

ATM Networks

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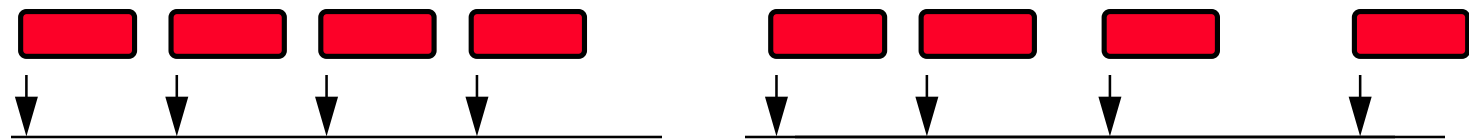
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- ❑ ATM: Overview
- ❑ ATM Protocol Layers
- ❑ Network Interfaces
- ❑ Adaptation Layers
- ❑ Physical Layers

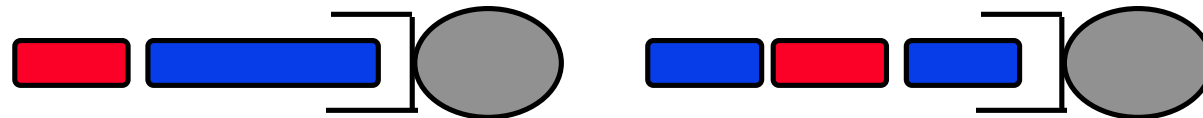
ATM Networks: Overview

- STM = Synchronous Transfer Mode,
ATM = Asynchronous Transfer Mode

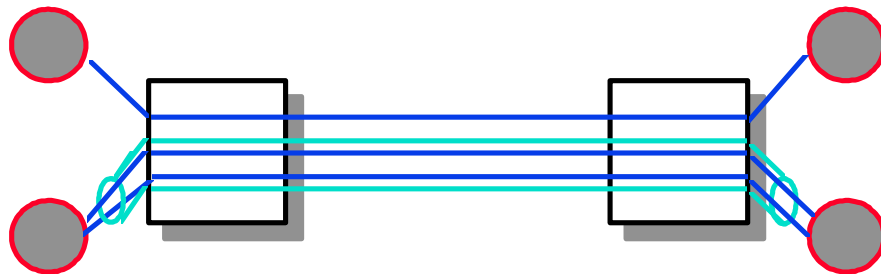


Allows **any-speed** and even **variable rate** connection

- ATM = Short fixed size 53-byte cells

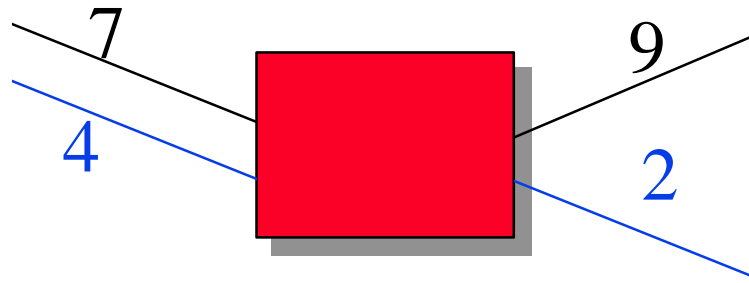


- Connection oriented \Rightarrow Virtual Channels (VC)



