ECE 4400/6400 Section 001
Performance Analysis of Local Computer Networks
Spring 2021

Section	001
Meeting Time	9:30am – 10:45am, Tuesday and Thursday
Room	Fike G17
Webpage	Canvas
Instructor	Prof. Harlan B. Russell
Office	316 Fluor Daniel Building (EIB)
Email	harlanr@clemson.edu
Office Hours	Thursday/Friday, 3:30-5:00pm Other times by appointment
Course Modality	MODIFIED TRADITIONAL
Prerequisites:	ECE 2720 and ECE 3170
Required textbook:	Joseph Hammond and Peter O'Reilly, Performance Analysis of Local Computer Networks, Addison Wesley, 1986, ISBN 0-201-11530-1. The book is out of print. University Bookstore sells a photocopied version. Used copies are also available from bookstores on the Internet.
Optional supplement:	1. W. Stallings, Local and Metropolitan Area Networks, 6th ed., Prentice Hall, 2000. 2. A. Tannenbaum, Computer Networks, 3rd ed., Prentice Hall, 1996

Introduction and Course Objectives

Computer networks are an essential component of modern day computing infrastructure. In recent years, a multitude of computer network technologies have formed a global infrastructure that pervasively interconnects a broad range of devices, systems, people, and communities in unprecedented ways. From day-to-day personal applications, government, commerce, and societal operations, to research computing, they all depend on the reliable operation and performance of the computer networks. They are the lifelines of our modern day world.

All networks around the globe and in every aspects of our society, while based on a wide range of different networking technologies, are built with local computer networks as the basic building blocks. Regardless of the technology of choice, local computer networks' operation and

performance characteristics can be captured in a few simple models applicable to statistical analyses. Effective use of the analytical models allows one to evaluate computer networks and to design computer networks for specific purposes and constraints.

Offered in spring 2021 to senior undergraduate students and entry graduate students, the course introduces basic networking concepts and methods for modeling and analyzing the performance of local computer networks. Building on random process concepts and basic probability, basic queueing models are constructed and analyzed. The effect of performance requirements on the choice of network solutions is considered, standard architectures and protocols are examined, and practical examples are discussed in the course. Emerging software defined networking (SDN) technology and tools will be used throughout the course for students to directly observe and experiment network performance issues on real networks at varying scales.

By the end of the course, students are expected to be able to:

- Identify standard architectures and protocols of local computer networks
- Utilize standard network models and probabilistic traffic models to analyze local computer networks
- Carry out mathematical calculations required in statistical analyses, including calculus, probability functions, logical and numerical algebra
- Determine suitable models, performance measures, and design factors of local computer networks
- Utilize software defined networking tools to compose and study network protocols and performance

Tentative outline

1.	**Review of probability and Calculus**	(notes)
2.	**Introduction to Networks**	(Chap.1)
3.	**Protocols and network architecture**	(Chap.10)
4.	**Introduction to local area networks**	(Chap.5)
5.	**Data flow in networks and queues**	(Chap.3)
6.	**Principles of medium access control**	(Chap.6 and notes)
7.	**Ring networks and Token based MAC**	(Chap.7 and 8)
8.	**Exams**	(1 week)

Assignments

In this course, assignments consist of in-class quizzes, homework, projects, and exams.

Quizzes

There will be a single quiz at the beginning of the semester on probability. It will be given after an in-class probability review.

Homework
There will be homework assignments given periodically throughout the semester. All problem sets are due at the time and date specified on the assignment. No late assignments will be accepted. These assignments are designed to allow you to practice the material discussed in class and in the text. Collaboration on homework assignments is permitted and encouraged; however, all students must submit individual assignments. Copying of solutions from other classmates or other sources will be considered academically dishonest and will not be accepted.

Guided Projects
There will be two guided projects given during the course. The guided projects are designed for students to learn hands-on skills for network performance measurement over real network testbeds.

Midterm Exams
There will be two midterm exams given approximately 1/3 and 2/3 of the way through the semester, respectively. **The second exam is cumulative**. **No make-up exams** will be given unless an acceptable reason is presented to the instructor at least one week prior to the exam date.

Testing will be online using Canvas tools. Details to be provided near exam times. In the event of an emergency, the student must make direct contact with the instructor before an exam takes place or an assignment is due, preferably via email. If it is not possible to make arrangements before the scheduled event, then the student must contact the instructor as soon as it is safe and reasonable to do so. It is the student's responsibility to secure documentation of emergencies.

Final Project
Instead of a final exam, the course requires a final project that demonstrates the understanding of network performance analysis and software tools. The topic is proposed by the student(s) and approved by the instructor, and the topic can be in a wide range of possible contexts. Detailed requirements will be announced. The final project requires a final report, due on the last scheduled lecture, and a final presentation due at the University scheduled final exam time, which is Wednesday April 28, 8-10:30am.

Re-grade Policy
Any re-grade request of an assignment or exam must be submitted in writing one week from the time the graded item is returned.

Grades

Grades will be weighted as follows:

- 2% Probability quiz
- 8% Homework
- 20% Projects
- 20% First midterm exam
- 20% Second midterm exam
- 30% Final project

ECE 6400 students will have additional homework, exam questions, and reading assignments beyond those given to ECE 4400 students.

