Pre-Ph.D. Course Work
Paper-1: Research Methodologies
Unit-3
Topic: Operating System basics

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OUTLINE

- What is Operating system?
- Computer system structure
- Computer system organisation
- Computer storage structure
- Computer system architecture
- Operating system structure
- Open source operating system

What is Operating system?

- ❖Operating System (OS) manages all resources and decides between conflicting requests for efficient and fair resource use.
- ❖OS Controls execution of programs to prevent errors and improper use of the computer.
- ❖OS execute user programs and make problem solving easier.
- ❖ OS make the computer system convenient to use.
- ❖OS use the computer hardware in an efficient manner.

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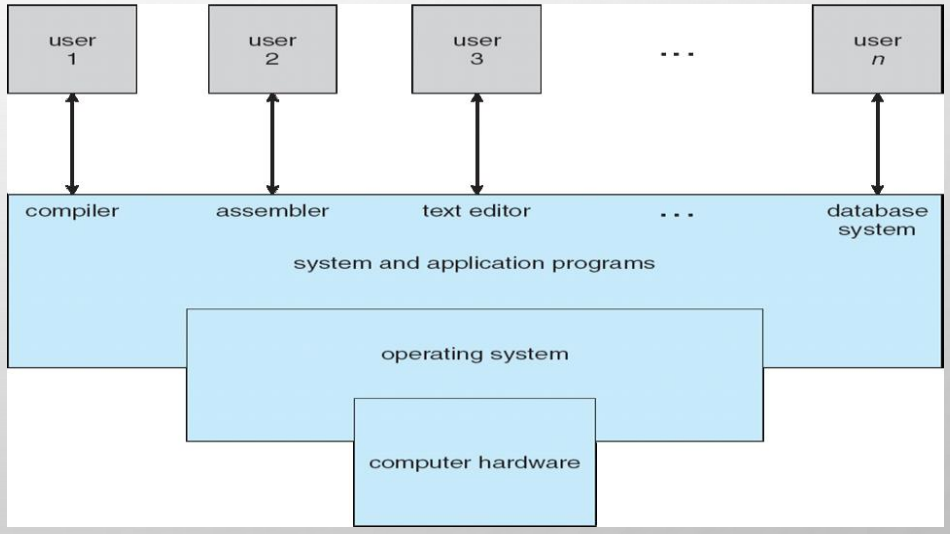
2. Operating System Concepts, Ninth Edition, By Avi Silberschatz, Peter Baer Galvin and Greg Gagne

Computer system structure

- Computer system can be divided into four components:
  - Hardware – provides basic computing resources
    - CPU, memory, I/O devices
  - Operating system
    - Controls and coordinates use of hardware among various applications and users
  - Application programs – define the ways in which the system resources are used to solve the computing problems of the users
    - Word processors, compilers, web browsers, database systems, video games
  - Users
    - People, machines, other computers



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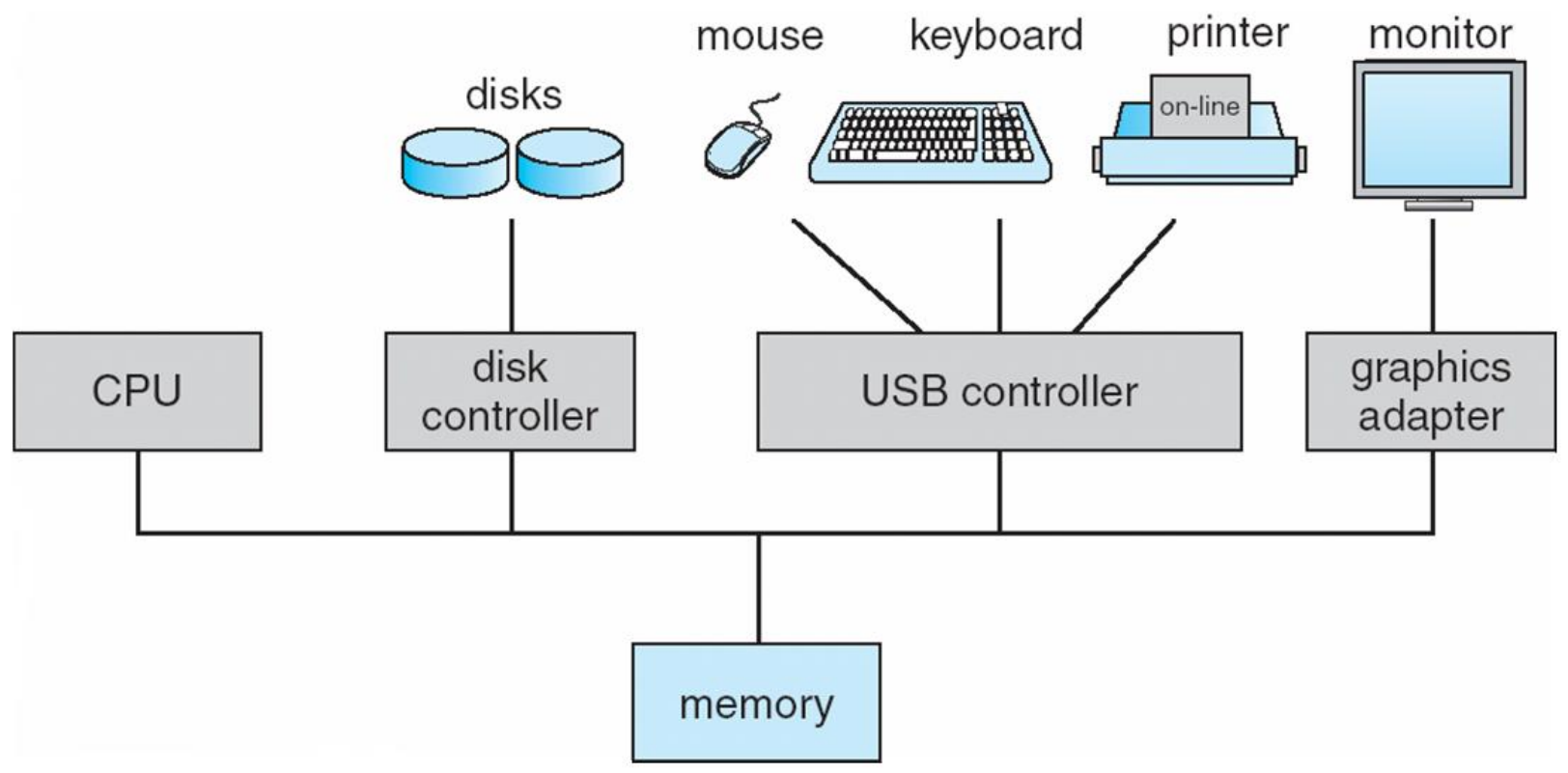
Computer system organisation



