BCS6B13: **Fundamentals of Operating Systems**
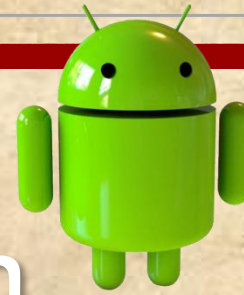
Module 1

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Computer…..

- **Hardware** **(can touch and feel)**

- **Software**

  - System Software (Operating System, compilers…..)

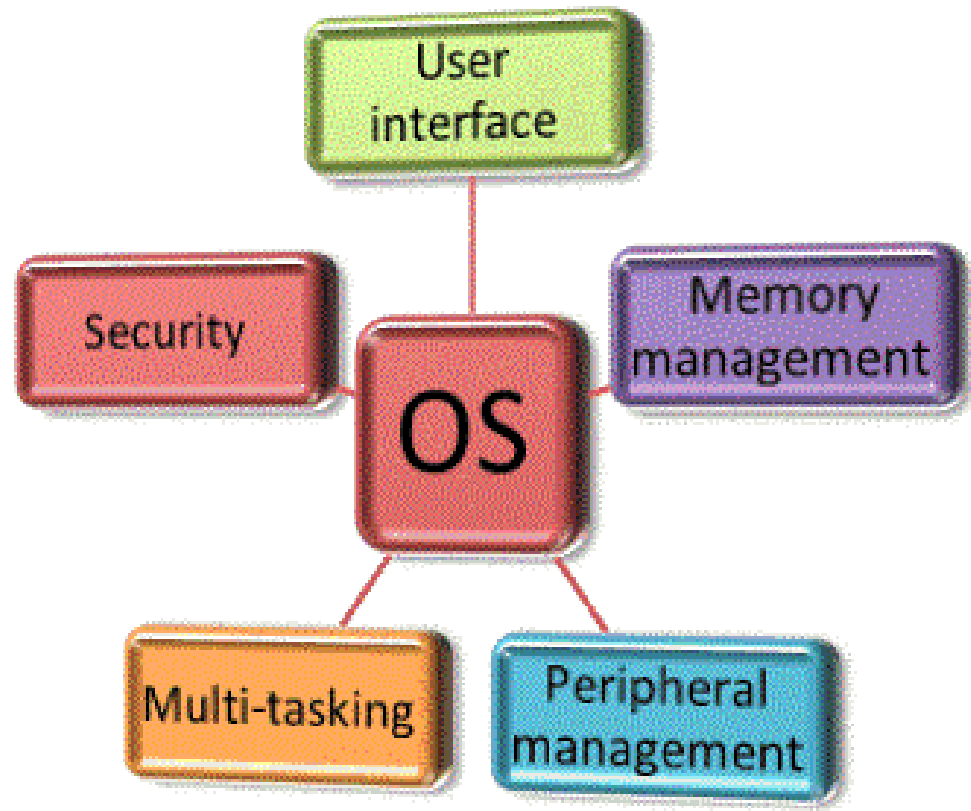 - Application Software (spread sheet, word processors….)
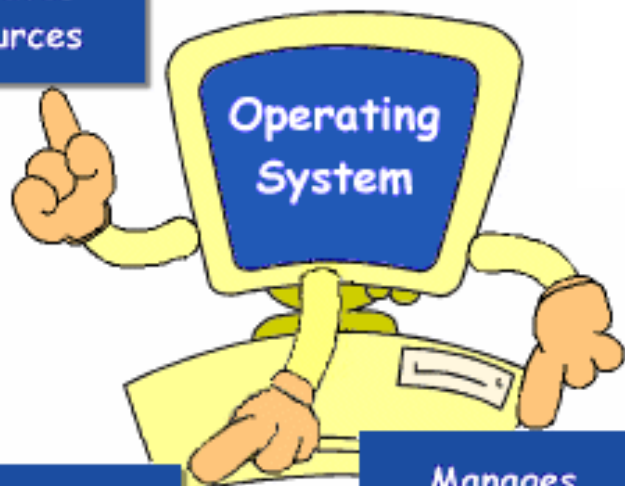
- Closed source ?

