Electronic Commerce: Network Infrastructure

Computer Networks

- Centralized Computing
  - Autonomous Computers
  - Host to Remote Terminal Environment

- Computer Network - An interconnected collection of autonomous computers
- Interconnected ➔ Exchange of Information via any media
- Autonomous ➔ No clear Master/Slave Relationship
- Master/Slave ➔ Computer can forcibly start, stop or control another one

Computer Network- Applications

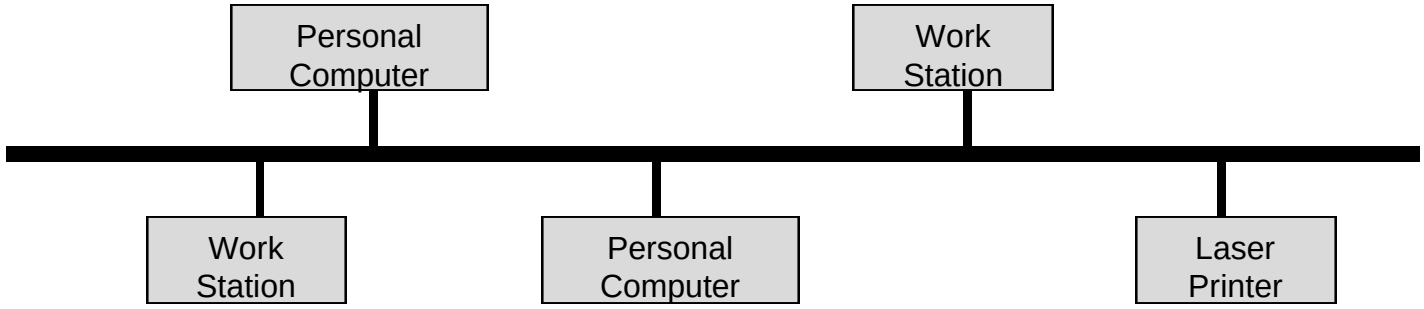
- Resource Sharing
  - Computing Power
  - Data - Airlines Reservation, Banking
- High Reliability
  - Space Missions and Process Control Applications
- Saving Money
  - Cost of Mainframes vs. Servers
  - Client Server Architecture
- Communications Medium
  - Collaborate on Common tasks - Reports, research
  - Access to Remote Information
    - Payment of Bills
    - Airlines/Hotel Reservations
    - Portfolio Management and Trading
    - Digital Libraries
    - Millions of Web Pages
  - Person to Person Communication
    - Email (Text, Audio, Video)
    - Virtual Meetings - Video Conferences, Tele-Offices
  - Interactive Entertainment

Computer Network- Classification

- **On Transmission Technology**
  - **Broadcast Networks**
    - single shared communication Channel
    - Intended Receiver is specified
    - Message heard by all, but, only the intended one responds
    - Examples - Airlines Announcements
    - Capable of broadcasting to all computers or
    - To a subset , this is called multicasting
  - **Point-to-Point Network**
    - Many connections between pairs of machines (nodes)
    - A packet may visit several intermediate nodes to before arriving at the destination. Routing algorithms determine the path.

Local Area Networks

Private networks that connect computers in a room, building or a campus of up to a few kilometers. Used for connecting the PCs, workstations and servers in a campus, office or a factory to facilitate the sharing of resources and exchange of information.



LANs are characterized by their

Size -- Worst case delay and transmission time has an upper bound.

Transmission Technology

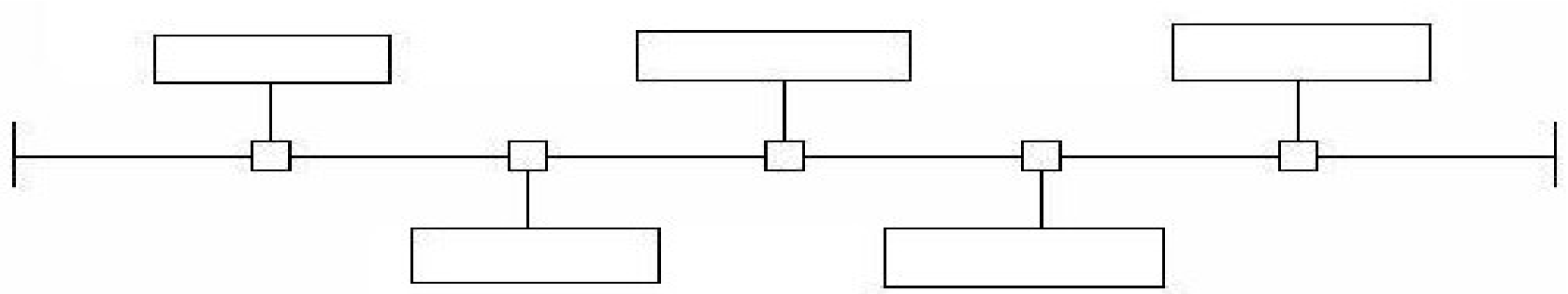
Single Cable on which all machines are attached.

