SECTION – C

LAN Interconnecting Devices

LAN Interconnecting Devices

- ☐ **Hubs**
- ☐ **Switches**
- ☐ **Bridges**
- ☐ **Routers**
- ☐ **Gateways**

Hubs

- Generic connection device used to tie several networking cables together to create a link between different stations on a network.

- Hubs that are plugged into electric power are called **Active Hubs.**

- A hub that merely connects different cables on a network & provide no signal regeneration is called a **Passive Hub**.

- ☐ "Hub" is a generic term applied to many different network connection devices.

- ☐ If a Hub in someway segments or subdivides the traffic on a network, it is an intelligent or switching hub.

- ☐ **<u>TOPOLOGY</u>**

- • Usually refers to the physical layout of network cable & devices.

- • When all stations are connected to a central hub, the topology is known as a star, because of its appearance.

# Hubs are physical-layer repeaters

- A **repeater** is specific hardware designed to overcome signal attenuation (reduction)

Hubs are essentially physical-layer repeaters:

- bits coming from one link go out all other links
- at the same rate
- no frame buffering
- no CSMA/CD at hub: adapters detect collisions
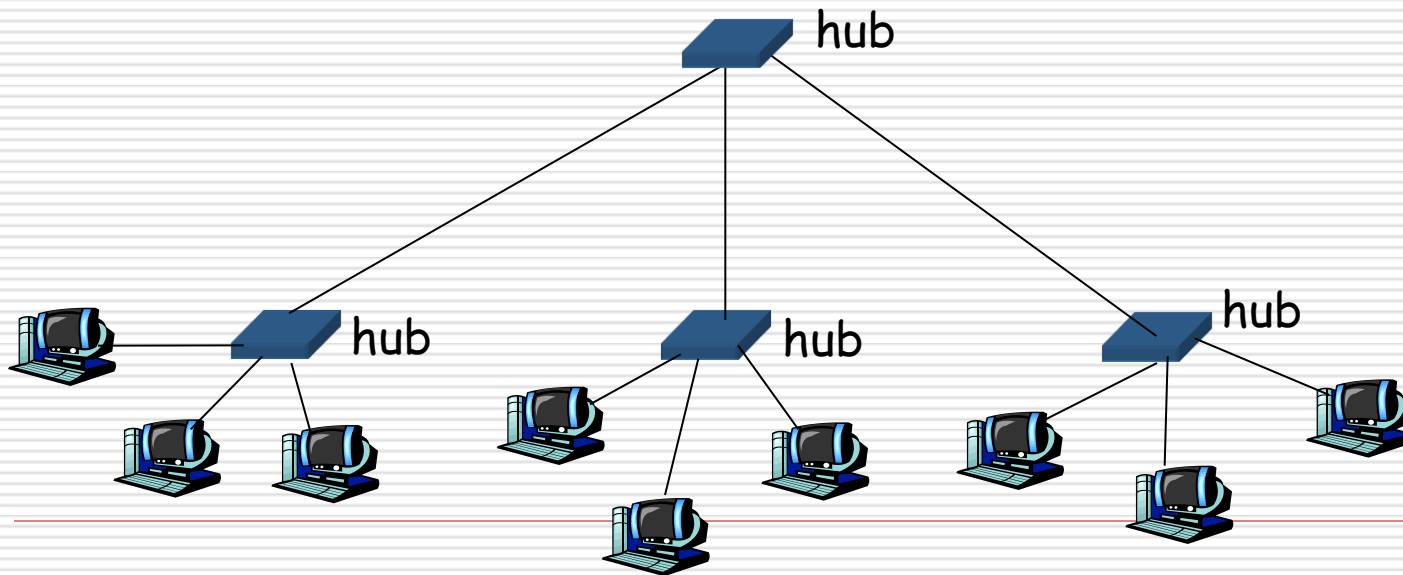- provides net management functionality

