



deploy

IPv6 Support in the DNS

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Contributors

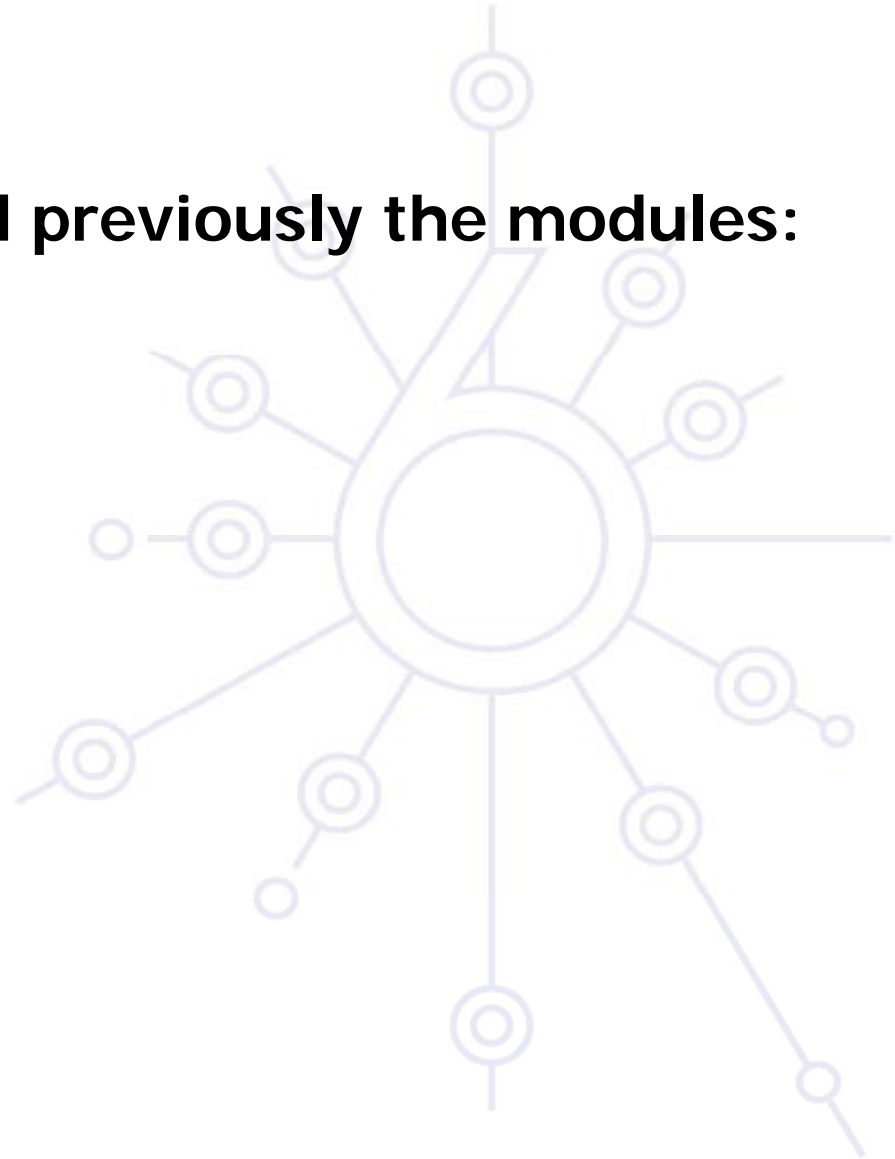
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Prerequisites

You should have followed previously the modules:

- 010-IPv6 Introduction
- 020-IPv6 Protocol
- 030-IPv6 Addressing



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

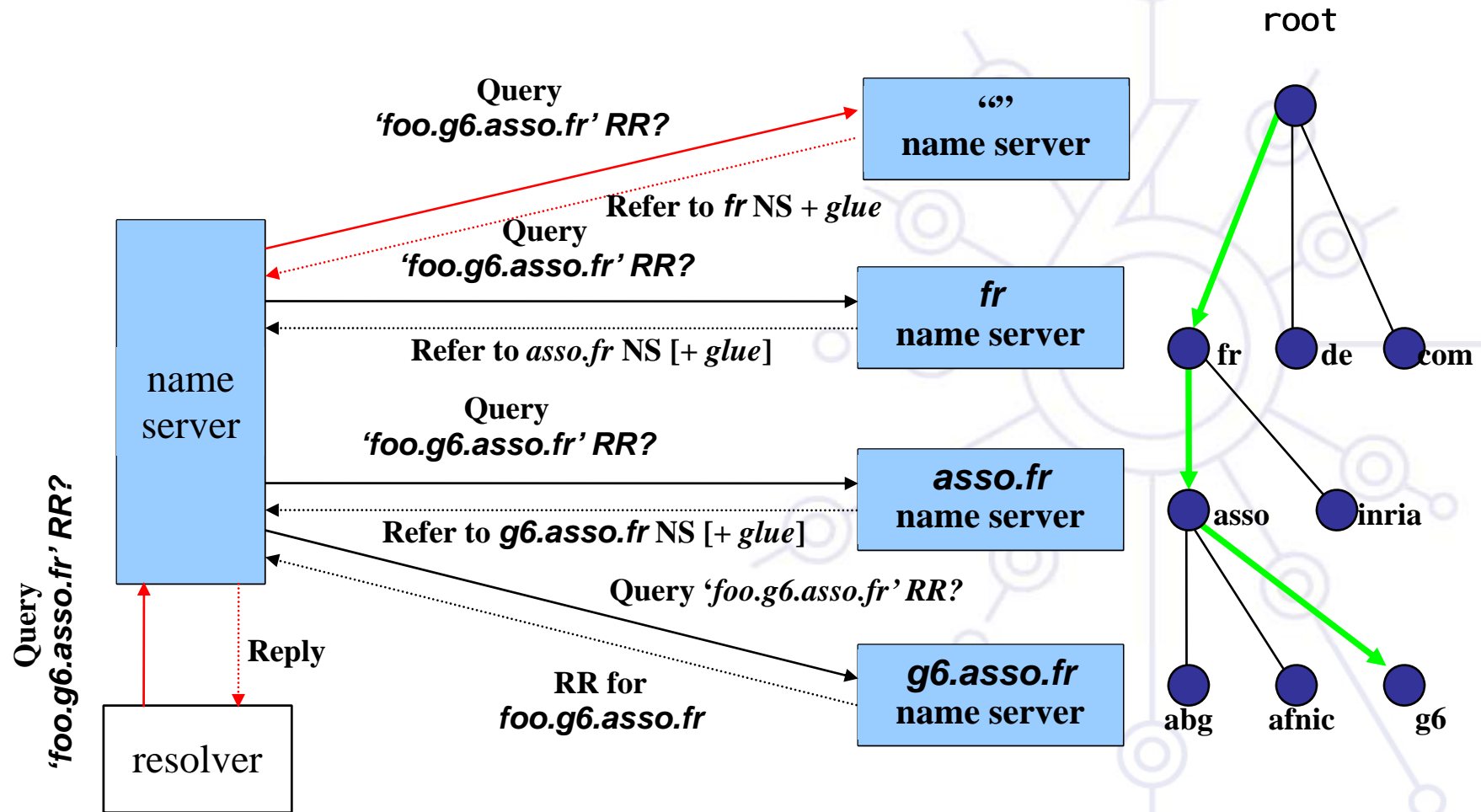
IPv6 DNS and root servers

**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 provides applications with several types of resources (domain name servers, mail exchangers, reverse lookups, ...)
- They need
 - Hierarchy
 - Distribution
 - Redundancy

