EECS 122
Communications Networks
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Course Information
• Instructor: Kevin Fall (kfall@cs)
• Office Hours: Thursdays 10-11am in 741 Soda Hall
• Home Page:
  - http://www-inst.eecs.berkeley.edu/~ee122
• Tas: Hoi-Sheung "Wilson" So, Lin He
• Final Exam: May 21, 12:30-3:30 [19]

TA Information
• Wilson So
  - Office Hours: Th 2.15-3.15, 179M Cory
  - E-mail: so@cs.berkeley.edu
• Lin He
  - Office Hours: Fri 2-3, 179M Cory
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Description
Design and implementation of computer networks and inter-networks
Fundamental design principles
Common underlying technologies
Implementation and programming

Grading
• Final Exam (35%), Mid-term (20%)
• Problem Sets (10%)
• Project (35%)
• TA input and class participation will be used to assess borderline cases
• (Details will appear on web page -- check frequently!)

Books
• Required Textbook:
  L. Peterson & B. Davie,
  Computer Networks: A Systems Approach
• Other Useful Networking Texts:
  - A. Tanenbaum, Computer Networks
  - R. Stevens, TCP/IP Illustrated (vol 1)
  - S. Keshav, An Engineering Approach to Computer Networking

Problem Set #1
• P & D, Chapter 1, Problems:
  - 6, 7, 8, 9, 12, 16
• Due Jan 28th end of class

8 Programming
• This course will involve programming. Projects may be implemented in either C or C++, on either Windows or UNIX.
• Your work can be done on your “named” account. If you lack one, you may log in as “newacct” on one of the clients listed below:
  http://www-inst.eecs.berkeley.edu/clients

9 Books on Programming
• S. Maguire, Writing Solid Code
• S. Lippman, C++ Primer
• R. Stevens, UNIX Network Programming, Volume 1, 2nd ed

10 Course Themes
• Supporting reliability and applications
• From bits to unreliable global messages
• Distributed applications
• Security, mobility, QoS and pricing

11 Course Outline
• Introduction and Motivation [1]
• Architecture, naming, addressing [2]
• Bits, LANs, unreliable transport [3]
• Switching, routing, multicast [3]
• Reliable transport [3]
• Distributed applications [2]
• Special topics [1]

12 Introduction
• What’s a network?

• Principles of network design

• What happens when you click on a Web link?

13 What’s a network?
• Link: carry bits from one place to another (or maybe to many other places)
• Switch/gateway/router: move bits between links, forming internetwork
• Host: communication endpoint (workstation, PDA, cell phone, toaster, tank)

14 An example link (a LAN):
• Ethernet is a broadcast-capable, multi-access LAN
An Internetwork
- Provides message delivery between multiple networks:

The Internet
- A global network of networks all using a common protocol (IP, the Internet Protocol)
- Focus of this class
- A challenge to understand:
  - large scale (10's of millions of users, 10's of thousands of networks)
  - heterogeneity, irregular topology, decentralized management

Scale of the Internet

Other Networks
- The Telephone Network
- Processor interconnect networks
- ATM Networks
- Cable-TV Networks

Resource Sharing
- Networks are shared resources
- Sharing via multiplexing
- Fundamental Question:
  how to achieve controlled sharing

Multiplexing
- Methods for sharing a communication channel
- Tradeoff between utilization and predictability
- Common Approaches:
  - TDM (time-division multiplexing)
  - Statistical Multiplexing

Time Division Multiplexing
(also called STDM --Synchronous Time Division Multiplexing)

Statistical Multiplexing

Analysis of STDM/FDM
- TDM, FDM (frequency division multiplexing), and WDM (wavelength) may under-utilize channel with idle senders
- applicable only to fixed numbers of flows
- requires precise timer (or oscillator and guard bands for FDM)
- resources are guaranteed

Analysis of Statistical Mux'ing
- traffic is sent on demand, so channel is fully utilized if there is traffic to send
- any number of flows
packets are limited in size
- prevents domination of single sender
• resources are not guaranteed

25 📖 Protocols
• Agreement dictating the form and function of data exchanged between two (or more) parties to effect a communication
• Two parts: syntax and semantics
  - syntax: where bits go
  - semantics: what they mean and what to do with them

26 📖 Protocol Example
• Internet Protocol (IP)
  - if you can generate and understand IP, you can be on the Internet
  - media, OS, data rate independent
• TCP and HTTP
  - if you can do these, you are on the web

27 📖 Protocol Standards
• New functions require new protocols
• Thus there are many (e.g. IP, TCP, UDP, HTTP, RIP, OSPF, IS-IS, SMTP, SNMP, Telnet, FTP, DNS, NNTP, NTP, BGP, PIM, DVMRP, ARP, NFS, ICMP, IGMP)
• Specifications do not change frequently
• Organizations: IETF, IEEE, ITU

28 📖 The IETF
• specifies Internet-related protocols
• produces “RFCs” (www.rfc-editor.org)
• Quotation from IETF T-shirt: