CS 455-002: Computer Communications and Networking
Fall 2020
Department of Computer Science, George Mason University

Time and location:

- Monday & Wednesday, 1:30 pm - 2:45 pm
- Online (Blackboard Collaborate Ultra)

Instructor:

- Dr. Shuochao Yao
- Email: shuochao@gmu.edu

- Office hours: Thursday 3:30 pm – 4:30 pm, or by appointment
- Zoom link: TBD

Description:

- This course introduces concepts and design principles of modern computer and telecommunication networks. It uses the Internet TCP/IP protocol suite to discuss how today's computer networks operate and how they have evolved over many years to meet the requirements of today's networking applications. The focus will be on both - fundamental networking and communication techniques, and protocols used in today's complex Internet architecture.
- Topics include DNS and HTTP protocols at the application layer, TCP and UDP at the transport layer, routing algorithms and forwarding with BGP and OSPF at network layer, and multiple access technologies along with Ethernet and WiFi LANs. Concepts of software defined networking, network security and wireless networking will also be introduced.

Prerequisites:

- Grade C or better in CS 310, CS 367 and STAT 344
- Ability to program in C or Python

Objectives:

- Gain a basic understanding of how computer and communication networks operate
- Understand various tradeoffs and performance metrics that drive the design of today's networks, especially the Internet
- Learn the basics of network programming, and relevant tools and protocols

Course outcomes:

Upon completion of this course, students should be able to:

- Understand the architectural principles of computer networking and overall structure of the Internet

- Show a clear understanding of layered Internet protocol framework, its design principles and functionality
- Explain various network performance metrics (throughput, latency, loss, etc.) and their impact on applications
- Describe the essential principles of reliable data delivery, flow control, and congestion control, and their implementation at transport layer
- Understand distributed routing protocols, and data and control plane operations of network layer in Internet
- Understand wired and wireless data link layer protocols for communication over a shared medium
- Demonstrate a basic understanding of network security, vulnerabilities at various layers, and associated protocols
- Implement network protocols using network stack programming libraries and use tools such as Wireshark to analyze real-world networks

Books:

- Required textbook:
    - James Kurose and Keith Ross, "Computer Networking: A Top-Down Approach", 7th Edition, Pearson, 2017
- Other recommended textbooks for references
    - Computer Networks: A Systems Approach, Larry Peterson and Bruce S. Davie.
    - Internetworking With TCP/IP Volume 1: Principles, Protocols, and Architecture, 6th edition, 2014. ISBN-10: 0-13-608530-X ISBN-13: 9780136085300
    - Computer Networks, 5th Edition, Andrew S. Tanenbaum, David J. Wetherall, Pearson, 2011
    - Unix Network Programming, Volume 1, The Sockets Networking API, 3rd Edition W. Stevens, Bill Fenner, Andrew Rudoff, Nov 2003

Graduate teaching assistant (TA):

- Shuai Wang
- Email: swang42@masonlive.gmu.edu
- Office hours: TBD
- Office: TBD

Topics:

- Introduction to computer networks and Internet protocol suite
- Internet architecture - edge, core and layered service model
- Application layer principles and protocols (DNS, HTTP, SNMP, etc.)
- Transport layer services, TCP, reliable delivery, congestion control, and UDP
- Network layer data plane principles, forwarding and routing, addressing, IPv6, and DHCP
- Network layer control plane overview, routing algorithms, SDN control plane, OSPF and BGP
- Link layer services, error detection and correction, and multiple access protocols

- Introduction to network security, vulnerabilities and protocols
- Introduction to wireless and mobile networks with 802.11 wireless LANs

Grading:

- Your grade will be calculated using the following percentages:
    - Homework and labs (30%)
        - To be done individually
    - Programming assignments (30%)
        - Can be done with a partner (team of two students)
    - Midterm exam (20%)
    - Final exam (20%)
    - Project or Survey (extra 10%)
        - Can be done with partners (team of 2-3 students)
- A total grade of less than 50 or a final exam score less than 40 will result in an F

Policies:

- Late submission:
    - Late submissions of homework, labs and programming assignments will be penalized at 15% each day, and will not be accepted after 2 days of the due date.
- Exams:
    - The final exam will be cumulative, which means that it will include all topics discussed during the term.
    - No early exams will be given. If you must miss an exam, you should provide an official/verifiable proof of why you are missing the exam before the exam. Once it is validated, the instructor can arrange a make exam.
- Honor code:
    - *Zero tolerance to cheating!*
    - All students must adhere to the GMU Honor Code and the Computer Science Department's Honor Code Policies.
    - The students are supposed to work individually on the homeworks, assignments, projects, unless told otherwise.
    - We reserve the right to use MOSS to detect plagiarism. Violation of the Honor Code will result in an F.
    - Use of public code repositories such as Git is not allowed for course projects during the semester or after the semester is over (to avoid future plagiarism).
- Accommodations for disabilities:
    - If you have a documented learning disability or other condition that may affect academic performance, you should: 1) make sure this documentation is on file with the Office for Disability Services (SUB I, Rm. 4205; 993-2474; http://ods.gmu.edu) to determine the accommodations you need; and 2) talk with me within the first week of the semester to discuss any accommodation needs.