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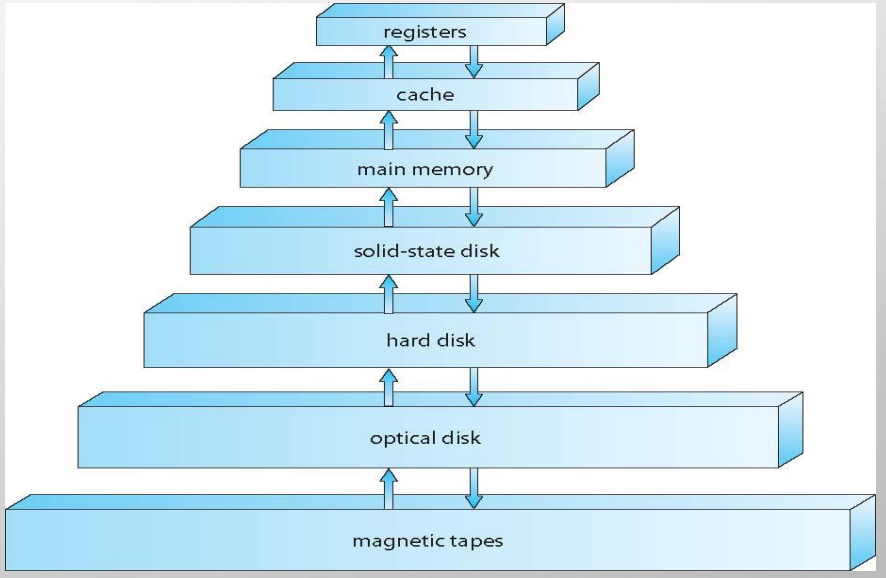
Computer storage structure

- Main memory – only large storage media that the CPU can access directly
  - **Random access**
  - Typically **volatile**
- Secondary storage – extension of main memory that provides large **nonvolatile** storage capacity
- Hard disks – rigid metal or glass platters covered with magnetic recording material
  - Disk surface is logically divided into **tracks**, which are subdivided into **sectors**
  - The **disk controller** determines the logical interaction between the device and the computer
- **Solid-state disks** – faster than hard disks, nonvolatile
  - Various technologies
  - Becoming more popular



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Storage definitions

- The basic unit of computer storage is the **bit**.
  - A bit can contain one of two values, 0 and 1. All other storage in a computer is based on collections of bits.
- A **byte** is 8 bits, and on most computers it is the smallest convenient chunk of storage.
- A less common term is **word**, which is a given computer architecture's native unit of data. A word is made up of one or more bytes.
  - For example, a computer that has 64-bit registers and 64-bit memory addressing typically has 64-bit (8-byte) words. A computer executes many operations in its native word size rather than a byte at a time.

