Standard Operating Procedure: Linux Storage Management

1. Basic Disk Management

1.1 List Available Disks

lsblk

```
[root@Sipl-204 ~]# lsblk
NAME                   MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
sda                      8:0    0 465.8G  0 disk
├─sda1                   8:1    0     1G  0 part /boot
└─sda2                   8:2    0 464.8G  0 part
  ├─ol_sipl--204-root 252:0    0    70G  0 lvm  /
  ├─ol_sipl--204-swap 252:1    0   5.9G  0 lvm  [SWAP]
  └─ol_sipl--204-home 252:2    0 388.9G  0 lvm  /home
sdb                      8:16   0     5G  0 disk
sde                      8:64   0     5G  0 disk
sdf                      8:80   0     5G  0 disk
[root@Sipl-204 ~]# _
```

1.2 Partition a New Disk

fdisk -l

```
[root@Sipl-204 ~]# fdisk -l
Disk /dev/sda: 465.76 GiB, 500107862016 bytes, 976773168 sectors
Disk model: ST500DM002-1ER14
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 4096 bytes
I/O size (minimum/optimal): 4096 bytes / 4096 bytes
Disklabel type: dos
Disk identifier: 0x3e8510b2

Device     Boot   Start       End   Sectors   Size Id Type
/dev/sda1  *       2048   2099199   2097152     1G 83 Linux
/dev/sda2       2099200 976773119 974673920 464.8G 8e Linux LVM


Disk /dev/mapper/ol_sipl--204-root: 70 GiB, 75161927680 bytes, 146800640 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 4096 bytes
I/O size (minimum/optimal): 4096 bytes / 4096 bytes
```

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2. LVM (Logical Volume Manager) Management

$ sudo pvcreate /dev/sdX1

Create a physical volume

```
[root@Sipl-204 ~]# sudo pvcreate /dev/sdb /dev/sde /dev/sdf
  Device /dev/sdb has no PVID (devices file 8VtCaCcSCU4stOLGpNTBSof0Ghm01TCB)
  Device /dev/sde has no PVID (devices file I8NX6nQJfDE6bpPA3NLZaN3nerhA0Q4J)
  Device /dev/sdf has no PVID (devices file DT9bTBi8OYOOm6pMHJs0wODNCC4c9prt)
  Physical volume "/dev/sdb" successfully created.
  Physical volume "/dev/sde" successfully created.
  Physical volume "/dev/sdf" successfully created.
[root@Sipl-204 ~]# _
```

$ sudo vgcreate my_vg /dev/sdb /dev/sde /dev/sdf

Create a volume group

```
[root@Sipl-204 ~]# sudo vgcreate my_vg /dev/sdb /dev/sde /dev/sdf
  Volume group "my_vg" successfully created
[root@Sipl-204 ~]# _
```

$ sudo lvcreate -L 10G -n my_lv my_vg

Create a logical volume

```
[root@Sipl-204 ~]# sudo lvcreate -L 10G -n my_lv my_vg
  Logical volume "my_lv" created.
[root@Sipl-204 ~]# _
```

$ sudo mkfs.ext4 /dev/my_vg/my_lv

Format the logical volume

```
[root@Sipl-204 ~]# sudo mkfs.ext4 /dev/my_vg/my_lv
mke2fs 1.46.5 (30-Dec-2021)
Creating filesystem with 2621440 4k blocks and 655360 inodes
Filesystem UUID: 13093a82-0064-4f08-882b-0d53ea825f4d
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632

Allocating group tables: done
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done
```

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$ sudo mkdir /mnt/mydata
$ sudo mount /dev/my_vg/my_lv /mnt/mydata

