

# **CIS 788.080**

# **Recent Advances in**

# **Networking 1999**

Raj Jain

The Ohio State University

Columbus, OH 43210

Jain@CIS.Ohio-State.Edu

These slides are available on-line at:

<http://www.cis.ohio-state.edu/~jain/cis788-99/>



- ❑ How am I going to grade you?
- ❑ What are **we** going to cover?
- ❑ When are **you** going to do it?
- ❑ Why you should **not** take this course?

# Grading

- ❑ Quizzes (Best 2 of 3) 40%
- ❑ Class participation 10%
- ❑ Homeworks 15%
- ❑ Project 35%
- ❑ Most of the homeworks will be related to the project.

# Text Book

- ❑ No required textbooks
- ❑ See “Books on Hot Topics in Networking,”  
[http://www.cis.ohio-state.edu/~jain/refs/hot\\_book.htm](http://www.cis.ohio-state.edu/~jain/refs/hot_book.htm)
- ❑ Supplementary Reading:
  - Recent ANSI, ITU, IEEE Standards
  - ATM Forum [www.atmforum.com](http://www.atmforum.com)
  - IETF RFCs and Internet Drafts [www.ietf.org](http://www.ietf.org)

# Prerequisite: CIS677

- ❑ Protocol Layers: ISO/OSI reference model
- ❑ Physical Layer: Coding, Manchester
- ❑ Transmission Media: UTP, Cat 5, Microwave, Radio
- ❑ Data Communication: Asynchronous vs synchronous, Baud, bit, and Hz, Half-Duplex vs Full-duplex, Modulation/Demodulation
- ❑ Packet Transmissions: Framing, Bit stuffing, byte stuffing
- ❑ Flow Control: On-Off, Window
- ❑ Error Detection: Parity, Checksum, Cyclic Redundancy Check

## Prerequisites (Cont)

- ❑ Error Recovery: Start and Stop, Go back  $n$ , Selective Reject
- ❑ LANs: Aloha, CSMA/CD, Ethernet, IEEE 802.3, Token Ring/IEEE 802.5, FDDI
- ❑ LAN Addressing: Unicast vs multicast, Local vs Global
- ❑ LAN wiring: 10Base5, 10Base2, 10Base-T, 100Base-T4, 100Base-TX, 100Base-FX
- ❑ Extended LANs: Hubs, Bridges, Routers, Switches
- ❑ Routing: Distance Vector vs Link State, Spanning tree, source routing
- ❑ Network Layer: Connectionless vs connection oriented

# Schedule (Tentative)

9/23/99 Course Overview, Networking Trends

9/28/99 Basic Concepts: Data Networks\*

9/30/99 Basic Concepts: Telecommunications Networks\*

10/5/99 ATM - Intro

10/7/99 IP Switching, Multiprotocol Label Switching

10/12/99 Optical Networks: WDM

**10/14/99 Quiz 1**

10/19/99 QoS over IP

10/21/99 Virtual Private Networks

# Schedule (Cont)

10/26/99 Directory Enabled Networks

10/28/99 Res. Broadband: Cable Modems, ADSL\*

**11/2/99 Quiz 2**

11/4/99 IP Over SONET

11/9/99 Web Service Distribution and Caching\*

11/11/99 Gigabit and 10 G Ethernet\*

11/16/99 Wireless Networks

**11/18/99 Quiz 3**

11/23/99 Graduating Seniors' grades due

# Project

- ❑ A survey paper on topic of your choice
- ❑ Stages:
  - Literature search
    - ❑ CD ROMs: Compendex, Books in Print, WWW
  - Reading
  - Writing
- ❑ 7.5 Hrs/week/person on project
- ❑ 7.5 Hrs/week/person on class

# Project Topics

- ❑ QoS over Data Networks: Protocols and Standards
- ❑ QoS over Data Networks: Products, Services, Issues
- ❑ QoS/constraint/policy based Routing
- ❑ Voice over IP: Products, Services, Issues
- ❑ Voice over IP: Protocols and Standards (SIP, SAP, SDP, MGCP, ...)
- ❑ Voice over IP: Signaling Transports
- ❑ Voice over ATM
- ❑ H.323 and Associated Protocols
- ❑ Video Compression Standards: DAVIC, MPEG-4,7
- ❑ Voice Compression Standards

# Topics (Cont)

- ❑ Optical Networks and DWDM
- ❑ Wavelength Routing
- ❑ Terabit switches/routers
- ❑ Local Multipoint Distribution Services (LMDS)
- ❑ 10 Gb Ethernet
- ❑ Web Distribution Systems: Caching and Replication
- ❑ Directory Enable Networks
- ❑ Next Generation Wireless Networks
- ❑ Next Generation Satellite Networks
- ❑ Home Networking
- ❑ Wireless Local Loop

