DNS Security

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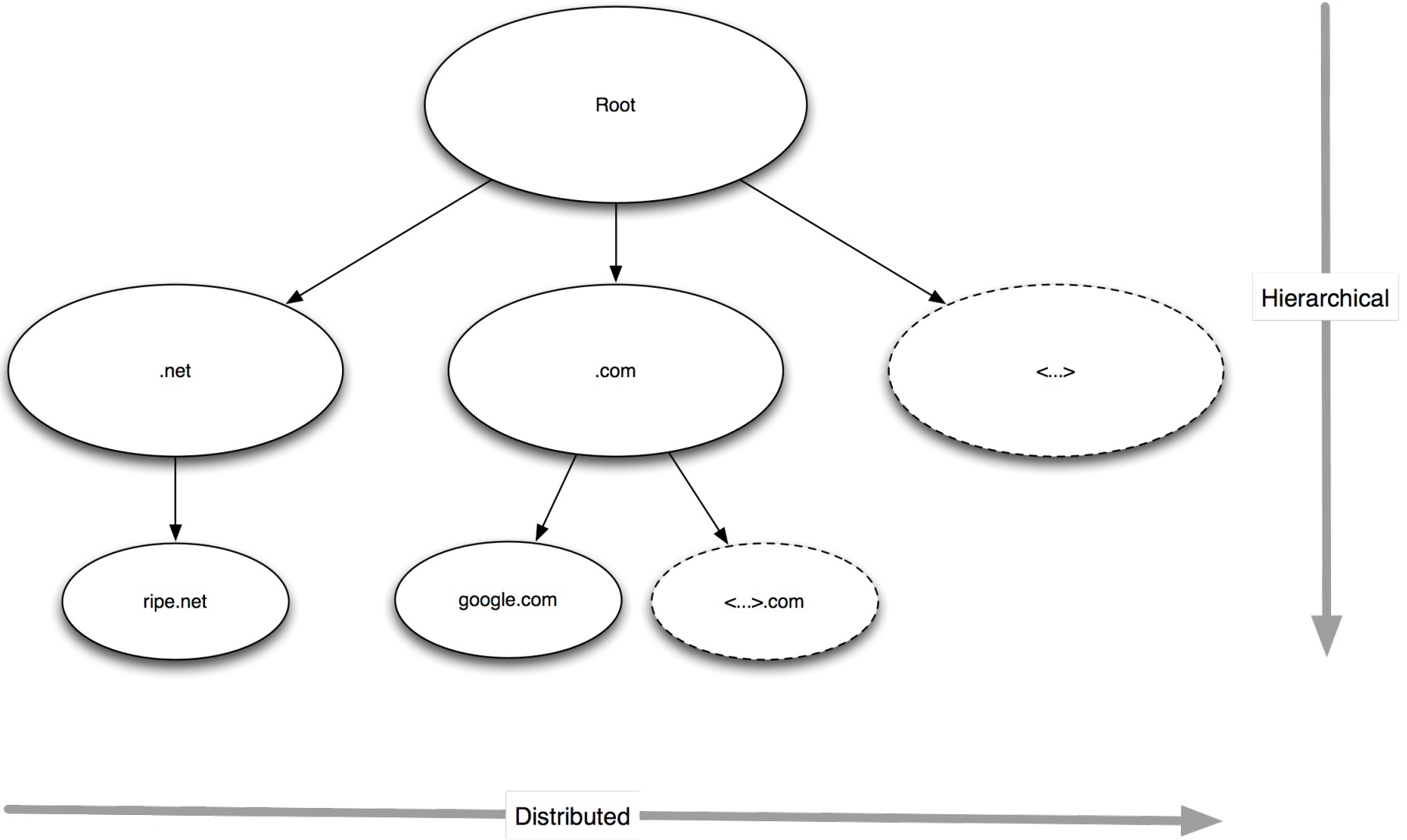
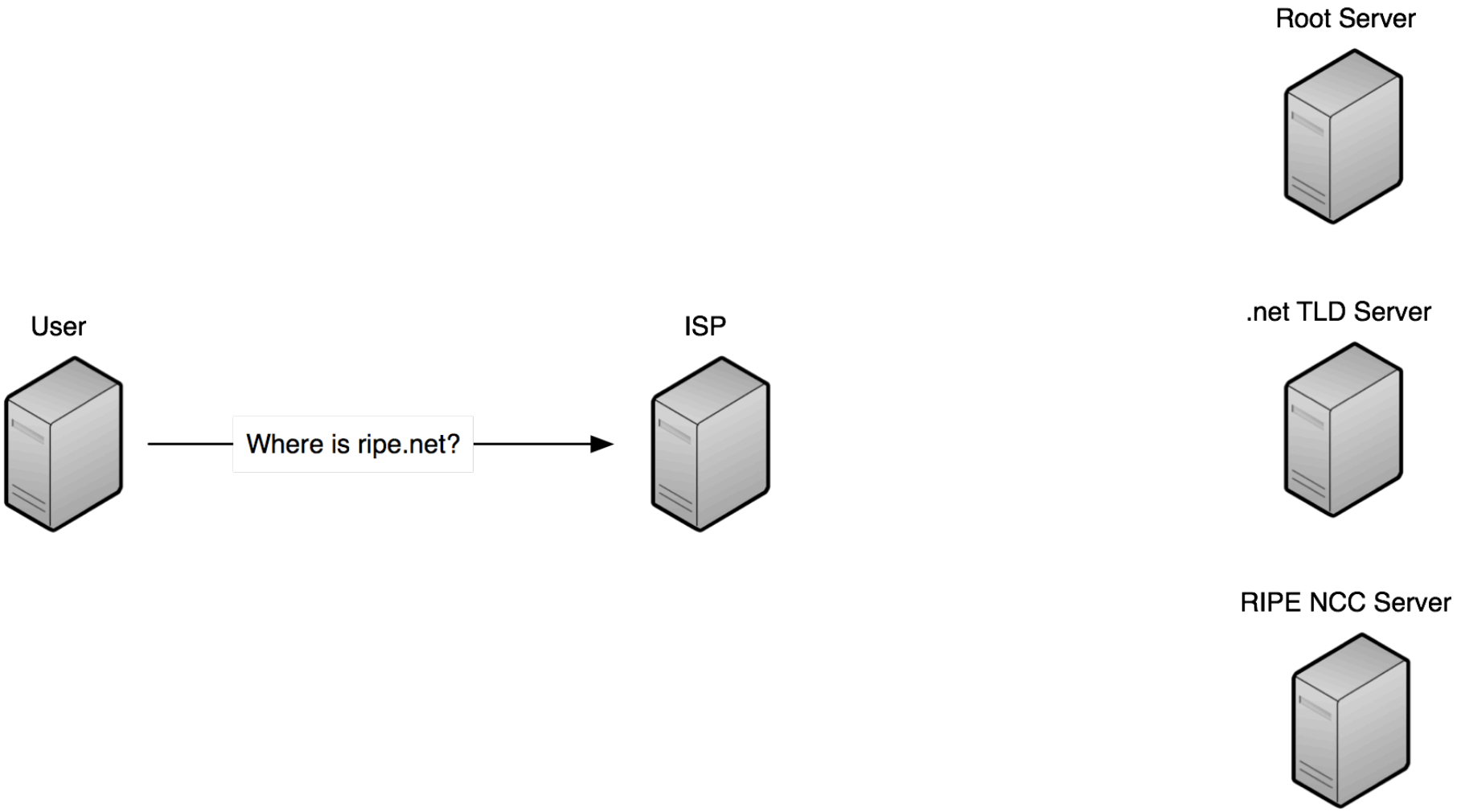
DNS: the Domain Name System

- Specified by Paul Mockapetris in 1983
- Distributed Hierarchical Database
  - Main purpose: Translate names to IP addresses
  - Since then: Extended to carry a multitude of information (such as SPF, DKIM)
- Critical Internet Infrastructure
  - Used by most systems (in the background)

DNS Tree Structure



How does it work?



