Université Constantine 2
جامعة قسنطينة 2

Network Management

– Course 2 –

Chapter 4: TCP/IP services oriented Configuration (2/2)

Introduction

Dr. Nadira Benlahrache

NTIC Faculty

email@univ-constantine2.dz

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Concerned Students :

Faculty	Department	Level	Speciality
NTIC	TLSI	License 3	G.L.

Objectives:

- Presentation of network configuration services,
- Presentation of DHCP service,
- Presentation of FNS service,
- Presentation of SAMBA service.
- **Presentation of DNS service.**

Problem statement

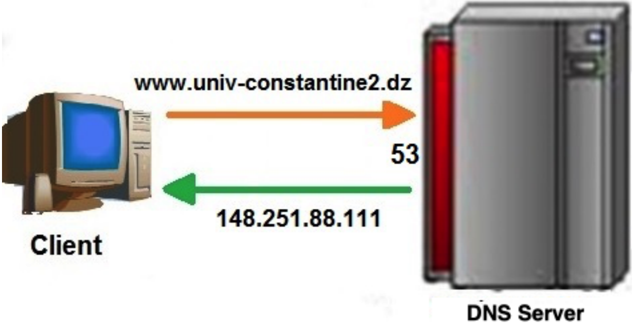
When connecting to a network, our machine, called the **Client**, must have:

- A **unique IP address** belonging to a logical network and a subnet mask,
- A **DNS address**, to be able to resolve host names, especially on the Internet,
- The address of the gateway that allows access to the Internet,
- Access to a number of **services**: identifying oneself to servers as a client, browsing web pages, downloading files, sending email, etc.

These services must be provided by one or more machines called **Servers**, *configured* to properly and adequately satisfy the requests of clients.

DNS (Domain Name System)

- Is a service that associates **names** with **IP addresses** of machines.
- Using a **DNS server** simplifies network management $\Longrightarrow$ No need to know the **IP addresses** of machines.
- On the Internet, a machine is identified by its IP address: Directory IP Address $\Longleftrightarrow$ Name.



Domain Notion

- **Domain** is a set of computers and users registered in a directory database, organized under a **common name**.
- A domain is a logical entity or label. It most often reflects a hierarchical organization in a company.
- For example, the domain *univ-constantine2.dz* designates all network machines (workstations, printers, etc.) of Constantine 2 University, and the user accounts authorized to **connect** and **share** resources there.

Notion of zone

- The concept of a **zone** is purely administrative. The declaration of machines in a domain is done in zones.
- The zone corresponds to a **physical file** called a zone file that stores the records of the database for a portion of the **naming** space.

TLD: top-level domain

- TLD (Top Level Domain): a top-level domain is defined by ICANN (Internet Corporation for Assigned Names and Numbers).
- Within each TLD, it is possible for any company, association, legal or natural person to register a domain name.
- All that is required is to make a request to a "**registrar**: registration office."
- The **registrar** will verify the uniqueness of the requested domain, any *conditions* and the *cost* of obtaining and the steps to register the domain.
- **.gov** or **.mil**: only by Americans.
- National domains: each country is free to organize its generic domain as it wishes, such as: **.dz**, **.fr** and **.it**
- The domains **.org**, **.net**, and **.com** are used in all countries.

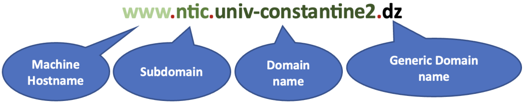
Domain Name and Host Name

- The domain is identified by a name, called the **domain name**.
- Domains can contain hosts (machines) and other domains (sub-domains).
- In general, only the following characters are allowed for host and domain names: 'a-z', 'A-Z', '0-9', and '-'.
- In October 2013, ICANN announced the internationalization of domain names (Arabic, Chinese, accented characters...)

Domain Name and Host Name

- The *host name* is made up of: **Machine-name.Domain-name.Generic-domain-name.**
- The domain name identifies a subnetwork, a department, or even an organization (e.g. dep.info or google.com...)
- This is referred to as the **FQDN**: *Fully Qualified Domain Name*.
- The machine name identifies a *machine* within a *grouping* of machines.
- The dot "." is used for concatenation of names.