Hubs

☐ Star topology

twisted pair

hub
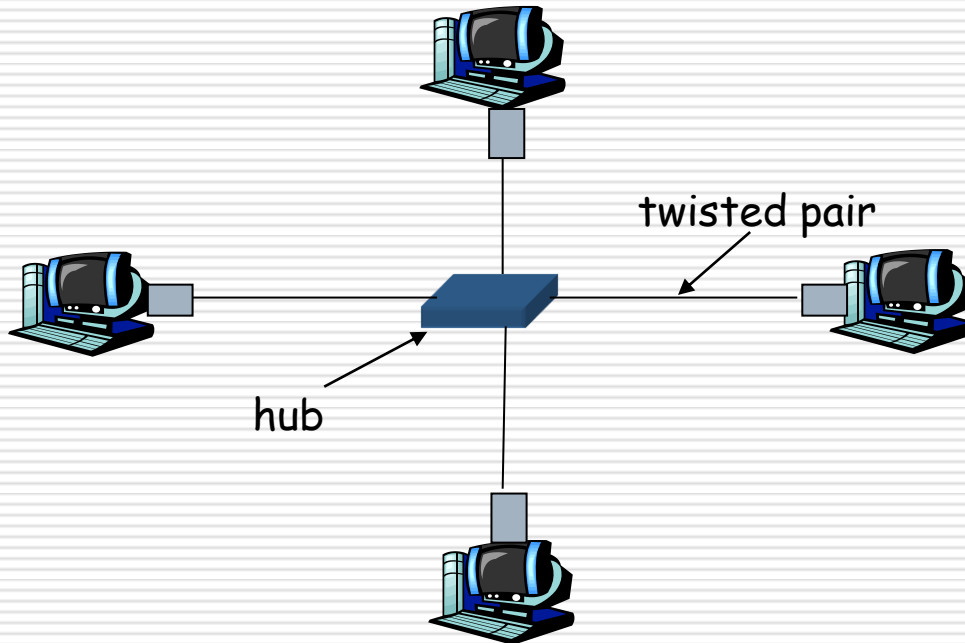
Interconnecting with hubs

- ☐ Backbone hub interconnects LAN segments
- ☐ Extends max distance between nodes
- ☐ But individual segment collision domains become one large collision domain
- ☐ Can't interconnect 10BaseT & 100BaseT

Advantages of Hubs

- **<u>Function</u>**

  A network hub provides simple connectivity for a home network that doesn't need complex switching to manage high rates of traffic.

- **<u>Cost</u>**

  A simple network hub is significantly less expensive than a switch or router. Some cost less than $30.

- **<u>Shared Internet Access</u>**

  A network hub allows a single Internet connection to be shared among multiple computers.

Advantages cont...

- **Scalability**

  Network hubs may have four, five, eight or 16 ports to which computers can be connected. Many network hubs also have an "uplink" port which allows the user to connect multiple hubs so that more computers can be connected to the network.

- **Network Monitoring**

  Because network hubs transmit all data received to all connected devices, they allow easy, inexpensive monitoring of the entire network.

Disadvantage of Hubs

- It is a non intelligent connection but tends to be very cheap. It allows all machines to send packets to every machine connected and wait for the required machine to reply. This causes delays as all the ports are used for every transmission.

Bridges

- ☐ Operate at the data-link layer of the OSI Model
- ☐ Filters traffic between network segments by examining the destination of MAC address.
- Based on this destination MAC address, the bridge either forwards or discards the frame.
- When a client sends a **broadcast** frame to the entire network, the bridge will always forward the frame.

