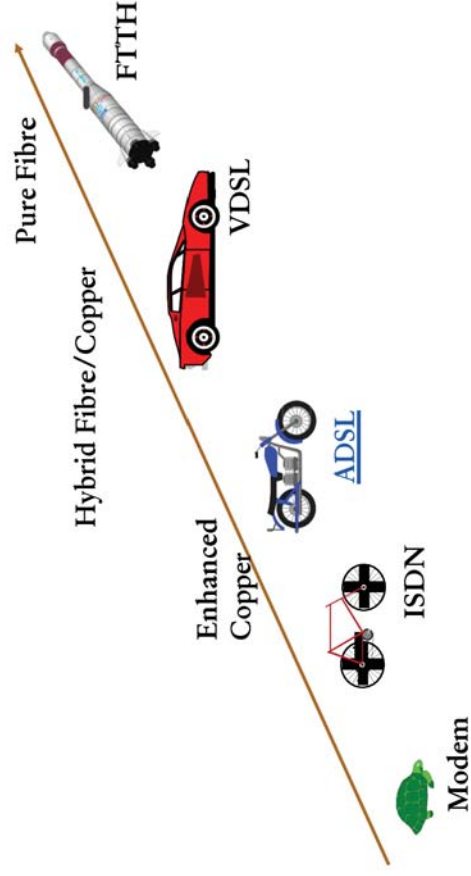


ADSL Technology

INTRODUCTION

Internet Speed Comparison

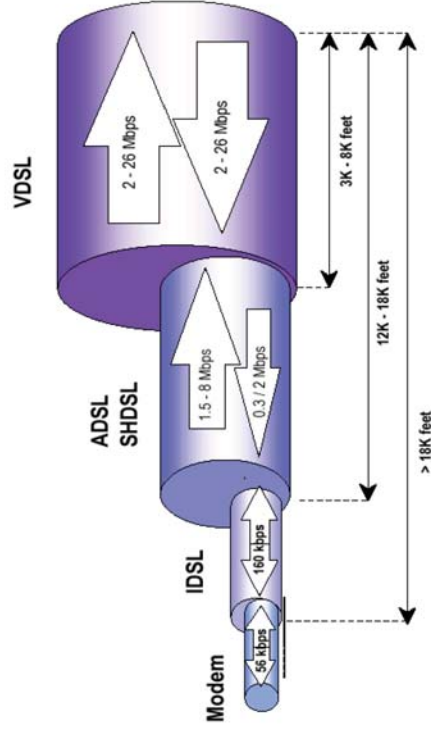


Modem

- **Modulate-demodulate**
- 28.8K 33.6K 56K bps
- PCM 64K bps



xDSL Speed Comparison



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ADSL Facts

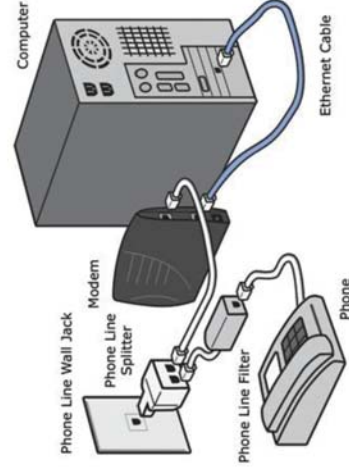
- **ADSL** is a broadband data communication technology over telephone lines.
- **ADSL** is **#1** to access Internet with 80% market share worldwide.



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ASDL Home Setup

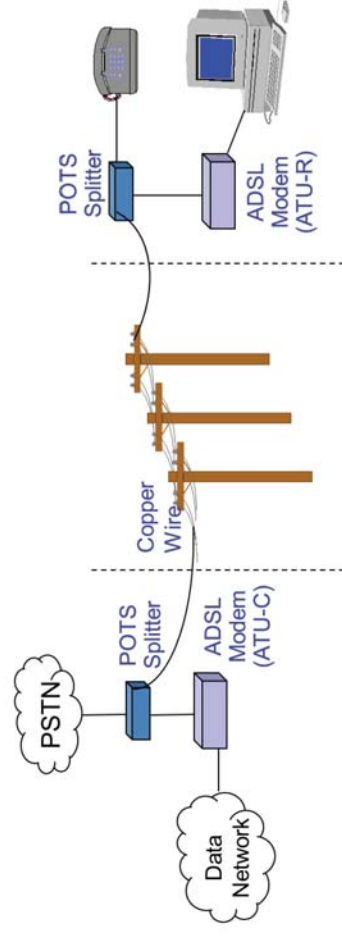
- Modem
- Phone Line
- Ethernet Cable
- Splitter



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What is ADSL?

