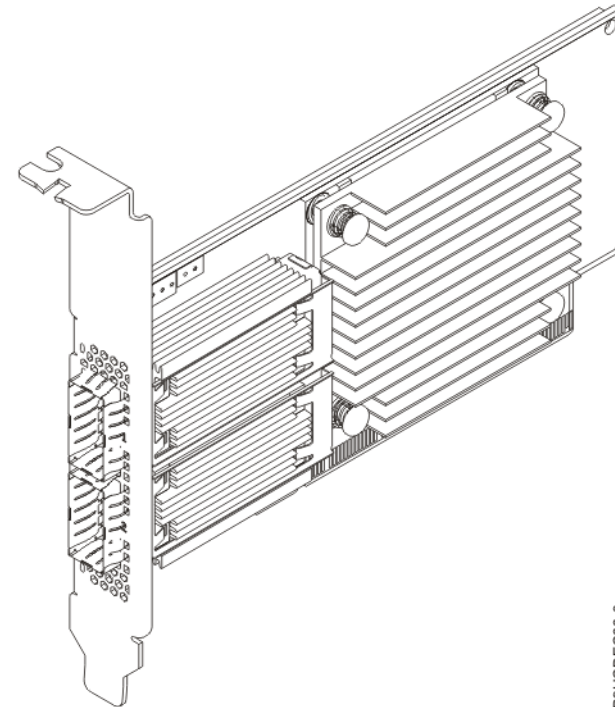
4 Adapter Options

- [PCIe3 2-port 10 Gb NIC & ROCE SR/Cu adapter \(FC EC2R and EC2S; CCIN 58FA\)](#)
- [PCIe3 2-port 25/10 Gb NIC & ROCE SFP28 adapter \(FC EC2T and FC EC2U; CCIN 58FB\)](#)
- [PCIe3 2-port 100 GbE NIC & ROCE QSFP28 Adapter \(FC EC3L and EC3M; CCIN 2CEC\)](#)
- [PCIe4 2-port 100 GbE ROCE x16 adapter \(FC EC66 and EC67; CCIN 2CF3\)](#)

 Max Cable length = 100 M

Optional RoCE switch

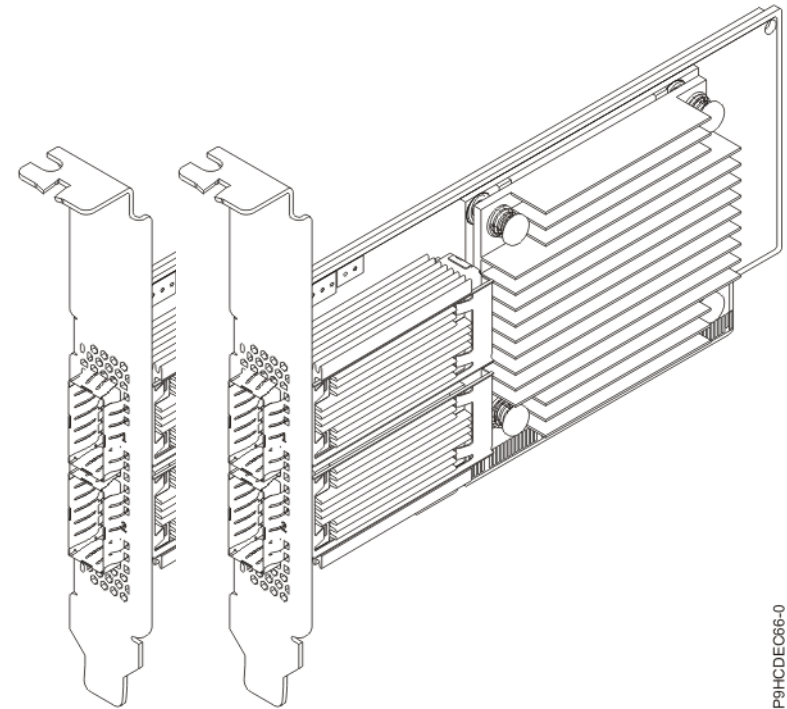
Power9 enables SR-IOV



P9HCDEC66-0

Network Redundancy Groups (NRG)

- Network Redundancy Groups are a logical group of physical ports.
- Up to 16 links can form an NRG.
- Ability to prioritize different types of traffic onto separate physical links
- Failover domain is the entire group of ports



P9HCDEC66-0

Db2 Mirror Setup

Primary - ZZ2P28 Secondary - ZZ2P29

Group ^	IP Address - ZZ2P28 ⇅	Priority ⇅	Link State ⇅	IP Address - ZZ2P29 ⇅
All ▾	All ▾	All ▾	All ▾	All ▾
✓ Database Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ Db2 Mirror Environment Manager	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ IFS Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ System Object Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ Resynchronization	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29

View NRG Statistics

5 separate NRG categories to isolate traffic



Db2 Mirror Setup

Primary - ZZ2P28 Secondary - ZZ2P29

Group	IP Address - ZZ2P28	Priority	Link State	IP Address - ZZ2P29
Load Balance: 1 All	All	All	All	All
Database Replication	169.254.2.28	1	Up	169.254.2.29
	169.254.3.28	1	Standby	169.254.3.29
Db2 Mirror Environment Manager	169.254.2.28	1	Up	169.254.2.29
	169.254.3.28	1	Standby	169.254.3.29
IFS Replication	169.254.2.28	1	Up	169.254.2.29
	169.254.3.28	1	Standby	169.254.3.29
System Object Replication	169.254.2.28	1	Up	169.254.2.29
	169.254.3.28	1	Standby	169.254.3.29
Resynchronization	169.254.2.28	1	Up	169.254.2.29
	169.254.3.28	1	Standby	169.254.3.29

[View NRG Statistics](#)

The Load Balance Link Count tells the NRG how many active links to use
The default is 1 up to the max of 16 links

Db2 Mirror Setup

Primary - ZZ2P28

Secondary - ZZ2P29

Group ^	IP Address - ZZ2P28 ^	Priority ^	Link State ^	IP Address - ZZ2P29 ^
Load Balance: 1	All	All	All	All
✓ Database Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ Db2 Mirror Environment Manager	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ IFS Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ System Object Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ Resynchronization	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29

View NRG Statistics

This config has 2 physical links and is showing with a Load Balance count of 1 only one is active.



Db2 Mirror Setup

Primary - ZZ2P28 Secondary - ZZ2P29

Group ^	IP Address - ZZ2P28 ⇅	Priority ⇅	Link State ⇅	IP Address - ZZ2P29 ⇅
All ▾	All ▾	All ▾	All ▾	All ▾
✓ Database Replication	169.254.2.28	2	⏻ Standby	169.254.2.29
	169.254.3.28	1	✓ Up	169.254.3.29
✓ Db2 Mirror Environment Manager	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ IFS Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ System Object Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ Resynchronization	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29

View NRG Statistics

The priority influences which link is active for the NRG



Db2 Mirror Setup

Primary - ZZ2P28 Secondary - ZZ2P29

Group ^	IP Address - ZZ2P28 ⇅	Priority ⇅	Link State ⇅	IP Address - ZZ2P29 ⇅
Load Balance: 2 All	All	All	All	All
✓ Database Replication	169.254.3.28	1	✓ Up	169.254.3.29
	169.254.2.28	2	✓ Up	169.254.2.29
✓ Db2 Mirror Environment Manager	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ IFS Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ System Object Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29
✓ Resynchronization	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	1	⏻ Standby	169.254.3.29

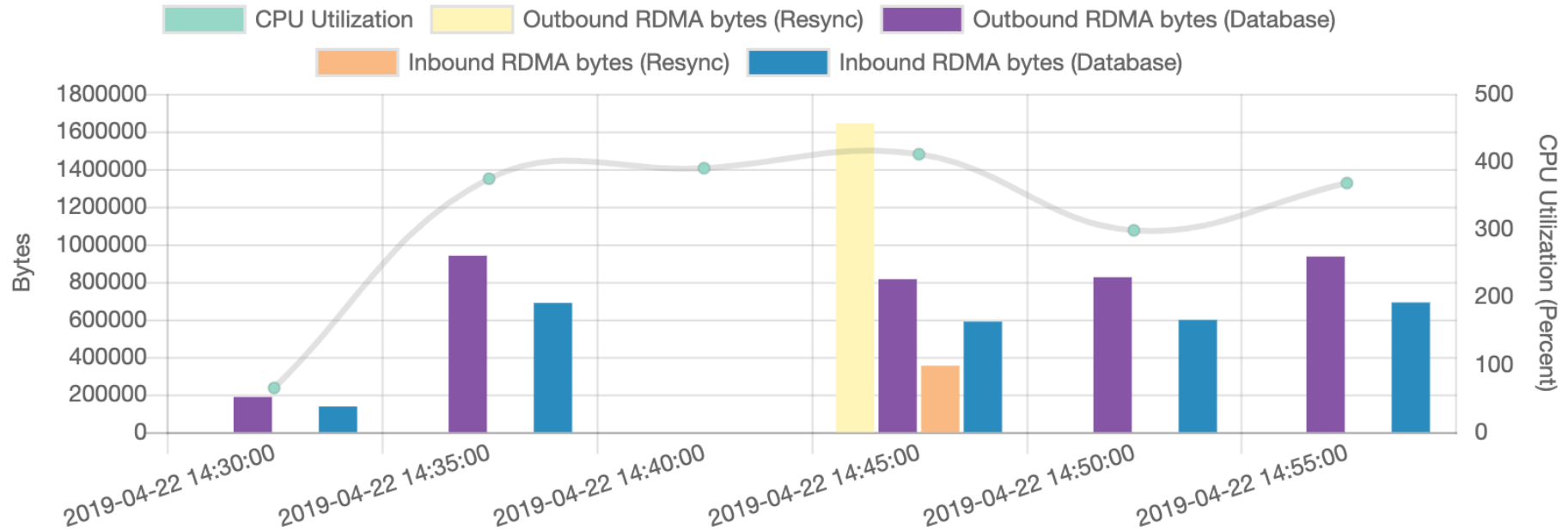
View NRG Statistics

This config has 2 physical links and is showing with a Load Balance count of 2 which makes both links active.



Db2 Mirror Network Statistics

] NRG Bytes



Group ^	IP Address - ZZ2P28 ⇅	Priority ⇅	Link State ⇅	IP Address - ZZ2P29 ⇅
Database Replication, Resynchronization ▾	All ▾	All ▾	All ▾	All ▾
✓ Database Replication	169.254.2.28	1	✓ Up	169.254.2.29
	169.254.3.28	2	⏻ Standby	169.254.3.29
✓ Resynchronization	169.254.3.28	1	✓ Up	169.254.3.29
	169.254.2.28	2	⏻ Standby	169.254.2.29

View NRG Statistics

week

Default Inclusion State for Replication Rules

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P28

Setup Db2 Mirror



Replication List Configuration ?

Mirror Options

*SYSBAS

Default Inclusion State

The objects within *SYSBAS or an IASP are eligible to be included in the Db2 Mirror environment. The default inclusion state must be set for each before continuing.

Exclude - All objects for this group are excluded by default. Additional rules may be added to include specific libraries and objects within this group.

Include - All eligible objects for this group are included by default. Additional rules may be added to restrict specific libraries and objects from being mirrored.

*SYSBAS Exclude

Refresh

NOTE: Can only be chosen at setup time or re-configuration time.

Replication List Rules

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr

GUI Build Time: 2019-04-14 10:34:34

Manage Replication List - Rules

Primary - ZZ2P28 Secondary - ZZ2P29

Rules Inspect

Active Pending Active/Pending

Add a Rule

test Object Type Object Name Exclude Include Definition Only

User Defined Rules Only

Default Inclusion State: Exclude

Status	Library Name	Object Name	Replication State	Rule Group	Action	Rule Source	IASP Name
	Filter		All	All		User	*SYSBAS
	QCMD325283		Exclude	Active		User	*SYSBAS
	QCMD333585		Exclude	Active		User	*SYSBAS
	QCMD542100		Exclude	Active		User	*SYSBAS
	QCMD681367		Exclude	Active		User	*SYSBAS
	QCMD759797		Exclude	Active		User	*SYSBAS
	QCMD821435		Exclude	Active		User	*SYSBAS
	QCMD980732		Exclude	Active		User	*SYSBAS
	QDEXDATA	*ALL	Include	Active		User	*SYSBAS
	QDEXDATA01	*ALL	Include	Active		User	*SYSBAS
	SPLMR000KW	*ALL	Include	Active		User	*SYSBAS
	TRANS1000	*ALL	Include	Active		User	*SYSBAS

Add Rules for existing objects and objects that don't exist yet

Add Rules for an object type or a specific object name

1 300 Total Rows: 14

Replication List Rules

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr

GUI Build Time: 2019-04-14 10:34:34

Manage Replication List - Rules

Primary - ZZ2P28 Secondary - ZZ2P29

Rules Inspect

Add a Rule

test *ALL *ALL Exclude Include Definition Only

User Defined Rules Only

Set the rule to include or exclude the object/library from replication

Default Inclusion State: Exclude

Status	Library Name	Object Type	Object Name	Replication State	Rule Group	Action	Rule Source	IASP Name
	Filter	All	Filter	All	All		All	All
	QCMD325283	*ALL	*ALL	Exclude	Active		User	*SYSBAS
	QCMD333586	*ALL	*ALL	Exclude	Active		User	*SYSBAS
	QCMD542101	*ALL	*ALL	Exclude	Active		User	*SYSBAS
	QCMD681367	*ALL	*ALL	Exclude	Active		User	*SYSBAS
	QCMD759797	*ALL	*ALL	Exclude	Active		User	*SYSBAS
	QCMD821435	*ALL	*ALL	Exclude	Active		User	*SYSBAS
	QCMD980732	*ALL	*ALL	Exclude	Active		User	*SYSBAS
	QDEXDATA	*ALL	*ALL	Include	Active		User	*SYSBAS
	QDEXDATA01	*ALL	*ALL	Include	Active		User	*SYSBAS
	SPLMR000KW	*ALL	*ALL	Include	Active		User	*SYSBAS
	TRANS1000	*ALL	*ALL	Include	Active		User	*SYSBAS

1 300

Total Rows: 14

Inspect what the Rules look like applied to the System

IBM Db2 Mirror for i Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

GUI Build Time: 2019-04-24 22:11:39

Manage Replication List - Inspect

Primary - ZZ2P28 Secondary - ZZ2P29

Rules **Inspect**

Library Name	Replication State	Object Count	Object Name	Object Type	Object Replication State
QUSR1EMP	Exclude	0	CPYSPLF	*FILE	Include
QUTL	Exclude	8	DTAQ001	*DTAQ	Include
QVOITEST	Exclude	0	DTAQ002	*DTAQ	Include
QWEBQRY	Exclude	658	DTAQ003	*DTAQ	Include
QWEBQRYX	Exclude	24	DTAQ004	*DTAQ	Include
QXMLSERV	Exclude	5	DTAQ005		Include
SBPGETLOG	Exclude	2	MSGQ001	*MSGQ	Ineligible
SPLMASTER	Exclude	200	OUTQFINAL		
SPLMR00KW	Include	13	OUTQ001		
SPLMR00SS	Include	13	OUTQ002		
SPLMR001KW	Include	8	OUTQ003		
SPLMR001SS	Include	8	OUTQ004		
SYSIBM	Exclude	65	OUTQ005		
SYSIBMADM	Exclude	81			
SYSPROC	Exclude	2			
SYSTOOLS	Exclude	59			
TRANSWL	Exclude	19			
TRANS1000	Include	1000			
TRANS10000	Exclude	10000			
VOLANO	Exclude	25			
WHITNEYK	Exclude	0			

→ SPLMR00KW + Include 13

Total Rows: 200

*SYSBAS - SPLMR00KW - *DTAQ - DTAQ004

Applied Rule:

Precedence Order	IASP Name	Library	Object Type	Object Name	State
1	*SYSBAS	SPLMR00KW	*ALL	*ALL	Include
2	*SYSBAS	*ALL	*ALL	*ALL	Exclude

OK Cancel

System Defined Rules

Manage Replication List - Rules

Primary - ZZ2P28 Secondary - ZZ2P29

Rules Inspect

Active Pending Active/Pending

All Pending Groups

Add a Rule

Library Name Object Type Object Name Exclude Include Definition Only

System Defined Rules Only

Default Inclusion State: Exclude

System Defined Rules are predefined and cannot be changed

Status	Library Name	Object Type	Object Name	Replication State	Rule Group	Action	Rule Source	IASP Name
	Filter	All	Filter	All	All		All	All
🔒	QBRM	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QCA400W	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QCLUSTER	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDB2MIR	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDB2MS	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDEVELOP	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDEVTOOLS	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDEXBASE	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDNS	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDOC	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDOC0002	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDOC0003	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDOC0004	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDOC0005	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDOC0006	*ALL	*ALL	Exclude	Active		System	*SYSBAS
🔒	QDOC0007	*ALL	*ALL	Exclude	Active		System	*SYSBAS

Pending Rules

IBM Db2 Mirror for i Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

Manage Replication List - Rules Success: Pending rule [Test1pgms-*PGM-*ALL-Include] has been successfully added to Pending Group 'app1'. GUI Build Time: 2019-04-24 22:11:39

Primary - ZZ2P28 Secondary - ZZ2P29 Rules Inspect

Active **Pending** Active/Pending
app1

Add a Rule Exclude Include Definition On

Test1pgms *PGM *ALL Create a group of rules before applying them to the system

User Defined Rules Only

Default Inclusion State: Exclude

Status	Library Name	Object Type	Object Name	Replication State	Rule Group	Action	Rule Source	IASP Name
	Filter	All	Filter	All	All		All	All
➔	TEST1	*ALL	*ALL	➕ Include	app1	🗑	User	*SYSBAS
➔	TEST1PGMS	*PGM	*ALL	➕ Include	app1	🗑	User	*SYSBAS

1 100 Total Rows: 2

Apply Pending Group

12

IBM

Visualize Pending Groups

IBM Db2 Mirror for i Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

✔ Success: Pending rule [Test1pgms-*PGM-*ALL-Include] has been successfully added to Pending Group 'app1'.

GUI Build Time: 2019-04-24 22:11:39

Manage Replication List - Rules

Primary - ZZ2P28 Secondary - ZZ2P29 Rules Inspect Active Pending Active/Pending app1

Add a Rule ?

