Course Description
CMPS 376

Computer Networks

Catalog Description:
A study of computer networks focusing on the tcp/ip Internet protocols and covering the four layers: physical, data link, network, and transport, in detail. This course includes a 2 1/2 hours per week laboratory in which students will cover important network utilities, debugging tools, process and thread control as it relates to network programming, and the coding of programs which do interprocess communication over sockets. The typical Internet client program which accesses a tcp network server daemon will be covered in detail.

Prerequisite:
CMPS 223

Units:
5

Instructor:
Marc Thomas

Goals:
(NC1) Historical development of computer networks, LAN’s and WAN’s, the DARPA Internet, connection-oriented versus connectionless networks, protocol layering in networks.
(NC2) Network standard, the 4-layer Internet standard (physical, datalink, network, and transport), the OSI 7-layer reference model and why it croaked (perhaps two more layers, ”political” and ”profit,” should have been added), circuit versus packet switching, stream versus datagram service.
(NC3) Basic network security issues, the natural insecurity of the physical media, authentication.
(NC4) Client-server protocol and program structure.
Cover the protocols, headers, etc. in detail for each of the cases: physical (ethernet), datalink (DIX and 802.3), network (Internet ip), and transport (Internet tcp).
Cover addressing issues for the cases: physical (ethernet addresses), network (ip addresses); cover both LAN and WAN name resolution including the arp and dns protocols.
(Laboratory) Become proficient in writing programs in C which use tcp stream sockets for interprocess communication (on possibly different hosts); be able to utilize non-blocking I/O, monitor multiple descriptors with select(), use fork() to create an offspring daemon, and understand skeleton code for both telnet and telnetd.

Texts:
Topics:

Introduction and discussion of desirable features and applications which a computer network should support; discussion of network topology, latency, bandwidth, and network architecture; Internet protocol versus the OSI 7-layer recommendations.

Protocols, sessions, processes, and threads; coding problems which arise from differences between operating systems (e.g. Unix vs. Windows NT/2000/XP).

The physical layer and lower datalink layer (media access control) of the network; bandwidth and Shannon’s law; encoding, framing, and error detection; reliable transmission and link protocols (stop & wait, sliding window, etc.); point-to-point versus multiple access local-area networks (LANs), case studies (RS-232, HDLC, ethernet and IEEE 802.3, token rings, token bus); design of the network adapter card and driver.

The full datalink layer, combining links with switches, virtual circuits versus datagrams; introduction to routing strategies and more on network topology; fixed size versus variable size frames, case study of ATM.

The network layer (which may be absent in broadcast LANs); building wide-area networks (WANs) from LANs and nodes, repeaters, bridges and routers; the Internet IPv4 protocol in detail; global addressing and address translation between the network and datalink layers (arp); error reporting by nodes; icmp packets; symbolic host names, aliases and the domain name service (dns).

The transport layer and end-to-end protocols; the Internet udp and tcp protocols in detail.

Security issues, authentication.

Laboratory:

The laboratory session will parallel the lecture, illustrating the principles and familiarizing the student with writing network application programs in C, using a standard BSD socket interface. This will include introducing the student to some associated process control, and special I/O system calls. We will also discuss the closely related winsock.dll programming on Windows NT/2000/XP/2003.

Grading:

Two midterms will be given, each worth 25%. I do not give make-up midterms; for an excused absence I count the other grades proportionately higher. One final exam, comprehensive but emphasizing the later material, will be given. It is mandatory and worth 25%. Homework and lab work are together worth the remaining 25%.