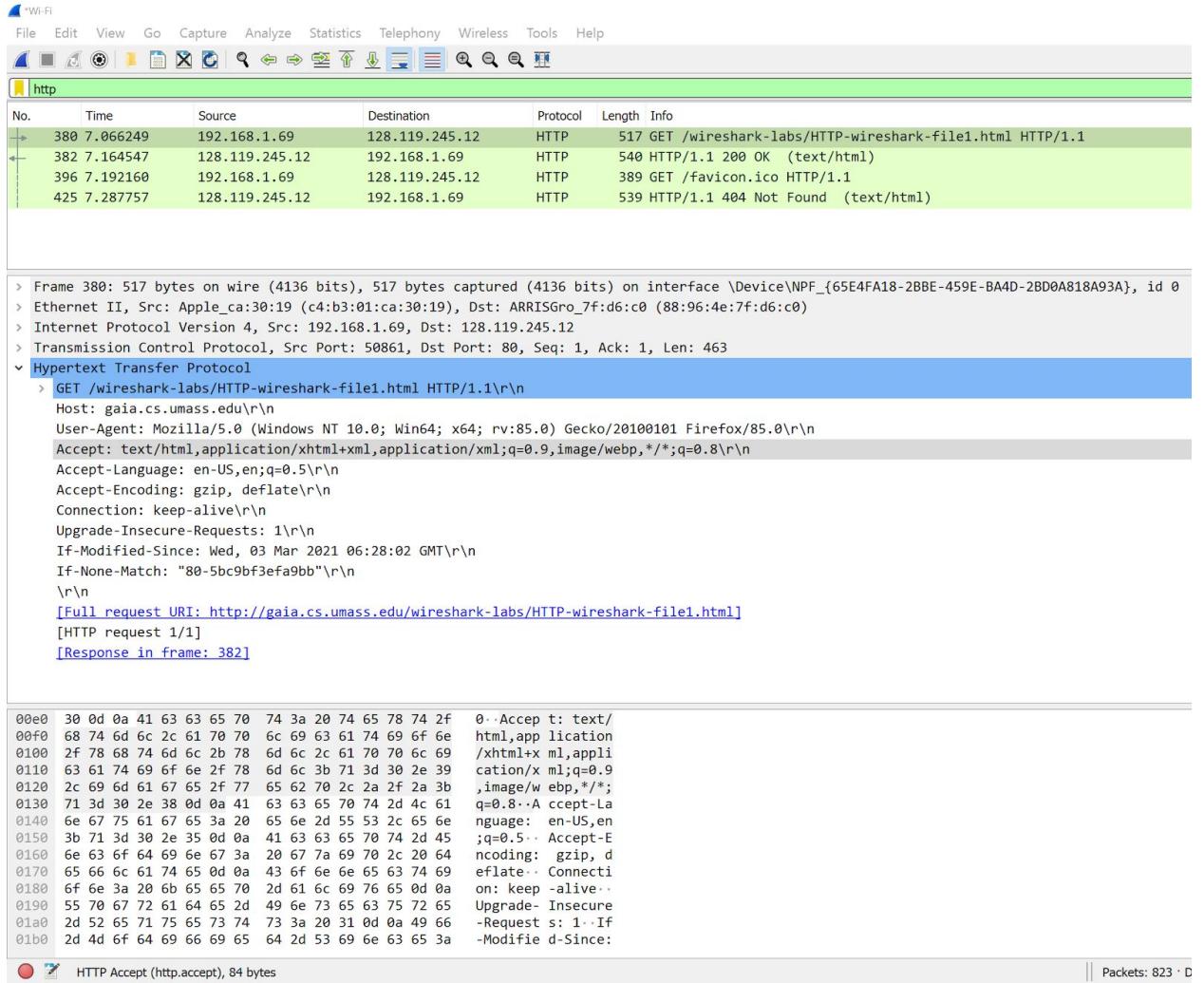


Melissa Jost  
 915842777  
 Section A03  
 Roberto Lozano  
 914294300  
 Section A01

## Wireshark Lab: HTTP

### 1. The Basic HTTP GET/response interaction



The screenshot shows a Wireshark capture window with the following details:

- Packets:** 823 · D
- Selected Packet:** 380 (HTTP GET request)
- Protocol View:**
  - Frame 380: 517 bytes on wire (4136 bits), 517 bytes captured (4136 bits) on interface \Device\NPF\_{65E4FA18-2BBE-459E-BA4D-2BD0A818A93A}, id 0
    - Ethernet II, Src: Apple\_ca:30:19 (c4:b3:01:ca:30:19), Dst: ARRISGro\_7f:d6:c0 (88:96:4e:7f:d6:c0)
    - Internet Protocol Version 4, Src: 192.168.1.69, Dst: 128.119.245.12
    - Transmission Control Protocol, Src Port: 50861, Dst Port: 80, Seq: 1, Ack: 1, Len: 463
  - HyperText Transfer Protocol
    - GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1\r\n
 Host: gaia.cs.umass.edu\r\n
 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:85.0) Gecko/20100101 Firefox/85.0\r\n
 Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,\*/\*;q=0.8\r\n
 Accept-Language: en-US,en;q=0.5\r\n
 Accept-Encoding: gzip, deflate\r\n
 Connection: keep-alive\r\n
 Upgrade-Insecure-Requests: 1\r\n
 If-Modified-Since: Wed, 03 Mar 2021 06:28:02 GMT\r\n
 If-None-Match: "80-5bc9bf3ef9bb"\r\n
    - [Full request URI: http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file1.html]
    - [HTTP request 1/1]
    - [Response in frame: 382]
- Hex View:** Shows the raw hex and ASCII representation of the selected packet.
- Selected Hex:** 00e0 30 0d 0a 41 63 63 65 70 74 3a 20 74 65 78 74 2f 0 · Accep t: text/
- Selected ASCII:** HTTP Accept (http.accept), 84 bytes

- My browser is running HTTP version 1.1
- The languages that the browser indicates that I can accept to the server is English US as seen by the text “en-US”
- The IP address of my computer is 192.168.1.69 and the IP address of the gaia.cs.umass.edu server is 128.119.245.12
- The status code returned from the server to my browser is 200 OK

- The HTML file was last modified on Wed, 03, Mar 2021 06:29:01 GMT

The screenshot shows the Wireshark interface with the following details:

- Packets List:** Shows four captured packets. The first three are part of an HTTP session between 192.168.1.69 and 192.168.1.69. The fourth packet is an HTTP 404 Not Found response from 192.168.1.69 to 192.168.245.12.
- Selected Packet:** The second packet (HTTP 200 OK) is selected. Its details are shown in the expanded tree view below.
- HTTP Headers:**
  - Date: Wed, 03 Mar 2021 06:29:53 GMT
  - Server: Apache/2.4.6 (CentOS) OpenSSL/1.0.2k-fips PHP/7.4.14 mod\_perl/2.0.11 Perl/v5.16.3
  - Last-Modified: Wed, 03 Mar 2021 06:29:01 GMT
  - ETag: "80-5bc9bf7764298"
  - Accept-Ranges: bytes
  - Content-Length: 128
  - Keep-Alive: timeout=5, max=100
  - Connection: Keep-Alive
  - Content-Type: text/html; charset=UTF-8
- Request in frame:** The request URI is http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file1.html.
- Hex and ASCII Data:** The content length is 128 bytes, and the ASCII representation of the content is displayed below.

