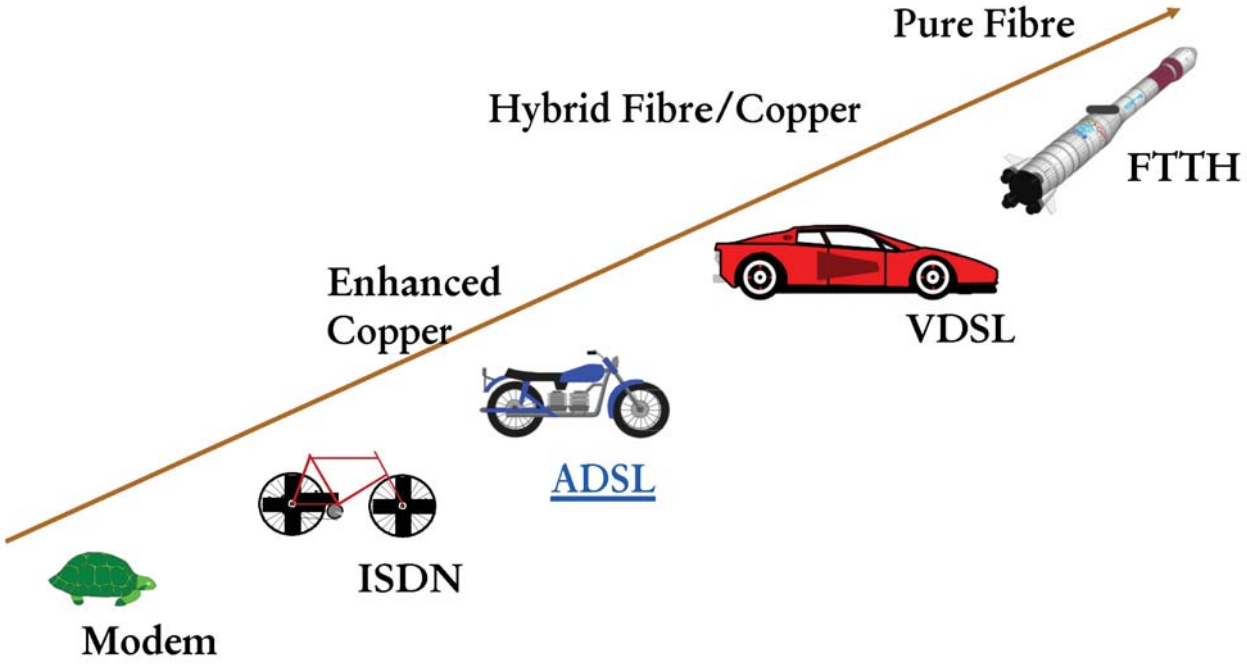
ADSL Technology

INTRODUCTION

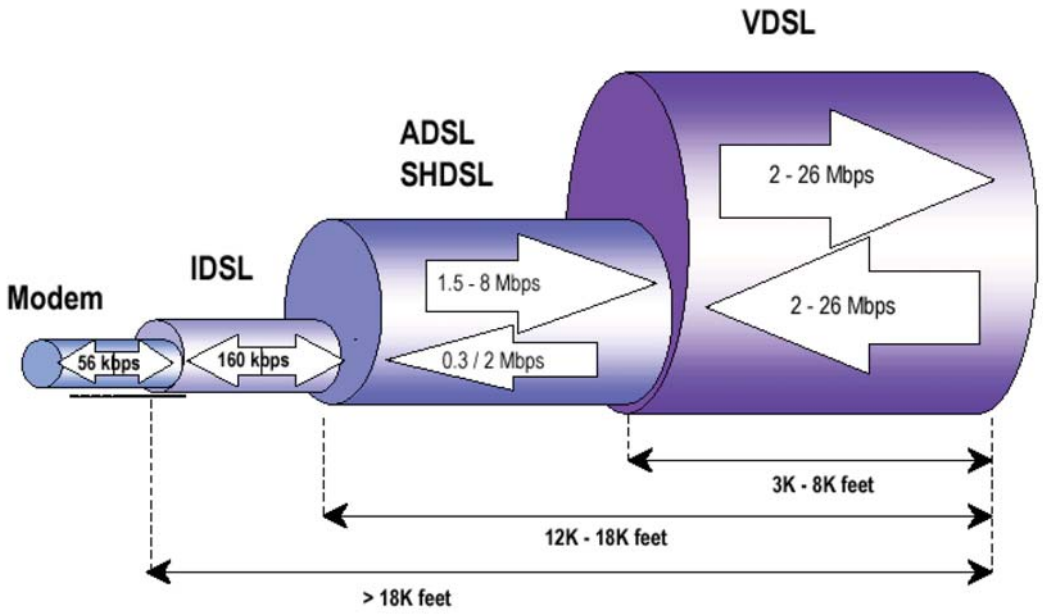
Internet Speed Comparison



Modem

- **Mod**ulate-**dem**odulate
- 28.8K 33.6K 56K bps
- PCM 64K bps

xDSL Speed Comparison

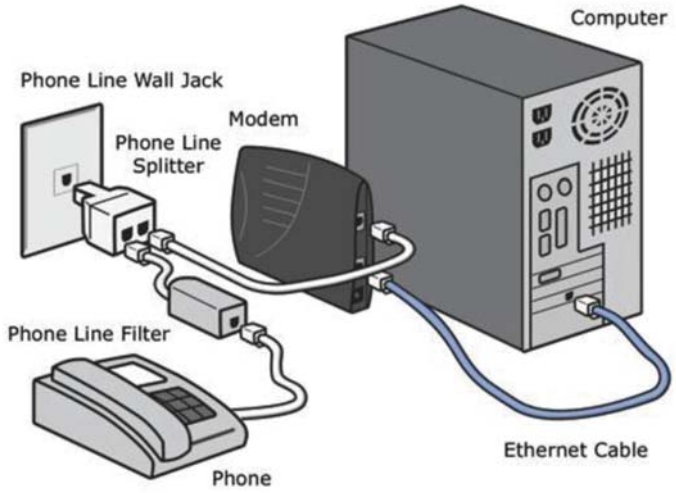


ADSL Facts

- **ADSL** is a broadband data communication technology over telephone lines.
- **ADSL** is **#1** to access Internet with 80% market share worldwide.

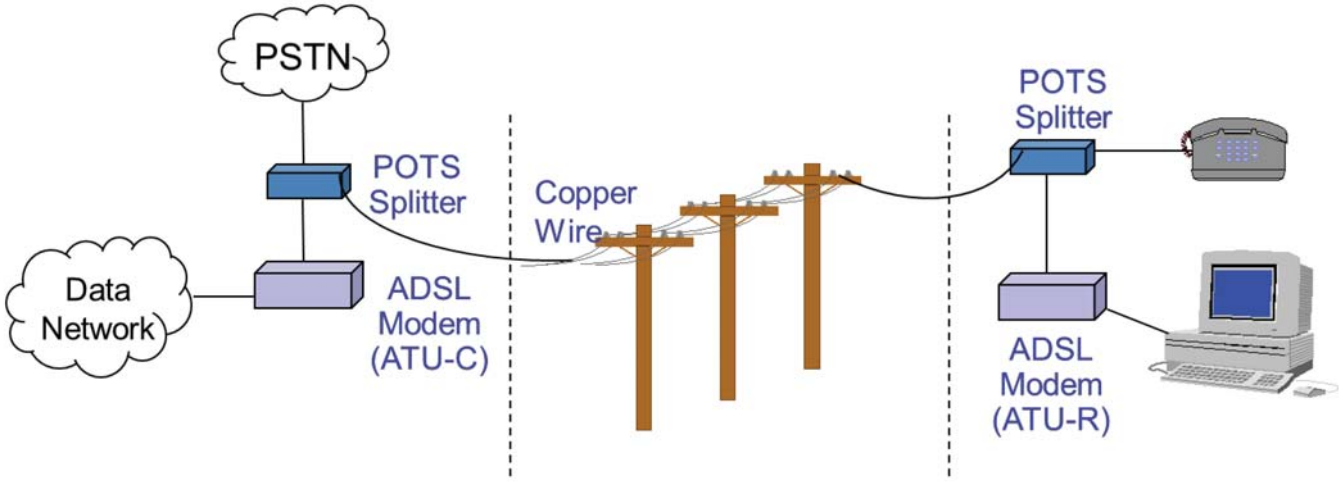
ASDL Home Setup

- Modem
- Phone Line
- Ethernet Cable
- Splitter



What is ADSL?