- **Asymmetric** | **Digital** | **Subscriber Line**



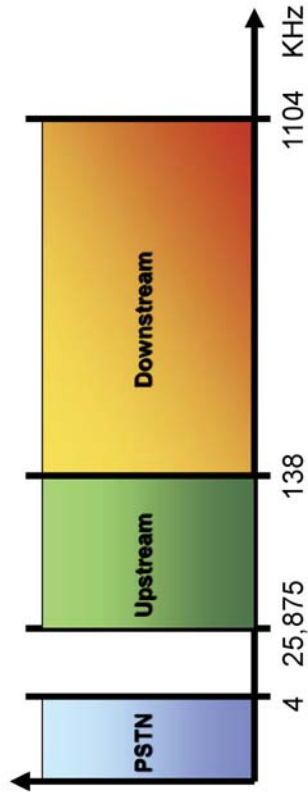
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TECHNOLOGY

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ADSL = Broad Bandwidth

- ADSL exploits the unused High-Frequency bandwidth



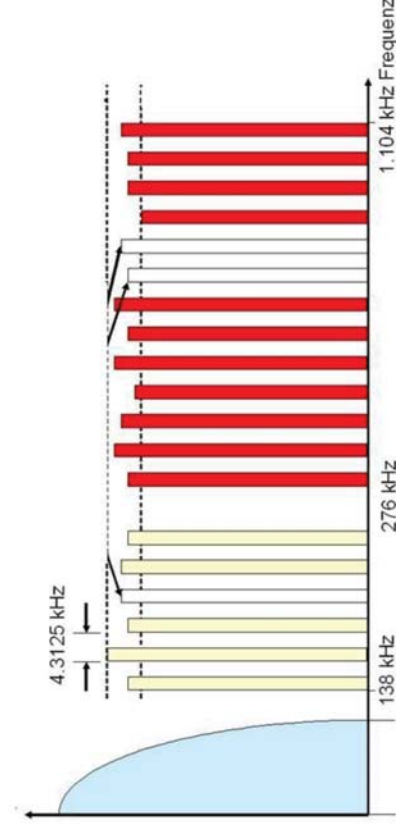
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Why ADSL Broadband?



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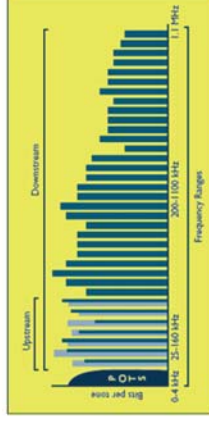
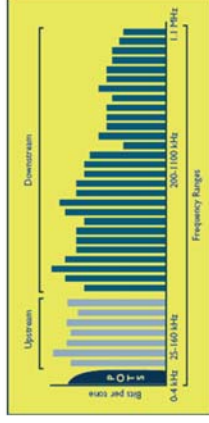
Discrete Multi Tone Modulation



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Discrete Multi Tone Modulation (2)

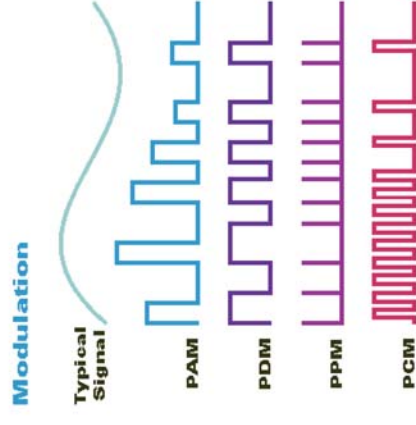
- **DMT** separates frequency into 256 channels
- **DMT** has 224 downstream, 32 upstream carriers
- **DMT** shifts signals between 256 channels for transmission



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Baseband Modulation

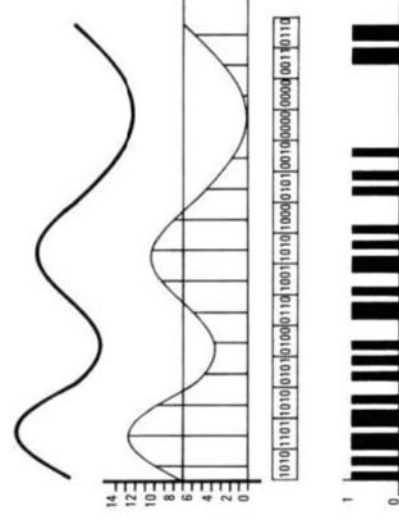
- **Modulation** is a technique to systematically sample the change of a signal, maintaining characteristic, but transmitting in different waveform.



