

ECE473/573 Embedded TCP/IP – 3CR

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Course description

Fundamental concept of computer networks and network programming; computer network topologies; TCP/IP stack; IP routing; lower layers protocols: IPv4, IPv6, IP routing, UDP, and TCP; Basic application-layer protocols: HTTP, SMTP, POP3, TIME, TFTP, and DHCP; Firewalls and principles of network security; Software: Berkeley Socket API; client-server paradigm; connected embedded systems.

Prerequisites by topics

Proficiency in computer programming in C or C++; Concepts of the data structures; some experience in programming a microprocessor system in assembly or C with use of interrupts; ECE103 and ECE205 satisfy these requirements.

Textbooks and/or other required material

1. *Computer Networking: A Top-Down Approach, 7th Ed.* by J. Kurose & K. Ross; ©2016 Pearson, ISBN13: 978-0133594140 (required)

Course Objectives

1. Understanding paradigm of client-server computing and of multicasting
2. Learning TCP/IP API (Application Programming Interface) for Windows and some for Unix
3. Learning details of Internet application protocols including HTTP, SMTP, POP3, and others
4. Learning how to use MQTT protocol in the cyber-physical systems, on PCs, and in the cloud
5. Understand Internet technology with underlying TCP/IP
6. Learning details of protocols including ARP, IP, ICMP, IGMP, TCP, UDP, RIP, DHCP
7. Learning how to use network sniffers to observe network activity and troubleshoot potential problems

Topics Covered

1. Fundamental concept of client-server computing used to build all distributed computing systems
2. Windows Sockets API used with the Microsoft Windows operating systems (and some Unix)
3. Python Socket API used on PC and Python on embedded platform (e.g. **HiLetgo NodeMCU ESP-12E / ESP8266**)
4. Case studies of various server designs as well as the tools and techniques used to build clients and servers
5. Application layer protocols including protocols: HTTP, SMTP, POP3, TIME, and others
6. MQTT protocol - interconnected cyber-physical systems, Internet of Things
7. TCP/IP protocol suite including protocols: ARP, IPv4, IPv6, IP routing, TCP, UDP, DHCP,
8. Introduction to Virtual Private Networks (VPNs) and Network Address Translation (NAT) technologies

Note: Network programming and network sniffing is introduced in parallel with theory of computer networks, topics are alternated.

