The Next Generation Internet and the Future of the Domain Name System

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My Background

- B.S., geology, Caltech
- Ph.D., geophysics, MIT
- 1988 -- Congressional Science Fellow
- 4 years as Senator Gore's science advisor
- 4 years as IT policy guru at White House
- 1998-1999 -- Technologist at FCC
- 9 years at IBM
- Georgetown, Studying future of the Internet
- Chairman, Information Section, AAAS
50 Things I learned in Washington

LESSON #1

ALWAYS have a good bumper sticker
50 Things I learned in Washington

LESSON #5

Always state your conclusions first
Conclusions

- The Internet Revolution is less than 15% complete
- We are seeing a profound paradigm shift:
  - As important as the World Wide Web was in 1995
  - New approaches to business and policy are essential
- The Domain Name System will be less important as new applications and new ways to locate online resources online.
- When in doubt, empower the user!
Outline

- Act I – DNS Past
- Act II – Internet Future
- Act III – DNS Future
- Act IV – Role of governments
50 Things I learned in Washington

LESSON #9

When you’re not sure what to say, tell a story
ACT I – DNS Past -- Origins of ICANN

- January 1998 – White House “green paper” on DNS
- May 1998 – White House white paper on DNS
The Big Issues Then

- How to ensure the stability of the Domain Name System?
- Can the DNS scale?
- Who’s in charge?
  - Non-governmental
  - International
  - Ensure legitimacy
  - Prevent capture
- How fine-grained to make domain names? What model?
  - Phone book?
  - Zoning?
- How to ensure flexibility and evolution?
- How to ensure users have a voice?
ACT II – Internet Future
The Information Explosion Continues…
(Actually, it’s accelerating)

Technology Trends

COMPUTING:
- Chips/$ 10x in 5 years
- Computing power/$ 10x in 4 years

STORAGE:
- Storage/$ 10x in 6 years

COMMUNICATIONS:
- Backbone 100x in 5 years
- Local loop 100x in next 5 years
Total Amount of Data Connected to The Internet

<table>
<thead>
<tr>
<th>Year</th>
<th>Data Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>1 petabyte</td>
<td>$10^{15}$ bytes</td>
</tr>
<tr>
<td>2006</td>
<td>1 exabyte</td>
<td>$10^{18}$ bytes</td>
</tr>
<tr>
<td>2010</td>
<td>1 zettabyte</td>
<td>$10^{21}$ bytes</td>
</tr>
</tbody>
</table>

The result of:

- More people spending
- More time using
- More data-rich applications
- More replication and caching of data
Much More to Come…

The Internet Revolution is <15% complete

- Number of users
- Number of devices
- Speed/bandwidth
- Amount of content
- Number of applications
Data, Data Everywhere…

- Video surveillance
- E-commerce
- Location-dependent services
- Customized video on-demand
- Video-conferencing
- Networked devices
- Embedded sensors
- Data mining
Sensors Will Predominate…

Internet-connected devices

- Computers
- Sensors
- Appliances

YEAR

1990 2000 2010 2020
What is the Cloud Computing?

A fundamentally new approach to computing.

It enables companies and users to use the Internet to almost instantly tap the data, software, storage, and computing power they need to respond to any customer demand, market opportunity, or competitive threat.
Phase One – Stand Alone Computer
Phase Two – The Web

Web sites
Phase Three – The Cloud
Phase Three – The Cloud
Phase Three – The Cloud
Phase Three – The Cloud
Many Flavors of Distributed Computing

- Peer-to-Peer (PC-based)
- SETI@home
- Kazaa
- Napster

Number of nodes

Power of the nodes
Many Flavors of Distributed Computing

- Peer-to-Peer (PC-based)
  - SETI@home
  - Kazaa
  - Napster

- Grid Computing (Server-based)
  - Teragrid
  - National Grids
Many Flavors of Distributed Computing

