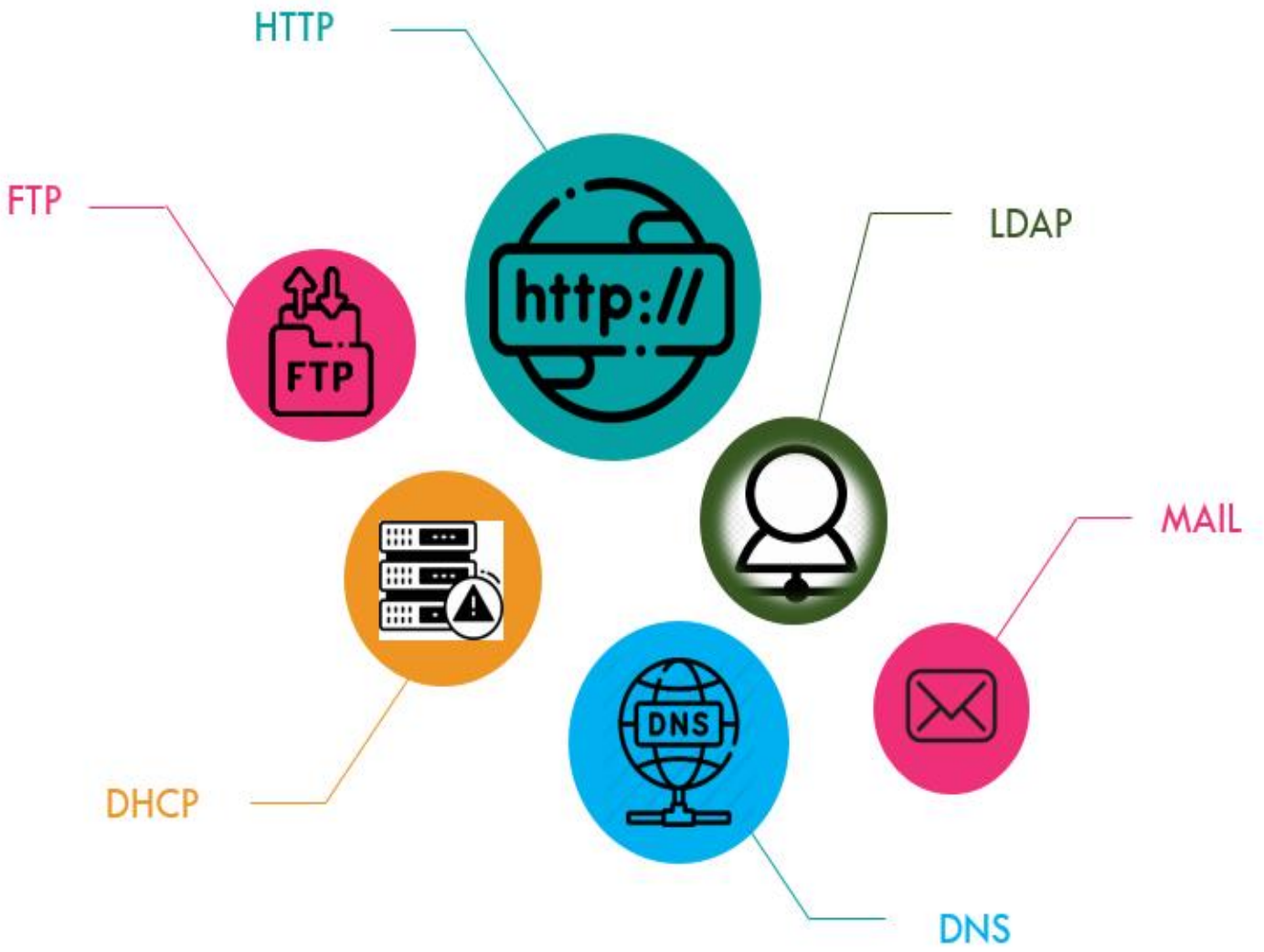


Enterprise Network

REPPORT

Produced by :

Fatima Ezzahra SEFFARI.

Amal LAMINI.

Framed by:

Mme Khawla TADIST.

Thanks:

First of all, we would like to particularly thank and testify all our gratitude to the following person, for her dedication and support in the realization of this engineering project:

- **Mme. Khawla TADIST.**

Table of content:

1. Introduction

As part of our third year of the common core curriculum in digital engineering and artificial intelligence, we are offered a 1-month project allowing us to put our knowledge and professional skills into practice.

An enterprise network consists of physical and virtual networks and protocols that serve the dual purpose of connecting all users and systems on a local area network and it's usually configured to facilitate access to data.

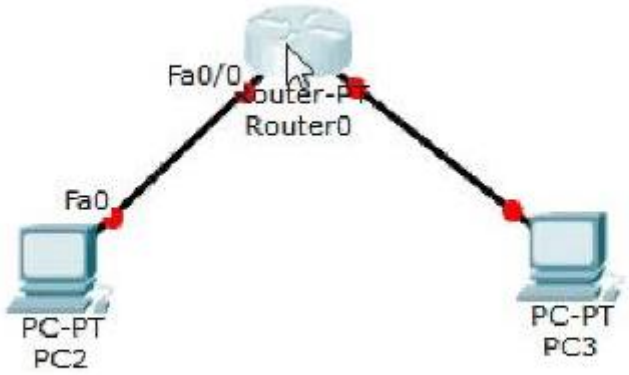
2. Goals

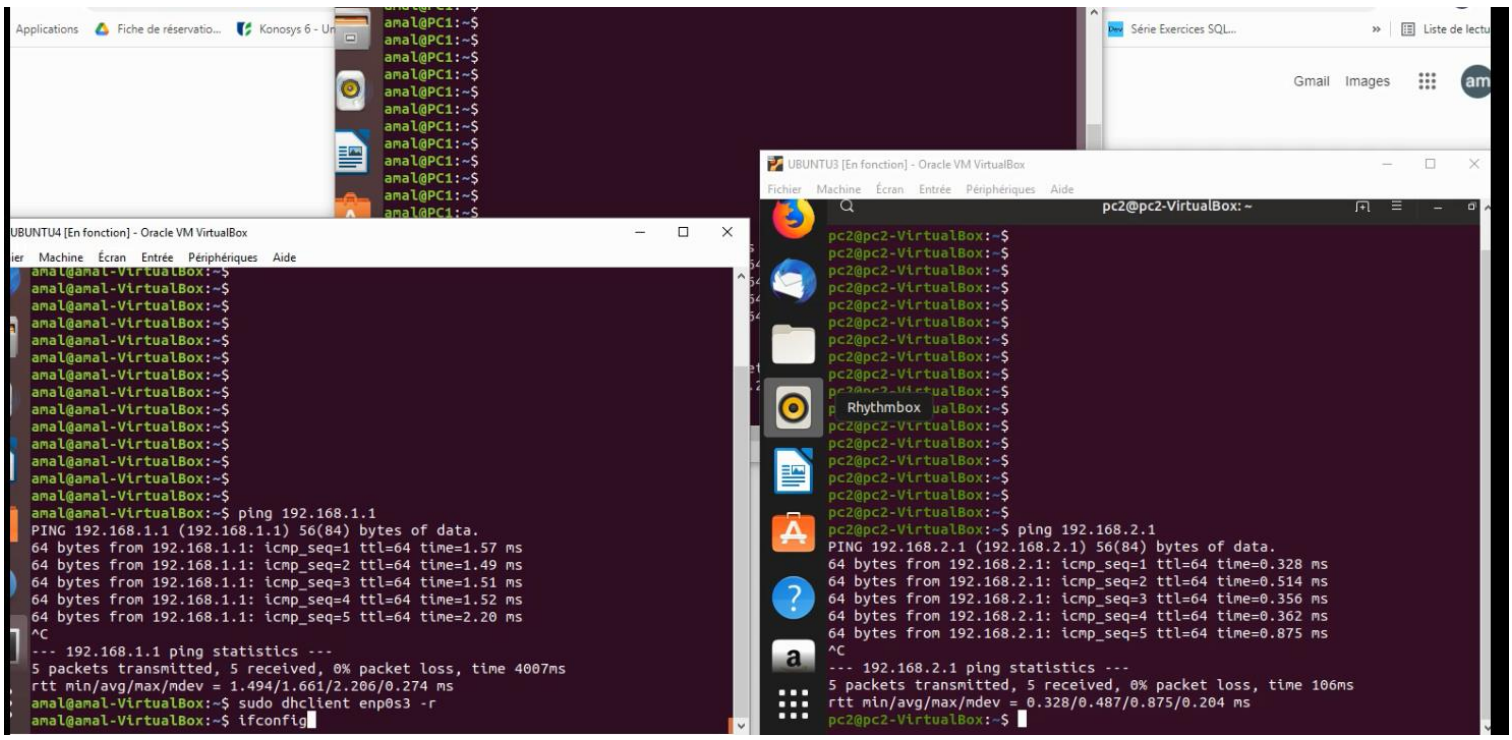
Our goal is to build a network capable to do and provide the following services:

- Delivering IP addresses to devices connected.
- Turn domain names into IP addresses
- Sharing files.
- Allow the user to access web pages.
- Transferring emails
- Managing directory services and authentication

3. Needs:

We installed 3 Linux machines (Ubuntu) and we tried to connect these machines together in different Subnets





4. Protocols:

4.1 DHCP server:

Every computer on a network has to have an I.P. address .There are 2 ways that a computer can be assigned an IPaddress:

Static IP or Dynamic IP.

A static IP is where a user assigns an IP address manually If we are dealing with a large network that has a lot of computers we should make sure that all IP addresses are unique if it's not it will cause an IP CONFLICT it's where two computers have the same IP.

A dynamic IP is where a computer gets an IP. Address from a DHCP server automatically assigns a computer an: • IP address.

