

Computer Network Lab – Week 2

PES1UG20CS806

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1. Configuration of Apache Server and Client Environment

- To create a server – client architecture, two Virtual Machines were setup. The former is referred to as the server machine and the latter is the client machine.
- 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.
- 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 Apache Server

- The Apache Server can be installed with `sudo apt install apache2`.
- The status of the newly installed server can be viewed **using `systemctl status apache2`**.

```
student@CSELAB:~$ systemctl status apache2
● apache2.service - LSB: Apache2 web server
   Loaded: loaded (/etc/init.d/apache2; bad; vendor preset: enabled)
   Drop-In: /lib/systemd/system/apache2.service.d
            └─apache2-systemd.conf
   Active: active (running) since Wed 2021-02-03 13:06:50 IST; 13min ago
     Docs: man:systemd-sysv-generator(8)
   Process: 3135 ExecReload=/etc/init.d/apache2 reload (code=exited, status=0/SUCCESS)
   Process: 1076 ExecStart=/etc/init.d/apache2 start (code=exited, status=0/SUCCESS)
   CGroup: /system.slice/apache2.service
           └─1212 /usr/sbin/apache2 -k start
             3154 /usr/sbin/apache2 -k start
             3155 /usr/sbin/apache2 -k start
             3156 /usr/sbin/apache2 -k start
             3157 /usr/sbin/apache2 -k start
             3158 /usr/sbin/apache2 -k start

Feb 03 13:06:44 CSELAB systemd[1]: Starting LSB: Apache2 web server...
Feb 03 13:06:44 CSELAB apache2[1076]: * Starting Apache httpd web server apache2
Feb 03 13:06:48 CSELAB apache2[1076]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1.
Feb 03 13:06:50 CSELAB apache2[1076]: *
Feb 03 13:06:50 CSELAB systemd[1]: Started LSB: Apache2 web server.
Feb 03 13:11:32 CSELAB systemd[1]: Reloading LSB: Apache2 web server.
Feb 03 13:11:32 CSELAB apache2[3135]: * Reloading Apache httpd web server apache2
Feb 03 13:11:32 CSELAB apache2[3135]: *
Feb 03 13:11:32 CSELAB systemd[1]: Reloaded LSB: Apache2 web server.
lines 1-25/25 (END)
```

- The Apache Server also needs to be configured to allow persistent connections. This is done by editing the **apache2.conf** configuration file and setting the options

o **Keep Alive to On**

o **MaxKeepAliveRequests to 2**

Command: \$sudo nano /etc/apache2/apache2.conf

```
GNU nano 2.5.3 File: apache2.conf
PidFile ${APACHE_PID_FILE}

#
# Timeout: The number of seconds before receives and sends time out.
#
Timeout 300

#
# KeepAlive: Whether or not to allow persistent connections (more than
# one request per connection). Set to "Off" to deactivate.
#
KeepAlive On

#
# MaxKeepAliveRequests: The maximum number of requests to allow
# during a persistent connection. Set to 0 to allow an unlimited amount.
# We recommend you leave this number high, for maximum performance.
#
MaxKeepAliveRequests 2

#
# KeepAliveTimeout: Number of seconds to wait for the next request from the
# same client on the same connection.
#
KeepAliveTimeout 5

# These need to be set in /etc/apache2/envvars
User ${APACHE_RUN_USER}
Group ${APACHE_RUN_GROUP}

#
# HostnameLookups: Log the names of clients or just their IP addresses
# e.g., www.apache.org (on) or 204.62.129.132 (off).
# The default is off because it'd be overall better for the net if people
# had to knowingly turn this feature on, since enabling it means that
```