Example:



DNS Server

- The DNS server stores information about the namespace of a domain.
- It manages a database containing:
  - name/@IP of machines in the domain,
  - name/@IP of servers in a subdomain.
- **It is a robust system by redundancy: several servers have the database of a domain.**

Principle of a DNS Server

- A name server is normally **authoritative** for one or more zones.
- A client who wants to access a host: looks in its *local cache*. If it knows the address of the host, it accesses it directly,
- Otherwise, it will query the name server. The name server will provide the @IP of the host.

Primary and Secondary Name Servers

- A name server is said to be the **primary** (master) server of a zone when it **directly reads** the information of this zone from a file stored on the same machine as itself.
- Changes to a zone, such as adding a new domain, are made on the *primary* server.
- A name server is called a **secondary** (slave) server when it obtains zone data from another name server on the network that has authority over that zone.
- A secondary server periodically copies the name base from the primary server.

Recursive DNS Servers

- A client can contact a name server to resolve a name,
- If the visited server takes the initiative to query the next server (in the DNS hierarchy) to obtain the answer to the question asked, then it is said to be **recursive**,
- ISPs make these *recursive* servers available to their clients.
- There are also **open** recursive servers such as **OpenDNS**.

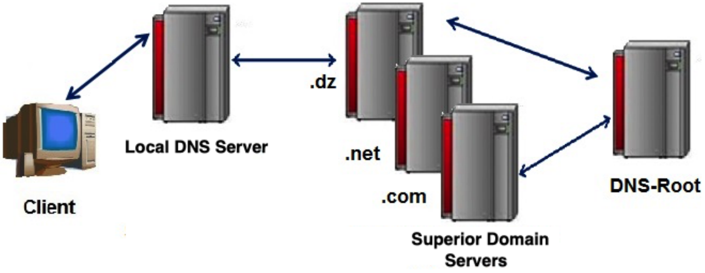
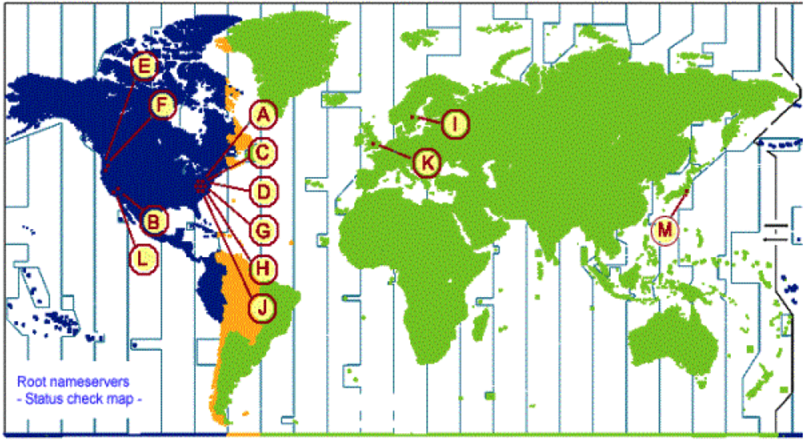


Figure: Hierarchy of DNS Servers.

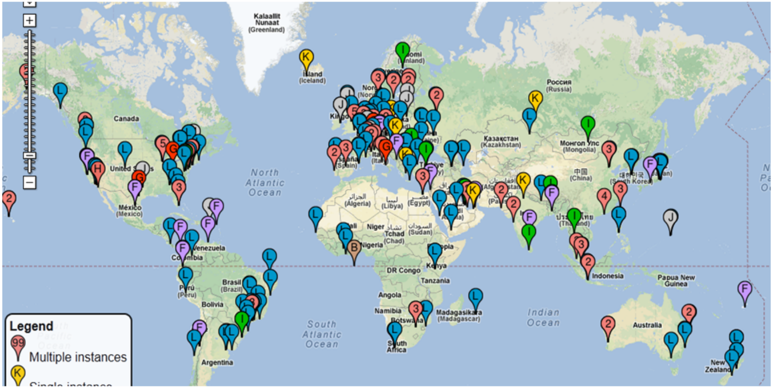
Root DNS Servers

- Root DNS Servers are approximately **13** servers distributed around the world.
- The primary server (also called master) is managed by ICANN: A.ROOT-SERVERS.NET
- Mirrored servers (also called secondary or slave): B.ROOT-SERVERS.NET to M.ROOT-SERVERS.NET.
- Manual modifications are made on the primary server. Automatic database exchange to secondary servers.

