Network Fundamentals (Fundamentals)

Introduction to computer networks

Uses

Sharing resources, such as printers, scanners, and storage devices, allows multiple users to access and use these resources efficiently, reducing the need for individual purchases and maximizing their utilization.

Communication between users is facilitated by networks, enabling real-time collaboration, data sharing, and remote access to information.

Networks provide centralized management and control of resources, ensuring security, backup, and maintenance.

Networks enable the creation of virtual environments, such as cloud computing and virtual private networks (VPNs), which provide flexible and scalable access to resources.

Types of networks

LAN (Local Area Network)

- Covers a small geographical area, such as a building or campus.
- Typically owned and managed by a single organization.
- Provides high-speed connectivity between devices.

Wireless LAN (WLAN)

- Similar to LAN, but uses wireless technology instead of cables.
- Allows devices to connect to the network without physical connections.
- Provides mobility and flexibility.

Metropolitan Area Network (MAN)

- Covers a larger geographical area than a LAN, such as a city or metropolitan area.
- Connects multiple LANs and provides high-speed connectivity.
- Used by organizations with multiple locations.

Wireless MAN (WMAN)

- Similar to MAN, but uses wireless technology instead of cables.
- Provides high-speed wireless connectivity between multiple locations.
- Used by organizations with multiple locations.

Network devices

Hub

- Connects multiple devices in a network.
- Broadcasts data packets to all connected devices.
- Operates at the physical layer of the OSI model.

Switch

- Connects multiple devices in a network.
- Forwards data packets to specific devices based on their MAC addresses.
- Operates at the data link layer of the OSI model.

Access Point

- Provides wireless connectivity to devices in a network.
- Allows devices to connect to the network without physical connections.
- Operates at the data link layer of the OSI model.

Router

- Connects multiple networks together.
- Forwards data packets between different networks.
- Operates at the network layer of the OSI model.

Gateway

- Connects two different networks together.
- Translates data packets between different protocols.
- Operates at the application layer of the OSI model.

Firewall

- Protects a network from unauthorized access and cyberattacks.
- Monitors and controls incoming and outgoing network traffic.
- Operates at the network layer of the OSI model.

Modem

- Modulates and demodulates signals between a computer and a telecommunication network.
- Allows devices to connect to the internet.
- Operates at the physical layer of the OSI model.

Repeater

- Amplifies and regenerates signals to extend the range of a network.
- Operates at the physical layer of the OSI model.

Bridge

- Connects two network segments together.
- Filters and forwards data packets based on their MAC addresses.
- Operates at the data link layer of the OSI model.

Network Interface Card (NIC)

- Provides a physical connection between a computer and a network.
- Allows data packets to be transmitted and received.
- Operates at the physical layer of the OSI model.

Network topologies

Star

- Central hub connects all devices in the network.
- Easy to troubleshoot and manage.
- Failure of the central hub affects the entire network.

Ring

- Data packets circulate in a ring-shaped network.
- Each device receives and forwards data packets.
- Failure of one device can affect the entire network.

Bus

- All devices connected to a single cable.
- Data packets are broadcasted to all devices.
- Failure of the cable affects the entire network.

Mesh

- Each device connects to multiple other devices.
- Provides redundancy and high reliability.
- Complex and expensive to implement.

Tree

- Combination of star and bus topologies.
- Hierarchical structure with multiple levels.
- Easy to expand and manage.

Network security

Firewalls act as a barrier between a trusted internal network and untrusted external networks, monitoring and controlling incoming and outgoing traffic to prevent unauthorized access and cyberattacks.

Network troubleshooting

Network troubleshooting involves identifying and resolving issues that affect the performance and reliability of a network. This can include tools and techniques such as ping, traceroute, and network monitoring software.

Bytes

Bits

Bits are the smallest unit of data in computer networks. They represent binary digits, which can be either 0 or 1. Bits are used to transmit and store information in digital form.