# CIS 21012 – Platform Technologies

Lesson 01

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# Operating Systems - Introduction

- What is an operating system?


- Evolution of OSs
  - Simple Batch Systems
  - Multiprogramming Batched Systems
  - Time-Sharing Systems


- Different Computer Systems
  - Personal-Computer Systems
  - Parallel Systems
  - Distributed Systems
  - Real -Time Systems

# Abstract View of System Components
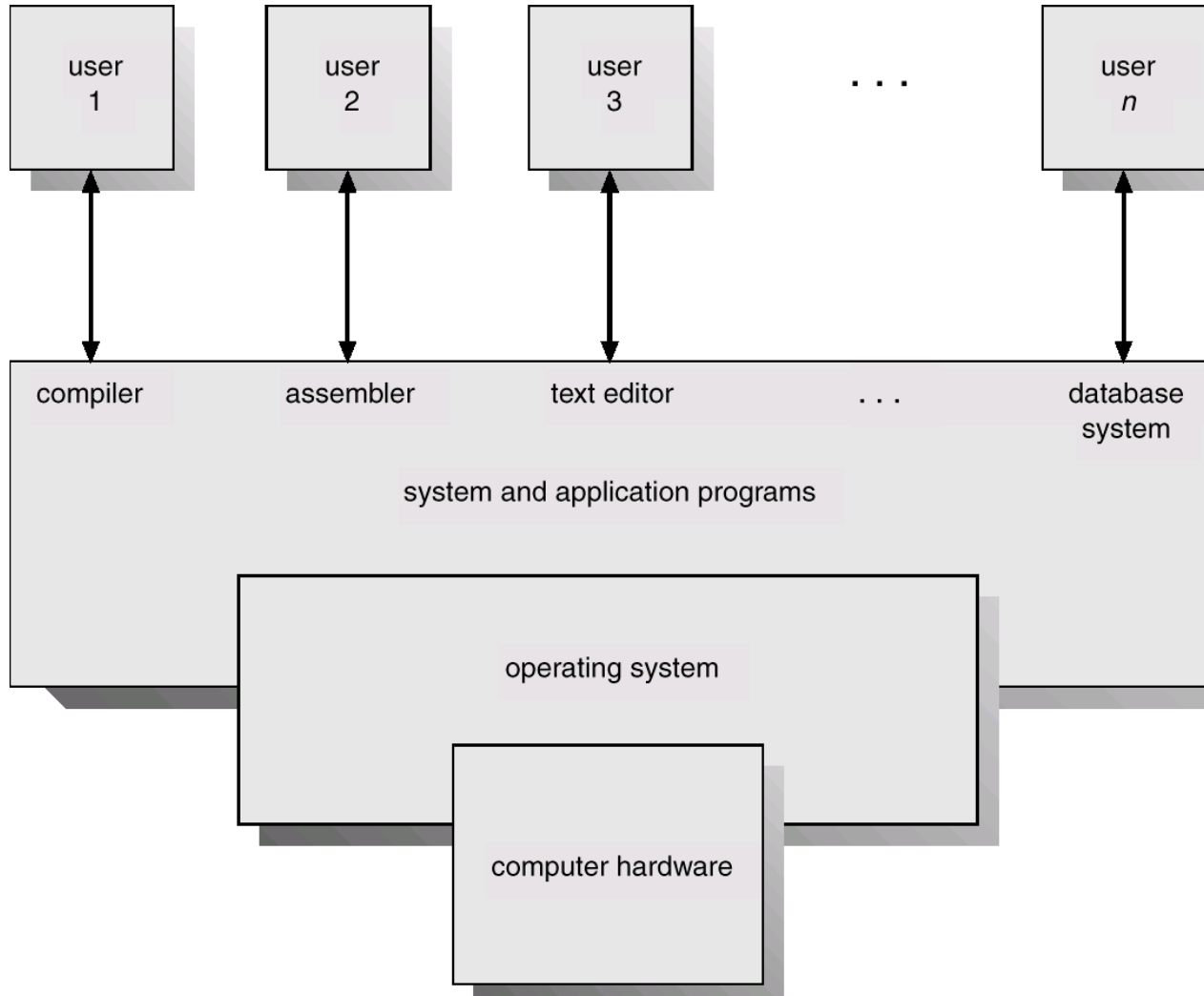
# What is an Operating System?

User View

- A program that acts as an intermediary between a user of a computer and the computer hardware.

