

Data Communication - 4th Chapter - Computer Networks (Ch)

Q1. What are computer networks?

Ans: Computer network is a group of interconnected devices, like, computer systems, printers, or servers, that can exchange data and share resources.

Q2. What is network topology?

Ans: Network topology refers to the physical or logical arrangement of devices, connection, and nodes within a network. It defines how devices communicate and exchange the data.

Q3. List the type of topologies.

Ans: The following are some types of topologies:

1. Bus Topology
2. Star Topology
3. Ring Topology
4. Mesh Topology

Q4. What is Bus Topology, list its advantages, disadvantages, and applications.

Ans: Bus topology is a network configuration where all the devices are connected to a single cable or backbone. Each device taps into cable/backbone to send or receive data.

Advantages:

1. Simple installation: easy to configure and install.
2. Cost Effective: require less cable than other topology.
3. Easy to add new device: Devices can be added/removed without disrupting the entire network.

Disadvantages:

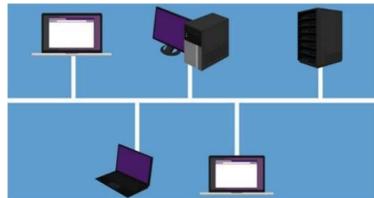
1. Signal Degradation: Signal strength decreases as data travels along the cable.
2. Fault Tolerance: A single fault can bring down entire network.
3. Limited scalability: Limited numbers of devices can be connected.

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Applications

1. Suitable for setting-up small networks.
2. Often used in older network installations.

Bus Topology Diagram



Q5. What is Star Topology, list its advantages, disadvantages, and applications.

Ans: Star topology is a network configuration where all devices connect to a central device, such as a hub or switch. Each device has a dedicated connection to the central device.

Advantages:

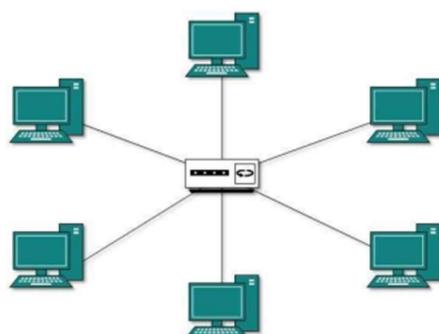
1. Easy to install and configure: simple to setup and manage.
2. Fault tolerance: A single device failure won't affect the entire network.
3. Easy to troubleshoot: Faults can be easily identified and isolated.
4. Scalability: Easy to add/remove devices without disrupting network.

Disadvantages:

1. Central device failure: If the central device fails, the entire network is affected.
2. Cable requirements: More cables are required compared to bus topology.

Applications:

1. Commonly used in LAN networks.
2. Suitable for large scale business models or enterprises.



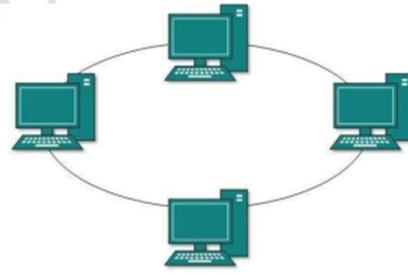
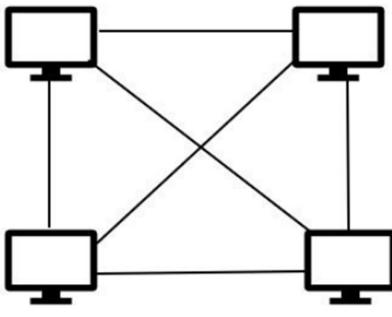
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Q5. Differentiate between Ring topology and Mesh Topology.

Ans:

Category	Ring Topology	Mesh Topology
Definition	<i>Ring topology is a network configuration where devices are connected in a circular configuration. Data travels in one direction around the ring</i>	<i>Mesh topology is a network configuration where each device connects directly to every other device. This creates multiple paths for data transmission.</i>
Characteristics	<ol style="list-style-type: none">1. Circular configuration: Device form a closed loop.2. Unidirectional data flow: Data travel in one direction.3. Token-based access: Devices access the network using a token.	<ol style="list-style-type: none">1. Interconnected devices: Each device connects to every other device.2. Multiple paths: Multiple paths exist for data transmission between devices3. High reliability: The network remains functional even if one or more devices fails.
Advantages	<ol style="list-style-type: none">1. Equal access: Each device has equal access to network.2. Predictable performance: Network performance is predictable.	<ol style="list-style-type: none">1. High reliability: The network is highly reliable due to multiple paths.2. Fault tolerance: Device failure does not disrupt entire network.3. Secure: Data can be transmitted through

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		<i>multiple paths, making it harder to intercept</i>
<i>Disadvantages</i>	<ol style="list-style-type: none"> 1. <i>Single Device failure: A single device failure can disrupt the entire network</i> 2. <i>Difficult troubleshooting: Faults can be hard to identify.</i> 3. <i>Limited scalability: Adding new devices can be challenging.</i> 	<ol style="list-style-type: none"> 1. <i>Complex installation: Installation and configuration can be complex.</i> 2. <i>High cost: Requires more cables and network devices.</i> 3. <i>Scalability: Adding new devices can be difficult.</i>
<i>Application</i>	<ol style="list-style-type: none"> 1. <i>Used in token passing/token ring networks</i> 2. <i>Used in Synchronous Optical Networking (SONET) and Synchronous Digital Hierarchy (SDH)</i> 	<ol style="list-style-type: none"> 1. <i>Used where reliability and fault tolerance is crucial.</i> 2. <i>Mesh Topology mostly used in wireless networks.</i>
<i>Diagram</i>		

Q6. What is LAN?

