

PES UNIVERSITY EC CAMPUS, BANGALORE
COMPUTER NETWORK LABORATORY
WEEK #2

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SEM: 4B

DATE: 06/02/2023

AIM: To understand persistent and non-persistent HTTP connections and corresponding performance impact

1. Installing apache and making sure the server is running.

```
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset: enabled)
   Active: active (running) since Mon 2023-02-06 11:52:10 IST; 24s ago
     Docs: https://httpd.apache.org/docs/2.4/
   Main PID: 3691 (apache2)
    Tasks: 55 (limit: 12786)
   Memory: 5.2M
      CPU: 42ms
   CGroup: /system.slice/apache2.service
           └─3691 /usr/sbin/apache2 -k start
             └─3692 /usr/sbin/apache2 -k start
               └─3693 /usr/sbin/apache2 -k start

Feb 06 11:52:10 atharva-VirtualBox systemd[1]: Starting The Apache HTTP Server...
Feb 06 11:52:10 atharva-VirtualBox apache2[3690]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. S
Feb 06 11:52:10 atharva-VirtualBox systemd[1]: Started The Apache HTTP Server.
```

service appears to have started successfully.

2. Server IP Address is 192.168.1.15/24

```
atharva@atharva-VirtualBox:~$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default 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 group default qlen 1000
   link/ether 08:00:27:01:72:e4 brd ff:ff:ff:ff:ff:ff
   inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3
       valid_lft 85901sec preferred_lft 85901sec
   inet6 fe80::a618:a80d:8d09:ba20/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
```

3. In apache2.conf

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

- b. The MaximumKeepAliveRequestswere set to 2

```
Timeout 300

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

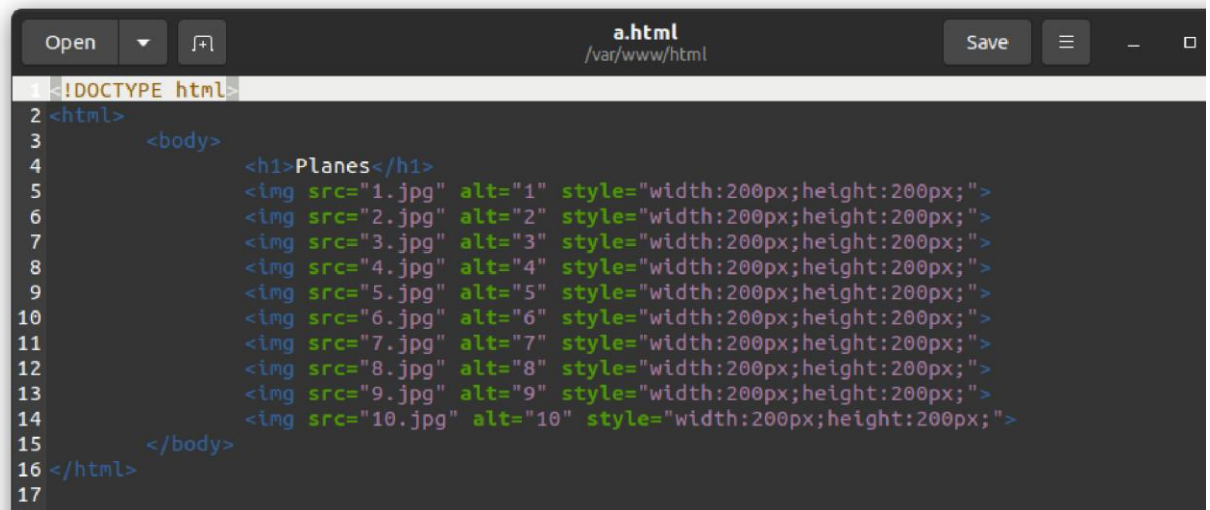
#
# MaxKeepAliveRequests: The maximum number of requests to allow
# during a persistent connection. Set to 0 to allow an unlimited amount.
# We recommend you leave this number high, for maximum performance.
#
MaxKeepAliveRequests 2

#
# 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}

#
```

4. Stored images and created a.html



```
a.html
/var/www/html

1 <!DOCTYPE html>
2 <html>
3   <body>
4     <h1>Planes</h1>
5     
6     
7     
8     
9     
10    
11    
12    
13    
14    
15  </body>
16 </html>
17
```

Observations:

1. Non Persistent

*wlp0s20f3

No.	Time	Source	Destination	Protocol	Length	Info
62	9.035331983	192.168.1.8	192.168.1.15	HTTP	479	GET /a.html HTTP/1.1
65	9.036246253	192.168.1.15	192.168.1.8	HTTP	589	HTTP/1.1 200 OK (text/html)
67	9.074566837	192.168.1.8	192.168.1.15	HTTP	453	GET /1.jpg HTTP/1.1
69	9.074567084	192.168.1.8	192.168.1.15	HTTP	452	GET /2.jpg HTTP/1.1
71	9.075095490	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
72	9.075188789	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
74	9.094824553	192.168.1.8	192.168.1.15	HTTP	453	GET /3.jpg HTTP/1.1
76	9.094824781	192.168.1.8	192.168.1.15	HTTP	453	GET /4.jpg HTTP/1.1
78	9.095463364	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
79	9.095485146	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
80	9.227086556	192.168.1.8	192.168.1.15	HTTP	453	GET /5.jpg HTTP/1.1
82	9.227086832	192.168.1.8	192.168.1.15	HTTP	453	GET /6.jpg HTTP/1.1
84	9.227525111	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
85	9.227559250	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
86	9.244668979	192.168.1.8	192.168.1.15	HTTP	453	GET /7.jpg HTTP/1.1
87	9.244669226	192.168.1.8	192.168.1.15	HTTP	453	GET /8.jpg HTTP/1.1
89	9.245172547	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
90	9.245194751	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
91	9.265224436	192.168.1.8	192.168.1.15	HTTP	453	GET /9.jpg HTTP/1.1
92	9.265224683	192.168.1.8	192.168.1.15	HTTP	454	GET /10.jpg HTTP/1.1
93	9.265761728	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
94	9.265728942	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified

$$\text{Time} = 9.265224683 - 9.074566837$$

$$= 0.1906578513$$

2. Persistent - 2

*wlp0s20f3

No.	Time	Source	Destination	Protocol	Length	Info
88	19.665143383	192.168.1.8	192.168.1.15	HTTP	453	GET /7.jpg HTTP/1.1
90	19.665144097	192.168.1.8	192.168.1.15	HTTP	453	GET /8.jpg HTTP/1.1
91	19.665583356	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
92	19.665610499	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
93	19.672924070	192.168.1.8	192.168.1.15	HTTP	453	GET /9.jpg HTTP/1.1
94	19.672924325	192.168.1.8	192.168.1.15	HTTP	454	GET /10.jpg HTTP/1.1
95	19.673342828	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
96	19.673368501	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
180	43.616626910	192.168.1.8	192.168.1.15	HTTP	479	GET /a.html HTTP/1.1
182	43.617553450	192.168.1.15	192.168.1.8	HTTP	589	HTTP/1.1 200 OK (text/html)
190	43.657193471	192.168.1.8	192.168.1.15	HTTP	453	GET /1.jpg HTTP/1.1
192	43.657193758	192.168.1.8	192.168.1.15	HTTP	452	GET /2.jpg HTTP/1.1
194	43.657676715	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
195	43.657698074	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
197	43.670549349	192.168.1.8	192.168.1.15	HTTP	453	GET /3.jpg HTTP/1.1
199	43.670549576	192.168.1.8	192.168.1.15	HTTP	453	GET /4.jpg HTTP/1.1
201	43.671007183	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
202	43.671030965	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
203	43.672755758	192.168.1.8	192.168.1.15	HTTP	453	GET /5.jpg HTTP/1.1
207	43.673066986	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
208	43.687542980	192.168.1.8	192.168.1.15	HTTP	453	GET /6.jpg HTTP/1.1
210	43.687543241	192.168.1.8	192.168.1.15	HTTP	453	GET /7.jpg HTTP/1.1
211	43.688011105	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
212	43.688032344	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
213	43.707139326	192.168.1.8	192.168.1.15	HTTP	453	GET /8.jpg HTTP/1.1
215	43.707139576	192.168.1.8	192.168.1.15	HTTP	453	GET /9.jpg HTTP/1.1
216	43.707586902	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
217	43.707610586	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
218	43.727102052	192.168.1.8	192.168.1.15	HTTP	454	GET /10.jpg HTTP/1.1
219	43.727437501	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified

$$\text{Time} = 43.727102052 - 43.657193471$$

$$= 0.069908581$$

3. Persistent - 4

*wlp0s20f3

No.	Time	Source	Destination	Protocol	Length	Info
36	8.515465141	192.168.1.8	192.168.1.15	HTTP	479	GET /a.html HTTP/1.1
38	8.516332425	192.168.1.15	192.168.1.8	HTTP	589	HTTP/1.1 200 OK (text/html)
47	8.532432291	192.168.1.8	192.168.1.15	HTTP	453	GET /1.jpg HTTP/1.1
50	8.532432517	192.168.1.8	192.168.1.15	HTTP	452	GET /2.jpg HTTP/1.1
53	8.532886211	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
54	8.532906953	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
55	8.534528143	192.168.1.8	192.168.1.15	HTTP	453	GET /3.jpg HTTP/1.1
57	8.534528473	192.168.1.8	192.168.1.15	HTTP	453	GET /4.jpg HTTP/1.1
60	8.534953432	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
61	8.535615174	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
63	8.538337400	192.168.1.8	192.168.1.15	HTTP	453	GET /5.jpg HTTP/1.1
65	8.538337623	192.168.1.8	192.168.1.15	HTTP	453	GET /6.jpg HTTP/1.1
68	8.538649006	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
69	8.538666261	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
70	8.540992508	192.168.1.8	192.168.1.15	HTTP	453	GET /7.jpg HTTP/1.1
72	8.540992732	192.168.1.8	192.168.1.15	HTTP	453	GET /8.jpg HTTP/1.1
74	8.541323255	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
75	8.541357501	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
76	8.554812843	192.168.1.8	192.168.1.15	HTTP	453	GET /9.jpg HTTP/1.1
78	8.554813130	192.168.1.8	192.168.1.15	HTTP	454	GET /10.jpg HTTP/1.1
80	8.555225468	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
81	8.555273740	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified

$$\begin{aligned}\text{Time} &= 8.554813130 - 8.532432291 \\ &= 0.022380839\end{aligned}$$

4. Persistent - 6

*wlp0s20f3

No.	Time	Source	Destination	Protocol	Length	Info
26	6.717216914	192.168.1.8	192.168.1.15	HTTP	479	GET /a.html HTTP/1.1
28	6.718136484	192.168.1.15	192.168.1.8	HTTP	589	HTTP/1.1 200 OK (text/html)
42	6.740942358	192.168.1.8	192.168.1.15	HTTP	453	GET /1.jpg HTTP/1.1
44	6.740942551	192.168.1.8	192.168.1.15	HTTP	452	GET /2.jpg HTTP/1.1
46	6.741320538	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
47	6.741420260	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
50	6.747919036	192.168.1.8	192.168.1.15	HTTP	453	GET /3.jpg HTTP/1.1
52	6.747919283	192.168.1.8	192.168.1.15	HTTP	453	GET /4.jpg HTTP/1.1
55	6.747919491	192.168.1.8	192.168.1.15	HTTP	453	GET /5.jpg HTTP/1.1
57	6.747919462	192.168.1.8	192.168.1.15	HTTP	453	GET /6.jpg HTTP/1.1
59	6.748431910	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
60	6.748454898	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
61	6.748472132	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
62	6.748546586	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
66	6.752973250	192.168.1.8	192.168.1.15	HTTP	453	GET /7.jpg HTTP/1.1
68	6.752973590	192.168.1.8	192.168.1.15	HTTP	453	GET /8.jpg HTTP/1.1
72	6.753330624	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
73	6.753348151	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
74	6.766620829	192.168.1.8	192.168.1.15	HTTP	453	GET /9.jpg HTTP/1.1
76	6.766621079	192.168.1.8	192.168.1.15	HTTP	454	GET /10.jpg HTTP/1.1
78	6.767055230	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
79	6.767076257	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified

$$\begin{aligned}\text{Time} &= 6.766621079 - 6.740942358 \\ &= 0.025678721\end{aligned}$$

5. Persistent - 10

*wlp0s20f3

No.	Time	Source	Destination	Protocol	Length	Info
49	4.624096321	192.168.1.8	192.168.1.15	HTTP	479	GET /a.html HTTP/1.1
51	4.624915606	192.168.1.15	192.168.1.8	HTTP	589	HTTP/1.1 200 OK (text/html)
63	4.647147765	192.168.1.8	192.168.1.15	HTTP	453	GET /1.jpg HTTP/1.1
69	4.647153690	192.168.1.8	192.168.1.15	HTTP	453	GET /3.jpg HTTP/1.1
76	4.647575617	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
77	4.647602793	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
81	4.657511903	192.168.1.8	192.168.1.15	HTTP	453	GET /4.jpg HTTP/1.1
82	4.657509684	192.168.1.8	192.168.1.15	HTTP	452	GET /2.jpg HTTP/1.1
86	4.657678356	192.168.1.8	192.168.1.15	HTTP	453	GET /5.jpg HTTP/1.1
89	4.657678417	192.168.1.8	192.168.1.15	HTTP	453	GET /6.jpg HTTP/1.1
91	4.658041806	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
92	4.658058667	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
93	4.658084999	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
94	4.658103995	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
97	4.659880046	192.168.1.8	192.168.1.15	HTTP	453	GET /7.jpg HTTP/1.1
99	4.659880163	192.168.1.8	192.168.1.15	HTTP	453	GET /8.jpg HTTP/1.1
103	4.660414099	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
104	4.660432835	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified
110	4.662460604	192.168.1.8	192.168.1.15	HTTP	453	GET /9.jpg HTTP/1.1
112	4.662512580	192.168.1.8	192.168.1.15	HTTP	454	GET /10.jpg HTTP/1.1
114	4.662788274	192.168.1.15	192.168.1.8	HTTP	249	HTTP/1.1 304 Not Modified
115	4.662910900	192.168.1.15	192.168.1.8	HTTP	250	HTTP/1.1 304 Not Modified

$$\begin{aligned} \text{Time} &= 4.662512580 - 4.647147765 \\ &= 0.015364815 \end{aligned}$$