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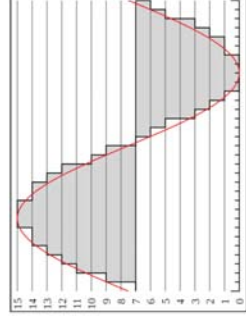
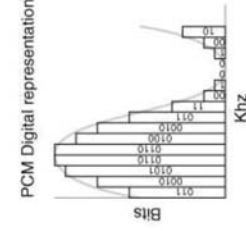
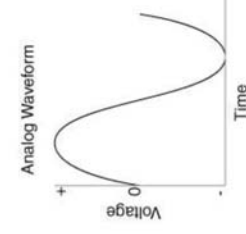
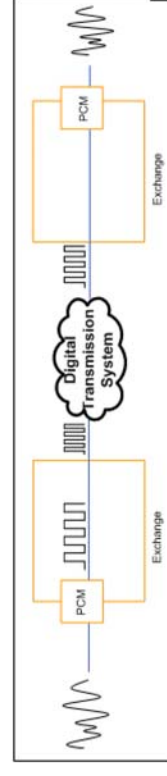
Review: Pulse Code Modulation

- Sampling
- Quantizing
- Encoding



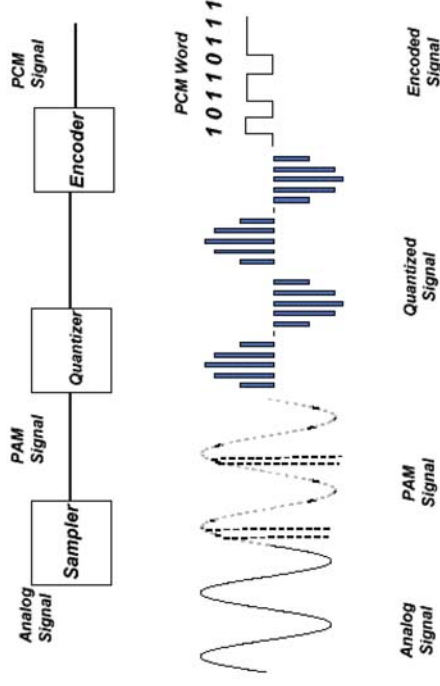
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Review: PCM(2)



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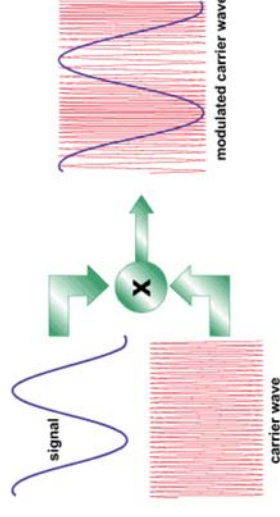
Review: PCM(3



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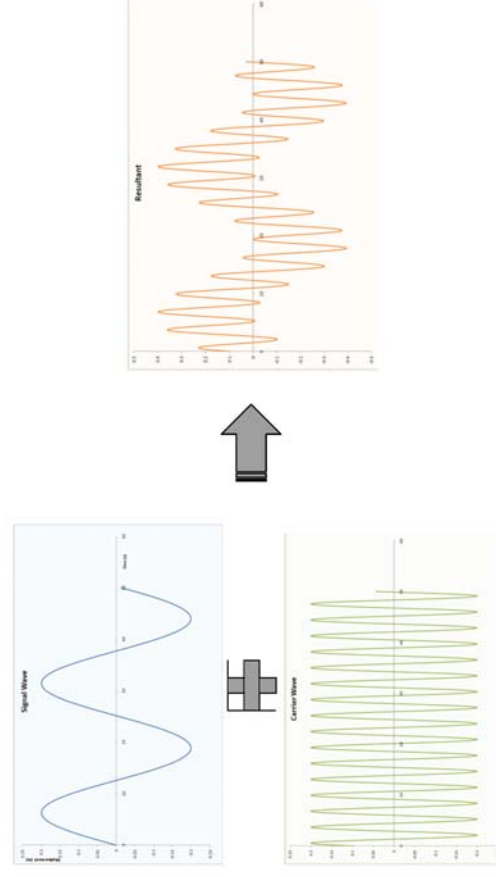
Carrier Modulation

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



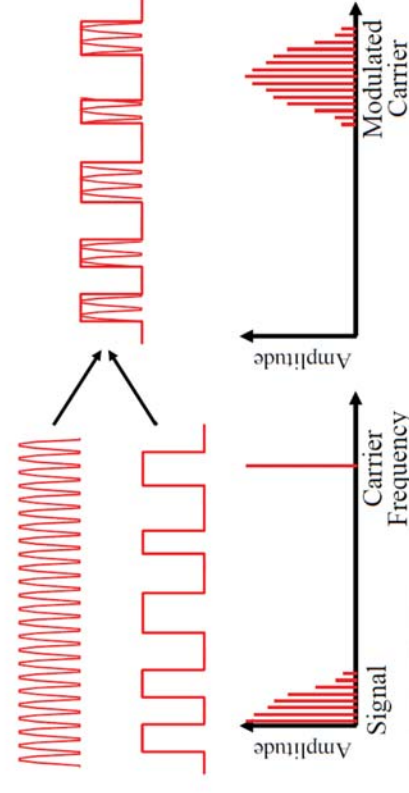
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Carrier Modulation Example



