11-07-2020
https://youtu.be/-rEm3lopuhw

Disk Management

Hard Disk (Hard Drive)

IDE – Linux will handle these kind fo devices /dev/hda
SCSI – Linux will handle these kind of devices /dev/sda
Virtual drive – Linux will handle these kind of devices /dev/vda

SCSI –

Small Computer System Interface is a set of standards for physically connecting and transferring data between computers and peripheral devices. The SCSI standards define commands, protocols, electrical, optical and logical interfaces

Very first drive	/dev/sda
Second drive	/dev/sdb
Third drive	/dev/sdc
26th drive	/dev/sdz
27th drive	/dev/sdaa
28th drive	/dev/sdab

List the disk

Lsblk

```
[root@zmpt01 ~]# lsblk
NAME          MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda             8:0    0   16G  0 disk
├─sda1          8:1    0    1G  0 part /boot
└─sda2          8:2    0   15G  0 part
  ├─centos-root 253:0    0 13.4G  0 lvm  /
  └─centos-swap 253:1    0  1.6G  0 lvm  [SWAP]
sdb             8:16   0   16G  0 disk
sdc             8:32   0    8G  0 disk
```

sr0 11:0 1 1024M 0 rom

Linux handles the devices as files

```
[root@zmpt01 ~]# ls -l /dev/sd*
brw-rw----. 1 root disk 8,  0 Nov  7 16:54 /dev/sda
brw-rw----. 1 root disk 8,  1 Nov  7 16:54 /dev/sda1
brw-rw----. 1 root disk 8,  2 Nov  7 16:54 /dev/sda2
brw-rw----. 1 root disk 8, 16 Nov  7 16:54 /dev/sdb     < ---Working on this disk
brw-rw----. 1 root disk 8, 32 Nov  7 16:54 /dev/sdc
```

Three comman ways to manage the disk

- Fdisk – Fixed disk setup program
- Gdisk – Same as fdisk, but uses GPT
- LVM – Logical Volume Manager

FDISK

Fixed Disk Setup Program

/dev/sdb – 16GB

8GB /dev/sdb1	

```
[root@zmpt01 ~]# fdisk /dev/sdb
Command (m for help): m
Command (m for help): n
Select (default p): p
Partition number (1-4, default 1): 1
First sector (2048-33554431, default 2048):   < ---hit enter
Last sector, +sectors or +size{K,M,G} (2048-33554431, default 33554431): +8G
Command (m for help): w
The partition table has been altered!
```

10-08-2020
https://youtu.be/QLM0NTsxtwA

Run partprobe

```
[root@zmpt01 ~]# partprobe
```

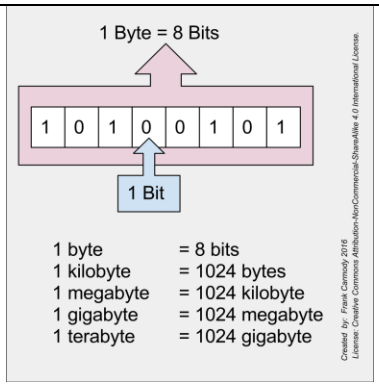
```
[root@zmpt01 ~]# lsblk
NAME          MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda             8:0    0   16G  0 disk
├─sda1          8:1    0    1G  0 part /boot
└─sda2          8:2    0   15G  0 part
  ├─centos-root 253:0    0 13.4G  0 lvm  /
  └─centos-swap 253:1    0  1.6G  0 lvm  [SWAP]
sdb             8:16   0   16G  0 disk
└─sdb1          8:17   0    8G  0 part        < ---New created partition
sdc             8:32   0    8G  0 disk
sr0            11:0    1 1024M  0 rom
```

Creating the file system

In computing, a file system or filesystem controls how data is stored(writing) and retrieved(access)

```
[root@zmpt01 ~]# mkfs.ext4 /dev/sdb1          < ---Command to create EXT4 file system
mke2fs 1.42.9 (28-Dec-2013)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)                  < ---4KB is the default black space (smallest useable block)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
524288 inodes, 2097152 blocks
104857 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=2147483648
64 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632

Allocating group tables: done
Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done
```



Binary is base 2 = 1 0
1 = on
0 = off

2^8

4096 = 4kb minimum useable

File Size	Disk Space used 4K
0	4 kb
1 kb	4kb
2 kb	4 kb
4 kb	4 kb
6 kb	8 kb
13 kb	16 kb
21	24 kb