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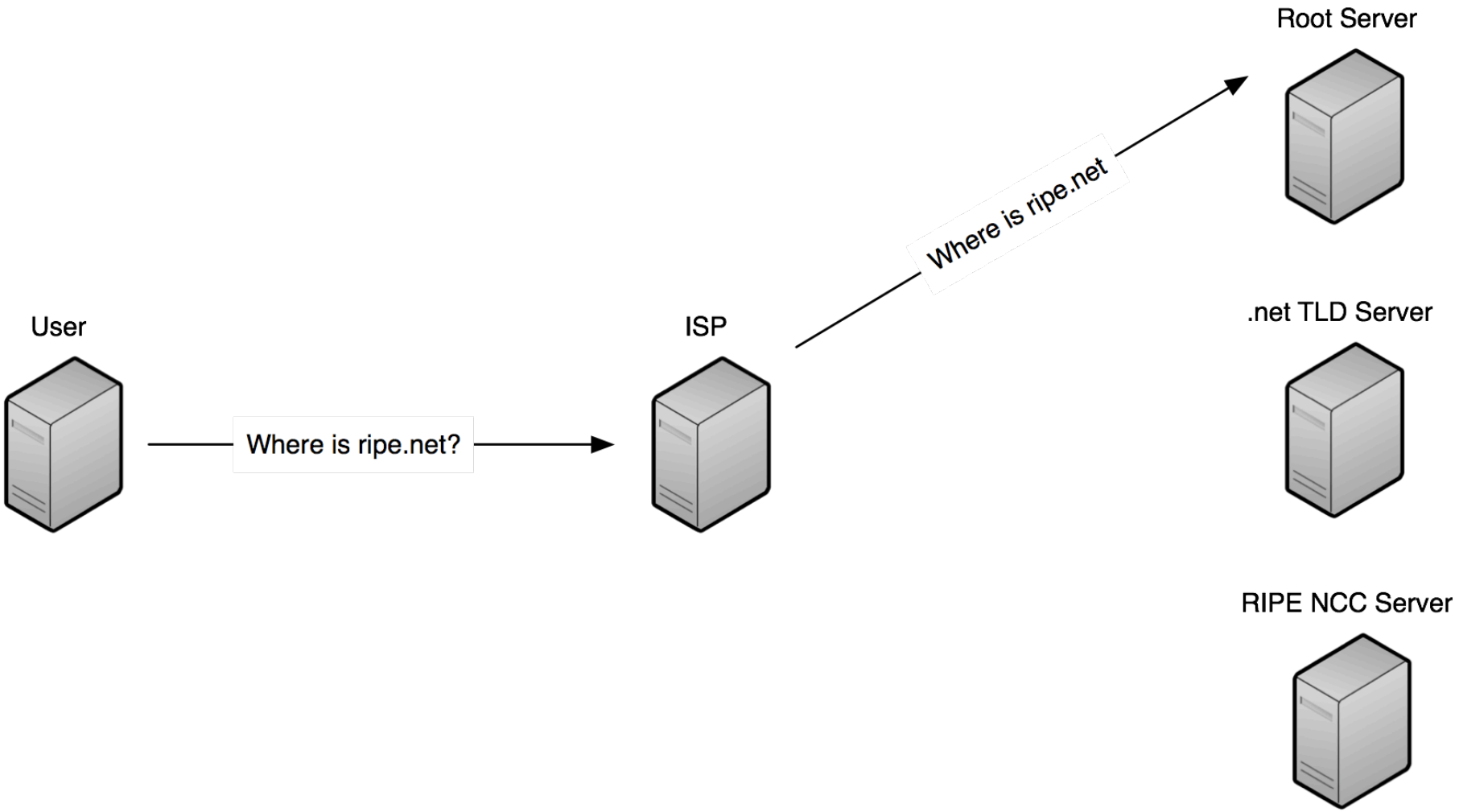

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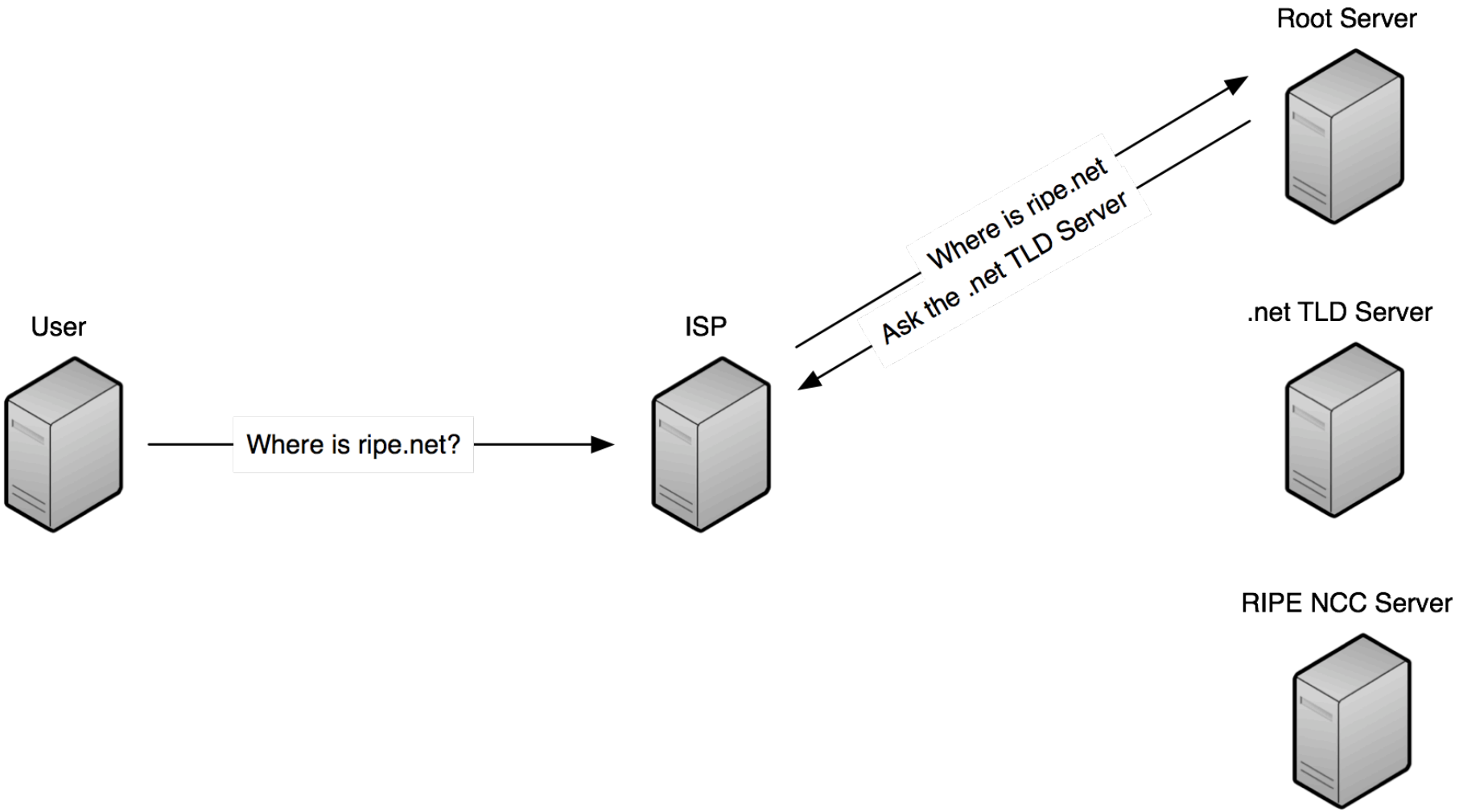

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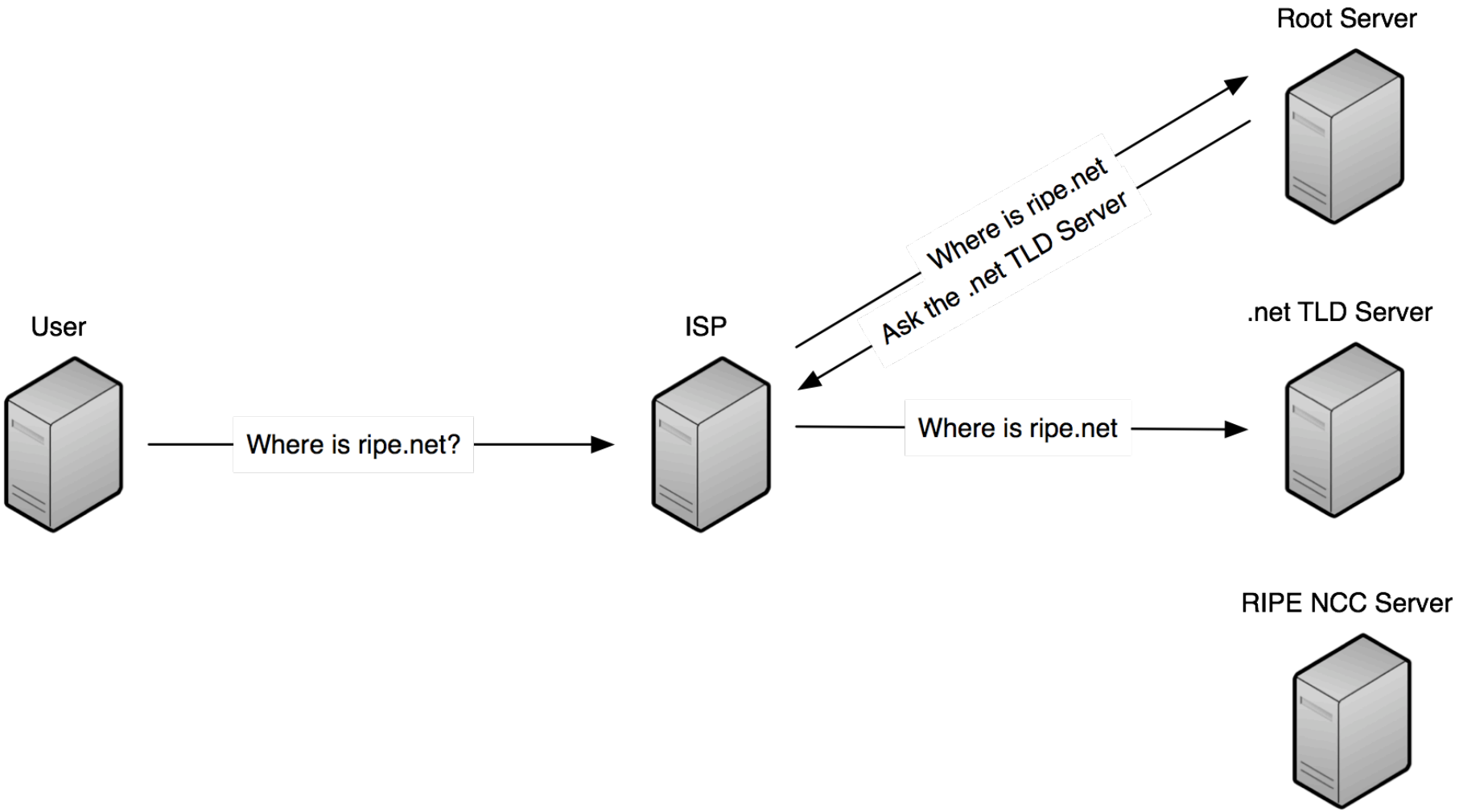

