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FACULTY OF ENGINEERING & TECHNOLOGY

BCS-501 Operating System

Lecturer-01

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Introduction

- Operating system
- Component
- Computer-System Architecture
- Operating-System Structure
- Simple Batch Systems
- Multiprogramming Batched Systems
- Time-Sharing Systems
- Distributed Systems
- Real -Time Systems
- Storage Management
- Computing Environments

OPERATING SYSTEM

- A program that perform as an interface between a computer hardware and user of a computer. An operating system is
- A software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.
- Main goals of Operating system :-

- ❑ Execute user programs and make solving user problems easier.
- ❑ Make the computer system helpful to utilize.
- ❑ Utilize the computer hardware in an efficient manner.

COMPONENTS

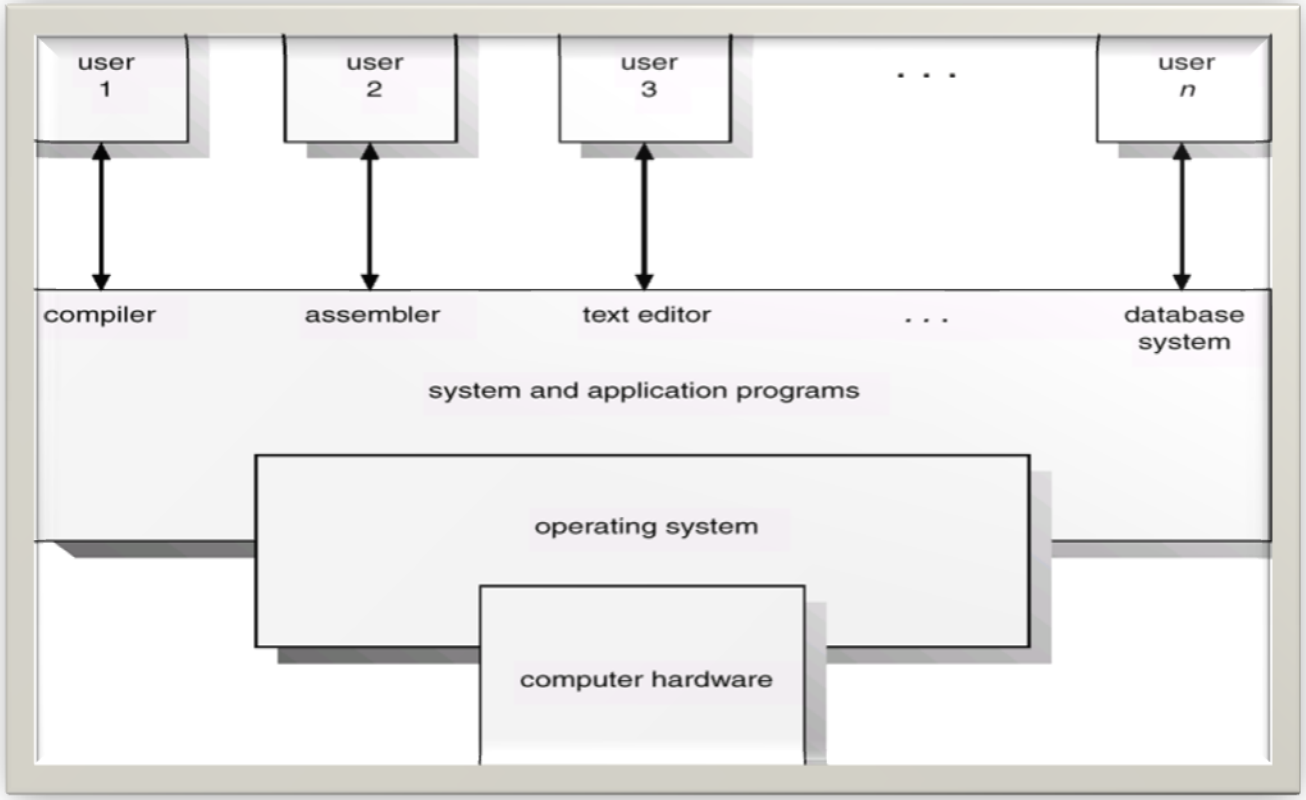
Computer system can be divided into four components:

- ❖Hardware –It will provides basic computing resources.
  CPU, memory, I/O devices

- ❖Operating system
  It will manage the controls and coordinates use of hardware among various applications for users.

