

1 Name:

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3 Name of code files:

non_persistent_http_HuilinZhang_917071562_TingweiLiu_917707784.py

persistent_http_HuilinZhang_917071562_TingweiLiu_917707784.py

4. Screen shot of Non-persistent http:

```
[Running] python -u "/Users/huilinzhang/Documents/GitHub/ECS152A_Project1/non_persistent_http_HuilinZhang_917071562_TingweiLiu_917707784.py"
*****
HTTP Client Version: Non-persistent HTTP
Total PLT = 0.07205319404602051
Average Request Delay = 0.012090527788867805
ATF PLT = 0.023411989212036133
RPS = 30.777692879994323
*****

[Done] exited with code=0 in 20.164 seconds
```

Persistent http:

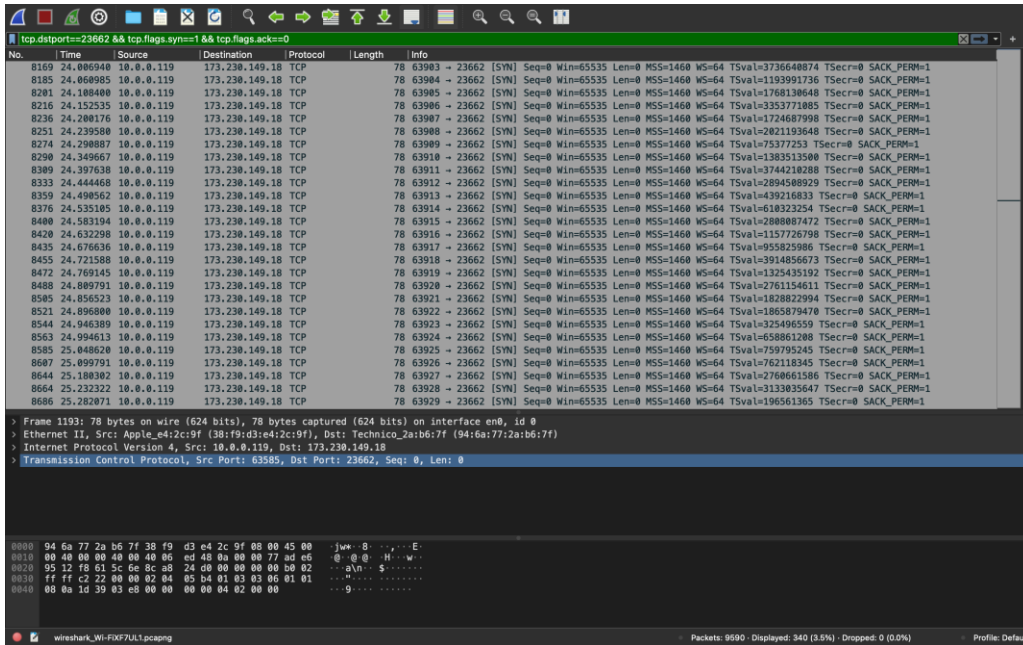
```
*****
HTTP Client Version: Persistent HTTP
Total PLT = 0.13712525367736816
Average Request Delay = 0.007615311246686411
ATF PLT = 0.02921438217163086
RPS = 9.86385561498517
*****

[Done] exited with code=0 in 18.709 seconds
```

Reconnect to Discord Ln 100, Col 19 Spaces: 4 UTF-8 CRLF MagicPython 3.8.2 64-bit