- There are 128 bytes of content being returned from the browser as seen in the Content-Length field.
- No, I don't see any headers within the data that are not displayed in the packet-listing window.

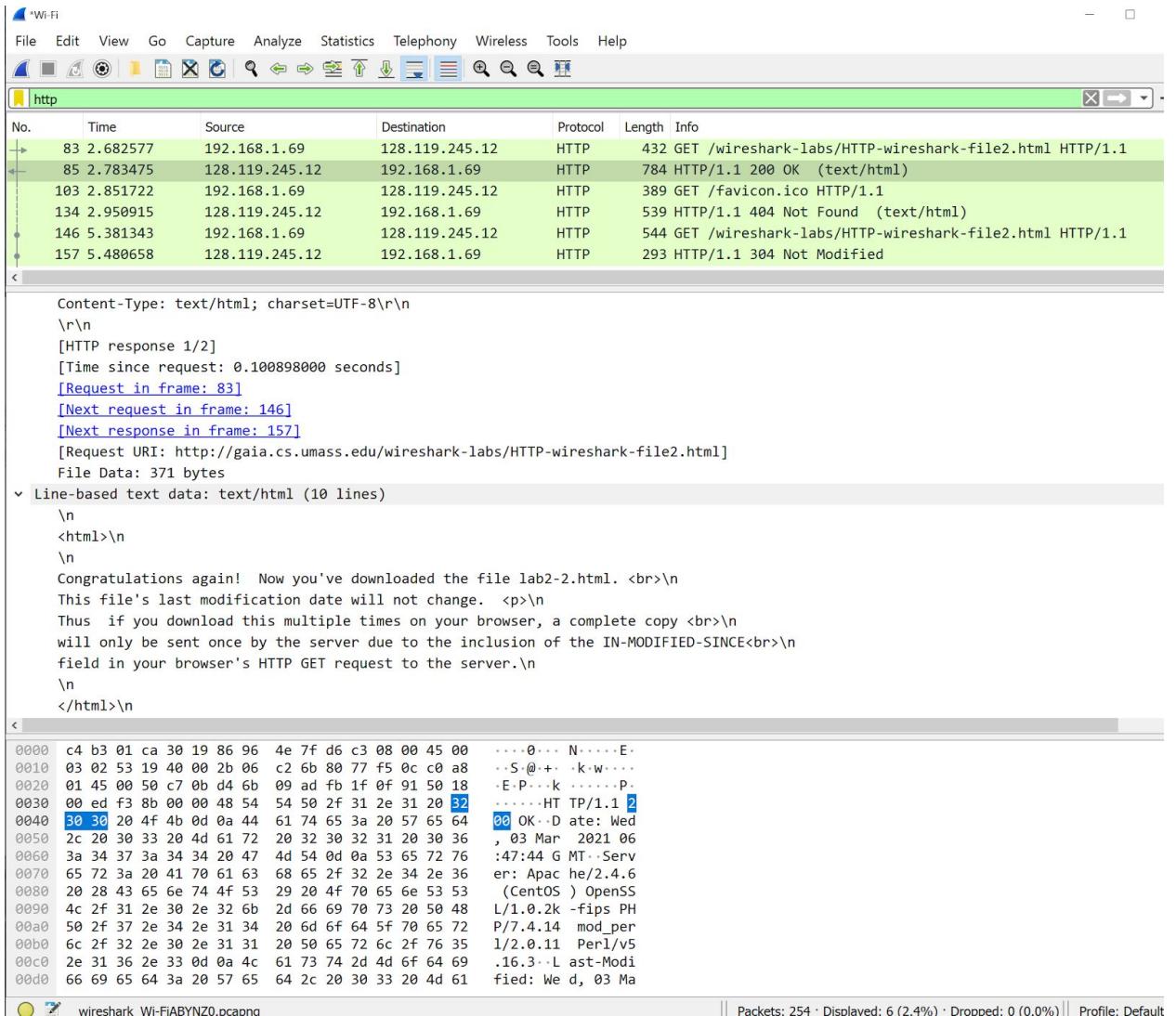
## 2. The HTTP CONDITIONAL GET/response interaction

The Wireshark interface displays an HTTP session. The packet list pane shows the following sequence:

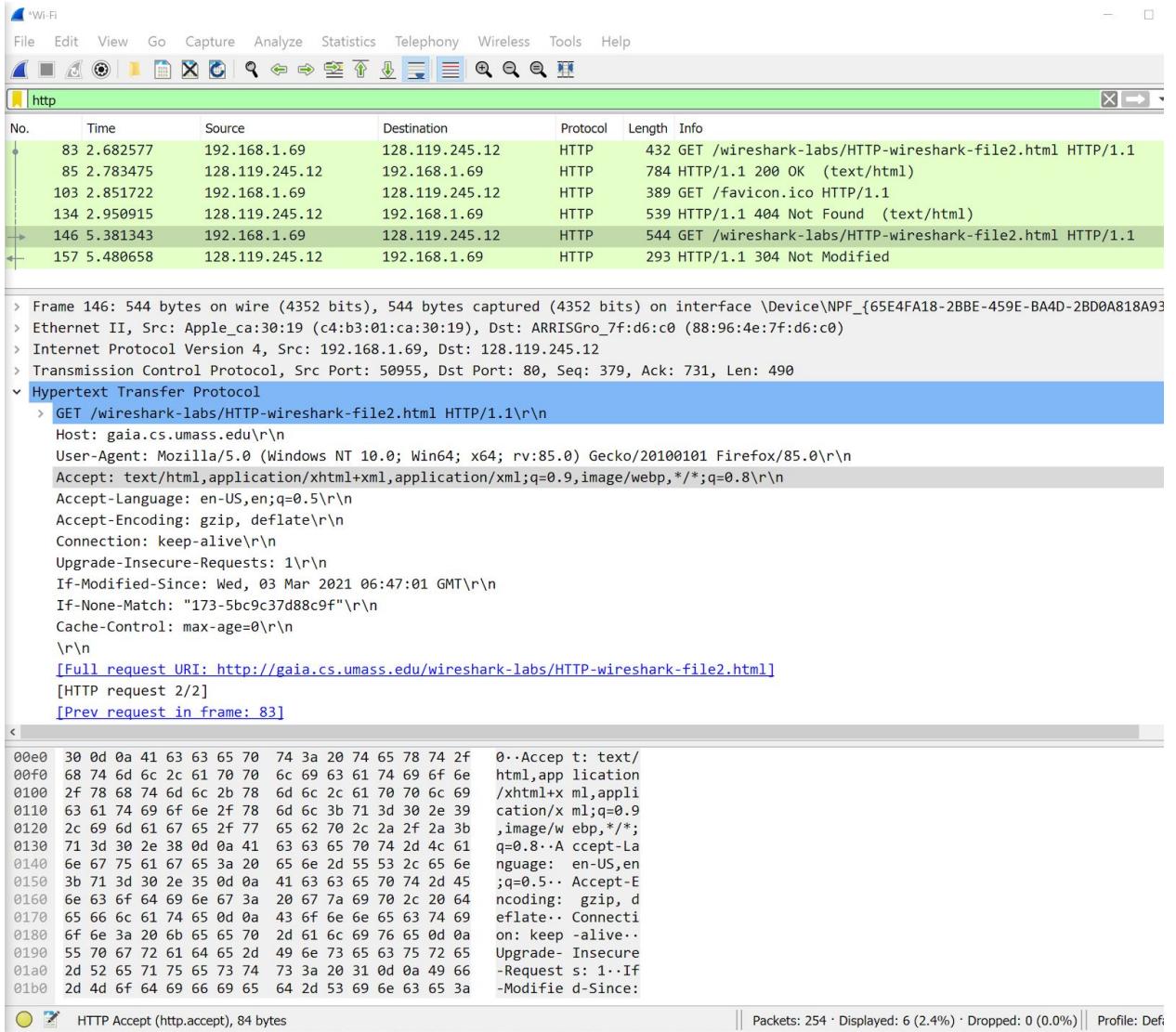
- Frame 83: 432 bytes on wire (3456 bits), 432 bytes captured (3456 bits) on interface \Device\NPF\_{65E4FA18-2BBE-459E-BA4D-2BD0A818A93A}, id 0
  - Ethernet II, Src: Apple\_ca:30:19 (c4:b3:01:ca:30:19), Dst: ARRISGro\_7f:d6:c0 (88:96:4e:7f:d6:c0)
  - Internet Protocol Version 4, Src: 192.168.1.69, Dst: 128.119.245.12
  - Transmission Control Protocol, Src Port: 50955, Dst Port: 80, Seq: 1, Ack: 1, Len: 378
- HyperText Transfer Protocol
  - GET /wireshark-labs/HTTP-wireshark-file2.html HTTP/1.1\r\n
 Host: gaia.cs.umass.edu\r\n
 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:85.0) Gecko/20100101 Firefox/85.0\r\n
 Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,\*/\*;q=0.8\r\n
 Accept-Language: en-US,en;q=0.5\r\n
 Accept-Encoding: gzip, deflate\r\n
 Connection: keep-alive\r\n
 Upgrade-Insecure-Requests: 1\r\n
 \r\n
 [Full request URI: http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file2.html]
 [HTTP request 1/1]
 [Response in frame: 85]

The bytes pane shows the raw hex and ASCII data for the selected GET request.

- I do not see an “IF-MODIFIED-SINCE” line in the first HTTP GET



- Yes, the server did explicitly return the contents of the file. I can tell by seeing the text of the HTML file displayed in the “line based text data” field



- Yes, I do see an “IF-MODIFIED SINCE” line in the second HTTP GET. The information that follows is Wed, 03 Mar 2021 06:47:01 GMT

Wi-Fi

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

http

No.	Time	Source	Destination	Protocol	Length	Info
83	2.682577	192.168.1.69	128.119.245.12	HTTP	432	GET /wireshark-labs/HTTP-wireshark-file
85	2.783475	128.119.245.12	192.168.1.69	HTTP	784	HTTP/1.1 200 OK (text/html)
103	2.851722	192.168.1.69	128.119.245.12	HTTP	389	GET /favicon.ico HTTP/1.1
134	2.950915	128.119.245.12	192.168.1.69	HTTP	539	HTTP/1.1 404 Not Found (text/html)
146	5.381343	192.168.1.69	128.119.245.12	HTTP	544	GET /wireshark-labs/HTTP-wireshark-file
157	5.480658	128.119.245.12	192.168.1.69	HTTP	293	HTTP/1.1 304 Not Modified

```

> Frame 157: 293 bytes on wire (2344 bits), 293 bytes captured (2344 bits) on interface \Device\NPF_{65E4FA18-2BBE-45
> Ethernet II, Src: 86:96:4e:7f:d6:c3 (86:96:4e:7f:d6:c3), Dst: Apple_ca:30:19 (c4:b3:01:ca:30:19)
> Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.69
> Transmission Control Protocol, Src Port: 80, Dst Port: 50955, Seq: 731, Ack: 869, Len: 239
< Hypertext Transfer Protocol
  > HTTP/1.1 304 Not Modified\r\n
    Date: Wed, 03 Mar 2021 06:47:47 GMT\r\n
    Server: Apache/2.4.6 (CentOS) OpenSSL/1.0.2k-fips PHP/7.4.14 mod_perl/2.0.11 Perl/v5.16.3\r\n
    Connection: Keep-Alive\r\n
    Keep-Alive: timeout=5, max=99\r\n
    ETag: "173-5bc9c37d88c9f"\r\n
    \r\n
    [HTTP response 2/2]
    [Time since request: 0.099315000 seconds]
    [Prev request in frame: 83]
    [Prev response in frame: 85]
    [Request in frame: 146]
    [Request URI: http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file2.html]
```

0000	c4 b3 01 ca 30 19 86 96	4e 7f d6 c3 08 00 45 00	.....0... N.....E.
0010	01 17 53 1a 40 00 2b 06	c4 55 80 77 f5 0c c0 a8	..S@-+.. .U-w....
0020	01 45 00 50 c7 0b d4 6b	0c 87 fb 1f 11 7b 50 18	.E-P...k .....{P.
0030	00 f5 fa 99 00 00 48 54	54 50 2f 31 2e 31 20 33	.....HT TP/1.1 3
0040	30 34 20 4e 6f 74 20 4d	6f 64 69 66 69 65 64 0d	04 Not M odified.
0050	0a 44 61 74 65 3a 20 57	65 64 2c 20 30 33 20 4d	.Date: W ed, 03 M
0060	61 72 20 32 30 32 31 20	30 36 3a 34 37 3a 34 37	ar 2021 06:47:47
0070	20 47 4d 54 0d 0a 53 65	72 76 65 72 3a 20 41 70	GMT. Se rver: Ap
0080	61 63 68 65 2f 32 2e 34	2e 36 20 28 43 65 6e 74	ache/2.4 .6 (Cent
0090	4f 53 29 20 4f 70 65 6e	53 53 4c 2f 31 2e 30 2e	OS) Open SSL/1.0.
00a0	32 6b 2d 66 69 70 73 20	50 48 50 2f 37 2e 34 2e	2k-fips PHP/7.4.
00b0	31 34 20 6d 6f 64 5f 70	65 72 6c 2f 32 2e 30 2e	14 mod_p erl/2.0.
00c0	31 31 20 50 65 72 6c 2f	76 35 2e 31 36 2e 33 0d	11 Perl/ v5.16.3.
00d0	0a 43 6f 6e 6e 65 63 74	69 6f 6e 3a 20 4b 65 65	.Connect ion: Kee

wireshark Wi-Fi ARVN70 mazarrn Darkrate: 254 · Discard rate: 0 (0.0%) · Drained: 0 (0.0%)

- The HTTP status code and phrase returned from the server in response to the second HTTP GET are 304 Not Modified. The server did not explicitly return the contents of the file as it was not modified since the last response.