# Topics (Cont)

- ❑ Virtual Private Networks: Products, Services, Issues
- ❑ Virtual Private Networks: Protocols and Standards
- ❑ Gigabit Networking Testbeds/Projects:  
    NGI, Internet2, ...
- ❑ Packet Scheduling Techniques:  
    WFQ, WF2Q, CBQ, PFQ, ...
- ❑ Packet over SONET
- ❑ New Developments in LANs: Flow Control,  
    Aggregation, QoS, Multicast, VLANs
- ❑ Recent Developments in Frame Relay: SVC, High-  
    speed, ATM Interworking, Voice, QoS

# Topics (Cont)

- ❑ Recent Developments in ATM: Frame-Based ATM, DiffServ, Rerouting, ...
- ❑ Wireless ATM
- ❑ Security for electronic commerce
- ❑ ATM Products, Services, and Deployment
- ❑ ATM Network Security
- ❑ IP QoS over ATM
- ❑ TCP Extensions for Wireless
- ❑ Wireless Ad Hoc Routing Protocols
- ❑ Multicasting over Wireless
- ❑ LAN WAN Convergence
- ❑ IP over DWDM: Issues

# Project Schedule

- ❑ 9/30/99: Preliminary Topic selection due
- ❑ 10/5/99: Final Topic Assignment
- ❑ 10/7/99: Literature search results due
- ❑ 10/12/99: Literature collection due
- ❑ 10/21/99: Key Points Due
- ❑ 10/28/99: Project report due
- ❑ 11/9/99: Peer Reviews Due
- ❑ **11/16/99: Final written Report (HTML Page) due**

Note: Will need to sign Web/Print publications release

# Office Hours

- Tuesday: 4:00 to 4:30 PM  
Thursday: 4:00 to 4:30 PM
- Office: 297 Drees Lab, 2015 Neil Ave

# Why You Shouldn't take this course?

- You aren't ready for the hardwork
- You don't have 15 hours/week
- You don't have the background
- You just want to sit and listen
- You were expecting an introductory course
- You are not ready to take the initiative  
Only key concepts will be covered in the class.  
Students are expected to research and read.
- This does not cover what you want

# Frequently Asked Questions

- ❑ Yes, I do use “curve”. Your grade depends upon the performance of the rest of the class.
- ❑ All homeworks are due at the beginning of the next class.
- ❑ All late submissions must be preapproved.
- ❑ All quizzes are open-book and extremely time limited.
- ❑ Quizzes consist of numerical as well as multiple-choice (true-false) questions.
- ❑ There is negative grading on incorrect multiple-choice questions. Grade: +1 for correct.  $-1/(n-1)$  for incorrect.
- ❑ Everyone including the graduating seniors are graded the same way.

