

School of Business  
Eastern Illinois University

## Review For Exam 2

March 9, 2010

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## Fundamentals of Data & Signals

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**Summary Questions**

3  
in Fundamentals of Data & Signals Notes

1. Distinguish between digital and analog signals in relation to noise. Answer: Digital signals are represented as discrete (i.e. non continuous) waveform, whereas digital signals are represented as continuous waveforms.	9-10
2. Distinguish between digital and binary transmission Answer: In digital transmission, the state of the signal varies from 2 to 64 states. In binary transmission, there are exactly two states.	12
3. What is the difference between the bit rate and the baud rate? Answer: see next slide.	16

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## Bits and Baud 4

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- Baud Rate = Number of clock cycles/sec  
In this example, 4 baud (not 4 bauds/second)  
Note: Number of clock cycles, not actual line changes
- Bit Rate = Number of bits/second ☆☆  
In this example, 8 bits/second
- Bit Rate = Baud Rate \* Bits per clock cycle

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## Equations 5

- # of states  
 $2^{\text{Bits per clock cycle}} = \text{Number of possible states (Eq. 1)}$
- Bit rate  
 $\text{Bit rate} = \text{Baud Rate} * \text{Bits per clock cycle (Eq. 2)}$
- Exercise  
(See next slide)

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## Exercise 6

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A) If a transmission line has a Baud rate of 10 000 baud, and if there are eight possible line states, what is the Bit rate?

B) If you wish to send two bits per clock cycle, how many possible states must you have?

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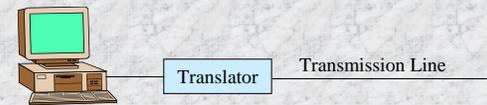
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## Translation Devices 7

- Source of Data versus Line ★★★★★



	Analog Line	Digital Line
Analog Device (e.g. Tel)		Codec
Digital Device (e.g. Computer)	Modem	DSU

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## Fundamentals of Data & Signals (Part 2)

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## Attenuation 9

- Attenuation = Loss of Signal Strength
- Function of Distance and Friction within the Medium
- If high signals get too weak, the receiver will not be able to detect it.
- Decibel (dB) is a relative measure of signal loss or gain of strength.
- $dB = 10 \log_{10} (P2 / P1)$ , Where P2 & P1 are ending and beginning power levels (in watt)

Figure 2-10  
Example demonstrating decibel loss and gain

(Figure 2-10 in textbook)

Overall gain or loss = -10 dB + 20dB - 15dB = -5dB

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## Attenuation ★ ★

- A signal starts at a transmitter with 10 watts of power and arrived at a receiver with 5 watts of power. Calculate the loss of power in dB.

1.  $dB = 10 \log_{10} (P2 / P1)$
2.  $dB = 10 \log_{10} (5/10)$
3.  $dB = 10 \log_{10} (0.5)$
4.  $dB = 10 (-0.3)$
5.  $dB = -3$

Q: What is the decibel loss of a signal that starts at 50 watts and experiences a 10-watt loss over a given section of cable ?

Q: What is the decibel loss of a signal that loses half its power during the course of transmission ?

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## Summary Questions

1. What is the main advantage of digital signals over analog signals in regards to noise?  
 Answer: It's easier to remove noise from digital signals (Slide #4 in Fundamentals of Data & Signals -continued)
2. What are the three main characteristics of signals ?  
 Answer: Amplitude, Frequency and Phase
3. What is the bandwidth of a signal ? The spectrum?  
 Bandwidth=absolute value of the difference between the maximum and the minimum frequencies  
 Spectrum=Range of frequencies from minimum to maximum
4. (a) Name one technique for converting digital data into digital signals.  
 (b) Name 3 techniques for converting digital data into analog signals

4a) NRZ-L or Differential Manchester. 4b) Amplitude modulation, Frequency modulation, Phase modulation

