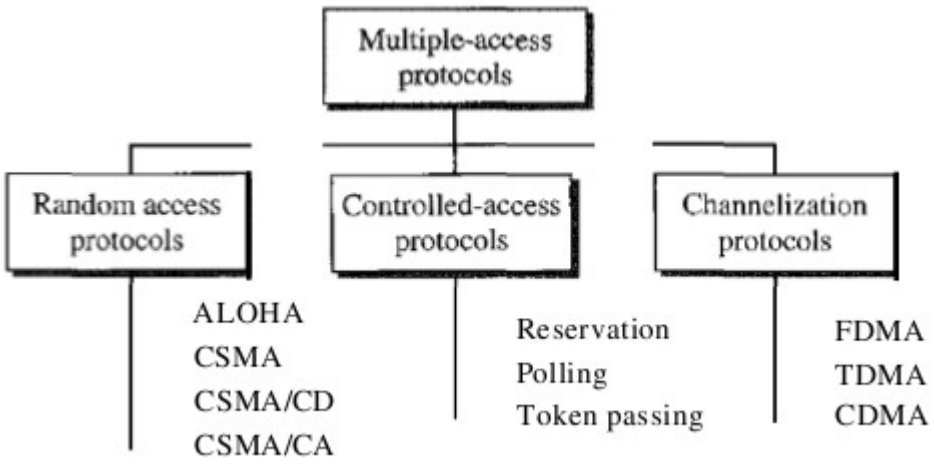
MULTIPLE ACCESS, SERVICES AND DATA LINK DEVICES

Multiple Access

The upper sublayer of Datalink layer, that is responsible for flow and error control is called the logical link control (LLC) layer; the lower sublayer that is mostly responsible for multiple- access resolution is called the media access control (MAC) layer.



According to CSMA/CD, a node should not send a packet unless the network is clear of traffic. If two nodes send packets at the same time, a collision occurs and the packets are lost. Then both nodes send a jam signal, wait for a random amount of time, and retransmit their packets. Any part of the network where packets from two or more nodes can interfere with each other is considered a collision domain. A network with a larger number of nodes on the same segment has a larger collision domain and typically has more traffic. As the amount of traffic in the network increases, the likelihood of collisions increases.

CSMA/CD Algorithm:

1. If the medium is idle, transmit; otherwise, go to step 2.
2. If the medium is busy, continue to listen until the channel is idle, then transmit immediately.
3. If a collision is detected during transmission, transmit a brief jamming signal to assure that all stations know that there has been a collision and then cease transmission.
4. After transmitting the jamming signal, wait a random amount of time, then attempt to transmit again. (Repeat from step 1.

Traditional Ethernet uses CSMA/CD.

Bridge:

A networking component used either to extend or to segment networks. Bridges work at the OSI data-link layer. They can be used both to join dissimilar media such as unshielded twisted-pair (UTP) cabling and fiber-optic cabling, and to join different network architectures such as Token Ring and Ethernet. Bridges regenerate signals

but do not perform any protocol conversion, so the same networking protocol (such as TCP/IP) must be running on both network segments connected to the bridge. Bridges can also support Simple Network Management Protocol (SNMP), and they can have other diagnostic features.

How it works?

Bridges operate by sensing the source MAC addresses of the transmitting nodes on the network and automatically building an internal routing table. This table is used to determine which connected segment to route packets to, and it provides the filtering capability that bridges are known for. If the bridge knows which segment a packet is intended for, it forwards the packet directly to that segment. If the bridge doesn't recognize the packet's destination address, it forwards the packet to all connected segments except the one it originated on. And if the destination address is in the same segment as the source address, the bridge drops the packet. Bridges also forward broadcast packets to all segments except the originating one.

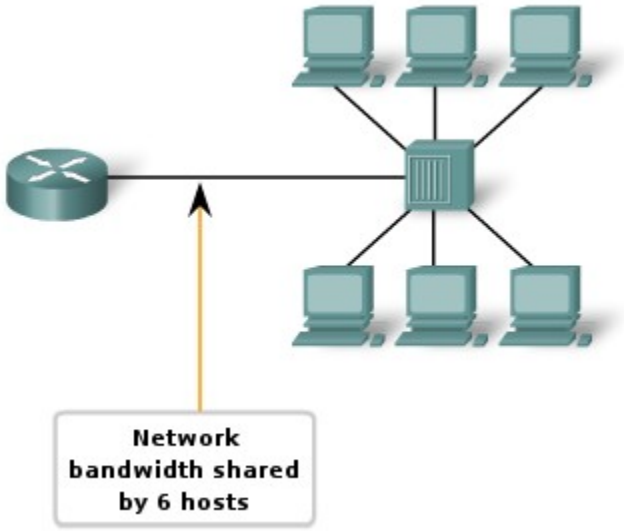
Hub:

The basic networking component used in traditional 10-Mbps Ethernet networks to connect network stations to form a local area network (LAN). Hubs can be used for

- Connecting about a dozen computers to form a workgroup or departmental LAN
- Connecting other hubs in a cascaded star topology to form a larger LAN of up to roughly a hundred computers

How It Works

Hubs are the foundation of traditional 10BaseT Ethernet networks. The hub receives signals from each station and repeats the signals to all other stations connected to the hub. In active hubs (which all of today's hubs are), the signal received from one port is regenerated (amplified) and retransmitted to the other ports on the hub. Hubs thus perform the function of a repeater and are sometimes called multiport repeaters. From a logical cabling point of view, stations wired into a hub form a star topology.



