

Unique Strengths for Extraordinary Challenges

Why EP.NET?

- Operates “B.ROOT-SERVER.NET” in conjunction w/ USC/ISI
 - Manages 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.
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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.
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Ways forward?

- Focus on Core competences
 - Recognize that all participants are bound by existing rules/laws ... are they sufficient?
 - Cross-discipline education is key...
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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
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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, RIPEnc, “K”
 - Scott Hollenbeck, Verisign, “A”/”J”
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The DNS system

- The Domain Name System (DNS) is a hierarchical 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.
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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.
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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
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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
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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.
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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
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Who we are

- Not “one group”, 12 distinct organizations.
 - Stable, consistent organizational grounding.
 - Close operational and technical cooperation.
 - Sometimes in spite of organizational divergence.
 - No formal organization for server operations.
 - Participate in RSSAC as advisory body to ICANN
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The List

■ Academic/Public Benefit

- ISI/EP.NET – B
- University 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
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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.
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Issues?

■ IPv6

- We worked with IETF on the technical issues
- Recommendations to RSSAC/ICANN submitted.

■ ENUM

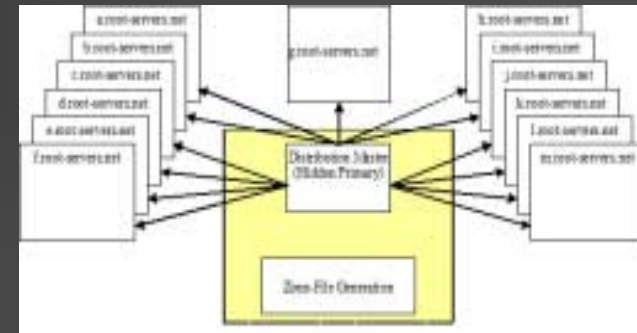
- Has no relation what so ever to root-servers.
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Security

- Physically protected.
 - Tested operational procedures.
 - Experienced, professional, trusted staff.
 - Major operational threat is DDoS
 - Defenses:
 - Diversity
 - Anycast
 - Overprovisioning
 - Work with law enforcement and government.
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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.
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Location of 13 DNS Root Servers (1996-2001)



Location of 13 DNS Root Servers (2002-20003)



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
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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.
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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
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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.
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- Questions?
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