Backend Networks

Backend networks are used to interconnect large systems such as mainframes, supercomputers, and mass storage devices. The key requirement for backend network is bulk data transfer with high reliability among a limited number of devices in a small area. Typical characteristics for backend networks are as follows.

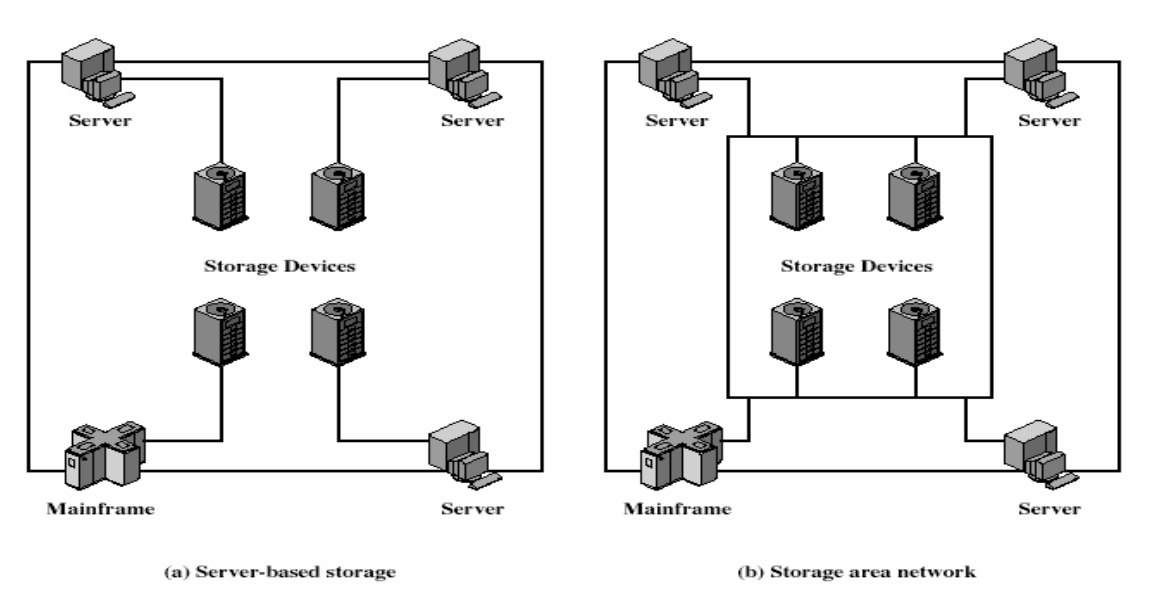
1. High Data Rate: To satisfy the high volume demand of data rates of 100 Mbps.
2. High Speed Interface: Data transfer operation between a large host system and a mass storage device are typically performed through high speed parallel I/O interfaces, rather than slower communications interfaces. Thus, the physical link between station and network must be high speed.
3. Distributed access: Since medium is shared by multiple stations, some sort of medium access control (MAC) is required to enable a number of devices to share the medium with efficient and reliable access.
4. Limited Distance: A backend network is employed in a computer room or a small number of contiguous rooms.
5. Limited number of devices: The number of mainframes and mass storage devices found in the computer room generally numbers in tens or so.

Storage Area Network

A SAN is a separate network to handle storage needs. The SAN detaches or separates storage tasks from specific servers and creates a shared storage facility across a high-speed network. SAN is actually an example or implementation of backend network.

In a conventional LAN installation, a number of servers has its own dedicated storage devices, and if a client needs to access to a particular storage device, it must go through the server that controls that device.

In a SAN, no server sits between the storage devices and the network; instead storage devices and servers are linked directly to the network as shown in the figure below.



Backbone LAN

There are many ways of establishing a LAN. One of the ways is to lay down the cable that spans the distances involved and that interconnects equipments in a single building or cluster of building. This approach has many drawbacks as listed below

1. Reliability: With a single LAN, a service interruption, even of short duration will result in a major disruption for users.
2. Capacity: A single LAN could be saturated over a period of time, as more devices are attached to the LAN.

Another better approach is to employ lower cost, lower capacity LANs within buildings and to interconnect these networks with a higher capacity LAN. This higher capacity LAN is called as backbone LAN.

