COMPUTER NETWORKS LAB

COURSE CODE:UE19CS255

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SECTION:E DATE:05/02/2021

EXPERIMENT: Create a web page with N (e.g. 10) embedded images. Each image should be of minimum 2 MB size. Configure your browser (Firefox) with following settings (each setting requires repeat of experiment)

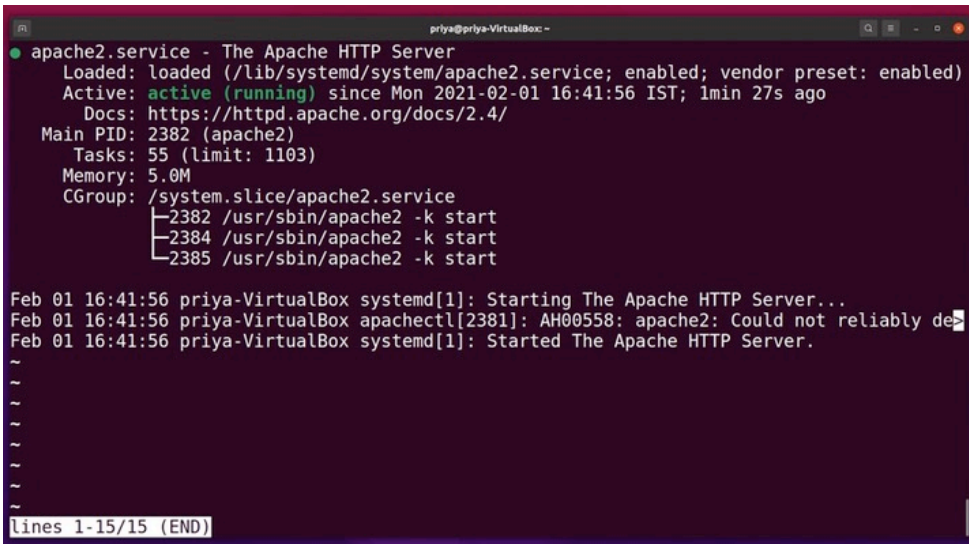
1. Non-persistent connection
2. 2 persistent connections
3. 4 persistent connections
4. 6 persistent connections
5. 8 persistent connections
6. 10 persistent connections

1.CONFIGURATION OF THE APACHE SERVER AND CLIENT ENVIRONMENT

1. To create a server – client architecture, machines were setup , the macOS and the ubuntu VM. The former is referred to as the client machine and the latter is the server machine.
2. Apache Server was installed and configured on the server machine, and a
   static webpage consisting of 10 objects (images) was created and hosted on the local network between these machines.
3. We need to observe and determine the effect of the number of persistent
   connections on the load time of this static webpage.

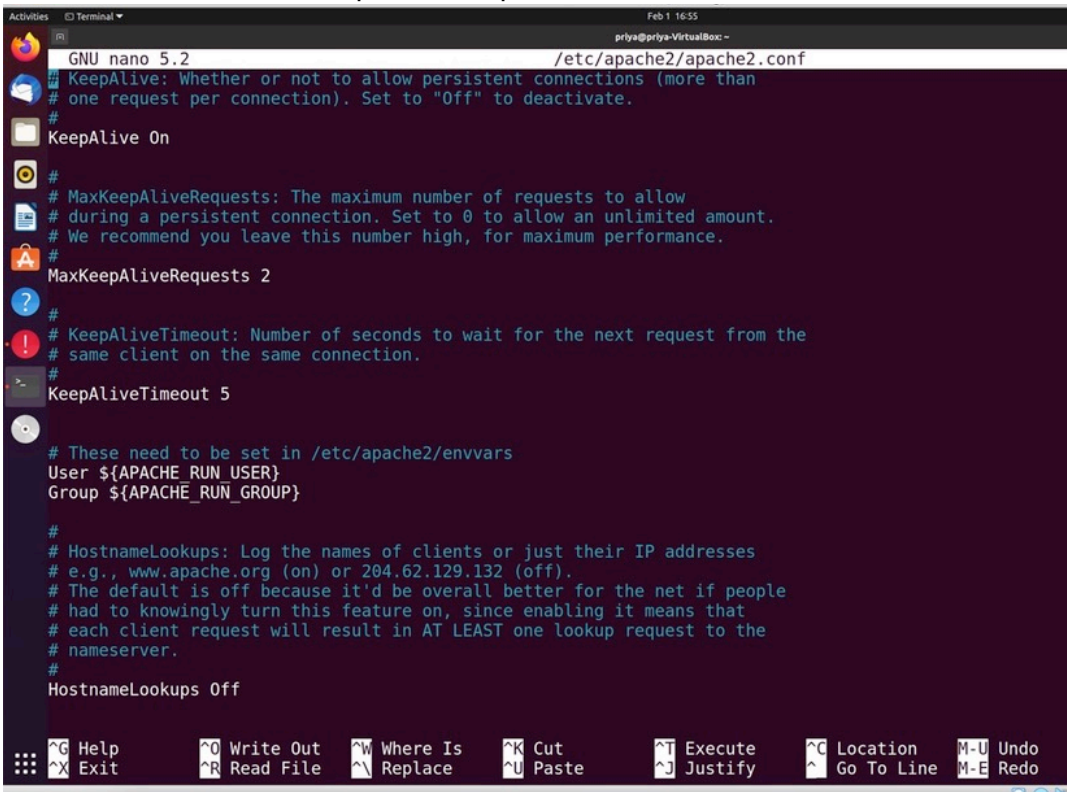
1.1 SETTING UP THE APACHE SERVER

Command used to install apache server : sudo apt install apache2
To view the status of the newly installed apache server : systemctl status apache2



1.2 CONFIGURING THE APACHE SERVER FOR THE EXPERIMENT

- We have to edit the apache2.conf configuration file
- We have to set KeepAlive to On
- We have to set MaxKeepAliveRequests to 2



1.3 ADDING CUSTOM IP ADDRESS TO SERVER AND CLIENT

- The server is given the IP Address 10.0.5.35
- The client is given the IP Address 10.0.5.36
- Command Used : sudo ip addr add IP-address dev interface-name
- Before (Server Machine)

```
priya@priya-VirtualBox:~$ sudo ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 100
0
    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 group defaul
t qlen 1000
    link/ether 08:00:27:a0:2c:49 brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.109/24 brd 192.168.0.255 scope global dynamic noprefixroute enp0s3
       valid_lft 6721sec preferred_lft 6721sec
    inet6 fe80::8182:ddc:713:8f31/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
priya@priya-VirtualBox:~$
```

