



# CLI Failover

## SAP on IBM Z

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PUBLIC



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# Agenda

Introduction

From SAP Failover to CLI Failover – How to configure CLI Failover

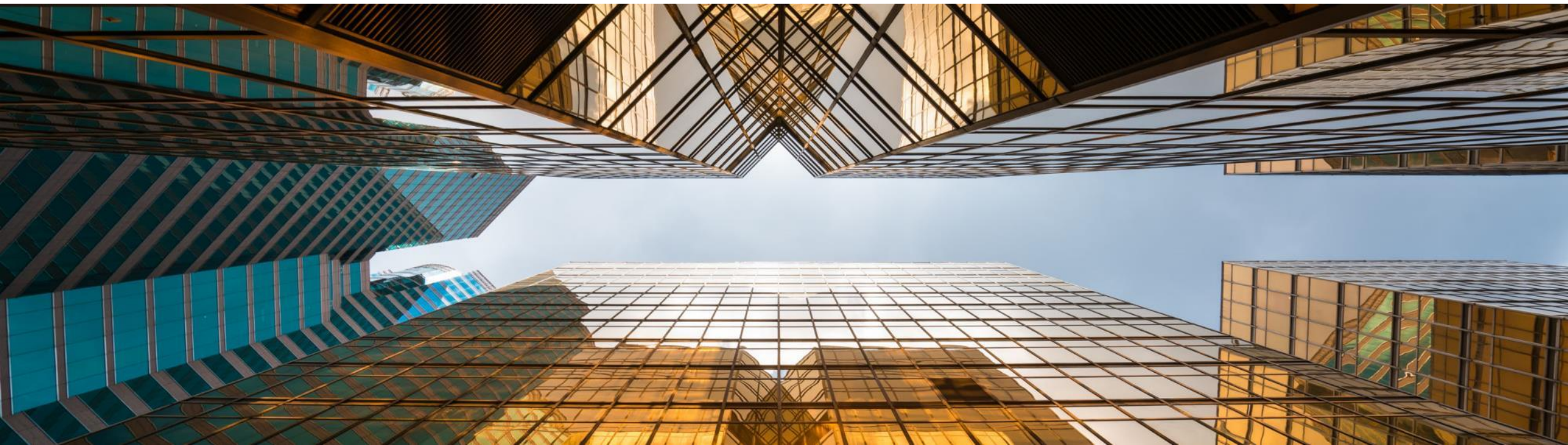
Triggering planned Failover

Timeout Parameters and additional SAP profile Settings

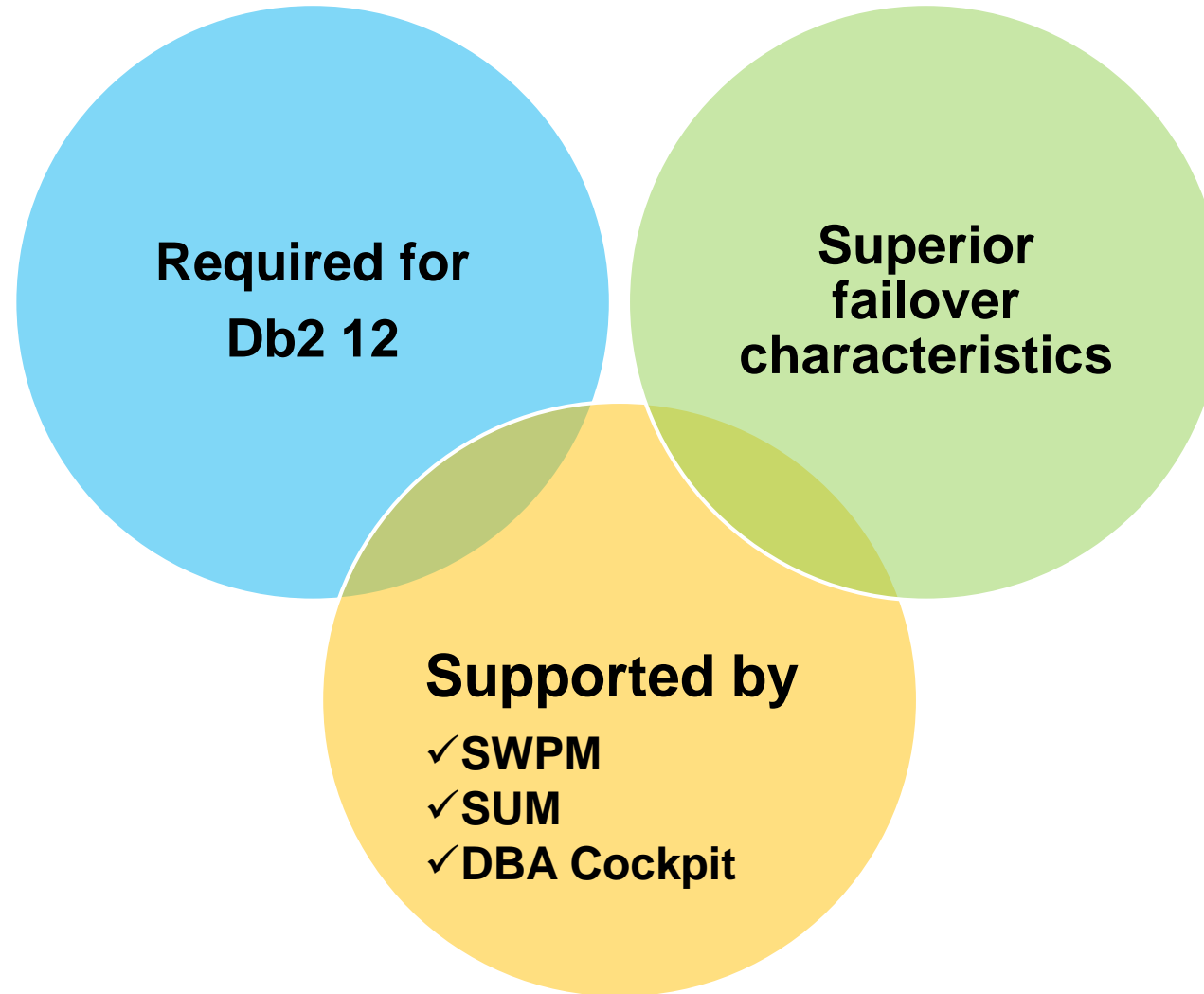
Appendix



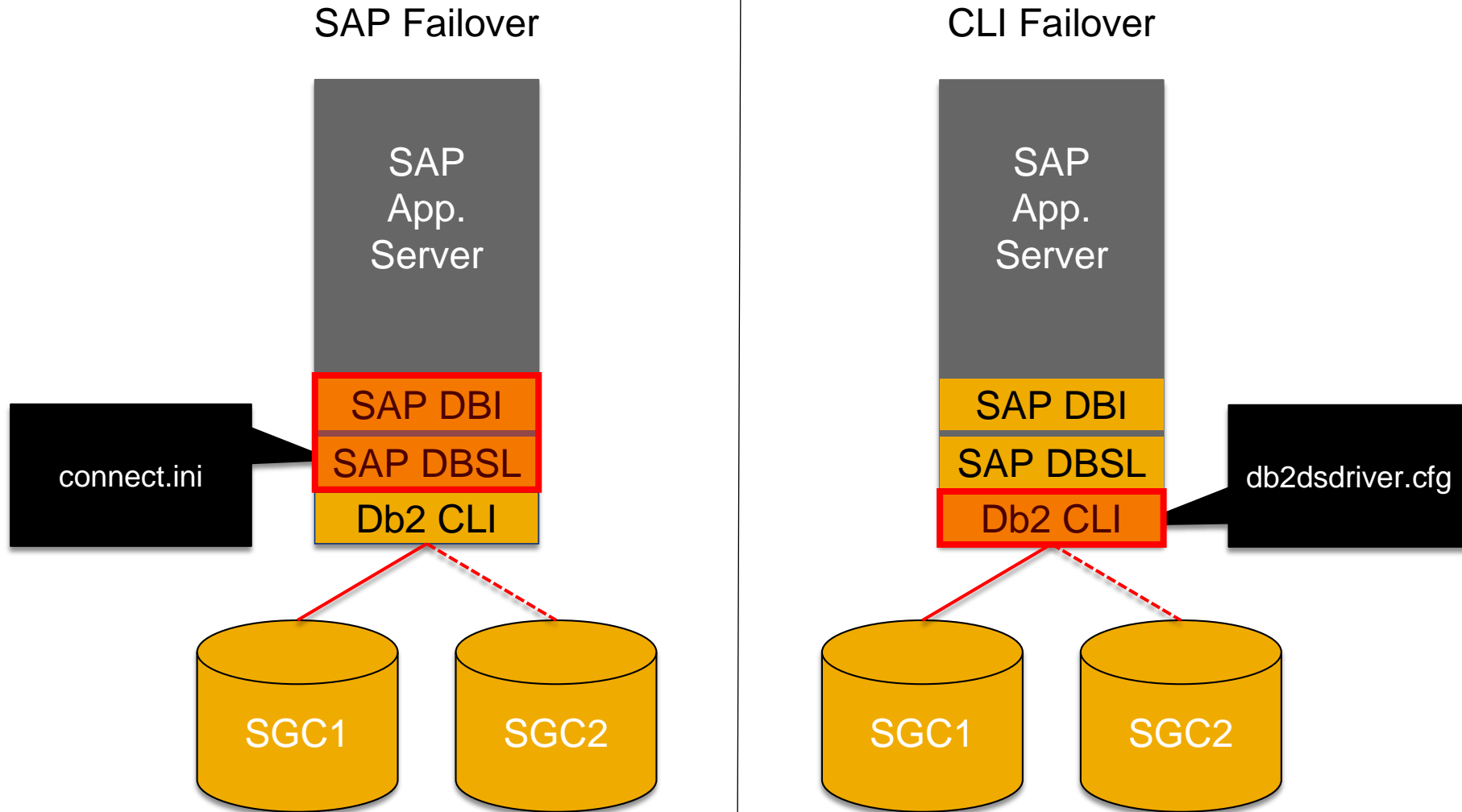
# Introduction



# Why CLI Failover ?



# Differences between SAP Failover and CLI Failover



# CLI Failover - Benefits

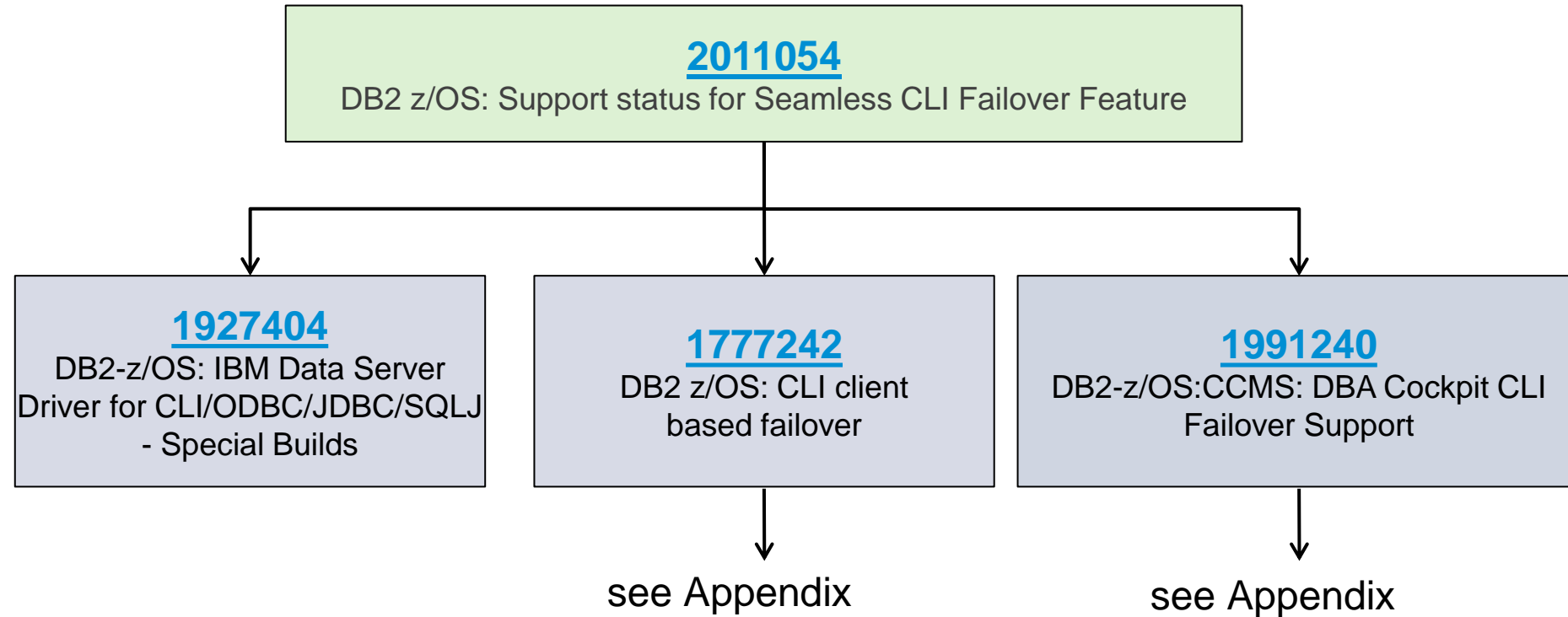
- **Same configuration **method** for ABAP stacks, Java stacks, non-SAP CLI based applications**

- **Important Note:** DO NOT simply copy parameter names. For example, following parameter names differ for db2dsdriver.cfg and config.xml.

db2dsdriver.cfg	config.xml
dsncollection	dsn_collection
affinitylist	affinity_list
Acr	ACR (all uppercase)
alternateserverlist	alternate_server_list
clientaffinitydefined	client_affinity_defined

- **Seamless failover for read-only transactions in case of unplanned failover**
  - Less ABAP dumps compared to SAP failover, see preconditions for seamless failover [here](#)
