Load Balancers

A load balancer is a device or software that distributes incoming network traffic across multiple servers to prevent overloading of any single server. It helps to ensure high availability and scalability of web applications by distributing the traffic across multiple servers. The load balancer can be hardware-based or software-based.

Benefits of Load Balancers

- High availability: A load balancer can direct traffic to available servers, ensuring that users can always access the application.

- Scalability: As traffic increases, additional servers can be added to handle the load.

- Improved performance: Traffic is distributed across multiple servers, reducing the load on any single server and improving overall performance.

- Simplified management: Load balancers can simplify the management of multiple servers, making it easier to deploy and manage web applications.

Apache Web Server

Apache is a popular open-source web server software that is used to serve web pages over the internet. It is the most widely used web server software in the world and offers a wide range of features and modules.

Benefits of Apache

- Open-source: Apache is free to use and can be modified to suit specific needs.

- Cross-platform: Apache can run on multiple platforms, including Linux, Windows, and macOS.

- High-performance: Apache is designed to handle high volumes of traffic and can be configured for optimal performance.

- Modular architecture: Apache's modular architecture allows for the addition of new features and functionality through modules.

- Security: Apache has built-in security features, such as SSL/TLS support, to help protect web applications from attacks.

Load Balancing with Apache

Apache can be used as a load balancer to distribute incoming traffic across multiple servers. The Apache module used for load balancing is called mod_proxy_balancer. When configured correctly, mod_proxy_balancer can distribute traffic across multiple servers based on various algorithms, such as round-robin or least connections.

To configure load balancing with Apache, you would need to:

1. Install Apache web server on a server

2. Install the mod_proxy_balancer module

3. Configure the virtual hosts for the web servers that will be load balanced

4. Configure the mod_proxy_balancer module to distribute traffic across the virtual hosts

With load balancing in place, web applications can handle higher traffic volumes and have improved availability and performance.

CONFIGURE APACHE AS A LOAD BALANCER

1. Create an Ubuntu Server 20.04 EC2 instance
2. Open TCP port 80 in your inbound rule on your aws instance
3. Install Apache Load Balancer on your server and configure it to point traffic coming to LB to both Web Servers

```
#Install apache2

sudo apt update -y

sudo apt install apache2 -y

sudo apt-get install libxml2-dev

#Enable following modules:

sudo a2enmod rewrite

sudo a2enmod proxy

sudo a2enmod proxy_balancer

sudo a2enmod proxy_http

sudo a2enmod headers

sudo a2enmod lbmethod_bytraffic
```

```
 #Restart apache2 service

sudo systemctl restart apache2
```

4. Make sure apache2 is up and running `sudo systemctl status apache2`
5. Configure load balancing `sudo vi /etc/apache2/sites-available/000-default.conf`

```
     #Add this configuration into this section <VirtualHost *:80>
</VirtualHost>

<Proxy "balancer://mycluster">
               BalancerMember
http://<WebServer1-Private-IP-Address>:80 loadfactor=5 timeout=1
               BalancerMember
http://<WebServer2-Private-IP-Address>:80 loadfactor=5 timeout=1
               ProxySet lbmethod=bytraffic
               # ProxySet lbmethod=byrequests
        </Proxy>

        ProxyPreserveHost On
        ProxyPass / balancer://mycluster/
        ProxyPassReverse / balancer://mycluster/

#Restart apache server

sudo systemctl restart apache2
```

   `Bytraffic` balancing method will distribute incoming load between your Web Servers according to current traffic load. We can control in which proportion the traffic must be distributed by `loadfactor` parameter.
6. Verify that our configuration works – try to access your LB's public IP address or Public DNS name from your browser: `http://<Load-Balancer-Public-IP-Address-or-Public-DNS-Name>/index.php`
7. Open two ssh/Putty consoles for both Web Servers and check your access log to see the traffic for both web servers `sudo tail -f /var/log/httpd/access_log`

   Try to refresh your browser page http://<Load-Balancer-Public-IP-Address-or-Public-DNS-Name>/index.php several times and make sure that both servers receive HTTP GET requests from your LB – new records must appear in each server's log file. The number of requests to each server will be approximately the same since we set loadfactor to the same value for both servers – it means that traffic will be disctributed evenly between them. '

If you have configured everything correctly – your users will not even notice that their requests are served by more than one server.

