Roadmap for 82: 10-late to 11-early

- Facebook used to launch explorations of:
  - Internet architecture and governance
  - Standards
  - Privacy

- Concerns about privacy?
  - Malware, cybercrime
  - Anonymity, censorship

- There's an App for .. Webapp, Desktopapp

Facebook news 10/20/10

  - Who uses Facebook according to WSJ
  - Can you get a job via social media sites?
  - Is this about Facebook or something else?
  - Also liked: http://bit.ly/aDxiNm

What is software? How does it run?

- For mobile devices, how does software run?
  - Code, app, development
  - Android and Java v. iPhone and Objective-C

- For laptop devices, how does software run?
  - Operating systems, programs, licenses
  - CPU, memory, disk: like mobile apps?

- For web browsers, how does software run?
  - Browser specific? Plugin specific? OS specific?
Users and clients on the Internet

- **Where does software run?**
  - DNS, BGP, 802.11
  - HTML, Javascript, Flash, Java
  - Apache, php, ASP, mySQL, Oracle,

- **Differences between client and server**
  - Web browser (e.g., Firefox), webserver (cnn.com)
  - Online games: poker, WOW, ...
  - Shazam music identification system

What's in a URL?

- **http://www.youtube.com/watch?v=D4gw_3nA5G4**
  - What does DNS do? What does YouTube do?
  - ?=bPMo14XTTvE&feature=related
  - What does ‘related’ mean?

- **Query String**
  - What processes the query? Utility? Cookie?

- **http://googleads.g.doubleclick.net/aclk?sa=1&ai=**

Bits, Hex: TinyURL, YouTube, bit.ly

- **6n7kqv** and **D3dKbq5AXz8** are links to ...
  - What does 6n7kqv mean? How is it generated?

- **# four digit, base-ten numbers?**
  - 10, 100, 1000, 10000, ...

- **# numbers represented by 4-bits, base-two**
  - 2, 4, 8, 16, ... aka 0000,0001,0010,0011,...1111

- **How many two letter words are there?**
  - aa, ab, ac, ..., az, ba, bb, bc, ..., za, zb, ...,zz
  - 26x26 = 676, three letter words?

How do tinyurl/bit.ly work?

- **Enter any URL, do some math stuff to turn the string/words into a number**
  - If only lower-case letters and digits used, then 36 different “digits”, so six-digit number is
  - \(36 \times 36 \times 36 \times 36 \times 36 = 2,176,782,336\)
  - What about upper and lower case?
  - What about YouTube, number of videos?

- **hashing, change words to number**
  - Any word converted to number? Collisions?
From *de facto* to *de jure* standards

- **How does the Internet work?**
  - Who makes it work that way?

- **How does the Internet scale?**
  - Does everything scale?

- **How has commercialization changed things**
  - People, bits, atoms, money

Internet Protocol RFC 791, 1981

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 you live

- **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**

Internet Addresses and Routing

There’s no place like 127.0.0.1

Thinkgeek.com
What is the Internet?
- A collection of autonomous systems (ASs)
  - Network of networks
  - How do these networks communicate?
  - Country level, company level, ...
  - Until 2007, 16-bit AS numbers, now 32...
- An AS has lots of IP addresses, all sharing a common prefix
  - AS communicates outward by BGP
  - Border Gateway Protocol

IP addresses, who makes them?
- IANA, ICANN, Jon Postel?
  - Give me a bunch of numbers, please.
  - All share common prefix, why?
- 152.3.119.0/24 means 256 addresses
  - 152.3.119.0, 152.3.119.1, ..., 152.3.119.255
- 152.3.112.0/20 means 4,096 addresses
  - 152.3.112.0, 152.3.112.1, ...152.3.127.255
- The /24 is more specific than the /20

BGP for routing
- YouTube has ASN 36561
- Duke has ASN 13371
- BGP Routers communicate with neighbors
  - I have a route to xyz
  - 45,000 updates/minute
- No central source of trust, who do you trust?
  - Transitive trust model for BGP routing

IETF: Internet Engineering Task Force
- “governs” the Internet (according to some)
  - What does this mean? Who elects the members?
- RFC: request for comments
  - Anyone can write an RFC and independently submit it to the RFC Editor for possible publication. It will be published after review, and perhaps revision, for technical competence, relevance, and adequate writing.
  - [http://www.rfc-editor.org/rfcfaq.html](http://www.rfc-editor.org/rfcfaq.html)
What does the IETF do?

