CS 555 – Computer Networking

Master of Science in Computer Science

Course Information

Course Section:
Course Term: Fall 2023

PROGRAM OBJECTIVES

1. **Foundations of Computer Science**: apply mathematical foundations and algorithmic principles in the modeling and design of computing systems.
2. **Computer Systems Fundamentals**: apply fundamental concepts in computer systems to model, design, and implement a computer-based system, process, or program that meets desired needs.
3. **Information Processing Fundamentals**: apply fundamental concepts in information processing to model, design, and implement a computer-based system, process, or program that meets desired needs.
4. **Advanced Computer Systems**: use advanced concepts in computer systems to design, implement, and evaluate a computer-based system, process, component, or program.
5. **Advanced Information Processing**: use advanced information processing concepts to design, implement, and evaluate a computer-based system, process, component, or program.

COURSE DESCRIPTION

Techniques and systems for communication of data between computational devices and layers of Internet Protocol Suite. Topics include role of various media and software components, local and wide area network protocols, network design, performance and cost considerations, and emerging advanced commercial technologies. Emphasizes TCP/IP family of protocols

Prerequisites: (CS 310 and 330) or (INFS 501, 515, 519, SWE 510) or equivalent

Each student enrolled in this class certifies that she/he has the prerequisites listed above.

COURSE METHODOLOGY

Each week, learners will:

- Study content in Blackboard, including lectures, tutorials, and interactive activities and discussion boards.
- Practice writing code in order to fulfill the programming assignments requirements.
- Work on assignments and programming projects.

COURSE OBJECTIVES

After completing the course, learners will be able to:

- Recognize the different components of a computer network and network functionality
- Recognize the main design issues of transport protocols and the mechanisms used to control traffic flow and congestion and provide robust data delivery.
- Identify the TCP/IP protocol suite and its characteristics.
- Analyze the rationale and workings of the different network layers: The Application Layer, the Transport Layer, the Network Layer, and the Data Link layer.
- Evaluate feasibility of LAN configurations and Medium Access Protocols.

- Apply the concepts of layered TCP/IP architecture in understanding how packets are transmitted and received over the Internet.
- Evaluate and implement the workings of the main Internet protocols such as HTTP, DNS, TCP, UDP, IP, ARP, and ICMP.
- Recognize and apply NATing and how it allows the communication among private IPs.
- Implement network applications using socket programming with TCP and UDP.
- Design and implement Internet addresses utilizing the common CIDR format.
- Design hybrid networks with IPv4 and IPv6 based routing.
- Recognize and analyze software defined networks and their contribution to the Internet protocol suit at Layer 4
- Analyze Wireless Links and wireless network characteristics in the context of the WiFi: 802.11 wireless LANs protocol
- Analyze the mobility principles and management in the context of the 4G/5G networks
- Recognize and evaluate mobility and its impact on higher-layer protocols
- Recognize the fundamentals of security: confidentiality, authentication and integrity
- Analyze and investigate attacks on authentication and message integrity
- Analyze and investigate securing the protocols used in the e-mail application
- Understand and investigate securing TCP connections at the transport layer using TLS
- Analyze and investigate securing the network layer: IPsec and the wireless and mobile networks security

Instructor Information

Refer to the Blackboard course shell for section-specific instructor contact, biography, and office hours information.

Course Resources

TEXTBOOKS AND READINGS

REQUIRED:

- **Textbook—The course schedule lists readings from:** *Computer Networking, a top down approach*, 8th (eighth) Edition, ISBN: 9356061319 by James Kurose, Keith Ross, Pearson (2022)

Recommended reading:

- *Internetworking with TCP_IP Volume One. Principles, Protocols, and Architecture,* Sixth Edition, ISBN: 013608530X, Douglas E. Comer - Addison-Wesley (2013)

COMPUTER REQUIREMENTS

HARDWARE

You will need access to a Windows or Macintosh computer with at least 2 GB of RAM and to a fast, reliable broadband Internet connection (e.g., cable, DSL). The recommended computer monitor and laptop screen size is at least 13 inches. Computer speakers or headphones are recommended for recorded content. A headset microphone is recommended for live audio sessions using course tools like Blackboard Collaborate. Computer hard disk space must allow for:

- Installing the required and recommended software.
- Saving your course assignments.

For hardware and software purchases, visit Patriot Computers.

You are strongly encouraged to back up all contents of your computer on a regular basis. Loss of data will not excuse late or unsubmitted assignments.

SOFTWARE

Software applications include the following:

- Web browser (See Blackboard Support for supported web browsers)
- Adobe Acrobat Reader (free download)
- Microsoft Office (purchase)
- Blackboard Collaborate (select from the course menu)

UPDATING YOUR COMPUTER

Please be sure to update your computer and prepare yourself to begin using the online format BEFORE the first day of class.

COMPUTING RESOURCES REQUIRED FOR THIS COURSE

- Wireshark, a free/shareware packet sniffer that runs on Windows, Linux/Unix, and Mac computers: Wireshark packet sniffer.
- Apache NetBeans 18: https://netbeans.apache.org/download/nb18/
    - Or Python 3.11.4: https://www.python.org/downloads/

Grading Information

GRADING SCALE

The following table describes the grading system:

GRADE	PERCENTAGE
A	90 or higher
B	75 or higher
C	60 or higher

A score of 90% or higher guarantees an A grade, 75% or higher a B grade, and 60% or higher a C grade. Late homework and project submission are NOT allowed. A submission is considered on time if submitted electronically on Blackboard on or before required submission date/time.