Hubs generally have RJ-45 ports for unshielded twisted-pair (UTP) cabling, and they range in size from 4 to 24 or more ports for connecting stations to the hub, plus one or more uplink ports for connecting the hub to other hubs in a cascaded star topology. Hubs generally have various light-emitting diode (LED) indicator lights to indicate the status of each port, link status, collisions, and so on.

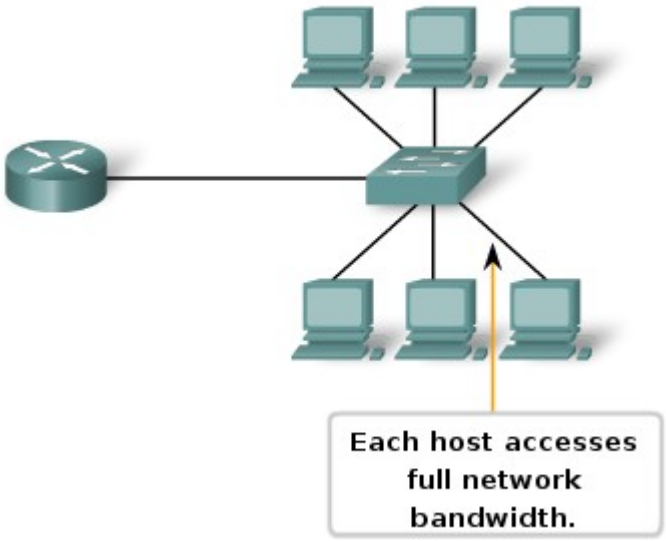
Switch:

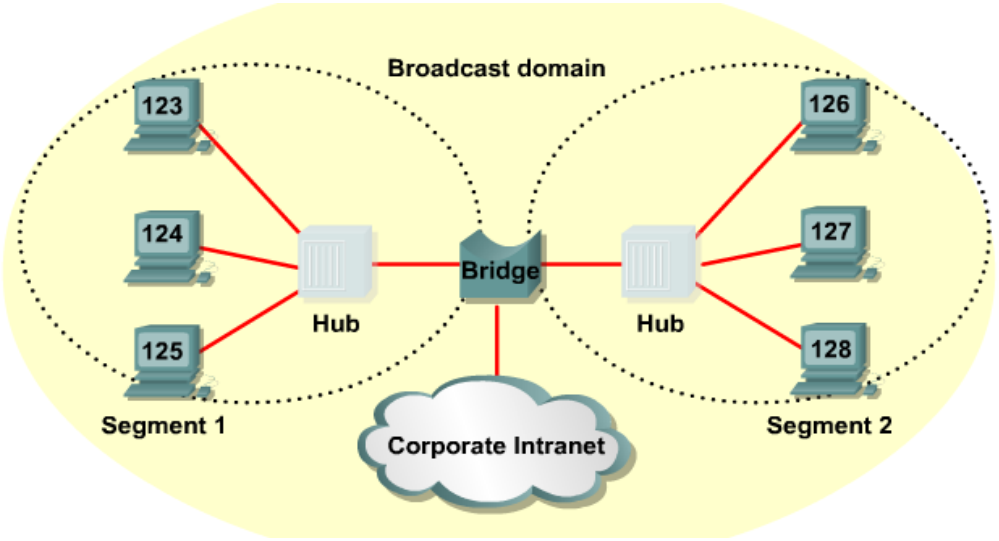
Switch is essentially a multi-port bridge. Switches allow the segmentation of the LAN into separate collision domains. Each port of the switch represents a separate collision domain and provides the full media bandwidth to the node or nodes connected on that port. With fewer nodes in each collision domain, there is an increase in the average bandwidth available to each node, and collisions are reduced.

Why Switches:

In a LAN where all nodes are connected directly to the switch, the throughput of the network increases dramatically. The three primary reasons for this increase are:

- Dedicated bandwidth to each port
- Collision-free environment
- Full-duplex operation





Hub VS Switch:

Hub	**Switch**
Works on physical layer	Works on Datalink layer
Half-duplex	Full Duplex
Hub extends the collision domain	Switch splits the collision domain (Each port of the switch acts as a collision domain)
Multiport Repeater	Multiport Bridge
Overall Bandwidth is shared	Each port receives its own bandwidth.

Cheap	Expensive
Not used in todays market due to degraded performance	Mostly used today.

There are three forwarding methods a switch can use:

- Cut through (cut-through switching is a switching method for packet switching systems, wherein the switch starts forwarding that frame (or packet) before the whole frame has been received, normally as soon as the destination address is processed. This technique reduces latency through the switch, but decreases reliability.)
- Store and forward - the switch, unlike cut through, buffers and typically, performs a checksum on each frame before forwarding it on.
- Fragment free (Fragment-free switching is suitable for backbone applications in a congested network, or when connections are allocated to a number of users. The packets are sent through the switch as a continuous flow of data--the transmit and receive rates are always the same. Because of this, fragment-free switching cannot pass packets to higher speed networks, for example, to forward packets from a 10 Mbit/s to a 100 Mbit/s Ethernet network. Therefore, if you opt for fragment-free switching, you cannot make direct connections to higher speed networks from that port.)

Framing:

The data link layer, needs to pack bits into frames, so that each frame is distinguishable from another. The Data Link layer prepares a packet for transport across the local media by encapsulating it with a header and a trailer to create a frame.

The Data Link layer frame includes:

- Data - The packet from the Network layer
- Header - Contains control information, such as addressing, and is located at the beginning of the PDU
- Trailer - Contains control information added to the end of the PDU

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