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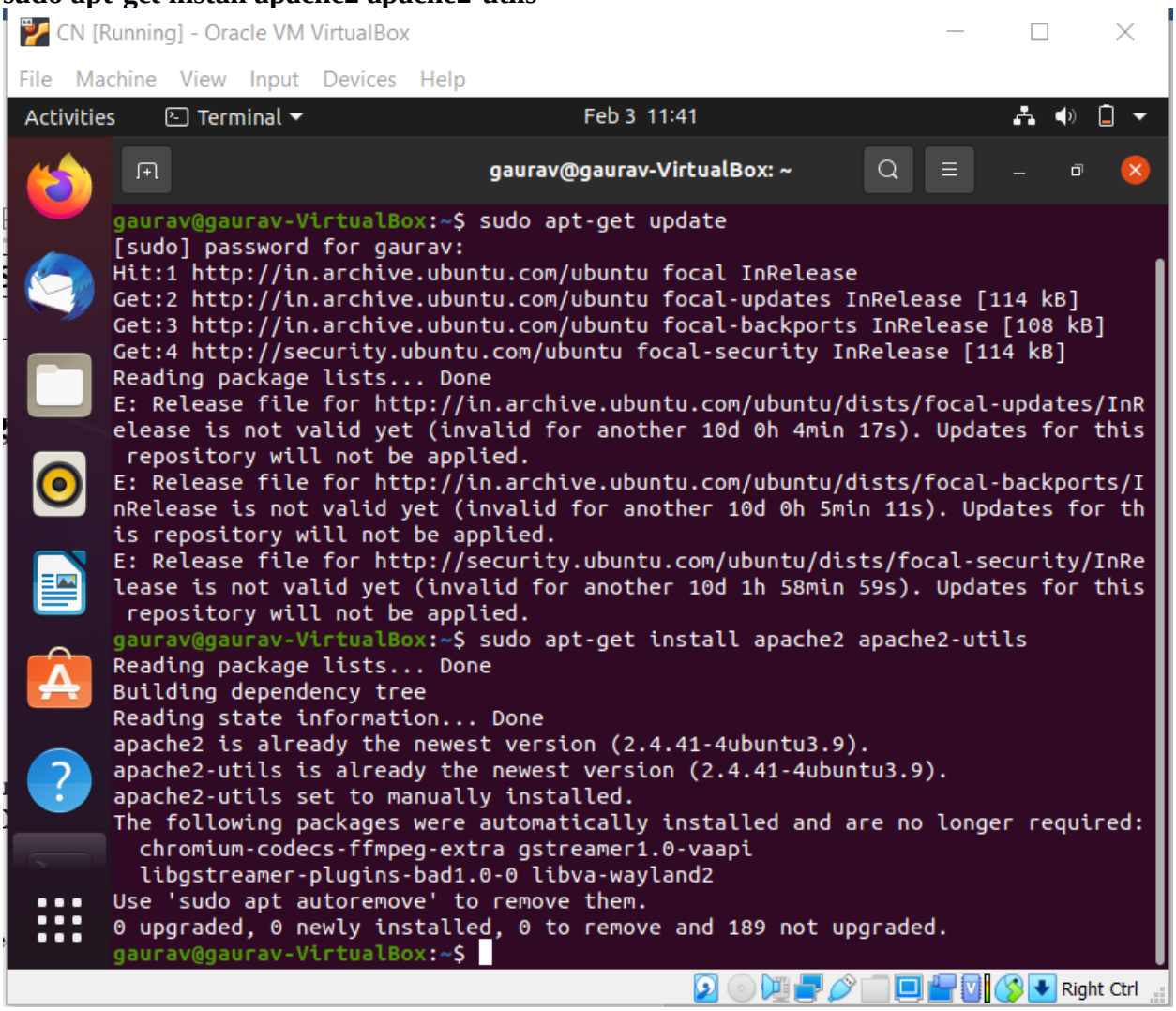
	Date: 09-02-2022	WEEK 3

3A. Understanding Working of HTTP Headers

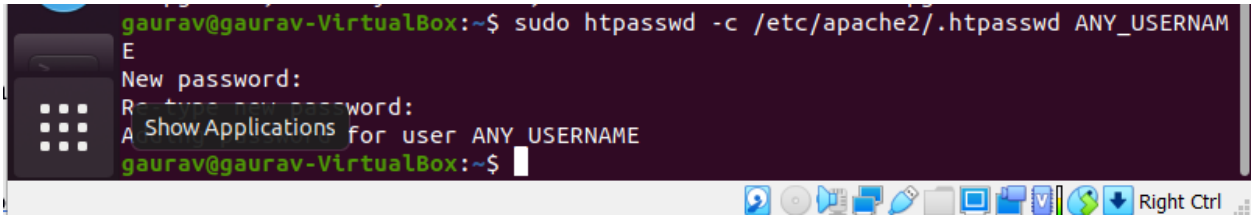
Steps of Execution (for Password Authentication) 1.
Executing the below commands on the terminal.

--> To update and integrate the existing softwares
sudo apt-get update

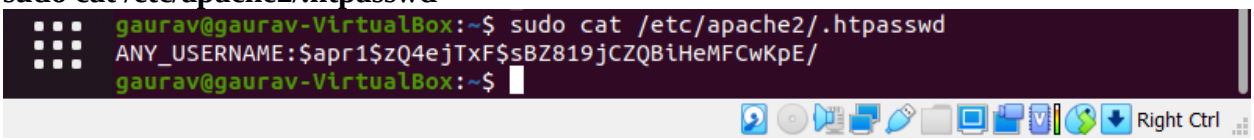
--> To install the apache utility
sudo apt-get install apache2 apache2-utils



--> Provide username and password to set authentication
sudo htpasswd -c /etc/apache2/.htpasswd ANY_USERNAME



--> View the authentication
sudo cat /etc/apache2/.htpasswd

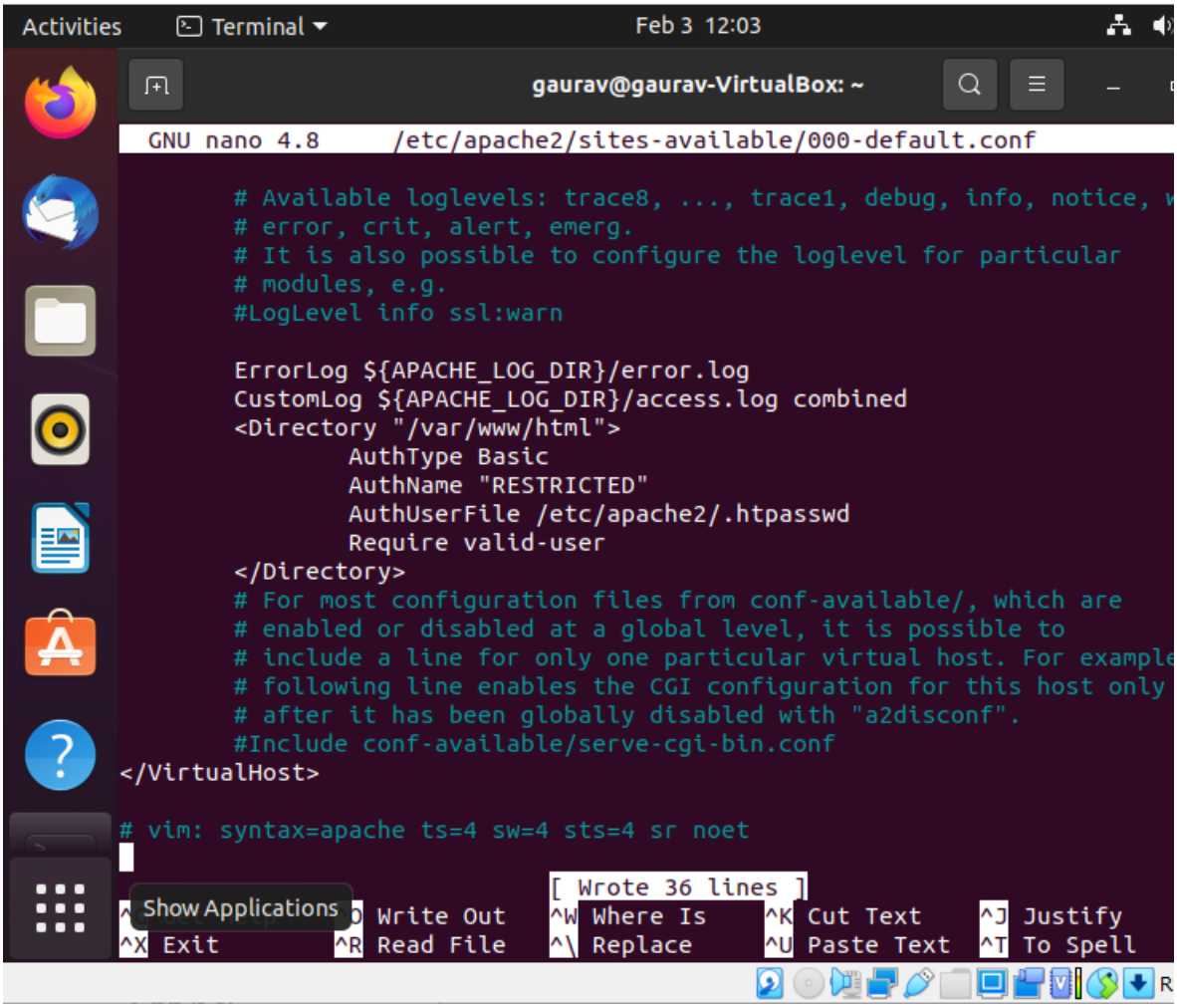


2. To setup the authentication phase, execute the following commands. Configuring Access control within the Virtual Host Definition.