LETTER GRADING DESCRIPTIONS:

Listed below are grades and academic standards for each grade awarded.

A. Consistently performs above and beyond the course/assignment requirements
B. Meets and occasionally exceeds the course/assignment requirements
C. Minimally meets the course/assignment requirements
F. Fails to meet the course/assignment requirements

CATEGORIES AND WEIGHTS

The following table lists the types of graded activities in this course and each category's weight in the final course grade.

ASSIGNMENT CATEGORY	% OF OVERALL COURSE GRADE
Programming projects	30%
Assignments and Wireshark Labs, to be done individually	25%
Activities and discussions	5%
Midterm exam	10%
Final exam, cumulative	30%
TOTAL:	**100%**

LATE ASSIGNMENTS

Late homework and project submission are NOT allowed. A submission is considered on time if submitted electronically on Blackboard on or before required submission date/time.

A submission is considered on time if submitted electronically on Blackboard on or before required submission date/time. The following are descriptions of the five assignment categories:

DISCUSSION BOARDS 2%

Participate in this discussions to get to discuss important topics related to the module, TA's will check these discussions for grading and to answer any ambiguous points.

ACTIVITIES 3%

The activities provided for each module are important to your understanding of the modules. The midterm and final exams involve questions similar to these activities. The guidelines of submissions are present in each activity description.

PROGRAMMING PROJECTS 30%

Programming assignments are very important for your understanding and real life implementaion of the different protocols presented in the course. These projects can be done in groups of two.

HOMEWORK ASSIGNMENTS 9%

You will be required to submit homework assignments in some weeks, as specified in the course schedule. Submit all homework assignments via Blackboard. The homework assignments reinforce your development of skill in applying key concepts and techniques. You will work on your assignments and received immediate feedback in a development environment;

For each assignment, review the corresponding assignment page in Blackboard for detailed instructions.

WIRESHARK LABS 16%

Follow the guidelines for each corresponding lab description and submit the required feedback as clearly provided in the corresponding pdf document.

Quizzes

Presented at the end of each chapter and are not graded. These quizzes serve as checks for your understanding of the material as we proceed in the course.

MIDTERM EXAM 10%

The Midterm Exam, due in Module 8, has the same structure as the Homework Assignments.

FINAL EXAM 30%

Like the Midterm Exam, the Final Exam has the same structure as the Homework assignments. This exam is due in Module 15.

Policies and Services

MASON HONOR CODE

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set forth this honor code:

Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

You are expected to familiarize yourself with and adhere to the Honor Code. Student members of the George Mason University community pledge not to cheat, plagiarize, steal, and/or lie in matters related to academic work.

For additional important information, including the Honor Code definitions of cheating, plagiarism, stealing, and lying, see the George Mason University Academic Integrity page.

All work performed in this course will be subject to Mason's Honor Code.

ACADEMIC INTEGRITY EXPECTATIONS

1. Working online requires dedication and organization. Proper preparation is expected every week. You are expected to log in to the course each week and complete the assignments and activities on or before the due dates.
2. Students must check their GMU email messages on a daily basis for course announcements, which may include reminders, revisions, and updates.
3. It is expected that you will familiarize yourself with and adhere to the Honor Code. Student members of the George Mason University community pledge not to cheat, plagiarize, steal, and/or lie in matters related to academic work.
4. It is essential that you promptly communicate any questions or problems to the instructor.

INDIVIDUALS WITH DISABILITIES

The university is committed to providing equal access to employment and educational opportunities for people with disabilities.

Mason recognizes that individuals with disabilities may need reasonable accommodations to have equally effective opportunities to participate in or benefit from the university educational programs, services, and activities, and have equal employment opportunities. The university will adhere to all applicable federal and state laws, regulations, and guidelines

with respect to providing reasonable accommodations as necessary to afford equal employment opportunity and equal access to programs for qualified people with disabilities.

Applicants for admission and students requesting reasonable accommodations for a disability should call the Office of Disability Services at 703-993-2474. Employees and applicants for employment should call the Office of Equity and Diversity Services at 703-993-8730. Questions regarding reasonable accommodations and discrimination on the basis of disability should be directed to the Americans with Disabilities Act (ADA) coordinator in the Office of Equity and Diversity Services.

EMAIL POLICY

Web: masonlive.gmu.edu

Mason uses electronic mail to provide official information to students. Examples include notices from the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. Students are responsible for the content of university communication sent to their Mason e-mail account and are required to activate that account and check it regularly.

Students are also expected to maintain an active and accurate mailing address in order to receive communications sent through the United States Postal Service

ADDITIONAL SERVICES AND POLICIES

UNIVERSITY POLICIES

Students must follow the university policies. See University Policies.

DIVERSITY

George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.

RESPONSIBLE USE OF COMPUTING

You are expected to adhere to the university policy for Responsible Use of Computing. See University Policies/Computing.

STUDENTS WITH DISABILITIES

Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester.

UNIVERSITY LIBRARIES

University Libraries provides Library services for distance students.

WRITING CENTER

The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing.

You can now sign up for an Online Writing Lab (OWL) session just as you may sign up for a face-to-face session in the Writing Center, which means YOU set the date and time of the appointment.

COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS)

The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance.

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)

The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights.

Course Schedule

Please check the course website for schedule and updates.