

IT 640 PROJECT

Keyur Patel

NJIT ID: 31533691

As part of this project, we implemented one of the most popular open-source web service and development stack know as “LAMP” stack. LAMP stack acronym represents the Linux operating system, Apache web server, MySQL database and dynamic content processed by PHP.

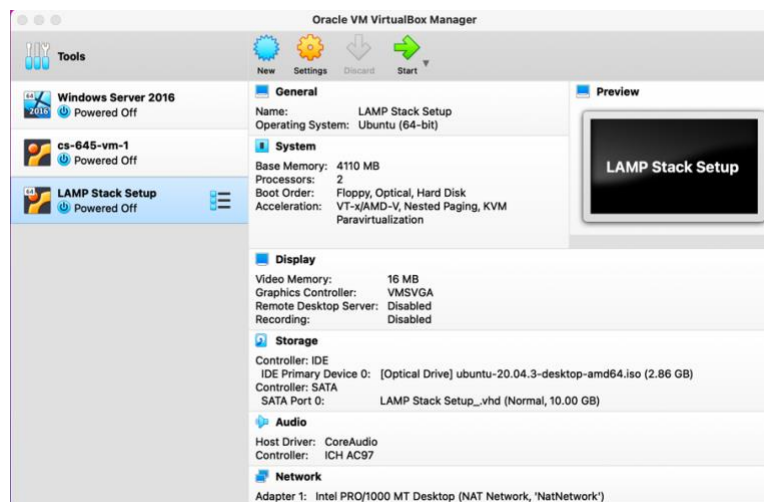
I will start with explaining why “LAMP” stack?

“LAMP” stack is entirely open-source, and its components are freely available to anyone who want to design, develop, and host a web application. Because of this, the stack has become popular in web development and hosting space.

Environment Setup

- Host OS; MacOS
- Guest OS: Ubuntu 20.04

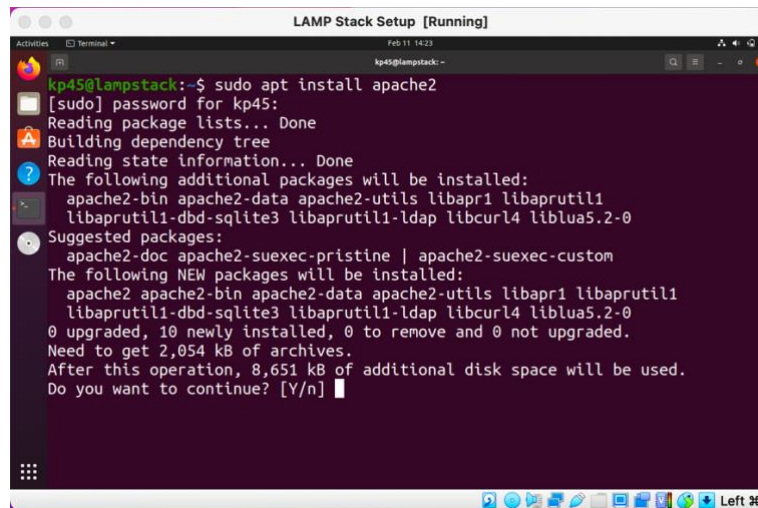
I used Virtual box to implement this project. As it shown in below SS I used, 4 GB of RAM, 2 processor, Ubuntu 20.04 and have 10 GB of virtual hard disk.



Configure and set up Apache Web Server

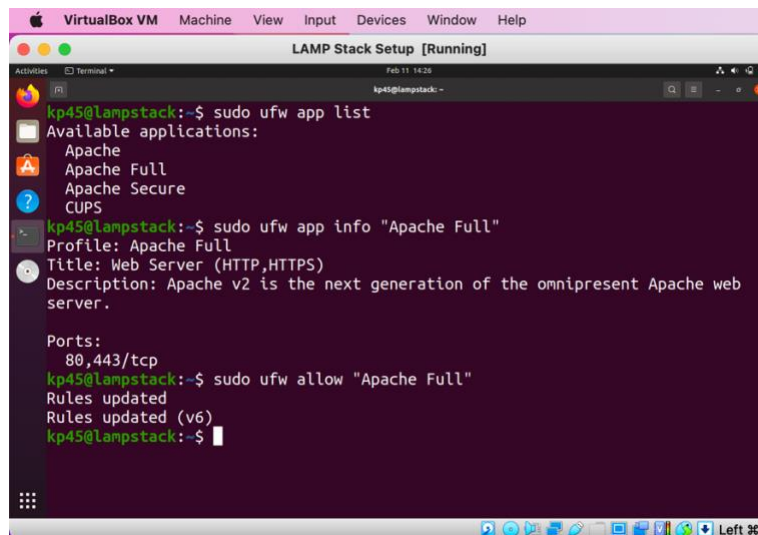
Apache web server is a popular open-source web server to host webpages. First step that I always take before installing any packages is to make sure that, my apt cache in OS is updated by executing “`sudo apt update`” command.

