CSci551 Syllabus—FA2011, Friday Section

John Heidemann

August 11, 2011

Class meets Fridays, 9am to 11:50am, beginning August 26 and ending December 2. Thanksgiving break (for my class) is November 25 and the stop period does not intersect classroom days. The date and time of the final is Monday, Dec. 12, 11am–1pm.

Changes: This syllabus may be updated over the semester. The most recent version can always be found at the class Moodle site.

2011-05-24: no changes yet

Obtaining these papers: All of these papers are available from the CSci551 Moodle site (see URL above) in PDF format. Because they are copyrighted they are available only for classroom use. The Moodle site is only available to students with class-specific accounts to enforce this; to get an account, go to http://www.isi.edu/~johnh/cs551.html and follow the instructions, or contact the professor or TA.

You are encouraged to download and print the papers. Downloaded they take up about 95MB storage. You're encouraged to print them out and make notes on them as you go. Because there are many papers and many, many pages, you are strongly encouraged to use a double-sided printer. You will need a 3-inch binder if you keep them that way. (If you have to pay for printing, you may find it cheaper to get together with other students to print one copy and photocopy additional ones.)

Some of the papers were scanned. These tend to have large (2–5MB) PDF files, and may look slightly fuzzy when printed. Some of the papers may not display well in Acrobat on the screen, but they all should look reasonable when printed.

In SP2005 we tried making hardcopies of the papers available to students. Unfortunately, USC requires that we charge for these (to recover the duplication costs), and the copyright owners (ACM, IEEE, etc.) insist that if there is any charge, then they must get a copyright fee. The total fee for the entire paper set was well over $250, and it was still more than $100 even if the optional papers were eliminated. For this reason I do not plan to make hardcopies available.

In this syllabus, I indicate “new” by papers relative to my section of CSci551 from last year. (There will be other variations between my section and sections taught by other professors.)

Primary and Supplementary Papers: There are two groups of papers. We will discuss primary papers in class. The concepts and details from primary papers is fair game in exams. On the other hand, supplementary will not be discussed in class, and you are not required to know details from those papers for exams (although the concepts might, since they are networking papers). You are encouraged to read the supplementary papers if you're interested in an area. (Supplementary papers will also appear on homework 1.)

I am happy to take questions about either primary or supplementary papers in class or office hours.

1 Reference and background

Supplementary:
All of the textbooks are optional. Peterson and Davies and Keshav provide an overview of some of the topics we talk about. They provide helpful background and are generally broader and more consistent in their coverage of networking, but less deep on the subjects we cover in class.

General background about networking: [Peterson00a]


Sockets programming (useful for the project): [Stevens97b]


(The Stevens *TCP/IP Illustrated* books are also excellent references relating the RFCs to the BSD code, but are less useful for class.)

**Class 1** (Aug. 26):

Primary: Tips for reading papers: [Hanson99a]


Another viewpoint of paper reading [Jamin03a]


What to look for in a paper: [Levin83a]


---

## 2 Design principles

**Class 2** (Sep. 2):

Primary: The Internet architecture: [Clark88a]


Naming: [Saltzer82a]


The end-to-end argument: [Saltzer81a]
3 Unicast Routing

Class 3 (Sep. 9):

Primary:

Review of unicast and distance vector routing. (Will use class notes, plus please review your EE450 work.)

Potential routing problems: [Labovitz00a]


Routing stability and oscillation: [Shaikh00a]


Routing outages, results, and causes (NEW FA2011): [Wang06b]


Supplementary:

Supplement with detailed BGP information: [Stewart99a]

Class 4 (Sep. 16):

Primary:
Delay-tolerant networking: [Fall08a]


Routing hierarchy and policy: [Gao01b]


Supplementary:
Classic cases where policy choices in peerings result in oscillations: [Griffin99a]


4 Transport protocols, Congestion Control, and Queue Management

Class 5 (Sep. 23):

Primary: Congestion control from first principles: [Ramakrishnan90a]


TCP and congestion control: [Jacobson88a]


Modeling TCP: [Padhye98a]

Supplementary:
An early academic paper on TCP, prompting the 2004 Turning Award to its authors: [Cerf74a]


An alternative, delay-based approach to detect congestion (more recent “FAST TCP” builds on this much earlier work): [Brakmo94a]


Class 6 (Sep. 30): TCP follow-up. XCP and other transport protocols. Queue management. Fair queueing.
Primary: Active queue management, such as fair queueing: [Demers89a]


Random early detection: [Floyd93a]


XCP and non-TCP congestion control: [Katabi02a]


Supplementary:
Router buffer sizing: [Beheshti08a]


5 Differentiated and Integrated Services

Class 7 (Oct. 7):
Primary: Quality of service and admission control: [Shenker95a]


Lighter-weight QoS: [Stoica03a]

Supplementary:
Resource reservation and RSVP: [Zhang93a]


Use of QoS and differentiated services: [Davie03a]


6 Midterm

Class 8 (Oct. 14): midterm exam The midterm exam will be half of the class period, with lecture the other half.