- **Reconnect to alternative Db2 member in case of planned failover**
  - CLI Failover: At end of Db2 transaction – at Commit when no resources are held or at Rollback
  - SAP Failover: Only at SAP task handler commit
- **More flexible by using dynamic location alias(es) which is recommended**
  - Ability to stop the dynamic location alias and triggering failover without actually stopping DDF and/or Db2
  - Even if the dynamic location alias is stopped you may allow access to DDF for 'failback' in case that connections to the 'failover' DDF break for whatever reason.
- **Automated failback can be configured**

# SAP Notes for CLI Failover





# Recommended CLI Driver, SAP Kernel and ABAP Levels

- **IBM Data Server Driver for ODBC and CLI (aka CLI Driver)**

- Check [SAP note 1927404](#) for recommended CLI Driver levels
- All OS platforms: release 11.5 M4 FP0 special build SB4600  
Remarks:
  - Linux on Power Big Endian is not supported any more
  - Type 3 JDBC driver (db2jcc.jar) is not supported any more
- For supported operating systems for CLI Driver 11.5 see: [Supported Operating Systems](#)

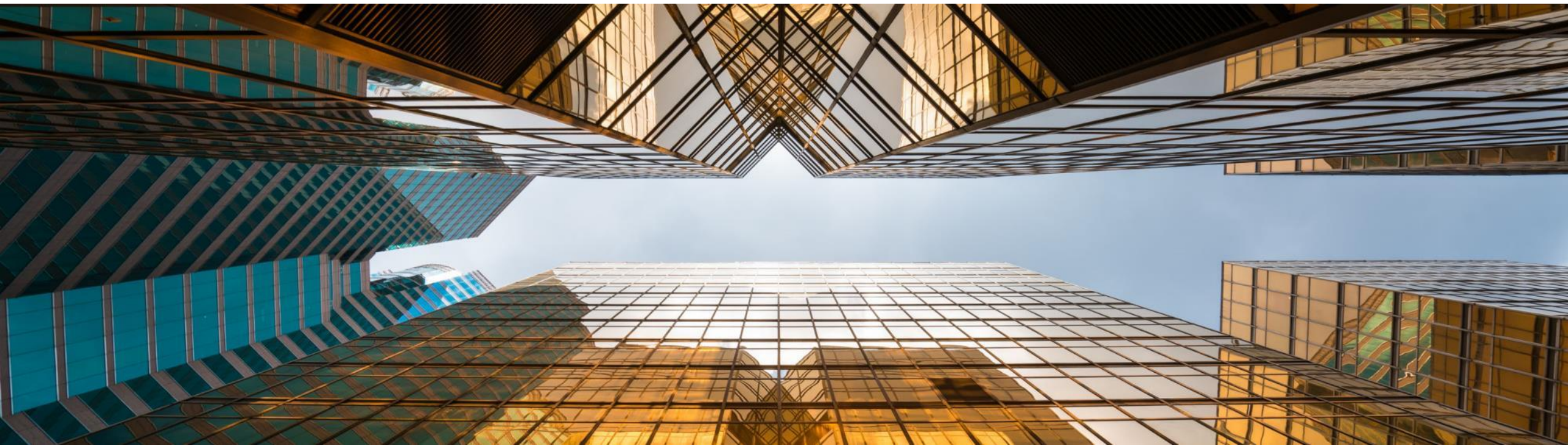
- **SAP Kernel**

- SAP Kernel 7.49 or higher
- SAP Kernel 7.22 or higher
- Prerequisites for older SAP kernel versions: [SAP note 1777242](#)