### 3. Retrieving Long Documents

The screenshot shows the Wireshark interface with the following details:

- Packets List View:** Shows four captured HTTP packets. The 47th packet is highlighted in blue, indicating it is the selected packet for analysis.
- Selected Packet Details:**
  - Frame 47:** 432 bytes on wire (3456 bits), 432 bytes captured (3456 bits) on interface \Device\NPF\_{65E4FA18-2BBE-459E-BA4D-2BD0A818A93A
  - Ethernet II, Src: Apple\_ca:30:19 (c4:b3:01:ca:30:19), Dst: ARRISGro\_7f:d6:c0 (88:96:4e:7f:d6:c0)**
  - Internet Protocol Version 4, Src: 192.168.1.69, Dst: 128.119.245.12**
  - Transmission Control Protocol, Src Port: 54280, Dst Port: 80, Seq: 1, Ack: 1, Len: 378**
  - Hypertext Transfer Protocol**
  - Request Headers:**
    - GET /wireshark-labs/HTTP-wireshark-file3.html HTTP/1.1\r\n
    - Host: gaia.cs.umass.edu\r\n
    - User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:85.0) Gecko/20100101 Firefox/85.0\r\n
    - Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,\*/\*;q=0.8\r\n
    - Accept-Language: en-US,en;q=0.5\r\n
    - Accept-Encoding: gzip, deflate\r\n
    - Connection: keep-alive\r\n
    - Upgrade-Insecure-Requests: 1\r\n
  - Full request URI:** <http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file3.html>
  - [HTTP request 1/1]**
  - [Response in frame: 541]**
- Hex Editor View:** Displays the raw hex and ASCII data for the selected packet (Frame 47). The ASCII view shows the beginning of the Bill of Rights document.

- The browser only sent 1 HTTP GET request message. The 47th packet contains the GET message for the Bill of Rights.
- The 54th packet contains the status code and the phrase associated with the response to the HTTP GET request.
- The status code and phrase in the response is 200 OK
- 5 TCP segments were needed to carry the single HTTP response and the text of the Bill of Rights.

## 4. HTML Documents with Embedded Objects

The screenshot shows the Wireshark interface with the following details:

- File Menu:** File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, Help.
- Toolbar:** Wi-Fi, File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, Help.
- HTTP Filter:** http
- Table Headers:** No., Time, Source, Destination, Protocol, Length, Info.
- Selected Frame (Frame 195):**
  - Time: 2.180468
  - Source: 192.168.1.69
  - Destination: 128.119.245.12
  - Protocol: HTTP
  - Length: 432
  - Info: GET /wireshark-labs/HTTP-wireshark-file4.html HTTP/1.1
- Frame Details:**
  - Frame 195: 432 bytes on wire (3456 bits), 432 bytes captured (3456 bits) on interface \Device\NPF\_{65E4FA18-2BBE-459E-BA4D-2BD0A818A93A}, id 0
  - Ethernet II, Src: Apple\_ca:30:19 (c4:b3:01:ca:30:19), Dst: ARRISGro\_7f:d6:c0 (88:96:4e:7f:d6:c0)
  - Internet Protocol Version 4, Src: 192.168.1.69, Dst: 128.119.245.12
  - Transmission Control Protocol, Src Port: 54510, Dst Port: 80, Seq: 1, Ack: 1, Len: 378
- HTTP Headers:**
  - GET /wireshark-labs/HTTP-wireshark-file4.html HTTP/1.1\r\n
  - Host: gaia.cs.umass.edu\r\n
  - User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:85.0) Gecko/20100101 Firefox/85.0\r\n
  - Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,\*/\*;q=0.8\r\n
  - Accept-Language: en-US,en;q=0.5\r\n
  - Accept-Encoding: gzip, deflate\r\n
  - Connection: keep-alive\r\n
  - Upgrade-Insecure-Requests: 1\r\n
- Full request URI:** <http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file4.html>
- HTTP request 1/1:**
- Response in frame:** 218
- Hex Dump:** Shows the raw hex and ASCII data for the selected frame.
- Statistics:** Packets: 926 · Displayed: 8 (0.9%)
- Profile:** Default

- The browser sent 3 HTTP GET requests and they were sent to the HTML page, to the Pearson image, and to the Pearson book image.
- The browser downloaded the two images serially instead of in parallel since the second image was not requested until the first image was received.

## 5. HTTP Authentication

The screenshot shows a Wireshark capture of network traffic. The packet list pane shows several HTTP requests and responses. The details pane shows the selected packet's HTTP headers, including the Authorization header. The bytes pane shows the raw hex and ASCII data for the selected packet.

```

> Frame 207: 507 bytes on wire (4056 bits), 507 bytes captured (4056 bits) on interface \Device\NPF_{65E4FA18-2BBE-459E-BA4D-2BD0A818A93A}, id 0
> Ethernet II, Src: Apple_ca:30:19 (c4:b3:01:ca:30:19), Dst: ARRISGro_7f:d6:c0 (88:96:4e:7f:d6:c0)
> Internet Protocol Version 4, Src: 192.168.1.69, Dst: 128.119.245.12
> Transmission Control Protocol, Src Port: 55062, Dst Port: 80, Seq: 1, Ack: 1, Len: 453
  Hypertext Transfer Protocol
    > GET /wireshark-labs/protected_pages/HTTP-wireshark-file5.html HTTP/1.1\r\n
      Host: gaia.cs.umass.edu\r\n
      User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:85.0) Gecko/20100101 Firefox/85.0\r\n
      Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8\r\n
      Accept-Language: en-US,en;q=0.5\r\n
      Accept-Encoding: gzip, deflate\r\n
      Connection: keep-alive\r\n
      Upgrade-Insecure-Requests: 1\r\n
      Authorization: Basic d2lyZXNoYXJrLXN0dWRlbz0m5ldHdvcms=\r\n
    \r\n
    [Full request URI: http://gaia.cs.umass.edu/wireshark-labs/protected_pages/HTTP-wireshark-file5.html]
    [HTTP request 1/2]
    [Response in frame: 209]
  
```

Activate Windows  
Go to Settings to activate Windows.

- The server's response in response to the initial HTTP GET message from the browser is 401 Unauthorized.
- The new field that is included in the HTTP GET message is the Authorization field.

## Part B Report: Web Proxy Cache

**Part A:** Explain your results in a few sentences and in addition to that, explain briefly how your program works in not more than two paragraphs.

Our program was able to successfully process requests from the client, retrieve those files either from our cache or the server and sucessfully display the pages on our browser, including other miscellaneous files such as imgs, css, videos, etc.. Occasionally a file may have been “moved permanently” or “moved temporarily” however most files will load on most sites.

