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IBM Geographically Dispersed Resilience for SAP HANA and SAP NetWeaver

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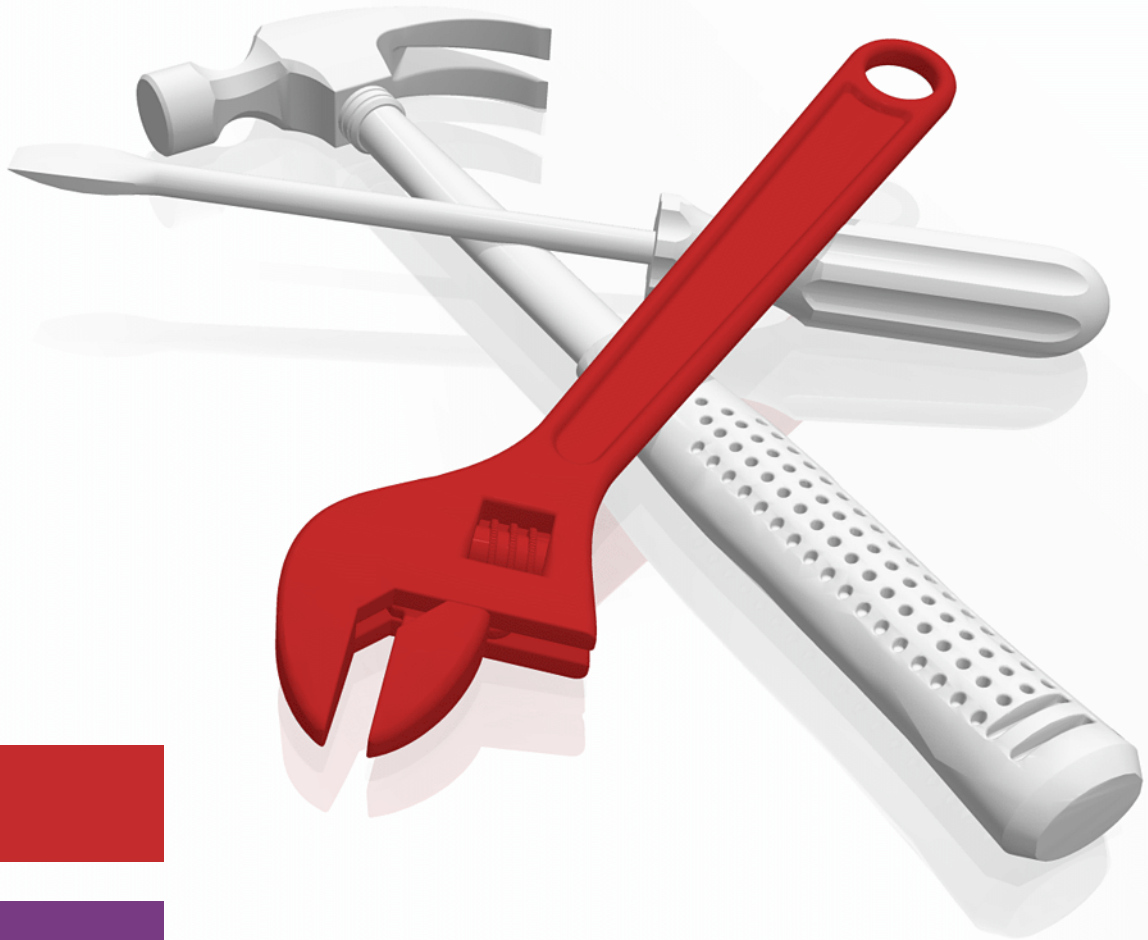

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Overview

This IBM® Redpaper™ publication explains the configuration, relocation, and verification of the IBM Geographically Dispersed Resiliency on IBM Power Systems™ solution to protect SAP HANA and SAP NetWeaver applications.

This is a supplemental guide to *IBM Geographically Dispersed Resiliency for IBM Power Systems*, SG24-8382, which outlines the specifics when using Geographically Dispersed Resilience for SAP applications, including SAP HANA.

Business continuity is a part of business operations. Downtime and disruptions can cause financial losses and impact public relations and trust in your business. Also, governments in many countries require businesses to have disaster recovery (DR) plans demonstrate regularly that the recovery plan tests successfully.

IBM Geographically Dispersed Resiliency for IBM Power Systems is a DR solution that covers servers but can include business applications. In particular, this solution provides features to support the high availability (HA) of logical partitions (LPARs) running SAP HANA and SAP NetWeaver applications.

Here are the features and values of the IBM Geographically Dispersed Resiliency solution for IBM Power Systems:

- Supports IBM Power Systems servers starting with POWER7®.
- Supports IBM AIX® and various Linux operating systems.
- Performs DR operations on hundreds of LPARs that are based on IBM PowerVM® virtualization with many servers.
- Administrator triggers the DR move initiation. After the move initiates, Geographically Dispersed Resiliency performs an automated failover and recovery process. There is also an automated cleanup of the primary site as part of a planned DR move operation.
- Runs daily verification checks across sites to ensure successful failovers. The administrator can initiate the verification manually at any time.
- Emails or text alerts with critical events in the environment.
- Available customization framework to plug in custom scripts for verification or event handling.
- Supports IBM Power Systems Power Enterprise Pools, which saves hardware costs by reusing resources from Power Enterprise Pools across sites.
- There is a service offering to support site-specific network configuration for LPARs.
- There is a service offering to support nondisruptive testing on the backup site.