Test1pgms *PGM *ALL Exclude Include Definition Only

User Defined Rules Only

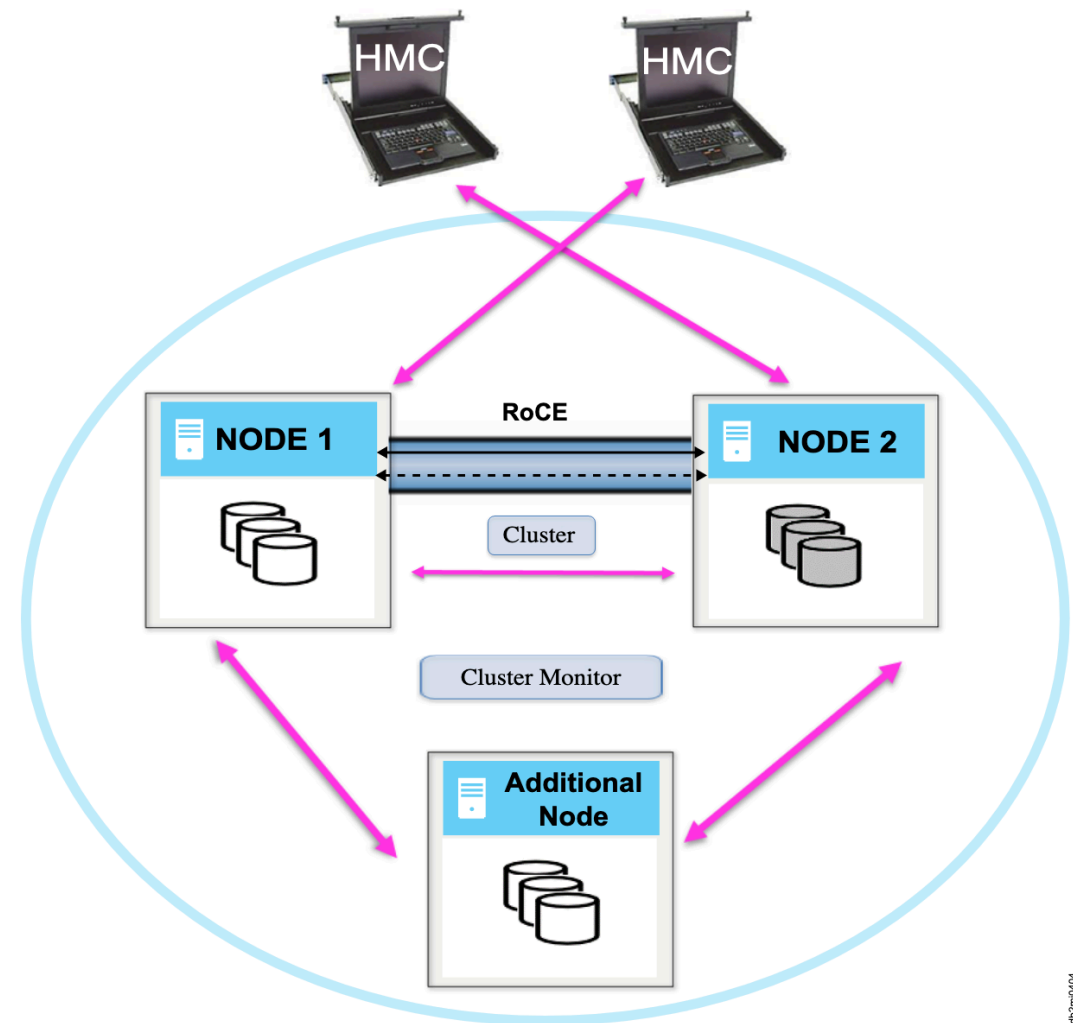
Default Inclusion State: ⊖ Exclude

Status	Library Name	Object Type	Object Name	Replication State	Rule Group	Action	Rule Source	IASP Name
	Filter	All	Filter	All	All		All	All
	QCMD325283	*ALL	*ALL	⊖ Exclude	Active	🗑	User	*SYSBAS
	QCMD333586	*ALL	*ALL	⊖ Exclude	Active	🗑	User	*SYSBAS
	QCMD542101	*ALL	*ALL	⊖ Exclude	Active	🗑	User	*SYSBAS
	QCMD681367	*ALL	*ALL	⊖ Exclude	Active	🗑	User	*SYSBAS
	QCMD759797	*ALL	*ALL	⊖ Exclude	Active	🗑	User	*SYSBAS
	QCMD821435	*ALL	*ALL	⊖ Exclude	Active	🗑	User	*SYSBAS
	QCMD980732	*ALL	*ALL	⊖ Exclude	Active	🗑	User	*SYSBAS
	QDEXDATA	*ALL	*ALL	⊕ Include	Active	🗑	User	*SYSBAS
	QDEXDATA01	*ALL	*ALL	⊕ Include	Active	🗑	User	*SYSBAS
	SPLMR000KW	*ALL	*ALL	⊕ Include	Active	🗑	User	*SYSBAS
	SPLMR000SS	*ALL	*ALL	⊕ Include	Active	🗑	User	*SYSBAS
	SPLMR001KW	*ALL	*ALL	⊕ Include	Active	🗑	User	*SYSBAS
	SPLMR001SS	*ALL	*ALL	⊕ Include	Active	🗑	User	*SYSBAS
➔	TEST1	*ALL	*ALL	⊕ Include	app1	🗑	User	*SYSBAS
➔	TEST1PGMS	*PGM	*ALL	⊕ Include	app1	🗑	User	*SYSBAS
	TRANS1000	*ALL	*ALL	⊕ Include	Active	🗑	User	*SYSBAS

Apply Pending Group 1 100 Total Rows: 19

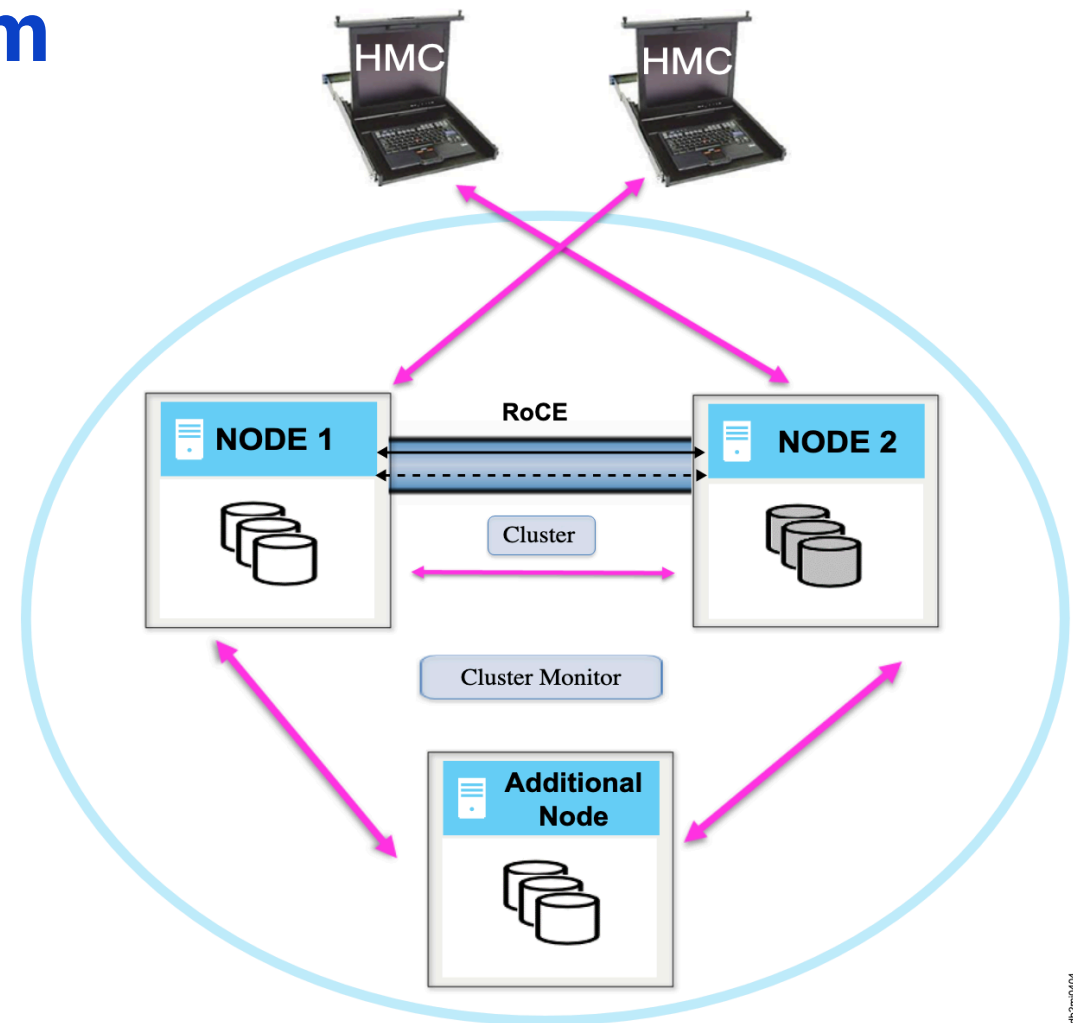
Detecting Errors

- Nodes are designed as a 'Primary' or 'Secondary' to indicate which node is preferred to 'track'.
- HMCs are used for failure detection of the partner node to indicate the Secondary can automatically take over as the Primary and begin tracking to allow Db2 transactions to continue.
- The Secondary side will block changes to Db2 transactions



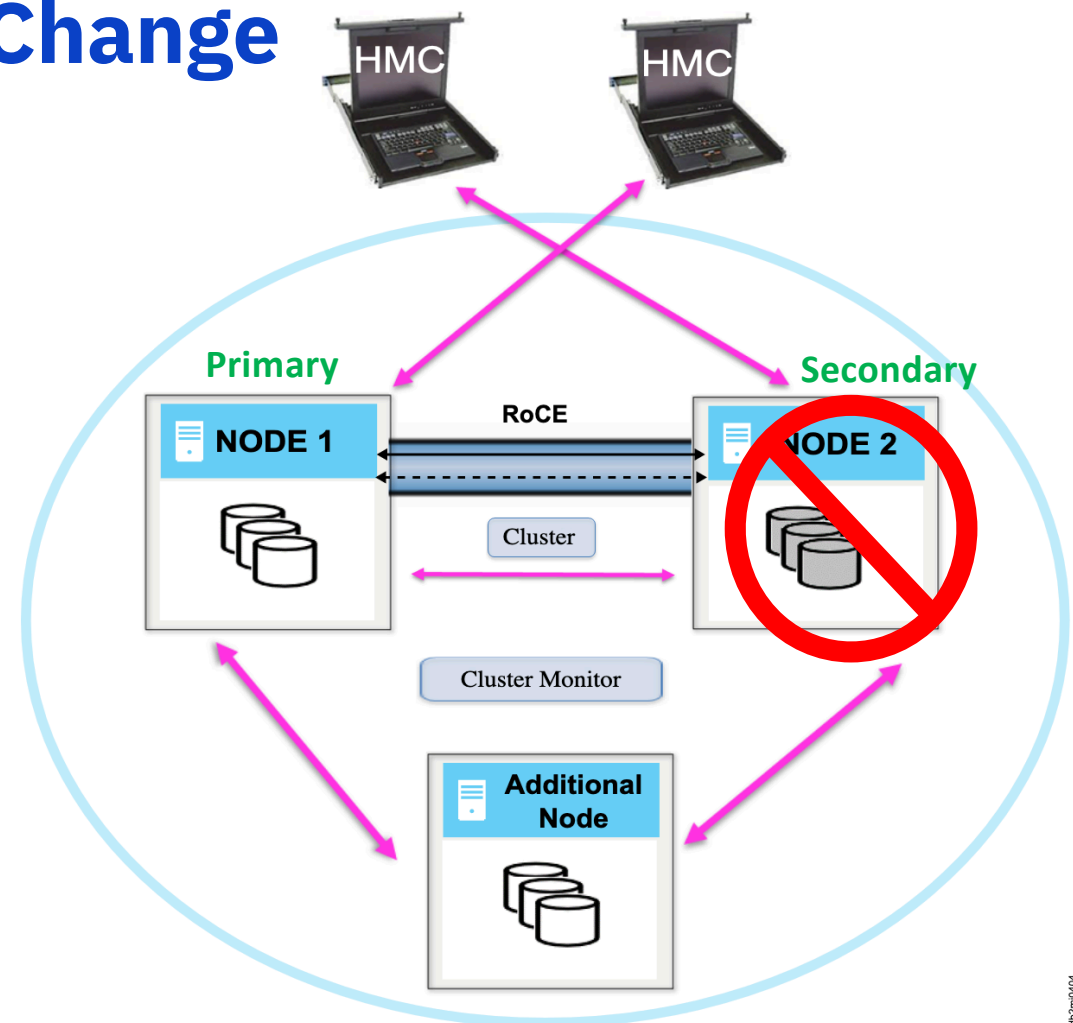
Detecting Errors - Quorum

- Additional nodes are added to the cluster to help determine the Primary and Secondary roles in the event that the partner node is down when node IPLs.
- The quorum data is shared amongst all nodes in the cluster and stores state information.
- Typically, if there is a DR configuration those nodes would serve as the additional nodes to store quorum data.



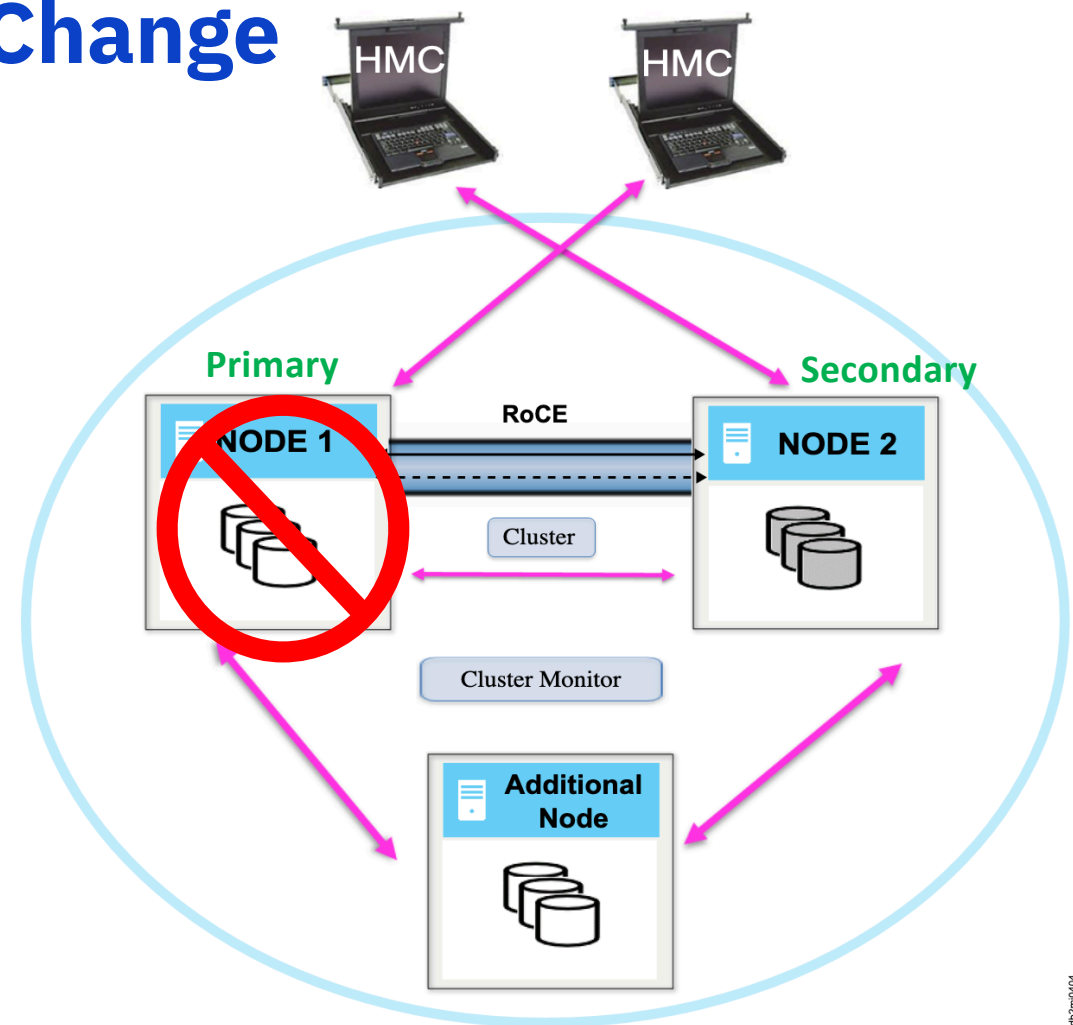
Detecting Errors – State Change

- **If the Secondary Fails:**
 - IPLs
 - MSD
 - **Goes to Restricted State**
- The Primary will begin tracking replicated object changes and the application will continue to run.
- The Secondary will be in a 'blocked' state and not allow changes to replicated objects until the two nodes have resumed mirroring.