- **A**symmetric I **D**igital I **S**ubscriber **L**ine

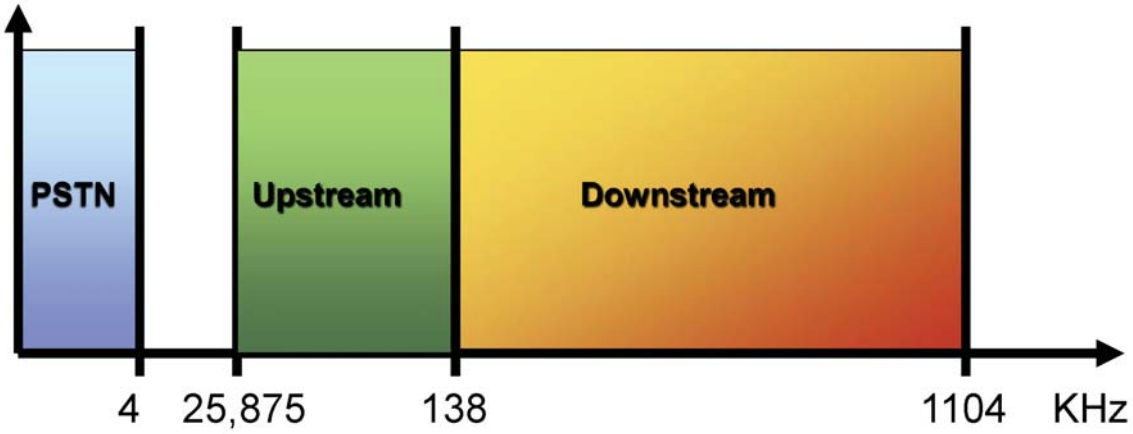


TECHNOLOGY

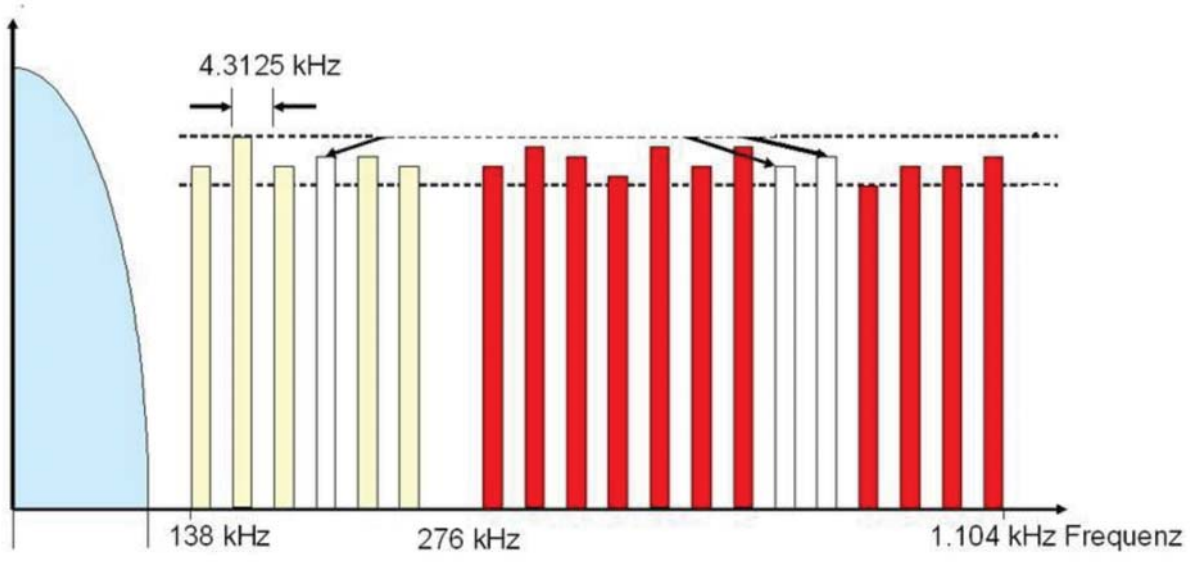
Why ADSL Broadband?

ADSL = Broad Bandwidth

- ADSL exploits the **unused High-Frequency bandwidth**

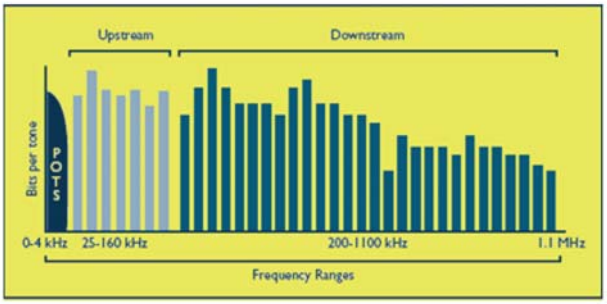


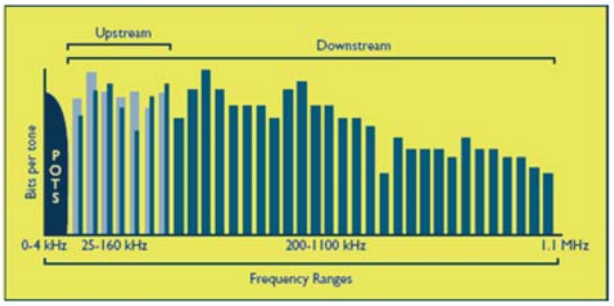
Discrete Multi Tone Modulation



Discrete Multi Tone Modulation (2)

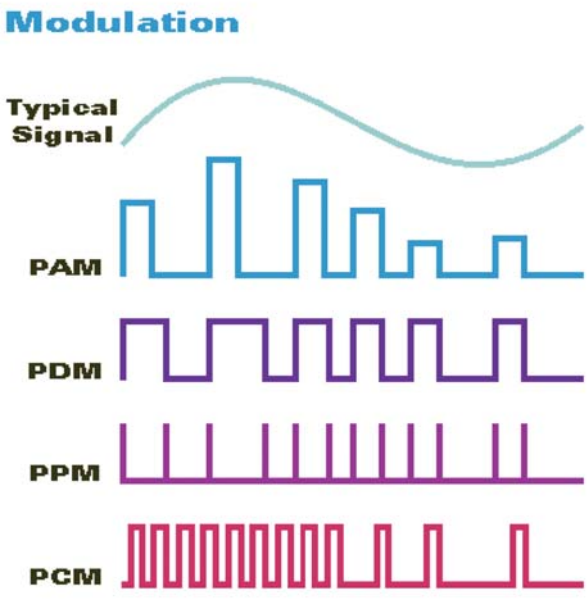
- **DMT** separates frequency into 256 channels
- **DMT** has 224 downstream, 32 upstream carriers
- **DMT** shifts signals between 256 channels for transmission





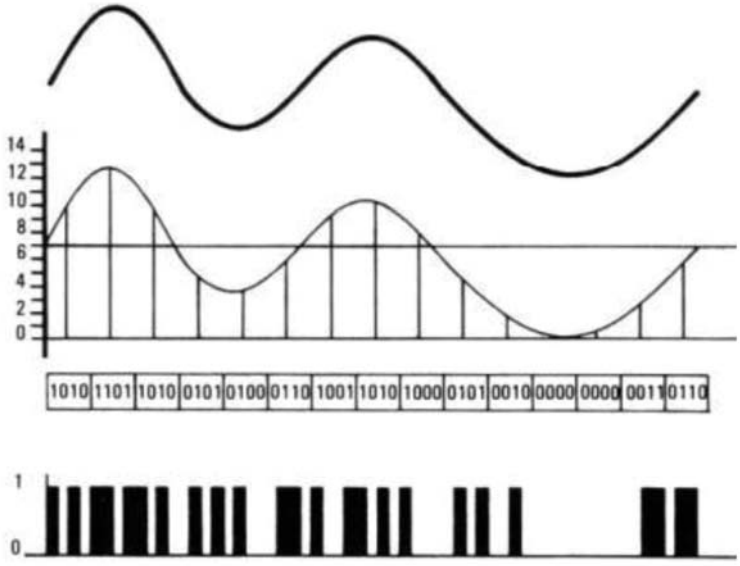
Baseband Modulation

- **Modulation** is a technique to systematically sample the change of a signal, maintaining characteristic, but transmitting in different waveform.