- Coexists with IBM PowerVC and IBM Power System Live Partition Mobility (LPM) with simplified remote restart operations on the primary site.
- Support for IBM SAN Volume Controller, IBM System Storage® DS8000® series, and Hitachi or Dell EMC Symmetric Remote Data Facility (SRDF) capable storage systems.

IBM Geographically Dispersed Resiliency enables simplified DR management for IBM Power Systems servers. In fewer than 10 steps, administrators can deploy and configure the solution. This is the only solution on IBM Power Systems that offers nondisruptive DR testing.

Introduction

IBM Geographically Dispersed Resiliency for IBM Power Systems solution is a DR solution that is easy to deploy and provides an automated process to recover LPARs at the remote or failover site after a disaster occurs. Because DR of applications and services is a key component for business continuity, the IBM Geographically Dispersed Resiliency solution provides an automated DR process that can be triggered after a failover. DR solutions are based mainly on cluster- and LPAR restart-based technology. This solution provides an easy deployment model that uses a controller system (called C(K)ontroller SYStem (KSYS)) to monitor the entire LPAR environment, as shown in Figure 1. This solution also provides flexible failover policies and storage replication management.

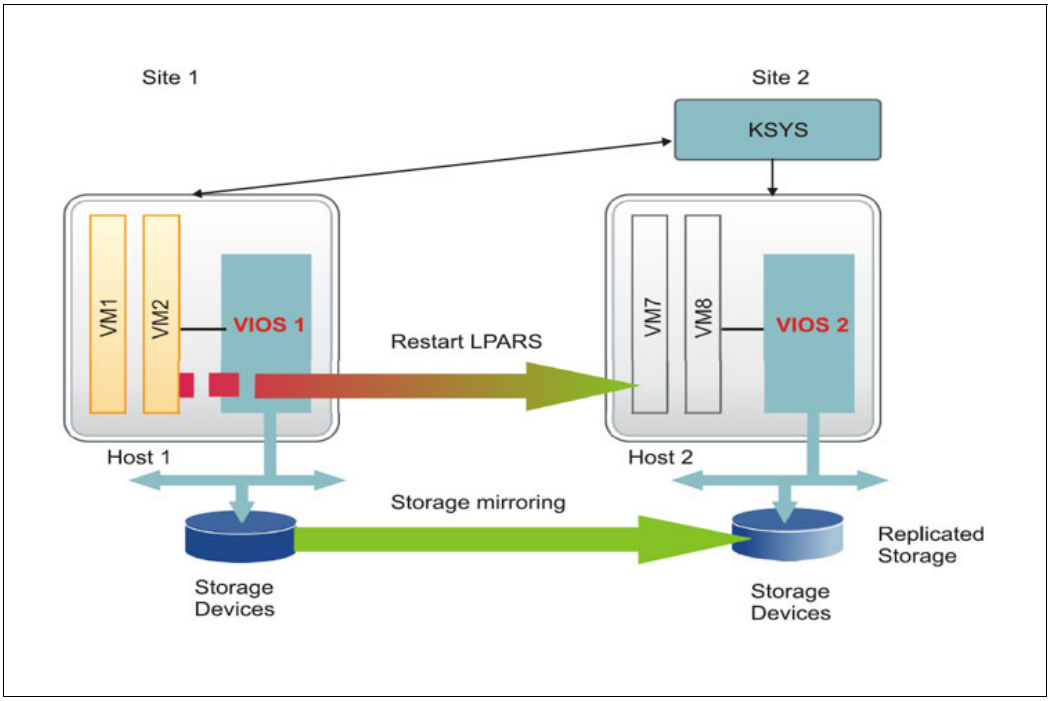

Figure 1 IBM Geographically Dispersed Resiliency solution architecture

You can learn more about Geographically Dispersed Resiliency for Power Systems by looking at the four article that are found at IBM developerWorks: Why GDR is the ideal DR solution for Power Systems and FAQs.

This paper demonstrates IBM Geographically Dispersed Resiliency for Power Systems handling of SAP HANA and SAP Net Weaver applications that run in LPARs during DR.

Key terminologies that are used in the IBM Geographically Dispersed Resiliency solution

Here are terminologies that are used in the Geographically Dispersed Resilience solution:

KSYS

KSYS is the LPAR, currently an IBM AIX LPAR, where the Geographically Dispersed Resiliency software is deployed. KSYS acts as the orchestrator that monitors, manages, and moves LPARs from one site to another. KSYS is configured by running the **ksysmgr** command in the following format:

```
ksysmgr ACTION CLASS [NAME] [ATTRIBUTES...].
```

Site

This is the logical name that represents the primary or active site, and the DR or backup site. Sites must be created at the KSYS level. All the Hardware Management Consoles (HMCs), hosts, Virtual I/O Servers (VIOSs), and storage devices are mapped to one of the sites. Sites can be one of the following types:

- **Active site (or primary site)**: The current site where the workloads are running.
- **Backup site (or DR site)**: The site that acts as a backup for the workload. During a disaster or a potential disaster, workloads are moved to the backup site.