- First of all we will configure our DHCP server

```
subnet 192.168.1.0 netmask 255.255.255.0 {
  range 192.168.1.1 192.168.1.100;
  option domain-name-servers 192.168.1.3;
  option domain-name "example.org";
  option subnet-mask 255.255.255.0;
  option routers 192.168.1.1;
  option broadcast-address 192.168.1.255;
  default-lease-time 600;
  max-lease-time 7200;
}
```

- Once the configuration is complete, launch the DHCP server and adding the service to start up:

```
amal@PC1:~$ sudo systemctl start isc-dhcp-server
amal@PC1:~$ sudo systemctl status isc-dhcp-server
```

Configuration verification

- Then we will see if our DHCP server is running correctly :

```
amal@PC1:~$ sudo systemctl status isc-dhcp-server
● isc-dhcp-server.service - ISC DHCP IPv4 server
   Loaded: loaded (/lib/systemd/system/isc-dhcp-server.service; enabled; vendor
   Active: active (running) since Fri 2022-01-28 00:06:33 +01; 12s ago
     Docs: man:dhcpd(8)
 Main PID: 1801 (dhcpd)
    Tasks: 1 (limit: 1118)
   CGroup: /system.slice/isc-dhcp-server.service
           └─1801 dhcpd -user dhcpd -group dhcpd -f -4 -pf /run/dhcp-server/dhc

ي ل ي 28 00:06:34 PC1 sh[1801]: Listening on LPF/enp0s3/08:00:27:bf:42:27/192.1
ي ل ي 28 00:06:34 PC1 dhcpd[1801]: Sending on   LPF/enp0s3/08:00:27:bf:42:27/19
ي ل ي 28 00:06:34 PC1 sh[1801]: Sending on   LPF/enp0s3/08:00:27:bf:42:27/192.1
ي ل ي 28 00:06:34 PC1 dhcpd[1801]: Sending on   Socket/fallback/fallback-net
ي ل ي 28 00:06:34 PC1 sh[1801]: Sending on   Socket/fallback/fallback-net
ي ل ي 28 00:06:34 PC1 dhcpd[1801]: Server starting service.
ي ل ي 28 00:06:41 PC1 dhcpd[1801]: DHCPDISCOVER from 08:00:27:bf:42:27 via enp0
ي ل ي 28 00:06:42 PC1 dhcpd[1801]: DHCPOFFER on 192.168.1.12 to 08:00:27:bf:42:
ي ل ي 28 00:06:42 PC1 dhcpd[1801]: DHCPREQUEST for 192.168.1.12 (192.168.1.1) f
ي ل ي 28 00:06:42 PC1 dhcpd[1801]: DHCPACK on 192.168.1.12 to 08:00:27:bf:42:27
lines 1-19/19 (END)
```

Now we will move to clients machines:

We will edit this file following this command:

Sudo nano /etc/network/interfaces

```
  GNU nano 2.9.3                  /etc/network/interfaces

# interfaces(5) file used by ifup(8) and ifdown(8)
auto lo
iface lo inet loopback

auto enp0s3
iface enp0s3 inet dhcp
```

Enpos3 will receive the ip address from our DHCP server.

- For the -r flag explicitly releases the current lease.

```
amal@amal-VirtualBox:~$ sudo dhclient enp0s3 -r
amal@amal-VirtualBox:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet6 fe80::a00:27ff:fea7:8ff3  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:a7:8f:f3  txqueuelen 1000  (Ethernet)
        RX packets 7652  bytes 621732 (621.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1069  bytes 131590 (131.5 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

- Now we will obtain a fresh IP address using the DHCP

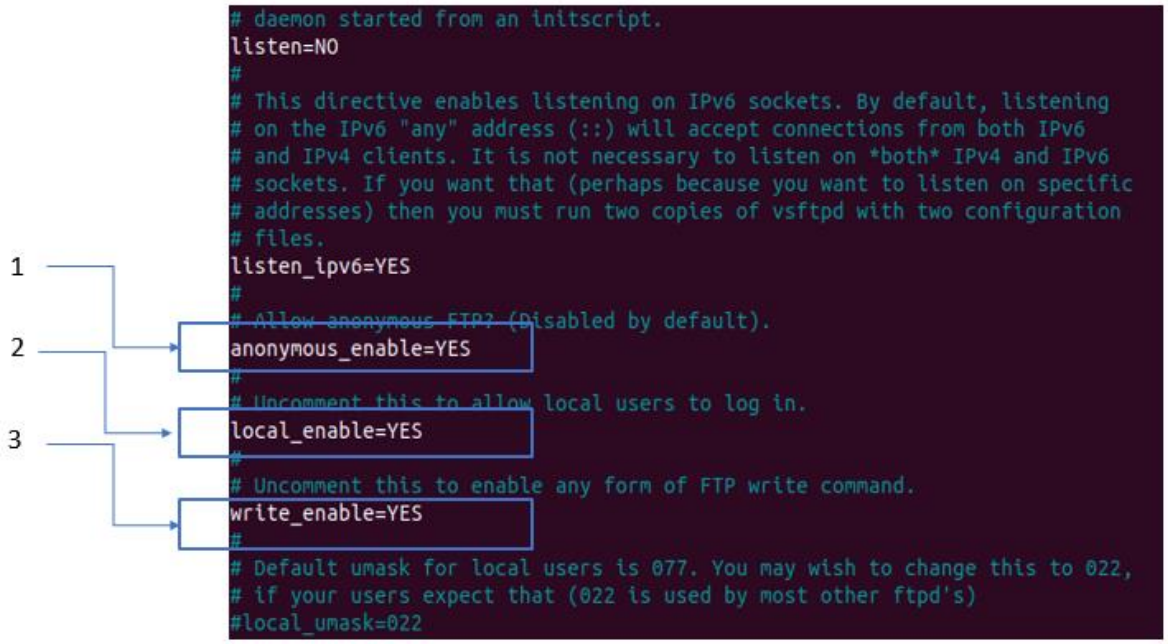
```
amal@amal-VirtualBox:~$ sudo dhclient enp0s3
amal@amal-VirtualBox:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.11  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::a00:27ff:fea7:8ff3  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:a7:8f:f3  txqueuelen 1000  (Ethernet)
        RX packets 7672  bytes 623778 (623.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1080  bytes 133602 (133.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Now as we can see our server is capable to deliver IP addresses to the other devices connected.

4.2 FTP Server:

vsftpd - FTP Server Installation

```
amal@amal-VirtualBox:~$ sudo apt-get install vsftpd
Reading package lists... Done
Building dependency tree
Reading state information... Done
vsftpd is already the newest version (3.0.3-9build1).
The following packages were automatically installed and are no longer required:
  libirs-export160 libisccfg-export160
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 23 not upgraded.
```



ANONYMOUS FTP CONFIGURATION

- By default vsftpd is *not* configured to allow anonymous download. If you wish to enable anonymous download edit /etc/vsftpd.conf by changing: no to yes

USER AUTHENTICATED FTP CONFIGURATION

- By default vsftpd is configured to authenticate system users and allow them to download files. If you want users to be able to upload files, edit /etc/vsftpd.conf:

SECURING FTP

- There are options in /etc/vsftpd.conf to help make vsftpd more secure. For example users can be limited to their home directories by uncommenting:

chroot_local_user=YES

- To allow local users to access the FTP server, the "local-enable=YES" entry must be set, which is the default setting. If you want to deny local users access to your Ubuntu FTP server, just enter the corresponding line with the pound sign in front.

- In the default configuration, neither local users or anonymous users can use FTP commands. The corresponding line for the global write "#write_enable=YES" is disabled. If connected users should be able to adapt the file system of the vsftpd server, it is therefore necessary to comment out the instruction:

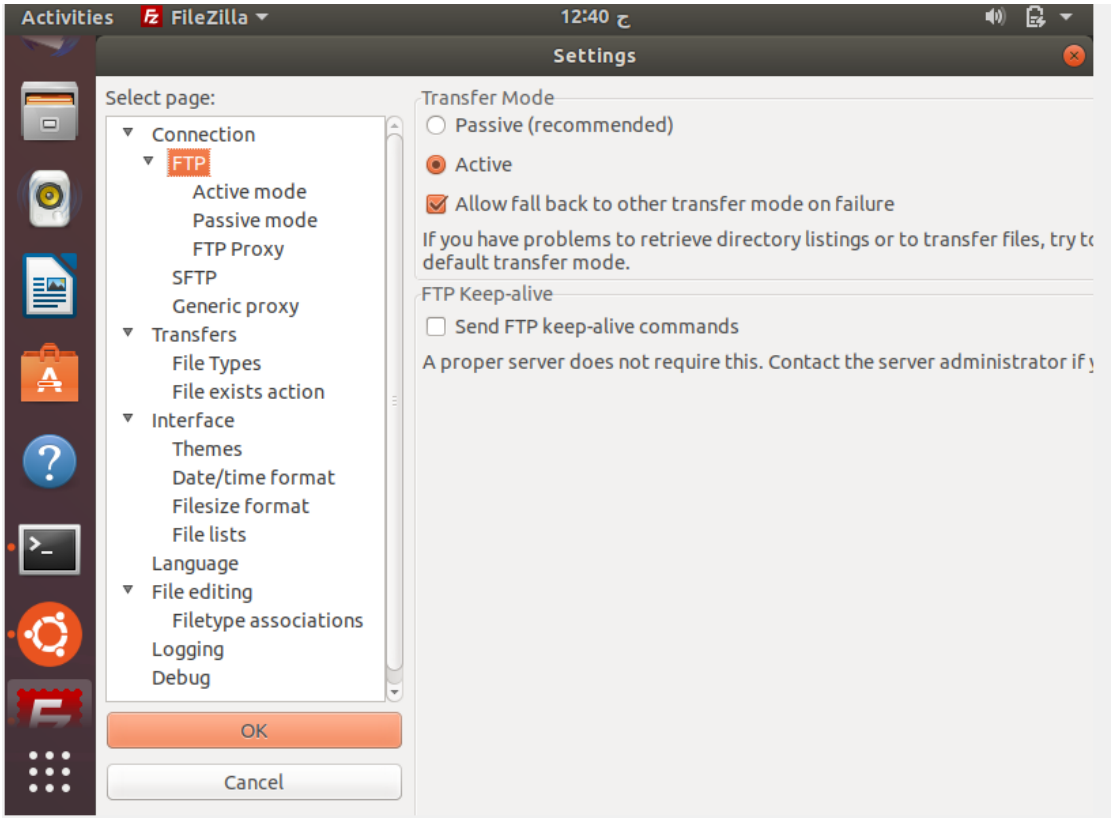
Now we will move to client machine

We will use **FileZilla** which is a **utility for transferring files to or from a remote computer** by a standard method known as FTP (File Transfer Protocol). It's also open source software that is installed and runs on Windows and Linux computers in the college; a Mac OS version is available.