Configure Local DNS Names Resolution

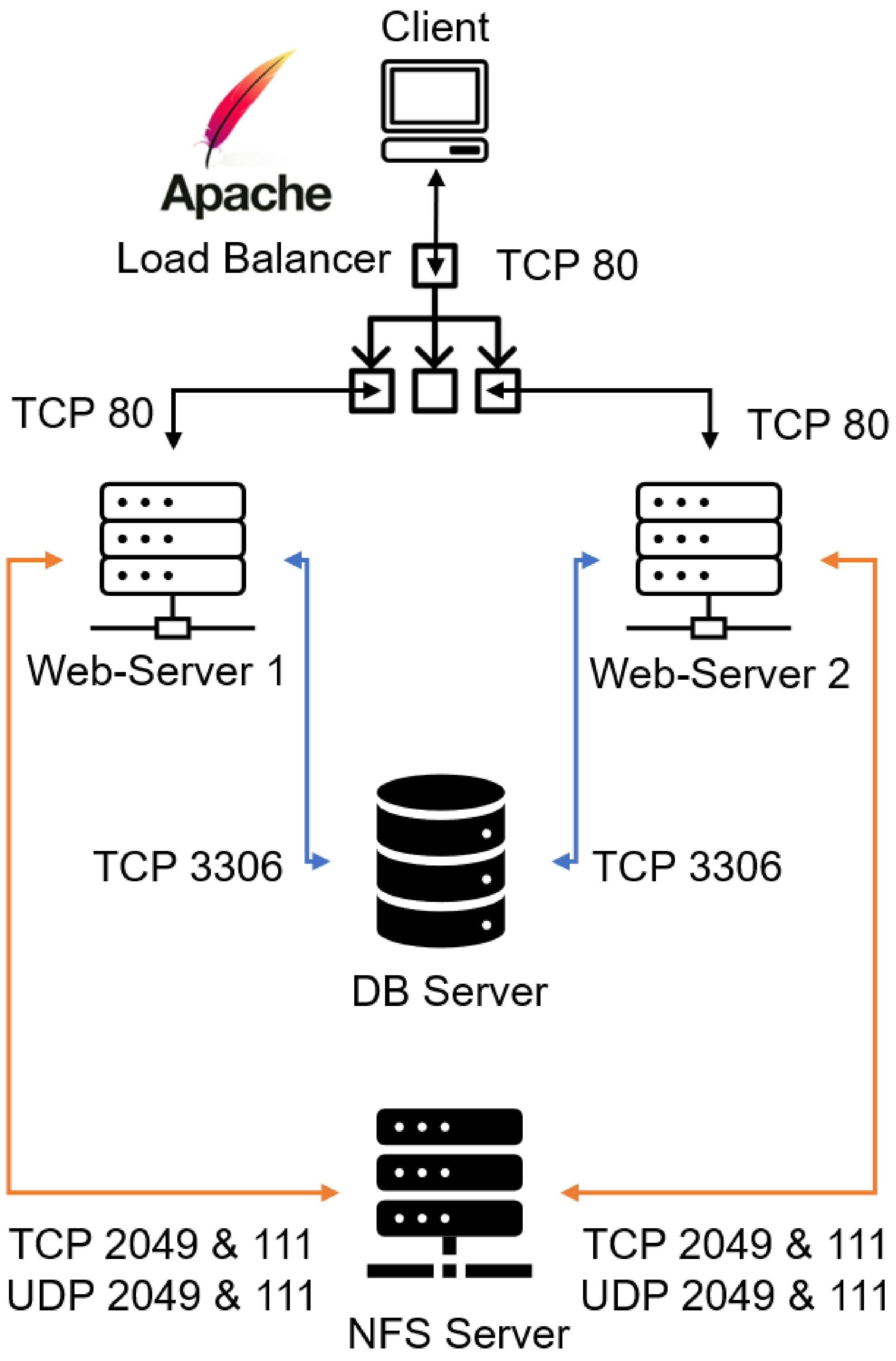
Sometimes it is tedious to remember and switch between IP addresses, especially if you have a lot of servers under your management. What we can do is to configure local domain name resolution. The easiest way is to use the /etc/hosts file, although this approach is not very scalable, but it is very easy to configure and shows the concept well. So let us configure IP address to domain name mapping for our LB.

