

Introduction to ATM

Revised 08-01-2000

Agenda

- ATM
 - ATM vs. Frame Relay
 - ATM header
 - Classes of Service
 - CBR
 - VBR
 - ABR
 - Traffic Management

Frame Relay & ATM Similarities

Frame Relay	ATM
Permanent Virtual Circuits built using DLCI	Permanent Virtual Circuits built using VPI and VCI
Committed Information Rate labeled CIR	Committed Information Rate measured as PCR, SCR, or MCR
Uses the DE (Discard Eligibility) Bit	Uses a CLP (Cell Loss Priority) Bit
Uses "Leaky Bucket" method of congestion control	Uses "Dual Leaky Bucket" method of congestion control

Frame Relay vs. ATM

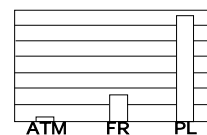
Frame Relay	ATM
Designed for Data	Designed for Voice, Data, and Video
No Priorities	Multiple Priorities
Variable Length Frames	Fixed-Length Cells (53 Bytes)
Access 56K - 20Mbps	Access 1.5Mbps - 155Mbps
WAN Technology	WAN or LAN Technology

ATM Customer Profile

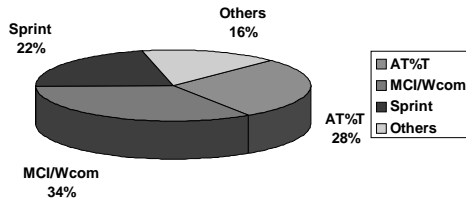
- Large corporations or government organizations with high bandwidth needs (ex. Disney uses ATM for collaborative editing).
- Organizations wishing to prioritize different types of traffic using the same network.
- Companies using ATM to the desktop.
- Leading edge companies using ATM to develop their own products.

Competing Technologies?

- Frame Relay revenues are more than 20x that of ATM (Data Communications Dec '97)
 - 1998 projected
 - \$6.16 Billion Frame Relay
 - \$320 Million ATM
- In contrast, approximately 75-80% data communications use private lines



Competitive Comparison

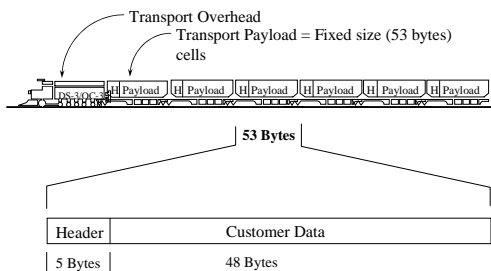


Source: Vertical Systems Group 1997
Note: MCI & WorldCom combined

ATM Switching Technology

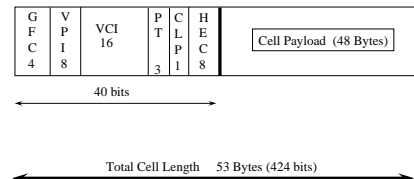
- Switches fixed-length 53-byte cells
 - provides predictability in delay variance
 - predictable delay enables traffic such as voice & video to be transported
 - Smaller Cells take less time to “fill” with data
 - Uniform-sized cells can be switched faster
- Based on *international standards*
 - Works on both LANs and WANs

ATM Transport Method



ATM Concepts: Cell Structure

ATM UNI (User Network Interface) Cell Format:



ATM Concepts: Cell Structure

ATM Cell Format:

- Generic Flow Control (GFC):** Not Used
- Virtual Path Identifier (VPI):** Defines Virtual Path Portion of Address. 1 Octet
- Virtual Channel Identifier (VCI):** Defines Channel Portion of Address. 2 Octets
- Payload Type:** Defines Management or User Cell. Includes EFCI Bit
- Cell Loss Priority (CLP):** Identifies Cell as Tagged For Discard (CLP=1)... Like DE bit in frame relay.
- Header Error Control (HEC):** Simple Bit Error Checking for Header Only

Voice, Data, and Video

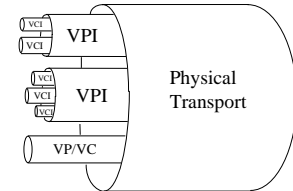
- ATM has a “built-in” priority system which allows customers to treat one PVC different from another.
 - Cuts down on delay for constant bit-rate applications
 - Ex: Cells transported over PVCs supporting voice will be sent ahead of cells traversing a PVC carrying e-mail

Connectivity: ATM vs. Frame

- Both ATM cells and Frame Relay frames have address fields used to route traffic over PVCs.
- However, ATM allows for “PVCs within PVCs” to aggregate traffic from different sources which are bound for the same destination.
- Network switches can police these different virtual circuits using “quality of service” parameters.

ATM Transport

Virtual Connection Types:
Virtual Channel Connections (VCC)
Virtual Paths Connections (VPC)



Permanent Virtual Circuits

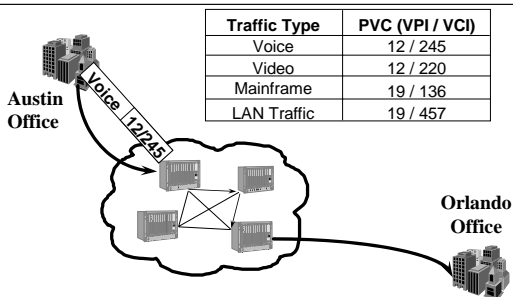
- There are two “types” of PVCs with ATM
 - VPC (Virtual Path Connection)
 - Address is the VPI (Virtual Path Identifier)
 - Used to simplify switching within the network
- VCC (Virtual Channel Connection)
 - Address is the VCI (Virtual Channel Identifier)
 - VCCs ride within VPCs
 - Different types of traffic going to the same destination can be assigned different virtual channels within the virtual circuit.

