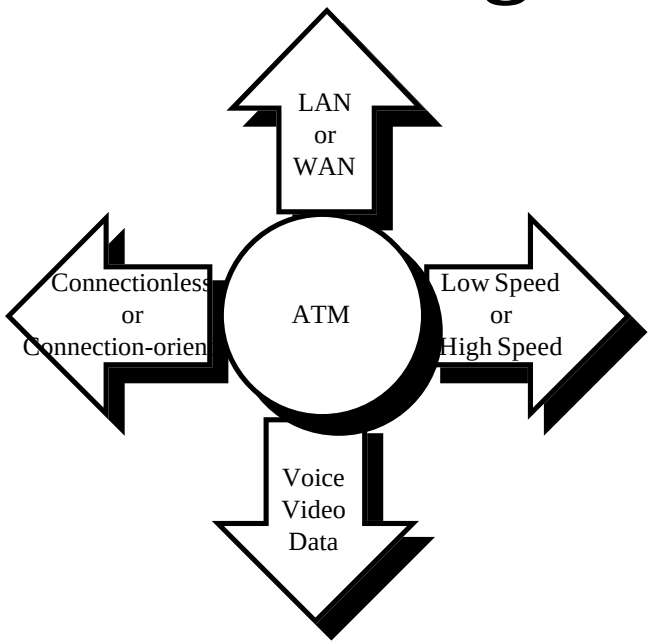
ATM Networking: Issues and Challenges Ahead



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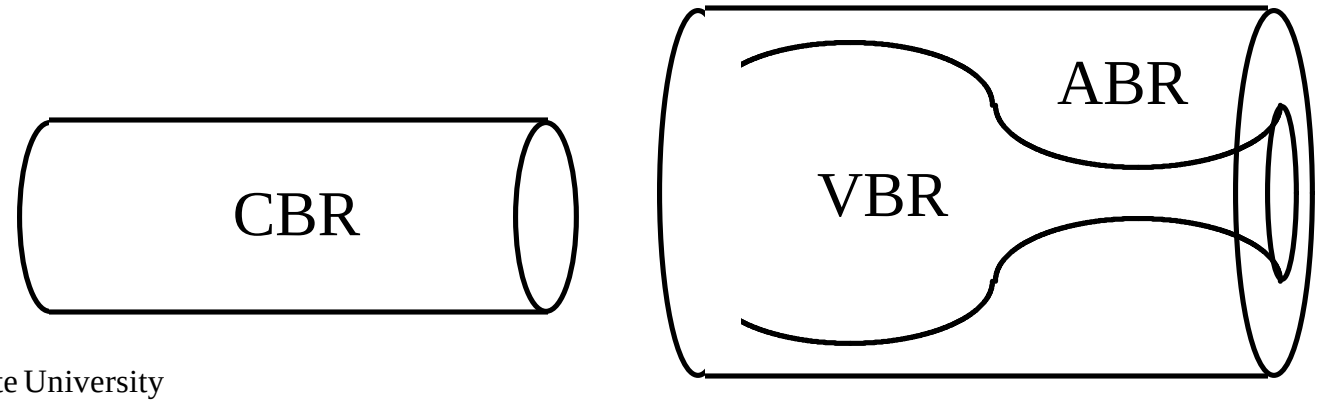
- ATM Networks Overview
- Connectionless Traffic: IP Over ATM
- Requirements for Success
- Tariff, Scalability, Applications, Simplicity

Service Categories

- CBR: Constant Bit Rate (Zero delay variation)
- VBR: Variable Bit Rate
  - VBR-RT: VBR real time (Low delay variation)
  - VBR-NRT: VBR non-real time
- ABR: Available Bit Rate
  (Source commits to control, Best effort to not loose cells)
- UBR: Unspecified Bit Rate (No commitment, No guarantee)



Current Service Categories

Attribute	CBR	VBR-RT	VBR-NRT	ABR	UBR
CLR for CLP=0	Specified			Specified	Unspecified
CLR for CLP=1	Optional			Specified	Unspecified
CTD	Specified		Specified*	Unspecified	Unspecified
CDV	Specified		Unspecified	Unspecified	Unspecified
PCR	Specified			Specified	N/A
MCR	N/A			Specified	N/A
Controllable?	No			Yes	No
Application	Circuit Switching	Interactive Multimedia	Multimedia Email	Data	Monitoring