Host

A host is a system that is managed by the HMC that is primarily used to run workloads. A host is identified by its universally unique identifier (UUID), which is tracked by the HMC. A host pair indicates a set of hosts that is paired across the sites for DR.

Virtual machines

Virtual machines (VMs), also known as LPARs, are associated with specific VIOS partitions for virtualized storage to run a workload. A host typically contains multiple VMs.

Storage agents

The Geographically Dispersed Resilience solution relies on data replication from the active site to the backup site on the storage layer. In the solution, the data is replicated from the active site to the backup site by using storage replication.

Discovery of site

After the initial configuration completes, the KSYS node discovers all the hosts that are managed by the HMCs in both the active and the backup site and displays their status. During discovery, the KSYS node monitors the discovery of all VMs in all the managed hosts within the selected site. The KSYS node collects the configuration information for each VM, and displays their status. The KSYS node discovers the disks of each VM and checks whether the VMs are configured currently for the storage devices mirroring.

Verification of site

In the verification phase, the KSYS node fetches information from the HMC to check whether the backup site can host the VMs during a disaster. The KSYS node also verifies storage replication-related details.

DR

After the verification phase, the KSYS node monitors the active site for any failures or issues in any of the resources in the site. When any planned or unplanned outages occur, and if the situation requires DR, recovery must be manually initiated by running **ksysmgr**. After the recovery initiates, a fully automated process of relocation and restart occurs.

Prerequisites

Here are the prerequisites for the IBM Geographically Dispersed Resiliency on Power Systems solution:

- The solution supports IBM POWER7, IBM POWER7+™, IBM POWER8®, and IBM POWER9™. For the SAP HANA minimum requirements, see SAP Note 2188482 - SAP HANA on IBM Power Systems: Allowed Hardware.
- The KSYS node must be running IBM AIX 7.2 Technology Level 1 or higher.
- Supported operating systems that are managed by the Geographically Dispersed Resilience KSYS node are AIX v6.1 or higher, Red Hat V7.x or higher, SUSE V11, or V12 or higher, Ubuntu, and IBM i 7.2 or higher. For a list of SAP HANA eligible operating systems, see SAP Note 2235581 - SAP HANA: Supported Operating Systems.
- Storage devices that are used to install SAP HANA production systems must be Tailored Datacenter Integration certified from SAP and supported by the Geographically Dispersed Resilience solution.

Figure 2 shows a sample hardware configuration.