- Labels vs addresses

⇒ Better scalability in number of nodes



- Switches vs routers

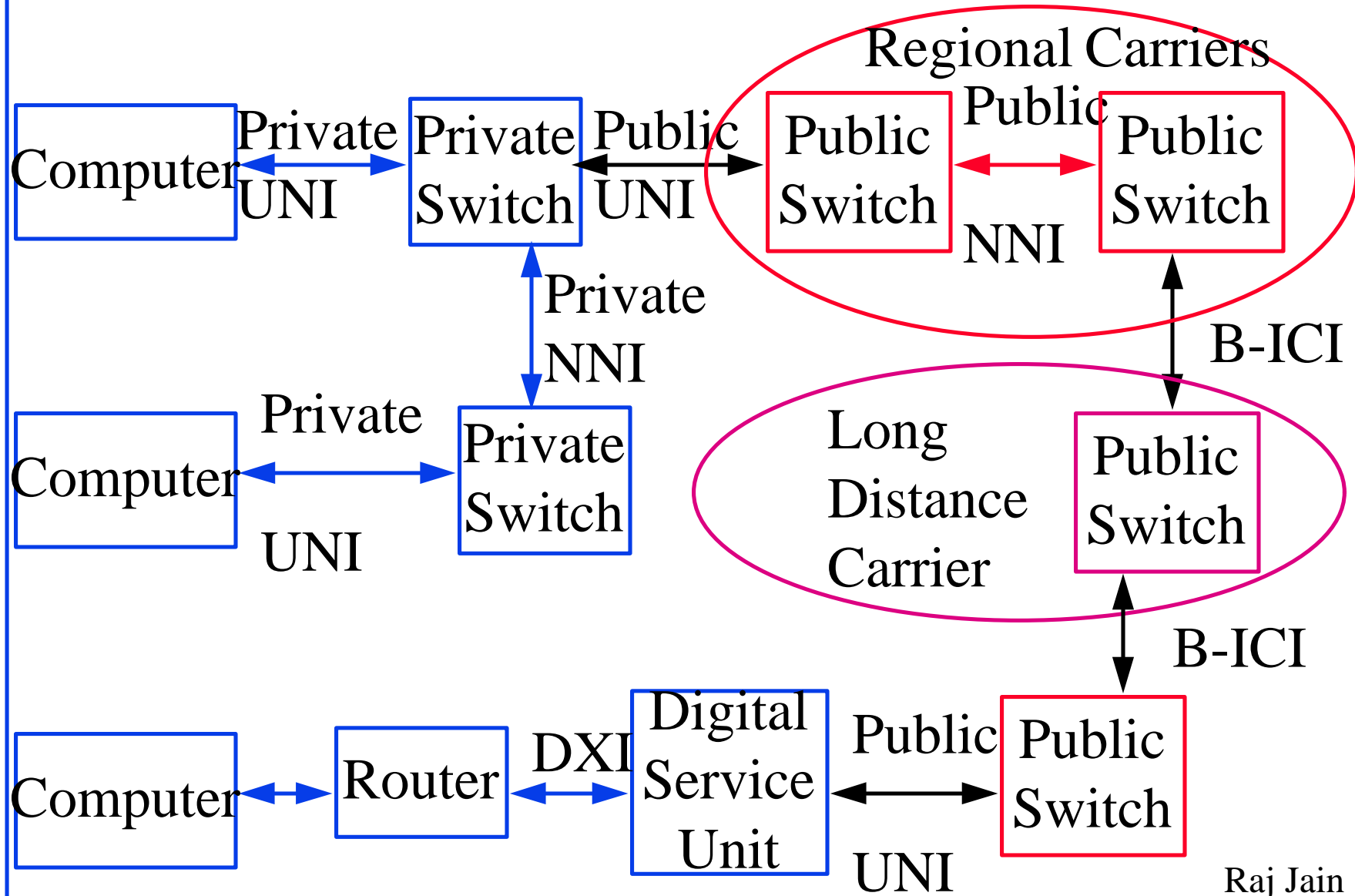
⇒ Faster due to fixed size, short address, simplicity

- Seamless ⇒ Same technology for LAN, WAN,

- Data, voice, video integration

- Everyone else is doing it

ATM Network Interfaces



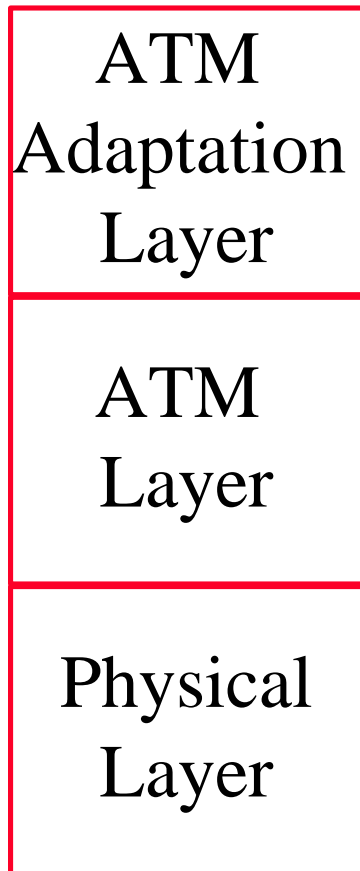
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ATM Network Interfaces