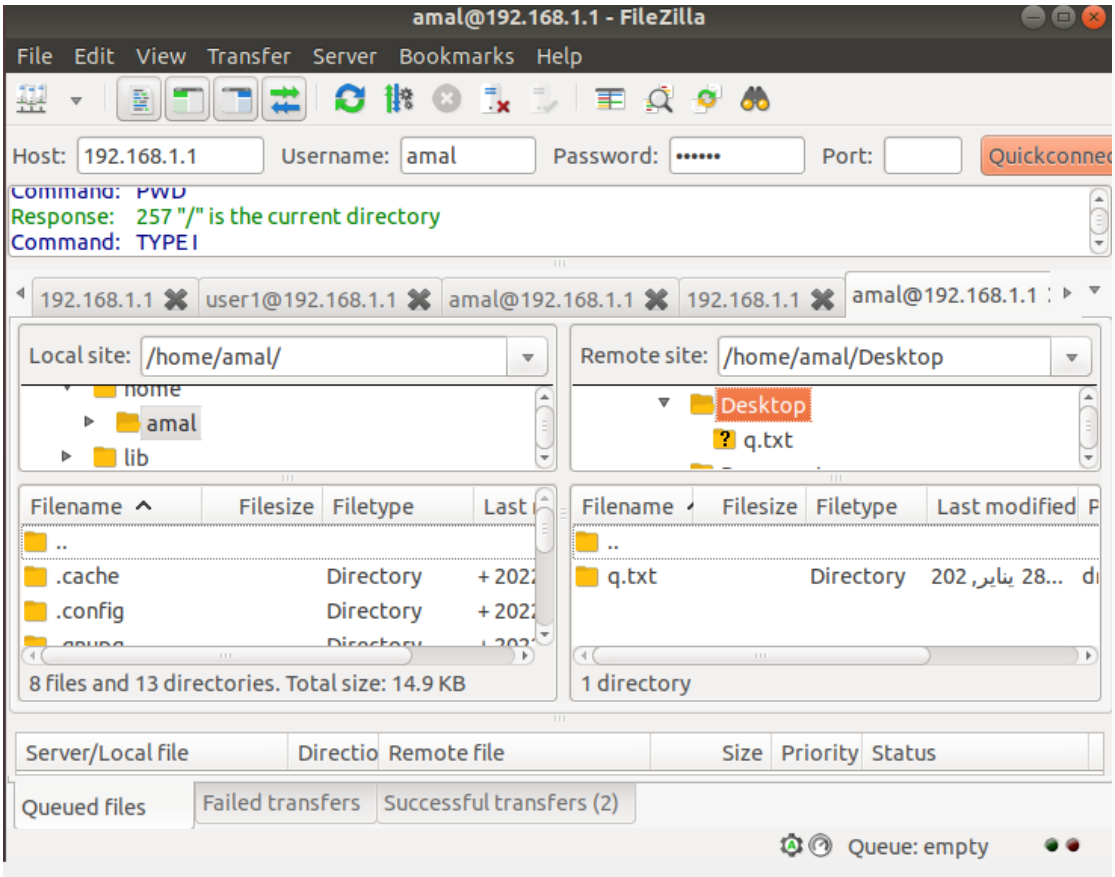
- To install **FileZella** we will use this command:

```
pc3@pc3-VirtualBox:~$ sudo apt install filezilla -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
filezilla is already the newest version (3.28.0-1).
0 upgraded, 0 newly installed, 0 to remove and 106 not upgraded.
pc3@pc3-VirtualBox:~$
```

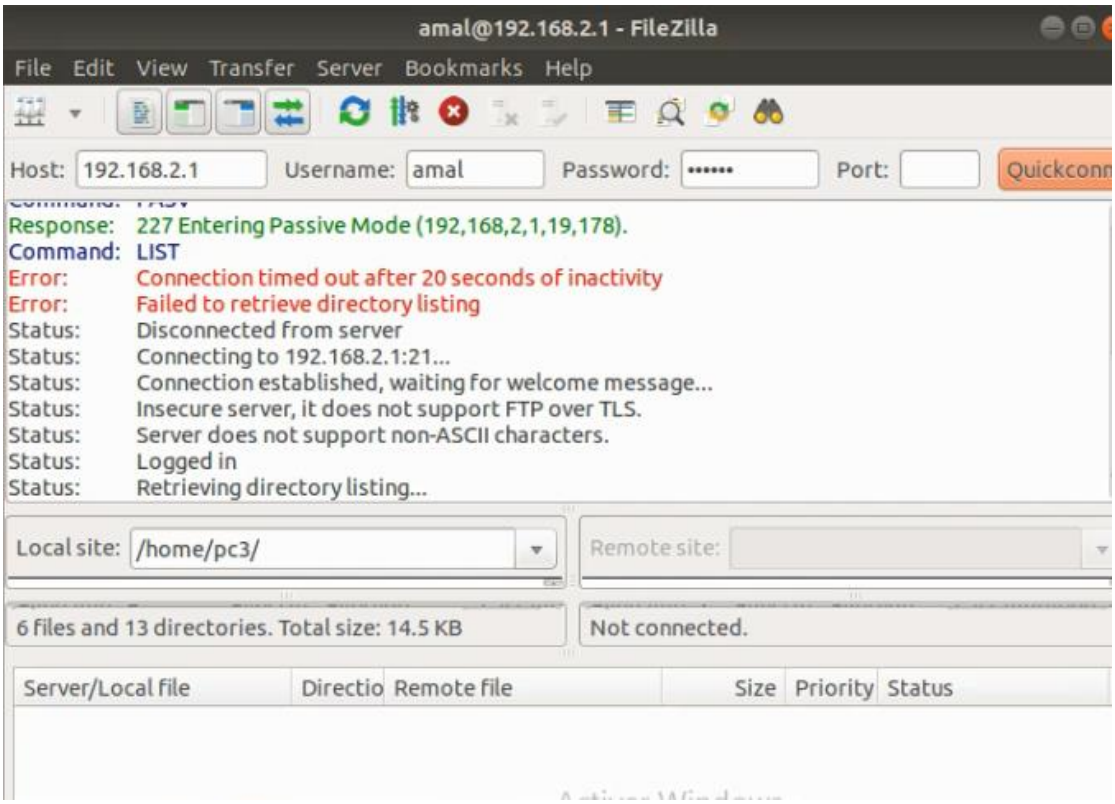
- In the first client we will active the ftp protocol so that computer can access all of our server files but in the opposite way we will not activate it



As we can see it will receive all of the files by typing the ip address of our server, username and password



It will not receive any file



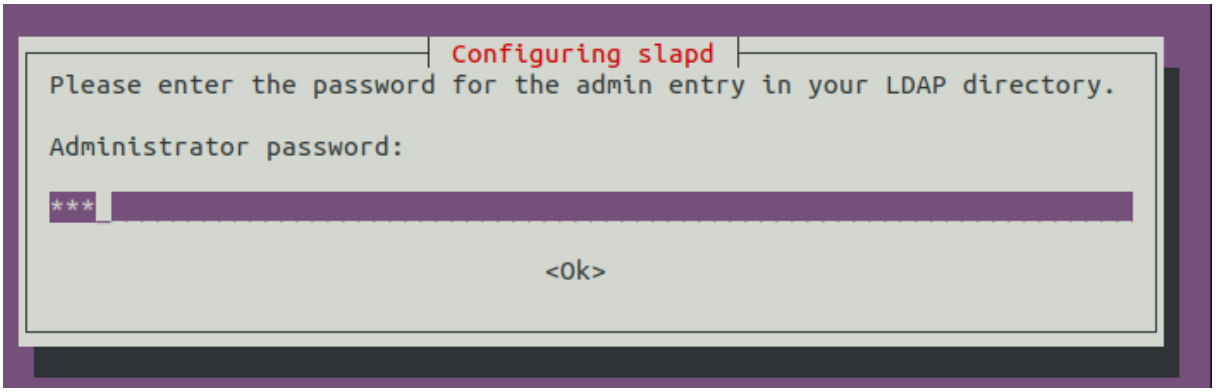
4.3 LDAP server

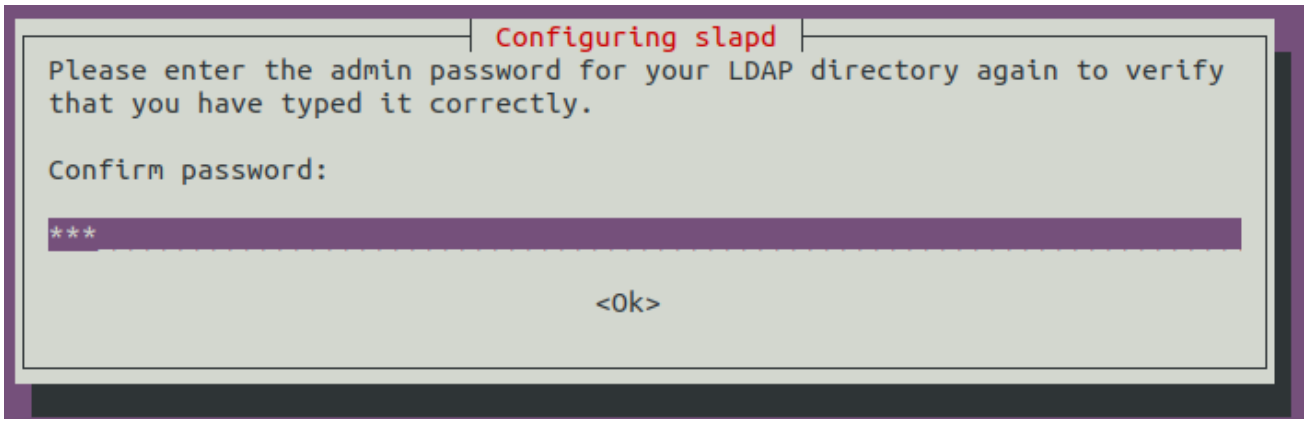
OpenLDAP is a free open source Light Weight Directory Access protocol developed by the OpenLDAP project. It is a platform independent protocol, so that it runs on all Linux/Unix like systems, Windows, AIX, Solaris and Android.