Installed Apache: `sudo apt install apache2` and during the installation it will prompt you with information that how much space it will take and press Y after confirming that I have enough space to install Apache.

A terminal window titled "LAMP Stack Setup [Running]" showing the command `sudo apt install apache2` being executed. The output shows the package lists being read, dependencies being built, and state information being read. It lists additional packages to be installed along with their sizes. It then asks for confirmation to continue, with 'Y' entered.

```
kp45@lampstack:~$ sudo apt install apache2
[sudo] password for kp45:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap libcurl4 liblua5.2-0
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap libcurl4 liblua5.2-0
0 upgraded, 10 newly installed, 0 to remove and 0 not upgraded.
Need to get 2,054 kB of archives.
After this operation, 8,651 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
```

Once I installed Apache, next step would be to make sure that my firewall rules are setup correctly to allow HTTP and HTTPS traffic on port 80 and 443. For this, I used following command:
`sudo ufw app list` – List Allowed Application on Ubuntu Firewall (UFW)
`sudo ufw app info "Apache Full"` - to make sure firewall allows traffic on Apache Server.

A terminal window titled "LAMP Stack Setup [Running]" showing the command `sudo ufw app list` being executed. The output lists available applications: Apache, Apache Full, Apache Secure, and CUPS. Then, the command `sudo ufw app info "Apache Full"` is executed, showing details about the Apache Full profile, including its title "Web Server (HTTP,HTTPS)" and the ports 80 and 443/tcp. Finally, the command `sudo ufw allow "Apache Full"` is executed, and the output shows that the rules have been updated.

```
kp45@lampstack:~$ sudo ufw app list
Available applications:
  Apache
  Apache Full
  Apache Secure
  CUPS

kp45@lampstack:~$ sudo ufw app info "Apache Full"
Profile: Apache Full
Title: Web Server (HTTP,HTTPS)
Description: Apache v2 is the next generation of the omnipresent Apache web
server.

Ports:
  80,443/tcp
kp45@lampstack:~$ sudo ufw allow "Apache Full"
Rules updated
Rules updated (v6)
kp45@lampstack:~$
```

After installing Apache and verifying firewall configuration, next I took was to check if Apache server is running or not by accessing the webpage wither by visiting server's IP (127.0.0.1) or hostname (<http://localhost>)

And, as seen in below SS, I can access default Apache web page on Ubuntu 20.04, which has some useful server information and used for testing purpose.

As it shown in above SS, after running the script it will ask me to configure the “VALIDATE PASSWORD PLUGIN” which allows administrator to set strong password policy. Hence, using this plugin user must require creating a strong password as per the MySQL password policy and it will reject if it finds any weak password, this way it makes more secure authentication process.

Once I selected YES or y it asked me to select level of password validation. I selected 1 and set medium level for my database. However, I found that if I select 2 (Strong level) then I cannot create a password from any common dictionary words and password should contain numbers, lowercase, uppercase and special characters. This created a strong security layer on our database.



```
LAMP Stack Setup [Running]
Feb 11 15:20
kp45@lampstack:~$ sudo mysql_secure_installation

Securing the MySQL server deployment.

Connecting to MySQL using a blank password.

VALIDATE PASSWORD COMPONENT can be used to test passwords
and improve security. It checks the strength of password
and allows the users to set only those passwords which are
secure enough. Would you like to setup VALIDATE PASSWORD component?

Press y|Y for Yes, any other key for No: y

There are three levels of password validation policy:

LOW    Length >= 8
MEDIUM Length >= 8, numeric, mixed case, and special characters
STRONG Length >= 8, numeric, mixed case, special characters and dictionary
       file

Please enter 0 = LOW, 1 = MEDIUM and 2 = STRONG: 1
```

Next, it will ask to set password for database root user which is an admin user with full privileges over the database system. Now, I have enabled password validation to medium hence it shows “100” as strength for root password and I do not want to change it so I have select NO or n.

