CSE 461: Computer Networks

Spring 2022

Ratul Mahajan

Jason Wyatt Miller, Monty Nitschket,

Edan Tessel Sneh, Mark Theeranantachai
Who we are
Jason Miller

- Hometown: Mukilteo, Washington
- Year: Junior, graduating June 2023
- Some fun facts:
  - Double major in CS and math, minor in applied math
  - I like rock climbing
  - I went to Vancouver over Spring break
  - I have a cat named Cosmo:
Monty Nitschke

Hometown: Spokane, Washington
Year: BS/MS, graduating Autumn 2022!

Some fun facts about me:

- Transfer student from CC
- Fourth time TA :)
  - Previous TA for 332, 351
- Love to go hiking and camping
- Love board games and card games
Edan Sneh
Hometown: Palo Alto, California
Year: BS/MS, graduating Spring 2022!
Some fun facts about me:
Love rock climbing
Love all sorts of puzzles and strategy games
I enjoy eating food and cooking meals
Absolutely hate flying but love traveling
Mark Theeranantachai

- Hometown: Thailand
- Year: Undergraduate Senior
- Graduating June 2022
- Some fun facts:
  - Really love live music and jamming (usually rock/pop)
  - Can play a lot of instruments but not so good at any :(
  - Sony Fanboy, have used 5 Xperia phones
  - Love thriller and action films/TV shows
  - Enjoy snowboarding, tennis, photography, and cycling
  - Thai foods are too spicy :(
  - Casual Dota2 player (900 hrs)
  - Currently work at the ICTD lab and pursuing a PhD.
CSE 461: Computer Networks
Focus of the course
Focus of the course (2)

Three “networking” topics:

- Distributed systems
- Networking
- Communications

<table>
<thead>
<tr>
<th>Distributed systems</th>
<th>CSE 452</th>
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</thead>
<tbody>
<tr>
<td>Networking</td>
<td>CSE 461</td>
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<tr>
<td>Communications</td>
<td>EE 417</td>
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</table>
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>
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<tr>
<td>Emergence of Web</td>
<td>Content Distribution Networks</td>
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<tr>
<td>Piracy</td>
<td>Peer-to-peer file sharing</td>
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<tr>
<td>Internet of Things</td>
<td>IPv6</td>
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<tr>
<td>Mobile Devices</td>
<td>Wireless, High bandwidth cellular</td>
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<td>Cloud computing</td>
<td>Virtualization</td>
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<tr>
<td>Crypto currencies</td>
<td>Blockchains</td>
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<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)...

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?