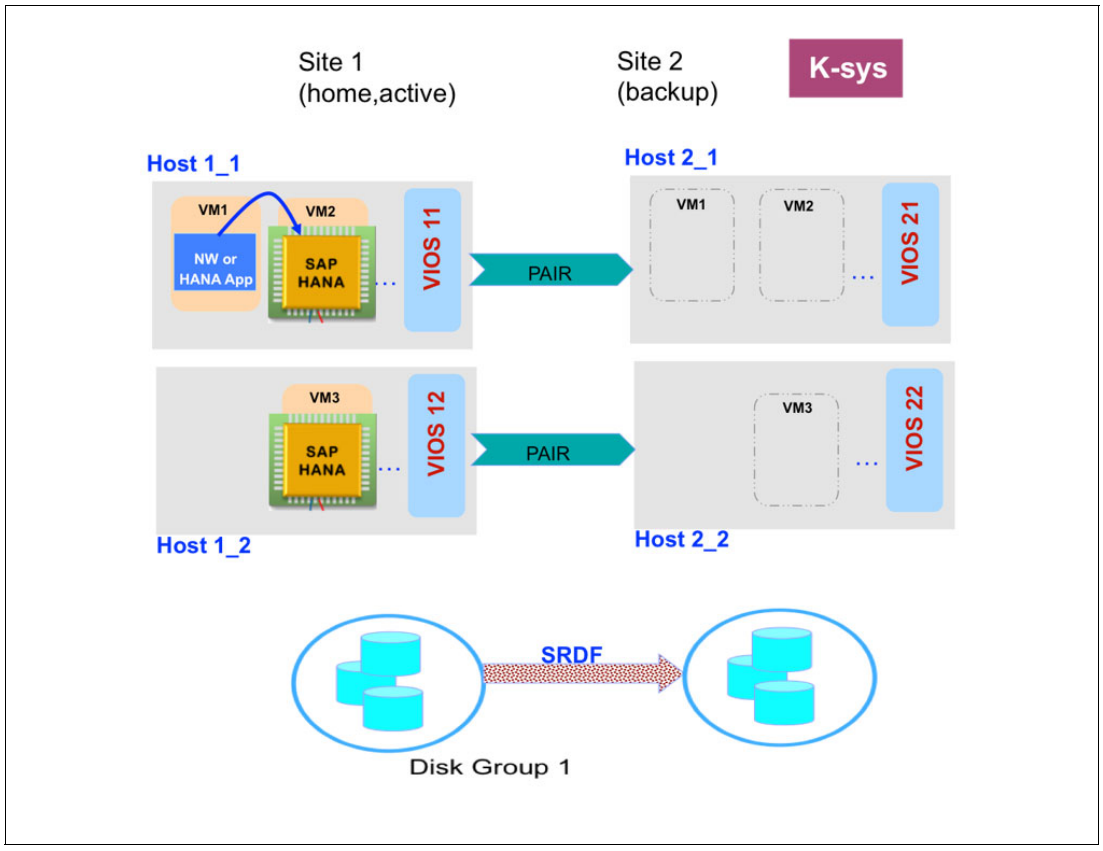

Figure 2 Hardware configuration example

Here are the hardware details of Figure 2:

- Ksysnode: r7r3m108.
- Source HMC: `gdrhmc4.aus.stglabs.ibm.com`.
- Target HMC: `gdrhmc3.aus.stglabs.ibm.com`.
- Source host: INDIA_HOST on active site INDIA.
- Target host: USA_HOST on backup or DR site USA.

- VM1: raichu1 runs an SAP NetWeaver application server ABAP (raichu_NW).
- VM2: racihu2 runs an SAP HANA database server (raichu_SAPHANA).

The details regarding the KSYS node, HMC, storages, host, and LPARs are for demonstration purposes only in this paper.

Hardware configuration that uses the ksysmgr utilities

To set up Geographically Dispersed Resiliency, see *IBM Geographically Dispersed Resiliency for IBM Power Systems*, SG24-8382.

Cluster details

Initially, the cluster is created in the KSYS node. This node, which is in a dedicated AIX LPAR, handles all the VMs that are owned by KSYS, as shown by the following command output:

```
(0) root @ r7r3m108: /
# ksysmgr query ksyscluster
Name:            test
State:           Online
```

After the cluster is created and its state is online, the virtual machine restart (VRM) daemon is activated. Then, the sites must be created with the following two types: active and backup. The active site is the production site where all the LPARs are running, including the SAP applications. The backup site acts as a backup for the workloads during a disaster or a potential disaster situation. In this paper, INDIA is the active site and USA is the backup site.

Hardware Management Console details

HMCs must add hosts to the ksys-cluster. At a minimum, one HMC in the active site and one HMC from the backup site are required. Set up redundant HMCs for each site that is configured, as shown in Example 1.

Example 1 Hardware Management Console configuration

```
(0) root @ r7r3m108: /
# ksysmgr query hmc
Name:            gdrhmc3_USA
Site:            USA
IP:              XXX.XXX.XXX.130
Login:                              userid
             Managed Host List:

Host Name                                          Uuid
=========                                         ====
gdrh6_8246-L2C-10018DA         b50e37b5-66b1-3929-80da-a057b20fe943
USA_HOST                       ecff9ff7-bab3-3414-b444-ab3a72874a9a
piccata_9119_MME_108D297       0ba5c176-95f8-3e9f-a58a-24527c6a06b3
gdrh5_8246-L2C-100192A         efb08de8-b41a-397f-9d55-9dc4653113fa
gelato_9119-MME-107A9E7        308e9059-06af-3f50-9f52-b24801fa04f1
=====================================================================
Name:            gdrhmc4_INDIA
Site:            INDIA
IP:              XXX.XXX.XXX.171
```

```
Login:          userid

                      Managed Host List:

Host Name                                       Uuid
=========                                      ====
pikachu_8247-42L-211E9EA        73f75ccb-3b6d-37e8-be37-5aa21827523e
doit2-8233-E8B-06DA57R          651b7677-3478-3f2a-bb71-034e76c25ee4
Cheese-9179-MHD-SN10788CP       d87b349c-efc1-3df7-9276-23c29f5749c8
piccata_9119_MME_108D297        0ba5c176-95f8-3e9f-a58a-24527c6a06b3
gelato_9119-MME-107A9E7         308e9059-06af-3f50-9f52-b24801fa04f1
snorlax_9117-MMB-100132P        8a4d03e7-5e5a-3b62-a1b9-9aa53fe1f1fe
```

Hosts details

The hosts that are intended to be monitored by Geographically Dispersed Resiliency are added to the ksys-cluster. The active site hosts are paired to the backup site hosts where the VMs are moved during DR. For example, host snorlax_9117-MMB-100132P is connected to site INDIA and USA_HOST is connected to site USA, as shown in Example 2.