Mount it

```
[root@Sipl-204 ~]# sudo mkdir /mnt/mydata
sudo mount /dev/my_vg/my_lv /mnt/mydata
[root@Sipl-204 ~]# lsblk
NAME                  MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
sda                     8:0    0 465.8G  0 disk
├─sda1                  8:1    0     1G  0 part /boot
└─sda2                  8:2    0 464.8G  0 part
  ├─ol_sipl--204-root 252:0    0    70G  0 lvm  /
  ├─ol_sipl--204-swap 252:1    0   5.9G  0 lvm  [SWAP]
  └─ol_sipl--204-home 252:2    0 388.9G  0 lvm  /home
sdb                     8:16   0     5G  0 disk
└─my_vg-my_lv         252:3    0    10G  0 lvm  /mnt/mydata
sde                     8:64   0     5G  0 disk
└─my_vg-my_lv         252:3    0    10G  0 lvm  /mnt/mydata
sdf                     8:80   0     5G  0 disk
└─my_vg-my_lv         252:3    0    10G  0 lvm  /mnt/mydata
[root@Sipl-204 ~]# _
```

2.2 Extend a Logical Volume

Extend LV size

$ sudo lvextend -L +2G /dev/my_vg/my_lv

```
[root@Sipl-204 ~]# sudo lvextend -L +2G /dev/my_vg/my_lv
  Size of logical volume my_vg/my_lv changed from 10.00 GiB (2560 extents) to 12.00 GiB (3072 ex
tents).
  Logical volume my_vg/my_lv successfully resized.
[root@Sipl-204 ~]# _
```

Resize filesystem (ext4)

$ sudo resize2fs /dev/my_vg/my_lv

```
[root@Sipl-204 ~]# sudo resize2fs /dev/my_vg/my_lv
resize2fs 1.46.5 (30-Dec-2021)
Filesystem at /dev/my_vg/my_lv is mounted on /mnt/mydata; on-line resizing required
old_desc_blocks = 2, new_desc_blocks = 2
The filesystem on /dev/my_vg/my_lv is now 3145728 (4k) blocks long.

[root@Sipl-204 ~]# _
```

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2.3 Reduce a Logical Volume (use with caution!)

Unmount the volume

$ sudo umount /mnt/mydata

```
[root@Sipl-204 ~]# sudo umount /mnt/mydata
[root@Sipl-204 ~]# _
```

Check filesystem

$ sudo e2fsck -f /dev/my_vg/my_lv

```
[root@Sipl-204 ~]# sudo e2fsck -f /dev/my_vg/my_lv
e2fsck 1.46.5 (30-Dec-2021)
Pass 1: Checking inodes, blocks, and sizes
Pass 2: Checking directory structure
Pass 3: Checking directory connectivity
Pass 4: Checking reference counts
Pass 5: Checking group summary information
/dev/my_vg/my_lv: 11/786432 files (0.0% non-contiguous), 76004/3145728 blocks
[root@Sipl-204 ~]# _
```

Resize filesystem

$ sudo resize2fs /dev/my_vg/my_lv 8G

```
[root@Sipl-204 ~]# sudo resize2fs /dev/my_vg/my_lv 8G
resize2fs 1.46.5 (30-Dec-2021)
Resizing the filesystem on /dev/my_vg/my_lv to 2097152 (4k) blocks.
The filesystem on /dev/my_vg/my_lv is now 2097152 (4k) blocks long.

[root@Sipl-204 ~]# _
```

Reduce LV size

$ sudo lvreduce -L 8G /dev/my_vg/my_lv

```
[root@Sipl-204 ~]# sudo lvreduce -L 8G /dev/my_vg/my_lv
  File system ext4 found on my_vg/my_lv.
  File system size (8.00 GiB) is equal to the requested size (8.00 GiB).
  File system reduce is not needed, skipping.
  Size of logical volume my_vg/my_lv changed from 12.00 GiB (3072 extents) to 8.00 GiB (2048 ext
ents).
  Logical volume my_vg/my_lv successfully resized.
[root@Sipl-204 ~]# _
```

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Mount it back

$ sudo mount /dev/my_vg/my_lv /mnt/mydata

```
[root@Sipl-204 ~]# sudo mount /dev/my_vg/my_lv /mnt/mydata
[root@Sipl-204 ~]# lsblk
NAME                  MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
sda                     8:0    0 465.8G  0 disk
├─sda1                  8:1    0     1G  0 part /boot
└─sda2                  8:2    0 464.8G  0 part
  ├─ol_sipl--204-root 252:0    0    70G  0 lvm  /
  ├─ol_sipl--204-swap 252:1    0   5.9G  0 lvm  [SWAP]
  └─ol_sipl--204-home 252:2    0 388.9G  0 lvm  /home
sdb                     8:16   0     5G  0 disk
└─my_vg-my_lv         252:3    0     8G  0 lvm  /mnt/mydata
sde                     8:64   0     5G  0 disk
└─my_vg-my_lv         252:3    0     8G  0 lvm  /mnt/mydata
sdf                     8:80   0     5G  0 disk
[root@Sipl-204 ~]# _
```