Next, it asked few security and access related questions:

- 1) Remove any anonymous users to access to MySQL and choose YES or y
- 2) Disallows any remote access and only allow from localhost as I do not want to my database to be access over the internet so choose YES or y
- 3) Next, to remove ‘test’ database that, anyone can access so I removed ‘test’ database and access as I will creating a sample database for myself with controlled access.
- 4) Lastly, it will ask to reload the privileges table which basically has all user access information and I choose YES or y to configure MySQL with these changes.

```
LAMP Stack Setup [Running]
Apr 18 11:55
kpt4@lampstack: ~
Change the password for root? ((Press y|Y for Yes, any other key for No) : n
... skipping.
By default, a MySQL installation has an anonymous user,
allowing anyone to log into MySQL without having to have
a user account created for them. This is intended only for
testing, and to make the installation go a bit smoother.
You should remove them before moving into a production
environment.
Remove anonymous users? (Press y|Y for Yes, any other key for No) : y
Success.

Normally, root should only be allowed to connect from
'localhost'. This ensures that someone cannot guess at
the root password from the network.
Disallow root login remotely? (Press y|Y for Yes, any other key for No) : y
Success.

By default, MySQL comes with a database named 'test' that
anyone can access. This is also intended only for testing,
and should be removed before moving into a production
environment.
Remove test database and access to it? (Press y|Y for Yes, any other key for No) : y
- Dropping test database...
Success.
- Removing privileges on test database...
Success.

Reloading the privilege tables will ensure that all changes
made so far will take effect immediately.
Reload privilege tables now? (Press y|Y for Yes, any other key for No) : y
Success.

All done!
kpt4@lampstack: ~
```

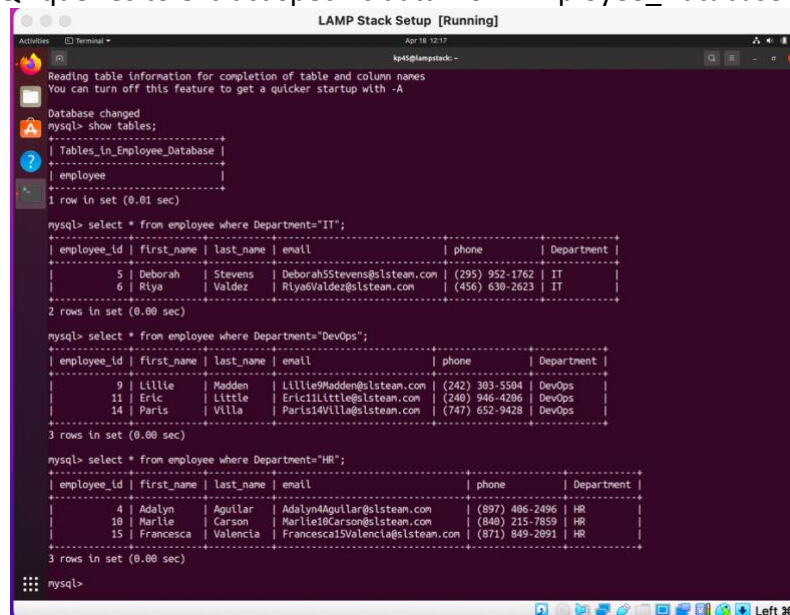
Next, I have verified database functionality by creating a sample database “Employee_Database” and run few sql queries to access the database.

```
mysql> use Employee_Database;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> select * from employee;
+-----+-----+-----+-----+-----+-----+
| employee_id | first_name | last_name | email | phone | Department |
+-----+-----+-----+-----+-----+-----+
| 1 | Braelyn | Richmond | Braelyn1Richmond@slsteam.com | (628) 737-8387 | Accounting |
| 2 | Kameron | Benson | Kameron2Benson@slsteam.com | (412) 542-1964 | Accounting |
| 3 | Hugo | Randolph | Hugo3Randolph@slsteam.com | (977) 281-4408 | Sales |
| 4 | Adalyn | Aguilar | Adalyn4Aguilar@slsteam.com | (897) 406-2496 | HR |
| 5 | Deborah | Stevens | Deborah5Stevens@slsteam.com | (295) 952-1762 | IT |
| 6 | Riya | Valdez | Riya6Valdez@slsteam.com | (456) 630-2623 | IT |
| 7 | Paityn | Liu | Paityn7Liu@slsteam.com | (357) 707-9281 | Engineering |
| 8 | Dorian | Gray | Dorian8Gray@slsteam.com | (342) 587-7675 | Engineering |
| 9 | Lillie | Madden | Lillie9Madden@slsteam.com | (242) 303-5504 | DevOps |
| 10 | Marlie | Carson | Marlie10Carson@slsteam.com | (840) 215-7859 | HR |
| 11 | Eric | Little | Eric11Little@slsteam.com | (240) 946-4206 | DevOps |
| 12 | Draven | Bauer | Draven12Bauer@slsteam.com | (752) 320-9309 | Sales |
| 13 | Judith | Walker | Judith13Walker@slsteam.com | (298) 754-7168 | Engineering |
| 14 | Paris | Villa | Paris14Villa@slsteam.com | (747) 652-9428 | DevOps |
| 15 | Francesca | Valencia | Francesca15Valencia@slsteam.com | (871) 849-2091 | HR |
+-----+-----+-----+-----+-----+-----+
15 rows in set (0.00 sec)

mysql>
```


