# Naming

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DNS
Domain Name Service

- Initially designed for name to address translation
- /etc/hosts file : limited solution…(does not scale)
  192.168.1.10   foo.mydomain.org foo
  Used to be manually distributed on hosts
- /etc/resolv.conf file (DNS servers) (since 1984)
  search imag.fr
  nameserver 129.88.38.1
  nameserver 129.88.30.10
- Name hierarchy, matching a server hiererarchy
- DNS : spine of the web, also of e-mail…

Naming hirerarchy
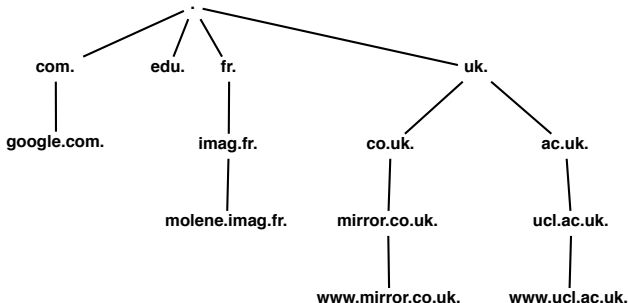
- "fr" is a *Top-Level Domain*
- A zone is a vertex in the tree, several redundant servers per zone
- Each zone server knows its sub-domains' servers

DNS records

- A: address, AAAA: IPv6 address
- NS: name server
- MX: mail exchange
- CNAME: alias
- SRV: generic service (used for SIP)
- SOA: start of authority (gives various info. about zone)
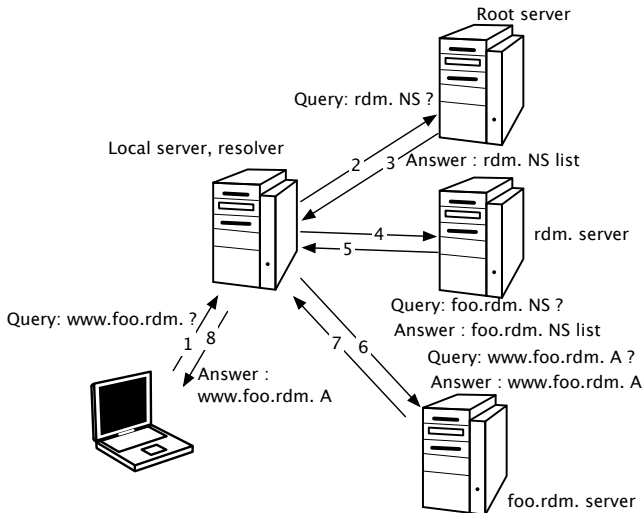- TXT: text

DNS recursive queries

- A host asks a question to local server L ("resolver") RESOLVER C'EST LE CLIENT !!

- L answers if response in cache or if L is authoritative
  else
    - If L is authoritative, there is no answer
    - otherwise, L sends a request to the known server best matching the query

- D tells L the sub-servers it knows etc.

A only "talks" to L
All further traffic is between L and other servers.

DNS recursive queries (cont.)

Root server

Query: rdm. NS ?

Local server, resolver

2 3 Answer : rdm. NS list

rdm. server

4
5

Query: www.foo.rdm. ?

Query: foo.rdm. NS ?

1 8

Answer : foo.rdm. NS list

Answer :
www.foo.rdm. A

7 6

Query: www.foo.rdm. A ?

Answer : www.foo.rdm. A

foo.rdm. server

host & dig commands

- host (prefer to nslookup)

  ```
  $ host www.enst-bretagne.fr
  www.enst-bretagne.fr is an alias for web-srv-01-redir.enst-bretagne.fr.
  web-srv-01-redir.enst-bretagne.fr has address 192.44.76.250
  ```

- dig

  ```
  $dig www.enst-bretagne.fr

  ; <<>> DiG 9.6.0-APPLE-P2 <<>> www.enst-bretagne.fr
  ;; global options: +cmd
  ;; Got answer:
  ;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 56675
  ;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 4, ADDITIONAL: 5

  ;; QUESTION SECTION:
  ;www.enst-bretagne.fr. IN A

  ;; ANSWER SECTION:
  www.enst-bretagne.fr. 21600 IN CNAME web-srv-01-redir.enst-bretagne.fr.
  web-srv-01-redir.enst-bretagne.fr. 21600 IN A 192.44.76.250
  ```

host & dig commands (cont.)

```
;; AUTHORITY SECTION:
enst-bretagne.fr. 197 IN NS rsm.enst-bretagne.fr.
enst-bretagne.fr. 197 IN NS univers.enst-bretagne.fr.
enst-bretagne.fr. 197 IN NS matell.enst-bretagne.fr.
enst-bretagne.fr. 197 IN NS ns2.nic.fr.

;; ADDITIONAL SECTION:
ns2.nic.fr. 76486 IN A 192.93.0.4
ns2.nic.fr. 76486 IN AAAA 2001:660:3005:1::1:2
rsm.enst-bretagne.fr. 2227 IN A 192.44.77.1
matell.enst-bretagne.fr. 197 IN A 192.108.115.2
univers.enst-bretagne.fr. 197 IN A 192.44.75.10

;; Query time: 29 msec
;; SERVER: 129.88.48.1#53(129.88.48.1)
;; WHEN: Wed Mar 30 13:55:13 2011
;; MSG SIZE  rcvd: 260
```

host & dig commands (cont.)

```
$ dig  www.imag.fr

; <<>> DiG 9.6.0-APPLE-P2 <<>> www.imag.fr
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 5463
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 4, ADDITIONAL: 6

;; QUESTION SECTION:
;www.imag.fr. IN A

;; ANSWER SECTION:
www.imag.fr. 172800 IN CNAME rillette.imag.fr.
rillette.imag.fr. 172800 IN A 129.88.34.211

;; AUTHORITY SECTION:
imag.fr. 172800 IN NS dns.inria.fr.
imag.fr. 172800 IN NS imag.imag.fr.
imag.fr. 172800 IN NS ns2.nic.fr.
imag.fr. 172800 IN NS isis.imag.fr.
```

host & dig commands (cont.)

```
;; ADDITIONAL SECTION:
dns.inria.fr. 5606 IN A 193.51.208.13
ns2.nic.fr. 76312 IN A 192.93.0.4
ns2.nic.fr. 76312 IN AAAA 2001:660:3005:1::1:2
imag.imag.fr. 172800 IN A 129.88.30.1
imag.imag.fr. 172800 IN AAAA 2001:660:5301:1e::101
isis.imag.fr. 172800 IN A 129.88.32.24

;; Query time: 9 msec
;; SERVER: 129.88.48.1#53(129.88.48.1)
;; WHEN: Wed Mar 30 13:58:07 2011
;; MSG SIZE  rcvd: 272
```

Delegation system

```
$dig +trace fr.
; <<>> DiG 9.2.1 <<>> +trace fr.
;; global options: printcmd
.               190181 IN   NS    C.ROOT-SERVERS.NET.
.               190181 IN   NS    D.ROOT-SERVERS.NET.
.               190181 IN   NS    E.ROOT-SERVERS.NET.
.               190181 IN   NS    F.ROOT-SERVERS.NET.
.               190181 IN   NS    G.ROOT-SERVERS.NET.
.               190181 IN   NS    H.ROOT-SERVERS.NET.
.               190181 IN   NS    I.ROOT-SERVERS.NET.
.               190181 IN   NS    J.ROOT-SERVERS.NET.
.               190181 IN   NS    K.ROOT-SERVERS.NET.
.               190181 IN   NS    L.ROOT-SERVERS.NET.
.               190181 IN   NS    M.ROOT-SERVERS.NET.
.               190181 IN   NS    A.ROOT-SERVERS.NET.
.               190181 IN   NS    B.ROOT-SERVERS.NET.
;; Received 244 bytes from 129.88.38.1#53(129.88.38.1) in 2 ms

fr.             172800 IN   NS    DNS.CS.WISC.EDU.
fr.             172800 IN   NS    DNS.INRIA.fr.
```

Delegation system (cont.)

```
fr.          172800 IN   NS   DNS.PRINCETON.EDU.
fr.          172800 IN   NS   NS1.NIC.fr.
fr.          172800 IN   NS   NS2.NIC.fr.
fr.          172800 IN   NS   NS3.NIC.fr.
fr.          172800 IN   NS   NS3.DOMAIN-REGISTRY.NL.
fr.          172800 IN   NS   NS-EXT.VIX.COM.
;; Received 351 bytes from 192.33.4.12#53(C.ROOT-SERVERS.NET) in 97 ms

fr.          86400 IN   SOA   ns1.nic.fr. nic.nic.fr. 2004013000 21600 3600 3600000 86400
;; Received 68 bytes from 128.105.2.10#53(DNS.CS.WISC.EDU) in 131 ms
```

The reply order changes from one query to the next ⇒ load balancing

(The number on each line is the entry TTL)

Name Resolution in C

- IPv4 name query in C : gethostbyname()

- Better method (v4 & v6 compliant) :

```
hints.ai_flags      = 0;
hints.ai_family     = PF_UNSPEC; //could be AF_INET
hints.ai_socktype   = SOCK_DGRAM;
hints.ai_protocol   = IPPROTO_UDP;
hints.ai_addrlen    = 0;
hints.ai_addr       = NULL;
hints.ai_canonname  = NULL;
hints.ai_next       = NULL;
...
getaddrinfo(hostname, portnum, &hints, &rai)
// keeping only the first answer
s = socket(rai->ai_family, rai->ai_socktype, rai->ai_protocol)
```

(This code does not include de usual error traps, cf. man getaddrinfo)