

# DSL and Cable Modems

Part 10c of  
“Electronics and Telecommunications”  
A Fairfield University E-Course  
Powered by LearnLinc

# Module: Digital Systems (in two parts)

- Texts:
  - “Computers,” Capron, Benjamin Cummings, 1996, ISBN 0-10053-0662-5
  - “Telecommunications,” Blyth, McGraw-Hill, 1990, ISBN 0-02-61001041-2
  - “Understanding Telephone Electronics,” Bigelow, Newnes, 1997, ISBN 0-7506-9944
- References:
  - [Electronics Tutorial](#) (Thanks to Alex Pounds)
  - [Electronics Tutorial](#) (Thanks to Mark Sokos)
- Part 9 – Computers
  - 5 on-line sessions plus one lab
- Part 10 – Digital Communications
  - 5 on-line sessions plus one lab
- Mastery Test part 5 follows this Module

# Digital Systems: Topics

- Computer Architecture
    - Memory: ROM, RAM, Cache, Error Checking
    - CPU and Program Control **Part 9**
    - Secondary Storage: Floppy, Hard Drive, CD / DVD
    - I/O (Human: Video, Keyboard, & Pointer)
  - Digital I/O: Serial, Parallel, IDE, USB, FireWire, SCSI
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- Serial I/O: RS232
- Modems **Part 10**
  - Telephone: Modulation and Data compression
  - Cable and DSL
- Telephony Digital Transmission
- Packet Transmission
- Fiber Optics: SONET

# Section 10 Schedule

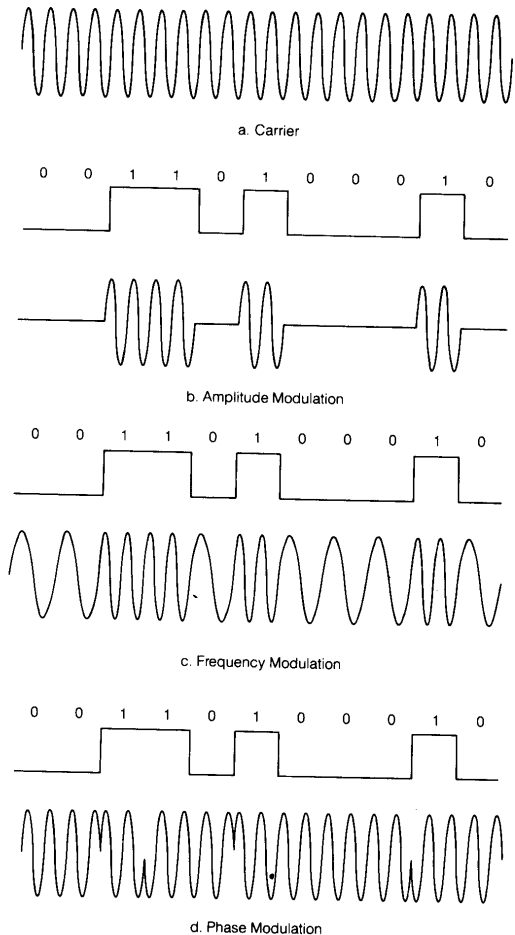
Session 10a	06/30	RS 232	Bigelow: 285-290; Blythe: 162-170
Session 10b	07/02	Telephone Modems	Bigelow: 290-307; Blythe: 170-176
<b>Session 10c</b> <b>No class 7/14, 7/16</b>	<b>07/07</b>	<b>Modems 2: DSL, Cable, Fax &amp; 56K</b>	<b>Bigelow: 307-321; Notes</b>
Session 10d	07/09	T-Carrier	Bigelow: 198-210
Session 10e	07/21	Packets & SONET	Bigelow: 308-309; Notes
Session 10f (Quiz 10 due 07/27) (Lab - 07/26, Sat.)	07/23	Review for Quiz 10	
Session 10g	07/28	Quiz 10 Results	
Session 10h No Class 8/4, 8/6	07/30	MT 5 Q&A	
Session 10i	08/13	MT 5 Q&A 2	If I'm back in time from Chicago
MT5 (Sat, Cheshire)	08/16	MT 5	
MT5 Results	08/18	MT 5 Results	

# Modem Review

- Modem = Modulator / Demodulator
- The Telephone Channel (300 Hz to 3.3 kHz)
- Modulation puts serial data in a form that can pass through the Telephone Channel
- Demodulation is the recovery of the serial data from the corrupted modulated signal.

