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# CS-3251-A: Computer Networking I

School of Computer Science, Georgia Tech

**Fall 2014**

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## Course Objectives

The main objective of this course is to provide students with a rigorous understanding of computer networking concepts, protocols and technologies. Even though we will cover the major Internet protocols in some detail, the emphasis will be on fundamental problems, ideas and algorithms. From this perspective, the architecture and protocols of the Internet are only a ``successful case-study'' among many others that were not so fortunate. Students will have the opportunity to design their own protocols, implement and test them over real networks, solve mathematical problems, and experiment with various network measurement and troubleshooting tools.

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## Instructor

[Prof. Constantine Dovrolis](#)

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Office hours: By appointment or after class

Email: [constantine@gatech.edu](mailto:constantine@gatech.edu) (but the best way to ask questions is through **Piazza**)

## Teaching assistant

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## Course Information

- Lectures: Tue and Thu - 9:35 - 10:55
  - Classroom: ES&T L1205
  - Prerequisite: CS2200
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## ``What's New'' and Important Reminders

- Midterm exam date: **October 2 (Thur), 9:30-11**
  - Final exam date: **December 9 (Tues), 8-11**
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## Textbooks

We will use the following two textbooks. The first (referred to as "KR" in the following) is our main textbook. The second (referred to "DC") is a short textbook for sockets programming. DC is available for either C or Java.

- Main textbook (KR): [Computer Networking, A top down approach featuring the Internet](#) by J. Kurose and K.Ross, Pearson, 6th edition.
  - Sockets programming (CD): [TCP/IP Sockets in Java: Practical Guide for Programmers](#) by K.L.Calvert and M.J.Donahoo, 2011, Morgan Kauffman. (Also available in C)
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## Syllabus (subject to minor changes)

- **Week-1:** *Course overview; Architectural layers, protocols and service models; Internet history*  
Readings: KR-1.1, KR-1.2, KR-1.3, KR-1.5, KR-1.7  
Install Wireshark on your laptop and learn how to use it
- **Week-2:** *Principles of network applications; An example of a simple protocol (TFTP); Finite-State Machines; Protocol specification; Transport services available to applications*  
Readings: KR-2.1, KR-2.3, CD-chp1, Finite-State Machines (Wikipedia or any other introductory source), RFC-1350  
Play with ping
- **Week-3:** *Sockets API; Network programming; DNS basics*  
Readings: KR-2.5, KR-2.7, CD-chp2  
Play with the DNS utilities nslookup or dig
- **Week-4:** *Transport Layer: Multiplexing applications; UDP protocol and unreliable datagram transport; Introduction to reliable data transport*  
Readings: KR-3.1, KR-3.2, KR-3.3, CD-chp3

Work on programming assignment-1

- **Week-5:** *Transport Layer: Reliable data transport; TCP basics; TCP connection management*  
Readings: KR-3.4  
Programming assignment-1 **DUE on Friday**  
Play with capacity estimation tools
- **Week-6:** *Transport Layer: RTT estimation; Flow control; Principles of congestion control*  
Readings: KR-3.5, KR-3.6  
Work on Homework-1  
Play with available bandwidth estimation tools
- **Week-7:** *Transport Layer: TCP congestion control; Midterm*  
Readings: KR-3.7  
Homework-1 **DUE on Tuesday**  
Play with TCP throughput measurement tools
- **Week-8:** *Network Layer: Forwarding and routing; Datagram vs virtual-circuit networking;*  
Readings: KR-4.1, KR-4.2  
Work on programming assignment-2
- **Week-9:** *Network Layer: What is in a router? The IP protocol*  
Readings: KR-4.3, KR-4.4  
Work on programming assignment-2 **Protocol specification DUE on Friday**  
Play with IP address/prefix allocation sites
- **Week-10:** *Network Layer: Link-State routing; Distance-Vector routing; Hierarchical routing*  
Readings: KR-4.5, KR-4.6  
Work on programming assignment-2  
Play with traceroute
- **Week-11:** *Network Layer: Interdomain routing; BGP; Multicast routing*  
Readings: KR-4.6, KR-4.7  
Homework-2 **DUE on Friday**  
Work on programming assignment-2  
Play with BGP mirror sites
- **Week-12:** *Link Layer: Error detection and correction; Multiple-Access Control (MAC) protocols, Switching*  
Readings: KR-5.1, KR-5.2, KR-5.3, KR-5.4  
Programming assignment-2 **Protocol implementation DUE on Friday**
- **Week-13:** *Link Layer: Wireless and cellular network access; 802.11*  
Readings: KR-6.1, KR-6.2, KR-6.3, KR-6.4  
Work on Homework-3  
Play with 802.11 monitoring tools

- **Week-14:** *Application Layer: The Web and HTTP; Email and SMTP; Peer-to-Peer applications*  
Readings: KR-2.2, KR-2.4, KR-2.6  
Homework-3 **DUE on Friday**  
Use Wireshark to understand how your email client or favorite p2p application works
  - **Week-15:** *Application Layer: Multimedia networking; Video streaming; Voice-over-IP*  
Readings: KR-7.1, KR-7.2, KR-7.3  
Use Wireshark to understand how the Netflix video player or how Skype works
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## Homeworks, Programming Assignments, and Wireshark Exercises

- **Homeworks:** We will have three homeworks throughout the semester. Each homework will include 3-4 problems that are of mathematical or algorithmic nature. Additionally, each homework will include a **Wireshark** exercise that you will do on your laptop.
  - **Programming assignments:** We will have two programming assignments. The first will be simpler than the second, and it will involve some basic sockets programming in Python, Java or C (you choose). The second assignment will be significantly more challenging: you will design your own protocol for reliable data transfers, write an RFC-like specification for that protocol, implement it, and demonstrate its operation across an unreliable network.
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## Grading

- *Midterm exam:* 25%
  - *Final exam:* 25%
  - *Homeworks and Wireshark exercises:* 15%
  - *Programming assignment 1:* 10%
  - *Programming assignment 2:* 25%
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## Miscellanea

- We will be using Piazza for all our interactions, Q&A, announcements, etc. No anonymous posts please.
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## Course Policies

- All work for this class is to be done individually. You are strongly urged to familiarize yourselves with the [GT Student Honor Code](#) rules. Specifically, the following is not allowed:
  1. Copying, with or without modification, someone else's work when this work is not meant to be publicly accessible (e.g., a classmate's program or solution).

2. Submission of material that is wholly or substantially identical to that created or published by another person or persons, without adequate credit notations indicating authorship (plagiarism).

You are encouraged to discuss problems and papers with others as long as this does not involve copying of code or solutions. Any public material that you use (open-source software, help from a text, or substantial help from a friend, etc...) should be acknowledged explicitly in anything you submit to us. If you have any doubt about whether something is legal or not please do check with the class Instructor or the TA.

- No late homeworks, assignments, or projects will be accepted. The deadline for each homework/assignment/project will be specified at the corresponding handout.
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