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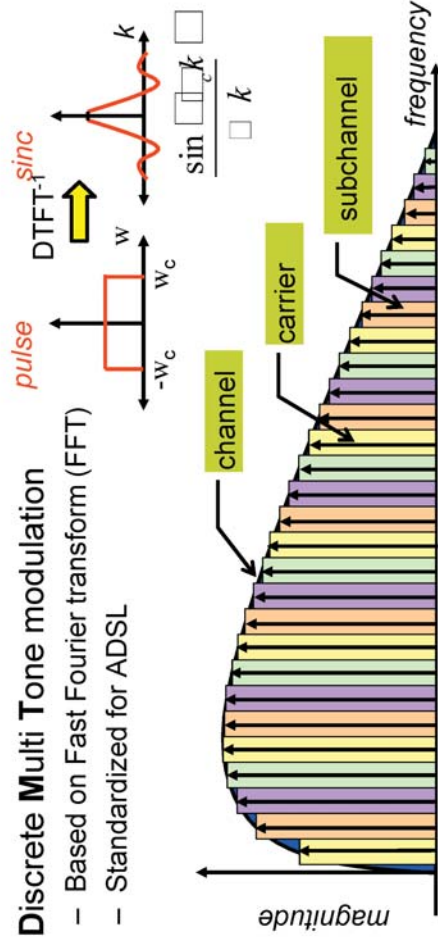
Carrier Modulation in Frequency Domain



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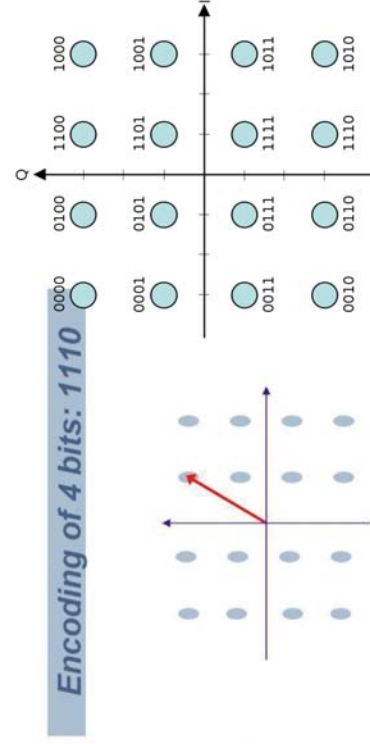
Multi Carrier Modulation

- **Discrete Multi Tone modulation**
 - Based on Fast Fourier transform (FFT)
 - Standardized for ADSL
-