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## Conducted Media

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## Summary Questions

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- What does cross talk interference mean? How can crosstalk interference be reduced?  
If transmission wires are placed side by side, electromagnetic radiation is emitted by one wire and picked up by the other. Twisting pair of wire reduce crosstalk interference.
- What categories of twisted pair are usually used in LANs?  
Categories 3, 4, 5, 6, 7, 8
- What are the advantages and disadvantages of STP compared to UTP?  
Advantage: better level of isolation from interference. Disadvantage: cost
- What is the main difference between Baseband coaxial cable and Broadband coaxial cable?  
Baseband transmit digital signal in a single channel, whereas broadband uses multiple channels to transmit digital or analog signals.
- What are the advantages of Optical fiber compared twisted pair and coaxial cable?  
Speed, No significant noise, No interference, Long distance
- Can you transmit video signal over twisted pair wire? Explain  
Yes, you can (e.g. Digital Video Service or DVS). Noise used to be a limiting factor.

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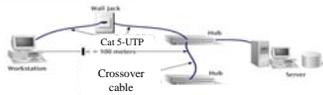
## Case study

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- The following figure shows a common situation in LANs.
- Remember:  
Using Category 5 UTP, the maximum segment length is 100 meters.  
A wall jack is a passive device and does not regenerate a signal

Figure 3-18

Example wiring setup  
Note: connecting a micro-  
computer and a local  
area network



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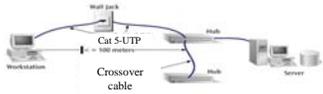
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## Case study

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Figure 3-18

Example wiring setup  
Note: connecting a micro-  
computer and a local  
area network



- What kind of problem there will be if the distance between the Workstation and the Hub is more than 100 meters? What solution can be applied?
- If the cable that connects the workstation and the hub passes through a noisy environment (Heating or cooling mechanical room) what action could be taken to prevent interference?

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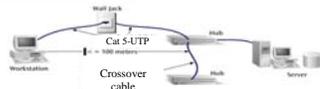
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## Case study



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Figure 3-18  
Example wiring scheme  
for connecting a mobile  
computer and a fixed  
area network



- If the needed data rate is higher than 100 Mbps, what are the possible solutions?

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## Wireless Media

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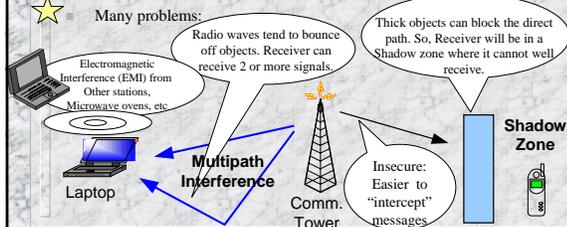
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## Wireless Media

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- Use electromagnetic waves or electromagnetic radiation for data transmission
- Propagation through space, and indirectly, through solid objects

Many problems:



+ Much more attenuation: Inverse Square law

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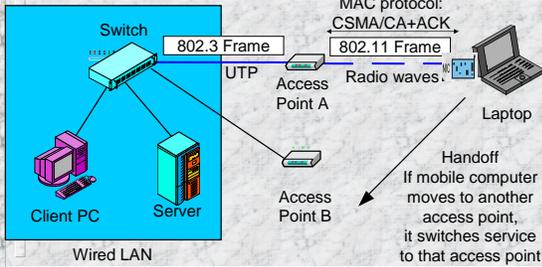
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## Wireless LAN (802.11 standard)

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- Typical physical typology: Point-to-Multipoint



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## Summary Questions

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- a) Wireless transmission can experience propagation problems due to shadow zones and multipath interference. Explain.
- b) What does handoff refer to?
- c) Explain how attenuation occurs in wireless communications: Inverse square law.

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## Local Area Networks

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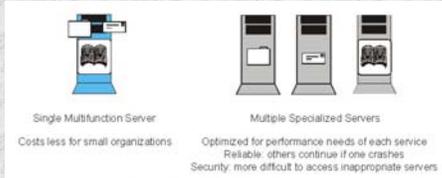
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## Servers

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- Single server Versus Multiple specialized Servers  
Decision based on Cost, Optimization, Reliability, and Security ★



- Optimization:  
File servers need storage capacity and rapid access ★  
Client/Server applications need very fast processors ★

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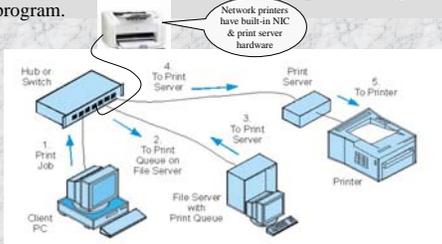
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## Print Server device

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- A **Print Server device** is basically: NIC + a parallel or USB port + Random Access Memory + Intelligence to receive data and commands from print queue manager program. ★



- Note:** Possible to connect printer directly to file server, but people might have to walk far to get their printout.

