Introduction to Computer Networks and Data Communications

Chapter 1

Learning Objectives

- Define the basic terminology of computer networks
- Recognize the individual components of the big picture of computer networks
- Outline the basic network configurations
- Cite the reasons for using a network model and how those reasons apply to current network systems
- List the layers of the OSI model and describe the duties of each layer
- List the layers of the Internet model and describe the duties of each layer
- Compare the OSI and Internet models and list their differences and similarities

Lecture Notes

The Language of Computer Networks

To better understand the area of computer networks, you should understand the basic broad categories of computer networks and data communications. For example, you should be able to define each of the following terms:

- computer network
- local area network
- metropolitan area network
- wide area network
- personal area network
- data communications
- voice network
- data network
- telecommunications
- network management

Computer Networks - Basic Configurations

Understand each of the following configurations. Examine the figure from the text or create your own example for each configuration. Describe how this configuration works in simple terms. Describe one or more applications that use each configuration:

- terminal-to-mainframe
- microcomputer-to-mainframe
- microcomputer-to-local area network
- microcomputer-to-Internet
- local area network-to-local area network
- personal area network-to-workstation
- local area network-to-metropolitan area network
- local area network-to-wide area network
- sensor-to-local area network
- satellite and microwave
- wireless telephone

Network Architecture Models.

Know the OSI Model and its 7 layers including the basic functions performed at each layer: Physical, Data Link, Network, Transport, Session, Presentation, and Application. Even though the OSI model is not the actual model used to support the Internet, its understanding is necessary as many networks and products often refer to the OSI model for definition.

It is also important to learn the Internet Model (or DoD model or TCP/IP model) and its 4 layers: (Network) Interface, Network, Transport, and Application. The Internet model is the model used to support all activities on the Internet.

Logical and Physical Connections

To avoid future confusion, you must know the difference between a logical connection and a physical connection. Note that the only physical connection in a network is at the physical or interface layer.

Fundamentals of Data and Signals

Chapter 2

Learning Objectives

- Distinguish between data and signals
- Cite the advantages of digital data and signals over analog data and signals
- Identify the three basic components of a signal
- Discuss the bandwidth of a signal and how it relates to data transfer speed
- Identify signal strength and attenuation and how they are related
- Outline the basic characteristics of transmitting digital data with digital signals, analog data with digital signals, digital data with analog signals, and analog data with analog signals
- List and draw diagrams of the basic digital encoding techniques, including the advantages and disadvantages of each Identify the different modulation techniques and describe their advantages, disadvantages, and uses
- Identify the different modulation techniques and describe their advantages, disadvantages, and uses
- Identify the two most common digitization techniques and describe their advantages and disadvantages
- Discuss the characteristics and importance of spread spectrum encoding techniques
- Identify the different data codes and how they are used in communication systems

Chapter Outline

1. Basics of transmission

2. Data and Signals
    a. Analog versus digital
    b. Fundamentals of signals
    c. Loss of signal strength

3. Converting Data into Signals
    a. Transmitting digital data with digital signals: digital encoding schemes
        - Non-return to zero digital encoding schemes
        - Manchester digital encoding schemes
        - 4B/5B digital encoding scheme
    b. Transmitting digital data with analog signals

  - Amplitude modulation
  - Frequency modulation
  - Phase modulation

c. Transmitting analog data with digital signals

  - Pulse code modulation
  - Delta modulation

d. Transmitting analog data with analog signals

4. Spread Spectrum Technology

5. Data Codes

a. EBCDIC

b. ASCII

Lecture Notes

Data and Signals

Information that is stored within computer systems and transferred over a computer network can be divided into two categories: data and signals. Data are entities that convey meaning within a computer or computer system. If you want to transfer this data from one point to another, either by using a physical wire or by using radio waves, the data has to be converted into a signal. Signals are the electric or electromagnetic encoding of data and are used to transmit data.

Converting Data into Signals

Like data, signals can be analog or digital. Typically, digital signals convey digital data, and analog signals convey analog data. However, you can use analog signals to convey digital data and digital signals to convey analog data. The choice of using either analog or digital signals often depends on the transmission equipment that is used and the environment in which the signals must travel. There are four combinations of data and signals: digital data transmitted using digital signals, digital data transmitted using analog signals, analog data transmitted using analog signals, and analog data transmitted using digital signals.