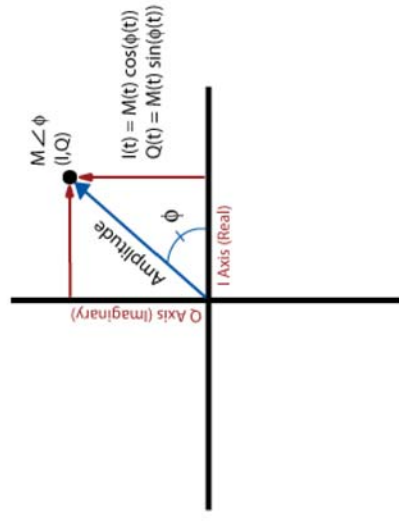
16 QAM Encoding

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

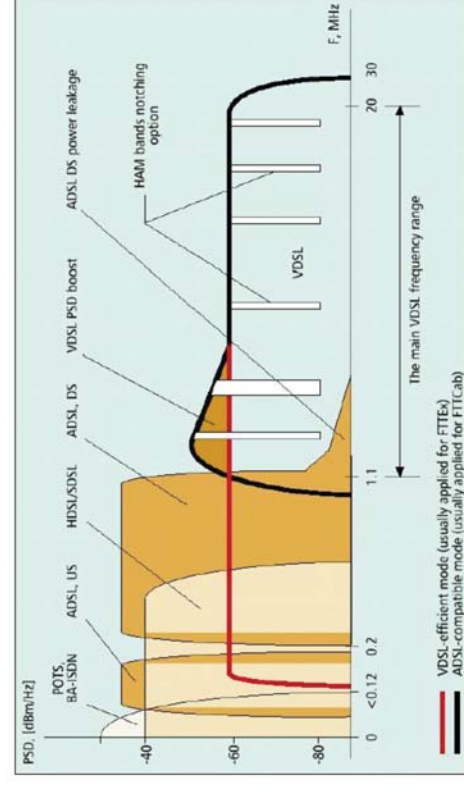


QAM Encoding

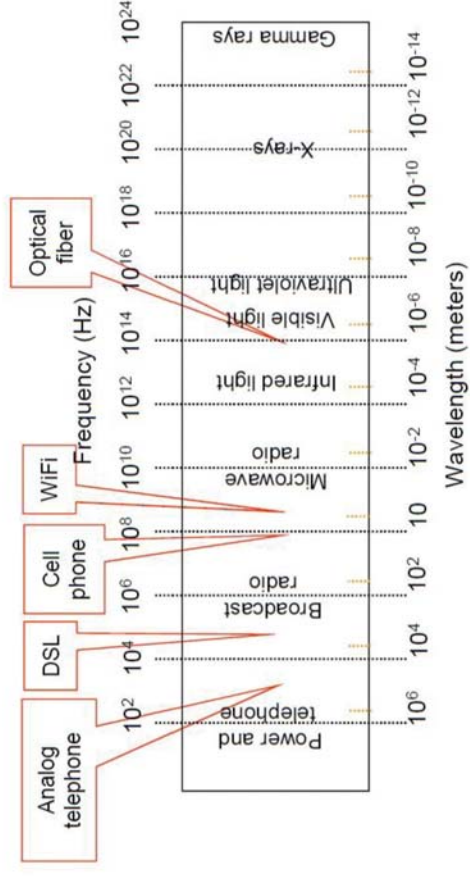
- Amplitude
- Phase



xDSL Frequency Comparison

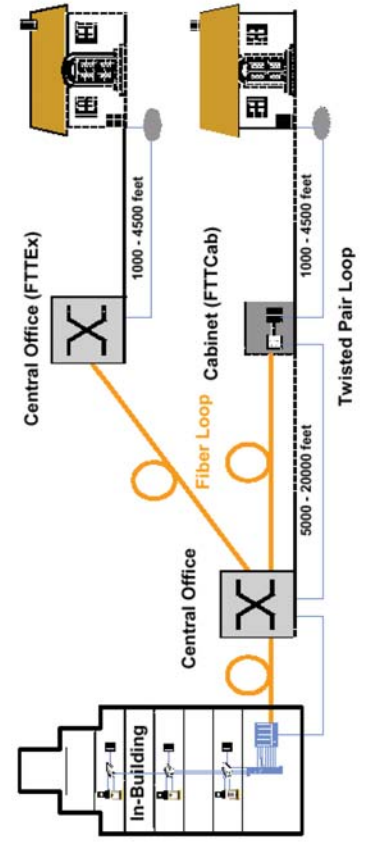


Communication Frequency Comparison



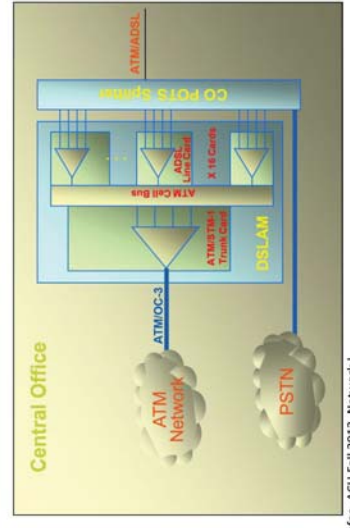
NETWORK

Network Architecture

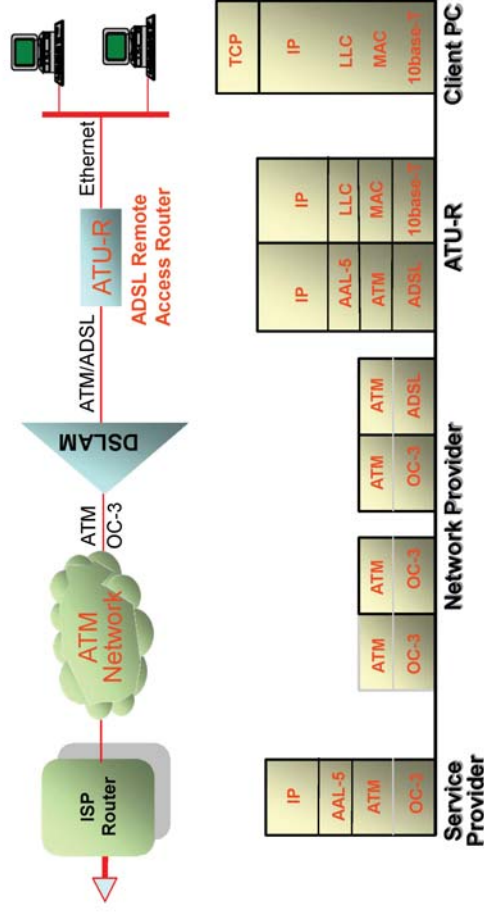


ADSL Network Compon

- ATU-R, ATU-C
- DSLAM (DSL Access Multiplexer)
- Splitter (low pass filter)

