

The Command used to trace the packets for port 1080 is 'sudo tcpdump port 1080 -w http\_1080.pcap -i en0'. For port 1081, 'sudo tcpdump port 1081 -w tcp\_1081.pcap -i en0' and for port 1082, 'sudo tcpdump port 1082 -w tcp\_1082.pcap -i en0';

#### 1) Resemble Each HTTP REQUEST AND HTTP RESPONSE

For tcp\_1080.pcap :

Output:

HTTP REQUEST [59687, 1080, 2745514761, 2289116921, 24, 512, 2061, 1602864774.875774]

HTTP RESPONSE [1080, 59687, 2289116921, 2745515207, 24, 891, 219, 1602864774.889964]

HTTP REQUEST [59688, 1080, 3208074028, 2882053170, 24, 452, 2061, 1602864774.984078]

HTTP RESPONSE [1080, 59688, 2882053170, 3208074414, 16, 1440, 219, 1602864774.998289]

HTTP REQUEST [59689, 1080, 3648904343, 339510979, 24, 402, 2061, 1602864775.004952]

HTTP RESPONSE [1080, 59689, 339510979, 3648904679, 24, 523, 219, 1602864775.018215]

HTTP REQUEST [59690, 1080, 52513253, 2602700421, 24, 453, 2061, 1602864775.00683]

HTTP RESPONSE [1080, 59690, 2602700421, 52513640, 16, 1440, 219, 1602864775.021044]

HTTP REQUEST [59691, 1080, 889179221, 1635110750, 24, 453, 2061, 1602864775.008324]

HTTP RESPONSE [1080, 59691, 1635110750, 889179608, 16, 1440, 219, 1602864775.022899]

HTTP REQUEST [59692, 1080, 1146388893, 2107876666, 24, 457, 2061, 1602864775.009774]

HTTP RESPONSE [1080, 59692, 2107876666, 1146389284, 16, 1440, 219, 1602864775.027515]

HTTP REQUEST [59693, 1080, 2775147511, 3365665423, 24, 463, 2061, 1602864775.009833]

HTTP RESPONSE [1080, 59693, 3365665423, 2775147908, 16, 1440, 219,  
1602864775.025372]

HTTP REQUEST [59694, 1080, 1821968906, 4115144644, 24, 461, 2061,  
1602864775.017694]

HTTP RESPONSE [1080, 59694, 4115144644, 1821969301, 16, 1440, 219,  
1602864775.03493]

HTTP REQUEST [59695, 1080, 176369818, 4144834843, 24, 458, 2061, 1602864775.032473]

HTTP RESPONSE [1080, 59695, 4144834843, 176370210, 16, 1440, 219,  
1602864775.050492]

HTTP REQUEST [59696, 1080, 2029893297, 2382102353, 24, 456, 2061,  
1602864775.036154]

HTTP RESPONSE [1080, 59696, 2382102353, 2029893687, 16, 1440, 219,  
1602864775.052338]

HTTP REQUEST [59697, 1080, 181150422, 3324597836, 24, 458, 2061, 1602864775.039045]

HTTP RESPONSE [1080, 59697, 3324597836, 181150814, 16, 1440, 219,  
1602864775.054249]

HTTP REQUEST [59698, 1080, 3977739736, 3238610077, 24, 456, 2061,  
1602864775.041562]

HTTP RESPONSE [1080, 59698, 3238610077, 3977740126, 16, 1440, 219,  
1602864775.05673]

HTTP REQUEST [59699, 1080, 51250120, 887858455, 24, 457, 2061, 1602864775.064775]

HTTP RESPONSE [1080, 59699, 887858455, 51250511, 16, 1440, 219, 1602864775.081122]

HTTP REQUEST [59700, 1080, 621279485, 3407149268, 24, 458, 2061, 1602864775.069866]

HTTP RESPONSE [1080, 59700, 3407149268, 621279877, 16, 1440, 219,  
1602864775.086257]

HTTP REQUEST [59701, 1080, 1810701483, 1050652451, 24, 456, 2061, 1602864775.07158]

HTTP RESPONSE [1080, 59701, 1050652451, 1810701873, 16, 1440, 219,  
1602864775.091808]

HTTP REQUEST [59702, 1080, 817652274, 4175236251, 24, 453, 2061, 1602864775.076489]  
HTTP RESPONSE [1080, 59702, 4175236251, 817652661, 16, 1440, 219, 1602864775.092807]

HTTP REQUEST [59703, 1080, 2541568197, 2755044044, 24, 453, 2061, 1602864775.093471]  
HTTP RESPONSE [1080, 59703, 2755044044, 2541568584, 16, 1440, 219, 1602864775.111753]

HTTP REQUEST [59704, 1080, 4159306559, 2247793895, 24, 449, 2061, 1602864775.414613]  
HTTP RESPONSE [1080, 59704, 2247793895, 4159306942, 24, 540, 219, 1602864775.428336]

2.

