CSE 461: Computer Networks

Ratul Mahajan – ratul@cs
Anirban Biswas – anirban@uw
Michael Chenyang Fang – chenyf@uw
Qian Yan – qiany7@uw
Who we are
Hi everyone, I’m Anir! (Anirban)

• I’m in the 5\textsuperscript{th} year master program

• I love low level systems programming and distributed systems

• This is my 2\textsuperscript{nd} quarter as a TA

• Interned at CDK Global, Facebeook and VMware in the past

• Currently doing research in the Systems Lab
Q: What do I like?
A: Scuba Diving + music

Q: What kind of music do you like?
A: British ones, like those made by The Stone Roses

Q: What song do you listen to recently?
A: Step into My World by Hurricane #1

Q: Any advice for this course?
A: This course is so much fun. Just go to lecture and section and don’t hesitate asking questions. There are a lot of things going to be covered in this course and a lot not going to be covered in this course. If you are very interested in Networking, the book(very good) is your best friend.

My Favorite Guitarist
John Squire

What I am reading:
Far From the Madding Crowd

My favorite cartoon
Qian (Will) Yan

- 5th Year Master
- I ski A LOT.
Class Structure
Grading

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

Assignments: 10%

Surprise Quizzes: 5%
  • Short unannounced 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
  • HTTP Proxy
Grading

Assignments: 10%
Surprise Quizzes: 5%
3 Projects: (15 + 15 + 15)%
**Midterm: 15%**
Final: 25%
Grading

Assignments: 10%
Surprise Quizzes: 5%
3 Projects: (15 + 15 + 15)%
Midterm: 15%
Final: 25%

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

• Office hours
  • Opportunity to have more personal interactions with both me and the TAs.

• Tools
  • Mailing list: primary class communications
  • Canvas Assignments: Homework and projects
  • Canvas Discussion: Back and forth discussions on class content
  • 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
Laptop policy

• Laptops are fine
  • If you are going to be on Facebook do it in the back of class
    • This is distracting to other students
  • TAs will be enforcing this policy
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>
</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>
</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>
</tr>
</tbody>
</table>
Main goals

1. To 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
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
Main goals

1. To 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
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
Main goals

1. To 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