

About Topology

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1. What is a topology?

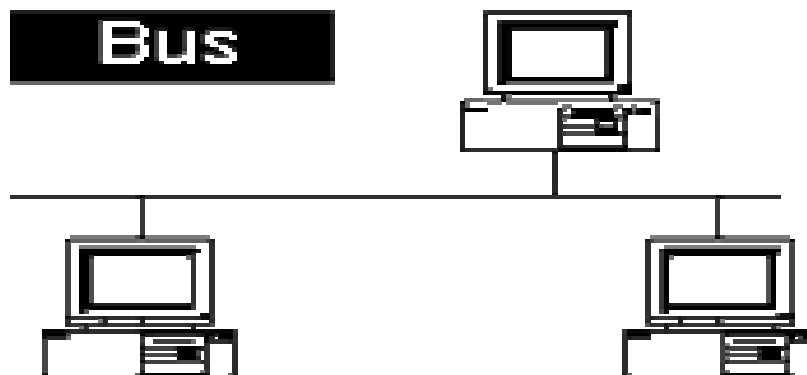
A *topology* refers to the manner in which the cable is run to individual workstations on the network. The dictionary defines topology as: the configurations formed by the connections between devices on a local area network (LAN) or between two or more LANs.

There are three basic network topologies (not counting variations thereon): the bus, the star, and the ring.

It is important to make a distinction between a topology and architecture. A *topology* is concerned with the physical arrangement of the network components. In contrast, an *architecture* addresses the components themselves and how a system is structured (cable access methods, lower level protocols, topology, etc.). An example of architecture is 10baseT Ethernet which typically uses the start topology.

2. What is a bus topology?

A *bus topology* connects each computer (node) to a single segment trunk. A '*trunk*' is a communication line, typically coax cable, which is referred to as the '*bus*.' The signal travels from one end of the bus to the other. A *terminator* is required at each end to absorb the signal so it does not reflect back across the bus.



In a bus topology, signals are broadcast to all stations. Each computer checks the address on the signal (data frame) as it passes along the bus. If the signal's address matches that

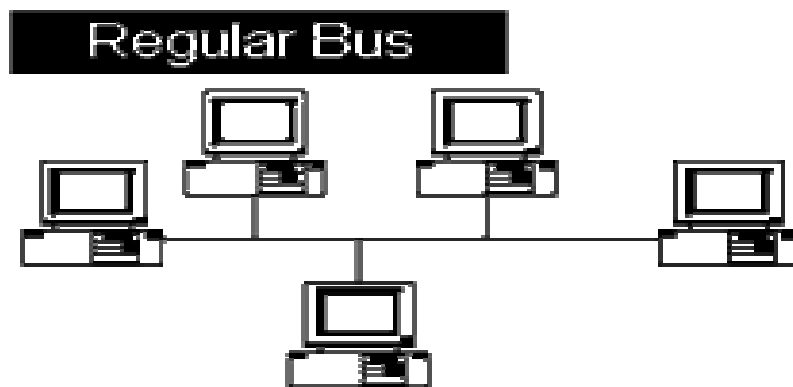
of the computer, the computer processes the signal. If the address doesn't match, the computer takes no action and the signal travels on down the bus.

Only one computer can 'talk' on a network at a time. A media access method called *CSMA/CD* is used to handle the collisions that occur when two signals are placed on the wire at the same time.

The bus topology is *passive*. In other words, the computers on the bus simply 'listen' for a signal; they are not responsible for moving the signal along.

A bus topology is normally implemented with coaxial cable.

3. What is the difference between a regular bus and a local bus?



In a *regular bus*, each computer is attached to the cable segment (called a backbone) by means of a *drop cable* (a shorter cable connecting the computer to the backbone)



In a *local bus*, each computer is attached directly to the backbone in a daisy-chain configuration by means of a "*T*" connector. Peer-to-peer networks are often configured as a local bus.