2.4 Remove LVM Setup

 # first umount the storage

sudo umount /mnt/mydata

```
[root@Sipl-204 ~]# sudo umount /mnt/mydata
[root@Sipl-204 ~]# _
```

 # remove lvm
sudo lvremove /dev/my_vg/my_lv

```
[root@Sipl-204 ~]# sudo lvremove /dev/my_vg/my_lv
Do you really want to remove active logical volume my_vg/my_lv? [y/n]: y
  Logical volume "my_lv" successfully removed.
[root@Sipl-204 ~]# _
```

 # remove vg
sudo vgremove my_vg

```
[root@Sipl-204 ~]# sudo vgremove my_vg
  Volume group "my_vg" successfully removed
[root@Sipl-204 ~]# _
```

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 # remove pv

sudo pvremove /dev/sdX1

```
[root@Sipl-204 ~]# sudo pvremove /dev/sdb /dev/sdf /dev/sde
  Labels on physical volume "/dev/sdb" successfully wiped.
  Labels on physical volume "/dev/sdf" successfully wiped.
  Labels on physical volume "/dev/sde" successfully wiped.
[root@Sipl-204 ~]# _
```

3. RAID Management (mdadm)

3.1 Create RAID 0, 1, or 5

 # Install mdadm

sudo mdadm --create --verbose /dev/md0 --level=1 --raid-devices=2 /dev/sdd /dev/sdf

```
[root@Sipl-204 nss]# sudo mdadm --create --verbose /dev/md0 --level=1 --raid-devices=2 /dev/sdb
/dev/sdf
mdadm: Note: this array has metadata at the start and
    may not be suitable as a boot device.  If you plan to
    store '/boot' on this device please ensure that
    your boot-loader understands md/v1.x metadata, or use
    --metadata=0.90
mdadm: size set to 5237760K
Continue creating array [y/N]? y
mdadm: Defaulting to version 1.2 metadata
mdadm: array /dev/md0 started.
[root@Sipl-204 nss]# _
```

 # Create filesystem

sudo mkfs.ext4 /dev/md0

```
[root@Sipl-204 nss]# sudo mkfs.ext4 /dev/md0
mke2fs 1.46.5 (30-Dec-2021)
Creating filesystem with 1309440 4k blocks and 327680 inodes
Filesystem UUID: 0e329b52-d16c-4e07-8ab8-79ba0ce94680
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736

Allocating group tables: done
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done

[root@Sipl-204 nss]#
```

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 # Mount

sudo mkdir /mnt/raid
sudo mount /dev/md0 /mnt/raid

```
[root@Sipl-204 nss]# mkdir /dev/raid
[root@Sipl-204 nss]# mount /dev/md0 /mnt/raid
mount: /mnt/raid: /dev/md0 already mounted on /mnt/raid.
[root@Sipl-204 nss]# _
```

3.2 View RAID Status

sudo mkdir /mnt/raid

```
Personalities : [raid1]
md0 : active raid1 sdf[1] sdb[0]
      5237760 blocks super 1.2 [2/2] [UU]
      [=====>.............]  resync = 26.5% (1390144/5237760) finish=10.1min speed=6306K/sec

md2 : active (auto-read-only) raid1 sdc[1]
      5237760 blocks super 1.2 [2/1] [_U]
        resync=PENDING

unused devices: <none>
[root@Sipl-204 nss]# _
```

sudo mdadm --detail /dev/md0

```
[root@Sipl-204 nss]# sudo mdadm --detail /dev/md0
/dev/md0:
           Version : 1.2
     Creation Time : Fri Apr 11 16:57:56 2025
        Raid Level : raid1
        Array Size : 5237760 (5.00 GiB 5.36 GB)
     Used Dev Size : 5237760 (5.00 GiB 5.36 GB)
      Raid Devices : 2
     Total Devices : 2
       Persistence : Superblock is persistent

       Update Time : Fri Apr 11 17:03:08 2025
             State : clean, resyncing
    Active Devices : 2
   Working Devices : 2
    Failed Devices : 0
     Spare Devices : 0

Consistency Policy : resync

     Resync Status : 35% complete
```

