Computer System

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Version 1

AGENDA

- What is operation system(OS)
- kind of OS:
  - Server:Linux, windows server 2022
  - Desktop OS: Windows 10/11
  - Mobile OS: android, ios
  - Real-time OS: RTOS
- Service/Function provided by OS
- Windows operation system
  - computer manager
  - task manager
  - Windows Commands
  - Windows Powershell
- Linux operation system
  - Something you must know about Linux
  - Kernel vs shell
  - Distributions: RedHat, Ubuntu, Centos, Kali linux
  - Linux command
  - VERSION 1: RED

Introduction to Operating Systems

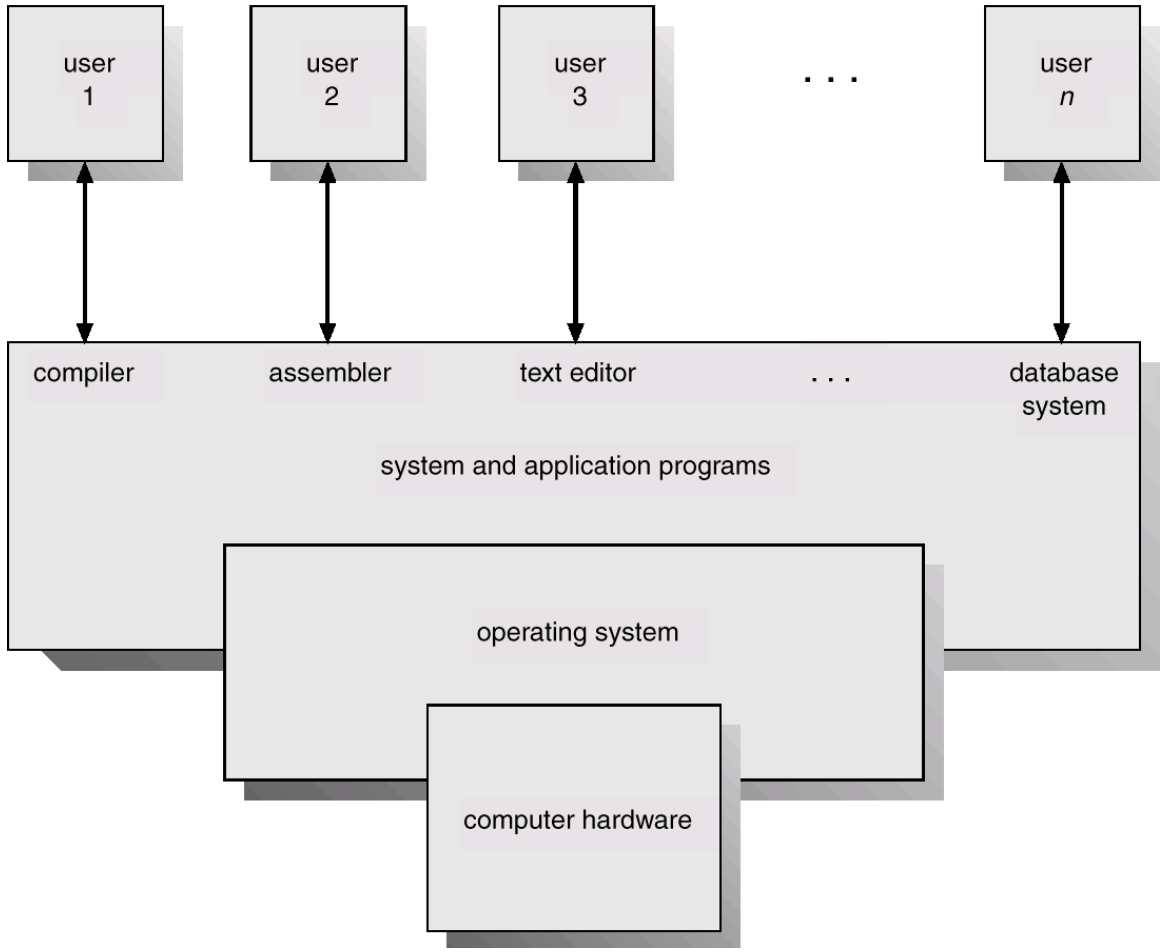
WHAT is an Operating System?

- What is an Operating System?
  - A program that acts as an intermediary between a user of a computer and the computer hardware.
- What is the purpose of an operating system?
  - To provide an environment in which a user can execute programs.
- What are the goals of an Operating System?
  - The primary goal of an Operating System is to make the computer system convenient to use.
  - The secondary goal is to make the computer system efficient to use.

Computer System Components

- Hardware – provides basic computing resources (CPU, memory, I/O devices).
- Operating system – controls and coordinates the use of the hardware among the various application programs for the various users.
- 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).
- Users (people, machines, other computers).

Abstract View of System Components



Function of Operating System

- OS as Extended machine
  - Computer Architecture shows that computer is made up of chips and wires
  - We do not want to program on the bare metal
  - Virtual machine creates a hardware abstraction
  - Abstract machine can provide hardware independent interfaces
  - Increase portability
  - Allow greater protection
  - Implication is that it is much faster and easier to program with less errors

Function of Operating System

- OS as resource manager
  - Coordination and control of limited resources such as memory, disk, network, etc
  - Deal with resource conflicts
  - Deal with resource fairness
  - Make access efficient as possible

Parts of an Operating System

- No universal agreement on the topic, but most likely
  - Memory Management
  - IO Management
  - CPU Scheduling
  - IPC
  - MultiTasking/Multiprogram ming
  - (On some Operating System, this functionality is provided by a single program known as the *kernel)*
- What about?
  - File System
  - Multimedia Support
  - UI (X Windows, MSWin)
  - Internet Browser?
  - Why would extras be important

