Jared Raiola

HW1

1/29/20

NOTE: In advance, I apologize if screenshotting the print pages is not allowed, I believed it would the best way to combine all the information.

Part 1

1. Three Protocols:
    a. SSDP
    b. HTTP
    c. DNS

2. Time for HTTP GET: 2.81154

No.	Time	Source	Destination	Protocol	Length	Info
230	2.841154	128.61.78.183	128.119.245.12	HTTP	520	GET /wireshark-labs/INTRO-wireshark-f
234	2.891030	128.119.245.12	128.61.78.183	HTTP	492	HTTP/1.1 200 OK (text/html)

3. Internet Address
    a. gaia.cs.umass.edu: 128.119.245.12
    b. My Computer: 128.61.78.183

4. Printed HTTP
    a. GET:

```
No.     Time           Source                Destination           Protocol Length Info
    230 2.841154       128.61.78.183         128.119.245.12        HTTP     520    GET /wireshark-labs/INTRO-wireshark-file1.html HTTP/1.1
Frame 230: 520 bytes on wire (4160 bits), 520 bytes captured (4160 bits) on interface \Device\NPF_{21790D17-9FE4-479E-8E54-C1B31A7A48BB},
id 0
Ethernet II, Src: 9e:b6:38:14:84:5c (9e:b6:38:14:84:5c), Dst: Cisco_ed:c0:c0 (00:1b:0d:ed:c0:c0)
Internet Protocol Version 4, Src: 128.61.78.183, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 54416, Dst Port: 80, Seq: 1, Ack: 1, Len: 466
Hypertext Transfer Protocol
    GET /wireshark-labs/INTRO-wireshark-file1.html HTTP/1.1\r\n
        [Expert Info (Chat/Sequence): GET /wireshark-labs/INTRO-wireshark-file1.html HTTP/1.1\r\n]
        Request Method: GET
        Request URI: /wireshark-labs/INTRO-wireshark-file1.html
        Request Version: HTTP/1.1
    Host: gaia.cs.umass.edu\r\n
    Connection: keep-alive\r\n
    Upgrade-Insecure-Requests: 1\r\n
    User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/79.0.3945.130 Safari/537.36\r\n
    Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,*/*;q=0.8,application/signed-
exchange;v=b3;q=0.9\r\n
    Accept-Encoding: gzip, deflate\r\n
    Accept-Language: en-US,en;q=0.9\r\n
    \r\n
    [Full request URI: http://gaia.cs.umass.edu/wireshark-labs/INTRO-wireshark-file1.html]
    [HTTP request 1/1]
    [Response in frame: 234]
```

    b. OK:

```
No.     Time           Source                Destination           Protocol Length Info
    234 2.891030       128.119.245.12        128.61.78.183         HTTP     492    HTTP/1.1 200 OK  (text/html)
Frame 234: 492 bytes on wire (3936 bits), 492 bytes captured (3936 bits) on interface \Device\NPF_{21790D17-9FE4-479E-8E54-C1B31A7A48BB},
id 0
Ethernet II, Src: Cisco_ed:c0:c0 (00:1b:0d:ed:c0:c0), Dst: 9e:b6:38:14:84:5c (9e:b6:38:14:84:5c)
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 128.61.78.183
Transmission Control Protocol, Src Port: 80, Dst Port: 54416, Seq: 1, Ack: 467, Len: 438
Hypertext Transfer Protocol
    HTTP/1.1 200 OK\r\n
        [Expert Info (Chat/Sequence): HTTP/1.1 200 OK\r\n]
        Response Version: HTTP/1.1
        Status Code: 200
        [Status Code Description: OK]
        Response Phrase: OK
    Date: Fri, 31 Jan 2020 01:59:11 GMT\r\n
    Server: Apache/2.4.6 (CentOS) OpenSSL/1.0.2k-fips PHP/5.4.16 mod_perl/2.0.11 Perl/v5.16.3\r\n
    Last-Modified: Thu, 30 Jan 2020 06:59:04 GMT\r\n
    ETag: "51-59d55fe144eee"\r\n
    Accept-Ranges: bytes\r\n
    Content-Length: 81\r\n
    Keep-Alive: timeout=5, max=100\r\n
    Connection: Keep-Alive\r\n
    Content-Type: text/html; charset=UTF-8\r\n
    \r\n
    [HTTP response 1/1]
    [Time since request: 0.049876000 seconds]
    [Request in frame: 230]
    [Request URI: http://gaia.cs.umass.edu/wireshark-labs/INTRO-wireshark-file1.html]
    File Data: 81 bytes
Line-based text data: text/html (3 lines)
    <html>\n
    Congratulations!  You've downloaded the first Wireshark lab file!\n
    </html>\n
```

PT 2:

