SAP HANA Restore Guide
(for A2040d RHEL)

23rd of January 2017
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 node appliance
- OS is RHEL 7

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. Use the commands `lsblk` and `blkid` to get details about existing block devices and their usage.

All data except swap, /var/crash and /backup in the following tables will be restored.

2.2. Appliances with 3 internal HDDs (up to 1TB)

<table>
<thead>
<tr>
<th>HDDs</th>
<th>RAID</th>
<th>Size</th>
<th>LD</th>
<th>LD Size</th>
<th>FS mount point</th>
<th>FS size</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>2 x 300GB (+ 1 spare)</td>
<td>1</td>
<td>279 GB</td>
<td>LD#1</td>
<td>ext3 /boot</td>
<td>1 GB</td>
<td>sda2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>vfat /boot/efi</td>
<td>1 GB</td>
<td>sda1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ext3 /</td>
<td>267 GB</td>
<td>lv_root</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>swap</td>
<td>swap</td>
<td>lv_swap</td>
</tr>
<tr>
<td>JBOD</td>
<td>24 x 600GB</td>
<td>1</td>
<td>12 x 558GB</td>
<td>LD#1~12</td>
<td>xfs /hana/data</td>
<td>3.120 GB</td>
<td>lv_data</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>xfs /hana/log</td>
<td>1.044 GB</td>
<td>lv_data</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>xfs /hana/shared</td>
<td>1.024 GB</td>
<td>lv_shared</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>xfs /backup</td>
<td>50 GB</td>
<td>lv_backup</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>xfs /var/crash</td>
<td>1.024 GB</td>
<td>lv_dump</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(free)</td>
<td>434 GB</td>
<td></td>
</tr>
</tbody>
</table>

2.3. Appliances with 8 internal HDDs (up to 2TB)

<table>
<thead>
<tr>
<th>HDDs</th>
<th>RAID</th>
<th>Size</th>
<th>LD</th>
<th>LD Size</th>
<th>FS mount point</th>
<th>FS size</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>2 x 900GB</td>
<td>1</td>
<td>838GB</td>
<td>LD#1</td>
<td>ext3 /boot</td>
<td>1 GB</td>
<td>sda2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>vfat /boot/efi</td>
<td>1 GB</td>
<td>sda1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ext3 /</td>
<td>776 GB</td>
<td>lv_root</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>swap</td>
<td>swap</td>
<td>lv_swap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>xfs /backup</td>
<td>50 GB</td>
<td>lv_backup</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>xfs /var/crash</td>
<td>1.118 GB</td>
<td>lv_dump</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(free)</td>
<td>552 GB</td>
<td></td>
</tr>
<tr>
<td>JBOD</td>
<td>24 x 600GB</td>
<td>1</td>
<td>12 x 558GB</td>
<td>LD#1~12</td>
<td>xfs /hana/data</td>
<td>6.144 GB</td>
<td>lv_data</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(free)</td>
<td>552 GB</td>
<td></td>
</tr>
</tbody>
</table>
### 2.4. Appliances with 8 internal HDDs (up to 4TB)

<table>
<thead>
<tr>
<th>HDDs</th>
<th>RAID</th>
<th>Size</th>
<th>LD</th>
<th>LD Size</th>
<th>FS</th>
<th>mount point</th>
<th>FS size</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>2 x 1.2TB</td>
<td>1</td>
<td>1,117 GB</td>
<td>LD#1</td>
<td>1.117 GB</td>
<td>ext3</td>
<td>/boot</td>
<td>1 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>vfat</td>
<td>/boot/efi</td>
<td>1 GB</td>
<td>sda1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ext3</td>
<td>/</td>
<td>955 GB</td>
<td>lv_root</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>swap</td>
<td>swap</td>
<td>10 GB</td>
<td>lv_swap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>xfs</td>
<td>/backup</td>
<td>150 GB</td>
<td>lv_backup</td>
</tr>
<tr>
<td></td>
<td>6 x 1.2TB</td>
<td>5(5+P)</td>
<td>5,585 GB</td>
<td>LD#2</td>
<td>1.024 GB</td>
<td>xfs</td>
<td>/hana/log</td>
<td>1.024 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LD#3</td>
<td>4.096 GB</td>
<td>xfs</td>
<td>/hana/shared</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(free)</td>
<td>465 GB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JBOD</td>
<td>24 x 1.2TB</td>
<td>1</td>
<td>12x1,117GB</td>
<td>LD#1~12</td>
<td>12x1,024 GB</td>
<td>xfs</td>
<td>/hana/data</td>
<td>12.288 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LD#13~24</td>
<td>12x93 GB</td>
<td>xfs</td>
<td>/var/crash</td>
</tr>
</tbody>
</table>

### 2.5. Restore procedure overview

The restore procedure exists of the following 3 phases:

- Boot up to the rescue mode.
- Restore each volume with the `tar` command.
- Reboot 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 7 Installation Media and boot from DVD.

