Basic concepts of Information Technology

Overview of the Computer System

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Learning Objectives

- Identify components of the computer system and functions of them correctly
- Define system software and application software
- Identify computer communication networks
- Discuss professional and ethical issues in IT

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Main Readings

- Computer Organization and Architecture Designing for Performance (8th Edition) - William Stallings
- Computer Fundamentals Architecture and Organization , Edition 3 - Ram B

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Evaluation Criteria

- 15 Lecture Hours
- 1 Credit
- 100% - Final Exam (2 Questions)

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Overview of the Computer System

- Evolution of Digital Computers
- Classification of Computers
- Main components of a Computer
- Functions of Computers

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The Computer

- A general purpose, programmable electronic device that automatically carries out a sequence of arithmetic and logical operations

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Generations of Computers

- Computer evolution: Five generations
- Technological developments over time
- Changes resulting in terms of:
  - Size
  - Price
  - Power
  - Efficiency
  - Reliability

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First Generation (1940-1950)

- Vacuum tubes/ electronic valves- circuitry
- Magnetic drums- memory
- Punched tape- input or output
- Expensive, bulky, unreliable power guzzlers
- Relied on machine language
- Very large, a lot of space for installation
- Solve one problem at a time
- Generated a large amount of heat, non-profitable and very slow
- Eg: ENIAC,UNIVAC I, UNIVAC II, UNIVAC 1101

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Second Generation(1950-1960)

- Transistors- CPU components
- Ferrite cores- Main memory
- Magnetic disks and tapes- Secondary memory
- Smaller, faster, cheaper, more energy-efficient and more reliable
- Assembly language, early versions of FORTRAN, ALGOL and COBOL
- Stored instructions in memory
- Eg:- UNIVAC 1107, UNIVAC III, RCA 501, IBM 1401

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Third Generation(1960-1970)

- Integrated Circuits(ICs)-SSI and MSI– CPU components
- Magnetic core memories and Semiconductor memories (RAMs and ROMs)
- Magnetic disks and tapes- Secondary memory
- Cache memory was incorporated
- Microprogramming, parallel processing, multiprocessing, multiprogramming, multiuser system were introduced
- Concept of virtual memory was introduced
- Small in size, consume less power and less heat generation
- Processing time reduced: microseconds to nanoseconds
- Eg:- CDC 7600, PDP II (16 bit mini computer)

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Fourth Generation(1971-present)

- VLSI - CPU, memory and supporting chips
- Microprocessors – CPU
- Clock Frequency – 400 to 1000 MHz
- FPU (Floating Point Unit) and MMU (Memory Management Unit)
- Two level cache memory (L1 and L2)
- GUIs, mouse, Handheld devices
- Very small, cheapest, portable and quite reliable
- Generate negligible amount of heat, low production cost
- 1980- IBM personnel computer, 1894 Apple's Macintosh
- Eg:- IBM RISC 6000, IBM RT

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Fifth Generation(Present & beyond)

- Based on Artificial Intelligence
- Use ultra large scale integrated (ULSI) chips
- Use Intelligent programming, knowledge based problem solving techniques, high performance multiprocessor systems, Improved human-machine interfaces
- Solve highly complex problem including decision making, logical reasoning
- Understand natural languages(Eg: English, Spanish..)
- Voice recognition
- Use more than one CPU

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Computer Types: Classification

- Supercomputers
- Mainframe computers
- Minicomputers
- Microcomputers
- Embedded computers/ Embedded systems

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Supercomputer

- Most powerful computer
- Use for very complex tasks
  - Plasma and nuclear analysis, weap development, sending rockets into space, weather forecasting
- Very expensive and fast
- Eg:- Cray I , Cray II, Blue Pacific- IBM's

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Mainframe Computer

- Large and expensive
- Capable of supporting hundreds/thousands of users simultaneously
  - Big hospitals, air line reservations companies and many other huge companies

Mark I mainframe- 1950

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Supercomputer Vs Mainframe

- Supercomputer: focus on problems which are limited by calculation speed

  Mainframe: focus on problems which are limited by input/output and reliability
- Supercomputer: optimized for complicated computations that take place largely in memory Eg:- weather forecasting

  Mainframe: Optimized for comparatively simple computations involving huge amounts of external data

  Eg:-insurance, business or payroll processing applications

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Supercomputer Vs Mainframe...

- Supercomputer: often purpose-built for one or a very few specific institutional tasks E.g. simulation and modeling

  Mainframe: typically handles a wider variety of tasks
- Both have parallel processing

  Supercomputer: typically exposed it to the programmer in complex manners

  Mainframe: typically use it to run multiple tasks

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Minicomputer

- Middle sized computer
- Multiprocessing system capable of supporting approximately from 4 to 200 users simultaneously

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Mainframe Vs Minicomputer

- Minicomputers are general purpose computer systems with reduced storage capacity and performance as compare to mainframe computers

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Microcomputer

- Personal computer; designed to be used by individuals
- Low cost, small in size
- Depends on a microprocessor
- Two types: Desktop and Portable (PCs, Laptops, PDAs, Workstations)

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Desktop Microcomputer

- A microcomputer intended to use at a single location rather than a portable computer
- Tower casing/ desktop casing

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Workstation

- A powerful PC designed for a specific task
  - Engineering applications ; eg:- CAD and CAM
  - DTP
- In terms of computing power, workstations lie between personal computers and minicomputers
- Typically link together to form a Local Area Network(LAN)

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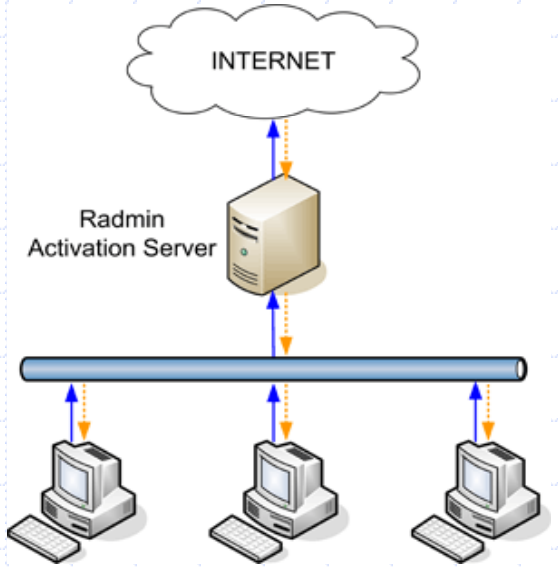
Server

- A computer that serves requested services to users (clients)
- Clients- running in the same computer or connecting through a LAN



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Portable Computers

- Laptops
- Palmtops : PDA / Handheld
- ???

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Laptop Computer

- Small in size, compact and light in weight
- More expensive than a comparable desktop

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PDA

- A palmtop computer; fits into a pocket run on batteries
- Employs touchscreen technology for entering data, a memory card slot for data storage, and IrDA, Bluetooth and/or Wi-Fi
- Can synchronize data with applications on a user's personal computer (as a backup)

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Minicomputer Vs Microcomputer

- Minicomputer: occupy a large area within a room and support multiple users simultaneously

  Microcomputer: small in size, generally one user

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Embedded Computer

- Designed for specific control functions within a larger system
- Range from portable devices such as digital watches, MP3 players to large stationary installations like traffic lights, the systems controlling nuclear power plants, mobile robots

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