Networking Essentials
ITC 2243

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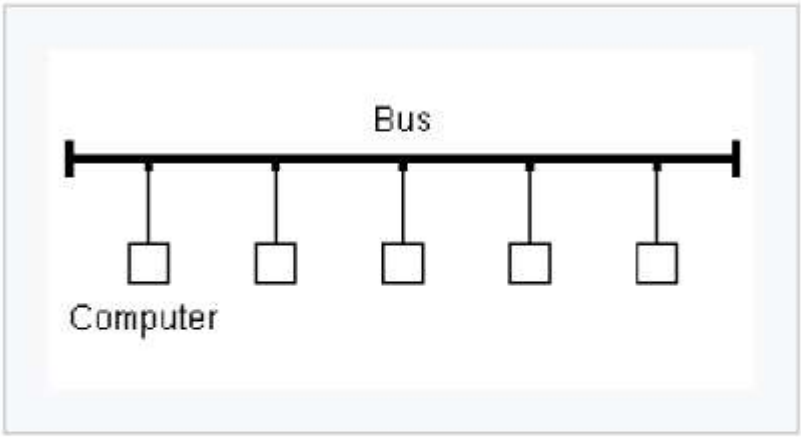
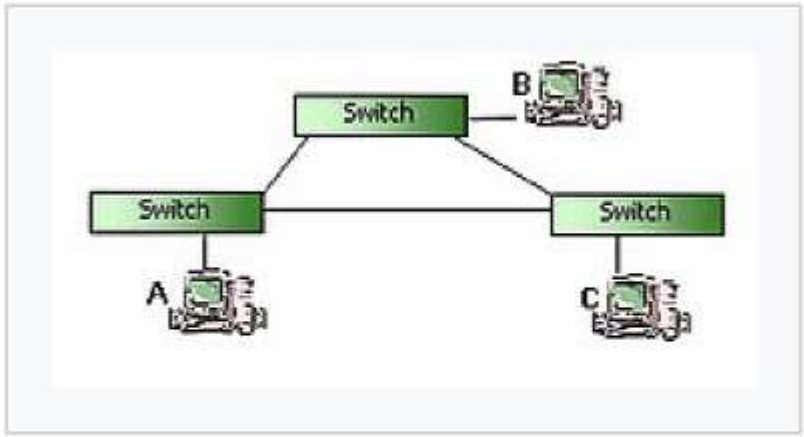
LAN architecture - Ethernet

- A LAN specification created by the Xerox Corporation and then improved through joint efforts of Xerox, Digital Equipment Corporation, and Intel.
- Over time, Ethernet has largely replaced competing wired LAN technologies such as Token Ring and FDDI.
- Systems communicating over Ethernet divide a stream of data into shorter pieces called frames. Each frame contains source (MAC add.) and destination addresses (MAC add), error-checking etc.
- As per the OSI model, Ethernet provides services up to and including the data link layer.
- Ethernet is widely used in homes and industry, and interworks well with Wi-Fi. The Internet Protocol (IP add) is commonly carried over Ethernet and so it is considered one of the key technologies that make up the Internet.

Comparison between original Ethernet and modern Ethernet





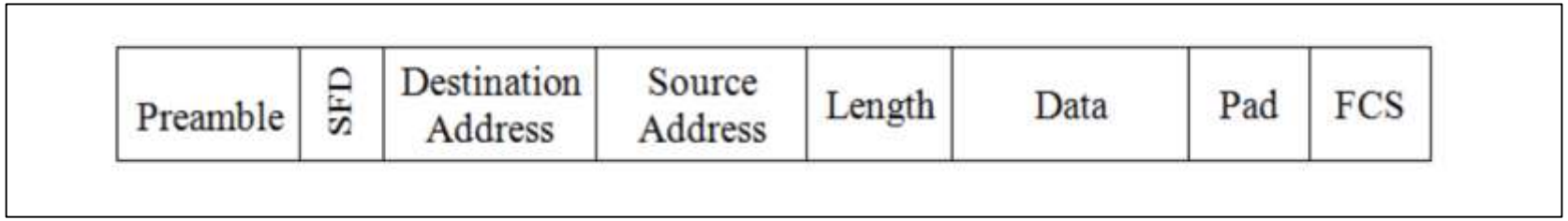
The original Ethernet implementation: shared medium, collision-prone. All computers trying to communicate share the same cable, and so compete with each other.

Modern Ethernet implementation: switched connection, collision-free. Each computer communicates only with its own switch, without competition for the cable with others.

LAN architecture - Ethernet

- Original Ethernet's shared coaxial cable (the shared medium) traversed a building or campus to every attached machine. A scheme known as CSMA/CD governed the way the computers shared the channel.
- In a modern Ethernet, the stations do not share one channel through a shared cable or a simple repeater hub; instead, each station communicates with a switch, which in turn forwards that traffic to the destination station.