Spread Spectrum Technology

Using a spread spectrum transmission system, it is possible to transmit either analog or digital data using an analog signal. However, unlike other encoding and modulation techniques, only an intended receiver with the same type of transmission system can accept and decode the transmissions. The idea behind spread spectrum transmission is to bounce the signal around on seemingly random frequencies rather than transmit the signal on one fixed frequency. Anyone trying to eavesdrop will not be able to listen because the transmission frequencies are constantly changing.

Data Codes

One of the most common forms of data transmitted between a sender and a receiver is textual data. This textual information is transmitted as a sequence of characters. To distinguish one character from another, each character is represented by a unique binary pattern of 1s and 0s. The set of all textual characters or symbols and their corresponding binary patterns is called a data code. Two important data codes are EBCDIC and ASCII.

The Media: Conducted and Wireless

Chapter 3

Learning Objectives

- Outline the differences between Category 1, 2, 3, 4, 5, 5e, 6, and 7 twisted pair wire.
- Outline the characteristics of coaxial cable including the advantages and disadvantages.
- Outline the characteristics of fiber optic cable including the advantages and disadvantages.
- Outline the characteristics of terrestrial microwave systems including the advantages and disadvantages.
- Outline the characteristics of satellite microwave systems including the advantages and disadvantages as well as the differences between low earth orbit, middle earth orbit, geosynchronous earth orbit, and highly elliptical earth orbit satellites.
- Describe the basics of wireless radio, including AMPS, D-AMPS, PCS systems, and third generation wireless systems.
- Outline the characteristics of pager systems including the advantages and disadvantages.
- Outline the characteristics of short-range transmissions, including Bluetooth
- Describe the characteristics, advantages, and disadvantages of wireless application protocol
- Outline the characteristics of broadband wireless systems including the advantages and disadvantages.
- Apply the media selection criteria of cost, speed, distance and expandability, environment, and security to various media in a particular application.

Chapter Outline

1. What is a transmission media

2. Conducted Media
    a. Twisted pair wire
    b. Coaxial cable
    c. Fiber optic cable

3. Wireless Media
    a. Terrestrial microwave transmission
    b. Satellite microwave transmission

c. Mobile telephones
d. Cellular digital packet data
e. Pagers
f. Infrared transmissions
g. Bluetooth
h. Wireless application protocol
i. Broadband wireless systems

4. Media Selection Criteria
    a. Cost
    b. Speed
    c. Distance and expandability
    d. Environment
    e. Security

Lecture Notes

Introduction

All communications media can be divided into two categories: physical or conducted media, such as wires, and radiated or wireless media, which use radio waves. Conducted media include twisted pair wire, coaxial cable, and fiber optic cable. In wireless transmission, various types of electromagnetic waves, such as radio waves, are used to transmit signals. This chapter examines seven basic groups of wireless media used for the transfer of data: terrestrial microwave transmissions, satellite transmissions, cellular radio systems, personal communication systems, pagers, infrared transmissions, and multichannel multipoint distribution service.

Twisted Pair Wire

The oldest, simplest, and most common type of conducted media is twisted pair wires. Twisted pair is almost a misnomer, as one rarely encounters a single pair of wires. To help simplify the numerous varieties, twisted pair can be specified as Category 1-5 and is abbreviated as CAT 1-5. While still a little away from being a published specification, Category 6 twisted pair should support data transmission as high as 200 Mbps for 100 meters while Category 7 twisted pair will support even higher data rates. If you determine that the twisted pair wire needs to go through walls, rooms, or buildings where there is sufficient electromagnetic interference to cause substantial noise problems, shielded twisted pair can provide a higher level of isolation from that interference than unshielded twisted pair wire, and thus a lower level of errors.

Coaxial Cable

Coaxial cable, in its simplest form, is a single wire wrapped in a foam insulation, surrounded by a braided metal shield, then covered in a plastic jacket. The braided metal shield is very good at blocking electromagnetic signals from entering the cable and producing noise. Because of its good shielding properties, coaxial cable is very good at carrying analog signals with a wide range of frequencies. There are two major coaxial cable technologies, depending on the type of signal each carries: baseband or broadband. Coaxial cable also comes in two primary physical types: thin coaxial cable and thick coaxial cable.

Fiber Optic Cable

Fiber optic cable (or optical fiber) is a thin glass cable approximately a little thicker than a human hair surrounded by a plastic coating. A light source, called a photo diode, is placed at the transmitting end and quickly switched on and off. The light pulses travel down the glass cable and are detected by an optic sensor called a photo receptor on the receiving end. Fiber optic cable is capable of transmitting data at over 100 Gbps (that's 100 billion bits per second!) over several kilometers. In addition to having almost error-free high data transmission rates, fiber optic cable has a number of other advantages over twisted pair and coaxial cable. Since fiber optic cable passes electrically nonconducting photons through a glass medium, it is immune to electromagnetic interference and virtually impossible to wiretap.

