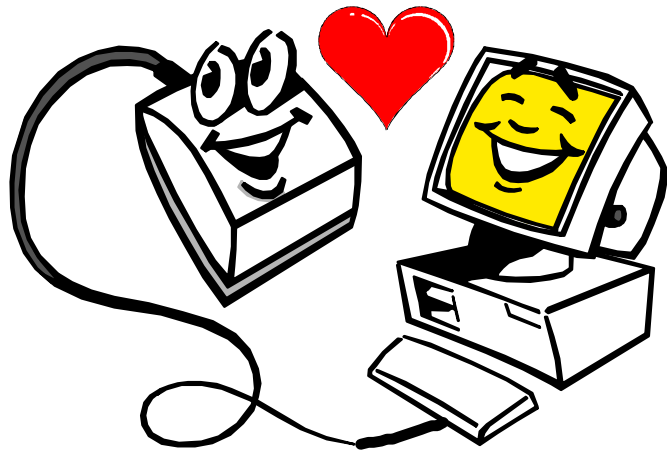


ATM Networks: An Overview



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MBone Instructions

- ❑ Handouts for the class are available on-line:
<http://www.ci.s.ohio-state.edu/~jain/cis788-97/index.html>
- ❑ The schedule keeps changing. Please always check current schedule at:
<http://www.ci.s.ohio-state.edu/~jain/cis788-97/schedule.html>
- ❑ We would like to know how many people are attending. Please send an email after the class with the subject word “**Attended #**” to mbone@netlab.ohio-state.edu. # is the number of people attending.

Instructions (Cont)

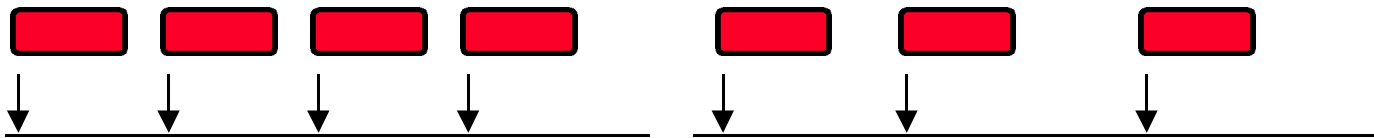
- ❑ Please email your positive and negative feedback about the quality of the reception as well as the content with a subject field of “**Feedback**” to mbone@netlab.ohio-state.edu
- ❑ If you are not able to receive the program due to some technical difficulties, please email “**Feedback**” to mbone@netlab.ohio-state.edu
- ❑ Please email technical questions with the subject field “**Question**” to mbone@netlab.ohio-state.edu. We will try to answer selected questions live.



- ❑ ATM: Overview
- ❑ ATM Protocol Layers
- ❑ Network Interfaces
- ❑ Adaptation Layers
- ❑ Physical Layers