Topology

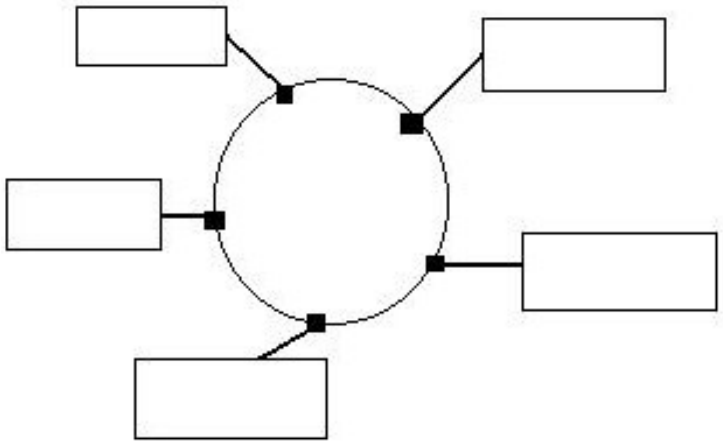
Bus - 10 -100 Mbps

Ring - Token based 4- 16 Mbps

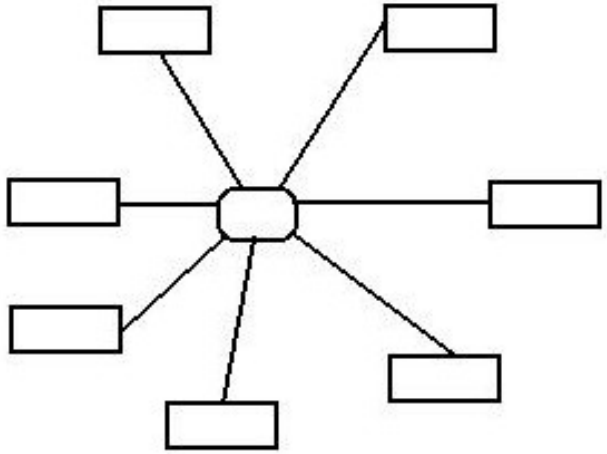
Local Area Networks- Topology



Bus Topology



RingTopology



Star Topology

Local Area Networks- Transmission Media

- **Coaxial Cable**
- **Twisted Pair**
  - **Unshielded Twisted Pair (UTP)**
    - **Category 3 (CAT-3)**
    - **Category 5 (CAT-5)**
  - **Shielded Twisted Pair (STP)**
- **Fiber Optic Cable**
  - **Multimode Step Index Fiber**
  - **Multimode Graded Index Fiber**
  - **Single Mode Fiber**
- **Wireless Transmission**
  - **Radio Based**
  - **Infrared Based**

Local Area Networks- Media Access

- **ALOHA**
- **Slotted ALOHA**
- **Carrier Sense Multiple Access (CSMA)**
  - **1-persistent**
  - **P-persistent**
  - **Non-persistent**
- **CSMA with Collision Detection (CSMA/CD)**

Local Area Networks- Ethernet

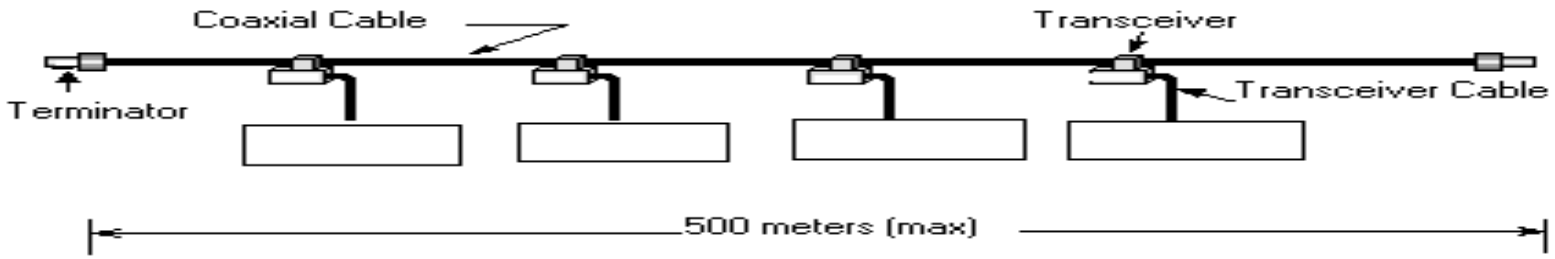
Originally

- **developed at XEROX Palo Alto Research Center**
- **Used 10 Mbps transmission rate**
- **CSMA/CD Media Access Protocol**
- **Evolved into IEEE 802.3 Standard**

