

Announcements

- Handouts

- class syllabus (on web page)
- programming assignment #1 (also on web page)
- info about jobs at Transarc outside my office

- Enrollment

- at least the first 5 on the waiting list who have taken 311/330 will be able to enroll for the class

Design Issues In Layers

- Rules for data transmission (Protocol)
 - full vs. half duplex
 - error control (detection, correction, etc.)
 - flow control (rate matching, overuse of shared resources)
 - message order (do things arrive in the same order as sent?)
- Abstractions for communications
 - end points for communication
 - switches, nodes, processes, threads in a process
 - how are these end points named (addresses)?
 - service providers and service users
- Service Primitives
 - operations performed by a layer
 - events and their actions
 - request, indication, response, confirm

Protocols are divided into layers

- ISO - seven layer reference model
 - Application
 - Presentation
 - Session
 - Transport
 - Network
 - Link
 - Physical
- TCP/IP - four layer model
 - link
 - network
 - transport/session/presentation
 - application
- Old Saying: If you know what you are doing, four layers is enough; if you don't seven won't help.

Physical Layer

- Goal: Raw bits over a communication channel
- Sample Issues:
 - how to encode a 0 vs. 1?
 - what voltage should be used?
 - how long does a bit need to be signaled?
 - what does the cable, plug, antenna, etc. look like?
- Examples:
 - modems
 - “knock once for yes, twice for no”

Data Link Layer

- Goal: transmit error free frames over the physical link
- Sample Issues:
 - how big is a frame?
 - can I detect an error in sending the frame?
 - what demarks the end of the frame?
 - how to control access to a shared channel?
- Examples:
 - Ethernet framing

The Network Layer

- Goal: controlling operations of the subset
- Sample Issues:
 - how route packets that have to travel several hops?
 - control congestion - too many messages at once
 - accounting - charge for use of the network
 - fragment or combine packets depending on rules of link layer
- Examples:
 - IP

The Transport Layer

- Goal: accurately transport session data in order
 - end points are the sending and receiving machines
- Sample Issues:
 - how to order messages and detect duplicates
 - error detection (corrupt packets) and retransmission
- Examples:
 - TCP

The Session & Presentation Layers

- Goal: common services shared by several applications
- Sample Issues:
 - network representation of bytes, ints, floats, etc.
 - encryption?? (this point is subject to lots of debate)
 - synchronization
- Examples:
 - eXternal Data Representation (XDR)

Application

- Goal: common types of exchanges standardized
- Sample Issues:
 - when sending email, what demarks the subject field
 - how to represent cursor movement in a terminal
- Examples:
 - Simple Mail Transport Protocol (SMTP)
 - File Transfer Protocol (FTP)
 - Hyper-Text Transport Protocol (HTTP)
 - Simple Network Management Protocol (SNMP)
 - Network File System (NFS)
 - Network Time Protocol (NTP)
 - Net News Transport Protocol (NNTP)
 - X (X Window Protocol)