7 Wireless and Mobile Networking

Class 9 (Oct. 21):

Primary:
MAC protocols: [Bharghavan94a]


DSR, an ad hoc routing protocol: [Johnson96c]


Non-IP routing in sensor networks: [Intanagonwiwat00a]


Wireless propagation characteristics: [Aguayo04a]


Supplementary:
TCP interactions with wireless: [Balakrishnan97c]

A survey of sensor net research: [Heidem04a]


8 Modeling Network Traffic

Class 10 (Oct. 28):

Primary:
Self-similarity in LAN traffic: [Leland94a]


And in WAN and web traffic: [Crovella97a]


Supplementary:
Interactions between network traffic and topology NEW FA2011: [Labovitz10c]


Packet-level network dynamics: [Paxson99b]


9 Large Scale Services and Cloud Computing

Class 11 (Nov. 4):

Primary:
While most of the class focuses on protocols that connect things, this class focuses on how one builds data services that can sit at one end of the connection. For more in this direction, see CSci555 (graduate operating systems).

Building large-scale services [Fox97a]

Data-parallel processing with map/reduce: [Dean04a]


Running an enterprise network: [Casado07b]


Supplementary:

Content distribution: [Freedman04a]


Supplemental to map/reduce:

Evaluation of Cloud computing (NEW FA2011): [Li10a]


10 Multicast Routing, Transport, and Applications

Class 12 (Nov. 11):

Primary:

Multicast routing (flood-and-prune, rendezvous): [Deering88b]


Reliable multicast and SRM: [Floyd97c]


File distribution and coding: [Byers98a]

Supplementary:
Multicast at the application layer: [Chu02b]


Layered multicast, congestion control, and multimedia/video: [McCanne96a]


Multimedia: [Bolot98a]


11 Network Security

Class 13 (Nov. 18):
Primary: Denial of service attacks: [Hussain03b]


Spam and anti-spam (NEW FA2011): [Levchenko11a]


Supplementary:
Spam countermeasures: [Xie08a]


Worms and viruses: [Moore03a]


Subverting routing with prefix hijacking: [Ballani07a]


Worm propagation: [Staniford02a]
(Note that, in this class, we intentionally do not do the cryptographic side of network security. There is coverage of that material in CSci555, Graduate Operating Systems, and most of CSci530, Security Systems, is about that.)

Unfortunately there is not time to talk about security and network protocols in CSci551. CSci555 provides a good coverage of security from an operating systems perspective; see the papers by Voydock and Kent and Needham and Schroder there.

12 Thanksgiving Break

Thanksgiving break and no class on Nov. 26.

13 Peer-to-peer storage

Class 14 (Dec. 2):

Primary:
Freenet and anonymous peer-to-peer file sharing: [Clarke02a]


Efficient peer-to-peer storage: [Stoica00a]


BitTorrent: [Bharambe06a]


Supplementary:
Novel routing with DHTs: [Caesar06a]


(This paper should be with routing, but we'll talk about it here because it assumes background about Chord.)
14 Current topics

Primary:

Wireless software radios: [Bahl09a]


Supplementary:

Network data collection and privacy: NEW FA2011 [McSherry10a]


Enterprise network fault diagnosis: [Kandula09a]


Peer-to-peer traffic loads and self-similarity: [Gummadi03a]


15 Other Topics

These are topics we cannot cover but that are considered in some similar network courses. All these materials are supplementary.

15.1 Router and hardware design

Supplementary:

Router design: [Partridge98a]


Modular hardware: [Anwer10a]


(NEW FA2011)

Optical networking: [Mukherjee00a]

15.2 Datacenter Networking

Supplementary: Optimizing a datacenter network: [Greenberg09a]


Data-center electrical usage: [Qureshi09a]


16 Final Exam

The final exam is Monday, December 12, 11am–1pm.