- ❖Application programs – that is to define in which the resources are used to solve the computing problems of the users
  Example :-Word processors, compilers, web browsers, database systems, video games

- ❖Users
  People, machines, other computers


user 1
user 2
user 3
. . .
user n
compiler
assembler
text editor
. . .
database system
system and application programs
operating system
computer hardware

Resource allocator –
OS is a resource allocator.
It will manages all resources and take the decision of allocates request of resources.

Control program –
OS is a control program.
It will controls the execution of user programs and operations of I/O devices .It is als helpful for finding out errors and im proper use of computer.
No all around acknowledged definition “Everything a vendor ships when you request an operating system” is ais a decen t estimation But varies wildly“The one program running consistently on the computer” is the kernel. Everything else is ei ther a framework program (ships with the operating system) , or an application program.

Kernel –
It is part of operating system ,kernel is one program running at all times (all else being application programs).
bootstrap program is loaded at power-up or reboot

- Typically stored in ROM or EPROM, generally known as firmware
- Initializes all aspects of system
- Loads operating system kernel and starts execution

Computer-System Architecture

•Most systems use a single general-purpose processor

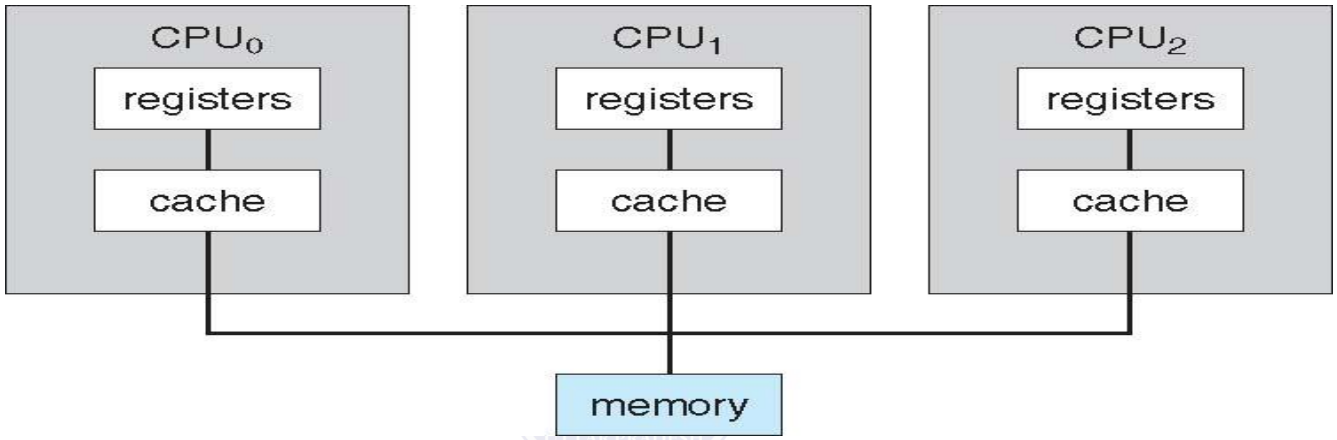
- ➢Most systems have special-purpose processors as well

•Multiprocessors systems growing in use and importance

- ➢ Also known as parallel systems, tightly-coupled systems
- ❖ Advantages include:
  1. Increased throughput
  2. Economy of scale
  3. Increased reliability – graceful degradation or fault tolerance

Two types :

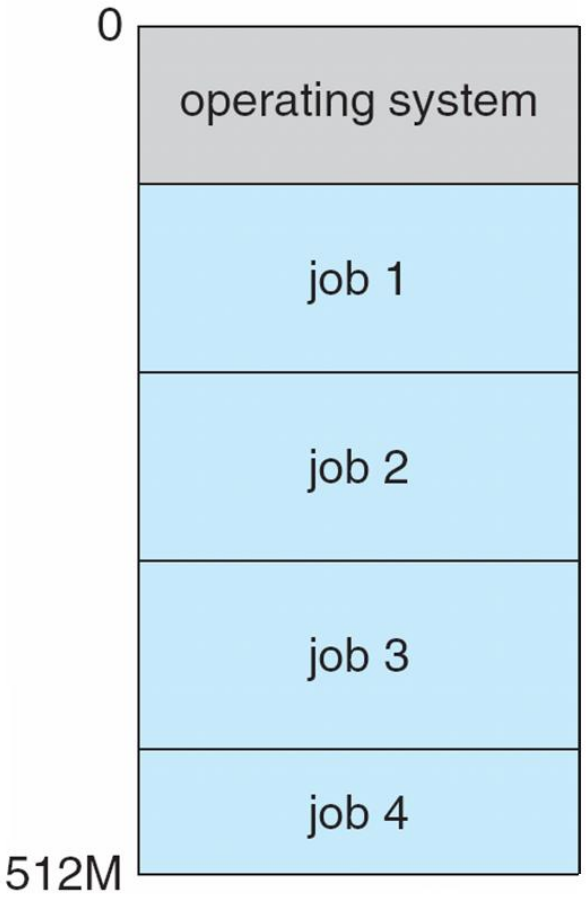
1. Asymmetric Multiprocessing – each processor is assigned a specie task.
2. Symmetric Multiprocessing – each processor performs all tasks