Important things to point out for our program is that we ran using <http://localhost:8888/><website> rather than configuring our browser to run through our proxy. We tested in Firefox.

EX: <http://localhost:8888/>www.apache.org. If for any reason a request may not work, attempt to rerun with or without the “www.” portion of the address depending on if you included it. Sometimes just simply reruning can also help. The sites that we used for our testing are listed at the bottom of Part B.

The way in which our program works is through the use of sockets and HTTP requests. First we set up a server socket that we bind to an address (in our case localhost) and to port 8888. From here we accept() the server Socket which gives us a Client Socket and Address touple. After accepting and having set up our connection with the client we now listen for any requests from the client. If we receive a request, then we do some string parsing in order to get the proper GET request format. After having parsed what file we want, we first try to see if the file hasn't already been stored in our cache. If it has then we read from the file and send that data back to the client, fulfilling their request.

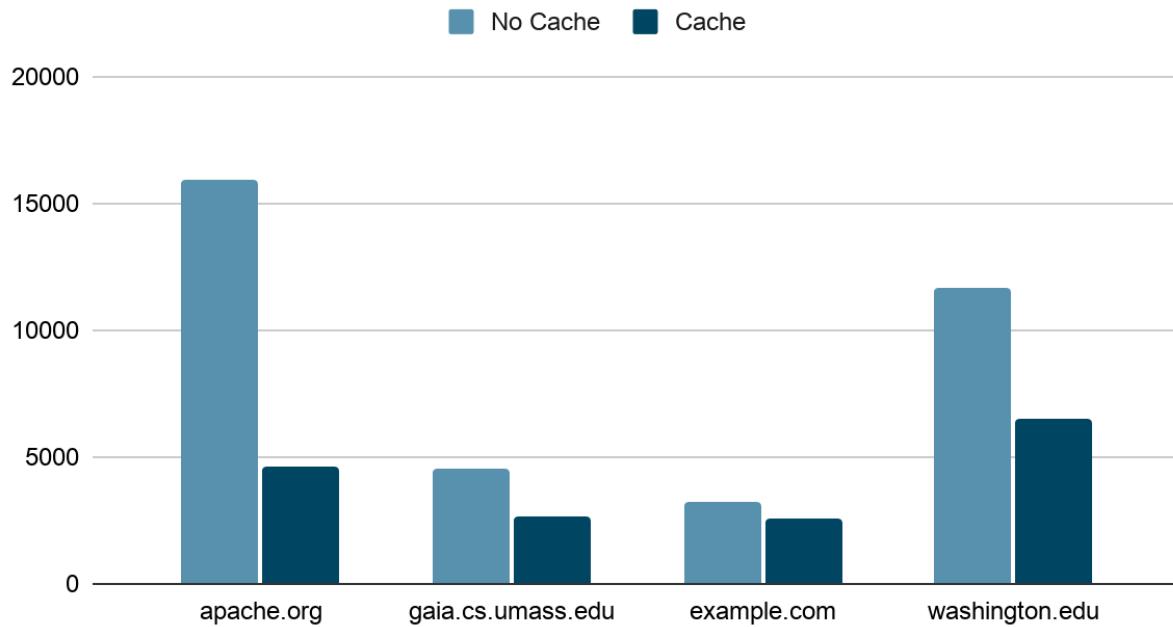
However if the request is not in our cache then we prepare to send the request to the server. First we create a new socket and connect the socket to port 80 and to the hostname of the site we want to request from. After this and ensuring our GET request is properly formatted we sent this request through the socket. After having sent the request, we receive the response through the same socket. We then write the file to our cache and send the response to the client to display the webpage.

**Part B:** Compare the load times of webpages from web sites before and after caching. You will need to build on top of part (a) to include code to make time measurements, write a paragraph briefly explaining how you did that. Hint: The load times for pages should be lower when cached than when they are not. Also think of a graphical way to show your results.

In order to measure the load time, we kept track of the time at which a request was received, and again when the request was completed, whether that be through contacting the server or through accessing the cache. Because we stay in the while loop the entire time the program executes, and the while loop runs many times in order to load a single page, we simply subtract the start time from the finish time, and add it to a running variable at the beginning of the while loop. This prints every time the program is ready to receive another request, so we see the length of time to load the page at every request. From this, we can store the final time result (in milliseconds) as the time it took to load the whole page, and restart the program to compare the time to another run. After adding this to our code, we tested on a few websites, and compared

the runtimes with and without a cache. Overall, we saw that there was a significant difference in load time when using the cache, with the specific load times listed below.

## Runtime of Web Proxy (in ms)



<http://localhost:8888/www.apache.org>

No cache: 15948 ms

Cache: 4602 ms

<http://localhost:8888/gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file2.html>

No cache: 4581 ms

Cache: 2621 ms

<http://localhost:8888/www.example.com>

No cache: 3236 ms

Cache: 2566 ms

<http://localhost:8888/www.washington.edu/>

No cache: 11674 ms

Cache: 6546 ms

Melissa Jost  
915842777  
Section A03  
Roberto Lozano  
914294300  
Section A01

### **Project 2 Part C: DNS and dig**

- a) In order to find the list of names of DNS servers that were used to find the IP address for [www.cs.ucdavis.edu](http://www.cs.ucdavis.edu), we had to use the command dig [www.cs.ucdavis.edu](http://www.cs.ucdavis.edu) +trace. Pictures of this trace are provided below, and the resulting line of servers were:
- i) l.root-servers.net
  - ii) k.edu-servers.net
  - iii) dns-2.ucdavis.edu
  - iv) 169.237.212.78
- b) We proceeded to use this same command to find the line of servers for [www.google.com](http://www.google.com), [www.yahoo.com](http://www.yahoo.com), and [www.amazon.com](http://www.amazon.com). Similarly, the pictures of these traces are provided below, as well as the resulting line of servers.
- i) [www.google.com](http://www.google.com):
    - 1) a.root-servers.net
    - 2) a.gtld-servers.net
    - 3) ns2.google.com
    - 4) 142.250.68.68
  - ii) [www.yahoo.com](http://www.yahoo.com):
    - 1) m.root-servers.net
    - 2) d.gtld-servers.net
    - 3) ns1.yahoo.com
    - 4) 98.138.11.157
  - iii) [www.amazon.com](http://www.amazon.com):
    - 1) a.root-servers.net
    - 2) a.gtld-servers.net
    - 3) pdns1.ultradns.net
    - 4) 208.78.70.31