CLP = Cell loss priority; 1 Cell can be dropped under overload

CLR = Cell Loss Ratio

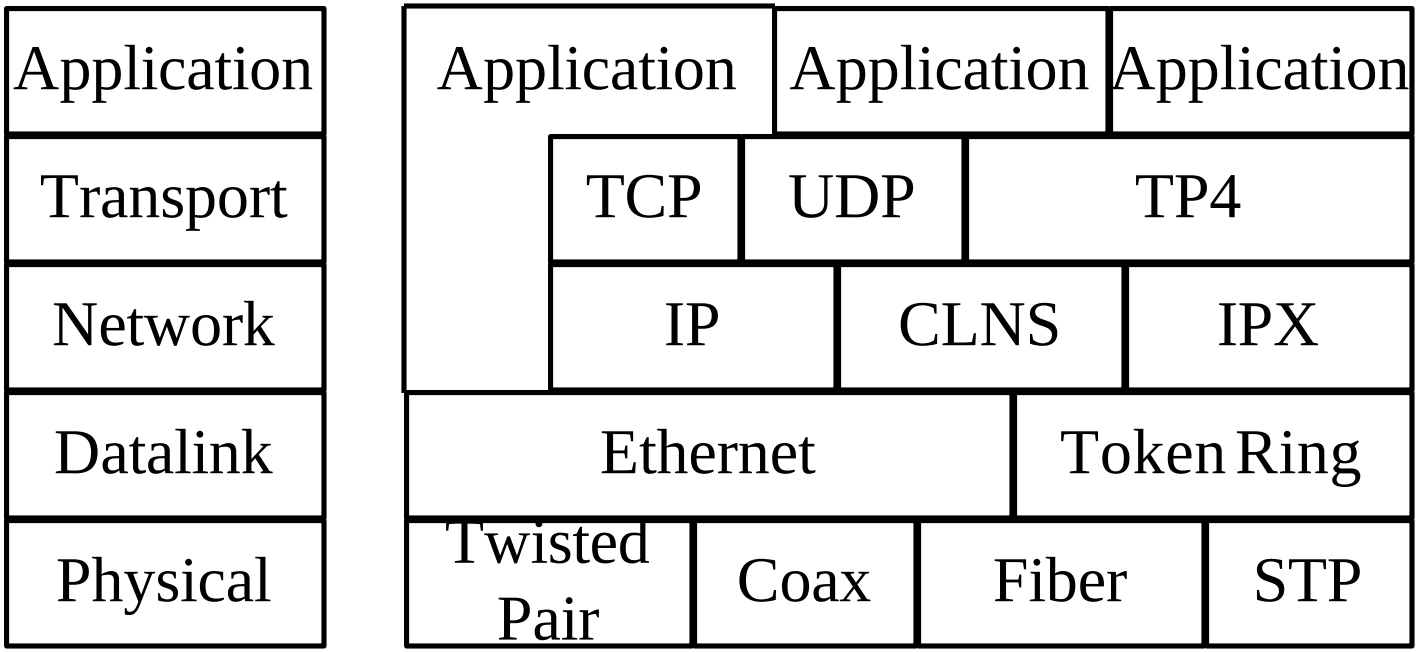
CTD = Cell transfer Delay = End-to-end delay