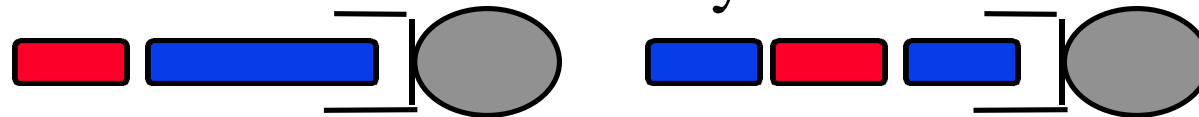
ATM Nets: Key Features

1. STM = Synchronous Transfer Mode,
ATM = Asynchronous Transfer Mode

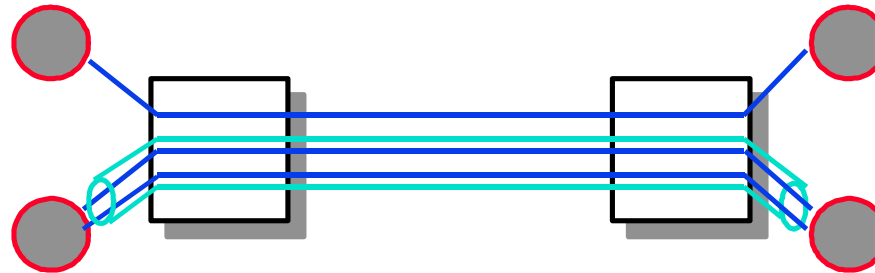


2. Allows **any-speed** and even **variable rate** connection

3. ATM = Short fixed size 53-byte cells

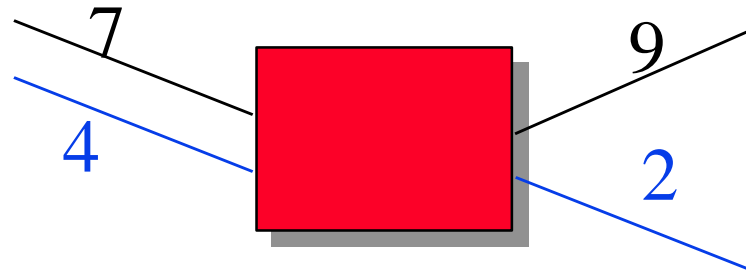


4. Connection oriented \Rightarrow Virtual Channels (VC)



5. Labels vs addresses

⇒ Better scalability in number of nodes



6. Switches vs routers

⇒ Faster due to fixed size, short address, simplicity

7. Data, voice, video integration

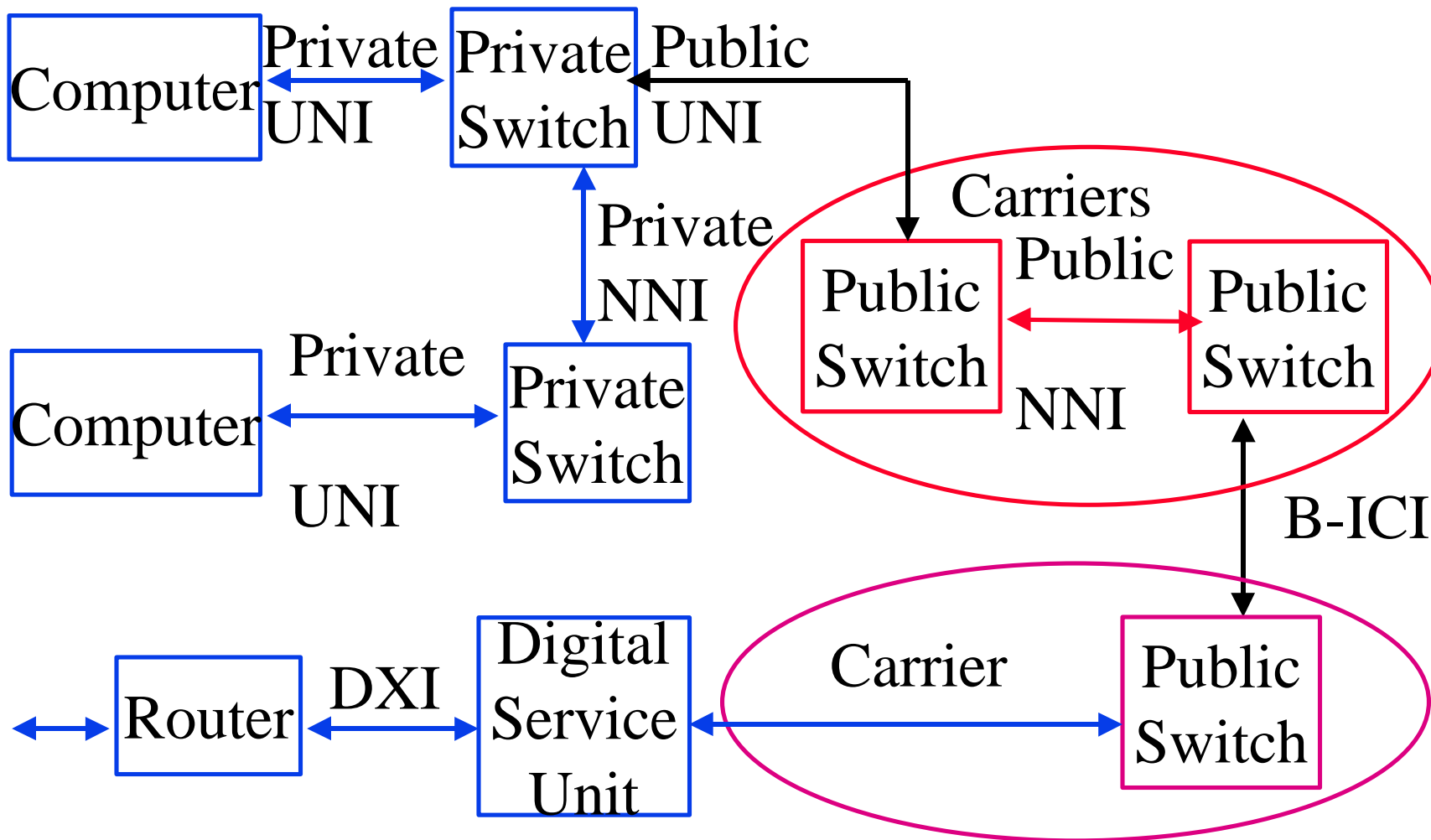
8. Seamless ⇒ Same technology for LAN, WAN,