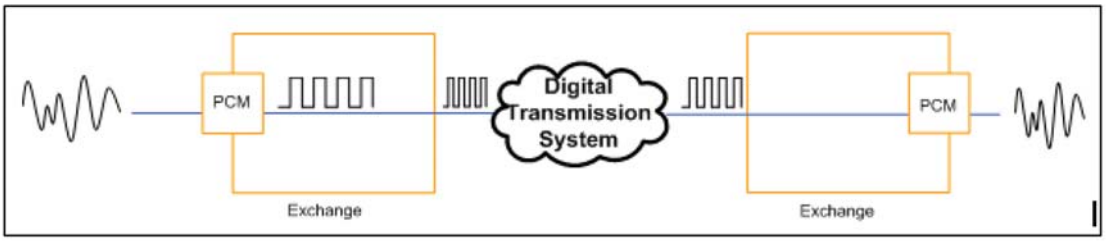


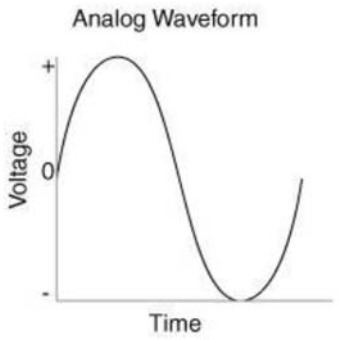
Review: Pulse Code Modulation

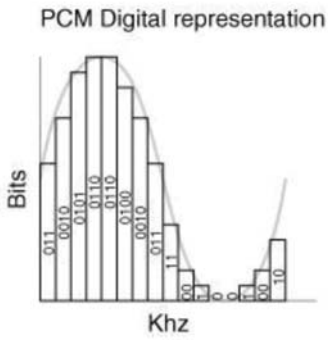
- Sampling
- Quantizing
- Encoding

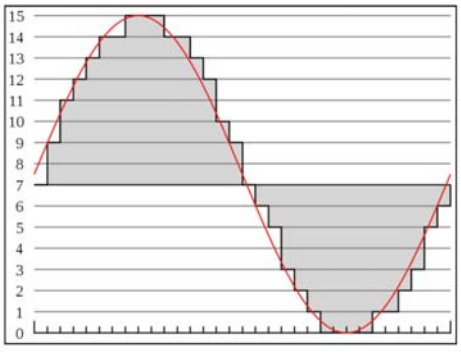


Review: PCM(2

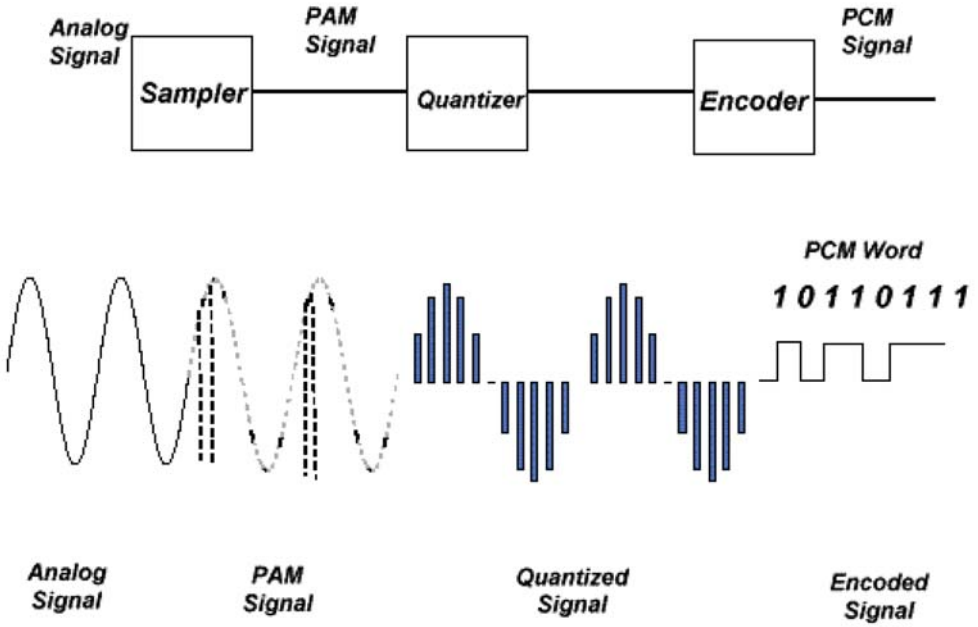






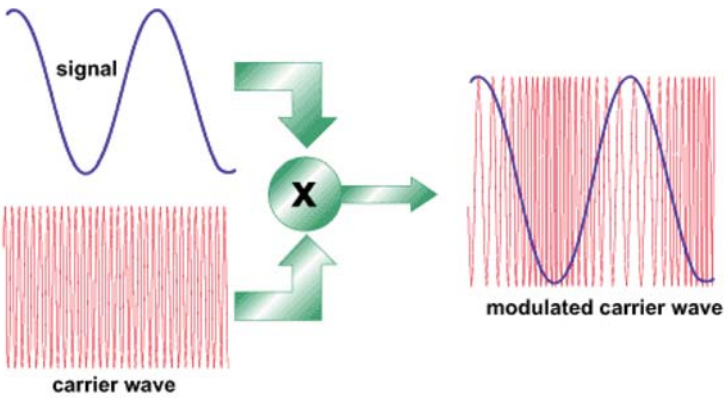


Review: PCM(3

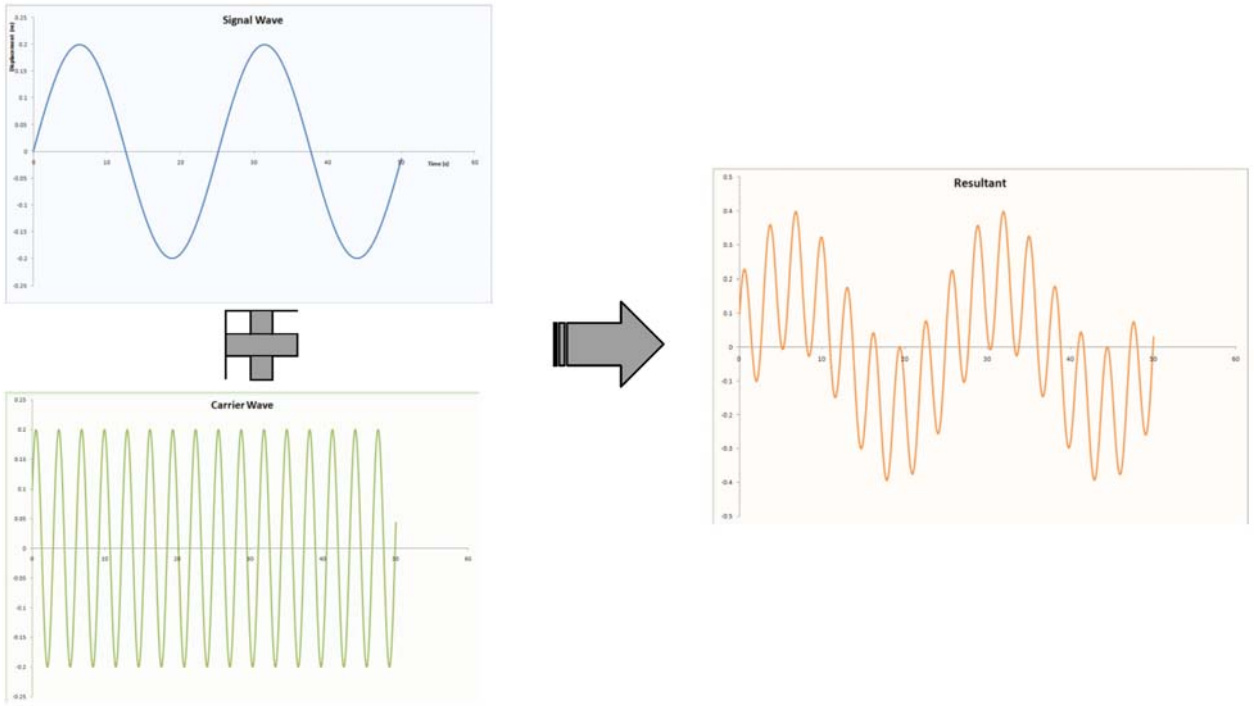


Carrier Modulation

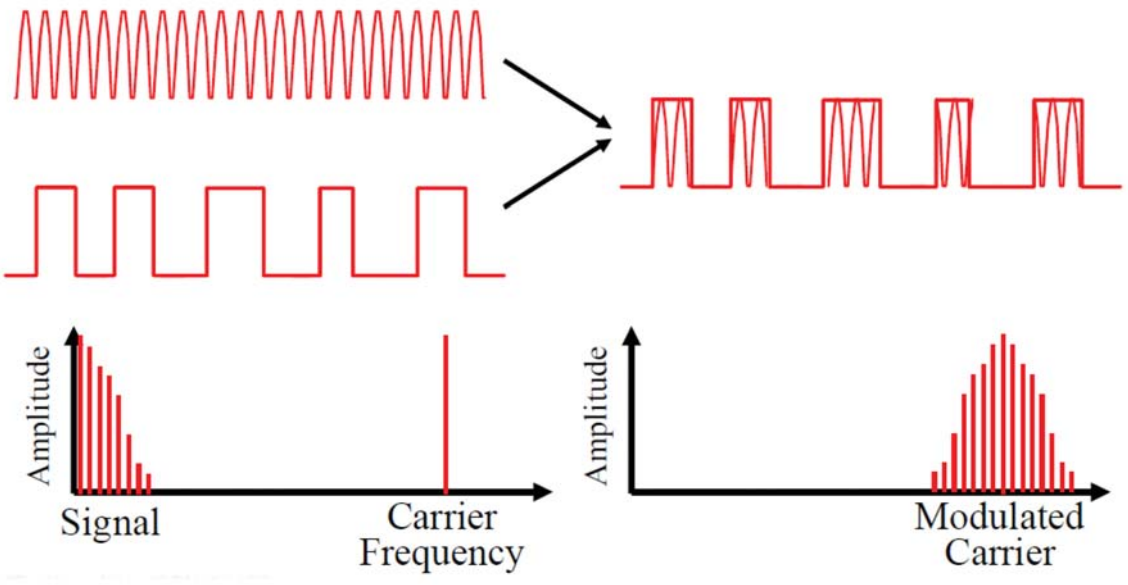
- **Modulation** is overlaying the original information onto an electronic carrier waveform.



