Root zone update for TLD managers
Mexico City, Mexico
March 2009

Kim Davies
Manager, Root Zone Services
A quick census
Delegated

11 testing

1 .arpa
280 delegated

11 testing

1 .arpa

248 country codes
280 delegated

11 testing

20 "g"s

1 .arpa

248 country codes
280 delegated

11 testing

20 "g"s

1 .arpa

248 country codes

13 sponsored
280 delegated

11 testing

20 "g"s

13 sponsored

3 generic restricted

1 .arpa

248 country codes
280 delegated

- 11 testing
- 20 "g"s
- 13 sponsored
- 3 restricted
- 4 unrestricted
- 248 country codes
- 242 in ISO 3166-1
- 1 .arpa
- 280 delegated
- 11 testing
- 20 "g"s
- 13 sponsored
- 3 generic restricted
- 4 unrestricted
- 248 country codes
- 242 in ISO 3166-1
- 6
280 delegated

11 testing

20 "g"s

1 .arpa

248 country codes

242 in ISO 3166-1

6

3 former countries

13 sponsored

4 unrestricted

3 generic restricted
280 delegated

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1 .arpa

248 country codes

242 in ISO 3166-1

6 in exceptional current "countries"

3 former countries

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3 generic restricted

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248 country codes

242 in ISO 3166-1

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3 exceptional current "countries"

246 in 3166-1

3 former countries
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20 "g"s

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3 generic

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248 country codes

242 in ISO 3166-1

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3 former countries

3 exceptional current "countries"

246 in ISO 3166-1

4 not deleg.
Technical Conformance
Technical Conformance

- Bring our minimum technical criteria for root zone changes up to date

- Phasing in:
  - Prohibition on open recursive name servers
  - More appropriate name server diversity requirement
  - No fragmentation of root zone referrals
Open recursive name servers

- Not good network citizens
  - Open to cache poisoning attacks (Kaminsky, et.al)
  - Open to amplification attacks
- Not required for authoritative service
1. Open recursive name servers

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Network diversity for name servers

- Current informal rule is a minimum of two “not in the same /24 subnet”
  - Not very relevant to networks today

- Each IP address on the Internet’s network location is derived through announcements in the “global routing table” using BGP

- Each network is roughly organised into a group called an “autonomous system”

- Require name servers to be announced in at least two different autonomous systems
.CX

ns.cx-nic.org.nz[203.119.12.245]
nanycast.nic.cx[204.61.216.16]
cx1.dyntld.net[208.78.70.77]
cx2.dyntld.net[204.13.250.77]
cx3.dyntld.net[208.78.71.77]
cx4.dyntld.net[204.13.251.77]
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<td>3 distinct networks</td>
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3 distinct networks ✔
ccTLDs with AS diversity
IANA currently has a minimum set of technical requirements for IPv4 name service. These include two nameservers separated by geography and by network topology, that each serve a consistent set of data, and are reachable from multiple locations across the globe. The registry will meet this same criterion for IPv6, requiring IPv6 transport to their network.

—Evaluation Criterion #40
Draft gTLD Applicant Guide Book
ccTLDs with AS diversity over IPv6
3 Referrals should not fragment

- A query for a domain name to the root servers results in a referral to a TLD’s authorities
Where is iana.org?

I don’t know, ask the .org name servers: ns1.org at 1.2.3.4 ns2.org at 2.3.4.5 ...
Referrals should not fragment

- A query for a domain name to the root servers should result in a referral to the TLD’s authorities.

- Classical limit for response size is 512 bytes.

- If the root server needs to send back more than 512 bytes of in a response, it will need to establish a much more complicated TCP connection, rather than use the simpler UDP protocol.

- This is not good for load and reliability.
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TCP ACK
TCP FIN ACK
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TCP ACK
TCP ACK
TCP FIN ACK
TCP ACK
TCP FIN ACK
TCP ACK
Limiting referral size

- Reduce the number of name servers
- Take advantage of name compression
ns1.iana.org and ns2.iana.com

Bytes used for names = 28
ns1.iana.org and ns2.iana.com

Bytes used for names = 28

ns1.iana.org and ns2.iana.org

Bytes used for names = 20

8 bytes saved
Limiting referral size

- Reduce the number of name servers
- Take advantage of name compression
- The more domains are shared for authorities, the better the compression outcome
- Tradeoff — you are now more reliant on certain domains
The bottom line
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TLDs with open recursive name servers 9.6%
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TLDs without diverse IPv4 connectivity 7.2%
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TLDs without diverse IPv6 connectivity 68.7%
The bottom line

- TLDs with open recursive name servers: 9.6%
- TLDs without diverse IPv4 connectivity: 7.2%
- TLDs without diverse IPv6 connectivity: 68.7%
  ... without any IPv6: 41.0%
The bottom line

- TLDs with open recursive name servers: 9.6%
- TLDs without diverse IPv4 connectivity: 7.2%
- TLDs without diverse IPv6 connectivity: 68.7%
  - ... without any IPv6: 41.0%
- TLDs with referrals that can fragment: 4.3%
How IDN ccTLD applications will be processed
(in theory)
Signing the Root Zone
Signing the root zone?

