Class meets Monday and Wednesday, noon to 1:50pm, beginning August 21 and ending November 29 (with a final exam on December 11 8). There will be no class on September 4 (Labor day) nor on November 22 (Thanksgiving recess). There will be no class September 27, when I have to travel for a PhD defense. We will have two short midterms at noon Sept. 20 and noon October 25. The date and time of the final is Monday, 2022-12-11, 8am–10am Friday, 2022-12-08, 11am–1pm (the mandatory university time for our class).

All students are expected to confirm they can make the midterms and final exams—we do not offer alternative dates.

All classes will be hybrid in-person and online via DEN’s web videoconferencing. I have an interactive lecture style and will do my best to adapt it to online class—I strongly encourage students to attend class synchronously and be prepared to comment during class to get the most out of class.

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

2023-08-18: No changes yet.

2023-08-19: The same papers, but shuffled slightly so each day has only one group of primary papers, and correct time of midterms.

2023-08-20: Correct time of final exam.

Obtaining class papers: All class papers are available from the CSci652 Moodle site (described below) 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 get a Moodle account, go to http://www.isi.edu/~johnh/cs652.html and follow the instructions, or e-mail the professor or TA.

The primary source of content for the class is these papers, so you will want to download the papers from the website and read them. Downloaded they take up about 95MB storage.

Class Pace: We will usually go over three or four papers or so per week, and occasionally more. The syllabus is designed to be slightly front-loaded, with the intent that we will run a paper or two (or sometimes a full class) behind for part of the semester.

Other class activities: This syllabus lists exams and papers. You should also expect a class project, typically in three parts (A, B and C), and several homework assignments (often 4, but at least 3 and no more than 6). Dates for these will be given as the semester progresses.

Please note that the class dates are when you are expected to have read the papers. At times during the semester we will probably be behind a couple of papers, but you are encouraged to stay with this syllabus for reading.
1 Reference and background

Class Week 1 (Aug. 21 and Aug. 23):


Primary: Tips for reading papers: [Hanson99a]


Finding and judging new ideas: [Heilmeier92a]


What to measure? Reverse engineering the Internet: [Spring03b]


No paper, but we will review and discuss: NABC talk presentation.

2 Design principles

Class Week 2 (Aug. 28 and Aug. 30):

The challenge of measuring (and simulating) the Internet:

[Floyd01a]


Sound internet measurement: [Paxson04a]


Ethics and network research: [Dittrich11a]


3 On-Path Estimation: RTT and Available Bitrate

Class Week 3 (Sep. 4—Labor Day holiday and Sep. 6—back to class):
No class Sept. 4 due to Labor Day, a USC holiday.

Estimating RTT in TCP: [Jacobson88a]


Estimating available bandwidth in BBR [Cardwell17a]


Packet pair: [Paxson97d]


Estimating packet loss: [Sommers05a]


Project B assigned Sep. 8, due October 15.

4 Topology

Class Week 4 (Sep. 11 and Sep. 13):

(Paris) Traceroute: [Augustin07a]


Building topologies: [Govindan00a]


IP Geolocation and CBG: [Gueye06a]


The physical topology: [Durairajan15a]

Supplemental: Geolocation validation applied to VPNs: [Weinberg18a]


Router geolocation and hostname hints: [Luckie21a]


Submarine cables: [Liu20a]


5 Routing and Autonomous Systems (ASes)

Class Week 5 (Sep. 18 and Sep. 20):

Short Midterm 1 will be the first 35 minutes of September 20.

WAN routing: [Paxson97f]


BGP background: [Caesar05a]


AS relationships: [Gao01b]


Supplemental: AS relationships, 15 years later: [Anwar15a]

BGPStream: processing BGP: [Orsini16a]


Class Week 6 (Sep. 25 and Sep. 27):

No class Sept. 27: the professor has to travel to attend a PhD defense.

Ground truth AS relationships: [Oliveira08a]


IXPs: [Ager12a]


Supplemental: AS-to-organizations: [Cai10c]


Class Week 7 (Oct. 2 and Oct. 4): More routing.

Anycast: [Vries17b]


CDNs: [Calder15a]


6 Trends in Routing and Peering

Class Week 8 (Oct. 9 and Oct. 11):

Project C assigned Oct. 13, due Nov. 18.

Hypergiants: [Labovitz10c]

Flattening of the Internet: [Chiu15a]


*Supplemental: IXP revisited: [Lutu21a]*


7 Reliability

Class Week 9 (Oct. 16 and Oct. 18):

Primary:

Internet outages: [Quan13c]


CDNs and outages: [Richter18a]


Partial reachability: [Baltra23a]


*Supplemental: Passive outages from darknets: [Guillot19a]*


## 8 Censorship

**Class Week 10** (Oct. 23 and Oct. 25):

**Short Midterm 2** will be the first 35 minutes of Oct. 25.

The great firewall and DNS: [Anonymous14a]


HTTPS in Kazakhstan: [Raman20a]


Application-level interference and ICLab: [Naiki20a]


*Supplemental: Uneven distribution of Internet access: [Weidmann16a]*


## 9 Security

**Class Week 11** (Oct. 30 and Nov. 1)

Spam: [Levchenko11a]


DDoS: [Moore01a]

Scanners: [Richter19a]


TLS from passive data: [Kotzias18a]


*Supplemental:* Booters (DDoS-as-a-Service): [Santanna15a]


DDoS from BGP: [Giotsas17b]


TLS Certificates: [Durumeric13b]


Malware: [Alrawi21a]


10 DNS and Services

**Class Week 12** (Nov. 6 and Nov. 8):

Traffic at the root: [Castro08a]


DNS under DDoS: [Moura16b]

Anycast in DNS and CDNs: [Koch21a]


Service discover: [Durumeric15b]


Supplemental: Defending DDoS with Anycast: [Rizvi22a]


Passive DNS databases: [Bilge14a]


Reverse DNS, passive and active: [Fiebig18a]


11 Traffic in the Aggregate

Class Week 13 (Nov. 13 and Nov. 15):

Self-Similarity: [Leland94a] and why [?]


Persistent congestion: [Dhamdhere18a]

12 Mobile and Wireless

Class Week 14 (Nov. 20 and Nov. 22): No Class Nov. 22 due to the Thanksgiving Holiday.

Wifi wireless networks: [Aguayo04a]


5G: [Narayanan21a]


Covid: [Lutu20a]


What’s inside your mobile provider? Regional access topologies: [Zhang21b]


13 Catch up and Hitlists

Class Week 15 (Nov. 27) and (Nov. 27)

We will have this week to catch up on any pending papers.

If we have time, we will cover these two papers:
IPv4 hitlists: [Fan10a]

IPv6 hitlists: [Gasser18a]


Supplemental: IP address assignment policies: [Padmanabhan20a]


Poster Session: we will have a poster session research projects on Nov. 29.

14 Final Exam

The final exam is Monday, December 11, 8am–10am and Friday, December 8, 11am-1pm.