Disks, Partitions & Filesystems (Core)

Linux Commands Course · Section 14

Storage Concepts

- **Disk** → physical device (e.g., /dev/sda, /dev/nvme0n1)
- **Partition** → logical segment of a disk (e.g., /dev/sda1)
- **Filesystem** → structure that defines how data is stored (e.g., ext4, xfs, btrfs)

Linux uses a single unified directory tree — all disks and partitions get *mounted* somewhere under /.

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Listing Storage Devices — lsblk

List block devices (disks, partitions, LVM volumes).

```
lsblk -f
```

Example output:

```
NAME     FSTYPE LABEL  UUID                                  MOUNTPOINT
sda
├─sda1 ext4     root   21f0-4c3f                             /
├─sda2 swap     swap   a1b2c3d4-e5f6-7890-1122-334455667788 [SWAP]
```

- NAME → device name
- FSTYPE → filesystem type
- MOUNTPOINT → where it's mounted

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Display UUIDs and Filesystem Info — blkid

Show filesystem type and unique IDs.

```
sudo blkid
```

Example:

```
/dev/sda1: UUID="21f0-4c3f" TYPE="ext4" PARTLABEL="root"
/dev/sda2: UUID="a1b2c3d4" TYPE="swap"
```

UUIDs are used in /etc/fstab for stable device mounting.

Check Disk Usage — df -h

View mounted filesystems and their space usage.

```
df -h
```

Example:

```
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda1        50G   20G   28G  42% /
tmpfs           2.0G  2.0M  2.0G   1% /run
```

-h makes sizes human-readable.

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Directory Usage — du

Show how much space files and directories take.

```
du -sh *
```

- -s → summarize totals
- -h → human-readable sizes

Example output:

```
4.0K  Documents
1.2G  Downloads
400M  Pictures
```

Great for finding large folders.

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Mounting a Filesystem — mount

Mount a device (attach it to a directory).

```
sudo mount /dev/sdb1 /mnt
```

Verify with:

```
df -h | grep sdb1
```

Unmount when done:

```
sudo umount /mnt
```

Mount read-only:

```
sudo mount -o ro /dev/sdb1 /mnt
```

Persistent Mounts — /etc/fstab

/etc/fstab defines filesystems that auto-mount at boot.

View file:

```
cat /etc/fstab
```

Example entry:

```
UUID=21f0-4c3f  /data  ext4  defaults  0 2
```

Fields:

1. Device or UUID
2. Mount point
3. Filesystem type
4. Options (defaults, ro, noatime, etc.)
5. Dump (backup flag)
6. fsck order (1=root, 2=others)

Partitioning (Demo Only!) — fdisk and parted

Use **only with care** — modifying partitions can erase data!

List disks and partitions:

```
sudo fdisk -l
```

Interactive mode (dangerous!):

```
sudo fdisk /dev/sdb
```

For modern disks (>2TB) use parted:

```
sudo parted /dev/sdb
```

You can view, create, and delete partitions. Always unmount before modifying.

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Creating a Filesystem — mkfs

Format a partition with a filesystem.

Example (ext4):

```
sudo mkfs.ext4 /dev/sdb1
```

Other examples:

```
sudo mkfs.xfs /dev/sdb1
sudo mkfs.vfat /dev/sdb1
```

Check before formatting to avoid destroying data!

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Filesystem Check — fsck

Scans and repairs filesystem errors.

```
sudo fsck /dev/sdb1
```

Run only on **unmounted** filesystems.

You can auto-confirm fixes with -y:

```
sudo fsck -y /dev/sdb1
```

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Filesystem Tuning — tune2fs

View or modify filesystem parameters (ext filesystems).

```
sudo tune2fs -l /dev/sda1
```

Example adjustments:

```
sudo tune2fs -m 1 /dev/sda1    # reserve 1% space for root
sudo tune2fs -c 0 /dev/sda1    # disable auto-check by mount count
```

Resizing Filesystems — resize2fs

Resize an **ext** filesystem after adjusting partition size.

Shrink (offline only):

```
sudo resize2fs /dev/sdb1 20G
```

Expand to fill available space:

```
sudo resize2fs /dev/sdb1
```

Run after resizing partition with fdisk or parted.

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Swap Space — Virtual Memory

Linux uses **swap** as overflow for RAM.

Enable swap area:

```
sudo swapon /dev/sda2
```

Disable it:

```
sudo swapoff /dev/sda2
```

Show current swap usage:

```
swapon --show
```

Or view via `free -h`.

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Creating a Swap File (Alternative)

If no swap partition exists, create one as a file.

```
sudo fallocate -l 2G /swapfile
sudo chmod 600 /swapfile
sudo mkswap /swapfile
sudo swapon /swapfile
```

Make it permanent in /etc/fstab:

```
/swapfile none swap sw 0 0
```

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Recap

- Inventory: lsblk, blkid, df -h, du -sh *
- Mounting: mount, umount, /etc/fstab
- Partitioning (demo): fdisk, parted
- Filesystems: mkfs, fsck, tune2fs, resize2fs
- Swap: swapon, swapoff, /swapfile

These commands form the foundation of disk and storage management in Linux.

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