- **ABAP Support Package levels for CLI Failover Configuration tool**

- Use at least the ABAP SAP Basis Support Package levels which are listed in [SAP note 2461759](#)

# **From SAP Failover to CLI Failover – How to configure CLI Failover**



# How to move from SAP Failover to CLI Failover

**Important:** It is highly recommended to use at least the base levels of the tool, listed in [SAP note 2461759](#)

## Launch Failover Configuration Tool

- Import connect.ini

## Review / Change Failover configuration

- Check and customize imported configuration

## Check and Write to Disk

- db2dsdriver.cfg is stored in global directory

## Validate generated file and Configure CLI Failover

- On success:
  1. Change <sid>adm environment
  2. Set profile parameter to activate CLI failover

**Restart all App Servers (in a rolling fashion)**

# Launch Failover Configuration Tool

Failover Configuration

System Configuration | DB Connections

System R50

Last Refresh 20.01.2021 14:46:26

DB Name DDFSGQ1 DB Server ihsappe Started 02.12.2020 12:07:35  
DB Release 11.01.0005

System Type ABAP Alias Input Format ABAP - connect.ini  
DDF Loc. Name DDFSGQ1 Host ihsappe.wdf.sap.corp:9171 Output Format ABAP - connect.ini

Input DB2-Servers Affinity Lists App-Servers Parameters Check Result

```
* ADDED 20160503 151537 by DB2RADM RELEASE 745 PATCHLEVEL 000
[COMMON]
RETRY_CNT=3

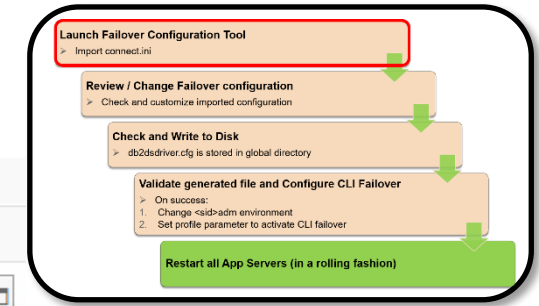
[GROUPS]
DEFAULT_GROUP=ibmvx232

[DEFAULT_GROUP]
CON1=SGQ1_on_ihsappe
CON2=SGQ2_on_ihsappe
CON3=SGQ3_on_ihsappe

[SGQ1_on_ihsappe]
SSID=SGQ1
HOST=ihsappe.wdf.sap.corp
PORT=9171
LOCATION=DDFSGQ1

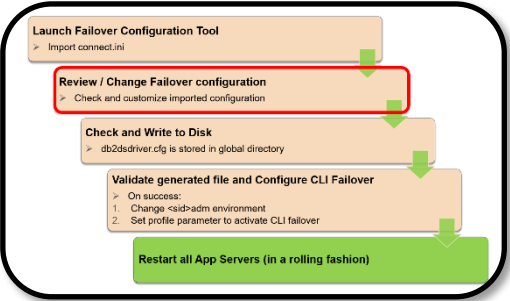
[SGQ2_on_ihsappe]
SSID=SGQ2
HOST=ihsappe.wdf.sap.corp
PORT=9171
LOCATION=DDFSGQ1

[SGQ3_on_ihsappe]
SSID=SGQ3
HOST=ihsappe.wdf.sap.corp
PORT=9171
LOCATION=DDFSGQ1
```





# Review the Failover Configuration



Input DB2-Servers Affinity Lists App-Servers			
Add Delete Clear Renumber			
Name	Member (SSID)	Hostname	Port
SGQ1		ihsappe.wdf.sap.corp	9171
SGQ2		ihsapfe.wdf.sap.corp	9171
SGQ3		ihsapje.wdf.sap.corp	9171
SGQ4		ihsapde.wdf.sap.corp	9171

DB2-Servers/Members

Input DB2-Servers Affinity Lists App-Servers	
Add Delete Clear Renumber	
Name	DB2-Server Order
list1	SGQ1
list2	SGQ3
list3	SGQ2
list4	SGQ4

Affinity Lists

Input DB2-Servers Affinity Lists App-Servers Parameters			
Add Delete Clear Renumber			
Name	Hostname	Affinity List	Preview
ibmvx232_...	ibmvx232	list7	DB2-Server Order
			SGQ4
			SGQ1
			SGQ2
			SGQ3

Application Servers

There is no [DEFAULT\_GROUP] like in connect.ini. Every appserver must have an explicit affinity list assigned to it.

Input DB2-Servers Affinity Lists App-Servers Parameters	
Parameter section acr	
Add Delete Clear Fill in	
Parameter Name	Parameter Value
acrRetryInterval	0
affinityFailbackInterval	0
enableAcr	true
enableSeamlessAcr	true
maxAcrRetries	3

Parameters



# Check and write Result db2dsdriver.cfg File to Disk (📁)

Input DB2-Servers Affinity Lists App-Servers Parameters **Check**

Failover Configuration check report  
Currently monitored system "R50" with alias "R50"

Checking DB2-Servers: Info

- Cannot check DB2-Server hostnames because of CLI Failover.
- Please review the DB2-Server entries carefully

Checking Affinity Lists: Error

- Affinity list "list1" is not referenced by any App-Server.
- Affinity list "list2" is not referenced by any App-Server.
- Affinity list "list3" is not referenced by any App-Server.
- Affinity list "list4" is not referenced by any App-Server.
- Affinity list "list5" is not referenced by any App-Server.
- Affinity list "list6" is not referenced by any App-Server.

Checking App-Servers: Ok

Checking Parameters: Ok

Check DDF Location: Ok

Checking dsn\_alias for CLI Failover: Info

- Profile Parameter "dbs/db2/dsn\_alias" is set to "R50".

Checking Environment for CLI Failover: Info

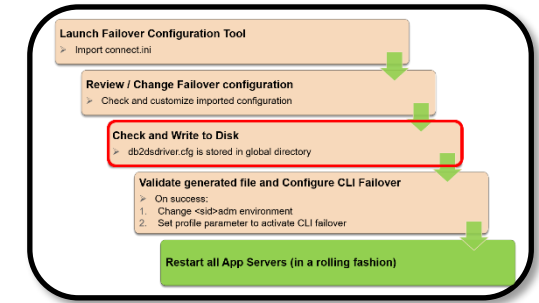
- Environment Variable "DB2SDRIVER\_CFG\_PATH" is set to "/usr/sap/R50/SYS/global".

Detected app servers: Info

- name:"ibmvx232\_R50\_51" - host:"ibmvx232" - serv:"sapdp51"

Detected ds members: Info

- memb\_name:"SGQ1" - ssid:"SGQ1" - zosname:"SAPP"
- memb\_name:"SGQ2" - ssid:"SGQ2" - zosname:"SAPF"
- memb\_name:"SGQ3" - ssid:"SGQ3" - zosname:"SAPJ"



Input DB2-Servers Affinity Lists App-Servers Parameters **Check** **Result**

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
  <dsncollection>
    <dsn alias="R50" name="DDFSGQ1" host="ihsappe.wdf.sap.corp" port="9171"/>
  </dsncollection>
  <databases>
    <database name="DDFSGQ1" host="ihsappe.wdf.sap.corp" port="9171">
      <parameter name="ConnectionTimeout" value="16"/>
      <parameter name="tcpipConnectTimeout" value="5"/>
      <parameter name="authentication" value="server"/>
      <acr>
        <parameter name="acrRetryInterval" value="0"/>
        <parameter name="affinityFallbackInterval" value="0"/>
        <parameter name="enableAcr" value="true"/>
        <parameter name="enableSeamlessAcr" value="true"/>
        <parameter name="maxAcrRetries" value="3"/>
      </acr>
      <alternateserverlist>
        <server name="SGQ1" hostname="ihsappe.wdf.sap.corp" port="9171"/>
        <server name="SGQ2" hostname="ihsapfe.wdf.sap.corp" port="9171"/>
        <server name="SGQ3" hostname="ihsapje.wdf.sap.corp" port="9171"/>
        <server name="SGQ4" hostname="ihsapde.wdf.sap.corp" port="9171"/>
      </alternateserverlist>
      <affinitylist>
        <list name="list1" serverorder="SGQ1,SGQ3,SGQ2,SGQ4"/>
        <list name="list2" serverorder="SGQ2,SGQ4,SGQ1,SGQ3"/>
        <list name="list3" serverorder="SGQ3,SGQ1,SGQ4,SGQ2"/>
        <list name="list4" serverorder="SGQ4,SGQ2,SGQ3,SGQ1"/>
        <list name="list5" serverorder="SGQ4,SGQ2,SGQ3,SGQ1"/>
        <list name="list6" serverorder="SGQ4,SGQ1,SGQ3,SGQ2"/>
        <list name="list7" serverorder="SGQ4,SGQ1,SGQ2,SGQ3"/>
      </affinitylist>
      <clientaffinitydefined>
        <client name="ibmvx232_R50_5x" hostname="ibmvx232" listname="list7"/>
      </clientaffinitydefined>
    </database>
  </databases>
</configuration>
```

# Validate db2dsdriver.cfg

Test db2dsdriver.cfg file with program db2cli:

1. Set temporarily in shell:  
**DB2DSDRIVER\_CFG\_PATH** to directory where db2dsdriver.cfg is located

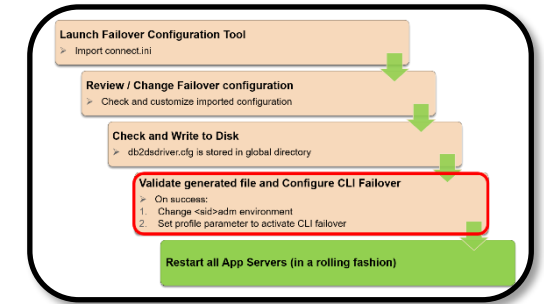
Note: "Temporarily" is for this test activity. For use with a SAP AppServer instance or stand-alone / life-cycle-management tools you must set DB2DSDRIVER\_CFG\_PATH permanently. See next page under "set in .dbenv\_XXX.sh/.csh files"

2. Set temporarily in shell:  
**DB2\_CLI\_DRIVER\_INSTALL\_PATH** to directory where CLI driver is installed.

3. Check driver level with:  
`$DB2_CLI_DRIVER_INSTALL_PATH/bin/db2level`

4. Validate only:  
`$DB2_CLI_DRIVER_INSTALL_PATH/bin/db2cli  
validate -dsn $dbs_db2_dsn_alias`

5. Validate and perform test connect:  
`$DB2_CLI_DRIVER_INSTALL_PATH/bin/db2cli  
validate -dsn $dbs_db2_dsn_alias  
-connect -user <user> -passwd <password>`



