



## COMPUTER NETWORKS LAB

### COURSE CODE:UE19CS255

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SECTION:E

DATE:11/02/2021

### EXPERIMENT : Understand working of HTTP Headers

Design a web page that has one embedded page (e.g. image) and sets a cookie and enables authentication. You are required to configure the web server (e.g. apache) with authentication mechanism. Show the behaviour of conditional get when embedded objects is modified and when it is not (you can just change the create date of the embedded object).

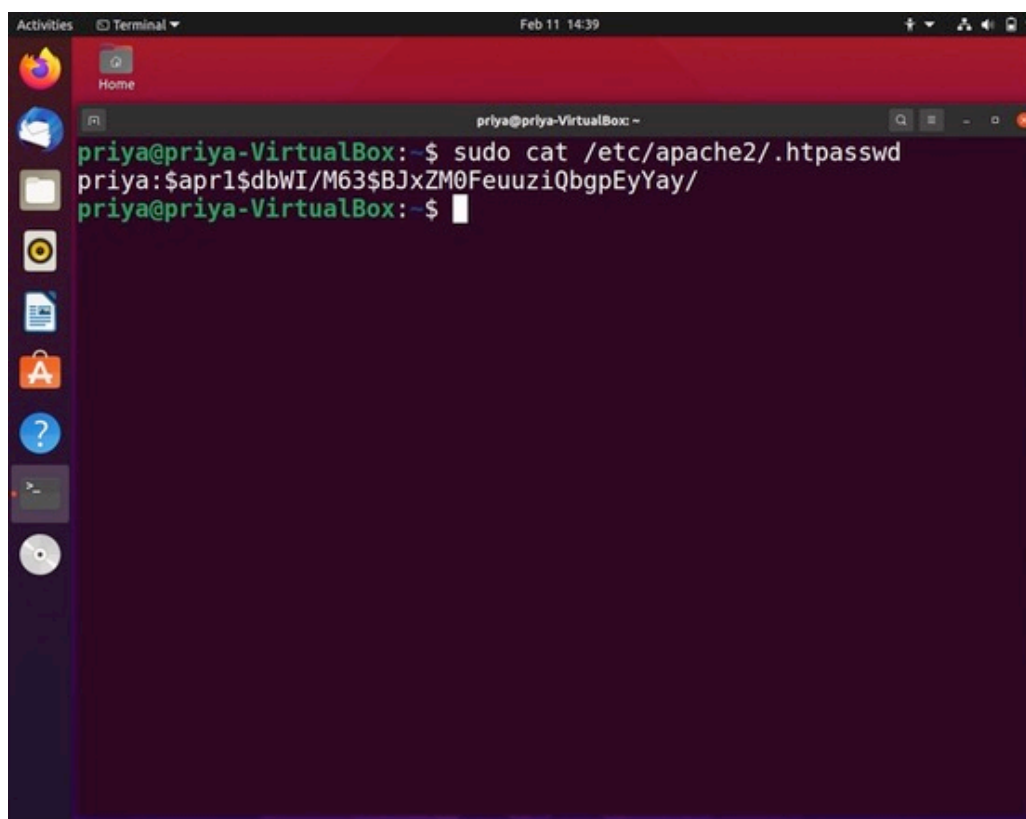
#### 3.1 PASSWORD AUTHENTICATION

COMMAND USED : To install the apache utility `sudo apt-get install apache2 apache2-utils`

```
priya@priya-VirtualBox:~$ sudo apt-get install apache2 apache2-utils
Reading package lists... Done
Building dependency tree
Reading state information... Done
apache2 is already the newest version (2.4.46-1ubuntu1).
apache2-utils is already the newest version (2.4.46-1ubuntu1).
apache2-utils set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 79 not upgraded.
priya@priya-VirtualBox:~$
```

- To enable basic authentication for HTTP, we need to generate a password file. This file can be generated using the `htpasswd` command.
- Using `sudo htpasswd -c /etc/apache2/.htpasswd username` we can set a password for the given user username and write it into the `.htpasswd` configuration file.
- The `cat` command can be used to view the encrypted password file, which is encrypted using the Data Encryption Standard algorithm.

```
priya@priya-VirtualBox:~$ sudo htpasswd -c /etc/apache2/.htpasswd priya
New password:
Re-type new password:
Adding password for user priya
```