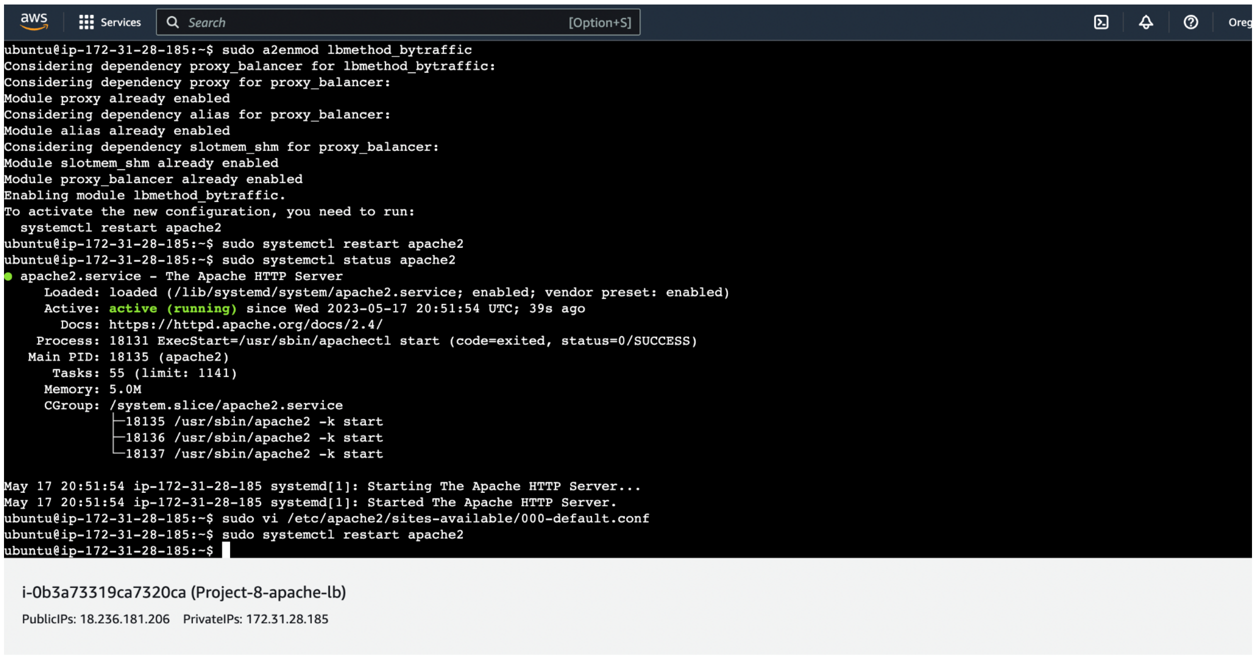
1. Open this file on your load balancer `sudo vi /etc/hosts`
   ```
   #Add 2 records into this file with Local IP address and arbitrary
   name for both of your Web Servers

   <WebServer1-Private-IP-Address> Web1
   <WebServer2-Private-IP-Address> Web2
   ```

2. Update the LB configuration file to reflect the change made on the names instead of still using the ip address `sudo vi /etc/apache2/sites-available/000-default.conf`
   ```
   BalancerMember http://Web1:80 loadfactor=5 timeout=1
   BalancerMember http://Web2:80 loadfactor=5 timeout=1
   ```

   You can try to curl your Web Servers from LB locally curl http://Web1 or curl http://Web2 – it shall work. Remember, this is only internal configuration and it is also local to your LB server, these names will neither be 'resolvable' from other servers internally nor from the Internet.

   Now ther set up looks like this

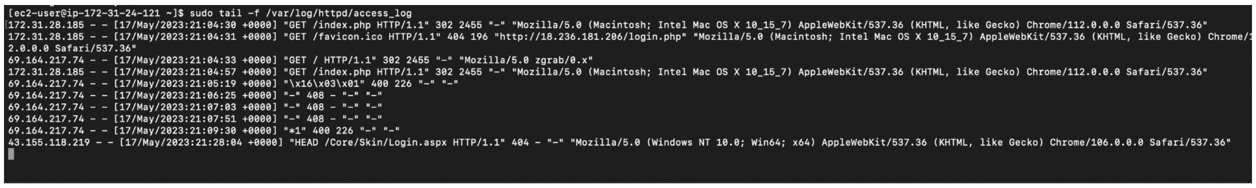

Client
Apache
Load Balancer
TCP 80
TCP 80
TCP 80
Web-Server 1
Web-Server 2
TCP 3306
TCP 3306
DB Server
TCP 2049 & 111
UDP 2049 & 111
TCP 2049 & 111
UDP 2049 & 111
NFS Server