--> Opening the file for setting authentication
sudo nano /etc/apache2/sites-available/000-default.conf

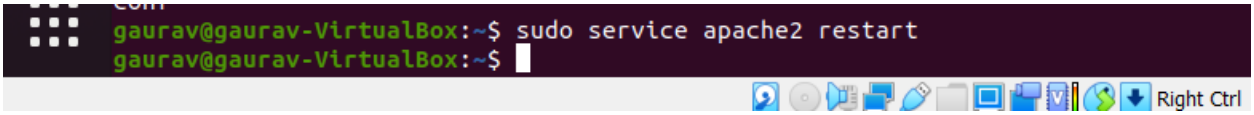
```
<VirtualHost*:80>
        ServerAdmin webmaster@localhost
        DocumentRoot  /var/www/html
        ErrorLog ${APACHE_LOG_DIR}/error.log
        CustomLog ${APACHE_LOG_DIR}/access.log combined
        <Directory "/var/www/html">
                AuthType Basic
                AuthName "RESTRICTED"
                AuthUserFile /etc/apache2/.htpasswd
                Require valid-user
        </Directory>
```

</VirtualHost>



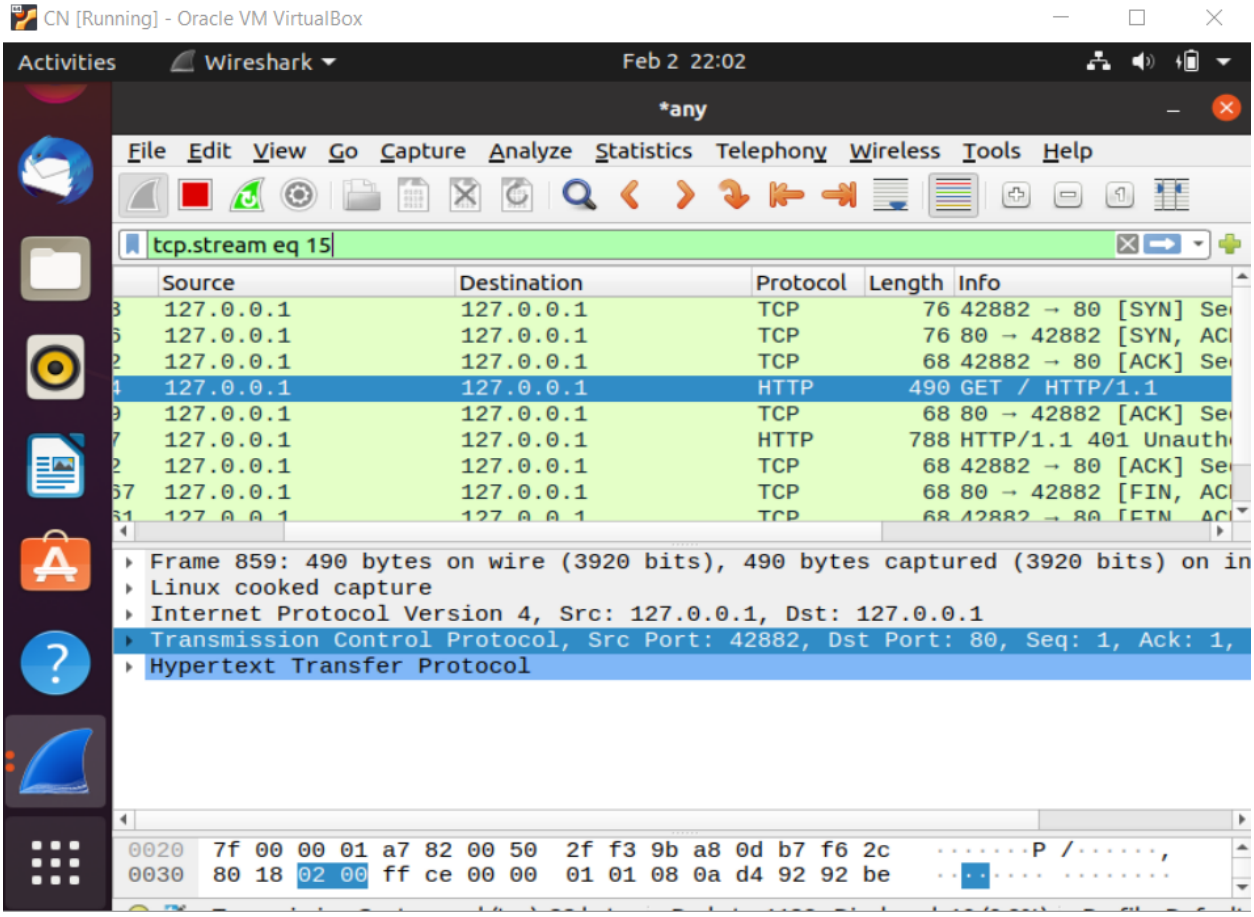
3. Password policy implementation is done by restarting the server as:

sudo service apache2 restart

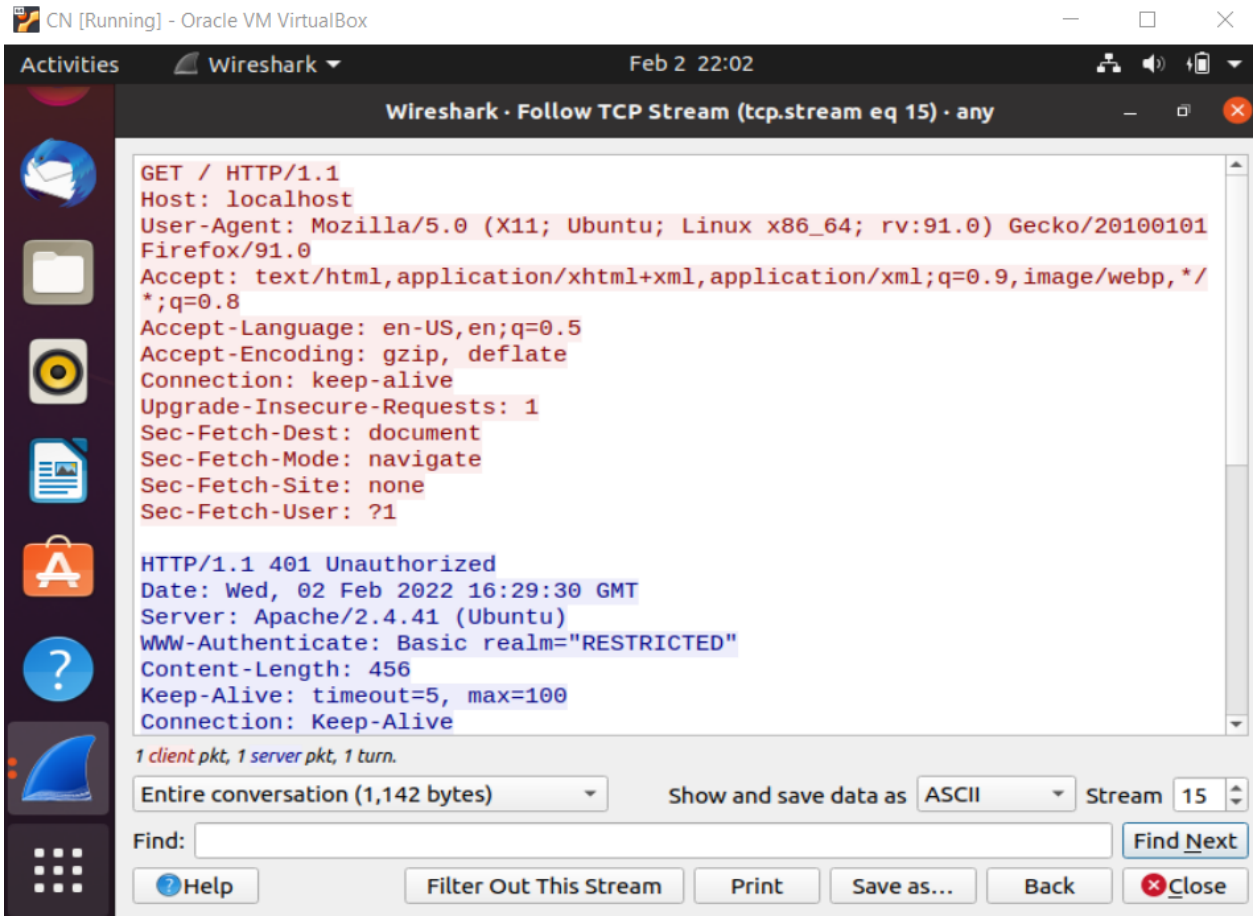


4. The localhost is then accessed using the Firefox browser requiring a username and a password set during the authentication phase.

5. Wireshark is used to capture the packets sent upon the network.



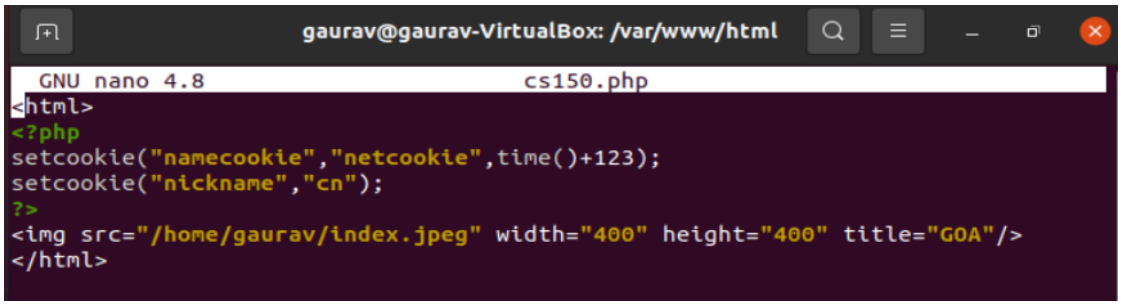
6. Using the “follow TCP stream” on the HTTP message segment the password was retrieved which was encrypted by the base64 algorithm and decryption could be done with same algorithm.



