

IPv6 support in the DNS

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IPv6DISSemination and Exploitation

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Prerequisites

- You must have followed previously the modules:
 - IPv6 Introduction
 - IPv6 Protocol
 - IPv6 Addressing
 - IPv6 Associated Protocols



Agenda

- How important is the DNS?
- DNS Resource Lookup
- DNS Extensions for IPv6
- Lookups in an IPv6-aware DNS Tree
- About Required IPv6 Glue in DNS Zones
- The Two Approaches to the DNS
- DNS IPv6-capable software
- IPv6 DNS and root servers
- DNSv6 Operational Requirements & Recommendations

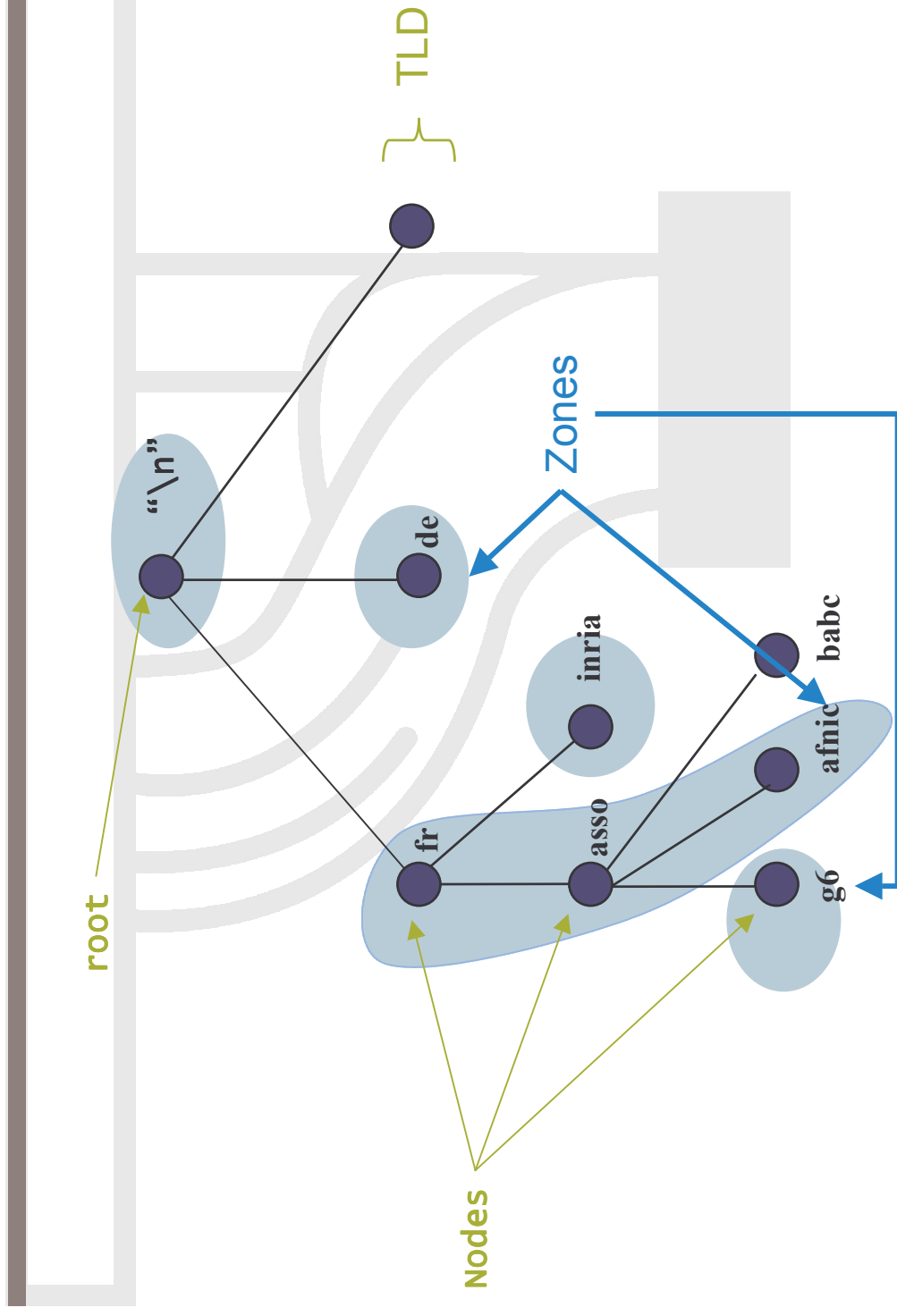


How important is the DNS?