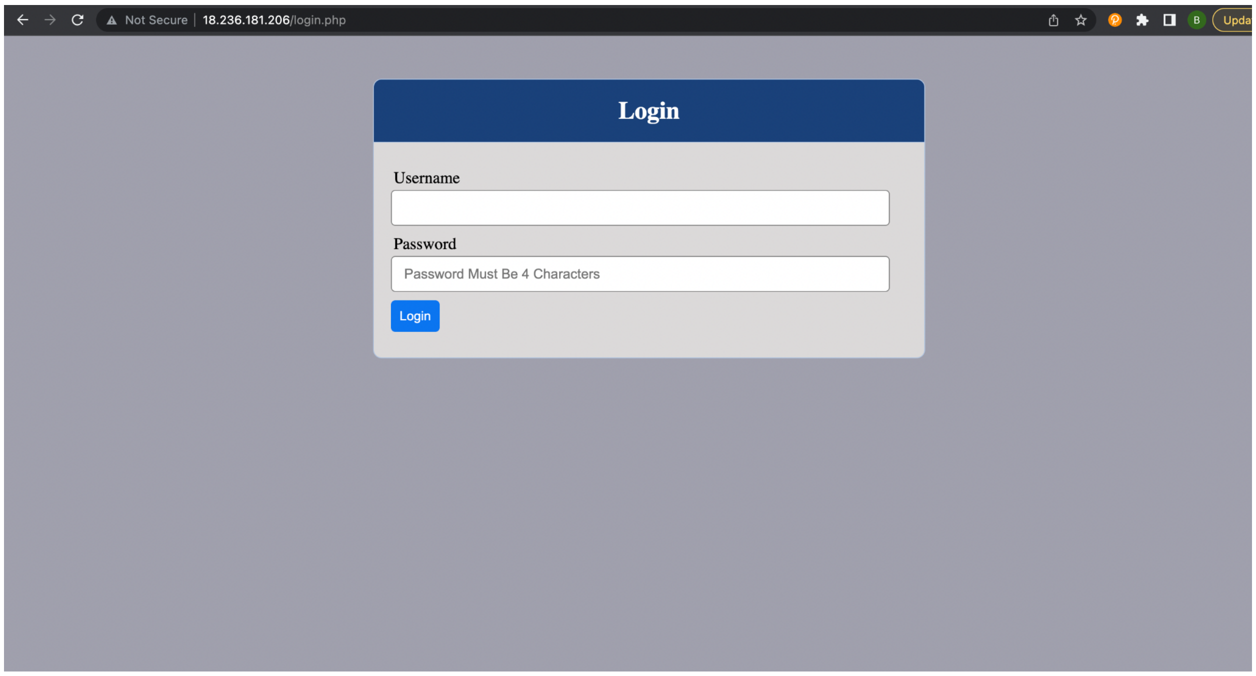
```
ubuntu@ip-172-31-28-185:~$ sudo a2enmod lbmethod_bytraffic
Considering dependency proxy_balancer for lbmethod_bytraffic:
Considering dependency proxy for proxy_balancer:
Module proxy already enabled
Considering dependency alias for proxy_balancer:
Module alias already enabled
Considering dependency slotmem_shm for proxy_balancer:
Module slotmem_shm already enabled
Module proxy_balancer already enabled
Enabling module lbmethod_bytraffic.
To activate the new configuration, you need to run:
  systemctl restart apache2
ubuntu@ip-172-31-28-185:~$ sudo systemctl restart apache2
ubuntu@ip-172-31-28-185:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
     Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset: enabled)
     Active: active (running) since Wed 2023-05-17 20:51:54 UTC; 39s ago
       Docs: https://httpd.apache.org/docs/2.4/
    Process: 18131 ExecStart=/usr/sbin/apachectl start (code=exited, status=0/SUCCESS)
   Main PID: 18135 (apache2)
      Tasks: 55 (limit: 1141)
     Memory: 5.0M
     CGroup: /system.slice/apache2.service
             ├─18135 /usr/sbin/apache2 -k start
             ├─18136 /usr/sbin/apache2 -k start
             └─18137 /usr/sbin/apache2 -k start

May 17 20:51:54 ip-172-31-28-185 systemd[1]: Starting The Apache HTTP Server...
May 17 20:51:54 ip-172-31-28-185 systemd[1]: Started The Apache HTTP Server.
ubuntu@ip-172-31-28-185:~$ sudo vi /etc/apache2/sites-available/000-default.conf
ubuntu@ip-172-31-28-185:~$ sudo systemctl restart apache2
ubuntu@ip-172-31-28-185:~$ 
```