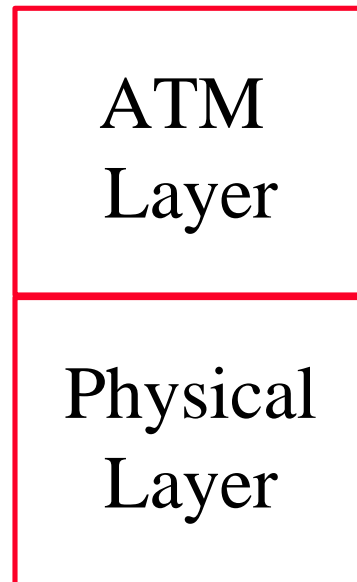
- ❑ User to Network Interface (UNI):
Public UNI, Private UNI
- ❑ Network to Node Interface (NNI):
 - ❑ Private NNI (P-NNI)
 - ❑ Public NNI = Inter-Switching System Interface (ISSI)
Intra-LATA ISSI (Regional Bell Operating Co)
 - ❑ Inter-LATA ISSI (Inter-exchange Carriers)
⇒ Broadband Inter-Carrier Interface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

Protocol Layers

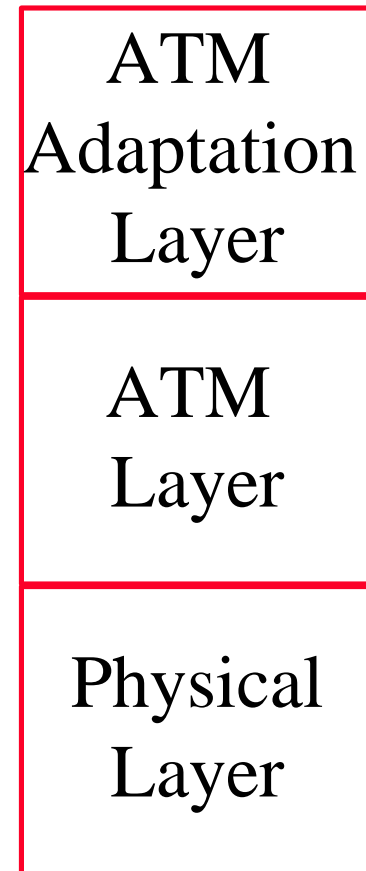
End System



Switch



End System



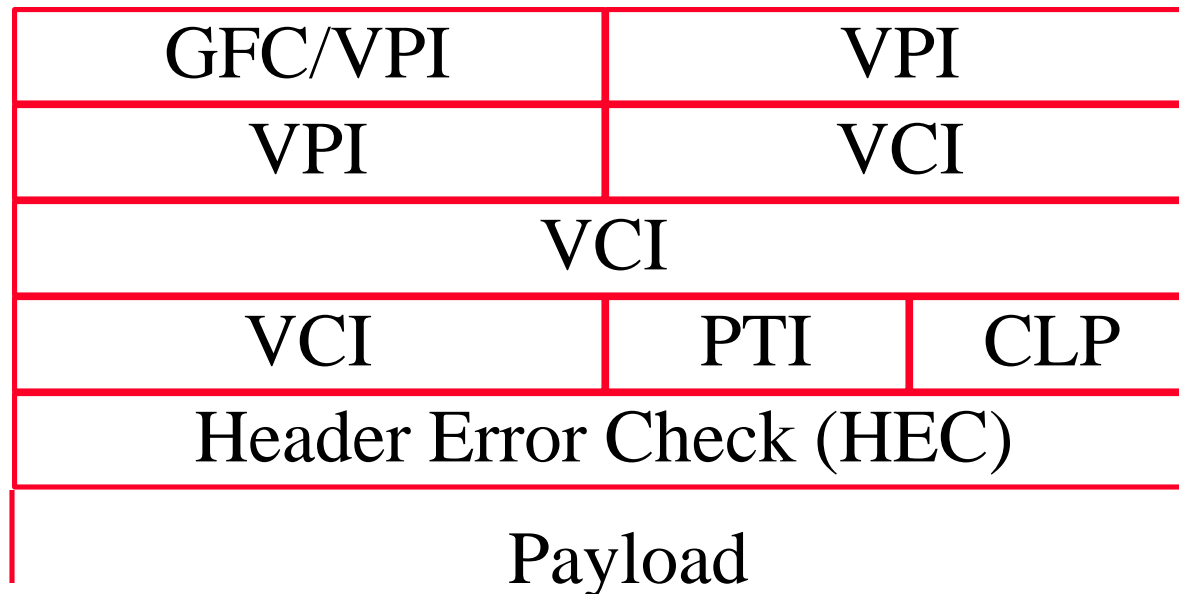
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Protocol Layers

