ECE/CSC 570: Computer Networks

Classroom: EB2-1231
Class Time: Mondays and Wednesdays, 1:30 PM – 2:45 PM
Instructor: Dr. Shih-Chun Lin
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Office Hours: Mondays, 3 - 4 PM or by email appointment with "[ECE/CSC570]" in the subject line.
TAs: Hao Zhang, Weiqi Sun

Description:
To impart to the student an understanding of the fundamental concepts of computer networking, knowledge of the basic taxonomy and terminology of the computer networking area. To allow the student expertise in some specific areas of networking. The stress is on theoretical and conceptual development rather than practical experience with specific technologies. General introduction to computer networks. Discussion of protocol principles, local area and wide area networking, OSI stack, TCP/IP and quality of service principles. Detailed discussion of topics in medium access control, error control coding, and flow control mechanisms. Introduction to networking simulation, security, wireless and optical networking.

Credit Hours: 3
Prerequisite: An introductory course in probability.
Textbook: Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks (5e)," Prentice Hall, 2011.
Course Materials: Class notes will be available in Moodle.

Grade Distribution:

Homework assignments	20%	
Project	20%	
Midterm exam	25%	
Final exam	35%	
In-class/Piazza Activity	3%	Attendance, discussions and presentation

Weighted averages of 90, 80, and 70 will guarantee minimal letter grades of A-, B-, and C-, respectively.

Course Outline
Introduction (~5 Lectures)
- Packet Switching vs Circuit Switching
- What is a protocol
- Delays (transmission, propagation, queueing, processing, [access])
- Throughput
- Building blocks
    - Components (hosts, servers, routers, switches)
    - Services (applications)
- Layers
- Multiplexing/Demultiplexing (in the stack)
- Virtualization - bandwidth, interfaces, switches, functions (routing, forwarding)
- Data plane vs control plane

Layer 1: Physical Layer (~6 Lectures)

- Modulation
- Nyquist, Shannon
- TDMA, FDMA, CDMA
- Wired and wireless examples (Ethernet, WiFi, Cellular, DOCSIS, ADSL)
- Probability Basics
  - Probability distributions
  - Bayes' theorem, examples

Layer 2: MAC Layer (~8 Lectures)

- Forward error correction (FEC)
- Automatic Repeat Request (ARQ)
- [Aloha, S-Aloha], CSMA, CSMA/CD
- Router internals (I/O Ports, switching fabric, scheduling)
- Wired and wireless examples, same systems as L1
  - Learning bridges, need for STP, but no STP
  - VLANs

Layer 3: Network Layer (~4 Lectures)

- (Generalized) forwarding - forwarding tables
- Routing algorithms (Dijkstra, Bellman-Ford)
- Hierarchical routing (concept)
- SDN Introduction
- Virtualized routing

Layer 4: Transport Layer (~2 Lectures)

- Services
  - End to end connection
  - Flow control
  - Congestion control
  - Reliable transmissions
- Congestion control principles
  - Definition, causes
  - Generic solutions
  - L2, L3, L4, L5 solutions

Security (~2 Lectures)

- Services (authentication, non-repudiation, encryption)
- Symmetric Key (block and stream)
- Asymmetric Key (RSA)

Academic Integrity: Students should refer to the University policy on academic integrity found at https://studentconduct.dasa.ncsu.edu/academic-integrity-overview/
Authorized aid on an individual assignment includes discussing the interpretation of the problem statement, sharing ideas or approaches for solving the problem, and explaining concepts involved in the problem. Any other aid would be unauthorized and a violation of the academic integrity policy. All cases of academic misconduct will be submitted to the Office of Student Conduct.