Installation of OpenLDAP

```
apt-get install slapd ldap-utils
```

During the installation, we will be asked to set the password for the LDAP admin account and Re-enter it again.



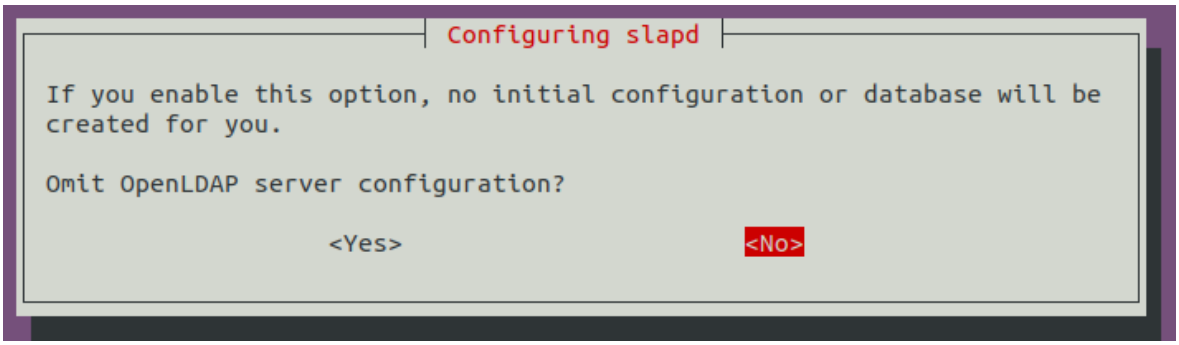


Then the installation will be completed:

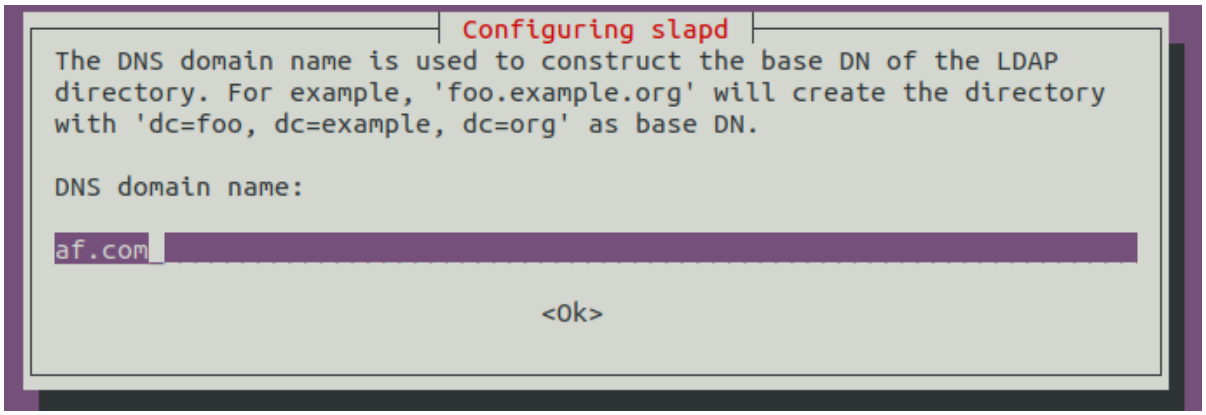
```
Reading package lists... Done
Building dependency tree
Reading state information... Done
ldap-utils is already the newest version (2.4.45+dfsg-1ubuntu1.10).
slapd is already the newest version (2.4.45+dfsg-1ubuntu1.10).
0 upgraded, 0 newly installed, 0 to remove and 23 not upgraded.
```

Next, we should reconfigure the slapd:

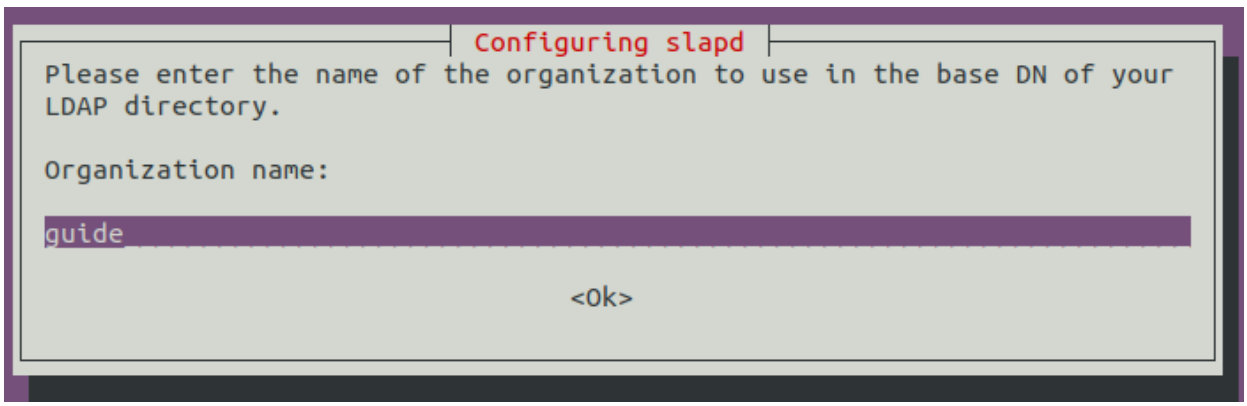
The following screen should appear and we will select « NO »



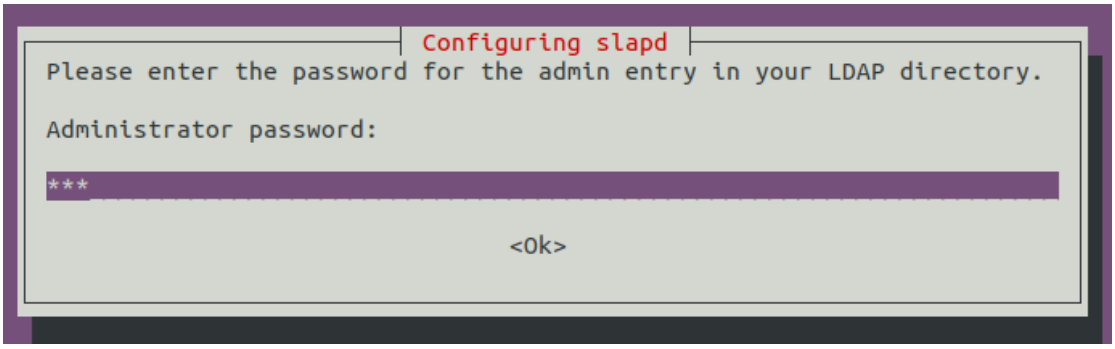
Then we will enter the domain name:



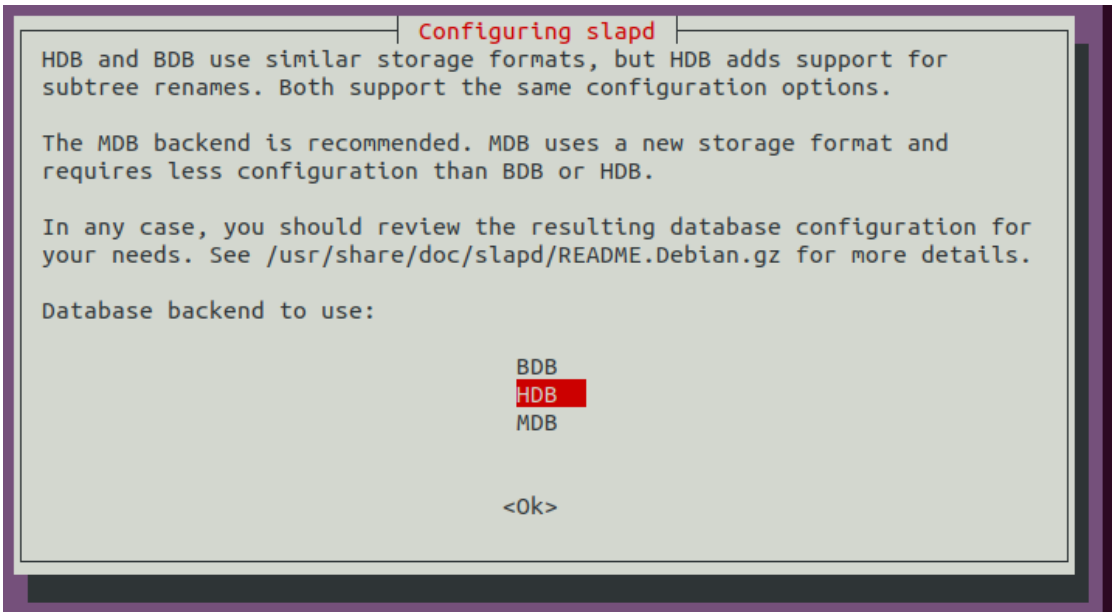
We will enter the Organization name



Enter the password and re-entrer

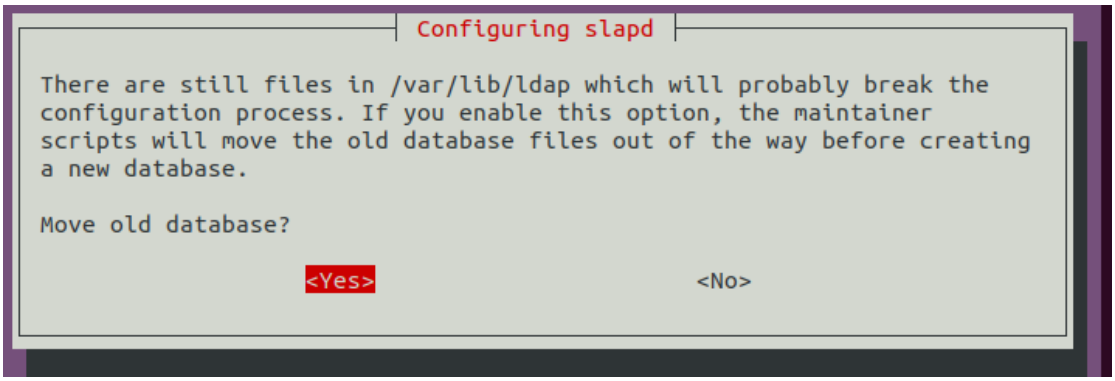


Select the backend database.



Select whether you want to delete the database automatically or keep it when slapd is removed. Here I want to keep my old database, so I clicked No.

We will select Yes to move old database.



That's it. We have successfully configured **OpenLDAP**.

LDAP Server Administration

Administration of LDAP server from command line mode is bit difficult. We can't memorize all LDAP commands. So, we will use an easier GUI administration tool called "**phpldapadmin**" to manage, configure, and administer LDAP server.

Installation:

We will install **phpLDAPadmin** to manage our LDAP server by typing the following command

```
Sudo apt-get install phpldapadmin
```

We will Edit the following "**/etc/phpldapadmin/config.php**" file by

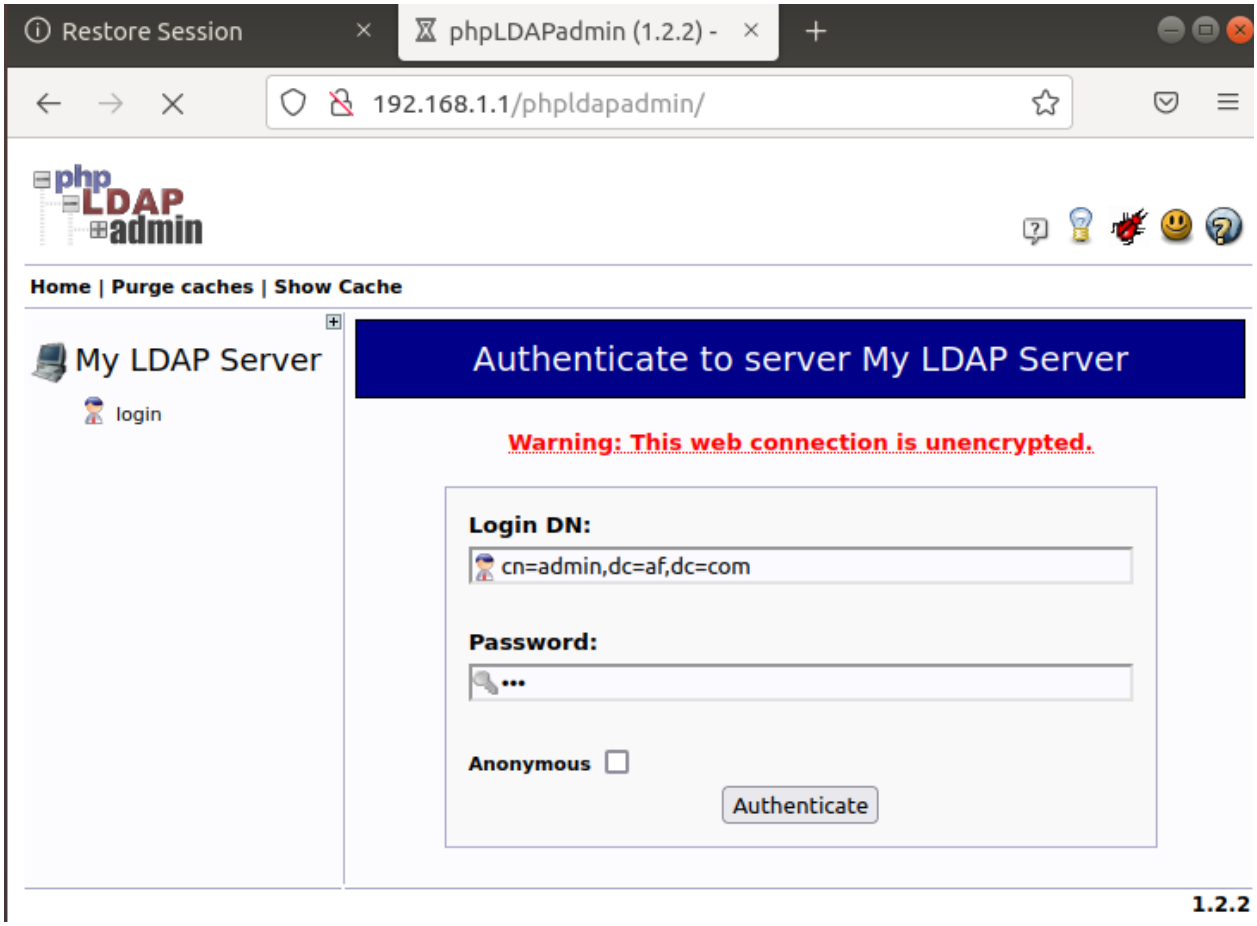
```
$config->custom->appearance['hide_template_warning'] = true;

   binds. */
$servers->setValue('login','bind_id','cn=admin,dc=af,dc=com');
#  $servers->setValue('login','bind_id','cn=Manager,dc=example,dc=com');

$servers->setValue('server','host','192.168.1.1');

/* The port your LDAP server listens on (no quotes). 389 is standard. */
// $servers->setValue('server','port',389);

/* Array of base DNs of your LDAP server. Leave this blank to have phpLDAPadmin
   auto-detect it for you. */
$servers->setValue('server','base',array('dc=af,dc=com'));
```

Now we will Test phpLDAPadmin

By opening our web browser and navigate to: "**http://IPAddress/phpldapadmin**".

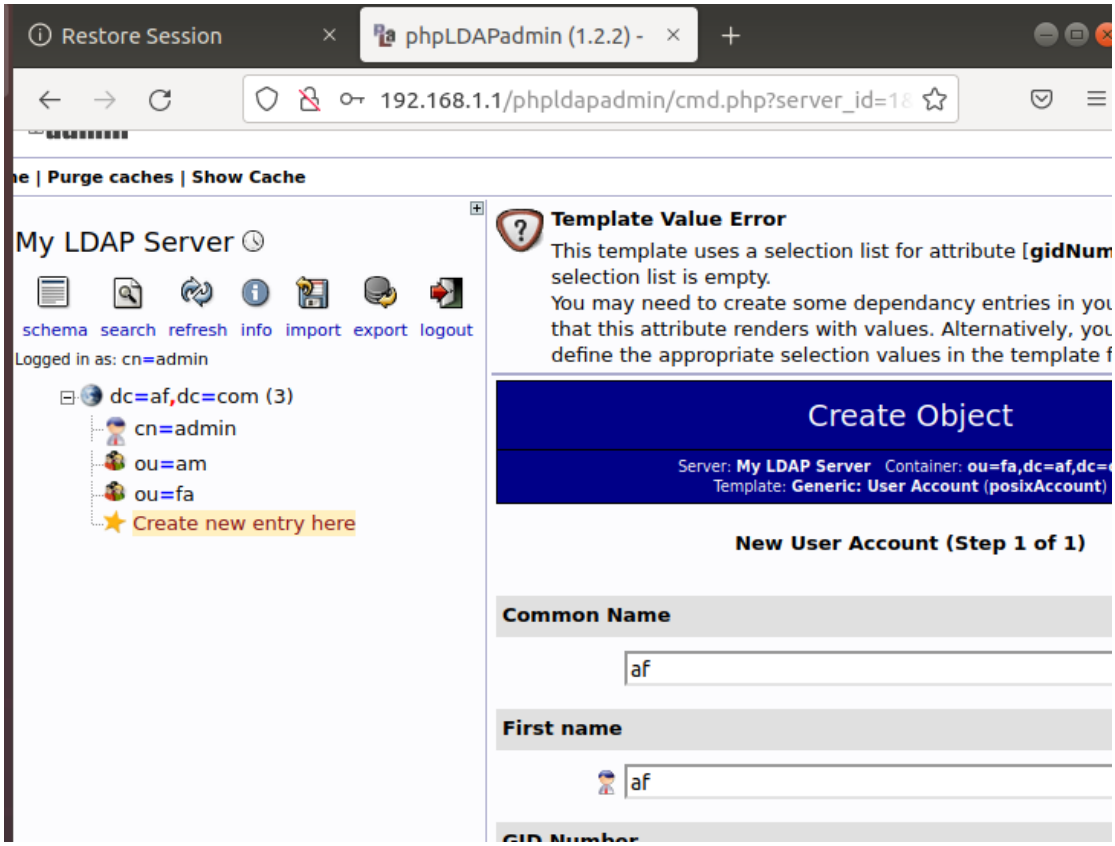
In our case "**http://192.168.1.1/phpldapadmin**".