Steps of Execution (Cookie Setting)

1. A PHP file to set the cookie is created which also contains an image in it (placed under the HTML directory) to be accessed once the cookie is set. The following code helped to set the cookie:

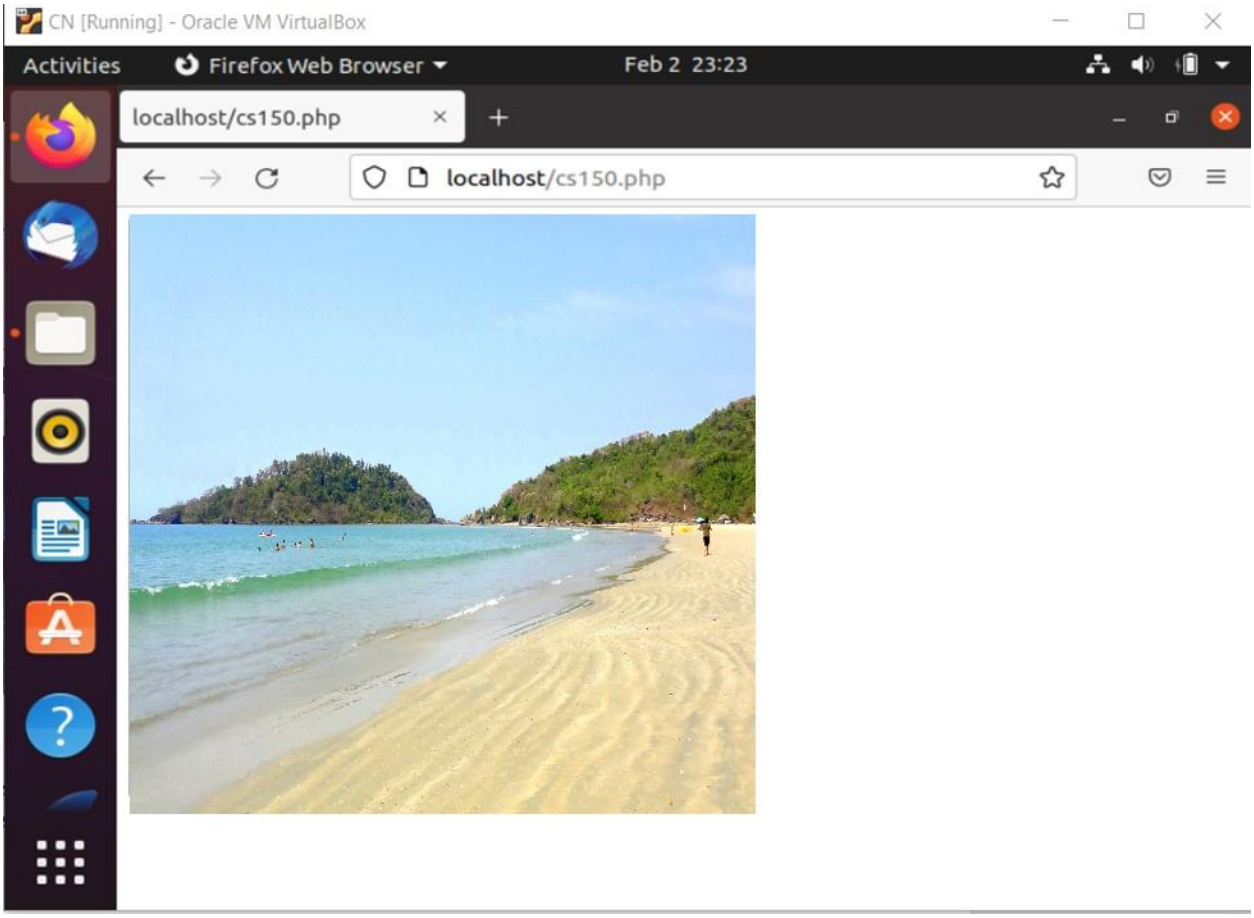
```
<html>
<?php

setcookie("namecookie","netqwerty",time()+123);
setcookie("nickname","work"); ?>
<img src= “highres.png” width= “300” height= “300” title= “password” />
</html>
```



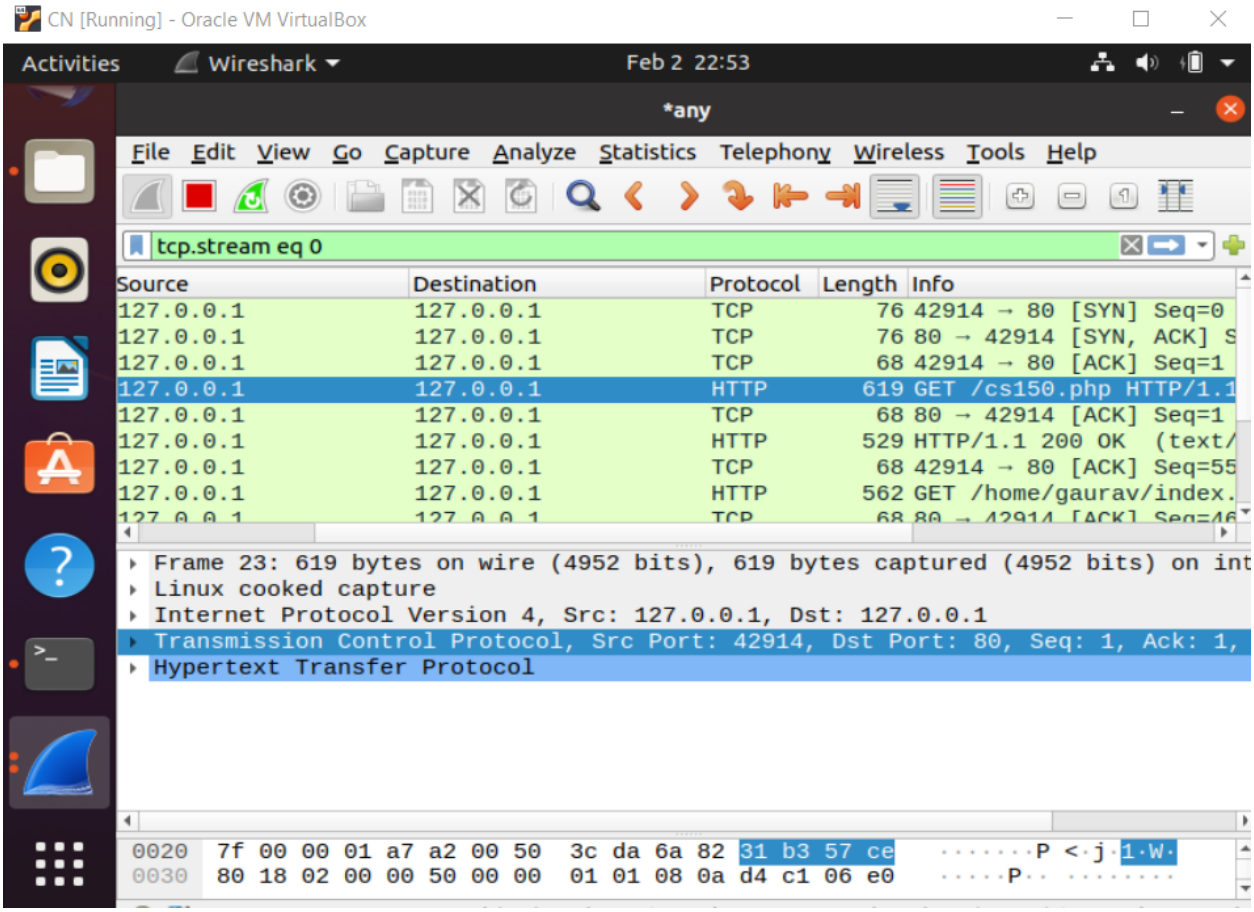
Note: Here you can add any image if required