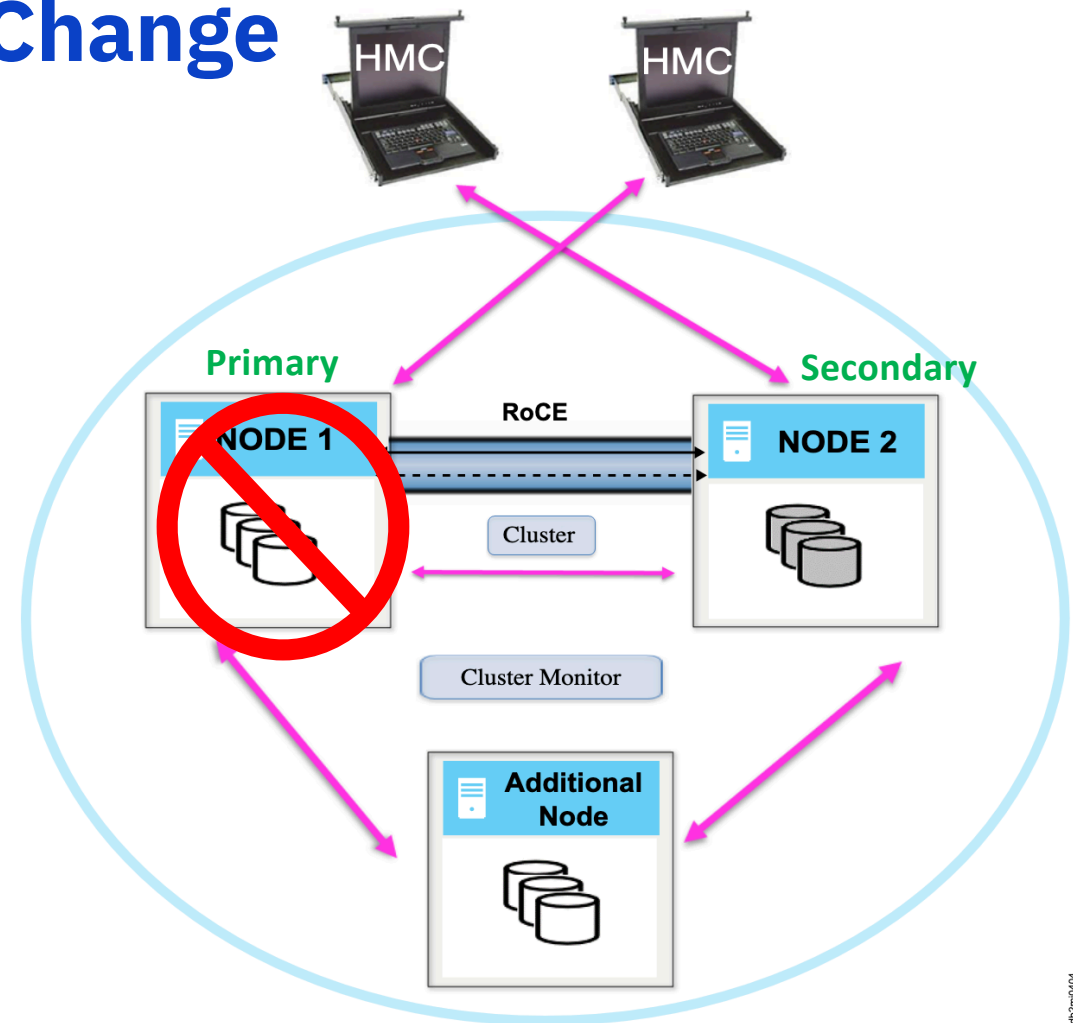
Detecting Errors – State Change

- **If the Primary Fails (Crash/MSD):**
- If the secondary can connect to the HMC and determine the primary has failed, the secondary will take over as the primary and begin tracking.
- If the secondary cannot detect the failure it will remain blocked. The user may choose to force the secondary to become the primary.



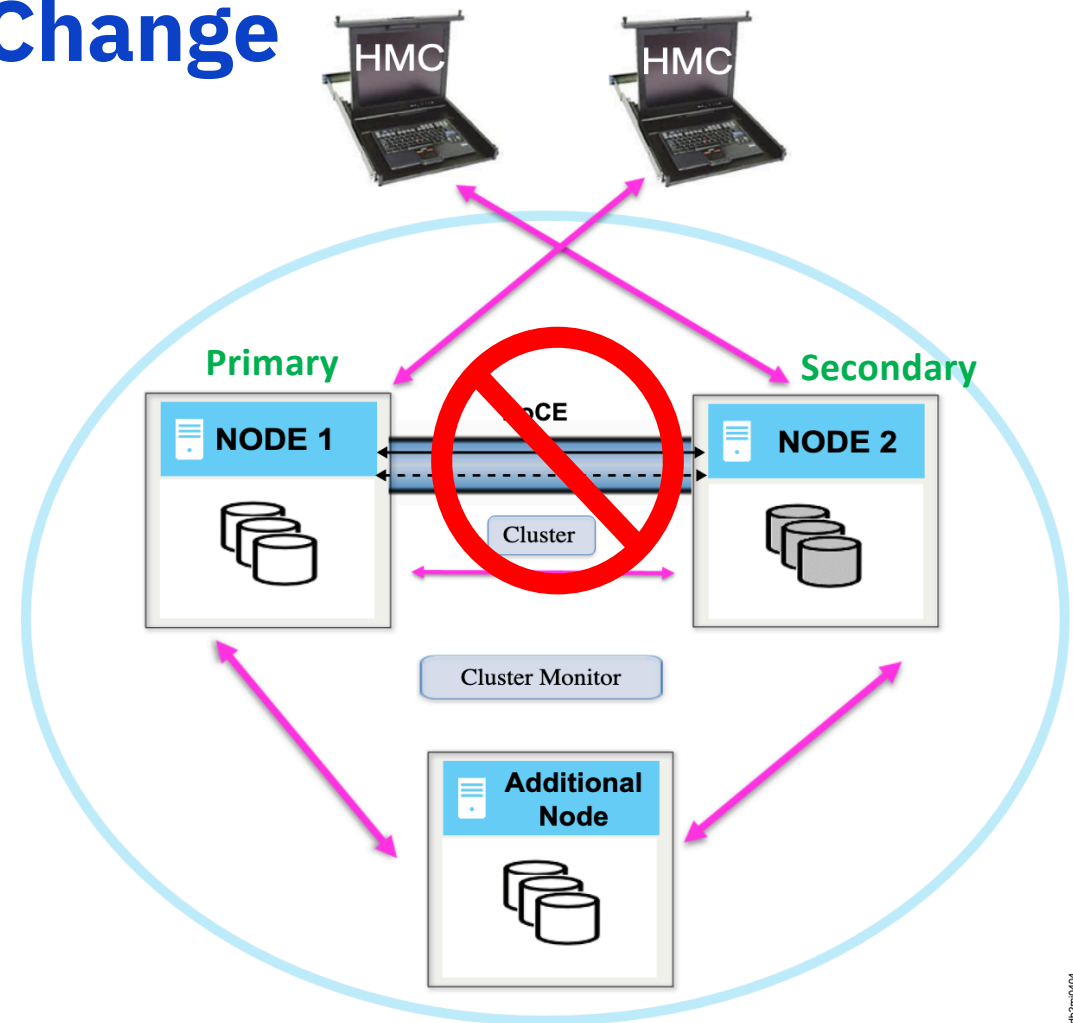
Detecting Errors – State Change

- If the Primary does an normal IPL or goes to restricted state:
- The secondary will remain blocked and primary will track while in restricted state or until the IPL completes.



Detecting Errors – State Change

- If the network fails:
- If there is no communication between the 2 nodes over the RoCE network, the Primary will continue to track replicated objects and the secondary will block changes to replicated objects until the mirroring is resumed.



Active Replication

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

GUI Build Time: 2019-04-14 10:34:34



Primary: ZZ2P28



Active Replicating



Secondary: ZZ2P29



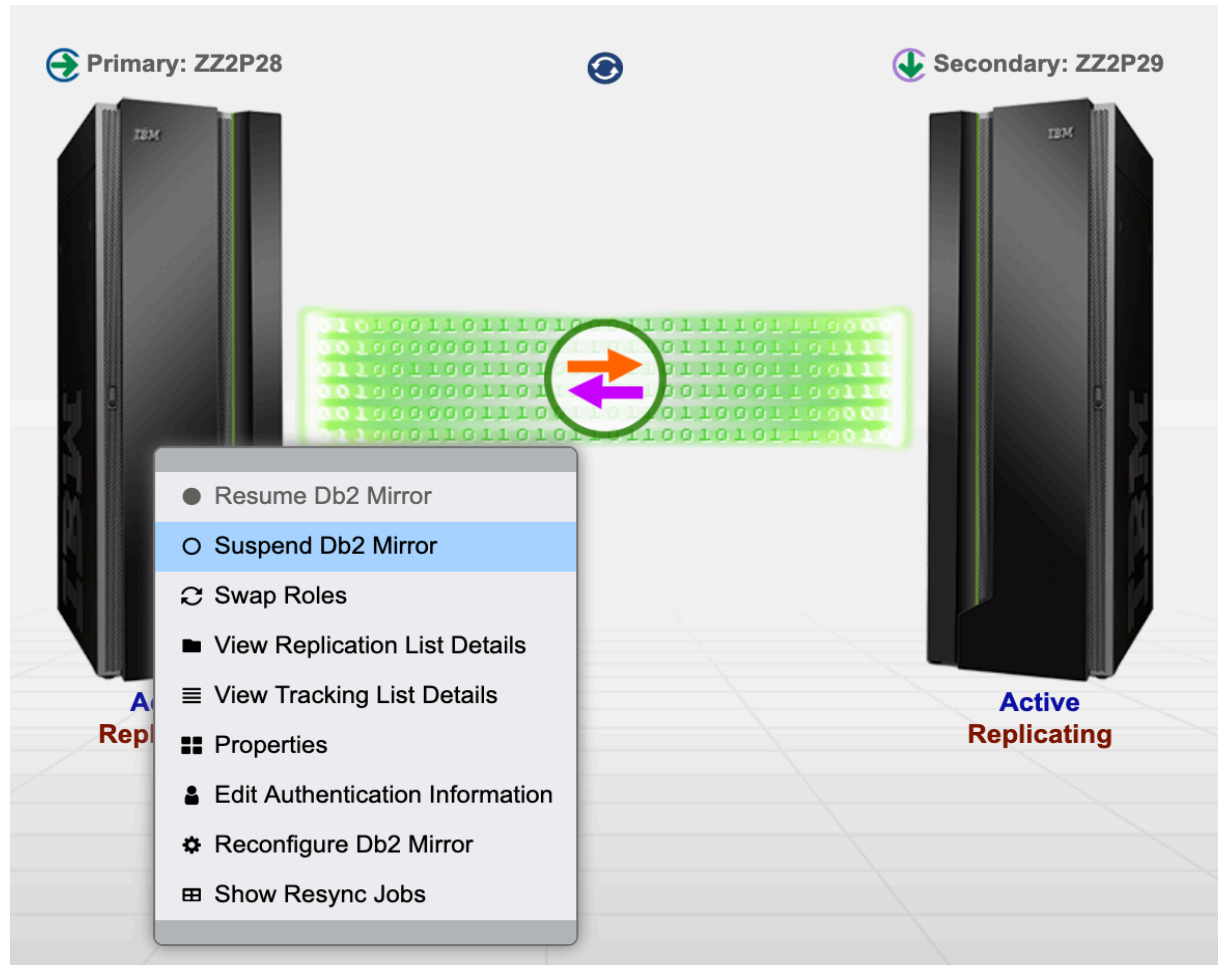
Active Replicating



The status of the system when one node goes offline



Suspend Mirroring from the GUI



Tracking / Blocked State

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

GUI Build Time: 2019-04-20 22:31:40



Primary: ZZ2P28



Tracking
Suspended



Secondary: ZZ2P29



Blocked
Suspended



Object Tracking List

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

GUI Build Time: 2019-04-20 22:31:40

All Tracking - Details

Primary - ZZ2P28 Secondary - ZZ2P29

Current Tracking Entries

[Summary](#) → [Details](#)

Filters X



Status	Resync Group	Add Time	Sync Start	Library Name	Object Type	Object Name	Member Name	Resync Type	Tracking Group
⌵	7	2019-04-23 19:44:08.554950250488		SPLMR000KW	*SPLF	OUTQ003		SAVE/RESTORE	4
⌵	7	2019-04-23 19:44:07.085290065917		SPLMR000KW	*SPLF	OUTQ001		SAVE/RESTORE	4
⌵	6	2019-04-23 19:44:06.219500269531		TRANS1000	*FILE	PF00000004	PF00000004	DB I/O	4
⌵	6	2019-04-23 19:44:06.212479492187		TRANS1000	*FILE	PF00000008	PF00000008	DB I/O	4
⌵	6	2019-04-23 19:44:06.189121234375		TRANS1000	*FILE	PF00000006	PF00000006	DB I/O	4
⌵	6	2019-04-23 19:44:06.180943060546		TRANS1000	*FILE	PF00000002	PF00000002	DB I/O	4
⌵	6	2019-04-23 19:44:06.180134039062		TRANS1000	*FILE	PF00000007	PF00000007	DB I/O	4
⌵	6	2019-04-23 19:44:06.165935968750		TRANS1000	*FILE	PF00000003	PF00000003	DB I/O	4
⌵	6	2019-04-23 19:44:06.161287496093		TRANS1000	*FILE	PF00000005	PF00000005	DB I/O	4
⌵	7	2019-04-23 19:44:02.206810774002		SPLMR000KW	*SPLF	OUTQ004		SAVE/RESTORE	4

300

Showing 111 of 111

Mirror Resume Progress

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

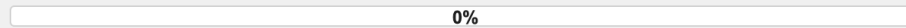
GUI Build Time: 2019-04-24 22:11:39

Summary - Current



*SYSBAS
TRACKING

> **Group 6**
(2019-04-27 10:24:25
-current)



946 operations (946 objects)



*SYSBAS
BLOCKED



IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

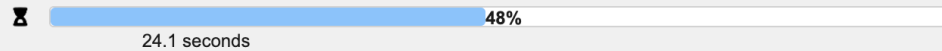
GUI Build Time: 2019-04-24 22:11:39

Summary - Current



*SYSBAS
TRACKING

> **Group 6**
(2019-04-27 10:24:25
-current)



1000 operations (1000
objects)



*SYSBAS
BLOCKED



week



History of Previous Resynchronizations

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

GUI Build Time: 2019-04-24 22:11:39

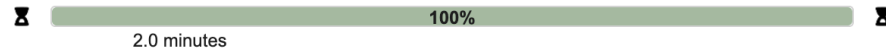
Summary - Historical

*SYSBAS
ACTIVE

*SYSBAS

*SYSBAS
ACTIVE

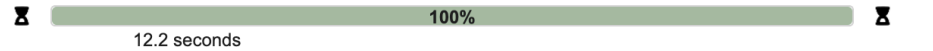
> Group 1
(2019-04-23 20:23:35
-2019-04-23 20:55:38)



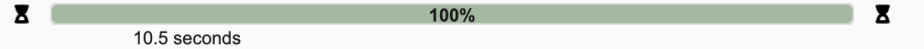
> Group 2
(2019-04-23 20:23:46
-2019-04-23 20:55:38)



> Group 4
(2019-04-24 13:20:56
-2019-04-27 10:22:51)



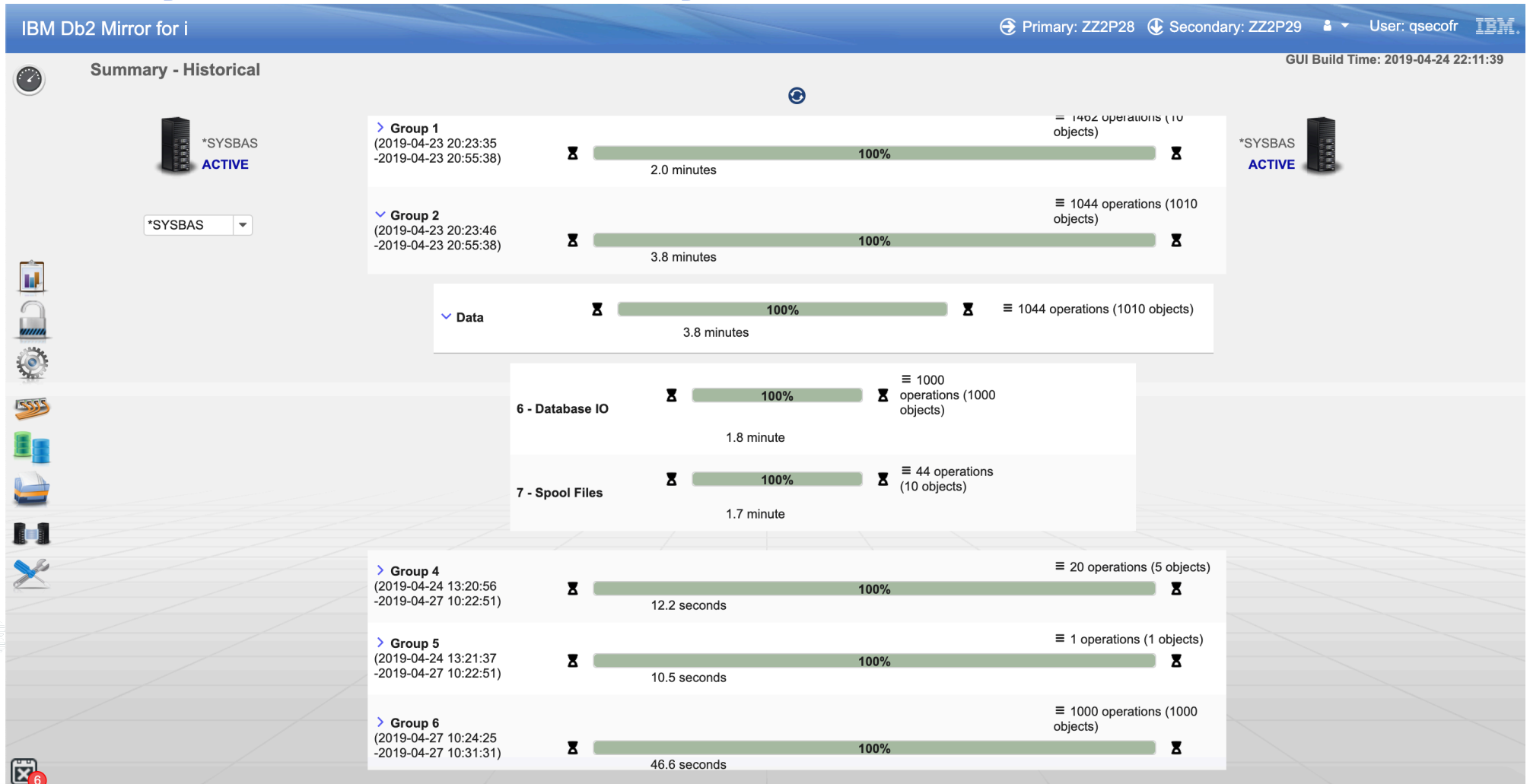
> Group 5
(2019-04-24 13:21:37
-2019-04-27 10:22:51)