1. HTTP Version:
    a. Browser: HTTP 1.1
    b. Server: HTTP 1.1

No.	Time	Source	Destination	Protocol	Length	Info
137	2.199081	128.61.78.183	128.119.245.12	HTTP	519	GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1
139	2.235883	128.119.245.12	128.61.78.183	HTTP	540	HTTP/1.1 200 OK (text/html)

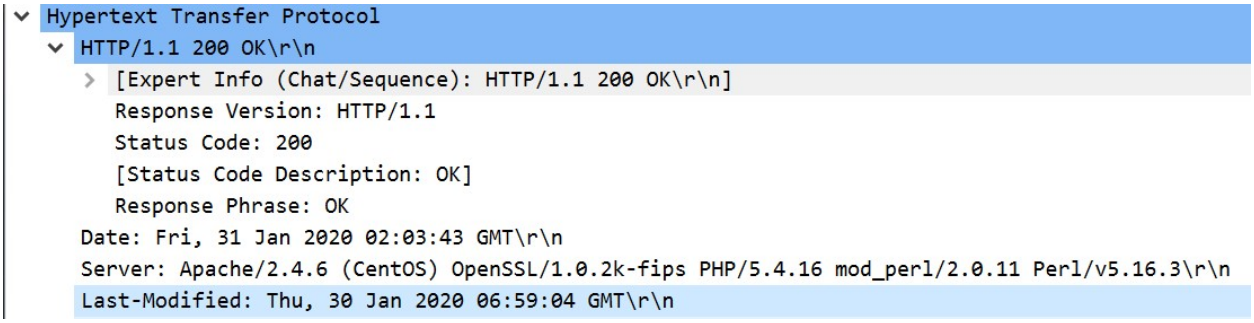
2. Language: en-US;en;q=0.9

```
> Frame 137: 519 bytes on wire (4152 bits), 519 bytes captured (4152 bits) on interface \Device\NPF_{21790D17-9FE4
> Ethernet II, Src: 9e:b6:38:14:84:5c (9e:b6:38:14:84:5c), Dst: Cisco_ed:c0:c0 (00:1b:0d:ed:c0:c0)
> Internet Protocol Version 4, Src: 128.61.78.183, Dst: 128.119.245.12
> Transmission Control Protocol, Src Port: 54580, Dst Port: 80, Seq: 1, Ack: 1, Len: 465
v Hypertext Transfer Protocol
  v GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1\r\n
    > [Expert Info (Chat/Sequence): GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1\r\n]
      Request Method: GET
      Request URI: /wireshark-labs/HTTP-wireshark-file1.html
      Request Version: HTTP/1.1
    Host: gaia.cs.umass.edu\r\n
    Connection: keep-alive\r\n
    Upgrade-Insecure-Requests: 1\r\n
    User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/79.0.3945.
    Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,*/*;q=0.8,application/sigr
    Accept-Encoding: gzip, deflate\r\n
    Accept-Language: en-US,en;q=0.9\r\n
    \r\n
    [Full request URI: http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file1.html]
    [HTTP request 1/1]
    [Response in frame: 139]
```

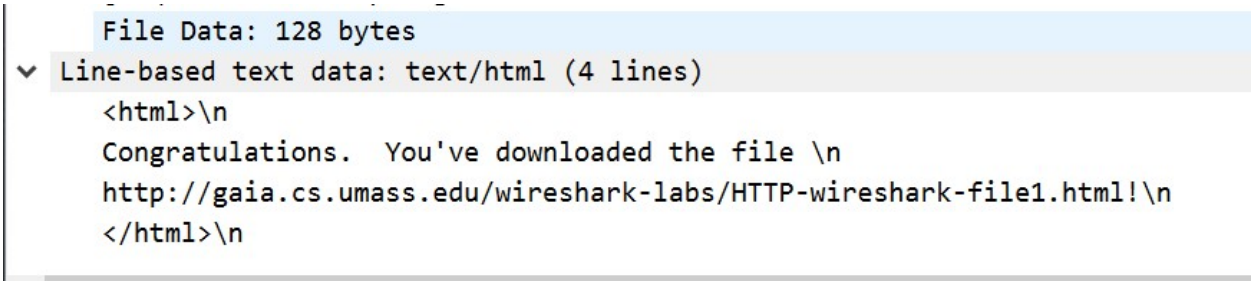
3. IP Address:

a. Computer: 128.61.78.183
b. Server: 128.119.245.12

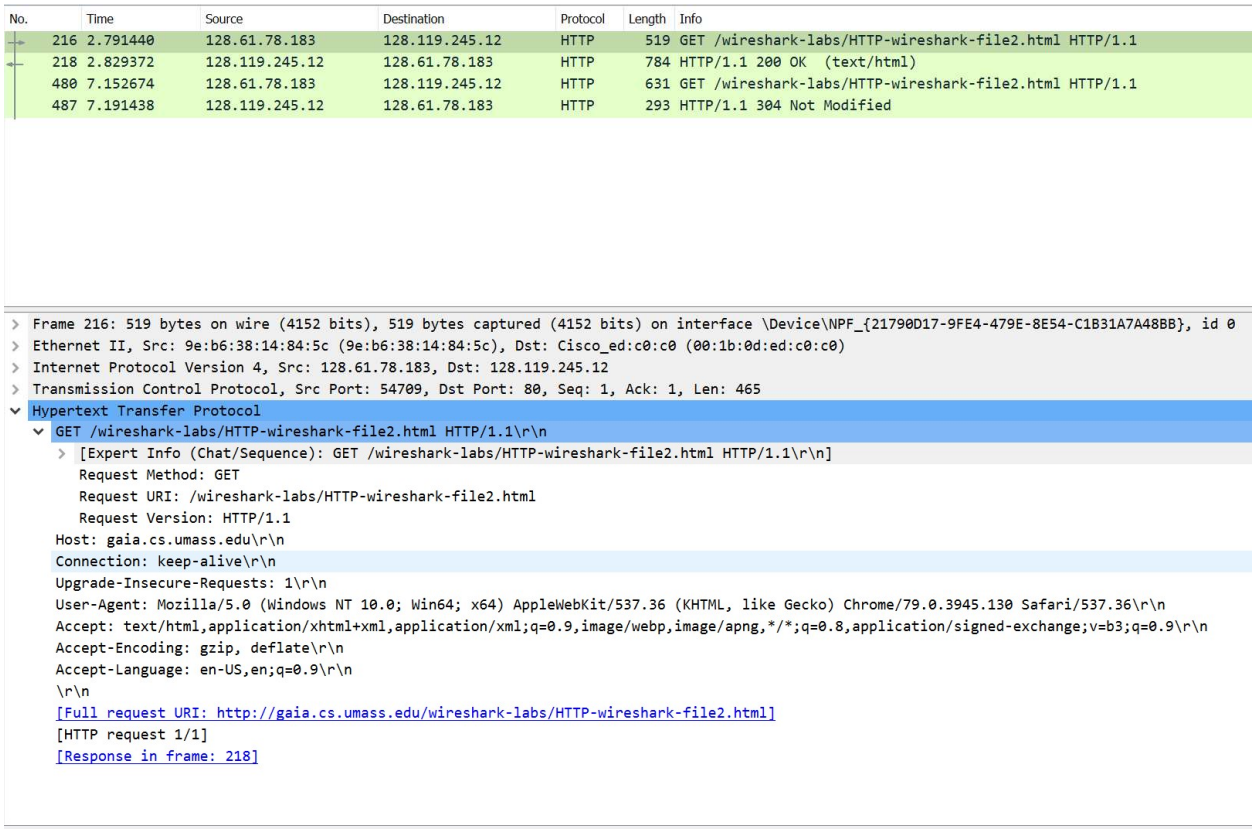
4. Status Code: 200 OK
5. Last Modified: Thu, 30 Jan 2020 06:59:04 GMT