## Pictures of Traces:

[www.cs.ucdavis.edu](http://www.cs.ucdavis.edu):

```
; <>> DIG 9.10.3-P4-Debian <>> www.cs.ucdavis.edu +trace
;; global options: +cmd
24453 IN NS l.root-servers.net.
24453 IN NS g.root-servers.net.
24453 IN NS i.root-servers.net.
24453 IN NS d.root-servers.net.
24453 IN NS e.root-servers.net.
24453 IN NS b.root-servers.net.
24453 IN NS m.root-servers.net.
24453 IN NS c.root-servers.net.
24453 IN NS h.root-servers.net.
24453 IN NS k.root-servers.net.
24453 IN NS j.root-servers.net.
24453 IN NS a.root-servers.net.
24453 IN NS f.root-servers.net.
24453 IN RRSIG NS 8 0 518400 20210320170000 20210307160000 42351 . ShUo5b1XVE0/4LbGQratRF1zeStFi
BjekpTz9XasyB3Gg1TtJv 9Vv0Ricc8RaJYYPBSzxV1xI4EBIemfBl0yIIYqByUx8nwq4t0Hw Vvh9CjfmAuyq1V34t0t+DmJu3M1BVrDvufsikvn311X
DqgqclbzuyC5 AUZx7y7HFpxpT5w+jSp+ARQ2uMBgwfx4/INFkq+2ldyPkQtSeghtfbg AwMg3+oplnxtvBvwhdMj107kjg0Anst/0dzAEbkXgeuYmEMNP4dvh2 Ge
SV1NSze8rFvuuV1Q27Qm0eTNEax159jZMScV/HKF8mGs05qvV2 auvHqg=
;; Received 525 bytes from 100.115.92.193#53(100.115.92.193) in 19 ms

.edu. 172800 IN NS k.edu-servers.net.
.edu. 172800 IN NS i.edu-servers.net.
.edu. 172800 IN NS l.edu-servers.net.
.edu. 172800 IN NS g.edu-servers.net.
.edu. 172800 IN NS m.edu-servers.net.
.edu. 172800 IN NS j.edu-servers.net.
.edu. 172800 IN NS e.edu-servers.net.
.edu. 172800 IN NS b.edu-servers.net.
.edu. 172800 IN NS h.edu-servers.net.
.edu. 172800 IN NS c.edu-servers.net.
.edu. 172800 IN NS a.edu-servers.net.
.edu. 172800 IN NS d.edu-servers.net.
.edu. 172800 IN NS f.edu-servers.net.
.edu. 86400 IN DS 28065 8 2 4172496CDE85545E51129040355BD04B1FCFBAE996DFDDE652006F6 F8B2CE76
.edu. 86400 IN RRSIG DS 8 1 86400 20210320170000 20210307160000 42351 . IAicvK7Knpd9xShnW8nw1zjg9q2d
sepdibyiFl0zNptX0TyuA2B3 NVB00d/tePSGN+2lzzCRAXSj8vXEl/1J8wUHScmIavfruSz0 wvvsAqh7dilqlq+ZfRtk69+34dl17jdgfHs1Dg88
7MDY1255RgR CzkdghfCN/nWwQ3CoDPFWHfayeo/OL7Pgwndi+wrm65YQKUpPg5q d50z67Teua7zInj/13hNTMqoUchtHS7LqP7951bm5yqxEuy6YeN04 bum
120CBs-NMT/40Yw226BF375xxj0trzJ5YdgtJ8JFLtAxeyIMJUT QUiQa===
;; Received 1177 bytes from 2001:500:12::d0#53(g.root-servers.net) in 115 ms

ucdavis.edu. 172800 IN NS dns-two.ucdavis.edu.
ucdavis.edu. 172800 IN NS dns-one.ucdavis.edu.
ucdavis.edu. 172800 IN NS dns-three.ucdavis.edu.
ucdavis.edu. 86400 IN DS 39682 8 1 55654FC807F54245974f1579031476B5144E3B
ucdavis.edu. 86400 IN DS 42136 8 2 25F196A168147BCBEAA81DE649983C03118FA5CDF5F7846974A7 553E5121
ucdavis.edu. 86400 IN RR(SIG DS 8 2 86400 20210313085838 20210306074838 62987 edu. E5U5ew71SfpfKIACQBgDUlo/R40
mx159BwHx1M8BFuzPKmBzGB5Vgx 9Vh9Cqncp10krxdmR65+qk2o2Fv/xthqzzniXhjwVAGjYXg GcqPMj2MxA1nk570mqU86yh1+i1AwqsLaM8mDjR40
wimMo4yS8e7h CN/cpclyoOcu/Ga13s3d/Eah5LipmQixcA/6ewNp6cQ==
;; Received 574 bytes from 2001:502:7094:30#53(j.edu-servers.net) in 222 ms

www.cs.ucdavis.edu. 28800 IN A 169.237.212.78
cs.ucdavis.edu. 28800 IN NS dns-one.ucdavis.edu.
cs.ucdavis.edu. 28800 IN NS dns-three.ucdavis.edu.
cs.ucdavis.edu. 28800 IN NS dns-two.ucdavis.edu.
;; Received 2315 bytes from 128.120.252.10#53(dns-two.ucdavis.edu) in 35 ms
```