Also, run some SQL queries to extract specific data from Employee_Database.



```
LAMP Stack Setup [Running]
Apr 18 12:17
mysql> show tables;
+-----+
| Tables_in_Employee_Database |
+-----+
| employee                     |
+-----+
1 row in set (0.01 sec)

mysql> select * from employee where Department="IT";
+-----+-----+-----+-----+-----+-----+
| employee_id | first_name | last_name | email | phone | Department |
+-----+-----+-----+-----+-----+-----+
| 5 | Deborah | Stevens | DeborahStevens@lsteam.com | (295) 952-1762 | IT |
| 6 | Riya | Valdez | RiyaValdez@lsteam.com | (456) 638-2623 | IT |
+-----+-----+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql> select * from employee where Department="DevOps";
+-----+-----+-----+-----+-----+-----+
| employee_id | first_name | last_name | email | phone | Department |
+-----+-----+-----+-----+-----+-----+
| 9 | Little | Rodden | LittleRodden@lsteam.com | (242) 383-5584 | DevOps |
| 11 | Eric | Little | EricLittle@lsteam.com | (240) 946-4286 | DevOps |
| 14 | Paris | Villa | Paris14Villa@lsteam.com | (747) 652-9428 | DevOps |
+-----+-----+-----+-----+-----+-----+
3 rows in set (0.00 sec)

mysql> select * from employee where Department="HR";
+-----+-----+-----+-----+-----+-----+
| employee_id | first_name | last_name | email | phone | Department |
+-----+-----+-----+-----+-----+-----+
| 4 | Adalyn | Aguilar | Adalyn4Aguilar@lsteam.com | (897) 486-2496 | HR |
| 10 | Marlie | Carson | Marlie10Carson@lsteam.com | (840) 215-7859 | HR |
| 15 | Francesca | Valencia | Francesca15Valencia@lsteam.com | (871) 849-2091 | HR |
+-----+-----+-----+-----+-----+-----+
3 rows in set (0.00 sec)

mysql>
```