Two Approaches

	Computer	Telecom
Traffic	Data	Voice
Switching	Packet	Circuit
Arrivals	Bursty	Periodic
Quality of Service	Best effort	Guaranteed
Delay Variation	Not critical	Critical
Resource Alloc	Shared	Dedicated
Connections	Connectionless	Connection-oriented

□ ATM = Computer + Telecom

ATM Interfaces

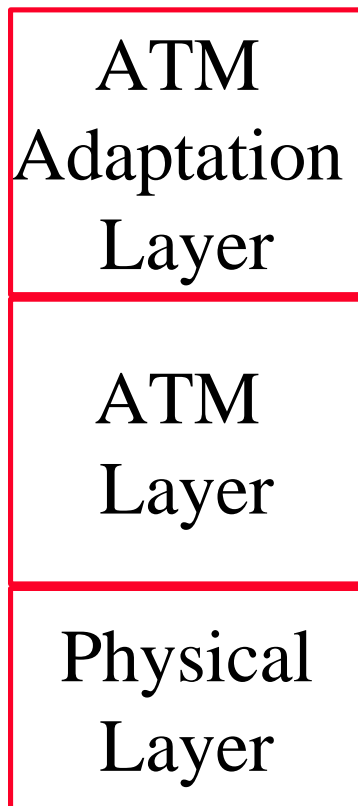


ATM Interfaces

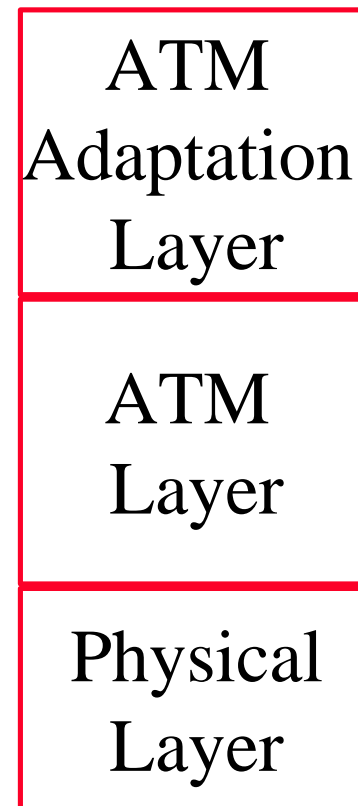
- ❑ User to Network Interface (UNI):
Public UNI, Private UNI
- ❑ Network to Node Interface (NNI):
 - Private NNI (P-NNI)
 - Public NNI = Inter-Switching System Interface (ISSI)
Intra-LATA ISSI (Regional Bell Operating Co)
 - Inter-LATA ISSI (Inter-exchange Carriers)
⇒ Broadband Inter-Carrier Interface (B-ICI)
- ❑ Data Exchange Interface (DXI)
Between routers and ATM Digital Service Units (DSU)

