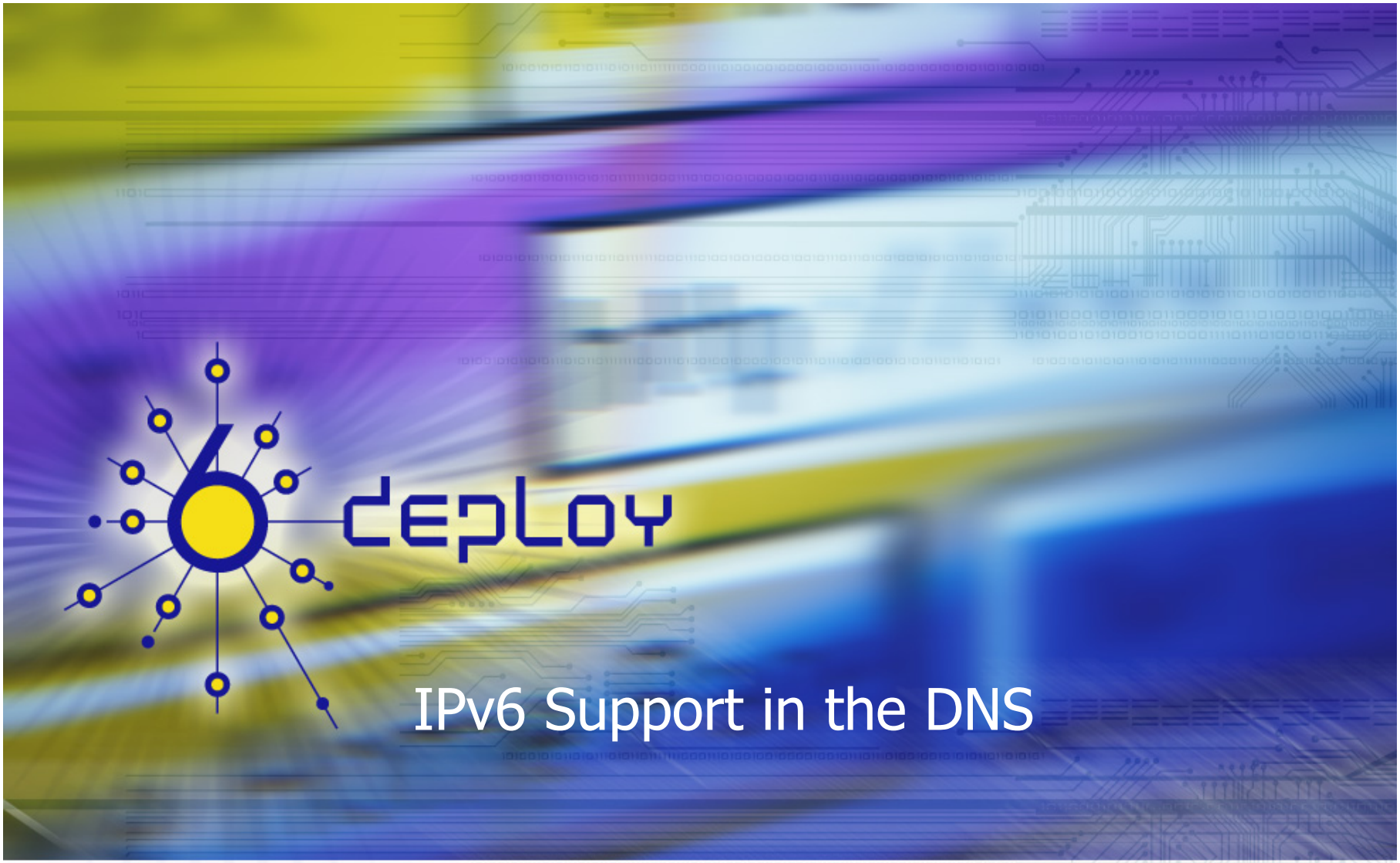

deploy
IPv6 Support in the DNS

Contributions

Main authors

- Miguel Baptista, FCCN, Portugal
- Carlos Friaças, FCCN, Portugal
- Laurent Toutain, ENST-Bretagne – IRISA, France
- Bernard Tuy, Renater, France