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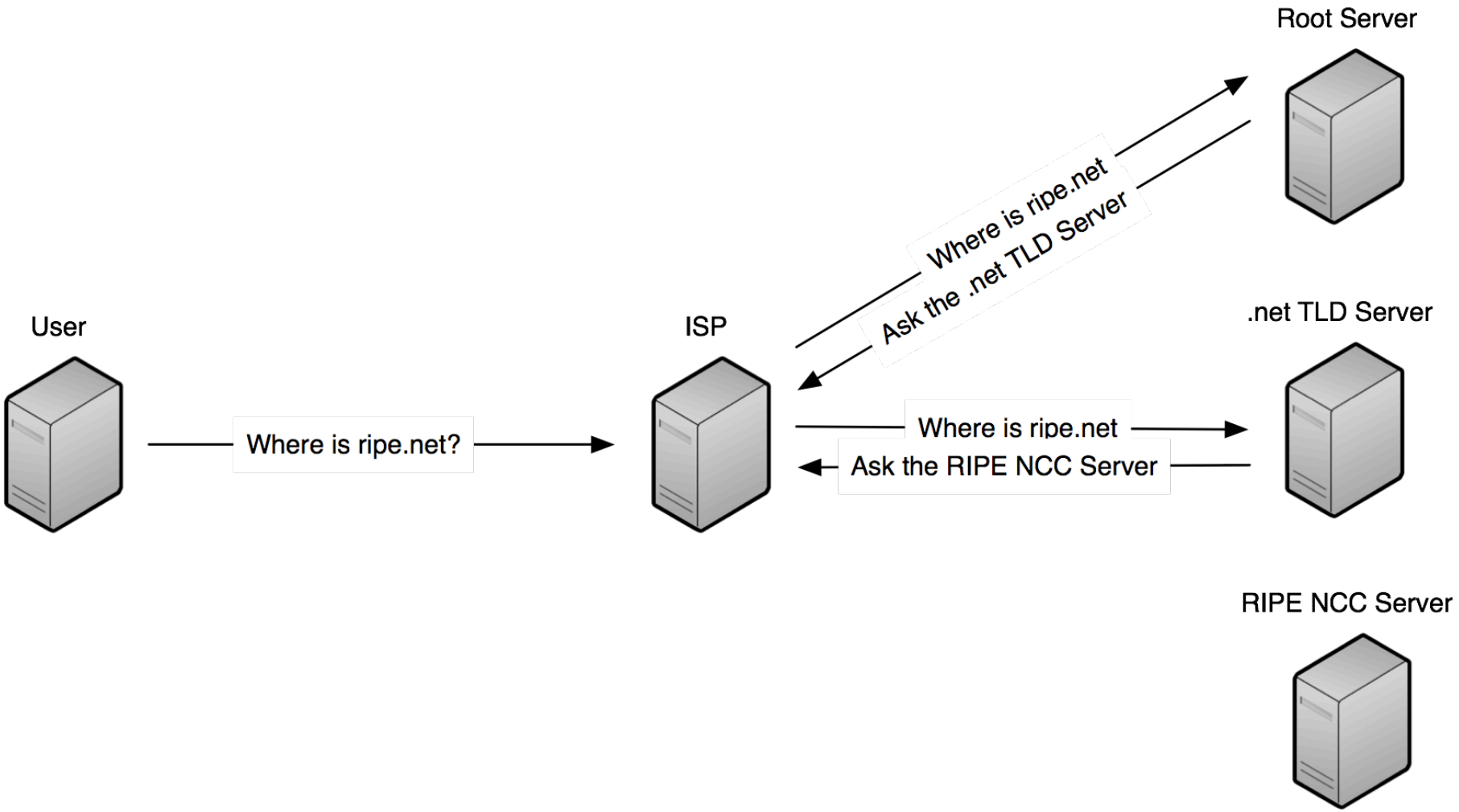

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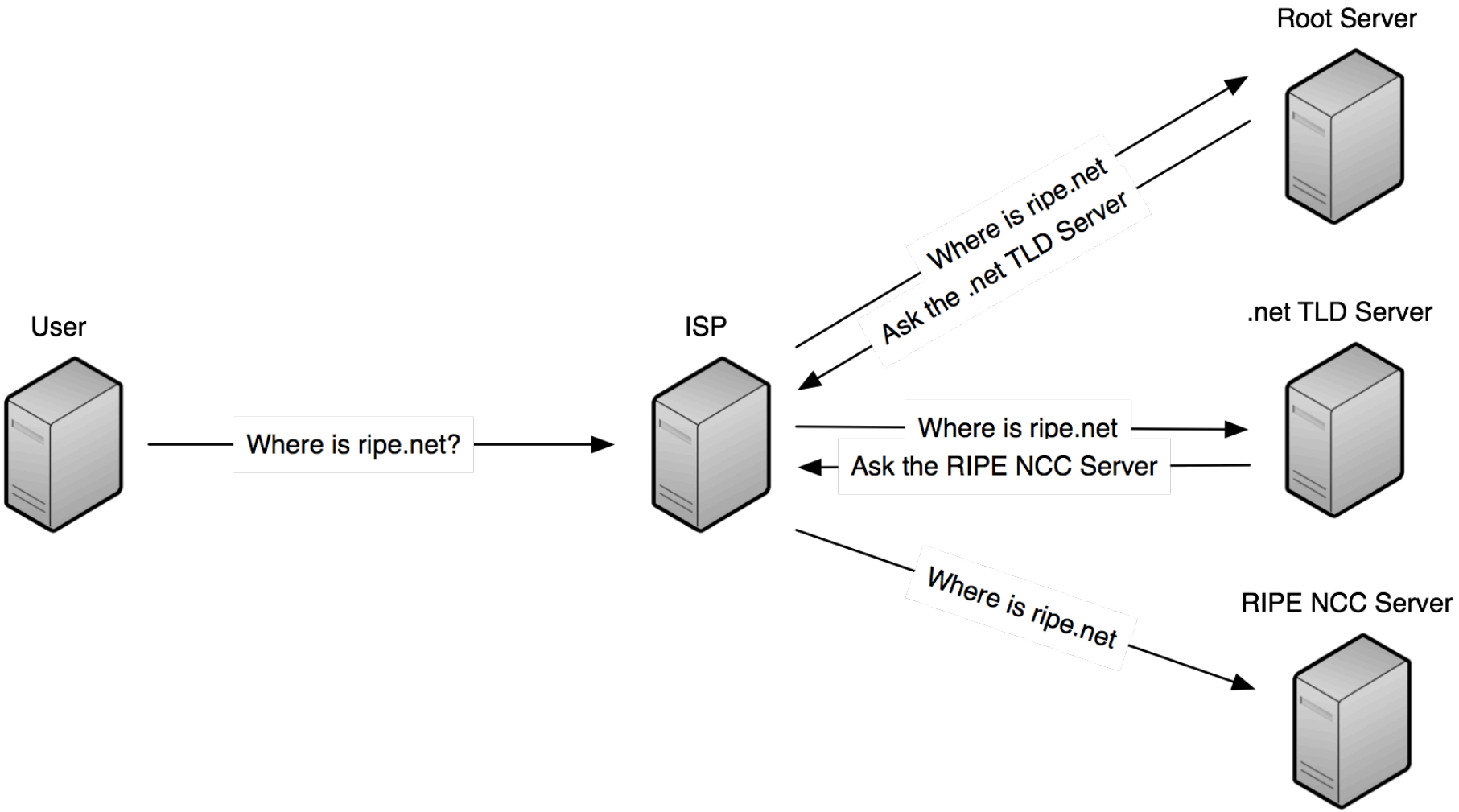