Transparent Bridges

- Also called learning bridges because they build a table of MAC addresses as they receive frames.
- ✓ This means that they "learn" which addresses are on which segments
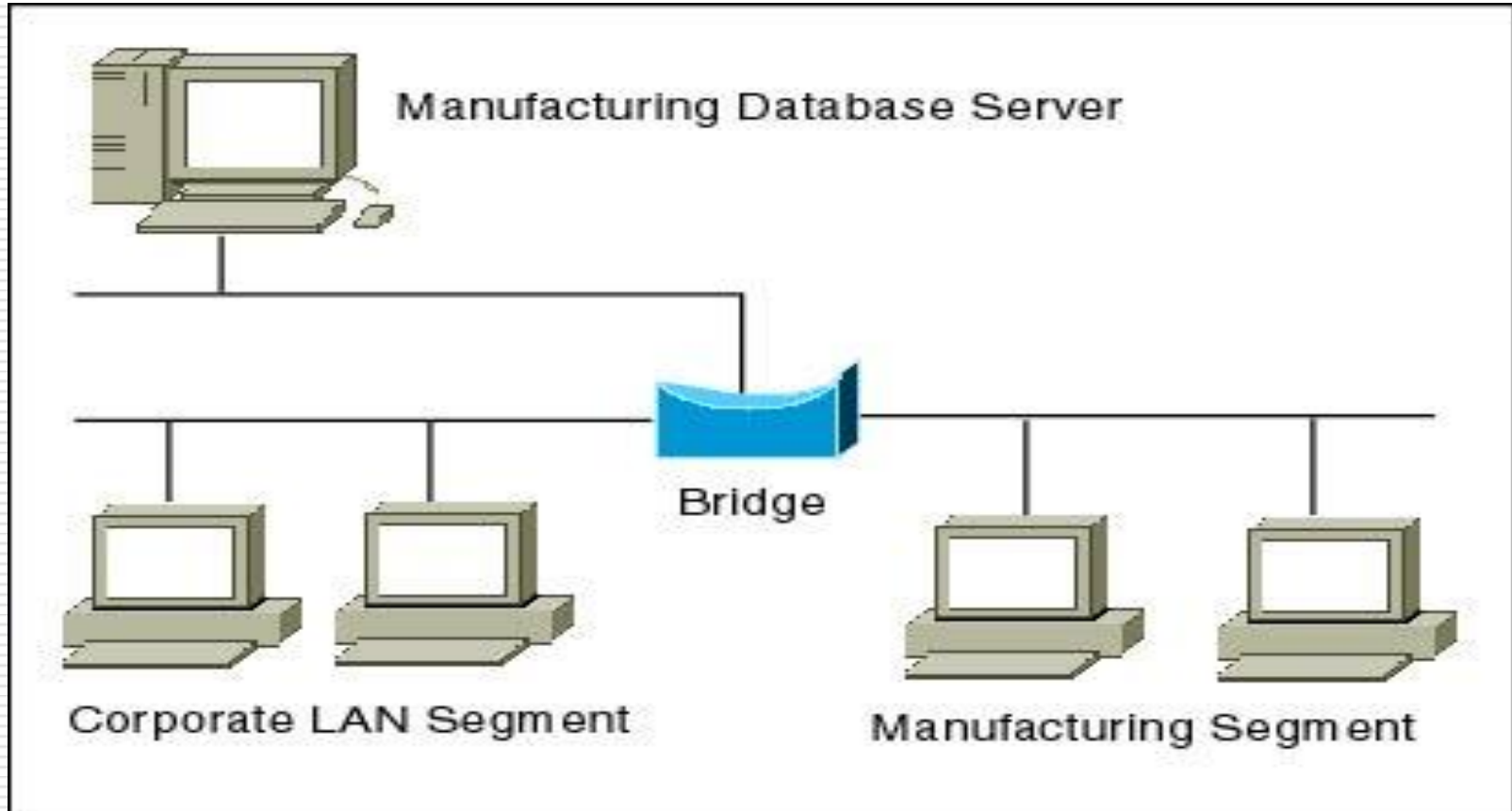- Ethernet mainly use transparent bridges.

Transparent Bridges

Figure: Bridges

Advantages & Disadvantages of Bridging

- ☐ **Advantages of using a bridge includes:**
- Bridges can extend a network by acting as a hub.
- Bridges can reduce network traffic on a segment by subdividing network communications.
- Bridges increase the available bandwidth to individual nodes because fewer nodes share a collision domain.
- Bridges reduce the likelihood of network collisions.
- Some bridges connect networks using different media types & architecture.

Advantages & Disadvantages of Bridging

☐ **<u>Disadvantages of using a bridge includes:</u>**

- Because bridges do more than hubs by viewing the MAC addresses, the extra processing makes them slower then hubs.

- Bridges forward frames indiscriminately , so they do not filter broadcast traffic.

- Bridges are more expensive then hubs.

- Because bridges forward broadcast traffic can be a major disadvantage on a network during a broadcast storm.

- **<u>Broadcast Storm</u>**:

- ✓ Excessive broadcast messages to every host on the network, launched by multiple computers.

Switches

- ☐ Increase network performance by reducing the number of packets transmitted to the rest of the network.

- ☐ Like Bridges, they also operate at the Data Link layer of the OSI Model.

- ☐ In an Ethernet network, computers are usually connected directly to a switch.

☐ **Link layer device**

- stores and forwards Ethernet frames

- examines frame header and selectively forwards frame based on MAC dest address

- when frame is to be forwarded on segment, uses CSMA/CD to access segment

☐ **transparent**

- hosts are unaware of presence of switches

☐ **plug-and-play, self learning**

- switches do not need to be configured

Switch : Traffic Isolation

☐ switch installation breaks subnet into LAN segments
☐ switch filters packets:
  - ■ same-LAN-segment frames not usually forwarded onto other LAN segments
  - ■ segments become separate collision domains