Contributors

- Octavio Medina, ENST-Bretagne, France
- Mohsen Souissi, AFNIC, France
- Vincent Levigneron, AFNIC, France
- Thomas Noel, LSIIT, France
- Alain Durand, Sun Microsystems, USA
- Alain Baudot, France Telecom R&D, France
- Bill Manning, ISI, USA
- David Kessens, Qwest, USA
- Pierre-Emmanuel Goiffon, Renater, France
- Jérôme Durand, Renater, France
- Mónica Domingues, FCCN, Portugal
- Ricardo Patara, LACNIC, Uruguay

Prerequisites

You should have followed previously the modules:

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

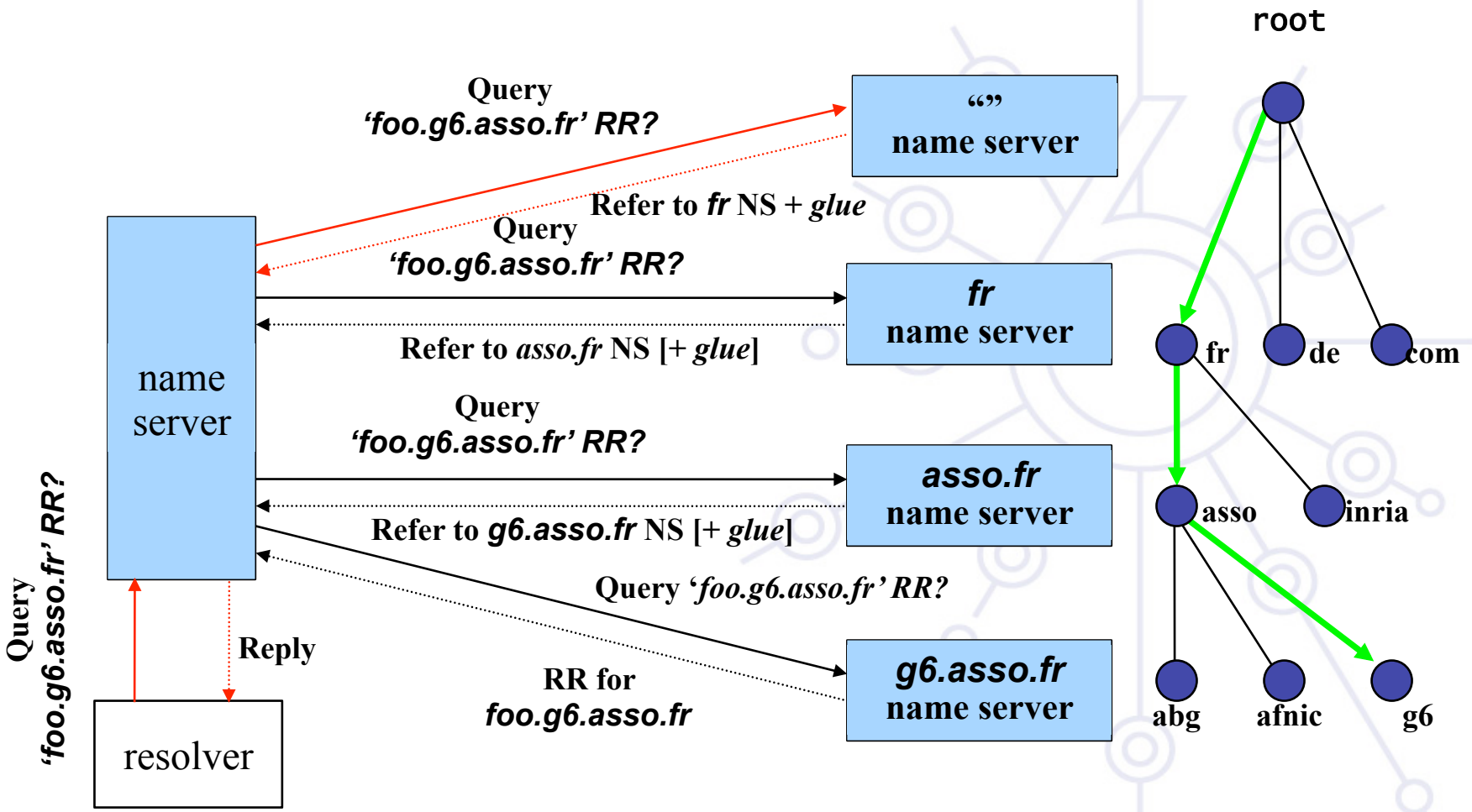
Agenda

- 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


Query
'foo.g6.asso.fr' RR?
""
name server
Refer to fr NS + glue
Query
'foo.g6.asso.fr' RR?
fr
name server
Refer to asso.fr NS [+ glue]
name
server
Query
'foo.g6.asso.fr' RR?
asso.fr
name server
Refer to g6.asso.fr NS [+ glue]
Query 'foo.g6.asso.fr' RR?
Query
'foo.g6.asso.fr' RR?
Reply
RR for
foo.g6.asso.fr
g6.asso.fr
name server
resolver
root
fr
de
com
asso
inria
abg
afnic
g6