Configure and set up PHP

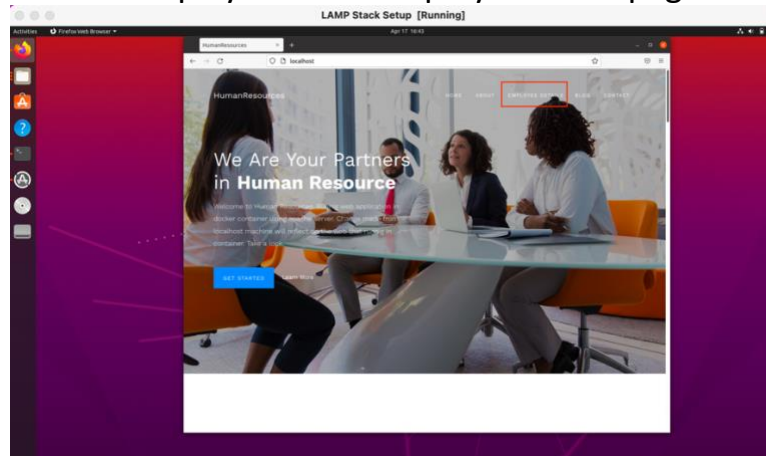
PHP use to display dynamic content on webpage and integrate with MySQL by running php scripts to process database information on webpage. Installed and verified php configuration and hosted on Apache server.



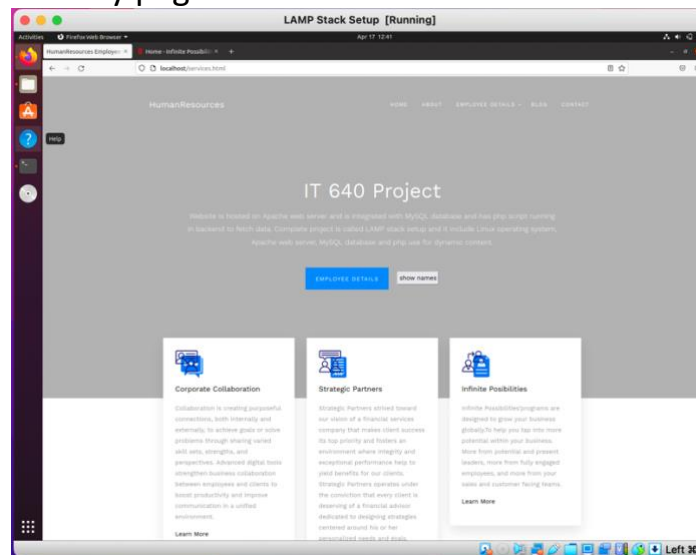
To implement LAMP stack setup as in real time, I have hosted a sample website of “XYZ” company and HR department of this company using this website for their internal use and update their employees about companies incites. To illustrate php and MySQL functionality, I have created a php script to connect to MySQL database called “Employee_Database”.

Employee_Database is mainly contained employee table which has record of current employees of the “XYZ” company and any employees can access information about how many employees working, what departments they are in and their contact details.

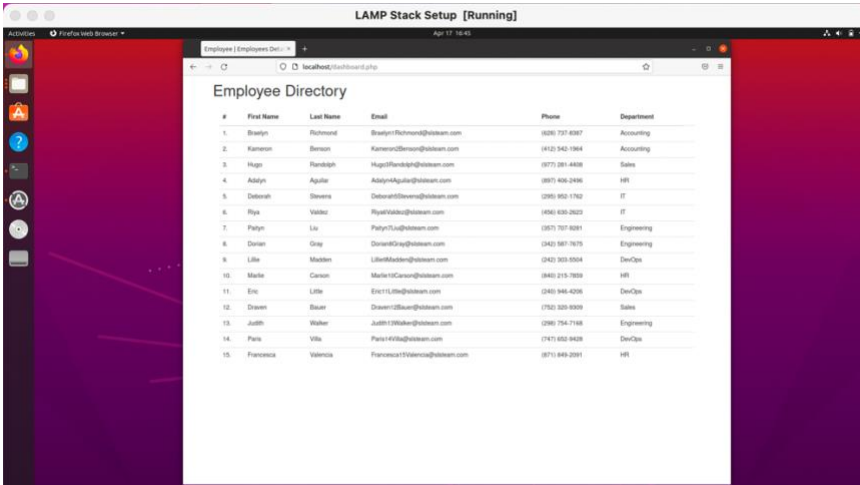
- 1) Companies Internal HR homepage. By navigating to EMPLOYEE DETAILS button and it will display internal employee detail page.



- 2) Internal employee details page. Select blue button and it will display employee directory page.