6. Content Length: 128 bytes

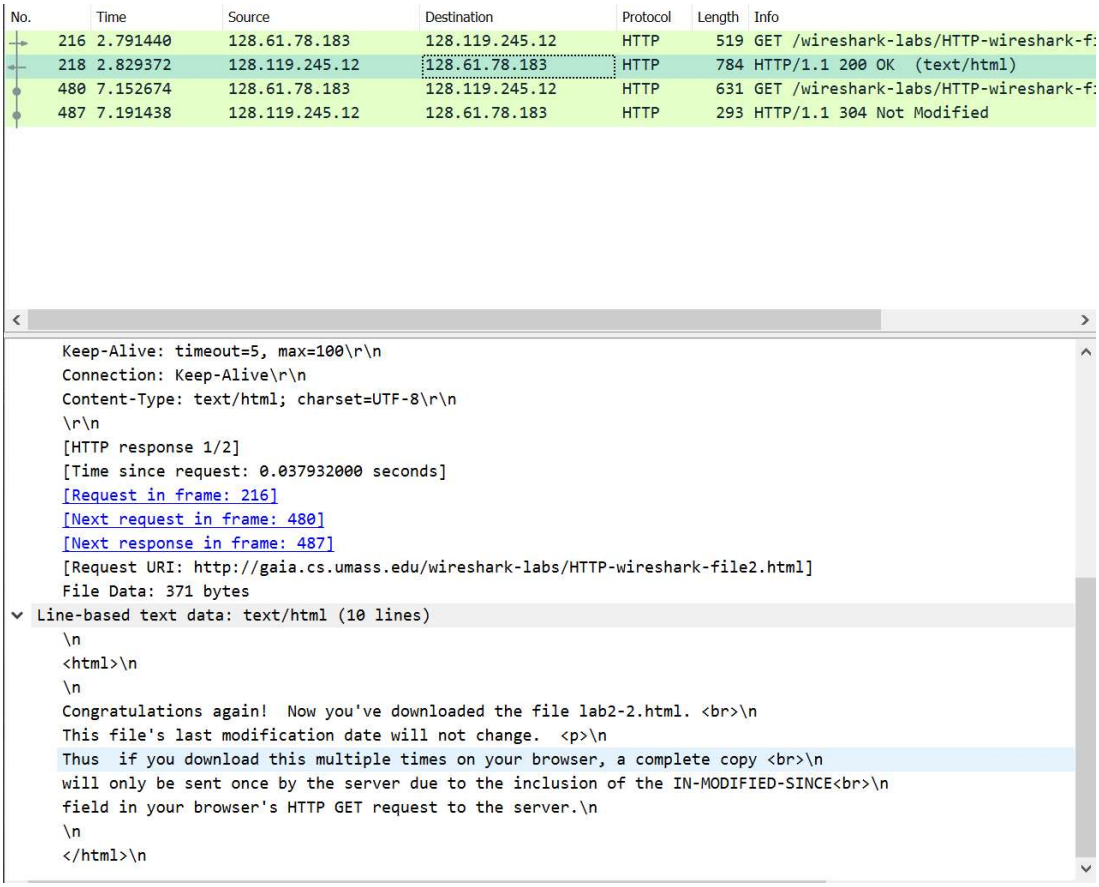


7. No I do not see any other headers not displayed.
8. No IF-MODIFIED-SINCE.



No.	Time	Source	Destination	Protocol	Length	Info
216	2.791440	128.61.78.183	128.119.245.12	HTTP	519	GET /wireshark-labs/HTTP-wireshark-file2.html HTTP/1.1
218	2.829372	128.119.245.12	128.61.78.183	HTTP	784	HTTP/1.1 200 OK (text/html)
480	7.152674	128.61.78.183	128.119.245.12	HTTP	631	GET /wireshark-labs/HTTP-wireshark-file2.html HTTP/1.1
487	7.191438	128.119.245.12	128.61.78.183	HTTP	293	HTTP/1.1 304 Not Modified

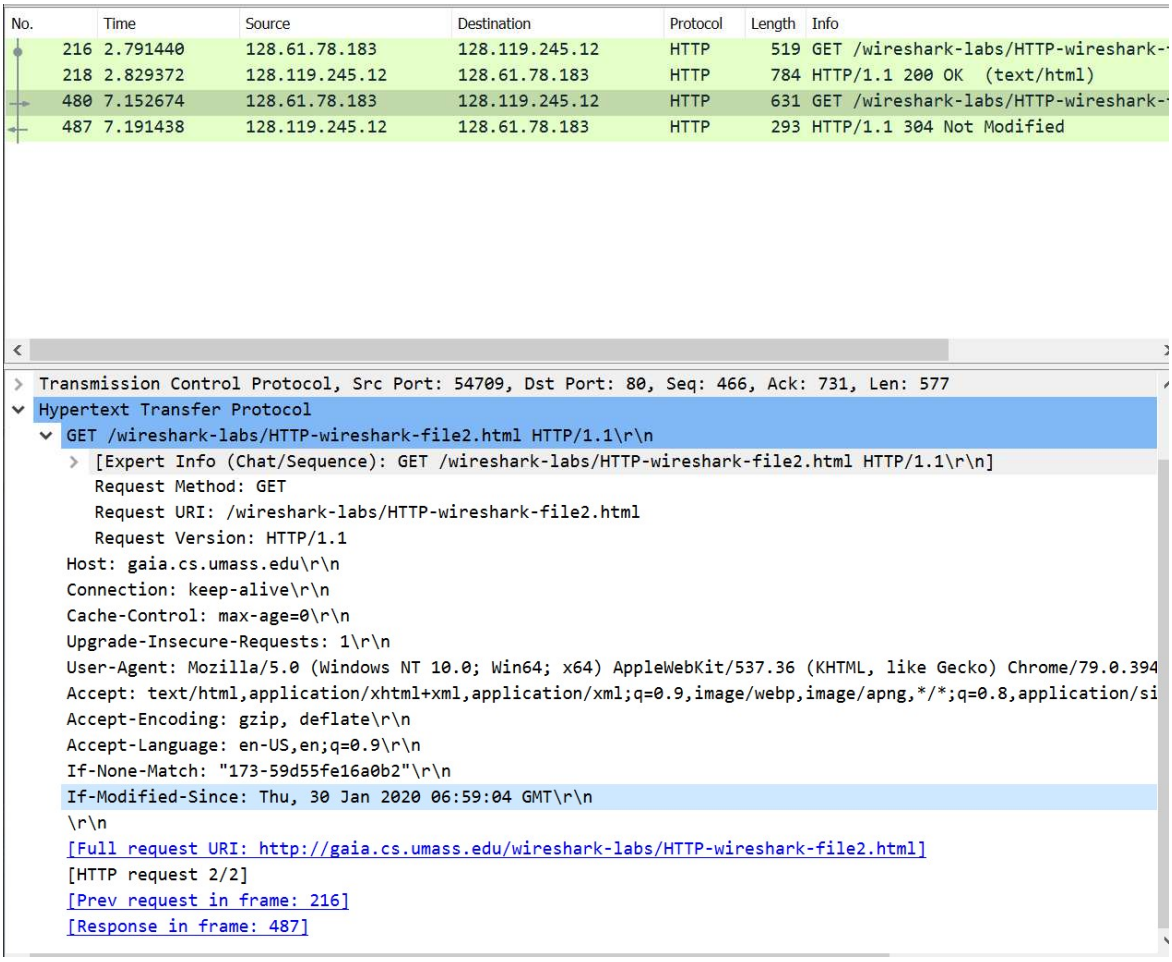
9. The server did return the contents of the file. You can tell by expanding the Line-based text data in Packet Contents of the response, which shows the file contents.