DNS Extensions for IPv6

RFC 1886 → RFC 3596

AAAA : forward lookup ('Name →IPv6 Address'):
Equivalent to 'A' record
Example:

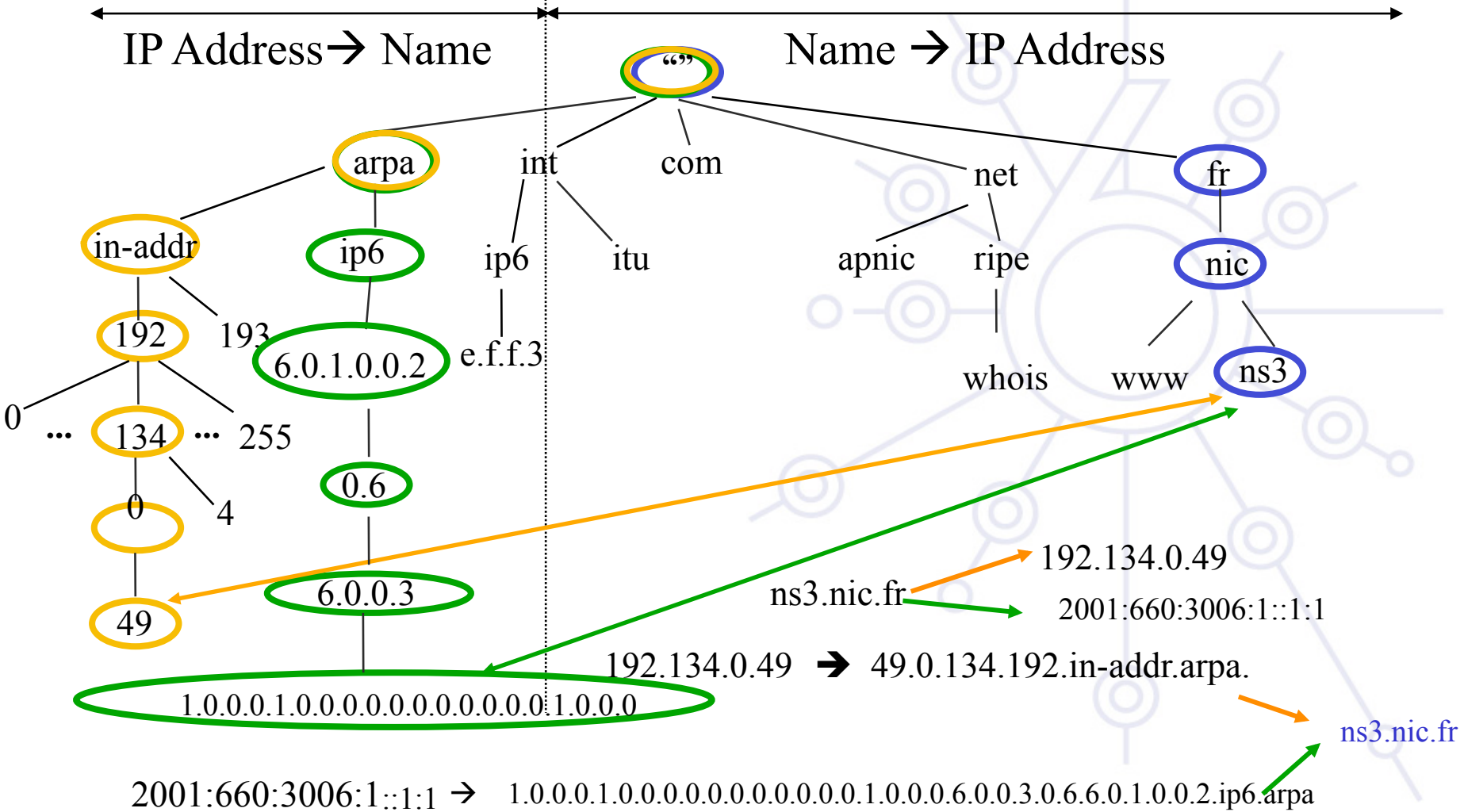
ns3.nic.fr.	IN	**A**	192.134.0.49
	IN	AAAA	2001:660:3006:1::1:1