Key Elements of a LAN

The key elements of a LAN are

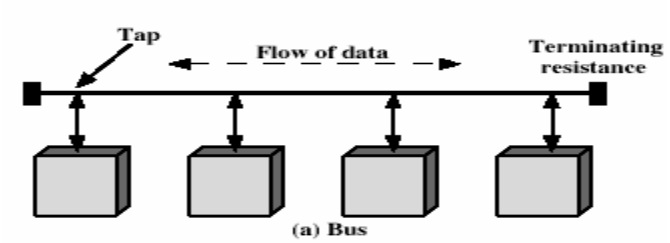
1. Topology
2. Transmission Medium
3. Medium Access Control

Together these elements decide the cost and capacity of the LAN, but also the type of data that can be transmitted, the speed and efficiency of applications.

In terms of communication network, topology is defined as the way nodes or systems in a network are physically laid out. The common topologies for LAN are bus, tree, ring, star and mesh.

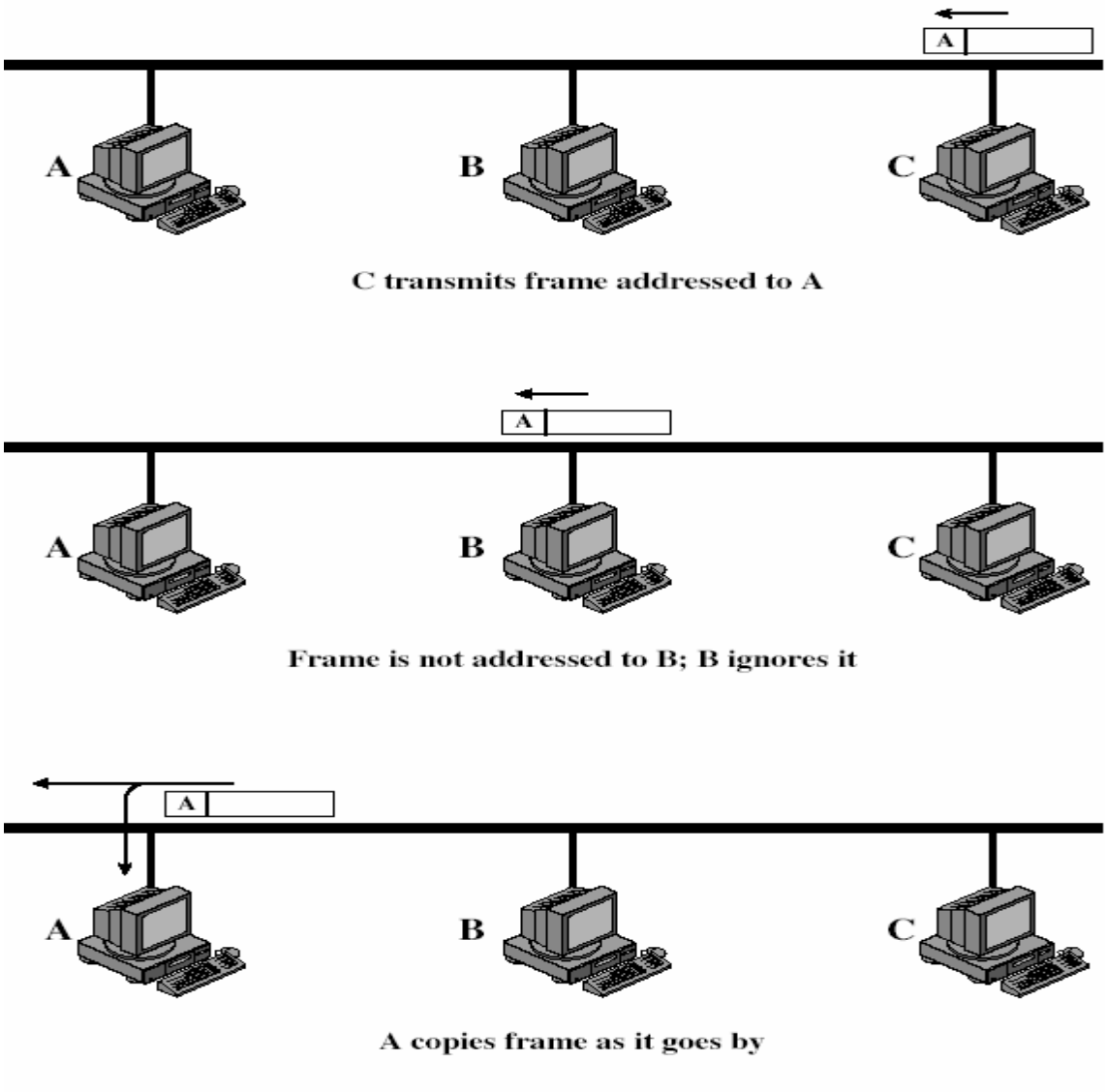
Bus Topology

Bus topology is characterized by the use of multipoint medium. In bus topology, all stations attach through appropriate hardware interfacing known as tap, to the transmission medium as shown in figure below.