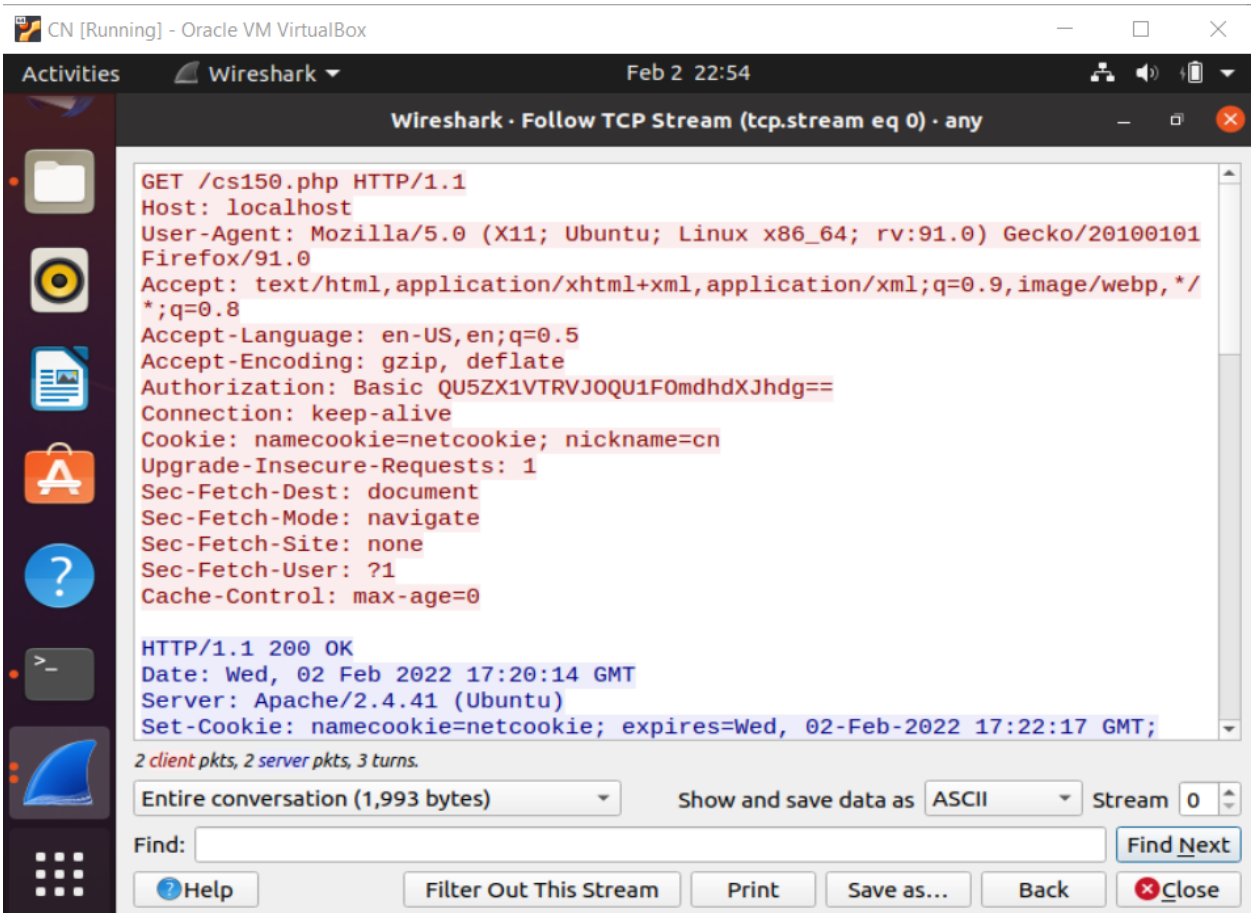
Note: You can capture Cookies mostly during the first time of web access. Hence keep wireshark capture ready before executing the task for the first time.

2. The combined file saved with a .php extension is placed under **/var/www/html** for accessing.



3. The packets are captured using Wireshark and using the “follow TCP stream” which checks for the set-cookie field whether the cookie is set or not set.


CN [Running] - Oracle VM VirtualBox
Activities
Wireshark
Feb 2 22:53
*any
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
tcp.stream eq 0
Source Destination Protocol Length Info
127.0.0.1 127.0.0.1 TCP 76 42914 → 80 [SYN] Seq=0
127.0.0.1 127.0.0.1 TCP 76 80 → 42914 [SYN, ACK] S
127.0.0.1 127.0.0.1 TCP 68 42914 → 80 [ACK] Seq=1
127.0.0.1 127.0.0.1 HTTP 619 GET /cs150.php HTTP/1.1
127.0.0.1 127.0.0.1 TCP 68 80 → 42914 [ACK] Seq=1
127.0.0.1 127.0.0.1 HTTP 529 HTTP/1.1 200 OK (text/
127.0.0.1 127.0.0.1 TCP 68 42914 → 80 [ACK] Seq=55
127.0.0.1 127.0.0.1 HTTP 562 GET /home/gaurav/index.
Frame 23: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits) on int
Linux cooked capture
Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
Transmission Control Protocol, Src Port: 42914, Dst Port: 80, Seq: 1, Ack: 1,
Hypertext Transfer Protocol
0020 7f 00 00 01 a7 a2 00 50 3c da 6a 82 31 b3 57 ce
0030 80 18 02 00 00 50 00 00 01 01 08 0a d4 c1 06 e0



The cookie is set as shown in the above screenshot.

Observation: Understand and work out base 64 algorithm and write in your observation. Observe various parameters associated with Cookie in the wireshark capture.

Conditional Get: If-Modified-Since

Before performing the steps below, make sure your browser's cache is empty. (To do this under Firefox, select Tools -> Clear Recent History and check the Cache box). Now do the following:

- Start up your web browser, and make sure your browser's cache is cleared, as discussed above.
- Start up the Wireshark packet sniffer.
- Enter the following URL into your browser
  http://gaia.cs.umass.edu/wiresharklabs/HTTP-wireshark-file2.html
- Your browser should display a very simple five-line HTML file.

- Quickly enter the same URL into your browser again (or simply select the refresh button on your browser)
- Stop Wireshark packet capture, and enter "http" in the display-filter-specification window, so that only captured HTTP messages will be displayed later in the packetlisting window.

Observations:

Inspect the contents of the first HTTP GET request from your browser to the server. Do you see an "IF-MODIFIED-SINCE" line in the HTTP GET?

→ YES

Inspect the contents of the server response. Did the server explicitly return the contents of the file? How can you tell?

→YES BECAUSE WE CAN SEE THE CONTENTS IN THE LINE-BASED TEXT DATA FIELD

Now inspect the contents of the second HTTP GET request from your browser to the server. Do you see an "IF-MODIFIED-SINCE:" line in the HTTP GET? If so, what information follows the "IF-MODIFIED-SINCE:" header?

→ YES. THE INFORMATION FOLLOWED IS: SUN, 13 FEB 2022 06:59:02 GMT\R\N WHICH IS THE DATE OF THE LAST MODIFICATION OF THE FILE FROM THE PREVIOUS GET REQUEST.

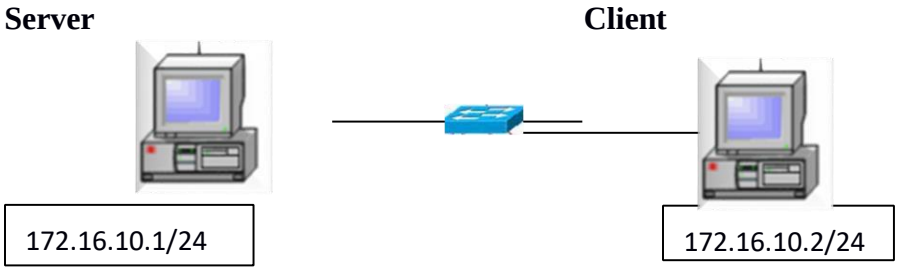
What is the HTTP status code and phrase returned from the server in response to this second HTTP GET? Did the server explicitly return the contents of the file? Explain.

→THE STATUS CODE AND PHRASE RETURNED FROM THE SERVER IS HTTP/1.1 304 NOT MODIFIED. THE SERVER

DIDN'T RETURN THE CONTENTS OF THE FILE SINCE THE BROWSER LOADED IT FROM ITS CACHE.

3B) Understanding Persistent and Non-persistent HTTP Connections

Step 1: Connect 2 desktops using switch and cables as shown below. (Use 2 VMs on Virtualbox or VMware instead of physical connections.)



Server Side:

Step 2: Check your Web Server

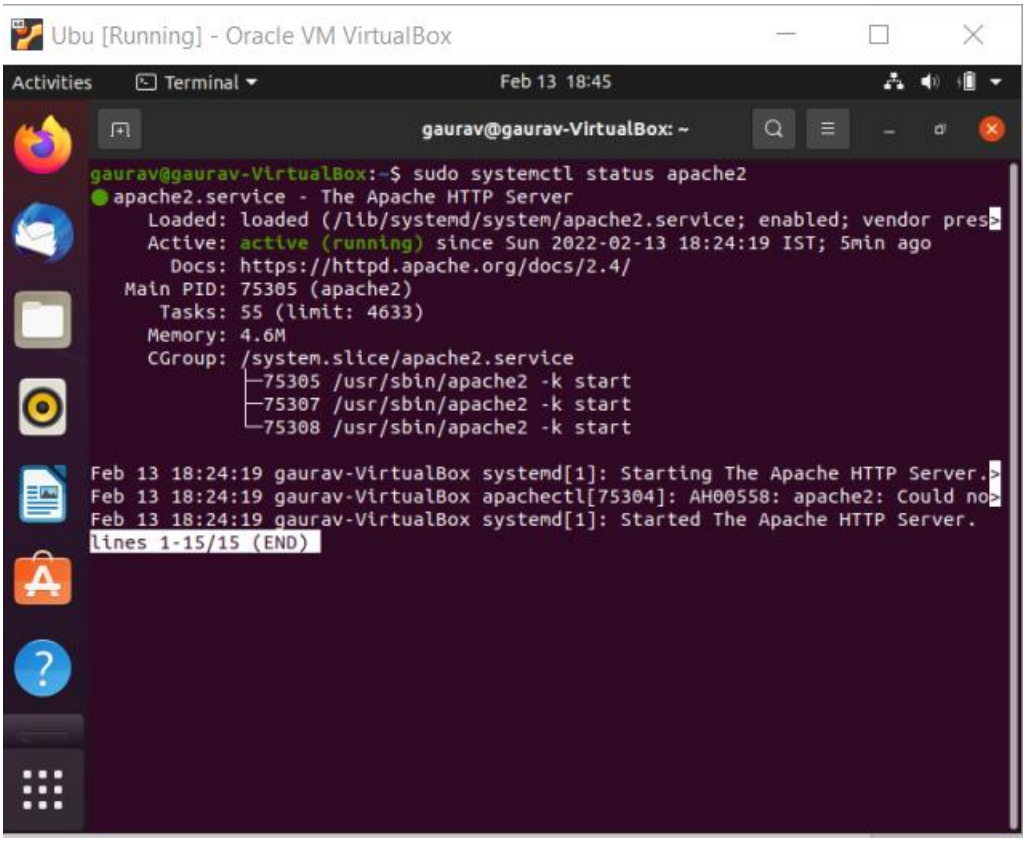
At the end of the installation process, Ubuntu 16.04 starts Apache. The web server should already be up and running. We can check with the `systemctl` command to make sure the service is running by typing:

sudo systemctl status apache2

or

sudo service apache2 status

As you can see above, the service appears to have started successfully. However, the best way to test this is to actually request a page from Apache. You can access the default Apache landing page to confirm that the software is running properly. You can access this through your server's domain name or IP address.