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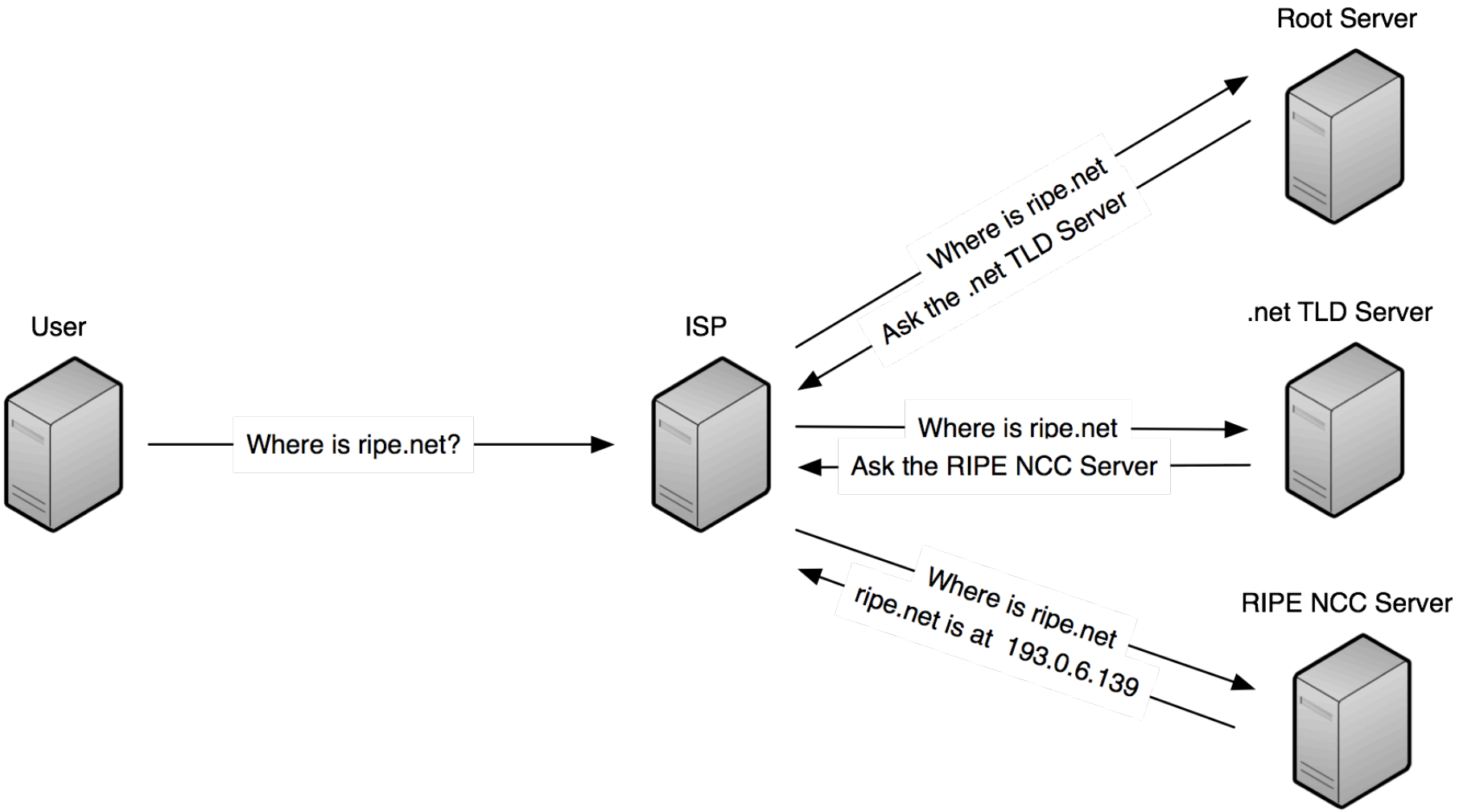

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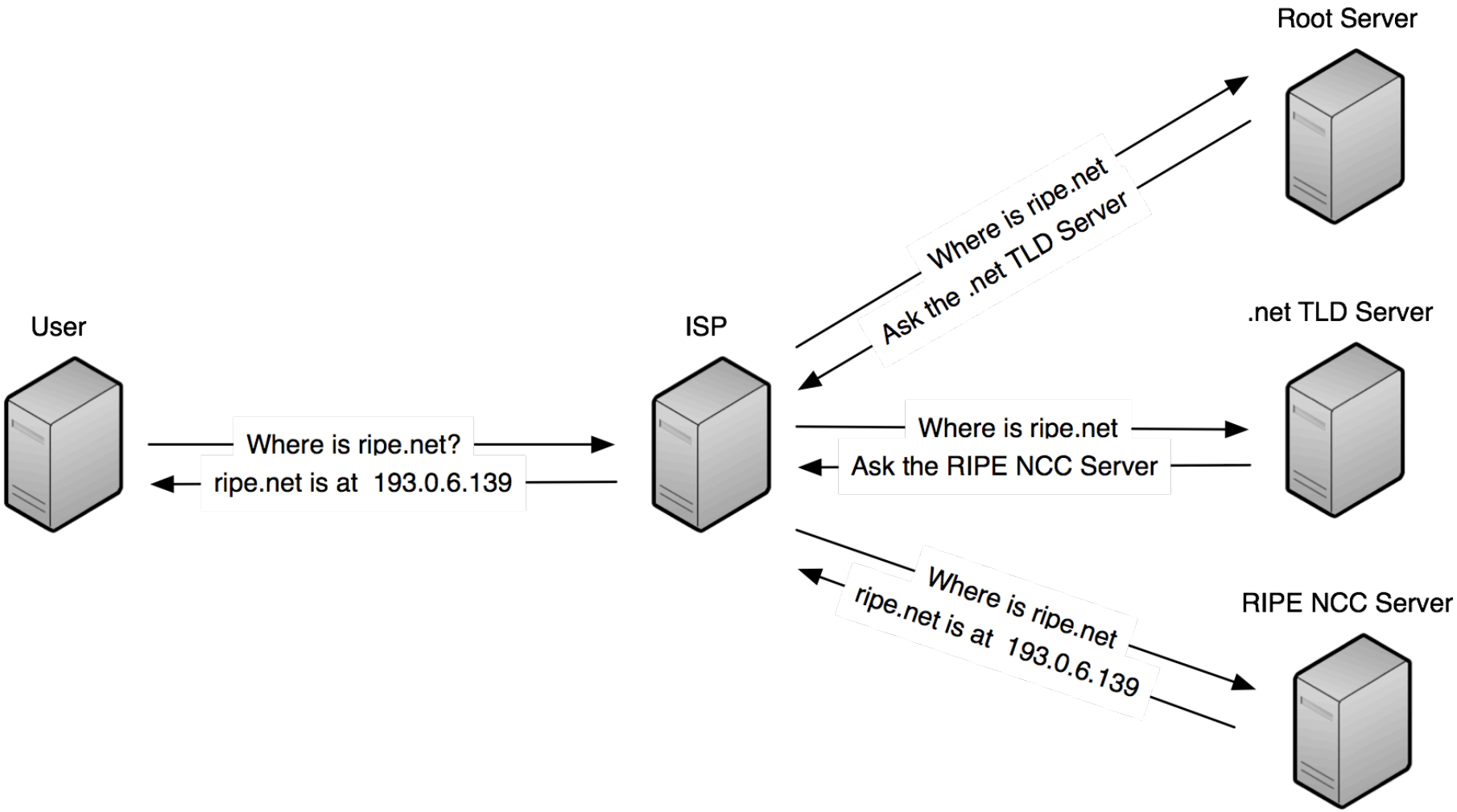


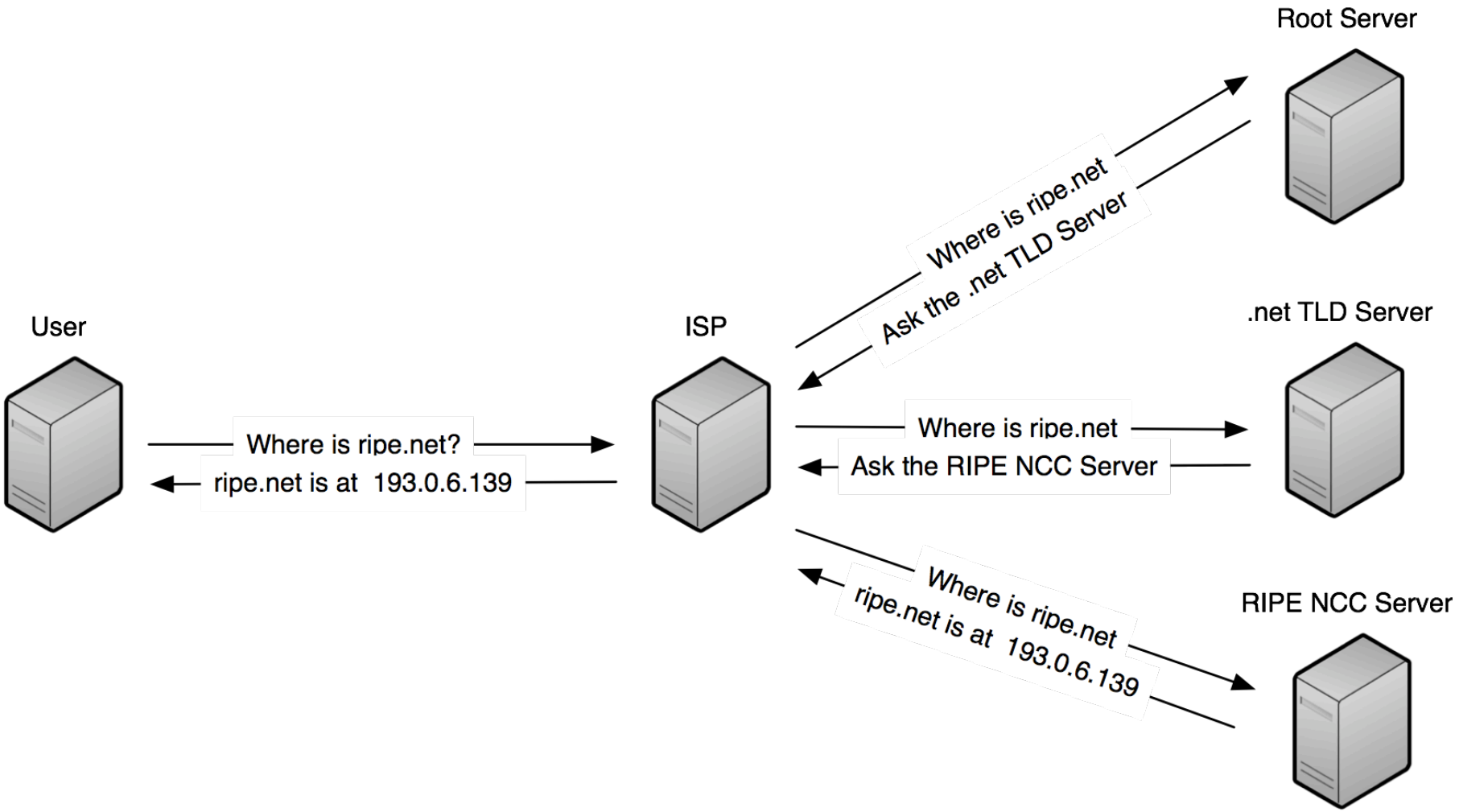
What is the problem?

