CSE 461: Computer Networks

Spring 2023

Ratul Mahajan

Gaith Boksmati, Tapan Chugh, Mohan Kukreja, Xieyang Xu, Jason Zhang
Who we are
Ghaith Boksmati

Hometown: Jeddah, Saudi Arabia

Year: Undergrad senior, graduating this spring!

Some fun facts about me:

- Love swimming, skiing and hiking
- Entry-level techno fan
- Addicted to chess (and blundering)
- Doing my first open-water swim this summer!
Tapan Chugh

4th Year PhD Student
Research: Distributed/ML Systems

Hometown: Delhi, India

Some fun facts about me:
1. I have a dog (Stormy) and lots of food plants. Enjoy cooking
2. Love the PNW outdoors: hiking, biking, hanging out at parks
3. Frequently found in the IMA gym or playing table tennis
Mohan Kukreja
Hometown: New Delhi, India
Year: MS ECE (Spring 2024)
Some fun facts about me:

- Passionate about Software Development.
- Spends most of my screen time on leetcode
- I enjoy eating food and cooking meals
- Into soccer and cricket
- Previously served as a TA for this course last quarter also
Xieyang Xu

Born in Zhejiang, China

PhD CSE 4th Year

Xieyang enjoys foods, bouldering and building network systems!

Network systems Xieyang has built:

- ID Card that communicates via visible light
- Antenna-array RFID reader that localize tags
- Coverage analyzer for testing $O(1M)$ routers
Jason Zhang

Hometown: Mercer Island, Washington
Year: Undergrad Junior, graduating Spring 2024
Some fun facts about me:

- Tetris is my favorite video game
- I listened to Mr. Brightside 206 times last year
- When I was a kid, a fortune teller foretold I would die by drowning
CSE 461: Computer Networks
Focus of the course
Focus of the course (2)

Three “networking” topics:

- Distributed systems
- Networking
- Communications

- CSE 452
- CSE 461
- EE 417
Main goals

1. Learn the fundamentals of computer networks
2. **Learn how the Internet works**
   - What really happens when you “browse the web”?  
   - TCP/IP, DNS, HTTP, NAT, VPNs, 802.11 etc.
3. Understand how and why of Internet design
   - SDN, Load Balancers, Architectures
Why learn the fundamentals?

Intellectual interest

Reinvention, broad applicability
  • Non-Internet networks
  • Changing Internet
Fundamentals - Reliable communication
Fundamentals – Channel throughput

1 Gbps

20ft container = 2,350,080 in³ (240 x 96 x 102)
3.5in SSD = 23 in³ (4 x 5.75 x 1)
SSDs / container = 50K (50% packing efficiency)
Container capacity = 25PB (512 GB per SSD)
Container speed = 100 mph
SEA <> NYC throughput = ~2000 Gbps
Fundamentals – Reinvention

• The Internet is constantly being re-invented!
  • Growth over time and technology trends drive upheavals in Internet design

• Today’s Internet is different from yesterday’s
  • And tomorrow’s will be different again
  • But the fundamentals remain the same
Internet growth

Data source: Based on data from the World Bank and data from the International Telecommunications Union. Internet users are people with access to the worldwide network.

The interactive data visualization is available at OurWorldinData.org. There you find the raw data and more visualizations on this topic. Licensed under CC-BY-SA by the author Max Roser.
Example upheavals

<table>
<thead>
<tr>
<th>Change</th>
<th>Enabling Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergence of Web</td>
<td>Content Distribution Networks</td>
</tr>
<tr>
<td>Piracy</td>
<td>Peer-to-peer file sharing</td>
</tr>
<tr>
<td>Internet of Things</td>
<td>IPv6</td>
</tr>
<tr>
<td>Mobile Devices</td>
<td>Wireless, High bandwidth cellular</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>Virtualization</td>
</tr>
<tr>
<td>Crypto currencies</td>
<td>Blockchains</td>
</tr>
<tr>
<td>....</td>
<td>....</td>
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Who cares about the internet?

1. Curiosity
2. Impact on our world
3. Job prospects!
From this experimental network (~1970)...

(a) Dec. 1969.  
(b) July 1970.  
(c) March 1971.
To this...
To this! (2011)
And this (2015)!

• An everyday institution used at work, home, and on-the-go

• Visualization contains millions of servers
  • Red = .com, Yellow= .org

• Network now contains literally 3 billion people!
Internet – Societal Impact

• An enabler of societal change
  • Easy access to knowledge
  • Electronic commerce
  • Personal relationships
  • Private communications
Internet – Economic impact

• An engine of economic growth
  • Information sources
    • And lots of ethical questions!
  • Online marketplaces
  • Social media/Crowdsourcing
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Architectures

Lots of ways to build networks with different tradeoffs

• Internet -- open access
  • Flexibility++, Privacy++, Security--

• Cellular -- identity first
  • Flexibility--, Privacy --, Security++,
Not a Course Goal

To learn IT job skills

• How to configure specific equipment or technologies
  • e.g., Cisco certifications,
  • Technical whack-a-mole

• But course material is relevant, and we use hands-on tools
  • Hopefully you’ll be able to use these tools to build stuff at the end of class
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Questions?
Class Structure
Grading

Assignments: 10%
  • Reading and homework from the book
Grading

Assignments: 10%

In-class Quizzes: 5%
  • Short quizzes during the quarter
  • Drop lowest
Grading

Assignments: 10%
In-class Quizzes: 10%

3 Projects: (15 + 15 + 15)%
  • 3 coding exercises:
    • Socket programming
    • Link and Network layer behavior
    • Buffer bloat
Grading

Assignments: 10%
In-class Quizzes: 5%
3 Projects: (15 + 15 + 15)%
Midterm: 15%
Final: 20%
Participation: 5%
Grading

Assignments: 10%
In-class Quizzes: 5%
3 Projects: (15 + 15 + 15)%
Midterm: 15%
Final: 20%
Participation: 5%

Late Policy:
• 10% penalty for each late day
• Each person gets three late days
Administrivia

• Office hours
  • Opportunity to have more personal interactions with course staff.

• Tools
  • Canvas: Assignments, quizzes, and projects
  • ed discussion: Back and forth discussions on class content, announcements
  • Canvas Gradebook: Grades will be posted here

• Slides
  • Adapted from Kurtis Heimerl, who adapted from David Wetherall
  • I will be posting my own slides online
Questions?