SAP HANA Restore Guide
(for A2040c RHEL)

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NEC SAP Global Competence Center
1. Introduction

1.1. Purpose
This manual describes a restore procedure of a HANA system from a full backup media.

1.2. Scope

・ SAP HANA single model appliance
・ OS is RHEL 6

1.3. Reference documents

・ SAP HANA Technical Operations Manual (TOM)
・ SAP HANA Database Administration Guide

The above documents are available from the following site, be sure to check http://help.sap.com/hana_appliance

2. Planning

2.1. SAP HANA data allocation
This chapter describes the disk and filesystem layout. You can check this by typing lsblk

If there was an additional (USB) drive mounted during system boot, then the devices attached to external storage may have an increased letter (e.g. /dev/sdb becomes /dev/sdc, and so on).
2.2. Appliances with 3 internal HDDs (up to 1TB)
All data except those on devices sda3, lv_kdump and lv_backup in the following table will be included with the restore.

<table>
<thead>
<tr>
<th>RAID</th>
<th>Size</th>
<th>Device</th>
<th>Partition name</th>
<th>File system</th>
<th>Size</th>
<th>Usage</th>
<th>Mount point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal disks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HW1</td>
<td>275GB</td>
<td>/dev/sda</td>
<td>/dev/sda1</td>
<td>vfat</td>
<td>1GB</td>
<td>uEFI</td>
<td>/boot/efi</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/sda2</td>
<td>ext4</td>
<td>1GB</td>
<td>Boot</td>
<td>/boot</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/sda3</td>
<td>swap</td>
<td>10GB</td>
<td>SWAP</td>
<td>(swap)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/sda4</td>
<td>ext3</td>
<td>263GB</td>
<td>OS/AP</td>
<td>/</td>
</tr>
<tr>
<td>External disks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HW1</td>
<td>87GB</td>
<td>/dev/sdn</td>
<td>/dev/md1</td>
<td>xfs</td>
<td>1,1TB</td>
<td>Log</td>
<td>/hana/log</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to /dev/sdy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>260GB</td>
<td>/dev/sdb</td>
<td>/dev/md0</td>
<td>xfs</td>
<td>3,1TB</td>
<td>Data</td>
<td>/hana/data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to /dev/sdm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>211GB</td>
<td>/dev/sdz</td>
<td>/dev/mapper/</td>
<td>xfs</td>
<td>1TB</td>
<td>Shared</td>
<td>/hana/shared</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to /dev/sdbk</td>
<td>vg_shared-lv_shared</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/mapper/</td>
<td>xfs</td>
<td>50GB</td>
<td>Backup</td>
<td>/backup</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>vg_shared-lv_backup</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/mapper/</td>
<td>xfs</td>
<td>1TB</td>
<td>Kdump</td>
<td>/var/crash</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>vg_shared-lv_kdump</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Attention: The device names md125 and md126 are the names in the rescue environment only as detected during step 6 in chapter 3.2.2, in the production system the device names are md_data and md_log.
2.3. Appliances with 8 internal HDDs (up to 2TB)

All data except those on devices sda3, sda4 and sda6 in the following table will be included with the restore.

<table>
<thead>
<tr>
<th>RAID</th>
<th>Size</th>
<th>Device</th>
<th>Partition name</th>
<th>File system</th>
<th>Size</th>
<th>Usage</th>
<th>Mount point</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW5 with HotSpare</td>
<td>1800GB</td>
<td>/dev/sda</td>
<td>/dev/sda1</td>
<td>vfat</td>
<td>1GB</td>
<td>uEFI</td>
<td>/boot/efi</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/sda2</td>
<td>ext4</td>
<td>1GB</td>
<td>Boot</td>
<td>/boot</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/sda3</td>
<td>xfs</td>
<td>1,1TB</td>
<td>Kdump</td>
<td>/var/crash</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/sda4</td>
<td>ext3</td>
<td>50GB</td>
<td>Backup</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/sda5</td>
<td>swap</td>
<td>10GB</td>
<td>SWAP</td>
<td>(swap)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/dev/sda6</td>
<td>ext3</td>
<td>702GB</td>
<td>OS/AP</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>2,1TB</td>
<td>/dev/sdb</td>
<td>/dev/sdb1</td>
<td>xfs</td>
<td>2,1TB</td>
<td>Shared</td>
<td>/hana/shared</td>
</tr>
<tr>
<td></td>
<td>1,2TB</td>
<td>/dev/sdc</td>
<td>/dev/sdc1</td>
<td>xfs</td>
<td>1,2TB</td>
<td>Log</td>
<td>/hana/log</td>
</tr>
<tr>
<td>HW1 with SW0</td>
<td>6,6TB</td>
<td>/dev/md0</td>
<td>/dev/md0</td>
<td>xfs</td>
<td>6,5TB</td>
<td>Data</td>
<td>/hana/data</td>
</tr>
</tbody>
</table>

External disks

Attention: The device name /dev/md127 is the name in the rescue environment only as detected during step 6 in chapter 3.2.2, in the production system the device name is /dev/md_data.

