CSS2C08

COMPUTER NETWORKS

MODULE 4

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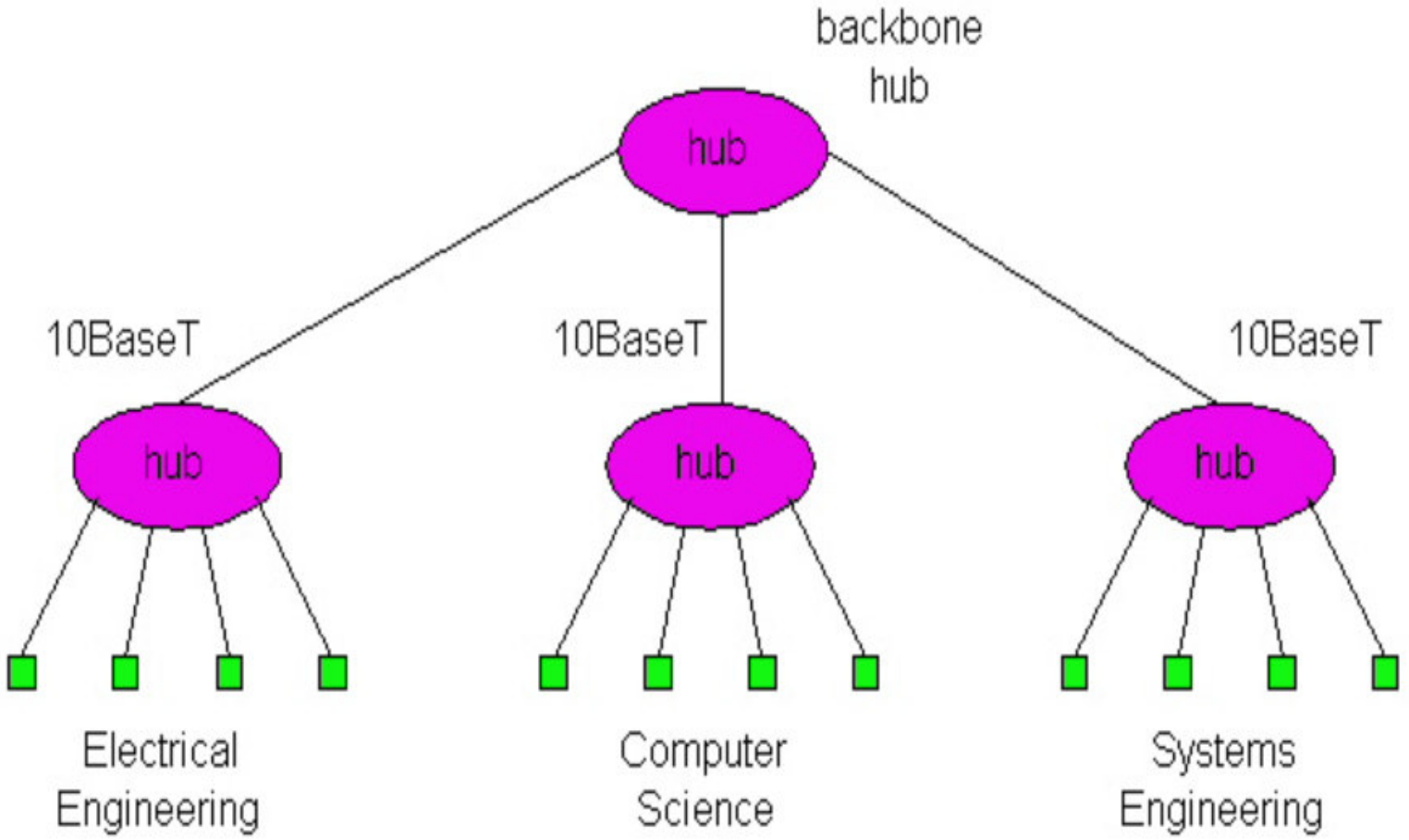
Connecting LANs

- Institutions – including, companies, universities and high schools – typically consist of many departments, with each department having and managing its own Ethernet LAN. Naturally, an institution will want its departments to interconnect their departmental LAN segments.
- Three approaches in which LANs can be connected together are: Hubs ,Bridges and Switches.

HUBS

- The simplest way to interconnect LANs is to use a hub.
- A hub is a simple device that takes an input (i.e., a frame's bits) an retransmits the input on the hub's outgoing ports.
- Hubs are essentially repeaters, operating on bits. They are thus physical-layer devices. When a bit comes into a hub interface, the hub simply broadcasts the bit on all the other interfaces.



Three departmental Ethernets interconnected with a hub.

- Each of the three departments has a 10BaseT Ethernet that provides network access to the faculty, staff and students of the departments. Each host in a department has a point-to-point connection to the departmental hub. A fourth hub, called a **backbone hub**, has point-to-point connections to the departmental hubs, interconnecting the LANs of the three departments.
- Hubs can be arranged in a hierarchy (or multi-tier design), with backbone hub at its top.

- In a multi-tier design, we refer to the entire interconnected network as a LAN, and we refer to each of the departmental portions of the LAN (i.e., the departmental hub and the hosts that connect to the hub) as a **LAN segment**.
- It is important to note that all of the LAN segments belong to the same **collision domain**, that is, whenever two or more nodes on the LAN segments transmit at the same time, there will be a collision and all of the transmitting nodes will enter exponential backoff.

- Interconnecting departmental LANs with a backbone hub has many benefits:
  - It provides inter-departmental communication to the hosts in the various departments.
  - It extends the maximum distance between any pair of nodes on the LAN. For example, with 10BaseT the maximum distance between a node and its hub is 100 meters; therefore, in a single LAN segment the maximum distance between any pair of nodes is 200 meters. By interconnecting the hubs, this maximum distance can be extended, since the distance between directly-connected hubs can also be 100 meters when using twisted pair (and more when using fiber).

- The multi-tier design provides a degree of graceful degradation. Specifically, if any one of the departmental hubs starts to malfunction, the backbone hub can detect the problem and disconnect the departmental hub from the LAN; in this manner, the remaining departments can continue to operate and communicate while the faulty departmental hub gets repaired.

- **Limitations:**
  - When departmental LANs are interconnected with a hub , then the independent collision domains of the departments are transformed into one large and common collision domain. Before interconnecting the three departments, each departmental LAN had a maximum throughput of 10 Mbps, so that maximum aggregate throughput of the three LANs was 30 Mbps. But once the three LANs are interconnected with a hub, all of the hosts in the three departments belong to the same collision domain, and the maximum aggregate throughput is reduced to 10 Mbps.

- If the various departments use different Ethernet technologies, then it may not be possible to interconnect the departmental hubs with a backbone hub.
- Each of the Ethernet technologies (10Base2, 10BaseT, 100BaseT, etc.) has restrictions on the maximum number of nodes that can be in a collision domain, the maximum distance between two hosts in a collision domain, and the maximum number of tiers that can be present in a multi-tier design. These restrictions constrain both the total number of hosts that connect to a multi-tier LAN as well as geographical reach of the multi-tier LAN.

- **Types of Hub:**
  - **Active Hub:** These are the hubs which have their own power supply and can clean, boost and relay the signal along with the network. It serves both as a repeater as well as wiring centre. These are used to extend the maximum distance between nodes.
  - **Passive Hub :** These are the hubs which collect wiring from nodes and power supply from active hub. These hubs relay signals onto the network without cleaning and boosting them and can't be used to extend the distance between nodes.