Managing and Monitoring a Root DNS Service

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Who am I?

• John Crain
  – Chief Technology Officer at ICANN

• Involved with ICANN since early days.
• Prior to ICANN at the RIPE NCC in Amsterdam,
• Prior to that a Design Engineer, designing processes for developing Advanced Thermoplastic Composites.
What is ICANN?

- International, Public Benefit, non-profit organization charged with managing the Internet’s identifier systems.
- Ensuring “Security and Stability” of those systems is a core goal.
- One of those systems is the Domain Name System. Specifically the content of the “Root Zone”.
Board & Staff Representation by Nationality

Hover for more information. Drag or click to zoom. Boundaries shown are not necessarily authoritative.

Representation on ICANN Staff  •  Representation on ICANN Board  •  Former representation on ICANN Board
Why is the DNS important

- People use domain names to navigate the Internet
  - Domain names are also used on business cards and advertising
  - What can you do without your domain name?
Domain Name System

• Translates the human usable names to machine usable IP addresses
  – www.icann.org to 208.77.188.103

• Hierarchical Database with the entry level, known to all DNS resolvers being the DNS root name servers
The Dot You Forgot!

http://www.icann.org.
Finding the IP address
(using www.ietf.org as example)

Uses “hints file” in server to find roots

Remembers Answer!
Caching
Root servers are part of the core infrastructure

• 13 Servers systems
  – Named a through m.root-servers.net
  – Through any-cast we have more than 100 locations

• Operated by 12 organizations
  – http://www.root-servers.org

• L.root-servers.net operated by ICANN
http://www.icann.org/maps/root-servers.htm
Monitoring the root takes coordination

- Monitoring can be done externally with standard tools such as DIG, NSLookup, Ping etc. etc.

- Good example is DNSmon
  - [http://dnsmon.ripe.net](http://dnsmon.ripe.net)
DNSmon run by RIPE NCC

- Sends DNS queries to servers from multiple locations giving a good status of the service as seen from “The Internet”.

- Monitors servers for various zones, including the “root zone”
DNSmon on a good day
DNSmon on a not so good day
Domain Name System Operations, Analysis and Research Center

• [http://www.dns-oarc.net](http://www.dns-oarc.net)

• Formed as a member organization where DNS operators and researches can collaborate on studying the DNS and on operational response when needed.
TLD status monitor

• Nagios running scripts written by the measurement factory.

  • https://tldmon.dns-oarc.net
  • https://tldmon.dns-oarc.net/nagios/
  • (We use versions of the same scripts for monitoring L-root)
TLDmon from OARC
Day In The Life of the Internet

- A project from CAIDA with data provided through OARC.
- 48 hr data dump from various authoritative DNS servers (Including 8 of the 13 root-servers)
- Overlapping 24hr data set used.
- 8 billion queries studied in 24hr data set
Lessons learnt from DITL

• Amount of unnecessary queries to the roots is massive > 97%
• Non existent TLDS (22% of total traffic!)
• Repeat queries (servers not caching answer?)
• A for A queries
  – (asking for the IP Address of an IP address)
Operating the L root

- Two large Clusters in Los Angeles and Miami.
- Combined total of more than 80 servers answering DNS.
- Peering directly with more than 50 networks throughout the globe
Local Monitoring

• Until recently no good DNS traffic monitoring software.

• Lots of Nagios/Cacti stats
  – Dig, Ping, Memory/CPU usage etc.

• Domains Statistics Collector
  – Developed by the measurement factory
  – Takes live feed of traffic and places stats into arrays based on predefined parameters.
Gives live view of queries

- Updates XML files to a presenter server every 60s
  - Shows us many of the trends that we see on DITL
  - For L root we publish a delayed version
    - [http://stats.l.root-servers.org](http://stats.l.root-servers.org)
Global DNS Risk Symposium

Feb 3-4 2009, Atlanta, Georgia

Goals:

Increase understanding of DNS risk to the user community

Examine strengths and weaknesses of current efforts to share technical practices and operational approaches with a goal of improving collaboration in mitigating risks and filling gaps.

Specific focus areas:

• Understanding large enterprise DNS reliance and enabling effective risk mitigation
• Meeting the challenges to secure and resilient DNS operations in the developing world
• Identifying and improving collaboration in combating malicious activity leveraging the DNS
Questions?

Thank You