CDV = Cell Delay variation = Max-Min End-to-end delay

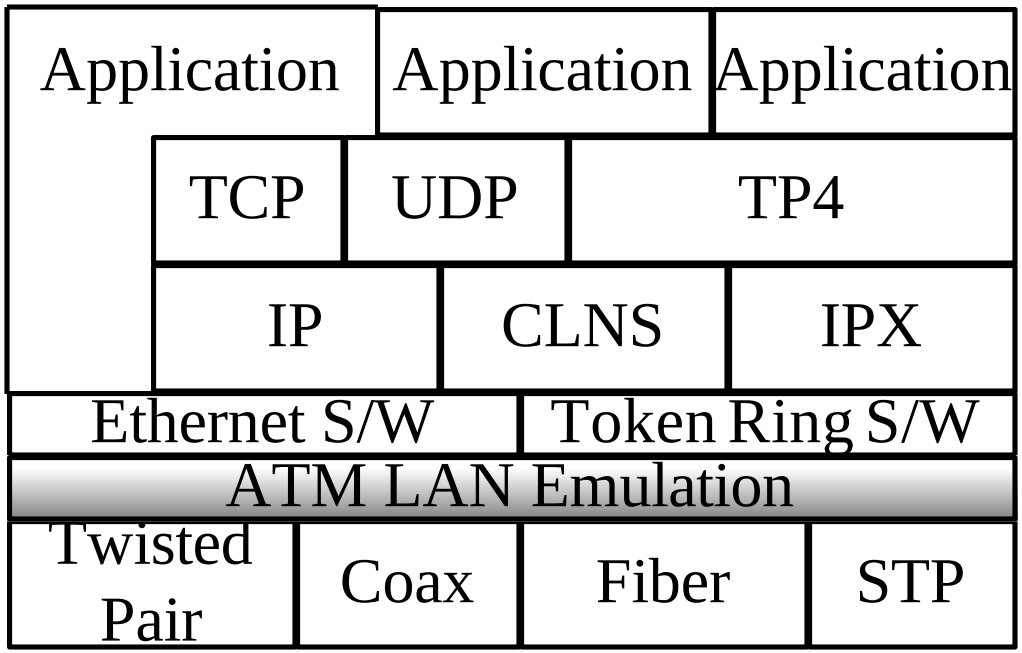
PCR = Peak Cell Rate

MCR = Minimum Cell Rate

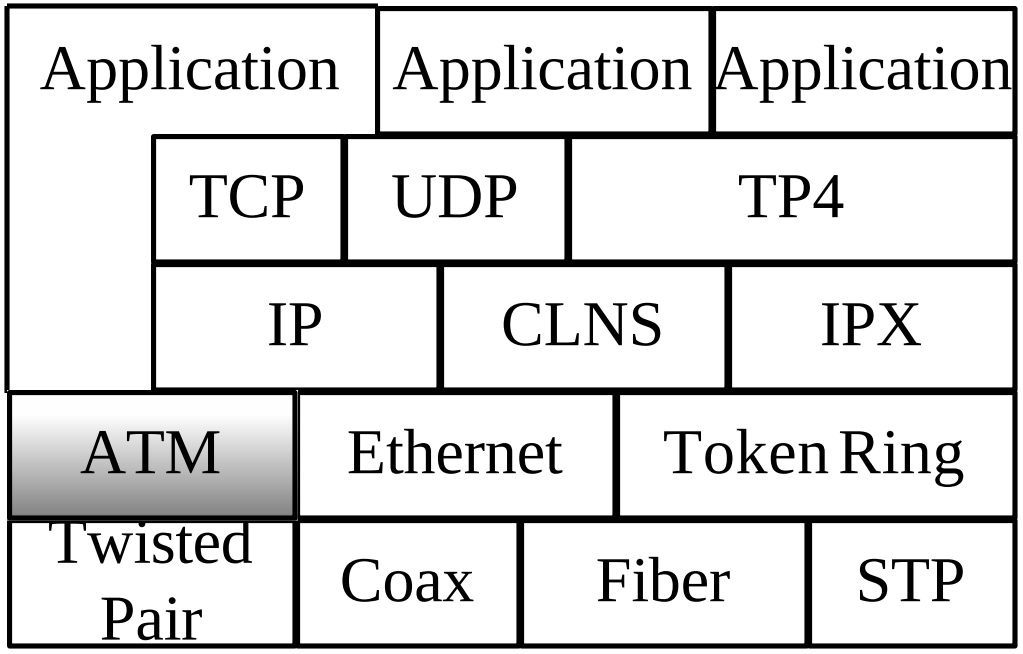
Protocol Layers



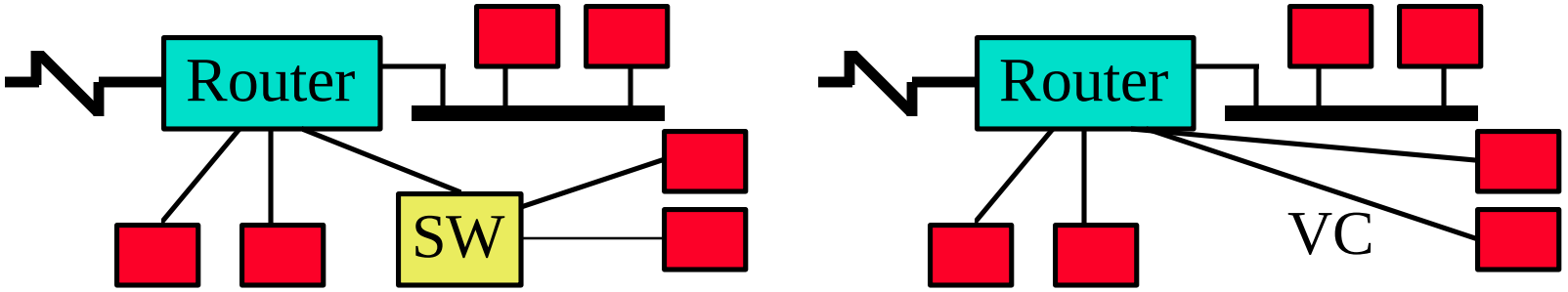
LAN Emulation



IP Over ATM

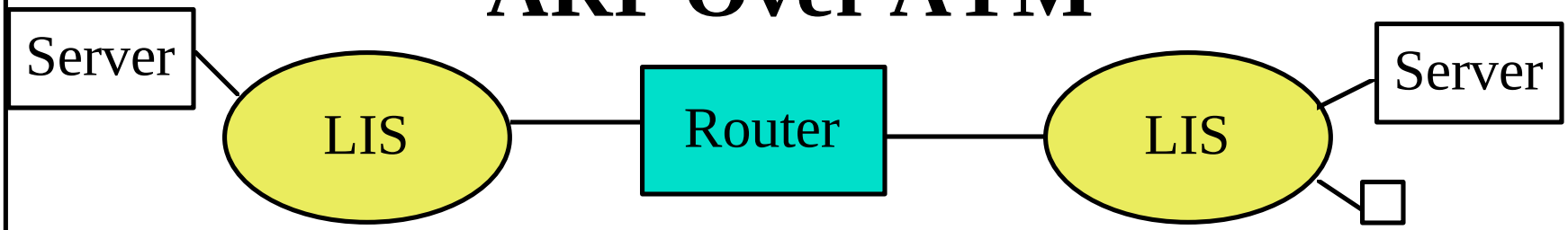

Application
Application
Application
TCP
UDP
TP4
IP
CLNS
IPX
ATM
Ethernet
Token Ring
Twisted Pair
Coax
Fiber
STP

IP Over ATM



- ATM similar to point-to-point WANs.
  Simpler than LAN emulation
- IP address:123.145.134.65
  ATM address:…1-614-999-2345-…
- Issue: IP Address ⇔ ATM Address translation
  - Address Resolution Protocol (ARP)
  - Inverse ATM ARP: VC ⇒ IP Address
- Solution: Logical IP Subnet (LIS) Server
- Ref: RFC 1577

