

Project 1: Part 2

Bradly T Booth

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non_persistent_http_BradlyTBooth_919346279.py

persistent_http_BradlyTBooth_919346279.py

20220508

Terminal Output:

```
brad@betsyU:~/ECS_152a/images$ python3 non_persistent_http_BradlyTBooth_919346279.py
*****
HTTP Client Version: Non Persistent HTTP
Total Page Load Time:      19.88148784637451 seconds
Average Request Delay:     0.05843038333904075 seconds
Above the Fold Load Time:  0.3381638526916504 seconds
Requests per Second:       17.114383696535526
*****
brad@betsyU:~/ECS_152a/images$ python3 persisten_http_BradlyTBooth_919346279.py
*****
HTTP Client Version: Persistent HTTP
Total Page Load Time: 16.225026607513428 seconds
Average Request Delay: 0.04754911442480144 seconds
Above the Fold Load Time: 0.25310516357421875 seconds
Request per Second:      21.03088589760157 seconds
*****
brad@betsyU:~/ECS_152a/images$
```

Question 1:

a) Non-Persistent: Used 339 sockets. 1 for the HTML file and 338, 1 for each image.

Persistent: Used 4 sockets. 1 socket for server 173.230.149.18. Since, this was a persistent connection, the socket didn't need to close. 3 sockets, 1 each for the sockets hosted on external servers.

b) Non-Persistent: I didn't bind the sockets to any port, so the program automatically determined port numbers. For each TCP connection, the program had the capability to use a different port. Then the number of ports I used was up to 339 ports. One for each connection made.

Using WireShark statistics, there indeed a great many number of ports used during the nonpersistent connection. Too many to count at the very least.

Persistent: I used 4 ports. 1 for server we made the initial GET request to. This connection stayed open while the program was running, so the port never changed. Then 1 socket for each image from the 3 external servers.

WireShark Image of Persistent Ports Used:

Address	Port	Packets	Bytes	Tx I
10.0.0.186	37586	2,215	1,286k	
10.0.0.186	37566	89	86k	
10.0.0.186	42240	45	47k	
10.0.0.186	40354	27	46k	

Question 2:

a) The program will connect to 4 servers.

WireShark:

(tcp.port == 23662 tcp.port == 80) && (tcp[13] == 02 tcp[13] == 12 (tcp.seq == 1 && tcp.ack == 1 && tcp.len == 0 && !(tcp.flags.push == 1)))						
No.	Time	Source	Destination	Protocol	Length	Info
65	2.052623081	10.0.0.186	173.230.149.18	TCP	74	37586 → 23662 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=1969137408 TSecr=0 WS=128
66	2.072218666	173.230.149.18	10.0.0.186	TCP	74	23662 → 37586 [SYN, ACK] Seq=0 Ack=1 Win=65160 Len=0 MSS=1460 SACK_PERM=1 TSval=3807476631 TSecr=1969137408 WS=128
67	2.672231749	10.0.0.186	173.230.149.18	TCP	66	37586 → 23662 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=1969137427 TSecr=3807476631
117	2.810235713	10.0.0.186	104.70.9.246	TCP	74	37566 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=1566692307 TSecr=0 WS=128
118	2.829960984	104.70.9.246	10.0.0.186	TCP	74	80 → 37566 [SYN, ACK] Seq=0 Ack=1 Win=65160 Len=0 MSS=1460 SACK_PERM=1 TSval=1751200772 TSecr=1566692307 WS=128
119	2.829976603	10.0.0.186	104.70.9.246	TCP	66	37566 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=1566692327 TSecr=1751200772
205	2.911305637	10.0.0.186	128.30.195.26	TCP	74	42240 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=3885062747 TSecr=0 WS=128
207	3.011074328	128.30.195.26	10.0.0.186	TCP	74	80 → 42240 [SYN, ACK] Seq=0 Ack=1 Win=62636 Len=0 MSS=8960 SACK_PERM=1 TSval=1551045384 TSecr=3885062747 WS=128
208	3.011088094	10.0.0.186	128.30.195.26	TCP	66	42240 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=3885062847 TSecr=1551045384
250	3.225251087	10.0.0.186	128.52.128.216	TCP	74	40354 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=1942707339 TSecr=0 WS=128
252	3.383220953	128.52.128.216	10.0.0.186	TCP	74	80 → 40354 [SYN, ACK] Seq=0 Ack=1 Win=26844 Len=0 MSS=8960 SACK_PERM=1 TSval=288074473 TSecr=1942707339 WS=128
253	3.383236182	10.0.0.186	128.52.128.216	TCP	66	40354 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=1942707497 TSecr=288074473