- Multi-chip and multicore
- Systems containing all chips
  - Chassis containing multiple separate systems

Operating-System Structure

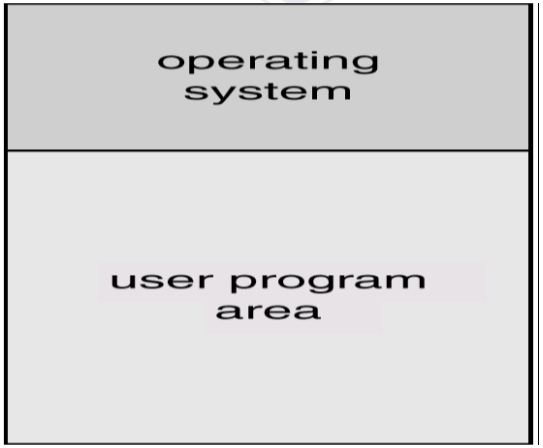
- Multiprogramming (Batch system) needed for efficiency
  - Single user cannot keep CPU and I/O devices busy at all times
  - Multiprogramming organizes jobs (code and data) so CPU always has one to execute
  - A subset of total jobs in system is kept in memory
  - One job selected and run via job scheduling
  - 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.
  - Interrupt driven (hardware and software)
    - Hardware interrupt by one of the devices
    - Software interrupt (exception or trap):
      - Software error (e.g., division by zero)
      - Request for operating system service
      - Other process problems include infinite loop, processes modifying each other or the operating system


0
operating system
job 1
job 2
job 3
job 4
512M

Simple Batch Systems

- Hire an operator
- User ≠ operator
- Add a card reader
- Reduce setup time by batching similar jobs
- Automatic job sequencing – automatically transfers control from one job to another. First rudimentary operating system.
- Resident monitor
  - initial control in monitor
  - control transfers to job
  - when job completes control transfers back to monitor

•Memory Layout for a Simple Batch System



Control Cards

Problems
1.How does the monitor know about the nature of the job (e.g., Fortran versus Assembly) or which program to execute2.How does the monitor distinguish
(a) job from job?
(b) data from program?
Solution
Introduce control cards
- Special cards that tell the resident monitor which programs to run

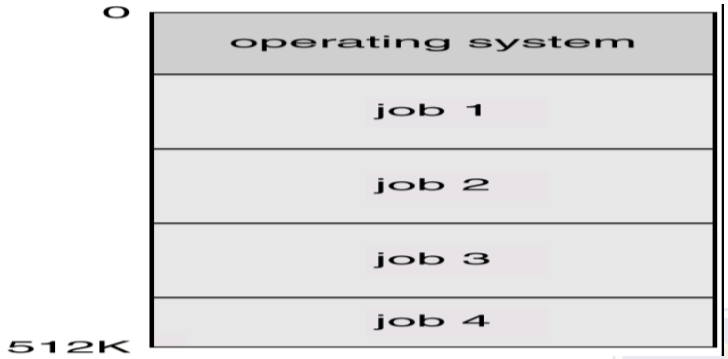
$JOB
$FTN
$RUN
$DATA
$END

- Special characters distinguish control cards from data or program cards:

$ in column 1
// in column 1 and 2

- Parts of resident monitor
  - Control card interpreter – responsible for reading and carrying out instructions on the cards.
  - Loader – loads systems programs and applications programs into memory.
  - Device drivers – know special characteristics and properties for each of the system's I/O devices.
- Problem: Slow Performance – I/O and CPU could not overlap ; card reader very slow.
- Solution: Off-line operation – speed up computation by loading jobs into memory from tapes and card readin g and line printing done off-line.

Multiprogramming Batched Systems



Several jobs are kept in main memory at the same time,and the CPU is multiplexed among them.

I/O routine supplied by the system.
Memory management – the system must allocate the memory to several jobs.
CPU scheduling – the system must choose among several jobs ready to run.
Allocation of devices.