- UDP transport can be spoofed
  - Anybody can pretend to originate a response
- If a response is modified the user will connect to a possibly malicious system

The Solution

- Make the responses verifiable
  - Cryptographic signatures
- Hierarchy exists so a Public Key Infrastructure is the logical choice
  - Same concept as used in eGovernment infrastructures

How does it work with DNSSEC?



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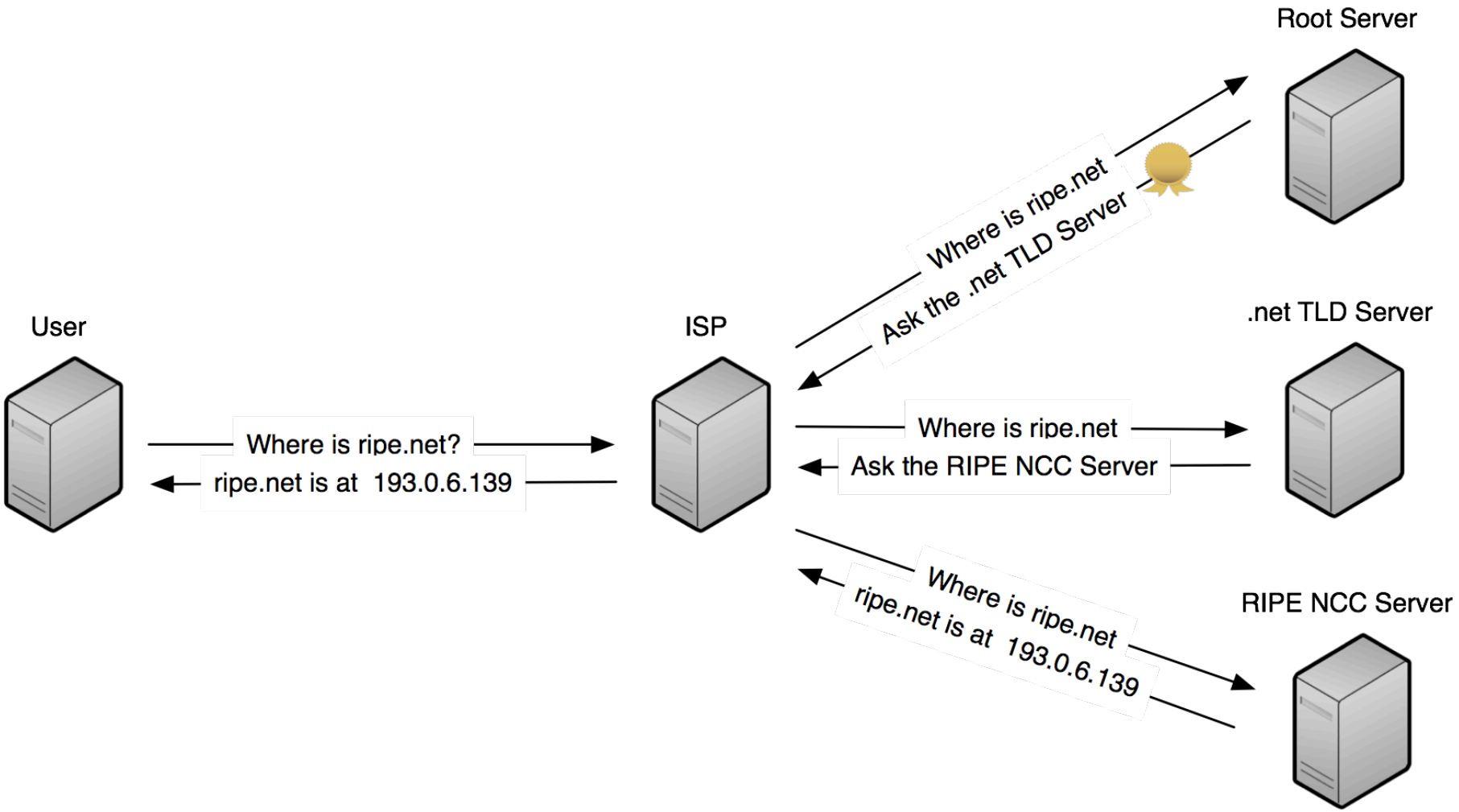

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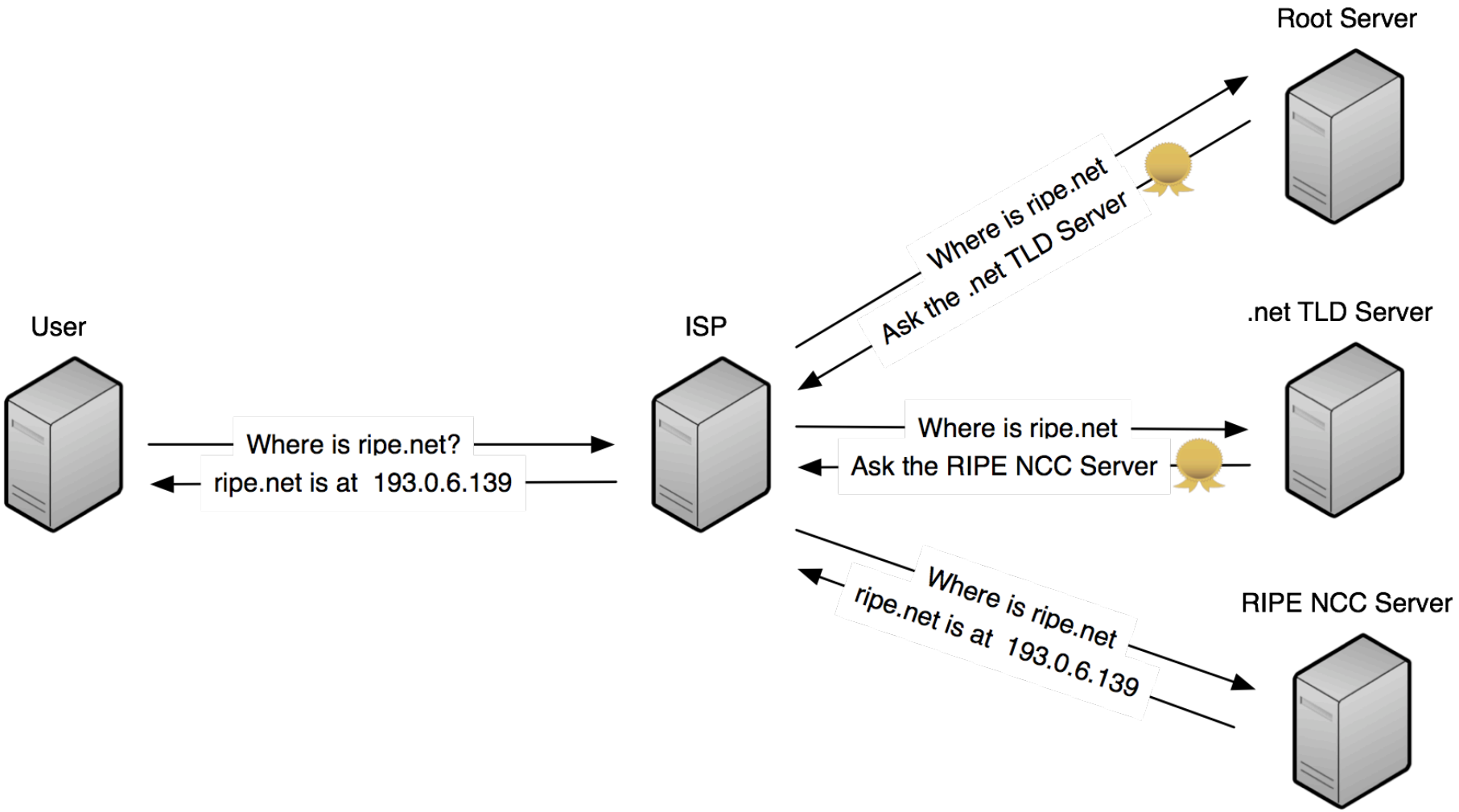