The following screen should appear.



We will click "**login**" on the left pane. Enter the LDAP admin password that you have created during **OpenLDAP** installation, and click "**Authenticate**".

Let's create some sample objects from the phpldapadmin console. First, we will create an Organizational Unit.



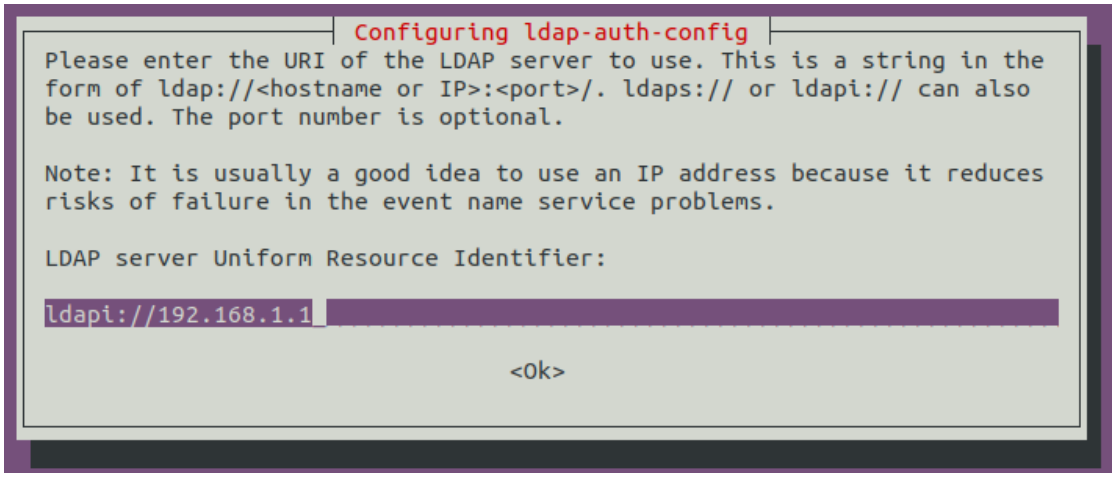
We can also create group, users...

Clients machines

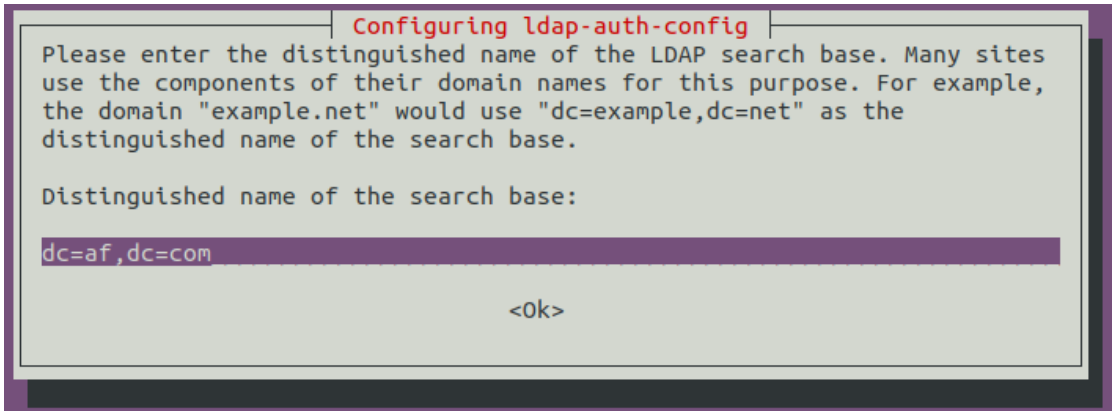
In this part we will configure our Linux clients to authenticate using OpenLDAP server.

During installation, we will be asked a variety of questions to answer First we will enter the ldap server IP address as shown in the below screenshot.

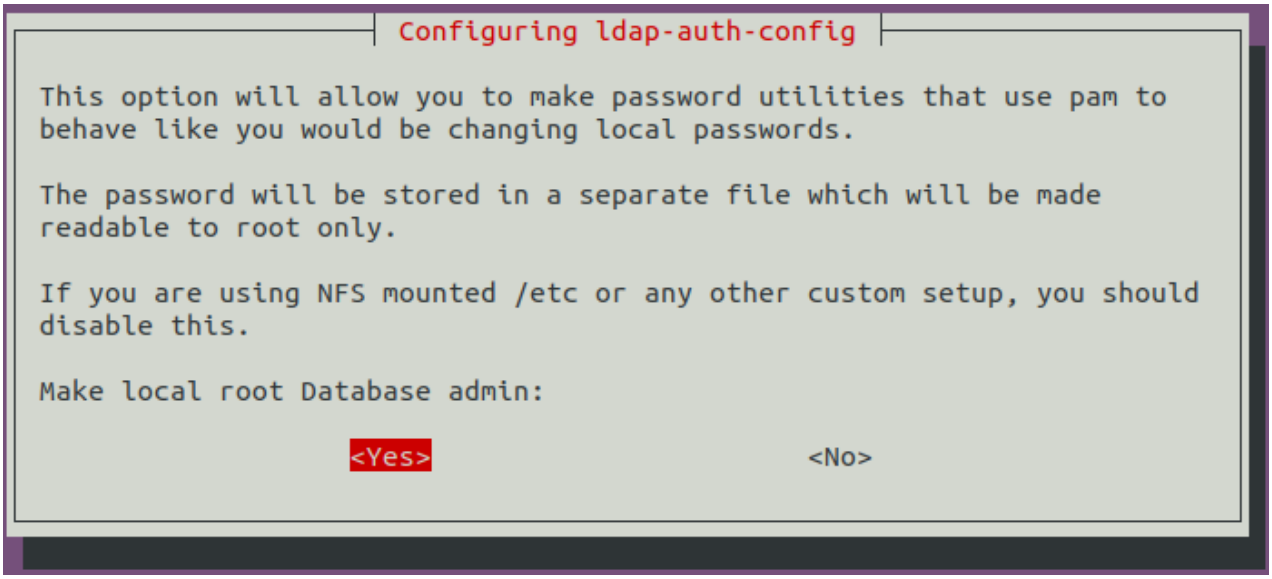
```
apt-get install libnss-ldap libpam-ldap nscd
```

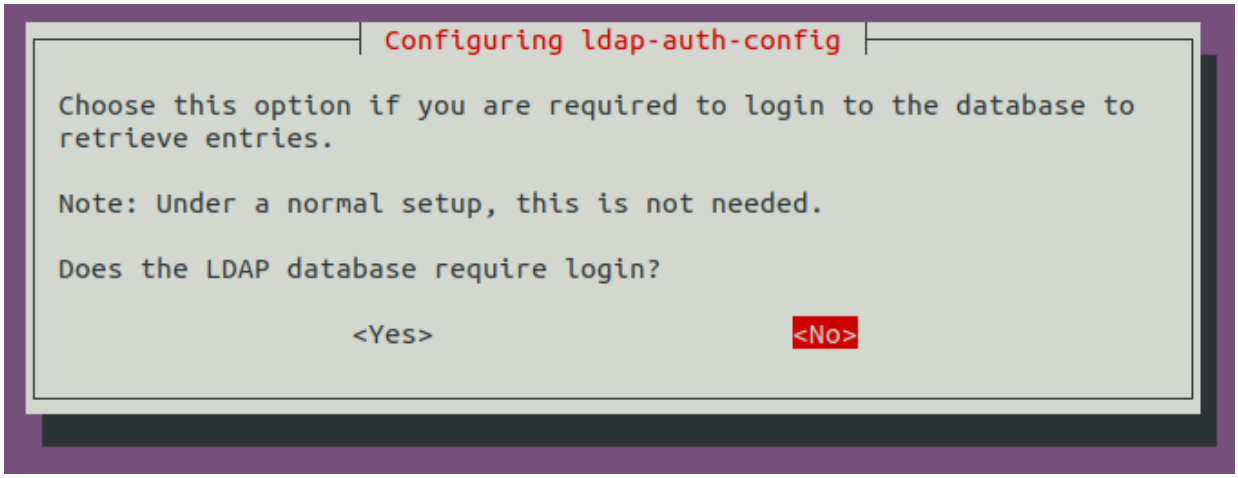


Then we will enter our distinguished name of the search base. This value should match with your LDAP server's **/etc/phpldaadmin/config.php** file values. In our case it's **dc=af, dc=com**.



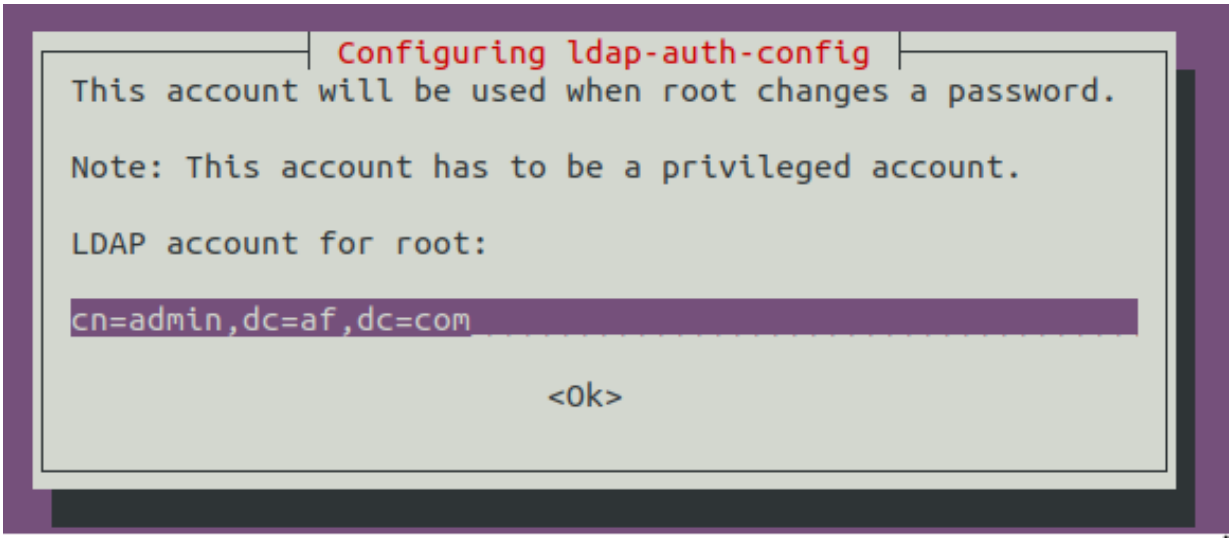
Select Ldap version to use as 3.