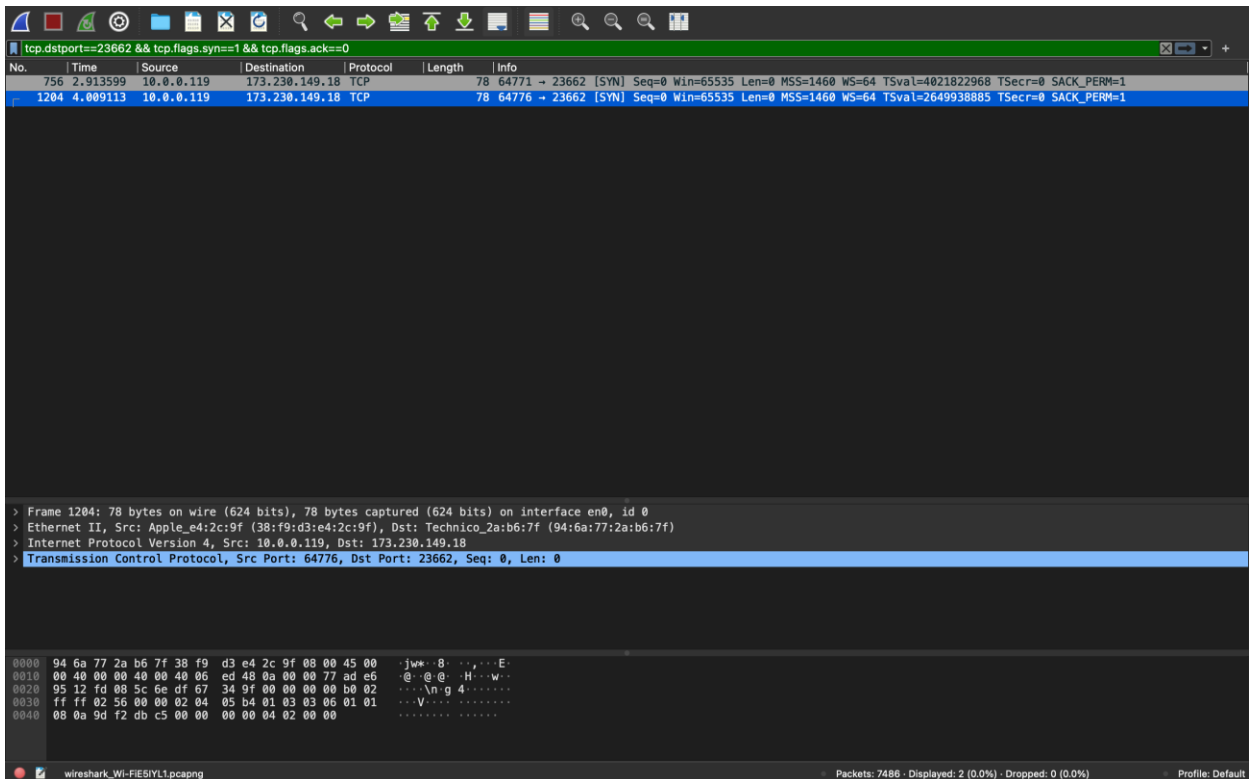
Question I: TCP Protocol

- A) The total number of TCP sockets used by **Non-persistent** http is 340. 335 images are got from the project server. Each image uses one separate socket. 3 images from different websites uses another 3 socket. Get index.html request uses one socket and the “three way handshake” uses another socket. Thus, $335+3+1+1 = 340$ TCP sockets are used. The result can also be proved by the wireshark:



The total number of Persistent http is 2. This is because one socket is used to do “three-way handshake” and one socket are used to get index.html file and the rest of the images.

Screen shot of the wireshark are attached below:



B)

For non-persistent protocol, there are 339 client ports used. 338 ports are used for get image. One port used for get index.html.

The screenshot shows a Wireshark packet capture of a non-persistent HTTP protocol. The filter is set to 'Ethernet I - 1 IPv4 - 1 IPv6 TCP - 339 UDP'. The table displays 339 individual TCP connections. Each connection is initiated by the client (10.0.0.119) to the server (173.230.149.18) on port 23662. The 'Packets' column shows a range from 19 to 6, and the 'Bytes' column shows a range from 1333 to 116 k. The 'Rel Start' column shows a range from 6.621185 to 9.705571. The 'Duration' column shows a range from 0.0963 to 0.0411. The 'Bits/s A -> B' column shows a range from 110 k to 94 k. The 'Bits/s B -> A' column shows a range from 0 to 0. The 'Conversation Types' dropdown is set to 'TCP'. The 'Limit to display filter' checkbox is checked. The 'Absolute start time' checkbox is unchecked. The 'Help' button is visible. The 'Copy' button is visible. The 'Follow Stream...' button is visible. The 'Graph...' button is visible. The 'Close' button is visible.