Ethernet Frame Format (IEEE 802.3)



- **Preamble -** Each frame starts with a Preamble of 7 bytes (this produces a 10 MHz square wave) which allows the receiver's clock to synchronize with the sender's.
- **SFD (Start Frame Delimiter) -** The SFD is 10101011, allows the receiver to detect the beginning of the data.
- **Destination Address (DA) -** This transmits a 48-bit value. The DA is used by receiving stations to determine whether an incoming packets addressed to a particular node.(MAC add)
- **Source Address (SA) -** The SA is a 48-bit MAC address used to identify the transmitting device.
- **Length field –** The number of bytes within the data field.
- **Data -** This is a packet sent down to the Data Link layer from the Network layer. The size can vary from 46 to 1500 bytes.
- **Pad -** Ethernet requires that valid frames must be at least 46 bytes long, from DA to FCS including both. If the data portion of a frame is less than 46 bytes, the Pad field is used to fill out the frame to the minimum size.
- **Frame Check Sequence (FCS) -** FCS is a field at the end of the frame that's used to store the cyclic redundancy check (CRC).

Ethernet Speed and Types

- **Fast Ethernet and Gigabit Ethernet**

Fast Ethernet is an Ethernet specification with a speed of 100Mbps. Fast Ethernet is ten times faster than 10BaseT, while retaining qualities such as MAC mechanisms and frame format.

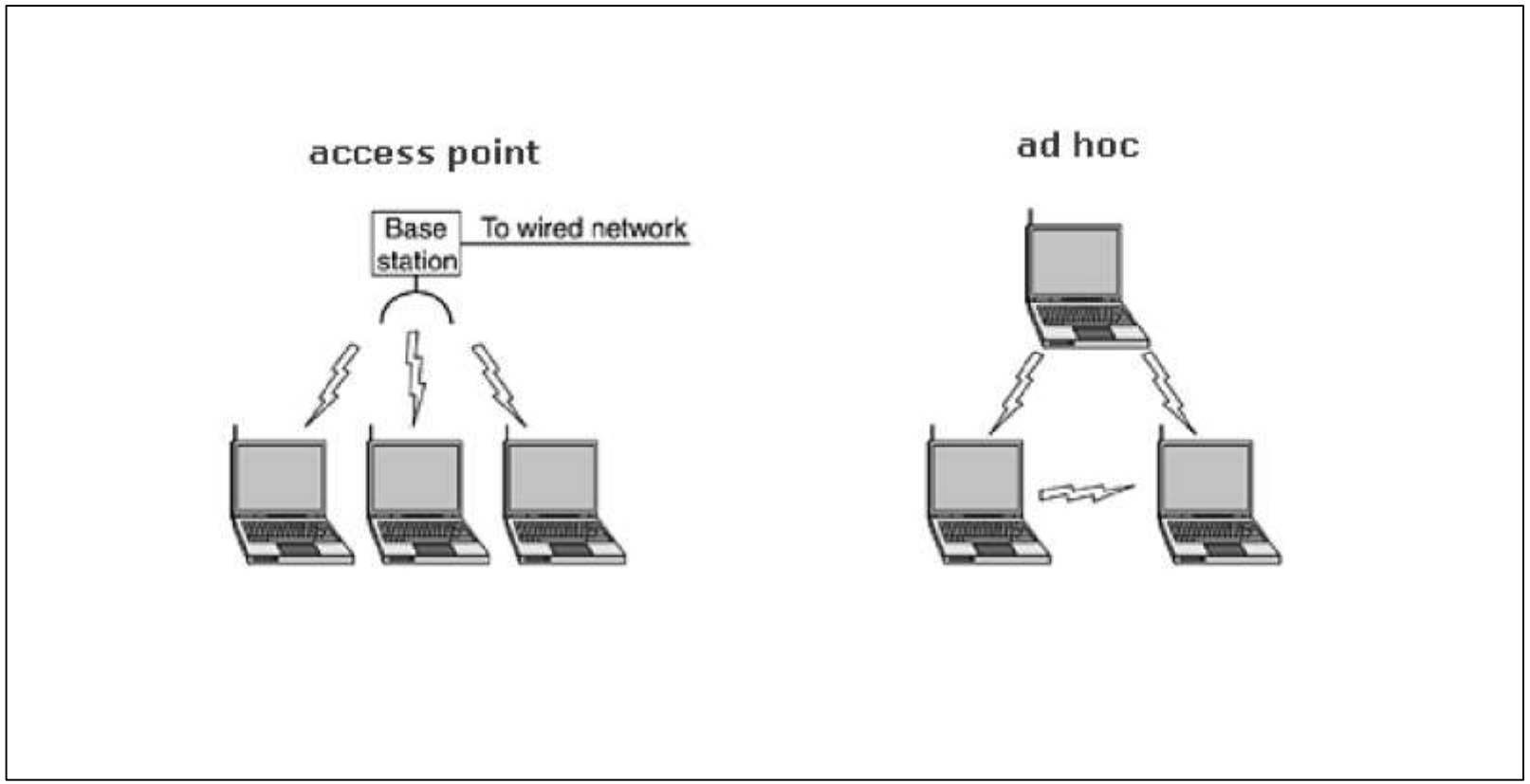
These similarities make it possible for existing 10BaseT applications and management tools to be used on Fast Ethernet networks. Fast Ethernet is based on an extension of IEEE 802.3u and Gigabit Ethernet is defined as 802.3ab with a speed of 1000Mbps.

