EE 450 – Introduction to Computer Networks

Summer 24
Mondays, and Wednesdays, 1-4:35pm (Lecture)
Friday, 3-3:50pm (Discussion)

Location: Check the Online Class Schedule
Course Website: DEN Brightspace

Instructor(s): Shahin Nazarian
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Office Hours: Mon, Wed: 4:45-5:45pm EEB 340
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Teaching Assistant and Grader: TBA

Summary

This course is aimed at electrical engineering, computer engineering and computer science students and provides an in-depth discussion and analysis of the global Internet. The focus is on the design principles, layering and protocol design and analysis. Topics covered include the Internet structure and architecture, transport and congestion control protocols, socket programming, network layer and routing protocols, link layer and MAC protocols, network applications and internetworking.

Catalog Description:

Network architectures; Layered protocols, Network service interface; Local Networks; long-haul Networks; Internal Protocols; Link protocols; Addressing; Routing; Flow and Congestion Control; Applications Protocols, Network Security

Prerequisite: None, but registration is closed to Freshmen and Sophomore

Course Materials

- Lecture slides, posted on the course page;
- https://www.amazon.com/Computer-Networking-Top-Down-Approach-7th/dp/0133594149

Additional (Recommended) Readings

5G:

- J.G. Andrews, et al., "What Will 5G be?", IEEE J. on S.A.Comm, 2014.

Autonomous Driving:

- M. Cheng, et al., "A General Trust Framework for Multi-Agent Systems ", AAMAS 2021

Cloud:

- M. Cheng, J. Li, P. Bogdan, S. Nazarian, "H2O-Cloud: A Resource and Quality of Service-Aware Task Scheduling Framework for Warehouse-Scale Data Centers - A Hierarchical Hybrid DRL (Deep Reinforcement Learning) based Approach", TCAD, 2019.
- M. Cheng, J. Li, S. Nazarian, "DRL-Cloud: Deep Reinforcement Learning-Based Resource Provisioning and Task Scheduling for Cloud Service Providers," ASPDAC, 2018.

IoT:

- Y. Xue, J. Li, S. Nazarian, P. Bogdan, "Fundamental Challenges Toward Making the IoT a Reachable Reality: A Model-Centric Investigation," TODAES, 2017.

Manycore Computers, Graph Learning and Complex Networks:

- G. Ma, et al., A Distributed Graph-Theoretic Framework for Automatic Parallelization in Multi-core Systems, Proc. Machine Learning and Systems, 2021.

- Y. Xiao, S. Nazarian, P. Bogdan, "Plasticity-on-Chip Design: Exploiting Self-Similarity for Data Communications, TC, 2021.

Description and Assessment of Assignments

Grading Breakdown

(HWs+Labs) =	18%
(Midterm, Final) =	(30%, 30%)
Project =	22%

Homework and Lab Assignments:
Roughly 4 HWs and 4 Labs that will be assigned weekly.

Final Project:
The project consists of 3 phases on basic app and socket programming in C/C++.

Assignment Submission Policy
Submission will be online using the submission link of DEN. See the header of each assignment for more details.

Grading Timeline
HW and lab assignments will be graded within a week.

Additional Policies
Attendance required.

Course Topics and Schedule:

Week 1 and 2: Overview of Networking. Network Classifications and Topologies. The concept of layered architecture modeling including OSI and the TCP/IP protocol suite. Client-server communications using Sockets. Network analysis and optimization

Week 3: Physical layer functionalities including signaling, modulation, multiplexing, line coding and synchronization. Transmission media. Network performance measures including throughput, delays are presented. Data vs. signaling rates, channel bandwidth and capacity.

Week 4: Link layer functionalities including frame synchronization, error detection and control including ARQ, flow control mechanisms including sliding windows.

Week 5: Local area network technologies including ETHERNET and Wireless (Wi-Fi). Multiple-access schemes such as CSMA/CD, CSMA/CA are discussed. MAC addressing. Switched vs. shared ETHERNETs. Performance evaluation, including

throughputs and delays of LAN technologies

Week 6 and 7: Interworking devices including repeaters, bridges, switches, routers and gateways. Network layer protocols, including IP. IP addressing

schemes (Classful and Classless), Subnetting and Subnet Masking, Internet routing including protocols used in the Internet such as RIP, OSPF and

BGP. Algorithms such as Bellman-ford and Dijkstra are discussed

Week 8 to Final: Transport layer protocols including UDP and TCP. Ports and sockets. TCP connection establishment. Error, flow and congestion control in TCP. Fundamentals of network security.

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 Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
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
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710
campussupport.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu
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
dps.usc.edu, emergency.usc.edu
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) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.