Protocol Layers

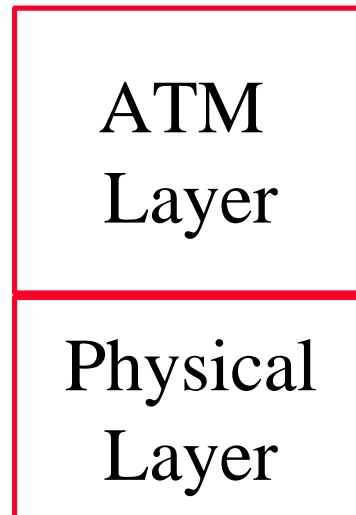
End System



End System



Switch

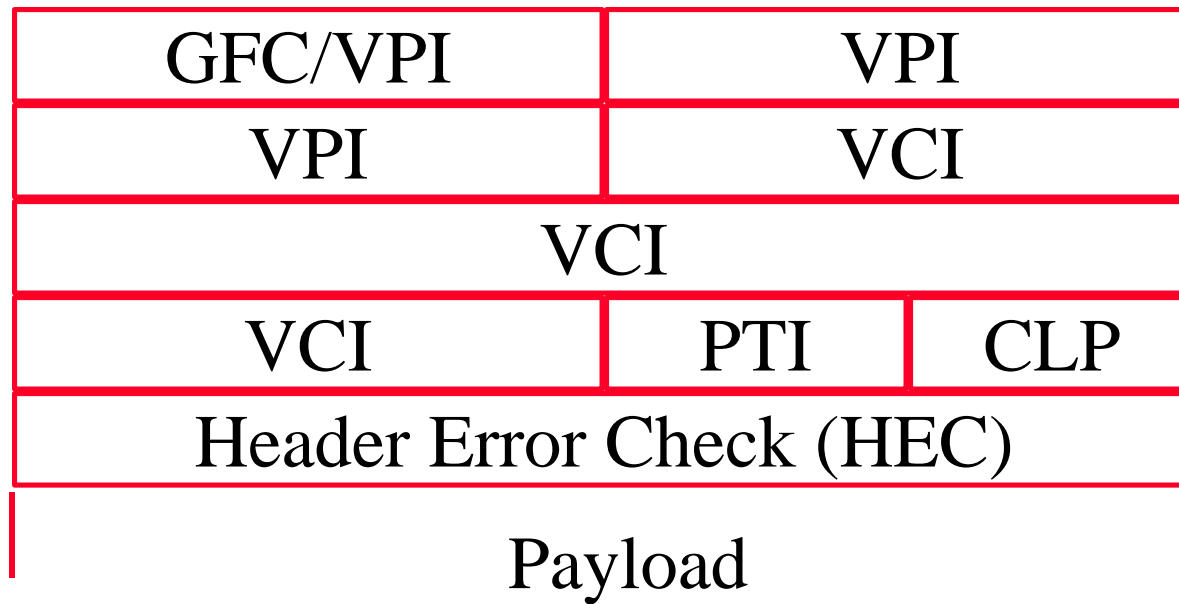


Protocol Layers

- ❑ The ATM Adaptation Layer
 - How to break messages to cells
- ❑ The ATM Layer
 - Transmission/Switching/Reception
 - Congestion Control/Buffer management
 - Cell header generation/removal at source/destination
 - Cell address translation
 - Sequential delivery

