K-Root Name Server Operations

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Outline

• Root Server System – brief update
  – Architecture
  – Current locations
  – Anycast deployment

• K.root-servers.net Server
  – Major milestones
  – Current status
  – K-Anycast deployment
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).

• Thirteen name server operators
  – Selected by IANA
  – Diversity in organisations and location
  – 13 is a practical limit
  – a.root-server.net ÷ m.root-server.net - equal publishers
  – All thirteen are authoritative servers for the root zone

• An average client comes here < 8 times per week
Root servers and operators

• Thirteen nameservers, selected before 1997
  – a.root-servers.net  Verisign
  – b.root-servers.net  USC-ISI
  – c.root-servers.net  Cogent Communications
  – d.root-servers.net  University of Maryland
  – e.root-servers.net  NASA
  – f.root-servers.net  ISC
  – g.root-servers.net  US DoD (DISA)
  – h.root-servers.net  US DoD (ARL)
  – i.root-servers.net  Autonomica
  – j.root-servers.net  Verisign
  – k.root-servers.net  RIPE NCC
  – l.root-servers.net  ICANN
  – m.root-servers.net  WIDE Project

• Look at www.root-servers.org
• Public primary nameserver
  – a.root-servers.net (ns.internic.net) primary
  – Other 12 are secondary
  – NSI generates the zone (Verisign since 2000)

• Enhanced architecture (2002)
  – Hidden distribution master
  – All ‘letter’ servers are equal
  – Authenticated transactions between the servers (TSIG)

• Wide deployment of anycast (2003)
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

More than 60 and number is growing
Global context/Major players

• ICANN/IANA
  – Reviews the changes in the zone file
• US DoC
  – Approves the changes
• Verisign
  – Edits the zone (technical)
• RSSAC
  – Advices ICANN regarding the Root Server System
• 13 Root Server Operators
  – Publish the zone
  – Coordinate operations/share information
• Others
  – IETF/IAB, OARC
  – BIND Forum, NLnetLabs
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
- Anycast since July 2003
  - Two global instances: London and Amsterdam
- Wider anycast deployment (2004)
  - 3-5 global nodes (Asia, Americas)
  - 10-15 local nodes
    - Frankfurt, January 2004
    - Athens, April 2004
“Local” Mirror Instances

• Objectives
  – Improving access to K for a significant ISP community
  – Isolating impact of an “external” DDoS
  – Localising impact of a “local” DDoS

• Location
  – Well connected points with significant ISP community (IXP, etc.)
  – Improved responsiveness for the members of the IX
  – Improved resilience of the whole system for others

• Model
  – Hosted by a neutral party
  – Open peering policy
  – Fully funded by a hosting party

• Operations
  – Exclusively performed by the RIPE NCC
“Global” 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
- Looking for 3-5 locations in Asia and the Americas
  - Excellent global connectivity
K-root Locations

Introduction
The RIPE NCC operates k.root-servers.net, one of the 13 Internet root name servers. The K-root service is provided by a set of distributed mirror instances using IPv4 anycast. Each mirror instance announces the 193.0.14.0/24 network in AS25152. A K-root server mirror instance consists of a cluster of server machines running the NSD name server software.

News
- [27 Apr 2004] K-root mirror instance deployed in Athens
- [27 Jan 2004] K-root mirror instance deployed in Frankfurt

Locations
Query Load Distribution

![Bar chart showing query load distribution across different locations]

- London
- Amsterdam
- Frankfurt
- Athens

The chart illustrates the query load distribution across different locations, with London having the highest load, followed by Amsterdam and Frankfurt, and Athens having the lowest load.
More Information

• Root operators
  – http://www.root-servers.org
  – http://[a-m].root-servers.org
    • http://dnsmon.ripe.net

• Root server 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](http://k.root-servers.org)

- **K-root anycasting**
  - Contact at [k-anycast@ripe.net](mailto:k-anycast@ripe.net)