CA – 1

Aromal S Kunnel – 22BAI10288

Q1 - Explain Computer Structure and Architecture.

Computer architecture refers to the design and organization of the components of a computer system. It includes the instruction set architecture (ISA), which defines the instructions that a processor can execute, the microarchitecture, which defines how the processor executes those instructions, and the system architecture, which defines how the different components of a computer system work together.

The main components of a computer system are:

Central processing unit (CPU): The CPU is the brain of the computer. It is responsible for executing instructions and performing calculations.

Memory: Memory stores data and instructions that the CPU needs to access. There are two main types of memory: RAM (random access memory), which is volatile and loses its contents when the computer is turned off, and ROM (read-only memory), which is non-volatile and retains its contents even when the computer is turned off.

Input/output (I/O) devices: I/O devices allow the computer to interact with the outside world. Examples of I/O devices include keyboards, mice, monitors, printers, and network cards.

Storage devices: Storage devices store data and programs permanently. Examples of storage devices include hard disk drives, solid-state drives, and optical discs.

The design of a computer system is a complex task that involves balancing many factors, such as performance, cost, power consumption, and reliability. Computer architects must carefully consider the needs of the users and the applications that will be running on the system when making design decisions.

Q2 - Explain OSI model in detail.

The OSI (Open Systems Interconnection) model is a conceptual framework that describes how information is transmitted between computer systems on a network. It's not a rigid standard, but rather a reference model that helps understand and troubleshoot network communication.

The OSI model is divided into **seven layers**, each with its own specific function:

1. Physical Layer: Deals with the physical transmission of data bits over a communication medium like cables or airwaves. It defines connectors, voltages, and transmission speeds.

2. Data Link Layer: Ensures reliable transmission of data frames between network nodes. It handles error detection and correction, flow control, and addressing of network devices.

3. Network Layer: Responsible for routing data packets across networks. It determines the best path for data to travel based on network addresses and traffic conditions.

4. Transport Layer: Provides reliable data transfer between applications on different devices. It establishes connections, segments data into packets, and ensures delivery in the correct order.

5. Session Layer: Manages communication sessions between applications. It establishes, manages, and terminates sessions, ensuring synchronized communication.

6. Presentation Layer: Deals with data format and presentation. It translates data between different formats used by different applications and encrypts/decrypts data for security.

7. Application Layer: Provides network services to user applications. It includes protocols like HTTP (web browsing), FTP (file transfer), and SMTP (email).

Q3 - How Different topologies are implemented? Explain in detail.

Implementing Different Network Topologies

When building a network, choosing the right topology is crucial for its performance, reliability, and scalability. Here's a breakdown of how different topologies are implemented:

1. Bus Topology:

- **Implementation:** All devices connect to a single central cable (bus). Each device listens to all transmitted data, and those with the intended destination address receive it. Terminators are placed at both ends to prevent signal reflection.
- **Common Use Cases:** Small networks, temporary setups, low-cost applications.
- **Implementation Tools:** Coaxial cables, Ethernet cables, BNC connectors.

2. Star Topology:

- **Implementation:** Each device connects to a central hub or switch. Devices communicate through the central device, which forwards data to the intended recipient.
- **Common Use Cases:** Most modern networks, medium to large setups, offers good manageability and scalability.
- **Implementation Tools:** Hubs, switches, Ethernet cables, RJ-45 connectors.

3. Ring Topology:

- **Implementation:** Devices are connected in a closed loop, forming a ring. Data travels in one direction, passing through each device until it reaches its destination.
- **Common Use Cases:** High-availability networks, fault-tolerant systems, specific industrial applications.
- **Implementation Tools:** Token ring adapters, special cabling, network interface cards (NICs).

4. Mesh Topology:

- **Implementation:** Every device connects directly to multiple other devices, creating multiple data paths. This offers redundancy and flexibility.

