ECE/CSC 570 – Computer Networks
North Carolina State University, Spring 2018

Classroom   : EB1-01011
Class Time   : Mondays and Wednesdays, 1:30 PM - 2:45 PM
Faculty   : Ismail Guvenc
Office Hours   : Wednesdays, 3:00 PM – 4:30 PM (or by appointment)
Course Site   : https://sites.google.com/site/ece570spring2018/
Email   : iguvenc@ncsu.edu
Teaching Assistant : TBA
TA Office Hour/Location : TBA
Pre-requisites   : An introductory course in probability
Textbook   : Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks (5e)", Prentice Hall, PTR, Copyright: 2011. ISBN-10: 0132126958, ISBN-13: 9780132126953.

Course Objective

To impart to the student an understanding of the fundamental concepts of computer networking, knowledge of the basic taxonomy and terminology of the computer networking area. To allow the student expertise in some specific areas of networking. The stress is on theoretical and conceptual development rather than practical experience with specific technologies.

Topics to be Covered (Tentative)

- Introduction (~5 lectures)
    - Packet Switching vs Circuit Switching
    - What is a protocol
    - Delays (transmission, propagation, queueing, processing,[access])
    - Throughput
    - Building blocks
        - Components (hosts, servers, routers, switches)
        - Services (applications)
    - Layers
    - Multiplexing/Demultiplexing (in the stack)
    - Virtualization - bandwidth, interfaces, switches, functions (routing, forwarding)
    - Data plane vs control plane
- Layer 1, Physical Layer (~5 lectures)
    - Modulation
    - Nyquist, Shannon
    - TDMA, FDMA, CDMA
    - Wired and wireless examples (Ethernet, WiFi, Cellular, DOCSIS, ADSL)
- Probability Basics (1 lecture)
    - Probability distributions

- o Bayes' theorem, examples
- Layer 2, MAC Layer (~8 lectures)
  - o Forward error correction (FEC)
  - o Automatic Repeat Request (ARQ)
  - o [Aloha, S-Aloha], CSMA, CSMA/CD
  - o Router internals (I/O Ports, switching fabric, scheduling)
  - o Wired and wireless examples, same systems as L1
    - ▪ Learning bridges, need for STP, but no STP
    - ▪ VLANs
- Layer 3, Network Layer (~4 lectures)
  - o (Generalized) forwarding - forwarding tables
  - o Routing algorithms (Dijkstra, Bellman-Ford)
  - o Hierarchical routing (concept)
  - o SDN Introduction
  - o Virtualized routing
- Layer 4, Transport Layer (~2 lectures)
  - o Services
    - ▪ End to end connection
    - ▪ Flow control
    - ▪ Congestion control
    - ▪ Reliable transmissions
  - o Congestion control principles
    - ▪ Definition, causes
    - ▪ Generic solutions
    - ▪ L2, L3, L4, L5 solutions
- Security (~2 lectures)
  - o Services (authentication, non-repudiation, encryption)
  - o Symmetric Key (block and stream)
  - o Asymmetric Key (RSA)

Grading Scheme and Scale

Grading:	Grading Scale:		
▪ Homeworks: 20%	▪ A+: Above 100	95 <= A <100	90 <= A- < 95
▪ Project: 20%	▪ 85 <= B+ < 90	80 <= B < 85	75 <= B- < 80
▪ Midterm: 25%	▪ 70 <= C+ < 75	65 <= C < 70	60 <= C- < 65
▪ Final (comprehensive): 35%	▪ 55 <= D+ < 60	50 <= D < 55	45 <= D- < 50
▪ Piazza Participation (Extra Credit): 3%	▪ F: Below 45		

Homework Policy

1. There will be a total of 5 homeworks throughout the semester.

2. Homeworks will be due in class or online - via Wolfware submit (hard copies due at 1:30 pm beginning of the class on homework's due date, while online submission due midnight).

3. Late homework assignments will receive a 50% penalty for being up to one day late, and no credit at all if submitted later than one day after the deadline.

4. If you missed the deadline for the homework by less than one day, email the homework to me and the TA and take the 50% penalty.

5. There will be no partial credit for parts of the homework problems. E.g. if a homework assignment has 2 problems with 2 parts each, the score for that homework can be 0,1,2,3 or 4 out of 4. Only the parts that are worked out completely and correctly will be credited.

6. Every homework assignment will have an equal weight.

Course Project

General Information:

- Course project will be a group project and each group will consist of 4 students.