- ❑ The ATM Adaptation Layer
 - ❑ How to break application 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

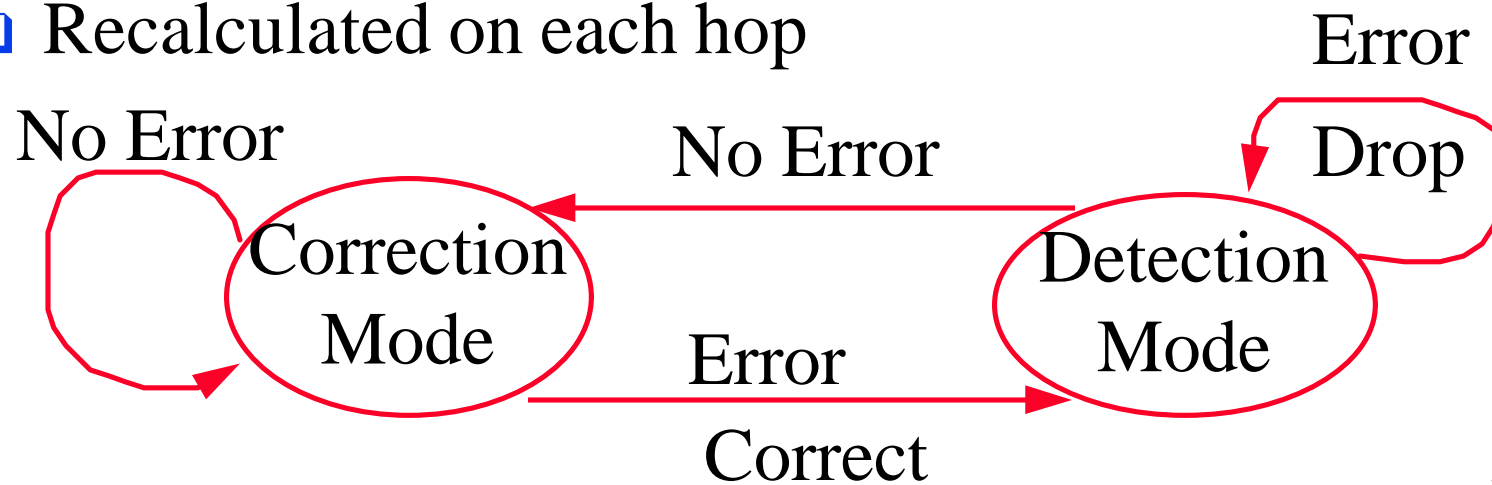
ATM Cell Header Format

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



Header Error Check (HEC)

