
# f.root-servers.net

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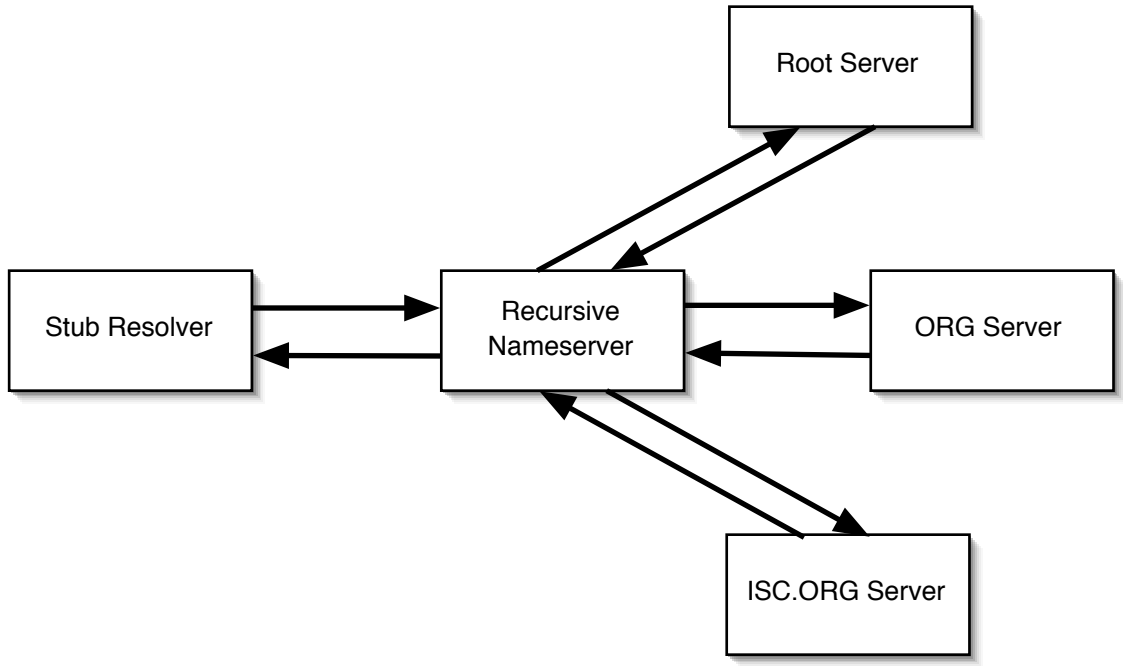
# DNS

- The Domain Name System is a huge database of resource records
  - globally distributed, loosely coherent, scaleable, reliable, dynamic
  - maps names to various other objects

# Resolving www.isc.org



# Root Servers

- Every recursive nameserver needs to know how to reach a root server
- Root servers are the well-known entry points to the entire distributed DNS database
- There are 13 root server addresses, located in different places, operated by different people
- http://www.root-servers.org/

# The Root Servers

| | | |
|---|---|---|
| A.ROOT-SERVERS.NET | Verisign Global Registry Services | Herndon, VA, US |
| B.ROOT-SERVERS.NET | Information Sciences Institute | Marina del Rey, CA, US |
| C.ROOT-SERVERS.NET | Cogent Communications | Herndon, VA, US |
| D.ROOT-SERVERS.NET | University of Maryland | College Park, MD, US |
| E.ROOT-SERVERS.NET | NASA Ames Research Centre | Mountain View, CA, US |
| F.ROOT-SERVERS.NET | Internet Software Consortium | Various Places |
| G.ROOT-SERVERS.NET | US Department of Defence | Vienna, VA, US |
| H.ROOT-SERVERS.NET | US Army Research Lab | Aberdeen, MD, US |
| I.ROOT-SERVERS.NET | Autonomica | Stockholm, SE |
| J.ROOT-SERVERS.NET | Verisign Global Registry Services | Herndon, VA, US |
| K.ROOT-SERVERS.NET | RIPE | London, UK |
| L.ROOT-SERVERS.NET | IANA | Los Angeles, CA, US |
| M.ROOT-SERVERS.NET | WIDE Project | Tokyo, JP |

# Challenges on the Root

- There have been a number of attacks on the root servers
- Distributed denial of service attacks can generate a lot of traffic, and make the root servers unreachable for many people
- Prolonged downtime would lead to widespread failure of the DNS