File System structure

File System	Max Disk Size	Single file size
Ext2	32 TB	2 TB
Ext3	32 TB	2 TB
Ext4	1 Eib	16 TB

XFS	16 Eib	500 TB for RHEL - 7 100 TB for RHEL - 8

Unit	Shortened	Capacity
Kilobyte	KB	1024 **bytes**
Megabyte	MB	1024 kilobytes
Gigabyte	GB	1024 megabytes
Terabyte	TB	1024 gigabytes

Mount the file system – makign it available for useage

[root@zmpt01 ~]# mkdir /DATA

[root@zmpt01 ~]# mount /dev/sdb1 /DATA/ < ---you have to provide absolute path when mounting

Command	Filesystem	Mount point/ location
Mount	/dev/sdb1	/DATA

To see the disk and mount point being used

```
[root@zmpt01 ~]# df -h
Filesystem              Size  Used Avail Use% Mounted on
devtmpfs                484M     0  484M   0% /dev
tmpfs                   496M     0  496M   0% /dev/shm
tmpfs                   496M  6.8M  489M   2% /run
tmpfs                   496M     0  496M   0% /sys/fs/cgroup
/dev/mapper/centos-root   14G  1.8G   12G  14% /
/dev/sda1               1014M  136M  879M  14% /boot
tmpfs                   100M     0  100M   0% /run/user/0
/dev/sdb1               7.8G   36M  7.3G   1% /DATA
```

```
[root@zmpt01 ~]# lsblk
NAME          MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda             8:0    0   16G  0 disk
```

```
├─sda1          8:1    0    1G  0 part /boot
└─sda2          8:2    0   15G  0 part
  ├─centos-root 253:0    0 13.4G  0 lvm  /
  └─centos-swap 253:1    0  1.6G  0 lvm  [SWAP]
sdb             8:16   0   16G  0 disk
└─sdb1          8:17   0    8G  0 part /DATA
sdc             8:32   0    8G  0 disk
sr0            11:0    1 1024M  0 rom
```

Unmount the disk

[root@zmpt01 ~]# umount /DATA/

```
NAME          MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda             8:0    0   16G  0 disk
├─sda1          8:1    0    1G  0 part /boot
└─sda2          8:2    0   15G  0 part
  ├─centos-root 253:0    0 13.4G  0 lvm  /
  └─centos-swap 253:1    0  1.6G  0 lvm  [SWAP]
sdb             8:16   0   16G  0 disk
└─sdb1          8:17   0    8G  0 part
sdc             8:32   0    8G  0 disk
sr0            11:0    1 1024M  0 rom
```

Reboot

[root@zmpt01 ~]# df –h

The file system is not mounted

FSTAB – File System Table

Configuration file helpful during boot for mounting disks

/etc/fstab

[root@zmpt01 ~]# vi /etc/fstab

Copy th existing line and paset into new line and edit as needed

Filesystem	Mount point	Filesystem type	OS handles this	priority
/dev/sdb1	/DATA	ext4	defaults	0 0

[root@zmpt01 ~]# mount –a < ---this command will read /etc/fstab and mounts the files if not already mounted

The file system will be mounted during boot up

persistence with the reboot

Changing the mount point

[root@zmpt01 DATA]# touch file{1..100}

/dev/sdb1 7.8G 36M 7.3G 1% /DATA < ---Files are actually written to /dev/sdb1

[root@zmpt01 ~]# umount /DATA
[root@zmpt01 ~]# df –h
[root@zmpt01 ~]# cd /DATA/
[root@zmpt01 DATA]# ls

[root@zmpt01 ~]# mount /dev/sdb1 /IBM
[root@zmpt01 ~]# df -h
Filesystem Size Used Avail Use% Mounted on
devtmpfs 484M 0 484M 0% /dev
tmpfs 496M 0 496M 0% /dev/shm
tmpfs 496M 6.8M 489M 2% /run
tmpfs 496M 0 496M 0% /sys/fs/cgroup
/dev/mapper/centos-root 14G 1.8G 12G 14% /
/dev/sda1 1014M 136M 879M 14% /boot
tmpfs 100M 0 100M 0% /run/user/0
/dev/sdb1 7.8G 36M 7.3G 1% /IBM < ---mount point is changed to IBM, but data will still be available