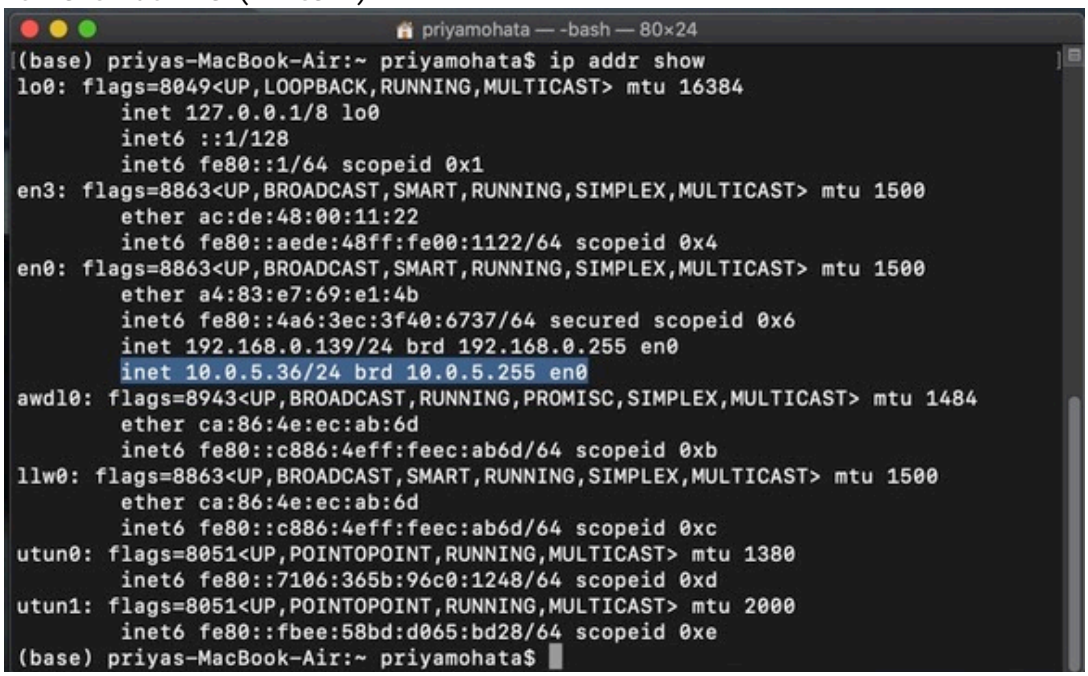
- After(Server Machine)

```
priya@priya-VirtualBox:~$ sudo ip addr add 10.0.5.35/24 dev enp0s3
priya@priya-VirtualBox:~$ sudo ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 100
0
    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 group defaul
t qlen 1000
    link/ether 08:00:27:a0:2c:49 brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.109/24 brd 192.168.0.255 scope global dynamic noprefixroute enp0s3
       valid_lft 6680sec preferred_lft 6680sec
    inet 10.0.5.35/24 scope global enp0s3
       valid_lft forever preferred_lft forever
    inet6 fe80::8182:ddc:713:8f31/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
priya@priya-VirtualBox:~$
```

- Client Machine – Before

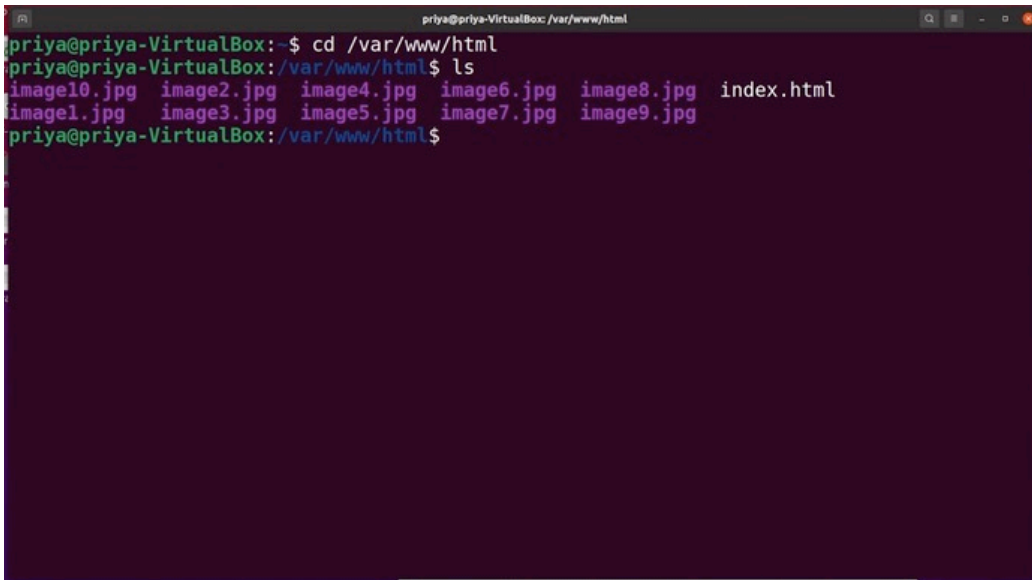
```
priyamohata — -bash — 80×24

(base) priyas-MacBook-Air:~ priyamohata$ ip addr show
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
        inet 127.0.0.1/8 lo0
        inet6 ::1/128
        inet6 fe80::1/64 scopeid 0x1
en3: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
        ether ac:de:48:00:11:22
        inet6 fe80::aede:48ff:fe00:1122/64 scopeid 0x4
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
        ether a4:83:e7:69:e1:4b
        inet6 fe80::4a6:3ec:3f40:6737/64 secured scopeid 0x6
        inet 192.168.0.139/24 brd 192.168.0.255 en0
awdl0: flags=8943<UP,BROADCAST,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1484
        ether ca:86:4e:ec:ab:6d
        inet6 fe80::c886:4eff:feec:ab6d/64 scopeid 0xb
llw0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
        ether ca:86:4e:ec:ab:6d
        inet6 fe80::c886:4eff:feec:ab6d/64 scopeid 0xc
utun0: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 1380
        inet6 fe80::7106:365b:96c0:1248/64 scopeid 0xd
utun1: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 2000
        inet6 fe80::fbee:58bd:d065:bd28/64 scopeid 0xe
(base) priyas-MacBook-Air:~ priyamohata$
```

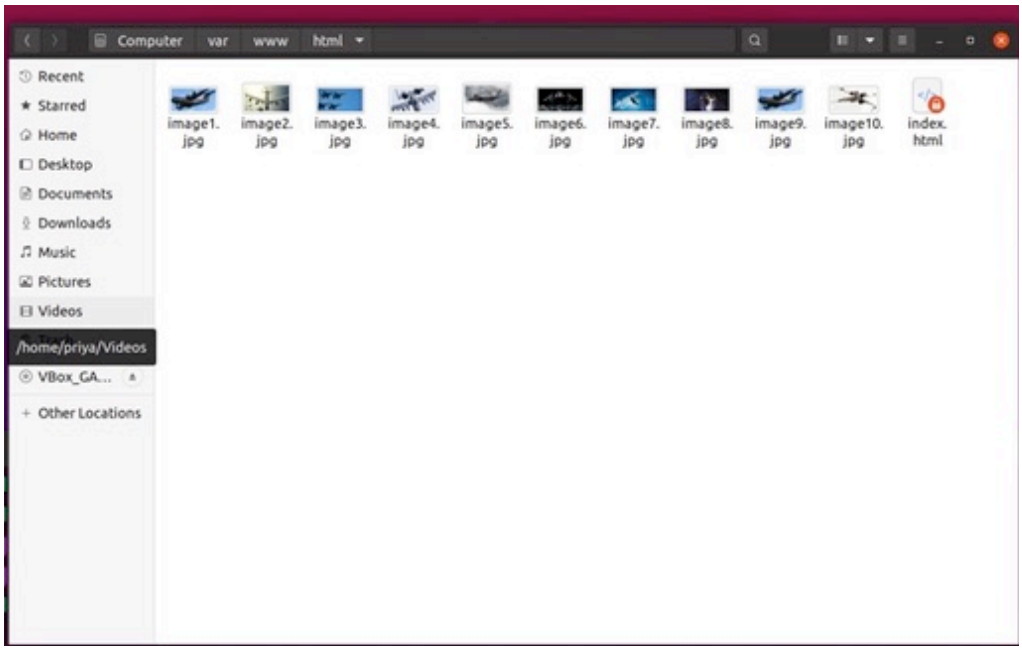
-Client Machine (After)



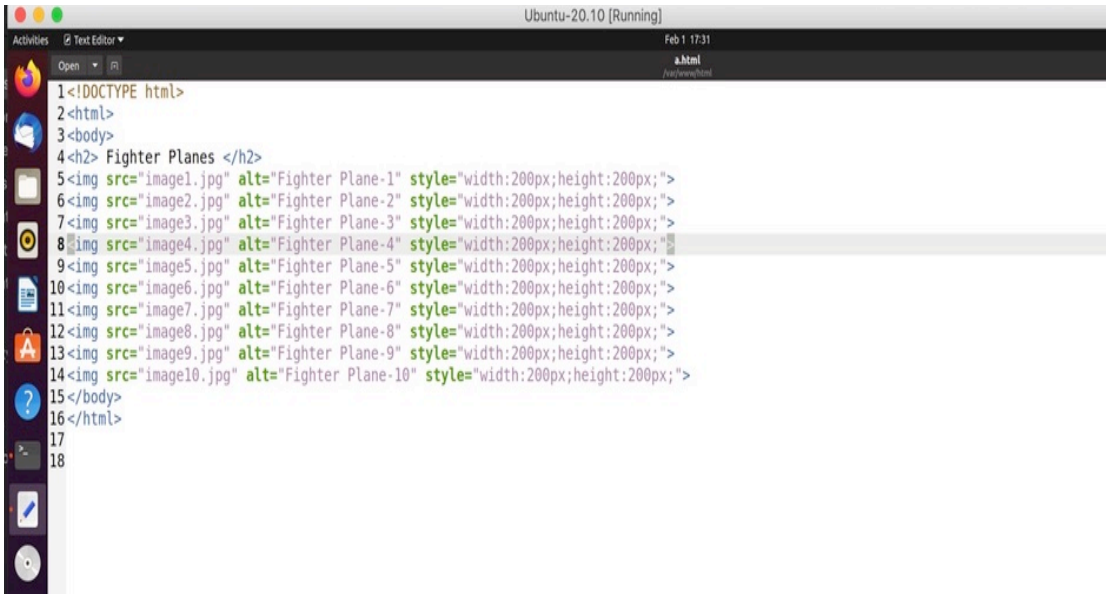
1.4 Hosting the Webpage

- The webpage can be hosted by moving the html file and the images to the server path
- The server path is /var/www/html