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.**0.0.0.0.0.0.0.0.0.0.0.0** **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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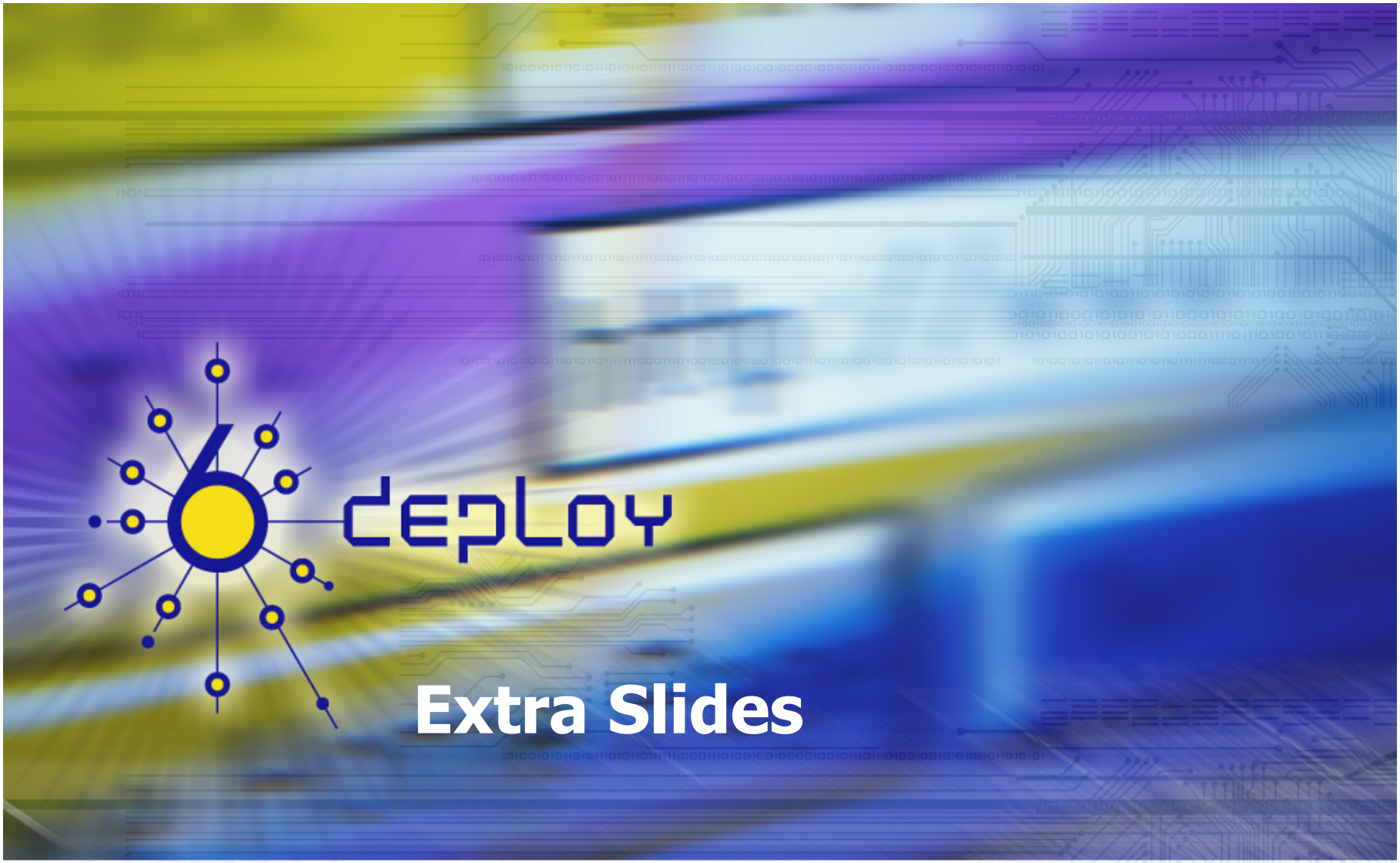
Questions …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Extra Slides

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