Welcome to

CSE 620 Advanced Networking Concepts
Time: MWF 16:00-16:50
Place: PARK 250
Fall 2005
Today’s Agenda

- Administrative aspects of this class
- A brief overview of the course
- A brief history of computer networking if time allows
Who Am I ?

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What is CSE 620?

A Computer Science graduate course on

- The present and future of computer networking
- Contemporary problems and research topics in computer networking
  - Lectured topics to be chosen at my discretion
  - I want to learn new things too!
- Highly research oriented
Who Should Take This Course?

Anyone who

- Is a graduate student in CSE
- Is interested in computer networking and in doing networking research
- Love sleepless nights

Or

- Thinks this course is a good choice for M.S. project
- Think it might help lend a good job
- Like taking my classes
The catch is

- Basic statistics, probability
- Basic knowledge of computer networking (CSE 589)
- Mathematical maturity
- Good critical thinking
- Hard-working
Who Should Teach This Course?

ME
Course Objectives:

- TCP
- IP
- ICMP
- ACM
- DSL
- ATM
- OSPF
- MTU
- PCM
- RTP
- HTTP
- FDDI
- MAC
- RFC
- T3
- TDM
- CDMA
- TDMA
- QoS
- PIM
- NIC
- NAP
- MOSPF
- MAN
- WAN
- I MAP
- T DMA
- IP sec
- PDU
- ESP
- TDM
- DES
- P2P
- MTU
- RTP
- MAN
- HTTP
- ICMP
- HTTP
- RFC
- RPF
- IP
- T3
- WAP
- EGP
- PDU
- DCE
- CGI
- ABR
- ATM
- MAC
- OSPF
- MOSPF
- RSVP
- IGMP
- NAP
- IPv6
- CDMA
- DSL
- FDM
- CRC
- I RSG
- PSTN
- UDP
- LAN
- BGP
- CSMA/CD
- XNS
- RIPv2
- COPS
- PPP
- NAT
- VBR
- L2CAP
- RIP
- SLIP
- OC12
- AUI
- TLI
- DDN
- SVC
- SNMP
- NIS
- DNS
- ARQ
- SONET
- 10BaseT
- 10Base3
- HTTP
- PDU
- NAT
- DCE
- CRC
- OC12
- COPS
- HTTP
- NIS
Not that bad

Just memorize all the **TLA**, and that’s about it.
What you’d achieve from this course

■ Have fun!!

■ Have a good overall picture of computer networking in general and the Internet in particular.

■ Be able to identify research problems in networking, have a good idea of how to go about solving them.

■ Improve research skills significantly, from critical thinking, problem solving, to writing and presentation.

■ You are a graduate student. Grade should not be the main issue!
Our TA

- Dazhen Pan
dpan@cse.buffalo.edu
Office hours: ???
Phone:
Place:
When/Where to talk to me?

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Algorithm 1 (to be made distributive)

1: send questions to class news group
   sunyab.cse.620

2: else
   email me at hungngo@cse.buffalo.edu

3: else
   use office hours 10-12 Thursdays – 239 Bell

4: else
   sneak in whenever the door is opened

5: goto 1
Course Materials

- **Online Materials**: (including lecture notes)
  - www.cse.buffalo.edu/~hungngo/classes/2005/620
- Online lecture notes: hopefully 12 hours before class time
Work Load

- Heavy! So, start early!!
- Approx. 80 pages of assigned reading per week
- Summaries of papers (almost) every week
- Research proposal review
- Research project review
- Research project: implementations, reports and presentations.
Grading Policy

- Research project (50%)
- Paper summaries (20%)
- Research reviews (25%)
- Class participation (5%) - this includes participation in lectures and classmates' presentations
- Assignments due at the beginning of the due date
  - No late assignment will be accepted
- No incompletes will be given
Academic Honesty

- No tolerance on plagiarism:
  - 0 on the particular assignment for first attempt
  - Fail the course on the second
  - Consult the University Code of Conduct for details on consequences of academic misconduct

- Group study/discussion is encouraged, but the submission (of paper summaries) must be your own work

- If you take materials from somewhere, cite the source!

- “Taking” intellectual property is stealing!

- I will take cheating VERY seriously.
Grade Expectation

- **Absolute grading scale**
  - You are competing with my standard, not with classmates

- **Just for reference:**
  - **A:** 90%
  - **A-:** 80%-90%
  - **B+, B, B-:** 65%-80%
  - **C+, C, C-:** 50%-65%
  - **D and below:** you don’t want to know

- I reserve the right to assign grades based on the overall performance.
Absolutely no lame excuses, please!!!