No.	Time	Source	Destination	Protocol	Length	Info
216	2.791440	128.61.78.183	128.119.245.12	HTTP	519	GET /wireshark-labs/HTTP-wireshark-f
218	2.829372	128.119.245.12	128.61.78.183	HTTP	784	HTTP/1.1 200 OK (text/html)
480	7.152674	128.61.78.183	128.119.245.12	HTTP	631	GET /wireshark-labs/HTTP-wireshark-f
487	7.191438	128.119.245.12	128.61.78.183	HTTP	293	HTTP/1.1 304 Not Modified

```
Keep-Alive: timeout=5, max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=UTF-8\r\n
\r\n
[HTTP response 1/2]
[Time since request: 0.037932000 seconds]
[Request in frame: 216]
[Next request in frame: 480]
[Next response in frame: 487]
[Request URI: http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file2.html]
File Data: 371 bytes
Line-based text data: text/html (10 lines)
\n
<html>\n
\n
Congratulations again!  Now you've downloaded the file lab2-2.html. <br>\n
This file's last modification date will not change.  <p>\n
Thus  if you download this multiple times on your browser, a complete copy <br>\n
will only be sent once by the server due to the inclusion of the IN-MODIFIED-SINCE<br>\n
field in your browser's HTTP GET request to the server.\n
\n
</html>\n
```

10. Yes, IF-MODIFIED-SINCE is present.
    a. If-Modified-Since: Thu, 30 Jan 2020 06:59:04 GMT\r\n



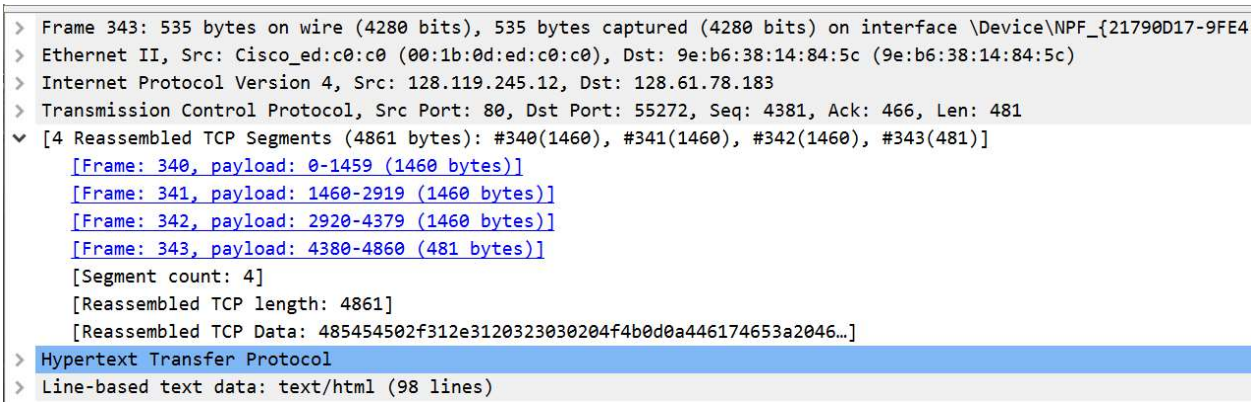
No.	Time	Source	Destination	Protocol	Length	Info
216	2.791440	128.61.78.183	128.119.245.12	HTTP	519	GET /wireshark-labs/HTTP-wireshark-
218	2.829372	128.119.245.12	128.61.78.183	HTTP	784	HTTP/1.1 200 OK (text/html)
480	7.152674	128.61.78.183	128.119.245.12	HTTP	631	GET /wireshark-labs/HTTP-wireshark-
487	7.191438	128.119.245.12	128.61.78.183	HTTP	293	HTTP/1.1 304 Not Modified

```
Transmission Control Protocol, Src Port: 54709, Dst Port: 80, Seq: 466, Ack: 731, Len: 577
Hypertext Transfer Protocol
  GET /wireshark-labs/HTTP-wireshark-file2.html HTTP/1.1\r\n
    [Expert Info (Chat/Sequence): GET /wireshark-labs/HTTP-wireshark-file2.html HTTP/1.1\r\n]
    Request Method: GET
    Request URI: /wireshark-labs/HTTP-wireshark-file2.html
    Request Version: HTTP/1.1
  Host: gaia.cs.umass.edu\r\n
  Connection: keep-alive\r\n
  Cache-Control: max-age=0\r\n
  Upgrade-Insecure-Requests: 1\r\n
  User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/79.0.394
  Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,*/*;q=0.8,application/si
  Accept-Encoding: gzip, deflate\r\n
  Accept-Language: en-US,en;q=0.9\r\n
  If-None-Match: "173-59d55fe16a0b2"\r\n
  If-Modified-Since: Thu, 30 Jan 2020 06:59:04 GMT\r\n
  \r\n
  [Full request URI: http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file2.html]
  [HTTP request 2/2]
  [Prev request in frame: 216]
  [Response in frame: 487]
```