1.2 Adding Custom IP Addresses for Server and Client

- A custom IP Address was set for both the Server and Client machines
- The **Server IP Address** was set to **10.0.8.06/24** and the **Client IP Address** was set to **10.0.8.80/24**
- The IP address were assigned using the **sudo ip addr add** command

```
student@CSELAB:~$ ifconfig
enp2s0    Link encap:Ethernet  HWaddr b8:ae:ed:a5:a5:4d
          inet addr:10.0.8.6  Bcast:10.0.8.255  Mask:255.255.255.0
          inet6 addr: fe80::a22f:b0bb:60d3:8e1c/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:25492 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17867 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:30679387 (30.6 MB)  TX bytes:1932660 (1.9 MB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:6566 errors:0 dropped:0 overruns:0 frame:0
          TX packets:6566 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:525327 (525.3 KB)  TX bytes:525327 (525.3 KB)

student@CSELAB:~$
```

1.3 Hosting the Webpage

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

```
student@CSELAB: /var/www/html
student@CSELAB:/var/www/html$ ls
img10.jpg  img2.jpg  img4.jpg  img6.jpg  img8.jpg  index1.html  info.php
img1.jpg   img3.jpg  img5.jpg  img7.jpg  img9.jpg  index.html
student@CSELAB:/var/www/html$ cat index1.html
<html>
<head>
<title>WEEK2</title>
</head>
<body>
<h2>IMAGES</h2>











</body>
</html>
student@CSELAB:/var/www/html$
```

Created index1.html file in the path /var/www/html/

```
index1.html (/var/www/html) - g
Open ▾
<html>
<head>
<title>WEEK2</title>
</head>
<body>
<h2>IMAGES</h2>







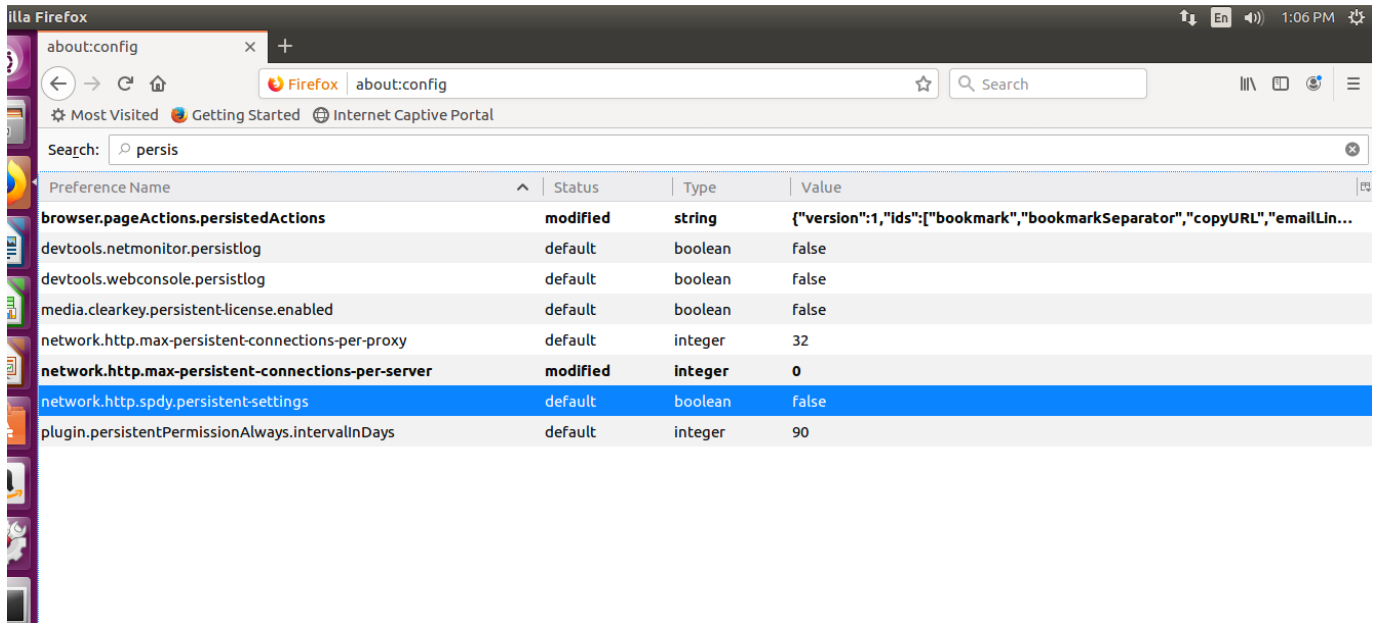




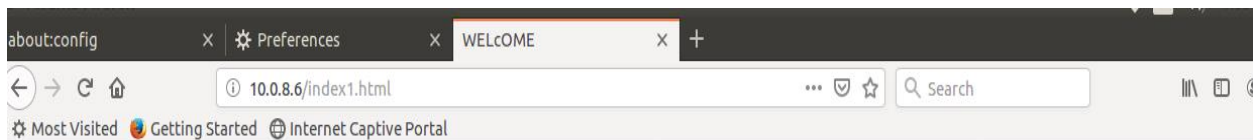
</body>
</html>
```