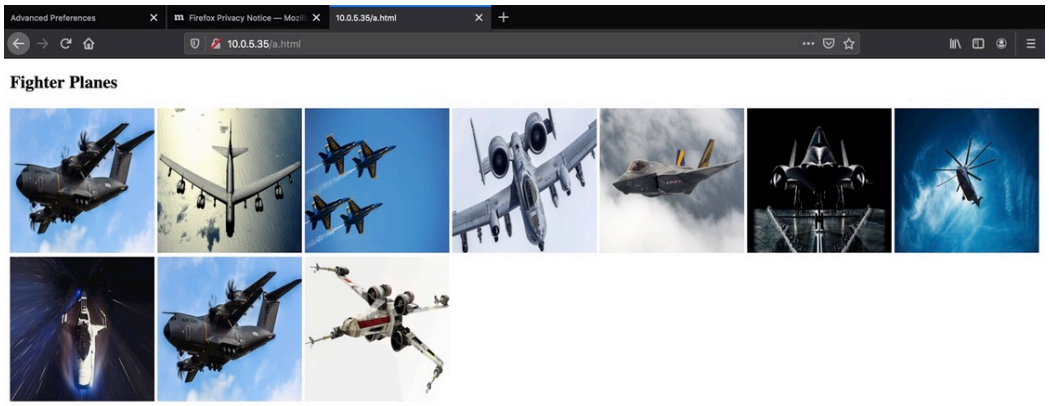




The var/www/html folder



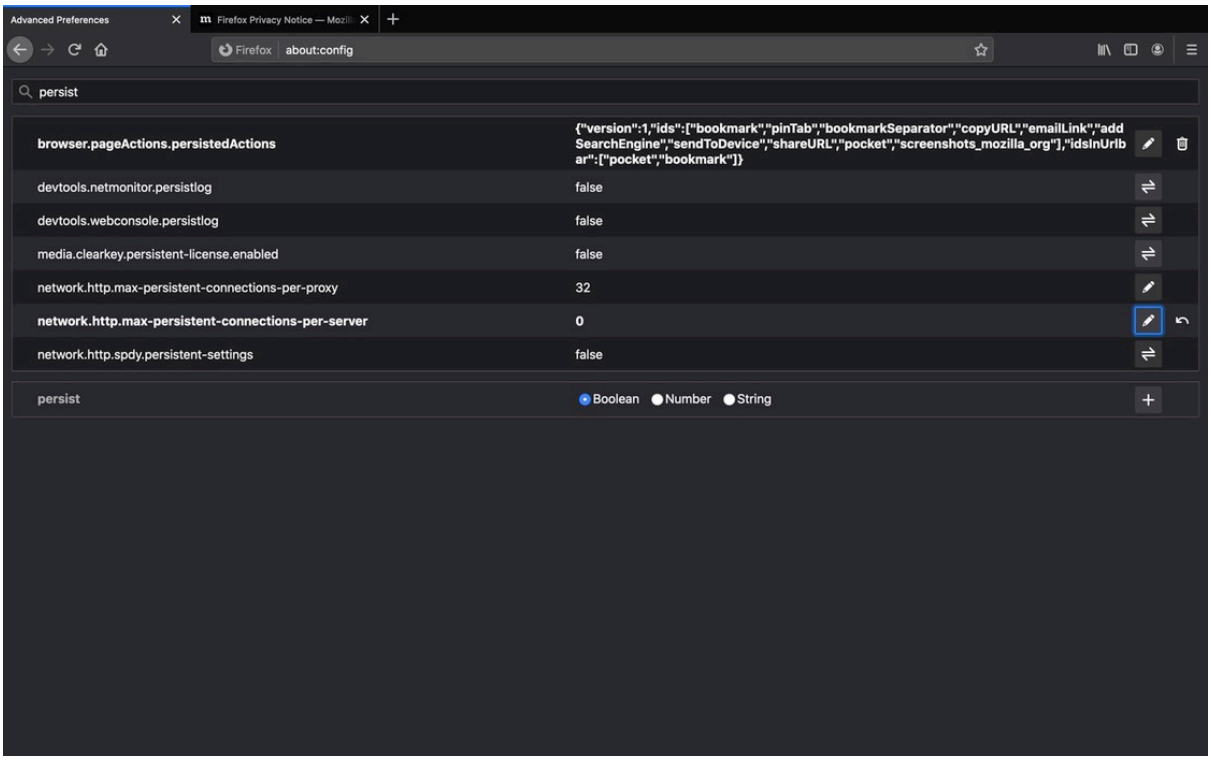
Html file (a.html)

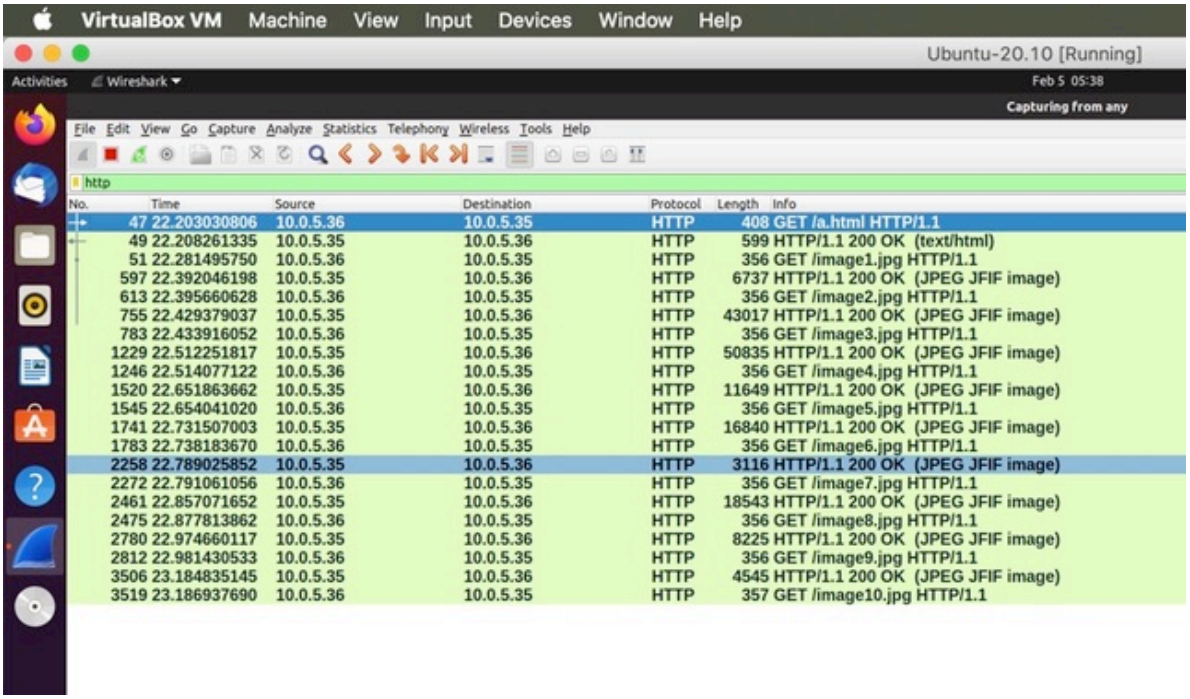


The html file in the server path var/www/html

2.Non Persistent Connection

- To setup a non-persistent connection, we need to configure a few settings on our browser
- On Firefox, we set the max-persistent-connections-per-server to 0 and persistent-settings to false