Example 2 Paired hosts details

```
(0) root @ r7r3m108: /
# ksysmgr query host
Name:           USA_HOST
UUID:           ecff9ff7-bab3-3414-b444-ab3a72874a9a
FspIp:          XX.XX.XX.237
Pair:           snorlax_9117-MMB-100132P
Site:           USA
VIOS:           raichuv1
HMCs:           gdrhmc3_USA

Name:           snorlax_9117-MMB-100132P
UUID:           8a4d03e7-5e5a-3b62-a1b9-9aa53fe1f1fe
FspIp:          XX.XX.XX.240
Pair:           USA_HOST
Site:           INDIA
VIOS:           snorlaxv1
HMCs:           gdrhmc4_INDIA
```

Storage agent details

The storage agents are added to the ksys-cluster, as shown in Example 3. If there is a DR event, KSYS automatically handles the storage replication end-to-end from the SAN to the LPAR.

Example 3 Storage agent details

```
(0) root @ r7r3m108: /
# ksysmgr query storage_agent
Name:           saremote
Serial:         196800508
Storagetype:    SRDF
Site:           USA
```

```
IP:               XXX.XXX.XXX.170
Login:            abc

Name:             salocal
Serial:           196800573
Storagetype:      SRDF
Site:             INDIA
IP:               XXX.XXX.XXX.209
Login:            abc
```

Discovering KSYS resources

After all the resources are added for monitoring, the discovery of the site is performed to check that KSYS is aware of all the profiles and storage-related information that are stored in the form of an LPAR configuration blob (LCB) and LPAR storage information (LSI). The following command triggers the discovery:

```
ksysmgr discover site <active_site_name>
```

Verifying resources on the target site

KSYS provides a verification option before moving a VM to the target site for planned relocations or safeguarding during DR. The verification process includes all resources that are available at the target site for the LPAR to be restarted. If there is any insufficient resource that is identified or any storage-related issue, KSYS gives notification.

For planned DR operations, the verification process is mandatory, but for unplanned DR, the administrator can skip this process. The following command triggers the verification:

```
ksysmgr verify site <active_site_name>
```

Verifying sample SAP HANA processes before and after disaster recovery

To verify the processes, complete the following steps:

1. Verify the SAP host agent process before the move:
   – Check the SAP HANA database raichu2, as shown in Example 4.

Example 4 Checking the status of SAP HANA database on raichu2

```
raichu2:~ # ps -ef| grep sapstartsrv
sapadm  4878    1          0 Jan12 00:00:14
/usr/sap/hostctrl/exe/sapstartsrv

pf=/usr/sap/hostctrl/exe/host_profile -D
db1adm 4992    1           0 Jan12 00:00:06
/usr/sap/DB1/HDB00/exe/sapstartsrv

pf=/usr/sap/DB1/SYS/profile/DB1_HDB00_raichu2 -D -u db1adm
```

– Check the NetWeaver application raichu1, as shown in Example 5.

Example 5 NetWeaver application status for rauchu1

```
raichu1:~ # ps -ef| grep sapstartsrv
sapadm    3610     1  0 05:17 ?        00:00:00 /usr/sap/hostctrl/exe/sapstartsrv

pf=/usr/sap/hostctrl/exe/host_profile -D
db1adm    3816     1  0 05:17 ?        00:00:01
/usr/sap/DB1/ASCS01/exe/sapstartsrv

pf=/usr/sap/DB1/SYS/profile/DB1_ASCS01_raichu1 -D -u db1adm
db1adm   4008    1  0 05:17 ?     00:00:00 /usr/sap/DB1/D00/exe/sapstartsrv

pf=/usr/sap/DB1/SYS/profile/DB1_D00_raichu1 -D -u db1adm
```

2. Verify that the SAP HANA database is running, as shown in Example 6.

Example 6 Verifying that the SAP HANA database is running

```
db1adm@raichu2:/usr/sap/DB1/HDB00> sapcontrol -nr 00 -function
GetSystemInstanceList
16.01.2017 05:57:01
GetSystemInstanceList
OK
hostname, instanceNr, httpPort, httpsPort, startPriority, features, dispstatus
raichu2,     0,               50013,    50014,      0.3,              HDB,
GREEN

db1adm@raichu2:/usr/sap/DB1/HDB00> sapcontrol -nr 00 -function GetProcessList
16.01.2017 05:57:15
GetProcessList
OK
name,                         description,            dispstatus, textstatus,
starttime,            elapsedtime, pid
hdbdaemon,              HDB Daemon,             GREEN, Running, 2017 01 12
13:41:05, 88:16:10, 5309
hdbcompileserver,   HDB Compileserver,   GREEN, Running, 2017 01 12 13:41:14,
88:16:01, 5412
hdbindexserver,       HDB Indexserver,        GREEN, Running, 2017 01 12 13:41:15,
88:16:00, 5448
hdbnameserver,      HDB Nameserver,        GREEN, Running, 2017 01 12 13:41:06,
88:16:09, 5325
hdbpreprocessor,    HDB Preprocessor,      GREEN, Running, 2017 01 12 13:41:14,
88:16:01, 5414
hdbwebdispatcher, HDB Web Dispatcher, GREEN, Running, 2017 01 12 13:41:45,
88:15:30, 5789
hdbxsengine,            HDB XSEngine,             GREEN, Running, 2017 01 12
13:41:15, 88:16:00, 5450
```

