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Computer Networks

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Abstract. Modern communication and information exchange is based on computer networks and allows transfer of data between local and international systems. In this paper, the author will discuss the basics of computer networks, their types, structure, and its uses. It puts particular emphasis on the way networks are used to promote connectivity, distributed systems, and are essential in other areas including education, business and research.

Keywords: Computer networks, network topology, protocols, communication, data transmission, Internet.

Introduction. The rise of computer networks has revolutionized global communication and information management. A computer network connects multiple computing devices to share resources, exchange data, and enable collaboration. These networks range from small local systems to massive global infrastructures such as the Internet. Computer networking plays a crucial role in virtually every field—education, business, healthcare, and government—allowing real-time access to data and services. This article introduces the basic structure, functioning, and classification of computer networks and highlights their applications and importance in today's digital world.

Discussion

Overview of Computer Networks

The computer network is a network of linked devices such as computers, servers, routers and switches that communicate with each other under the established protocols. A network design and functioning is based on its size, use, and mode of communication.

Types of Networks:

1. **Local Area Network (LAN):** Connects devices within a limited area such as a building or campus. LANs offer high-speed data transfer and are commonly used in offices and schools.
2. **Metropolitan Area Network (MAN):** Covers a larger geographical area than LANs, such as a city. Used by institutions or organizations that operate across multiple locations.
3. **Wide Area Network (WAN):** Extends over large areas, connecting multiple LANs. The Internet is the largest example of a WAN.

4. **Personal Area Network (PAN):** Connects devices in close proximity, such as smartphones and laptops via Bluetooth.

Network Topologies

The structure of a network, or topology, defines how devices are connected. Common topologies include:

- **Bus Topology:** All devices share a single communication line. It is cost-effective but prone to data collisions.
- **Star Topology:** All devices connect to a central hub or switch. Easy to manage and expand.
- **Ring Topology:** Devices are connected in a circular manner, with data traveling in one or both directions.
- **Mesh Topology:** Each device connects directly to others, offering high reliability but increased cost.

Network Protocols

Protocols are the communication rules that govern data exchange in networks. The most important include:

- **TCP/IP (Transmission Control Protocol/Internet Protocol):** The foundation of the Internet, responsible for reliable communication between devices.
- **HTTP/HTTPS:** Protocols for web communication.
- **FTP (File Transfer Protocol):** Used for transferring files between computers.
- **SMTP (Simple Mail Transfer Protocol):** Used for sending and receiving emails.

Applications of Computer Networks

Computer networks have countless real-world applications, including:

- **Education:** Online learning platforms, virtual classrooms, and research collaboration.
- **Business:** E-commerce, cloud computing, and enterprise resource management.
- **Healthcare:** Telemedicine, digital patient records, and hospital information systems.
- **Government:** E-governance, public information systems, and secure communication channels.

Advantages and Limitations

Advantages:

- Enables resource and information sharing.
- Facilitates communication and collaboration.
- Increases efficiency and productivity.
- Provides remote access to data and services.

Limitations:



- Vulnerable to cyberattacks and unauthorized access.
- Network failures can disrupt operations.
- Requires significant setup and maintenance costs.

Conclusion. The modern communication is supported by computer networks that unite people, companies, and systems around the world. Nets facilitate the innovation and development in every sector by allowing transfer of data quickly and securely. Nevertheless, there are certain challenges associated with the development of networking, like cybersecurity and data privacy, that should be resolved in order to have a sustainable and secure connectivity.

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