Step 3: Server IP address can be set by the following command

$sudo ip addr add 172.16.10.1/24 dev enps0

$sudo ip addr

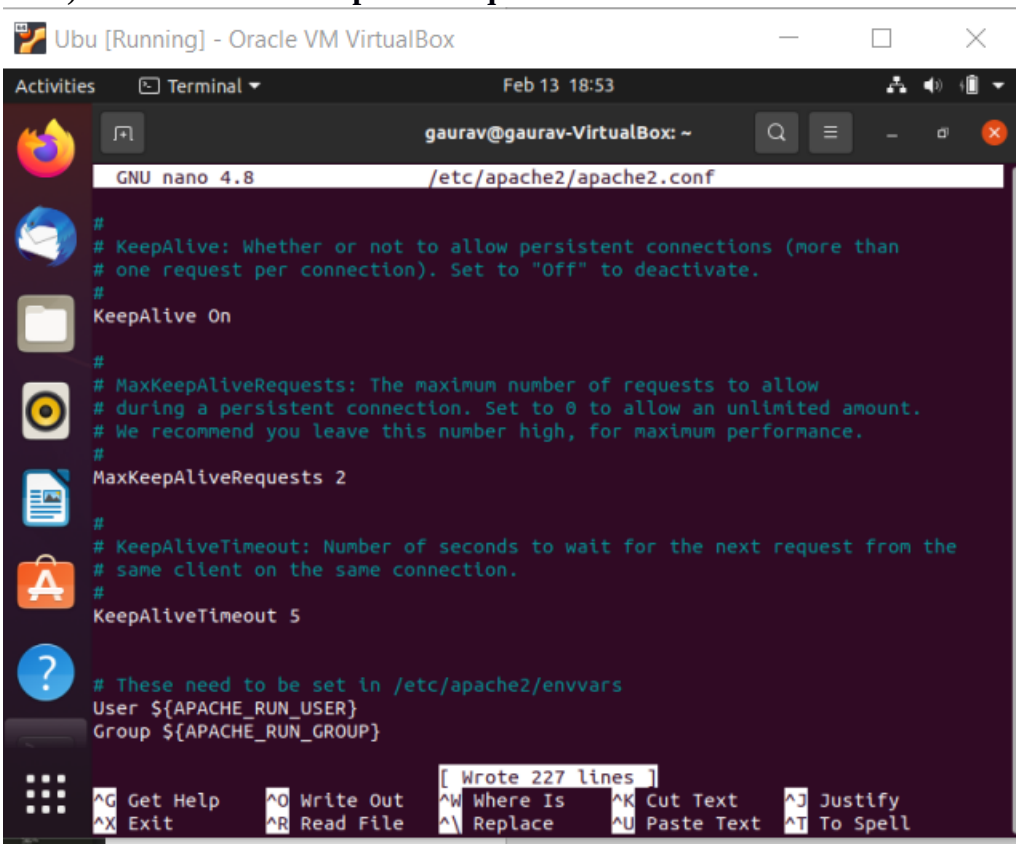
Note: If IP address fluctuates, kindly setup the IP address manually using 'Edit connections'.

```
gaurav@gaurav-VirtualBox:/var/www/html$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP gr
oup default qlen 1000
    link/ether 08:00:27:e2:67:1a brd ff:ff:ff:ff:ff:ff
    inet 10.0.2.5/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3
       valid_lft 501sec preferred_lft 501sec
    inet6 fe80::2488:7f22:7a0:78d3/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
gaurav@gaurav-VirtualBox:/var/www/html$
```

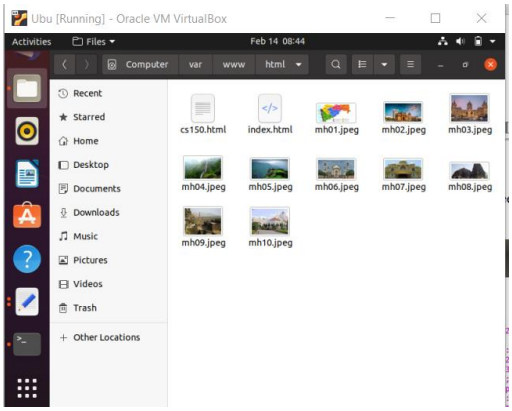
Step 4: The **apache2.conf** file present in the **etc/apache2** directory is modified as:

a) The **keep-alive** option was set (i.e. value was made **ON**)

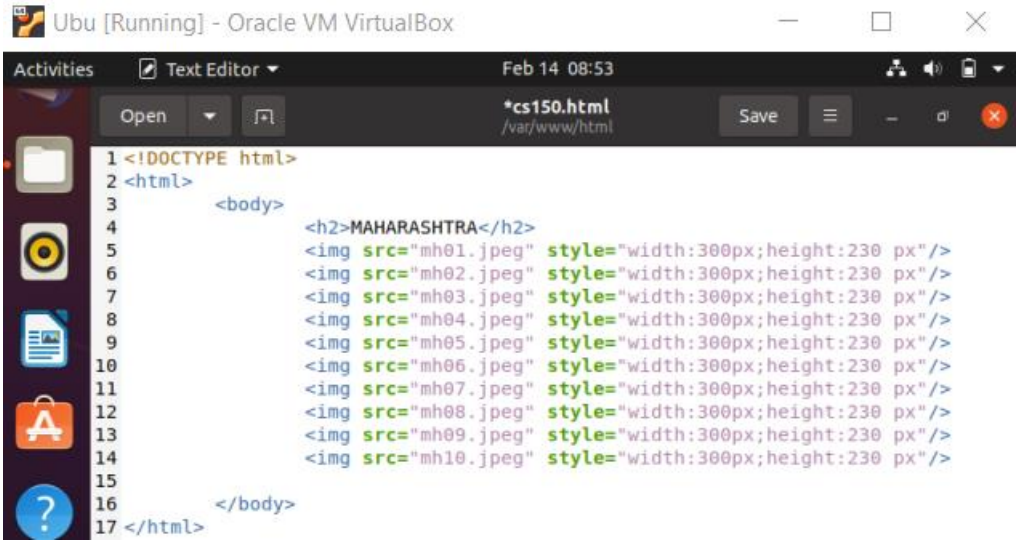
b) The **MaximumKeepAliveRequests** were set to **2**

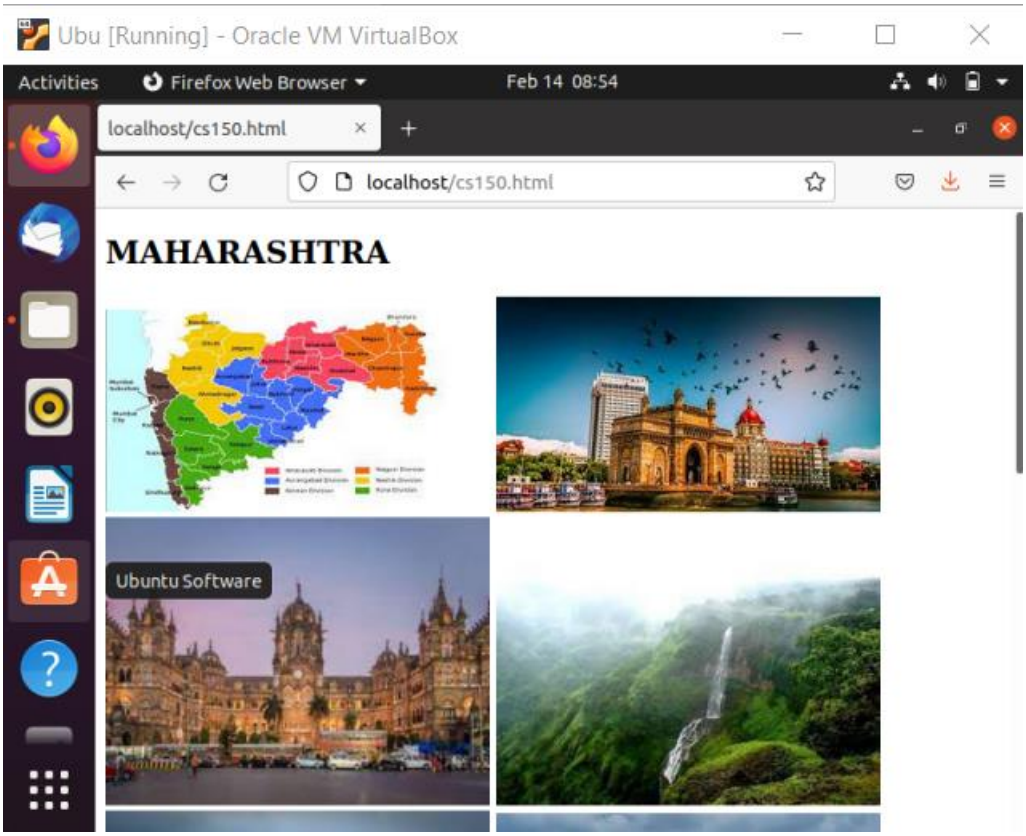


Step 5: Store images in the server path. A html page consisting of 10 images having size > 2MB were placed and accessed by the client. This html page is stored in the location - **/var/www/html/file_name.html**.