Address A	Port A	Address B	Port B	Packets	Bytes	Packets A -> B	Bytes A -> B	Packets B -> A	Bytes B -> A	Rel Start	Duration	Bits/s A -> B	Bits/s B -> A
10.0.0.119	63585	173.230.149.18	23662	19	1333	19	1333	0	0	6.621185	0.0963	110 k	0
10.0.0.119	63586	173.230.149.18	23662	4	276	4	276	0	0	6.780594	0.1517	14 k	0
10.0.0.119	63588	173.230.149.18	23662	4	276	4	276	0	0	6.941417	0.2847	7755	0
10.0.0.119	63590	173.230.149.18	23662	4	276	4	276	0	0	7.389447	0.3592	6147	0
10.0.0.119	63592	173.230.149.18	23662	6	494	6	494	0	0	7.905212	0.0451	87 k	0
10.0.0.119	63593	173.230.149.18	23662	6	484	6	484	0	0	7.950626	0.0481	80 k	0
10.0.0.119	63594	173.230.149.18	23662	6	496	6	496	0	0	7.999052	0.0472	82 k	0
10.0.0.119	63595	173.230.149.18	23662	6	490	6	490	0	0	8.046474	0.0460	85 k	0
10.0.0.119	63596	173.230.149.18	23662	6	493	6	493	0	0	8.092602	0.0726	54 k	0
10.0.0.119	63597	173.230.149.18	23662	7	548	7	548	0	0	8.165412	0.0417	105 k	0
10.0.0.119	63598	173.230.149.18	23662	6	495	6	495	0	0	8.207327	0.0479	82 k	0
10.0.0.119	63599	173.230.149.18	23662	6	496	6	496	0	0	8.255364	0.0506	78 k	0
10.0.0.119	63600	173.230.149.18	23662	6	492	6	492	0	0	8.306102	0.0485	84 k	0
10.0.0.119	63601	173.230.149.18	23662	8	635	8	635	0	0	8.352774	0.0486	104 k	0
10.0.0.119	63602	173.230.149.18	23662	6	497	6	497	0	0	8.401639	0.0464	85 k	0
10.0.0.119	63603	173.230.149.18	23662	6	478	6	478	0	0	8.448371	0.0505	75 k	0
10.0.0.119	63604	173.230.149.18	23662	6	514	6	514	0	0	8.499051	0.0498	82 k	0
10.0.0.119	63605	173.230.149.18	23662	6	498	6	498	0	0	8.549012	0.0499	79 k	0
10.0.0.119	63606	173.230.149.18	23662	6	485	6	485	0	0	8.599169	0.0335	115 k	0
10.0.0.119	63607	173.230.149.18	23662	6	477	6	477	0	0	8.632873	0.0459	83 k	0
10.0.0.119	63608	173.230.149.18	23662	7	564	7	564	0	0	8.679218	0.0470	95 k	0
10.0.0.119	63609	173.230.149.18	23662	6	509	6	509	0	0	8.726430	0.0444	91 k	0
10.0.0.119	63610	173.230.149.18	23662	6	498	6	498	0	0	8.771092	0.0352	113 k	0
10.0.0.119	63611	173.230.149.18	23662	6	485	6	485	0	0	8.806517	0.0511	75 k	0
10.0.0.119	63612	173.230.149.18	23662	6	497	6	497	0	0	8.857904	0.0487	81 k	0
10.0.0.119	63613	173.230.149.18	23662	6	499	6	499	0	0	8.906780	0.0451	88 k	0
10.0.0.119	63614	173.230.149.18	23662	6	483	6	483	0	0	8.952150	0.0474	81 k	0
10.0.0.119	63615	173.230.149.18	23662	6	494	6	494	0	0	8.999710	0.0410	96 k	0
10.0.0.119	63616	173.230.149.18	23662	7	562	7	562	0	0	9.040851	0.0662	67 k	0
10.0.0.119	63617	173.230.149.18	23662	6	497	6	497	0	0	9.107281	0.0492	80 k	0
10.0.0.119	63618	173.230.149.18	23662	6	504	6	504	0	0	9.156836	0.1087	37 k	0
10.0.0.119	63619	173.230.149.18	23662	6	480	6	480	0	0	9.265655	0.0670	57 k	0
10.0.0.119	63620	173.230.149.18	23662	7	547	7	547	0	0	9.332808	0.0409	107 k	0
10.0.0.119	63621	173.230.149.18	23662	8	609	8	609	0	0	9.373846	0.0471	103 k	0
10.0.0.119	63622	173.230.149.18	23662	6	479	6	479	0	0	9.421132	0.0542	70 k	0
10.0.0.119	63623	173.230.149.18	23662	6	495	6	495	0	0	9.475636	0.0444	89 k	0
10.0.0.119	63624	173.230.149.18	23662	6	488	6	488	0	0	9.520223	0.0400	97 k	0
10.0.0.119	63625	173.230.149.18	23662	6	483	6	483	0	0	9.560539	0.0456	84 k	0
10.0.0.119	63626	173.230.149.18	23662	8	660	8	660	0	0	9.606234	0.0526	100 k	0
10.0.0.119	63627	173.230.149.18	23662	7	547	7	547	0	0	9.659163	0.0464	94 k	0
10.0.0.119	63628	173.230.149.18	23662	6	482	6	482	0	0	9.705571	0.0411	93 k	0

