UC Berkeley EECS
Sr Lecturer SOE
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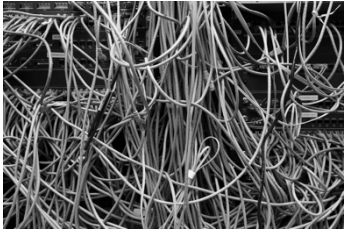
The Beauty and Joy of Computing

Lecture #15
Internet I

FCC Sets Net Neutrality Rules!

The FCC recently set new Net Neutrality rules that (1) regulate broadband Internet providers like a public utility, and (2) prevent ISPs from charging certain companies (like YouTube) from priority delivery, and (3) will be challenged in courts. For now, it seems, the good guys have won.

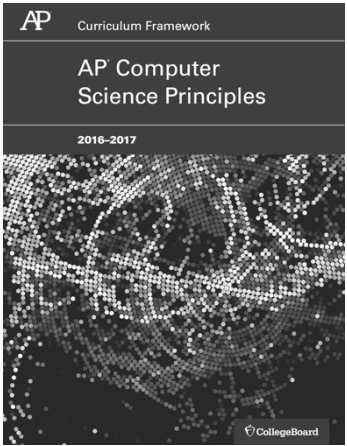


www.nytimes.com/2015/03/13/technology/fcc-releases-net-neutrality-rules.html

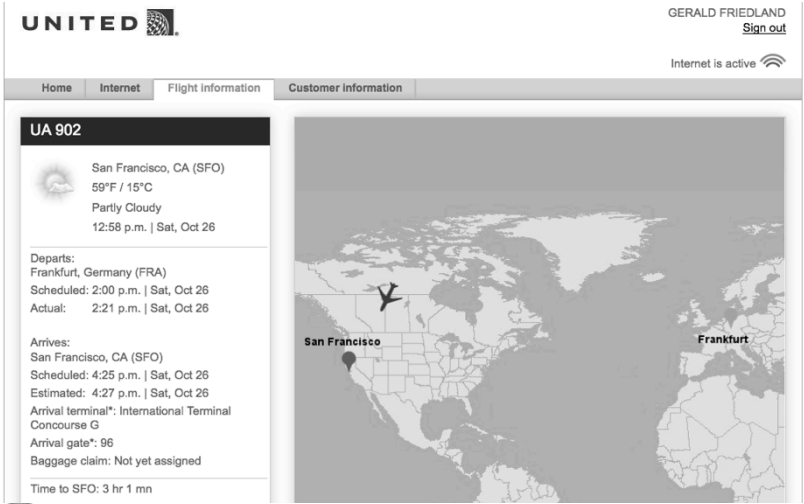
(AP) Computer Science Principles

7 Big Ideas

- Creativity
- Abstraction
- Data and Information
- Algorithms
- Programming
- The Internet
- Global Impact



Internet is pretty much everywhere! (1/2)



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Internet is pretty much everywhere! (2/2)

Astronaut using the Internet on the International Space Station

Source: NASA

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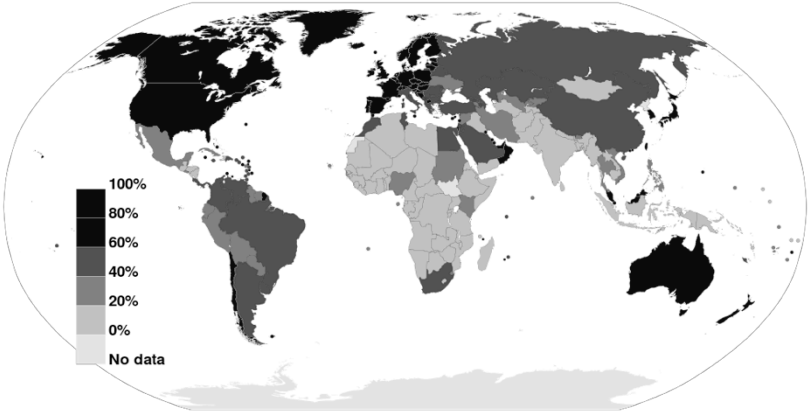
The Internet Today



Internet Usage as a Percentage of Population (2012)

Source: Wikimedia Commons

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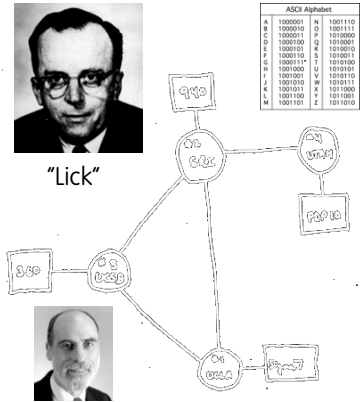
The Internet (1962)

- Founders
  - JCR Licklider, as head of ARPA, writes on "intergalactic network"
  - 1963 : ASCII becomes first universal computer standard
  - 1969 : Defense Advanced Research Projects Agency (DARPA) deploys 4 "nodes" @ UCLA, SRI, Utah, & UCSB
  - 1973 Robert Kahn & Vint Cerf invent TCP, now part of the Internet Protocol Suite
- Internet growth rates
  - Exponential since start!