[root@zmpt01 IBM]# ls
file1 file2 file30 file41 file52 file63 file74 file85 file96

UUID – Universal Unique Identifier

[root@zmpt01 ~]# blkid

/dev/sdb1: UUID="1dfbb3a5-8b04-4883-89e7-ceb9e78db6e4" TYPE="ext4"

[root@zmpt01 ~]# vi /etc/fstab

#/dev/sdb1 /DATA ext4 defaults 0 0

```
UUID=1dfbb3a5-8b04-4883-89e7-ceb9e78db6e4 /DATA                 ext4    defaults        0 0

[root@zmpt01 ~]# mount –a

[root@zmpt01 ~]# df –h
/dev/sdb1             7.8G   36M  7.3G   1% /DATA    < ---UUID is associated with /dev/sdb1
```

Mount using label

```
[root@zmpt01 ~]# e2label /dev/sdb1 zmpt01

[root@zmpt01 ~]# blkid
/dev/sda1: UUID="160e6caa-b0a9-468b-9de1-04189acc84ce" TYPE="xfs"
/dev/sda2: UUID="oLnQZF-bJU0-02T3-t0wF-DhnB-2JI6-CQI9f2" TYPE="LVM2_member"
/dev/sdb1: LABEL="zmpt01" UUID="1dfbb3a5-8b04-4883-89e7-ceb9e78db6e4" TYPE="ext4"
/dev/mapper/centos-root: UUID="5c79b16a-cfd4-4d5a-8e9c-b9b1a37b4936" TYPE="xfs"
/dev/mapper/centos-swap: UUID="c7801c38-9828-49b2-8a12-7610376d8b8a" TYPE="swap"


[root@zmpt01 ~]# vi /etc/fstab

LABEL="zmpt01" /DATA                    ext4    defaults        0 0      < ---using the LABEL

[root@zmpt01 ~]# mount -a
[root@zmpt01 ~]# df –h
/dev/sdb1             7.8G   36M  7.3G   1% /DATA                < ---Mounted using LABEL
```

Multiple filesystem on same disk

/dev/sdb – 16GB

8GB /dev/sdb1 Ext4	2GB /dev/sdb2 XFS	2GB /dev/sdb2 XFS	2GB /de/sdb3 swap

```
[root@zmpt01 ~]# fdisk /dev/sdb
Command (m for help): m
Command (m for help):

p
```

```
Command (m for help): n
Select (default p): p
Partition number (2-4, default 2): 2
First sector (16779264-33554431, default 16779264):   < ---hit “Enter” – use default value
Last sector, +sectors or +size{K,M,G} (16779264-33554431, default 33554431): +2G


Command (m for help): p

Disk /dev/sdb: 17.2 GB, 17179869184 bytes, 33554432 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x5460be06

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1            2048    16779263     8388608   83  Linux
/dev/sdb2        16779264    20973567     2097152   83  Linux    < ---New partition is created

Command (m for help): w
```

```
[root@zmpt01 ~]# lsblk
NAME          MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda             8:0    0   16G  0 disk
├─sda1          8:1    0    1G  0 part /boot
└─sda2          8:2    0   15G  0 part
  ├─centos-root 253:0    0 13.4G  0 lvm  /
  └─centos-swap 253:1    0  1.6G  0 lvm  [SWAP]
sdb             8:16   0   16G  0 disk
├─sdb1          8:17   0    8G  0 part /DATA
└─sdb2          8:18   0    2G  0 part                < ---Newly created partition 2GB
sdc             8:32   0    8G  0 disk
```

```
[root@zmpt01 ~]# mkfs.xfs /dev/sdb2
```

```
[root@zmpt01 ~]# mount /dev/sdb2 /IBM/
```

```
[root@zmpt01 ~]# df -h
Filesystem            Size  Used Avail Use% Mounted on
devtmpfs              484M     0  484M   0% /dev
tmpfs                 496M     0  496M   0% /dev/shm
tmpfs                 496M  6.8M  489M   2% /run
tmpfs                 496M     0  496M   0% /sys/fs/cgroup
/dev/mapper/centos-root   14G  1.8G   12G  14% /
/dev/sda1            1014M  136M  879M  14% /boot
tmpfs                 100M     0  100M   0% /run/user/0
/dev/sdb1             7.8G   36M  7.3G   1% /DATA
/dev/sdb2             2.0G   33M  2.0G   2% /IBM          < ---disk is mounted to /IBM
```