- Operating system goals:
  - Execute user programs and make solving user problems easier.
  - Make the computer system convenient to use.

- Use the computer hardware in an efficient manner.

# Command Line Interface



# Graphical User Interface
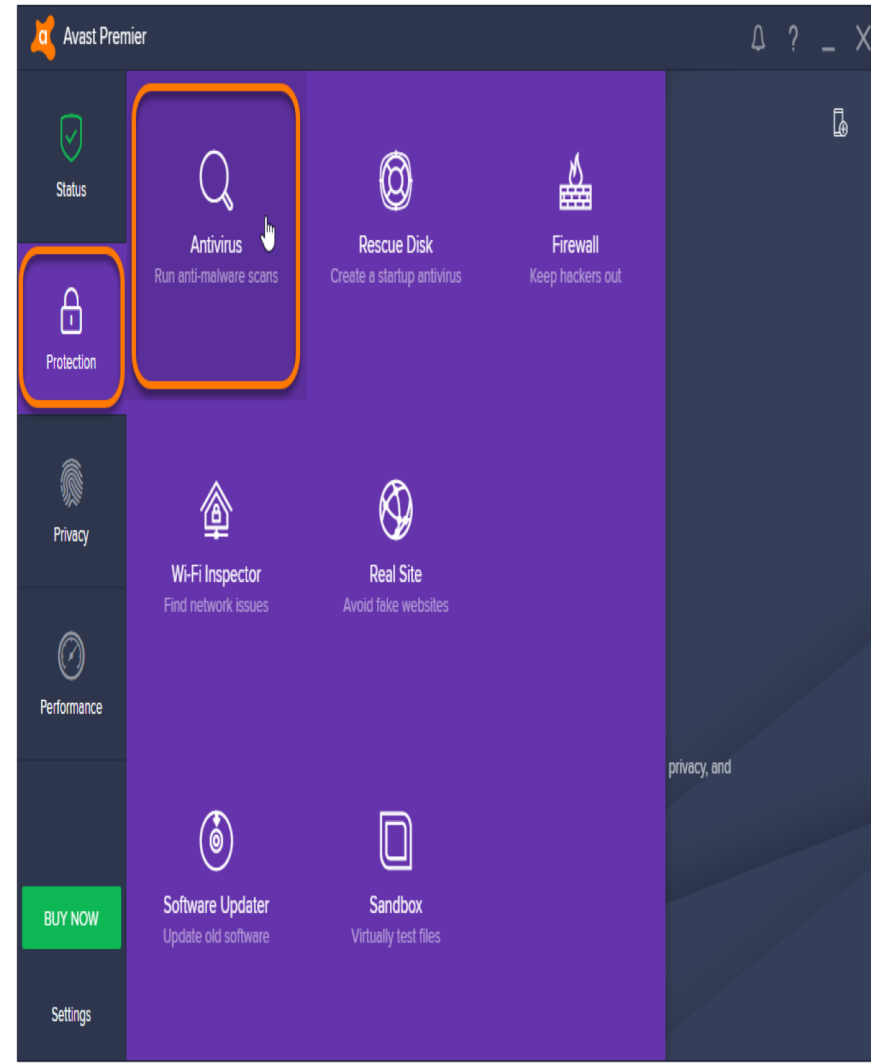
# Operating System Definitions

System View

- Resource allocator – manages and allocates resources.

- Control program – controls the execution of user programs and operations of I/O devices .

- Kernel – the one program running at all times (all else being application programs).

# Computer System Components

1.  Hardware – provides basic computing resources (CPU, memory, I/O devices).

2.  Operating system – controls and coordinates the use of the hardware among the various application programs for the various users.

3.  Applications programs – define the ways in which the system resources are used to solve the computing problems of the users (compilers, database systems, video games, business programs).

