

## **CS 555: Computer Communications and Networking**

**Fall 2019**

**Department of Computer Science, George Mason University**

*(This syllabus may be updated throughout the semester)*

### **Time and location:**

- Tuesday, 4:30 pm - 7:10 pm
- Innovation Hall 136

### **Instructor:**

- [Professor Eric Osterweil](#)
- Email: [eoster@gmu.edu](mailto:eoster@gmu.edu)
- Office hours: M 3:30pm-5:00pm, or by appointment
- Office: Engineering building, Room 5346

### **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 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 network security and related protocols like the Transport Layer Security (TLS) suite and DNS' Security Extensions (DNSSEC) 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 basic understanding of how computer and communication networks operate
- Understand various tradeoffs and performance metrics that drive the design of today's networks, especially Internet
- Learn the basics of network programming, and relevant tools and protocols

### **Course outcomes:**

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

- Demonstrate fundamental knowledge of computer communications and networks

- Show a clear understanding of layered Internet protocol suite and its operations, design principles and functionality
- Explain various performance metrics (throughput, latency, loss, etc.) and their implications on applications
- Demonstrate a good understanding of various challenges and problems faced in today's networks (for example, reliable delivery) and how they are addressed at various layers
- Demonstrate a clear understanding of commonly used protocols such as DNS, HTTP, TCP, UDP, IP, ARP, CSMD, CSMA, etc.
- Explain the logical distinction between control, management and data planes in networks
- Understand the basics and importance of security and security enhancements to networking and protocol evolution
- Implement protocols using socket programming 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):**

- Roshan Dhakal
- 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, security enhancements, OSPF and BGP
- Link layer services, error detection and correction, and multiple access protocols

- Introduction to wireless and mobile networks with 802.11 wireless LANs

### Grading:

- Your grade will be calculated using the following percentages:
  - Homeworks and labs (~35%)
    - To be done individually
  - Programming assignments (~25%)
    - Can be done with a partner (team of two students)
  - Midterm exam (~15%)
  - Final exam (~20%)
  - Participation and quizzes (~5%)
- 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 homeworks, 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 midterm and final exams will be closed book
  - 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, 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.
- 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 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.