```
>$DB2_CLI_DRIVER_INSTALL_PATH/bin/db2cli validate -dsn $dbs_db2_dsn_alias
```

```
=====
Client information for the current copy:
=====
```

```
Client Package Type      : IBM Data Server Driver For ODBC and CLI
Client Version (level/bit): DB2 v11.5.4.0 (s2006161200/64-bit)
Client Platform          : Linux/Z64
... ..
```

```
alternate server list:
```

```
name:SGQ1  hostname:ihsappe.wdf.sap.corp  port:09171
name:SGQ2  hostname:ihsapfe.wdf.sap.corp  port:09171
name:SGQ3  hostname:ihsapje.wdf.sap.corp  port:09171
name:SGQ4  hostname:ihsapde.wdf.sap.corp  port:09171
```

```
affinity list:
```

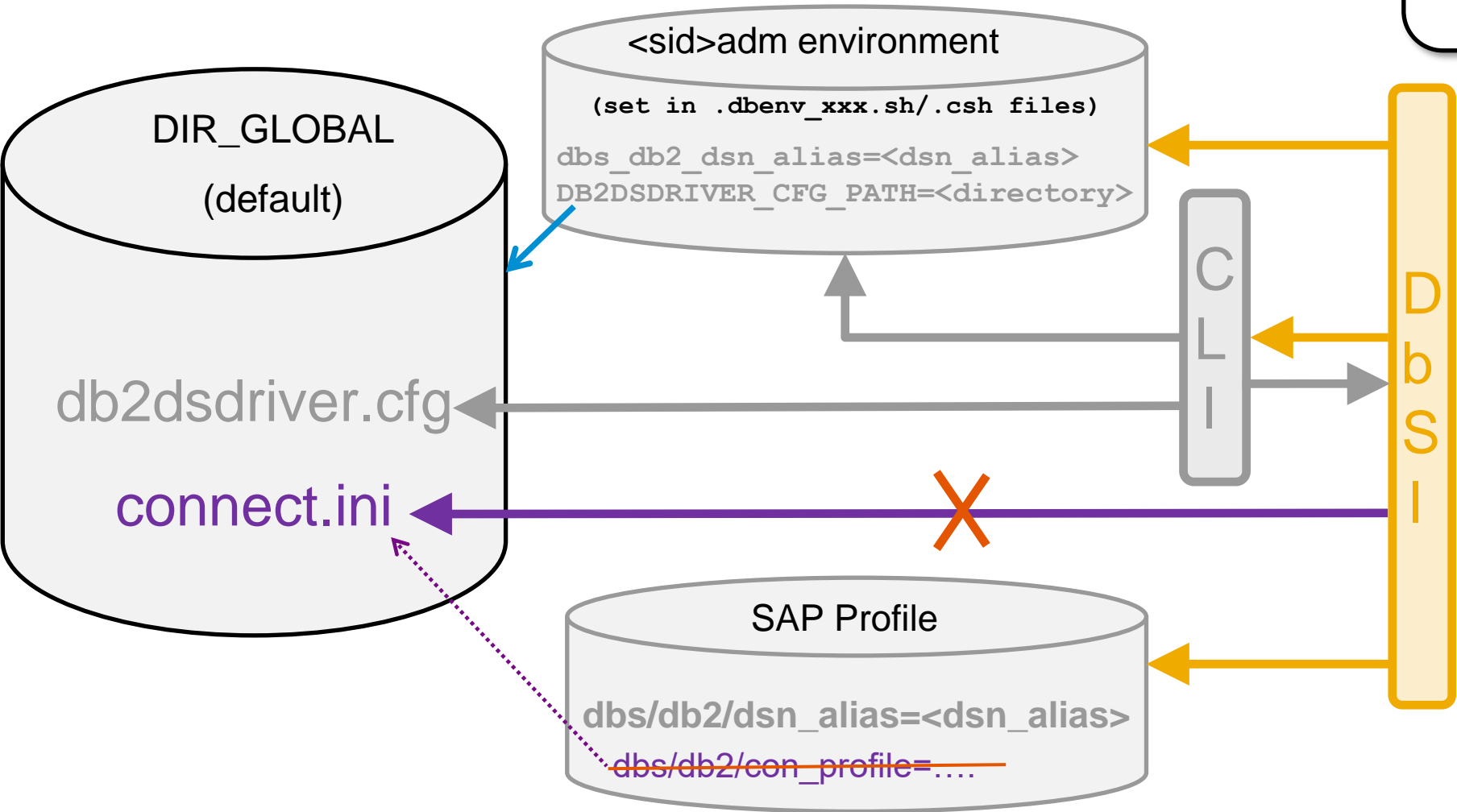
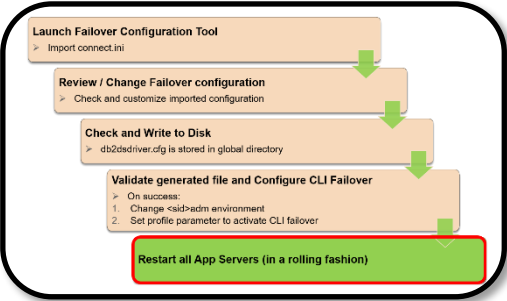
```
name:list1  serverorder:SGQ1,SGQ3,SGQ2,SGQ4
name:list2  serverorder:SGQ2,SGQ4,SGQ1,SGQ3
name:list3  serverorder:SGQ3,SGQ1,SGQ4,SGQ2
name:list4  serverorder:SGQ4,SGQ2,SGQ3,SGQ1
name:list5  serverorder:SGQ4,SGQ2,SGQ3,SGQ1
name:list6  serverorder:SGQ4,SGQ1,SGQ3,SGQ2
name:list7  serverorder:SGQ4,SGQ1,SGQ2,SGQ3
```