# Modem Review (2)

- Amplitude Modulation  
(Amplitude Shift Keying)
  - Bit value controls the amplitude of the carrier (sine wave)
- Frequency Modulation  
(Frequency Shift Keying)
  - Bit value controls the frequency of the carrier (sine wave)
- Phase Modulation  
(Phase Shift Keying)
  - Bit value controls the Phase of the carrier (sine wave)
  - Here a “1” shifts the phase by 180°; A “0” lets the sine wave continue smoothly



# Modem Review (3)

- 300 Baud – Bell 103
- 1200 Baud – V.23 (FSK)
- 2400 Baud – V.22bis (PSK, QAM)
- 9600 Baud – V.32
- 14.4 kBaud – V.32bis
- 28 kBaud – V.42
- 33 kBaud – V.42bis (adds data compression)
- 56 kBaud – Only on a 64 kBit/s digital channel

# Modem Review (4)

- Modern modems include data compression
  - Lossless: no introduced errors
  - Two schemes combined to give up to 4x reduction
- Run Length encoding (RLL)
- Dynamic Lemple Ziv (Used in V.42bis)
- Huffman Code: (Used in Faxes)
- Protocols
  - Modem-to-Modem handshake
  - RS232 handshake

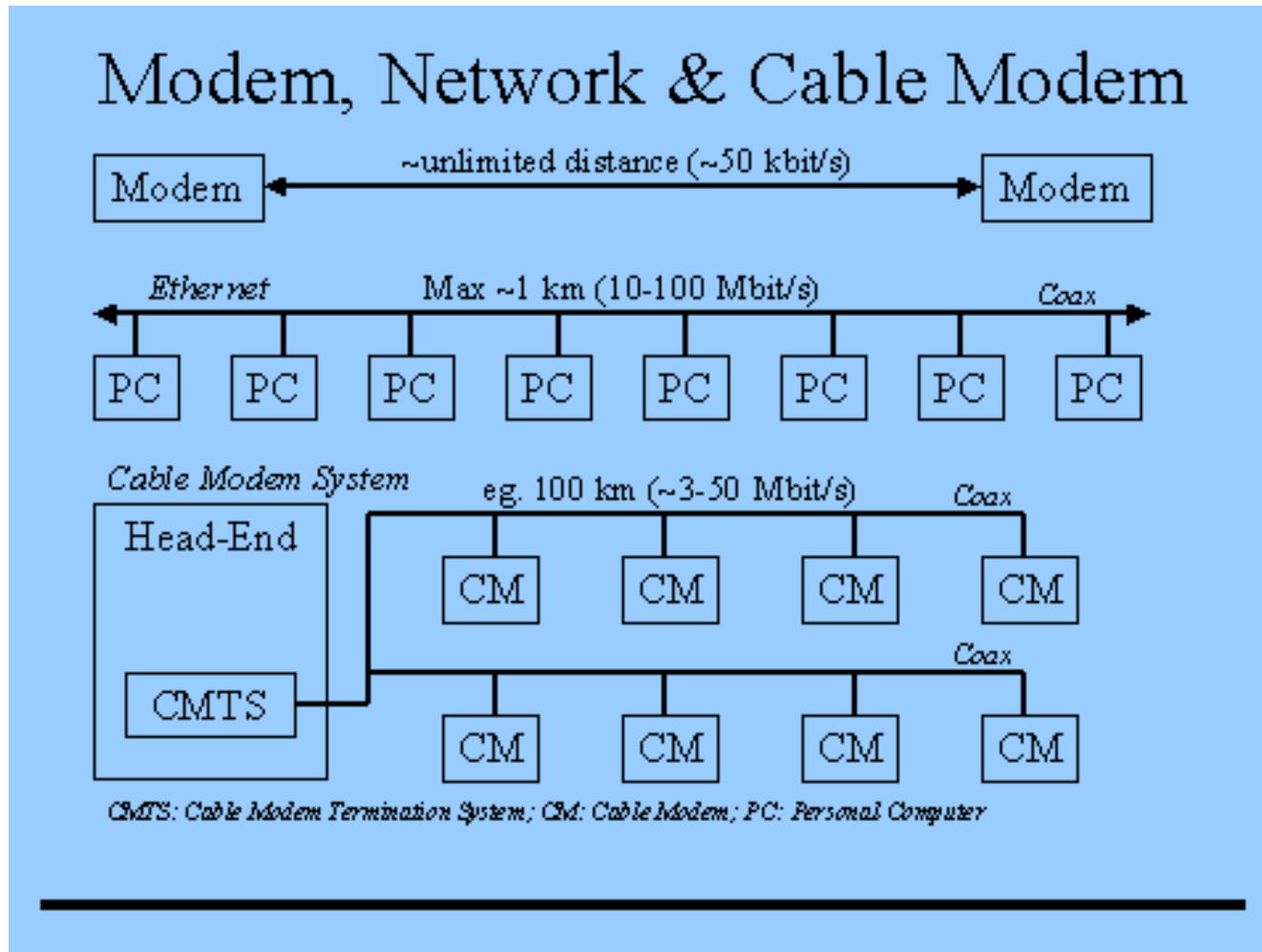