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**



- Access web page on client-side browser (Firefox)
- The client could access the file as: **10.0.8.6/index1.html**
- Here the file name is index1.html present in server. So, by typing **10.0.8.6/index1.html** in client browser, we will be able to open the requested web page



IMAGES



2.1 Non-Persistent connection Packet Capture Screenshot

No.	Time	Source	Destination	Protocol	Length	Info
70	0.091407617	10.0.8.80	10.0.8.6	HTTP	403	GET /index1.html HTTP/1.1
72	0.092183646	10.0.8.6	10.0.8.80	HTTP	558	HTTP/1.1 200 OK (text/html)
74	0.163577508	10.0.8.80	10.0.8.6	HTTP	359	GET /img1.jpg HTTP/1.1
676	0.210185997	10.0.8.6	10.0.8.80	HTTP	168	HTTP/1.1 200 OK (JPEG JFIF image)
678	0.210405140	10.0.8.80	10.0.8.6	HTTP	359	GET /img2.jpg HTTP/1.1
1117	0.249224614	10.0.8.6	10.0.8.80	HTTP	1630	HTTP/1.1 200 OK (JPEG JFIF image)
1124	0.250148539	10.0.8.80	10.0.8.6	HTTP	359	GET /img3.jpg HTTP/1.1
1270	0.260218720	10.0.8.6	10.0.8.80	HTTP	2109	HTTP/1.1 200 OK (JPEG JFIF image)
1272	0.260307573	10.0.8.80	10.0.8.6	HTTP	359	GET /img4.jpg HTTP/1.1
1511	0.280747265	10.0.8.6	10.0.8.80	HTTP	1067	HTTP/1.1 200 OK (JPEG JFIF image)
1513	0.281545487	10.0.8.80	10.0.8.6	HTTP	359	GET /img5.jpg HTTP/1.1
1661	0.295855039	10.0.8.6	10.0.8.80	HTTP	1199	HTTP/1.1 200 OK (JPEG JFIF image)
1668	0.296475542	10.0.8.80	10.0.8.6	HTTP	359	GET /img6.jpg HTTP/1.1
2969	0.400301483	10.0.8.6	10.0.8.80	HTTP	2228	HTTP/1.1 200 OK (JPEG JFIF image)
2971	0.400393155	10.0.8.80	10.0.8.6	HTTP	359	GET /img7.jpg HTTP/1.1
3686	0.459497404	10.0.8.6	10.0.8.80	HTTP	1094	HTTP/1.1 200 OK (JPEG JFIF image)
3687	0.459596084	10.0.8.80	10.0.8.6	HTTP	359	GET /img8.jpg HTTP/1.1
5178	0.583068042	10.0.8.6	10.0.8.80	HTTP	1928	HTTP/1.1 200 OK (JPEG JFIF image)
5185	0.583492723	10.0.8.80	10.0.8.6	HTTP	359	GET /img9.jpg HTTP/1.1
5746	0.627384689	10.0.8.6	10.0.8.80	HTTP	1281	HTTP/1.1 200 OK (JPEG JFIF image)
5748	0.627480568	10.0.8.80	10.0.8.6	HTTP	360	GET /img10.jpg HTTP/1.1
6143	0.663101968	10.0.8.6	10.0.8.80	HTTP	1180	HTTP/1.1 200 OK (JPEG JFIF image)
6144	0.665035957	10.0.8.80	10.0.8.6	HTTP	324	GET /favicon.ico HTTP/1.1
6145	0.665383064	10.0.8.6	10.0.8.80	HTTP	518	HTTP/1.1 404 Not Found (text/html)