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sudo umount /mnt/raid

sudo mdadm --stop /dev/md0

```
[root@Sipl-204 nss]# sudo umount /mnt/raid
[root@Sipl-204 nss]# sudo mdadm --stop /dev/md0
mdadm: stopped /dev/md0
[root@Sipl-204 nss]# _
```

4. Filesystem and Mounting

4.1 Format and Mount

sudo mkfs.ext4 /dev/sdX1

sudo mkdir /mnt/mydisk

sudo mount /dev/sdX1 /mnt/mydisk

4.2 Add to /etc/fstab (Persistent Mount)

/dev/sdX1 /mnt/mydisk ext4 defaults 0 2

Important commands and their options :

pvcreate – Initialize a physical volume

Option	Description	Example
--dataalignment	Align data to improve performance	pvcreate --dataalignment 1m /dev/sdX
--zero	Wipe first 4 sectors (default: y)	pvcreate --zero y /dev/sdX
--uuid	Set custom UUID	pvcreate --uuid YOUR-UUID /dev/sdX

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vgcreate – Create a volume group

Option	Description	Example
-s	Set physical extent size	vgcreate -s 16M vg1 /dev/sdX
--addtag	Add tag to VG	vgcreate --addtag mytag vg1 /dev/sdX

lvcreate – Create a logical volume

Option	Description	Example
-L	Specify size	lvcreate -L 10G -n lv1 vg1
-n	Name the logical volume	lvcreate -L 10G -n lv1 vg1
--type	Specify RAID type or striped/mirrored	lvcreate --type raid1 -L 10G -n lv1 vg1
-i	Number of stripes	lvcreate -i2 -I64 -L 10G -n lv1 vg1
-I	Stripe size	lvcreate -i2 -I64 -L 10G -n lv1 vg1

lvextend – Extend a logical volume

Option	Description	Example
-L	Set new absolute size	lvextend -L 15G /dev/vg1/lv1
-l	+%FREE or +XG relative increase	lvextend -l +100%FREE /dev/vg1/lv1
-r	Resize filesystem after extending	lvextend -r -L 15G /dev/vg1/lv1

lvreduce – Reduce a logical volume

Option	Description	Example
-L	Set reduced size	lvreduce -L 8G /dev/vg1/lv1
--resizefs	Resize filesystem before reducing	lvreduce --resizefs -L 8G /dev/vg1/lv1

lvremove – Remove a logical volume

Option	Description	Example
-f	Force removal without confirmation	lvremove -f /dev/vg1/lv1

vgremove – Remove a volume group

Option	Description	Example
-f	Force removal	vgremove -f vg1

pvremove – Remove a physical volume

Option	Description	Example
--force	Force removal	pvremove --force /dev/sdX

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mkfs.ext4 – Format a disk/partition with ext4

Option	Description	Example
-L	Set volume label	mkfs.ext4 -L mydata /dev/sdX1
-m	Set reserved block percentage	mkfs.ext4 -m 1 /dev/sdX1

resize2fs – Resize ext2/ext3/ext4 filesystem

Option	Description	Example
(no option)	Resize to max	resize2fs /dev/vg1/lv1
<size>	Resize to specific size	resize2fs /dev/vg1/lv1 8G

mdadm – Manage software RAID

Option	Description	Example
--create	Create RAID array	mdadm --create /dev/md0 --level=1 --raid-devices=2 /dev/sdX /dev/sdY
--verbose	Show verbose output	mdadm --create --verbose ...
--level	RAID level	mdadm --level=1 ...
--raid-devices	Number of devices	mdadm --raid-devices=2 ...
--detail	Show RAID details	mdadm --detail /dev/md0
--stop	Stop RAID device	mdadm --stop /dev/md0
--remove	Remove RAID device	mdadm --remove /dev/md0
--detail --scan	Output config info	mdadm --detail --scan