As soon as the system starts from the DVD the boot menu is displayed. Select the “Troubleshooting” option here:
On the next screen select rescue system:

Select option 3) to proceed to the rescue system:

Now you will be dropped into a shell.

### 3.2. Restore

In this chapter you will restore every partition. All commands are valid for all appliance sizes.

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 "sdab".

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/sdab1 /tmp/usbdevice
   ```
5. Create a temporary mount point to store the backup data:
   mkdir /tmp/backup

6. Initialize software raid and lvm:
   mdadm --assemble --scan -v
   cat /proc/mdstat
   This should activate one software raid:
   lvm vgscan -v
   lvm vgchange -a y
   lvs

   You will find the following lvs:

7. Mount backup partition in writeable mode
   mount -o rw -L SYS_BACKUP /tmp/backup

8. Verify that the backup data files exist in the correct directory
   ls -l /tmp/usbdevice
   • hana-root.tgz
   • hana-log.tgz
   • hana-boot.tgz
   • hana-bootefi.tgz
   • hana-shared.tgz
   • hana-data.tgz

9. Copy all tar files to the backup data device to speed up the restore process:
   cp /tmp/usbdevice/hana-*.tgz /tmp/backup/

10. Create a temporary mount point for every device:
    mkdir /tmp/osmount
    mkdir /tmp/logmount
    mkdir /tmp/bootmount
    mkdir /tmp/booteefi
    mkdir /tmp/datamount
    mkdir /tmp/sharedmount

11. Take a note of the UUIDs. You will need them in them in the next step. Use the command:
    blkid | grep -v SUB
⑫ Format partitions

**For appliances with 3 internal disks only:**

Format the following partitions uEFI Boot (/dev/sda2), Boot (/dev/sda1), OS/AP (lv_root), HANA data (lv_data), HANA log (lv_log) and HANA 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 recovered system won’t boot correctly!

```bash
mkfs.vfat /dev/sda1 -i <UUID of /dev/sda1 without “-” like 11428CC3>
mkfs.ext3 /dev/sda2 -U <UUID of /dev/sda2>
mkswap /dev/mapper/vg_root-lv_swap -L HANA_SWAP -U <UUID of /dev/mapper/vg_root-lv_swap>
mkfs.xfs -f /dev/md127 -d su=128k,sw=12,agcount=51 -L HANA_DATA
mkfs.xfs -f /dev/mapper/vg_log-lv_log -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=49 -L HANA_SHARED
mkfs.xfs -f /dev/mapper/vg_dump-lv_dump -d su=256k,sw=12,agcount=49 -L KDUMP
xfs_admin -U <UUID of /dev/md127> /dev/md127
xfs_admin -U <UUID of /dev/mapper/vg_log-lv_log> /dev/mapper/vg_log-lv_log
xfs_admin -U <UUID of /dev/mapper/vg_log-lv_log> /dev/mapper/vg_log-lv_log
xfs_admin -U <UUID of /dev/mapper/vg_log-lv_log> /dev/mapper/vg_log-lv_log
xfs_admin -U <UUID of /dev/mapper/vg_shared-lv_shared> /dev/mapper/vg_shared-lv_shared
xfs_admin -U <UUID of /dev/mapper/vg_dump-lv_dump> /dev/mapper/vg_dump-lv_dump
```
For appliances with 8 internal disks only:
Format the following partitions uEFI Boot (/dev/sda2), Boot (/dev/sda1), OS/AP (lv_root), HANA data (lv_data), HANA log (lv_log) and HANA 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 recovered system won’t boot correctly!