Make appropriate entry into /etc/fstab

```
/dev/sdb2 /IBM                  xfs     defaults        0 0
```

```
[root@zmpt01 ~]# mount –a

[root@zmpt01 ~]# df -h
Filesystem            Size  Used Avail Use% Mounted on
devtmpfs              484M     0  484M   0% /dev
tmpfs                 496M     0  496M   0% /dev/shm
tmpfs                 496M  6.8M  489M   2% /run
tmpfs                 496M     0  496M   0% /sys/fs/cgroup
/dev/mapper/centos-root   14G  1.8G   12G  14% /
/dev/sda1            1014M  136M  879M  14% /boot
tmpfs                 100M     0  100M   0% /run/user/0
/dev/sdb1             7.8G   36M  7.3G   1% /DATA
/dev/sdb2             2.0G   33M  2.0G   2% /IBM          < ---disk is mounted to /IBM using mount -a
```

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https://youtu.be/AneCZr5-tLA

Extending inodes

To create random amount of blank files

```
touch file{1..110000}
```

```
[root@zmpt01 IBM]# df –h

/dev/sdb2             2.0G  582M  1.5G  29% /IBM
```

[root@zmpt01 IBM]# df –I < ---this is used for checking the iNodes

/dev/sdb2 1048640 1048640 0 100% /IBM

Ext4 file system

[root@zmpt01 ~]# df -i /dev/sdb1
Filesystem Inodes IUsed IFree IUse% Mounted on
/dev/sdb1 524288 110 524178 1% /DATA

[root@zmpt01 ~]# umount /dev/sdb1
[root@zmpt01 ~]# mkfs.ext4 -N 1000000 /dev/sdb1 < ---ALL DATA will be deleted

[root@zmpt01 ~]# mount /dev/sdb1 /DATA/
[root@zmpt01 ~]# df -i
/dev/sdb1 1000448 11 1000437 1% /DATA

Increase the partition size

[root@zmpt01 ~]# df –h
/dev/sdb2 2.0G 582M 1.5G 29% /IBM < --- Increase size of file system to 4GB

Unmount the partition that needs to be extended

[root@zmpt01 ~]# umount /IBM/

[root@zmpt01 ~]# fdisk /dev/sdb
Command (m for help): m
Command (m for help): d
Command (m for help): w

[root@zmpt01 ~]# fdisk /dev/sdb
Command (m for help): p
Command (m for help): n
Partition type:
  p primary (1 primary, 0 extended, 3 free)
  e extended
Select (default p): p
Partition number (2-4, default 2): 2

First sector (16779264-33554431, default 16779264):
Using default value 16779264
Last sector, +sectors or +size{K,M,G} (16779264-33554431, default 33554431): +4G
Partition 2 of type Linux and of size 4 GiB is set

Command (m for help): p

```
  Device Boot      Start         End      Blocks   Id  System
/dev/sdb1            2048    16779263     8388608   83  Linux
/dev/sdb2        16779264    25167871     4194304   83  Linux
```

Command (m for help): w

[root@zmpt01 ~]# partprobe

[root@zmpt01 ~]# mount –a

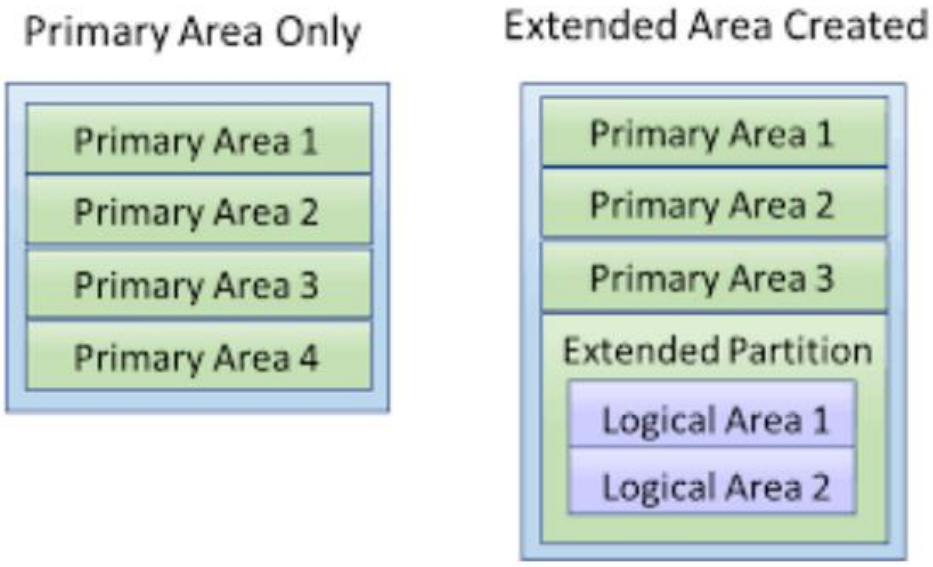
[root@zmpt01 ~]# df –h
/dev/sdb2 2.0G 582M 1.5G 29% /IBM

