

EE 450 – Introduction to Computer Networks

Units: 4

Term—Day—Time: TTh 2:00 to 3:50 PM Lectures

Location: WHP B28

Discussion: Wednesday 5 to 5:50 AM

Location: SGM 601

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

Cross listed 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, 8th 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	20
Quizzes	10
Mid Term Exam	25
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		
Week 15 Dates	Advanced Topics and Course review		Final Project Due
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 .

Academic Integrity

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the [USC Student Handbook](#). All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the [student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

Statement on Academic Conduct and Support Systems

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, compromises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

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For more information about academic integrity see [the student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. [The Office of Student Accessibility Services](#) (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

[Counseling and Mental Health](#) - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

[988 Suicide and Crisis Lifeline](#) - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

[Relationship and Sexual Violence Prevention Services \(RSVP\)](#) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

[Office for Equity, Equal Opportunity, and Title IX \(EEO-TIX\)](#) - (213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

[Reporting Incidents of Bias or Harassment](#) - (213) 740-5086 or (213) 821-8298

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

[The Office of Student Accessibility Services \(OSAS\)](#) - (213) 740-0776

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

[USC Campus Support and Intervention](#) - (213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#) - (213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#) - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call
Non-emergency assistance or information.

[Office of the Ombuds](#) - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - (323) 442-2850 or otfp@med.usc.edu

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.