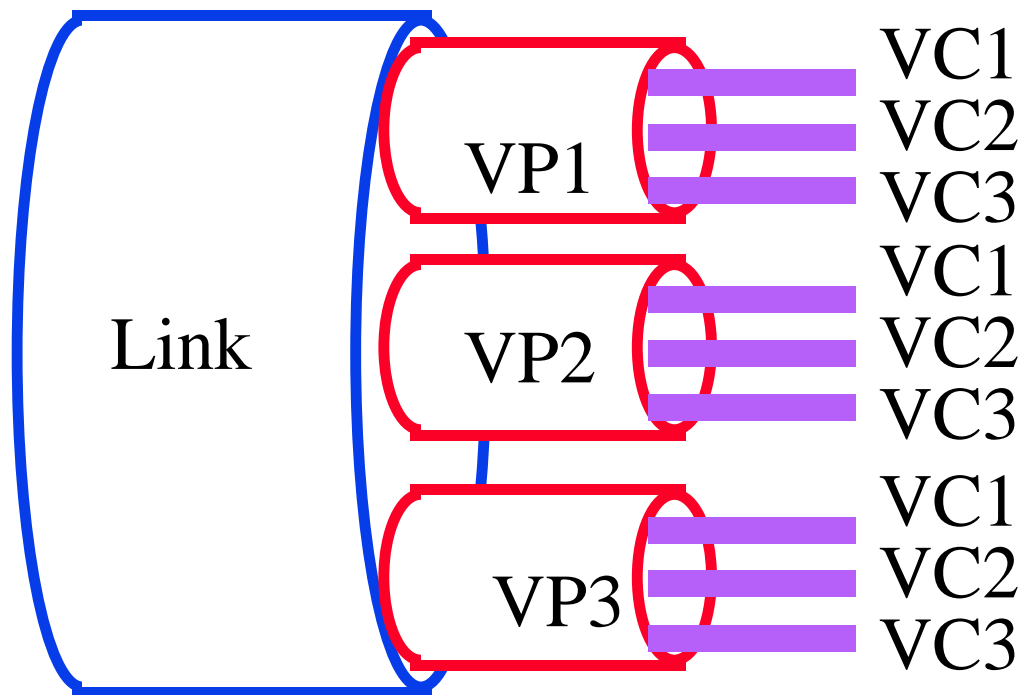
Cell Header Format

- GFC = Generic Flow Control
 - (Was used in UNI but not in NNI)
- VPI/VCI = 0/0 \Rightarrow Idle cell; 0/n \Rightarrow Signaling
- HEC: $1 + x + x^2 + x^8$

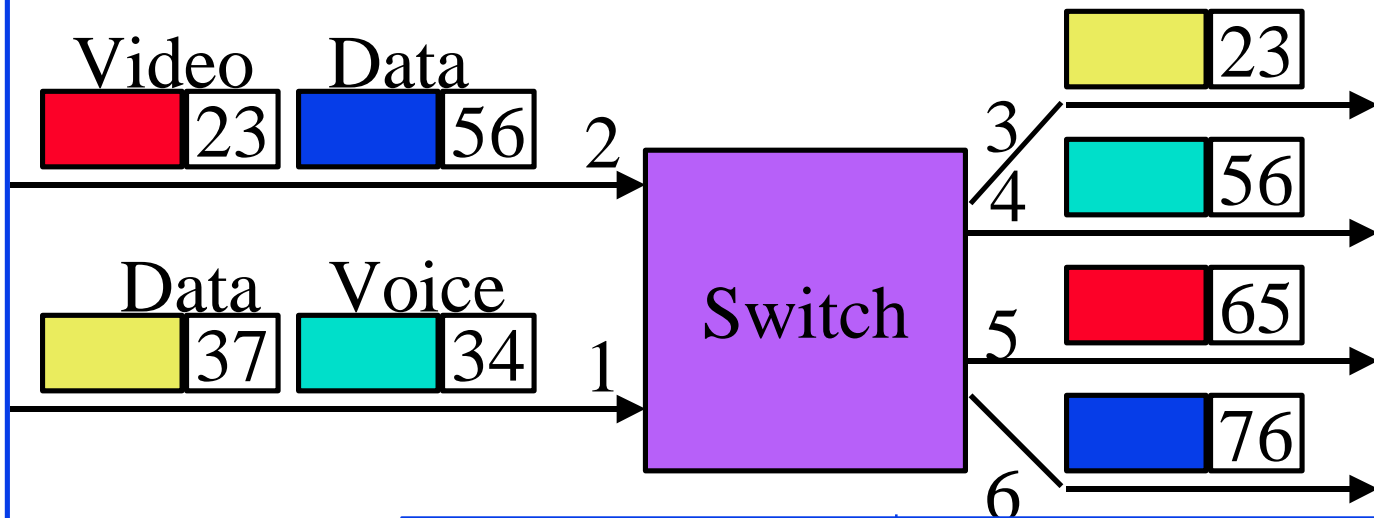


Path vs Channels

- 24/28-bit connection identifier
First 8/12 bits: Virtual Path,
Last 16 bits: Virtual Circuit
- VP service allows new VC's w/o orders to carriers