> Group 6
(2019-04-27 10:24:25
-2019-04-27 10:31:31)

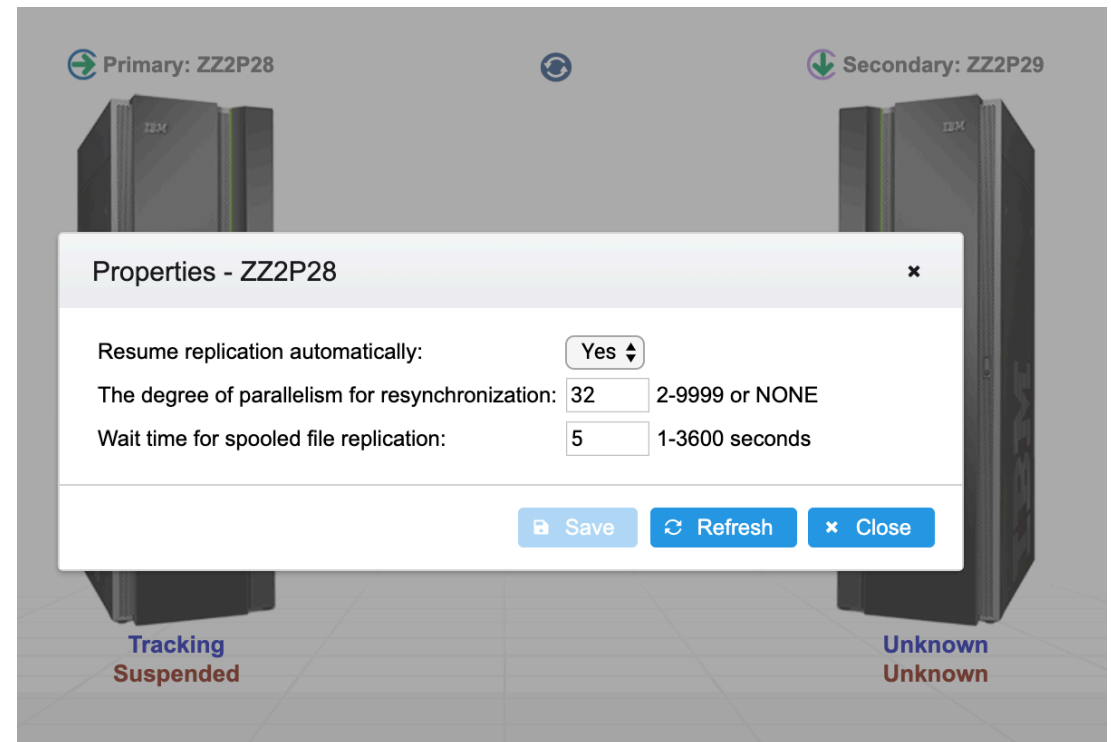


History of Previous Resynchronizations



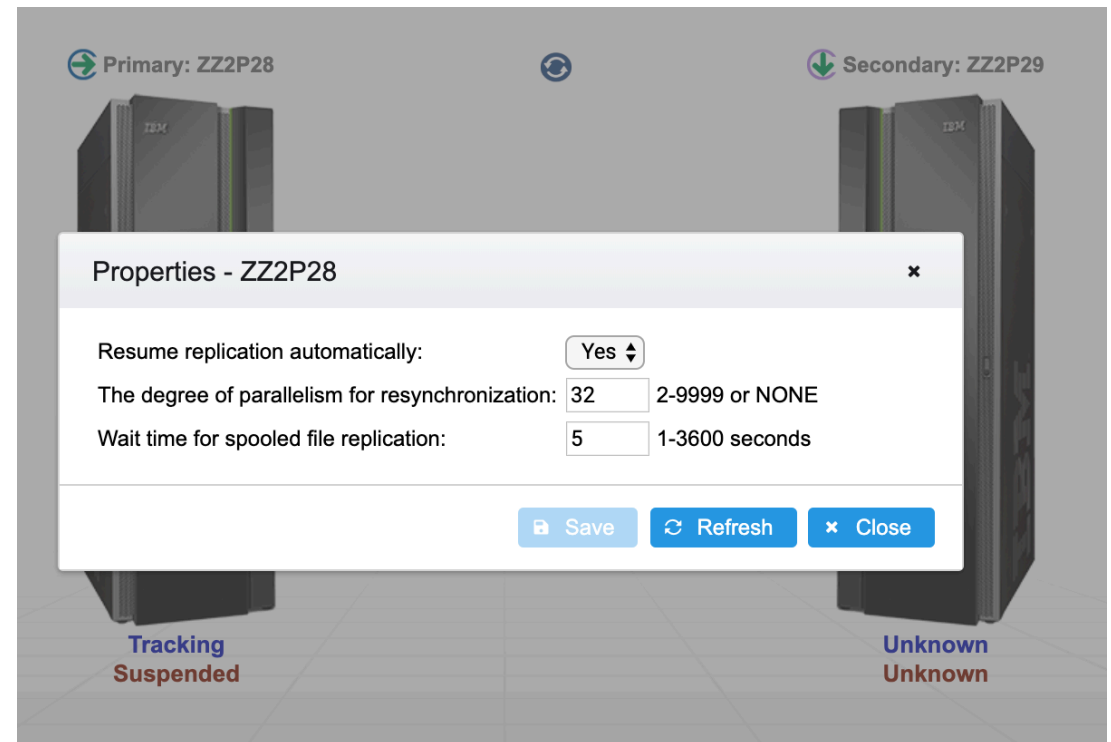
Resume Automatically

- The resume automatically property is defaulted to yes. This means if it was a system detected event such as a communication failure or crash, the mirror will resume once the failure is resolved.
- If the user suspends mirroring, then the user has to explicitly call resume.



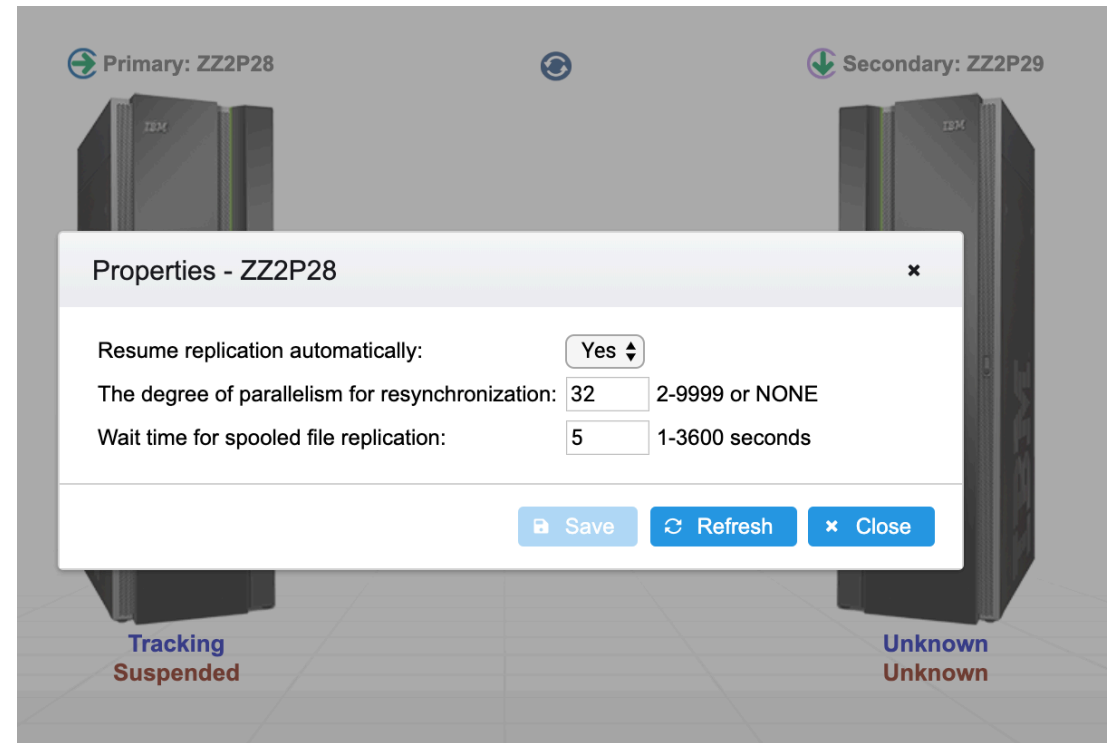
Resync Parallelism

- If 5770SS1 Option 26 (DB2® Symmetric Multiprocessing) is installed you can take advantage of resyncing multiple objects at the same time.



Spool File Wait Time

- Spool files are periodically gathered up and saved/restored to the other node. The wait time defines the interval to wait before bundling them up. If your system creates spool files very rapidly this can be a more efficient way to replicate them to the other side.



Suggested Priority Example

All Tracking - Details

Primary - ZZ2P28 Secondary - ZZ2P29

Add a Suggested Priority

[Summary](#) → [Details](#)

TRANS1000 *ALL *ALL 1 Add

Suggested Priority Entries

Suggested Priority	Library Name	Object Type	Object Name	Last Update	IASP Name
1	TRANS1000	*ALL	*ALL	2019-04-27 10:47:07.591641624023	
2	SPLMR001KW	*ALL	*ALL	2019-04-27 10:46:52.062538640625	

Suggested Priority Example

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr

GUI Build Time: 2019-04-24 22:11:39

All Tracking - Details

Primary - ZZ2P28 Secondary - ZZ2P29

Current Tracking Entries

Summary → Details

Filters X

Status	Resync Group	Library Name	Object Type	Object Name	Member Name	Resync Type	Tracking Group	Replication Reason	Changed Row Estimate	Suggested Pri
	0	TRANS1000	FILE	PF00000057	PF00000057	DB I/O	10	MIRROR		1
	6	TRANS1000	*FILE	PF00000053	PF00000053	DB I/O	10	UNABLE TO MIRROR		1
	6	TRANS1000	*FILE	PF00000051	PF00000051	DB I/O	10	UNABLE TO MIRROR		1
	6	TRANS1000	*FILE	PF00000050	PF00000050	DB I/O	10	UNABLE TO MIRROR		1
	6	TRANS1000	*FILE	PF00000049	PF00000049	DB I/O	10	UNABLE TO MIRROR		1
	7	SPLMR000KW	*SPLF	OUTQ001		SAVE/RESTORE	10	UNABLE TO MIRROR		2
	7	SPLMR000KW	*SPLF	OUTQ004		SAVE/RESTORE	10	UNABLE TO MIRROR		2
	7	SPLMR000KW	*SPLF	OUTQ003		SAVE/RESTORE	10	UNABLE TO MIRROR		2
	6	TRANS1000	*FILE	PF00000047	PF00000047	DB I/O	10	UNABLE TO MIRROR		1
	6	TRANS1000	*FILE	PF00000048	PF00000048	DB I/O	10	UNABLE TO MIRROR		1

Managing and Monitoring

- Exit Points for several of the state transitions

Exit Point	Exit Point Format	Description
QIBM_QMRDB_PRECLONE	PREC0100	Db2 Mirror ASP pre-clone
QIBM_QMRDB_POSTCLONE	PSTC0100	Db2 Mirror ASP post-clone
QIBM_QMRDB_ROLE_CHG	RCHG0100	Db2 Mirror replication role change
QIBM_QMRDB_STATE_CHG	SCHG0100	Db2 Mirror replication state change

Serviceability

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr IBM

GUI Build Time: 2019-01-08 15:51:42

Primary: ZZ2P28



Active
Replicating



Secondary: ZZ2P29



Active
Replicating



Serviceability

Compare

View GUI Logs

Configure GUI Logs

History Log Info

Db2 Mirror Flight Recorder

Capture Job Logs

QSYSOPR Messages

Compare

Compare

Primary - ZZ2P28 Secondary - ZZ2P29

Compare Results

Library Name ^	Replication State ⇅	Object Count ⇅	Object Name ⇅	Object Type ⇅	Object Replication State
			PF00000001	*FILE	INCLUDE
			PF00000002	*FILE	INCLUDE
			PF00000003	*FILE	INCLUDE
			PF00000004	*FILE	INCLUDE
			PF00000005	*FILE	INCLUDE
			PF00000006	*FILE	INCLUDE
			PF00000007	*FILE	INCLUDE
			PF00000008	*FILE	INCLUDE
			PF00000009	*FILE	INCLUDE
			PF00000010	*FILE	INCLUDE
			PF00000011	*FILE	INCLUDE
			PF00000012	*FILE	INCLUDE
			PF00000013	*FILE	INCLUDE
			PF00000014	*FILE	INCLUDE
			PF00000015	*FILE	INCLUDE
			PF00000016	*FILE	INCLUDE
			PF00000017	*FILE	INCLUDE
			PF00000018	*FILE	INCLUDE
			PF00000019	*FILE	INCLUDE
			PF00000020	*FILE	INCLUDE
			PF00000021	*FILE	INCLUDE
			PF00000022	*FILE	INCLUDE
			PF00000023	*FILE	INCLUDE
QUSRDIRCF	EXCLUDE	3			
QUSRDIRDB	EXCLUDE	190			
QUSRHASM	EXCLUDE	0			
QUSRICC	EXCLUDE	66			
QUSRSYS	EXCLUDE	2244			
QUSRTEMP	EXCLUDE	0			
QUTL	EXCLUDE	8			
QVOITEST	EXCLUDE	0			
QWEBQRY	EXCLUDE	658			
QWEBQRYX	EXCLUDE	24			
QXMLSERV	EXCLUDE	5			
SBPGETLOG	EXCLUDE	2			
SYSIBM	EXCLUDE	65			
SYSIBMADM	EXCLUDE	96			
SYSPROC	EXCLUDE	2			
SYSTOOLS	EXCLUDE	55			
TRANSWL	EXCLUDE	19			
TRANS1000	INCLUDE	1000			
TRANS10000	EXCLUDE	10000			
VOLANO	EXCLUDE	25			
WHITNEYK	EXCLUDE	0			

- Compare Attributes
- Compare Data
- Compare Data/Attributes

Showing 161 of 161

Showing 300 of 1000



Compare Results

IBM Db2 Mirror for i

Primary: ZZ2P28 Secondary: ZZ2P29 User: qsecofr

GUI Build Time: 2019-04-20 22:31:40

Compare - Results

Primary - ZZ2P28 Secondary - ZZ2P29

Compare Results

	lasp Name	Library Name	Compare Attributes	Compare Data	Job Number	User Name	Job Name	Start Time	End Time	State	Failu
0	*SYSBAS	TRANS1000	YES	YES	560785	QUSER	QZDASOINIT	2019-04-23 21:07:31	2019-04-23 21:08:51	COMPLETED	
0	*SYSBAS	SPLMR000KW	YES	YES	560759	QUSER	QZDASOINIT	2019-04-23 21:05:24	2019-04-23 21:07:15	COMPLETED	
0	*SYSBAS	TRANS1000	YES	YES	482347	QUSER	QZDASOINIT	2019-04-22 15:09:06	2019-04-22 15:11:40	COMPLETED	
0	*SYSBAS	TRANS1000	YES	YES	395559	QUSER	QZDASOINIT	2019-03-18 10:45:03	2019-03-18 10:52:26	COMPLETED	

1 300

Showing 4 of 4

Alerts



Primary: ZZ2P28



Active Replicating



Secondary: ZZ2P29



Active Replicating



Alerts



Alerts

IBM Db2 Mirror for ... User: qsecofr IBM
Alerts
Time: 2019-01-08 15:51:42

QSYSOPR Messages
Primary - ZZ2P28 Secondary - ZZ2P29

Mark All Read Filters X Print Refresh

Time Stamp	Message ID	Severity	Message Text
2019-01-13 16:14:41.208034	CPIC904	0	Db2 Mirror replication is active for ASP group *SYSBAS.
2019-01-13 16:13:17.868360	CPIC901	0	Db2 Mirror replication is suspended for ASP group *SYSBAS. Reason code 212.
2019-01-13 16:04:29.968608	CPIC904	0	Db2 Mirror replication is active for ASP group *SYSBAS.
2019-01-13 16:00:53.233493	CPDC905	0	Db2 Mirror Network Redundancy Group (NRG) link 169.254.3.28 is active.
2019-01-13 16:00:48.458097	CPDC905	0	Db2 Mirror Network Redundancy Group (NRG) link 169.254.2.28 is active.
2019-01-13 15:38:10.982108	CPIC901	0	Db2 Mirror replication is suspended for ASP group *SYSBAS. Reason code 212.
2019-01-13 14:24:51.426806	CPF32CD	60	Db2 Mirror resynchronization failed for job 125827/QSYS/QMRDBESYNC.
2019-01-13 14:24:26.206567	CPIC904		
2019-01-13 14:13:19.059670	CPDC905		
2019-01-13 14:12:49.197270	CPDC905		

Message Details

Message ID:	CPIC904	Severity:	0
Message Type:	INFORMATIONAL	Time Sent:	2019-01-13 16:14:41
From User:	QSYS	From Job:	131507/QSYS/QMRDBECTLR
From Program:	QMRDBEUTIL		

Message Text:
Db2 Mirror replication is active for ASP group *SYSBAS.

Cause:
Db2 Mirror replication has been started or resumed for the ASP group.

Recovery:

Technical Description:
For more information, refer to the Db2 Mirror topic collection in the IBM Knowledge Center.

Close

Close

QSYSOPR Messages

- **Db2 Mirror product state change messages sent to QSYSOPR:**
- **CPDC905** - Db2 Mirror Network Redundancy Group (NRG) link <ip address> is active.
- **CPDC906** - Network Redundancy Group (NRG) link <ip address> is inactive.
- **CPIC901** - Db2 Mirror replication is suspended for ASP group IASP33P. Reason code <reason code>.
- **CPIC902** - Db2 Mirror replication is suspended for ASP group <iASP name or *SYSBAS> due to an error. Reason code <reason code>.
- **CPIC903** - Db2 Mirror replication is suspended for maintenance operations.
- **CPIC904** - Db2 Mirror replication is active for ASP group <iASP name or *SYSBAS>.
-
- **Db2 Mirror product failure messages sent to QSYSOPR:**
- **CPD3E43** - DRDA/DDM Db2 Mirror server error occurred with reason code <reason code>.
- **CPF32CD** - Db2 Mirror resynchronization failed for job <job name or *ALL>.