For tcp\_1080.pcap :  
The HTTP Version is  
HTTP 1.0

For tcp\_1081.pcap:  
The HTTP Version is  
HTTP 1.1

For tcp\_1082.pcap:  
The HTTP Version is  
HTTP 2

Explanation:

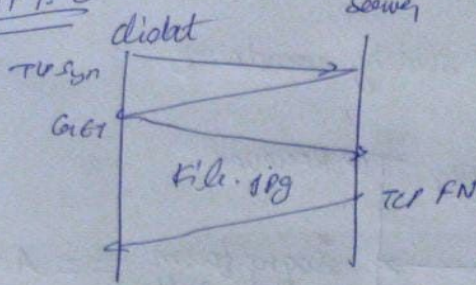
For the file tcp\_1080.pcap (HTTP1.0), there were no packets getting retransmitted from the client-side(Number of GET MESSAGE = 1)

For the file tcp\_1081.pcap (HTTP 1.1), there were 6 parallel connections being made at the client-side and there can be one or more packets getting retransmitted(Number of GET MESSAGES could be more than 1 )

For the file tcp\_1082.pcap (HTTP 2), the number of connections being made is two. The first connection is used for sending encryption keys and the second one is used for sending the data.

Further explanation is explained in the notes below.

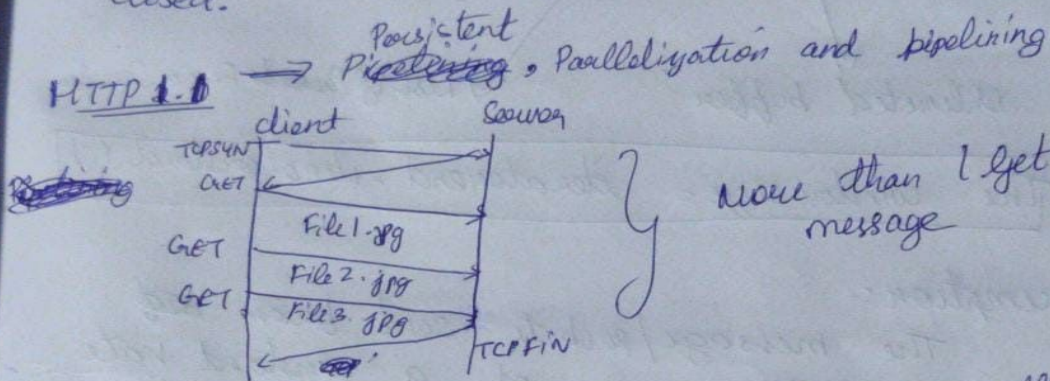
## HTTP 1.0



One file gets transferred after each time a file is opened

Each packet sends only 1 Get request from the client before being closed.

## HTTP 1.1



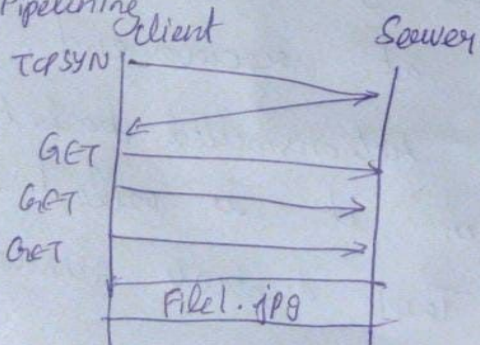
more than 1 get message

Parallelization ⇒ Browser ~~only~~ allow 6 parallel connection per server

~~No of server~~ ~~open at an instance~~

No of connections at client side can only be upto 6.

## ~~Persistent~~ Pipelining



Waiting time is cut down

### 3. Transmission Time, Number of raw bytes, and Number of sent packets:

For tcp\_1080.pcap - HTTP 1.0 :

Number of sent packets 1029

Number of Raw bytes sent 75425

The Transmission time for Port: 1080 is 0.5788309574127197

For tcp\_1081.pcap - HTTP 1.1 :

Number of sent packets 1051

Number of Raw bytes sent 81468

The Transmission time for Port: 1081 is 15.644810199737549

For tcp\_1082.pcap - HTTP 2.0 :

Number of sent packets 570

Number of Raw bytes sent 40600

The Transmission time for Port: 1082 is 5.527446985244751

Analysis:

#### a) Transmission Time:

The time it took to load HTTP1.0 is very low. This is because of packets travelling across a linear fashion and no parallelism.