[www.google.com](http://www.google.com):

```
; <>> DIG 9.10.3-P4-Debian <>> www.google.com +trace
;; global options: +cmd
47787 IN NS a.root-servers.net.
47787 IN NS b.root-servers.net.
47787 IN NS c.root-servers.net.
47787 IN NS d.root-servers.net.
47787 IN NS e.root-servers.net.
47787 IN NS f.root-servers.net.
47787 IN NS g.root-servers.net.
47787 IN NS h.root-servers.net.
47787 IN NS i.root-servers.net.
47787 IN NS j.root-servers.net.
47787 IN NS k.root-servers.net.
47787 IN NS l.root-servers.net.
47787 IN NS m.root-servers.net.
47787 IN RR(SIG NS 8 0 518400 20210320170000 20210307160000 42351 . ShUo5b1XVE0/4LbGQratRF1zeStFi
BjekpTz9XasyB3Gg1TtJv 9Vv0Ricc8RaJYYPBSzxV1xI4EBIemfBl0yIIYqByUx8nwq4t0Hw Vvh9CjfmAuyq1V34t0t+DmJu3M1BVrDvufsikvn311X
DqgqclbzuyC5 AUZx7y7HFpxpT5w+jSp+ARQ2uMBgwfx4/INFkq+2ldyPkQtSeghtfbg AwMg3+oplnxtvBvwhdMj107kjg0Anst/0dzAEbkXgeuYmEMNP4dvh2 Ge
SV1NSze8rFvuuV1Q27Qm0eTNEax159jZMScV/HKF8mGs05qvV2 auvHqg=
;; Received 525 bytes from 100.115.92.193#53(100.115.92.193) in 24 ms

com. 172800 IN NS a.gtd-servers.net.
com. 172800 IN NS b.gtd-servers.net.
com. 172800 IN NS c.gtd-servers.net.
com. 172800 IN NS d.gtd-servers.net.
com. 172800 IN NS e.gtd-servers.net.
com. 172800 IN NS f.gtd-servers.net.
com. 172800 IN NS g.gtd-servers.net.
com. 172800 IN NS h.gtd-servers.net.
com. 172800 IN NS i.gtd-servers.net.
com. 172800 IN NS j.gtd-servers.net.
com. 172800 IN NS k.gtd-servers.net.
com. 172800 IN NS l.gtd-servers.net.
com. 172800 IN NS m.gtd-servers.net.
com. 86400 IN DS 30989 8 2 E2D5C916F6DEEAC73294E8268FB5885044A833FC5459588F4A9184CF C41A5766
com. 86400 IN RR(SIG DS 8 1 86400 20210320170000 20210306074838 62987 . UFVRH+M7j1-z@0WtcTcgrMvTyH2im
mg659EztW2aUldjRQySaEYF-Xg J41YipaIlsihpZj1aAweG844tSPenfmfqHHJAFwNnhJz9Edk Vyn3vJh3tZBtEnFRECxycBV7829akt3851HnExv14
B1G0Ce4Myq4 MvvTadqLASEvOwsos7sh/v4+v3J9p1gY3KShf7gAx3Pj8kQ s4fSP13mNvnlwYgkogdZwQ4NpCewSxoYjuPcGD92XYKu8oPe6y7s06 097
6oCspPpQeiauhpknko5p1e+d52kxiF2Lyeyz61NQ-8R8C2d+irk6 u5bcg=
;; Received 1174 bytes from 2001:500:9f:4:24253(1.root-servers.net) in 87 ms
```

```
google.com. 172800 IN NS ns2.google.com.
google.com. 172800 IN NS ns1.google.com.
google.com. 172800 IN NS ns3.google.com.
google.com. 172800 IN NS ns4.google.com.
CK0P0MG574LJREF7EFN8438QVIT885M.com. 86400 IN NSEC3 1 0 - CK0Q1GIN43N1ARR905M6QPQR81H5M9A NS 50A RRSIG DNSKEY NSEC3PARAM
CK0P0MG574LJREF7EFN8438QVIT885M.com. 86400 IN RRSIG NSEC3 8 2 86400 20210313054023 20210306043023 58548 com. ML/ush@Hvdw0xTHUz8
cgFElwTp92y/40Xq96G2k1MqHE/R9acR21n hjs5euFMsKst1Fx0GtUri0Ahn9Pgn6wonCH121TBeyFVbhPnlnJ PX3N1f0j1zs2ewK2Ynd9f8Vkoqgs@v45UM
eeQyjztaGHSuf2knt3K78d2p9K4q4Cs10hky7s3YktWm6-Hff!EnfxqJbGKg==
S848DVKN95AGD517F5J003NPRH0U67JQ.com. 86400 IN NSEC3 1 0 - S84BU064GCVN69JFU06LVC7FSLUNJ NS 0 RRSIG
S848DVKN95AGD517F5J003NPRH0U67JQ.com. 86400 IN RRSIG NSEC3 8 2 86400 20210314053430 20210307842430 58548 com. IbEg7Bt85LY/t0D1oY
Zj1LN7Rz7m/migEyT1deexA1asUvMp1hKD /cded/1212z90ppYGNzOfLs3kyciyTjuX-Aspzc2aBx5n6byTPuwx z8Mz0tM2#EuKX1Dp6xtksX4JyC8R5p3X
dhq3xzvDdJhP0hJhJfXJN1 urwBtJyBy89ApTqQoabznDqHlkwn2Le7AU-Sw3NjUw==#
;; Received 848 bytes from 192.41.162.30#53(ns2.google.com) in 25 ms

www.google.com. 300 IN A 142.258.68.68
;; Received 59 bytes from 2001:4860:4802:34:a#53(ns2.google.com) in 24 ms
```

## [www.yahoo.com](http://www.yahoo.com):

```
; <>> DIG 9.10.3-P4-Debian <>> www.yahoo.com +trace
;; global options: +cmd
.          24306 IN  NS      m.root-servers.net.
.          24306 IN  NS      b.root-servers.net.
.          24306 IN  NS      c.root-servers.net.
.          24306 IN  NS      d.root-servers.net.
.          24306 IN  NS      e.root-servers.net.
.          24306 IN  NS      f.root-servers.net.
.          24306 IN  NS      g.root-servers.net.
.          24306 IN  NS      h.root-servers.net.
.          24306 IN  NS      a.root-servers.net.
.          24306 IN  NS      i.root-servers.net.
.          24306 IN  NS      j.root-servers.net.
.          24306 IN  NS      k.root-servers.net.
.          24306 IN  NS      l.root-servers.net.
.          24306 IN  RRSIG NS 8 0 518400 20210320170000 20210307160000 42351 . ShUo5blXVE0/4LbG0ratRF1zeStF
BjekTz9XasyB3GgITN4Uk7TjV 9YVvrQcc8RjYYPRSzX1kJ4EBIemfBL0y1IyqByUx8NmWq4t0Hw YVh9CjfmAuqy1V34t0t+dmJu3M1BVbRdvufsikvn311X
DqgtclbruyC5 AUZX7y7HPXPpTsWj6p+A0Q2uMB6wfx4JNFKg+2ldyPkQtSegh6bg AwMg9+oplntxvBwhdzMj107kjg0Anst/OdzAEbkXgeuYmEMNP4dvh2 Ge
SV1RsSze8FvuyyVI0Z708me07Neax159j5MSvC/HKF8mpGs05qyVZ auvh0qg==
;; Received 525 bytes from 100.115.92.193#53(100.115.92.193) in 27 ms

com.          172800 IN  NS      d.gtld-servers.net.
com.          172800 IN  NS      l.gtld-servers.net.
com.          172800 IN  NS      j.gtld-servers.net.
com.          172800 IN  NS      a.gtld-servers.net.
com.          172800 IN  NS      h.gtld-servers.net.
com.          172800 IN  NS      m.gtld-servers.net.
com.          172800 IN  NS      i.gtld-servers.net.
com.          172800 IN  NS      c.gtld-servers.net.
com.          172800 IN  NS      e.gtld-servers.net.
com.          172800 IN  NS      g.gtld-servers.net.
com.          172800 IN  NS      b.gtld-servers.net.
com.          172800 IN  NS      k.gtld-servers.net.
com.          172800 IN  NS      f.gtld-servers.net.
com.          86400  IN  DS    30909 8 2 E2D3C16F6DEEAC73294E826FB5885044A833FC545958F4A9184CF C41A5766
com.          86400  IN  RRSIG DS 8 1 86400 20210320170000 20210307160000 42351 . UFvH+2M7j1+zAwTctGmWtMyH2m
mgf9EzTzW2aUdjRQySaEV-Xg_41YipafIshp7WjklAweGZB44t5PlenkfhighHJAfWfNmUlJz3EDk Vym3VrhJ3tZBtEnFRECxycBV7829akt03851HNEv14
B1GQc4m04Y MvTaDqLASeAV-Ows0s57sh/w+v319p1cyg6580QSKShTgAh3Pj8Q s4fSP13mVmWlYfg8kogdZwQ4NpcEwSxoYjuPcGD92XYku8oPe6Y7j06 097
6oCSpPqQeiauhUpnko5pElr+EdszkxiFLzye361hQ-8R2d+gIkR6 usBcYg==
;; Received 1173 bytes from 2001:dc3:35#53(m.root-servers.net) in 27 ms

yahoo.com.     172800 IN  NS      ns1.yahoo.com.
yahoo.com.     172800 IN  NS      ns5.yahoo.com.
yahoo.com.     172800 IN  NS      ns2.yahoo.com.
yahoo.com.     172800 IN  NS      ns3.yahoo.com.
yahoo.com.     172800 IN  NS      ns4.yahoo.com.
CK0P0IMG574LREF7EEF8430QVIT885M. com. 86400  IN  NSEC3 1 0 - CK0Q1G1N43NIARRC90SMQ0PQR81HSM9A NS SOA RRSIG DNSKEY NSEC3PARAM
CK0P0IMG574LREF7EEF8430QVIT885M. com. 86400  IN  RRSGI NSEC3 8 2 86400 20210313054023 20210306043023 58540 com. ML/ush@Hvdw0xdtHu28
cgFwLwqTq92y/40XQp9G2k1XMyHE/89acR21n h1$5SeufMksKst1Fx0gtUri0Ehn9Pppn6wOnch121tBEyFvBhPno1nj PX3NfOj1z2ewK2YD9f8Vkoqgs0v45UM
e80yv1 ztpaGHSUf2kn4c510nkqy75s3XyktWn+HtfyfNxqfGbKg==
GPI0Q0L0L7V.L2LSBACTA1LU5T263MU96. com. 86400  IN  NSEC3 1 0 - GPT0vE5CC3CA0B114G14J8835GEK8 NS DS RRSIG
GPI0Q0L0L7V.L2LSBACTA1LU5T263MU96. com. 86400  IN  RRSGI NSEC3 8 2 86400 20210313063239 20210306052239 58540 com. q2vo+s17wGBVC+Iy1Fj
AHwgfaCDj6D0p9X1Cels3mtk1wrJoxk1lkq7t LwvYB9BcP3d5fsvUyJvOnHiwzszRkTzhfJfdrrXkBD71dhHc9eR LM3gNgfk1skyarac1d0NzV+692bhs51/kx
70AHltku52tQQRp57u5X0. MTUQqrky1wD5CtGg0JyD6GJlypqNkRxfi4+ztR389yUA==
;; Received 873 bytes from 192.12.94.304#53(e.gtld-servers.net) in 80 ms

www.yahoo.com.   60   IN  CNAME  new-tp-shed.wg1.b.yahoo.com.
wg1.b.yahoo.com. 172800 IN  NS      yf1.yahoo.com.
wg1.b.yahoo.com. 172800 IN  NS      yf4.al1.b.yahoo.net.
wg1.b.yahoo.com. 172800 IN  NS      yf1.al1.b.yahoo.com.
wg1.b.yahoo.com. 172800 IN  NS      yf3.al1.b.yahoo.net.
;; Received 192 bytes from 98.138.11.157#53(ns4.yahoo.com) in 66 ms
```