- I have to go home early, please allow me to do XYZ early
  - NO, NO, NO, NO, NO

- I had a fight with my girlfriend
  - ... you can get my deepest condolences, just not the grade

- I’ve worked very hard, I understood the stuff very well, but I got a C, please consider giving an A-
  - ... you could easily win “Last Comic Standing”

- My partners suck, I’m good!
  - Then get the job done!

- Make up another lame excuse here.
About M.S. Projects

- Taking this course to fulfill M.S. project requirement is not the reason you’ll get B or more
- This is the risk you chose to take
Make it more interesting

- Participate: discuss & answer and ask questions ("the only stupid question is the question you don’t ask")
- Give suggestions: I’ll take them seriously
- **Tips & Tricks** every week

- Do the assigned readings and occasionally surf the web to read related things
- **Start early!**
Brief history of the Internet

- 1947-1991: The cold-war, the space race
- 1972-1980: Internetworking and Proprietary Networks
- 1980-1990: A Proliferation of Networks
- 1990-present: Commercialization and the Web
- The future: wireless + optical, nomadic/intelligent/pervasive, and … ???

“Toy projects” from University played big role
Students played big roles, too
1947-1991: The cold war & the space race

- 1957: Sputnik 1 surprises the West

[picture taken from Wikipedia]

- 1958: Eisenhower formed ARPA and NASA in response
1961-1972: Early Packet Switching Principles (1)

- In the 60’s:
  - telephone networks dominate – circuit switching
  - Computers are expensive – networking “makes sense”
  - Data traffic pattern is intrinsically different than telephone’s

- Three independent efforts on packet switching:
  - RAND’s Paul Baran – 1964 – packet switching for secured voice over military networks
  - National Physical Lab (England)’s D. Davies & R. Scantlebury – 1964
1961-1972: Early Packet Switching Principles (2)

- J. Licklider & L. Roberts lead CS program at DARPA
  - 1967: Roberts published a proposal for ARPAnet
- BBN Corp. contracted to build IMPs - early routers
- By 1969
  - First IMP at UCLA (Sep 2)
  - Node 2 at SRI, node 3 at UCSB, node 4 at U. Utah
  - First test from UCLA to SRI: crash!!
- By 1972, ARPAnet has 15 nodes
- First email program: R. Tomlinson at BBN (197[1,2])
ARPANet Map by 1971

Courtesy of the Computer History Museum
http://www.computerhistory.org/
1972-1980: Internetworking and Proprietary Networks

- Other networks and network architectures were developed:
  - ALOHAnet (Abramson), DARPA's packet-satellite, packet-radio network
  - Telenet, Tymnet, Transpac, DECnet, Cyclades
  - Xerox's XNS, IBM's SNA (→ ISO protocol stack)
- Need internetworking: Cerf & Kahn (1974) proposed Open Network Architecture (Turing Award!)
- Metcalfe & Boggs: Ethernet (1975 – amazing!!) built upon on ALOHA
- TCP split into TCP & IP in 1978
Bob Kahn and Vint Cerf

Courtesy of the Computer History Museum
http://www.computerhistory.org/
Open Network Architecture

- **Minimalism, autonomy**: a network is on its own, no internal changes to interconnect
- **Best-effort service**: users responsible for losses → balance out the load, simplify routers, less costly for YOU
- **Stateless routers**: no per-flow maintenance
- **Decentralized control**: no single point of failure

Make sense? The sense of Genius!!

These principles hold strong today! Or not.
1980-1990: A Proliferation of Networks

- End of 70s: 200 hosts on ARPAnet, end of 80’s: 100,000
- How? More networks connected: MFENET, HEPNET (Dept. Energy), SPAN (NASA), BITnet, CSnet, NSFnet, ...
- TCP/IP standardized in 1980
- DNS by P. Mockapetris (USC)
- Berkeley incorporated TCP/IP into BSD Unix, key!
  Since incorporating networking modules into OSs is very important. They implemented it well, too!!
  Many networking applications were developed under BSD
1990-present: Commercialization and the Web

- 1990: ARPAnet decommissioned
- 1991: NSFnet privatized
- 1991: the WWW invented (Tim Berners-Lee at CERN), he and friends developed HTML, HTTP, web server, simple (text) web browser
  - Has anyone used Gophers (1991) before?
- M. Andreesen (UIUC) released Mosaic in 1993, formed Mosaic Communications in 1994, later Netscape Communications, later killed by IE
- Yahoo, Amazon, Google, E-commerce
Tim Berners-Lee

Courtesy of the Computer History Museum
http://www.computerhistory.org/
The Future: Speculate for Yourself

- Proliferation and maturity of wireless, sensor, optical networks
- Nomadic computing, Pervasive computing
- …
Last Words for Today

- You will learn as much from me as I will learn from you
- Welcome, again!!