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Root Name Service Evolution




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Disclaimer

- Root server organizations operate individually.
- I can only speak authoritatively for i.root-servers.net operated by Autonomica AB based in Stockholm, Sweden.



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Around 1992

- Just an ordinary workstation ...
- Sitting on a desk in an office ...
- Manually updated ...
- Just 13 machines ...
- We've come a long way since then!



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Stepping up to New Tasks

- Expanding system under given restraints.
- New DNS protocol requirements
 - IPv6
 - DNSSEC
- New operational challenges:
 - More servers – anycast!
 - Complexity of large installations.
 - Various types of attacks.



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What is it Today?

- Servers at ~~182~~ 133 sites
 - ... and counting.
- Cryptographically signed data transfers.
- Tight engineering cooperation.
 - Regular meetings 3 times/year.
 - Technical coordination.
- Relationship with ICANN
 - Root Server System Advisory Committee.



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Monitoring

- Normal "inside" monitoring
- Probe networks
 - RIPE NCC (K-root) (active)
 - WIDE (Univ. of Tokyo – M-root) (active)
 - Autonomica (I-root)
 - Old, small: active
 - New, much bigger: under deployment
 - Others outside the root ops community.
- ISC Operations, Analysis, and Research Center (OARC)
- Cooperative Association for Internet Data Analysis (CAIDA)



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Attacks

- Yes, they do happen.
- **THEY DON'T BREAK THE INTERNET!**
 - DNS is a **very, very** robust protocol!
 - Clients cache data, including lists of TLD servers.
- Anycast gives decent protection.
- Very close cooperation with software vendors, Internet service providers, law enforcement, and computer emergency response teams.



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The Future?

- Still wider spread
 - Many corners of the world still underprovisioned.
 - This is ongoing.
- IPv6
- DNSSEC
- Traffic analysis
 - Preventive measures

