



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*)

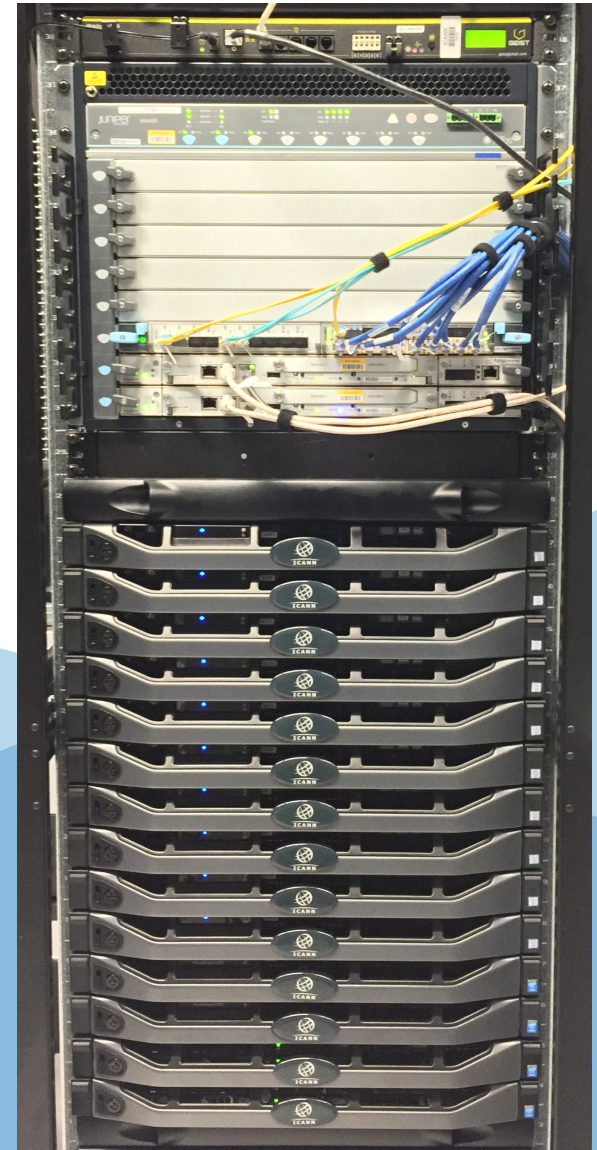
Root Server operated by ICANN

- + 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)
 - + Still answering in old IPv6 address:
http://stats.dns.icann.org/plotcache/L-Root/server_addr/2017-04-30T23:41-2017-05-01T23:40-all.html

Operations

Architecture: Hardware

- + Current architecture is based on 2 different configurations
 - + **Single Instances** (3 server classes) hosted by ICANN partners
 - o 156 instances (old and new version)
 - + **3 Clusters** hosted by ICANN
 - o 2 different versions
 - o Made with many Singles



Architecture: Software

- + DNS Software used:

- + Name Server Daemon (**NSD**) from NLnetLabs

- + **Knot DNS** from CZ.NIC

- + BGP Routing Software used:

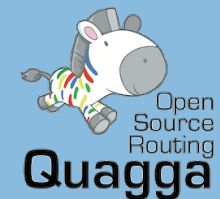
- + **Quagga** (intention to move to BIRD)

- + **OpenBGP**

- + OS systems used:

- + Linux based - **Ubuntu**

- + Unix based - **FreeBSD**

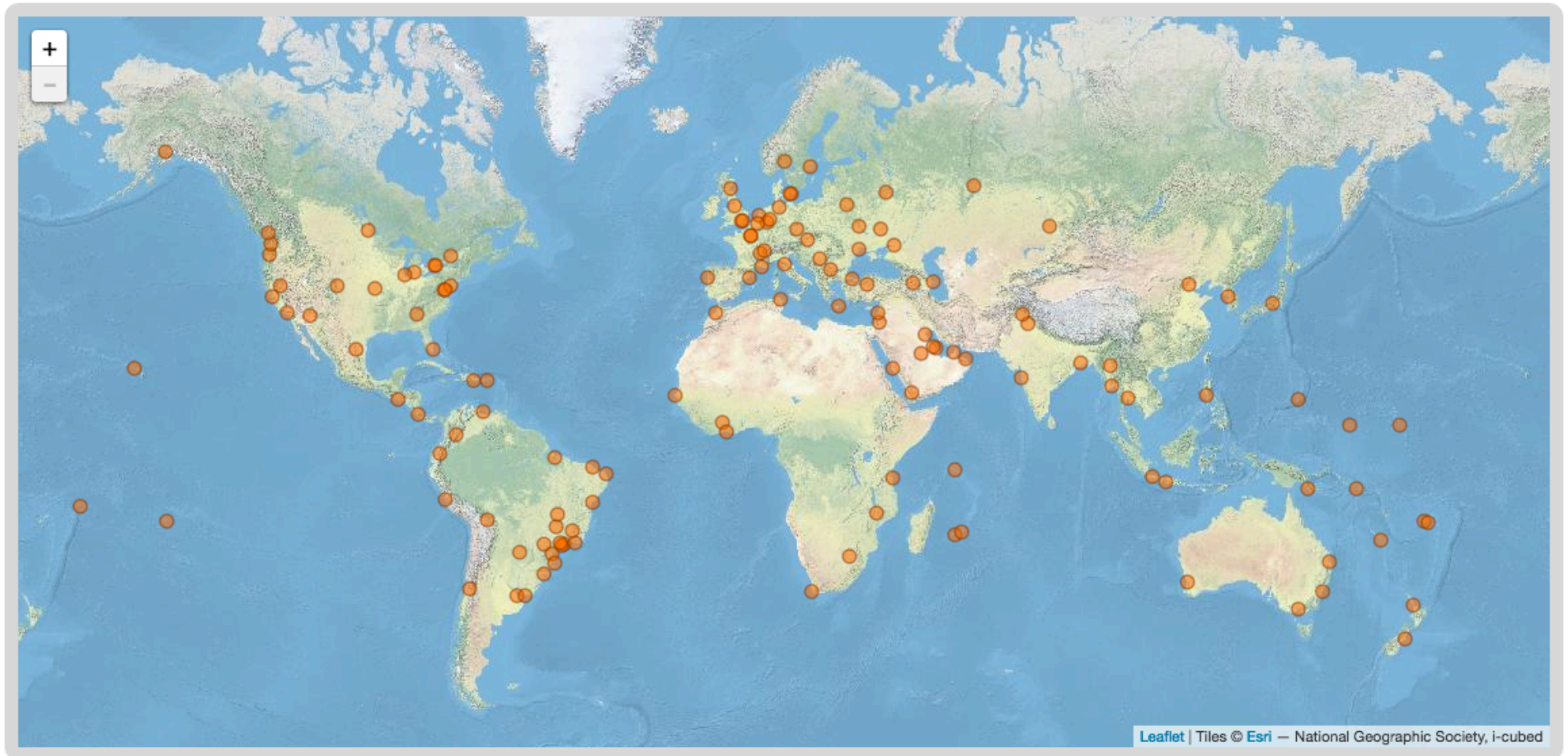


Geographical diversity via Anycast

- + 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>
 - + 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>