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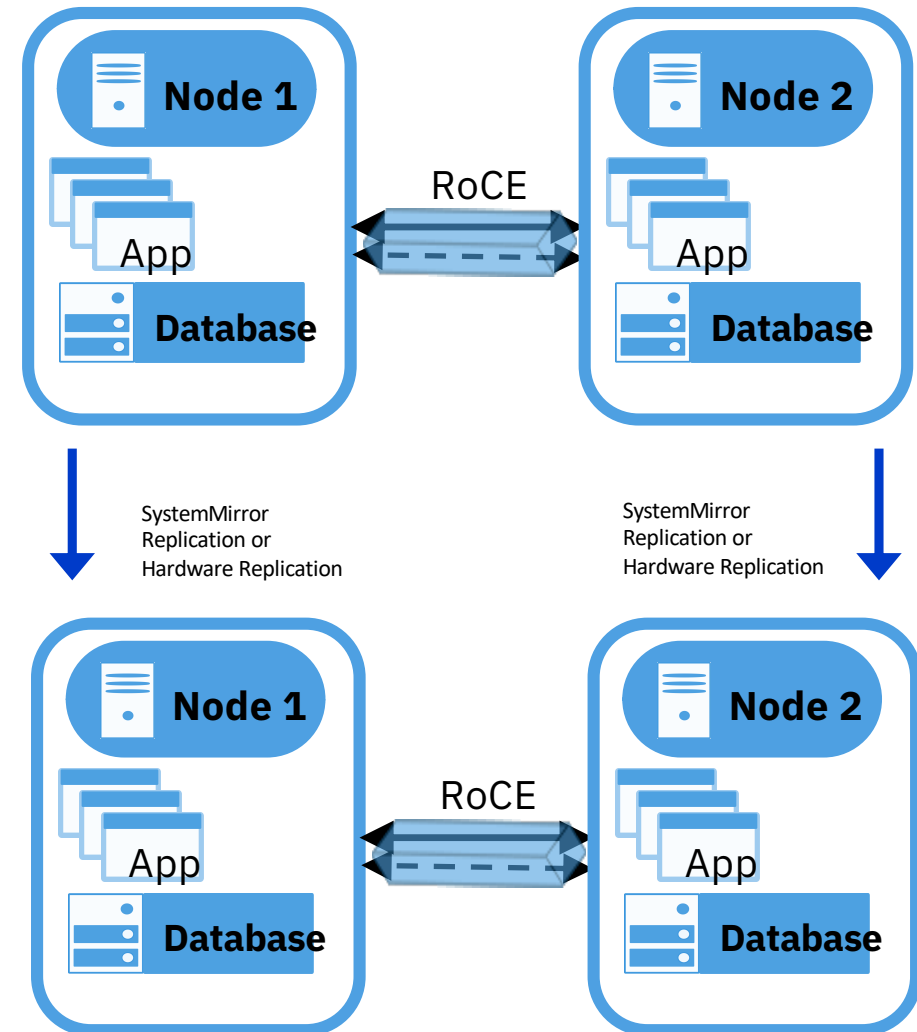
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Disaster Recovery

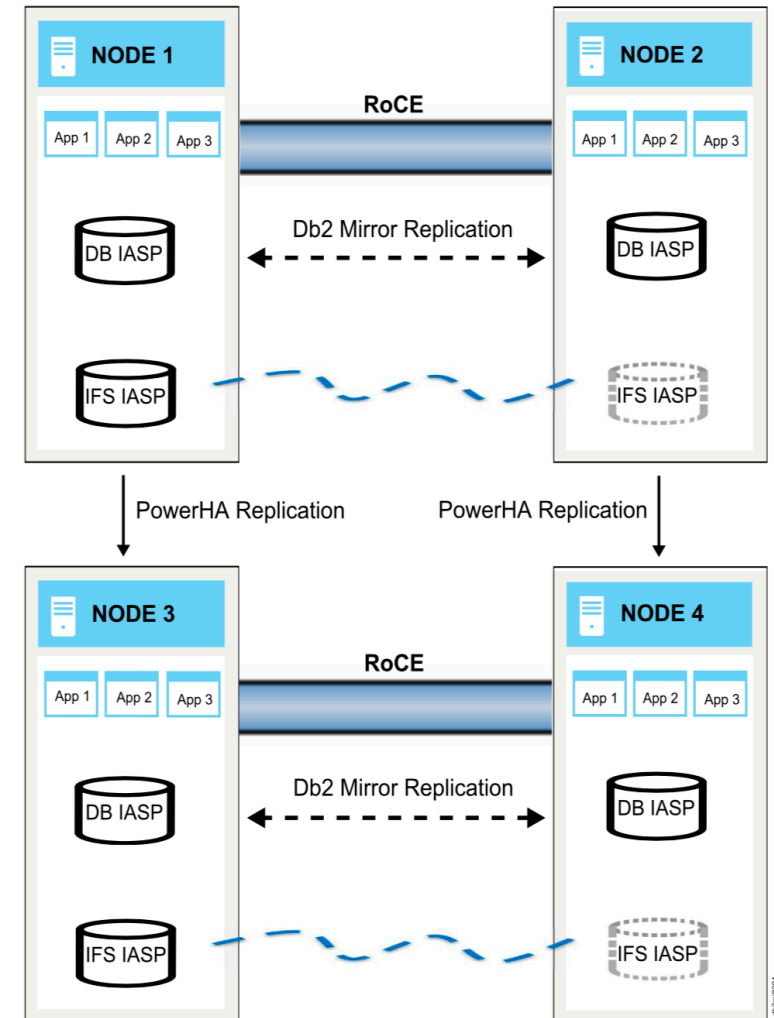
Topology Options – DR

- As long as one local Db2Mirror node is up, production will remain at the local site.
- If both local nodes are unavailable, then a switch to the DR site can be initiated.
- The default will be that a switch to DR requires system administrator intervention, although a policy could be defined to initiate the switch automatically.
- Only one node will be activated at the DR site, and then a Db2Mirror resynch will be started to the 2nd DR node.



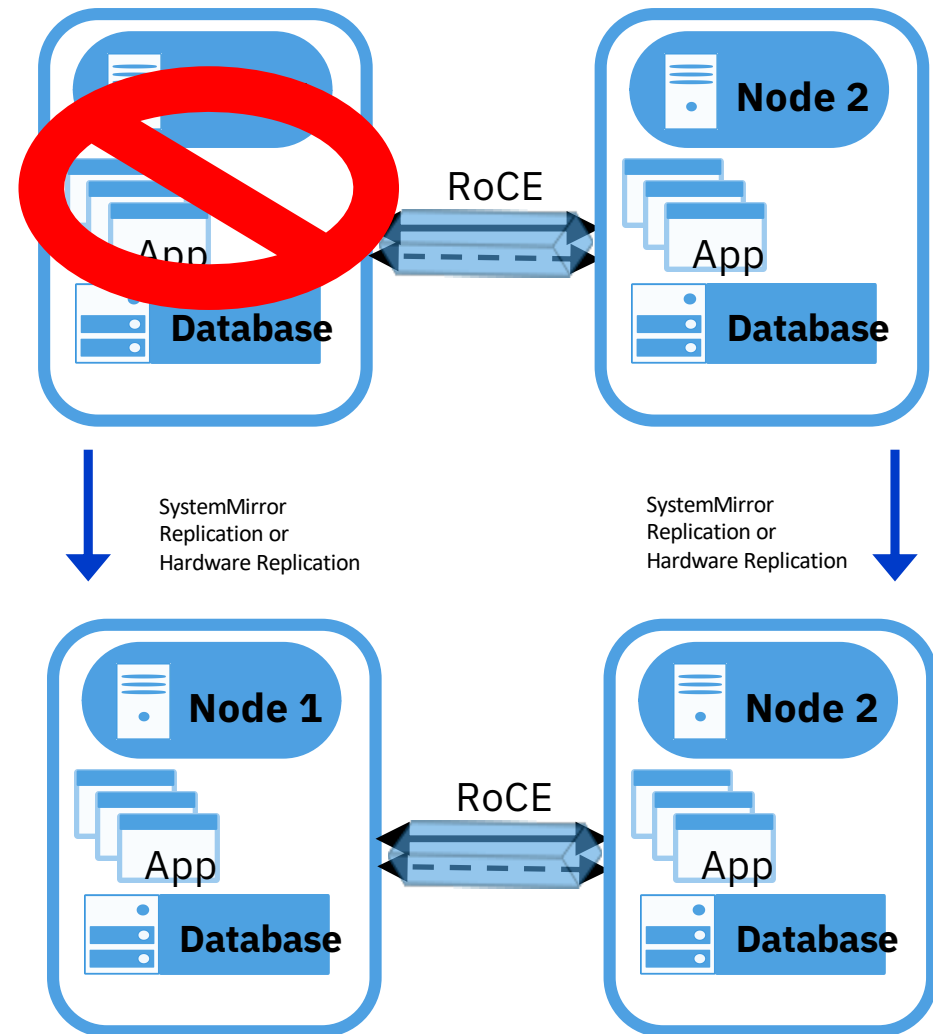
DB2 Mirror & PowerHA for IBM i

- Replicated database in IASP due to PowerHA DR solution
- DB2 Mirror between Node–Node2
- If need to switch to Node3-Node4, will use PowerHA technology to switch IASP to DR site.



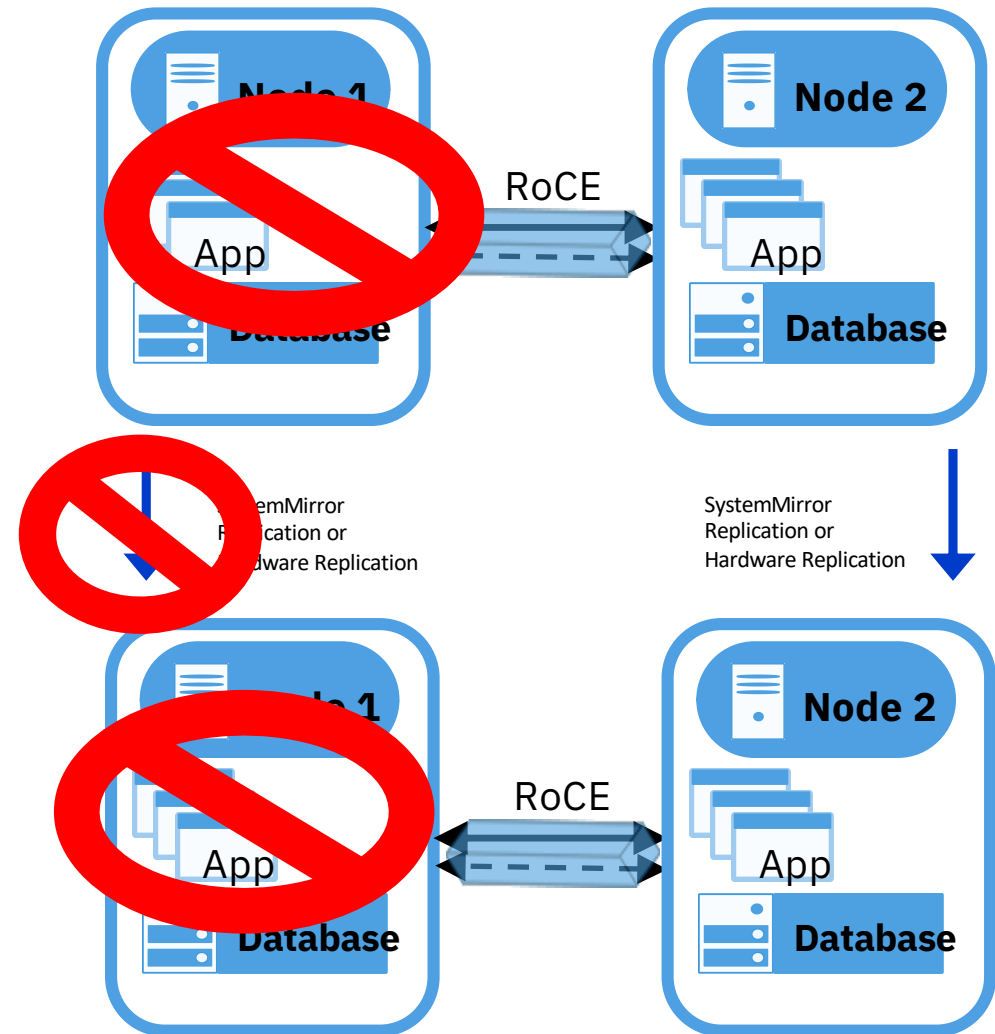
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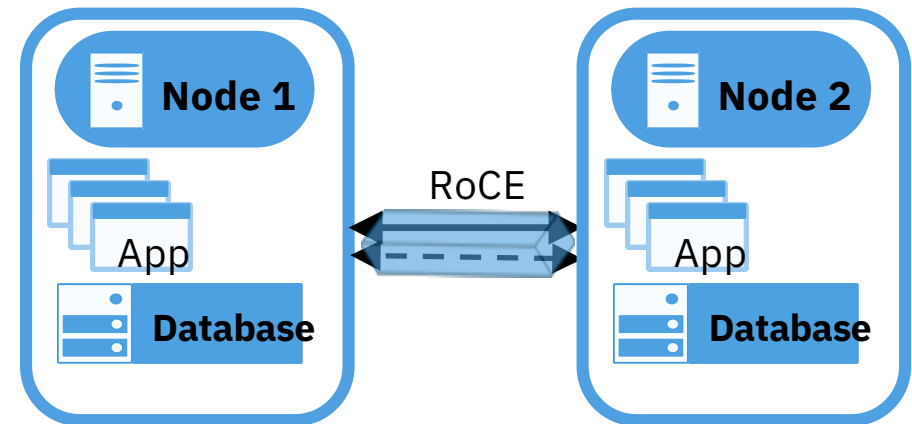
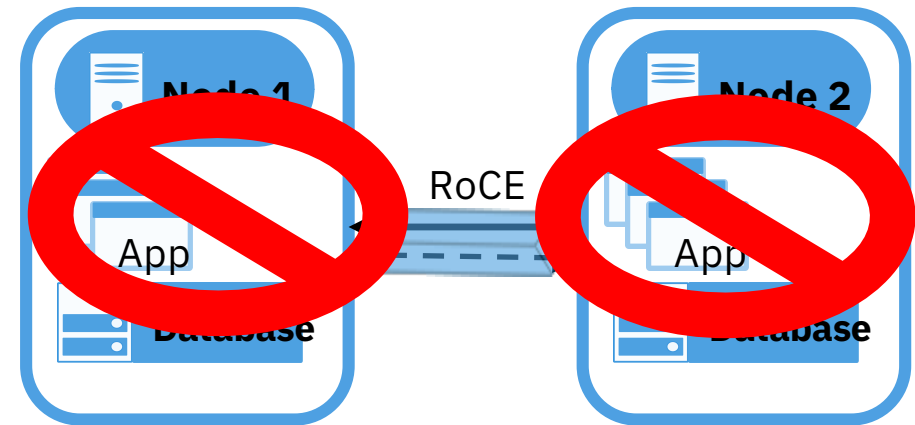
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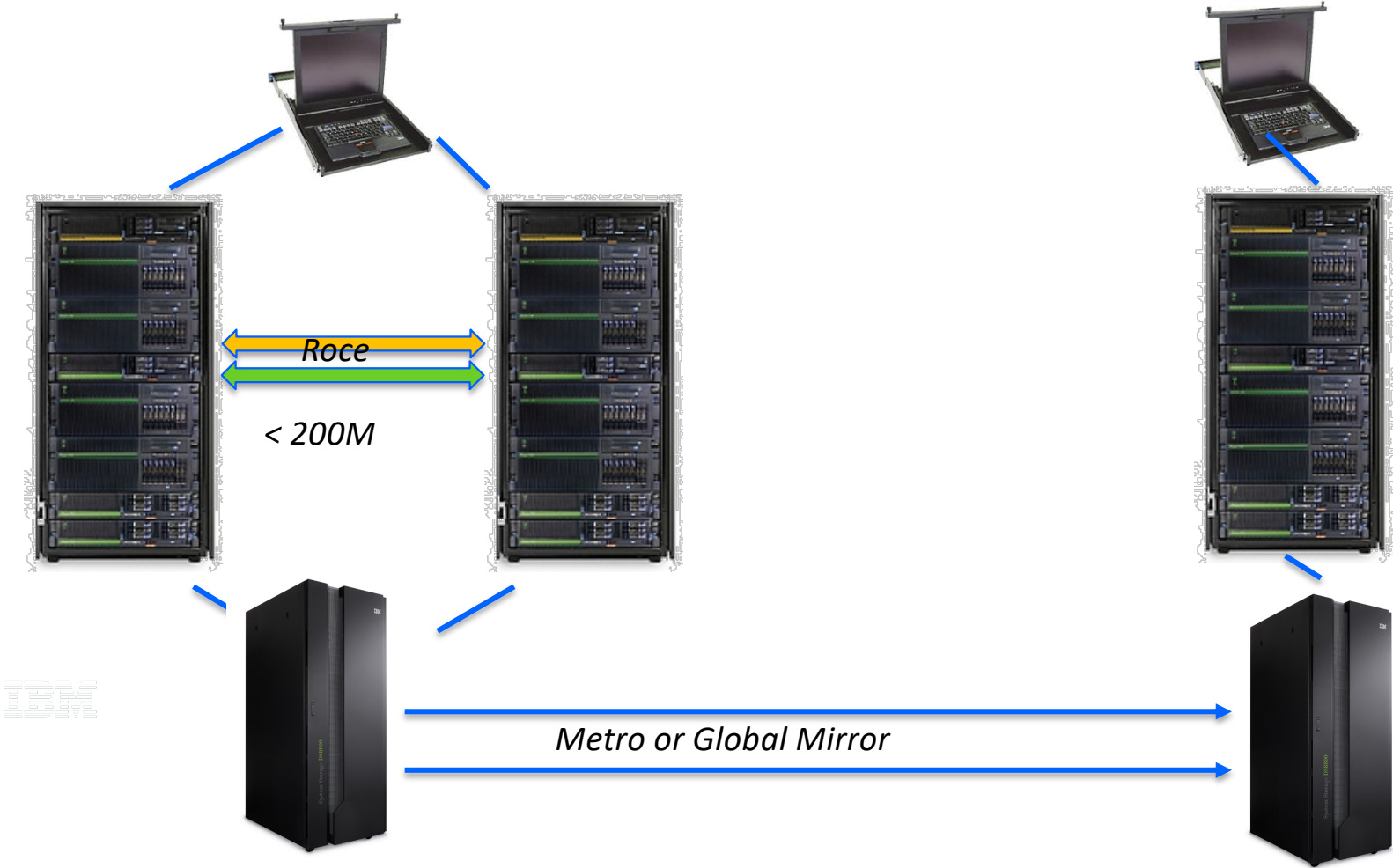


