Unique Strengths for Extraordinary Challenges

Why EP.NET?

- Operates "B.ROOT-SERVER.NET" in conjunction w/ USC/ISI

- Manges and promotes global Internet exchange creation by local constituencies since 1994

- Is active in developing Best Practices for DNS operations in conjunction with Government, Industry, and concerned Individuals who manage portions of the DNS hierarchy.

The drivers – internal/external

- Converged Networks – Technology/Policy
- actor interactions
  - Each has invaluable / required assets
  - re-use is key – "rebuilding the airplane in flight"
- Shifting cost/revenue streams – who pays?
- Technology Innovations
  - Advances do not wait. Lightweight, rapid response is a key enabler.

  Will we be Overtaken by Events?

What exists today.

- There are rules and processes in place now. These procedures should be well understood before suggesting changes.

- The nature of Internet Protocols as designed and deployed, allow communities of interest to emerge without formal review or license.

- My impression: any governance which may exist, does so with the consent of the governed.

Ways forward?

- Focus on Core competences
- Recognize that all participants are bound by existing rules/laws … are they sufficient?
- Cross-discipline education is key…

A brief review of Root Server operations.

- Presented in the ICANN Rio de Janeiro GAC meeting.

- Additional material from Andrei Robachevsky, presented to APNIC17/APRICOT in KL

Operators of the Root Name Servers reviewing this material

- Lars-Johan Liman, Autonomica AB. "I"
  - John Crain, ICANN, "L"
- Suzanne Woolf, Internet Systems Consortium, "F"
  - Bill Manning, USC/EP.NET, "B"
- Axel Pawlik, Rob Blokzijl, RIPEncc, "K"
  - Scott Hollenbeck, Verisign, "A"/"J"

The DNS system

- The Domain Name System (DNS) is a heirarchical lookup system.

- It is used **before** any actual Internet transaction (like web page transfer).

- The root servers are only used as the entry point to the system.

- "Caching" makes clients remember answers, and avoid contacting the root servers whenever possible.

  - Hence the number of lookups is comparatively small.

What we do

- Copy a very small database, the content of which is currently decided by IANA and the US Dept. of Commerce.

- Put that database in our servers.

- Make the data available to all Internet users.

- Cooperate among ourselves and with others to maintain the level of service demanded by the modern Internet.

What we do NOT do

- Interfere with the content of the database.
  - We run the printing presses, we don't write the book.
- Make policy decisions
  - Who runs TLDs, or what domains are in them.
  - What systems TLDs use, or how they are connected to the Internet

What are we?

- A highly focused group of professional server operators, with very long experience in DNS and network operations.
- Diversity is stability:
  - Types of organizations
  - Professional experiences
  - Hardware
  - Software

What are we?

- Work stems from a common agreement about the technical basis:
  - The DNS information is not maintained by us.
  - Everyone on the Internet should have equal access to the data
  - The entire root system should be as stable and responsive as possible.

Where we are

- We are a close-knit technical group, geographically diverse
  - USA, Netherlands, Sweden, Japan
- High level of trust among operators.
- Root operators show up at many technical meetings and some policy meetings

Who we are

- Not "one group", 12 distinct organizations.
- Stable, consistant organizational grounding.
- Close operational and technical cooperation.
  - Sometimes in spite of organizational divergence.
- No formal organization for sever operations.
- Participate in RSSAC as advisory body to ICANN

The List

- ## Academic/Public Benefit
  - ISI/EP.NET – B
  - Univeristy of Maryland – D
  - Internet Systems Consortium – F
  - RIPE NCC – K
  - ICANN – L
  - WIDE - M

- ## Commercial/Private Sector
  - Verisign – A, J
  - Cogent – C
  - Autonomica – I

- ## Governmental
  - US-NASA – E
  - US-DISA – G
  - US-ARMY – H

Issues?

- Internationalized Domain Names (IDN):
  - Not specifically a root problem. We publish what we get.
- DNSSEC: technical issues with the current version of the specification.
  - We contribute to the IETF work to develop the standard.
  - We work with RSSAC and others to develop procedures.

Issues?

- IPv6
    - We worked with IETF on the technical issues
   - Recommendations to RSSAC/ICANN submitted.
- ENUM
    - Has no relation what so ever to root-servers.

Security

- Physically protected.
- Tested operational procedures.
- Experienced, professional, trusted staff.
- Major operational threat is DDoS
- Defenses:
    - Diversity
    - Anycast
    - Overprovisioning
    - Work with law enforcement and government.

Evolution Architecture

- **Enhanced architecture (2002)**
  - Hidden distribution master
  - All 'letter" servers are equal
  - Authenticated transactions between the servers (TSIG)
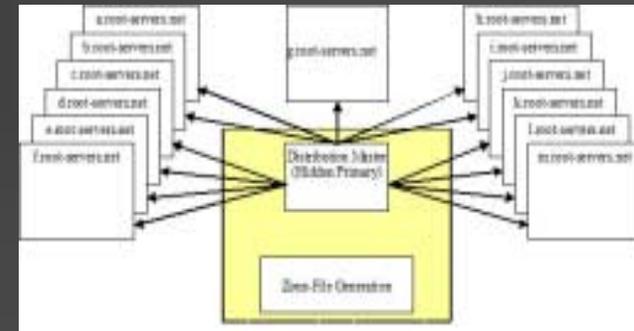
Anycast

- Setting up identical copies of existing servers.
  - Same IP address.
  - Exactly the same data.
- Works like transmitter antennas for radio.
  - You will talk to (listen to) the nearest one.
  - Standard Internet routing will bring the queries to the nearest server.
  - Provides better service to more users.
  - Mitigates impact of denial of service attacks.

Location of 13 DNS Root Servers (1996-2001)

Location of 13 DNS Root Servers (2002-2003)

Communications Procedures

- Normal operations:
  - regular meetings, three times a year, at IETF.
  - E-mail: internal lists.
  - Normal telephone.
- Special situations:
  - Encrypted e-mail.
  - Private telephone numbers.
  - Conference telephone bridges.
  - Other means as appropriate

Avoiding Common Misconceptions

- Not all Internet traffic goes through a root server.
- Not every DNS query is handled by a root server.
- Root Servers are not managed by volunteers as a hobby.
  - Professionally managed and well funded.
- No single organization (neither commercial or governmental) controls the entire system.

Avoiding Common Misconceptions

- The "A" server is not special.
- We don't administrate the zone content.
    - We publish the IANA-approved data.
- Not 13 machines, but 13 installations providing service!
    - 36 sites deployed, more planned
    - More sites outside the US than in
    - Planned/Tested/Deployed in less than 24 months

End of combined material…

As an individual and operator… my role is to:

- Empower and enable a high-quality Internet experience.

- Robustness and availability are primary metrics

- Data Integrity is paramount

- All others are secondary.

Fin

- Questions?

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