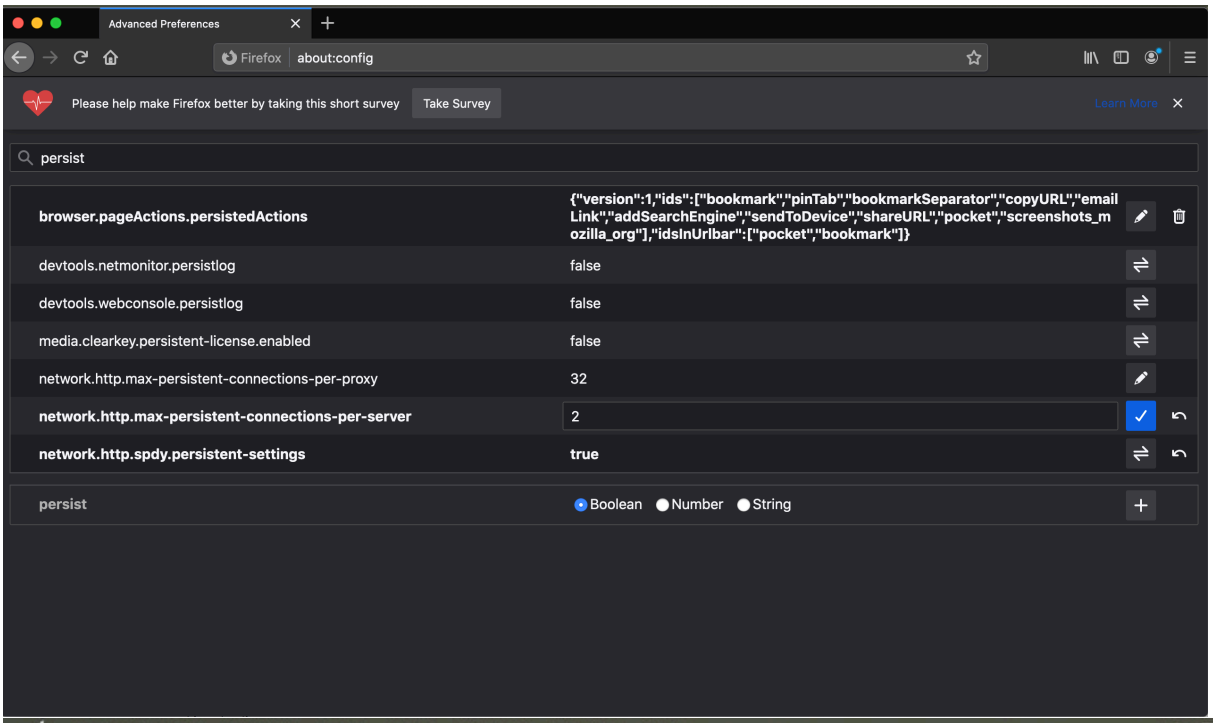


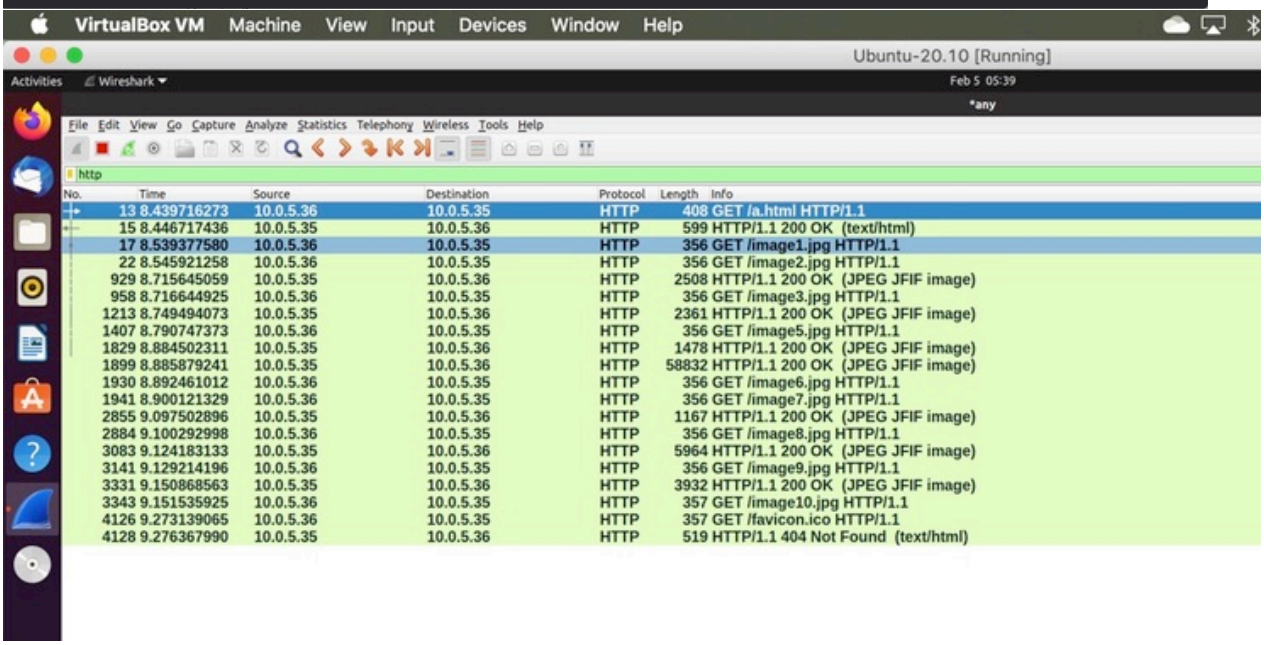


Time = 23.186937690 – 22.208261335 =0.978676355

4.Persistent Connection

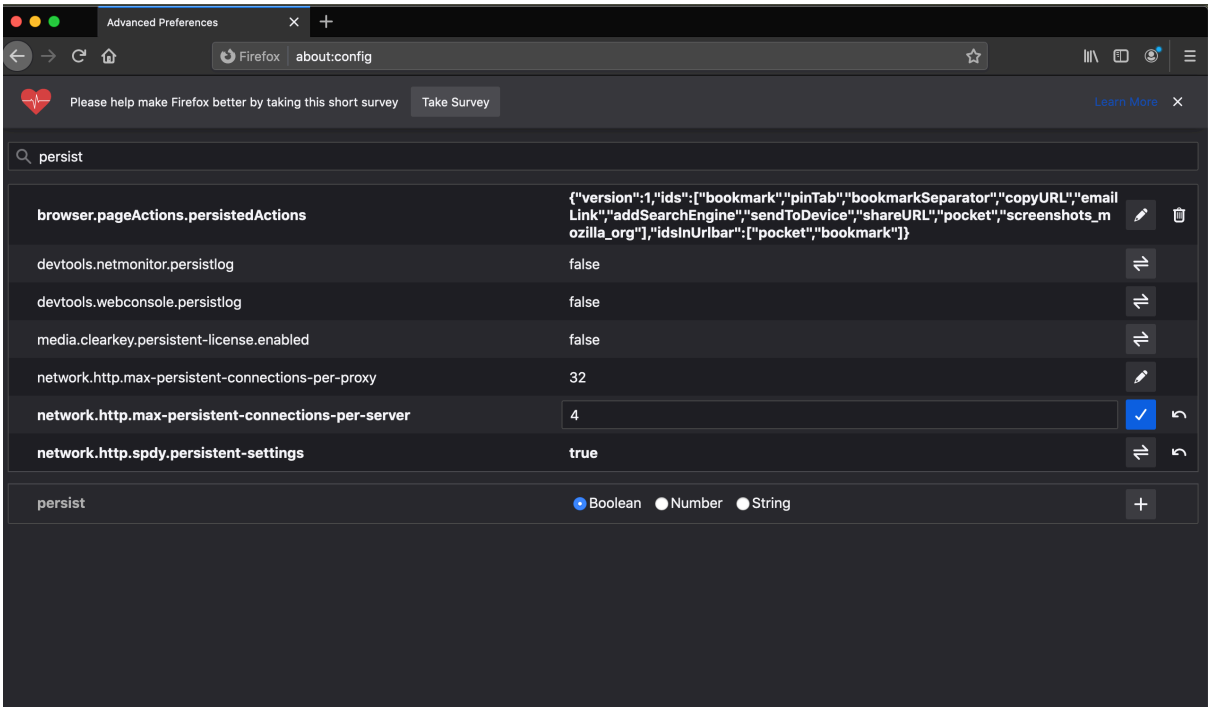
4.1 Two persistent connections

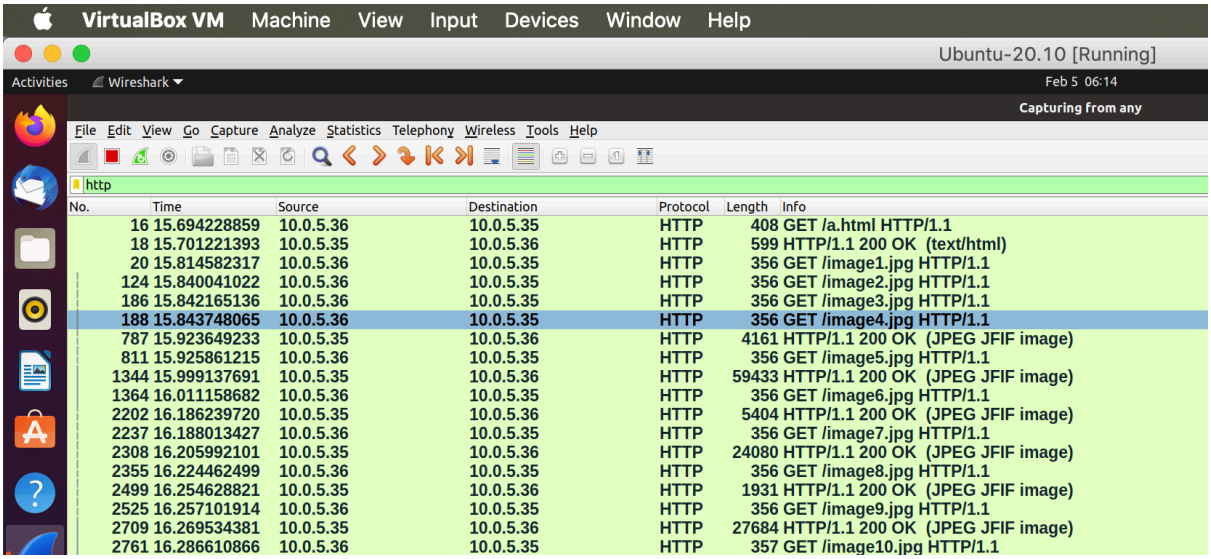




Time : 9.151535925-8.446717436=0.704818489

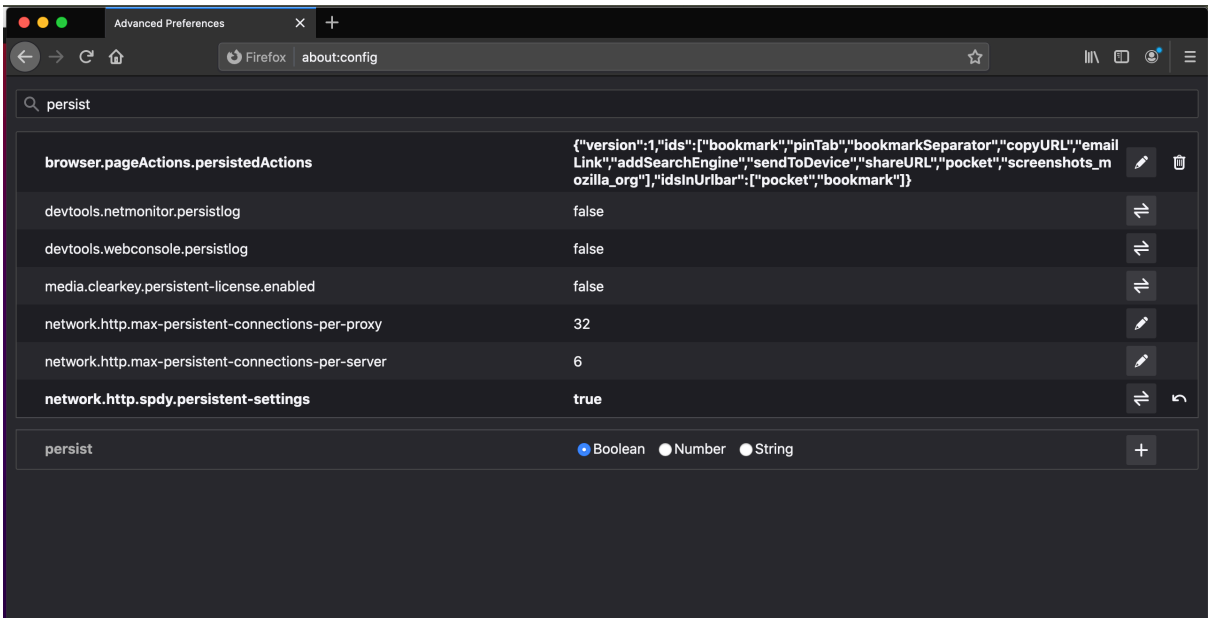