Carrier Modulation Example

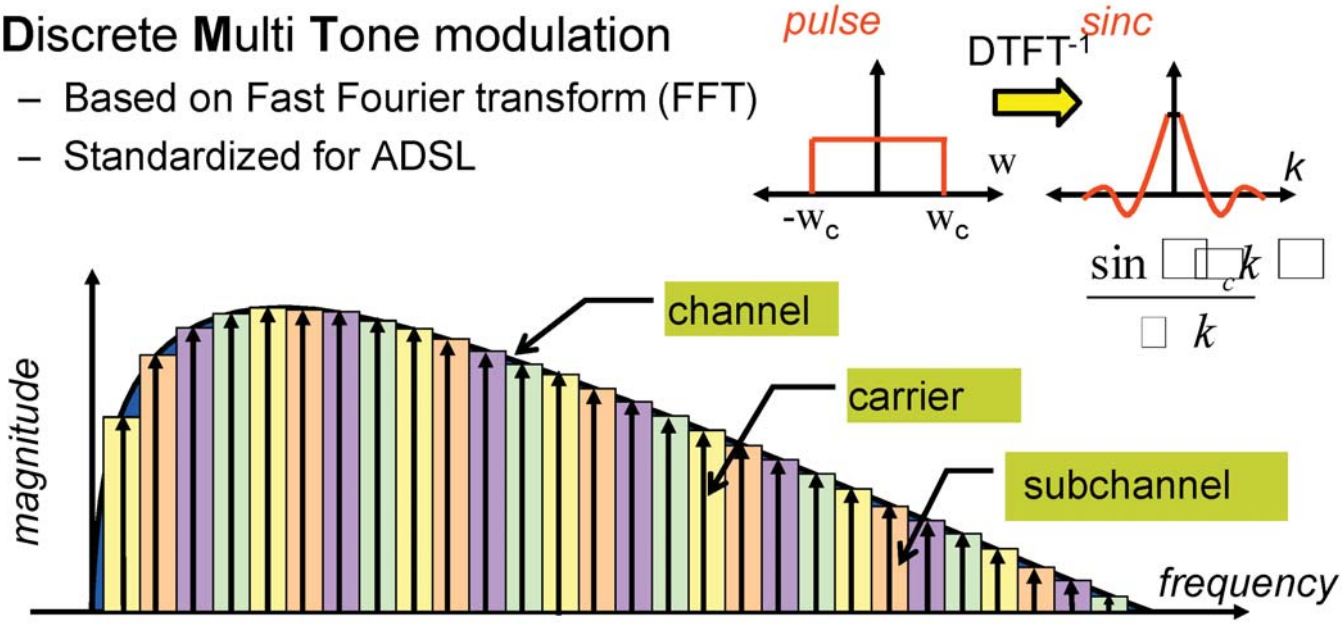


Carrier Modulation in Frequency Domain



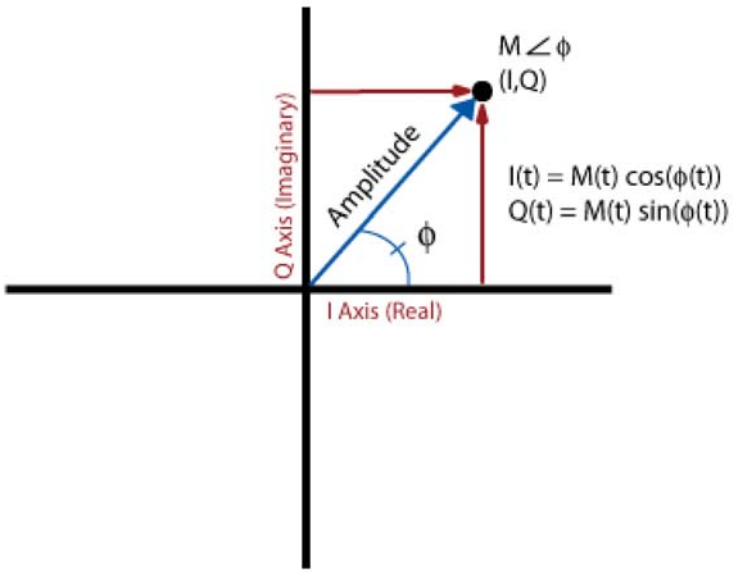
Multi Carrier Modulation

- **D**iscrete **M**ulti **T**one modulation
  - Based on Fast Fourier transform (FFT)
  - Standardized for ADSL



QAM Encoding

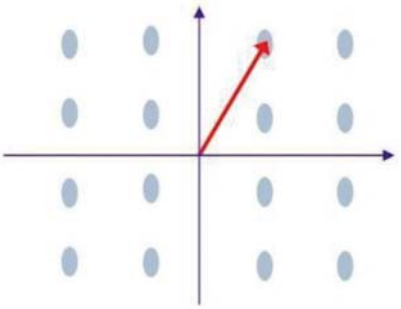
- Amplitude
- Phase

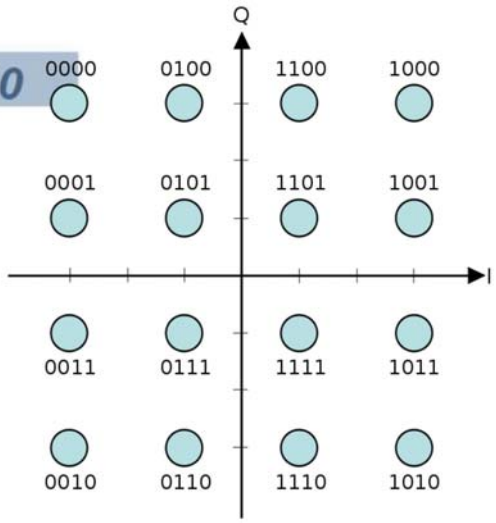


16 QAM Encoding

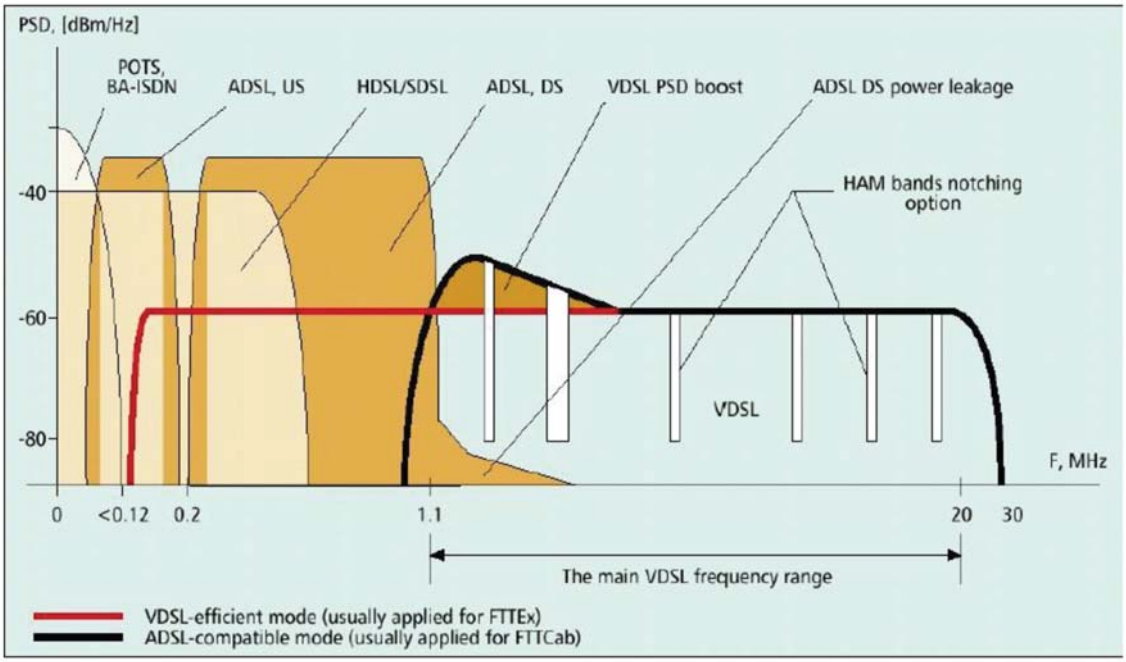
Bits	Phase	Amplitude
0000	-1	-1
0001	-1	-3
0010	-3	-1
0011	-3	-3
0100	-1	1
0101	-3	-1
0110	-1	3
0111	-3	3
1000	1	-1
1001	3	-1
1010	1	-3
1011	3	-3
1100	1	1
1101	1	3
1110	3	1
1111	3	3