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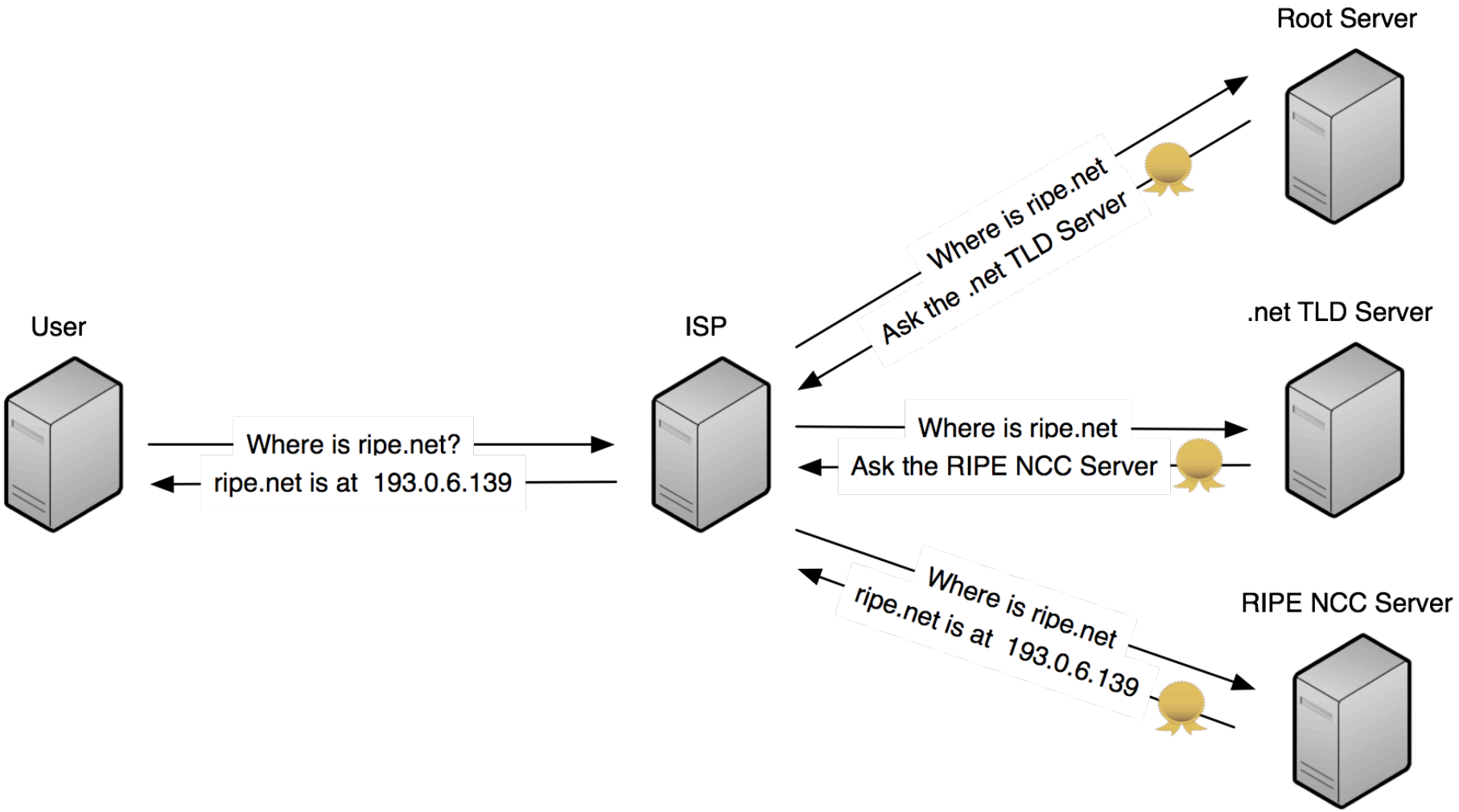

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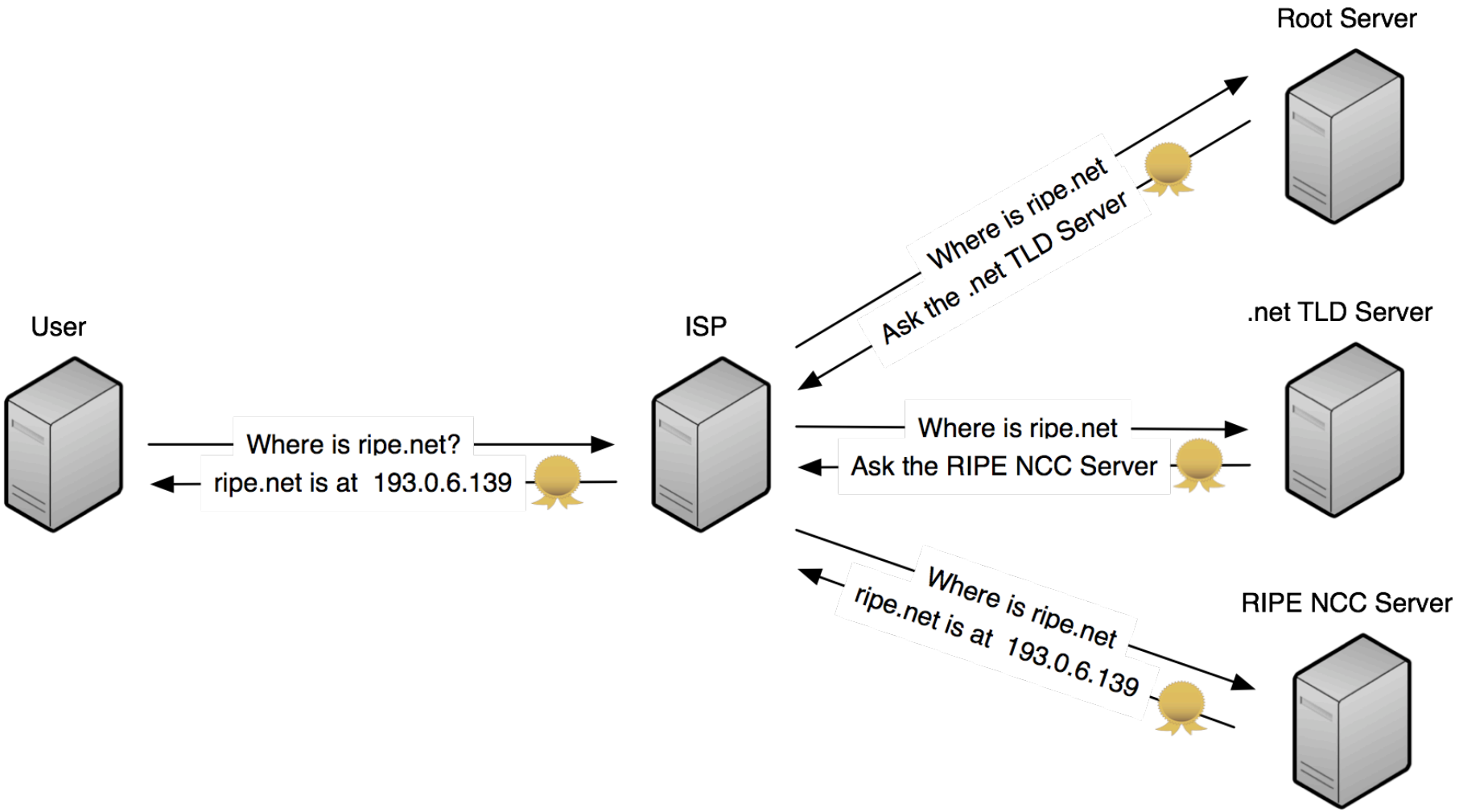


DNS Security Extensions: A Long Story

- 1990: Theoretical problem discovered (Bellovin)
- 1995: Work on DNSSEC started
- 1999: First support for DNSSEC in BIND
- 2005: Standard is redesigned to better meet operational needs

  RIPE NCC along with .SE among the first to deploy it in their zones

DNS Security Extensions

- 2005 - 2008: Stalled deployments due to the lack of a signed root zone
- 2008: D. Kaminsky shows the practical use of the protocol weakness

  Focus comes back to DNSSEC
- July 2010: Root Zone signed with DNSSEC
- Oct 2011: 72/306 signed TLDs

