CS555 Computer Communications and Networking

Section 001 Fall 2018: Monday 19:20 - 22:00, Innovation Hall 134

Last Revised 10-21-2018

Professor: Dr. J. Mark Pullen
Mail drop: CS Dept, 4301 Engineering Building
Office hours Mondays 16:00 to 18:00; also by appointment any mutually convenient time
   (optionally, via Internet conferencing)
Preferred contact is email: mpullen@netlab.gmu.edu

TA: Zhaozhuo "Alan" Li
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Current Catalog 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.

Textbook
* Larry Peterson and Bruce Davie, Computer Networks, A Systems Approach, 5th Edition, Morgan-Kaufmann
* Pullen, Understanding Internet Protocols, Wiley, 2000 (out of print; available online to CS555 students)

References
Stallings, Data and Computer Networks 9th Ed. Prentice-Hall, 2010 (older editions also useful)

Course Outcomes
1. Explain basic electrical engineering principles that enable communication at the physical layer
2. Demonstrate an understanding of wired and wireless data link layer protocols for shared medium and point-to-point communication
3. Demonstrate an understanding of the graph theory concepts required for unicast and multicast routing
4. Demonstrate an understanding of distributed routing protocols
5. Describe how protocols and applications use ARQ algorithms for distributed reliability
6. Demonstrate an understanding of end-to-end transport layer protocols and basic Web prototcols
7. Explain basic concepts in cryptography and networking security protocols.
8. Illustrate fundamental understanding of networking by programming portions of the network protocols stack.
9. Demonstrate a basic understanding of performance analysis for computer networking
10. Demonstrate a basic working vocabulary of data communications and networking terminology

Prerequisites by Topic
Grade of C or better in CS 310 (Data Structures)
Grade of C or better in CS 367 (Computer Systems and Programming)
Grade of C or better in STAT 344 (Probability and Statistics for Engineers and Scientists)
These will not be waived nor accepted as co-requisites; however equivalent study or experience elsewhere may be accepted at the instructor's discretion.

Major Topics Covered in the Course
1. OSI 7-layer model
2. Flow/error control
3. Medium access control
4. Ethernet
5. Routing
6. Multicasting
7. Internet architecture

8. TCP/UDP protocols
9. Multimedia networking and the WWW
10. Network cybersecurity

The grading breakdown is as follows:
* 5% Quizzes
* 45% Projects
* 20% Midterm exam
* 30% Final exam

Project: We will use the Java Network Workbench 2 (JNW2), software developed at GMU that simulates a protocol stack and displays the results, using a text interface. Students will create modules for Internet stack layers and run them in the JNW2 environment, as described in the text by Pullen. JNW2 will be available for download through the CS555 Moodle page http://disted.c4i.gmu.edu. Well commented code must be submitted for grading via an upload link on the Moodle page. Student problems with the project are to be addressed to the TA, who may refer them the instructor if needed.

Project credit breakout: DLC1, DLC2, DLC3, LAN1, WAN1, WAN2, WAN3, TRN1, TRN2 five points each; extra credit assignment to be announced, up to five points.

Missed exams/quizzes/assignments must be arranged with the instructor BEFORE the exam date.

Quizzes will be held during class, on dates chosen at random, and will cover content of the previous class and reading assignment for the current class.

All assignments are due by start of class on assigned date. Late assignments lose 10% per class credit. No project submission will be accepted after 12/10/2018.

All students are expected to abide by the Honor Code as stated in the GMU catalog and elaborated for Computer Science. Students should be aware that their submissions may be checked by plagiarism detection software.

Grading is proficiency-based (no curve), cutoffs will be in the vicinity of (but not higher than) A 93; A- 90; B+ 87; B 83; B- 80; C+ 75; C 70.

Extra credit is available by doing assigned extra project work; however, no student who fails the final exam will receive a grade higher than C, regardless of extra credit earned.

SYLLABUS (subject to revision)
date and topic/readings in Peterson text/project assignment

8-27 Course introduction; network concepts; 7-layer and 5-layer models; data comm basics / Sections 1.1 to 1.4 / JNW2 Setup introduced

9-3 No class (Labor Day)

9-10 Physical layer: analog and digital telecommunications / Section 1.5, 2.1, 2.2 / Project DLC1: bit stuffing introduced

9-17 Data compression, security principles, integrity, appropriate use / Sections 2.3, 2.4 & 7.2 / Project DLC2: CRC introduced

9-24 Data link control; discrete event simulation / Section 2.5 / Project DLC3: ARQ introduced; Project DLC1 due

10-1 Local area networks / Sections 2.6 and 2.7 / Project LAN1: CSMA/CD LAN introduced; Project DLC2 due

10-9 (NOTE: this is a Tuesday) Network Layer: WANs, X.25, routing / Chapter 3 except Section 3 / Project WAN1 introduced; Project DLC3 due

10-15 mid-term exam (covers first five lectures)

10-22 Internet Architecture (IPv4); Metcalfe's Law; IPv6 / Section 3.3, Chapter 4 / Project WAN2 and WAN3: Forwarding and Routing introduced; Project LAN1 due

10-29 Network queueing basics; transport layer: TCP and UDP / Chapter 5 & Sections 6.1 to 6.4i Projects TRN1 and TRN2: Reliable Transport introduced / Project WAN1 due

11-5 Multicast, multimedia and ATM networking (online presentation) / Chapter 4; Section 6.5; Chapter 7 / extra-credit assignment introduced / Project WAN2 due

11-12 Network Security Technology and Network Management (guest lecture) / Chapter 8 / Project WAN3 due

11-19 recorded mini-course in WebApps programming by prof, via Moodle/MISTC

11-26 no class; work on projects / Project TRN1 due

12-3 Higher layer protocols and Future of the Internet / Chapter 9 / Project TRN2 due

12-10 Extra credit project due; no project work accepted after 19:20 on this day

12-17 Final exam (comprehensive) / all chapters listed above / *Exam location: classroom*

Course communication: we will use email extensively. Students are responsible to read GMU email accounts daily. Announcements will be sent to the class email list, which consists of GMU email accounts.

Course notices and assignments will be provided via email using GMU accounts only. Course materials (for example, homework solutions) will be available though the course Moodle page, http://disted.c4i.gmu.edu. Students are responsible for assigned readings and all material outlined in lecture slides.

Lectures will be presented using the MIST/C distance education tool set and captured in recordings that will be available to students registered in CS555.

University Requirements
Honor Code Statement.

Students with 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 of Disability Services (SUB I, Rm. 222; 993-2474; www.gmu.edu/student/drc) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.