Number of nodes

1 M
100 K
10 K
1000

1

Peer-to-Peer
(PC-based)
SETI@home
Kazaa Napster

The Holy Grid
Everything integrated
with everything

Grid Computing
(Server-based)
Teragrid
National Grids

Power of the nodes

1

100
ACT III – DNS Future

Myths about DNS
- DNS and ICANN are the key to Internet governance
- People need domain names to find what they want
- The DNS is “set in concrete”
Critical Phase for the Internet

- New systems developing to:
  - Authenticate people
    - Microsoft Cardspace
    - Open ID
    - Liberty Alliance
    - Shibboleth
  - Identify RFID tags and sensors
  - Find and identify computing resources
  - Identify documents
    - Amazon
    - Digital Object Identifiers
ACT IV – Governments and the Net

- National policy decisions
  - Convergence of telephone, data, broadcasting
- OECD “Future of the Internet Economy” conf.
  - June 2008
  - Seoul, South Korea
- WSIS, Internet Governance Forum
  - October 2008 in Delhi, India
- Various European Union directives
Who “manages” the Internet?

- World Summit on the Information Society
- Governments realizing the power of Net
  - Media
  - E-business
  - Threat to monopoly phone company (VoIP)
  - Political speech
- So they want to regulate or control it
- “Internet governance”
Policy-Legal-Regulatory Ecosystem

- **Germany**: BNETZA-T, BfV
- **France**: ARCEP, Justice
- **Netherlands**: EZ, CIOT
- **UK**: Parliament, Home Office, DTI, OFCOM
- **USA**: FCC, NSTAC, DOD, DOJ, DOC, NANC, ASIO
- **Canada**: Industry Canada, PSECP
- **Australia**: ACA, Parliament
- **Other multilateral and bilateral agreements**: CITEL, APEC-TEL, CITEL
- **Cybercrime Convention Signatories & Justice Ministers**: NGN WG, NGN reg, eSec, TG
- **ITU Convention Int’l Telecom Regs**: PP2006, [WCIT]

Tony Rutkowski, Verisign, ITU NGN workshop, March 2006
Ten P’s of Cyber-policy

Privacy
Piracy
Pornography
Protection
Pricing
Policing
Psychology
Procurement
Payments
Protectionism
LESSON #17

There is nothing more dangerous than an old model applied to a new medium
“Phone governance” (1970):
Who made choices about phone service?

- International Telecommunication Union
- Hundreds of governments
- Hundreds of government-run telephone companies
- (“subscribers”)
Who makes choices about the Net?

- Millions of Internet users
- Hundreds of governments and national consortia
- Thousands of IT vendors, network providers, ISPs...
- Dozens of intergovernmental organizations, standards bodies, and international NGOs
Locus of Decision-making

- International
  - Spectrum policy
  - Internet standards
  - DNS
  - IP addresses
- Regional
  - Cybercrime
  - Development aid
- National
  - Online taxes
  - Censorship
  - Telecom regulation
- Company/Local
  - Spam
  - Cyber-security
- Individual
  - On-line privacy

No government

All government
50 Things I learned in Washington

LESSON #25

Politicians look for one SOLUTION. Techies look for SOLUTIONS.
Locus of Decision-making

(Many different decisions in many different places)

- International
- Regional
- National
- Company/Local
- Individual

Spam

No government  All government
Locus of Decision-making

Where “Internet governance” is needed

- Internet standards
- DNS
- IP addresses
- Spectrum
- Online taxes
- Censorship
- Telecom regulation
- E-government
- Spam
- Cyber-security
- On-line privacy
- Trade policy
- Cyber-crime
- Development aid
- Spam
- On-line privacy
- Cyber-security
- E-government

No government

All government

Michael R. Nelson
Vienna, Austria
21 February 2008
Where are we headed?

Global “Internet governance”

Scenario #1

International
Regional
National
Company/Local
Individual

No government
All government

Scenario #2

Scenario #3
Conclusions

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