2.4. Restore procedure overview

The restore procedure exists of the following 4 phases:

- Boot up to the rescue mode.
- Read-write mount each volume.
- Restore all volumes.
- Reboot the server and start SAP HANA.
3. Restore procedure

In this chapter a procedure to restore the NEC SAP HANA appliance from an initial backup kept on external USB media is shown.

3.1. Boot to rescue mode

Insert the RHEL Installation Media and boot from DVD.
As soon as the system starts from the DVD the boot menu is displayed:

![Boot menu]

Please press any key to enter the boot menu.

Select “Rescue System” in the menu and then press “ENTER” to start loading the rescue system.

![Rescue menu]

When the rescue mode loads it will ask you several questions. Please use the following settings:

- Change a Language : English
- Keyboard Type : us
- Rescue Method : Local CD/DVD
- Setup Networking : No
- Rescue : Skip (no automatic mount on /mnt/sysimage)
- Start shell : Ok
3.2. Restore

This chapter describes the restore procedure of the different partitions.

1) Connect the USB device with the initial backup to the NEC SAP HANA appliance.
2) Check how the device has been identified within the rescue system by typing:

```
dmesg | tail
```

In this example the USB memory has been detected as “sde”.

3) Create a temporary mount point to attach the USB memory:

```
mkdir /tmp/usbdevice
```

4) Mount the USB memory to the mount point created before:

```
mount /dev/sde1 /tmp/usbdevice
```

5) Create a temporary mount point to store the backup data:

```
mkdir /tmp/backup
```

6) Mount the backup data partition to the temporary mount point created before:

   Start the software raid:
   ```
   mdadm --assemble --scan -v
   cat /proc/mdstat
   ```

   Screenshot for 1TB appliance, 2TB appliance will show only one md raid.

   **For appliances with 3 internal disks only:**
   Start lvm with the command:
   ```
   lvm vgscan -v
   ```
   This will find the volume group “vg_shared”. The next step is to activate this volume group:
   ```
   lvm vgchange -a y
   ```
   Finally mount the backup volume:
   ```
   mount -o rw /dev/mapper/vg_shared-lv_backup /tmp/backup
   ```

   **For appliances with 8 internal disks only:**
   ```
   mount -o rw /dev/sda4 /tmp/backup
   ```

7) Verify that the backup data files exist in the correct directory

   ```
   ls -l /tmp/usbdevice
   ```
   - hana-root.tar.gz
   - hana-log.tar.gz
   - hana-boot.tar.gz
   - hana-bootefi.tar.gz
   - hana-shared.tar.gz
   - hana-data.tar.gz

8) Copy all tar files to the backup data device to speed up the restore process:

   ```
   cp /tmp/usbdevice/* /tmp/backup/
   ```
9) Create a temporary mount point for every device:

   mkdir /tmp/osmount
   mkdir /tmp/logmount
   mkdir /tmp/boottmount
   mkdir /tmp/boottefimount
   mkdir /tmp/datamount
   mkdir /tmp/sharedmount

10) Take a note of the UUIDs. You will need them in them in the next step. Use the command:

   blkid | grep -v SUB

   Screenshot from appliance with 3 internal disks

11) Format partitions

   **For appliances with 3 internal disks only:**
   Format the following partitions uEFI Boot (/dev/sda1), Boot (/dev/sda2), OS/AP (/dev/sda4), HANA data (/dev/md0), HANA log (/dev/md1) and HANA shared (/dev/mapper/vg_shared-lv_shared) with the appropriate filesystem and use the previous UUIDs.

   **Attention: You must use the UUIDs you found in the previous step, otherwise your recovery will fail!**

   mkfs.vfat /dev/sda1 -i <UUID of /dev/sda1 without “-” like 11428CC3>
   mkfs.ext4 /dev/sda2 -U <UUID of /dev/sda2>
   mkfs.ext3 /dev/sda4 -L HANA_ROOT -U <UUID of /dev/sda4>
   mkswap /dev/sda3 -L HANA_SWAP -U <UUID of /dev/sda3>
   mkfs.xfs -f /dev/md125 -d su=128k,sw=12,agcount=51 -L HANA_DATA
   mkfs.xfs -f /dev/md126 -d su=64k,sw=12,agcount=51 -L HANA_LOG
   mkfs.xfs -f /dev/mapper/vg_shared-lv_shared -d \
   su=256k,sw=12,agcount=51 -L HANA_SHARED
   xfs_admin -U <UUID of /dev/md125> /dev/md125
   xfs_admin -U <UUID of /dev/md126> /dev/md126
   xfs_admin -U <UUID of /dev/mapper/vg_shared-lv_shared> \
   /dev/mapper/vg_shared-lv_shared
For appliances with 8 internal disks only:
Format the following partitions uEFI Boot (/dev/sda1), Boot (/dev/sda2), OS/AP (/dev/sda6), HANA shared (/dev/sdb1), HANA log (/dev/sdc1) and HANA data (/dev/sdd1) with the appropriate filesystem and use the previous UUIDs.