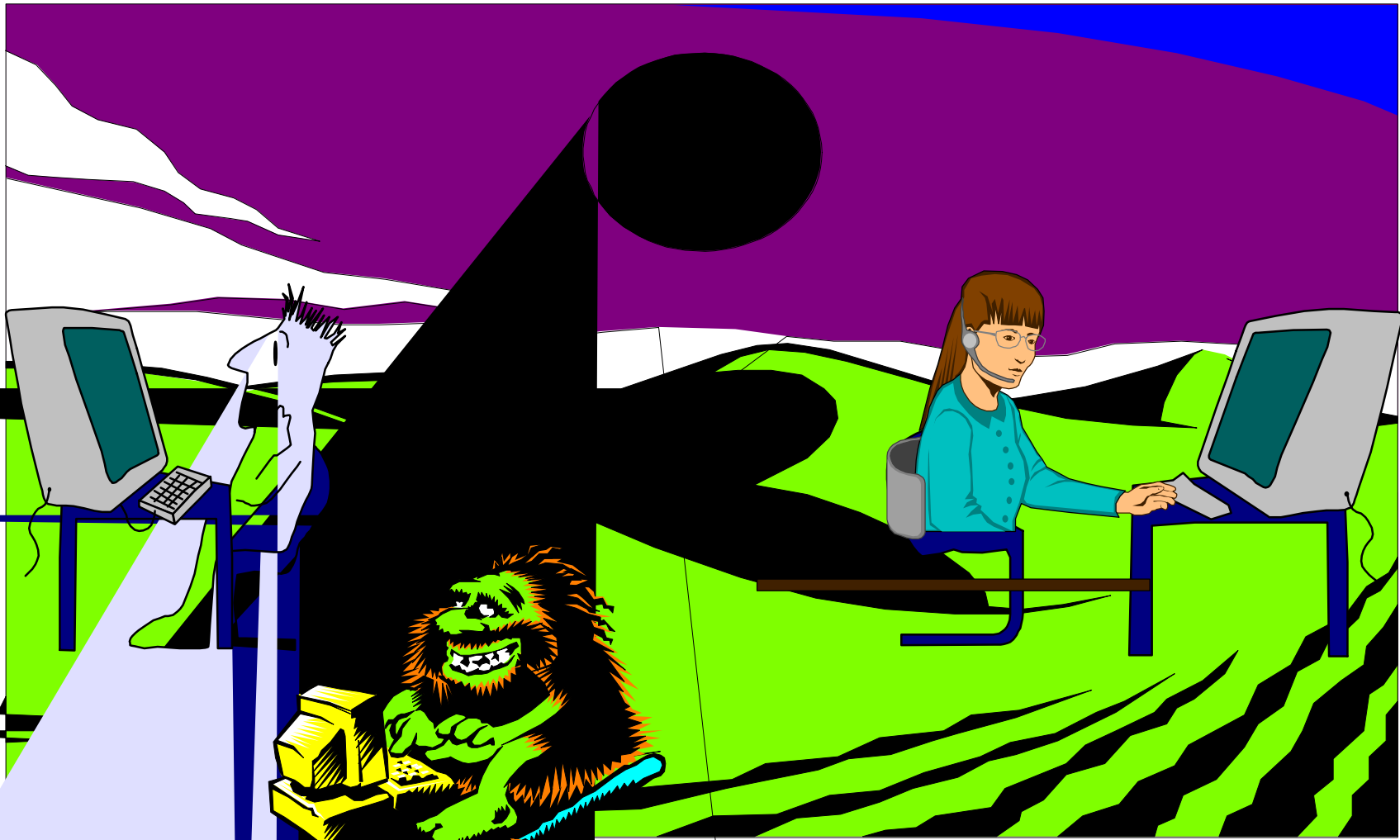
# Trend: Networking Age



- ❑ No need to get out for
  - Office
  - Shopping
  - Entertainment
  - Education

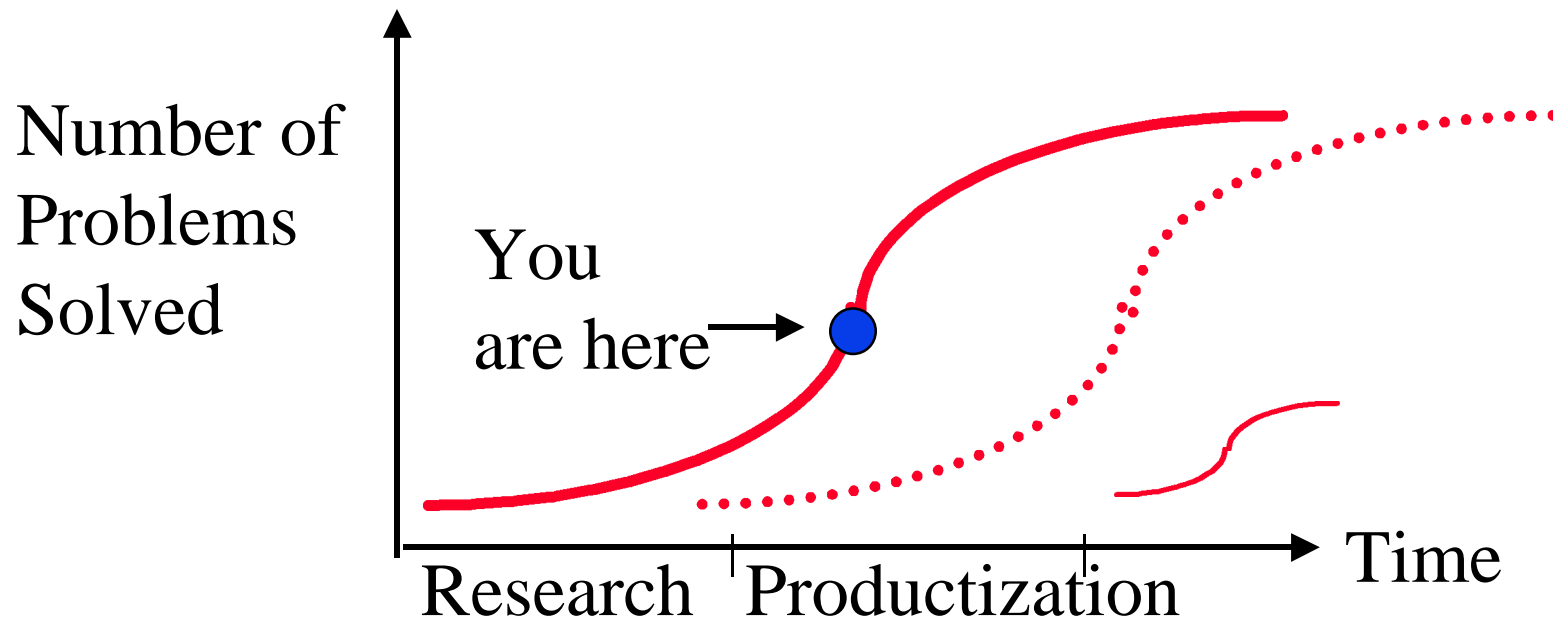
- ❑ Virtual Schools
- ❑ Virtual Cash
- ❑ Virtual Workplace  
(55 Million US workers will work remotely by 2000)

