

# Comparison of Network Topologies

## Network Topologies

A network topology defines the physical or logical arrangement of nodes and communication links in a network. Different topologies offer different trade-offs in terms of performance, cost, scalability, and fault tolerance.

## Comparative Analysis of Network Topologies

## Topology Use Cases

## Important Technical Points

- Star topology is the most commonly used topology in modern LANs.
- Mesh topology offers highest reliability but is expensive.
- Bus and ring topologies are rarely used in modern networks.
- Tree topology is an extension of star topology.
- Hybrid topology is most practical for large-scale networks.

Topology	Number of Connections	Mode of Communication	Advantages	Disadvantages
Bus	$n - 1$	Broadcast	Simple design, low cost, easy installation	Single point of failure, collision-prone, poor scalability
Star	$n$	Point-to-point (via hub/switch)	Easy fault isolation, scalable, good performance	Central device failure affects entire network
Ring	$n$	Unidirectional or bidirectional (token-based)	No collisions, predictable performance	Difficult troubleshooting, single node failure disrupts network
Mesh (Full)	$\frac{n(n-1)}{2}$	Point-to-point	High reliability, fault tolerant, multiple paths	Very high cost, complex cabling
Mesh (Partial)	$< \frac{n(n-1)}{2}$	Point-to-point	Better reliability than star, lower cost than full mesh	Complex design, higher cost than star
Tree	$n - 1$	Hierarchical	Scalable, structured management	Root failure affects entire network
Hybrid	Varies	Mixed	Flexible, scalable, combines strengths	Complex design, higher cost

Topology	Typical Use Case
Bus	Small temporary networks, legacy LANs
Star	Modern Ethernet LANs, enterprise networks
Ring	Token Ring networks, MANs (historical)
Mesh	Backbone networks, WANs, mission-critical systems
Tree	Large organizational networks, campus networks
Hybrid	Internet, large enterprise and data center networks