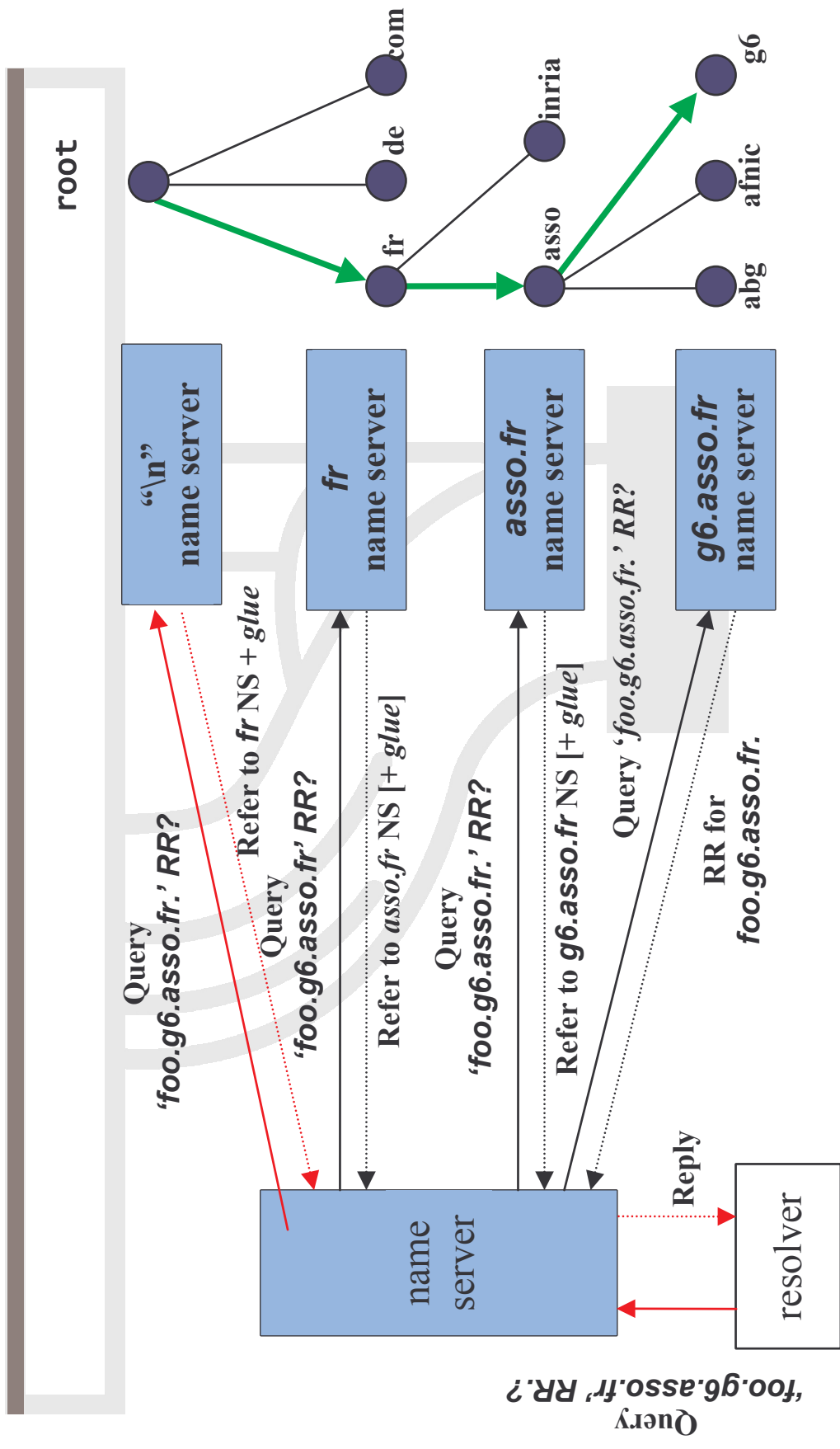
- Getting the IP address of the remote endpoint is necessary for every communication between TCP/IP applications
- Humans are unable to memorize millions of IP addresses (specially IPv6 addresses)
- To a larger extent: the Domain Name System (DNS) provides applications with several types of resources (domain name servers, mail exchangers, reverse lookups, ...) they need
- DNS design
 - hierarchy
 - distribution
 - redundancy



DNS tree



DNS Lookup



DNS Extensions for IPv6

RFC 1886 → RFC 3596 (upon successful interoperability tests)

AAAA : forward lookup ('Name IPv6 → Address'):

Equivalent to 'A' record

Example:

ns3.nic.fr.