```
client affinity defined:
```

```
name:ibmvx232_R50_5x  hostname:ibmvx232  listname:list7
```

```
=====
The validation is completed.
=====
```

# Configure CLI Failover



# Restart Application Servers

## Launch Failover Configuration Tool

- Import connect.ini

## Review / Change Failover configuration

- Check and customize imported configuration

## Check and Write to Disk

- db2dsdriver.cfg is stored in global directory

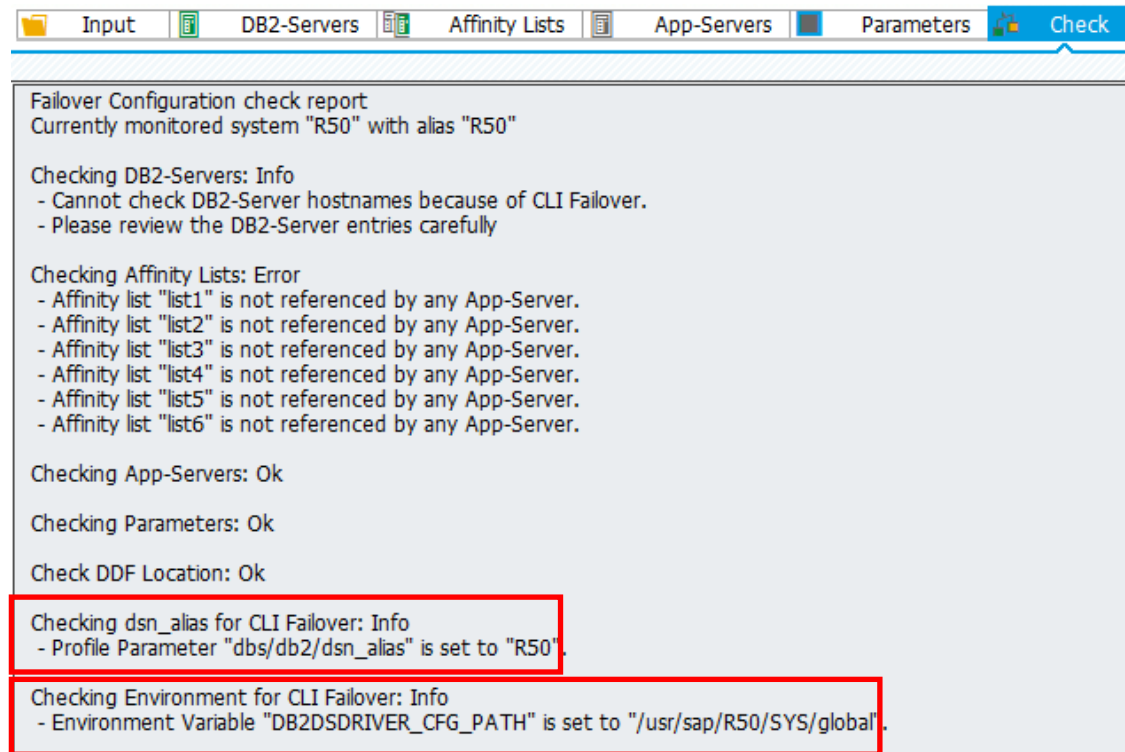
## Validate generated file and Configure CLI Failover

- On success:
  1. Change <sid>adm environment
  2. Set profile parameter to activate CLI failover

**Restart all App Servers (in a rolling fashion)**

# Which Failover Method is defined?

- **How to check dsn\_alias and DB2DSDRIVER\_CFG\_PATH settings**
  - See SAP Profile for dbs/db2/dsn\_alias or Environment for dbs\_db2\_dsn\_alias
  - Check environment variable DB2DSDRIVER\_CFG\_PATH for <sid>adm user
  - Perform “Check” in DBA Cockpit Failover Configuration (requires Support Package listed in SAP note 2111003)





# Which Failover Method is active?

- **Run R3trans -x and check trans.log file**

- The following string can be found if **CLI Failover** is active

```
DB2Trc: dbs/db2/dsn_alias is set (R50) -> we use the DB2 Connect fail over feature
```

- The following string can be found if **SAP Failover** is active

```
DB2Trc: dbs/db2/dsn_alias is not set -> we use the SAP fail over feature
```

- **Check SAP Application Server developer trace file**

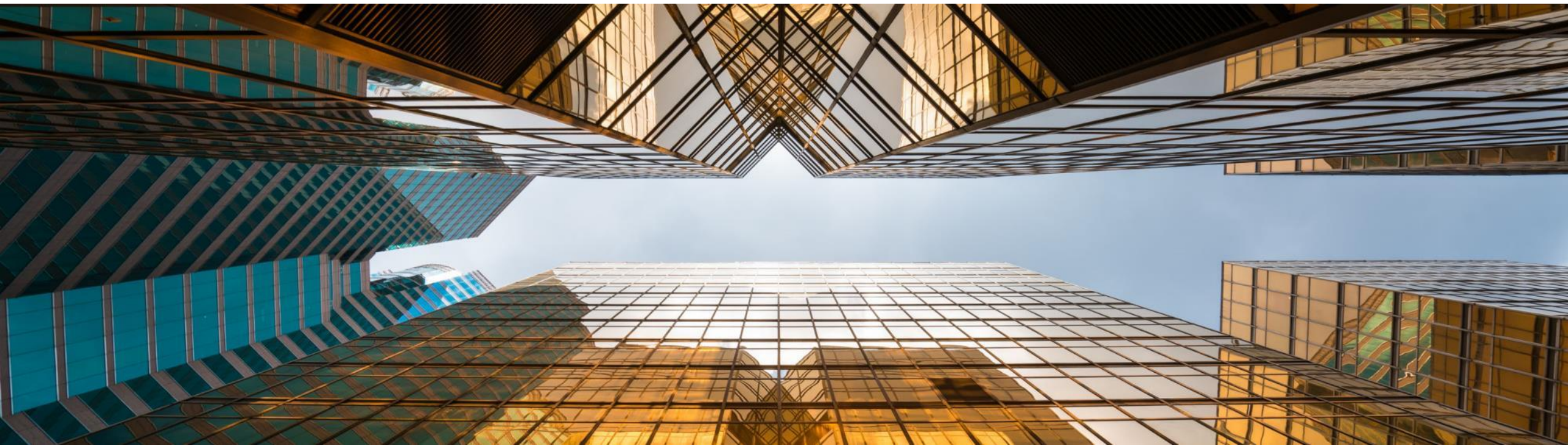
- The following string can be found in file dev\_w0 if **CLI Failover** is active

```
C DB2Trc: dbs/db2/dsn_alias is set (R50) -> we use the DB2 Connect fail over feature
```

- The following string can be found in file dev\_w0 if **SAP Failover** is active

```
C DB2Trc: dbs/db2/dsn_alias is not set -> we use the SAP fail over feature
```

# Triggering planned Failover



# Prerequisites to db2dsdriver.cfg File

Long database host names including domain are required by Db2 CLI driver

```
<configuration>
  <dsncollection>
    <dsn alias="R50" name="DDFSGQ1" host="ihsappe.wdf.sap.corp" port="09171" />
  </dsncollection>
  <databases>
    <database name="DDFSGQ1" host="ihsappe.wdf.sap.corp" port="09171">
      <parameter name="ConnectionTimeout" value="10"/>
      <parameter name="tcpipConnectTimeout" value="5"/>
      <parameter name="authentication" value="server"/>
    <acr>
      <parameter name="acrRetryInterval" value="0" />
      <parameter name="affinityFailbackInterval" value="0" />
      <parameter name="enableAcr" value="true" />
      <parameter name="enableSeamlessAcr" value="true" />
      <parameter name="maxAcrRetries" value="3" />
    <alternateserverlist>
      <server name="SGQ1" hostname="ihsappe.wdf.sap.corp" port="09171" />
      <server name="SGQ2" hostname="ihsapfe.wdf.sap.corp" port="09171" />
      <server name="SGQ3" hostname="ihsapje.wdf.sap.corp" port="09171" />
      <server name="SGQ4" hostname="ihsapde.wdf.sap.corp" port="09171" />
    </alternateserverlist>
  </database>
</databases>
</configuration>
```

Domain names required!

# ABAP Prerequisites for Planned Failover

## SAP Basis related prerequisites:

- [SAP note 1973798 - DB2-z/OS:CCMS: db2dsdriver.cfg and SAPCL / DB13](#)
- [SAP note 1975716 - DB2-z/OS:CCMS: db2dsdriver.cfg and DB Connection List / RSDB2SWITCH](#)

## Db2dsdriver.cfg File Prerequisites:

- The values for parameter „server name“ in db2dsdriver.cfg need to be in **UPPER CASE**

