Root Server Operated by ICANN
DNS Engineering | DNS Symposium Madrid | May 2017
Root Server in a nutshell

+ **RSSAC 026**
  + Entry point to the *root server system*.
  + Authoritative name server that answer queries for the contents of the *root zone*.

+ **RFC 7720** (*DNS Root Name Service Protocol and Deployment Requirements*)
  + Protocol Requirements:
    - core DNS functions (*RFC 1035*) and clarifications (*RFC 2181*)
    - IPv4 (*RFC 791*) and IPv6 (*RFC 2460*)
    - UDP (*RFC 768*) and TCP (*RFC 793*)
    - DNSSEC (*RFC 4035*)
    - DNS EDNS0 (*RFC 6891*)
  + Deployment Requirements:
    - Valid IP Address (*RFC 1122*)
    - Unique Root Zone (*RFC 2826*)
Root Server operated by ICANN

- ICANN operates one of the 13 Root Servers through its **DNS Engineering Team**
- ASN 20144
  - IPv4: **199.7.83.42** (/23 & /24)
  - IPv6: **2001:500:9f::42** (/47 & /48)
  - DNS label: **l.root-servers.net**
- Anycasted since 2007
- Renumbered IPv4 address in 2007 (old was 198.32.64.12)
- Renumbered IPv6 address in 2016 (old was 2001:500:3::42)
Operations
Current architecture is based on 2 different configurations

- **Single Instances** (3 server classes) hosted by ICANN partners
  - 156 instances (old and new version)
- 3 **Clusters** hosted by ICANN
  - 2 different versions
  - Made with many Singles
Architecture: Software

+ DNS Software used:
  + Name Server Daemon (NSD) from NLnetLabs
  + Knot DNS from CZ.NIC

+ BGP Routing Software used:
  + Quagga (intention to move to BIRD)
  + OpenBGP

+ OS systems used:
  + Linux based - Ubuntu
  + Unix based - FreeBSD
Anycast allow multiple copies of a server to be on multiple places, allowing us to:

- Put the service closer to the user
- Lower RTT
- Improve user experience
- Increase query capacity
- Reduces the likelihood some types of attack traffic would affect the rest of the internet by keeping it closer to the source
- Flexibility to add/remove instances
Locations and world presence

http://lrootmap.dns.icann.org
Measuring Traffic and Statistics

+ DNS Stats (Hedgehog) [http://stats.dns.icann.org](http://stats.dns.icann.org)
  + Provides *near real-time* statistics for our Root Server instances
  + Some of the features available are:
    + Query type, query attributes, aggregation, per second
    + IP Protocol and Transport Protocol
  + Version **2.3.0** released on October, 2016
  + Looking into new version. Optimized DB and data input process
    + Alternative to DSC Collector (able to gather more data)
  + Released to the community with a open license in August 2014. More information on [http://www.dns-stats.org](http://www.dns-stats.org)
DNS Stats

DNS-STATS
Hedgehog 2.3.0:
Four-toed release

From Wed, 26 Apr 2017 00:00:00 UTC
To Thu, 27 Apr 2017 23:59:00 UTC

Start 2017-04-26 00:00
End 2017-04-27 23:59

IP version carrying DNS queries
from 2017-04-26 00:00 UTC to 2017-04-27 23:59 UTC (smoothed)

Static Link: http://stats.dns.icann.org/ploc/cache/L-Root/dns_ip_version/2017-04-26T00:00-2017-04-27T23:59-all.html
Mechanisms for the Identification of Anycast Nodes

- HOSTNAME.BIND
- ID.SERVER
- NSID
- RFC 7108
  - IDENTITY.L.ROOT-SERVERS.ORG (TXT and A/AAAA Records)

```
$ dig identity.l.root-servers.org TXT +short
"iad63.l.root-servers.org" "Reston" "Virginia" "United States" "NorthAmerica"
```

- NODES.L.ROOT-SERVERS.ORG (TXT Record)
  - Will display a list of all the active Nodes for L-Root
Monitoring

+ **External** monitoring
  + DNSMON, BGPMON, ThousandEyes and more

+ **Internal** monitoring
  + Zabbix
  + Icinga
  + DNS-Stats
  + Nexpose
  + A LOT of custom scripts
Hosting an instance in your network
Want to host an instance on your network?

+ Pre-requisites:
  + Your organization is willing to host a server instance managed by ICANN.
  + Your organization can provide all the following:
    - Sign a NDA and an ICANN Agreement
    - Purchase a hardware appliance (as spec’d by ICANN)
    - Provide housing for the appliance (hosting/power/v4 & v6 connectivity)
    - Ability to establish a BGP peering session to propagate AS20144 prefixes
If you can satisfy the prerequisites

Your organization will need to contact your **ICANN GSE** local representative and complete a contact information document

- Your organization will then need to sign a NDA
- Your organization will then need to sign the contract
- Your organization will need to complete a technical form (addressing and routing details)
- ICANN will return the documents executed
- ICANN DNS Engineering team installs and commissions the appliances(s).
About ICANN DNS Engineering Team

+ DNS Engineering Team is part of ICANN IT Department
+ Currently distributed in 4 different Time Zones (follow-the-sun mode)
ICANN DNS Engineering team Goals

+ DNS expertise and excellence
+ Strengthen, diversity and growth of Root Server system worldwide
+ Collaboration within our peers
+ Best engineering process
+ Transparency and documented process
How to engage with ICANN DNS Engineering

+ Research bodies (DNS-OARC)
+ Network Operations (NANOG, LACNOG, AUSNOG, CENTR)
+ Standard bodies (IETF)
+ Participation on many different mailing lists
+ Social media (Website, Twitter)
+ [https://dns.icann.org](https://dns.icann.org)

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Questions?