IANA and ICANN

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Some Major Milestones

- 1969 - 1985 Basic Packet Net Research
- 1974 - Internet design first published
- 1983 - first major deployment
- 1986 - first router companies
- 1989 - WWW; MCI Mail/Internet link
- 1990 - ARPANET retired; first comm’l services (UUNet, PSINet)
- 1994 - commercial WWW (Netscape)
- 1995 - NSFNet retired, competitive backbone
- 1998 - New IANA/ICANN
How does Internet work?
Protocols and Identifiers

- Protocols are procedures and formats that are used to enable computer to computer communication.
- To support this, computers share common knowledge of identifiers to make clear which protocols are being used. For example, Internet Protocol version 4 is in use today; IPv6 is coming.
What is the Internet?

Packet vs Circuit Switching

- Circuit (telephony) like reserving bicycle lanes from LA to NY!
- Packet (Internet) like sharing of the highway among high speed cars.
### Internet Packet Formats

<table>
<thead>
<tr>
<th>“from” address</th>
<th>“to” address</th>
<th>Version number</th>
<th>CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>166.45.18.99</td>
<td>204.146.165.100</td>
<td>“4”</td>
<td>“hello”</td>
</tr>
</tbody>
</table>

An Internet Packet
How Does Internet Protocol work?

- Internet Packets are like electronic Postcards (100M X faster)
- To/From Addresses
- Finite Content
- Best Efforts (QOS coming!)
How Does TCP Work?

- Like Sending a Novel on Postcards
  - Page numbering (ordering, duplicate detection)
  - Positive Acknowledgement
  - Retransmission on Timeout
  - Finite Mailbox
Ye Olde ARPANET

- 1969 - First “IMP” (packet switch) installed at UCLA in Len Kleinrock’s Lab
- Steve Crocker leads the Network Working Group
- Jon Postel becomes “numbers Czar” and RFC editor
- Vint Cerf programs network measurement center
Jon Postel
1943-1998
To: vcerf@ucla, From: Kahn@arpa

“Host.txt” table translated “ucla” into a network address (kind of like a telephone number)

packets were sent between computers using addresses derived from the tables. Every computer had a copy of host.txt. SRI International updated table
Postel served as “czar”

SRI International, under contract to DARPA, managed day to day assignment of names/addresses initially for ARPANET and later (after 1983 deployment of TCP/IP) for Internet
The Domain Name System

- Internet started to grow after 1983
- Host.Txt table was unwieldy and hard to keep up to date in all hosts
- In 1984/5, Paul Mockapetris and Jon Postel developed a distributed database system call the Domain Name System to accommodate much larger scale
Domain Names

- Kahn@arpa became Kahn@arpa.mil
- Cerf@ucla became Cerf@ucla.edu
- Tomlinson@bbn became Tomlinson@bbn.com
- Other top level domains:
  - .GOV, .ORG, .NET (“generic”)
  - and country codes: .US, .UK, .FR, .DE...
- The system is hierarchical and each name is unique: www.reston.mci.com
Internet Assigned Numbers Authority (Postel’s group at USC/ISI) managed top level assignments.

Volunteers were found to manage next levels.

Postel managed .edu, .US

SRI managed .com, .org, .net, .mil, .gov and .int
1969 - 1974 SRI manages day to day name space under direction of Postel as “numbers czar”, both under contract to DARPA.

1975 - DCA picks up SRI Contract.

1987 - NSF picks up .int, .com, .org, .net, and .edu, contracts w/SRI.
1991 - DCA competes .mil, .gov and awards to Network Solutions

1993 - NSF creates “InterNIC” and awards to AT&T, CERFNet, and NSI (doing domain name registration for .org, .net, .com, .edu, .int - the latter two subcontracted to IANA)
1995 - NSF contract cannot cover costs of exploding .com registrations and allows NSI to recover costs by charging $100 for 2 year registration [note, NSF is a RESEARCH agency]

1998 - NSF transfers DNS responsibility to Dept of Commerce

1998 - DOC extends contract with NSI for two years (Sept 30, 2000)
1996 - Postel initiates Internet Ad Hoc Committee with support from Internet Society to institutionalize the IANA functions and open top level domains to competitive registration.

This proves to be very difficult with many people with differing views and interests. The debate doesn’t come to closure...
Many entrepreneurs see NSI’s cash flow as a model for Internet business opportunities. Some want to create new “top level domains” (like .com), but the trademark community has reservations...
1998 - Ira Magaziner, at the request of President Clinton, initiates an effort to facilitate formation of a neutral, industry-sponsored oversight organization to continue the IANA functions performed in the past under US Government contract in a global, consensus building setting.

- Green and White Papers developed
Creation of ICANN

- Nov 1998 - the USG recognizes the Internet Corporation for Assigned Names and Numbers (ICANN)
- 1999 - ICANN organizes the many components specified in the White Paper (Board, Supporting Organizations, Membership, Advisory committees...)
Why do we need ICANN?

- IANA acted for 30 years to mediate disputes and to assure proper technical function of all parts of the domain name system.
- These functions are still critical to the successful operation of Internet which is now a GLOBAL and rapidly growing medium.
What are the remaining Challenges?

- Making ICANN Work
  - funding
  - mechanisms for global consensus building
- Managing the transition from monopoly to competition
- Resolving the Trademark/Domain Name conflict
Trademark and Domain Name Conflict

- Trademarks are NOT unique (MCI is trademarked by MCI WorldCom but also by a bus manufacturing company)
- Domain Names MUST BE UNIQUE in order for the Internet to work just like 800 numbers
When the Internet was mostly an R&D environment, generic top level domains were managed under contract and ccTLDs were managed by volunteers sought by IANA. Today, .com, .org, .net, and all other top level domains are managed and registered as monopolies.
An Unnecessary Monopoly

- There is no technical requirement that domain name registrations be provided by a monopoly registrar.
- It IS desirable to have a common REGISTRY of names within a given domain to assure uniqueness but this could be done under a cost-based contract.
Internet Addressing

- IPv4 - 32 bits
- Initially, 256 networks … then mix of:
  - Class A (128 with 16 M hosts)
  - Class B (16,384 with 65K hosts)
  - Class C (2M with 256 hosts)
- Now, Classless Inter-domain addresses
  - Up to 4 Billion hosts, hundreds of thousands of networks
Next Generation Internet

- IPv6 - 128 bits of addressing
- Theoretically $10^{38}$ hosts
- Significant transition effort needed (sort of like changing engines on aircraft while in flight)
- IANA officially announced allocations this week (July 14, 1999)
ICANN’s IP Addressing Role

- ICANN oversees Regional Internet Registries (RIRs) for allocation and assignment of IP addresses
- ICANN just released guidance for IPv6 and allocated the first blocks