$$0.663101968 - 0.091407617 = 0.571694351$$

3. Persistent Connection

- To setup a persistent connection, we need to configure a few settings on our browser
- On Firefox, we set the max-persistent-connections-per-server to anything greater than 0 and persistent-settings to **true**

Preference Name	Status	Type	Value
browser.pageActions.persistedActions	modified	string	{"version":1,
devtools.netmonitor.persistlog	default	boolean	false
devtools.webconsole.persistlog	default	boolean	false
media.clearkey.persistent-license.enabled	default	boolean	false
network.http.max-persistent-connections-per-proxy	default	integer	32
network.http.max-persistent-connections-per-server	modified	integer	2
network.http.spdy.persistent-settings	modified	boolean	true
plugin.persistentPermissionAlways.intervallInDays	default	integer	90

3.1. 2 Persistent Connections Packet Capture Screenshot

No.	Time	Source	Destination	Protocol	Length	Info
68	0.077573273	10.0.8.80	10.0.8.6	HTTP	403	GET /index1.html HTTP/1.1
70	0.078812951	10.0.8.6	10.0.8.80	HTTP	558	HTTP/1.1 200 OK (text/html)
72	0.156406167	10.0.8.80	10.0.8.6	HTTP	359	GET /img1.jpg HTTP/1.1
76	0.157024880	10.0.8.80	10.0.8.6	HTTP	359	GET /img2.jpg HTTP/1.1
1080	0.234903931	10.0.8.6	10.0.8.80	HTTP	1665	HTTP/1.1 200 OK (JPEG JFIF image)
1083	0.235027476	10.0.8.80	10.0.8.6	HTTP	359	GET /img3.jpg HTTP/1.1
1224	0.247108868	10.0.8.6	10.0.8.80	HTTP	1616	HTTP/1.1 200 OK (JPEG JFIF image)
1227	0.247226956	10.0.8.80	10.0.8.6	HTTP	359	GET /img4.jpg HTTP/1.1
1310	0.254266683	10.0.8.6	10.0.8.80	HTTP	661	HTTP/1.1 200 OK (JPEG JFIF image)
1311	0.254377635	10.0.8.80	10.0.8.6	HTTP	359	GET /img5.jpg HTTP/1.1
1657	0.282955477	10.0.8.6	10.0.8.80	HTTP	1199	HTTP/1.1 200 OK (JPEG JFIF image)
1681	0.284343866	10.0.8.80	10.0.8.6	HTTP	359	GET /img6.jpg HTTP/1.1
1689	0.285070626	10.0.8.6	10.0.8.80	HTTP	2480	HTTP/1.1 200 OK (JPEG JFIF image)
1719	0.286505503	10.0.8.80	10.0.8.6	HTTP	359	GET /img7.jpg HTTP/1.1
3230	0.405721288	10.0.8.6	10.0.8.80	HTTP	1094	HTTP/1.1 200 OK (JPEG JFIF image)
3233	0.405884057	10.0.8.80	10.0.8.6	HTTP	359	GET /img8.jpg HTTP/1.1
4219	0.487051736	10.0.8.6	10.0.8.80	HTTP	780	HTTP/1.1 200 OK (JPEG JFIF image)
4221	0.487150904	10.0.8.80	10.0.8.6	HTTP	359	GET /img9.jpg HTTP/1.1
5292	0.575197536	10.0.8.6	10.0.8.80	HTTP	1281	HTTP/1.1 200 OK (JPEG JFIF image)
5293	0.575287140	10.0.8.80	10.0.8.6	HTTP	360	GET /img10.jpg HTTP/1.1
6146	0.645616423	10.0.8.6	10.0.8.80	HTTP	1145	HTTP/1.1 200 OK (JPEG JFIF image)
6180	0.648371233	10.0.8.6	10.0.8.80	HTTP	1963	HTTP/1.1 200 OK (JPEG JFIF image)
6182	0.649760194	10.0.8.80	10.0.8.6	HTTP	324	GET /favicon.ico HTTP/1.1
6183	0.650080096	10.0.8.6	10.0.8.80	HTTP	518	HTTP/1.1 404 Not Found (text/html)