A transmission from any station propagates the length of the medium in both the directions and can be received by all other stations in the network. At each end of the bus is a terminator, which absorbs any signal, and thus removing it from the bus.

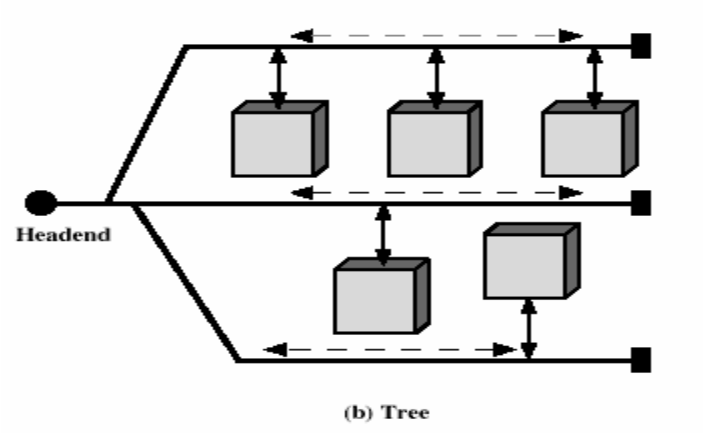
In bus topology, any transmission made, will propagate through the medium and will be received by all stations in the network, so we require some way of indicating for whom the transmission is intended, i.e. who is the intended recipient. To solve this problem, station transmits in small blocks, called as frames, and each frame contains the date and frame header. Each station has a physical address, and this physical address is included in the frame header. The transmission happens as shown below.



There is another problem associated with the bus topology, and it is controlling the access of the medium i.e. Medium Access Control. If two stations wish to transmit at the same moment of time, then their frames will collide and hence garbled up. So some mechanism is needed for controlling the access of medium among the stations. This we will discuss later in MAC.

Tree Topology

Actually bus is a special case of tree, with only one trunk and no branches. The transmission medium is a branching cable with no closed loops as shown in the figure below. The tree layout begins at a point known as headend. One or more cables start at the headend, and each of these may have branches. As with the bus, transmission from any station will propagate throughout the medium, received by all the stations and finally at each end there are terminators, which absorb the signals.



(b) Tree

In bus topology, any transmission made, will propagate through the medium and will be received by all stations in the network, so we require some way of indicating for whom the transmission is intended, i.e. who is the intended recipient. To solve this problem, station transmits in small blocks, called as frames, and each frame contains the date and frame header. Each station has a physical address, and this physical address is included in the frame header.

Transmission Media for Bus LANs
There are four possible alternatives that can be used for Bus LANs

1. Twisted Pair:
2. Baseband Coaxial Cable
3. Broadband Coaxial Cable
4. Optical Fiber

Ring Topology

In ring topology, the network consists of stations joined together in a ring like fashion through point-to-point links. These links are unidirectional i.e. data circulate around the ring in one direction. In ring topology token passing technique is used. a special control frame called as **token**. Generally this token propagates around the logical ring, with only the token holder being permitted to transmit frame. Since only one station can hold the token at a time, and there is only one token in the ring, no collisions can occur. This access method is called as **token passing.** After a station get hold of the token, he starts transmitting the data. A token with the data is known as frame, so a frame is placed on the transmission medium, which also contains the address of intended recipient. All the station in the network can receive the packet, but only intended receipt will copy the contents of the frame, and finally when the frame reaches again to the source, he removes the data from the frame.