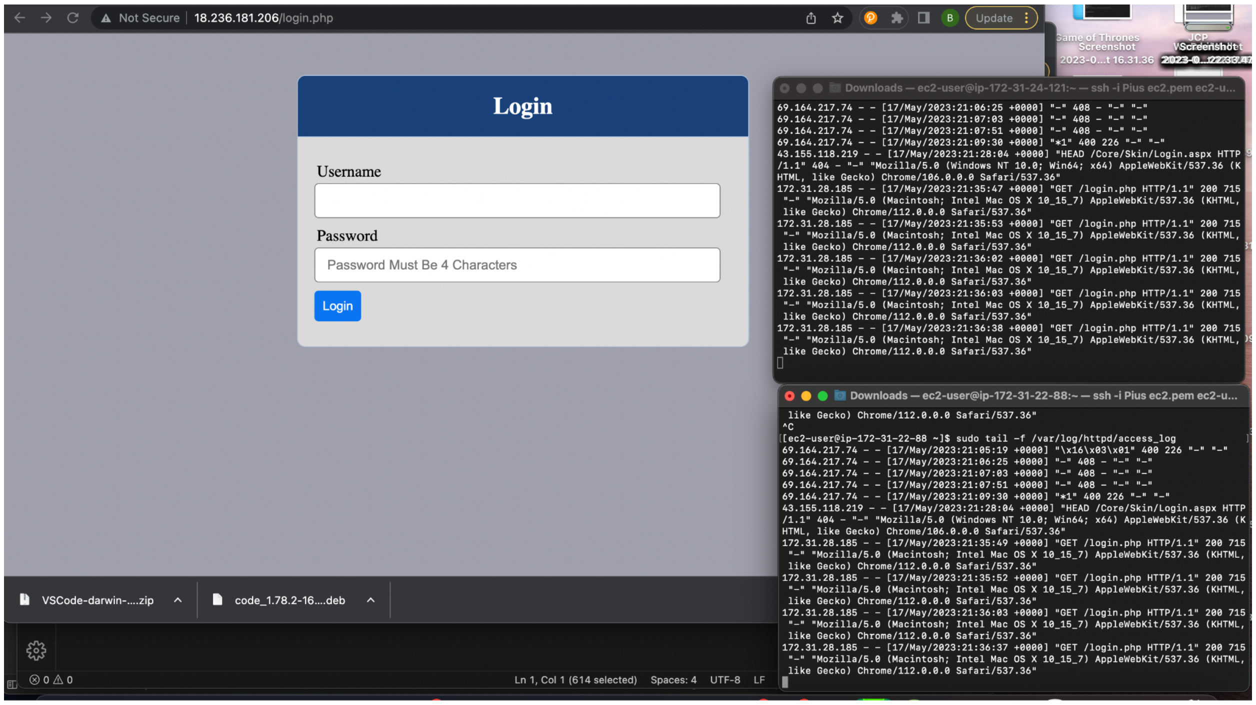
i-0b3a73319ca7320ca (Project-8-apache-lb)