Above is a screen shot of the 3-way handshake to each of the 4 servers. This of course is in persistent http. In non-persistent there would be a lot more than 4 3-way handshakes.

b) 4 Servers:

Host:

Ethernet · 2	IPv4 · 5	IPv6	TCP · 8	UDP		
Address	Packets	Bytes	Tx Packets	Tx Bytes	Rx Packets	Rx Bytes
173.230.149.18	2,215	1,286k	1,091	1,170k	1,124	116k
128.52.128.216	27	46k	13	45k	14	1,039
128.30.195.26	45	47k	23	46k	22	1,539
104.70.9.246	89	86k	45	83k	44	2,993

Host: 173-230-149-18.ip.linodeusercontent.com, IPv4 = 173.230.149.18,
of GET = 336

(tcp.port == 23662 tcp.port == 80) && http.request.method == GET && ip.addr == 173.230.149.1					
No.	Time	Source	Destination	Protocol	Length Info
68	2.672246128	betsyU.local	173-230-149-18.ip.l	HTTP	157 GET /ecs152a.html HTTP/1.1
275	3.870775719	betsyU.local	173-230-149-18.ip.l	HTTP	196 GET /images/visuel_salle_reunion.jpg HTTP/1.1
282	3.912699451	betsyU.local	173-230-149-18.ip.l	HTTP	186 GET /images/imagen_003.jpg HTTP/1.1
288	3.947537029	betsyU.local	173-230-149-18.ip.l	HTTP	188 GET /images/room_bistro2.jpg HTTP/1.1
293	3.978210273	betsyU.local	173-230-149-18.ip.l	HTTP	192 GET /images/GrossesFsphs.gif.jpg HTTP/1.1
307	4.056371682	betsyU.local	173-230-149-18.ip.l	HTTP	195 GET /images/pantry_47_13_flickr.jpg HTTP/1.1
313	4.094775773	betsyU.local	173-230-149-18.ip.l	HTTP	184 GET /images/Kirche45.jpg HTTP/1.1
324	4.129966222	betsyU.local	173-230-149-18.ip.l	HTTP	197 GET /images/floreria_09_04_flickr.jpg HTTP/1.1
332	4.206931689	betsyU.local	173-230-149-18.ip.l	HTTP	198 GET /images/Spielzeug_56_09_flickr.jpg HTTP/1.1
337	4.238830580	betsyU.local	173-230-149-18.ip.l	HTTP	194 GET /images/AT_04_05_6000_54_l.jpg HTTP/1.1
342	4.274307160	betsyU.local	173-230-149-18.ip.l	HTTP	205 GET /images/20070418Klpcnaecl_364_Ies_SCO.jpg HTTP/1.1
350	4.306663138	betsyU.local	173-230-149-18.ip.l	HTTP	199 GET /images/boulangerie_12_13_yahoo.jpg HTTP/1.1
356	4.383514638	betsyU.local	173-230-149-18.ip.l	HTTP	180 GET /images/ins9.jpg HTTP/1.1
361	4.418568861	betsyU.local	173-230-149-18.ip.l	HTTP	216 GET /images/Hotel_Panama_Corridor_to_the_Pool_Amador.jpg HTTP/1.1
366	4.449236553	betsyU.local	173-230-149-18.ip.l	HTTP	200 GET /images/dentista_03_17_altavista.jpg HTTP/1.1
372	4.524187419	betsyU.local	173-230-149-18.ip.l	HTTP	187 GET /images/indoor_0332.jpg HTTP/1.1
377	4.555539335	betsyU.local	173-230-149-18.ip.l	HTTP	179 GET /images/S67.jpg HTTP/1.1
382	4.591401036	betsyU.local	173-230-149-18.ip.l	HTTP	200 GET /images/Salle_de_Jeux_Villa_3_1_.jpg HTTP/1.1
396	4.629787211	betsyU.local	173-230-149-18.ip.l	HTTP	199 GET /images/lavanderia_03_09_flickr.jpg HTTP/1.1
404	4.705948587	betsyU.local	173-230-149-18.ip.l	HTTP	188 GET /images/bowling_0105.jpg HTTP/1.1