Topology Options – DR

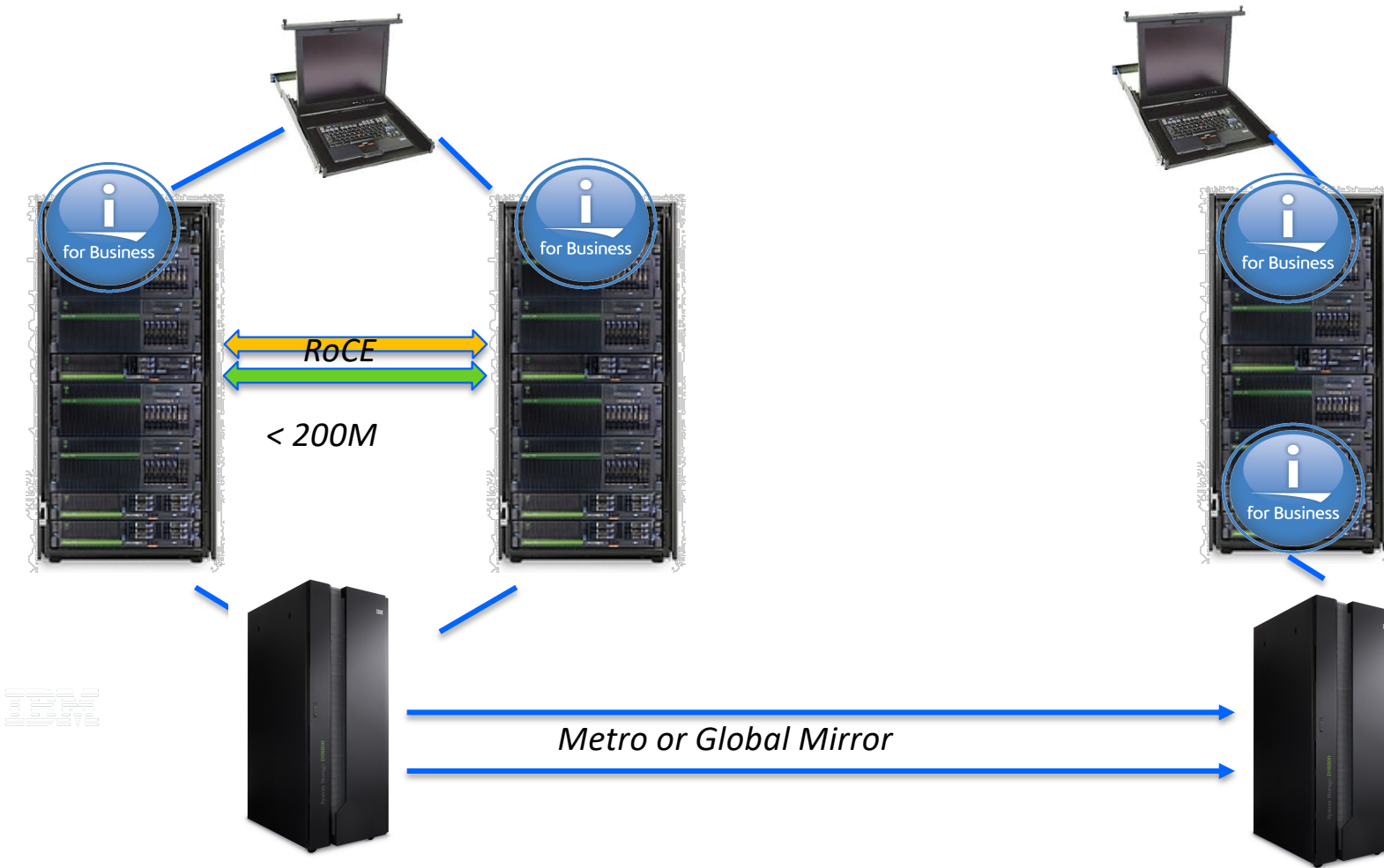
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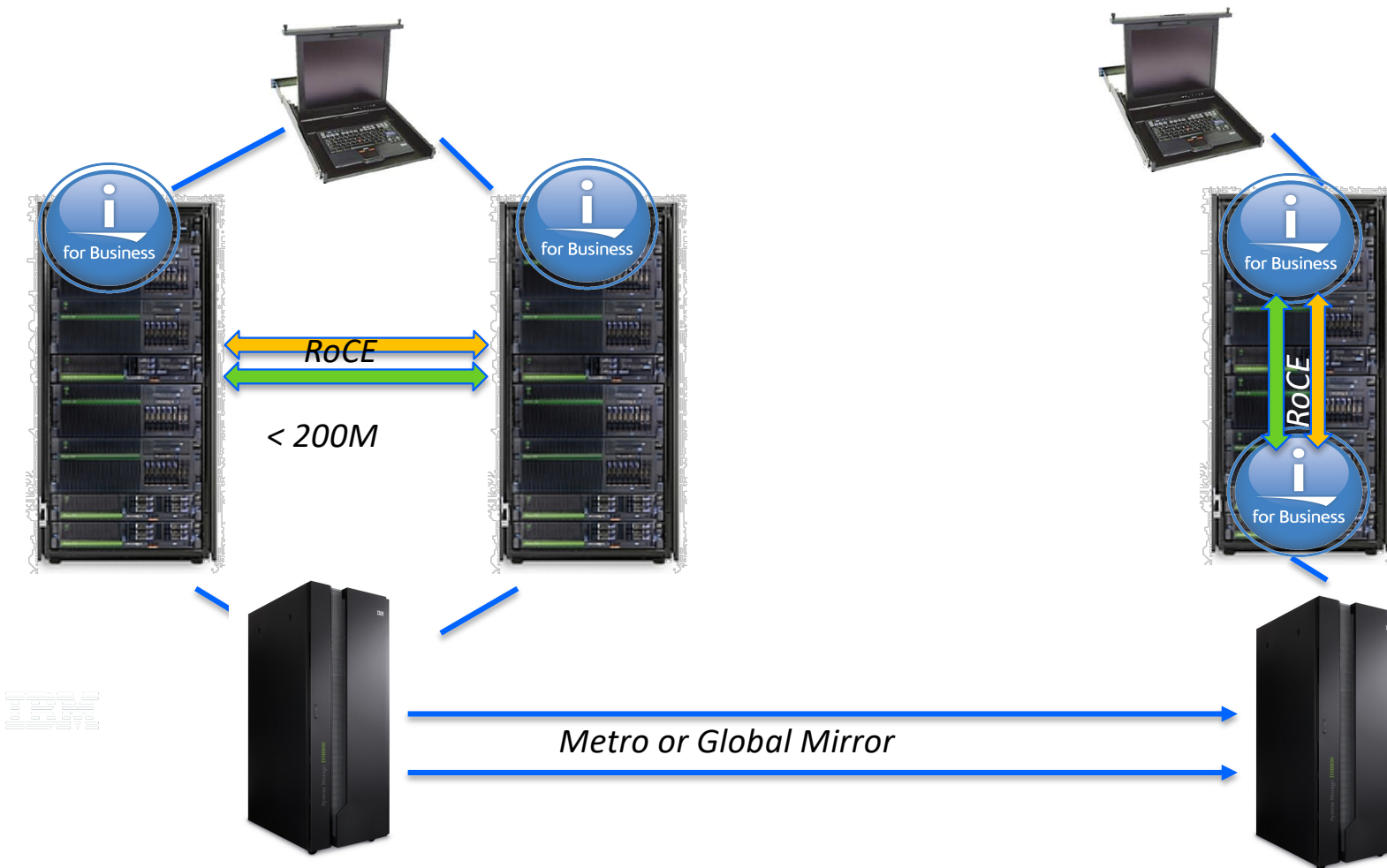
Topology Options – Common DR Options