- **10 GB Ethernet**

10-Gigabit Ethernet (10GBASE-T), being standardized in IEEE 802.3an. 10 GB Ethernet uses the familiar IEEE 802.3 Ethernet media access control (MAC) protocol and its frame format and size. Like Fast Ethernet and Gigabit Ethernet, 10-Gigabit Ethernet uses full-duplex transmission. This is a version of Ethernet with a nominal data rate of 10 Gbit/s, ten times as fast as Gigabit Ethernet.

Wireless LAN

- Local Area Network using wireless transmissions, such as radio or bluetooth instead of phone lines or fiber-optic cable to connect data devices. Wireless LANs provide all the functionality of wired LANs, without the need for physical connections (wires).
- The IEEE 802.11 is a wireless LAN industry standard, and the objective of IEEE 802.11 is to make sure that different manufactures' wireless LAN devices can communicate to each other. The proposed standard had to work in two modes:
    1. In the presence of a base station.
    2. In the absence of a base station.
- In the presence of a base station, all communication will go through the base station, which is called an access point in 802.11 terminology.
- In the absence of a base station, the computers would just send to one another directly. This mode is called ad hoc networking.



Wireless LAN

Networking Standards

- A Standard is an agreed upon definition of a protocol.
- Standards are industry wide protocol definitions that are not tied to a particular manufacturer.
- Many organizations are involved in setting standards for networking

The five most important organizations are:

- ✓ American National Standards Institute (ANSI)
- ✓ Institute of Electrical & Electronics Engineers (IEEE)
- ✓ International Organization for standardization (ISO)
- ✓ Internet Engineering Task Force (IETF)
- ✓ World Wide Web Consortium (W3C)

IEEE

- The Institute of Electrical and Electronic Engineers (IEEE) is a global association and organization of professionals working toward the development, implementation and maintenance of technology-centered products and services.
- IEEE is a nonprofit organization founded in 1963.
- It works solely toward innovating, educating and standardizing the electrical and electronic development industry.

IEEE 802 Standard

- In 1985,the computer society of the IEEE started a project called , **Project 802,**to set standards to enable intercommunication among equipment from a variety of manufactures .
- Instead , it is away of specifying functions of the physical layer and the data link layer of major LAN protocols.

IEEE 802 Standard

IEEE 802 Standards		
Standard	Name	Topic
802.1	Internetworking	Routing,Bridging,and network-to-network Communications
802.2	Logical Link Control	Error and flow control over data frames
802.3	Ethernet LAN	All forms of Ethernet media and interfaces
802.4	Token BUS LAN	All forms of Token Bus media and interfaces
802.5	Token Ring LAN	All forms of Token Ring media and interfaces
802.6	Metropolitan Area Network	MAN technologies,Addressing, and Services
802.7	Broadband technical Advisory Group	Broadband network media,interfaces, adn other Equipments
802.8	Fiber Optic Technical Advisory Group	Fiber Optic media used in token-passing Networks like FDDI
802.9	Integrated Voice/ Data Network	Integration of voice and data traffic Over a single network medium
802.10	Netwok Security	Network access controls,encryption,Certification, and other Security topics
802.11	Wireless Networks	Standards for wireless networking for many different broadcast frquencies and usage techniques
802.12	High-Speed Networking	A variety of 100 Mbps-plus technologies,including 100 BASE-VG
802.14	Cable Broadband LANs and MANs	Standards for designing network over coaxial cable-based broadband connections.
802.15	Wireless Personal Area Networks	The coexistence of wireless personal area networks with Others wireless devices in unlicensed frequency bands.
802.16	Broadband Wireless Access	The atmospheric interface and related functions associated with Wireless Local Loop(WLL)

Thank you!!!