```
<acr>
  <parameter name="acrRetryInterval" value="0" />
  <parameter name="affinityFailbackInterval" value="0" />
  <parameter name="enableAcr" value="true" />
  <parameter name="enableSeamlessAcr" value="true" />
  <parameter name="maxAcrRetries" value="3" />
  <alternateserverlist>
    <server name="SGQ1" hostname="ihsappe.wdf.sap.corp" port="09171" />
    <server name="SGQ2" hostname="ihsapfe.wdf.sap.corp" port="09171" />
    <server name="SGQ3" hostname="ihsapje.wdf.sap.corp" port="09171" />
    <server name="SGQ4" hostname="ihsapde.wdf.sap.corp" port="09171" />
  </alternateserverlist>
```

# Recommended Planned Failover trigger

- **Most flexible: Use a dynamic location alias per data sharing group.**

Stop the dynamic location alias for a member to initiate a planned failover. DDF / Db2 subsystem stay active

Prereq.: The alias and its associated port must be used in the db2dsdriver.cfg

**Example:** SAP SID is HA5 with 3 data sharing members HA51, HA52 and HA53. Dynamic location alias (DLA) is SAPHA5 with port 55551. To stop the DLA for member HA51 execute on z/OS console:

`/-HA51 modify ddf alias(sapha5) STOP` (- is the Db2 subsystem command prefix)

After you have done maintenance including stops, restarts and verification of the member, start the DLA again. Then SAP Application Server will be able reconnect, for example, with active automatic failback

Optional: Even if the DLA is stopped you may allow access to DDF by adding the server name and port of the location alias to the serverorder. This allows 'failback' in case that connections to the 'failover' DDF break for whatever reason.

- **Stop the DDF of a member with mode(quiesce)**

**Example:** `/-HA51 Stop ddf` (- is the Db2 subsystem command prefix and mode(quiesce) the default)

Note that SAP Application Server will be able to reconnect as soon as the DDF is started again.

If you use TCPIP bind statement to bind a VIPA to DDF at startup, then you must implement

[SAP note 2875883 DB2-z/OS: Transparently using STOP DDF MODE\(QUIESCE\) with member specific DVIPA created.](#)

- **Use SAP ABAP supported functions available for example in DBA Cockpit as listed on next page**

You need to handle restarted work processes, if there are.

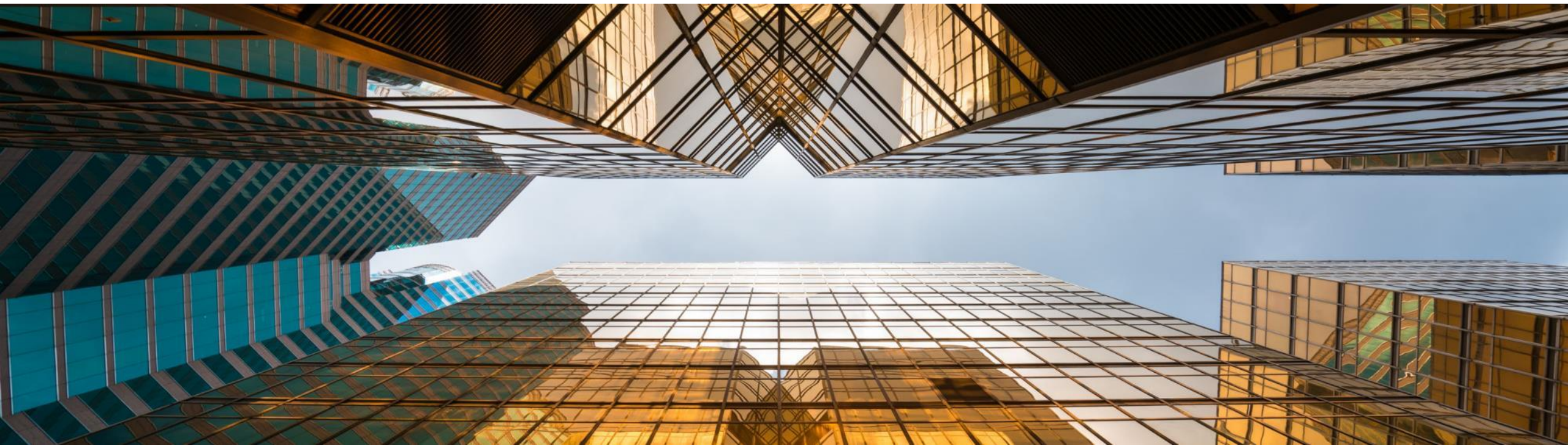


# ABAP Supported Functions

- **Optionally activate a db2dsdriver.cfg file containing an adapted serverorder where the target DS member is the new primary member**
  - Update and validate the db2dsdriver.cfg file, either manually or using the DBA Cockpit Failover Configuration Tool
  - To activate a new db2dsdriver.cfg, the work processes need to pick it up at start time. Therefore either restart the Application server or for more seamless activation, use the following recommended procedure:
    - Activate profile parameter (with RZ11) rdisp/wp\_auto\_restart and rdisp/noptime. Set both to 60 (seconds) for example
    - Wait until all work processes have been restarted, especially batch work processes
    - De-activate both parameter again (set both to 0) to avoid interference with the default hourly Db2 thread recycle and planned failover initiated from DBA Cockpit or program interface
- **Planned failover via DBA Cockpit \***
  - Switch current application server to a new target DS member:
    - double-click an entry in DBA Cockpit -> Diagnostics -> DB Connections -> DB Connection List
- **Planned failover via program interface \***
  - Execute ABAP Report RSDB2SWITCH
  - Call STU3\_ADMIN\_SWITCH\_DB\_CON via SAP RFC
    - Input parameter NEWDBCON is a “server name” from db2dsdriver.cfg
    - Find server name in column “Logical Name” in:  
DBA Cockpit -> Diagnostics -> DB Connections -> DB Connection List

**\* Note:** If a work process restarts for whatever reason, it again connects to its primary member, because it uses its server order defined in db2dsdriver.cfg.  
Using wp\_auto\_restart does NOT work with a planned failover initiated from DBA cockpit, running report RSDB2SWITCH or using STU3\_ADMIN\_SWITCH\_DB\_CON via SAP RFC. See this [page](#).

# Timeout Parameters and additional SAP Profile Changes



# CLI Connection Timeouts and Failover

- If the Db2 member hostname/IP is -not- pingable/active<sup>1</sup>, then CLI relies on timeout, when connecting or reconnecting - error “Connection timed out”
- CLI timeout parameter are not defined by default or thru SAPinst  
→ Operating System (OS) ‘tcp connect timeout’ hits
- Formula for Failover Time for existing SAP connections to next Db2 member:  
$$(<\text{Timeout}> + \text{acrRetryInterval}) * \text{maxAcrRetries}$$
  - acrRetryInterval defines the sleep time in seconds between connect retries, default is 0
  - maxAcrRetries defines how often a connect to **one** Db2 Member is attempted, default is 3
- OS ‘tcp connect timeout’ is ~125 seconds under Linux (~75 sec. AIX).  
→ Delay for the first successful connection to second/next Db2 member:
  - Linux:  $(125 + 0) * 3 = 375 \text{ sec}$
  - AIX:  $(75 + 0) * 3 = 225 \text{ sec}$

<sup>1</sup> and IP is forwardable by default gateway

# CLI Connection Timeouts and Failover Recommendations

## Set CLI timeout parameter:

- **tcpipConnectTimeout to 5 (seconds)**
- **ConnectionTimeout to 1 + <value resulting from below formula>**

$(\text{<Timeout>} + \text{acrRetryInterval}) * \text{maxAcrRetries} * (\text{<\# of Db2 members in affinity list>} - 1)$

### Recommendation for a 2 Db2 member setup:

- Set ConnectionTimeout to **16** (seconds) =  $1 + (5 + 0) * 3 * (2 - 1)$

### Recommendation for a 4 Db2 member setup:

- Set ConnectionTimeout to **46** (seconds) =  $1 + (5 + 0) * 3 * (4 - 1)$

**Setting ConnectionTimeout to smaller values as recommended results in not attempting all members for failover.**

More details: See Appendix

# TCP/IP KEEPALIVE Timeout

Changed default value for TCP/IP KEEPALIVE parameter

- For Db2 Connect 10.1 or higher the default is 15 seconds
- SQL error -30081 may occur in high load situations



Consider explicitly setting DB2TCP\_CLIENT\_KEEPAIVE\_TIMEOUT or keepAliveTimeout to avoid this error

For recommendations and details see [SAP note 2082467 - DB2-z/OS: TCP/IP timeout hit for communication between DB2 client and DB2 server](#)



# Additional SAP Profiles changes

Db2 server has per default a hourly recycling of the Db2 threads

- If this periodic recycling of Db2 threads **–is–** desirable:
  - Remove from SAP Profile: rdisp/wp\_auto\_restart and rdisp/noptime (or set to 0)
- If this periodic recycling of Db2 threads **–is NOT–** desirable:
  - Proceed as follows:  
Issue the following Db2 commands, which are introduced with Db2 12. These commands change the recycle frequency to 1200 minutes permanently (until issued again with other values):

```
MODIFY DDF KDRMUSED(1200)  
MODIFY DDF KDRMIDLE(1200)
```

Set in AppServer profile `rdisp/wp_auto_restart = 71000` and `rdisp/noptime = 71500`

With this configuration, the SAP work processes are recycled before DDF recycles threads.

**Note:** Using `wp_auto_restart` does NOT work with a planned Failover initiated from DBA cockpit. You may:

- Initiate a planned Failover by issuing a Stop DDF for the member to be freed
- Change upfront the `db2dsdriver.cfg` and add the AppServer to a list which has its primary member not listed first. Then you need to wait until `wp_auto_restart` has hit the next time (or restart the AppServer).

See [Database Administration Guide](#)

# Migrating Connection Timeout settings from SAP Failover to CLI Failover

**If:** you previously used SAP Failover and SAP profile parameters:

- dbs/db2/pcon\_timeout
- dbs/db2/scon\_timeout

to set timeouts for DB connection attempts of primary and secondary DB connections,

**Then:** switching to CLI Failover you should:

- Set **tcpipConnectTimeout** and **ConnectionTimeout** in db2dsdriver.cfg to the recommended values as described on [page](#) or
- Set **ConnectionTimeout** in db2dsdriver.cfg to the value of pcon\_timeout or scon\_timeout and
  - Set **tcpipConnectTimeout** in db2dsdriver.cfg to the value resulting from:  
$$\text{tcpipConnectTimeout} \leq (((\text{ConnectionTimeout} - 1) / (\text{<\# of Db2 members in affinity list} - 1)) / \text{maxAcrRetries}) - \text{acrRetryInterval}$$
- Remove pcon\_timeout and scon\_timeout parameters from SAP profile

For details on pcon\_timeout and scon\_timeout parameters

see [SAP note 1465252 - DB2 z/OS: Exploit CLI time out parameter](#)

# CLI Failover and Virtual Application Server host names

- Environment variable `SAPLOCALHOST`
  - no longer needed for support of virtual host names - it was needed for `connect.ini`
- Use virtual application server host names in client affinity definition in `db2dsdriver.cfg`
- CLI driver maps virtual host names to the physical host, on which the virtual host name is defined, and assigns the correct affinity list to the SAP application server.

