Internet Infrastructure
A 15,385 Meter Overview

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NH IEEE Section
Jim's Background

• 30 Years in computer industry
  – IBM, Calma (CAD/CAM), Data General, Charles River Data Systems, Digital
  – Chair of IEEE and ISO POSIX/UNIX Stds
  – Board member: IEEE, X/Open, Society for the Social Implications of Tech.

• 6 Years in academia (Prof at SNHU)
2010 Computer Society President

- 85,000 members world wide
- 150 Conferences per year
- 14 magazines (Peer reviewed/Practical)
- 13 Transactions (top of line academic)
- Student branches & Local Chapters
- Standards: 802, POSIX, Software Engineering, Test Technology
First a word from our sponsor

A Licensing Exam is being developed for Software Engineering
Hopefully consistent with the body of knowledge, curriculum, and certification programs in place
Oct. 20, at SNHU Steve Swarm will talk about the software engineering world.
Internet Infrastructure
Layer 1 - Physical

- Media --- separating all the rest from media
- Wireless – Bluetooth to Satellite
  - And of course WiFi and WiMax
  - Or IEEE Std 802.11 & 802.16
- Wire-by-design: Ethernet (802.3)
  - Or re-use: Twisted Pair, Fiber Optic
  - And perhaps power lines, etc!
Layer 2 - Link

• Here the OSI and TCP/IP folks vary
  – Realistic implementations are not “layered”
• Essential are the most primitive level of connection components:
  – Framing of packets
  – Rejecting 'obvious' errors (frame level)
  – Media access (control of Layer 1)
• MAC addresses (& Google Earth)
Layer 3 - Network

- IP in the Internet – how to get message through net
  - Reliability: packet loss, duplication, sequence
  - IP Address
    - IPv4 – 32 bits (192.168.0.1)
    - IPv6 – 128 bits (“every lightbulb” 1998...)
  - Address for routing “tree”
- DNS – domain name service resolution
Layer 4 - Transport

- TCP in the Internet – logical content mgmt
  - Take source information
  - Package it up to deliver to “other side”
  - Confirm receipt of packages
  - Manage “ports” to distinguish sources

- Quality, not performance focus
Layer 5 – Session Layer

• Manages a time window of connection
  – We are now talking “hello – hello”
  – We are done talking “Good bye- Good bye”

• Internet folks bundle this into “Application”
  – With some denial of OSI validity (the “layer” confusion)

• You don't know when it “stopped” - “timeouts” are a key assurance
Layer 6 - Presentation

• How do I interpret what you just sent me?
  – Code to Code is one “perspective” (MIME data types helps here)
  – English to Chinese is higher level
  – Logical document structure is a third (tied to screen rendering)

• How many used the Internet before 1990?
The Web Explosion 1991-1995

• Tim Berners-Lee, at CERN
  – How to share documents in LAB
  – SGML ISO standard, but ambiguous
• Hyperlinks to resolve references: HTML
  – With HTTP as underlying protocol
• Add Windowing (PARC, Apple, MS)
• Add Browser (Marc Andreessen, Mosaic)
Browser Wars, bells and whistles

• Bundle into OS (anti trust issue)
• Incorporate “InPage code”
  – Server Side (PHP, etc.)
  – Client Side (Javascrip)
• Download loadable Executables: Java, ActiveX
• Plug-ins (Flash, PDF, Quicktime, etc.)
Layer 7 - Application

- Email & FTP
- Web Browsing
- Search
  - Altavista (Digital); Yahoo; Google
  - Optimization, Gaming & paid placement
- Thin Client, Cloud Computing, ...
The “Internet Cloud”
WWW – Warning: Wild West!

- Cookies – not all are from Girl Scouts
  - 3rd party tracking – embedded references
  - Sessions, span sessions
- “Nobody Knows Your a Dog” but they might know your history
- Phishing & Pharming & Evil Pholks
And that's the folks you visit

- Hacking
  - Viruses (infect your computer)
  - Worms (and your friends computers)
  - Bots (and swarm to get targets)
- “Russian Mafia” and Governments
  - Who did attack Estonia May 2007
And Defense Mechanisms

- Anti Virus
- Firewall
- Spyware/Adware detector
  - And on it goes
- Social Engineering
  - Halloween cards; news events
  - “Security Software”
And – Bits are Bits

• Text and Songs and Child Porn and …
  – Encryption
  – Steganography
  – Copyright, trademark
  – “Illegal activities: like decryption”

• Suppliers business models based on value of one bit over another
Once upon a time

• There was one phone company
  – And it was a blessed monopoly

• Mandated to bring phone service to all
  – Below cost if necessary

• Extra fees for: colored phone, touch phone, Long distance, etc. etc.

• “Preferential pricing”
But … Stuff Happens

• Codaphone, AT&T Breakup, Competing Long Distance, etc etc etc
• Community Cable TV, now Cable TV
  – To deliver a specific range of content
• Internet, ISP to deliver “that stuff”
  – But … Bits are Bits
• Voice over IP, Video over IP, …
And the thing runs both ways

- Click on a URL – get a page
  - Get a song – get a video
  - Asymmetric use (slow up, fast down)
- User Sourcing …
  - Send my videos out, video conferencing...
  - And of course Peer-to-Peer use/abuse
The Strategic Implications

• Dis-intermediation
  – Amazon – publisher to buyer
• Intermediation
  – Travel Sites – comparison shopping
• Business Models
  – Skype calls; publishing;
Strategic Challenges

• Privacy – tracking activity, cross connecting data (property tax files, etc.)
  – Not to mention stupidity: Sexting, etc.
• Security – Money and Politics
  – Bad guys investing more, moving faster
• Copyright, payment (& ownership)
Who Controls the Net?

- ICANN created to manage naming
- Trademark trumps cyber-squating (sort of)
- China, Singapore, et al site-censors
- “Network Neutrality” battle in U.S. (FCC)
  - Bits, QOS, priorities/blocking, etc.
- Spans into bandwidth allocation, ...
Brave New World

Are we there yet?

• Internet invented in 1969
• Web invented in 1991
• Google ad model
• Paypal et al for “micropayments”
• YouTube, Wikipedia, Twitter, social sites
• Second Life, World of Warcraft, VR …
Check Out

- “Did you know” video on YouTube
  - http://www.youtube.com/watch?v=cL9Wu2kWwSY
- And TED.com for ongoing insight on the net
  - And everything else

Steve Swarm, “CSDA/ CSDP Certifications: Next Best Thing to Software Engineer Licensing”, 7PM SNHU Manchester - Academic Center Building, Room 106

Questions???