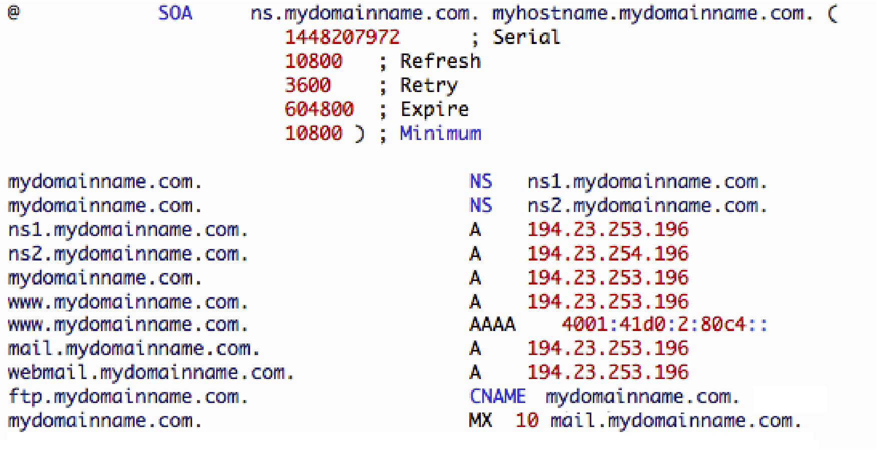
A.ROOT-SERVERS.NET



Secondary Root Servers

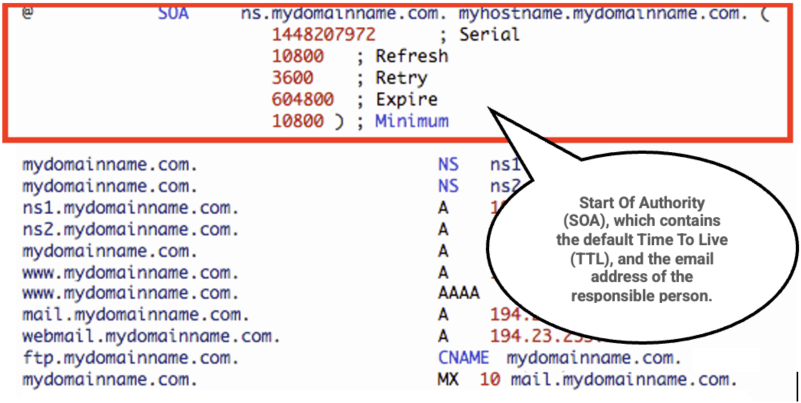


Example of DNS configuration file



```
@           SOA     ns.mydomainname.com. myhostname.mydomainname.com. (
                       1448207972       ; Serial
                       10800    ; Refresh
                       3600     ; Retry
                       604800   ; Expire
                       10800 ) ; Minimum

mydomainname.com.                       NS    ns1.mydomainname.com.
mydomainname.com.                       NS    ns2.mydomainname.com.
ns1.mydomainname.com.                   A     194.23.253.196
ns2.mydomainname.com.                   A     194.23.254.196
mydomainname.com.                       A     194.23.253.196
www.mydomainname.com.                   A     194.23.253.196
www.mydomainname.com.                   AAAA     4001:41d0:2:80c4::
mail.mydomainname.com.                  A     194.23.253.196
webmail.mydomainname.com.               A     194.23.253.196
ftp.mydomainname.com.                   CNAME  mydomainname.com.
mydomainname.com.                       MX  10 mail.mydomainname.com.
```