- The IETF has at times been ascribed nearly magical abilities by the trade press, who assumed its mechanisms were responsible for the success of the Internet because it works on the Internet's core protocols. The reality that it is a group of engineers putting together specifications so that multiple vendors' products can operate across networks is considerably more mundane.


The Tao of the IETF

- The Internet Engineering Task Force is a loosely self-organized group of people who contribute to the engineering and evolution of Internet technologies. It is the principal body engaged in the development of new Internet standard specifications. The IETF is unusual in that it exists as a collection of happenings, but is not a corporation and has no board of directors, no members, and no dues;

Rough consensus and running code

- One of the "founding beliefs" is embodied in an early quote about the IETF from David Clark: "We reject kings, presidents and voting. We believe in rough consensus and running code". Another early quote that has become a commonly-held belief in the IETF comes from Jon Postel: "Be conservative in what you send and liberal in what you accept".

Is the IETF a governing body?

"A government interested in using us is a government interested in how we work." In other words, once governments realize what a treasure there is in the Net, they want to mess with it, regulate it, and censor it

http://www.wired.com/wired/archive/3.10/ietf_pr.html
Who runs the Internet? You do!

- One more thing that is important for newcomers: the IETF in no way "runs the Internet", despite what some people mistakenly might say. The IETF makes standards that are often adopted by Internet users, but it does not control, or even patrol, the Internet. If your interest in the IETF is because you want to be part of the overseers, you may be badly disappointed by the IETF.

http://www.marvel.com/universe/Antiphon_the_Overseer

What is IPv6?

- What is the 6 in IPv6? Is Vint Cerf in on it?
  - What’s needed to deploy the protocol?
  - What incentives are needed to deploy?
  - What disincentives are there?

- Difference between 32 bits and 128 bits?
  - \(2^{32} = 4,294,967,296\)
  - \(2^{128} = 340,282,366,920,938,463,463,374,607,431,768,211,456\)

IP, CIDR, Youtube

- Originally Duke got 65,536 IP addresses
  - Original IP protocol, how many bits?
  - How do you figure this out?
  - Only 24 or 16 or 8 bits originally

- CIDR (Classless Inter-Domain Routing)
  - Any power of 2 for range of addresses
  - Youtube advertises: 208.65.152.0/22
  - Pakistan advertises: 208.65.153.0/24

Internet Governance

- IETF: What do they “govern”?
  - Wikipedia rough consensus model?

Consensus is not determined by counting heads, but by looking at strength of argument, and underlying policy (if any). Arguments that contradict policy, are based on opinion rather than fact, or are logically fallacious, are frequently discounted. For instance, if someone finds the entire page to be a copyright violation, a page is always deleted. If an argument for deletion is that the page lacks sources, but an editor adds the missing references, said argument is no longer relevant.
Other Players in Internet “Governance”

- Differences between web and internet
  - Content v Delivery?
  - HTTP: ietf standard
- W3c activities
  - Math, mobile, e-govt
- ITU and ECMA
  - Proprietary/private
  - Differences?
- Javascript
  - EcmaScript
- Telecommunication

Open or Proprietary

- What is an open standard?
  - Advantages of proprietary standards?
  - Open office compared to Msoft Word?
- What about iTap compared to T9?
- What do we want for the Internet? Why?
  - Effects of internationalation (i18n)

IETF, IANA, ICANN, IGF, ITU

- What’s the I in these organization
  - Internet or International
- IANA: Internet Assigned Numbers Authority
  - Operated by ICANN
  - Root-zone management ccTLD, gTLD
    - DNS, we’ll see openDNS later
  - Role of US Department of Commerce
    - Possible issues here?

Rough Consensus

- Does Wikipedia and/or IETF model work?
  - What does “government” mean?
  - Are companies governed? Countries?
- Why did the IETF model work originally?
  - Similarities to Wikipedia? Differences?
- Future of standards making
  - Will “real” governments have a role?