- Open source ?

- Free software ?

Android – Mobile OS

Operating System

- A program that controls the execution of application programs

- Program that is running all times on the computer

- An interface between applications and hardware

- It manages computer hardware and controls and coordinates the use of hardware among various application programs.
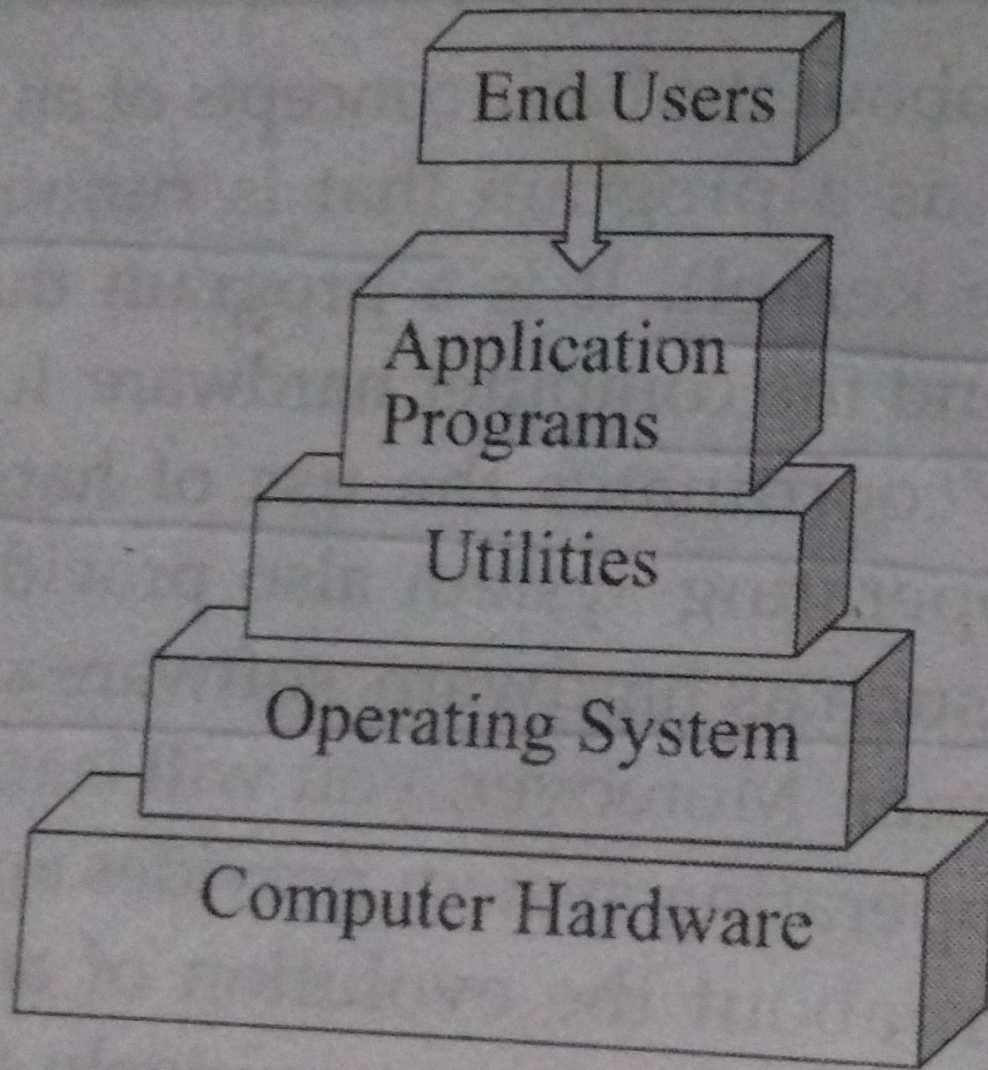
Fig. 1.1 Components of a Computer System

View Points

- **USERS VIEW**

  - OS designed for Ease of use.

