1. Server Components Summary

- Motherboard: Main circuit board connecting all components (CPU, RAM, etc.).

- CPU: Executes instructions; performs computations.

- RAM: Temporary storage for active processes.

- Storage Drives: HDD (mechanical), SSD (flash), NVMe (high-speed SSD).

- RAID Controller: Manages disk arrays for redundancy/performance (e.g., HP Smart Array).

- PSU: Supplies power; redundant PSUs ensure uptime.

- NIC: Network interface for connectivity (embedded or PCIe-based).

- Cooling System: Fans/heat sinks to dissipate heat.

- PCIe Slots: For expansion cards (GPUs, NICs, etc.).

- Chassis: Enclosure (rack/tower/blade).

- BIOS/UEFI: Firmware for hardware initialization/boot.

- Backplane: Connects drives to controllers (hot-swappable in servers).

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2. IPMI and iLO

- IPMI: Open standard for remote server management (power control, monitoring).

- iLO: HP's proprietary IPMI-like tool with enhanced features.

- Function: Out-of-band management (independent of OS).

3. Relation to BIOS/UEFI

IPMI/iLO can access/modify BIOS/UEFI settings remotely (e.g., boot order).

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4. CPU Sockets

- Purpose: Physical interface to install processors.

- Servers: Often multiple sockets (2P/4P) for scalability.

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5. Pseudo File Systems in Linux

- Why Introduced: Adheres to Unix philosophy ("everything is a file"); provides virtual files to interact with kernel/hardware (e.g., /proc, /sys).

6. Pseudo vs. Normal FS

- Pseudo FS: Virtual (no disk storage); dynamic kernel data (e.g., /proc/cpuinfo).

- Normal FS: Stores actual files on disk (e.g., ext4, NTFS).

7. /sys/ Directory Info

Exposes kernel objects (devices, drivers, power settings). Example:

- /sys/block/: Block devices.

- /sys/power/: Power management controls.

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8. DMA (Direct Memory Access)

- What: Hardware feature to transfer data between devices/RAM without CPU.

- Use Case: High-speed I/O (e.g., disk/network operations).

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9. lsblk Internals

- Action: Queries kernel (via sysfs/udev) for block device info (disks, partitions).

- Similar Commands:

  - lsusb: USB devices (kernel's USB subsystem).

  - lspci: PCI devices (kernel's PCI subsystem).

  - lshw: Comprehensive hardware info (combines multiple sources).

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10. Simulate Shutdown via /sys

bash

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echo "poweroff" > /sys/power/state
```

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11. Kernel Types

Type	Pros	Cons
Monolithic	Fast (all in kernel space)	Less secure/modular (e.g., Linux).
Microkernel	Secure (services in user space)	Slower (IPC overhead; e.g., QNX).
Hybrid	Balance (e.g., Windows, macOS).	Complex design.

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12. MBR in First Sector

- Why: Standardized location for bootloaders; BIOS knows to check sector 0.

13. MBR and Bootloader

- MBR Structure: 512 bytes (boot code + partition table).

- Process: MBR's boot code loads the next stage (e.g., GRUB) from the active partition.

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14. .efi Files

- What: Executables for UEFI firmware (e.g., grubx64.efi).

- Role: Replace legacy bootloaders; loaded by UEFI from ESP.

15. ESP (EFI System Partition)

- What: FAT32 partition storing .efi files.

- Usage: UEFI firmware reads ESP to load OS bootloaders.

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16. GRUB Configuration (grub.conf)

- Breakdown:

  - menuentry: Boot entry for Ubuntu.

  - insmod: Loads modules (e.g., ext2, part_gpt).

  - set root: Specifies boot partition (hd0,gpt2).

  - search: Locates partition by UUID.

  - linux: Loads kernel with parameters (e.g., root=/dev/mapper/vg0-root).

- initrd: Loads initial RAM disk.