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ASSIGNMENT ON:
NETWORK TOPOLOGIES:
TYPES, ADVANTAGES,
DISADVANTAGES, AND
DETAILED COMPARISON

NETWORK TOPOLOGIES: TYPES, ADVANTAGES, DISADVANTAGES, AND COMPARISON

Network topology refers to the arrangement of elements (links, nodes, etc.) in a communication network. Understanding different topologies is essential for designing efficient, scalable, and fault-tolerant networks. The different types of topologies with their advantages and disadvantages are discussed below:

1. BUS TOPOLOGY

Advantages:

- Easy to implement and extend
- Requires less cable length
- Cost-effective for small networks

Disadvantages:

- Difficult to troubleshoot
- Performance degrades as traffic increases
- A failure in the main cable can disrupt the entire network

2. STAR TOPOLOGY

Advantages:

- Easy to install and manage
- Failure of one node doesn't affect the network
- Easy to add new devices

Disadvantages:

- Central hub is a single point of failure
- Requires more cable
- Can be costly to install

3. RING TOPOLOGY

Advantages:

- Data flows in a single direction reducing chances of collision
- Better performance than bus under heavy load
- Easy to install and reconfigure

Disadvantages:

- A failure in any cable or device breaks the loop
- Adding or removing devices disrupts the network
- Troubleshooting is difficult

4. MESH TOPOLOGY

Advantages:

- High fault tolerance due to multiple paths
- Excellent reliability and redundancy
- Dedicated links ensure high performance

Disadvantages:

- High cost due to cabling and ports
- Complex installation and configuration
- Difficult to manage

5. TREE TOPOLOGY

Advantages:

- Scalable and easy to expand
- Allows for easy fault isolation and detection
- Hierarchical structure suits large networks

Disadvantages:

- Dependent on the main backbone line
- Difficult to configure and maintain
- Failure in backbone affects entire segments

6. HYBRID TOPOLOGY

Advantages:

- Highly flexible and scalable
- Can be optimized for specific needs
- Combines strengths of various topologies

Disadvantages:

- Complex to design and manage
- Can be costly to implement
- Troubleshooting is more difficult

Detailed Comparison Table of Network Topologies based on some Criteria

Topology	Cost	Scalability	Reliability	Ease of Setup	Fault Tolerance	Information Transfer	Security
Bus	Very low cost for small networks as it uses a single backbone cable.	Limited scalability due to signal degradation and collision.	Unreliable; a fault in the main cable affects entire network.	Simple to set up but hard to troubleshoot.	Low; any cable fault affects the whole network.	Slower as all devices share the same line; prone to collisions.	Low; data is broadcast to all devices, making it less secure.
Star	Moderate cost due to the use of a central hub and more cables.	Highly scalable; new nodes can be added easily.	Reliable; individual node failure does not affect others.	Very easy; configuration and expansion are simple.	Medium; dependent on the central hub's reliability.	Fast and efficient as each node has dedicated connection to the hub.	Moderate; centralized monitoring possible but vulnerable if hub is compromised.
Ring	Moderate cost; cable requirements increase with each device.	Not very scalable; adding/removing devices interrupts flow.	Moderate; but a single break disrupts the network.	Moderately difficult; more complex than star or bus.	Low; single point of failure exists.	Data flows in one direction, reducing collisions but increasing delay.	Moderate; each device handles and forwards data, increasing exposure.
Mesh	Very high cost due to extensive	Moderate; scalable but	Highly reliable; multiple	Complex; requires	Very high; if one link fails,	Fast and redundant; multiple	High; isolated secure links, though setup

	cabling and network ports.	becomes complex fast.	paths between nodes.	experienced setup.	communication continues.	paths for efficient transfer.	must be thorough.
Tree	Medium cost; combines advantages of star and bus.	Highly scalable with hierarchical branching.	Moderate; backbone failure impacts major parts.	Moderate; setup requires planning.	Medium; backbone is a vulnerability.	Efficient at top levels; bottlenecks possible in lower tiers.	Moderate; threats can be isolated but root levels are exposed.
Hybrid	High; combines multiple topologies hence cost varies.	Highly scalable and adaptable.	Highly reliable if well-designed.	Complex; varies by implementation.	High; inherits best traits from integrated topologies.	Flexible; depends on base topology used.	High; allows layered security based on components.