

# K-Root Name Server Operations

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# Outline

- An Overview of the Root Server System
  - Architecture
  - Anycasting
- k.root-servers.net Server
  - Major milestones
  - K-Anycast deployment
  - Current status



# Root Server System

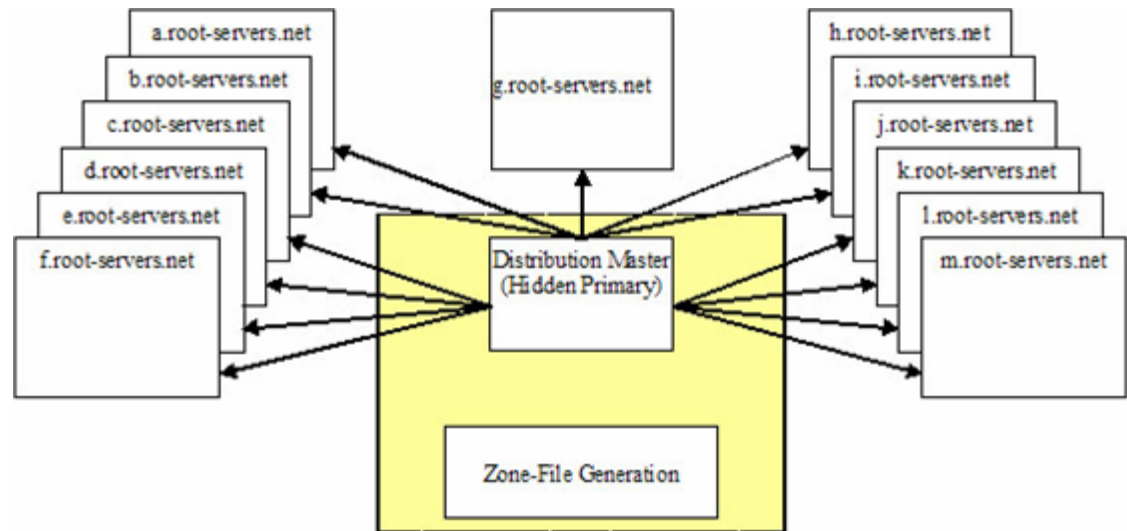
- Provides nameservice for the **root zone**
  - The root DNS node with pointers to the authoritative servers for all top-level domains (gTLDs, ccTLDs).
  - A file with less than 2500 lines and less than 100KBytes
- Thirteen name server operators
  - Selected by IANA
  - Diversity in organisations and location
  - 13 is a practical limit
  - [a ÷ m].root-servers.net - equal publishers
  - All 13 are authoritative servers for the root zone
- An average client comes here < 8 times/week

# Root servers and operators

- Thirteen root nameservers
  - a. root-servers.net Veri sign
  - b. root-servers.net USC-I SI
  - c. root-servers.net Cogent Communi cations
  - d. root-servers.net Uni versi ty of Maryl and
  - e. root-servers.net NASA
  - f. root-servers.net I SC
  - g. root-servers.net US DoD (DI SA)
  - h. root-servers.net US DoD (ARL)
  - i. root-servers.net Autonomi ca
  - j. root-servers.net Veri sign
  - k. root-servers.net RI PE NCC
  - l. root-servers.net I CANN
  - m. root-servers.net WI DE Proj ect
- Look at [www.root-servers.org](http://www.root-servers.org)

# Current Root System Architecture

- Hidden distribution master
- All 'letter' servers are equal
- Authenticated transfers between the servers (TSIG)





# Anycasting

- Point-to-point communication between a single client and the “nearest” destination server
  - Basics described in RFC 1546 in 1993
- “Cloning” a server
  - Multiple locations
  - Same operator
  - Same IP address belonging to the operator
  - Identical data
- Benefits
  - Distribution, Resilience, Performance, Redundancy, Simplicity

