CSE 60774: Graduate Networks

Department of Computer Science and Engineering
University of Notre Dame

Description: Survey of topics in advanced networking including scaling, connectivity, and performance.

Class: MW 2-3:15 PM
203 DeBartolo

Instructor: Prof. Aaron Striegel, 211B Cushing Hall
striegel@nd.edu

Office Hours: On-Demand via CSE Slack or E-Mail

Course Content: Canvas - Links to External Sites
GitHub - Class Repository - Notes + Assignments

Required Text: None – Materials via IEEE Xplore / ACM Digital Library
Mirrored via Google Drive
Peterson / Davies - Computer Networks: Systems Approach
available on-line for free

Course Overview

This course will explore advanced networking topics, specifically the mechanics regarding scaling, connectivity, and performance. Topics that are likely to be covered include inter/intra-domain routing, TCP fundamentals, quality of service (QoS), content distribution, software-defined networking, and wireless. Students will be expected to evaluate and present contemporary networking research papers and complete a networking-centric research project.

Grading

Assignments / Exams		Course Project	
Assignments	7.5%	Project Proposal	2.5%
Presentations	7.5%	Interim Results	7.5%
Mid-Term Exam	15%	Final Presentation	15%
Final Exam (Written)	10%	Final Paper	25%
Final Exam (Oral)	10%		

- Fixed grading scale with +/- A=90-100, B=80-89, C=70-79, D=60-69
- Inquiries about graded assignments/exams must be made within **one week** after the assignments are returned.
- Late assignments will be reduced at 25% per day. A five-minute grace period is allowed. Being **proactive** rather than reactive generally will result in a satisfactory outcome.

Course Objectives

At the end of the course, you should be able to:

- Illustrate the dominant protocols / architectural components that affect a packet from end-to-end (LAN, WAN, Network, Transport, Application)
- Compare / contrast the evolution of congestion control approaches and their respective strengths and weaknesses
- Describe how Quality of Service has evolved into Quality of Experience and key performance metrics related to QoS / QoE and content distribution
- Understand and articulate the impact of wireless in the last-mile for connectivity
- Demonstrate an understanding of the tradeoffs in protocol design versus current protocols in the Internet
- Capture and analyze packets via libpcap and tcpdump
- Be able to describe and discuss contemporary research problems in networking
- Propose, write, and present an effective research paper

Topics

Topics that will likely be studied in CSE 60774 include:

- Networking Fundamentals
- TCP Fundamentals / Evolution
- Protocol Analysis (tcpdump / libpcap, IPv4, IPv6, IPsec, TCP, UDP)
- Quality of Service / Quality of Experience (IntServ, DiffServ, RSVP)
- Content Distribution (Caching, CDNs, P2P, Multicast)
- Network Simulation
- Contemporary Research (Software Defined Networking, Named Domain Networking, Information Centric Networking)
- Wired vs. Wireless Networking, Sensor Networks

Course Policies

Inclusive Excellence: As a Catholic research university, Notre Dame is committed to defending the dignity of every human person, to promoting a just society in which every person can flourish, and to attending particularly to the needs of the most vulnerable. This class shares that commitment.

Honor Code: As a member of the Notre Dame community, you acknowledge that it is your responsibility to learn and abide by principles of intellectual honesty and academic integrity, and therefore you will not participate in nor tolerate academic dishonesty.

Usage of AI: Responsible AI tool usage is allowed for this class. As a graduate student, you should understand the proper limitations of AI tools if you elect to use them. Reliance on AI tools without proper verification (ex. phantom citations) or confirmation (weird / obscure AI induced bugs) will result in a zero for that assignment.

Deadlines: Be pro-active to the extent possible. Start projects early and embrace a work-conserving approach to reading and assignments (e.g. work early rather than waiting as close as

possible to the deadline). Extensions are generally granted when requested sufficiently early as the specific situation warrants.

Lecture: Lecture will be recorded only upon request with sufficient advanced notice. As this is a graduate class, you are expected to attend (including those auditing the course) and should convey advance notice when possible if you will miss lecture. You should **expect to take extensive notes** as part of the class as slides will largely not be used. All handouts and limited lecture outlines will be provided via Google Drive or the class GitHub repository.

Background Material: The course does not have undergraduate Computer Networks as a pre-requisite. The course will spend the first three lectures covering key aspects of undergraduate networking. Depending on your background and experience, you may need to do extensive background reading. You are also welcome to visit Prof. Striegel's office as needed for appropriate tutorials.