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## Summary Questions

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- What are the four factors to take into account in deciding how many servers to use to implement a LAN's services?

Answer: Optimization, reliability, security, cost

- To what two devices does a print server connect?

Answer: To a printer via a parallel or USB cable and to a hub/switch via UTP (or fiber optic cable in some case).

- Where does a print job go when it leaves the client PC (not counting the hub or switch)?

Answer: The print job first goes to a file server, which puts it in a print queue.

- Do you have to use special printers for print service?

Answer: You do not need special printers, because any printer with a parallel or USB cable could be connected to a print server. Network printers include integrated NIC. They can be used without a print server device.

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# The Internet

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IP address 29 ★

- 32-bits and Dotted Decimal Notation
  - IP addresses are really strings of 32 bits (1s and 0s)
    - 10000000101010100001000100001101
  - To convert this to dotted decimal notation, first, divide them into four bytes (also called octets)
    - 10000000 10101010 00010001 00001101
  - (Both *octets* and bytes are collections of eight bits)
  - Convert each binary (Base 2) octet into decimal (Base 10)

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IP address 30 ★★

**Binary**  
10100011  
=  
**Decimal**  
163

Position (N)	Place Value (2 <sup>N</sup> )	Bit	Decimal
7	128	1	128
6	64	0	0
5	32	1	32
4	16	0	0
3	8	0	0
2	4	0	0
1	2	1	2
0	1	1	1
			163

Note: Starts with 0 →

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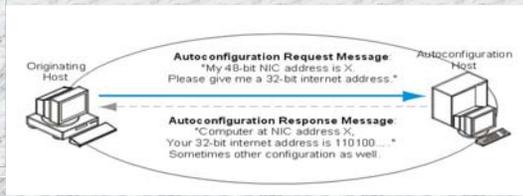


## Autoconfiguration service

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### Request-Response Cycle

- User software requests IP address for the user PC in *Autoconfiguration Request* message
- *Autoconfiguration Response* message contains temporary IP address to use in current session



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## Autoconfiguration

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- Most popular autoconfiguration protocol is *DHCP*
  - *Dynamic Host Configuration Protocol*
  - Built into Windows after Win 3.1
  - Supplies host with temporary IP address
- DHCP can give more information too
  - Usually gives IP address of a default *gateway*. (Microsoft terminology for router)
  - Can give IP address of a local DNS host
  - Can give other information

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## Summary Questions

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1. a) Distinguish between IP address and host name. b) Which is the official address of a host? c) Does a server host need an IP address? d) Does your home PC need an IP address when you are on the Internet? e) Does a server host need a host name? f) Does your home PC need a host name when you are on the Internet?
2. Using the conversion system in slide #23, convert the following IP address to dotted decimal notation: 10101010 11110000 11001100 01010101. (spaces are included to facilitate reading.)
3. Using the conversion system in slide #30, convert the following dotted decimal IP address into a 32-bit IP address: 192.128.2.4

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### Summary Questions

- 4. a) When is DNS needed? b) What information do you send in a DNS request message? c) What information do you receive in a DNS response message?  
(a) When a computer's user enters a domain name or host name (e.g. eiu.edu) in a web browser, the computer needs to request the corresponding IP address from a DNS. (b) the domain name or host name). (c) the IP address that corresponds to the domain name
- 5. a) What information do we get back, at a minimum, from an autoconfiguration server? b) What other information may we get back?  
(a) We get a temporary IP address for a computer to use on the Internet. (b) Could get the local DNS server's IP address, the default gateway IP address, etc.

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