Wireless Media

All wireless systems employ radio waves at differing frequencies. The FCC strictly controls which frequencies are used for each particular type of service. The services covered in this section will include terrestrial microwave transmissions, satellite transmissions, cellular radio systems, personal communication systems, pagers, infrared transmissions, and multichannel multipoint distribution service Terrestrial microwave transmission systems transmit tightly focused beams of radio signals from one ground-based microwave transmission antenna to another. Satellite microwave transmission systems are similar to terrestrial microwave systems except that the signal travels from a ground station on earth to a satellite and back to another ground station on earth, thus achieving much greater distances than line-of-sight transmission. Satellites orbit the earth from four possible ranges: low earth orbit (LEO), middle earth orbit (MEO), geosynchronous earth orbit (GEO), and highly elliptical earth orbit (HEO). Two basic categories of mobile telephone systems currently exist: cellular telephone and personal communication systems (PCS). Cellular digital packet data (CDPD) technology supports a wireless connection for the transfer of computer data from a mobile location to the public telephone network and the Internet. Another wireless communication technology that has grown immensely in popularity within the last decade is the pager. Infrared transmission is a special form of radio transmission that uses a focused ray of light in the infrared frequency range. A broadband wireless system is one of the latest techniques for delivering Internet services into homes and businesses. Bluetooth transmissions will support the new short-range personal area networks, and wireless application protocol will support cellular telephone to Internet connections.

Media Selection Criteria

When designing or updating a computer network, the selection of one type of media over another is an important issue. The principal factors you should consider in your decision include cost, speed, expandability, distance, environment, and security.

Making Connections

Chapter 4

Learning Objectives

- Identify a standard modem and cite its basic operating characteristics
- Discuss the advantages of the newer digital modems and recognize why they do not achieve the high transfer speeds as advertised
- List the alternatives to traditional modems, including T1 modems, cable modems, IDSN modems, and DSL modems.
- Recognize the uses of a modem pool and its advantages and disadvantages
- List the four components of all interface standards
- Discuss the basic operations of the EIA-232F interface standard
- Cite the advantages of FireWire and Universal Serial Bus interface standards
- Outline the characteristics of asynchronous and synchronous data link interfaces
- Recognize the difference between half duplex, full duplex, and simplex connections
- Identify the operating characteristics of terminal-to-mainframe connections and why they are unique from other types of computer connections

Chapter Outline

1. Modems
    a. Basic modem operating principles
    b. Data transmission rate
    c. Standard telephone operations
    d. Connection negotiation
    e. Compression and error correction
    f. Facsimile
    g. Security
    h. Self-testing (loop back)
    i. Internal versus external models
    j. Modems for laptops

3. The 56K Digital Modem

4. Alternatives to Traditional Modems
    a. Channel Service Unit / Data Service Unit (CSU/DSU)
    b. Cable modems
    c. ISDN modems

d. DSL modems

7. High-speed Interface Protocols
    a. FireWire
    b. Universal Serial Bus (USB)

8. Data Link Connections
    a. Asynchronous connections
    b. Synchronous connections
    c. Half duplex, full duplex, and simplex connections

Lecture Notes

Introduction

To better understand the interconnection between a computer and a device such as a modem requires you to understand the concept of interfacing. Interfacing a device to a computer is considered a physical layer activity since it deals directly with analog signals, digital signals, and hardware components. We will examine the four basic components of an interface—electrical, mechanical, functional and procedural—and then introduce several of the more common interface standards.

Modems

Today's modems are complex and offer so many functions and features that the user manuals accompanying them are sometimes hundreds of pages long. For example, most contemporary modems include functions such as support for multiple transmission rates, standard telephone operations, connection negotiation, compression, error correction, facsimile transmission, security, and loop-back testing. Modems can also be physically characterized by whether they are internal or external models and whether they are suitable for use with a laptop computer.

The 56k Digital Modem

Approximately two years after the 33,600 bps modem was announced, the 56,000 bps modem was announced. Did something change to allow the faster transmission speed, or were the industry experts wrong? The experts were correct—two important facts changed with the 56,000 bps modems: digital signaling was introduced, and the signal power level was increased.