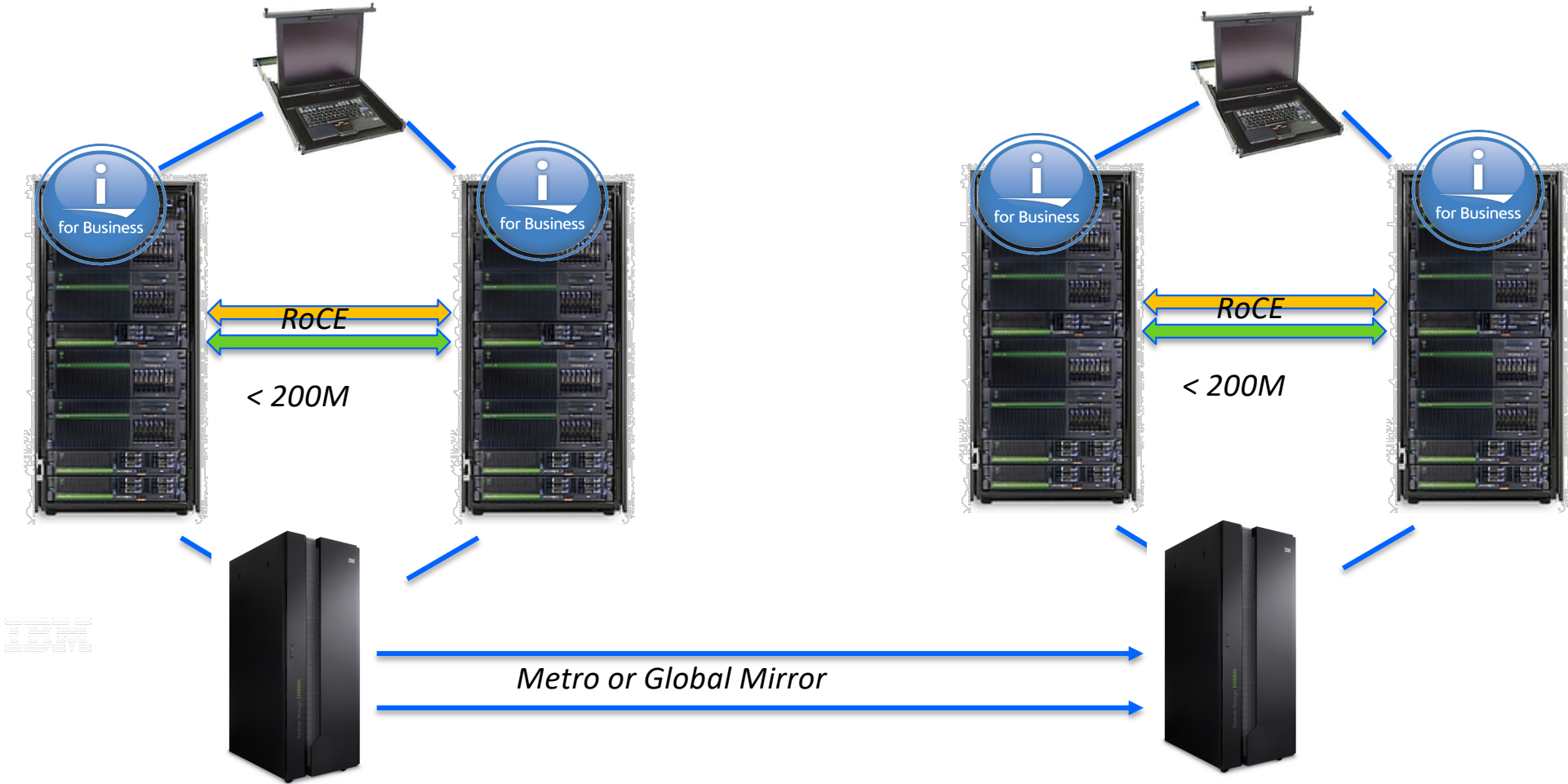
Topology Options – Common DR Options



Topology Options – Common DR Options

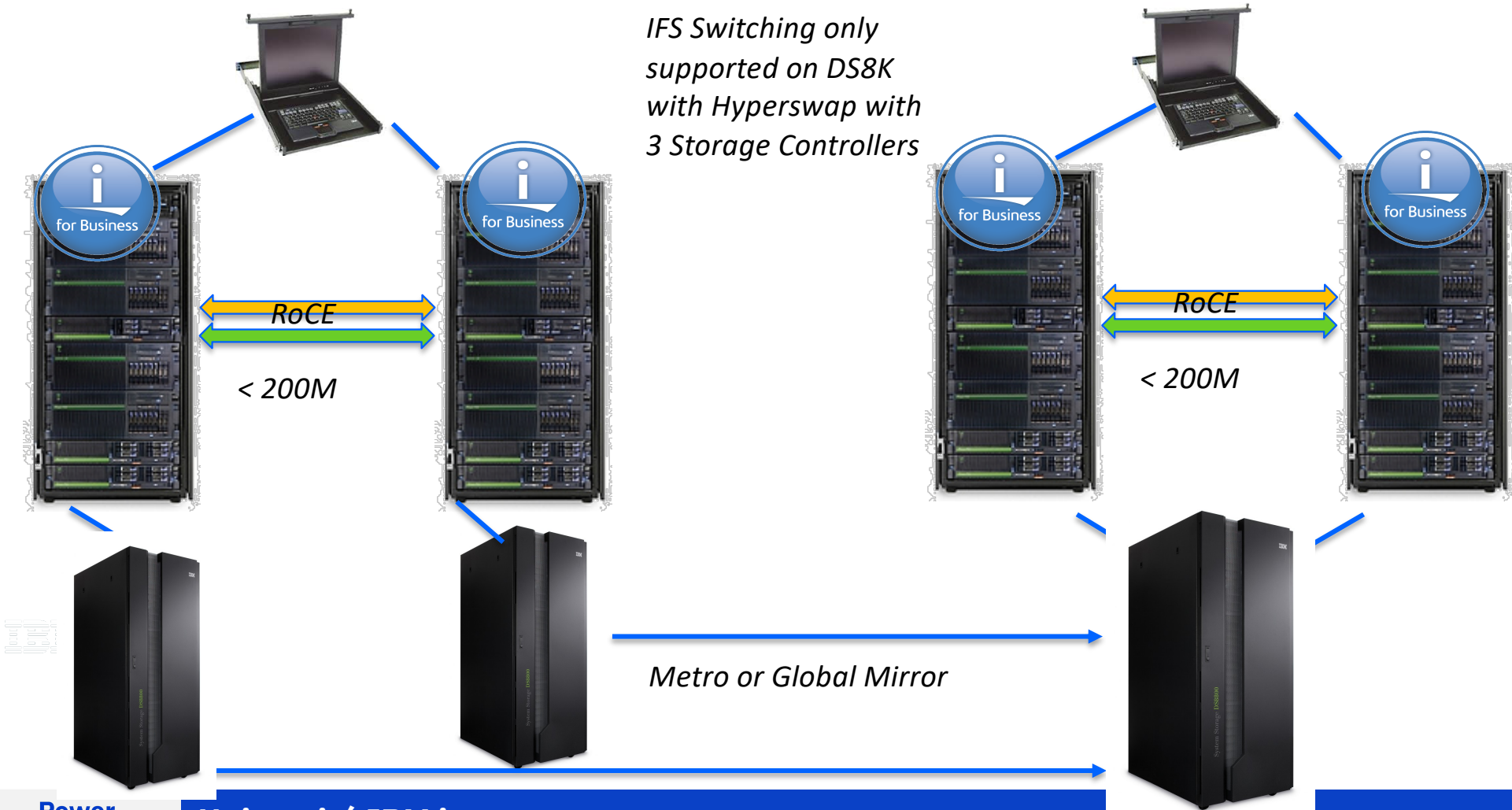


Topology Options – Common DR Options

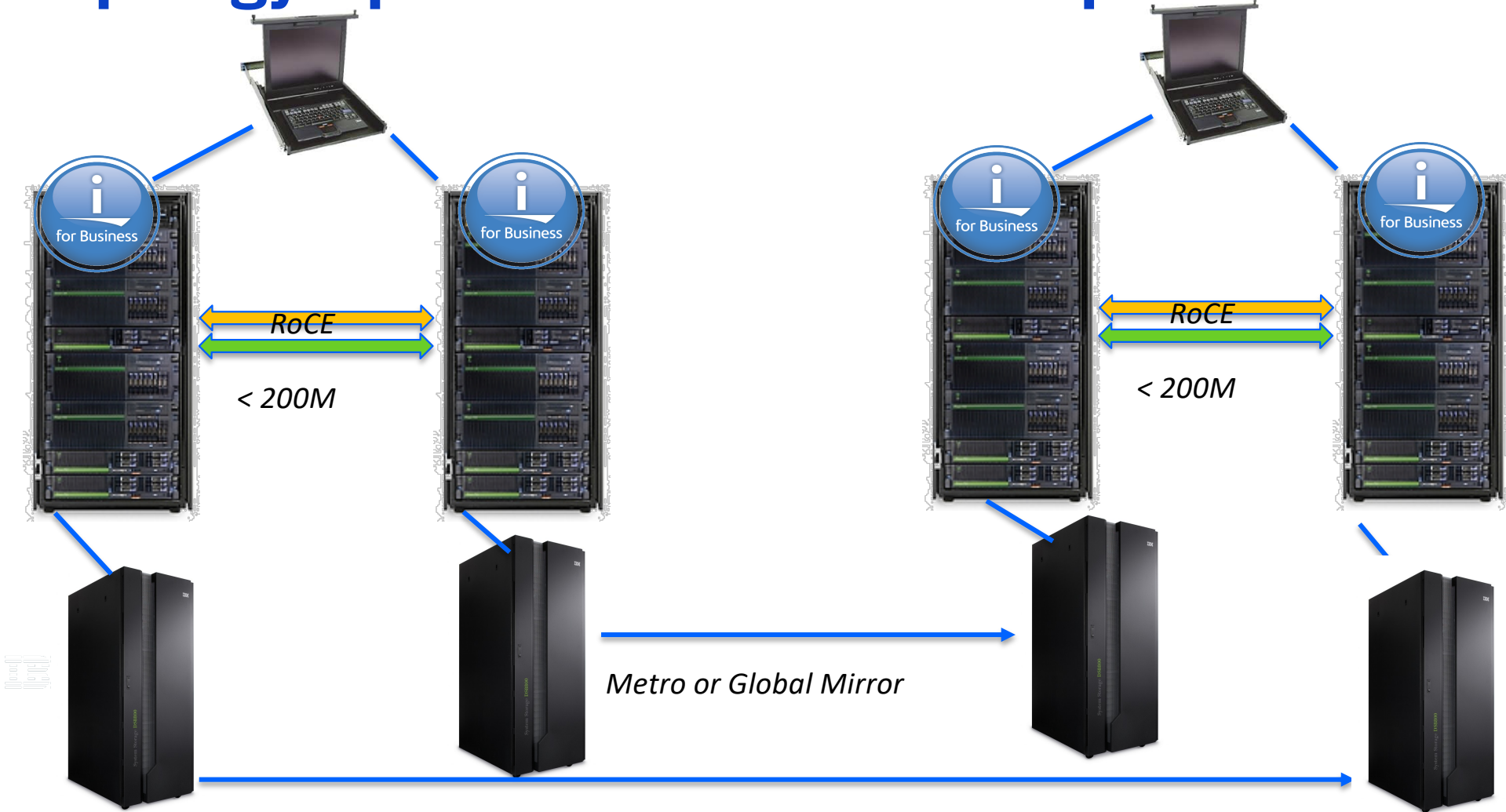


Topology Options – Common DR Options

IFS Switching only supported on DS8K with Hyperswap with 3 Storage Controllers

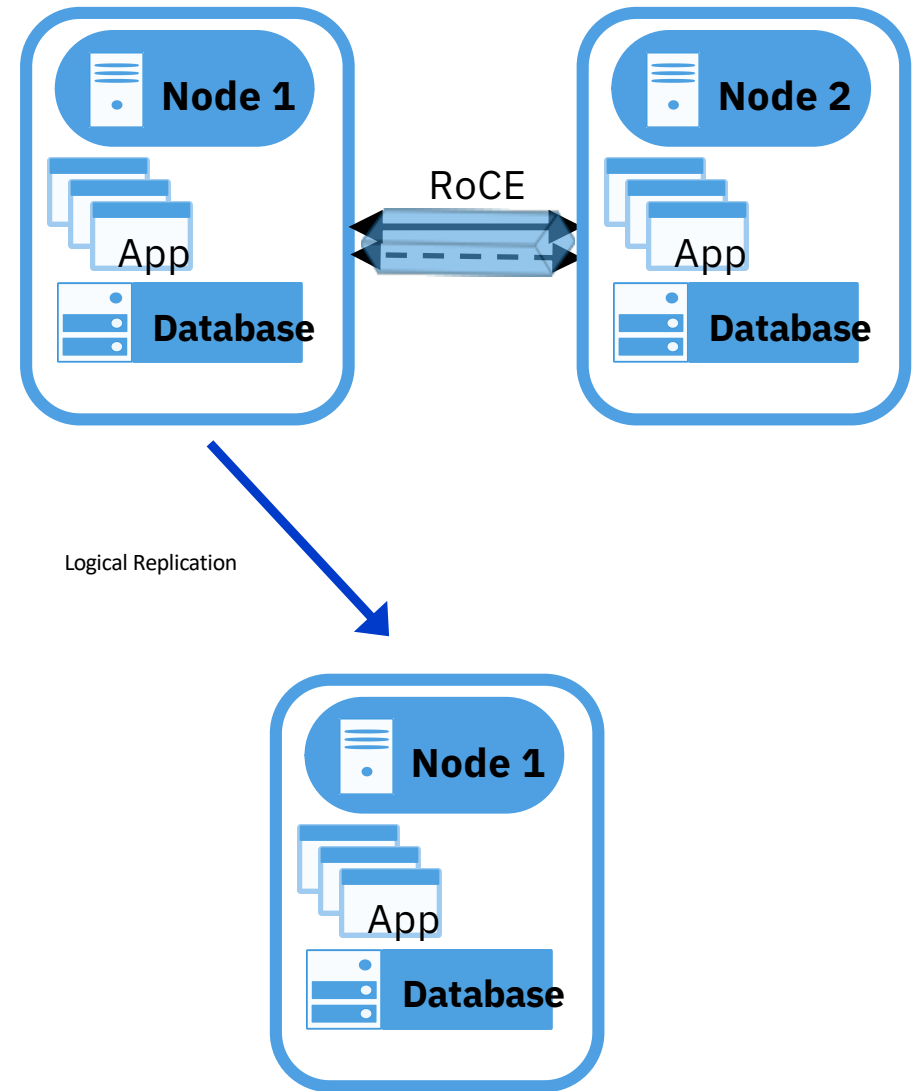


Topology Options – Common DR Options



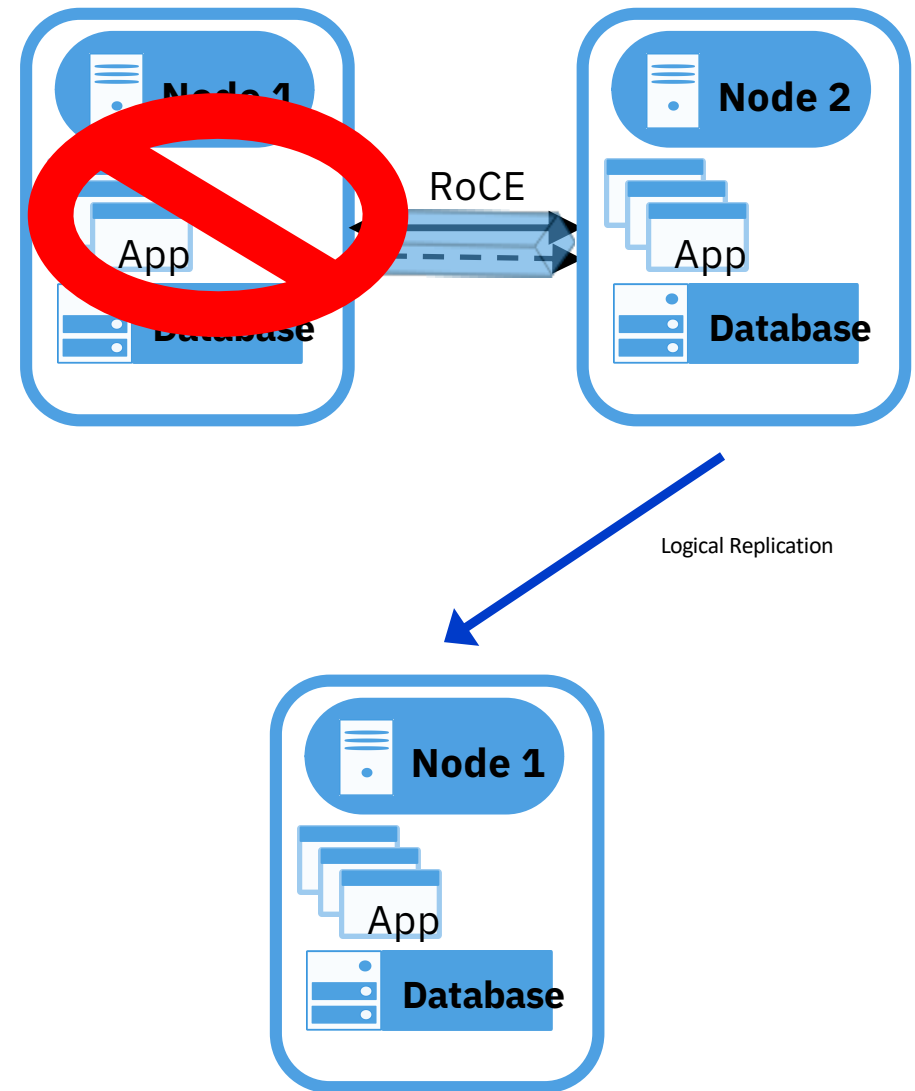
Logical Replication

- Logical replication solutions have the option to move the source node between the Db2 Mirror nodes and go to a single DR node



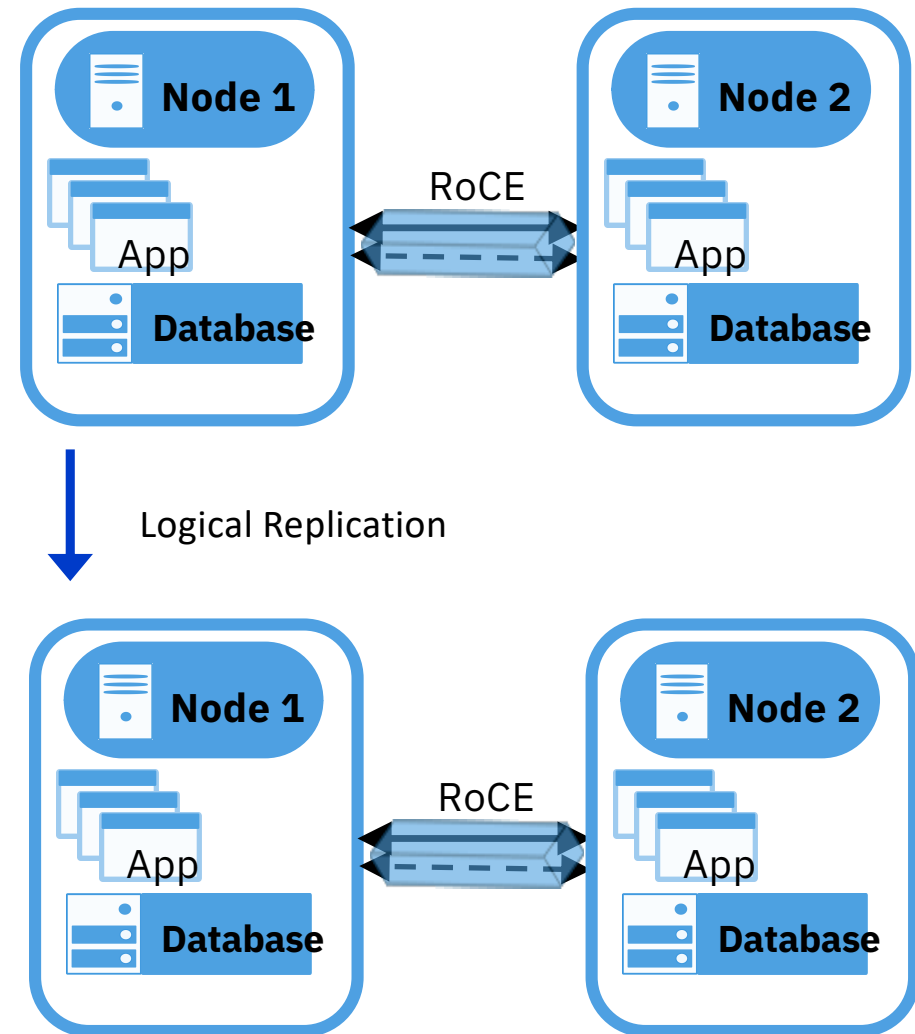
Logical Replication

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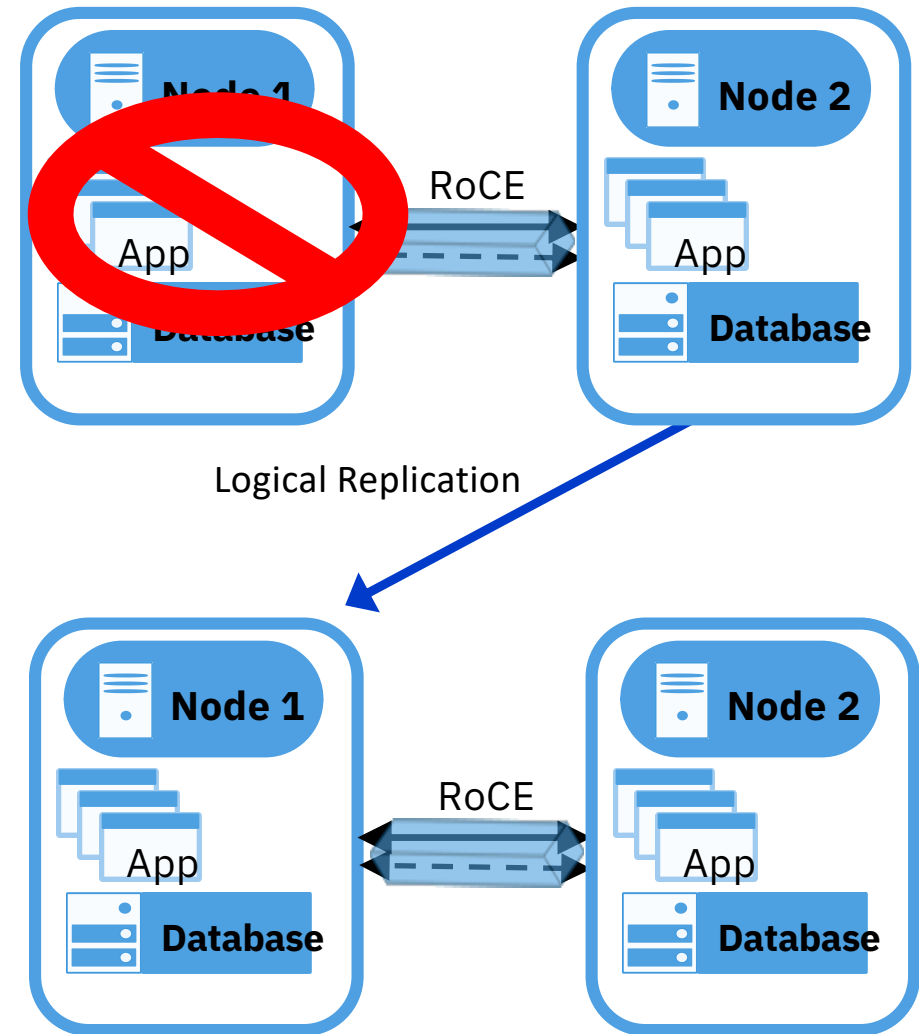
Logical Replication

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Logical Replication

- Logical replication solutions have the option to move the source node between the Db2 Mirror nodes and go to a Db2 Mirror pair.



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Software Requirements and Licensing

IBM

Software Required for Db2 Mirror Pair

- 5770SS1 Option 3 (Extended Base Directory Support)
- 5770SS1 Option 12 (Host Servers)
- 5770SS1 Option 22 (ObjectConnect)
- 5770SS1 Option 26 (DB2® Symmetric Multiprocessing) - Optional
- 5770SS1 Option 30 (Qshell)
- 5770SS1 Option 34 (Digital Certificate Manager)
- 5770SS1 Option 41 (High Availability Switchable Resources)
- 5770SS1 Option 48 (IBM Db2Mirror)
- 5770JV1 *BASE (IBM Developer Kit for Java)
 - Option 16 (Java SE 8 32 bit)
 - Option 17 (Java SE 8 64 bit)
- 5733SC1 *BASE(IBM Portable Utilities for i)
 - Option 1 (OpenSSH, OpenSSL, zlib)
- 5770DG1 *BASE (IBM HTTP Server for i)
- 5770DBM *BASE (IBM Db2 Mirror for i)
 -  Option 1 (Db2 Mirror Enablement)

Open Source Packages Required for Setup

- python2-six-1.10.0-1.ibm7.1.noarch.rpm
- python2-itoolkkit-1.5.1-1.ibm7.1.ppc64.rpm
- python2-ibm_db-2.0.5.8-1.ibm7.1.ppc64.rpm
- cloudinit-1.0-0.ibm7.1.ppc64.rpm



Software Required for Db2 GUI Node

- 5770SS1 Option 3 (Extended Base Directory Support)
- 5770SS1 Option 12 (Host Servers)
- 5770SS1 Option 22 (ObjectConnect)
- ~~▪ 5770SS1 Option 26 (DB2® Symmetric Multiprocessing) — Optional~~
- 5770SS1 Option 30 (Qshell)
- ~~▪ 5770SS1 Option 34 (Digital Certificate Manager)~~
- ~~▪ 5770SS1 Option 41 (High Availability Switchable Resources)~~
- ~~▪ 5770SS1 Option 48 (IBM Db2Mirror)~~
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- 5770DG1 *BASE (IBM HTTP Server for i)
- 5770DBM *BASE (IBM Db2 Mirror for i)
 - ~~▪ Option 1 (Db2 Mirror Enablement)~~

Licensing

Db2 Mirror for i (5770-DBM)

- Pricing: \$20K (U.S. list price)* per processor core - for any size machine
 - Note: e-config offers Small and Medium price features, both are priced the same
 - Includes one year of SWMA
- License both source and target
 - The processor cores to support the workload on source and target must be licensed
- IBM i (5770-SS1) Option 48 “Db2 Data Mirroring” is required and automatically included with 5770-DBM orders
 - No additional charge for Option 48
 - Option 48 is only available with Db2 Mirror and cannot be ordered separately
- 70-day evaluation period available for 5770-DBM and IBM i Option 48
 - I.e. standard try-and-buy period as IBM i and the keyed IBM i LPPs. After 70 days, enter the software license key

Licensing, continued

- Db2 Mirror price structure:
 - Processor feature is 5051 is the priced feature
 - Base feature 5050 is a no-charge user interface for managing Db2 Mirror on other systems in the network
- The Db2 Mirror two production nodes will not qualify as a CBU. DR nodes could qualify
- For Db2 Mirror, the processor charge metric and subcapacity terms are the same for DB2 Mirror as, e.g., IBM i operating system and PowerHA for i
 - Workload Capping Groups are not supported for subcapacity licensing for Db2 Mirror

[Db2 Mirror Software License Terms](#)





Db2 Mirror for i workshop

IBM Systems Lab Services — Power Systems IBM i

Overview

The Db2 Mirror for i workshop will provide customers and business partners the opportunity to build skills in Db2 mirror as well as testing their applications on a DB2 Mirror environment in the lab. The workshop will be 2 weeks with the first week covering planning, implementation, setting up libraries in a DB2 Mirror environment and Database requirements/changes. The second week will focus on application changes and performance requirements/testing.