Step 6: Prepare a web page as shown below. The html file needs to add 10 images. (Kindly skip the style attribute in the below image)





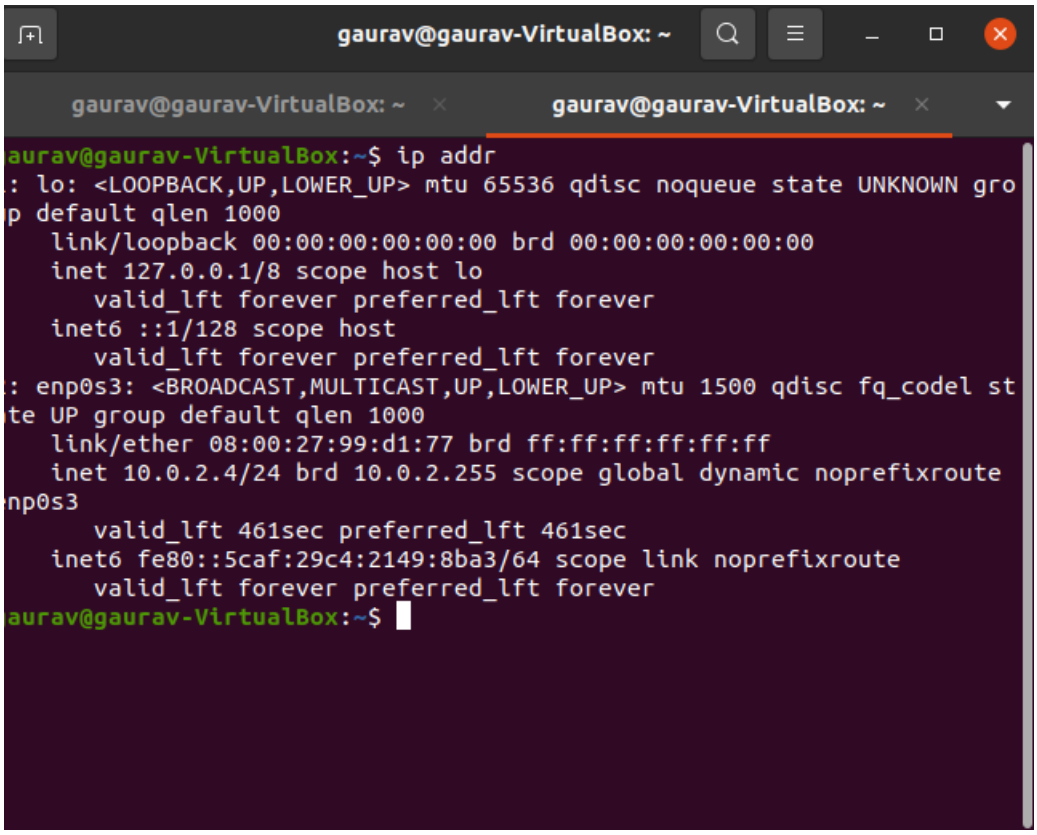
Client side:

Client IP address can be set by the following command.

$sudo ip addr add 172.16.10.2/24 dev enps0

$sudo ip addr

Note: If IP address fluctuates, kindly setup the IP address manually using 'Edit connections'.



There are broadly two parts of execution:

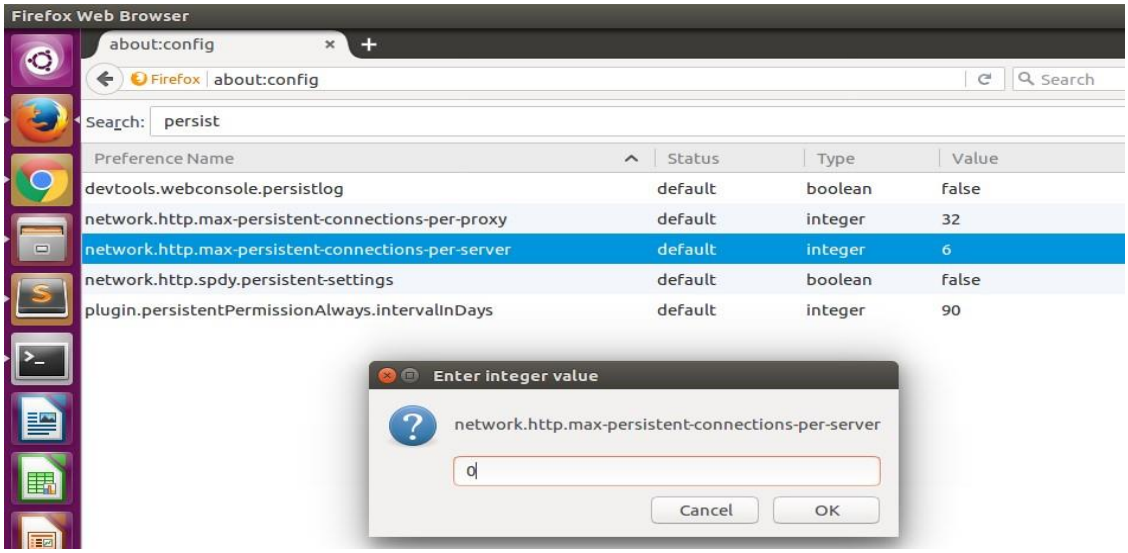
1. Dealing with non-persistent connections
2. Dealing with persistent connections

Open Firefox browser to configure for persistent option. Go to browser and type **about:config** and search for the term **'persistent'**

- While using non-persistent connection experiment, the **max-persistent-connectionsper-server** has the value set to **0** and **persistent-settings** value set to false.
- While using persistent connection experiment, the **max-persistent-connections-perserver** should have value greater than 0 (depending on the number of persistent connections needed) and **persistent-settings** value set to true.

PART 1: NON-PERSISTENT CONNECTION

Step 1: This is done by setting the value of max-persistent-connection-per-server to 0 in the client computer.



Step 2: Access web page on client-side browser (Firefox)

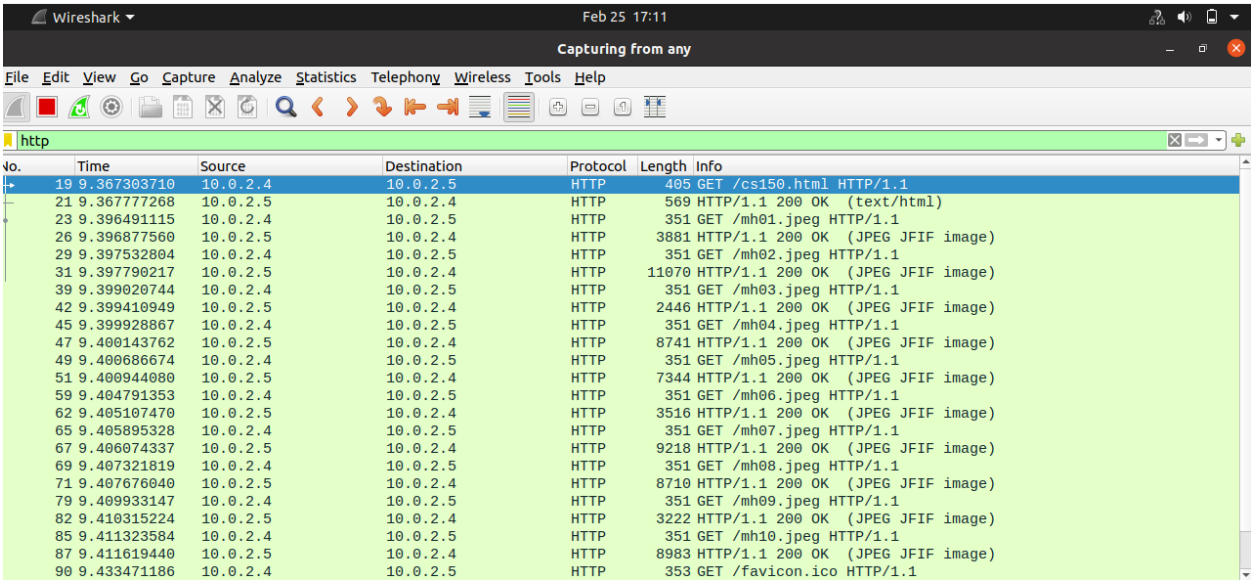
The client could access the file as:

172.16.10.1/file_name.html where--> **172.16.10.1** is Server's IP

Here the file name is **a.html** present in server. So, by tying **172.16.10.1/a.html** in client browser, we will be able to open the requested web page.

Note 1: The wireshark should capture the packets between the client and the server while the file is accessed.
Note 2: The images in the HTML page should have all the permissions specified through the server for the proper access.

Step 3: Use wireshark**.** Open wireshark in the server computer while client is trying to access the server's local host webpage. Apply 'http' filter and note the time to capture all the 10 images.