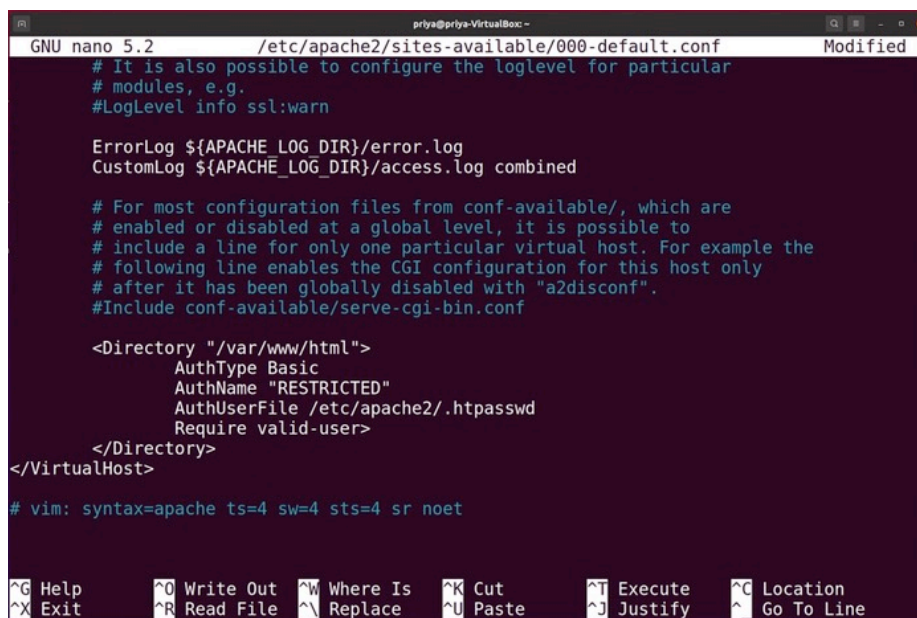
The image shows a terminal window titled "priya@priya-VirtualBox: ~" with a red header bar. The terminal displays the following commands and output:

```
priya@priya-VirtualBox:~$ sudo cat /etc/apache2/.htpasswd
priya:$apr1$dbwI/M63$BJxZM0FeuuziQbgpEyYay/
priya@priya-VirtualBox:~$
```

The terminal window is part of a desktop environment with a sidebar on the left containing icons for Activities, Home, and various applications. The top status bar shows the date and time as "Feb 11 14:39".

## 3.2 APACHE SERVER AUTHENTICATION

- To enable password authentication in the server, we need to modify the Apache configuration file.
- This can be done using **sudo nano /etc/apache2/sites-available/000-default.conf**
- Password authentication is added to the **/var/www/html** directory which is the localhost home directory so that all files hosted here will require authentication to access.
- To activate the authentication and policy, we need to restart the server using **sudo service apache2 restart**.



```
GNU nano 5.2 /etc/apache2/sites-available/000-default.conf Modified
# It is also possible to configure the LogLevel for particular
# modules, e.g.
#LogLevel info ssl:warn

ErrorLog ${APACHE_LOG_DIR}/error.log
CustomLog ${APACHE_LOG_DIR}/access.log combined

# For most configuration files from conf-available/, which are
# enabled or disabled at a global level, it is possible to
# include a line for only one particular virtual host. For example the
# following line enables the CGI configuration for this host only
# after it has been globally disabled with "a2disconf".
#Include conf-available/serve-cgi-bin.conf

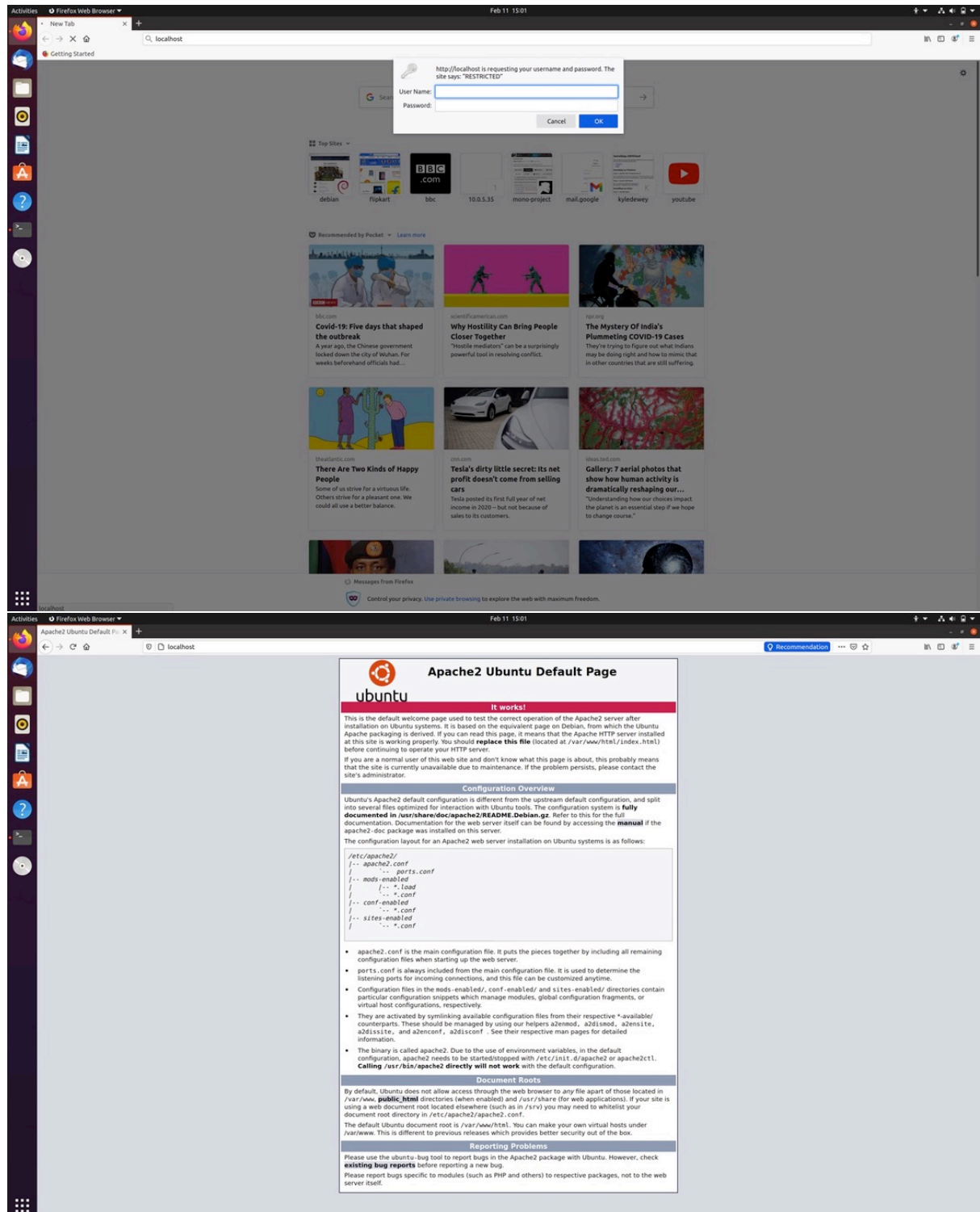
<Directory "/var/www/html">
    AuthType Basic
    AuthName "RESTRICTED"
    AuthUserFile /etc/apache2/.htpasswd
    Require valid-user
</Directory>
</VirtualHost>

# vim: syntax=apache ts=4 sw=4 sts=4 sr noet

^G Help      ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location
^X Exit      ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^_ Go To Line
```

