Lecture 1

CS625: Advanced Computer Networks
Fall 2004

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http://www.cse.iitk.ac.in/users/braman/courses/cs625-fall2004/outline.html

Agenda for Today

- Introductions
- Course structure, outline, and purpose
- *Scribe for today?*
- Communication: what and how?
- Internet history
- Internet design and architecture
- OSI layering

Communication: what and how?

- *Communication:* The exchange of thoughts, messages, or information, as by speech, signals, writing, or behavior.
- Requirements for communication
  - Medium + Energy, Protocol
- Design goals/criteria
  - Reliability, Security, Efficiency (time, cost, energy), etc...

Communication networks

- Before the electronic age
  - Using doves/pigeons
  - Postal system
- Telegraph
- Telephone network
- Internet
- Cellular/Wireless
Inter-Network (Internet)

- Connect different “networks”
- Pigeon-powered Internet takes flight

History (continued)

- Networks from DoE, NASA, NSF, AT&T
- NSFNET backbone was created
- Privatization: 1985-1995
  - 6 nodes (56kbps links) to 21 nodes (45Mbps links)
- Steady exponential growth for 15 years
  - In bandwidth, number of hosts, total traffic, etc.
- http://www.isc.org/ds/

History of the Internet

- 1961-62: Packet-switching as a concept
- 1969: Four host computers on ARPANET
- 1972: E-mail application launched
- Network Control Protocol (NCP) used in ARPANET
- 1980s: LANs, PCs, Workstations
- Until 1985: Internet used by researchers/developers

The Internet, as of 1999
**Internet Design Goals**

- Primary goal: Inter-networking

![Diagram of three networks interconnected by two gateways. Source: [CK74]](image)

- Sources of variability: addressing, MTU, delivery guarantees, delay/bandwidth, routing

**Internet Design Goals**

1. Communication in the presence of failures
2. Multiple types of service
3. Accommodate different networks
4. Distributed management
5. Cost effective
6. Dynamic host attachment, removal
7. Resource accounting

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**OSI Layering**

- What is layering?
  - "Structuring technique which permits the network... to be viewed as logically composed of a succession of layers, each wrapping the lower layers and isolating them from higher layers" [Zim80]

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**Advantages of Layering**

- Handle heterogeneity
- Software reuse, modularity
- Allows extensibility, new technologies
Internet Service Semantics

- Best-effort
- Packets may be:
  - Dropped
  - Delayed
  - Duplicated
  - Reordered
- Packets will NOT be *created*

Later in the Week

- The end-to-end principle
  - *How to* separate functionalities into layers?
  - Assigned reading [SRC84]
- MAC and LLC issues
  - Techniques for multiple-access
  - Adaptive LLC for wireless links