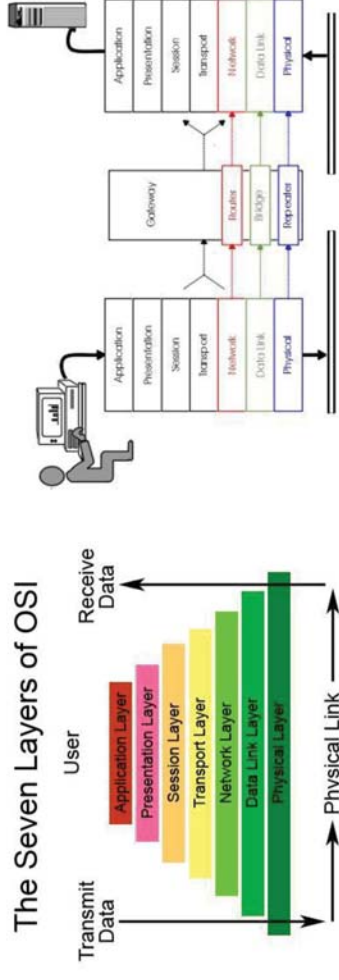


ADSL Network Protocol



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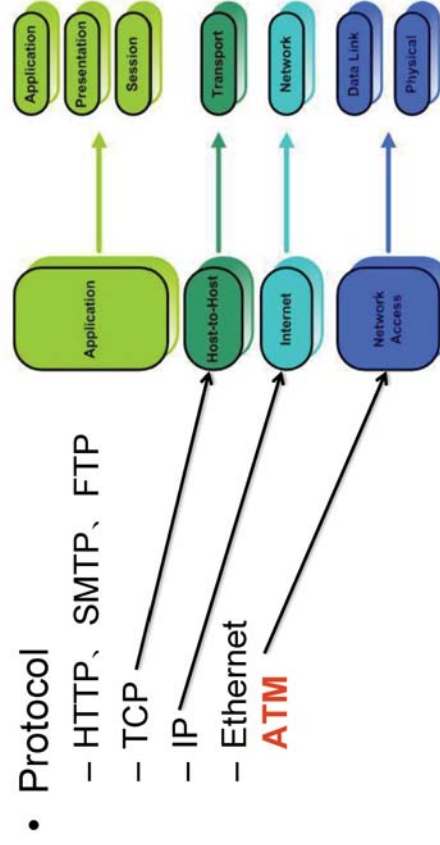
Review: OSI Model



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Review: TCP/IP

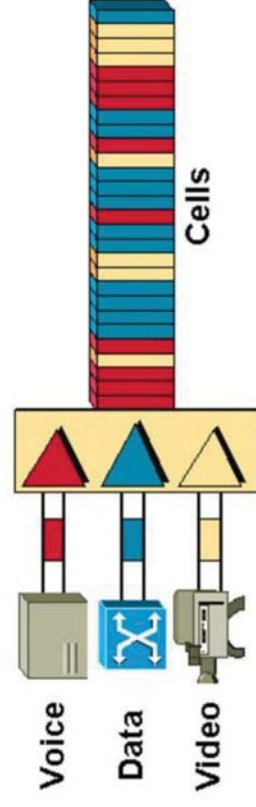
The TCP/IP and OSI Models



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Asynchronous Transfer Mode

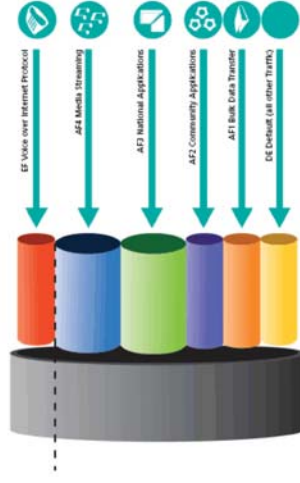
- Integration of Voice, Data, and Video



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Asynchronous Transfer Mode (2)