Alternatives to Traditional Modems

There are four alternative transmission technologies available, other than the traditional telephone line, that can be used to connect a computer into a remote network system: T-1 digital telephone lines, cable television networks, Integrated Services Digital Network (ISDN), and Digital Subscriber Line (DSL). Each of these transmission technologies requires a particular kind of device that converts the digital data of a computer to the proper form for transmission.

Modem Pools

A modem pool is a relatively inexpensive technique that allows multiple workstations to access a modem without placing a separate modem on each workstation. Modem pools are also used to allow multiple outside users to dial into a computer system.

Interfacing a Computer to Modems and Other Devices

Interfacing is a complex area of study. It is a relatively technical process and varies greatly depending upon the type of device, the computer, and the desired connection between the device and computer. Various organizations set about creating a standard interface between devices such as computers and modems. An interface standard consists of four parts or components: the electrical component, the mechanical component, the functional component, and the procedural component.

High-speed Interface Protocols

Interface standards such as EIA-232F, X.21, and Hayes have existed for many years and, by current standards, are relatively complex to create and difficult to support. They were designed primarily to support modems. Computer designers have been working for many years trying to create a new interface that is flexible and fast and supports not only modems but the growing array of peripheral devices such as document scanners and video cameras. Two new interface standards that have great potential are FireWire and Universal Serial Bus.

Data Link Connections

Assuming that the physical layer connections are already defined by some protocol such as EIA-232F, what is the basic form of the data that is passed between sender and receiver? Is the data transmitted in single-byte blocks, or does the connection create a larger, multiple-byte block? The former connection is an example of an asynchronous connection, while the latter is a synchronous connection.

Multiplexing: Sharing a Medium

Chapter 5

Learning Objectives

- Describe frequency division multiplexing and list its applications, advantages, and disadvantages
- Describe synchronous time division multiplexing and list its applications, advantages, and disadvantages
- Outline the basic multiplexing characteristics of both T1 and ISDN telephone systems
- Describe statistical time division multiplexing and list its applications, advantages, and disadvantages
- Cite the main characteristics of dense wavelength division multiplexing and its advantages and disadvantages
- Cite the main characteristics of code division multiplexing and its advantages and disadvantages

Chapter Outline

1. What is multiplexing

2. Frequency Division Multiplexing

3. Time Division Multiplexing
    a. Synchronous time division multiplexing
    b. T-1 multiplexing
    c. ISDN multiplexing
    d. SONET multiplexing
    e. Statistical time division multiplexing

4. Dense Wavelength Division Multiplexing

5. Code Division Multiplexing

6. Comparison of Multiplexing Techniques

Lecture Notes

Introduction

Under the simplest conditions, a medium can carry only one signal at any moment in time. Many times, however, we want a medium to carry multiple signals at the same time. This technique of transmitting multiple signals over a single medium is **multiplexing**. Multiplexing is a technique performed at the physical layer of the OSI model or the interface layer of the Internet model.

Frequency Division Multiplexing

Frequency division multiplexing is the assignment of non-overlapping frequency ranges to each "user" of a medium. So that multiple users can share a single medium, each user is assigned a channel. A channel is an assigned set of frequencies that is used to transmit the user's signal.

Time Division Multiplexing

Time division multiplexing directly supports digital signals. In time division multiplexing, sharing of the signal is accomplished by dividing available transmission time on a medium among users. Since time division multiplexing was introduced in 1960s, it has split into two roughly parallel but separate technologies: *synchronous* time division multiplexing and *statistical* time division multiplexing.

Dense Wavelength Division Multiplexing

Dense wavelength division multiplexing is a fairly new technology that multiplexes multiple data streams onto a single fiber optic line. Unlike frequency division multiplexing, which assigns input sources to separate sets of frequencies, and time division multiplexing, which divides input sources by time, wave division multiplexing uses different wavelength lasers to transmit multiple signals.

Code Division Multiplexing

This multiplexing technique assigns a multiple-bit sequence to each transmitter's binary 1 and binary 0. When all transmitters transmit at the same time, the receiver sums all received values and performs a mathematical computation on the sums to separate one code from another.

Comparison of Multiplexing Techniques

Frequency division multiplexing relies on analog signaling and is the simplest and most noisy of all the multiplexing techniques. Synchronous time division multiplexing is also relatively straight forward, and like frequency division multiplexing, input devices that have nothing to transmit can waste transmission space. The big advantage of synchronous TDM is the lower noise during transmission. Statistical TDM is one step above synchronous TDM because it transmits data only from those input devices that have data to transmit. Thus, statistical TDM wastes less bandwidth on the transmission link. Dense wavelength division multiplexing is a very good, albeit expensive, technique for transmitting multiple concurrent signals over a fiber optic line.