# Cave Persons of 2050

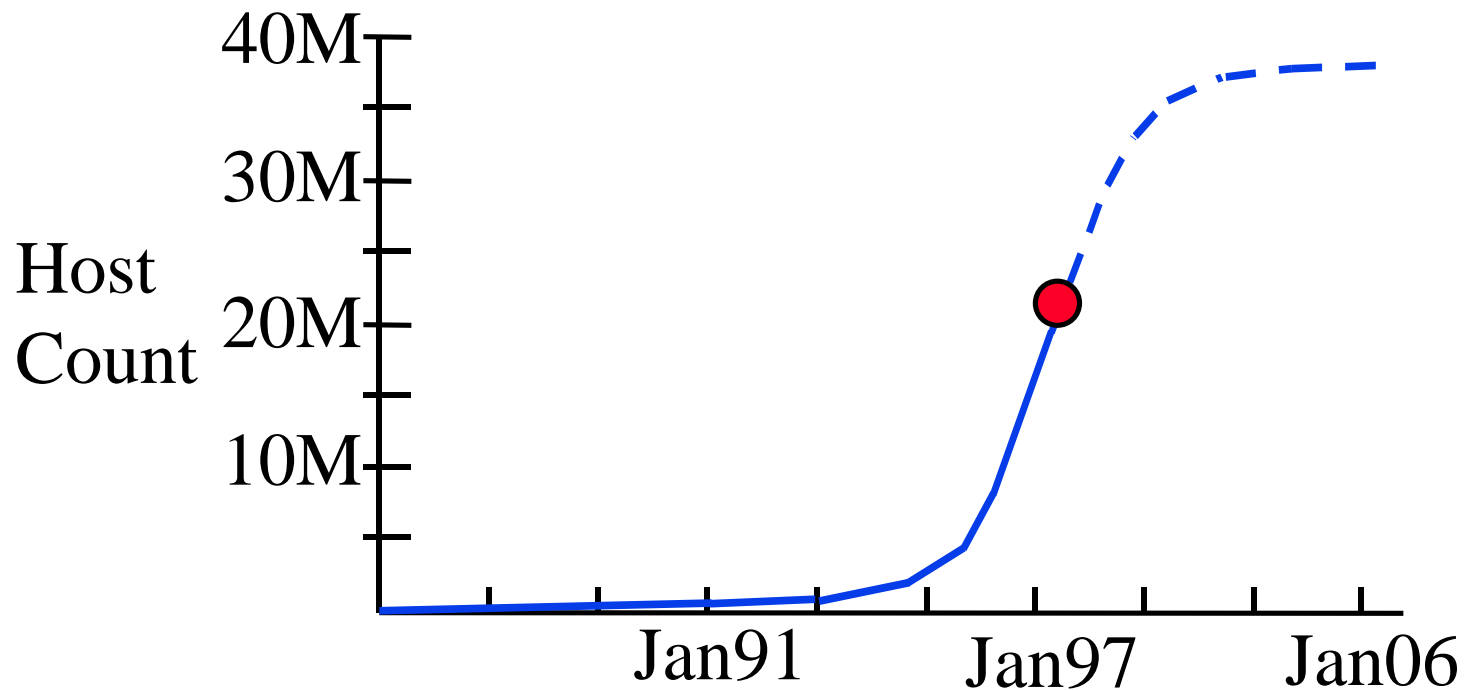


Raj Jain

# Life Cycles of Technologies

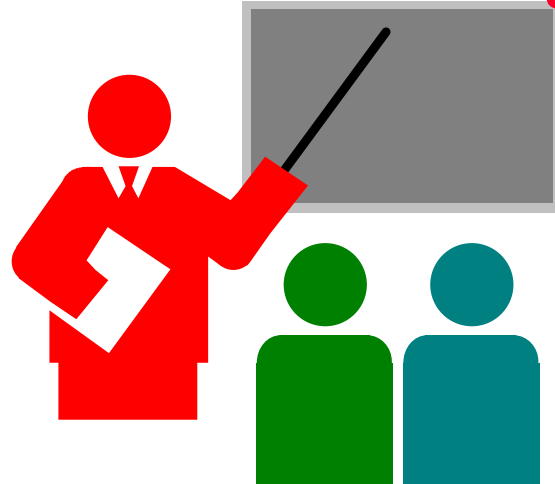


# Internet Technology



- ❑ **New Challenges:** Exponential growth in number of users. Exponential growth in bandwidth per user. Traffic management, Security, Usability, ...

# Summary



- ❑ There will be a lot of self-reading
- ❑ Goal: To prepare you for a career in networking
- ❑ Get ready to work hard
- ❑ Networking is a hot field

# Quiz 0: Prerequisites

True or False?

T F

- Datalink refers to the 2nd layer in the ISO/OSI reference model
- Category 5 unshielded twisted pair cable is better than category 3 cable.
- Finding path from one node to another in a large network is a transport layer function.
- It is impossible to send 3000 bits/second through a wire which has a bandwidth of 1000 Hz.

## Prerequisites (Cont)

- ❑ Bit stuffing is used so that characters used for framing do not occur in the data part of the frame.
- ❑ For long delay paths, on-off flow control is better than window flow control.
- ❑ Ethernet uses a CSMA/CD access method.
- ❑ 10Base2 runs at 2 Mbps.
- ❑ The packets sent in a connection-oriented network are called datagrams.
- ❑ Spanning tree algorithm is used to find a loop free path in a network.

Marks = Correct Answers \_\_\_\_\_ - Incorrect Answers

# Homework 1: Due 9/28/99

- Search web pages, Compendex CD-ROM (Science and Engineering Library), and Ohio link for one of the following topics:
  - Optical Networking
  - Directory Enabled Networks
  - Terabit Networking
  - Wavelength Division Multiplexing

# Homework 1 (Cont)

- ❑ Ignore all entries dated 1995 or before. List others in the following format (5 each):
  - Author, “Title,” publisher, year. (for 5 books)