4. What are the advantages and disadvantages of the bus topology?

Advantages of bus topology:

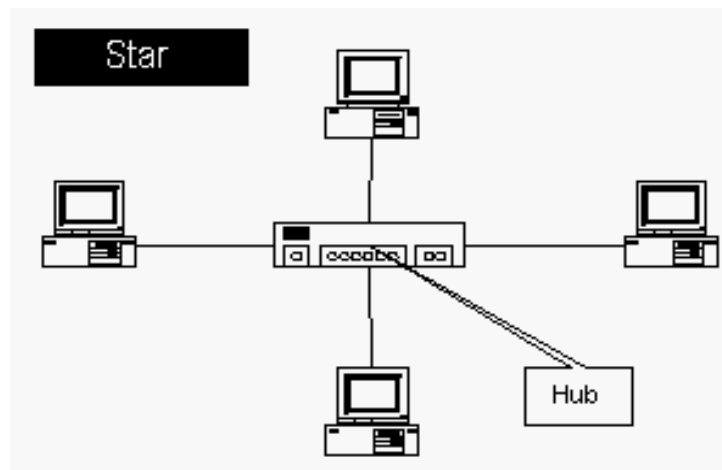
- Easy to implement and extend
- Well suited for temporary networks that must be set up in a hurry
- Typically the least cheapest topology to implement
- Failure of one station does not affect others

Disadvantages of bus topology:

- Difficult to administer/troubleshoot
- Limited cable length and number of stations
- A cable break can disable the entire network; no redundancy
- Maintenance costs may be higher in the long run
- Performance degrades as additional computers are added

5. What are the key features of a star topology?

All of the stations in a *star topology* are connected to a central unit called a *hub*.



The hub offers a common connection for all stations on the network. Each station has its own direct cable connection to the *hub*. In most cases, this means more cable is required than for a bus topology. However, this makes adding or moving computers a relatively easy task; simply plug them into a cable outlet on the wall.

If a cable is cut, it only affects the computer that was attached to it. This eliminates the single point of failure problem associated with the bus topology. (Unless, of course, the hub itself goes down.)

Star topologies are normally implemented using twisted pair cable, specifically unshielded twisted pair (UTP). The star topology is probably the most common form of network topology currently in use.

6. What are the advantages and disadvantages of a star topology?

Advantages of star topology:

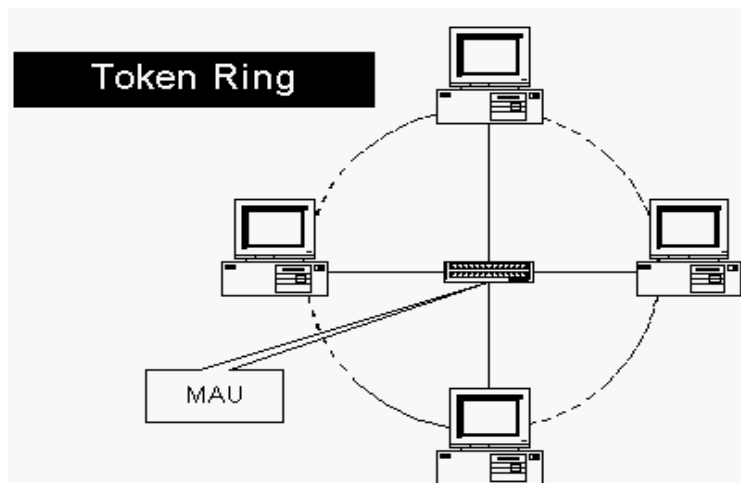
- Easy to add new stations
- Easy to monitor and troubleshoot
- Can accommodate different wiring

Disadvantages of ring topology:

- Failure of hub cripples attached stations
- More cable required

7. What are the key features of a ring topology?

A *ring topology* consists of a set of stations connected serially by cable. In other words, it's a circle or ring of computers. There are no terminated ends to the cable; the signal travels around the circle in a clockwise direction.



Note that while this topology functions logically as ring, it is physically wired as a star). The central connector is not called a hub but a *Multistation Access Unit* or *MAU*. (Don't

confuse a Token Ring MAU with a 'Media Adapter Unit' which is actually a transceiver.)

