

CS 455: Computer Communications and Networking

Fall 2021

Department of Computer Science, George Mason University

(This syllabus may be updated throughout the semester)

Time and location:

- Monday/Wednesday, 3:00 pm - 4:15 pm

- **East 201 / Blackboard Collaborate Ultra - Online**

*Lectures will be in-person, by default. However, **be prepared to go on-line** on any lecture day, to accommodate if a health concern / situation arises during class. This will only be for exceptional circumstances, the primary/expected format for this course will be in-person.*

For virtual sessions, students should have convenient access to audio/visual and computing facilities.

For virtual sessions, click on the "Lecture 'Classroom'" link

Instructor:

- [Professor Eric Osterweil](#)
- Email: eoster@gmu.edu
- Office hours: M 1:00pm – 2:00pm, or by appointment
- Office: Engineering building, Room 5346

TA:

- Na Wang
- Email: nwang4@gmu.edu
- Office hours: M/W 4:30pm – 6:00pm
- Office: Blackboard Collaborate Ultra (linked off 'Tools' menu), or in-person by appointment

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:

- 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", 8th Edition, Pearson, 2021
- 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):

- Na Wang
- 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 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:
 - Homeworks and labs (30%)
 - To be done individually
 - Programming assignments (30%)
 - 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 in the course 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.
 - Use of public code repositories such as GitHit, GitLab, or any other 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 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.
- Safe Return to Campus Statement
 - *All students taking courses with a face-to-face component are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (<https://www2.gmu.edu/safe-return-campus>). Similarly, all students in face-to-face and hybrid courses must also complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, Red, or Blue email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you*

suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

- *Students are required to follow Mason's current policy about facemask-wearing. As of August 11, 2021, all community members are required to wear a facemask in all indoor settings, including classrooms. An [appropriate facemask](#) must cover your nose and mouth at all times in our classroom. If this policy changes, you will be informed; however, students who prefer to wear masks either temporarily or consistently will always be welcome in the classroom.*
- *In the event that any student in the course fails to adhere to George Mason guidelines, sessions of the class will be moved to virtual instruction. This will be done to ensure the health and safety of the students and staff, and maybe impromptu if non-compliance cannot be corrected. Students must, therefore, be prepared to attend virtual instruction on any given day. As much notice as is possible will be given.*
- Campus Closure
 - *If the campus closes or class is canceled due to weather or other concern, students should check Blackboard [or other instruction as appropriate] for updates on how to continue learning and information about any changes to events or assignments.*
- Basic Course Technology Requirements
 - *Activities and assignments in this course will regularly use the Blackboard learning system, available at <https://mymason.gmu.edu>. Students are required to have regular, reliable access to a computer with an updated operating system (recommended: Windows 10 or Mac OSX 10.13 or higher) and a stable broadband Internet connection (cable modem, DSL, satellite broadband, etc., with a consistent 1.5 Mbps [megabits per second] download speed or higher. You can check your speed settings using the speed test on that website.)*
- Course Materials and Student Privacy

Video recordings of class meetings that are shared only with the instructors and students officially enrolled in a class do not violate FERPA or any other privacy expectation. Video recordings that only include the instructor (no student names, images, voices, or identifiable texts) may be shared without violating FERPA (but see below, University Policies: Privacy, for some qualifications and recommendations)

 - *All course materials posted to Blackboard or other course site are private to this class; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class.*

- Video recordings — whether made by instructors or students — of class meetings that include audio, visual, or textual information from other students are private and must not be shared outside the class
- Live video conference meetings (e.g. Collaborate, WebEx, Zoom, etc.) that include audio, textual, or visual information from other students must be viewed privately and not shared with others in your household or recorded and shared outside the class
- Some/All of our synchronous meetings in this class will be recorded to provide necessary information for students in this class. Recordings will be stored on Blackboard [or other secure site] and will only be accessible to students taking this course during this semester.
- The [**School of Integrative Studies**](#), an intentionally inclusive community, promotes and maintains an equitable and just work and learning environment. We welcome and value individuals and their differences including race, economic status, gender expression and identity, sex, sexual orientation, ethnicity, national origin, first language, religion, age, and disability.
- As a faculty member and designated “Responsible Employee,” I am required to report all disclosures of sexual assault, interpersonal violence, and stalking to Mason’s [Title IX Coordinator](#) per [university policy 1412](#). If you wish to speak with someone confidentially, please contact the [Student Support and Advocacy Center](#) (703-380-1434) or [Counseling and Psychological Services](#) (703-993-2380). You may also seek assistance from [Mason’s Title IX Coordinator](#) (703-993-8730; titleix@gmu.edu).
- Students must use their MasonLive email account to receive important University information, including communications related to this class. I will not respond to messages sent from or send messages to a non-Mason email address.