$$0.648371233 - 0.077573273 = 0.57079796$$

3.2. 4 Persistent Connections Packet Capture Screenshot

Preference Name	Status	Type	Value
login.persistentPermissionAlways.intervalInDays	default	integer	90
network.http.spdy.persistent-settings	modified	boolean	true
network.http.max-persistent-connections-per-server	modified	integer	4
network.http.max-persistent-connections-per-proxy	default	integer	32
media.clearkey.persistent-license.enabled	default	boolean	false
evtools.webconsole.persistlog	default	boolean	false
evtools.netmonitor.persistlog	default	boolean	false
browser.pageActions.persistedActions	modified	string	{"version":1,

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help						
http						
No.	Time	Source	Destination	Protocol	Length	Info
196	1.849693076	10.0.8.80	10.0.8.6	HTTP	403	GET /index1.html HTTP/1.1
198	1.850907783	10.0.8.6	10.0.8.80	HTTP	558	HTTP/1.1 200 OK (text/html)
200	1.911510400	10.0.8.80	10.0.8.6	HTTP	359	GET /img1.jpg HTTP/1.1
206	1.912570734	10.0.8.80	10.0.8.6	HTTP	359	GET /img2.jpg HTTP/1.1
246	1.914629134	10.0.8.80	10.0.8.6	HTTP	359	GET /img3.jpg HTTP/1.1
273	1.916129104	10.0.8.80	10.0.8.6	HTTP	359	GET /img4.jpg HTTP/1.1
850	1.954337022	10.0.8.6	10.0.8.80	HTTP	661	HTTP/1.1 200 OK (JPEG JFIF image)
853	1.954630902	10.0.8.80	10.0.8.6	HTTP	359	GET /img5.jpg HTTP/1.1
1520	2.009239508	10.0.8.6	10.0.8.80	HTTP	1067	HTTP/1.1 200 OK (JPEG JFIF image)
1527	2.009754555	10.0.8.80	10.0.8.6	HTTP	359	GET /img6.jpg HTTP/1.1
1539	2.010648760	10.0.8.6	10.0.8.80	HTTP	1234	HTTP/1.1 200 OK (JPEG JFIF image)
1543	2.011038298	10.0.8.80	10.0.8.6	HTTP	359	GET /img7.jpg HTTP/1.1
2094	2.057543261	10.0.8.6	10.0.8.80	HTTP	217	HTTP/1.1 200 OK (JPEG JFIF image)
2100	2.057879907	10.0.8.80	10.0.8.6	HTTP	359	GET /img8.jpg HTTP/1.1
2380	2.080806283	10.0.8.6	10.0.8.80	HTTP	168	HTTP/1.1 200 OK (JPEG JFIF image)
2383	2.080900099	10.0.8.80	10.0.8.6	HTTP	359	GET /img9.jpg HTTP/1.1
4380	2.245022485	10.0.8.6	10.0.8.80	HTTP	1059	HTTP/1.1 200 OK (JPEG JFIF image)
4409	2.246950552	10.0.8.80	10.0.8.6	HTTP	360	GET /img10.jpg HTTP/1.1
4509	2.254607127	10.0.8.6	10.0.8.80	HTTP	1246	HTTP/1.1 200 OK (JPEG JFIF image)
5586	2.368317407	10.0.8.6	10.0.8.80	HTTP	1180	HTTP/1.1 200 OK (JPEG JFIF image)
5874	2.392054117	10.0.8.6	10.0.8.80	HTTP	780	HTTP/1.1 200 OK (JPEG JFIF image)
6230	2.422478991	10.0.8.6	10.0.8.80	HTTP	515	HTTP/1.1 200 OK (JPEG JFIF image)
6232	2.459300074	10.0.8.80	10.0.8.6	HTTP	324	GET /favicon.ico HTTP/1.1
6233	2.459788947	10.0.8.6	10.0.8.80	HTTP	518	HTTP/1.1 404 Not Found (text/html)