For persistent protocol, there are 2 ports are used from the client side, and one server port are used. The first port used to get the index.html, the second used for getting image.

The screenshot shows a Wireshark packet capture of a persistent HTTP protocol. The filter is set to 'Ethernet I - 1 IPv4 - 1 IPv6 TCP - 2 UDP'. The table displays 2 individual TCP connections. Both connections are initiated by the client (10.0.0.119) to the server (173.230.149.18) on port 23662. The 'Packets' column shows 22 and 1,217. The 'Bytes' column shows 1531 and 116 k. The 'Rel Start' column shows 2.913599 and 4.009113. The 'Duration' column shows 0.0991 and 14.4790. The 'Bits/s A -> B' column shows 123 k and 64 k. The 'Bits/s B -> A' column shows 0 and 0. The 'Conversation Types' dropdown is set to 'TCP'. The 'Limit to display filter' checkbox is checked. The 'Absolute start time' checkbox is unchecked. The 'Help' button is visible. The 'Copy' button is visible. The 'Follow Stream...' button is visible. The 'Graph...' button is visible. The 'Close' button is visible.

Address A	Port A	Address B	Port B	Packets	Bytes	Packets A -> B	Bytes A -> B	Packets B -> A	Bytes B -> A	Rel Start	Duration	Bits/s A -> B	Bits/s B -> A
10.0.0.119	64771	173.230.149.18	23662	22	1531	22	1531	0	0	2.913599	0.0991	123 k	0
10.0.0.119	64776	173.230.149.18	23662	1,217	116 k	1,217	116 k	0	0	4.009113	14.4790	64 k	0

Question II: HTTP Protocol

- a) There is only one server connected for both persistent and non-persistent http protocol, which is the project server. Wireshark attached with blue highlight is the project server we connected to.

Non-persistent:

Address	Port	Packets	Bytes	Tx Packets	Tx Bytes	Rx Packets	Rx Bytes
10.0.0.119	63891	7	555	7	555	0	0
10.0.0.119	63892	7	557	7	557	0	0
10.0.0.119	63893	6	510	6	510	0	0
10.0.0.119	63894	6	488	6	488	0	0
10.0.0.119	63895	6	513	6	513	0	0
10.0.0.119	63896	7	551	7	551	0	0
10.0.0.119	63897	10	747	10	747	0	0
10.0.0.119	63898	8	612	8	612	0	0
10.0.0.119	63899	6	491	6	491	0	0
10.0.0.119	63900	6	497	6	497	0	0
10.0.0.119	63901	6	502	6	502	0	0
10.0.0.119	63902	8	626	8	626	0	0
10.0.0.119	63903	6	497	6	497	0	0
10.0.0.119	63904	6	505	6	505	0	0
10.0.0.119	63905	6	496	6	496	0	0
10.0.0.119	63906	6	493	6	493	0	0
10.0.0.119	63907	6	481	6	481	0	0
10.0.0.119	63908	7	551	7	551	0	0
10.0.0.119	63909	6	495	6	495	0	0
10.0.0.119	63910	6	483	6	483	0	0
10.0.0.119	63911	8	614	8	614	0	0
10.0.0.119	63912	8	615	8	615	0	0
10.0.0.119	63913	6	502	6	502	0	0
10.0.0.119	63914	8	620	8	620	0	0
10.0.0.119	63915	6	488	6	488	0	0
10.0.0.119	63916	6	482	6	482	0	0
10.0.0.119	63917	6	488	6	488	0	0
10.0.0.119	63918	6	493	6	493	0	0
10.0.0.119	63919	6	483	6	483	0	0
10.0.0.119	63920	6	494	6	494	0	0
10.0.0.119	63921	6	483	6	483	0	0
10.0.0.119	63922	8	610	8	610	0	0
10.0.0.119	63923	6	490	6	490	0	0
10.0.0.119	63924	7	560	7	560	0	0
10.0.0.119	63925	6	492	6	492	0	0
10.0.0.119	63926	9	685	9	685	0	0
10.0.0.119	63927	6	501	6	501	0	0
10.0.0.119	63928	8	617	8	617	0	0
10.0.0.119	63929	6	515	6	515	0	0
173.230.149.18	23662	2,263	181 k	0	0	2,263	181 k

☐ Name resolution ☒ Limit to display filter Endpoint Types ▾

Help Copy ▾ Map ▾ Close

Persistent:

Ethernet · 2							
IPv4 · 2							
IPv6							
TCP · 3							
UDP							
Address	Port	Packets	Bytes	Tx Packets	Tx Bytes	Rx Packets	Rx Bytes
10.0.0.119	64771	22	1531	22	1531	0	0
10.0.0.119	64776	1,217	116 k	1,217	116 k	0	0
173.230.149.18	23662	1,239	117 k	0	0	1,239	117 k

- b) Host name: 173-230-149-18.ip.linodeusercontent.com
 IPV4 address: 173.230.149.18

