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
  - \([a \div m].\text{root-servers.net}\) - 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 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
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 then “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://dnsmon.ripe.net

• Root server analysis

• Anycasting
More Information (cont.)

• K-root
  - http://k.root-servers.org

• K-root anycasting
Questions?