3. Verify that the SAP NetWeaver instances are running, as shown in Example 7.

Example 7 SAP NetWeaver instances running

```
raichu1:db1adm 53> sapcontrol -nr 00 -function GetProcessList
16.01.2017 05:23:38
GetProcessList
```

```
OK
name,          description,      dispstatus, textstatus, starttime,
elapsedtime, pid
disp+work, Dispatcher,       GREEN,      Running, 2017 01 16 05:19:21, 0:04:17,
9527
igswd_mt,  IGS Watchdog, GREEN,      Running, 2017 01 16 05:19:21, 0:04:17, 9528
gwrd,          Gateway,           GREEN,      Running, 2017 01 16 05:19:25,
0:04:13, 9560
icman,        ICM,                    GREEN,     Running, 2017 01 16 05:19:25,
0:04:13, 9561

raichu1:db1adm 54> sapcontrol -nr 00 -function GetSystemInstanceList
16.01.2017 05:23:46
GetSystemInstanceList
OK
hostname, instanceNr, httpPort, httpsPort, startPriority, features,
dispstatus
raichu1,      1,                  50113,     50114,       1,
MESSAGESERVER|ENQUE|WEBDISP, GREEN
raichu1,      0,                  50013,     50014,       3,
ABAP|GATEWAY|ICMAN|IGS,            GREEN
```

4. Verify the NUMA topology for the HANA VM.

   Before starting HANA, check the NUMA topology on the target site. There might be an unfortunate distribution of memory, which can cause performance degradation.

   Starting with SUSE Linux Enterprise Server 12 SP3, you can check the NUMA topology by running **`numactl --hardware`**", as shown in Example 8. Before SUSE Linux Enterprise Server12 SP3, this information is ensured to be valid *only* after an operating system restart. For more information about how to look into NUMA layouts and improve them, see “Checking the NUMA layout before starting SAP HANA and after DR” on page 11.

Example 8 Checking the NUMA topology by running numactl -- hardware

```
# numactl -- hardware
available: 4 nodes (0-3)
node 0 cpus: 0 1 2 3 4 5 6 7
node 0 size: 88668 MB
node 0 free: 70570 MB
node 1 cpus:
node 1 size: 16623 MB
node 1 free: 16563 MB
node 2 cpus: 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
node 2 size: 90783 MB
node 2 free: 28146 MB
node 3 cpus: 24 25 26 27 28 29 30 31
node 3 size: 65502 MB
node 3 free: 42126 MB
node distances:
node   0   1   2   3
  0:  10  20  20  20
  1:  20  10  20  20
  2:  20  20  10  20
  3:  20  20  20  10
```

On the SAP HANA site, you can check the NUMA topology by running the commands that are shown in Example 9. The commands offer general information about the NUMA topology status from the SAP HANA perspective.

Example 9 Checking the NUMA topology by running hdbcons 'mm numa -t'

```
# hdbcons 'mm numa -t'

************************************************************
               Configuration of NUMA topology
************************************************************
     Is NUMA-awareness enabled? (0|1) :    1
           Valid NUMA Topology? (0|1) :    1
                 Number of NUMA Nodes :    4
Number of NUMA Nodes with logical cpus :    3
Number of NUMA Nodes with attached memory:    4
Number of NUMA Nodes with both cpus and memory:    3
              Number of Logical cpus  :   32
                    Cpu-only node IDs : NONE
                    Mem-only node IDs :    1
************************************************************

"hdbcona 'mm numa -v'". The command create information about the node to memory
configuration:

********************************************************************************
**
               Virtual Memory allocations by HANA Memory Manager
********************************************************************************
**
Total number of NUMA Nodes = 4
Target NODE   #Allocs   #Deallocs   Alloc size (MB)  Fallback size (MB)   Dealloc size (MB)
-----------   -------   ---------   ---------------  ------------------ -----------------
          0        55           0          7296.00        0.00                0.00
          1         0           0             0.00                0.00       0.00
          2       108           0         13952.00                0.00       0.00
          3        63           0          8192.00                0.00       0.00
 INTERLEAVED         0           0             0.00                  --       0.00
```

You can also run **hdbcons 'jexec info'** to display the NUMA topology, as shown in Example 10.

Example 10 Displaying the NUMA topology by running hdbcons jexec info

```
Using 4 numa nodes
numa_features:        1, config: -1
bind_workers:         1, config: -1
max_concurrency:      32 (cfg=0, dyn=32)
max_concurrency_hint: 32 (cfg=0)
min_concurrency_hint: 4 (cfg=0)
concurrency_policy:   2 (cfg=0)
stealing_policy:      3 (cfg=0)
0 statement limiters
System info:
4 possible NUMA nodes, 48 possible cores, 3 active NUMA nodes, 32 active logical
cores
```

```
Using global restriction to a subset of cores: [11111111 11111111 11111111
11111111 00000000 00000000 ]
Numa node [0], Socket ID [0]: usable cores=8
  has 3 neighbors: 1 2 3
  max_concurrency: 8, dyn=8
Numa node [1], Socket ID [1]: usable cores=0
  has 3 neighbors: 0 2 3
  max_concurrency: 1, dyn=1
Numa node [2], Socket ID [2]: usable cores=16
  has 3 neighbors: 0 1 3
  max_concurrency: 16, dyn=16
Numa node [3], Socket ID [3]: usable cores=8
  has 3 neighbors: 0 1 2
  max_concurrency: 8, dyn=8
current memory usage, operative: 9840, background: 1041688
```