Encoding of 4 bits: 1110

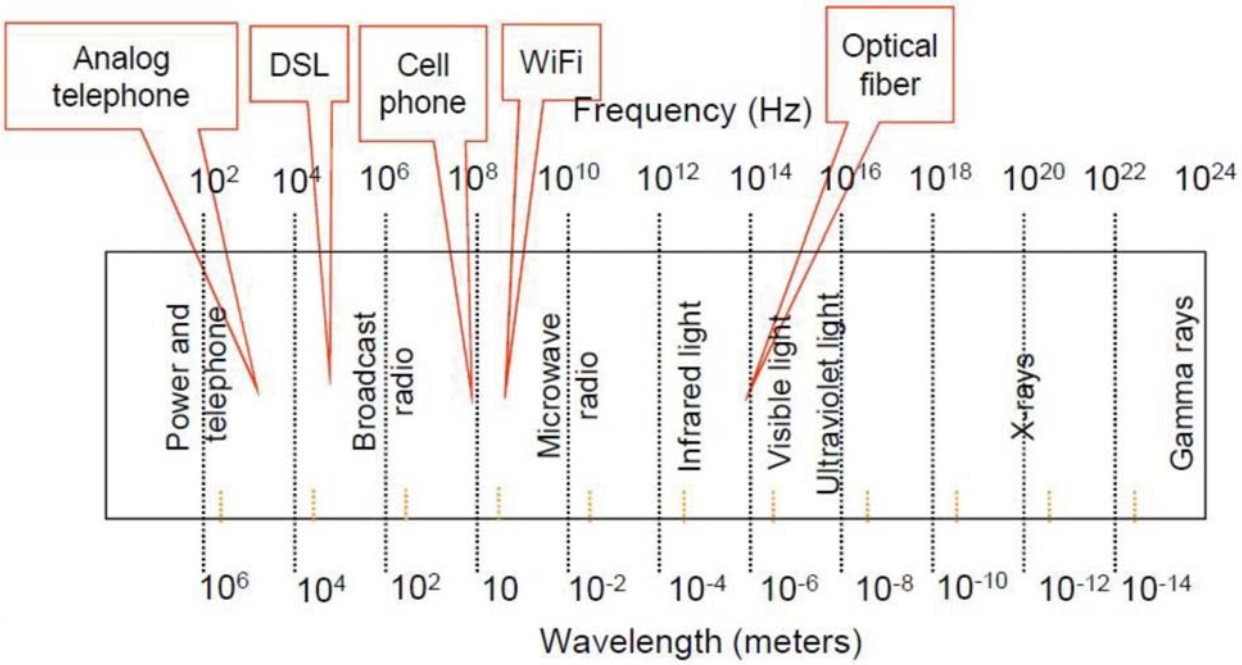




xDSL Frequency Comparison

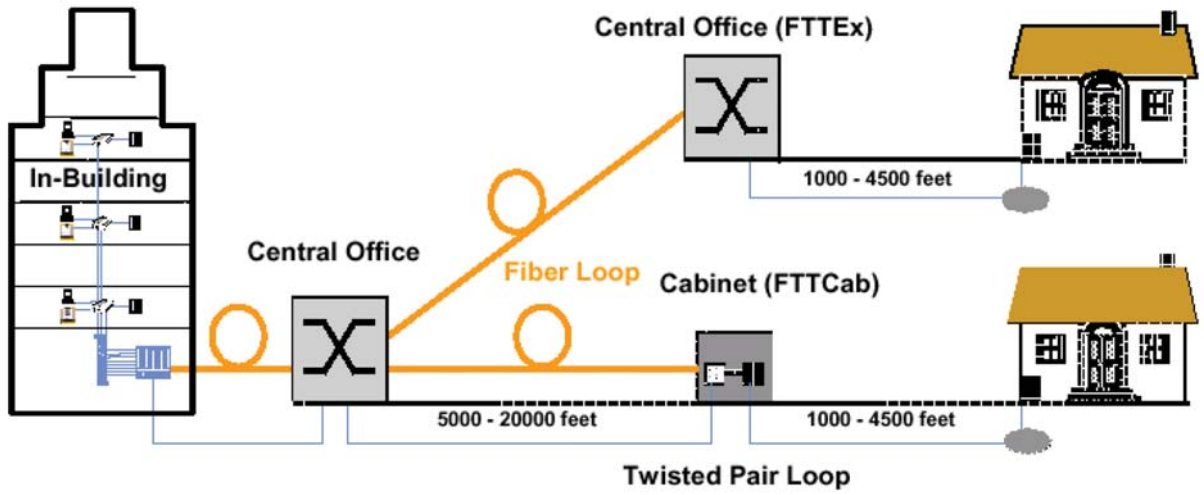


Communication Frequency Comparison



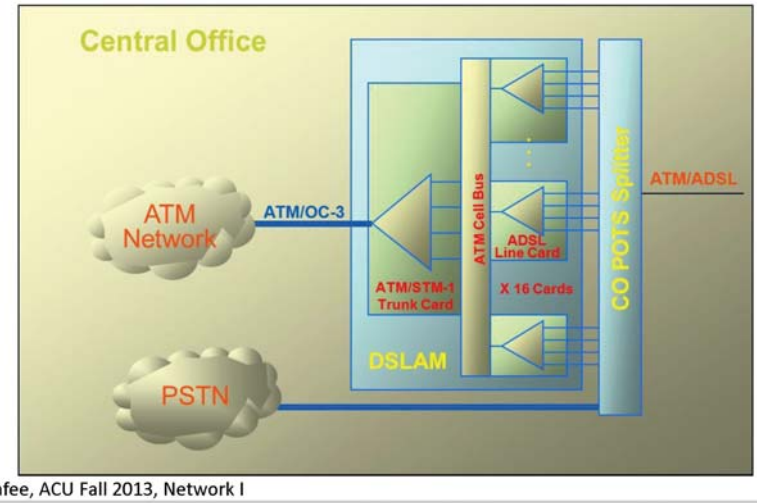
NETWORK

Network Architecture

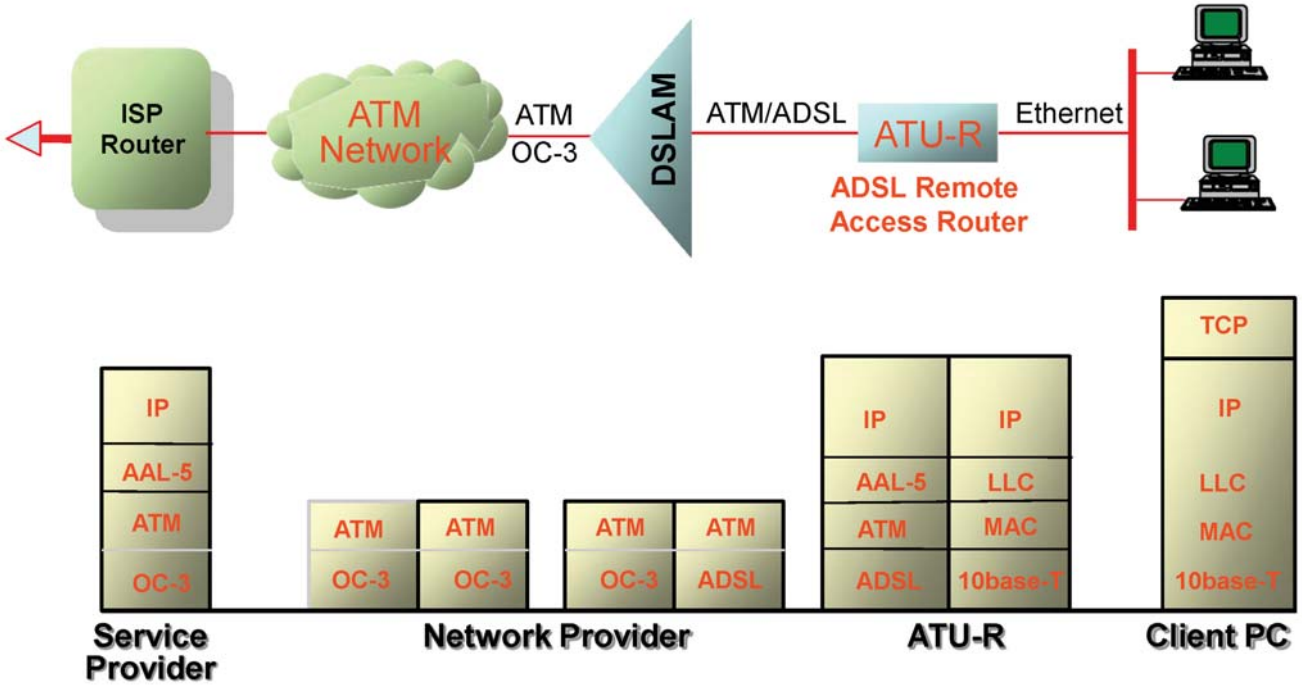


ADSL Network Compon

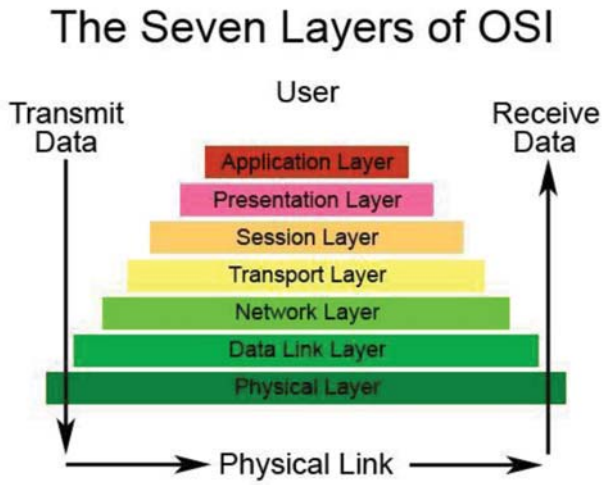
- ATU-R、ATU-C
- DSLAM
  (**DSL A**ccess **M**ultiplexer)
- Splitter
  (low pass filter)

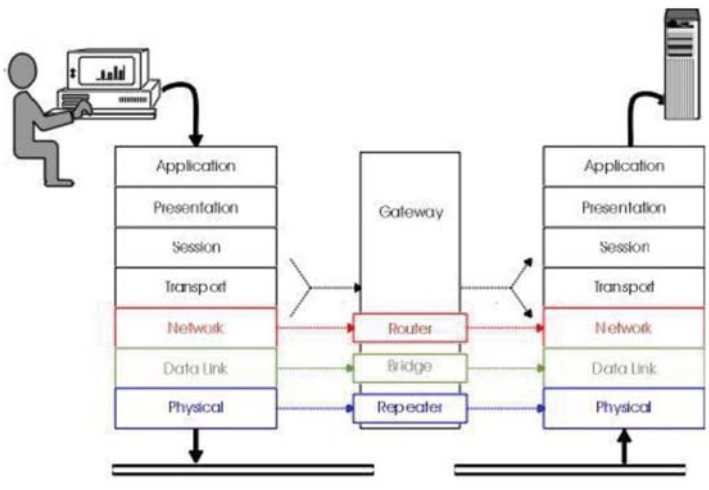