  - “Title,” URL [One line description] (for 5 web pages)
  - Author, “Title,” source (for 5 articles)
  - Organization name, URL (for 5 organizations)
- ❑ Serially number the references and submit electronically to [durreesi@netlab.ohio-state.edu](mailto:durreesi@netlab.ohio-state.edu) (Please note the address carefully) . The mail must have a subject field of “**CIS 788 Homework 1**”

# Homework 1 (Cont)

- For web page search use at least the following starting points:
  - <http://google.stanford.edu/>
  - <http://liinwww.ira.uka.de/bibliography/index.html>
  - <http://www.ncstrl.org>
  - <http://www.allonesearch.com/>
  - <http://www.freeality.com/metat.htm>
  - <http://stoat.shef.ac.uk:8080/megaweb/>
- Make a list of other interesting search starting points, add it to your homework, and share with the class.

# Homework 2: Due 9/30/99

- Prepare your personal web page.
- Must include your photograph
- Use meta-HTML commands in the header to indicate title, author, keywords, and description.
- Recommended HTML Editor: Netscape Gold
- Use netlab facilities to take your picture
- Submit a one-page hard-copy printout

# Project Selection: Due 9/30/99

Name: \_\_\_\_\_

Project Choice 1: \_\_\_\_\_

Why? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

---

Name: \_\_\_\_\_

Project Choice 2: \_\_\_\_\_

Why? \_\_\_\_\_

\_\_\_\_\_

# Project Selection (Cont)

Name: \_\_\_\_\_

Project Choice 3: \_\_\_\_\_

Why? \_\_\_\_\_  
\_\_\_\_\_

---

Name: \_\_\_\_\_

Project Choice 4: \_\_\_\_\_

Why? \_\_\_\_\_  
\_\_\_\_\_

# Student Questionnaire

Name: \_\_\_\_\_

Email: \_\_\_\_\_

Phone: \_\_\_\_\_

Networking courses taken

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Prior Networking Background:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_