switch

collision domain
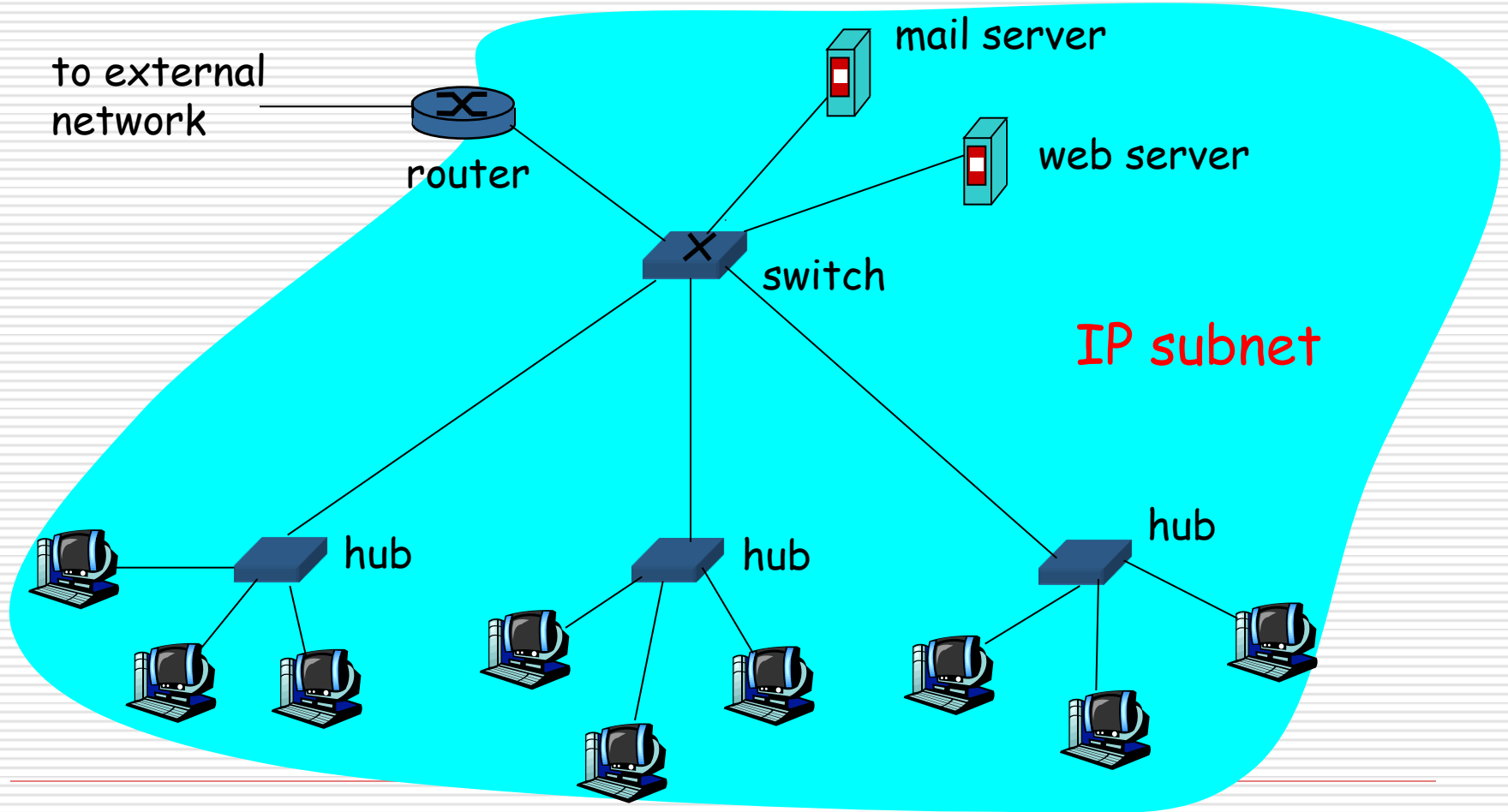
hub

hub

hub

collision domain

collision domain
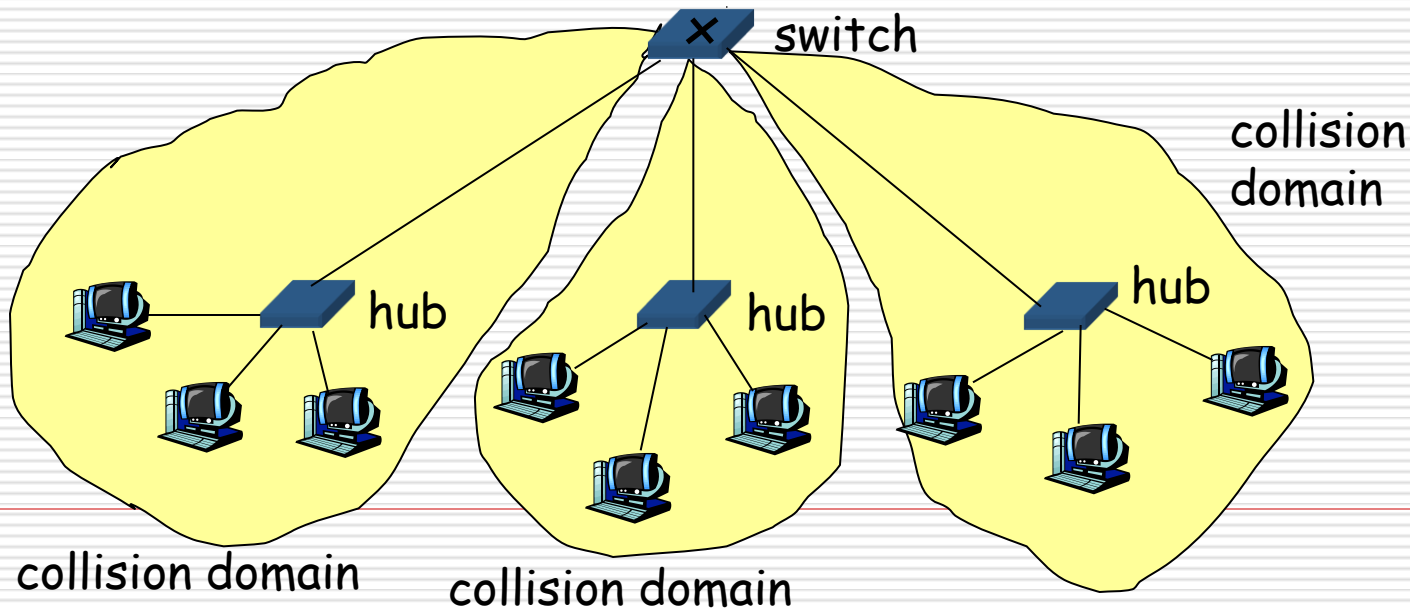
Switches: dedicated access

- ☐ Switch with many interfaces
- ☐ Hosts have direct connection to switch
- ☐ No collisions; full duplex

Switching: A-to-A' and B-to-B' simultaneously, no collisions
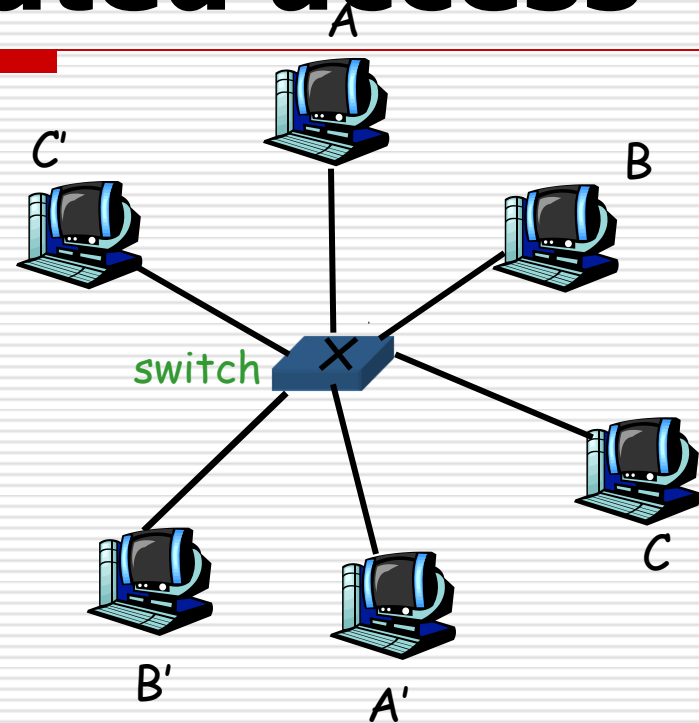
Institutional network

Advantages of Switches

- ☐ Switches increase available network bandwidth.
- ☐ With switches there is reduced workload on individual computers.
- ☐ Switches increase network performance.
- ☐ There are fewer frame collisions because switches create collision domains for each connection.
- ☐ Switches have an unlimited number of ports and connect directly to workstations.

Disadvantages of Switches

- ☐ Switches are significantly more expensive then Bridges.
- ☐ Network connectivity problems can be difficult to trace through a switch.
- ☐ Broadcast traffic maybe troublesome.