VP/VC Assignment/Use



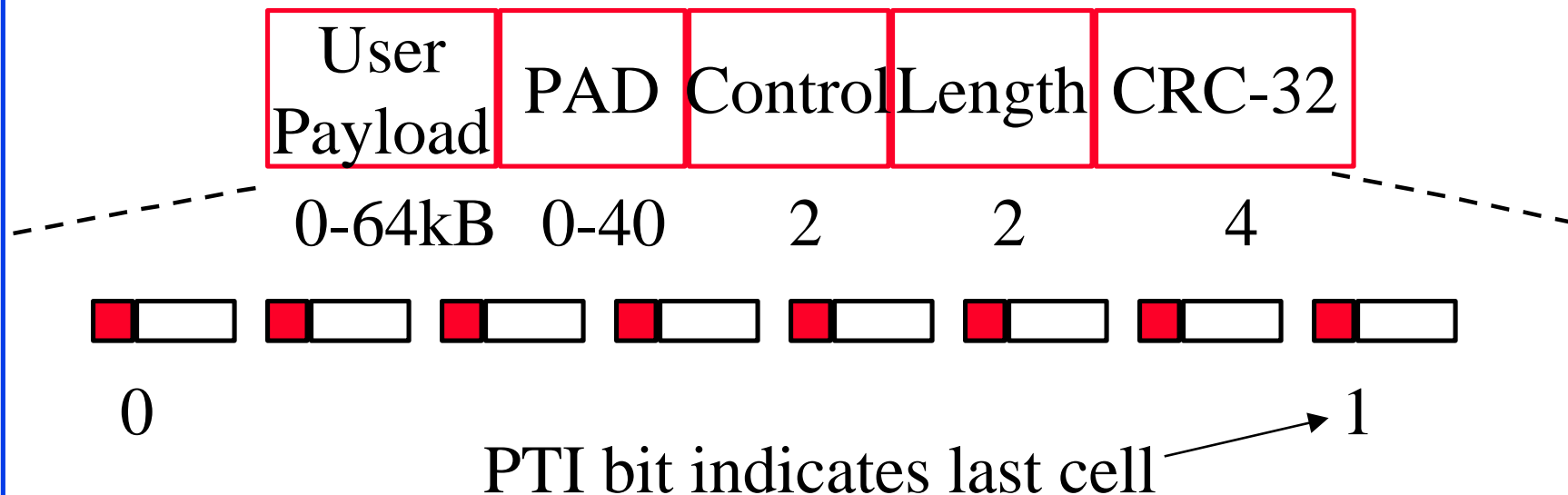
In		Out	
Port	VPI/VCI	Port	VPI/VCI
1	0/37	3	1/23
1	0/34	4	0/56
2	0/23	5	0/65
2	0/56	6	4/76

Original Classes of Traffic

	Class A	Class B	Class C	Class D
Time Sync	Required	Required	Not Required	Not Required
Bit Rate	Constant	Variable	Variable	Variable
Connection	Connection Oriented	Connection Oriented	Connection Oriented	Connection less
AAL	AAL1	AAL2	AAL3	AAL4
Examples	Circuit Emulation	Compressed Video	Frame Relay	SMDS

AAL 5

- ❑ Designed for data traffic
- ❑ Less overhead bits than AAL 3/4
Simple and Efficient AAL (SEAL)
- ❑ No per cell length field, No per cell CRC