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



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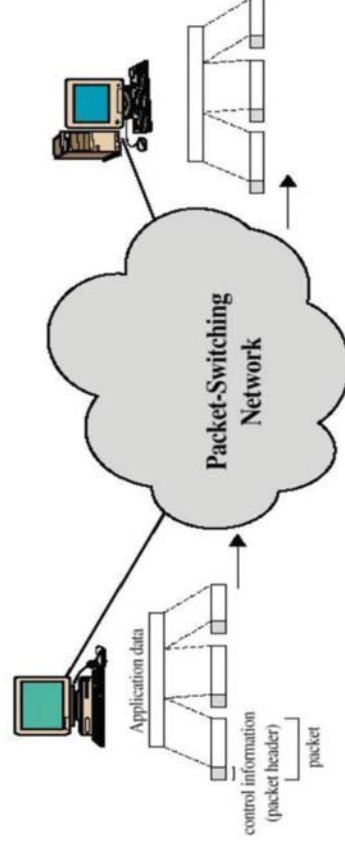
Asynchronous Transfer Mode (3)

- **Flow Control**



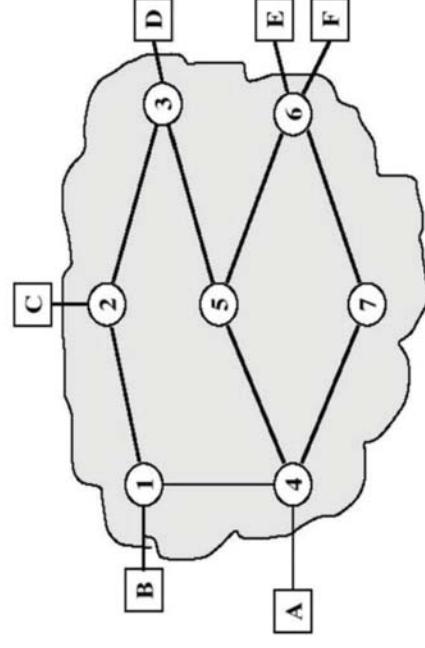
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Packet Switching



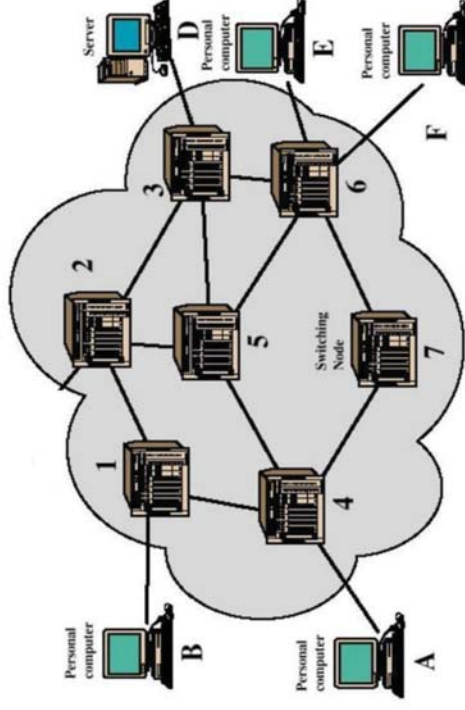
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Network



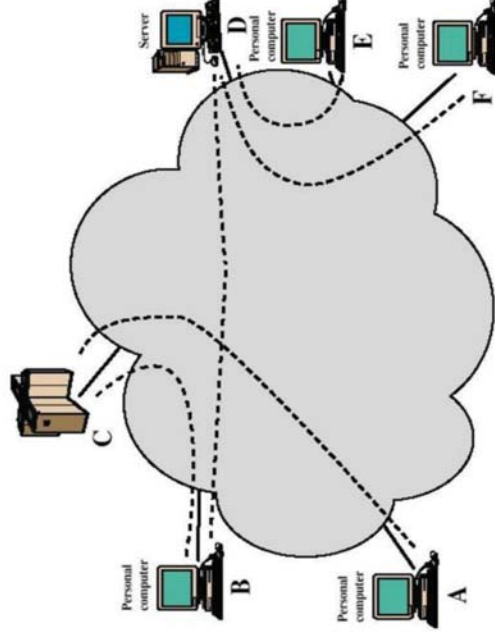
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Packet Switching / Routing