[root@zmpt01 ~]# xfs_growfs /dev/sdb2

[root@zmpt01 IBM]# df –h
/dev/sdb2 4.0G 582M 3.5G 15% /IBM

Patititon Inforamtion

- You can have maximum of four primary partitions on single disk
- If you want to create more than four partitions
- Then you need to create extended partion, then you can nest multiple partitions inside extended partition



Max Four Primary Partitions |

Create extended Partition - then create multiple logical parititions

SWAP

Swap is a space on a disk that is used when the amount of physical memory (RAM) is full. When a lunux system runs out of RAM, inactive pages are moved from RAM to **swap** space. **Swap** space can take the form of either a dedicated **swap** partition or a **swap** file.

- What is swap? Swap is standby memory
- It's a virtual memory used from hard drive
- Real memory is 1GB
- SWAP memory is 1.6 GB
- Total useable size is 2.6 GB
- If the real memory is full the swap is utilized
- OS will mvoe inactive processes to the swap memory
- Think of it as a safety net for Physical Memory.

```
[root@zmpt01 ~]# fdisk /dev/sdb

Command (m for help): p


   Device Boot      Start         End      Blocks   Id  System
```

```
/dev/sdb1         2048    16779263     8388608   83  Linux
/dev/sdb2     16779264    25167871     4194304   83  Linux

Command (m for help): m
Command (m for help): n
Partition type:
   p   primary (2 primary, 0 extended, 2 free)
   e   extended
Select (default p): p
Partition number (3,4, default 3): 3
First sector (25167872-33554431, default 25167872):
Using default value 25167872
Last sector, +sectors or +size{K,M,G} (25167872-33554431, default 33554431): +2G
Partition 3 of type Linux and of size 2 GiB is set

Command (m for help): m
Command (m for help): t
Partition number (1-3, default 3): 3
Hex code (type L to list all codes): 82
Changed type of partition 'Linux' to 'Linux swap / Solaris'

Command (m for help): p

Disk /dev/sdb: 17.2 GB, 17179869184 bytes, 33554432 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x5460be06

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1         2048    16779263     8388608   83  Linux
/dev/sdb2     16779264    25167871     4194304   83  Linux
/dev/sdb3     25167872    29362175     2097152   82  Linux swap / Solaris

Command (m for help): w

[root@zmpt01 ~]# partprobe

[root@zmpt01 ~]# mkswap /dev/sdb3   < ---creates the swap partition


[root@zmpt01 ~]# swapon /dev/sdb3  < ----make the swap useable

[root@zmpt01 ~]# vi /etc/fstab
```

```
/dev/sdb3 swap                swap    defaults       0 0

[root@zmpt01 ~]# free -h
              total        used        free      shared  buff/cache   available
Mem:           991M        284M        345M       1.6M        360M        549M
Swap:          3.6G        279M        3.3G
```

```
[root@zmpt01 ~]# swapoff /dev/sdb3

[root@zmpt01 ~]# free -h
              total        used        free      shared  buff/cache   available
Mem:           991M        283M        347M       1.6M        360M        550M
Swap:          1.6G        278M        1.3G

[root@zmpt01 ~]# free -h
              total        used        free      shared  buff/cache   available
Mem:           991M        283M        347M       1.6M        360M        550M
Swap:          1.6G        278M        1.3G

[root@zmpt01 ~]# vi /etc/fstab

[root@zmpt01 ~]# swapon –a

[root@zmpt01 ~]# free -h
              total        used        free      shared  buff/cache   available
Mem:           991M        284M        345M       1.6M        360M        549M
Swap:          3.6G        278M        3.3G
```