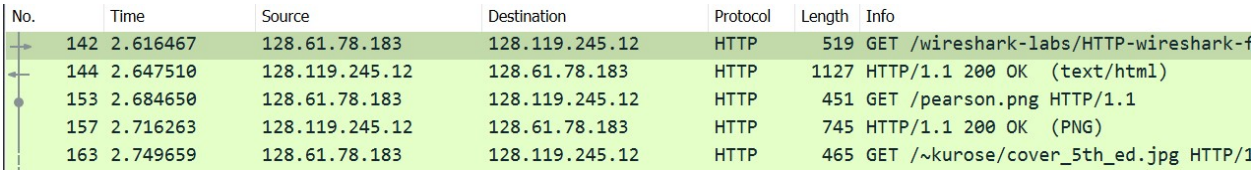
11. HTTP Status Code: 304 Not Modified
    a. We did not receive the full file contents as Line-based text data is not present
12. # of Packet with HTTP GET Requests: 1
    a. Packet # = 338
13. # of Packet with Status Code and Phrase: 343

No.	Time	Source	Destination	Protocol	Length	Info
338	4.815710	128.61.78.183	128.119.245.12	HTTP	519	GET /wireshark-labs/HTTP-wireshark-
343	4.851359	128.119.245.12	128.61.78.183	HTTP	535	HTTP/1.1 200 OK (text/html)

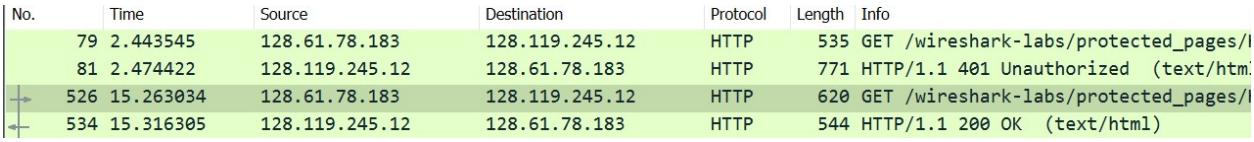
14. Status Code and Phrase: 200 OK
15. # of data-containing TCP segments: 4 TCP Segments and then they were reassembled.