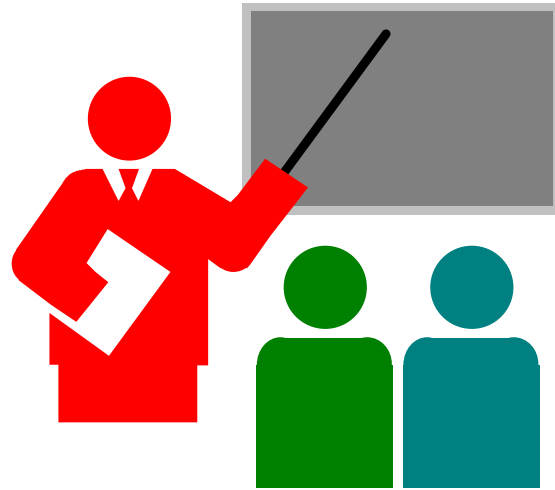
Classes of Service

- ❑ ABR (Available bit rate): Follows feedback
Network gives max throughput with min loss.
- ❑ UBR (Unspecified bit rate):
User sends whenever it wants. No feedback. No guarantee. Cells may be dropped during congestion.
- ❑ CBR (Constant bit rate): User declares required rate.
Throughput, delay and delay variation guaranteed.
- ❑ VBR (Variable bit rate): Declare avg and max rate.
 - ❑ rt-VBR (Real-time): Conferencing.
Max delay and delay variation guaranteed.
 - ❑ nrt-VBR (non-real time): Stored video.

Physical Media Dependent Layers

- ❑ Multimode Fiber: 100 Mbps using 4b/5b, 155 Mbps SONET STS-3c, 155 Mbps 8b/10b
- ❑ Single-mode Fiber: 155 Mbps STS-3c, 622 Mbps
- ❑ Shielded Twisted Pair (STP): 155 Mbps 8b/10b
- ❑ Coax: 45 Mbps, DS3, 155 Mbps
- ❑ Unshielded Twisted Pair (UTP)
 - ❑ UTP-3 (phone wire) at 25.6 Mbps, 51.84 Mbps
 - ❑ UTP-5 (Data grade UTP) at 155 Mbps
- ❑ DS1, DS3, STS-3c, STM-1, E1, E3, J2, $n \times T1$

Summary



- ❑ ATM Overview: History, Why and What
- ❑ Protocol Layers: AAL, ATM, Physical layers, Cell format
- ❑ Interfaces: PNNI, NNI, B-ICI, DXI
- ❑ ABR, CBR, VBR, UBR

ATM : Key References

- ❑ H. Dutton and Peter Lenhard, “Asynchronous Transfer Mode (ATM) Technical Overview,” 2nd Ed., Prentice Hall, 1995.
- ❑ S. Siu and R. Jain, "A brief overview of ATM: Protocol Layers, LAN Emulation and Traffic Management" Computer Communications Review (ACM SIGCOMM), April 1995. Available at <http://www.cis.ohio-state.edu/~jain/>
- ❑ ATM Forum specs are available at <ftp://ftp.atmforum.com/pub/approved-specs/>

References (Cont)

- A very detailed list of references including books is available at http://www.cis.ohio-state.edu/~jain/refs/atm_refs.htm

Current Schedule

6/24/97 Course Overview

6/26/97 Networking Trends and their impact

7/1/97 ATM - Introduction

7/3/97 LAN Emulation and ATM Emulation

7/8/97 IP Switching

7/10/97 Virtual LANs and LAN Switching

7/15/97 Quiz 1 (No Mbone transmission)

7/17/97 Gigabit Ethernet

7/22/97 **No Class**

Schedule (Cont)

7/24/97 Multimedia: Compression Standards

7/29/97 Multimedia over IP: RSVP, RTP

7/31/97 Quiz 2 (No MBone transmission)

8/5/97 Wireless LANs and WANs

8/7/97 Residential broadband: Cable Modems, xDSL

8/12/97 Mobile Networking: Mobile IP, Wireless ATM

8/14/97 IPng - IP Next Generation (IPng)

8/19/97 Quiz 3 (No MBone transmission)

8/21/97 Graduating Seniors' grades due

Credits

This MBone transmission was made possible by:

- ❑ Mark Fullmer, OSU/UTS
- ❑ Mike Iverson, OSU/UTS
- ❑ Bob Dixon, OSU/UTS
- ❑ Mike Douglas, OSU/UTS
- ❑ Jayaraman Iyer, OSU/CIS
- ❑ Sohail Munir, OSU/CIS