Moving virtual machines from source to target

After discovery is done, profile-related and storage-related information is stored in KSYS in the form of LCB and LSI. For planned moves, a verification must be triggered by running the following command:

```
ksysmgr verify site < active_site_name>
```

After verification or the case of an unplanned move, run the following command to start the relocation of the VMs:

```
ksysmgr move site from=<active_site> to=<backup_site>
```

The Geographically Dispersed Resiliency verification process warns whether there are insufficient server resources on the target site because the VM cannot be relocated until the target site hold sufficient resources. After the target is ready to hold the VM, use the following Geographically Dispersed Resiliency recovery command:

```
ksysmgr recover site <site_name>
```

Checking the NUMA layout before starting SAP HANA and after DR

A good NUMA topology is beneficial to the solution's performance. After a Geographically Dispersed Resiliency operation, the layout might not be optimal. This section is optional and is used only if the user experiences issues with performance or if the maximum performance must be mandatory.

After the restart of the operating system and SAP HANA, check the NUMA topology by running **`numactl --hardware`**, as described in Example 8 on page 9. For more information, see the SAP HANA on IBM Power Systems documentation at IBM TechDocs.

There are three options to address a less than optimal layout:

- Proactive: Before HANA starts, verify the NUMA topology by running **`numactl --hardware`** and optimize the topology before starting SAP HANA.
- Reactive: Verify and optimize the NUMA layout and restart the operating system and HANA.
- Reactive or proactive: Change the HANA runtime tunable, as described in “Changing the HANA runtime tunable” on page 12. You can perform this action proactively when the user-experienced performance is not a priority. This action does not require downtime.

Note: Before SUSE Linux Enterprise Server 12 SP2, the operating system must be restarted after a topology change.

Optimizing the NUMA layout for SAP HANA

This task is not applicable to application server instances. It is applicable only to SAP HANA.

Note: If you run **`optmem`** on the HMC, this command impacts all LPARs that are *not* excluded on the specific IBM Power Server system. The preferred practice is to exclude all running SAP HANA LPARs that use HANA V2 Support Package Stack (SPS) 02 or higher from this operation.

The usage of the **`optmem`** command is described in the SAP HANA on IBM Power Implementation Guide at IBM TechDocs.

Changing the HANA runtime tunable

Changing the SAP HANA tunables reduces the experienced performance impact but does not erase it. If the NUMA topology is not optimal, check the following SAP HANA parameters by running the following command (enable **`olap numa`**):

```
SELECT * FROM M_INIFILE_CONTENTS \
   WHERE FILE_NAME = 'indexserver.ini' AND KEY = 'enable_olap_numa'
```

This parameter must be set to `false` or not set only on LPARs that do not have an uneven NUMA distribution.

If the parameter is set to `true`, disable the parameter by running either of the following commands:

```
ALTER SYSTEM ALTER CONFIGURATION ('indexserver.ini', 'SYSTEM') \
   SET ('parallel','enable_olap_numa') = 'false' WITH RECONFIGURE
```

or

```
ALTER SYSTEM ALTER CONFIGURATION ('indexserver.ini', 'SYSTEM') \
   UNSET ('parallel','enable_olap_numa') WITH RECONFIGURE
```

Verifying the SAP HANA database and NetWeaver on LPARs after migration

After the move, start the SAP HANA database first and then the NetWeaver application. Then, verify the processes by completing the following steps:

1. Verify the HANA processes as Offline after the move. Check the SAP HANA database VM raichu2, as shown in Example 11.

Example 11 Checking the SAP HANA database on raichu2

```
raichu2:~ # ps -ef| grep sapstartsrv
sapadm   4878    1  0 Jan12 ?      00:00:14 /usr/sap/hostctrl/exe/sapstartsrv

pf=/usr/sap/hostctrl/exe/host_profile -D
db1adm    4992     1  0 Jan12 ?        00:00:06 /usr/sap/DB1/HDB00/exe/sapstartsrv

pf=/usr/sap/DB1/SYS/profile/DB1_HDB00_raichu2 -D -u db1adm
```

2. Check the SAP processes as Offline after the move, as shown in Example 12.

Example 12 Checking the SAP processes

```
raichu1:~ # ps -ef| grep sapstartsrv
sapadm   3610    1  0 05:17 ?     00:00:00 /usr/sap/hostctrl/exe/sapstartsrv

pf=/usr/sap/hostctrl/exe/host_profile -D
db1adm    3816     1  0 05:17 ?        00:00:01
/usr/sap/DB1/ASCS01/exe/sapstartsrv

pf=/usr/sap/DB1/SYS/profile/DB1_ASCS01_raichu1 -D -u db1adm
db1adm    4008     1  0 05:17 ?        00:00:00 /usr/sap/DB1/D00/exe/sapstartsrv

pf=/usr/sap/DB1/SYS/profile/DB1_D00_raichu1 -D -u db1adm
```