409	4.753993236	betsyU.local	173-230-149-18.ip.l	HTTP	187 GET /images/casino_0435.jpg HTTP/1.1
414	4.804728837	betsyU.local	173-230-149-18.ip.l	HTTP	199 GET /images/bookstore_143_18_flickr.jpg HTTP/1.1
419	4.883230680	betsyU.local	173-230-149-18.ip.l	HTTP	201 GET /images/tv_studio_01_01_altavista.jpg HTTP/1.1
424	4.927202833	betsyU.local	173-230-149-18.ip.l	HTTP	185 GET /images/easyst022.jpg HTTP/1.1
429	4.958139496	betsyU.local	173-230-149-18.ip.l	HTTP	184 GET /images/sLobby16.jpg HTTP/1.1
434	5.039467445	betsyU.local	173-230-149-18.ip.l	HTTP	198 GET /images/Supermarkt6_1216096090.jpg HTTP/1.1
446	5.071305491	betsyU.local	173-230-149-18.ip.l	HTTP	199 GET /images/wet_lab_24_09_altavista.jpg HTTP/1.1
455	5.101496030	betsyU.local	173-230-149-18.ip.l	HTTP	206 GET /images/restaurant_kitchen_google_0079.jpg HTTP/1.1
461	5.179510903	betsyU.local	173-230-149-18.ip.l	HTTP	182 GET /images/arbys4.jpg HTTP/1.1
466	5.214208339	betsyU.local	173-230-149-18.ip.l	HTTP	183 GET /images/G28bsdc.jpg HTTP/1.1
476	5.245476587	betsyU.local	173-230-149-18.ip.l	HTTP	179 GET /images/bnf.jpg HTTP/1.1
488	5.277917574	betsyU.local	173-230-149-18.ip.l	HTTP	181 GET /images/50_7_.jpg HTTP/1.1
493	5.353195328	betsyU.local	173-230-149-18.ip.l	HTTP	197 GET /images/private_recovery_room.jpg HTTP/1.1
498	5.385524533	betsyU.local	173-230-149-18.ip.l	HTTP	190 GET /images/scrnewjailcell.jpg HTTP/1.1
503	5.421891959	betsyU.local	173-230-149-18.ip.l	HTTP	185 GET /images/Cloister2.jpg HTTP/1.1
510	5.499210312	betsyU.local	173-230-149-18.ip.l	HTTP	230 GET /images/st_joseph_michigan_shopping_fashion_boutique_clothing3.jpg HTTP...
523	5.536697288	betsyU.local	173-230-149-18.in.l	HTTP	183 GET /images/Browns2.inc HTTP/1.1
Frame 68: 157 bytes on wire (1256 bits), 157 bytes captured (1256 bits) on interface wlp3s0, id 0 Ethernet II, Src: IntelCor_84:95:68 (38:68:93:84:95:68), Dst: ARRISGro_73:a3:70 (9c:34:26:73:a3:70) Internet Protocol Version 4, Src: betsyU.local (10.0.0.186), Dst: 173-230-149-18.ip.linodeusercontent.com (173.230.149.18) Transmission Control Protocol, Src Port: 37586, Dst Port: 23662, Seq: 1, Ack: 1, Len: 91 Hypertext Transfer Protocol					
0000 9c 34 26 73 a3 70 38 68 93 84 95 68 08 00 45 00 -4&s p8h ...h·E· wireshark_wlp3s0FJHZL1.pcapng					
Packets: 2654 · Displayed: 336 (12.7%) · Dropped: 0 (0.0%) · Profile: Default					

Host: labelme2.csail.mit.edu, IPv4: 128.52.128.216, # of GET = 1

(tcp.port == 23662 tcp.port == 80) && http.request.method == GET && ip.addr == 128.52.128.216					
No.	Time	Source	Destination	Protocol	Length Info
254	3.383258825	betsyU.local	labelme2.csail.mit.edu	HTTP	173 GET /Release3.0/browserTools/icons/labeling.jpg HTTP/1.1