# Location of 13 DNS Root Servers





# Global context

- ICANN/IANA
  - Reviews the changes in the zone file
- US DoC
  - Approves the changes
- Verisign
  - Edits the zone (technical)
- 13 Root Server Operators
  - Publish the zone
  - Coordinate operations/share information

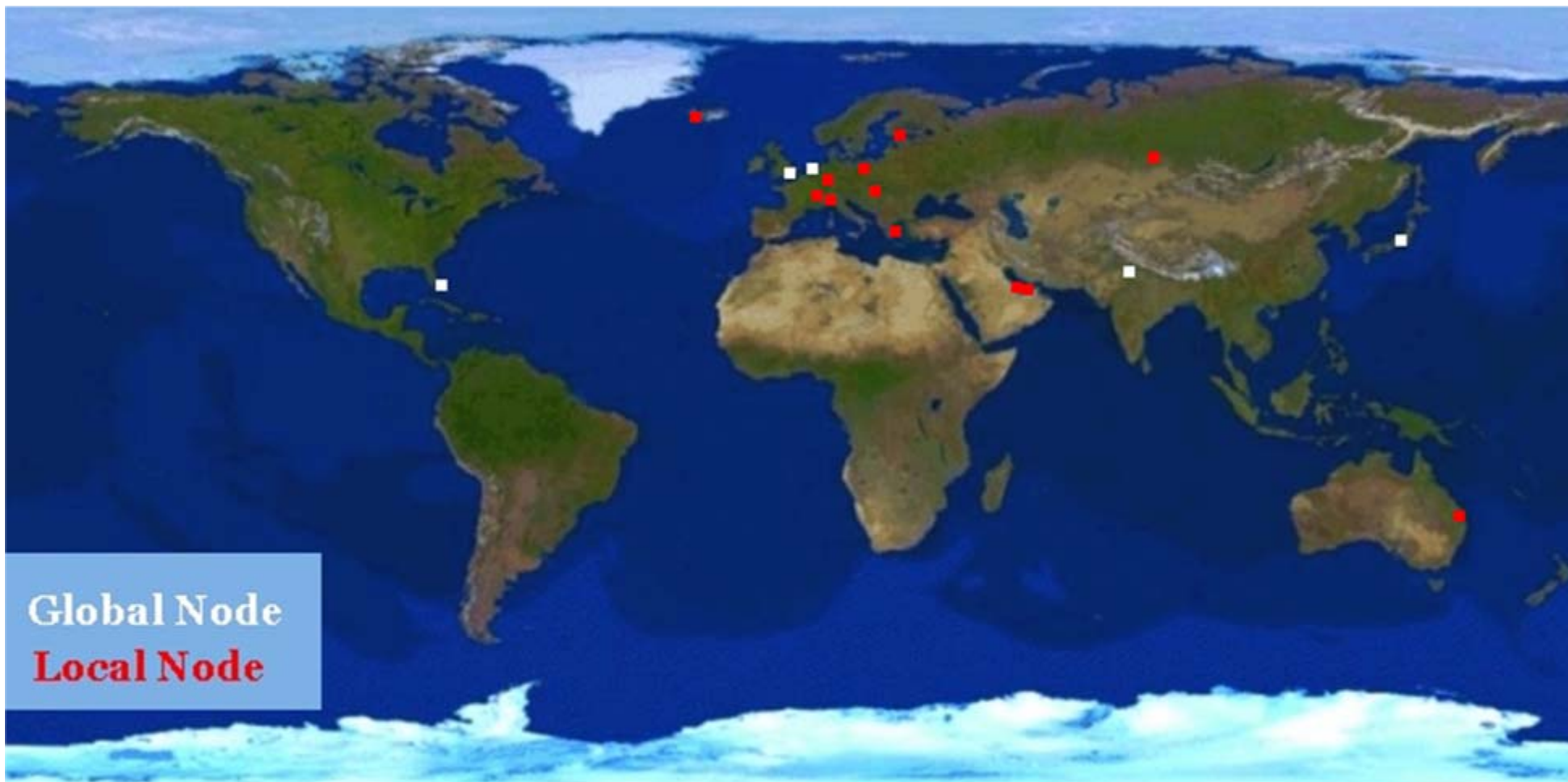




# K-root Milestones

- Operated by RIPE NCC since May 1997
  - Hosted by LINX in London
- Running NSD since February 2003
  - Increased software diversity and performance
  - NSD jointly developed with NLnet Labs
- Anycast since July 2003
  - Two global instances: London and Amsterdam
- Wider anycast deployment (since 2004)
  - 12 local anycast nodes
  - 5 Global nodes

# K-root Locations





# “Local” K-root Mirror Instances

- Objectives
  - Improving access to K for a significant ISP community
  - Isolating impact of an “external” DDoS