  - OS designed for System performance.

  - Network environment: Resource Utilisation

  - Hand held System : Individual usability.

  - Embedded system: OS for run without user intervention.

View Points

- **SYSTEM VIEW**

  - OS as Resource Allocator

  - OS as Control Program

Operating System: Objectives

■ The ultimate goal of an easy to use and human friendly operating system is to transform the computer into a useful, user friendly, acceptable and affordable machine to all users. This is achieved through the following objectives:

Main objectives of an OS:

- Convenience
- Efficiency
- Ability to evolve

Convenience or ease of use

- Hide the peculiarity of the hardware through Abstraction

  - Role of Device drivers.

- Built in functionalities of an OS

  - Interrupt, System Call, Library function

Efficient Allocation and Utilization of Resources

- Resource manager

- Improve system through put

  - Number of Job executed per unit time

Ability to Evolve

- New and improved services.

- Must include provisions for easy introduction of new services and removing, improving and replacing existing services.

- Must provide interfacing facilities to connect , communicate with new types of hardware devices and upgrade versions of the existing hardware devices.

Functions of an OS

- Processor Management(scheduling algo)

- RAM management (virtual memory)

- Input / Output Management(through drivers)

- Managing the implementation of Applications.

- Authorizations Management.

- File Management.

- Information Management

Evolution of Operating Systems

TYPES OF OPERATING SYSTEMS

- Early system/ serial Processing

- Batch Processing system

- Multiprogramming system

- Time shared system

- Single user system

- Multitasking system

- Parallel system

- Distributed system

- Real time system

Early systems / serial Processing

- Mid 1940 / machines with toggle keys

- No OS/ No Programming Language/only machine coding

- Only programmers use the system.

- 1950 – Punch cards

- Magnetic tape memory - High level language

- Have to manually reserve the system\

- Costly and time consuming

Batch Processing System

- Mid 1950

- Executing programs of different users without user intervention.

- The system was called first rudimentary OS/resident monitor

- Job control Language(JCL)

- Privileged/non privileged mode

- CPU utilization less

- Swapping to improve response time.

- SPOOLing – Simultaneous Peripheral Operation Online

    - High speed disk is placed between a running program and a low speed device

Multiprogramming system

- Jobs – alternate cycles of I/O bound and CPU bound

- Separate processors – I/O Processor and main Processor.

- Takes one process – if I/O bound the main processor takes other processes and vice versa

- Main CPU waits for completion of I/O only when no other jobs to be executed in the system

- Loading of more than one program in memory.

Time shared system

- Interactive time shared multiprogramming technique.

- Separate terminal keyboard and monitor.

- For many users time is shared.

- Resource utilization is high

- Overheads – unproductive computations due to job switching

Single user system

- Computer where only one user can work at a time

- Eg: Intel processor based windows OS personal computer.

- Single keyboard, mouse and monitor.

- A user can concurrently execute many task.

- Major design issue is response time.

- Windows 95, NT,2000 vista are single user OS

Multitasking system

- Multitasking is concerned with a single user executing more than one program simultaneously.

- The OS executes each task for a small time slice in a round robin fashion so that user cannot distinguish the switching of CPU among different applications.

Multitasking system

The advantages of this system are as follows:

(i) The ability of multitasking system that permits the user to run more than one task simultaneously, leads to increased productivity.

(ii) Improves the system resource utilization, throughput and overall efficiency of the system.

The disadvantages are as follows:

(i) Increased overhead processing time.

(ii) Needs more resources like memory, CPU time and I/O devices for achieving user satisfaction.

Parallel System

- Increase in clock speed increases the throughput of a system.