ADSL Network Protocol



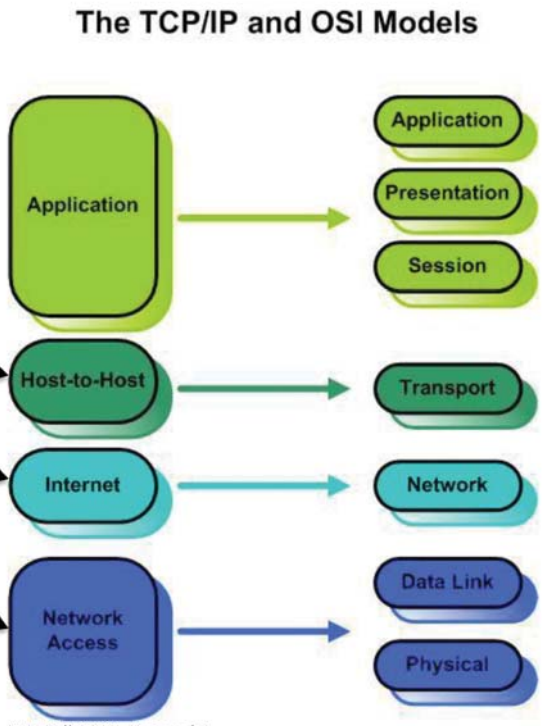
Review: OSI Model





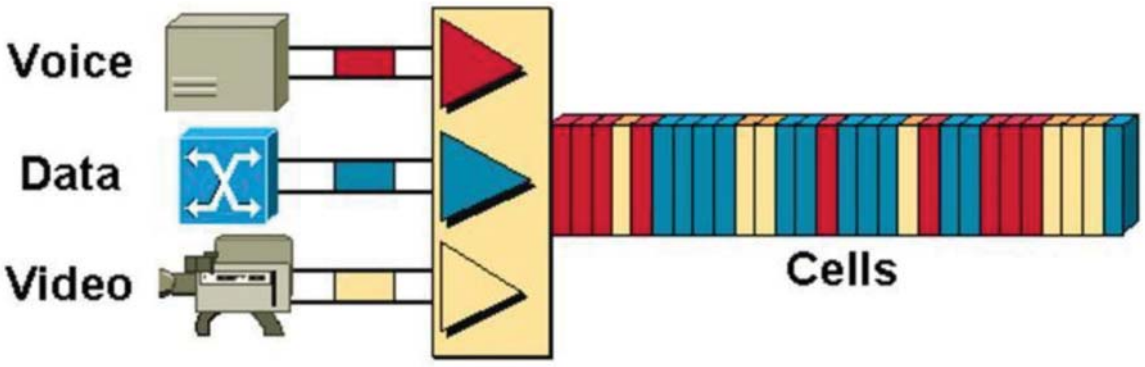
Review: TCP/IP

- Protocol
  - HTTP、SMTP、FTP
  - TCP
  - IP
  - Ethernet
    ATM



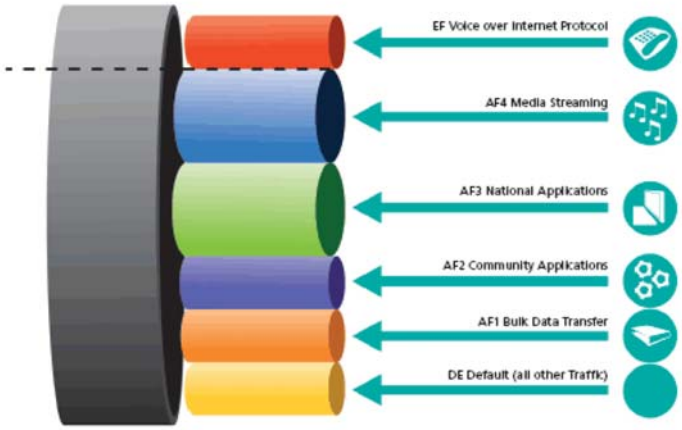
Asynchronous Transfer Mode

- **Integration of Voice, Data, and Video**



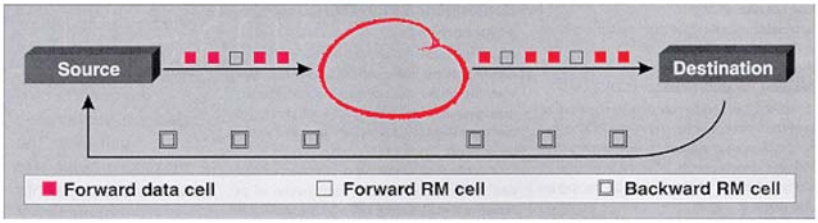
Asynchronous Transfer Mode (2

- **Quality of Service** (Traffic Shaping、Admission Control)