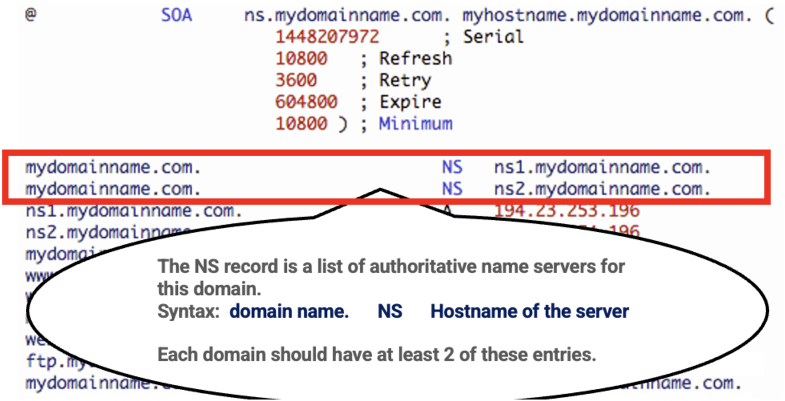
Example of DNS configuration file



```
@               SOA      ns.mydomainname.com. myhostname.mydomainname.com. (
                            1448207972       ; Serial
                            10800    ; Refresh
                            3600     ; Retry
                            604800   ; Expire
                            10800 )  ; Minimum
mydomainname.com.                         NS    ns1
mydomainname.com.                         NS    ns2
ns1.mydomainname.com.                     A     1
ns2.mydomainname.com.                     A
mydomainname.com.                         A
www.mydomainname.com.                     A
www.mydomainname.com.                     AAAA
mail.mydomainname.com.                    A     194.
webmail.mydomainname.com.                 A     194.23.2
ftp.mydomainname.com.                     CNAME  mydomainname.com.
mydomainname.com.                         MX  10 mail.mydomainname.com.
```

Start Of Authority (SOA), which contains the default Time To Live (TTL), and the email address of the responsible person.

Example of DNS configuration file



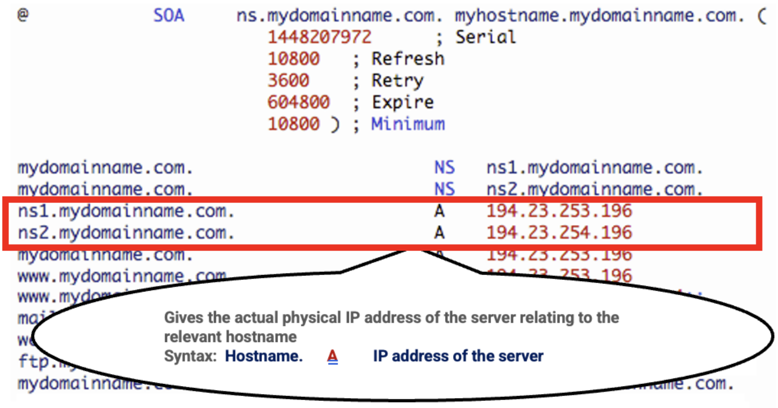
```
@               SOA     ns.mydomainname.com. myhostname.mydomainname.com. (
                           1448207972       ; Serial
                           10800     ; Refresh
                           3600      ; Retry
                           604800    ; Expire
                           10800 )   ; Minimum

mydomainname.com.                         NS    ns1.mydomainname.com.
mydomainname.com.                         NS    ns2.mydomainname.com.
ns1.mydomainname.com.                     A     194.23.253.196
ns2.mydomainname                                          196
mydomai
ww
we
ftp.my
mydomainname.c                                         ainname.com.
```

The NS record is a list of authoritative name servers for this domain.

Syntax: **domain name.** **NS** **Hostname of the server**

Each domain should have at least 2 of these entries.

Example of DNS configuration file

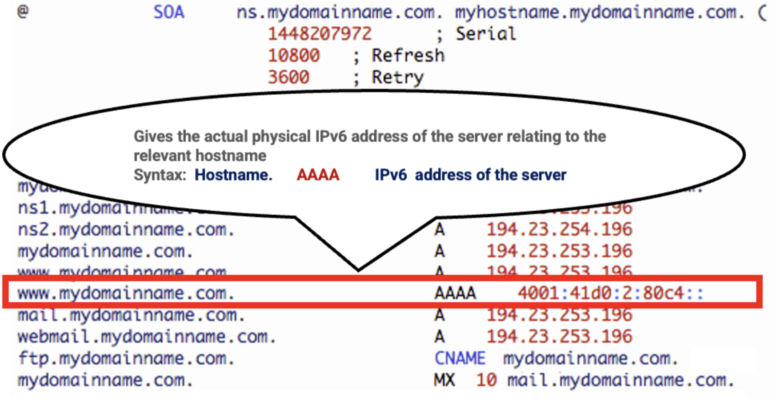


```
@            SOA      ns.mydomainname.com. myhostname.mydomainname.com. (
                         1448207972       ; Serial
                         10800    ; Refresh
                         3600     ; Retry
                         604800   ; Expire
                         10800 ) ; Minimum

mydomainname.com.                             NS    ns1.mydomainname.com.
mydomainname.com.                             NS    ns2.mydomainname.com.
ns1.mydomainname.com.                         A     194.23.253.196
ns2.mydomainname.com.                         A     194.23.254.196
mydomainname.com.                             A     194.23.253.196
www.mydomainname.com                                194.23.253.196
www.mydo
mai
we
ftp.m
mydomainname.c                                               name.com.
```

Gives the actual physical IP address of the server relating to the relevant hostname

Syntax: **Hostname.** **A** **IP address of the server**

Example of DNS configuration file

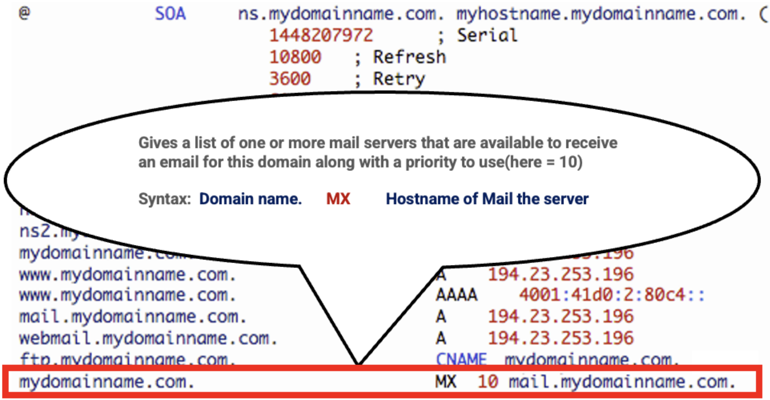


```
@           SOA     ns.mydomainname.com. myhostname.mydomainname.com. (
                       1448207972        ; Serial
                       10800    ; Refresh
                       3600     ; Retry
myd                                                                      m.
ns1.mydomainname.                                    .253.196
ns2.mydomainname.com.                   A      194.23.254.196
mydomainname.com.                       A      194.23.253.196
www.mydomainname.com                    A      194.23.253.196
www.mydomainname.com.                   AAAA      4001:41d0:2:80c4::
mail.mydomainname.com.                  A      194.23.253.196
webmail.mydomainname.com.               A      194.23.253.196
ftp.mydomainname.com.                   CNAME  mydomainname.com.
mydomainname.com.                       MX   10 mail.mydomainname.com.
```

Gives the actual physical IPv6 address of the server relating to the relevant hostname

Syntax: **Hostname.** **AAAA** **IPv6 address of the server**

Example of DNS configuration file

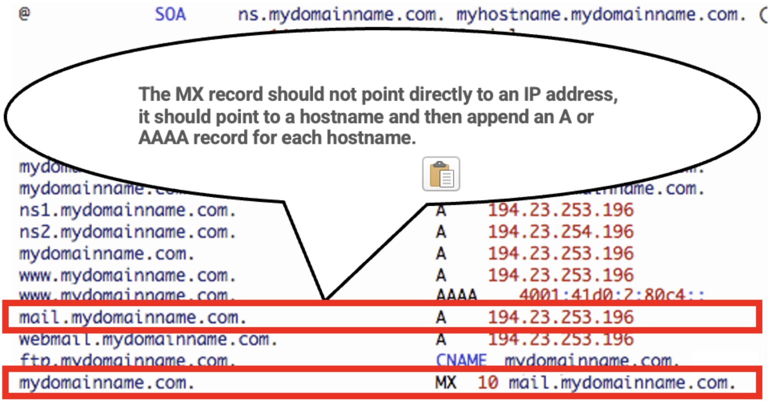


```
@               SOA     ns.mydomainname.com. myhostname.mydomainname.com. (
                          1448207972       ; Serial
                          10800    ; Refresh
                          3600     ; Retry

ns2.my
mydomainname.com                                        .196
www.mydomainname.com.                    A      194.23.253.196
www.mydomainname.com.                    AAAA      4001:41d0:2:80c4::
mail.mydomainname.com.                   A      194.23.253.196
webmail.mydomainname.com.                A      194.23.253.196
ftp.mydomainname.com.                    CNAME  mydomainname.com.
mydomainname.com.                        MX  10 mail.mydomainname.com.
```