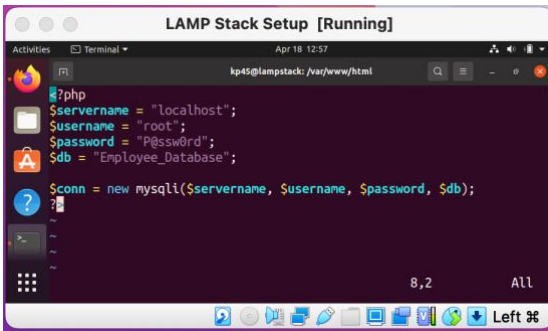
As we can see Employee data displays on our website running on localhost. You can verify by comparing with MySQL database table [here](#).



The screenshot shows a web browser window titled 'Employee Directory' displaying a table with 15 rows of employee data. The table has columns for #, First Name, Last Name, Email, Phone, and Department. The data is as follows:

| # | First Name | Last Name | Email | Phone | Department |
|-----|------------|------------|-------------------------------|----------------|-------------|
| 1. | Bruce | Richardson | BruceR1Richardson@tbsl.com | (920) 737-8387 | Accounting |
| 2. | Kameron | Benson | KameronC2Benson@tbsl.com | (912) 542-1864 | Accounting |
| 3. | Hugo | Randolph | HugoH3Randolph@tbsl.com | (977) 281-4838 | Sales |
| 4. | Aditya | Agarwal | AdityaA4Agarwal@tbsl.com | (987) 436-2496 | HR |
| 5. | Danesh | Severson | DaneshD5Severson@tbsl.com | (298) 952-1762 | IT |
| 6. | Riya | Valdez | RiyaR6Valdez@tbsl.com | (456) 432-2623 | IT |
| 7. | Patryk | Liu | PatrykL7Liu@tbsl.com | (987) 737-8381 | Engineering |
| 8. | Dorian | Gray | DorianD8Gray@tbsl.com | (242) 587-7675 | Engineering |
| 9. | Libe | Madden | LibeL9Madden@tbsl.com | (242) 353-8584 | DevOps |
| 10. | Mark | Cannon | MarkM10Cannon@tbsl.com | (848) 215-7859 | HR |
| 11. | Eric | Little | EricE11Little@tbsl.com | (242) 946-4206 | DevOps |
| 12. | Drew | Bauer | DrewD12Bauer@tbsl.com | (782) 329-8939 | Sales |
| 13. | Justin | Wahler | JustinJ13Wahler@tbsl.com | (298) 754-7168 | Engineering |
| 14. | Patsy | Vila | PatsyP14Vila@tbsl.com | (747) 652-9428 | DevOps |
| 15. | Francisco | Valencia | FranciscoF15Valencia@tbsl.com | (877) 849-2891 | HR |

Php script to connect to database:

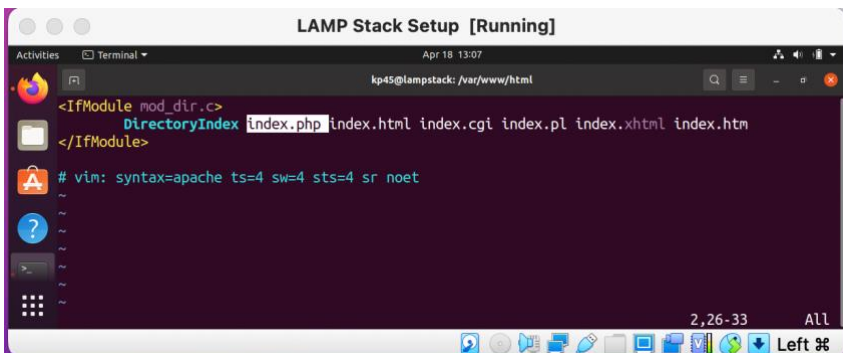


```
#!/php
$servername = "localhost";
$username = "root";
$password = "P@ssw0rd";
$db = "Employee_Database";

$conn = new mysqli($servername, $username, $password, $db);
```

Problem I faced during the host configuration:

Apache by default host index.html page, as part of this project I wanted to host php pages as they are more dynamic in nature so, initially I'd to change the default dir.conf file of the Apache and it can be found at /etc/apache2/mods-enabled/dir.conf and changed the DirectoryIndex specification and set below index and it solved my issue.



```
<IfModule mod_dir.c>
    DirectoryIndex index.php index.html index.cgi index.pl index.xhtml index.htm
</IfModule>

# vim: syntax=apache ts=4 sw=4 sts=4 sr noet
```