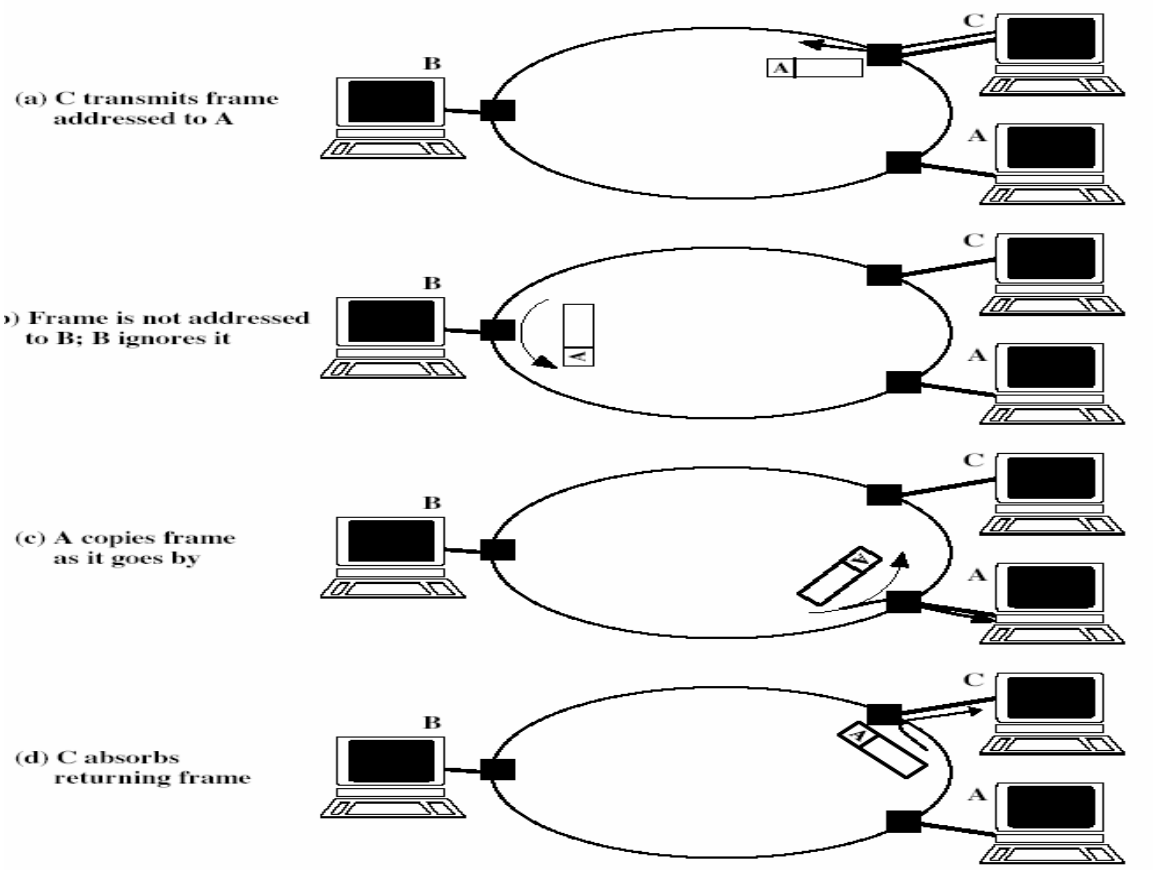
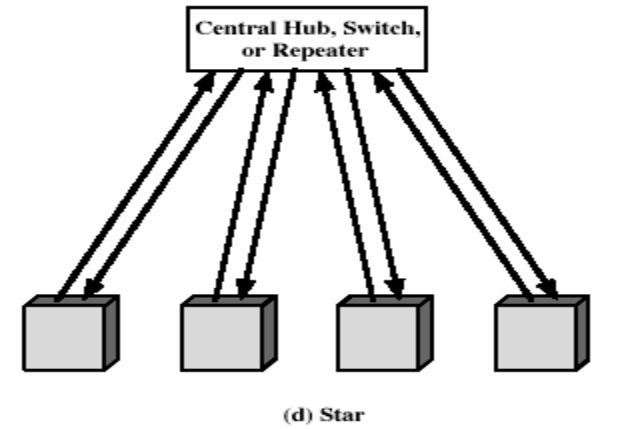


Figure 15.4 Frame Transmission on a Ring LAN

The above diagram shows, how frame transmission happens in the case of ring LAN.

Star Topology

In the star LAN topology, each station is directly connected to a common central node. Each station attaches to a central node via two point-to-point links, one for transmission and one for reception. The central node act as frame switching device. An incoming frame is buffered in the central node and then retransmitted on an outgoing link to the destination station.



(d) Star

For more discussion on LAN topology refer to Brendan Tangney.
You should be able to answer the following question.
What is the difference between various topologies, and also you should be able to write short notes on each topology, covering every point.