Target Audience

- Any customer or BP who wishes to learn about Db2 mirror in depth and test their application

Benefits

- By the end of the workshop, the attendees will have the skills to start planning their Db2 mirror environment.

Qualifying Questions

- Do you need a zero time failover environment to an active high availability system
- Do you wish to start working towards a true active/active solution

Team Contacts

Owner: Selwyn Dickey sdickey@us.ibm.com

Eric Barsness ericbar@us.ibm.com

Opportunity manager Mike Gordon mgordo@us.ibm.com

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Key Features

- The workshop is fixed price for 2 weeks. It is anticipated that not all people will attend both weeks. The first week is aimed more at technical specialists while the second week is more application and performance.
- During the 2 weeks, access to consultants across aspects of IBM i will be available to maximize the benefit of the workshop. This includes, performance, database/SQL, application and infrastructure experts
- The hardware will be capped at 5 x Power 8 processors per partition with 32 GB of memory per core, and 10TB of DS8000 disk per partition.
- The testing can be performed for IASP/PowerHA, or full system
- No HIPAA or PHI data can be loaded on the IBM systems

Deliverables

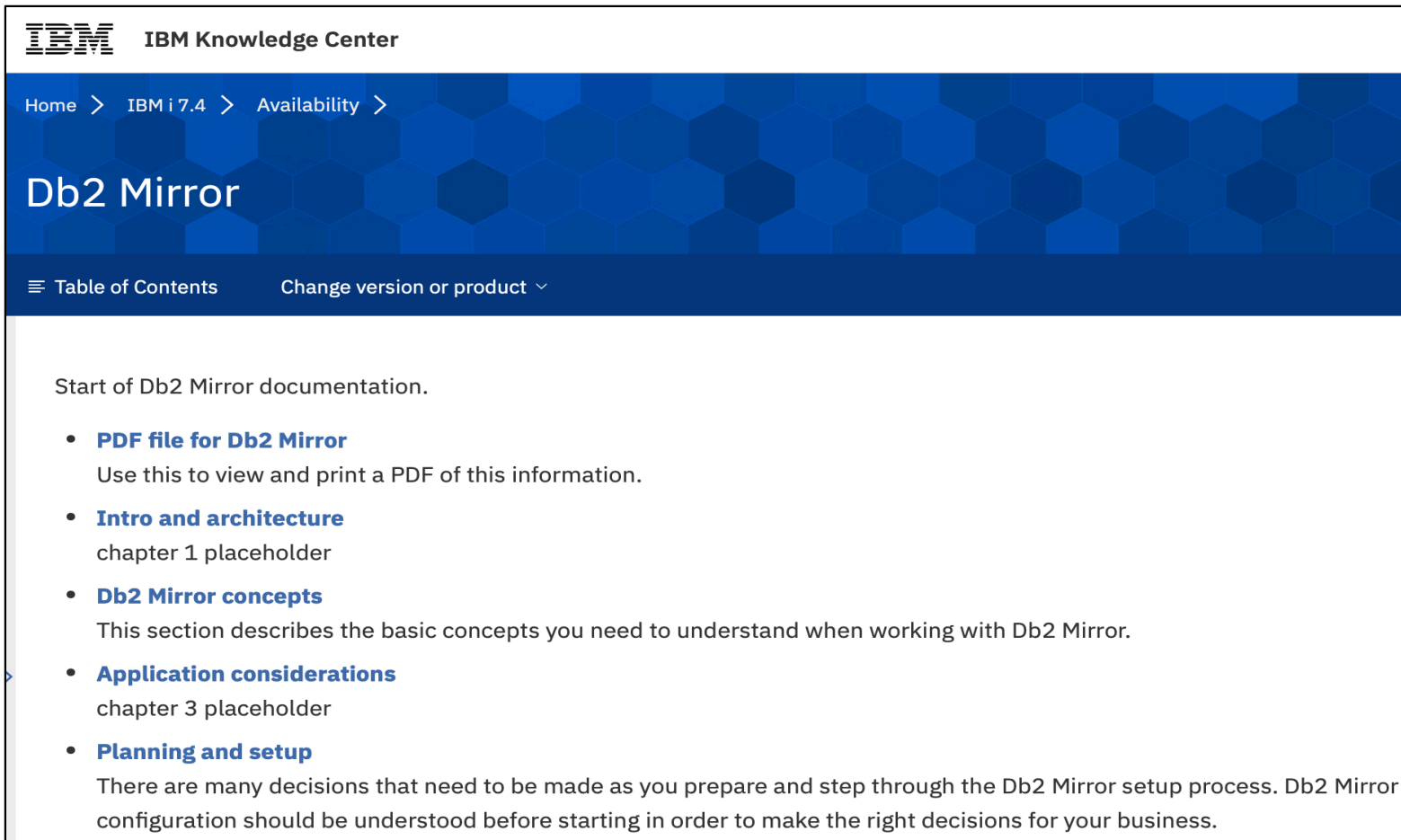
- Any presentation used in the workshop will be available to the attendees
- Any data (performance, object changes etc) will be available for the attendees to save to tape and take home

Duration (optional)

80 hours (no outside working hours)

Db2 Mirror – Where to get more information

www.ibm.com/support/knowledgecenter/ssw_ibm_i_74/db2mi/db2mintro.htm



The screenshot shows the IBM Knowledge Center interface for the Db2 Mirror documentation. The page has a blue header with the IBM logo and 'IBM Knowledge Center'. Below the header is a breadcrumb trail: 'Home > IBM i 7.4 > Availability >'. The main title 'Db2 Mirror' is displayed in a large font. Below the title, there are two links: 'Table of Contents' and 'Change version or product'. The main content area contains the following text and list:

Start of Db2 Mirror documentation.

- **PDF file for Db2 Mirror**
Use this to view and print a PDF of this information.
- **Intro and architecture**
chapter 1 placeholder
- **Db2 Mirror concepts**
This section describes the basic concepts you need to understand when working with Db2 Mirror.
- **Application considerations**
chapter 3 placeholder
- **Planning and setup**
There are many decisions that need to be made as you prepare and step through the Db2 Mirror setup process. Db2 Mirror configuration should be understood before starting in order to make the right decisions for your business.



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IASPs

IBM

Db2 Mirror IASP Support

- IASPs are optional for Db2 data
- IASPs are required for IFS concurrent sharing
 - PowerHA required to switch IFS IASPs
- DB IASPs have their own Replication Rules and Object Tracking List

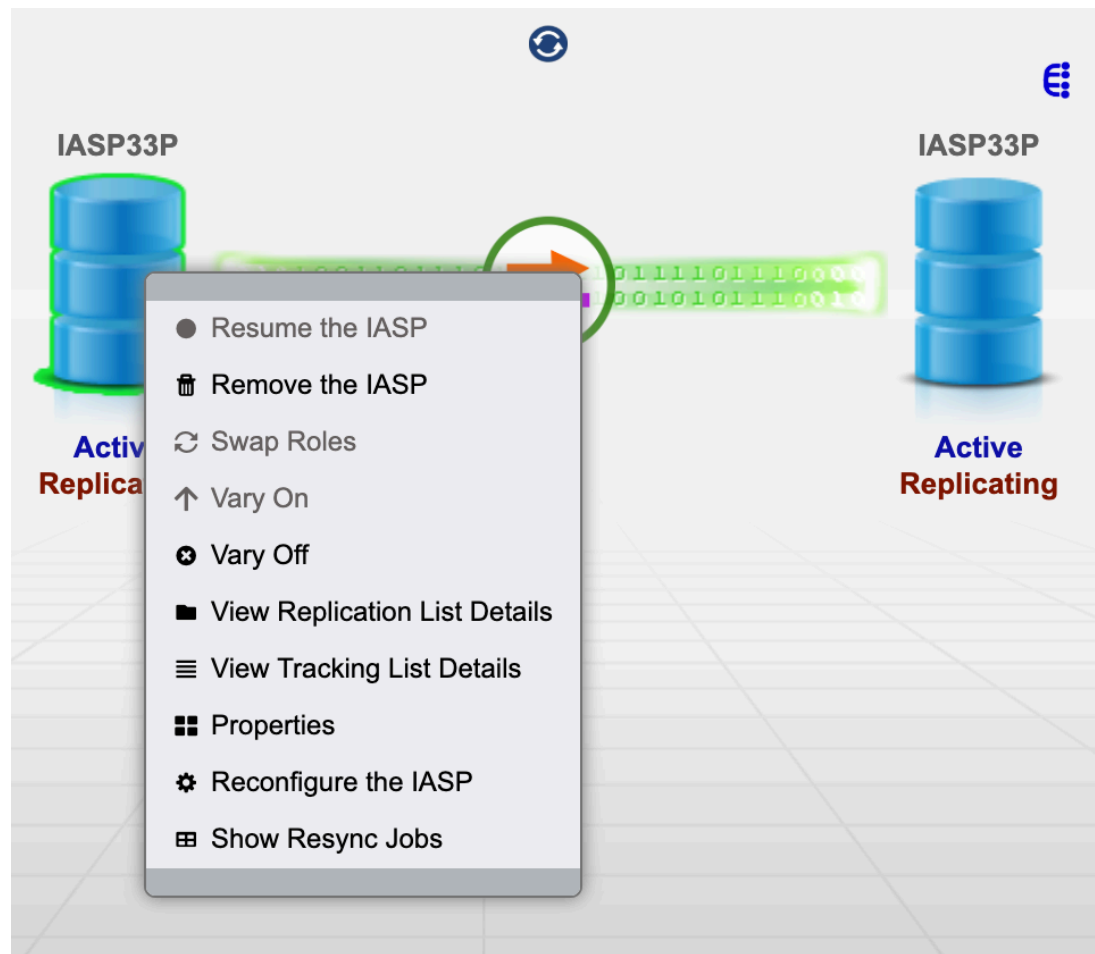


IASP Support

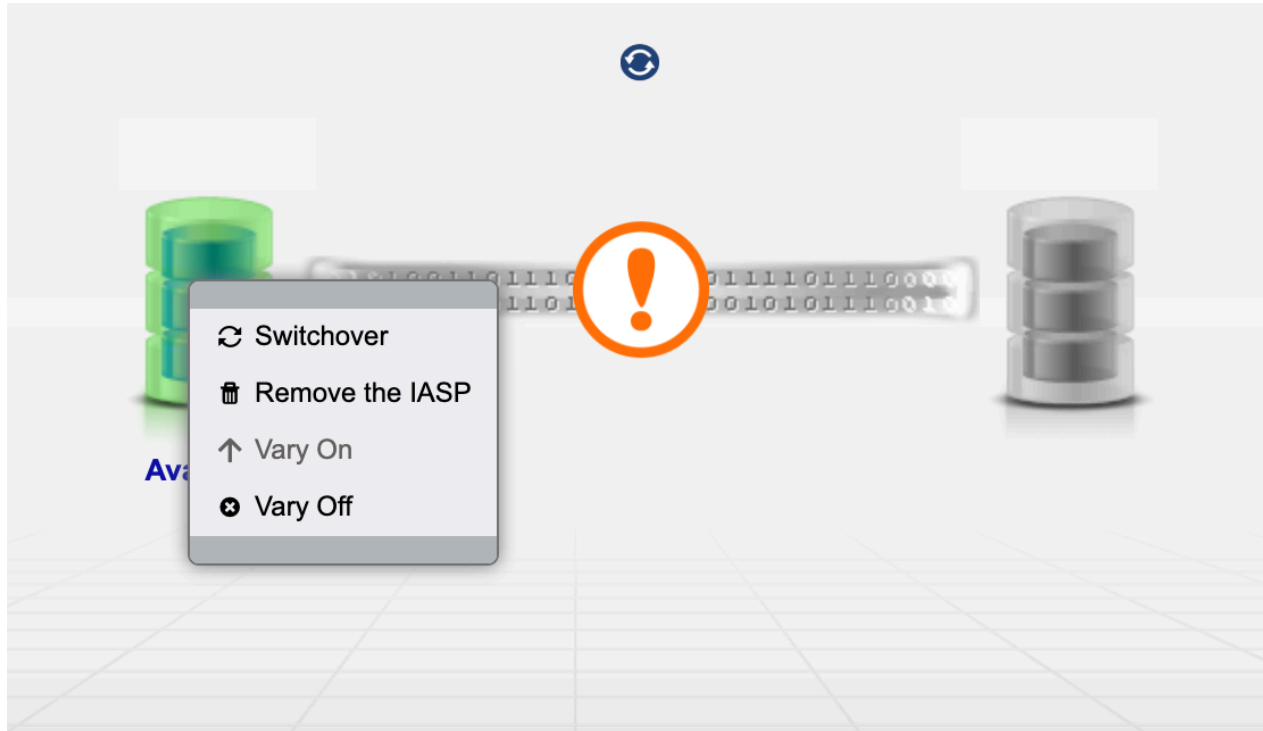
The screenshot displays the IBM Db2 Mirror for i management console. The browser address bar shows the URL `sync3.rch.stglabs.ibm.com:2006/Db2Mirror/mainframe/home`. The page header includes the title "IBM Db2 Mirror for i", the primary/secondary instance names "Primary: SYNC3" and "Secondary: RESYNC3", the user "User: whitneyk", and the GUI build time "2019-04-24 22:11:39".

The main interface shows two server racks representing the Primary (SYNC3) and Secondary (RESYNC3) instances. Both are labeled "Active Replicating". A central graphic depicts data replication between the two servers, with a green double-headed arrow and binary code. A taskbar at the bottom contains icons for various components: SYSBASE (highlighted with a red oval), IASP33P, ITST1, ITST2, ITST3, IFS1, and IFS2.

IASP Support



Switch over IFS IASPs



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Specific Object Replication Details

DB2 Mirror – Database “must have” knowledge

1. DDS and SQL DDL files are supported
2. Native DB I/O (e.g. RPG) and SQL are supported
3. Mirrored database files contain the same data, at the same RRNs
4. Journaling is optional, but encouraged
5. Record level operations against mirrored files will yield identical results, regardless of whether the source or target are being used
6. Database DDL and I/O operations are synchronous



Database trigger considerations

- Configured via ADD/CHGPFTRG and ALTER/CREATE TRIGGER

```
-----  
V____(1) |  
>>-ALTER TRIGGER--trigger-name-----++-SECURED-----++-><  
| '-NOT SECURED-' |  
++-ENABLE-----+  
| '-DISABLE-' |  
'--MIRROR NO--+'  
'-MIRROR YES-'
```

MIRROR NO or MIRROR YES

Specifies where the trigger will be called in a mirrored environment. This option is ignored if mirroring is not active.

Default

MIRROR NO

In a mirrored environment, the trigger will be called only on the system firing the trigger.

MIRROR YES

In a mirrored environment, the trigger will be called on both systems in the mirrored pair.



Output Queue (*OUTQ) Objects

Objects of type *OUTQ will be replicated synchronously

- OUTQ's kept identical across both systems
- Creates, updates, and deletes blocked if
 - Initiated on secondary system while DB2 Mirror is interrupted
 - A required object not available on both systems
 - DTAQ
 - MSGQ
 - WSCST
- Customers configure which to replicate

IBM

Characteristics of Spooled Files

Spooled file have unique properties for DB2 Mirror

- All the data spooled originate from a single system
- Often generated over a long-running process
- Can be quite large
- Usually not useful if incomplete
- Limited number of spooled files allowed on a system
- Duplicate spooled files not allowed
- Not true objects, in an IBM i sense



Spooled File Replication

- Spooled files will be replicated near-synchronously
 - At close, spooled file will be added to the OTL as deferred
 - A system job will resynch spooled files to the target system at configurable intervals
 - Cannot guarantee that the order of spooled files will be the same on both systems
 - Generation of spooled files is never blocked.
 - Spooled files added to OTL on both systems when replication suspended
 - Resynchronized both ways when replication resumed
- Replicated to the same library/output queue on the target system



Spooled File Status

- Replicated spooled files will be restored in *HLD status
 - Prevents processing of replicated files until they are released
 - Ignored by active writers
 - No entries added to an associated DTAQ
 - On failover, spooled files in *HLD must be released to be processed
- Once processed, replicated copies will be set to *SAV or *FIN status
- *RLS, *HLD, *PND, *WTR, and *PRT status not replicated



Considerations for replicating spooled files

- Due to the large amount of potential data transfer, care should be taken to limit replication of spooled files to those needed.
 - We help by permanently excluding the following output queues
 - QUSRSYS/QEZJOBLOG
 - QUSRSYS/QEZDEBUG
 - QGPL/QPRINT
 - We help by excluding the following output queues, by default
 - All *OUTQs in QUSRSYS
 - All *OUTQs in QGPL
 - These *OUTQs may be explicitly included in replication by name.
 - When including a library, users should exclude unneeded OUTQs at the same
 - RCL configuration allows multiple changes to be submitted as a group



Synchronously Replicated Authority Changes

The following will be replicated synchronously:

(Synchronous changes occur at the same time on both systems. They either succeed on both, or fail on both.)

- Authority & ownership changes to database file (table) objects including securing the file with an authorization list
 - Using e.g. GRTOBJAUT, RVKOBJAUT, CHGOBJOWN, CHGOBJPGP, ...
- Authority & ownership changes to any other supported object via database (SQL) operations
- Authority changes to IFS objects on the hardware mirrored IASP
- Creation of a *AUTL object. Adding users to/from a *AUTL. Changing ownership of a *AUTL.
- Change of object audit attribute via CHGOBJAUD
- Change of user profile parameters PASSWORD and UID/GID
- Creation of a user profile
 - User profile is created on both systems with the same attributes including UID and GID

Authority Changes Not Supporting Replication

The following will not be replicated:

- Authority changes to objects not supported by DB2Mirror, or to objects which DB2Mirror is configured to exclude.
- Cryptographic and digital certificate management capabilities
 - e.g. master keys, key store updates, and certificate store info
- Configuration for functions like Kerberos / EIM
 - plus other considerations like keytab files, EIM relationships, etc



Replicated Objects that can change while in the blocked state

- User Profiles
- Authorization Lists
- Function Usage Information
- Environmental Variables
- System Values
- Spooled Files

For more information on specific behavior:

https://www.ibm.com/support/knowledgecenter/ssw_ibm_i_74/db2mi/db2mobjblocked.htm