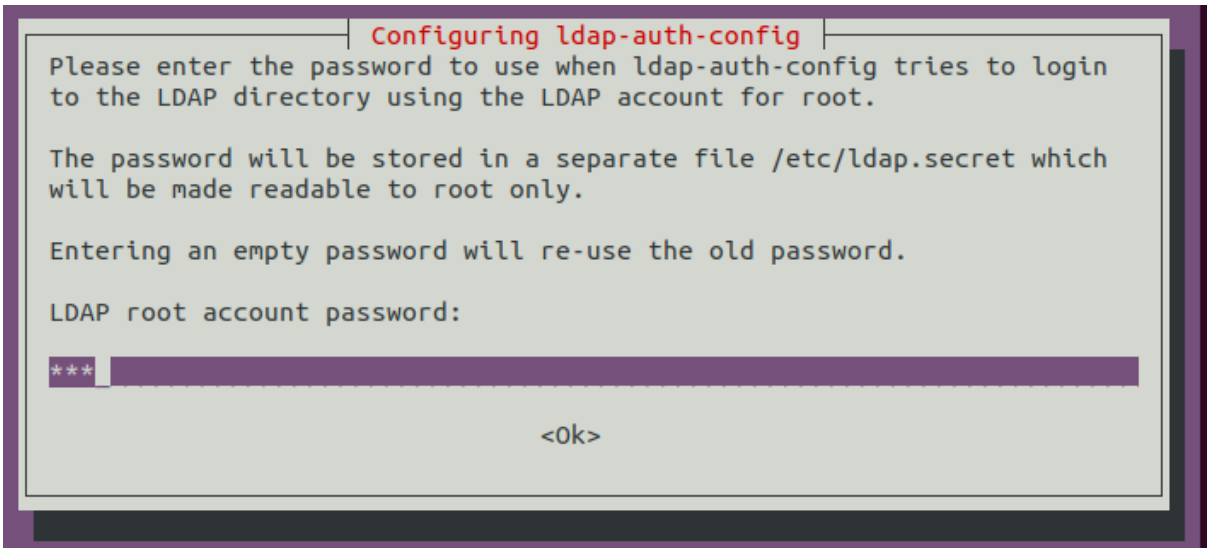


Now we will enter our LDAP administrative account details.

In our case, it was: cn=admin, dc=af, dc=com.



Enter LDAP administrative password:



Edit file **/etc/nsswitch.conf**

We will edit this file by adding some lines

```
# /etc/nsswitch.conf
#
# Example configuration of GNU Name Service Switch functionality.
# If you have the `glibc-doc-reference' and `info' packages installed, try:
# `info libc "Name Service Switch"' for information about this file.

passwd:         ldap compat
group:          ldap compat
shadow:         ldap compat

hosts:          files mdns4_minimal [NOTFOUND=return] dns myhostname
networks:       files

protocols:      db files
services:       db files
ethers:         db files
rpc:            db files

netgroup:       nis
```

Now restarting nscd service:

```
pc4@pc4-VirtualBox:~$ systemctl restart nscd
pc4@pc4-VirtualBox:~$ systemctl status nscd
● nscd.service - Name Service Cache Daemon
   Loaded: loaded (/lib/systemd/system/nscd.service; enabled; vendor preset: en
   Active: active (running) since Tue 2022-02-01 16:14:15 +01; 8s ago
  Process: 4237 ExecStop=/usr/sbin/nscd --shutdown (code=exited, status=0/SUCCE
  Process: 4238 ExecStart=/usr/sbin/nscd (code=exited, status=0/SUCCESS)
 Main PID: 4239 (nscd)
    Tasks: 10 (limit: 1118)
   CGroup: /system.slice/nscd.service
           └─4239 /usr/sbin/nscd

ي ايف 01 16:14:15 pc4-VirtualBox nscd[4239]: 4239 monitoring directory `/etc`
ي ايف 01 16:14:15 pc4-VirtualBox nscd[4239]: 4239 monitoring file `/etc/group`
ي ايف 01 16:14:15 pc4-VirtualBox nscd[4239]: 4239 monitoring directory `/etc`
ي ايف 01 16:14:15 pc4-VirtualBox nscd[4239]: 4239 monitoring file `/etc/hosts`
ي ايف 01 16:14:15 pc4-VirtualBox nscd[4239]: 4239 monitoring directory `/etc`
ي ايف 01 16:14:15 pc4-VirtualBox nscd[4239]: 4239 monitoring file `/etc/resolv
ي ايف 01 16:14:15 pc4-VirtualBox nscd[4239]: 4239 monitoring directory `/etc`
ي ايف 01 16:14:15 pc4-VirtualBox nscd[4239]: 4239 monitoring file `/etc/servic
ي ايف 01 16:14:15 pc4-VirtualBox nscd[4239]: 4239 monitoring directory `/etc`
ي ايف 01 16:14:15 pc4-VirtualBox systemd[1]: Started Name Service Cache Daemon

pc4@pc4-VirtualBox:~$
```

Now we will install **ssh** .We use it to make two computers them communicate with each other

```
pc4@pc4-VirtualBox:~$ sudo apt-get install ssh
[sudo] password for pc4:
Reading package lists... Done
Building dependency tree
Reading state information... Done
ssh is already the newest version (1:7.6p1-4ubuntu0.5).
```

With the fllowing command we will be authenticated by the server

```
pc4@pc4-VirtualBox:~$ sudo ssh pc3@192.168.1.1
[sudo] password for pc4:
pc3@192.168.1.1's password:
Permission denied, please try again.
pc3@192.168.1.1's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-84-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

111 updates can be applied immediately.
88 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your
 Internet connection or proxy settings

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Mon Jan 31 22:32:10 2022 from 192.168.1.2
```

```
pc3@pc3-VirtualBox:~$ sudo mkdir hb
pc3@pc3-VirtualBox:~$
```

In the client machine

```
pc3@pc3-VirtualBox:~$ ls
Desktop    Downloads         hb      Pictures  Templates
Documents  examples.desktop  Music   Public    Videos
pc3@pc3-VirtualBox:~$
```

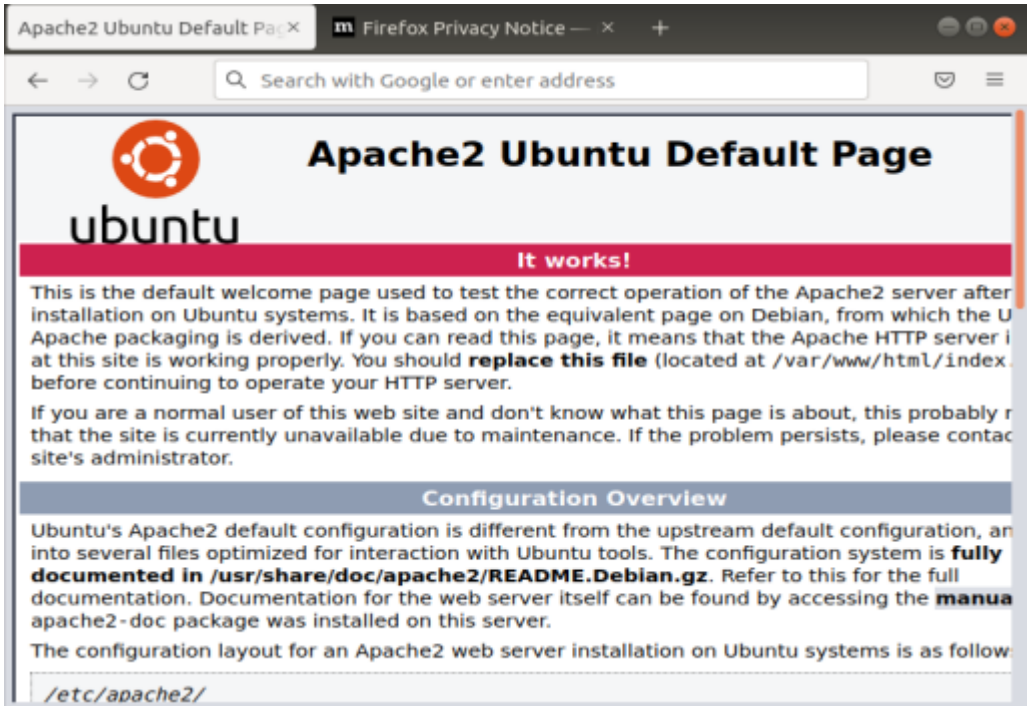
4.4 HTTP server

One of the most widely used protocol in the world that it used for viewing web pages on the internet which is HTTP, its stands for Hypertext Transfer Protocol. It's a formally defined set of rules for communication between a client (the network resource requesting data or services) and a server (the resource that receives and responds to the request).

To install Apache2, we will run this command:

```
amal@amal-VirtualBox:~$ sudo apt-get install apache2
[sudo] password for amal:
Reading package lists... Done
Building dependency tree
Reading state information... Done
apache2 is already the newest version (2.4.29-1ubuntu4.21).
The following packages were automatically installed and are no longer required:
  libirs-export160 libisccfg-export160
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 23 not upgraded.
```

We can test it out by typing in our IP address for the web server.



That means that Apache has been successfully installed.

