

Devices, Abstractions Provided, OS Structure

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Hardware/Software Hierarchy

Applications
UI/Windowing/Shell/GUI
Operating System/System Calls
Hardware abstraction layer (HAL)
Hardware

Abstractions (1 of 2)

- Operating System provides an extended abstraction above the hardware
 - System calls
 - Convenient interface to Input/Output devices
 - Protection/Security
 - Virtual memory
 - Consistent interface even with different hardware
 - Multitasking/Processes
 - Threads
 - Network access
 - Network may be transparent to programmer

Abstractions (2 of 2)

- Client Server Model
- Virtual Machine
 - Hypervisor

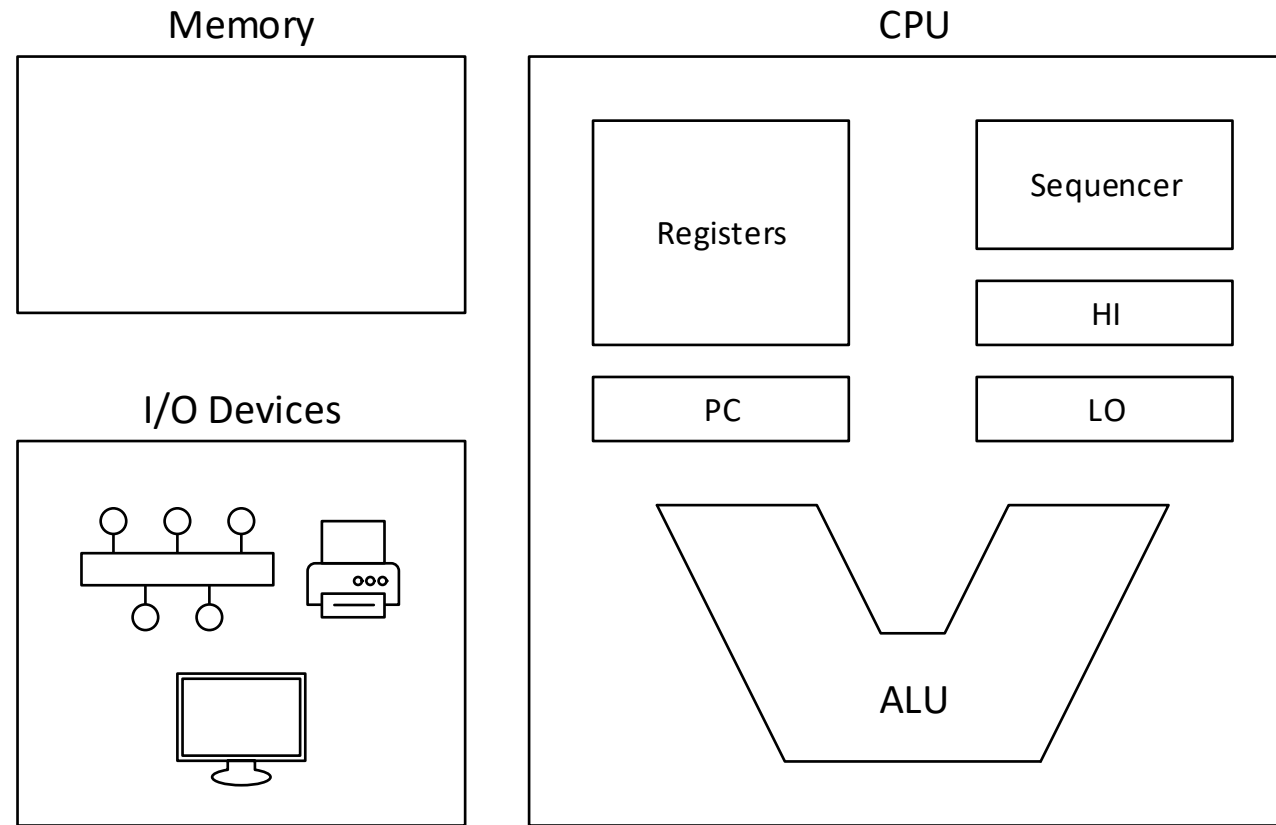
History of Operating Systems

- Single user
- Batch
- Multiprogramming with RJE, RJO
- Timesharing option (TSO)
- CTSS, Multics, Unix
- PC's

Computer Hardware Components (1 of 2)

- Processor (CPU – Central Processing Unit)
 - Arithmetic/Logic Unit (ALU)
 - Datapath
 - Sequencer
 - Program Counter
 - Stack Pointer
 - PSW (Processor Status Word)
 - General Purpose Registers
 - Registers can be accessed at instruction execution speed
 - Above is replicated in Multiple Cores
- Memory
 - Access to memory is slower than access to registers
 - User's data and code reside in memory
 - RAM (Random Access Memory)
 - Cache
 - ROM (Read Only Memory), Flash, EEPROM (Electrically Erasable Programmable ROM)

Simplified Block Diagram of Computer Hardware



Computer Hardware Components (2 of 2)

- Disk Storage
 - Magnetic
 - SSD (Solid State Drives) – usually built from FLASH
- Magnetic tape
- Auxiliary Processors
 - GPU (Graphics Processing Unit)
- I/O (Input/Output) Devices

I/O Devices

- Display/Video
- Keyboard
- Pointing Devices
 - Mouse
 - Touchpad
 - Trackball
- Printer
- Scanner
- External Disks
- Serial ports
- Memory Card Readers
- Lots more...

- Networks

Networks

- PCIe (PCI Express)
- PCI (Peripheral Component Interconnect)
 - Replacement for the older ISA (Industry Standard Architecture) bus
- USB (Universal Serial Bus)
- SATA (Serial ATA) Interface
 - Replacement for the older PATA – Parallel ATA – Interface
- DMI (Direct Media Interface)
- Ethernet, IEEE 802.3 (LAN) – Copper Coax Thicknet (10BASE5), Copper Coax Thinnet (10BASE2), Copper Twisted Pair (10BASE-T, 100BASE-TX, etc.), Fiber Optic Cable (10BASE-F, etc.)
- Bluetooth
- IEEE 802.15.4 (Zigbee) (PAN)
- WiFi, IEEE 802.11 – a, b, g, n, ac, etc.
- Firewire (IEEE 1394)

OS Concepts

- Processes
- Address Spaces
- Files
- I/O Capability
 - Allow unprivileged users to access I/O devices in an organized manner
- Protection
- Shell
- System Calls

Memory Partitioning