Gives a list of one or more mail servers that are available to receive an email for this domain along with a priority to use(here = 10)

Syntax: **Domain name.** **MX** **Hostname of Mail the server**

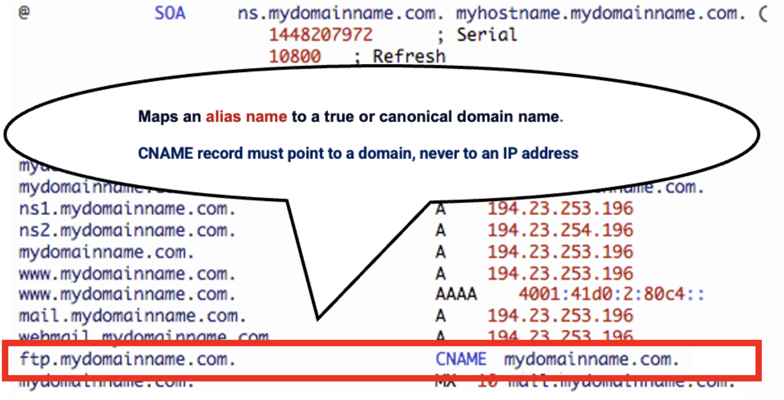
Example of DNS configuration file



```
@              SOA     ns.mydomainname.com. myhostname.mydomainname.com. (
mydom                                                                     m.
mydomainname.co                                                     name.com.
ns1.mydomainname.com.                             A     194.23.253.196
ns2.mydomainname.com.                             A     194.23.254.196
mydomainname.com.                                 A     194.23.253.196
www.mydomainname.com.                             A     194.23.253.196
www.mydomainname.com.                             AAAA     4001:41d0:2:80c4::
mail.mydomainname.com.                            A     194.23.253.196
webmail.mydomainname.com.                         A     194.23.253.196
ftp.mydomainname.com.                             CNAME  mydomainname.com.
mydomainname.com.                                 MX  10 mail.mydomainname.com.
```

The MX record should not point directly to an IP address, it should point to a hostname and then append an A or AAAA record for each hostname.

Example of DNS configuration file



```
@           SOA     ns.mydomainname.com. myhostname.mydomainname.com. (
                        1448207972       ; Serial
                        10800    ; Refresh
my
mydomainname.c                                              name.com.
ns1.mydomainname.com.                       A     194.23.253.196
ns2.mydomainname.com.                       A     194.23.254.196
mydomainname.com.                           A     194.23.253.196
www.mydomainname.com.                       A     194.23.253.196
www.mydomainname.com.                       AAAA     4001:41d0:2:80c4::
mail.mydomainname.com.                      A     194.23.253.196
webmail.mydomainname.com.                   A     194.23.253.196
ftp.mydomainname.com.                       CNAME  mydomainname.com.
mydomainname.com.                           MX   10 mail.mydomainname.com.
```

Maps an alias name to a true or canonical domain name.

CNAME record must point to a domain, never to an IP address

Domain Name Records

NS Record

The NS (Name Server) record specifies the name of the primary name server for the domain zone, allowing other servers to query the domain names.
Here is its format:

domain IN NS hostname

Examples:

edu 10800 IN NS 100.13.52.102

or:

@ IN NS My-ns.dns-server.net.

Domain Name Records

A Record

An **A** (Address) record associates hostnames with an IP address within a zone.
These records make up the vast majority of the zone file.
Format:

hostname IN A host-IP-address

Examples: www 10800 IN A 92.13.88.105
machine1 10800 IN A 157.55.201.143
nameserver2 10800 IN A 157.55.200.2

Domain Name Records

MX Record

To send an email to *student@mydomain.com*, you need to know the IP address of the server that retrieves emails from "**mydomain.com**".
MX records are used to designate this type of server.

Format:

domain IN MX mail-server-hostname.

Example:

@ 10800 IN MX exp1.yahoo.com

Domain Name Records

CNAME Record

CNAME (Canonical Name) allows you to define domain name **aliases**, meaning equivalences.

The format:

domain IN CNAME domain-name-alias.

Example:

edu 10800 IN CNAME univ-constantine2.dz.