$$2.422478991 - 1.849693076 = 0.572785915$$

3.4. 6 Persistent Connections Packet Capture Screenshot

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help						
http						
No.	Time	Source	Destination	Protocol	Length	Info
198	5.428478889	10.0.8.80	10.0.8.6	HTTP	403	GET /index1.html HTTP/1.1
200	5.429856708	10.0.8.6	10.0.8.80	HTTP	558	HTTP/1.1 200 OK (text/html)
202	5.486510265	10.0.8.80	10.0.8.6	HTTP	359	GET /img1.jpg HTTP/1.1
227	5.488594290	10.0.8.80	10.0.8.6	HTTP	359	GET /img2.jpg HTTP/1.1
260	5.490160002	10.0.8.80	10.0.8.6	HTTP	359	GET /img3.jpg HTTP/1.1
267	5.490414255	10.0.8.80	10.0.8.6	HTTP	359	GET /img4.jpg HTTP/1.1
282	5.491200008	10.0.8.80	10.0.8.6	HTTP	359	GET /img5.jpg HTTP/1.1
287	5.491305596	10.0.8.80	10.0.8.6	HTTP	359	GET /img6.jpg HTTP/1.1
1215	5.552619825	10.0.8.6	10.0.8.80	HTTP	661	HTTP/1.1 200 OK (JPEG JFIF image)
1219	5.552736255	10.0.8.80	10.0.8.6	HTTP	359	GET /img7.jpg HTTP/1.1
1566	5.581329458	10.0.8.6	10.0.8.80	HTTP	1234	HTTP/1.1 200 OK (JPEG JFIF image)
1573	5.581694281	10.0.8.80	10.0.8.6	HTTP	359	GET /img8.jpg HTTP/1.1
2043	5.620156143	10.0.8.6	10.0.8.80	HTTP	1067	HTTP/1.1 200 OK (JPEG JFIF image)
2046	5.620280228	10.0.8.80	10.0.8.6	HTTP	359	GET /img9.jpg HTTP/1.1
2731	5.677502477	10.0.8.6	10.0.8.80	HTTP	1616	HTTP/1.1 200 OK (JPEG JFIF image)
2733	5.677588338	10.0.8.80	10.0.8.6	HTTP	360	GET /img10.jpg HTTP/1.1
3433	5.734860327	10.0.8.6	10.0.8.80	HTTP	217	HTTP/1.1 200 OK (JPEG JFIF image)
4454	5.818633945	10.0.8.6	10.0.8.80	HTTP	1145	HTTP/1.1 200 OK (JPEG JFIF image)
4878	5.853188919	10.0.8.6	10.0.8.80	HTTP	1281	HTTP/1.1 200 OK (JPEG JFIF image)
5225	5.881694331	10.0.8.6	10.0.8.80	HTTP	1094	HTTP/1.1 200 OK (JPEG JFIF image)
5926	5.939285892	10.0.8.6	10.0.8.80	HTTP	2228	HTTP/1.1 200 OK (JPEG JFIF image)
6397	5.978476761	10.0.8.6	10.0.8.80	HTTP	1963	HTTP/1.1 200 OK (JPEG JFIF image)
6399	5.979803063	10.0.8.80	10.0.8.6	HTTP	324	GET /favicon.ico HTTP/1.1
6400	5.980176396	10.0.8.6	10.0.8.80	HTTP	518	HTTP/1.1 404 Not Found (text/html)