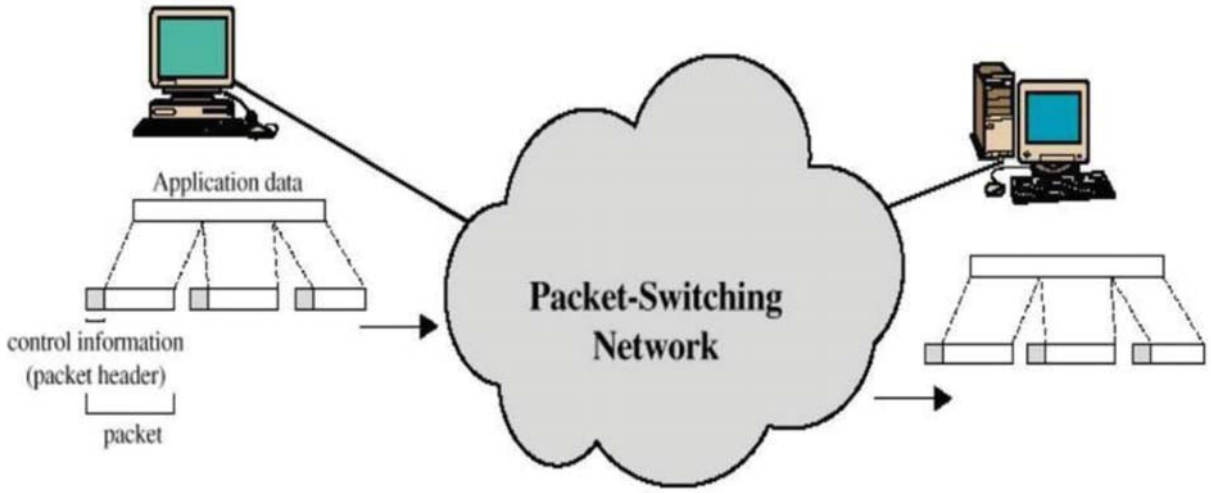


Asynchronous Transfer Mode (3

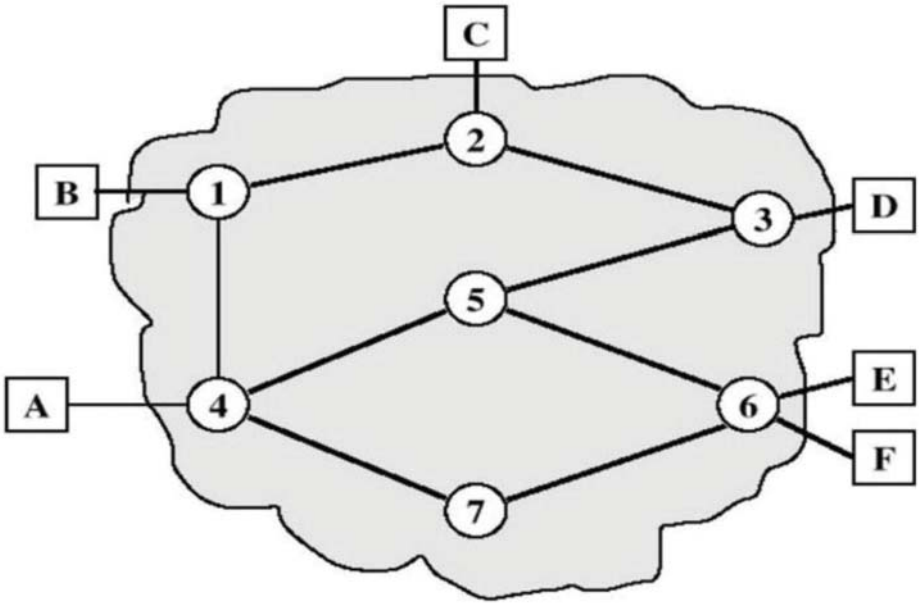
- **Flow Control**



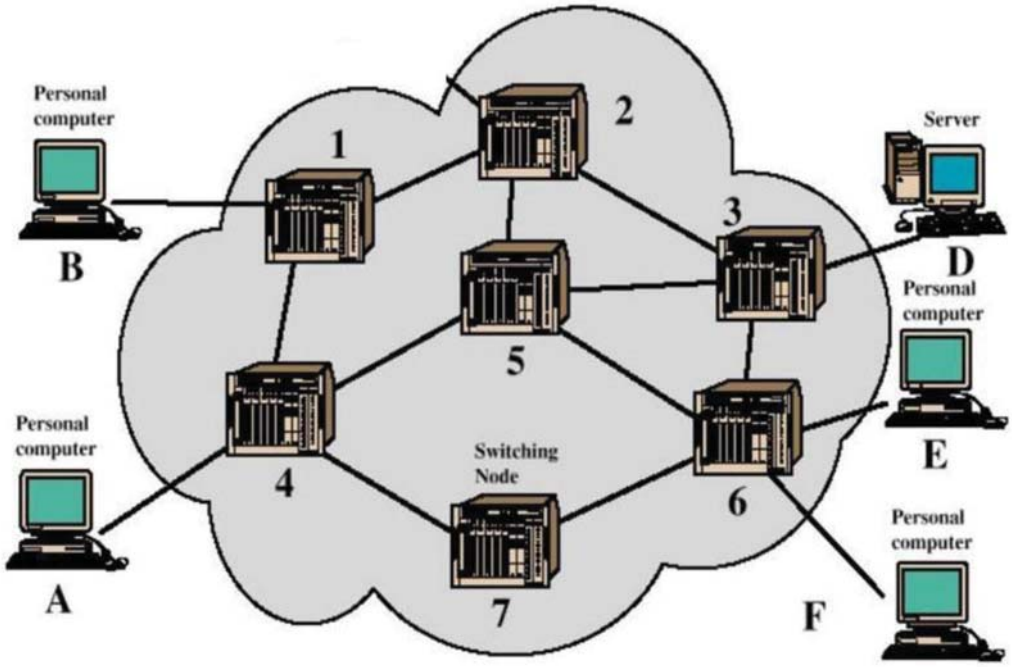
Packet Switching



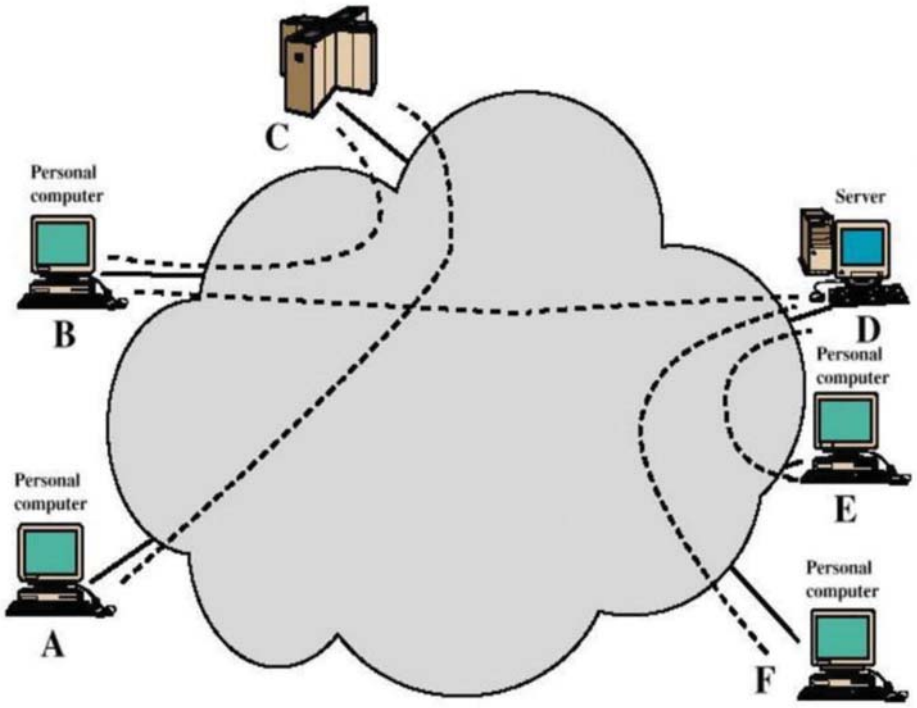
Network



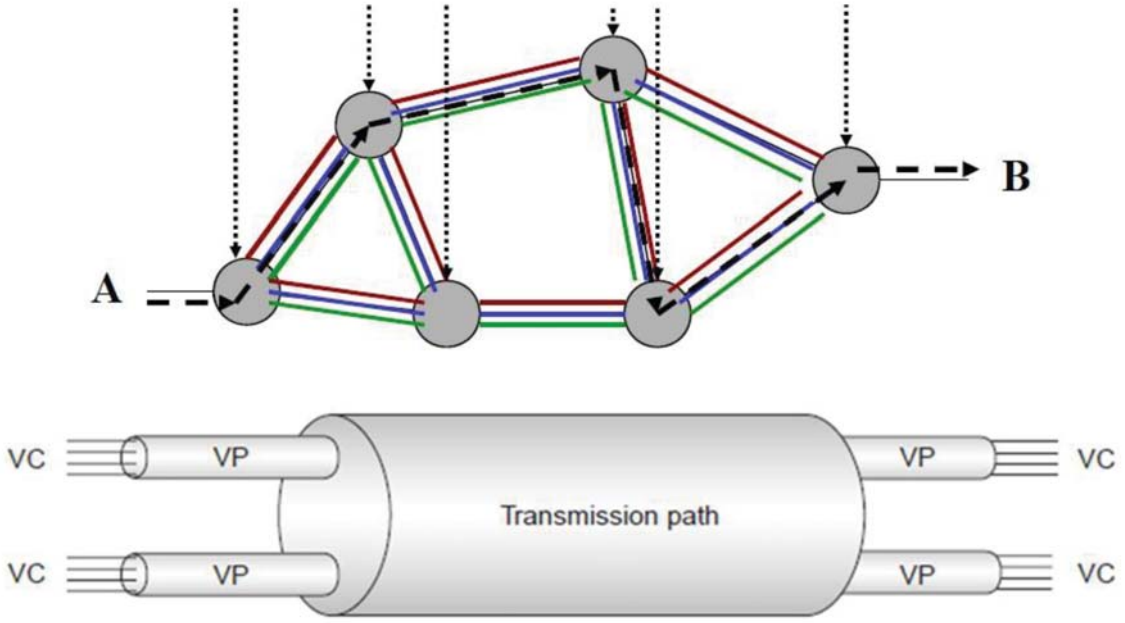
Packet Switching / Routing



Circuit Switching

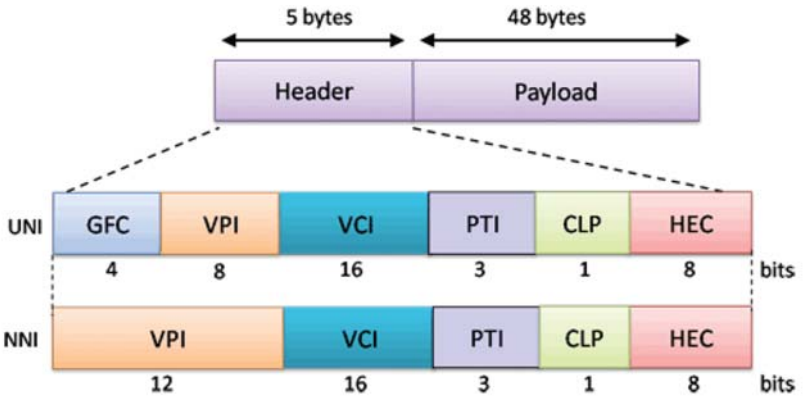


Virtual Circuit Switching

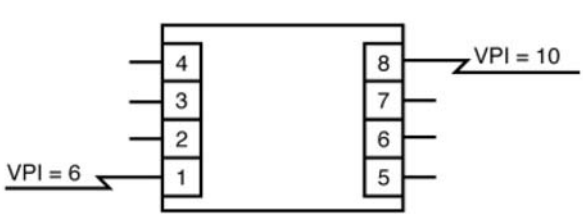


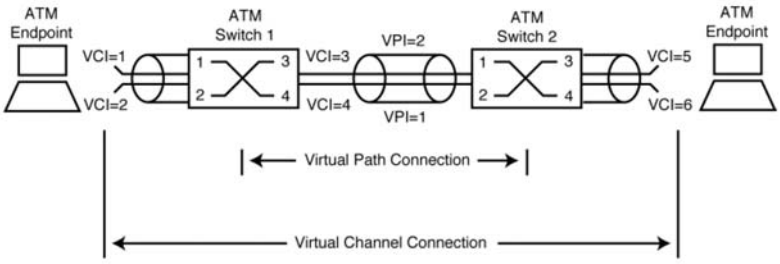
ATM Cell

- **Why 53 Bytes?**
  - IP Packet
  - Smaller
  - Fixed



ATM Virtual Path / Virtual Channel

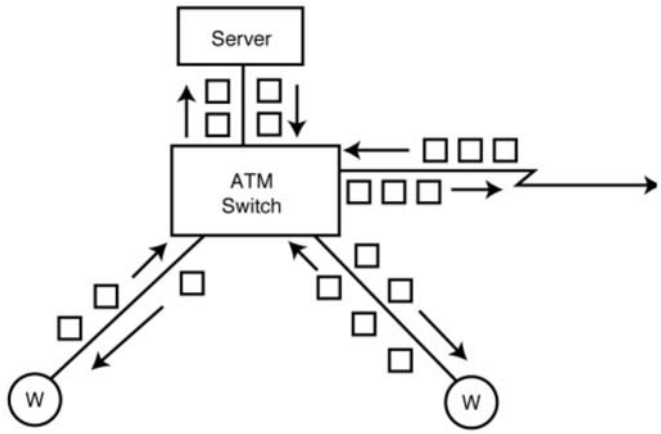




Routing Table Entries

Received		Transmit	