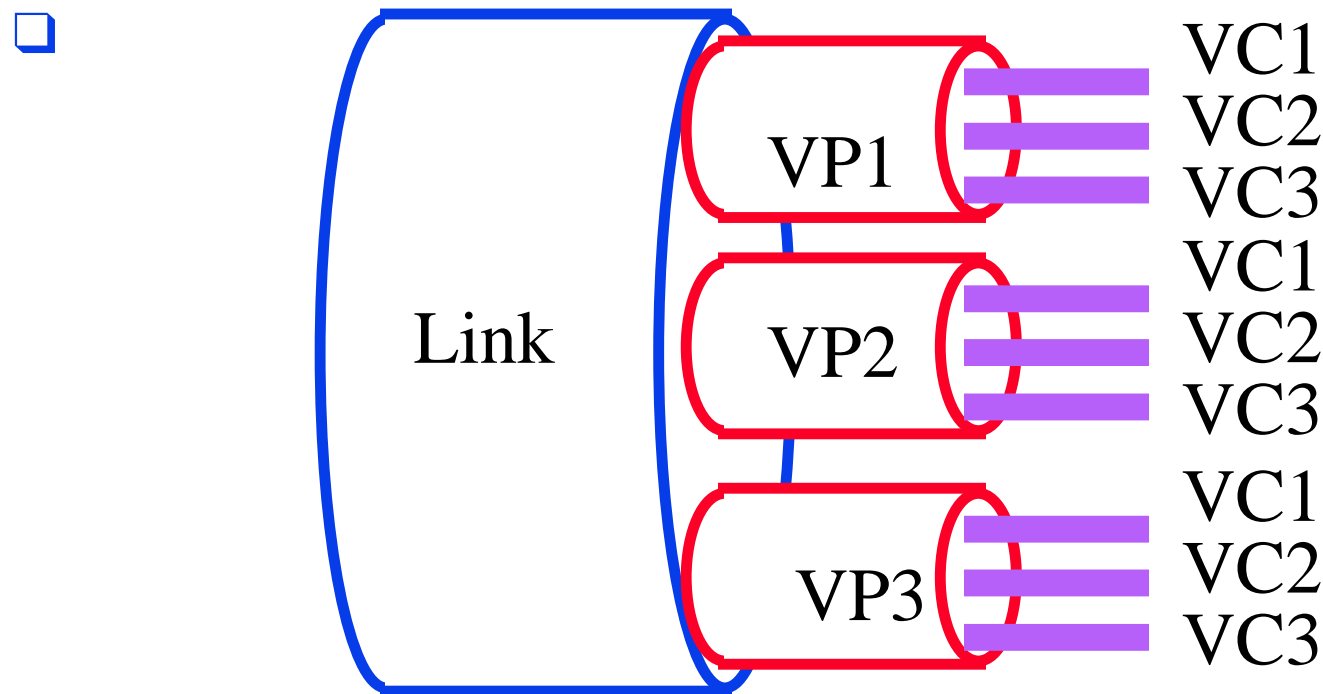
- ❑ Protects header only
- ❑ Optional Correction mode: Correct one bit errors if no earlier errors
- ❑ Discard cells with bad HEC
- ❑ Used for cell delineation in SONET
- ❑ Recalculated on each hop



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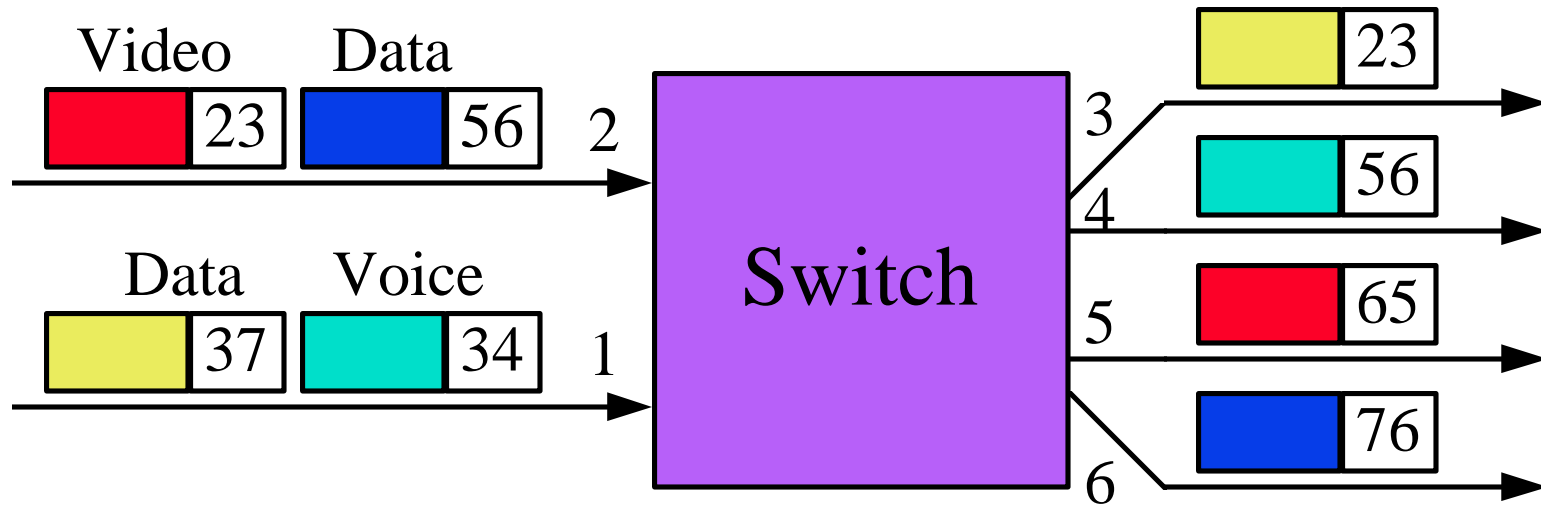
Connection Identifiers

