COURSE DESCRIPTION

Dept., Number  CSC 138  Course Title  Computer Networks and Internets
Semester hours  3  Course Coordinator  Richard Smith
URL (if any):  http://gaia.ecs.csus.edu/~dsmith/

Catalog Description

An overview of the fundamentals of computer networks and connections between networks, from the physical layer up through peer-to-peer communications at the application level. Lower layer characteristics including serial vs. parallel, capacity issues, high-speed connections, LAN framing and error handling. LAN vs. WAN characteristics, network architecture and the ISO network model. Internetworking components including LANs, repeaters, hubs, bridges, switches and routers. Internet addresses, TCP/IP, and the Domain Name System. Common Internet client/server application protocols including SMTP and FTP. Client/Server programming involving sockets. World Wide Web characteristics including CGI and HTTP protocol, Web pages, Web browsers, Web servers, and Applets. Introduction to advanced Web issues such as Web security, search engine operations, and Web database operations. Prerequisite: At least a C- grade in CSC 035, CSC 060 and CSC 130, and full CSC, CPE, or MATH/CSC major status. Cross-listed as CPE 138; only one may be counted for credit.

Textbook


References


Course Goals

1. Introduce electrical engineering, computer engineering, and computer science students to fundamental network architecture concepts and their application in the network of networks.
2. Provide a solid foundation of networking that can lead to study of advanced topics and detailed network architectures.

Prerequisites by Topic

Thorough understanding of:

- Programming design tools such as logic flow-charting, high level pseudo code or machine state diagrams.
- Specifications, design, implementation, testing and debugging a large complex program.
• Advanced data structures used in file descriptor tables and complex network structures.
• High level programming language techniques to manipulate bits and bytes.

Basic understanding of:
• Application programming interface (API).
• Asynchronous and synchronous timings.
• UNIX command line interface.
• UNIX X-windows interactive development environment (IDE).

Exposure to:
• 1’s complement arithmetic.
• Big-Endian and Little-Endian order of bytes and words.
• Hardware interrupt programming.

Major Topics Covered in the Course

1. Introduction to information communications (3 hours).
2. Encoding, Modulation, Transmission Media (3 hours).
3. Long-Distance Digital Technologies and Multiplexing (5 hours).
4. Transmission impairments, error detection and correction; introduction to layered network architectures (ISO, IEEE 802, TCP/IP) (6 hours).
5. Asynchronous and synchronous communications; RS-232 and related standards; modems (2.75 hours).
6. Data Link Protocols; ARP, DNS, UDP, TCP and ATM (6 hours).
7. Local Area Networks; Ethernet, Token Ring, and WAN Networks (6 hours).
8. Fiber Optic and Satellite technologies; PBX (3 hours).
9. Introduction to higher layer protocols; SMTP, RIP, OSPF, BGP-4 and IPV6 (6 hours).
10. World Wide Web protocols (HTTP) and document technologies; network security and privacy in electronic communications (3 hours).
11. Exam (1.25 hours).

Outcomes

Thorough understanding of:
• Basic categories of network wiring schemes and advantages of each.
• Layering approach to the design of network architecture.
• ISO and Internet (TCP/IP) standards and protocol stack.
• The TCP/IP suite of protocols.
• Distributed computing with client/server socket programming.
• Hardware and software devices used in internetworking.

Basic understanding of:
• Network congestion and flow control and why they must be handled.
• Errors; their cause, detection, and various control techniques.
• ATM and Frame Relay protocols.
• Internet routing protocols (RIP, IGRP, EIGRP, OSPF).
• HTTP and Web CGI programming.
• Host and Network configuration protocols (BOOTP, DHCP).
• Domain name system (DNS) and addressing schemes used in internetworking.

Exposure to:
• Technology of dynamic Web documents (CGI: Perl, ASP, JSP, PHP).
• Technology of active Web documents (Java, JavaScript).
• Security of computer systems and networks.
• Border Gateway Protocols (BGP-4).
• High-speed networks and new protocols (IPv6, IPsec).

Laboratory Projects

1. Research RFC for Computing the Internet Checksum (IP, UDP, TCP) (.5 week).
2. Network diagnostic tool “ping” (.5 week).
3. Network diagnostic tool “traceroute” (.5 week).
4. Configure two Cisco network routers (1 week).
5. Perform analysis of 3 compression utilities (.5 week).
6. Configure four Cisco network routers (1 week).
7. Write research paper on a topic from a list of suitable topics (1 week).
8. Design and write a program to send a message (talk) between two workstations using an RS-232 LAN or RS-232 Token Ring (6 weeks).
9. Use the HP 4972A protocol analyzer to determine packet header information (.5 week).
10. Write a Perl TCP client program to send information to a server and receive a confirmation message (.5 week).
11. Write a 3-tier client/server application prototype for an on-line voting system (1 week).
12. Create an HTML form with one input text and the CGI program to process the data (.5 week).
13. Create a Guest book Web application with form entry (1 week).
14. Write a UDP Java client program that sends a username and password to a server for authentication (.5 week).

Estimated Curriculum Category Content (Semester hours)

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Oral and Written Communications

Every student is required to submit at least one written research report (not including exams, tests, quizzes, or commented programs) of a minimum of 2 to 4 pages.

Social and Ethical Issues

Students participate in-group discussions on the subject of security and privacy in electronic communications (1 hour).

Theoretical Content

Finite state machine, action go to tables to design protocols (1-1/2 hours).

Problem Analysis

Students are required to do an analysis of the problem where multiple programs are running on multiple systems and yet they have to be synchronized so that they can perform input and output operations to each other. Analyze the problem of a stateless interrupt process that executes only for a byte at a time.

Solution Design

Students are required to do a design then implement a message transfer application between workstations modeling TCP/IP on IEEE 802.3 (CSMA/CD) or on alternate semesters the IEEE 802.5 Token-passing ring protocol.