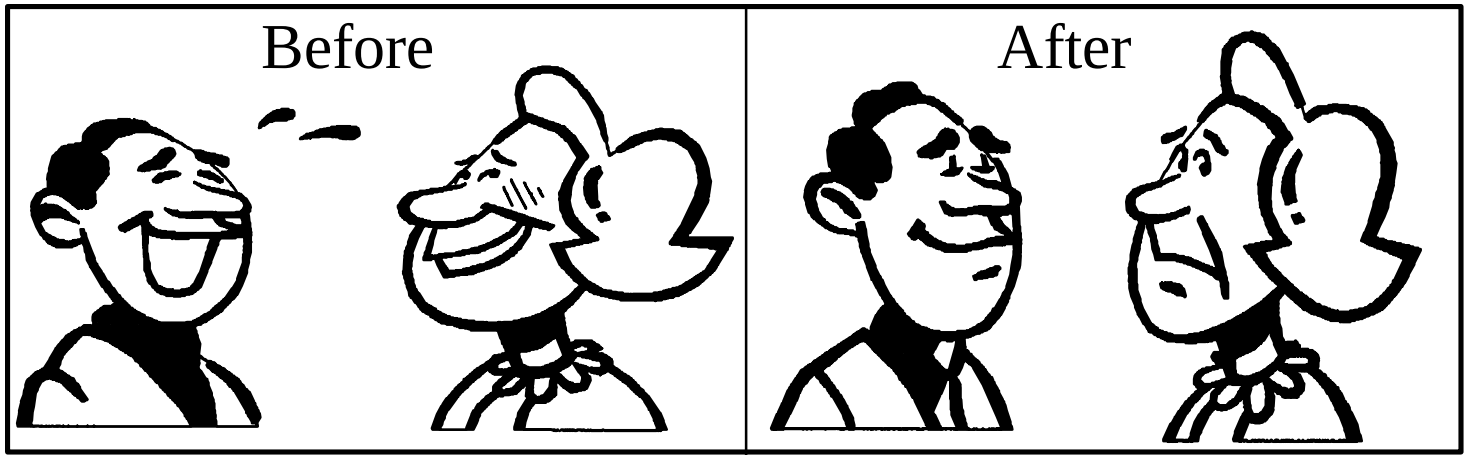
ARP Over ATM



- Only one ATM ARP server per subnet ⇒ No synchronization
- Clients are configured with server's ATM address
- Clients setup a VC with the server
- Server sends an inverse ARP (What's your IP Address?)
- Client responds with its IP Address
- Clients ask server by ARP request
  (What's ATM address of 123.145.134.65?)
- Server replies with ATM address. NAKs if not in table.
- ARP requests are NOT broadcast to all LIS members
- No broadcast or multicast in LIS

Issues and Challanges Ahead

- New technologies are like new marriages



Networking Failures vs Successes

- 1980: Broadband (vs baseband)
- 1981: PBX (vs Ethernet)
- 1984: ISDN (vs Modems)
- 1986: MAP/TOP (vs Ethernet)
- 1988: OSI (vs TCP/IP)
- 1991: DQDB
- 1992: XTP (vs TCP)

Requirements for Success

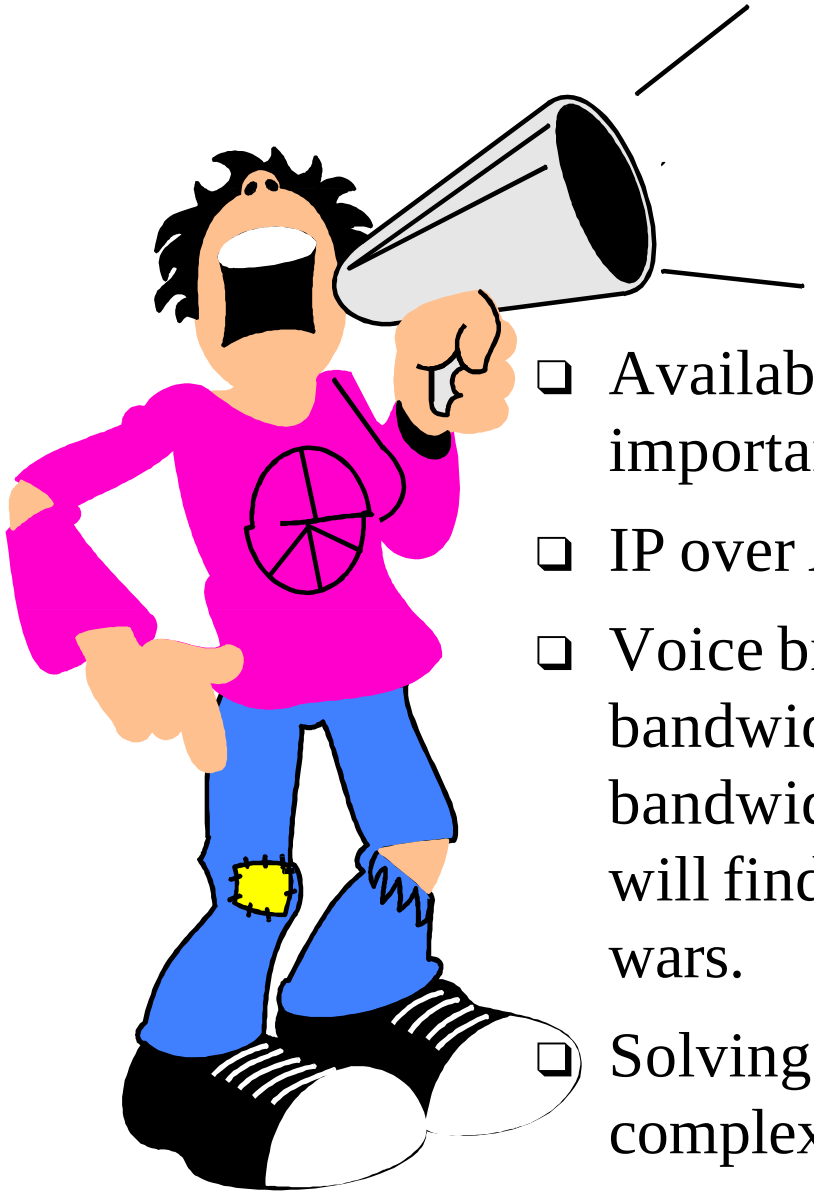
- Low Cost
- High Performance
- Killer Applications
- Timely completion
- Manageability
- Interoperability
- Coexistence with legacy LANs
  Existing infrastructure is more important than new technology