4.2 Four Persistent Connections

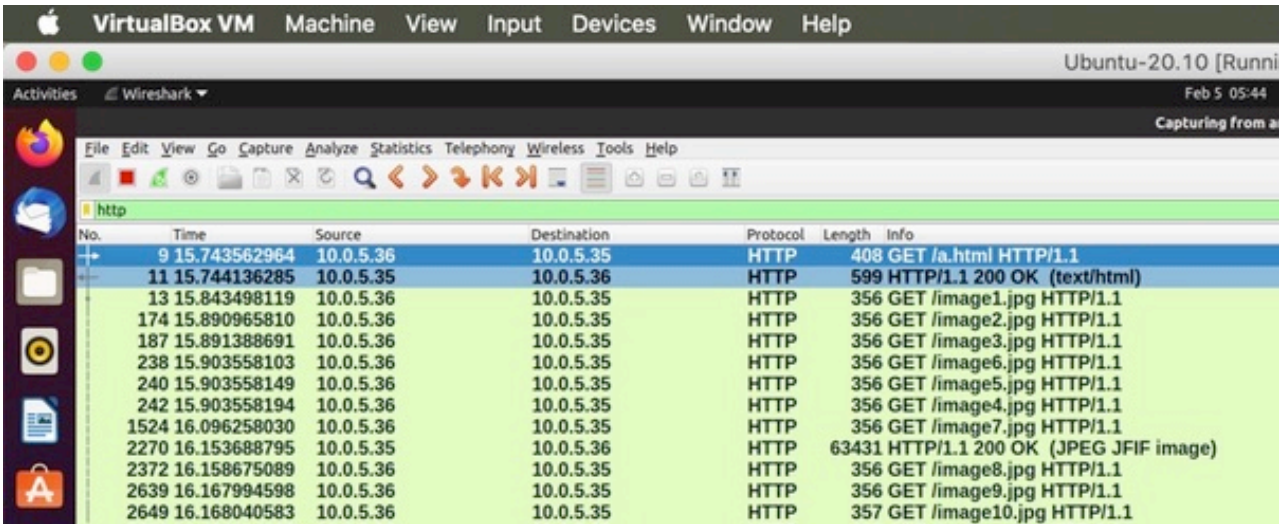




Time = 16.286610866-15.701221393=0.585389473

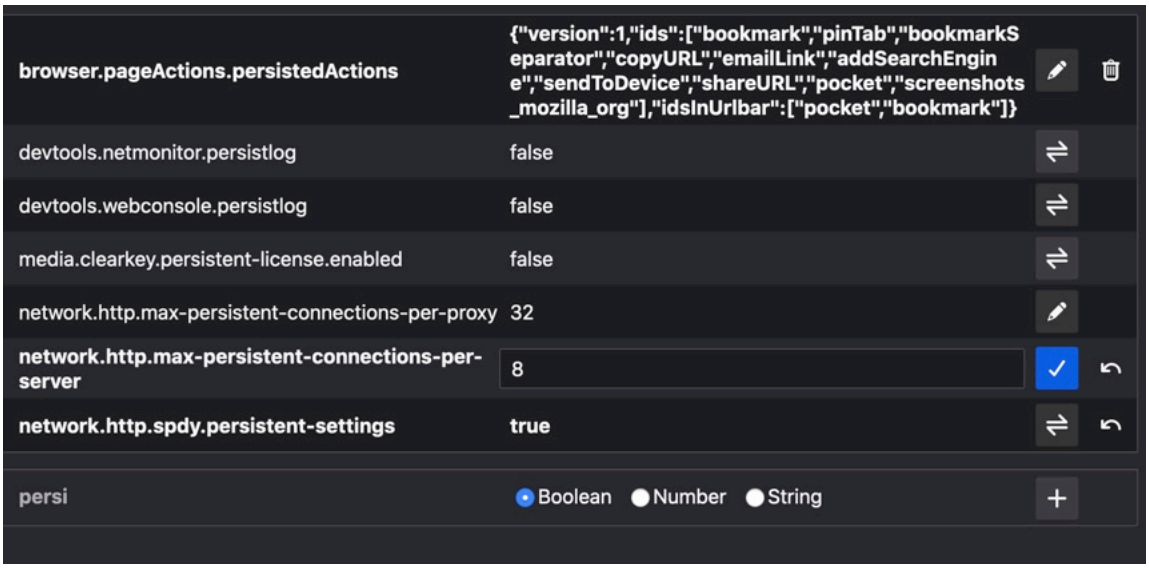
4.3 Six Persistent Connections

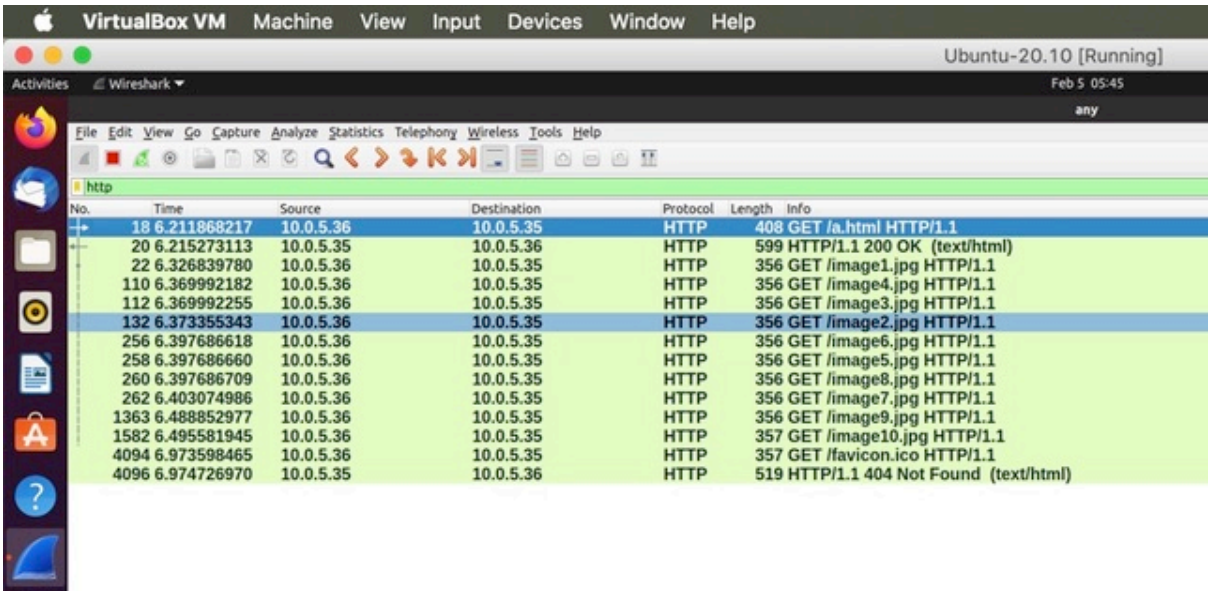




Time = 16.168040583-15.744136285= 0.423904298

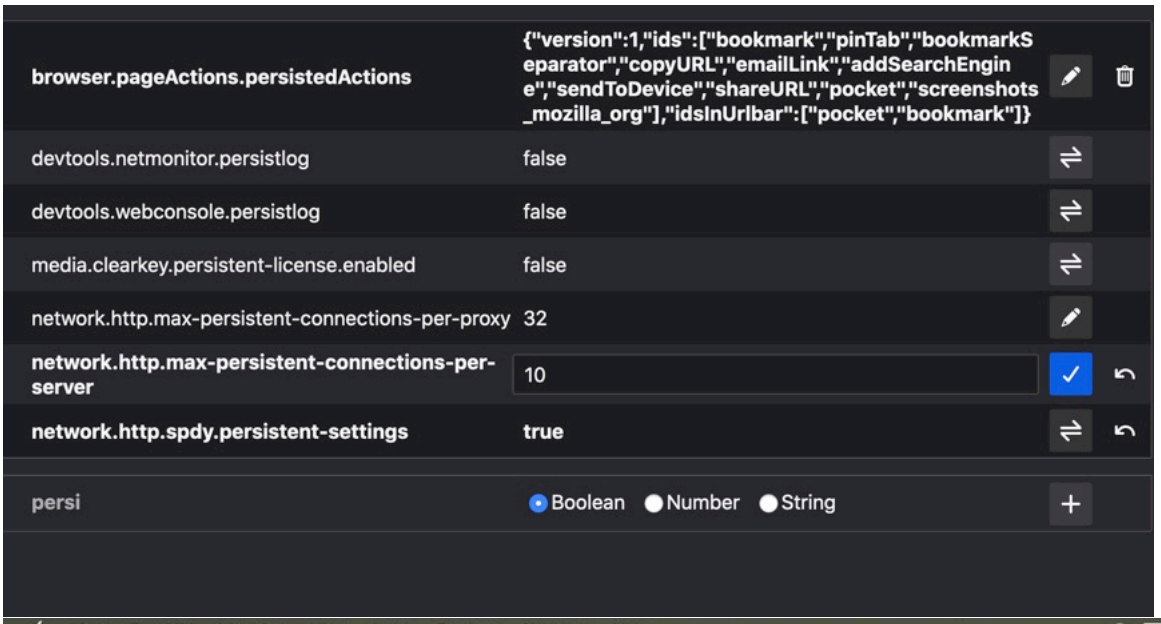