# DOCSIS Cable Modems

- Uses a Video channel (BW = 6 MHz) for downlink data
  - 2000 times the BW of a telephone channel
  - 2000 times faster data (about 6 Mbit/sec)
  - Shared data flow for a neighborhood - similar to a Local Area Network (LAN)
- Low frequencies used for uplink data
  - Smaller BW
  - Slower (asymmetrical)
- Attaches to PC via an Ethernet NIC (RJ45)



# DOCSIS Cable Modems (2)

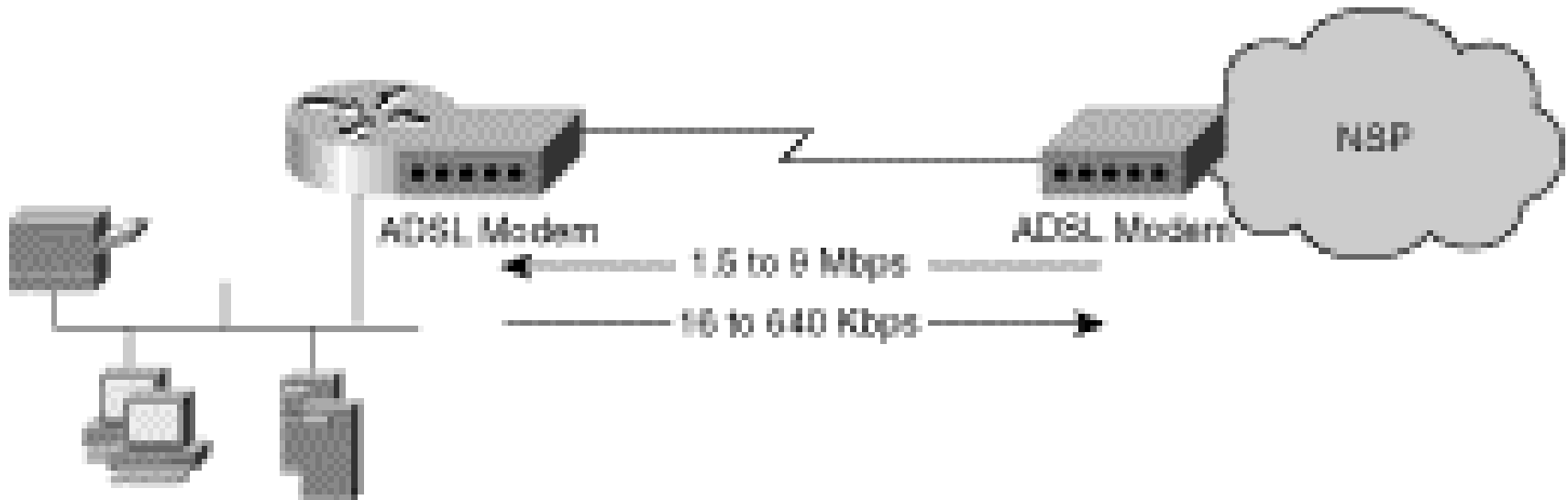


# Asymmetrical Digital Subscriber Line (ADSL)

- The Copper Loop (Tip/Ring)
  - Not limited to 3 KHz BW
  - Much Larger Data rate possible
    - Not too long
    - Clean cable
- Dedicated data path to/from telephone office
- Shared bandwidth (LAN) at local office

# ADSL (2)

- Other Digital Telephony Standards
  - High-data-rate digital subscriber line (HDSL): T1 rate (Symmetric)
  - Single-lined digital subscriber line (SDSL): Rate Adaptive
  - Integrated services digital network (ISDN)
    - 128 Kbit/sec – 2B + D
    - 1.5 MBit/sec – 23B + D



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