Evolution (History) of OS

- First Generation: Punched cards
- Second Generation: Transistors and batch systems.
- Third Generation: (Integrated Circuits)
  - Spooling
  - Multiprogramming
  - Multitasking
  - Virtual Memory

Spooling

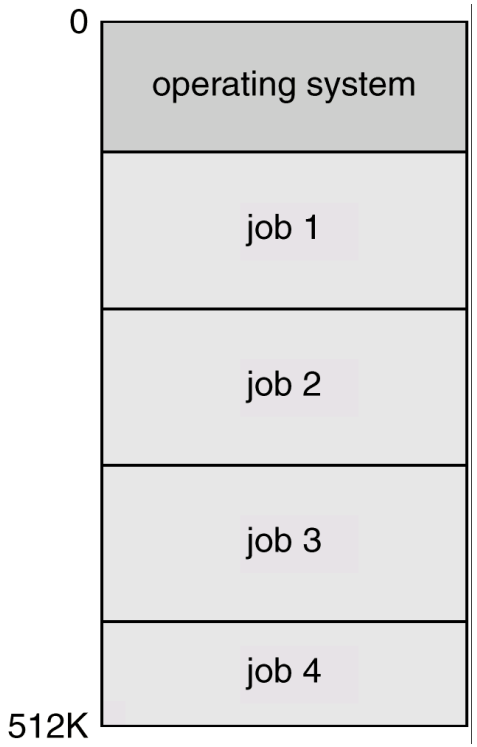
- Stands for Simultaneous Peripheral Operation On-Line
- Takes advantage of disk technology (new at this point)
- Allows for overlap of IO from one job with the computation of another job
- While executing current job
  - Read next job from card reader to disk
  - Print previous job to printer
- Disk is relegated to the role of a partitioned buffer

Job pool

- Advent of disk allows for random access
  - (Tape and card are sequential)
- Several jobs can be waiting on the disk
- The job pool is a data structure that contains info and points to the jobs on the disk
- We can now have job scheduling to determine the order in which the jobs run so that CPU utilization can increase.

Multiprogramming

- Memory partitioned into several pieces
- CPU Starts a job
- If the job is waiting for IO, the CPU can switch to another task



Multitasking (Time-sharing)

- Extension of Multiprogramming
  - Need for user interactivity
  - Instead of switching jobs when waiting for IO, a timer causes jobs to switch
- User interacts with computer via CRT and keyboard
  - Systems have to balance CPU utilization against response time
  - Better device management
- Need for file system to allow user to access data and code
- Need to provide user with an “interaction environment”

Virtual Memory

- Programs can be larger than memory
  - Program loaded into memory as needed
  - Active program and data “swapped” to a disk until needed
- Memory space treated uniformly

Key Events 3rd Generation

- 1964-1966 IBM/360 and OS/360
- 1964 Dartmouth Time Sharing System
- 1965 DEC PDP-8
- 1965 MIT – Multics Time sharing System
- 1969 – Beginnings of ARPANet
- 1969 - Unix
- 1971 IBM 4001 – Processor on a chip
- 1973 – Ethernet concept Bob Metcalf @ Xerox Parc
- 1974 - Gary Kildall – CP/M OS
- 1974 Zilog Z80 Processor

Key Events (cont)

- 1974 - Edward Roberts, William Yates and Jim Bybee
  - MITS Altair 8800.
    - $375
    - contained 256 bytes of memory
    - no keyboard, no display, and no aux storage device.
- 1976 Steve Jobs and Steve Wozniak
  - Apple II
- 1977 Commodore PET, Radio Shack TRS_80
- 1979 Unix 3BSD

Fourth Generation : (1980 – 1990)

- Personal Computers
- Computer dedicated to a single user
- IO Devices now consist of keyboards, mice, CGA-VGA displays, small printers
- User convenience and responsiveness
- Can adopt lessons from larger operating systems
- No need for some of the advanced options at the personal level

Key Events 4th Generation

- 1981 IBM PC (8086)
- 1981 Osborne 1
- 1981 Vic 20
- 1981 Xerox Star Workstation
- 1984 Apple macintosh
- 1984 SunOS
- 1985 C++
- 1985 MSWindows
- 1986 – 386 Chip

Key Events 4th Generation (cont)

- 1987 OS/2
- 1988 Next Unix Workstations
- 1989 Motif
- 1990 Windows 3,
- 1990 Berners-Lee Prototype for the web

5th Gen 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
    - graceful degradation
    - fail-soft systems

Parallel Systems (Cont.)

- *Symmetric multiprocessing (SMP)*
  - Each processor runs an identical copy of the operating system.
  - Many processes can run at once without performance deterioration.
  - Most modern operating systems support SMP
- *Asymmetric multiprocessing*
  - Each processor is assigned a specific task; master processor schedules and allocates work to slave processors.
  - More common in extremely large systems

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 (known as *deterministic*).
- *Hard real-time system*.
  - 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 system*
  - Limited utility in industrial control or robotics
  - Useful in applications (multimedia, virtual reality) requiring advanced operating-system features.

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.

Why Operating Systems?

- OS for CSE :
  - Real world OS is a software engineering problem
    - Design of the Virtual/Extended machine
    - Development of the Kernel
  - OS Usability, Human Factors for OS
- OS for CSE:
  - New algorithms to help make OS better, more efficient
  - Hypothesis, experiments regarding OS approaches
- OS for anyone else :
  - Help to understand better the parts of the OS and how to compare and contrast the various qualities of Operating Systems