  - Localising impact of a “local” DDoS
- Benefits
  - Improved responsiveness for the members of the IX
  - Improved resilience of the whole system for others
- Model
  - Hosted and funded by a neutral party
- Operations
  - Exclusively performed by the RIPE NCC



# “Global” K-root Mirror Instances

- Ideally located at topologically equidistant places
  - In practice there are not so many choices
- Globally reachable
  - But less preferable than “local” mirror instances
- Powerful in terms of **connectivity** and CPU
  - Have to sustain DDoS and local nodes failures
- The same management model as for local nodes
  - RIPE NCC is the operator
- Different funding model
  - No distinguished group of local beneficiaries
  - Costs are mainly borne by the RIPE NCC
- Excellent global connectivity

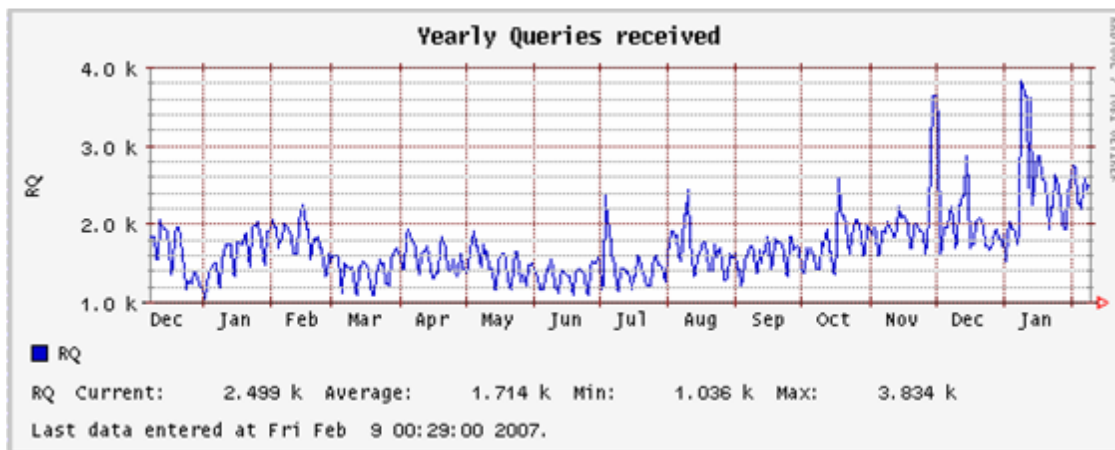
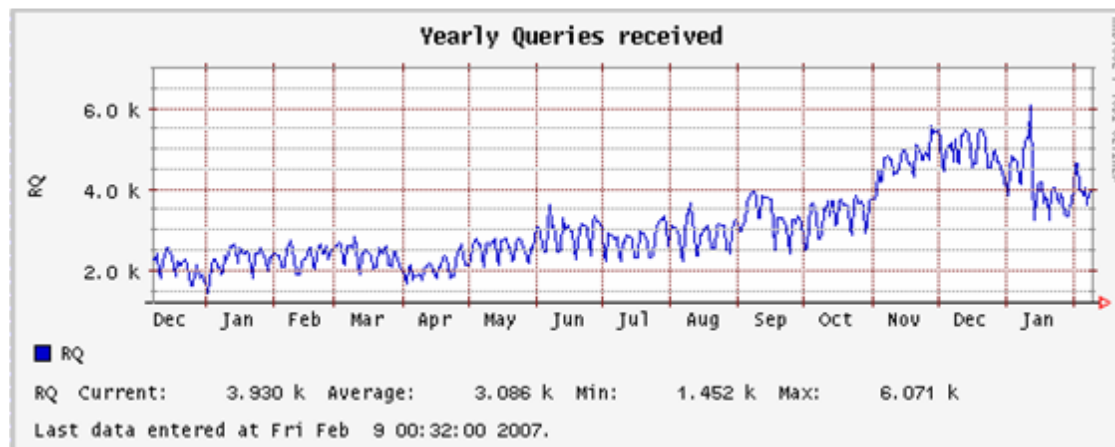