The get request of Non-persistent http protocol is 336. (335 images + 1 get index.html). Since there three images outside project server, we use request() method instead of get request.

```
tcp.dstport==23662 && http.request

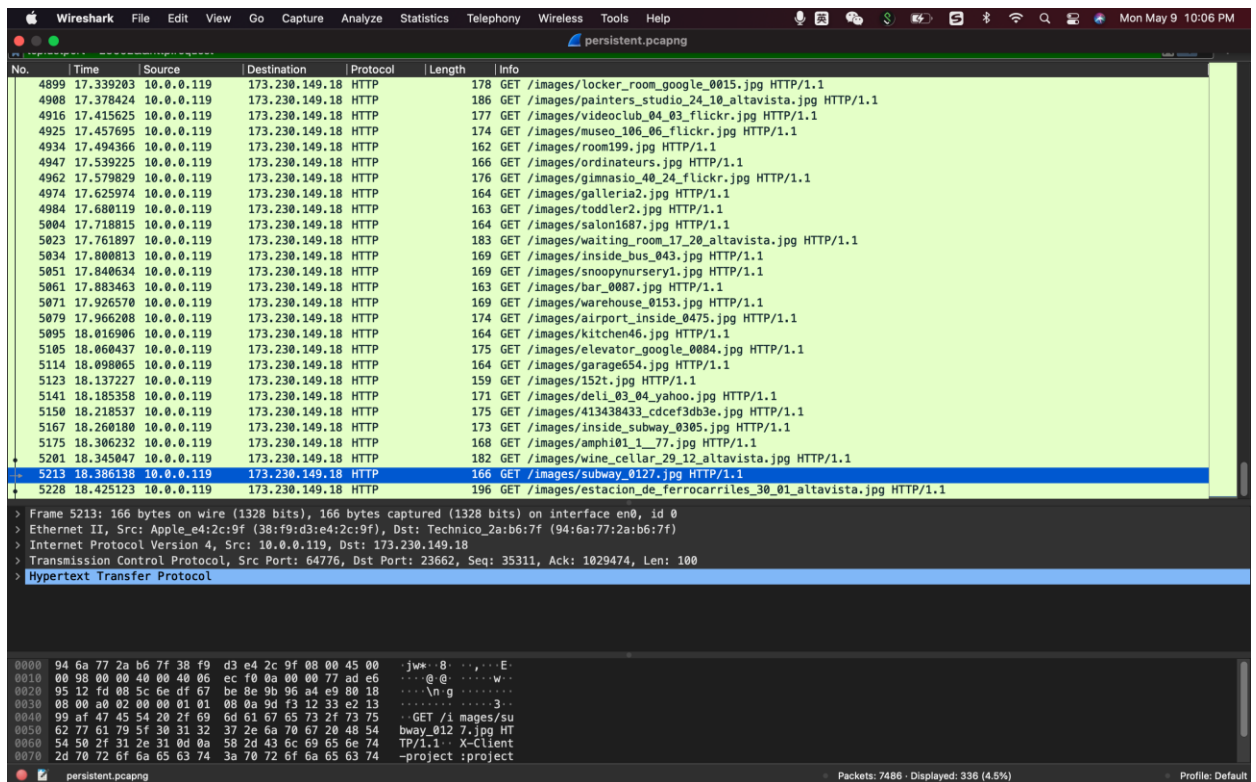
No. | Time | Source | Destination | Protocol | Length | Info
---+---+---+---+---+---+---
764 | 2.934876 | 10.0.0.119 | 173.230.149.18 | HTTP | 133 | GET /ecsi52a.html HTTP/1.1
1209 | 4.029203 | 10.0.0.119 | 173.230.149.18 | HTTP | 175 | GET /images/visuel_salle_reunion.jpg HTTP/1.1
1222 | 4.083792 | 10.0.0.119 | 173.230.149.18 | HTTP | 165 | GET /images/imagen_003.jpg HTTP/1.1
1234 | 4.132724 | 10.0.0.119 | 173.230.149.18 | HTTP | 167 | GET /images/room_bistro2.jpg HTTP/1.1
1245 | 4.175050 | 10.0.0.119 | 173.230.149.18 | HTTP | 171 | GET /images/GrossesFspshs.gif.jpg HTTP/1.1
1253 | 4.217921 | 10.0.0.119 | 173.230.149.18 | HTTP | 174 | GET /images/pantry_47_13_flickr.jpg HTTP/1.1
1263 | 4.267254 | 10.0.0.119 | 173.230.149.18 | HTTP | 163 | GET /images/Kirche45.jpg HTTP/1.1
1275 | 4.310006 | 10.0.0.119 | 173.230.149.18 | HTTP | 176 | GET /images/Floreria_09_04_flickr.jpg HTTP/1.1
1282 | 4.348035 | 10.0.0.119 | 173.230.149.18 | HTTP | 177 | GET /images/Spielzeug_56_09_flickr.jpg HTTP/1.1
1290 | 4.389779 | 10.0.0.119 | 173.230.149.18 | HTTP | 173 | GET /images/AT_04_05_0000_54_1.jpg HTTP/1.1
1297 | 4.430700 | 10.0.0.119 | 173.230.149.18 | HTTP | 184 | GET /images/20070418klpcnael_364_Ies_SCO.jpg HTTP/1.1
1312 | 4.473848 | 10.0.0.119 | 173.230.149.18 | HTTP | 178 | GET /images/boulangerie_12_13_yahoo.jpg HTTP/1.1
1319 | 4.516534 | 10.0.0.119 | 173.230.149.18 | HTTP | 159 | GET /images/ins9.jpg HTTP/1.1
1326 | 4.555728 | 10.0.0.119 | 173.230.149.18 | HTTP | 195 | GET /images/Hotel_Panama_Corridor_to_the_Pool_Amador.jpg HTTP/1.1
1334 | 4.599745 | 10.0.0.119 | 173.230.149.18 | HTTP | 179 | GET /images/dentista_03_17_altavista.jpg HTTP/1.1
1343 | 4.650699 | 10.0.0.119 | 173.230.149.18 | HTTP | 166 | GET /images/indoor_0332.jpg HTTP/1.1
1351 | 4.692871 | 10.0.0.119 | 173.230.149.18 | HTTP | 158 | GET /images/S67.jpg HTTP/1.1