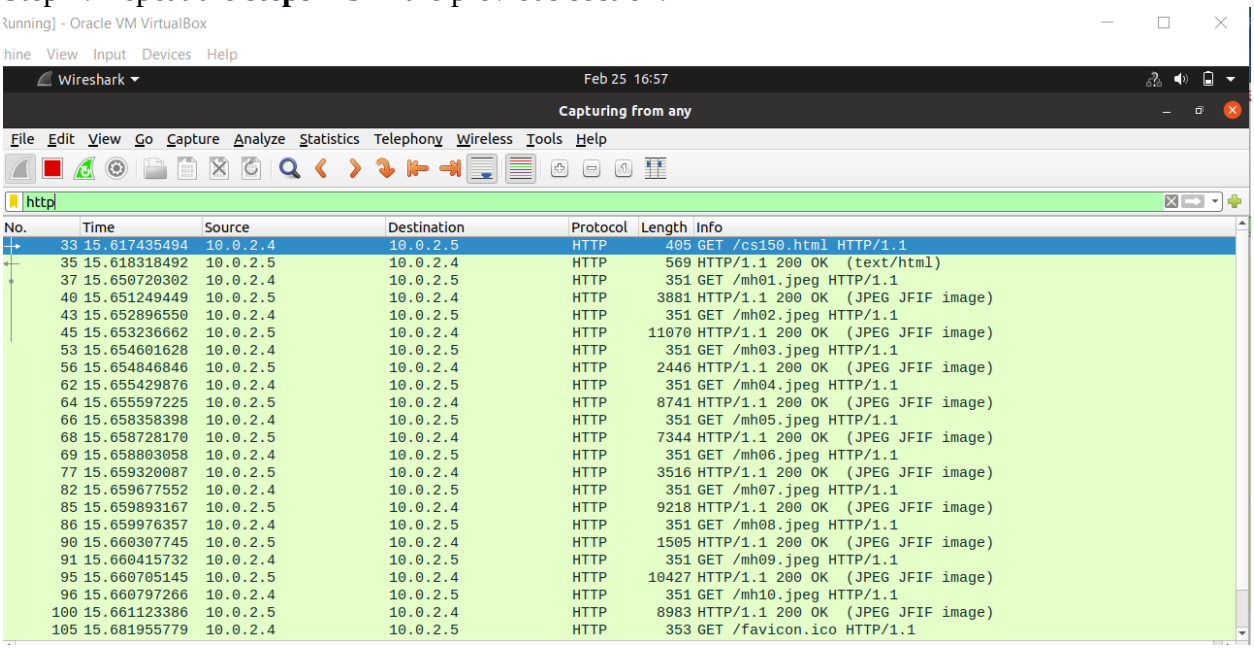
No.	Time	Source	Destination	Protocol	Length	Info
19	9.367303710	10.0.2.4	10.0.2.5	HTTP	405	GET /cs150.html HTTP/1.1
21	9.367777268	10.0.2.5	10.0.2.4	HTTP	569	HTTP/1.1 200 OK (text/html)
23	9.396491115	10.0.2.4	10.0.2.5	HTTP	351	GET /mh01.jpeg HTTP/1.1
26	9.396877560	10.0.2.5	10.0.2.4	HTTP	3881	HTTP/1.1 200 OK (JPEG JFIF image)
29	9.397532804	10.0.2.4	10.0.2.5	HTTP	351	GET /mh02.jpeg HTTP/1.1
31	9.397790217	10.0.2.5	10.0.2.4	HTTP	11070	HTTP/1.1 200 OK (JPEG JFIF image)
39	9.399020744	10.0.2.4	10.0.2.5	HTTP	351	GET /mh03.jpeg HTTP/1.1
42	9.399410949	10.0.2.5	10.0.2.4	HTTP	2446	HTTP/1.1 200 OK (JPEG JFIF image)
45	9.399928867	10.0.2.4	10.0.2.5	HTTP	351	GET /mh04.jpeg HTTP/1.1
47	9.400143762	10.0.2.5	10.0.2.4	HTTP	8741	HTTP/1.1 200 OK (JPEG JFIF image)
49	9.400686674	10.0.2.4	10.0.2.5	HTTP	351	GET /mh05.jpeg HTTP/1.1
51	9.400944080	10.0.2.5	10.0.2.4	HTTP	7344	HTTP/1.1 200 OK (JPEG JFIF image)
59	9.404791353	10.0.2.4	10.0.2.5	HTTP	351	GET /mh06.jpeg HTTP/1.1
62	9.405107470	10.0.2.5	10.0.2.4	HTTP	3516	HTTP/1.1 200 OK (JPEG JFIF image)
65	9.405895328	10.0.2.4	10.0.2.5	HTTP	351	GET /mh07.jpeg HTTP/1.1
67	9.406074337	10.0.2.5	10.0.2.4	HTTP	9218	HTTP/1.1 200 OK (JPEG JFIF image)
69	9.407321819	10.0.2.4	10.0.2.5	HTTP	351	GET /mh08.jpeg HTTP/1.1
71	9.407676040	10.0.2.5	10.0.2.4	HTTP	8710	HTTP/1.1 200 OK (JPEG JFIF image)
79	9.409933147	10.0.2.4	10.0.2.5	HTTP	351	GET /mh09.jpeg HTTP/1.1
82	9.410315224	10.0.2.5	10.0.2.4	HTTP	3222	HTTP/1.1 200 OK (JPEG JFIF image)
85	9.411323584	10.0.2.4	10.0.2.5	HTTP	351	GET /mh10.jpeg HTTP/1.1
87	9.411619440	10.0.2.5	10.0.2.4	HTTP	8983	HTTP/1.1 200 OK (JPEG JFIF image)
90	9.433471186	10.0.2.4	10.0.2.5	HTTP	353	GET /favicon.ico HTTP/1.1

Here it is 9.411619440- 9.367303710 = 0.04431573

PART 2: PERSISTENT CONNECTIONS

Step 1: For 2 persistent connections, set the value of **max-persistent-connection-per-server to 2** in the client computer.

Step 2: Repeat the **steps 1-3** in the previous section.

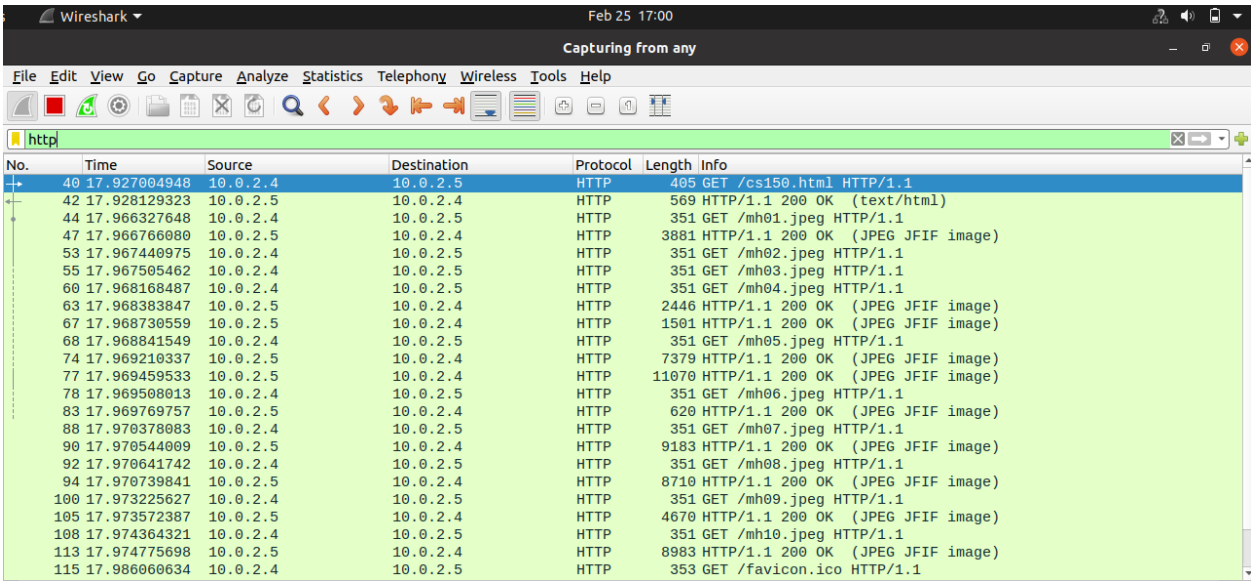


No.	Time	Source	Destination	Protocol	Length	Info
33	15.617435494	10.0.2.4	10.0.2.5	HTTP	405	GET /cs150.html HTTP/1.1
35	15.618318492	10.0.2.5	10.0.2.4	HTTP	569	HTTP/1.1 200 OK (text/html)
37	15.650720302	10.0.2.4	10.0.2.5	HTTP	351	GET /mh01.jpeg HTTP/1.1
40	15.651249449	10.0.2.5	10.0.2.4	HTTP	3881	HTTP/1.1 200 OK (JPEG JFIF image)
43	15.652896550	10.0.2.4	10.0.2.5	HTTP	351	GET /mh02.jpeg HTTP/1.1
45	15.653236662	10.0.2.5	10.0.2.4	HTTP	11070	HTTP/1.1 200 OK (JPEG JFIF image)
53	15.654601628	10.0.2.4	10.0.2.5	HTTP	351	GET /mh03.jpeg HTTP/1.1
56	15.654846846	10.0.2.5	10.0.2.4	HTTP	2446	HTTP/1.1 200 OK (JPEG JFIF image)
62	15.655429876	10.0.2.4	10.0.2.5	HTTP	351	GET /mh04.jpeg HTTP/1.1
64	15.655597225	10.0.2.5	10.0.2.4	HTTP	8741	HTTP/1.1 200 OK (JPEG JFIF image)
66	15.658358398	10.0.2.4	10.0.2.5	HTTP	351	GET /mh05.jpeg HTTP/1.1
68	15.658728170	10.0.2.5	10.0.2.4	HTTP	7344	HTTP/1.1 200 OK (JPEG JFIF image)
69	15.658803058	10.0.2.4	10.0.2.5	HTTP	351	GET /mh06.jpeg HTTP/1.1
77	15.659320087	10.0.2.5	10.0.2.4	HTTP	3516	HTTP/1.1 200 OK (JPEG JFIF image)
82	15.659677552	10.0.2.4	10.0.2.5	HTTP	351	GET /mh07.jpeg HTTP/1.1
85	15.659893167	10.0.2.5	10.0.2.4	HTTP	9218	HTTP/1.1 200 OK (JPEG JFIF image)
86	15.659976357	10.0.2.4	10.0.2.5	HTTP	351	GET /mh08.jpeg HTTP/1.1
90	15.660307745	10.0.2.5	10.0.2.4	HTTP	1505	HTTP/1.1 200 OK (JPEG JFIF image)
91	15.660415732	10.0.2.4	10.0.2.5	HTTP	351	GET /mh09.jpeg HTTP/1.1
95	15.660705145	10.0.2.5	10.0.2.4	HTTP	10427	HTTP/1.1 200 OK (JPEG JFIF image)
96	15.660797266	10.0.2.4	10.0.2.5	HTTP	351	GET /mh10.jpeg HTTP/1.1
100	15.661123386	10.0.2.5	10.0.2.4	HTTP	8983	HTTP/1.1 200 OK (JPEG JFIF image)
105	15.681955779	10.0.2.4	10.0.2.5	HTTP	353	GET /favicon.ico HTTP/1.1

Here it is 15.661123386-15.617435494= 0.043687892

Step 3: For 4 persistent connections, Set the value of **max-persistent-connection-per-server to 4** in the client computer.

