CS551 Syllabus—Spring 2007, Thursday Section

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January 3, 2007

Class meets Thursday, 9am to 11:50am, beginning January 11 and ending April 26 Spring break is March 15 and the stop period does not intersect classroom days. The date and time of the final is Tuesday, May 8, 8–10am.

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

3-Jan-07: fixed the P/S marking on last two primary papers.

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 (2–5 MB) 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 comparing what’s different relative to last year’s section of CSci551 I taught. (There will be slight variations with sections of CSci551 taught by other professors.)

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 (Jan. 11):

Primary: Tips for reading papers: [Hanson99a]


Another viewpoint of paper reading [Jamin97b]


What to look for in a paper: [Levin83a]


### 2 Design principles

### Class 2 (Jan. 18):

Primary: The Internet architecture: [Clark88a]


The Internet architecture, 10 years later: [Deering98a]

Naming: [Saltzer82a]


The end-to-end argument: [Saltzer81a]


Supplementary:
How “tussles” affect network architecture: [Clark02a]


NEW: Ways to design the next Internet? [Anderson05a]


3 Unicast Routing

**Class 3** (Jan. 25):

Primary:

Review of unicast and distance vector routing: [Narten89a]


 Stranger kinds of routing: [Tsuchiya88a]


 Potential routing problems: [Labovitz00a]


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Supplementary:
Supplement with detailed BGP information: [Stewart99a]


Synchronization problems in routing (but also applies much wider): [Floyd94b]


Class 4 (Feb. 1):

Primary:
Routing stability and oscillation: [Shaikh00a]


NEW: AS topology and effects on routing: [Muehlbauer06a]


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


4 Transport protocols, Congestion Control, and Queue Management

Class 5 (Feb. 8):

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]


A recent look at a two-bit feedback from routers: [Xia05a]


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


**Class 6** (Feb. 15): 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]

5 Differentiated and Integrated Services

Class 7 (Feb. 22):
Primary: Quality of service and admission control: [Shenker95a]


Lighter-weight QoS: [Stoica03a]


Supplementary:
Resource reservation and RSVP: [Zhang93a]


6 Wireless and Mobile Networking

Class 8 (Mar. 1):
Primary:
MAC protocols: [Bharghavan94a]


Ad hoc routing: [Johnson96c]


Non-IP routing in sensor networks: [Intanagonwiwat00a]

Wireless propagation characteristics: [Aguayo04a]


Supplementary:
TCP interactions with wireless: [Balakrishnan97c]


A survey of sensor net research: [Heidemann04a]


7 Midterm and Spring Break

Class 9 (Mar. 8): midterm exam The midterm exam will be half of the class period, with lecture the other half.

Spring break: March 15, no class.

8 Modeling Network Traffic

Class 10 (Mar. 22):
Primary:
Self-similarity in LAN traffic: [Leland94a]


And in WAN and web traffic: [Crovella97a]


Packet-level network dynamics: [Paxson99b]
9 Web Caching and Content Delivery

Class 11 (Mar. 29):

Primary:

Web caching and cache consistency: [Wolman99a]


NEW: Web search: [Brin98a]


Supplementary:

Transport Layer Security (used in https): [Dierks99a]


10 Multicast Routing, Transport, and Applications

Class 12 (Apr. 5):

Primary:

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

An alternate take at multicast: [Holbrook99a]


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 Security

Class 13 (Apr. 12):
Primary: Denial of service attacks: [Hussain03b]

Worms and viruses: [Moore03a]


Supplementary:
NEW Spam: [Ramachandran06a]


Worm propagation: [Staniford02a]


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 Peer-to-peer storage

Class 14 (Apr. 19):
Primary:
Freenet and anonymous peer-to-peer file sharing: [Clarke02a]


Efficient peer-to-peer storage: [Stoica00a]


Geographical peer-to-peer storage: [Ratnasamy02b]

Supplementary:
NEW BitTorrent traffic profiles: [Guo05a]


13 Current topics

Class 15 (Apr. 26):
Primary:
Peer-to-peer traffic loads and self-similarity: [Gummadi03a]


NEW: Novel routing approaches: [Caesar06a]


Supplementary:
Overlay networks: [Andersen01a]


Traffic engineering: [Feldmann00a]


Revisiting statistical multiplexing: [BenFredj01a]

14 Other Topics

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

**Supplementary:**
Router design: [Partridge98a]


Fast IP lookup in routers: [Degermark97a]


Optical networking: [Mukherjee00a]