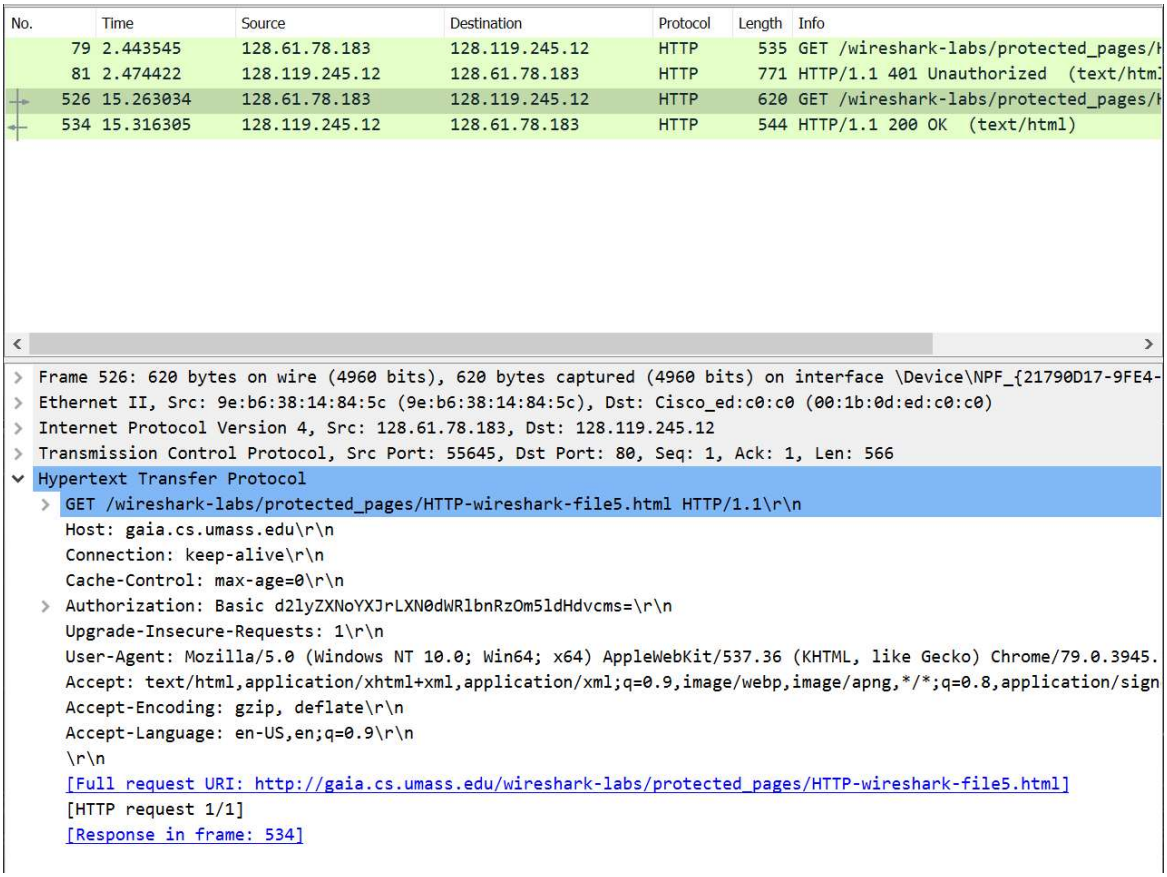
16. # of HTTP GET: 3.
    a. First Request: The first page: 128.119.245.12
    b. Second Request: Pearson Logo: 128.119.245.12
    c. Third Request: Cover of the Pearson Textbook: 128.119.245.12



17. The browser downloaded the images serially as the request for the logo was sent and received before the request for the book cover was sent.
18. Status Code and Phrase: 401 Unauthorized



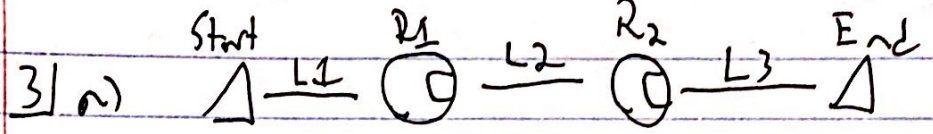
19. New Field: Authorization Field in HTTP Protocol



No.	Time	Source	Destination	Protocol	Length	Info
79	2.443545	128.61.78.183	128.119.245.12	HTTP	535	GET /wireshark-labs/protected_pages/H
81	2.474422	128.119.245.12	128.61.78.183	HTTP	771	HTTP/1.1 401 Unauthorized (text/html
526	15.263034	128.61.78.183	128.119.245.12	HTTP	620	GET /wireshark-labs/protected_pages/H
534	15.316305	128.119.245.12	128.61.78.183	HTTP	544	HTTP/1.1 200 OK (text/html)

```
> Frame 526: 620 bytes on wire (4960 bits), 620 bytes captured (4960 bits) on interface \Device\NPF_{21790D17-9FE4-
> Ethernet II, Src: 9e:b6:38:14:84:5c (9e:b6:38:14:84:5c), Dst: Cisco_ed:c0:c0 (00:1b:0d:ed:c0:c0)
> Internet Protocol Version 4, Src: 128.61.78.183, Dst: 128.119.245.12
> Transmission Control Protocol, Src Port: 55645, Dst Port: 80, Seq: 1, Ack: 1, Len: 566
v Hypertext Transfer Protocol
  > GET /wireshark-labs/protected_pages/HTTP-wireshark-file5.html HTTP/1.1\r\n
    Host: gaia.cs.umass.edu\r\n
    Connection: keep-alive\r\n
    Cache-Control: max-age=0\r\n
  > Authorization: Basic d2lyZXNoYXJrLXN0dWRlbnRzOm5ldHdvcms=\r\n
    Upgrade-Insecure-Requests: 1\r\n
    User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/79.0.3945.
    Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,*/*;q=0.8,application/sign
    Accept-Encoding: gzip, deflate\r\n
    Accept-Language: en-US,en;q=0.9\r\n
    \r\n
    [Full request URI: http://gaia.cs.umass.edu/wireshark-labs/protected_pages/HTTP-wireshark-file5.html]
    [HTTP request 1/1]
    [Response in frame: 534]
```