# K-root Statistics

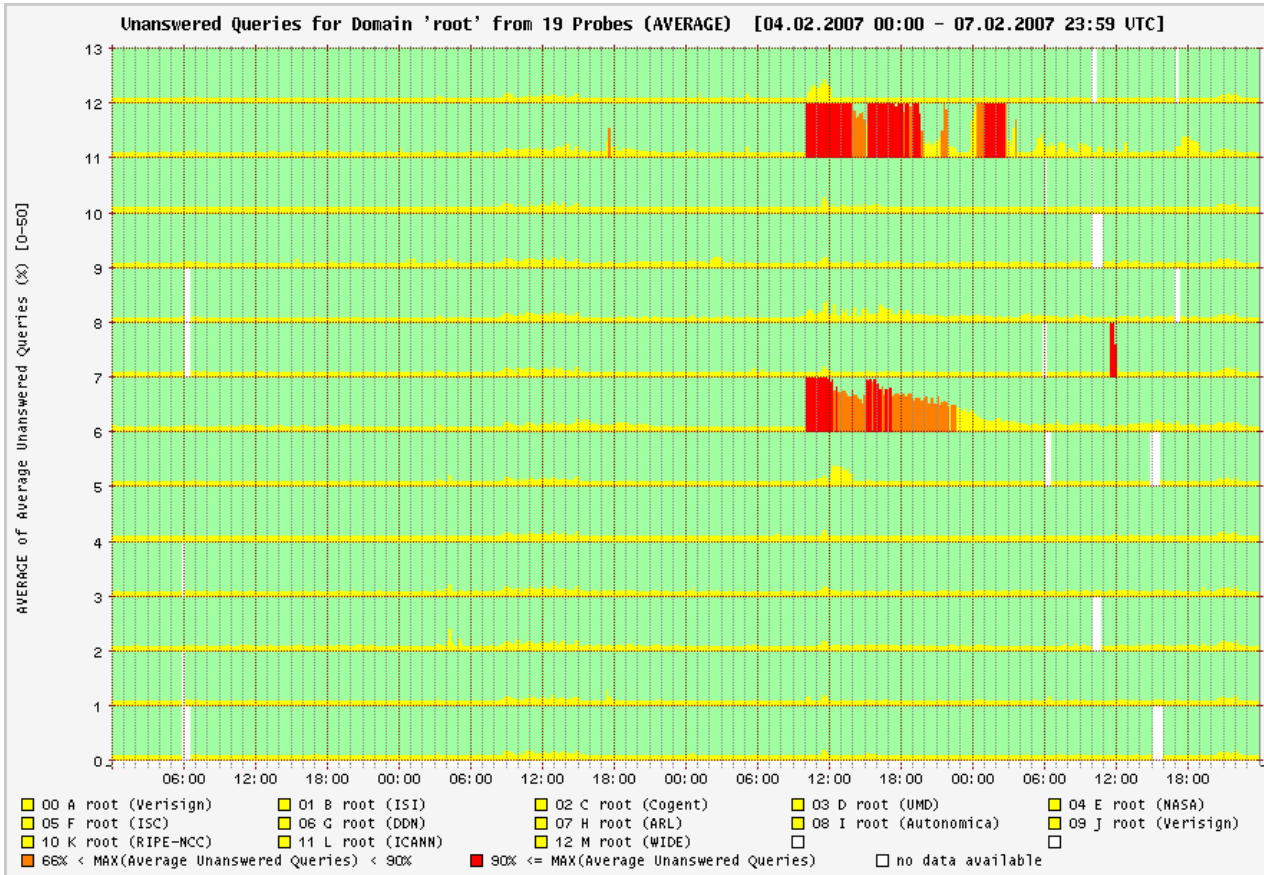
London

More than 80% of these queries are “Crap”!

Amsterdam



# DoS Attack on 6-Feb-2007



This graph represents a four day period with more than 5 million separate measurements from more than 70 probes.

The probes are located worldwide but predominantly in Europe.

- Not noticeable to Internet users
- “10.8 of the 13 servers available at all times





# Tutorials

- DNS Root Name Servers Explained For Non-Experts

<http://www.isoc.org/briefings/019/>

- The Internet Domain Name System Explained for Non-Experts

<http://www.isoc.org/briefings/016/>

- DNS Root Name Servers Frequently Asked Questions

<http://www.isoc.org/briefings/020/>

# More Information

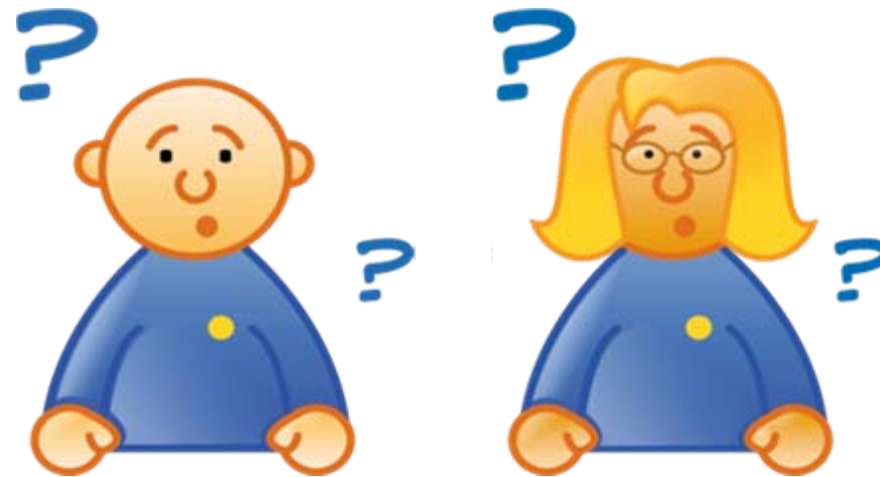
- Root operators & servers
  - <http://www.root-servers.org>
  - [http://\[a-m\].root-servers.org](http://[a-m].root-servers.org)
    - <http://dnsmon.ripe.net>
- Root server analysis
  - <http://www.caida.org/projects/dns-analysis/>
- Anycasting
  - [Host Anycasting Service](#), RFC1546, <http://www.ietf.org/rfc/rfc1546.txt>
  - [Distributing Authoritative Name Servers via Shared Unicast Addresses](#). RFC3258, <http://www.ietf.org/rfc/rfc3258.txt>





# More Information (cont.)

- K-root
  - <http://k.root-servers.org>
- K-root anycasting
  - Distributing K-Root Service by Anycast Routing, RIPE- 268, <http://www.ripe.net/ripe/docs/ripe-268.html>
  - General Requirements and Guidelines, <http://k.root-servers.org/docs/hosting-guidelines.html>



# Questions?