All grades will be kept on Canvas (https://clemson.instructure.com). It is your responsibility to ensure all your grades are correct.

Attendance Policy:

As a modified traditional course, attendance is not mandatory, but highly encouraged. Note students who are attending in-person classes in traditional courses and are not approved to be online for all spring semester are expected to return to in-person attendance once cleared by the University. Students that must quarantine/isolate will not suffer any grade penalties associated with their physical absence from in-person classes.

In person attendance is optional on days a student is to come physically. You are expected to participate synchronously in all lectures either in person or online. If you miss class, you are responsible for the material covered in the lecture and for any assignment made.

To maintain physical distancing, individuals arriving first to the classroom should sit farthest from the door. Similarly, at the conclusion of class, students closest to the door should leave first.

While on campus, face coverings are required in all buildings and classrooms. Face coverings are also required in outdoor spaces where physical distance cannot be guaranteed. If a student does not have a face covering or refuses to wear an approved face covering without valid documented accommodation, the instructor will ask the student to leave the academic space and may report the student's actions to the Office of Community & Ethical Standards as a violation of the Student Code of Conduct. If the student's actions disrupt the class to the extent that an immediate response is needed, the instructor may call the Clemson University Police Department at 656-2222.

For a student who reports testing positive or is being asked to quarantine because of exposure to the COVID-19 virus, it will be up to the student to inform the instructor that they will be moving to online only instruction for at least the next two weeks. Students are directed to use the Notification of Absence form in Canvas to initiate this notification, which can be found under the "Help" button on the left navigation. Additional communication via email is encouraged; students should follow up with their instructor to develop a continued plan of study for each course. Students cannot be penalized in their grade for needing to move to online instruction

Notification of Absence

The Notification of Absence module in Canvas allows students to quickly notify instructors (via an email) of an absence from class and provides for the following categories: court attendance, death of family member, illness, illness of family member, injury, military duty, religious observance, scheduled surgery, university function, unscheduled hospitalization, other anticipated absence, or other unanticipated absence. The notification form requires a brief explanation, dates and times. Based on the dates and times indicated, instructors are automatically selected, but students may decide which instructors will receive the notification. This does not serve as an "excuse" from class, and students are encouraged to discuss the absence with their instructors, as the instructor is the only person who can excuse an absence. If a student is unable to report the absence electronically, he/she may call the Office of Advocacy and Success at 864-656-0935 for assistance and guidance.

The Office of Advocacy and Success also assists students in identifying various appropriate methods of documenting absences and assists families in using the electronic Notification of Absence system when students are unable to do so themselves.

Class Cancellation Policy:

Class is cancelled if the instructor is more than 15 minutes late to class.

Academic Continuity Plan

In the event the physical classroom facility becomes unavailable, as determined by the University's administration, class will be conducted in a virtual (online) format. The University issues official disruption notifications through email /www /text notification/social media. When notified, use one of the following links to navigate to Clemson Canvas where you will find important information about attending class:

- Primary access link: https://www.clemson.edu/canvas
- Secondary access link, if needed: https://clemson.instructure.com/
- You can also use the Canvas Student App.

Inclement Weather Policy

Any exam that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless contacted by the instructor. Any assignments due at the time of a class cancellation due to inclement weather will be due at the next class meeting unless contacted by the instructor. Any extension or postponement of assignments or exams must be granted by the instructor via email or Canvas within 24 hours of the weather related cancellation

Accessibility Statement

Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing studentaccess@lists.clemson.edu. Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: http://www.clemson.edu/campus-life/campus-services/sds/.

Title IX Statement:

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The University is committed to combatting sexual harassment and sexual violence. As a result, you should know that University faculty and staff members who work directly with students are required to report any instances of sexual harassment and sexual violence, to the University's Title IX Coordinator. What this means is that as your professor, I am required to report any incidents of sexual harassment, sexual violence or misconduct, stalking, domestic and/or relationship violence that are directly reported to me, or of which I am somehow made aware. There are two important exceptions to this requirement about which you should be aware:

> Confidential Resources and facilitators of sexual awareness programs such as "Take Back the Night and Aspire to be Well" when acting in those capacities, are not required to report incidents of sexual discrimination.
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> Another important exception to the reporting requirement exists for academic work. Disclosures about sexual harassment, sexual violence, stalking, domestic and/or relationship violence that are shared as part of an academic project, a research project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX Coordinator.

This policy is located at http://www.clemson.edu/campus-life/campus-services/access/title-ix/ . Ms. Alesia Smith is the Executive Director for Equity Compliance and the Title IX Coordinator. Her office is located at 223 Holtzendorff Hall, phone number is 864.656.3181, and email address is alesias@clemson.edu.

Safe Campus:

Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

a. Ensure you are signed up for emergency alerts (https://www.getrave.com/login/clemson)
b. Download the Rave Guardian app to your phone (https://www.clemson.edu/cusafety/cupd/rave-guardian/)
c. Learn what you can do to prepare yourself in the event of an active threat (http://www.clemson.edu/cusafety/EmergencyManagement/)

Copyright Statement:

Modification Statement:

The instructor reserves the right to modify any aspect of the syllabus at any time during the semester for reasons including but not limited to COVID-related situations.

Date of last update: January 6, 2021.