DNS Stats

DNS-STATS
Hedgehog 2.3.0:
Four-toed release

Basic Time | **Advanced time** | Today

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

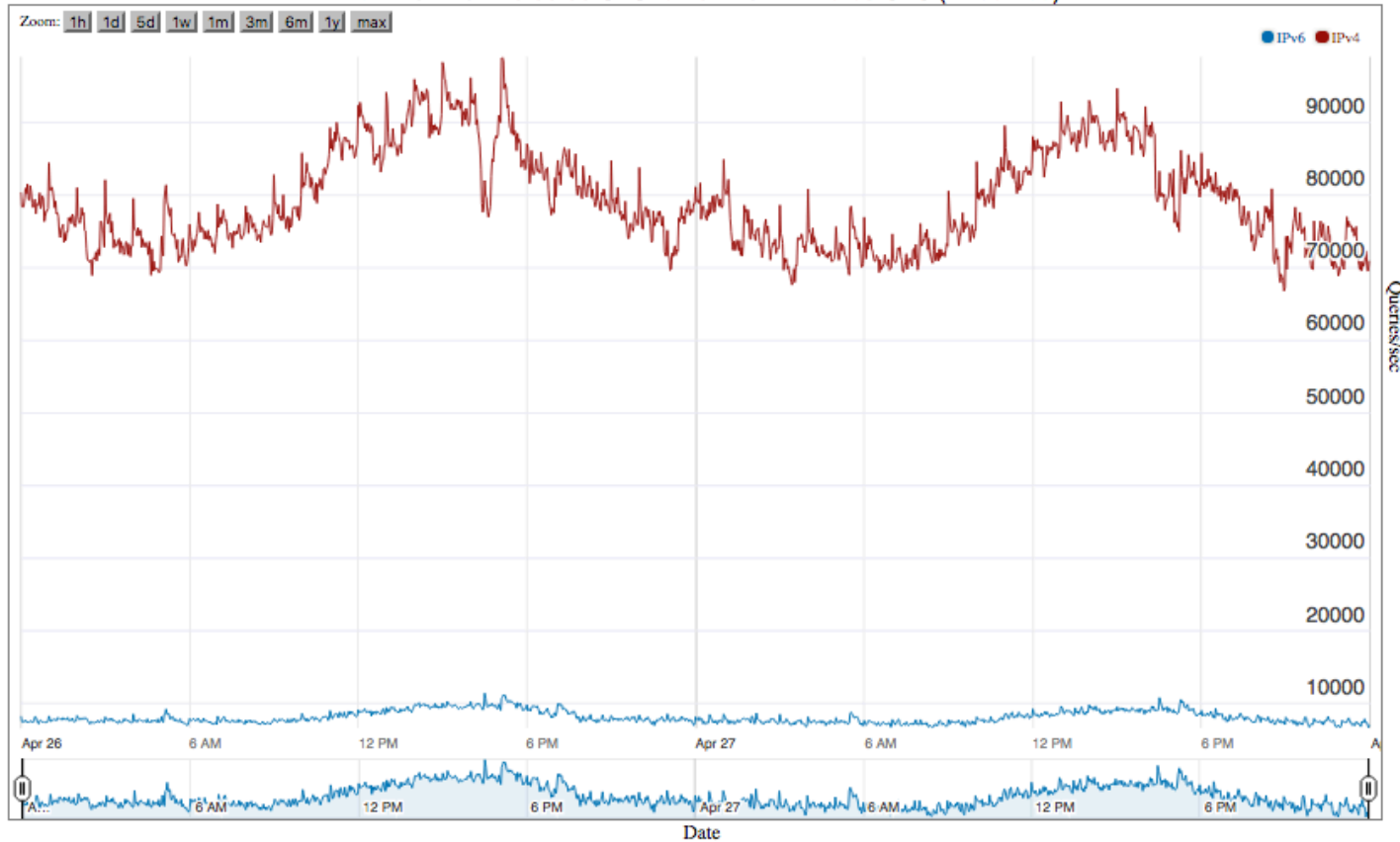
Start 20170426, 00:00
End 20170427, 23:59

Static plot Interactive plot

Plot IP version

Generate Plot!

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/plotcache/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

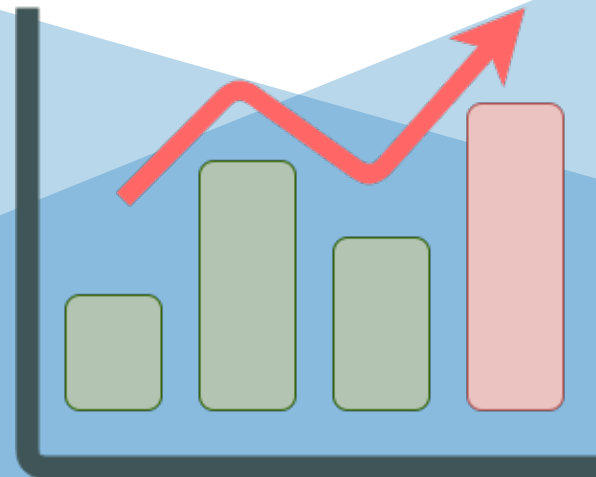
Monitoring

- + **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:

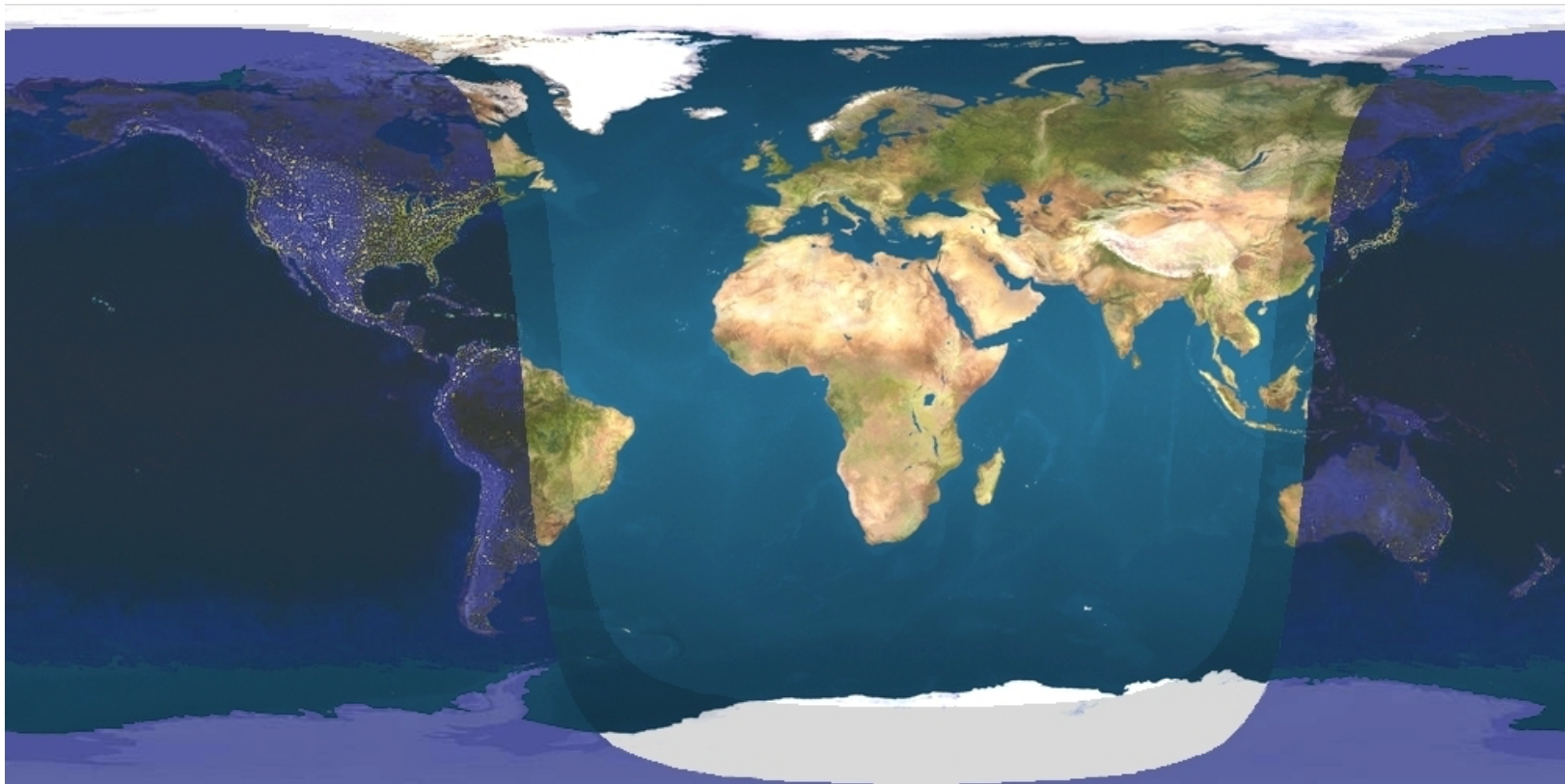
- ⦿ Sign a NDA and an ICANN Agreement
- ⦿ Purchase a hardware appliance (as spec'd by ICANN)
- ⦿ Provide housing for the appliance (hosting/power/v4 & v6 connectivity)
- ⦿ Ability to establish a BGP peering session to propagate **AS20144** prefixes

Hosting an ICANN Root Server Workflow

- + 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>



@ICANNdnsEng

Questions?



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