Asynchronous Transfer Mode (ATM) and Competing Technologies for High-Speed Computer Networking

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Overview

- Networking Trends
- Impact of Networking
- ATM Networks
- Competing technologies

Trends

- Communication is more critical than computing
  - Greeting cards contain more computing power than all computers before 1950.
  - Genesis's game has more processing than 1976 Cray supercomputer.
- Internet: 0.3 M hosts in Jan 91 to 9.5 M by Jan 96
  $\Rightarrow$ More than 5 billion (world population) in 2003

Stone Age to Networking Age

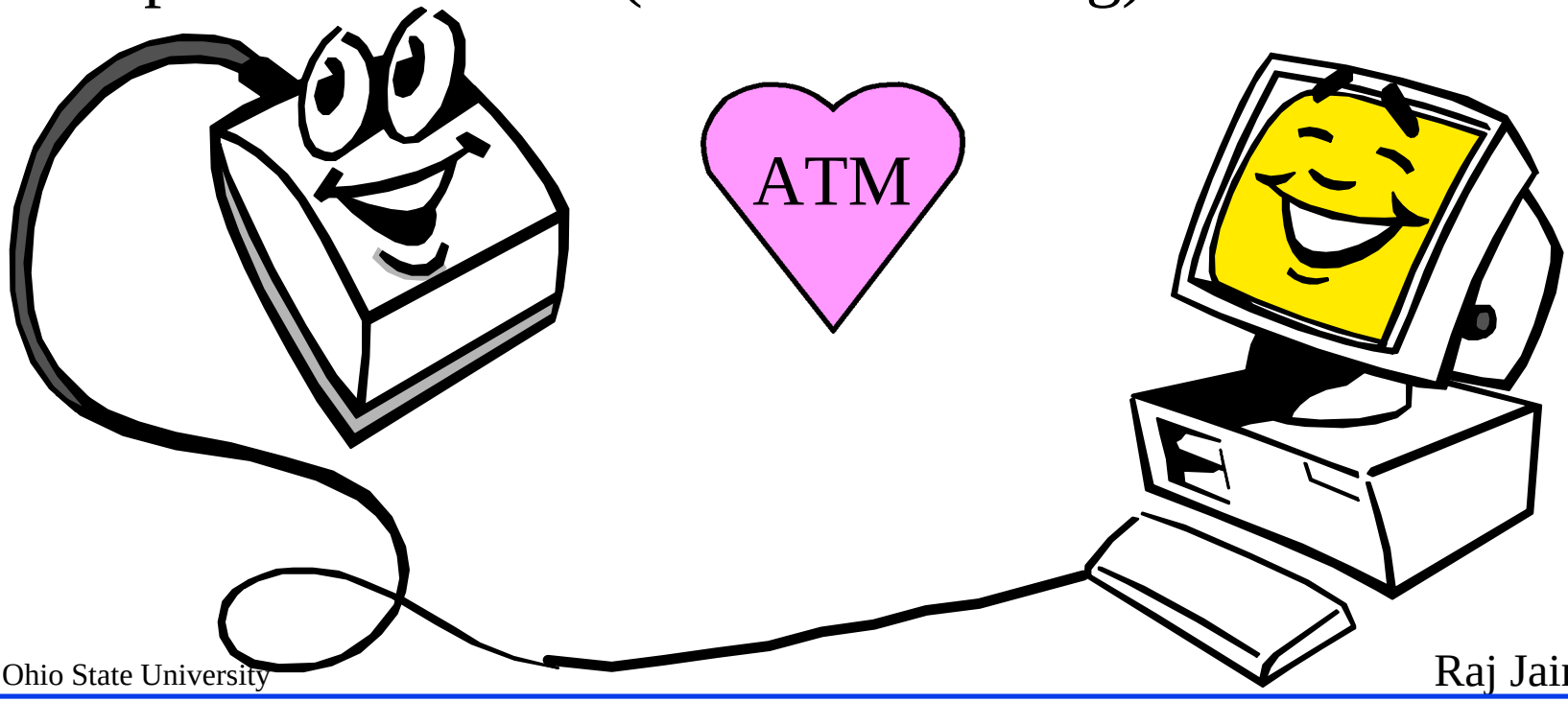
- Microwave ovens, stereo, VCRs, had some effect. But, Stone, iron, …, automotive, electricity, telephone, jet plane,…, networks caused a fundamental change in our life style
- In 1994, 9% of households with PC had Internet link. By 1997, 26%. Soon 98% … like TV and telephone.
- URL is more important than a company's phone number. (54 URLs in first 20 pages of March'97 Good Housekeeping.)
- Better communication ⇒ Distance not important

Impact on R&D

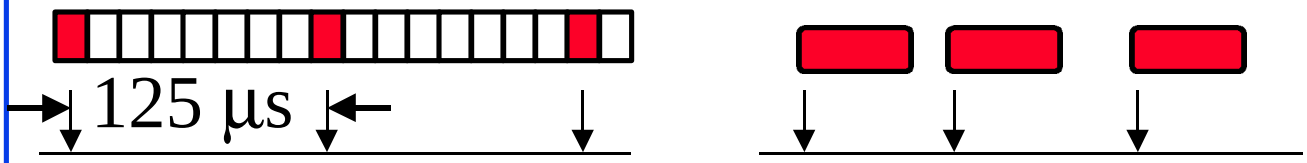
- Too much growth in one year
  $\Rightarrow$ Can't plan too much into long term
- Long term = 1_2 year or 10_2 years at most
- Products have life span of 1 year, 1 month, …
- Short product development cycles.
  Chrysler reduced new car design time
  from 6 years to 2.
- Distance between research and products has narrowed
  $\Rightarrow$ Collaboration between researchers and developers
  $\Rightarrow$ Academics need to participate in industry consortia

ATM

- ATM Net = Data Net + Phone Net
- Combination of Internet method of communication (packet switching) and phone companies' method (circuit switching)



ATM vs Phone Networks



- Current phone networks are synchronous (periodic).
  ATM = Asynchronous Transfer Mode
- Phone networks use circuit switching.
  ATM networks use "Packet" Switching
- In phone networks, all rates are multiple of 8 kbps.
  With ATM service, you can get any rate.
  You can vary your rate with time.
- With current phone networks, all high speed circuits are manually setup. ATM allows dialing any speed.