# Widespread Failure

- Probability of the entire DNS system failing is low
  - the most important data in the DNS (records which are frequently queried) are cached
- Regional failure is more likely
  - e.g. loss of international connectivity, bulk probe traffic from worms

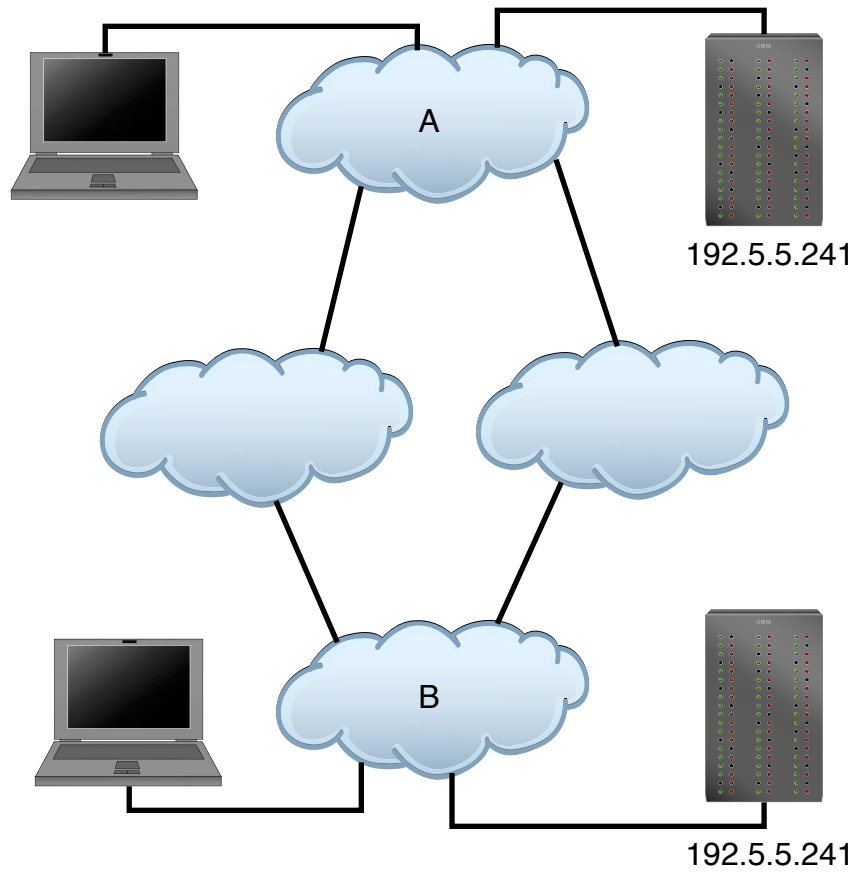
# f.root-servers.net

- Has a single IP address (192.5.5.241)
  - no change there
- Requests sent to 192.5.5.241 are routed to different nameservers, depending on where the request is made from
  - this behaviour is transparent to devices which send requests to F

# Routing

- Most traffic on the Internet is unicast
  - packets have a single destination
- Some traffic is multicast
  - packets are directed to multiple destinations
- Traffic to f.root-servers.net is anycast
- packets are directed to a single instance of F, but different queries (from different places) may land on different instances

# Anycast Routing



# Restricted Anycast

- Some of the F root nameserver nodes provide service for 192.5.5.241 to the entire Internet (master nodes)
  - very large, well-connected, secure and over-engineered nodes
- Others provide service for 192.5.5.241 to a particular region (remote nodes)
  - smaller

# Failure Modes

- If a remote node fails, queries to 192.5.5.241 are automatically routed to a master node
- If a master node fails, queries are automatically routed to another master node
- Catastrophic failure of all master nodes results in continued service by remote nodes within their catchment areas

# Sponsorship

- ISC is a non-profit company
- Equipment, colo, networks for remote nodes are paid for by a sponsor
- All equipment is operated by ISC engineers
- The sponsor covers the ISC's operational costs of running the remote node

# F in Asia Pacific

- ISC is working with APNIC to deploy remote nodes in Asia Pacific
- http://www.apnic.net/services/rootserver/

# Deployment Status

- Two master nodes
  - Palo Alto, CA, US
  - San Francisco, CA, US
- Two remote nodes
  - Madrid, Spain
  - Hong Kong

# Deployment Targets

- 10 remote nodes live by the end of 2003
- 20 more in 2004

# For More Information

- Contact ISC
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  - Joe Abley <jabley@isc.org>
- Contact APNIC
  - Paul Wilson <dg@apnic.net>