PublicIPs: 18.236.181.206   PrivateIPs: 172.31.28.185



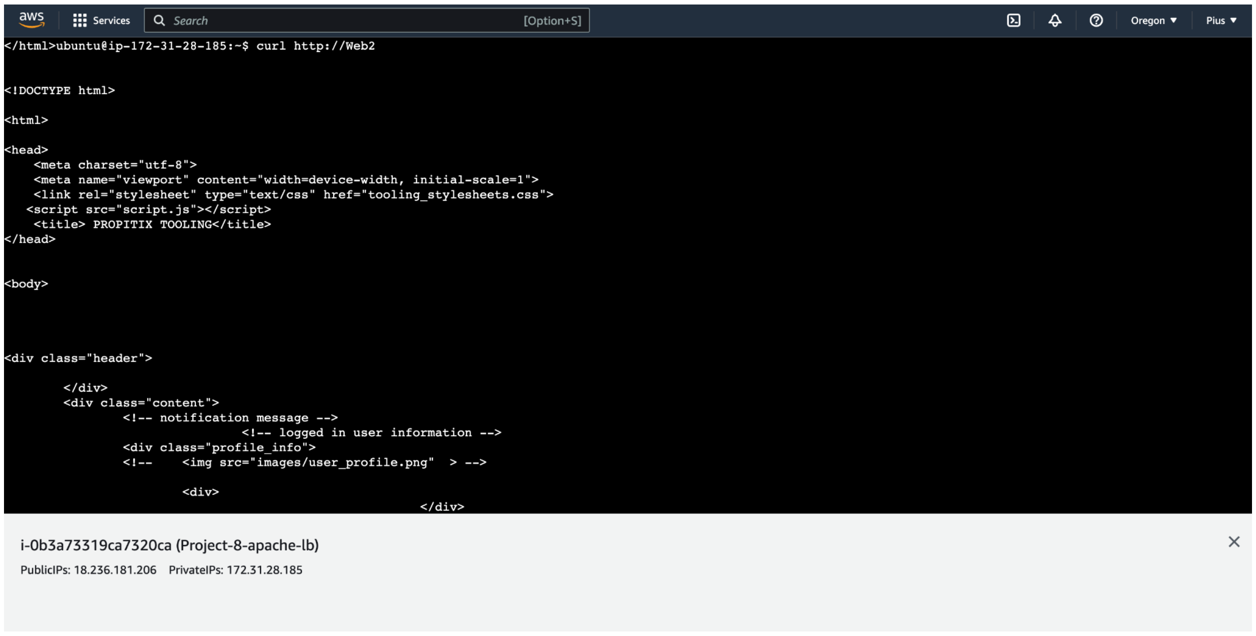
```
[ec2-user@ip-172-31-24-121 ~]$ sudo tail -f /var/log/httpd/access_log
172.31.28.185 - - [17/May/2023:21:04:30 +0000] "GET /index.php HTTP/1.1" 302 2455 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/112.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:04:31 +0000] "GET /favicon.ico HTTP/1.1" 404 196 "http://18.236.181.206/login.php" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/1
2.0.0.0 Safari/537.36"
69.164.217.74 - - [17/May/2023:21:04:33 +0000] "GET / HTTP/1.1" 302 2455 "-" "Mozilla/5.0 zgrab/0.x"
172.31.28.185 - - [17/May/2023:21:04:57 +0000] "GET /index.php HTTP/1.1" 302 2455 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/112.0.0.0 Safari/537.36"
69.164.217.74 - - [17/May/2023:21:05:19 +0000] "\x16\x03\x01" 400 226 "-" "-"
69.164.217.74 - - [17/May/2023:21:06:25 +0000] "-" 408 - "-" "-"
69.164.217.74 - - [17/May/2023:21:07:03 +0000] "-" 408 - "-" "-"
69.164.217.74 - - [17/May/2023:21:07:51 +0000] "-" 408 - "-" "-"
69.164.217.74 - - [17/May/2023:21:09:30 +0000] "*1" 400 226 "-" "-"
43.155.118.219 - - [17/May/2023:21:28:04 +0000] "HEAD /Core/Skin/Login.aspx HTTP/1.1" 404 - "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/106.0.0.0 Safari/537.36"
```