- ICANN’s strategic plan is to be “operationally ready”
  - Signed root test bed operating for over a year
  - System is built with advice from current DNSSEC operators, and many other experts in both DNS and cryptography
  - ICANN already signs 11 top-level domains operationally, and incrementally signing the last remaining zones under our control
Signing the root zone?

- ICANN developed a proposal to sign the root zone which was submitted to US Government.
- VeriSign followed up with a different proposal to sign the root zone.
- The US Government has issued a “Notice of Inquiry” to seek views relating to signing the DNS root zone, which was open to comments until November 24.
  - [http://tinyurl.com/3v8akt](http://tinyurl.com/3v8akt)

**ACTION:** Notice of Inquiry

**SUMMARY:** The Department of Commerce (Department) notes the increase in interest among government, technology experts and industry representatives regarding the deployment of Domain Name and Addressing System Security Extensions (DNSSEC) at the root zone level. The Department remains committed to preserving the security and stability of the DNS and is exploring the implementation of DNSSEC in the DNS hierarchy, including at the authoritative root zone level. Accordingly, the Department is issuing this notice to invite comments regarding DNSSEC implementation at the root zone.

**DATES:** Comments are due on November 24, 2008.

**ADDRESSES:** Written comments may be submitted by mail to Fiona Alexander, Associate Administrator, Office of International Affairs, National Telecommunications and Information Administration, U.S. Department of Commerce, 1401 Constitution Avenue, N.W., Room 4701, Washington, DC 20230. Written comments may also be sent by facsimile to (202) 482–1865 or electronically via electronic mail to DNSSEC@ntia.doc.gov. Comments will be posted on NTIA’s website at [http://www.ntia.doc.gov/DNS/DNSSEC.html](http://www.ntia.doc.gov/DNS/DNSSEC.html).
Interim Trust Anchor Repository
Interim Trust Anchor Repository

- A mechanism to publish keys of top-level domains that currently implement DNSSEC
- If the root zone is DNSSEC signed, such a repository is unnecessary
  - Therefore this is a stopgap measure
- Should be decommissioned when the root is signed
root

com

org

se

测试

iana.com

iana.org

例子.测试
KEYS I TRUST
root

- root
  - com
    - iana.com
  - org
    - iana.org
  - se
    - 测试
root

com
  iana.com
/org
  iana.org

se

测试
Benefits

- Fully meets a set of recommendations provided by RIPE
- Simple to use for both top-level domain operators, and end users.
- Works with different DNS software, different protocols, etc. Non proprietary.
- Almost fully automated
- Helps DNSSEC deployment
IANA provides an **Interim Trust Anchor Repository** to share the key material required to perform DNSSEC verification of signed top-level domains, in lieu of a signed DNS root zone. This is a temporary service until the DNS root zone is signed, at which time the keying material will be placed in the root zone itself, and this service will be discontinued.

**What is the repository for?**
The Interim Trust Anchor Repository, or ITAR, acts as a mechanism to disseminate "trust anchors" that have been provided by the operators of top-level domains who use DNSSEC to secure their zones. IANA is responsible for managing the DNS root zone, and uses these existing trust relationships to verify the supplied trust anchors come from the correct party. The system is considered interim as it is designed to be deprecated once the DNS root zone itself is signed with DNSSEC.

**What is a beta?**
This is a preliminary testing version of the service for the community to try. We will take feedback and improve the product before it is considered fully production ready. In particular, we appreciate feedback on problems that occur, as well as features that could be added to make the service more useful. You can send any comments to itar@iana.org.

**Who may submit trust anchors?**
This repository is limited to trust anchors for top-level domains. Top-level domain operators who have DNSSEC-signed their zones may use this service. The IANA contacts for a domain must cross-verify their intent to publish anchors before they will be accepted by IANA into the ITAR, so third parties are not able to submit trust anchors without their consent.

**How is this connected to IANA's DNSSEC test bed?**
This is a different project. The IANA DNSSEC test bed offers a signed DNS root zone (see http://ns.iana.org/dnssec/status.html). Trust anchors supplied to the ITAR, however, will be used for the DNSSEC test bed.

**How can I download the trust anchors?**
The trust anchor formats are distributed either via HTTP (above), Rsync (rsync://rsync.iana.org/itar), and FTP (ftp://ftp.iana.org/itar). We also provide a digest of the file, and a PGP signature, to help verify the contents. During initial testing we are using a PGP key with ID 1024494.
Thanks!
kim.davies@icann.org