3. Start the HANA database on raichu2, as shown in Example 13.

Example 13 Starting the HANA database

```
raichu2:~ # su - db1adm
db1adm@raichu2:/usr/sap/DB1/HDB00> HDB start
StartService
Impromptu CCC initialization by 'rscpCInit'.
  See SAP note 1266393.
OK
OK
Starting instance using: /usr/sap/DB1/SYS/exe/hdb/sapcontrol -prot NI_HTTP -nr 00
-function StartWait 2700 2
16.01.2017 05:15:08
Start
OK
16.01.2017 05:15:18
StartWait
OK
db1adm@raichu2:/usr/sap/DB1/HDB00>
```

4. Verify that the HANA database successfully started on raichu2, as shown in Example 14.

Example 14 Verifying that the HANA database started on raichu2

```
db1adm@raichu2:/usr/sap/DB1/HDB00> sapcontrol -nr 00 -function
GetSystemInstanceList
16.01.2017 05:57:01
GetSystemInstanceList
OK
hostname, instanceNr, httpPort, httpsPort, startPriority, features, dispstatus
raichu2,    0,               50013,     50014,     0.3,              HDB,
GREEN

db1adm@raichu2:/usr/sap/DB1/HDB00> sapcontrol -nr 00 -function GetProcessList
16.01.2017 05:57:15
GetProcessList
OK
name,            description,                         dispstatus, textstatus,
starttime,            elapsedtime, pid
hdbdaemon,             HDB Daemon,               GREEN, Running, 2017 01 12
13:41:05, 88:16:10, 5309
hdbcompileserver,  HDB Compileserver,    GREEN, Running, 2017 01 12 13:41:14,
88:16:01, 5412
hdbindexserver,       HDB Indexserver,        GREEN, Running, 2017 01 12 13:41:15,
88:16:00, 5448
hdbnameserver,      HDB Nameserver,        GREEN, Running, 2017 01 12 13:41:06,
88:16:09, 5325
hdbpreprocessor,    HDB Preprocessor,      GREEN, Running, 2017 01 12 13:41:14,
88:16:01, 5414
hdbwebdispatcher, HDB Web Dispatcher, GREEN, Running, 2017 01 12 13:41:45,
88:15:30, 5789
hdbxsengine,            HDB XSEngine,             GREEN, Running, 2017 01 12
13:41:15, 88:16:00, 5450
db1adm@raichu2:/usr/sap/DB1/HDB00>
```

5. Start the NetWeaver instance on raichu1, as shown in Example 15.

Example 15 Starting the NetWeaver instance

```
raichu1:db1adm 52> startsap r3
Checking db Database
Database is running
-----------------------------------------
Starting Startup Agent sapstartsrv
OK
Instance Service on host raichu1 started
-----------------------------------------
starting SAP Instance ASCS01
Startup-Log is written to /home/db1adm/startsap_ASCS01.log
-----------------------------------------
/usr/sap/DB1/ASCS01/exe/sapcontrol -prot NI_HTTP -nr 01 -function Start
Instance on host raichu1 started
Starting Startup Agent sapstartsrv
OK
Instance Service on host raichu1 started
-----------------------------------------
starting SAP Instance D00
```

```
Startup-Log is written to /home/db1adm/startsap_D00.log
----------------------------------------
/usr/sap/DB1/D00/exe/sapcontrol -prot NI_HTTP -nr 00 -function Start
Instance on host raichu1 started
```

6. Verify that the NetWeaver instance started on raichu1, as shown in Example 16.

Example 16 Verifying that the NetWeaver instance started on raichu1

```
raichu1:db1adm 53> sapcontrol -nr 00 -function GetProcessList
16.01.2017 05:23:38
GetProcessList
OK
name,      description, dispstatus, textstatus, starttime, elapsedtime, pid
disp+work, Dispatcher,   GREEN, Running, 2017 01 16 05:19:21, 0:04:17, 9527
igswd_mt,  IGS Watchdog, GREEN, Running, 2017 01 16 05:19:21, 0:04:17, 9528
gwrd,      Gateway,      GREEN, Running, 2017 01 16 05:19:25, 0:04:13, 9560
icman,     ICM,          GREEN, Running, 2017 01 16 05:19:25, 0:04:13, 9561

raichu1:db1adm 54> sapcontrol -nr 00 -function GetSystemInstanceList
16.01.2017 05:23:46
GetSystemInstanceList
OK
hostname, instanceNr, httpPort, httpsPort, startPriority, features, dispstatus
raichu1,  1,          50113,    50114,     1, MESSAGESERVER|ENQUE|WEBDISP, GREEN
raichu1,  0,          50013,    50014,     3, ABAP|GATEWAY|ICMAN|IGS,      GREEN
```

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