Attention: You must use the UUIDs you found in the previous step, otherwise your recovery will fail!

- mkfs.vfat /dev/sda1 –i <UUID of /dev/sda1 without “-” like 701665E3>
- mkfs.ext4 /dev/sda2 –U <UUID of /dev/sda2>
- mkswap /dev/sda5 –L HANA_SWAP –U <UUID of /dev/sda5>
- mkfs.xfs -f /dev/sdb1 -d su=256k,sw=6,agcount=51 -L HANA_SHARED
- mkfs.xfs -f /dev/sdc1 -d su=64k,sw=6,agcount=51 -L HANA_LOG
- mkfs.xfs -f /dev/md127 -d su=128k,sw=12,agcount=51 -L HANA_DATA
- xfs_admin -U <UUID of /dev/sdb1> /dev/sdb1
- xfs_admin -U <UUID of /dev/sdc1> /dev/sdc1
- xfs_admin -U <UUID of /dev/md127> /dev/md127

12) Mount all devices to relevant mount points:

For appliances with 3 internal disks only:

- mount /dev/sda1 /tmp/bootefimount
- mount /dev/sda2 /tmp/bootmount
- mount /dev/sda4 /tmp/osmount
- mount /dev/md125 /tmp/datamount
- mount /dev/md126 /tmp/logmount
- mount /dev/mapper/vg_shared-lv_shared /tmp/sharedmount

For appliances with 8 internal disks only:

- mount -o rw /dev/sda1 /tmp/bootefimount
- mount -o rw /dev/sda2 /tmp/bootmount
- mount -o rw /dev/sda4 /tmp/osmount
- mount -o rw /dev/sdb1 /tmp/sharedmount
- mount -o rw /dev/sdc1 /tmp/logmount
- mount -o rw /dev/md127 /tmp/datamount

13) Change the current directory to “/tmp/bootefimount” and restore the uEFI boot partition:

- cd /tmp/bootefimount
- tar -zxvf /tmp/backup/hana-bootefi.tar.gz

14) Verify if the last operation was successful. The following command should give you a “0”.

- echo $?

15) Change the current directory to “/tmp/bootmount” and restore the boot partition:

- cd /tmp/bootmount
- tar -zxvf /tmp/backup/hana-boot.tar.gz

16) Verify if the last operation was successful. The following command should give you a “0”.

- echo $?

17) Change the current directory to “/tmp/osmount” and restore the OS / AP partition:

- cd /tmp/osmount
- tar -zxvf /tmp/backup/hana-root.tar.gz

18) Verify if the last operation was successful. The following command should give you a “0”.

- echo $?

19) Change the current directory to “/tmp/datamount” and restore the partition for HANA data:

- cd /tmp/datamount
- tar -zxvf /tmp/backup/hana-data.tar.gz
20) Verify if the last operation was successful. The following command should give you a “0”.
   
   echo $?

21) Change the current directory to “/tmp/sharedmount” and restore the partition for HANA shared:

   cd /tmp/sharedmount
   tar -zxvf /tmp/backup/hana-shared.tar.gz

22) Verify if the last operation was successful. The following command should give you a “0”.

   echo $?

23) Change the current directory to “/tmp/logmount” and restore the HANA log partition:

   cd /tmp/logmount
   tar -zxvf /tmp/backup/hana-log.tar.gz

24) Verify if the last operation was successful. The following command should give you a “0”.

   echo $?

3.3. Reboot and HANA startup

After the backup finished restart your NEC HANA appliance and start HANA

① Reboot your server by typing

   shutdown -r now

② Remove the DVD media before the system boot starts.

③ Login to the OS, open a terminal and change to /usr/sap/hostctrl/exe/:

   cd /usr/sap/hostctrl/exe

④ Start your HANA instance and verify the command output is “OK”:

   ./sapcontrol -nr <instance no> -function Start

⑤ Run this command and check its output says “OK” and all listed processes have the status “Green”. If some are still “Initializing”, wait a while and issue the same command again:

   ./sapcontrol -nr <instance no> -function GetProcessList