Not Secure | 18.236.181.206/login.php
Update
Login
Username
Password
Password Must Be 4 Characters
Login
VSCode-darwin-....zip
code_1.78.2-16....deb
Ln 1, Col 1 (614 selected) Spaces: 4 UTF-8 LF

```
Downloads — ec2-user@ip-172-31-24-121:~ — ssh -i Pius ec2.pem ec2-u...
69.164.217.74 - - [17/May/2023:21:06:25 +0000] "-" 408 - "-" "-"
69.164.217.74 - - [17/May/2023:21:07:03 +0000] "-" 408 - "-" "-"
69.164.217.74 - - [17/May/2023:21:07:51 +0000] "-" 408 - "-" "-"
69.164.217.74 - - [17/May/2023:21:09:30 +0000] "*1" 400 226 "-" "-"
43.155.118.219 - - [17/May/2023:21:28:04 +0000] "HEAD /Core/Skin/Login.aspx HTTP
/1.1" 404 - "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (K
HTML, like Gecko) Chrome/106.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:35:47 +0000] "GET /login.php HTTP/1.1" 200 715
 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML,
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:35:53 +0000] "GET /login.php HTTP/1.1" 200 715
 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML,
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:36:02 +0000] "GET /login.php HTTP/1.1" 200 715
 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML,
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:36:03 +0000] "GET /login.php HTTP/1.1" 200 715
 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML,
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:36:38 +0000] "GET /login.php HTTP/1.1" 200 715
 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML,
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
```

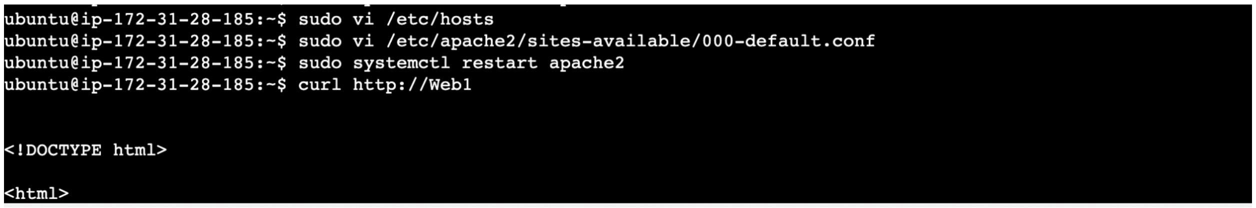
```
Downloads — ec2-user@ip-172-31-22-88:~ — ssh -i Pius ec2.pem ec2-u...
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
^C
[ec2-user@ip-172-31-22-88 ~]$ sudo tail -f /var/log/httpd/access_log
69.164.217.74 - - [17/May/2023:21:05:19 +0000] "\x16\x03\x01" 400 226 "-" "-"
69.164.217.74 - - [17/May/2023:21:06:25 +0000] "-" 408 - "-" "-"
69.164.217.74 - - [17/May/2023:21:07:03 +0000] "-" 408 - "-" "-"
69.164.217.74 - - [17/May/2023:21:07:51 +0000] "-" 408 - "-" "-"
69.164.217.74 - - [17/May/2023:21:09:30 +0000] "*1" 400 226 "-" "-"
43.155.118.219 - - [17/May/2023:21:28:04 +0000] "HEAD /Core/Skin/Login.aspx HTTP
/1.1" 404 - "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (K
HTML, like Gecko) Chrome/106.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:35:49 +0000] "GET /login.php HTTP/1.1" 200 715
 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML,
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:35:52 +0000] "GET /login.php HTTP/1.1" 200 715
 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML,
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:36:03 +0000] "GET /login.php HTTP/1.1" 200 715
 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML,
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
172.31.28.185 - - [17/May/2023:21:36:37 +0000] "GET /login.php HTTP/1.1" 200 715
 "-" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML,
 like Gecko) Chrome/112.0.0.0 Safari/537.36"
```



```
</html>ubuntu@ip-172-31-28-185:~$ curl http://Web2


<!DOCTYPE html>

<html>

<head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1">
    <link rel="stylesheet" type="text/css" href="tooling_stylesheets.css">
   <script src="script.js"></script>
    <title> PROPITIX TOOLING</title>
</head>


<body>




<div class="header">

        </div>
        <div class="content">
                <!-- notification message -->
                                <!-- logged in user information -->
                <div class="profile_info">
                <!--    <img src="images/user_profile.png"  > -->

                        <div>
                                                        </div>
```

i-0b3a73319ca7320ca (Project-8-apache-lb)

PublicIPs: 18.236.181.206   PrivateIPs: 172.31.28.185



```
ubuntu@ip-172-31-28-185:~$ sudo vi /etc/hosts
ubuntu@ip-172-31-28-185:~$ sudo vi /etc/apache2/sites-available/000-default.conf
ubuntu@ip-172-31-28-185:~$ sudo systemctl restart apache2
ubuntu@ip-172-31-28-185:~$ curl http://Web1


<!DOCTYPE html>

<html>
```