Host: vision16.csail.mit.edu, IPv4: 128.30.195.26, # of GET = 1

(tcp.port == 23662 tcp.port == 80) && http.request.method == GET && ip.addr == 128.30.195.26					
No.	Time	Source	Destination	Protocol	Length Info
209	3.011111358	betsyU.local	vision16.csail.mit.edu	HTTP	145 GET /imgs/demo/7.jpg HTTP/1.1

Host: e9566.dscb.akamaiedge.net, IPv4: 104.70.9.246 # of GET = 1

(tcp.port == 23662 tcp.port == 80) && http.request.method == GET && ip.addr == 104.70.9.246					
No.	Time	Source	Destination	Protocol	Length Info
120	2.829992193	betsyU.local	e9566.dscb.akamaiedge.net	HTTP	147 GET /torralba/www/allIndoors.jpg HTTP/1.1

c) Total Number of Images Downloaded: 338

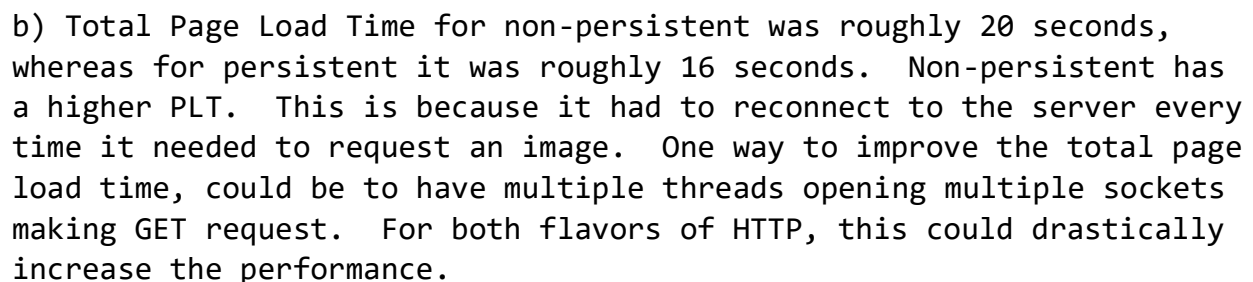
d) 1.2 MB

e) Nothing happens. The header gets ignored.