- ❑ Each cell contains a 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



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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

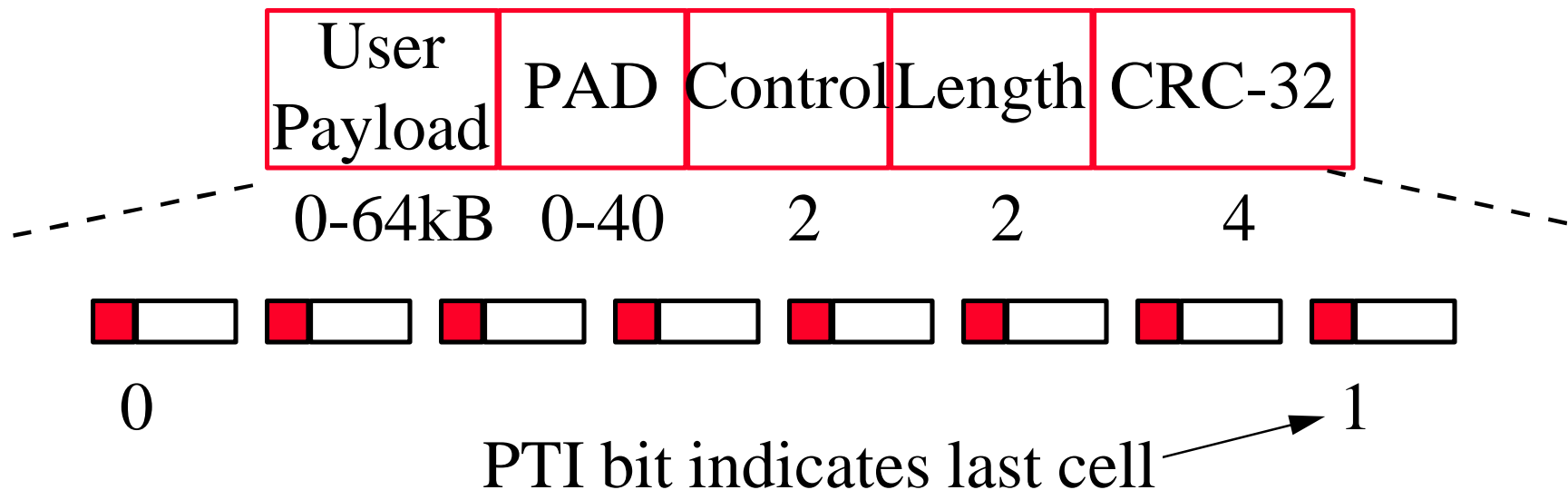
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Original Classes of Traffic

	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



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Classes of Service

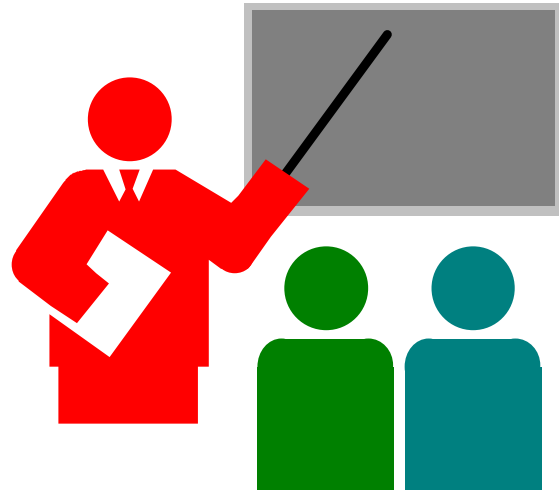
- ❑ **ABR** (Available bit rate): Follows feedback
Network gives max throughput with minimum loss.
- ❑ **UBR** (Unspecified bit rate):
User sends whenever it wants. No feedback. No guarantee. Cells may be dropped during congestion.
- ❑ **CBR** (Constant bit rate): User declares required rate.
Throughput, 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 (PMDs)

- ❑ Multimode Fiber: 100 Mbps using 4b/5b (TAXI), 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, $n \times T1$

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Summary



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

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/>
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