1362 | 4.732817 | 10.0.0.119 | 173.230.149.18 | HTTP | 179 | GET /images/Salle_de_Jeux_Villa_3_1.jpg HTTP/1.1
1382 | 4.772335 | 10.0.0.119 | 173.230.149.18 | HTTP | 178 | GET /images/lavanderia_03_09_flickr.jpg HTTP/1.1
1391 | 4.812481 | 10.0.0.119 | 173.230.149.18 | HTTP | 167 | GET /images/bowling_0105.jpg HTTP/1.1
1400 | 4.862562 | 10.0.0.119 | 173.230.149.18 | HTTP | 166 | GET /images/casino_0435.jpg HTTP/1.1
1407 | 4.902433 | 10.0.0.119 | 173.230.149.18 | HTTP | 178 | GET /images/bookstore_143_18_flickr.jpg HTTP/1.1
1417 | 4.941834 | 10.0.0.119 | 173.230.149.18 | HTTP | 180 | GET /images/tv_studio_01_01_altavista.jpg HTTP/1.1
1425 | 4.984522 | 10.0.0.119 | 173.230.149.18 | HTTP | 164 | GET /images/easyst022.jpg HTTP/1.1
1432 | 5.025819 | 10.0.0.119 | 173.230.149.18 | HTTP | 163 | GET /images/sLobby16.jpg HTTP/1.1
1439 | 5.069630 | 10.0.0.119 | 173.230.149.18 | HTTP | 177 | GET /images/Supermarkt6_1216096090.jpg HTTP/1.1
1455 | 5.117537 | 10.0.0.119 | 173.230.149.18 | HTTP | 178 | GET /images/wet_lab_24_09_altavista.jpg HTTP/1.1

> Frame 764: 133 bytes on wire (1064 bits), 133 bytes captured (1064 bits) on interface en0, id 0
> Ethernet II, Src: Apple_e4:2c:9f (38:f9:d3:e4:2c:9f), Dst: Technico_2a:b6:7f (94:6a:77:2a:b6:7f)
> Internet Protocol Version 4, Src: 10.0.0.119, Dst: 173.230.149.18
> Transmission Control Protocol, Src Port: 64771, Dst Port: 23662, Seq: 1, Ack: 1, Len: 67
> Hypertext Transfer Protocol

0000 94 6a 77 2a b6 7f 38 f9 d3 e4 2c 9f 08 00 45 00 .jw...8...E
0010 00 77 00 00 40 00 40 06 ed 11 0a 00 00 77 ad e6 .w...@...w...
0020 95 12 fd 03 5c 6e f6 92 74 cc 78 04 2b 91 80 18 ....\n...t:x+...
0030 08 0a 93 21 00 00 01 01 00 0a ef b5 26 0d c2 13 ...1...6...
0040 5d 53 47 45 54 20 2f 65 63 73 31 35 32 61 2e 68 [SGET /e csi52a.h
0050 74 6d 6c 20 48 54 50 2f 31 2e 31 0d 0a 58 2d tml HTTP /1.1 X-
0060 43 6c 69 65 6e 74 2d 70 72 6f 6a 65 63 74 3a 70 Client-p roject:p
0070 72 6f 6a 65 63 74 2d 31 35 32 41 2d 70 61 72 74 roject-1 52A-part

Request: Boolean
Packets: 7486 · Displayed: 336 (4.5%) · Dropped: 0 (0.0%) · Profile: Default
```

