

Network Topologies

Bus, ring, star, and other types of network topology

In computer networking, *topology* refers to the layout of connected devices. This article introduces the standard topologies of networking.

Topology in Network Design

Think of a topology as a network's virtual shape or structure. This shape does not necessarily correspond to the actual physical layout of the devices on the network. For example, the computers on a home [LAN](#) may be arranged in a circle in a family room, but it would be highly unlikely to find a ring topology there.

Network topologies are categorized into the following basic types:

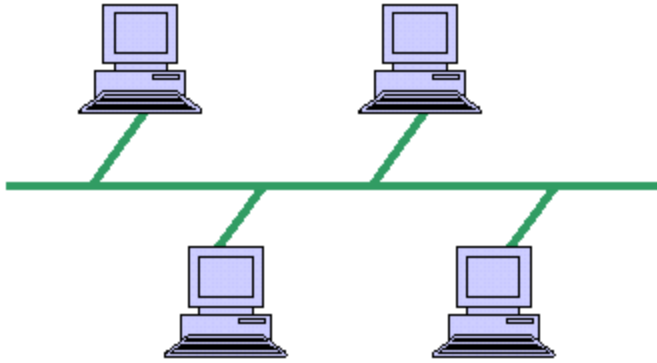
- bus
- ring
- star
- tree
- mesh

More complex networks can be built as hybrids of two or more of the above basic topologies.

Bus Topology

Bus networks (not to be confused with the system bus of a computer) use a common backbone to connect all devices. A single cable, the backbone functions as a shared communication medium that devices attach or tap into with an interface connector. A device wanting to communicate with another device on the network sends a broadcast message onto the wire that all other devices see, but only the intended recipient actually accepts and processes the message.

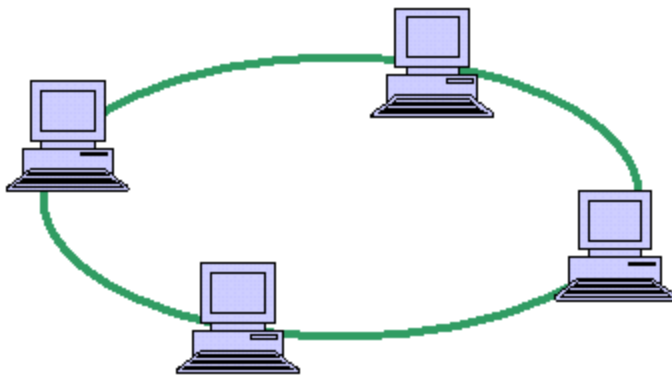
Ethernet bus topologies are relatively easy to install and don't require much cabling compared to the alternatives. 10Base-2 ("ThinNet") and 10Base-5 ("ThickNet") both were popular Ethernet cabling options many years ago for bus topologies. However, bus networks work best with a limited number of devices. If more than a few dozen computers are added to a network bus, performance problems will likely result. In addition, if the backbone cable fails, the entire network effectively becomes unusable.



Ring Topology

In a ring network, every device has exactly two neighbors for communication purposes. All messages travel through a ring in the same direction (either "clockwise" or "counterclockwise"). A failure in any cable or device breaks the loop and can take down the entire network.

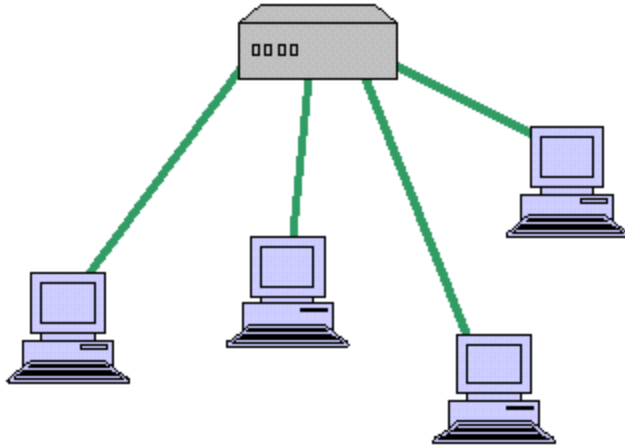
To implement a ring network, one typically uses FDDI, [SONET](#), or [Token Ring](#) technology. Ring topologies are found in some office buildings or school campuses.