The first step is to create a new directory:

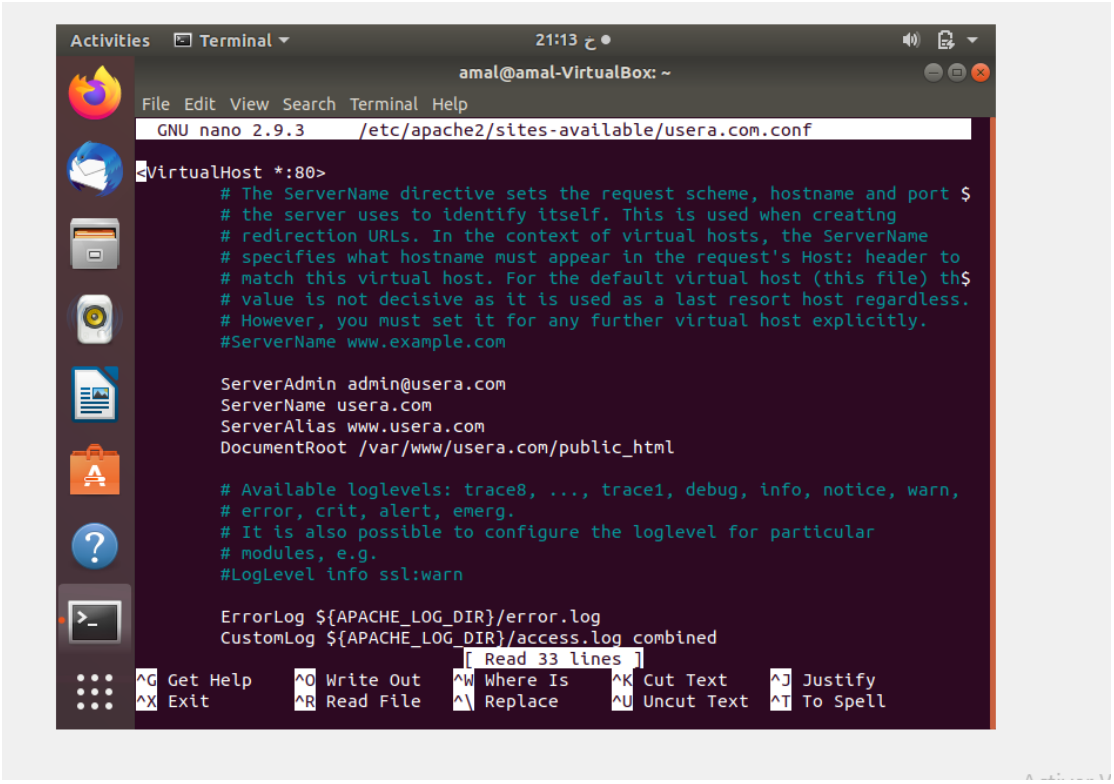
```
amal@amal-VirtualBox:~$ sudo mkdir -p /var/www/usera.com/public_html
```

```
amal@amal-VirtualBox:~$ sudo chown -R $USER:$USER /var/www/usera.com/public_htm
l
amal@amal-VirtualBox:~$ sudo chown -R 755 /var/www
```

Now we will create the sample page using Nano editor and write these lines of HML code:

```
File  Edit  View  Search  Terminal  Help
  GNU nano 2.9.3       /var/www/usera.com/public_html/index.html

<html>
<head>
<h1>Page accessible for any host </h1>
</head>
</html>
```

To generate the configuration file for our virtual host, we will modify the file configuration as the following image:



- ServerAdmin :refers to the sysadmin email.
- ServerName refers to the name of the Virtual Host.
- ServerAlias define how it is translated by the server.
- DocumentRoot identifies the path where its contents on the server disk are.

As a result

Now we will create another repository and secure it

First of all we will create a user name with the password :

```
amal@amal-VirtualBox:~$ sudo htpasswd -c /etc/apache2/.htpasswd website1
New password:
Re-type new password:
Adding password for user website1
```

We can protect a specific directory or an entire application by injecting few lines of code in our virtual host file.

```
amal@amal-VirtualBox:~$ sudo nano /etc/apache2/sites-enabled/000-default.conf
```

```
  GNU nano 2.9.3     /etc/apache2/sites-enabled/000-default.conf

<VirtualHost *:80>
ServerAdmin webmaster@userA.com
DocumentRoot /home/userA/public_html/
ErrorLog ${APACHE_LOG_DIR}/error.log
CustomLog ${APACHE_LOG_DIR}/access.log combined
<Directory "/home/userA/public_html/">
AuthType Basic
AuthName "Restricted Content"
AuthUserFile /etc/apache2/.htpasswd
Require valid-user
</Directory>
</VirtualHost>
```

```
amal@amal-VirtualBox:~$ sudo nano /etc/apache2/apache2.conf
amal@amal-VirtualBox:~$ sudo nano /var/www/html/.hraccess
```

```
  GNU nano 2.9.3                /etc/apache2/apache2.conf

# your system is serving content from a sub-directory in /srv you must allow
# access here, or in any related virtual host.
<Directory />
        Options FollowSymLinks
        AllowOverride None
        Require all denied
</Directory>

<Directory /usr/share>
        AllowOverride None
        Require all granted
</Directory>

<Directory /var/www/>
        Options Indexes FollowSymLinks
        AllowOverride All
        Require all granted
</Directory>
```

To check the configuration:

```
amal@amal-VirtualBox:~$ apache2ctl configtest
Syntax OK
```

We have to restart the Apache server to apply the changes

```
amal@amal-VirtualBox:~$ systemctl restart apache2
amal@amal-VirtualBox:~$ systemctl status apache2
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset:
  Drop-In: /lib/systemd/system/apache2.service.d
           └─apache2-systemd.conf
   Active: active (running) since Sun 2021-12-26 15:52:59 +01; 12s ago
  Process: 2713 ExecStop=/usr/sbin/apachectl stop (code=exited, status=0/SUCCES
  Process: 2447 ExecReload=/usr/sbin/apachectl graceful (code=exited, status=0/
  Process: 2718 ExecStart=/usr/sbin/apachectl start (code=exited, status=0/SUCC
 Main PID: 2722 (apache2)
    Tasks: 55 (limit: 1118)
   CGroup: /system.slice/apache2.service
           ├─2722 /usr/sbin/apache2 -k start
           ├─2723 /usr/sbin/apache2 -k start
           └─2724 /usr/sbin/apache2 -k start

ديسمبر 26 15:52:59 amal-VirtualBox systemd[1]: Starting The Apache HTTP Server..
ديسمبر 26 15:52:59 amal-VirtualBox systemd[1]: Started The Apache HTTP Server.
```

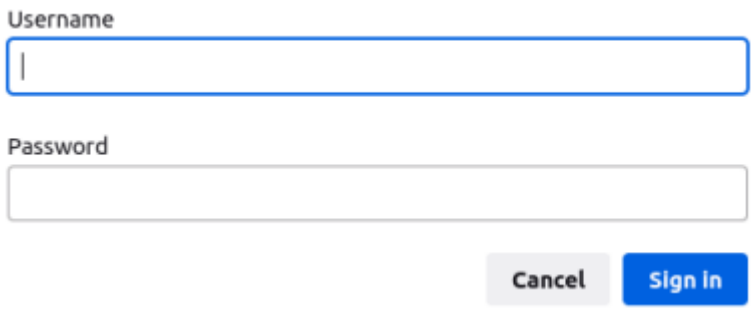
We will edit the .htaccess file on our server to protect the contents.

```
amal@amal-VirtualBox:~$ sudo nano /etc/apache2/apache2.conf
amal@amal-VirtualBox:~$ sudo nano /var/www/html/.hraccess
```

```
  GNU nano 2.9.3                    /var/www/html/.hraccess

AuthType Basic
AuthName "Restricted Content"
AuthUserFile /etc/apache2/.htpasswd
Require valid-user
```

```
amal@amal-VirtualBox:~$ systemctl restart apache2
amal@amal-VirtualBox:~$ systemctl status apache2
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset:
  Drop-In: /lib/systemd/system/apache2.service.d
           └─apache2-systemd.conf
   Active: active (running) since Sun 2021-12-26 15:56:39 +01; 10s ago
  Process: 2803 ExecStop=/usr/sbin/apachectl stop (code=exited, status=0/SUCCES
  Process: 2447 ExecReload=/usr/sbin/apachectl graceful (code=exited, status=0/
  Process: 2808 ExecStart=/usr/sbin/apachectl start (code=exited, status=0/SUCC
 Main PID: 2812 (apache2)
    Tasks: 55 (limit: 1118)
   CGroup: /system.slice/apache2.service
           ├─2812 /usr/sbin/apache2 -k start
           ├─2813 /usr/sbin/apache2 -k start
           └─2814 /usr/sbin/apache2 -k start

ديسمبر 26 15:56:39 amal-VirtualBox systemd[1]: Starting The Apache HTTP Server..
ديسمبر 26 15:56:39 amal-VirtualBox systemd[1]: Started The Apache HTTP Server.
```

As a result this will aprear:



5. Conclusion

Fatima Ezzahra SEFFARI

This project was an opportunity for me to discover an environment that interests me, namely network techniques. This is an area that seems complicated to tackle alone and the fact of having done so in a group and accompanied by a teacher allowed me to learn many things.I am very proud of the result obtained, which is the result of a collaborative effort between me and my partner. Although the project has been punctuated by highs and lows, we have been able to redouble our efforts to achieve the desired result, This project has therefore brought me a lot: I have learned things in the network domain.

Amal LAMINI

This project was an opportunity for me to discover a discipline different from what I used to study, because designing a business network from start to finish within a group restrains has been a very productive challenge for me. I will remember a lot of things from this project. Semi-annual, but what I appreciated the most was the resolution of the problems that we encountered as our final project progressed. It was therefore a very interesting computer and collective experience.