The get request of Persistent protocol is also 336. Since there three images outside project server, we use request() method instead of get request.



- c) Total number of images download from the server is 338(335 images from Project server, 3 image outside project server)
- d) Total size of all source got is approximately 2.4 Mb
- e) Requesting with header X-Client-Project other than Project Server will get a status code 404 and unable to request information form it. For example, when accessing the <http://web.mit.edu/torralba/www/allIndoors.jpg>, which is an image that is outside the project server. 404 not found will show up when adding header “X-Client-Project”.
This is because X-Client-Project is a custom header only designed for this server. Other server will not recognize it.

Question III : HTTP Performance

- a) ATF for Non-persistent: 0.023
ATF for persistent: 0.029
This time constitute of the index.html file ending at the element with ID “Pantry”. Since the line with element Pantry is the end line of the page without scrolling down.
- b) PLT for Non-persistent: 0.072
PLT for persistent: 0.137
Non-persistent is faster than persistent protocol. This is because non-persistent close every time transmit finished, which is less possible to have conjunction happened in the network. Enlarging the buffer size would be one possible way to improve page load time.

- c) Project Server implement non-persistent by default. When implementing the Get request, the socket automatically close connection when transition end. We need to add header “Connection: keep-alive” to make it to persistent protocol.
- d) Non-persistent protocol(top 256, bottom 4096):

```
TERMINAL  PROBLEMS 10 OUTPUT  DEBUG CONSOLE  Code

[Running] python -u "/Users/huilinzhang/Documents/GitHub/ECS152A_Project1/non_persistent_http_HuilinZhang_917071562_TingweiLiu_917707784.py"
*****
HTTP Client Version: Non-persistent HTTP
Total PLT = 0.07904314994812012
Average Request Delay = 0.0055912418190236625
ATF PLT = 0.023664236068725586
RPS = 12.660375459578558
*****

[Done] exited with code=0 in 24.944 seconds

[Running] python -u "/Users/huilinzhang/Documents/GitHub/ECS152A_Project1/non_persistent_http_HuilinZhang_917071562_TingweiLiu_917707784.py"
*****
HTTP Client Version: Non-persistent HTTP
Total PLT = 0.07205319404602051
Average Request Delay = 0.012090527788867805
ATF PLT = 0.023411989212036133
RPS = 30.777692879994323
*****

[Done] exited with code=0 in 20.164 seconds
```

Persistent Protocol:

```
TERMINAL  PROBLEMS 10 OUTPUT  DEBUG CONSOLE  Code

[Running] python -u "/Users/huilinzhang/Documents/GitHub/ECS152A_Project1/persistent_http_HuilinZhang_917071562_TingweiLiu_917707784.py"
*****
HTTP Client Version: Persistent HTTP
Total PLT = 0.07726788520812988
Average Request Delay = 0.018207332145336062
ATF PLT = 0.02421712875366211
RPS = 21.649852013744994
*****

[Done] exited with code=0 in 16.076 seconds

[Running] python -u "/Users/huilinzhang/Documents/GitHub/ECS152A_Project1/tempCodeRunnerFile.py"

[Done] exited with code=0 in 0.192 seconds

[Running] python -u "/Users/huilinzhang/Documents/GitHub/ECS152A_Project1/tempCodeRunnerFile.py"

[Done] exited with code=0 in 0.102 seconds

[Running] python -u "/Users/huilinzhang/Documents/GitHub/ECS152A_Project1/persistent_http_HuilinZhang_917071562_TingweiLiu_917707784.py"
*****
HTTP Client Version: Persistent HTTP
Total PLT = 0.13712525367736816
Average Request Delay = 0.007615311246686411
ATF PLT = 0.02921438217163086
RPS = 9.86385561498517
*****

[Done] exited with code=0 in 18.709 seconds

Reconnect to Discord  Ln 100, Col 19  Spaces: 4  UTF-8  CRLF  MagicPython  3.8.2 64-bit
```

According to the image attached above, both persistent and non-persistent protocol shows that the buffer with size 4096 performs better. This is because larger buffer size makes it possible to have less amount of packets separated, which reduces the number of `recv()` request. By doing so, total request delay decrease, thus improving the performance.