CSE 461: Computer Networks

Spring 2021

Ratul Mahajan

Milin Kodnongbua, Pat Kosakanchit, Nicolas Monses, Nathan White, Michael Wiem
Who we are
Ratul
Milin Kodnongbua

- Hometown: Thailand
- Year: Undergraduate Junior, Graduating June 2022
- Some fun facts:
  - Minor in Economics
  - Likes binge-watching KDrama
  - Still plays Vainglory
Pat Kosakanchit

- Hometown: Bangkok, Thailand
- Year: BS/MS, graduating December 2021
- Some fun facts about me:
  - Doing research at ICTD lab
  - Loves board games
  - Loves street photography
  - I go to Sisi Kay in Wallingford for authentic Pad Thai
  - Just starts learning aerial hammock
Nick Monsees

- Hometown: Orange, California
- Year: BS/MS, graduating June 2021

- Some fun facts:
  - Member of UW’s rocket club (SARP)
  - Has caused a (minor) explosion on campus
  - Cares too much about the NFL Draft
  - Still believes in Blackberry stock
Nathan White

- **Hometown:** Los Angeles, California
- **Year:** Senior
  - B.S. Computer Science
  - Minor in Entrepreneurship
- **Internships at Amazon**
- **Fun facts**
  - I compete in security competitions like CCDC
  - I like hiking and biking
  - I also enjoy photography/video production
  - I play way too much Overwatch
Michael Wiem

- Hometown: Jakarta, Indonesia
- Year: Senior, final quarter!
- Facts, that are fun:
  - SEAL member
  - FIUTS Student Board Member
  - Somehow bad at all sports known to humankind
  - I once met Andy Jassy
  - Prefer ethernet than wifi
Class Structure
Grading

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

Assignments: 10%

**Surprise Quizzes: 5%**
- Short quizzes during the quarter
- Drop lowest
Grading

Assignments: 10%
Surprise Quizzes: 10%

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

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

Assignments: 10%
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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?
CSE 461: Computer Networks
Focus of the course
Focus of the course (2)

Three “networking” topics:

<table>
<thead>
<tr>
<th>Distributed systems</th>
<th>CSE 452</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networking</td>
<td>CSE 461</td>
</tr>
<tr>
<td>Communications</td>
<td>EE 417</td>
</tr>
</tbody>
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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 in$^3$ (240 x 96 x 102)
3.5in SSD = 23 in$^3$ (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. Here 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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<tbody>
<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>
</tr>
<tr>
<td>Mobile Devices</td>
<td>Wireless, High bandwidth cellular</td>
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<tr>
<td>Cloud computing</td>
<td>Virtualization</td>
</tr>
<tr>
<td>Crypto currencies</td>
<td>Blockchains</td>
</tr>
<tr>
<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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