Time-Sharing Systems

- The CPU is multiplexed among several jobs that are kept in memory and on disk (the CPU is allocated to a job only if the job is in memory).
- A job is swapped in and out of memory to the disk.
- On-line communication between the user and the system is provided; when the operating system finishes the ex ecution of one command, it seeks the next “control statement” not from a card reader, but rather from the user’s keyboard.
- On-line system or time sharing system must be available for users to access data and code.

Distributed Systems

- Distribute the computation among several physical processors.
- Loosely coupled system – each processor has its own local memory; processors communicate with one an other through various communications lines, such as high-speed buses or telephone lines.
- Advantages of distributed systems.
  - Resources Sharing
  - Computation speed up – load sharing
  - Reliability
  - Communications

- Requires networking infrastructure
- Local area networks (LAN) or Wide area networks (WAN)
- May be either client-server or peer-to-peer systems

- Network Operating System
  provides file sharing
  provides communication scheme
  runs independently from other computers on the network

Distributed Operating System
  less autonomy between computers
  gives the impression there is a single operating system controlling the network.

Real -Time Systems

•Often used as a control device in a dedicated application such as controlling scientific experiments, medical imaging systems, industrial control systems, and some display systems.

•Well-defined fixed-time constraints

•Real-Time systems may be either *hard* or *soft* real-time

Hard real-time:

- ➢Secondary storage limited or absent, data stored in short term memory, or read-only memory (ROM)
- ➢Conflicts with time-sharing systems, not supported by general-purpose operating systems.

Soft real-time

- ➢Limited utility in industrial control of robotics
- ➢Integrate-able with time-share systems
- ➢Useful in applications (multimedia, virtual reality) requiring tight response times.

Storage Management

- OS provides uniform, logical view of information storage
  - Abstracts physical properties to logical storage unit - file
  - Each medium is controlled by device (i.e., disk drive, tape drive)
    - Varying properties include access speed, capacity, data-transfer rate, access method (sequential or rand om)

- File-System management
  - Files usually organized into directories
  - Access control on most systems to determine who can access what
  - OS activities include
    - Creating and deleting files and directories
    - Primitives to manipulate files and directories
    - Mapping files onto secondary storage
    - Backup files onto stable (non-volatile) storage media
- Usually disks used to store data that does not fit in main memory or data that must be kept for a “long” period of time
- Proper management is of central importance
- Entire speed of computer operation hinges on disk subsystem and its algorithms
- OS activities
  - Free-space management
  - Storage allocation
  - Disk scheduling
- Some storage need not be fast
  - Tertiary storage includes optical storage, magnetic tape
  - Still must be managed – by OS or applications
  - Varies between WORM (write-once, read-many-times) and RW (read-write)

Computing Environments

- Stand-alone general purpose machines
- But blurred as most systems interconnect with others (i.e., the Internet)
- Portals provide web access to internal systems
- Network computers (thin clients) are like Web terminals
- Mobile computers interconnect via wireless networks
- Networking becoming ubiquitous – even home systems use firewalls to protect homecomputers from Internet attacks
- Handheld smartphones, tablets, etc
- What is the functional difference between them and a “traditional” laptop?
- Extra feature – more OS features (GPS, gyroscope)
- Allows new types of apps like *augmented reality*
- Use IEEE 802.11 wireless, or cellular data networks for connectivity
- Leaders are Apple iOS and Google Android
- Distributed computiing-----
    - Collection of separate, possibly heterogeneous, systems networked together
        - Network is a communications path, TCP/IP most common
            - Local Area Network (LAN)
            - Wide Area Network (WAN)
            - Metropolitan Area Network (MAN)
            - Personal Area Network (PAN)
    - Network Operating System provides features between systems across network
        - Communication scheme allows systems to exchange messages
        - Illusion of a single system

Continue….

- Traditional computing
  - PCs, Servers, limited remote access
- Web-Based Computing
  - Client-server and web services, convenient remote access, location-less servers
- Embedded Computing
  - Most computers (auto engine controllers, microwaves)
  - Very limited operating system features
  - Little or no user interface, remote access

MCQ

What is operating system?
A. collection of programs that manages hardware resources
B. system service provider to the application programs
C. link to interface the hardware and application programs
D. all of the mentioned

To access the services of operating system, the interface is provided by the:
A. system calls
B. API
C. library
D. assembly instructions

The main function of the command interpreter is:
A. to get and execute the next user-specified command
B. to provide the interface between the API and application program
C. to handle the files in operating system
D. none of the mention

For real time operating systems, interrupt latency should be _____
A) Minimal
B) Maximum
C) Zero
D) Dependent On The Scheduling

Which One of the following is not a real time operating system?
A. VxWorks
B. Windows CE
C. RTLinux
D. Palm OS