IPv6 support in the DNS

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IPv6DISSemination and Exploitation

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Prerequisites

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

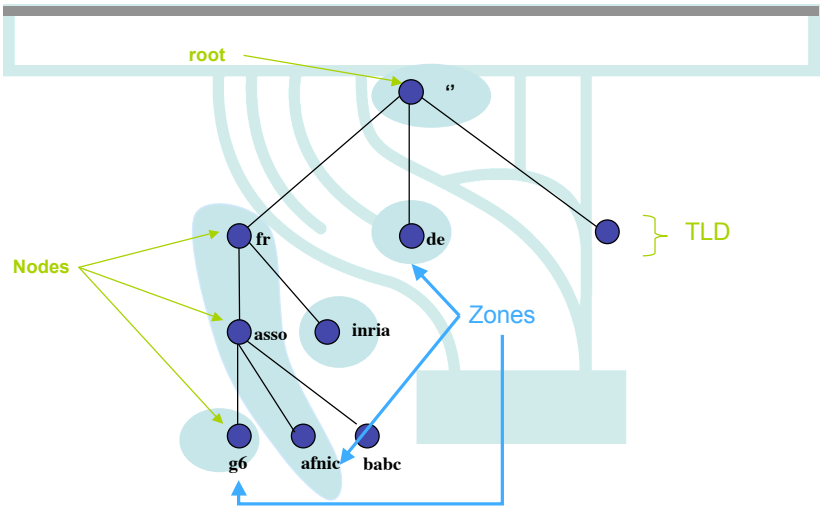
Agenda

- 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

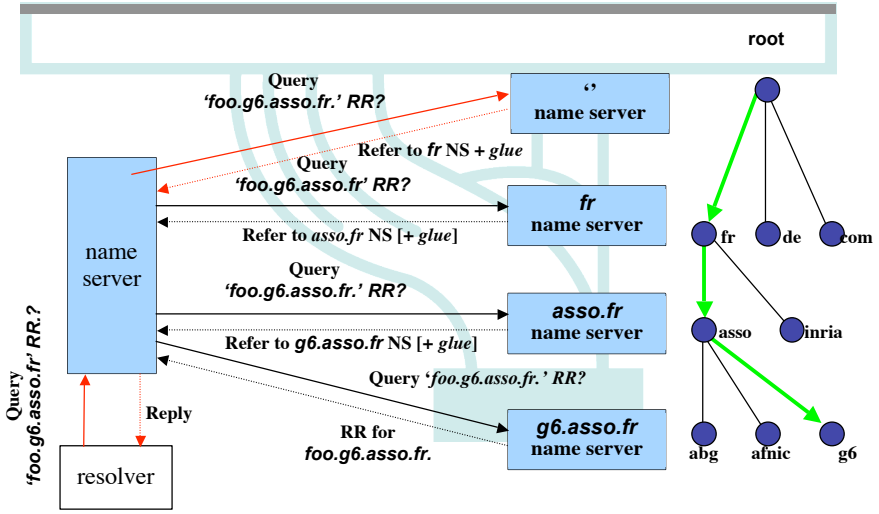
How important is the DNS?

- 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)**

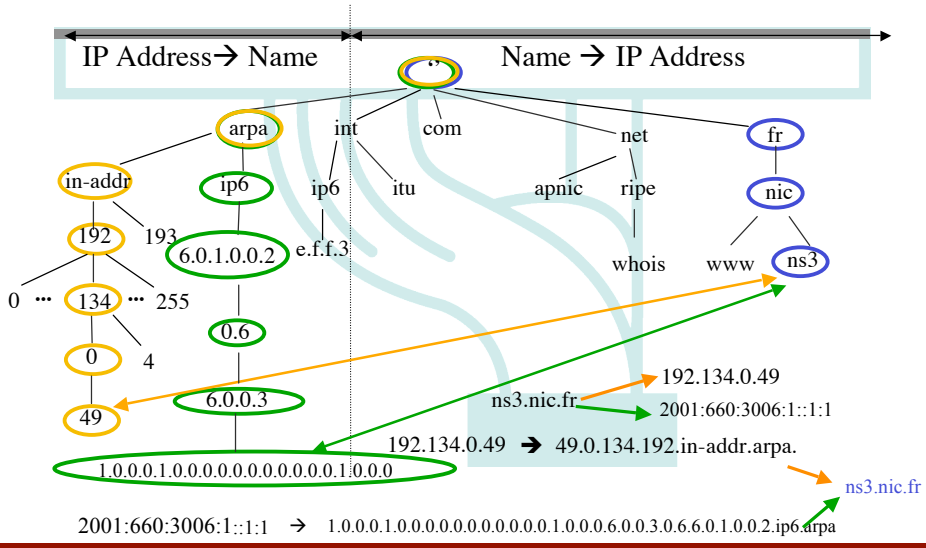
Former tree: ip6.int **(deprecated)**

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.

Lookups in an IPv6-aware DNS 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.
[...]
ipv6            IN      NS      rhadamanthe.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)…
  - M root server: Tokyo (WIDE), Paris (Renater), …
  - 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 an 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 way on existing networks
  - DO NOT BREAK something that works fine (production IPv4 DNS)!

Questions?

EXTRA SLIDES

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 renamed 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