```
<affinitylist>
  <list name="l1" serverorder="SZ81,SZ82" />
  <list name="l2" serverorder="SZ82,SZ81" />
</affinitylist>
<clientaffinitydefined>
  <client name="APP1" hostname="ihlscoh5v" listname="l1" />
  <client name="APP2" hostname="ihlscoh4v" listname="l2" />
</clientaffinitydefined>
```

Real host names are  
'ihlscoh5' and 'ihlscoh4'

- **Note:** In case of a wrong hostname you get the following error message:  
SQL5163N A required configuration parameter "a qualifying client in affinity group" is missing from the `db2dsdriver.cfg` configuration file.

# Thank you.

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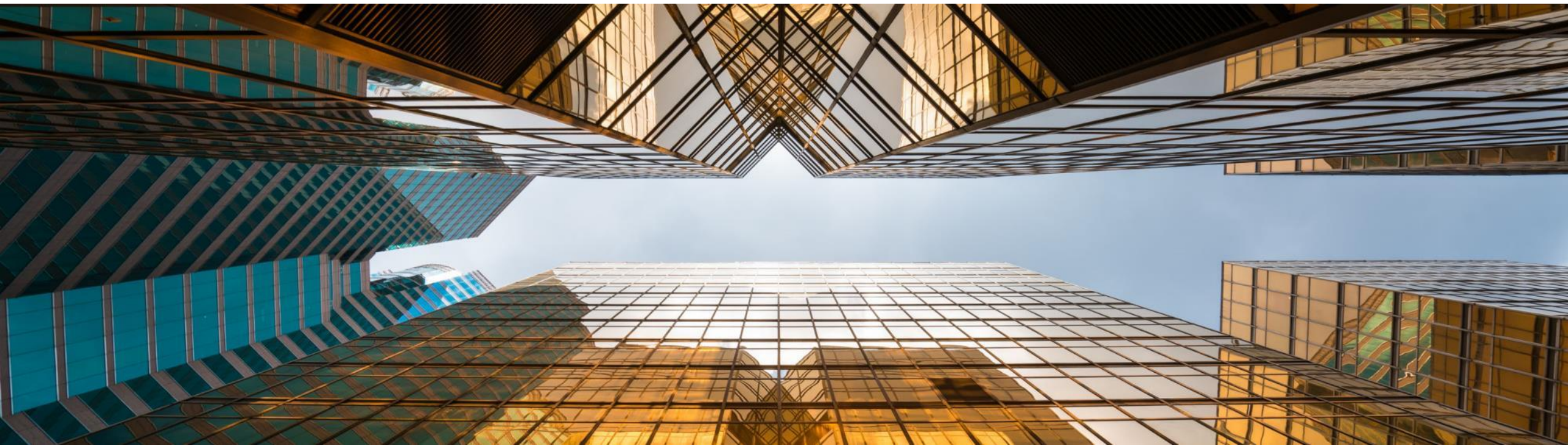
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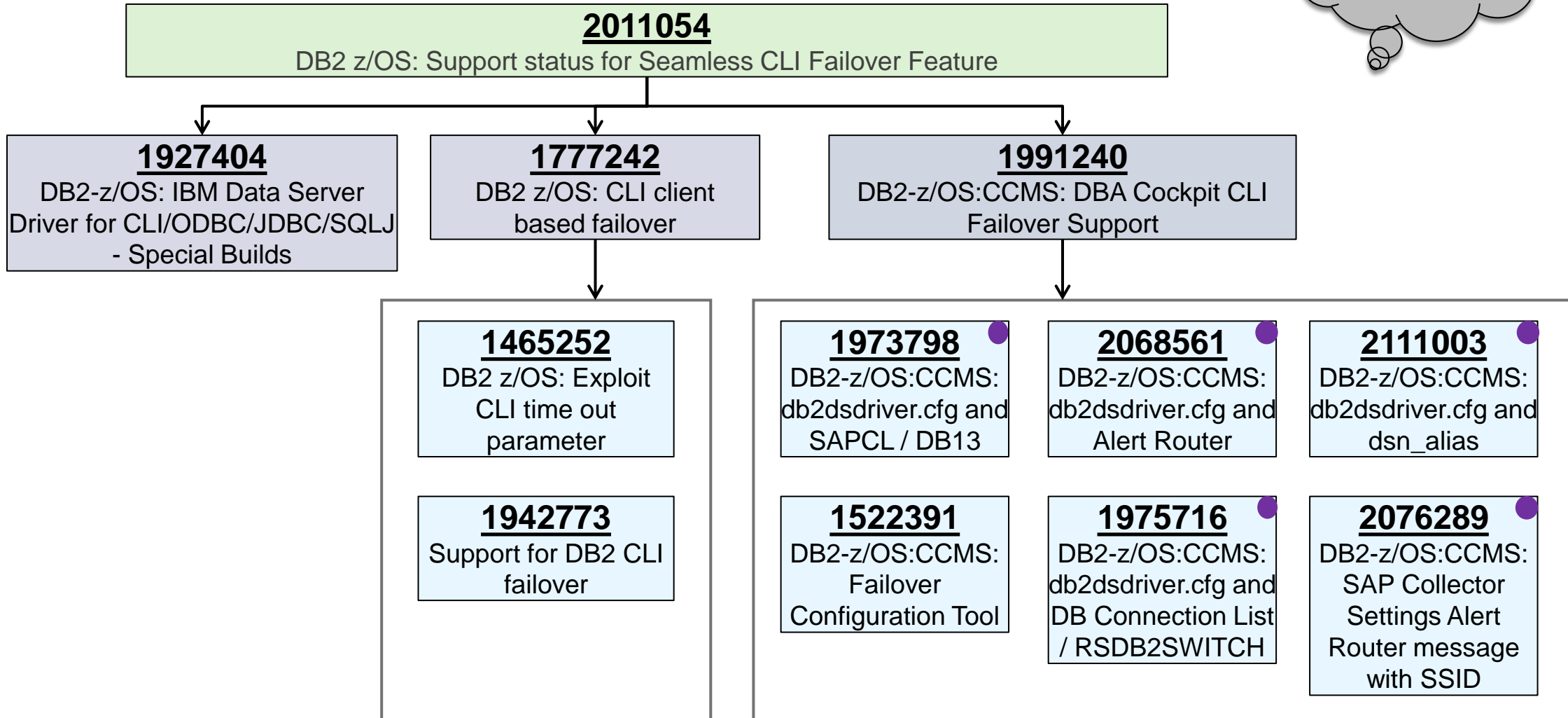
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# Appendix



# SAP Notes for CLI Failover - Details



# Alert Router Setup - DBCON Connections

- Review DBA Cockpit -> DB Connections with Name CCMS\_DB2\_\*
- Check that database host names in DBCON do not include the domain name

The screenshot shows the SAP DBA Cockpit interface. The left sidebar displays the navigation tree with 'DB Connections' highlighted. The main area shows a table of database connections. The table has columns: Remote Database Connection, DB Name, DB Host, DB ... (likely DB Type), User Name, Permanent, Max. Connections, and a status column. Three connections are listed, all with the host 'ihsappe'.

Remote Database Connection	DB Name	DB Host	DB ...	User Name	Permanent	Max. Connections	Status
CCMS_DB2_SGQ1	DDFSGQ1	ihsappe	SAPS5		<input type="checkbox"/>	0	0
CCMS_DB2_SGQ2	DDFSGQ1	ihsappe	SAPS5		<input type="checkbox"/>	0	0
CCMS_DB2_SGQ3	DDFSGQ1	ihsappe	SAPS5		<input type="checkbox"/>	0	0

# Alert Router Setup - DBCON host names

- Database host names in db2dsdriver.cfg have to include the domain name
- Database host names in CCMS\_DB2\_\* DBCON connections do not include the domain name
- See [SAP note 2068561 - DB2-z/OS:CCMS: db2dsdriver.cfg and Alert Router](#)
- Reason:
  - CCMS\_DB2\_\* DBCON connections are used to start and stop the Alert Router
  - One Alert Router serves one and only one specific Db2 data sharing member and therefore Automatic client reroute (ACR) of the CLI driver must not happen during start and stop of the Alert Router
  - ACR does not take place if CCMS\_DB2\_\* DBCON host name and db2dsdriver.cfg host names differ
  - A CCMS\_DB2\_\* DBCON short host name and the fully qualified host names of db2dsdriver.cfg fulfill this requirement, although they point to the same host



# CLI Connection Timeouts and Failover

- If the Db2 member hostname/IP is -not- pingable/active<sup>1</sup>, then CLI relies on timeouts, when connecting or reconnecting - error “Connection timed out”
- CLI timeouts are defined differently:
  - For establishing a new Application connection (like R3trans/AppServer start) the timeout is defined for the application by setting  
→ **ConnectionTimeout** CLI parameter, which defines the maximum time allowed to establish a connection (corresponds to SQL\_ATTR\_LOGIN\_TIMEOUT); [details](#)
  - For an established/existing connection (like an established SAP Application Server connection to Db2 DDF) the timeout to reconnect is defined for CLI by setting  
→ **tcpipConnectTimeout** CLI parameter, which defines the maximum time allowed for opening a socket; [details](#)
- Rules:
  - If tcpipConnectTimeout is not explicitly set, it takes the value of ConnectionTimeout
  - tcpipConnectTimeout must be less than ConnectionTimeout

<sup>1</sup> and IP is forwardable by default gateway

# CLI Connection Timeouts and Failover con't

- db2dsdriver.cfg defines for each SAP Application Server the sequence of Db2 members to try to connect to (affinity list)
- maxAcrRetries defines how often a connect to **one** Db2 Member is attempted, default is 3
- acrRetryInterval defines the sleep time in seconds between connect retries, default is 0

## Formula for Failover Time for existing SAP connections to next Db2 member:

$$(<\text{Timeout}> + \text{acrRetryInterval}) * \text{maxAcrRetries}$$

where <Timeout> is ConnectionTimeout or tcpipConnectTimeout or OS-level 'tcp connect timeout' (if neither CLI parameter is defined)



Remember: <Timeout> is 0, if the connection request is directly refused, for example, if hostname/IP is active but Db2 member is down.

## Formula for Failover Time for new Application connection to next Db2 member:

Same as above, BUT failover happens ONLY, if tcpipConnectTimeout is set and the following condition is satisfied:

$$(\text{tcpipConnectTimeout} * \text{maxAcrRetries}) < \text{ConnectionTimeout}$$

# CLI Connection Timeouts and Failover samples

- **Worst case:** Of <n> Db2 members <n>-1 are not pingable, only the last one in the affinity list. The time to establish a SAP connection to this 'last' Db2 member is:  
$$(\text{<Timeout>} + \text{acrRetryInterval}) * \text{maxAcrRetries} * (\text{<\# of Db2 members in affinity list>} - 1)$$
  
→ Set ConnectionTimeout to above value + 1
- Example '2-way' data sharing system and the first Db2 member hostname is **not** pingable:
  - Case 1: No CLI timeout parameter set:  
→ the OS level 'tcp connect timeout', for example about 125 sec. under Linux, causes a long delay for the first successful connection to second Db2 member:  $(125 + 0) * 3 * 1 = 375 \text{ sec}$  (75/225 sec AIX)
  - Case 2: ConnectionTimeout/ SQL\_ATTR\_LOGIN\_TIMEOUT set to 15 sec:  
→ the first successful connection to second Db2 member:  $(15 + 0) * 3 * 1 = 15 \text{ sec}$  for existing connections **BUT**  
 **no failover to second member for new connections (tcpipConnectTimeout is implicitly set to 15 sec)**
  - Case 3: ConnectionTimeout set to 16 sec and tcpipConnectTimeout set to 5 sec:  
→ the first successful connection to second Db2 member:  $(5 + 0) * 3 * 1 = 15 \text{ sec}$  (< 16 sec)
  - Case 4: ConnectionTimeout set to 10 sec and tcpipConnectTimeout set to 5 sec:  
→ **no failover to second member at all:**  $(5 + 0) * 3 * 1 = 15 \text{ sec}$  (> 10 sec) 
- Example '2-way' data sharing system and first Db2 member hostname **is** pingable:  $(0 + 0) * 3 * 1 = 0 \text{ sec}$

## Note:

SAPinst does **not** insert a value for either ConnectionTimeout or tcpipConnectTimeout.  
See the SAP Database Administration Guide for the CLI parameter values that SAP installation inserts into db2dsdriver.cfg.

# SAP Failover vs. CLI Failover Timeout Parameters

Semantic changed for pcon\_timeout and scon\_timeout

SAP Profile Parameter  
db2dsdriver.cfg Parameter

Setting for	SAP Failover	CLI Failover
Number of retries per DS Member	rsdb/reco_trials	maxAcrRetries
Sleep time between retries	rsdb/reco_sleep_time	acrRetryInterval
Individual time per connection attempt for SAP primary connection	dbs/db2/pcon_timeout	ConnectionTimeout
Individual time per connection attempt for SAP secondary connection	dbs/db2/scon_timeout	ConnectionTimeout
Maximum time to establish a SAP primary connection	Results out of the above parameter	$(tcpipConnectTimeout + acrRetryInterval) * \maxAcrRetries * (\# \text{ of Db2 members } - 1)$
Maximum time to establish a SAP secondary connection	Results out of the above parameter	$(tcpipConnectTimeout + acrRetryInterval) * \maxAcrRetries * (\# \text{ of Db2 members } - 1)$

# Failover Timeout Parameter Defaults and Behavior

SAP Profile Parameter  
db2dsdriver.cfg Parameter

Parameter Name	Value set by SAP AppServer installation	Comment
maxAcrRetries rsdb/reco_trials	3 3	CLI Failover SAP Failover
acrRetryInterval rsdb/reco_sleep_time	0 5	CLI Failover SAP Failover
affinityFailbackInterval	300 (for ABAP AS) 300 (for Java AS)	Automatic failback attempted every 300 seconds. If you want to control failover for ABAP via SAP DBA Cockpit or ABAP report RSDB2SWITCH, it needs to be set to 0.
ConnectionTimeout	not set (default: 0 second)	Recommendation: Set to 16 (seconds) for 2 member setup, 46 (seconds) for 4 member setup
tcpipConnectTimeout	not set (default: 0 second)	Recommendation: Set to 5 (seconds) ConnectionTimeout must be set greater than (tcpipConnectTimeout * maxAcrRetries), so that there is time to complete all the maxAcrRetry attempts for a member.



# CLI Failover and Virtual Application Server host names

- Special case: Multiple Application Server instances on the same host with different affinity lists for each instance:

Assume there are 3 Application Server instances (APP1,2 and 3) and 3 network interfaces. The hostname is ihls100 for example and 3 additional hostnames ihls1000, ihls1001 and ihls1002 are defined in /etc/hosts per network interface:

```
192.168.216.100 ihls1000
192.168.217.100 ihls1001
192.168.218.100 ihls1002
```

1. Add the following definition for the DB2DSDRIVER client hostname in each SAP Application Server instance profile:

```
SETENV_xx = DB2DSDRIVER_CLIENT_HOSTNAME=<virtual hostname>
```

where xx is the next free number in the instance profile for SETENV\_nn statements.

The DB2DSDRIVER\_CLIENT\_HOSTNAME should be set to the hostname of the interface it should use to communicate with a specific Db2 Data Sharing member. For example:

```
SETENV_08 = DB2DSDRIVER_CLIENT_HOSTNAME=ihls1000
```

2. Adapt the db2dsdriver.cfg and define for each Application Server an affinity as shown:

```
<clientaffinitydefined>
  <client name="APP1" hostname="ihls1000" listname="l1" />
  <client name="APP2" hostname="ihls1001" listname="l2" />
  <client name="APP3" hostname="ihls1002" listname="l3" />
</clientaffinitydefined>
```

3. For R3trans (and other utilities) the environment of <sapsid>adm must be changed and one of the hostnames must be defined as client hostname. Add in .dbenv.csh for example:

```
setenv DB2DSDRIVER_CLIENT_HOSTNAME ihls1000
```

and in .dbenv.sh for example:

```
DB2DSDRIVER_CLIENT_HOSTNAME = ihls1000; export DB2DSDRIVER_CLIENT_HOSTNAME
```