$$5.978476761 - 5.428478889 = 0.549997872$$

3.5. 10 Persistent Connections Packet Capture Screenshot

No.	Time	Source	Destination	Protocol	Length	Info
68	0.059048913	10.0.8.80	10.0.8.6	HTTP	403	GET /index1.html HTTP/1.1
70	0.060251487	10.0.8.6	10.0.8.80	HTTP	558	HTTP/1.1 200 OK (text/html)
72	0.113862106	10.0.8.80	10.0.8.6	HTTP	359	GET /img1.jpg HTTP/1.1
169	0.120209915	10.0.8.80	10.0.8.6	HTTP	359	GET /img3.jpg HTTP/1.1
170	0.120251842	10.0.8.80	10.0.8.6	HTTP	359	GET /img2.jpg HTTP/1.1
241	0.124205274	10.0.8.80	10.0.8.6	HTTP	359	GET /img4.jpg HTTP/1.1
253	0.124713508	10.0.8.80	10.0.8.6	HTTP	359	GET /img5.jpg HTTP/1.1
295	0.126786546	10.0.8.80	10.0.8.6	HTTP	359	GET /img6.jpg HTTP/1.1
390	0.131963638	10.0.8.80	10.0.8.6	HTTP	359	GET /img7.jpg HTTP/1.1
393	0.132158393	10.0.8.80	10.0.8.6	HTTP	359	GET /img8.jpg HTTP/1.1
394	0.132177559	10.0.8.80	10.0.8.6	HTTP	359	GET /img9.jpg HTTP/1.1
395	0.132192042	10.0.8.80	10.0.8.6	HTTP	360	GET /img10.jpg HTTP/1.1
1272	0.188488145	10.0.8.6	10.0.8.80	HTTP	661	HTTP/1.1 200 OK (JPEG JFIF image)
2172	0.256924198	10.0.8.6	10.0.8.80	HTTP	1234	HTTP/1.1 200 OK (JPEG JFIF image)
2788	0.307503742	10.0.8.6	10.0.8.80	HTTP	1067	HTTP/1.1 200 OK (JPEG JFIF image)
3639	0.377216820	10.0.8.6	10.0.8.80	HTTP	168	HTTP/1.1 200 OK (JPEG JFIF image)
4112	0.415974451	10.0.8.6	10.0.8.80	HTTP	1180	HTTP/1.1 200 OK (JPEG JFIF image)
4182	0.421512978	10.0.8.6	10.0.8.80	HTTP	217	HTTP/1.1 200 OK (JPEG JFIF image)
4604	0.456202544	10.0.8.6	10.0.8.80	HTTP	1281	HTTP/1.1 200 OK (JPEG JFIF image)
5346	0.516955609	10.0.8.6	10.0.8.80	HTTP	1094	HTTP/1.1 200 OK (JPEG JFIF image)
5793	0.553625208	10.0.8.6	10.0.8.80	HTTP	2228	HTTP/1.1 200 OK (JPEG JFIF image)
6439	0.605857425	10.0.8.6	10.0.8.80	HTTP	1963	HTTP/1.1 200 OK (JPEG JFIF image)
6441	0.607002109	10.0.8.80	10.0.8.6	HTTP	324	GET /favicon.ico HTTP/1.1
6442	0.607445565	10.0.8.6	10.0.8.80	HTTP	553	HTTP/1.1 404 Not Found (text/html)

$$0.605857425 - 0.059048913 = 0.546808512$$

4. Observations:

- We can calculate the total load time as the difference between the first GET time which corresponds to the time when the html page was requested and the last response time, which corresponds to when the last image was sent back.
- On doing so, we can construct the following observations table –

Persistent Connections	Time at first GET	Time at last Response	Load Time
0	0.091407617	0.663101968	0.571694351
2	0.077573273	0.648371233	0.57079796
4	1.849693076	2.422478991	0.572785915
6	5.428478889	5.978476761	0.549997872
10	0.059048913	0.605857425	0.546808512