Errors, Error Detection, and Error Control

Chapter 6

Learning Objectives

- Identify the different types of noise commonly found in computer networks
- Specify the different error prevention techniques and be able to apply an error prevention technique to a type of noise
- Compare the different error detection techniques in terms of efficiency and efficacy
- Perform simple parity calculations, and enumerate their strengths and weaknesses
- Cite the advantages of cyclic redundancy checksum, and specify what types of errors cyclic redundancy checksum will detect
- Differentiate the three basic forms of error control, and describe under what circumstances each may be used

Chapter Outline

1. Noise, errors, error prevention, detection and control

2. Noise and Errors
    a. White noise
    b. Impulse noise
    c. Crosstalk
    d. Echo
    e. Jitter
    f. Delay distortion
    g. Attenuation

3. Error Prevention

4. Error Detection Techniques
    a. Parity checks
    - Simple parity
    - Longitudinal parity

    b. Cyclic redundancy checksum

5. Error Control
    a. Do nothing
    b. Return a message
    - Stop and wait ARQ
    - Sliding window protocol
    - Go-back-N ARQ
    - Selective-reject ARQ
    c. Correct the error

Lecture Notes

Introduction

Given that noise is inevitable and errors happen, something needs to be done to detect error conditions. This chapter examines some of the more common error detection methods and compares them in terms of efficiency and efficacy. Once an error has been detected, what action should a receiver take? There are three options: ignore the error, return an error message to the transmitter, or correct the error without help from the transmitter.

Noise and Errors

Transmitted data—both analog and digital—are susceptible to many types of noise and errors. Copper-based media have traditionally been plagued with many types of interference and noise. Satellite, microwave, and radio networks are also prone to interference and crosstalk. Even near-perfect fiber optic cables can introduce errors into a transmission system, though the probability of this happening is less than with the other types of media.

Error Prevention

Since there are so many forms of noise and errors, and since one form of noise or another is virtually a given, every data transmission system must include precautions to reduce noise and the possibility of errors. If you can reduce the possibility of noise before it happens, the transmitting station may not have to slow down its transmission stream. With proper error prevention techniques, many types of errors can be reduced.

Error Detection Techniques

Despite the best attempts at prevention, errors still occur. If an error is detected, it is typical to perform some type of request for retransmission. Error detection techniques themselves can be relatively simple or relatively elaborate. Generally, simple techniques do not provide the same degree of error checking as more elaborate schemes. For example, the simplest error detection technique is simple parity. It adds a single bit to a character of data, but catches the fewest number of errors. At the other end of the spectrum is the most elaborate and most effective technique available today: cyclic redundancy checksum. Although it is more complex and typically adds 16 bits of error detection code to a block of data, it is the most effective error detection technique ever devised.

Error Control

Once an error is detected in the received data transmission stream, what is the receiver going to do about it? The receiver can do one of three things: nothing, return a message to the transmitter asking it to resend the data packet that was in error, or correct the error.

Local Area Networks: The Basics

Chapter 7

Learning Objectives

- State the definition of a local area network.
- List the primary function, activities, and application areas of a local area network.
- Cite the advantages and disadvantages of local area networks.
- Identify the physical and logical local area network topologies.
- Cite the characteristics of wireless local area networks and their medium access control protocols.
- Specify the different medium access control techniques.
- Recognize the different IEEE 802 frame formats
- Describe the common local area network systems

Chapter Outline

1. Parts of the OSI

2. Primary Function of Local Area Networks

3. Advantages and Disadvantages of Local Area Networks

4. Basic Local Area Network Topologies
   a. Bus/tree topology
   b. Star-wired bus topology
   c. Star-wired ring topology
   d. Wireless LANs
   e. Comparison of bus, star-wired bus, star-wired ring and wireless topologies

5. Medium Access Control Protocols
   a. Contention-based protocols
   b. Round robin protocol
   c. Reservation protocols
6. Medium Access Control Sublayer
   a. IEEE 802 Frame Formats

7. Local Area Network Systems
    a. Ethernet
    b. IBM token ring
    c. Fiber data distributed interface (FDDI)
    d. 100VG-AnyLAN

Lecture Notes

Introduction

A local area network (LAN) is a communication network that interconnects a variety of data communicating devices within a small geographic area, and broadcasts data at high data transfer rates with very low error rates. Since the local area network first appeared in the 1970s, its use has become widespread in commercial and academic environments. It would be very difficult to imagine a collection of personal computers within a computing environment that does not employ some form of local area network. This chapter begins by discussing the basic layouts or topologies of the most commonly found local area networks, followed by the medium access control protocols that allow a workstation to transmit data on the network. We will then examine most of the common local area network products such as Ethernet and token ring.