- **Common Use Cases:** Wireless networks, complex networks with high bandwidth demands, self-healing networks.
- **Implementation Tools:** Wireless access points, mesh routers, multiple network interfaces per device.

5. Hybrid Topology:

- **Implementation:** Combines two or more of the above topologies. For example, connecting multiple star networks with a ring topology or using a bus within a star network.
- **Common Use Cases:** Large, complex networks with specific requirements, combining strengths of different topologies.
- **Implementation Tools:** Varies depending on the chosen combination of topologies.

Q4 - Explain LAN, MAN, WAN.

1. Local Area Network (LAN):

- **Scope:** Covers a small area like a home, office building, or school campus.
- **Distance:** Up to a few kilometers.
- **Ownership:** Usually private, owned by an individual or organization.
- **Technology:** Typically uses wired connections like Ethernet cables for high speeds and reliability.
- **Examples:** Home network connecting computers and printers, office network connecting workstations and servers.

2. Metropolitan Area Network (MAN):

- **Scope:** Covers a larger area like a city or town.
- **Distance:** Up to tens of kilometers.
- **Ownership:** Can be private (owned by a company) or public (owned by a city or consortium).
- **Technology:** Can use wired connections like fiber optics or wireless technologies like microwave links.
- **Examples:** Network connecting government offices and educational institutions within a city, network connecting hospitals within a medical district.

3. Wide Area Network (WAN):

- **Scope:** Covers a vast geographical area like a country, continent, or even the entire globe.
- **Distance:** Unlimited, spanning large distances.
- **Ownership:** Can be private, public, or a combination of both.

- **Technology:** Uses various technologies like leased lines, satellite links, and the internet backbone.
- **Examples:** The internet, corporate network connecting offices across different countries, airline reservation system spanning worldwide.

Feature	LAN	MAN	WAN
Scope	Small area (building, campus)	Larger area (city)	Vast area (country, globe)
Distance	Up to few km	Up to tens of km	Unlimited
Ownership	Private	Private/Public	Private/Public/Shared
Technology	Wired (Ethernet)	Wired/Wireless	Various (leased lines, satellite, internet)
Examples	Home network, office network	City network, hospital network	Internet, corporate network, airline reservation system

Q5 - Mention important benefits of computer network.

Connecting computers through a network offers numerous advantages, both for individuals and organizations. Here are some of the most crucial benefits:

Resource Sharing:

- **Hardware:** Easily share printers, scanners, storage devices, etc., reducing costs and maximizing resource utilization.
- **Software:** Share software licenses and applications across multiple users, eliminating redundant purchases and installations.
- **Data:** Access and collaborate on documents, files, and other data from any authorized device within the network.

Communication and Collaboration:

- **Email:** Efficiently send and receive messages within the network, fostering communication and teamwork.
- **Instant Messaging:** Real-time communication for quick questions and collaboration.
- **Video Conferencing:** Connect and interact with colleagues regardless of their location, enabling virtual meetings and remote work.

Improved Efficiency and Productivity:

- **Centralized Management:** Manage users, devices, and resources efficiently from a central point.
- **Automation:** Automate routine tasks like backups and file distribution, saving time and effort.
- **Remote Access:** Access work resources and files from anywhere with an internet connection, increasing flexibility and productivity.

Enhanced Security:

- **Centralized Security Measures:** Implement firewalls, access control lists, and other security measures at the network level, protecting all connected devices.
- **Data Backup and Recovery:** Back up data centrally and recover it quickly in case of system failures or security breaches.
- **User Authentication:** Control access to sensitive data and resources based on individual permissions.

Other Benefits:

- **Global Connectivity:** Access the internet and connect with others worldwide, opening up new opportunities and information.
- **Scalability:** Expand the network easily to accommodate new users and devices as needed.
- **Cost Savings:** Share resources and reduce hardware and software costs.
- **Improved Customer Service:** Businesses can offer online support and communication channels to enhance customer interaction.