4.  Users (people, machines, other computers).

# Computer Startup / Booting

- Starting a computer is called booting

- Booting steps:

  - Switching on power supply
  - Loading operating system into computer's main memory. How it is happening?
  - Keeping all applications in a state of readiness

- The first program or set of instructions that run when the computer is switched on is called BIOS or Basic Input Output System

- BIOS is a firmware and resides on ROM

- Rebooting – Restarting a system when it is already running

- Rebooting may be required if:
  - A software or hardware has been installed
  - System is unusually slow

- Two types of booting
  - Cold booting – when switching on the power supply
  - Warm booting – when restarting the computer

- Warm booting is faster than cold booting

# Evolution - Simple Batch Systems

- Early computer were huge mainframe one

- They did one job at time

- Usually in batch-wise

- When job completes control transfers back to monitor

Problems

- Speed inconsistencies of CPU and output devices

- Over the time, it became worse as CPU powers grew at a rate more than the speed of mechanical devices (inherently slow speeds)

# Memory Layout for a Simple Batch System
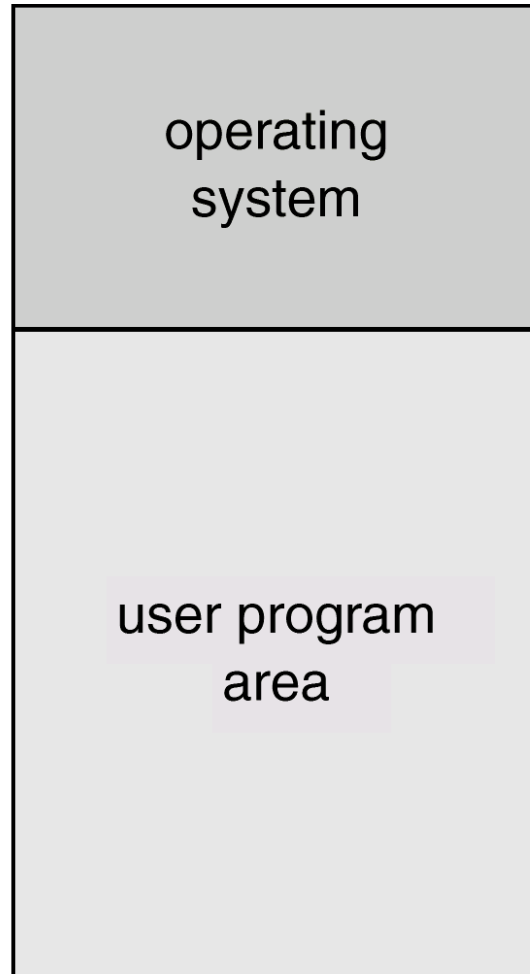
# Spooling

- To overcome the speed inconsistencies, the idea of multi-programming evolved

- Overlap I/O of one job with computation of another job.  While executing one job, the OS.

  - Reads next job from card reader into a storage area on the disk (job queue).
  - Outputs printout of previous job from disk to printer.

- *Job pool* – data structure that allows the OS to select which job to run next in order to increase CPU utilization.