- We have reached the upper limits of the clock speed.

- For further increase in processing speed parallel systems with multiple CPUs are developed.

- There are **two classes of Parallel Processing System**.

  - Tightly coupled bus based shared memory multiprocessor system

  - Loosely coupled distributed memory multiprocessor system

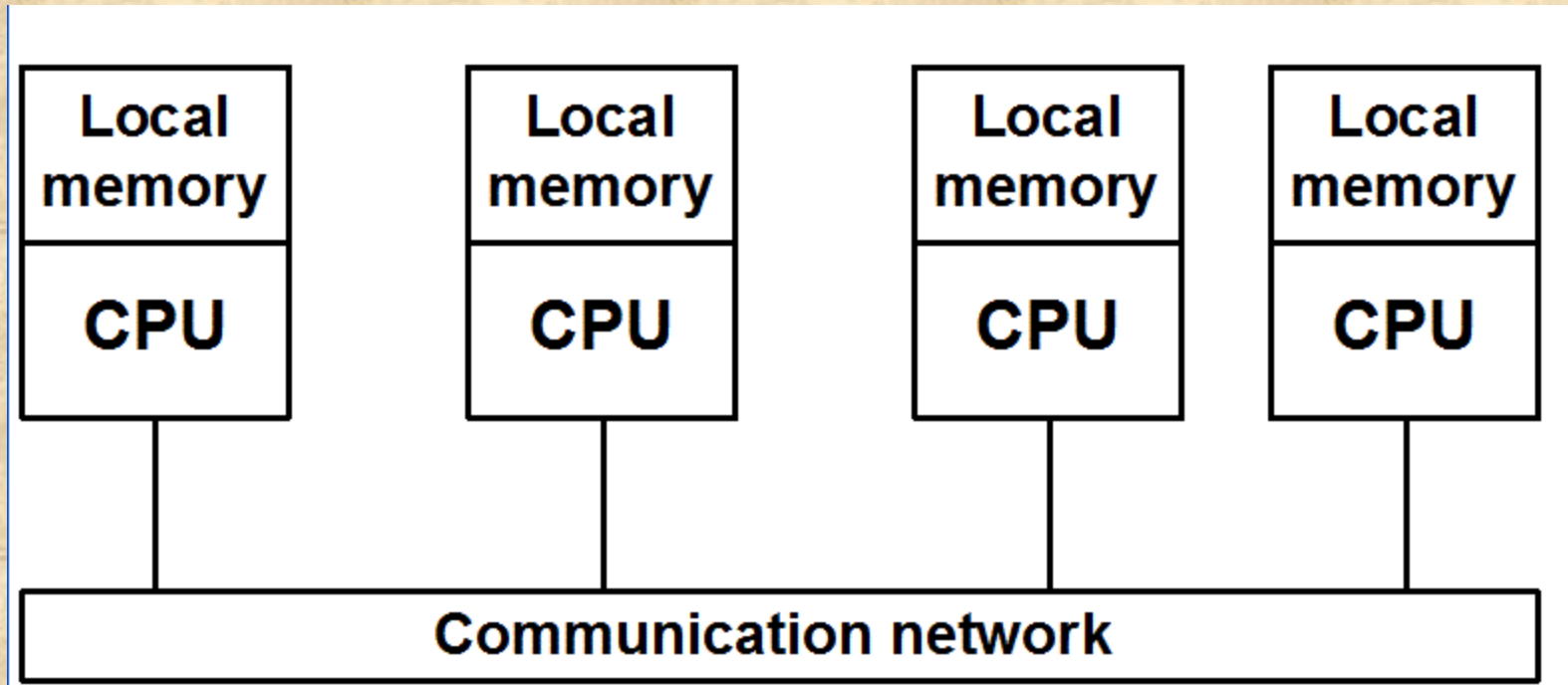# Parallel System

Tightly coupled- Shared Memory Multiprocessor System
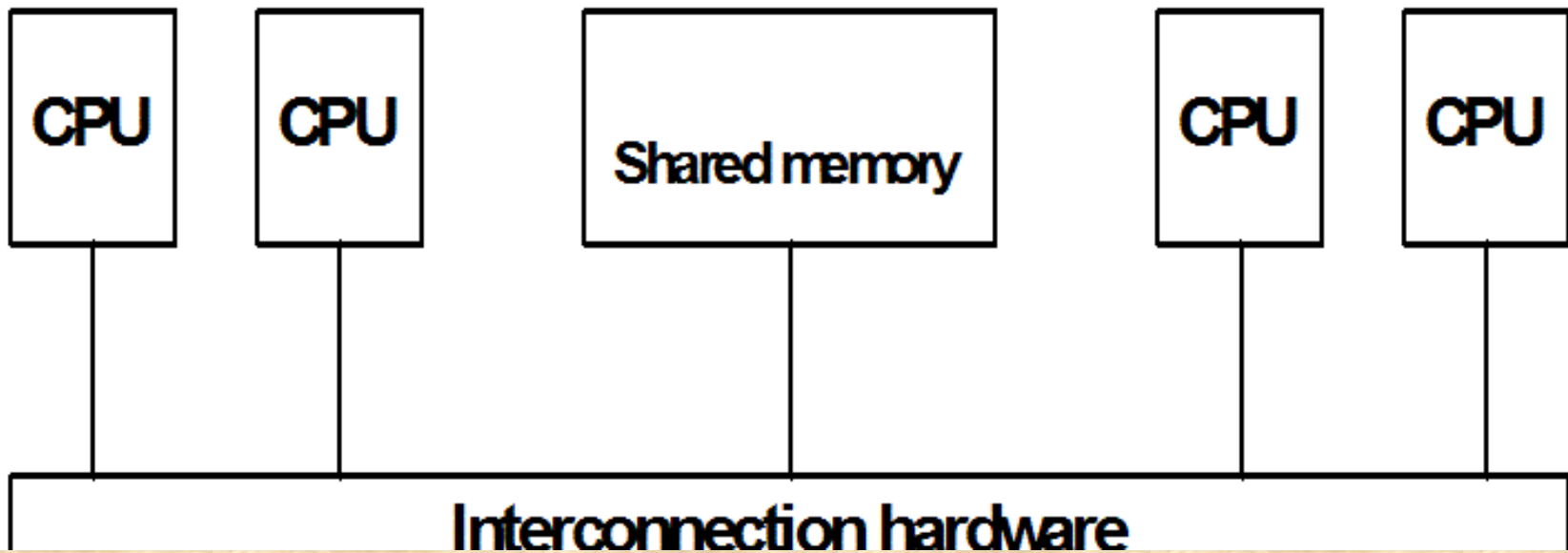
Parallel System

Loosely coupled- Distributed memory multiprocessor system

Distributed System

- Large number of Computers connected by high speed network.

- Computers are independent , but appears to be a single unit.

- Users can work from any independent computer.

- The application can run on any of the member computers in the system depending on the availability and workload.

- Load balancing….single file system, Eg: ATM

- Advantages: data sharing, device sharing, communication, even workload distribution.

- Disadvantages: delayed communication and security

Real Time system

- It is the one which responds to real time events or inputs within a specified time limit.

- Eg: satellite control system, robots, air traffic etc….

- A real time system must work with a guaranteed response time depending on the task, otherwise the application must fail.

- Two types

- Hard real time: must meet deadline to avoid damage

- Soft real time: have deadline but failures don't make great loss

Real Time systems

- **Hard real time systems**
  - Aircraft
  - Airport landing services
  - Nuclear Power Stations
  - Chemical Plants
  - Life support systems

- **Soft real time systems**
  - Mutlimedia
  - Interactive video games