4.4 Eight persistent connections

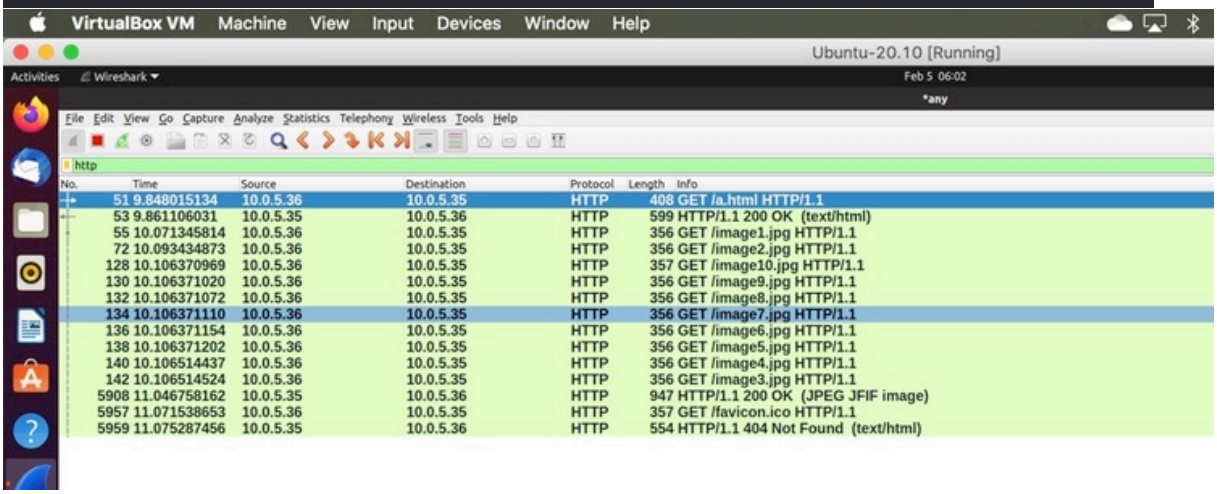




Time = 6.973598465 – 6.215273113=0.758325352

4.5 Ten persistent connections





Time = 11.046758162-9.861106031=1.185652131

Observations :

- Optimal Number of Connections = 6
- For six persistent connection the load time is the minimal
- The load time initially decreases as the number of persistent connections and becomes minimal at the value six and then the load time increases as the number of persistent connections increase
- Here is the table and the line graph for better insights

Number of Connections	Load Time
0	0.978676355
2	0.704818489
4	0.585389473
6	0.423904298
8	0.758325352
10	1.185652131