⇒ (**univ-constantine2.dz.** can replace **edu.mydomain.com**)

Server installation

In Linux, two types of files are used:

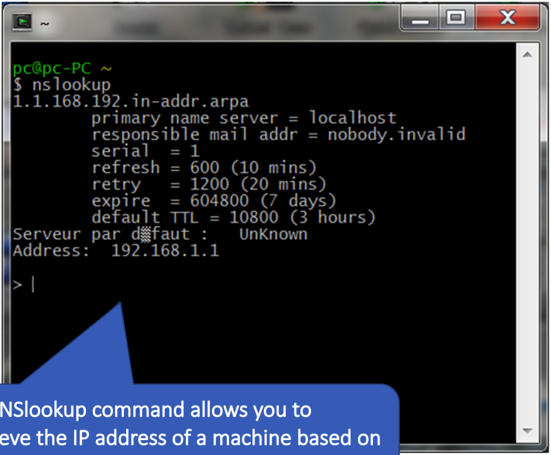
1. The file **/etc/bind/named.conf**, which describes the general configuration of the DNS server,
2. The files that contain resource records for the zone in **/etc/bind**.

Usually, one file is created for forward zone resolution and one file for reverse zone resolution.

The daemon responsible for this service is: **named**.

nslookup command

The **nslookup** command is used to find the *IP* address of a machine from its *DNS* name.

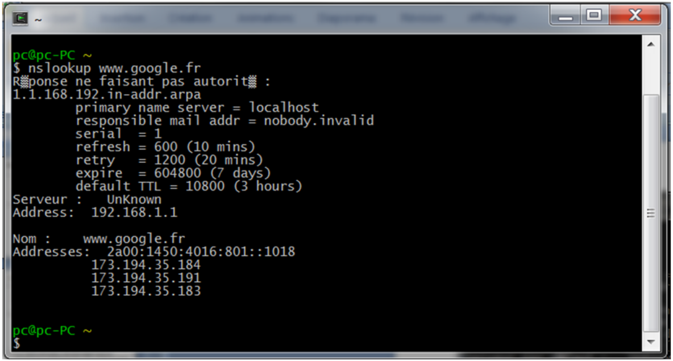


```
pc@pc-PC ~
$ nslookup
1.1.168.192.in-addr.arpa
        primary name server = localhost
        responsible mail addr = nobody.invalid
        serial  = 1
        refresh = 600 (10 mins)
        retry   = 1200 (20 mins)
        expire  = 604800 (7 days)
        default TTL = 10800 (3 hours)
Serveur par d▒faut :   UnKnown
Address:  192.168.1.1

> |
```

The NSlookup command allows you to retrieve the IP address of a machine based on its domain name.

nslookup command

The **nslookup** command is used to find the *IP* address of a machine from its *DNS* name.



```
pc@pc-PC ~
$ nslookup www.google.fr
R▓ponse ne faisant pas autorit▓ :
1.1.168.192.in-addr.arpa
        primary name server = localhost
        responsible mail addr = nobody.invalid
        serial  = 1
        refresh = 600 (10 mins)
        retry   = 1200 (20 mins)
        expire  = 604800 (7 days)
        default TTL = 10800 (3 hours)
Serveur :   UnKnown
Address:  192.168.1.1

Nom :    www.google.fr
Addresses:  2a00:1450:4016:801::1018
          173.194.35.184
          173.194.35.191
          173.194.35.183


pc@pc-PC ~
$
```

Conclusion

The aim of this course was to:

- Introduce the main network service that the administrator must consider to ensure the proper functioning of their network and other services.
- The services covered is DNS.
- This service may not be visible to a network user, but it is essential to ensure the sharing and proper functioning of other network services.

References

- Cricket Liu , Paul Albitz , ”DNS and BIND ”, Paperback , Jun 2006
- Michel DUTREIX - Pierre FAUQUEMBERGUE, ”Debian GNU/Linux - Services réseau (DHCP, DNS, Apache, CUPS, NFS, Samba, Puppet, Nagios...)”, Editions ENI, jannuary 2018, ISBN : 9782409012068
- Julien Rouxel, ”SAMBA”, Editions ENI, ISBN : 9782746066526E12
- Sujata Biswas, ”Understanding NFS: Network File System on Linux”, Kindle Edition,

Some useful links

- https://www.it-connect.fr/cours/dhcp-du-protocole-a-la-configuration/
- www.frameip.com/dhcp/
- https://www.frameip.com/dns/