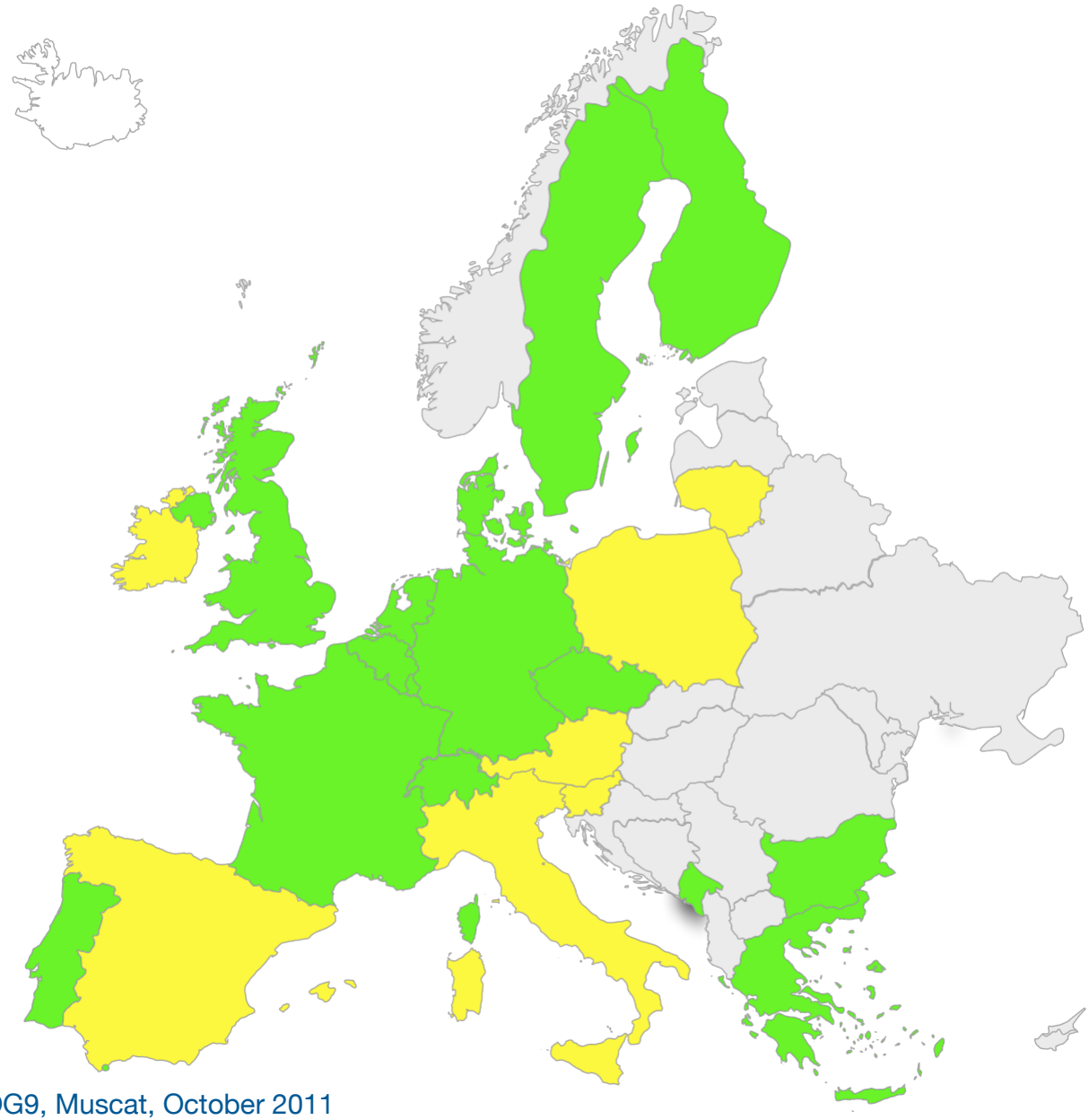
DNSSEC and the RIPE NCC

- Sponsor development of NSD DNS software
- Participated in the “Deployment of Internet Security Infrastructure” project
  - Signed all our DNS zones
    - IPv4 & IPv6 reverse space
    - E164.arpa
    - ripe.net
- K-root server readiness for a signed root zone

Singing of the Root Zone

- Shared custody by Root Zone maintainers
  - Currently: U.S. DoC NTIA, IANA/ICANN, VeriSign
- Split key among 21 Trusted Community Representatives
- In production since July 2010

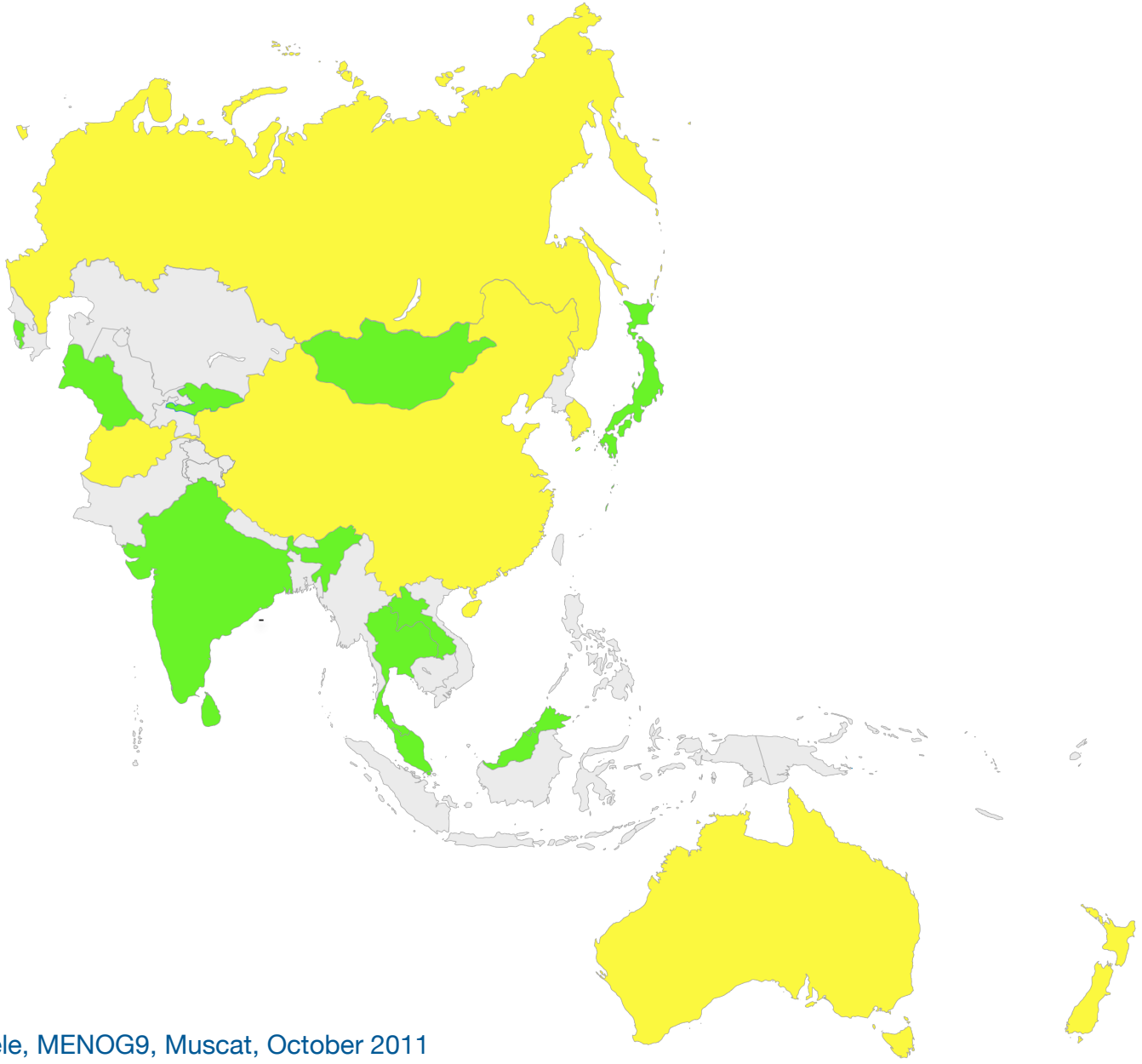
Deployment in ccTLDs: Europe



Deployment in ccTLDs: Middle East

OH NO!

Deployment in ccTLDs: Asia Pacfic



Deployment in ccTLDs

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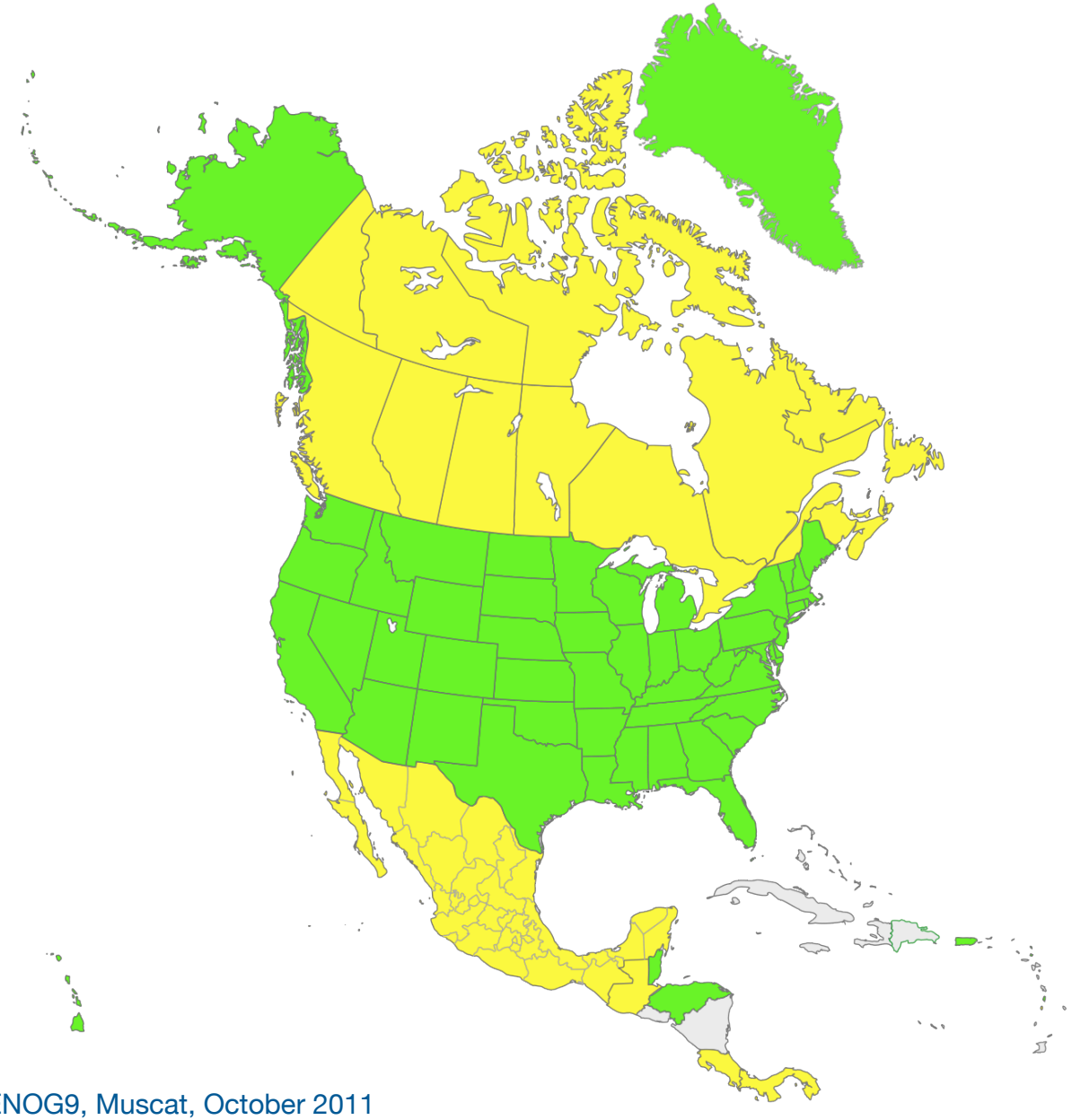


