

EE 450 – Introduction to Computer Networks

Units: 4

Term—Day—Time: TTh 2 to 3:50 PM Lectures

Discussion: Monday 5 to 5:50 AM

Location: THH 116 & Online

Instructor: Prof. Cauligi Raghavendra

Office: EEB 216

Office Hours: TTh 4 to 5:30 PM

Contact Info: raghu@usc.edu, (213) 740-9133

Catalogue Course Description

Network architectures; layered protocols, network service interface; local, wide area, wireless networks; Internet protocols; link protocols; addressing; routing; flow control; software defined network; multimedia networks.

Learning Objectives

Students will learn fundamentals of computer networks, main protocols and applications of the Internet, design and analysis of networks, and use of software tools for understanding workings of the Internet. Writing socket programming to learn about protocols and applications and use simulation and emulation for performance evaluation.

Registration Restriction: Open only to junior standing and above

Crosslisted as CSCI 450

Technological Proficiency and Hardware/Software Required

Students are required to have basic familiarity of programming and elementary probability theory.

Required Readings and Supplementary Materials

Required textbook “Computer Networking: A Top Down Approach” by James Kurose and Keith Ross, 7th Ed., Pearson Publishers.

Supplementary materials are tutorial notes on Unix, C, C++, and Mininet user guides.

Description and Assessment of Assignments

This course is based on established materials from a widely used textbook. There will be weekly homeworks with problems on materials covered in class, programming projects (see below for examples), network simulations on simulation platforms like OPNET and NS-3, and lab exercises in the discussion period. Sample programming projects include:

Programming Assignment #1: Error Detection Algorithm

In this Programming assignment, students are required to implement an error detection mechanism discussed in class. This scheme is used in the DLC/MAC layers to detect any possible errors in the received frame. Recommended language C/C++ or Python.

Programming Assignment 2: The Dijkstra Least-cost Path Algorithm

In this assignment, students are asked to write a Program that computes the shortest spanning tree between a given node (the root) and every other node in the network. Recommended language C/C++ or Python.

Term Programming Project: Network Socket Programming: The objective of this assignment is to familiarize students with UNIX socket programming. The Project consists of 3 parts. The **first part** involves creating a server in C/C++ or Python. The **second part** requires the creation of a UDP client (communicating with a server using Datagram sockets) and a TCP client (communicating with a server using Stream sockets) and the **third part** will be to create a multi-threaded proxy web server capable of supporting multiple requests at the same time

Grading Breakdown

Assignment	Points
Home Works	5
Programming Projects	15
Quizzes	10
Mid Term Exam	30
Final Exam	40
TOTAL	100

Assignment Submission Policy

Assignments are assigned weekly and due in class the following week. Programming projects and mininet exercises are explained and assigned in discussion section.

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings	Homework Deliverable/ Due Dates
Week 1 Dates	Introduction and overview of course Network elements, Internet, Protocols, Physical media	Chapter 1	Home Work 1
Week 2 Dates	Packet and message switching; performance, metrics; protocol layers; Link Layer	Chapter 1	Home Work 2 Quiz 1
Week 3 Dates	Error Detection and Correction; Ethernet	Chapter 6	Home Work 3 Quiz 2 Programming project #1 assigned
Week 4 Dates	Multiple Access protocols, CSMA/CD, Data Centers	Chapter 6	Home Work 4 Quiz 3
Week 5 Dates	Applications, Web and HTTP, e-mail, SMTP	Chapter 2	Programming Project #1 Due Term programming project part 1 assigned
Week 6 Dates	DNS, HTTP, P2P applications,	Chapter 2	Home Work 5 Quiz4
Week 7 Dates	Transport Layer Protocols; TCP and UDP	Chapter 3	Home Work 6

			Term programming project part 1 due Term programming project part 2 assigned
Week 8 Dates	Flow and Congestion Control; MID TERM	Chapter 3	
Week 9 Dates	TCP Congestion Control Data and Control Planes	Chapter 3/4	Home Work 7 Programming project #2 assigned
Week 10 Dates	Network Layer, Forwarding, SDN Approach	Chapter 4	Quiz 5 Home Work 8 Term programming project part 2 due
Week 11 Dates	Routing Algorithms, BGP, Broadcasting, and Multicasting, Network management	Chapter 5	Quiz 6 Home Work 9 Programming project #2 Due
Week 12 Dates	Wireless and Mobile Networks	Chapter 7	Quiz 7 Home Work 10 Programming project part 3 assigned
Week 13 Dates	Network Security, Cryptography, RSA scheme	Chapter 8	
Week 14 Dates	Multimedia networks and applications, Content Distribution Networks	Chapter 9	
Week 15 Dates	Advanced Topics and Course review		
FINAL Date			Date: For the date and time of the final for this class, consult the USC <i>Schedule of Classes</i> at www.usc.edu/soc .

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu> or to the *Department of Public Safety* <http://adminopsnet.usc.edu/department/department-public-safety>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.