Step 4: Repeat the **steps 1-3** in the previous section.

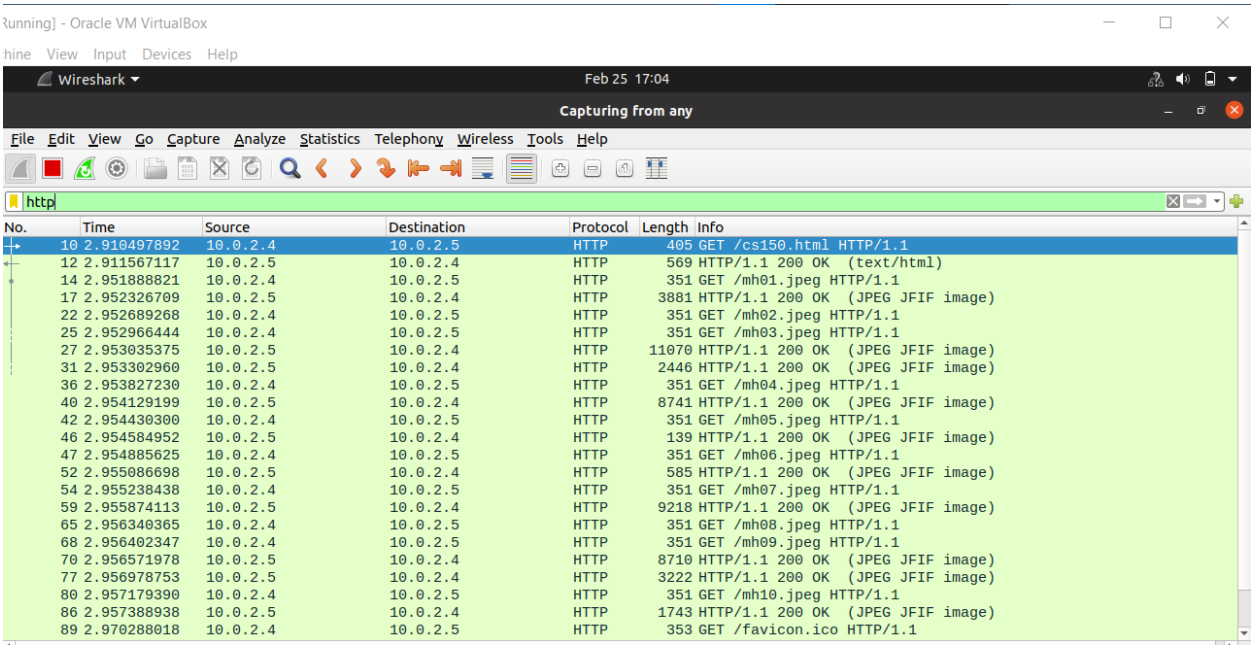


No.	Time	Source	Destination	Protocol	Length	Info
40	17.927004948	10.0.2.4	10.0.2.5	HTTP	405	GET /cs150.html HTTP/1.1
42	17.928129323	10.0.2.5	10.0.2.4	HTTP	569	HTTP/1.1 200 OK (text/html)
44	17.966327648	10.0.2.4	10.0.2.5	HTTP	351	GET /mh01.jpeg HTTP/1.1
47	17.966766080	10.0.2.5	10.0.2.4	HTTP	3881	HTTP/1.1 200 OK (JPEG JFIF image)
53	17.967440975	10.0.2.4	10.0.2.5	HTTP	351	GET /mh02.jpeg HTTP/1.1
55	17.967505462	10.0.2.4	10.0.2.5	HTTP	351	GET /mh03.jpeg HTTP/1.1
60	17.968168487	10.0.2.4	10.0.2.5	HTTP	351	GET /mh04.jpeg HTTP/1.1
63	17.968383847	10.0.2.5	10.0.2.4	HTTP	2446	HTTP/1.1 200 OK (JPEG JFIF image)
67	17.968730559	10.0.2.5	10.0.2.4	HTTP	1501	HTTP/1.1 200 OK (JPEG JFIF image)
68	17.968841549	10.0.2.4	10.0.2.5	HTTP	351	GET /mh05.jpeg HTTP/1.1
74	17.969210337	10.0.2.5	10.0.2.4	HTTP	7379	HTTP/1.1 200 OK (JPEG JFIF image)
77	17.969459533	10.0.2.5	10.0.2.4	HTTP	11070	HTTP/1.1 200 OK (JPEG JFIF image)
78	17.969508013	10.0.2.4	10.0.2.5	HTTP	351	GET /mh06.jpeg HTTP/1.1
83	17.969769757	10.0.2.5	10.0.2.4	HTTP	620	HTTP/1.1 200 OK (JPEG JFIF image)
88	17.970378083	10.0.2.4	10.0.2.5	HTTP	351	GET /mh07.jpeg HTTP/1.1
90	17.970544009	10.0.2.5	10.0.2.4	HTTP	9183	HTTP/1.1 200 OK (JPEG JFIF image)
92	17.970641742	10.0.2.4	10.0.2.5	HTTP	351	GET /mh08.jpeg HTTP/1.1
94	17.970739841	10.0.2.5	10.0.2.4	HTTP	8710	HTTP/1.1 200 OK (JPEG JFIF image)
100	17.973225627	10.0.2.4	10.0.2.5	HTTP	351	GET /mh09.jpeg HTTP/1.1
105	17.973572387	10.0.2.5	10.0.2.4	HTTP	4670	HTTP/1.1 200 OK (JPEG JFIF image)
108	17.974364321	10.0.2.4	10.0.2.5	HTTP	351	GET /mh10.jpeg HTTP/1.1
113	17.974775698	10.0.2.5	10.0.2.4	HTTP	8983	HTTP/1.1 200 OK (JPEG JFIF image)
115	17.986060634	10.0.2.4	10.0.2.5	HTTP	353	GET /favicon.ico HTTP/1.1

Here is it 17.974775698 – 17.927004948 = 0.04777075

Step 5: For 6 persistent connections, set the value of **max-persistent-connection-per-server to 6** in the server computer.

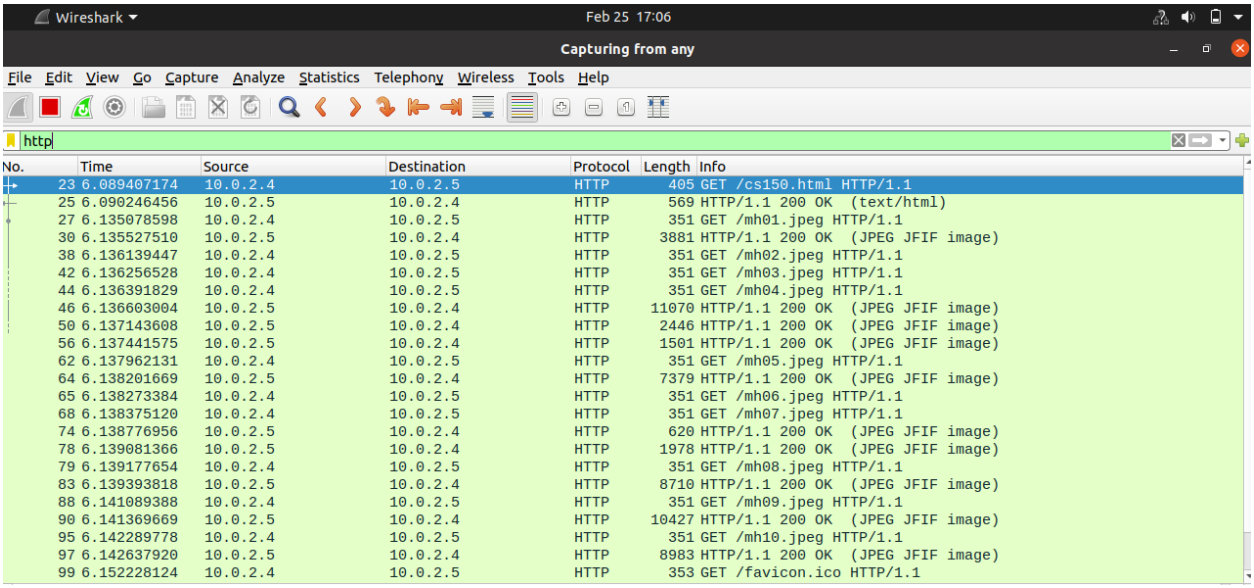
Step 6: Repeat the **steps 1-3** in the previous section.



Here it is 2.957388938- 2.910497892= 0.046891046

Step 7: For 10 persistent connections, set the value of **max-persistent-connection-perserver to 10** in the client computer.

Step 8: Repeat the **steps 1-3** in the previous section.



Here it is 6.142637920-6.089407174= 0.053230746