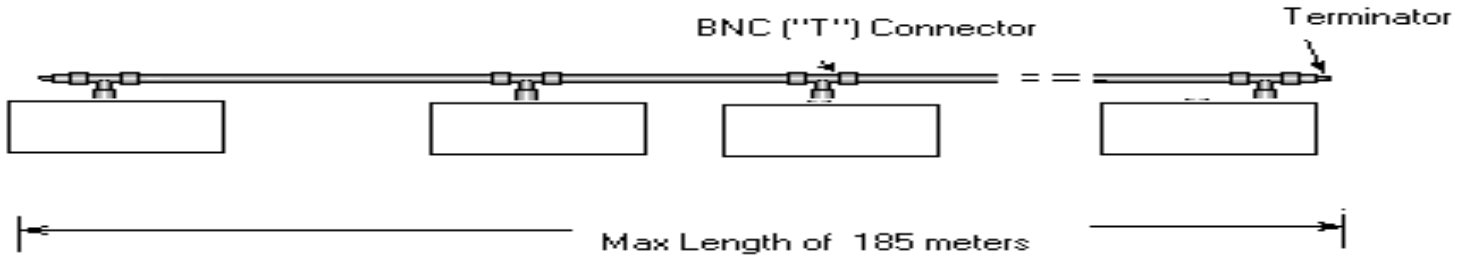
Today supports
Uses 10 and 100 Mbps transmission standards and Cabling systems

Ethernet – Transmission Media

- **10base5 (Thick Coaxial Cable)**
  - Garden Hose like thick cable with markings on every 2.5 m
  - Connections through Vampire taps.

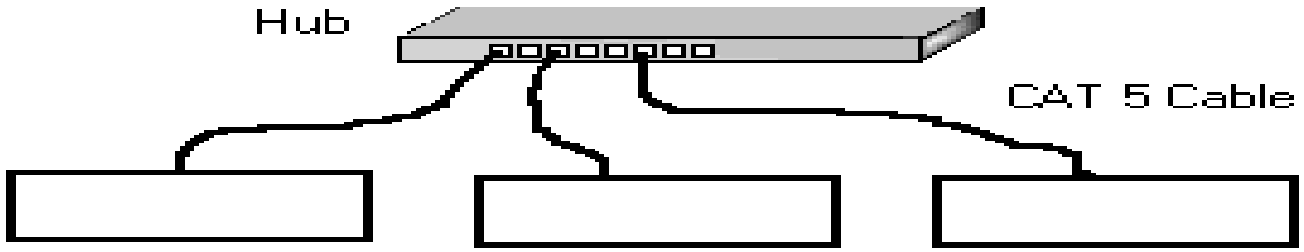


- **10base2 (Thin Coaxial Cable)**
  - Thin Ethernet, bends easily connections through BNC connectors (T-junctions)
  - BNC are easier to install, and reliable compared to Vampire taps
  - Detecting cable breaks, loose connections, bad taps is a major problem with both



Ethernet – Transmission Media

- **10baseT (Twisted Pair)**
  - All station have a cable running to a central device called hub
  - The wires are telephone cos twisted pairs
  - A problems with break in cable remains confined to a node



- **10baseF (Fiber Optic)**
  - Uses Fiber optic media
  - highly reliable, no signal fading issues
  - Expensive due to cost of connectors and terminators

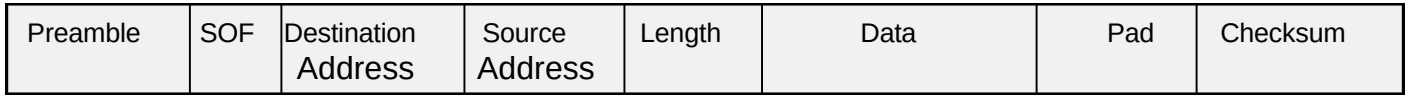
Ethernet- Transmission Media Comparison

Name	Cable	Max. Segment	Nodes / Segment	Advantages.
10Base5	Thick Coax	500 m	100	Good for Backbone
10Base2	Thin Coax	200 m	30	Cheapest System
10BaseT	Twisted Pair	100 m	1024	Easy Maintenance
10BaseF	Fiber Optics	2000 m	1024	Best between Buildings