## [www.amazon.com](http://www.amazon.com):

```
; <>> DIG 9.10.3-P4-Debian <>> www.amazon.com +trace
;; global options: +cmd
.          24741 IN  NS      a.root-servers.net.
.          24741 IN  NS      b.root-servers.net.
.          24741 IN  NS      c.root-servers.net.
.          24741 IN  NS      d.root-servers.net.
.          24741 IN  NS      e.root-servers.net.
.          24741 IN  NS      f.root-servers.net.
.          24741 IN  NS      g.root-servers.net.
.          24741 IN  NS      h.root-servers.net.
.          24741 IN  NS      i.root-servers.net.
.          24741 IN  NS      j.root-servers.net.
.          24741 IN  NS      k.root-servers.net.
.          24741 IN  NS      l.root-servers.net.
.          24741 IN  NS      m.root-servers.net.
.          24741 IN  RRSIG NS 8 0 518400 20210320170000 20210307160000 42351 . ShUo5blXVE0/4LbG0ratRF1zeStF
BjekTz9XasyB3GgITN4Uk7TjV 9YVvrQcc8RjYYPRSzX1kJ4EBIemfBL0y1IyqByUx8NmWq4t0Hw YVh9CjfmAuqy1V34t0t+dmJu3M1BVbRdvufsikvn311X
DqgtclbruyC5 AUZX7y7HPXPpTsWj6p+A0Q2uMB6wfx4JNFKg+2ldyPkQtSegh6bg AwMg9+oplntxvBwhdzMj107kjg0Anst/OdzAEbkXgeuYmEMNP4dvh2 Ge
SV1RsSze8FvuyyVI0Z708me07Neax159j5MSvC/HKF8mpGs05qyVZ auvh0qg==
;; Received 525 bytes from 100.115.92.193#53(100.115.92.193) in 27 ms

com.          172800 IN  NS      a.gtld-servers.net.
com.          172800 IN  NS      b.gtld-servers.net.
com.          172800 IN  NS      c.gtld-servers.net.
com.          172800 IN  NS      d.gtld-servers.net.
com.          172800 IN  NS      e.gtld-servers.net.
com.          172800 IN  NS      f.gtld-servers.net.
com.          172800 IN  NS      g.gtld-servers.net.
com.          172800 IN  NS      h.gtld-servers.net.
com.          172800 IN  NS      i.gtld-servers.net.
com.          172800 IN  NS      j.gtld-servers.net.
com.          172800 IN  NS      k.gtld-servers.net.
com.          172800 IN  NS      l.gtld-servers.net.
com.          172800 IN  NS      m.gtld-servers.net.
com.          86400  IN  DS    30909 8 2 E2D3C16F6DEEAC73294E826FB5885044A833FC545958F4A9184CF C41A5766
com.          86400  IN  RRSGI DS 8 1 86400 20210320170000 20210307160000 42351 . UFvH+2M7j1+zAwTctGmWtMyH2m
mgf9EzTzW2aUdjRQySaEV-Xg_41YipafIshp7WjklAweGZB44t5PlenkfhighHJAfWfNmUlJz3EDk Vym3VrhJ3tZBtEnFRECxycBV7829akt03851HNEv14
B1GQc4m04Y MvTaDqLASeAV-Ows0s57sh/w+v319p1cyg6580QSKShTgAh3Pj8Q s4fSP13mVmWlYfg8kogdZwQ4NpcEwSxoYjuPcGD92XYku8oPe6Y7j06 097
6oCSpPqQeiauhUpnko5pElr+EdszkxiFLzye361hQ-8R2d+gIkR6 usBcYg==
;; Received 741 bytes from 2001:503:ee:0:30#53(g.gtld-servers.net) in 20 ms

www.amazon.com. 1800   IN  CNAME  tp-47c72c89-frontier.amazon.com.
47c72c89-frontier.amazon.com. 900 IN  NS      ns-1881.awsdns-43.co.uk.
47c72c89-frontier.amazon.com. 900 IN  NS      ns-553.awsdns-05.net.
47c72c89-frontier.amazon.com. 900 IN  NS      ns-477.awsdns-59.com.
47c72c89-frontier.amazon.com. 900 IN  NS      ns-1484.awsdns-47.org.
;; Received 229 bytes from 208.78.70.31#53(ns1.ns1.dyndns.net) in 25 ms
```