# Multiprogramming Batch Systems

- Multi-programming is one solution - Several jobs are kept in main memory at the same time, and the CPU is multiplexed among them.

```
0
   ┌─────────────────────┐
   │   operating system  │
   ├─────────────────────┤
   │                     │
   │        job 1        │
   │                     │
   ├─────────────────────┤
   │                     │
   │        job 2        │
   │                     │
   ├─────────────────────┤
   │                     │
   │        job 3        │
   │                     │
   ├─────────────────────┤
   │        job 4        │
512K └─────────────────────┘
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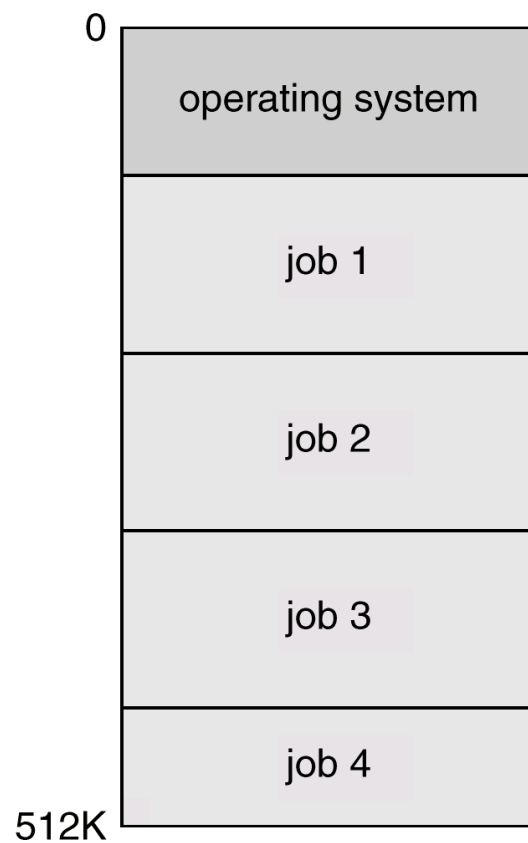
# OS Features Needed for Multiprogramming

- 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–Interactive Computing

Extension to multi-programming to multi-user system

- 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.

- Interactive can be improved

- Uses quantum time for each job

- Reduce response time

- Reduce CPU idle time

# Multiprocessing Batch Systems

- Instead of having single CPU, having multiple CPUs

- Similar to having Multi computers

- Many jobs can be processed simultaneously


- What is the different between having Multi processors and multi computers?


- What are advantages of Multiprocessing batch system than the other?

# Personal-Computer Systems

- *Personal computers* – computer system dedicated to a single user.

- I/O devices – keyboards, mice, display screens, small printers.

- User convenience and responsiveness.

- Can adopt technology developed for larger operating system' often individuals have sole use of computer and do not need advanced CPU utilization of protection features.

# Parallel Systems

- Multiprocessor systems with more than one CPU in close communication.

- *Tightly coupled system* – processors share memory and a clock; communication usually takes place through the shared memory.

- Advantages of parallel system:
    - Increased *throughput*
    - Economical
    - Increased reliability

# Parallel Systems (Cont.)

- *Symmetric multiprocessing (SMP)*
  - Each processor runs an identical copy of the operating system which means each processor directly deals with OS.
  - Many processes can run at once without performance deterioration and shares a common memory.
  - Most modern operating systems support SMP

- *Asymmetric multiprocessing*
  - Each processor is assigned a specific task; master processor schedules and allocates work to slave processors. Master processors only directly deals with OS.
  - More common in extremely large systems

# Symmetric Multiprocessing Architecture
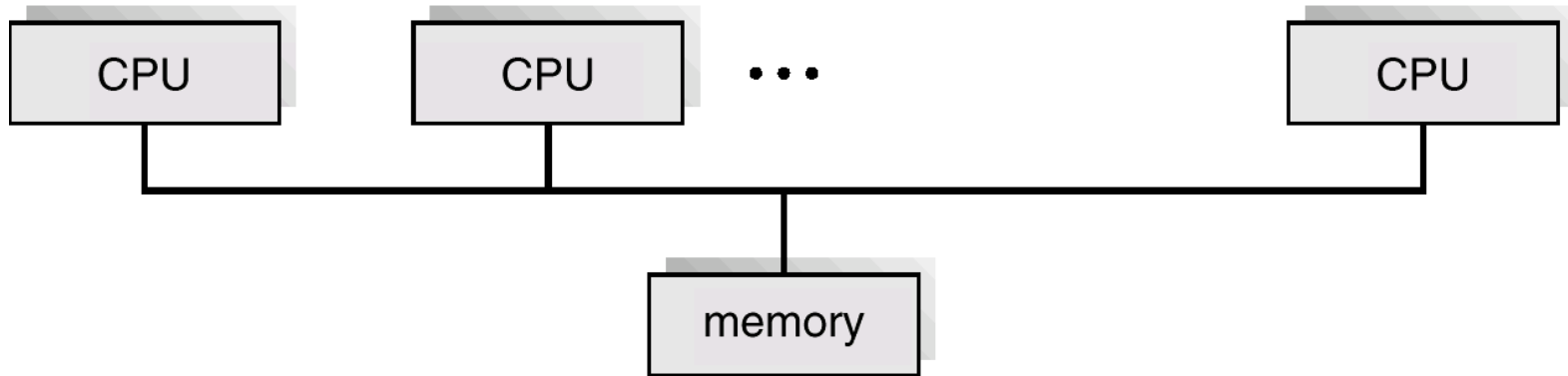
# Real-Time Systems

- 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.

- Each jobs having some deadlines

- Well-defined fixed-time constraints.

# Distributed Systems

- Distribute the computation among several physical processors.

- *Loosely coupled system* – each processor has its own local memory; processors communicate with one another 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

# Distributed Systems (Cont.)

- 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.