VPI 6	Port Number 1	VPI 10	Port Number 8
10	8	6	1

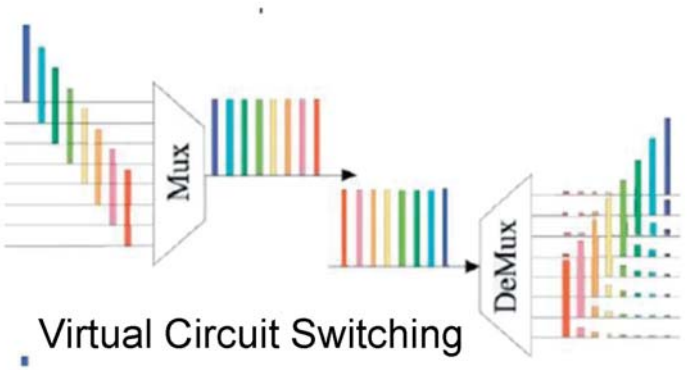
ATM Switching



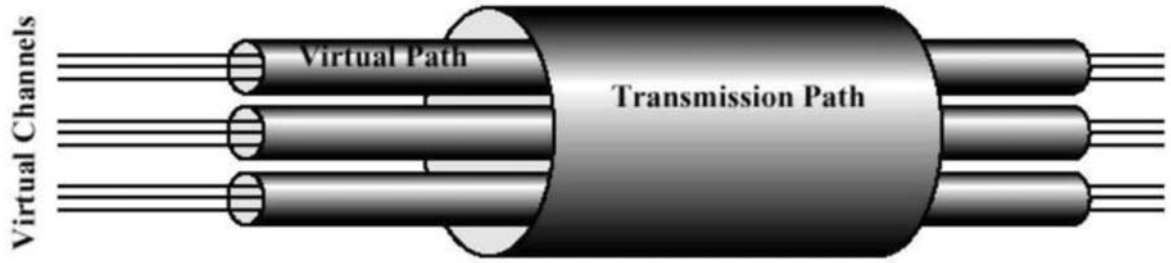
Legend

W = workstation

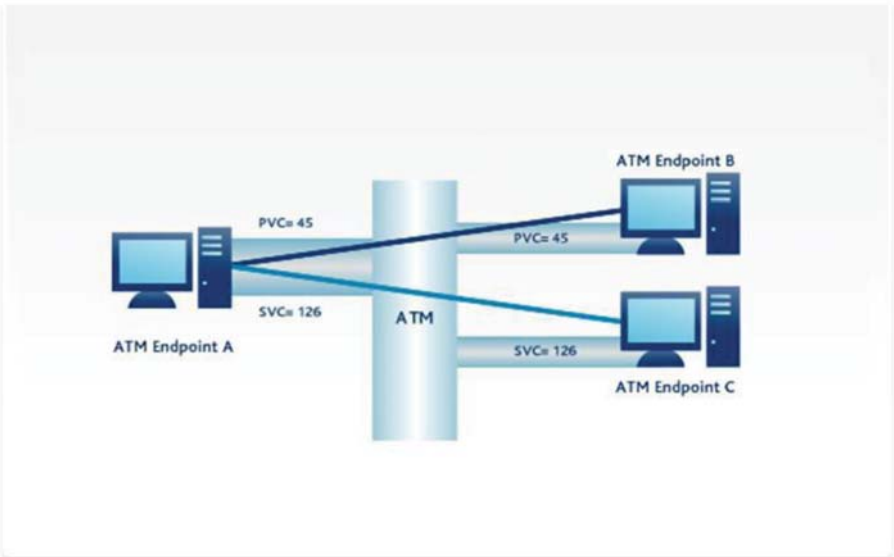
= 53–byte cells



ATM Connection: VP / VC



ATM Connection: PVC / SVC



Switching Comparison

	ATM	Conventional Telecom	Conventional LAN
Traffic Type	Data, Voice, Video	Voice	Data
Transmission Unit	Fixed Cell	Fixed Frame	Variable Packet
Switching	Cell	Circuit	Packet
Connection Type	Connection-oriented	Connection-oriented	Connectionless
Delivery	Defined Classes	Guaranteed	Best Effort
Access	Dedicated	Dedicated	Shared
Rate & Media	Application Dependent	Channel Dependent	Protocol Dependent

Any Question?