Goals for next two weeks

- **Concepts and use of HTML and CSS**
  - Novice, beginner, apprentice, master, ...
  - Know what you don’t know?
  - Create, converse, discuss, appreciate, ...
  - Learning by doing, reading, re-doing

Goals for this week

- **Web and Internet, from A..Z**
  - Don’t know much about history
- **Foundation of deeper knowledge**
  - Differences between client and server
  - DNS and IP and .. Names and Numbers
  - How HTTP works in relation to TCP/IP
    - P is for protocol, who decides on these?

Understanding: Internet and Web

- **Yesterday in the news:**
  - Leap second problems?
    - [http://cnnmon.ie/1xmg7F2](http://cnnmon.ie/1xmg7F2)
  - Cyber security a national imperative?
    - [http://abcn.ws/1Ch8d4z](http://abcn.ws/1Ch8d4z)
- **This week in CompSci 92**
  - Creating web pages
  - Understanding basics of the technical and social foundations of information and the internet

Technical and Social Foundations

- **What is the Internet?**
  - A collection of autonomous systems (AS)s
  - Network of networks
  - How do these networks communicate?
  - Country level, company level, ...
  - Until 2007, 16-bit AS numbers, now 32 bits .. Explore this in more detail
Technical and Social Foundations

● What is the Internet?
  ➢ According to Wikipedia
  ➢ According to Jon Stewart and Ted Stevens
  ➢ According to Stephen Colbert

What is Net Neutrality?

● http://on.cc.com/1DEJrPt

Communication on the Internet

● What is an Autonomous System?
  ➢ On the surface? Deeper down?

● Duke has ASN 13371
  ➢ what is an ASN for YouTube?
  ➢ Protocols: BGP, IP, STMP, these don't matter today, but next week ...
Internet Protocol RFC 791, 1981

The internet protocol is specifically limited in scope to provide the functions necessary to deliver a package of bits (an internet datagram) from a source to a destination over an interconnected system of networks. There are no mechanisms to augment end-to-end data reliability, flow control, sequencing, or other services commonly found in host-to-host protocols. The internet protocol can capitalize on the services of its supporting networks to provide various types and qualities of service.

http://www.ietf.org/rfc/rfc791.txt

A distinction is made between names, addresses, and routes [4]. A name indicates what we seek. An address indicates where it is. A route indicates how to get there. The internet protocol deals primarily with addresses.

An address indicates where it is

● IPv4 address: dotted quad
  ➢ `dig www.cnn.com : 157.166.224.25`
  ➢ Why do we use name and not address?
  ➢ Quad part: 0-255, note that $2^8=256$
  ➢ Why is this a 32-bit address? What’s a bit?
  ➢ Limitations of 32 bits?

● DNS: map name to address
● Routers: map address to route

Powers of two

● $2^2 = 4$, $2^3 = 8$, ..., $2^{10} = 1024$, ...
  ➢ 00, 01, 10, 11
  ➢ 000, 001, 010, 011, 100, 101, 110, 111

● IP address first 32 bits, what is $2^{32}$?
  ➢ Bit is a binary digit, why use binary?

● Now IPv6 address is 128 bits, $2^{128}$?
  ➢ Internet of Things?
  ➢ `http://www.wolframalpha.com/input/?i=number+of+atoms+on+earth`
Bits, Bytes, Atoms …

- **Byte is 8-bits:** $10101010$
- **Kilobyte usually 1000 bytes (1024 bytes)**
- **Megabyte is $1000^2$ bytes ($1024^2$)**
- **Gigabyte is $1000^3$, or a billion**

- **1 Mb is:** [http://en.wikipedia.org/wiki/Megabyte](http://en.wikipedia.org/wiki/Megabyte)
  - One minute of music on an mp3
  - 500 pages of 2000 characters/page book

Interlude

- We'll discuss answers, reasons, questions

IETF: Internet Engineering Task Force

- [https://www.youtube.com/watch?v=Fpuzl9IvOSM](https://www.youtube.com/watch?v=Fpuzl9IvOSM)
Why do we need standards?
How do we agree on what they are?

Standards can be flexible!
- high school: 12 lb
- open: 16 lb
- 85+ woman: 8 lb

Sir Tim Berners-Lee
Compsci 92: what does web do?

● We want you to create: this doesn't necessarily imply you're creative
  ➢ You will learn and understand at different levels
  ➢ We will learn about you, e.g., "my favorite things"
  ➢ You will learn about each other: toward a successful course

Compsci 92: What does web do?

● Levels of knowledge and computational thinking
  ➢ Everyone has used the web
  ➢ Fourth graders can create pages on weebly.com
  ➢ Google engineers are optimizing mobile web experience
  ➢ What does web have to do with net neutrality?

What is a web page?

● Depends on your point of view
  ➢ You, parents, grandparents?
  ➢ Student in Compsci Compsci 92?
  ➢ Software engineer at Amazon, Google, ...

● What is a webserver?
  ➢ What is a browser?

What is a webserver?

● http://wiki.nginx.org/Main
  ➢ Nginx powers several high-visibility sites, such as Netflix, Hulu, Pinterest, CloudFlare, Airbnb, WordPress.com, GitHub, SoundCloud, Zynga, Eventbrite, Zappos, Media Temple, Heroku, RightScale, Engine Yard and MaxCDN

● What does this software do?
What is a web browser?

- [http://www.w3counter.com/trends](http://www.w3counter.com/trends)
- What does this software do?
  - Try a different browser
  - Browsers are free and easy to install

Computer Science

- [https://www.youtube.com/watch?v=-Ht4qiDRZE8](https://www.youtube.com/watch?v=-Ht4qiDRZE8)
- Who is Luis von Ahn, what's his path?
  - Visiting Duke to talk to in April

Internet: Technical Foundations

- What is IPv4? Who created it? IPv6?
- Who governs the Internet?
- What is a domain name?
- What is a cookie?
- What is DNS? ICANN?
- What is IP, SMTP, BGP, HTTP?

Susan Athey

- [https://www.youtube.com/watch?v=8XyRVcJz7RY](https://www.youtube.com/watch?v=8XyRVcJz7RY)
- From Data to Bitcoin
  - Duke connection