DNS Lookup



DNS Extensions for IPv6

RFC 1886 → RFC 3596

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

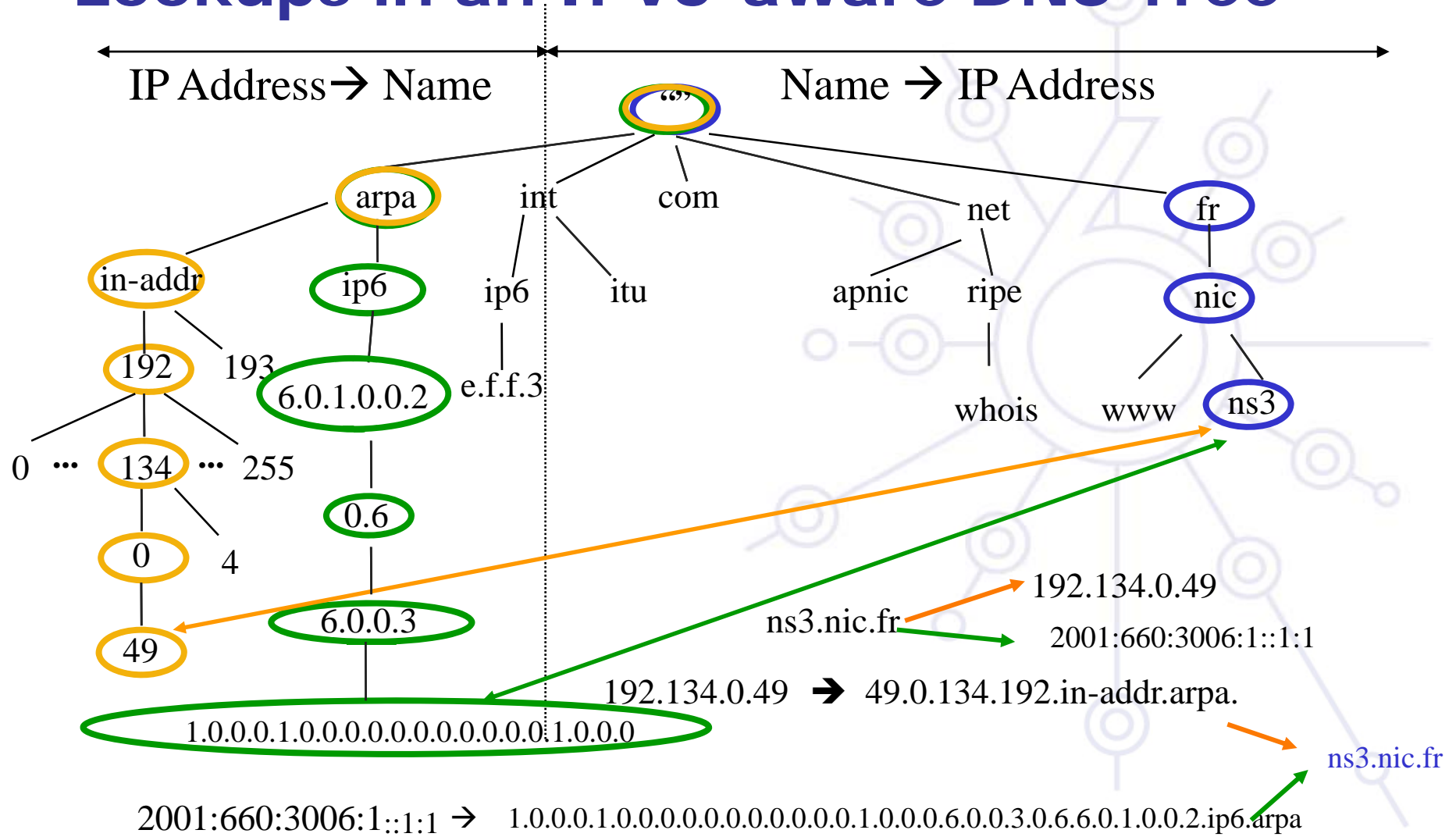
Main tree: **ip6.arpa**

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)
 - As of 04/02/2008, 6 root servers are IPv6 enabled
 - and reachable via IPv6 networks
 - **A, F, H, J, K & M**
- Need for mirror-like function for the root name servers
 - To be installed in other locations (EU, Asia, Africa, ...)

IPv6 DNS and root servers /2

New technique : anycast DNS server

- To build a clone from the primary master
- Containing the same information (files)
- Using the same IP address(es)

Such anycast servers have proved a successful strategy and a lot of them are already installed :

- F root server: Ottawa, Paris(Renater), Hongkong, Lisbon (FCCN)...
- M root server: Tokyo, Paris (Renater), Seoul
- 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 (RRs)
 - SOA, NS, A, AAAA, MX, 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 (1)

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)

- It has been reported that Windows XP resolver cannot interact with DNS servers over an IPv6 transport.
 - It needs an IPv4 network to query a DNS server.
- => This is no more an issue for Windows Vista users.



DNS IPv6-capable software (2)

Microsoft Windows XP default resolver only queries over IPv4 transport:

- Install BIND 9 for Windows XP and uses BINDs resolver; or
- Have a local dual stack DNS server.
 - Via DHCP, assign IPv4 address
 - advertise the DNS server IPv4 address to XP users.

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)!



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Questions ...



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Extra Slides

TLDs and IPv6 (1)



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 resource records information ?

- Usually conservative approaches
 - Preferably two name servers
- => located in geographically different areas

Don't use long server names.

⇒ 1024 bytes limit in DNS response datagrams

- Some ccTLDs had to renamed their servers
- same philosophy used by root servers

TLDs and IPv6 (3)

As of April 14th 2008

- 13 out of 21 TLDs
 - with at least one IPv6 enabled DNS server (glued)
- 102 out of 252 ccTLDs
 - with at least one IPv6 enabled DNS server (glued)

Servers: 124 different ones, worldwide