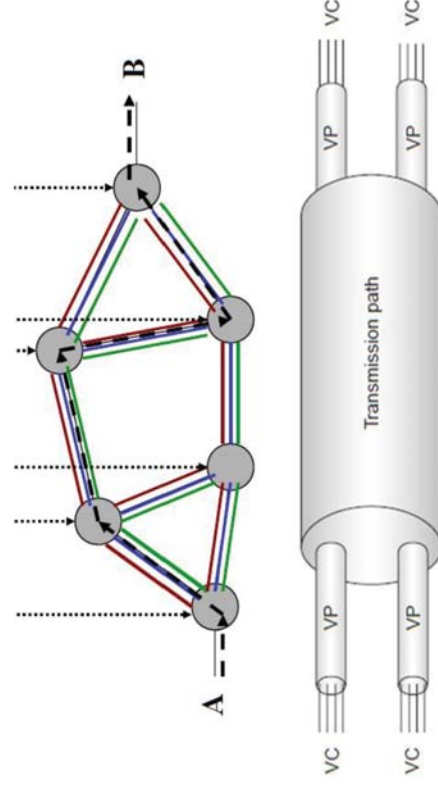
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Circuit Switching



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Virtual Circuit Switching

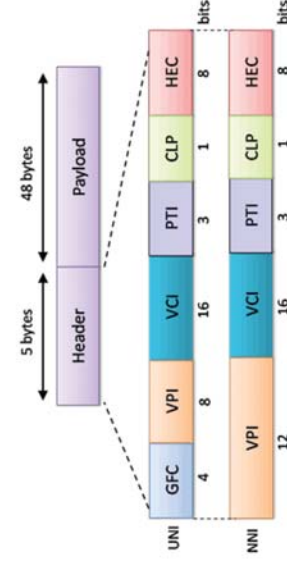


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ATM Cell

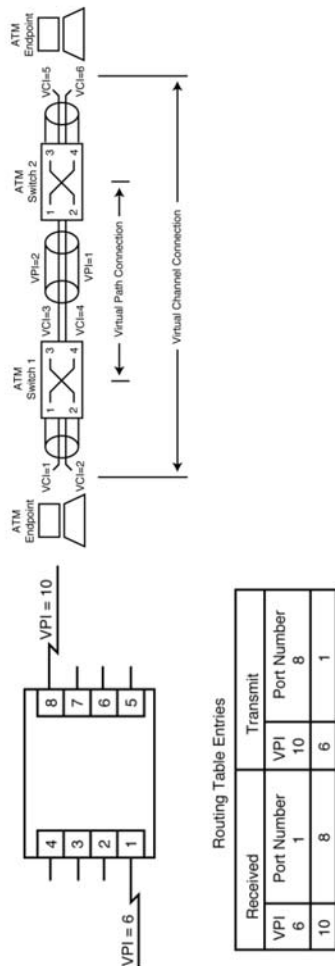
• Why 53 Bytes?

- IP Packet
- Smaller
- Fixed

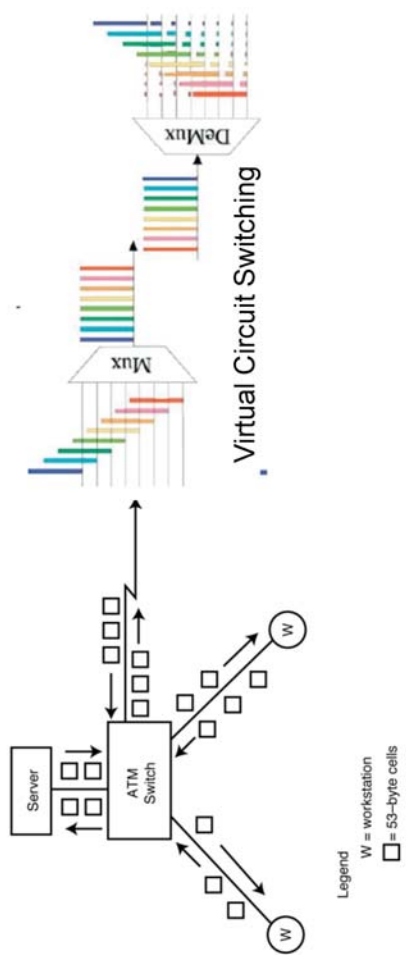


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ATM Virtual Path / Virtual Channel



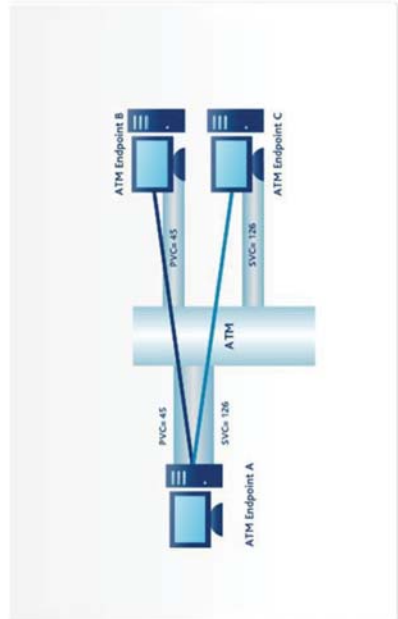
ATM Switching



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?