

The Internet: Co-Evolution of Technology and Society

CPSC 156b, Spring 2007
Time: Tu & Th, 2:30-3:45 pm
Room: ML 221

Distribution Group: IV
Not QR or Natural Science

<http://zoo.cs.yale.edu/classes/cs156>

Partial Topic Outline

- Internet architecture and design philosophy
- Internet-based business
- Internet security
 - User privacy
 - Online identity
 - Viruses, spam, DoS attacks, *etc.*
- Digital copyright

Schedule

Feb. 1: First HW Assignment Due

Feb. 13: Second HW Assignment Due

Feb. 22: Third HW Assignment Due

Mar. 1: First In-Class Exam

Mar. 6: Grades on HW1, HW2, HW3, and Ex1 will be returned to students today or earlier.

Mar. 9: Drop Date

Apr. 10: Fourth HW Assignment Due

Apr. 19: Fifth HW Assignment Due

Apr. 26: Second In-Class Exam

Requirements

- Modest reading assignments
- 5 Written HW Assignments, 4 of which will each be worth 15% of the course grade and one of which will be worth 10% of the course grade
- 2 In-Class Exams, each worth 15% of the course grade
- No final exam during exam week

Rules and Guidelines

- Deadlines are firm. Dean's excuses are needed for all make-up exams or late homeworks. Hand them in promptly.
- You are responsible for all content of lectures and the class webpage.
- No "collaboration" on homeworks unless you are told otherwise.
- Pick up your graded homeworks and exams promptly, and tell the TA immediately if one is missing.
- Students who have previously taken CPSC155 may not take CPSC156 for credit but may audit it.

Instructor: Joan Feigenbaum

Office: AKW 512

Office Hours: Tuesday 4-5 pm

Thursday 9-10 am

Phone: 203-432-6432

Assistant: Judi Paige

(judi.paige@yale.edu, 203-436-1267, AKW
507a, 9am-2pm M-F)

Note: Do not send email to Professor Feigenbaum, who suffers from RSI. Contact her through Ms. Paige or the TA.

TA: Richard Alimi

Office: AKW 303

Office Hours:

Wednesday 11 am - 1 pm
or by appointment

Email: richard.alimi@yale.edu

Phone: 860-614-7498

Sample Notes and Reading

If you are undecided, see:

- <http://zoo.cs.yale.edu/classes/cs156/2003>
- "Rethinking the design of the Internet: The end-to-end arguments vs. the brave new world," by Clark and Blumenthal
- "Commons-based Peer Production and Virtue," by Benkler and Nissenbaum

Pointers to these three items are in the "Schedule and Assignments" section of the CPSC156b class website.

Questions?

Internet History

- Late 1960s and early 1970s: ARPANET
 - US Department of Defense
 - Connects small ARPA-sponsored data networks
 - Ground breaking testbed for network ideas and designs
- Early 1980s: Other wide-area data networks are established (e.g., BITNET and Usenet).
- Late 1980s and early 1990s:
 - "ARPANET" fades out.
 - US Gov't sponsors NSFNET, which connects large regional networks.
 - Commercial data networks become popular (e.g., Prodigy, CompuServe, and AOL).
- Mid-1990s: Unified "Internet"

Internet Protocols Design Philosophy

- Ordered set of goals:
 1. multiplexed utilization of **existing networks**
 2. survivability in the face of failure
 3. support multiple types of communications service
 4. accommodate a variety of network types
 5. permit distributed management of resources
 6. cost effective
 7. low effort to attach a host
 8. account for resources
- Not all goals have been met

Packets!

- Basic decision: use packets not circuits (Kleinrock)
- Packet (*a.k.a.* datagram)



- self contained
- handled independently of preceding or following packets
- contains destination and source **internetwork** address
- may contain processing hints (*e.g.*, QoS tag)
- **no delivery guarantees**
 - net may drop, duplicate, or deliver out of order
 - reliability (where needed) done at higher levels

Telephone Network

- Connection-based
- Admission control
- Intelligence is "in the network"
- Traffic carried by relatively few, "well-known" communications companies

Internet

- Packet-based
- Best effort
- Intelligence is "at the endpoints"
- Traffic carried by many routers, operated by a changing set of "unknown" parties

Technology Advances

	1981	2006	Factor
MIPS	1	50000	50,000
\$/MIPS	\$100K	\$0.02	5,000,000
DRAM Capacity	128KB	4GB	30,000
Disk Capacity	10MB	750GB	75,000
Network B/W	9600b/s	40Gb/s	4,000,000
Address Bits	16	64	4
Users/Machine	10s	≤ 1	< 0.1

- Expensive machines, cheap humans
- Cheap machines, expensive humans
- (Almost) free machines, really expensive humans, and communities

The Network *is* the Computer

- Relentless decentralization
 - "Smaller, cheaper, more numerous"
mainframe → mini → PC → palms → ubiquitous/embedded
 - More computers → more data communication
- (Shifting) reasons computers talk to each other
 - Efficient sharing of machine resources
 - Sharing of data
 - Parallel computing
 - *Human communication*

The Network *is* the computer (continued)

- Networks are everywhere and they are converging.
 - SAN, LAN, MAN, WAN
 - All converging towards a similar technology
 - Sensor nets
- New chapter of every aspect of computer science
 - Re-examine virtually all the issues in the context of distributed systems or parallel systems
- This is only the beginning.

Discussion Point

- Ubiquitous computers and networks
- More data communication begets more human communication.
- “(Almost) free machines, really expensive humans”

Are humans on a collision course with networks?