- Computer storage, is generally measured and manipulated in bytes and collections of bytes.
  - A **kilobyte**, or **KB**, is 1,024 bytes
  - A **megabyte**, or **MB**, is $1{,}024^2$ bytes
  - A **gigabyte**, or **GB**, is $1{,}024^3$ bytes
  - A **terabyte**, or **TB**, is $1{,}024^4$ bytes
  - A **petabyte**, or **PB**, is $1{,}024^5$ bytes
- Computer manufacturers often round off these numbers and say that a megabyte is 1 million bytes and a gigabyte is 1 billion bytes

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Computer system architecture

- Most systems use a single general-purpose processor
  - Most systems have special-purpose processors as well
- **Multiprocessors** systems growing in use and importance
  - Also known as **parallel systems**
  - Advantages include:
    - **Increased throughput**
    - **Economy of scale**
    - **Increased reliability** – graceful degradation or fault tolerance
  - Two types:
    - **Asymmetric Multiprocessing** – each processor is assigned a specie task.
    - **Symmetric Multiprocessing** – each processor performs all tasks

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Operating system structure

- **Multiprogramming** (**Batch system**) needed for efficiency
  - Single user cannot keep CPU and I/O devices busy at all times
  - Multiprogramming organizes jobs (code and data) so CPU always has one to execute
  - A subset of total jobs in system is kept in memory
  - One job selected and run via **job scheduling**
  - When it has to wait (for I/O for example), OS switches to another job
- **Timesharing** (**multitasking**) is logical extension in which CPU switches jobs so frequently that users can interact with each job while it is running, creating **interactive** computing
  - **Response time** should be < 1 second
  - Each user has at least one program executing in memory ⇨**process**
  - If several jobs ready to run at the same time ⇨ **CPU scheduling**
  - If processes don't fit in memory, **swapping** moves them in and out to run
  - **Virtual memory** allows execution of processes not completely in memory

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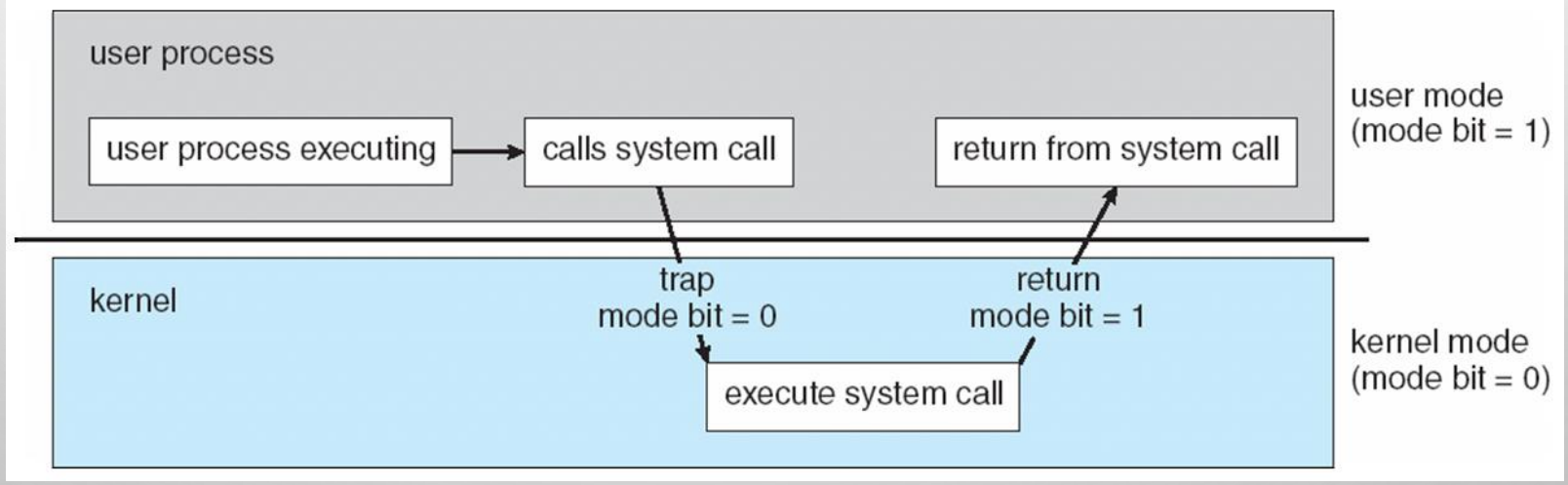
Cont….

- **Dual-mode** operation allows OS to protect itself and other system components
  - **User mode** and **kernel mode**
  - **Mode bit** provided by hardware
    - Provides ability to distinguish when system is running user code or kernel code
    - Some instructions designated as **privileged**, only executable in kernel mode
    - System call changes mode to kernel, return from call resets it to user
- Increasingly CPUs support multi-mode operations
  - i.e. **virtual machine manager** (**VMM**) mode for guest **VMs**



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Open source operating system

- Operating systems made available in source-code format rather than just binary **closed-source**
- Counter to the **copy protection** and **Digital Rights Management (DRM)** movement
- Started by **Free Software Foundation (FSF)**, which has "copyleft" **GNU Public License (GPL)**
- Examples include **GNU/Linux** and **BSD UNIX** (including core of **Mac OS X**), and many more
- Can use VMM like VMware Player (Free on Windows), Virtualbox (open source and free on many platforms - http://www.virtualbox.com)
  - Use to run guest operating systems for exploration

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