IN

A

192.134.0.49

IN

AAAA

2001:660:3006:1::1:1

PTR : reverse lookup ('IPv6 Address → Name'):

Reverse tree equivalent to in-addr.arpa

New tree: **ip6.arpa** (under deployment)

Former tree: **ip6.int** (deprecated)

Example:

\$ORIGIN 1.0.0.0.6.0.0.3.0.6.6.0.1.0.0.2.ip6.**arpa**.

1.0.0.0.1.0.0.0.0.0.0.0.0.0.0.0 **PTR**

ns3.nic.fr.



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Tree



About Required IPv6 Glue in DNS Zones

When the DNS zone is delegated to a DNS server (among others) contained in the zone itself

Example: In zone file rennes.enst-bretagne.fr

```
@      IN      SOA      rsm.rennes.enst-bretagne.fr. fradin.rennes.enst-bretagne.fr.
```

```
(2005040201 ;serial  
86400      ;refresh  
3600       ;retry  
3600000    ;expire}
```

```
IN      NS      rsm  
IN      NS      univers.enst-bretagne.fr.
```

```
[...]    IN      NS      rhadamanthe.ipv6  
ipv6     IN      NS      ns3.nic.fr.  
;        IN      NS      rsm
```

```
,  
rhadamanthe.ipv6  
[...]    IN      A      192.108.119.134  
         IN      AAAA   2001:660:7301:1::1
```

IPv4 glue (A 192.108.119.134) is required to reach rhadamanthe over IPv4 transport
IPv6 glue (AAAA 2001:660:7301:1::1) is required to reach rhadamanthe over IPv6 transport



IPv6 DNS and root servers

- DNS root servers are critical resources!
- 13 roots « around » the world (#10 in the US)
- Not all the 13 servers already have IPv6 enabled and globally reachable via IPv6.
- Need for (mirror) root servers to be installed in other locations (EU, Asia, Africa, ...)
- New technique : anycast DNS server
 - To build a clone from the master/primary server
 - Containing the same information (files)
 - Using the same IP address
- Such anycast servers have already begun to be installed :
 - F root server: Ottawa, Paris(Renater), Hongkong, Lisbon (FCCN)...
 - Look at <http://www.root-servers.org> for the complete and updated list.



The Two Approaches to the DNS

- The DNS seen as a Database
 - Stores different types of Resource Records (RR): SOA, NS, A, AAAA, MX, SRV, PTR, ...
- ☐ DNS data is independent of the IP version (v4/v6) the DNS server is running on!
- The DNS seen as a TCP/IP application
 - The service is accessible in either transport modes (UDP/TCP) and over either IP versions (v4/v6)
- ☐ Information given over both IP versions **MUST BE CONSISTENT!**



DNS IPv6-capable software

- BIND (Resolver & Server)
 - <http://www.isc.org/products/BIND/>
 - BIND 9 (avoid older versions)
- On Unix distributions
 - Resolver Library (+ (adapted) BIND)
- NSD (authoritative server only)
 - <http://www.nlnetlabs.nl/nsd/>
- Microsoft Windows (Resolver & Server)

...



DNSv6 Operational Requirements & Recommendations

- The target today **IS NOT** the transition from an IPv4-only to an IPv6-only environment
- How to get there?
 - Start by testing DNSv6 on a small network and get your own conclusion that DNSv6 is harmless, **but remember:**
 - **The server (host) must support IPv6**
 - **And DNS server software must support IPv6**
 - Deploy DNSv6 in an incremental fashion on existing networks
 - DO NOT BREAK something that works fine (production IPv4 DNS)!





Questions?



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EXTRA SLIDES



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TLDs and IPv6



- One of IANA's functions is the DNS top-level delegations
- Changes in TLDs (e.g ccTLDs) has to be approved and activated by IANA
- Introduction of IPv6-capable nameservers at ccTLDs level has to be made through IANA



TLDs and IPv6 #2

- How many servers supporting a domain should carry AAAA records?
- Usually conservative approaches
 - One or two servers
 - Don't use long server names. 1024 bytes limit in DNS responses
 - Some ccTLDs had to rename their servers (same philosophy used by root servers)



TLDs and IPv6 #3

- 17/04/2005
 - 4 TLDs (.AEROS, .NET, .COM, .INT)
 - 42 ccTLDs
- European: About half already glued
- Servers: 35 different ones, worldwide