Star Topology

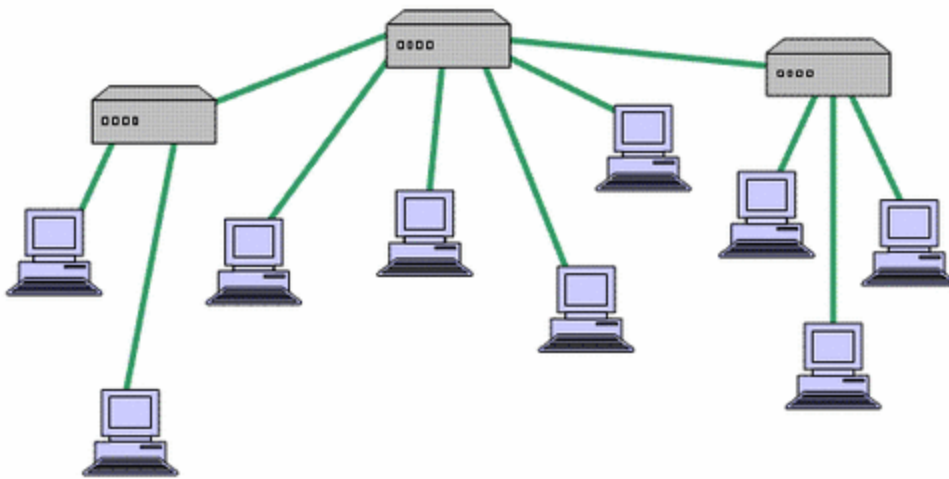
Many home networks use the star topology. A star network features a central connection point called a "hub" that may be a [hub](#), [switch](#) or [router](#). Devices typically connect to the hub with Unshielded Twisted Pair (UTP) Ethernet.

Compared to the bus topology, a star network generally requires more cable, but a failure in any star network cable will only take down one computer's network access and not the entire LAN. (If the hub fails, however, the entire network also fails.)



Tree Topology

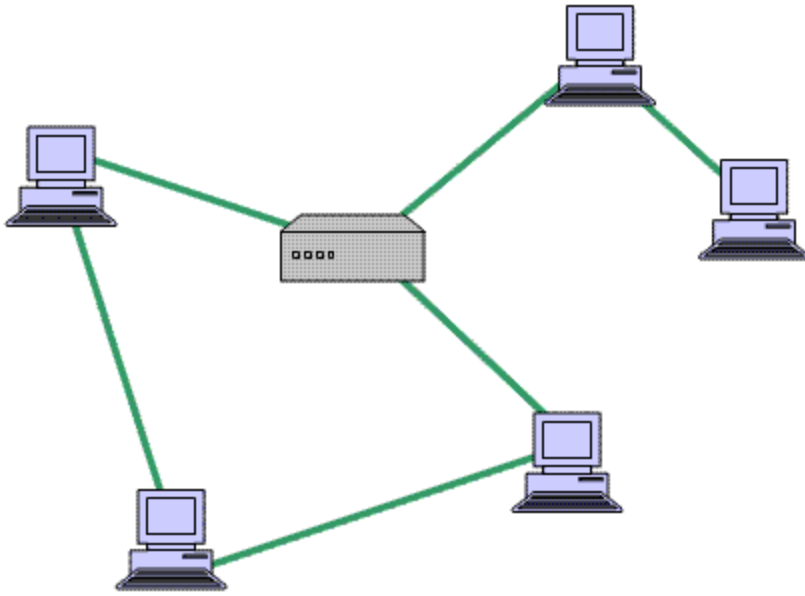
Tree topologies integrate multiple star topologies together onto a bus. In its simplest form, only hub devices connect directly to the tree bus, and each hub functions as the "root" of a tree of devices. This bus/star hybrid approach supports future expandability of the network much better than a bus (limited in the number of devices due to the broadcast traffic it generates) or a star (limited by the number of hub connection points) alone.



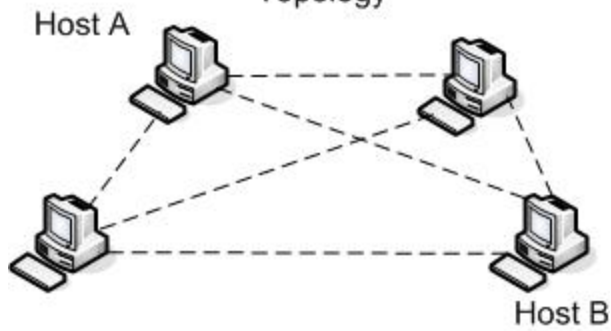
Mesh Topology

Mesh topologies involve the concept of routes. Unlike each of the previous topologies, messages sent on a mesh network can take any of several possible paths from source to destination. (Recall that even in a ring, although two cable paths exist, messages can only travel in one direction.) Some [WANs](#), most notably the Internet, employ mesh routing.

A mesh network in which every device connects to every other is called a full mesh. As shown in the illustration below, partial mesh networks also exist in which some devices connect only indirectly to others.



Full-Mesh
Network
Topology



Summary

Topologies remain an important part of network design theory. You can probably build a home or small business computer network without understanding the difference between a bus design and a star design, but becoming familiar with the standard topologies gives you a better understanding of important networking concepts like hubs, broadcasts, and routes.