ATM vs Data Networks

- Signaling: Internet Protocol (IP) is connectionless.
  You cannot reserve bandwidth in advance.
  ATM is connection-oriented.
  You declare your needs before using the network.
- PNNI: Path based on quality of service (QoS)
- Switching: In IP, each packet is addressed and processed individually.
- Traffic Management: Loss based in IP.
  ATM has 1996 traffic management technology.
  Required for high-speed and variable demands.
- Cells: Fixed size or small size is not important

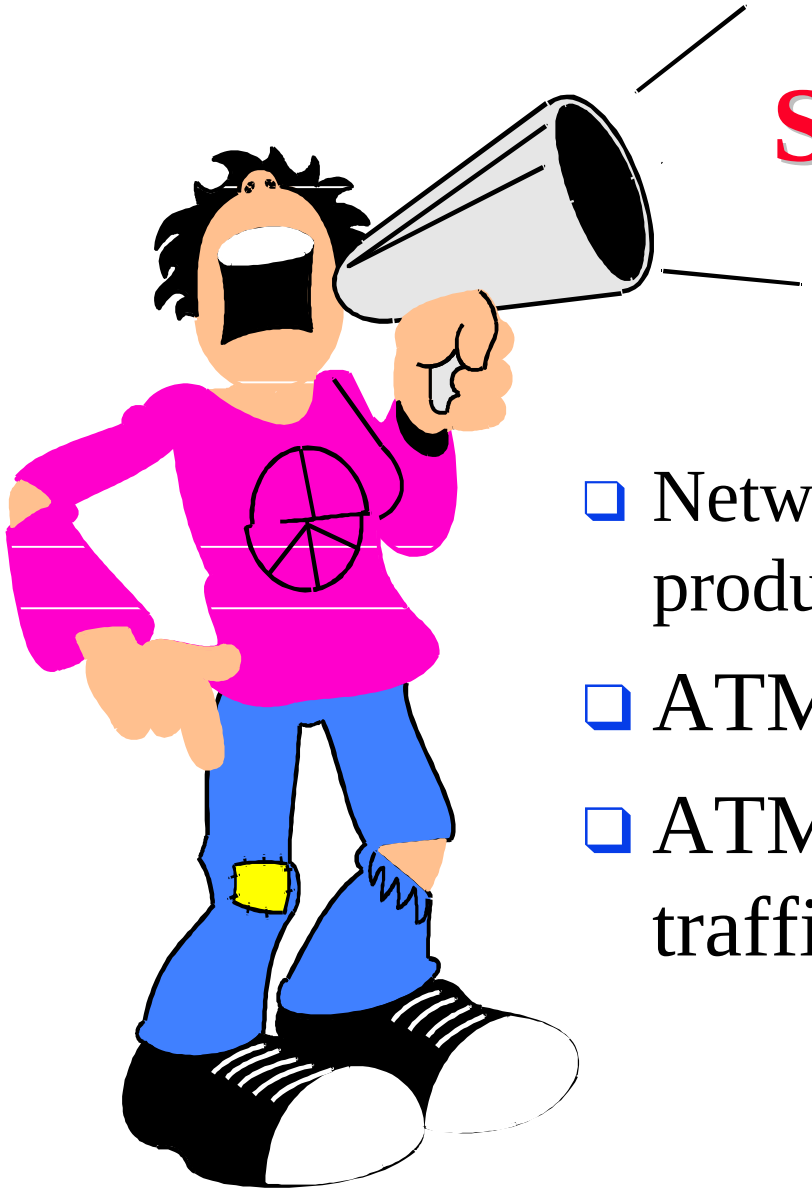
Why ATM?

- ATM vs IP: Key Distinctions
  - Traffic Management:
    Explicit Rate vs Loss based
  - Signaling: Coming to IP in the form of RSVP
  - PNNI: QoS based routing
  - Switching: Coming soon to IP
  - Cells: Fixed size or small size is not important

Competing Technologies

- Fast Ethernet to the desktop
  Gigabit Ethernet for the campus backbone
  - No traffic management. No priority. (Being added)
- Frame-Relay for Wide-area networking
  - Lower speed only (1.5 Mbps - 10 Mbps)
  - No support for quality of service (for video/voice)
- IP over SONET
  - No signaling ⇒ Fixed bandwidth. Can't dial in.
  - No traffic management ⇒ Unused bandwidth wasted.

Summary



- Networking is the key to productivity
- ATM Net = Phone + Data
- ATM vs IP: Signaling and traffic management

References

- All our ATM Forum contributions and papers are available on-line at *http://www.cis.ohio-state.edu/~jain/*
  Specially see “Recent Hot Papers” and “References on Recent Advances in Networking”
- D. Tapscott, "The Digital Economy: Promise and Peril in the Age of Networked Intelligence," McGraw-Hill, 1995.
- G. Sackett and C. Y. Metz, “ATM and Multiprotocol Networking,” McGraw-Hill, 1997 (Technical).