T2- Parsa Mirzaie(Mirzaie_parsa@protonmail.ch)

What is a "Sector" in fdisk?

In `fdisk`, a **sector** is the smallest chunk of storage on a disk.
Think of it like a brick in a wall — traditionally **512 bytes** each, but newer disks may use **4096 bytes** (Advanced Format).
The "Sectors" column tells you how many bricks (sectors) your partition uses.

Partitioning Tips for Different Server Types

Linux Desktop

- `/home`: Big and separate — for your personal files.
- `/`: Root of the system — where Linux lives.
- `swap`: 1–2× your RAM (less if you have a lot of RAM).
- Optional: `/var` or `/opt` if you log or install a lot.

Linux Server (Database / Web / Logging)

- `/var`: Make it big — logs and changing data go here.
- `/`: Root, small to medium.
- `swap`: Equal to or slightly more than RAM.
- Optional: `/data` or `/var/lib/mysql` for database files.
- `/home`: Minimal — admins only.

University Lab / Staging (Multi-user)

- `/home`: Large — every user needs space.
- `/`: Standard root.
- `/var`: Moderate — some logs expected.
- `swap`: Based on user count and memory usage.

How Does Linux Run More Apps Than RAM Allows?

It uses virtual memory techniques.

Process Scheduling

- Linux slices CPU time among processes.
- Each gets a turn (like time-sharing at a game console).

How Process Data Enters RAM

- Only needed parts are loaded — called demand paging.
- Linux watches and loads pages when accessed.

What if RAM Is Full?

- Least-used memory pages go to swap (on disk).
- The OS reclaims space for active processes.

Paging vs. Swapping

- **Paging**: Moves memory pages (small blocks) in/out.
- **Swapping**: Moves whole processes if needed.

Memory Management Techniques

- **Demand Paging**: Load pages only when needed.
- **Page Replacement**: Algorithms (like LRU) choose what to swap.

Do All Pages Load to Run?

- No. Only the ones currently in use are loaded.

What is the TLB?

The Translation Lookaside Buffer (TLB) is a fast-access cache in the CPU.

- It remembers recent virtual-to-physical address translations.
- If there's a TLB miss, the system must check the page table (slower).

Pages, Virtual Pages & Context Switching

- **Page**: A fixed-size memory block (usually 4KB).
- **Virtual Page**: A logical page in virtual memory.
- **Context Switch**: CPU switches from one process to another.

How Does Swap Affect Switching?

- Heavy swapping slows down context switches.
- More swap may help run more apps, but too much causes slowdowns.

Page Size Impact

- **Smaller pages**: Less waste but more overhead.
- **Larger pages**: Fewer TLB misses, but may waste memory.

What Are Huge Pages?

Huge pages are large memory pages (e.g., 2MB or 1GB each).

- They reduce TLB misses and boost performance.
- Often used for high-memory applications like databases and virtual machines.

What is Memory Fragmentation?

Memory fragmentation happens when free memory is scattered in small chunks.

Problems It Causes:

- Can't allocate large memory blocks even with free space.
- Increased page faults.
- Slower performance or even application crashes.
