

## Outline for May 2, 2007

1. Greetings and felicitations!
  - a. Midterm has been *moved* to Friday, May 4. If this change causes problems for you, please come see me, or e-mail me, *at once*.
  - b. Sample midterm is available on the web; so are the answers.
  - c. Warning: no office hours on Wednesday of next week!
  - d. I will hold a review session for Thursday, May 3, from 3:30–4:30 in 1227 Haring Hall.
  - e. I will also hold special office hours on Thursday: 10:00–11:00AM. Also, don't forget I have office hours on Friday from 9:00–9:50AM.
2. Inside a network, from you to the wire (con't)
  - a. Application layer converts message to bits and attaches sending and receiving computer
  - b. Presentation layer converts bits to ASCII, compresses and encrypts (if you are encrypting)
  - c. Session layer sets boundaries for a message
  - d. Transport layer divides data into segments and creates checksums
  - e. Network layer selects route and forms segments into packets.
  - f. Data Link layer confirms checksum, and addresses packets appropriate for medium.
  - g. Physical layer encodes for the medium that will carry the packets.
3. Addresses
  - a. Host name; this is what you are familiar with (nob.cs.ucdavis.edu, www.cnn.com, etc.); this is used at the Transport layer and above
  - b. Network address: this is what the computers use (IP address), composed of 4 numbers between 0 and 255 (eg, 169.237.6.105 corresponds to nob.cs.ucdavis.edu, 64.236.16.52 corresponds to www.cnn.com); this is used at the Network layer
  - c. MAC address is the address of the computer that the physical network (Data Link layer) understands (eg, an Ethernet address of 00:14:51:31:86:a0)
  - d. System translates your host name to an IP address as it is sent over the Internet; when it reaches its destination LAN, the IP address is translated into a MAC address to get the packet to its destination
4. Moving packets around the network
  - a. Check packet's destination IP address; if in same LAN, translate it to MAC address and send it over
  - b. If not in same LAN, ask another computer, a router, how to get to destination; router determines best "path", or route, to get packet there
  - c. Using information supplied by router, send packet to next host in the path
  - d. Packet arrives at a "gateway", which connects a LAN to a WAN or another LAN; gateway is responsible for moving data from one network to another
  - e. If not in same WAN, packet will arrive at a network access point (NAP), which passes packet on to the backbone (a connection of very powerful networks between NSF supercomputing centers)
  - f. Packets move overbackbone to appropriate WAN, then LAN, then host
  - g. Problem: as data moves over the network, it "fades" or becomes weaker; repeaters amplify it to solve this problem
5. How email works
  - a. A server receives e-mail from a client and sends onward to the destination mail server; these clients and servers use "Simple Mail Transfer Protocol" (SMTP) to transfer mail among themselves
  - b. Post Office Protocol (POP) holds e-mail at the destination mail server until requested by the recipient, at which point it is downloaded
  - c. Problem: many mail servers cannot handle binary data; so binary data is encoded in a special form called MIME (Multipurpose Internet Mail Extension) before being sent to the mail server, and is decoded after mail arrives at the recipient's client system
  - d. Individuals send e-mail messages to a list server to subscribe or unsubscribe from a mailing list.
6. Sharing files on the Internet
  - a. Client/server: store the files on a central file server, client hosts download them

- b. Distributed structure: ask central server where a file is; central server checks a table, replies with name of host that the file is on; your computer asks that host to send the file over
  - c. Peer-to-peer: no central server; if you want a file, ask your neighbor hosts; if they don't have it, they will ask their neighbors, and your request spreads. Eventually someone who is asked will have the file, and will reply
7. Chatting on the Internet
- a. Chat server has list of everyone in your chat room
  - b. When you send a message, server broadcasts it to everyone in your room
8. Instant messaging (IM)
- a. Like chatting, except that the messaging server sends the message only to the person you name
  - b. You have a list of "buddies", or addresses of people who are registered with this instant messaging system
  - c. Server keeps track of who is online
  - a. Different IM systems may use different mechanisms, and if so often cannot communicate with one another; for example, AOL cannot talk to MSN and Yahoo!
9. Streaming audio
- a. Browser sent a "metafile" saying where to get the audio file (may be on a different server) and which plug-in to use
  - b. Browser starts plug-in and contacts server, which sends audio over using a special protocol called UDP that ignores small errors in sound packets
  - c. As packets arrive, they go to plug-in and are not saved (hence, "streaming")
10. Streaming video
- a. Video sent to your computer just like audio, above
  - b. The plug-in does detect errors in frames; if any found, just reuse previous frame