Ans: A LAN, or Local Area Network, is a group of interconnected devices within a small, limited area like a home, office, or school. It allows devices to communicate and share resources such as files, printers, and internet access.

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Advantages:

1. LAN is a private network, this no outside body can interfere or controls it.
2. LAN offers a much higher speed (approximate 100Mbps).
3. LAN is cost-effective, in terms of installation, expansion and maintenance.

Disadvantages:

1. A LAN is restricted to a small geographical area, such as a single building or school or small colony, etc
2. Although LAN is secure than WAN, LAN is still vulnerable to attacks. A single infected device can spread malware to entire network.
3. LAN administrator can see and check personal data files as well as internet history of each and every LAN user. Hence, the privacy of the user is violated.

Q7. Differentiate between MAN and WAN?

Ans:

Feature	MAN	WAN
Definition	A network that connects computers and LAN across a large geographical area, typically a single city or large campus (for e.g., IIT Madras Campus).	A network that spans vast geographical area, connecting networks across cities, countries, or even continents. It interconnects MANs and LANs globally (for e.g., internet).
Advantages	1. High speed data transfer rate than WAN because of shorter distance 2. Excellent for connecting multiple offices within same city.	1. Allows business and users to communicate and share info over any distance. 2. Helps large companies manage and back up data

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	<p><i>3. Cheaper to set up and maintain than a vast WAN</i></p>	<p><i>from one central location across all their branches</i></p> <p><i>3. WAN allows to access data from anywhere in the world</i></p>
<i>Disadvantages</i>	<p><i>1. More difficult and expensive to set up and manage.</i></p> <p><i>2. Vulnerable to security threats.</i></p> <p><i>3. Costly installation.</i></p>	<p><i>1. The setup and maintenance costs are very high.</i></p> <p><i>2. It has low data speed transmission rate.</i></p> <p><i>3. It's complex to manage and more susceptible to security vulnerabilities and troubleshooting issues.</i></p>
<i>Speed</i>	<i>Generally higher than WAN.</i>	<i>Generally slower than MAN</i>
<i>Example</i>	<i>A cable TV network that serves a single city.</i>	<i>The INTERNET itself is WAN.</i>

Q8. What are wireless networks?

Ans: Wireless Networks are communication networks that use radio waves or IR signals instead of cables to transmit data between devices. They are a fundamental part of modern communication, enabling mobile computing and internet across homes, businesses, and public spaces.

Key Types of Wireless Networks.

1. *WLAN (Wireless Local Area Network)*
 - a. *Example: Wi-Fi.*
 - b. *Used in homes, offices and schools.*
 - c. *Follows IEEE 802.11 standards.*

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2. WPAN (Wireless Personal Area Network)

- a. Example: Bluetooth.
- b. Short range (within a few meters).
- c. Used for device-to-device communication (e.g., headphones, smartwatches, etc).

3. WWAN (Wireless Wide Area Network)

- a. Example: Cellular networks (4G, 5G).
- b. Covers large geographical areas.
- c. Used for mobile phones, IoT devices.

4. WMAN (Wireless Metropolitan Area Network)

- a. Example: WiMAX.
- b. Covers city-scale area.
- c. Used for broadband access in urban areas.

Q9. What is Ethernet?

Ans: Ethernet is a technology used to connect computers and devices inside a LAN. It helps devices to send and receive data through cables. Ethernet uses frames to transfer data and it uses MAC addresses to identify which device is sending and which device is receiving.

Q10. Write the speed of Standard Ethernet and Fast Ethernet?

Ans: Standard Ethernet speed is 10Mbps.

Fast Ethernet speed is 100Mbps.

Q11. Which address is used by Ethernet to identify device in network?

Ans: Ethernet uses MAC address to identify devices in network.

Q12. Explain Fast Ethernet with its speed and usage?

Ans: Fast Ethernet is an improved version of Standard Ethernet. It provides a data transfer speed of 100 Mbps, which is ten times faster than 10 Mbps Ethernet. This type of Ethernet is commonly used in offices, labs, schools and small networks.

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where normal internet/file transfer should be fast but not extremely high level. Fast Ethernet supports twisted pair cables like Cat5/Cat5e. It is also backward compatible, which means devices that support 10 Mbps can also work with Fast Ethernet networks. Fast Ethernet was a major upgrade in LAN technology because it made local networks smoother, faster and more efficient.

Q13. Write a short note on gigabit ethernet?

Ans: Gigabit Ethernet provides a speed of 1 Gbps (1000 Mbps) which is much faster than both Standard Ethernet and Fast Ethernet. It is mostly used in modern networks where high speed data transfer is required like gaming, streaming, offices, server systems and routers. Gigabit Ethernet works with twisted pair cables like Cat5e and Cat6, and also supports fibre optic cable for long-distance high-performance connections. Because of its speed, it is used in today's main LAN backbones and most new computers and network devices support Gigabit ports by default.

Q14. Write the Difference between Standard Ethernet, Fast Ethernet and Gigabit Ethernet.

Ans:

Types	Speed	Usage
Standard Ethernet	10 Mbps	Old Simple Network
Fast Ethernet	100 Mbps	Small schools, offices.
Gigabit Ethernet	1 Gbps	Modern LANs, server, high speed networks

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Q15. Explain how Ethernet helps devices communicate inside a LAN?

Ans: Ethernet connects all devices inside a LAN with cables. When a device wants to send data, it sends it in the form of frames. Each frame contains the sender's MAC address and the receiver's MAC address. This helps the network know exactly where the data should go. Ethernet also controls the data flow so that there is less collision or confusion in the network. Because of this, communication becomes fast, smooth and reliable between devices. So, Ethernet makes LAN communication easy, organized and efficient.

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