Jared Raiola

3) a) 

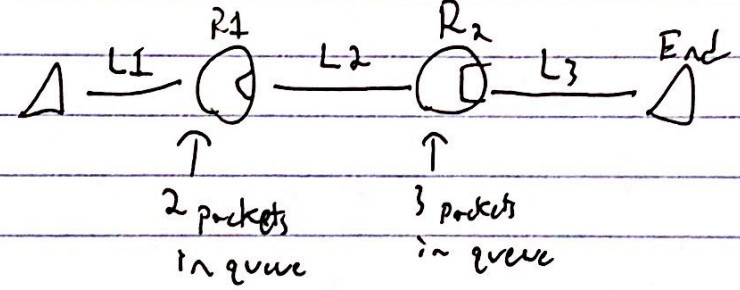
$$\text{Time} = \frac{\text{size of packet}}{\text{Bandwidth}}$$

$$\text{Time} = (\text{start} \to L1) + (R1 \to L2) + (R2 \to L3)$$

10,000 bits = 10^4 bits

$$= \left(2 \times \left(\frac{10^4}{20\,\text{Mbps}}\right) + \left(\frac{10^4}{100\,\text{Mbps}}\right)\right) = \left(2 \times \frac{1}{20 \times 10^2} + \frac{1}{10^4}\right)$$

$$= \left(\frac{2}{20 \times 10^2} + \frac{1}{10^4}\right) = \left(\frac{1}{40^4} + \frac{1}{10^3}\right) = \left(\frac{11}{10^4}\right) s = \boxed{1100\,\mu s}$$

b) 

$$\text{Time} = (\text{start} \to L1) + 3(R1 \to L2) + 4(R2 \to L3)$$

$$= \left(\frac{10^4 \text{ bits}}{20 \times 10^6}\right) + 3\left(\frac{10^4}{100 \times 10^6}\right) + 4\left(\frac{10^4}{20 \times 10^6}\right)$$

$$= 5\left(\frac{10^4}{20 \times 10^6}\right) + 3\left(\frac{10^4}{100 \times 10^6}\right)$$

$$= \frac{5}{20 \times 10^2} + \frac{3}{10^4} = \frac{1}{10^2}\left[\frac{28}{100}\right] = \boxed{\frac{28}{10^4}\,s}$$

3 cont. c) total time = time + propagation delay

propagation delay = $\frac{\text{distance}}{\text{speed}}$

$= 2\left(\frac{2000\times10^3}{200\times10^6}\right)+\left(\frac{4000\times10^3}{200\times10^6}\right) = \frac{8000\times10^3}{200\times10^6} = \frac{8}{200} = 0.04s$

$0.04 + 0.0011 = \boxed{0.0411s}$

4) End to end delay = transmit on each link + propagation on each link + switch delays

packet length = L propagation speed = S_i where $i = 1, 2, 3$
link length = d_i transmission = R_i

transmit on a link = $\frac{L}{R_i}$ switch delay = $d_{(proc)}$

propagation on a link = $\frac{S_i}{d_i}$

Since there are 3 links, there are 2 switch delays
Link 1 → Link 2 and Link 2 → Link 3

$$\text{End to end delay} = \frac{L}{R1}+\frac{L}{R2}+\frac{L}{R3}+\frac{d1}{S1}+\frac{d2}{S2}+\frac{d3}{S3}+d_{(proc)}+d_{(proc)}$$

$L = 1500$ bytes $S_i = 2.5\times10^8$ m/s Link 1 length = 5000 km
$d_{(proc)} = 3$ msec $R_i = 2$ Mbps Link 2 length = 4000 km
Link 3 length = 1000 km

End to end delay = $\frac{L}{R1}+\frac{L}{R2}+\frac{L}{R3}+\frac{d1}{S1}+\frac{d2}{S2}+\frac{d3}{S3}+2(d_{(proc)})$

$= \left(\frac{1500\text{ bytes}}{2\text{ Mbps}}\right)\times3 + \frac{5000\text{ km}}{2.5\times10^8\text{ m/s}} + \frac{4000\text{ km}}{2.5\times10^8\text{ m/s}} + \frac{1000\text{ km}}{2.5\times10^8\text{ m/s}} + 2(3\text{ msec})$

↑ Since transmission rate does not change and packet size (length) doesn't change

4 cnt. | 1000 msec = 1 sec

$= 3(0.06s) + 0.02s + 0.016s + 0.004s + 2(0.003s)$

$= \boxed{0.064s}$