- There will be three types of course projects:

  1. Survey: Choose a contemporary computer networking topic, read some recent papers related to your selected topic, and prepare a survey covering these papers. While some suggested topics will be provided by the instructor (available in a first-come first-serve basis), you can also propose your own survey topic that may be of higher interest to your group.

  2. Wireshark Simulations: Implement 6 Wireshark experiments at your own pace, prepare a project report to present your findings at the end of the semester

  3. NS3 Simulations: Choose a contemporary area of computer networks, and run simulations/experiments in this area (e.g., using NS3, Opnet, GENI, Wireshark, GNU Radio, etc.), and report your findings. Again, while some suggested topics will be provided by the instructor, you can also propose your own topic.

Two project deliverable are expected (no partial credit will be given for late project submissions):

  1. A 1-page extended abstract (15%): ***Due February 5, 2018, in class***

  2. A final report (85%): ***Due May 4, 2018, in class***

Extended Abstract and Final Report Format:

- Extended abstract and final report should be written based on the IEEE conference paper template, and should be 5 to 6 pages (double-column, single spaced), which can be found in the following link:

    - http://www.ieee.org/conferences_events/conferences/publishing/templates.htm   (use of LaTeX over MS Word is strongly encouraged for writing your reports)

- Your 1-page extended abstract should include a summary of proposed work, and a plan (in table format) on how each group member will contribute to the project. Similarly, your final report should include an appendix section that briefly describes who worked on which part of the project.

- All used references should be explicitly cited within your report. Plagiarism (e.g., copy/paste from Wikipedia or other papers without providing citations and changing wording) will be heavily penalized during grading. Everything in your reports should be in your own words.

Course Policies

- **Audit students** need to do all the homeworks and take the midterm exam, and have at least a B- from those in order to get a passing grade. They do not need to work on the project and take the final exam.
- **Academic Misconduct:** For work submitted, it is expected that each student will submit their own original work. Any evidence of duplication, cheating or plagiarism will be result in <u>at least a failing grade</u> for the course, and may be reported to NCSU for further action.
- Cell phones, communicators, MP3 players, head sets are not allowed to be used in class.
- If you have any questions regarding the homework, please see the TA first, and seek answers in online discussion forum of the course. If you still need clarifications after contacting the TA, you are welcome to contact me.
- There will be no make-up exams.

Tentative Course Schedule

	Dates	Topic	Homework Assigned	Homework Due	Project Deadlines
Week-1	Jan 8	Introduction			
	Jan 10	Introduction			
Week-2	Jan 15	Martin Luther King Day (No Class)			
	Jan 17	Introduction			
Week-3	Jan 22	Introduction	HW1		
	Jan 24	Introduction			
Week-4	Jan 29	Introduction			
	Jan 31	Layer 1 (Physical Layer)		HW1	
Week-5	Feb 5	Layer 1 (Physical Layer)	HW2		1-Page Project Proposals Due (15%)
	Feb 7	Layer 1 (Physical Layer)			
Week-6	Feb 12	Layer 1 (Physical Layer)			
	Feb 14	Layer 1 (Physical Layer)			
Week-7	Feb 19	Probability Basics		HW2	
	Feb 21	Layer 2 (MAC Layer)			
Week-8	Feb 26	Layer 2 (MAC Layer)	HW3		
	Feb 28	Layer 2 (MAC Layer)			
Week-9	Mar 5	Spring Break (No Class)			
	Mar 7	Spring Break (No Class)			
Week-10	Mar 12	Layer 2 (MAC Layer)			
	Mar 14	Layer 2 (MAC Layer)		HW3	
Week-11	Mar 19	Midterm Exam (Tentative)			
	Mar 21	Layer 2 (MAC Layer)			
Week-12	Mar 26	Layer 2 (MAC Layer)	HW4		
	Mar 28	Layer 2 (MAC Layer)			
Week-13	Apr 2	Layer 3 (Network Layer)			
	Apr 4	Layer 3 (Network Layer)			
Week-14	Apr 9	Layer 3 (Network Layer)	HW5	HW4	
	Apr 11	Layer 3 (Network Layer)			
Week-15	Apr 16	Layer 4 (Transport Layer)			
	Apr 18	Layer 4 (Transport Layer)			
Week-16	Apr 23	Security			
	Apr 25	Security		HW5	
	Apr 30	Final Exam (1-4PM, EB1 01011)			
	May 4				Final Project Reports Due (85%)