(tcp.port == 23662 tcp.port == 80) && ip.addr == 128.30.195.26									
Packet list		Narrow & Wide		<input type="checkbox"/> Case sensitive		Regular Expression		200	
Find		Cancel							
No.	Time	Source	Destination	Protocol	Length	Info			
203	2.635435759	10.0.0.186	128.30.195.26	TCP	74	42260 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK			
204	2.732160982	128.30.195.26	10.0.0.186	TCP	74	80 → 42260 [SYN, ACK] Seq=0 Ack=1 Win=62636 Len=0 MSS			
205	2.732191130	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=39			
206	2.732236376	10.0.0.186	128.30.195.26	HTTP	183	GET /imgs/demo/7.jpg HTTP/1.1			
207	2.830390944	128.30.195.26	10.0.0.186	TCP	66	80 → 42260 [ACK] Seq=1 Ack=118 Win=62592 Len=0 TSval=			
208	2.832100518	128.30.195.26	10.0.0.186	TCP	1514	80 → 42260 [ACK] Seq=1 Ack=118 Win=62592 Len=1448 TSval=			
209	2.832112281	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=1449 Win=63104 Len=0 TSval=			
210	2.834121138	128.30.195.26	10.0.0.186	TCP	2962	80 → 42260 [ACK] Seq=1449 Ack=118 Win=62592 Len=2896 TSval=			
211	2.834125767	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=4345 Win=61056 Len=0 TSval=			
212	2.835782209	128.30.195.26	10.0.0.186	TCP	1514	80 → 42260 [ACK] Seq=4345 Ack=118 Win=62592 Len=1448 TSval=			
213	2.835786717	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=5793 Win=63104 Len=0 TSval=			
214	2.836809005	128.30.195.26	10.0.0.186	TCP	1514	80 → 42260 [ACK] Seq=5793 Ack=118 Win=62592 Len=1448 TSval=			
215	2.836813544	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=7241 Win=63104 Len=0 TSval=			
216	2.837837344	128.30.195.26	10.0.0.186	TCP	1514	80 → 42260 [ACK] Seq=7241 Ack=118 Win=62592 Len=1448 TSval=			
217	2.837841713	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=8689 Win=63104 Len=0 TSval=			
218	2.838867437	128.30.195.26	10.0.0.186	TCP	1514	80 → 42260 [ACK] Seq=8689 Ack=118 Win=62592 Len=1448 TSval=			
219	2.838871815	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=10137 Win=63104 Len=0 TSval=			
220	2.839889254	128.30.195.26	10.0.0.186	TCP	1514	80 → 42260 [ACK] Seq=10137 Ack=118 Win=62592 Len=1448 TSval=			
221	2.839891418	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=11585 Win=63104 Len=0 TSval=			
222	2.840912764	128.30.195.26	10.0.0.186	TCP	1514	80 → 42260 [ACK] Seq=11585 Ack=118 Win=62592 Len=1448 TSval=			
223	2.840914097	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=13033 Win=63104 Len=0 TSval=			
224	2.841947195	128.30.195.26	10.0.0.186	TCP	1514	80 → 42260 [ACK] Seq=13033 Ack=118 Win=62592 Len=1448 TSval=			
225	2.841948377	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=14481 Win=63104 Len=0 TSval=			
227	2.935971586	128.30.195.26	10.0.0.186	TCP	2962	80 → 42260 [ACK] Seq=14481 Ack=118 Win=62592 Len=2896 TSval=			
228	2.935988177	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=17377 Win=61056 Len=0 TSval=			
229	2.937899117	128.30.195.26	10.0.0.186	TCP	2962	80 → 42260 [ACK] Seq=17377 Ack=118 Win=62592 Len=2896 TSval=			
230	2.937905249	10.0.0.186	128.30.195.26	TCP	66	42260 → 80 [ACK] Seq=118 Ack=20273 Win=69888 Len=0 TSval=			
231	2.938208319	128.30.195.26	10.0.0.186	TCP	2962	80 → 42260 [ACK] Seq=20273 Ack=118 Win=62592 Len=2896 TSval=			
232	2.938209300	128.30.195.26	10.0.0.186	TCP	1514	80 → 42260 [ACK] Seq=22460 Ack=118 Win=62592 Len=1448 TSval=			
[Time since previous frame in this TCP stream: 0.000045246 seconds]									
TCP payload (117 bytes)									
Hypertext Transfer Protocol									
GET /imgs/demo/7.jpg HTTP/1.1\r\n									
Host:places2.csail.mit.edu\r\n									
Connection:close\r\n									
X-Client-project: project-152A-part2\r\n									
\r\n									
[Full request URI: http://places2.csail.mit.edu/imgs/demo/7.jpg]									
[HTTP request 1/1]									
[Response in frame: 248]									
0080 6e 65 63 74 69 6f 6e 3a 63 6c 6f 73 65 0d 0a 58 nection: close-X									

The highlighted packet is a GET request sent to 128.30.195.26 with the special header in the request. The header is highlighted. The GET was accepted, and the image was sent in response. I could not find the status code, but I assume it was 200 since the image was sent.

a) Above the fold load time was .34 seconds for non-persistent and .25 seconds for persistent connections. Resources needed to load this were the HTML file and allindoors.jpg. Justification for why only these 2 resources is in screenshot below.



c) Well, my persistent HTTP program gets stuck when removing the connection header. It does download the html file but then doesn't do anything after. However, removing connection from GET requests in my non-persistent program, it works fine. But, this doesn't help me. I have connection closed statement after each GET request. I also tried printing out the header, and the header does not return connection header when I give none. Based on this information, I am going to

assume that the connection is default to HTTP/1.1 which is a persistent connection.

e)

```
brad@betsyU:~/ECS_152a/images$ python3 persisten_http_BradlyTBooth_919346279.py
*****
HTTP Client Version: Persistent HTTP
Total Page Load Time: 17.21974015235901 seconds
Average Request Delay: 0.05045036098660802 seconds
Above the Fold Load Time: 0.257274866104126 seconds
Request per Second:      19.82146372085323 seconds
*****
brad@betsyU:~/ECS_152a/images$
```

Changing the buffer size to 256 did increase the page load time, but not by much. From this application, I would argue that a buffer of 4096 is better. In practice, I am not sure which is better.