Ethernet - Media Access Protocol

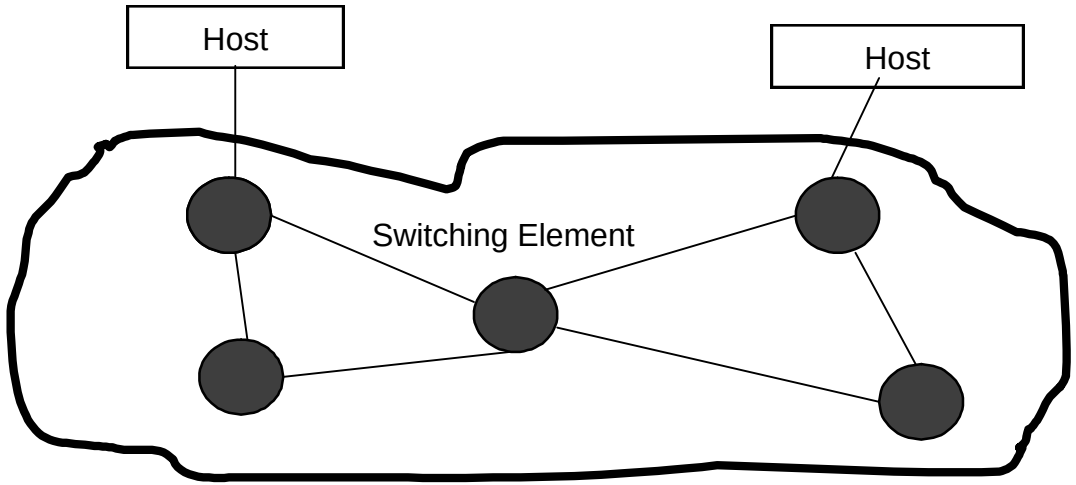
- **It Uses Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol with binary exponential backoff**
  - **On detection of collision all sending stations back off and select a number 0 or 1. They wait for the selected number of slot times before attempting retransmission.**
  - **On K^{th} collision they select a integer between 0 and 2^{k-1}**
  - **After 10th collision number chosen remains between (0 -1023)**
  - **After 16th Collision, it throws in the towel**

Ethernet Frame Format



Wide Area Networks

- Spans a large geographical area - Continents. It's a collection of machines called hosts connected through the communication subnet.



Wide Area Networks

Subnet –

carries messages from host to host, similar to telephone system. Host handle the application aspect. Subnet is concerned with the pure communication aspect. It consists of two distinct components:

1. **Transmission lines (channels) -** for moving bits
2. **Switching element** - an specialized computer that connects two or more transmission lines. When data arrives on incoming line, it must forward it on outgoing line. These are called packet switching nodes, or data switching exchanges. We use a generic term ROUTER for this element.

Wide Area Networks

The topology of subnet is an important design issue.

If two routers that do not share a cable wish to communicate with each other, they have to go through an indirect path through other routers.

When a packet is sent from a router to another one via intermediate router. The intermediate router receives the packet in entirety, stores it and forwards it once the line is free. The subnet using this principle is called **Store-and-forward, point-to-point, or packet-switched** subnet.

Wide Area Networks (Routers and Gateways)

Router is a device that operates at network layer, it examines the source and destination address in the packet, consults the routing tables and forwards the packet on a line leading to the destination address

Routers are sensitive to IP, IPX and OSI packets

The inter-network routing may require routing from one IP to IPX network. This situation is handled by GATEWAYS .

Being connected to Internet has it's downside. You have opened a doorway for corporate espionage, leakage of information or to fancies of an intruder (Hackers). Also, danger of malicious information leaking in, in form of a virus.

Internet-

- Many Networks using different hardware, software and protocols.
- Any two such networks can be interconnected using a gateway computer, that is capable of translating and communicating with both sides.
- The 1984 National Science Foundation (NSF) of USA established a backbone that interconnected 6 supercomputer centers across USA.
- 1983, USDCA recommends adoption of a common protocol standard-- TCP/IP (Birth of modern internet)

"An Inter-network of many networks, all running TCP/IP protocol suite, connected through gateways and sharing common name and address space"

TCP/IP – Reference Architecture

