

TCP/IP NETWORK PROGRAMMING for ES – 3CR

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The course is typically taught every three semesters, also available as prerecorded in summer and interim semesters

Actual course description

This course gives the fundamental concept of computer networks and network programming used to build all distributed computing systems. Various server designs as well as techniques used to build clients and servers are discussed. Main Internet protocols are introduced and exercised. The network programming is introduced using Winsock sockets API and utilization of C language so that the concepts can be easily extrapolated to various embedded systems. About one third of the course is devoted to applying learned knowledge to programming a selected 8-bit or 16-bit embedded system with provided simplified TCP/IP stack library.

Prerequisites by topics

Proficiency in computer programming, preferably in C/C++; Knowledge of the data structures concept; Experience in programming a microprocessor system in assembly or C with use of interrupts; EE221 and EE365 satisfies these requirements.

Textbooks and/or other required material

1. **MANDATORY** *TCP/IP Protocol Suite, 3rd Edition* by B. A Forouzan; McGraw Hill; ISBN13: 9780072967722
2. **RECOMMENDED HARDWARE** *Silicon Lab 8051-based Embedded Ethernet Development Kit* approx. \$120
http://www.silabs.com/tgwWebApp/public/web_content/products/Microcontrollers/en/EthernetDK.htm

Course Objectives

1. Understand Internet technology with underlying TCP/IP
2. Learning details of protocols including ARP, RARP, IP, ICMP, IGMP, TCP, UDP, SCTP, RIP, DHCP, OSPF
3. Understanding paradigm of client-server computing and of multicasting
4. Learning TCP/IP API (Application Programming Interface) for Windows and some for Unix
5. Learning details of Internet application protocols including HTTP, SMTP, POP3, and others
6. Learning programming a particular 8- or 16-bit microcontroller in C with use of interrupts, and hardware configuration
7. Learning how to use an example implementation of embedded TCP/IP stack for custom applications

Topics Covered

1. TCP/IP protocol suite including protocols: ARP, RARP, IP, ICMP, IGMP, TCP, UDP, SCTP, RIP, DHCP, OSPF
2. Introduction to Virtual Private Networks (VPNs) and Network Address Translation (NAT) technologies
3. Fundamental concept of client-server computing used to build all distributed computing systems
4. Windows Sockets API used with the Microsoft Windows operating systems (and some Unix)
5. Case studies of various server designs as well as the tools and techniques used to build clients and servers
6. Application layer protocols including protocols: HTTP, SMTP, POP3, and others
7. Programming Silicon Labs 8051 in Kyle C with utilization of hardware configuration and interrupts
8. Custom applications utilizing Silicon Labs TCP/IP stack and embedded Web server

Note: embedded system programming is introduced in parallel with theory of computer networks, lectures are alternated

A Word of Caution: Laborious Course

This is a fast paced course. It is not very difficult but it may be laborious as we will cover an almost entirely different topic each week. It could be very laborious to students who are slow programmer or do not know microprocessors. Graduate students who took only one programming course, or took their programming courses and microprocessor course long time ago are cautioned. This is not a substitute course for introductory programming course.