ATM Virtual Connections

Virtual Addressing: Used to route cells across the network

- **Virtual Path Identifier (VPI):**
 - 8 Bit UNI Address
 - 1-256 Possible Connections Supported
- **Virtual Channel Identifier (VCI):**
 - 16 Bit UNI Address
 - 1-65,536 Possible Connections Supported

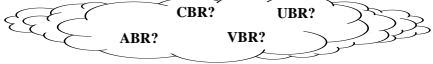
Building PVCs




Building PVCs

- With standard frame relay, all traffic from a customer bound for the same destination received the same DLCI.
- With ATM, traffic leaving a site is given an address (VPI/VCI) based on what type of traffic it is (voice, video, LAN, e-mail, etc.)
 - This helps our network keep track of which type of traffic is coming, and we can prioritize the traffic.

ATM Concepts: Class of Service (CoS)



ATM
Classes of
Service




ATM Concepts: Class of Service

- Constant Bit Rate (CBR)
- Variable Bit Rate (VBR)
- Available Bit Rate (ABR)
- Unspecified Bit Rate (UBR)

CBR (Constant Bit Rate)

- Used primarily for Voice and Fixed -Rate Video
- VCCs carrying CBR traffic are policed on:
 - Peak Cell Rate: To make sure they don't burst and have cells marked discard eligible
 - Cell Delay Variation: To make sure the delay between cells falls within an acceptable level.



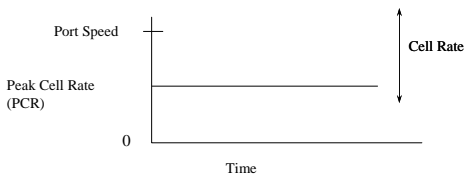
Thank You!

Voice or Video

Please... after you! And Don't dawdle!

Data

CBR Traffic Management

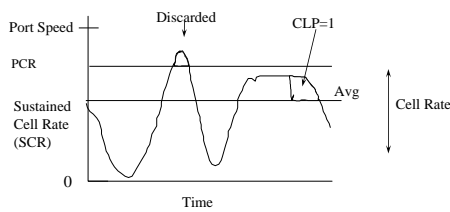


* Above PCR is Discarded
* Customers network equipment should send data to IXC at PCR

VBR (Variable Bit Rate)

- variable bit rate in non real time (VBR-NRT)
- This service is **similar to Frame Relay** allowing bursting above SCR (Sustained Cell Rate)
- Cells transmitted above PCR (Peak Cell Rate) and MBS (Maximum Burst size) are tagged discard eligible.

VBR Traffic Management



* Can Burst Up To PCR
* Above PCR is Discarded
* Cells Violating SCR (Over a Specified Period of Time = MBS) are Tagged or Discarded
* MBS on a DS-3 port is 2000 cells

ABR (Available Bit Rate)

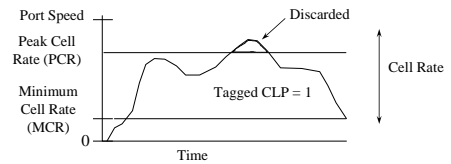
- Used for very “elastic” applications like LAN emulation
- For best results, customer equipment should be able to communicate with our network to see how much bandwidth is available.

Hey guys, can I squeeze in?

ABR



ABR Traffic Management



- * MCR is Guaranteed
- * Can Burst above MCR if Bandwidth is Available
- * Cells Between MCR and PCR are Tagged
- * Can Burst Up To PCR
- * Above PCR is Discarded
- * Extra charges apply if PCR is set over 200% above MCR

UBR (Unspecified Bit Rate)

- IXC's "Best Effort" Service
- No Guaranteed Bandwidth (All cells tagged CLP=1)

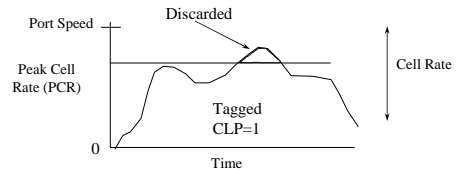
We'll tell you when there's room!

CLP=1

UBR

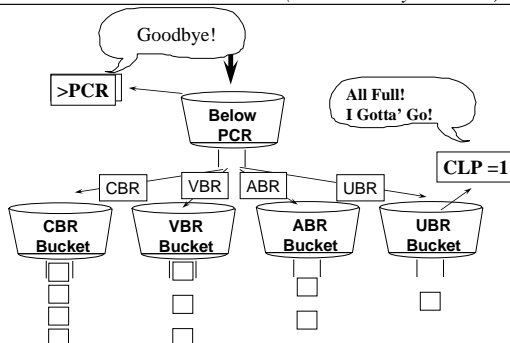


UBR Traffic Management



- * Has No Minimum Guaranteed bandwidth
- * All Cells Are Tagged
- * Can Transmit Up To PCR
- * Above PCR is Discarded

Congestion Control ("Dual Leaky Bucket")



Other Rules of Thumb

- No single SCR, MCR or PCR can exceed port speed (or port minus CBR PCR)
- VBR and ABR can be oversubscribed up to 200%
- No oversubscription on "CBR only" ports
- If CBR traffic is mixed with other classes of service, port speed available for VBR, ABR, and UBR is port speed minus CBR PCR.
 - This "remaining" port speed can be oversubscribed 200%
- No single VBR, ABR, or UBR PVC can exceed 20Mbps