Under the ring concept, a signal is transferred sequentially via a "token" from one station to the next. When a station wants to transmit, it "grabs" the token, attaches data and an address to it, and then sends it around the ring. The token travels along the ring until it reaches the destination address. The receiving computer acknowledges receipt with a return message to the sender. The sender then releases the token for use by another computer.

Each station on the ring has equal access but only one station can talk at a time. In contrast to the 'passive' topology of the bus, the ring employs an '*active*' topology. Each station repeats or 'boosts' the signal before passing it on to the next station.

Rings are normally implemented using twisted pair or fiber-optic cable.

8. What are the advantages and disadvantages of a ring topology?

Advantages of ring topology:

- Growth of system has minimal impact on performance
- All stations have equal access

Disadvantages of ring topology:

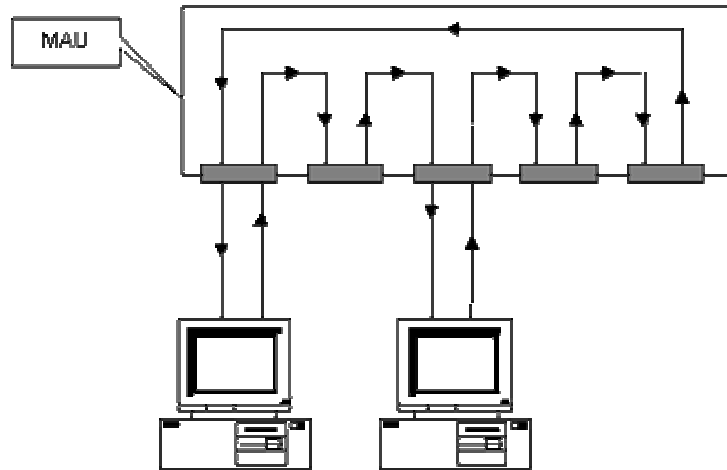
- Most expensive topology
- Failure of one computer may impact others
- Complex

9. Why is a ring topology wired as a star?

A *ring topology* has the same outward appearance as a *star*; all the stations are individually connected to a central location. In the star topology the device at the center is called a hub. In a ring topology, the center is called a MAU.

While they look the same, a closer examination reveals that the *ring* actually consists of a continuous circuit. Signals are passed along the circuit and accessed by stations in sequence. In a *star* topology the signal is split and sent out simultaneously to all stations.

The diagram below illustrates the continuous circuit of a ring.



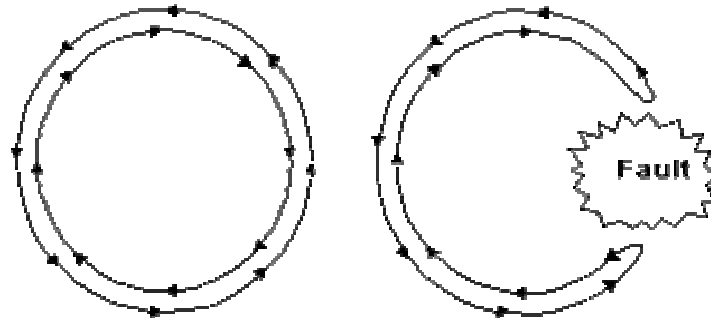
10. What counter ring?

is a rotating

A *counter ring* is a topology

rotating ring that consists

of two rings transmitting in opposite directions. The intent is to provide fault tolerance in the form of redundancy in the event of a cable failure. If one ring goes, the data can flow across to the other path, thereby preserving the ring.



11. Can you 'mix' topologies?

Yes, you can mix various topologies on the same network.

One very common example is a large Ethernet network with multiple hubs. Usually the hubs are located on different floors in a building or perhaps outside in another building. Each hub is wired in the typical star configuration. However, the hubs are connected together along a bus, typically referred to as a '*backbone*.' The backbone between hubs might consist of fiber optic cable while the workstations are wired to each individual hub with UTP (unshielded twisted pair) cable.

12. What are the costs considerations for choosing a topology?

The following factors should be considered when choosing a topology:

- Installation
- Maintenance and troubleshooting
- Expected growth
- Distances
- Infrastructure
- Existing network

As a general rule, a bus topology is the cheapest to install, but may be more expensive to maintain because it does not provide for redundancy.