"Lick"



Vint Cerf

"Revolutions like this don't come along very often"

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The basics of the basics

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It's a Network of Autonomous Systems (1)

- The Internet and the systems built on it facilitate collaboration.
- The Internet connects devices and networks all over the world.
- An end-to-end architecture facilitates connecting new devices and networks on the Internet.
  - This means all the hard work (e.g., checking if a file is corrupted) is done by the endpoints, and the middle network is "dumb", "unreliable", "dynamic"
- Connecting new devices to the Internet is enabled by assignment of an Internet protocol (IP) address.
- The domain name system (DNS) translates names to IP addresses.

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It's a Network of Autonomous Systems (2)

- The Internet is built on evolving standards, including those for addresses and names.
  - We'll see how IP has changed, names added!
- Devices & networks that make up the Internet are connected and communicate using addresses and protocols.
  - Protocols = agreements on standards
- Standards such as hypertext transfer protocol (HTTP), IP, and simple mail transfer protocol (SMTP) are developed and overseen by the Internet EngineeringTask Force (IETF).

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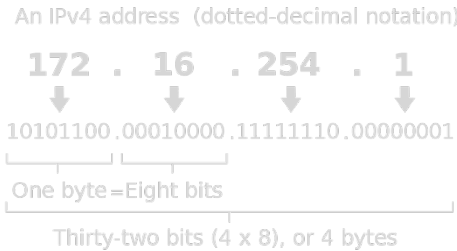
IP Addresses (this one is called IPv4)



- 2^{32} = ~4 billion unique numbers
  (world population 7 billion)

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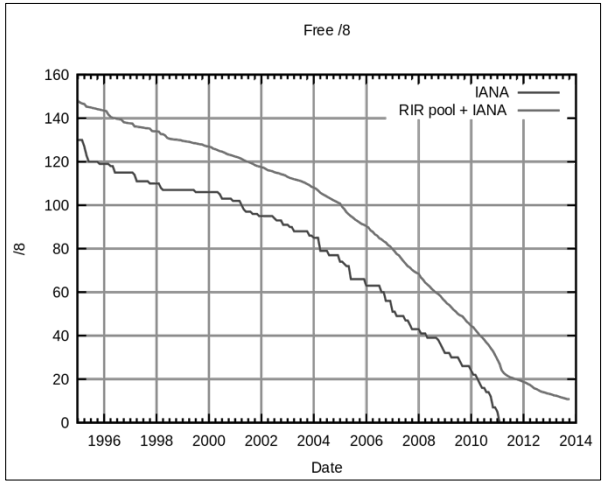
Problem: No more IP addresses left…



Source: Wikimedia Commons

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Solution: IPv6

- $2^{128} = 3.403 \times 10^{38}$ unique addresses
- Issue: Adoption still in progress

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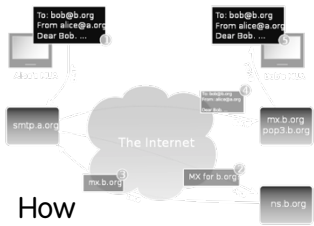
Email (1965)

- Fundamentally changed the way people interact!
- 1965: MIT's CTSS
  - Compatible Time-Sharing Sys
- Exchange of digital info
  - Model: "Store and Forward"
  - "Push" technology
- Pros
  - Solves logistics (where) & synchronization (when)
- Cons
  - "Email Fatigue"
  - Information Overload
  - Loss of Context



- How
  - Alice composes email to bob@b.org
  - Domain Name System looks up where b.org is
  - DNS server with the mail exchange server for b.org
  - Mail is sent to mx.b.org
  - Bob reads email from there

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The World Wide Web (1989)

- "System of interlinked Internet hypertext documents"
- History
  - 1945: Vannevar Bush describes hypertext system called "memex" in article
  - 1989: Tim Berners-Lee proposes, gets system up '90
  - ~2000 Dot-com entrepreneurs rushed in, 2001 bubble burst
- Wayback Machine
  - Snapshots of web over time
- Today : Access anywhere!

Tim Berners-Lee

World's First web server in 1990

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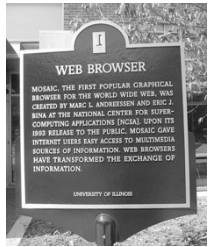
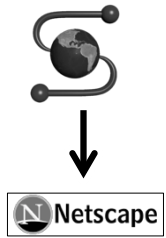
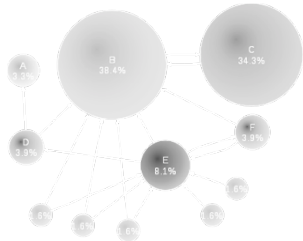
WWW Search & Browser (1993)

- Browser
  - Marc L. Andreesen and Eric J. Bina @ NCSA create Mosaic, 1st popular WWW browser
    - First Internet "Killer App"
    - Later: Netscape Navigator
  - Now IE (23%), Firefox (30%)
- Search
  - Before engines, there was a complete list of all servers!
  - 1993 Martijn Koster Aliweb is 1st web search engine
  - 1997 Stanford Sergey Brin and Larry Page develop Google's search, based on PageRank (each: $30 Billion)







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Web 2.0 : The Social Network (2004)

- "…web development & design that facilitates interactive information sharing, interoperability, user-centered design and collaboration on WWW"
  - Users change content via "architecture of partipation"
- Examples
  - Web communities, apps, social networks, video & photo sharing, wikis, blogs, tweets, …
- "Take back the web!"

"You" – Time's 2006 Person of the Year ☑

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