Primary Function of a Local Area Network

The majority of users expect a local area network to perform the primary function of sharing resources. This often includes the following applications: file serving, database and application serving, print serving, electronic mail, remote links, video transfers, process control and monitoring, and distributed processing.

Advantages and Disadvantages of Local Area Networks

Local area networks have several advantages, including: hardware and software sharing, workstation survival during network failure, component and system evolution, heterogeneous mix of hardware and software, and access to other LANs, WANs, and mainframe computers. Disadvantages include complexity, maintenance costs, and the network is only as strong as the weakest link.

Basic Network Topologies

Local area networks are interconnected using one of four basic configurations, or topologies: bus/tree, star-wired bus, star-wired ring, and wireless. The choice of topology is occasionally dictated by the physical environment in which the local area network is to be placed. More than likely, the choice of a topology is determined by other factors such as a preferred access method, data transfer speeds, and brand loyalty. Let’s examine each of the four topologies, paying special attention to advantages and disadvantages.

Medium Access Control Protocols

A medium access control protocol is part of the software that allows a workstation to place data onto a local area network. Depending on the network’s topology, several types of protocols may be applicable. The bottom line with all medium access control protocols is this: since a local area network is a broadcast network, it is imperative that only one workstation at a time be allowed to transmit its data onto the network. In the case of a broadband local area network, which can support multiple channels at the same time, it is imperative that only one workstation at a time be allowed to transmit its data onto a channel on the network. There are three basic categories of medium access control protocols for local area networks: contention-based protocols, such as carrier sense multiple access with collision detection; round robin protocols, such as token passing; and reservation protocols, such as demand priority.

Medium Access Control Sublayer

Although the seven-layer OSI model was designed to support most types of communication systems, it fell short in several areas. One of these areas was the data link layer. Thus, the data link layer has been split into two sublayers: the medium access control sublayer and the logical link control sublayer. The medium access control (MAC) sublayer works more closely with the physical layer and contains a header, computer (physical) addresses, error detection codes, and control information. The logical link control (LLC) sublayer is primarily responsible for logical addressing and providing error control and flow control information.

IEEE 802 Frame Formats

To standardize many of the local area network protocols, IEEE created a series of protocols called the IEEE 802 suite of protocols. With the IEEE 802 standards, the frame formats for data at the medium access control (MAC) sublayer were also created. Thus, as data comes down from the application layer through the lower layers of the communications model and arrives at the MAC sublayer, MAC software places the data into a unique frame format, ready for transmission across the medium (the physical layer).

Local Area Network Systems

The discussion of local area networks started by examining the main types of network topologies: bus, star-wired bus, ring, and wireless. Then the three major categories of medium access control protocols that can operate on these different topologies were introduced: CSMA/CD, token passing, and demand priority. Actual products or local area network systems that are found in a typical computer environment. Four of the most popular local area network systems are Ethernet, IBM token ring, fiber data distributed interface, and 100VG-AnyLAN.

Wireless Networks

From Lecture

Learning Objectives

- What are wireless networks
- How are they used
- Types of wireless systems
  - Fixed Wireless Access (last mile)
  - Wide Area Wireless Data Services (WWANs)
  - Cellular Systems
  - Satellite Systems & Paging Systems
  - HomeRF (SWAP)
  - Bluetooth
  - Wireless LANs , also know as or WLANs
    - WiFi
    - WiFi5

- HomeRF vs Bluetooth vs WiFi
- Bluetooth – piconets and scattenets
  - Bluetooth issues:
    Cost
    Limited support
    Shortcomings in protocol itself
    Positioning in marketplace
    Conflicts with other devices in radio spectrum
- 802.11b WiFI (wireless Ethernet)
  - Wireless NICs
  - Access points APs
    - Base station
    - Bridge to wired LANs
  - Ad Hoc modes
- Infrastructure Mode, also called Basic Service Set (BSS), has wireless clients and an access point
  - More access points can be added to create an Extended Service Set (ESS)
- Wireless Gateway
- All WLAN functions in physical and data link areas of OSI
- 802.11b uses Distributed Coordination Function (DCF) with modified procedure known as Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)