Challenge: Tariff

- High-speed is important for LANs
  Low-cost is critical for WANs.
- Phone company's goal: How to keep the voice business and get into data too?
- Customer's goal: How to transmit the data cheaper?
- Tariff Today:
  - 64 kbps voice line = $300/year
  - 45 Mbps line (coast to coast) = $180 k-240 k/year
    $\Rightarrow$ 155 Mbps line = $540 k - $720 k/year
- Tomorrow: 155 Mbps = $1k/month+ $28/G cells
  $\Rightarrow$ $13k - $45k/year

Challenge: Simplicity

- No equal competition ⇒ Complexity
- Ethernet vs Token ring war ⇒ improvements
- One size fits all ⇒ Complexity
  Too many options too soon. Should work for
  - CBR and ABR LAN and WAN
  - Private and Public Low speed and High speed
- Switches have to do connection setup, route determination, address translation, anycasting, multicasting, flow control, congestion control, ...
- Too few header bits. Bits used for dual purposes
  ⇒ Implementation complexity
- Many independent forums (ITU vs ATM Forum)
  ⇒ People energy divided



Summary

- Available bit rate (ABR) service is important for data.
- IP over ATM is designed to KISS.
- Voice brings a lot of bucks for a little bandwidth. Data requires a lot of bandwidth for little bucks. Old companies will find it difficult to survive the tarriff wars.
- Solving all problems can lead to complexity and failure.

References

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- L.G. Cuthbert and J-C Sapanel, *ATM: The broadband Telecommunication Solution* IEE 1993, London, 161 pp.
- David Benham, *ATM in Local Area Networks*, 11 April 1994, Hughes LAN Systems, (800)395-LANs, (415)966-7300.
- *Communications of ACM*, Special issue on ATM, February 1995
- *Presentation ATM Basics*, ATM Forum, Fax on demand (415)-688-4318, Document #5007, 8 pp.
- Computer based training (CBT) diskettes, ATM Forum

References

- RFC 1577, "*Classical IP and ARP over ATM*" by M. Laubach, January 1994.
- RFC 1483, "*Multiprotocol Encapsulation over ATM Adaptation Layer 5*" by J. Heinanen, July 1993.
- *User-Network Interface Specifications, V3.0*, Prentice-Hall, September 10, 1993., (515)-284-6751
- From ATM Forum, (415)-578-6860
  - B-ICI V1.1
  - DXI V1
  - DS1 Phy V1.0
  - 52 Mb/s Category 3 UTP
  - 155 Mb/s Category 5 UTP

Information Sources

- ATM Forum (415)578-6860 info@atmforum.com
  - http://www.atmforum.com
- Internet Engineering Task Force
  - IP over ATM: atm-request@hpl.hp.com
  - Routing over Large Clouds: rolc-request@nsco.netcom.com
  - atommib-request@thumper.bellcore.com
  - RFCs: mail-server@nisc.sri.com (Send Help in message)
  - Draft RFC's: Internet-Drafts@cnri.reston.va.us
- Internet News: cell-relay-request@indiana.edu
  - comp.dcom.cell-relay@indiana.edu
- International Telecommunications Union (ITU)

Recent Advances in Networking and Telecommunications Seminar Series 1995

Last Tuesday of the month (mostly), 3:45-5:15 PM at Ives 100

- January 31: High Speed Networks: Trends and Issues
- February 21: ATM Networks: Introduction
- March 28: ATM Networks: Advanced Issues
- April 25: Multimedia Networks
- May 30: Multimedia Networks
- June 27: Wireless Networks
- July 25: Wireless Networks
- September 19: Congestion Control
- October 31: Signaling
- November 28: All-Optical Networks