Deployment in gTLDs

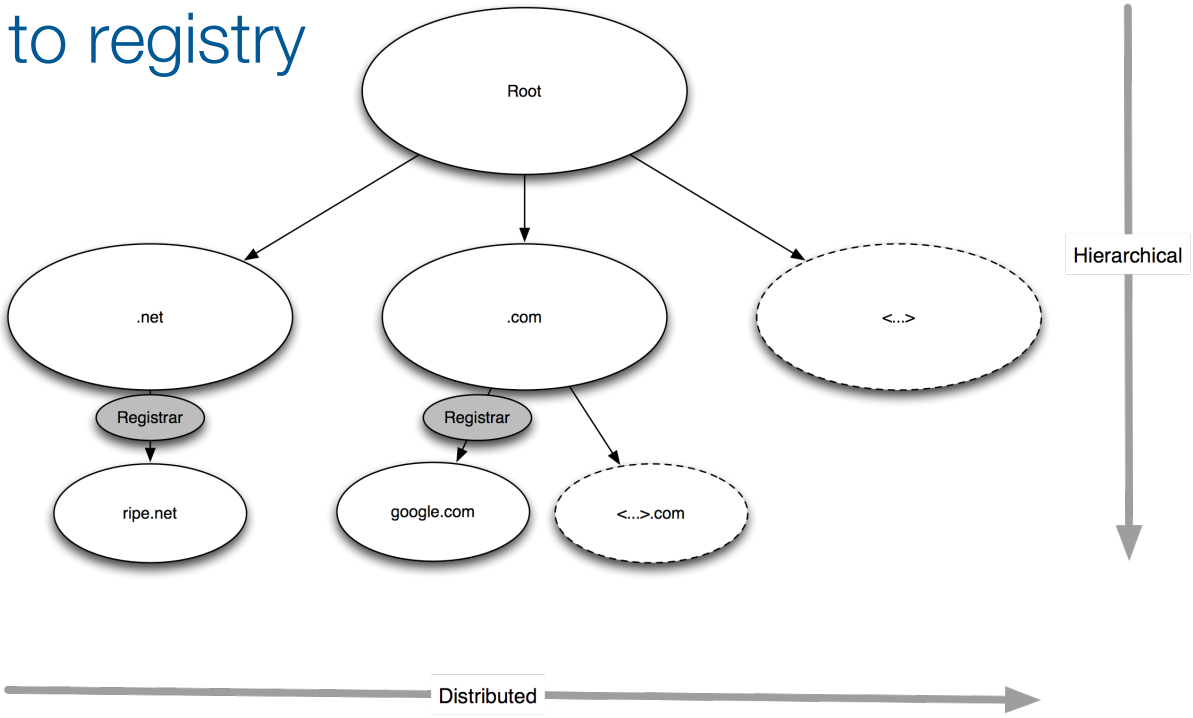
- .com/.net/.org (57% of world wide total domains)
- .asia
- .cat
- .biz
- .edu
- .gov
- .info
- .museum
- .mobi (Planned)

Deployment in Infrastructure TLD .arpa

- E164.arpa
  - ENUM number mapping
  - signed by the RIPE NCC
- in-addr.arpa
  - Reverse DNS for IPv4
- ip6.arpa
  - Reverse DNS for IPv6

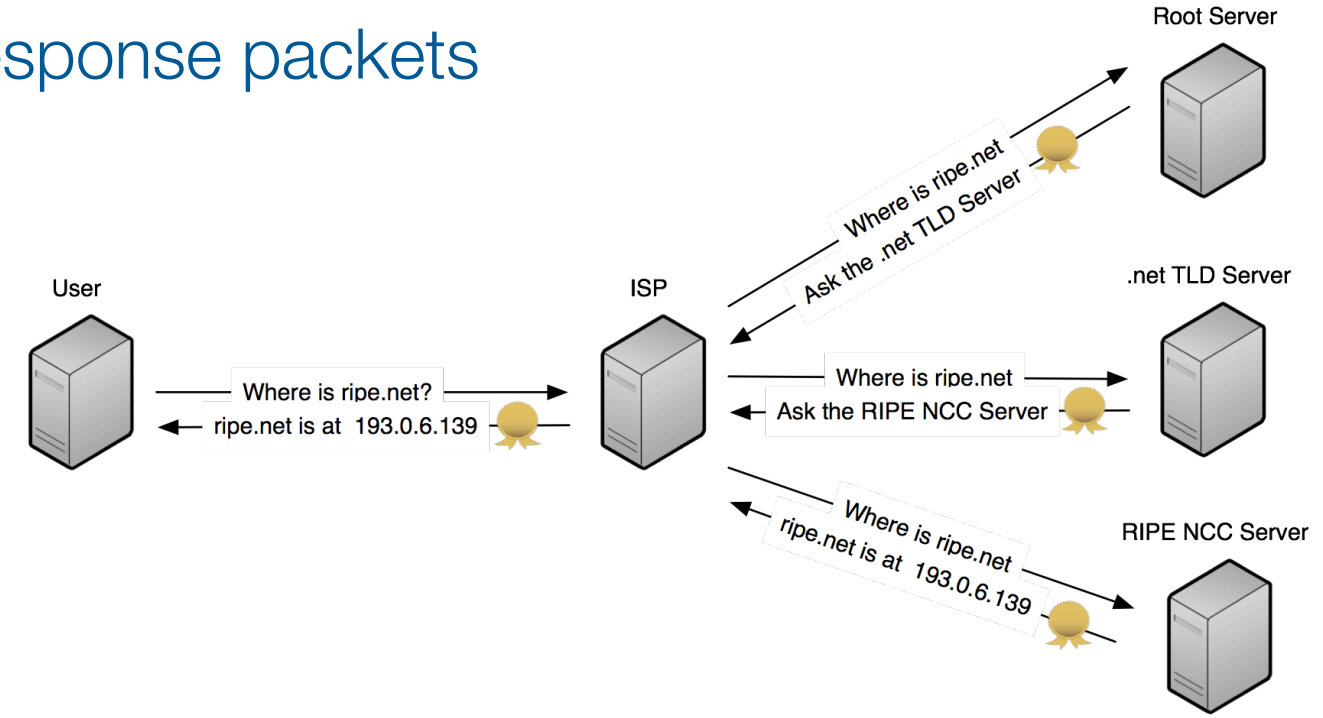
Are We Done?

- Signed TLD is not the same as a signed domain
  - Thick registry model (Registry-Registrar-Registrant)
  - Registrars need to enable their customers to provide public key data to registry



Are We Done?

- Ultimately responses should be verified by the end user
  - Home routers need to support DNS specifications with large response packets



Leverage Infrastructure

- DNS is a cross organisational data directory
- DNSSEC adds trust to this infrastructure
  - Anybody can verify data published under ripe.net was originated by the domain holder
  - Could be used to make DKIM and SPF widely used and trusted
  - SSL certificates can be trusted through the DNS
  - More ideas to come …

What about SSL/TLS?

- SSL as a transport is well established
- CA system currently in use is inherently broken
  - Any Certificate Authority delivered with a browser to date can issue a certificate for any domain
    - 100 and more shipped in every Browser
  - If any one of them fails - security fails with it
    - Recent incident with Comodo & Digitnotar CA is one example
- DANE working group at IETF
  - Supported in Chrome 14 browser

DNSSEC and the Middle East

- ccTLDs need to get signed
- ISPs need to enable validation on their resolvers

- What keeps you from deploying?

Questions?

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RIPE NCC