```
mkfs.vfat /dev/sda1 -i <UUID of /dev/sda1 without “-” like 11428CC3>
mkfs.ext3 /dev/sda2 -U <UUID of /dev/sda2>
mkfs.ext3 /dev/mapper/vg_root-lv_root -L HANA_ROOT 
   -U <UUID of /dev/mapper/vg_root-lv_root>
mkswap /dev/mapper/vg_root-lv_swap -L HANA_SWAP -U 
   <UUID of /dev/mapper/vg_root-lv_swap>
mkfs.xfs -f /dev/md127 -d su=128k,sw=12,agcount=51 -L HANA_DATA 
mkfs.xfs -f /dev/mapper/vg_log-lv_log -d su=64k,sw=5,agcount=51 
   -L HANA_LOG
mkfs.xfs -f /dev/mapper/vg_shared-lv_shared -d 
   su=256k,sw=5,agcount=49 -L HANA_SHARED
xfs_admin -U <UUID of /dev/md127> /dev/md127
xfs_admin -U <UUID of /dev/mapper/vg_log-lv_log> 
   /dev/mapper/vg_log-lv_log
xfs_admin -U <UUID of /dev/mapper/vg_shared-lv_shared> 
   /dev/mapper/vg_shared-lv_shared
```

Attention: For a 2TB appliance change sw=12 to sw=5 in the following command (sw=12 fits for a 4TB appliance):
```
mkfs.xfs -f /dev/mapper/vg_dump-lv_dump -d 
   su=256k,sw=12,agcount=51 -L KDUMP
xfs_admin -U <UUID of /dev/mapper/vg_dump-lv_dump> 
   /dev/mapper/vg_dump-lv_dump
```

⑬ Mount all devices to relevant mount points:
```
mount /dev/sda1 /tmp/bootefimount
mount /dev/sda2 /tmp/bootmount
mount /dev/mapper/vg_root-lv_root /tmp/osmount
mount /dev/md127 /tmp/datamount
mount /dev/mapper/vg_log-lv_log /tmp/logmount
mount /dev/mapper/vg_shared-lv_shared /tmp/sharedmount
```
⑭ Change the current directory to “/tmp/bootefimount” and restore the uEFI boot partition:
```
cd /tmp/bootefimount
tar -zxvf /tmp/backup/hana-bootefi.tgz
```
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.tgz
```
Verify if the last operation was successful. The following command should give you a “0”.
```
echo $?
```
⑯ Change the current directory to “/tmp/osmount” and restore the OS / AP partition:
```
cd /tmp/osmount
tar -zxvf /tmp/backup/hana-root.tgz
```
Verify if the last operation was successful. The following command should give you a “0”.
```
echo $?
```
Change the current directory to “/tmp/datamount” and restore the partition for HANA data:
```bash
cd /tmp/datamount
tar -zxvf /tmp/backup/hana-data.tgz
```
Verify if the last operation was successful. The following command should give you a “0”.
```bash
echo $?
```

Change the current directory to “/tmp/sharedmount” and restore the partition for HANA shared:
```bash
cd /tmp/sharedmount
tar -zxvf /tmp/backup/hana-shared.tgz
```
Verify if the last operation was successful. The following command should give you a “0”.
```bash
echo $?
```

Change the current directory to “/tmp/logmount” and restore the HANA log partition:
```bash
cd /tmp/logmount
tar -zxvf /tmp/backup/hana-log.tgz
```
Verify if the last operation was successful. The following command should give you a “0”.
```bash
echo $?
```

### 3.3. Reboot and HANA startup

After the restore finished restart your NEC HANA appliance and start HANA:

1. Reboot your server by typing
   ```bash
   shutdown –r now
   ```
2. Remove the DVD media before the system boot starts.
3. Login to the OS, open a terminal and and enter the following commands to start HANA:
   ```bash
   su - <sid>adm
   HDB start
   ```
4. 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:
   ```bash
   sapcontrol –nr <instance no> -function GetProcessList
   ```

```
neadm@hdbvm1:/usr/sap/<SID>/HDB300> sapcontrol -nr 00 -function GetProcessList
23.01.2017 14:40:30 GetProcessList
OK
name, description, dispstatus, textstatus, starttime, elapsetime, pid
hdbdaemon, HDB Daemon, GREEN, Running, 2017 01 23 14:39:20, 0:01:10, 2701
hdbcopieserver, HDB Copieserver, GREEN, Running, 2017 01 23 14:39:26, 0:01:04, 2835
hdbindexserver, HDB Indexserver, GREEN, Running, 2017 01 23 14:39:29, 0:01:01, 2911
hdbnameserver, HDB NameServer, GREEN, Running, 2017 01 23 14:39:20, 0:01:10, 2717
hdpreserver, HDB Preserver, GREEN, Running, 2017 01 23 14:39:26, 0:01:04, 2837
hdbwebdispatch, HDB Web Dispatcher, GREEN, Running, 2017 01 23 14:39:47, 0:00:43, 3144
hdbxsengine, HDB XSEngine, GREEN, Running, 2017 01 23 14:39:29, 0:01:01, 2913
```