The time it took to load HTTP 1.1 is the highest. This is because of the Parallelization and Pipelining.

#### b) The number of Sent packets:

The number packets sent by HTTP1.1 is comparable to that of HTTP1.0. HTTP2.0 sent the least amount of packet due to the compression.

#### c) The Number of Raw bytes sent:

The number of raw bytes sent by HTTP1.0 and HTTP1.1 are similar but HTTP2.0 sends very low number of raw bytes

## Output:

### 1. analysis\_pcap\_http.py

HTTP REQUEST [59687, 1080, 2745514761, 2289116921, 24, 512, 2061, 1602864774.875774]

HTTP RESPONSE [1080, 59687, 2289116921, 2745515207, 24, 891, 219, 1602864774.889964]

HTTP REQUEST [59688, 1080, 3208074028, 2882053170, 24, 452, 2061, 1602864774.984078]

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HTTP REQUEST [59690, 1080, 52513253, 2602700421, 24, 453, 2061, 1602864775.00683]

HTTP RESPONSE [1080, 59690, 2602700421, 52513640, 16, 1440, 219, 1602864775.021044]

HTTP REQUEST [59691, 1080, 889179221, 1635110750, 24, 453, 2061, 1602864775.008324]

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HTTP RESPONSE [1080, 59694, 4115144644, 1821969301, 16, 1440, 219, 1602864775.03493]

HTTP REQUEST [59695, 1080, 176369818, 4144834843, 24, 458, 2061, 1602864775.032473]

HTTP RESPONSE [1080, 59695, 4144834843, 176370210, 16, 1440, 219, 1602864775.050492]

HTTP REQUEST [59696, 1080, 2029893297, 2382102353, 24, 456, 2061, 1602864775.036154]

HTTP RESPONSE [1080, 59696, 2382102353, 2029893687, 16, 1440, 219, 1602864775.052338]

HTTP REQUEST [59697, 1080, 181150422, 3324597836, 24, 458, 2061, 1602864775.039045]

HTTP RESPONSE [1080, 59697, 3324597836, 181150814, 16, 1440, 219, 1602864775.054249]

HTTP REQUEST [59698, 1080, 3977739736, 3238610077, 24, 456, 2061, 1602864775.041562]

HTTP RESPONSE [1080, 59698, 3238610077, 3977740126, 16, 1440, 219, 1602864775.05673]

HTTP REQUEST [59699, 1080, 51250120, 887858455, 24, 457, 2061, 1602864775.064775]

HTTP RESPONSE [1080, 59699, 887858455, 51250511, 16, 1440, 219, 1602864775.081122]

HTTP REQUEST [59700, 1080, 621279485, 3407149268, 24, 458, 2061, 1602864775.069866]

HTTP RESPONSE [1080, 59700, 3407149268, 621279877, 16, 1440, 219, 1602864775.086257]

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HTTP RESPONSE [1080, 59701, 1050652451, 1810701873, 16, 1440, 219, 1602864775.091808]

HTTP REQUEST [59702, 1080, 817652274, 4175236251, 24, 453, 2061, 1602864775.076489]

HTTP RESPONSE [1080, 59702, 4175236251, 817652661, 16, 1440, 219, 1602864775.092807]

HTTP REQUEST [59703, 1080, 2541568197, 2755044044, 24, 453, 2061, 1602864775.093471]

HTTP RESPONSE [1080, 59703, 2755044044, 2541568584, 16, 1440, 219, 1602864775.111753]

HTTP REQUEST [59704, 1080, 4159306559, 2247793895, 24, 449, 2061, 1602864775.414613]

HTTP RESPONSE [1080, 59704, 2247793895, 4159306942, 24, 540, 219, 1602864775.428336]

The HTTP Version is

HTTP 1.0

Number of sent packets 1029

Number of Raw bytes sent 75425

The Transmission time for Port: 1080 is 0.5788309574127197

## **2. analysis\_pcap\_http1081.py**

The HTTP Version is

HTTP 1.1

Number of sent packets 1051

Number of Raw bytes sent 81468

The Transmission time for Port: 1081 is 15.644810199737549

## **3. analysis\_pcap\_http1082.py**

The HTTP Version is

HTTP 2

Number of sent packets 570

Number of Raw bytes sent 40600

The Transmission time for Port: 1082 is 5.527446985244751