### 3.3 ACCESSING LOCALHOST

- We can now access localhost only after entering the username and password set earlier
- These credentials are entered on the browser window.



### 3.4 WIRESHARK PACKET CAPTURE

- Wireshark can be used to capture the packets sent on the network. The first GET request corresponding to the HTML file is analysed and its TCP Stream is expanded, and parameters examined.

The screenshot displays a VirtualBox VM environment with Ubuntu-20.10 installed. The top window shows the Wireshark interface with a packet capture of HTTP traffic. The bottom window shows the expanded TCP stream for the first GET request.

**Packet Capture Table:**

No.	Time	Source	Destination	Protocol	Length	Info
768	59.955103179	127.0.0.1	127.0.0.1	HTTP	449	GET /index.html HTTP/1.1
772	60.033699222	127.0.0.1	127.0.0.1	HTTP	3545	HTTP/1.1 200 OK (text/html)
810	61.853610557	127.0.0.1	127.0.0.1	HTTP	408	GET /icons/ubuntu-logo.png HTTP/1.1
812	61.862177198	127.0.0.1	127.0.0.1	HTTP	3691	HTTP/1.1 200 OK (PNG)
814	62.287896832	127.0.0.1	127.0.0.1	HTTP	398	GET /favicon.ico HTTP/1.1
816	62.293625940	127.0.0.1	127.0.0.1	HTTP	555	HTTP/1.1 404 Not Found (text/html)

**Expanded TCP Stream (tcp.stream eq 16) - any:**

```

GET /index.html HTTP/1.1
Host: localhost
User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:84.0) Gecko/20100101 Firefox/84.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Authorization: Basic cHJpeWE6YmFzYTg4MTQ=
Connection: keep-alive
Upgrade-Insecure-Requests: 1

HTTP/1.1 200 OK
Date: Thu, 11 Feb 2021 09:40:36 GMT
Server: Apache/2.4.46 (Ubuntu)
Last-Modified: Thu, 11 Feb 2021 09:20:22 GMT
ETag: "2aa6-5bb0c077a577a577-gzip"
Accept-Ranges: bytes
Vary: Accept-Encoding
Content-Encoding: gzip
Content-Length: 3138
Keep-Alive: timeout=5, max=100
Connection: Keep-Alive
Content-Type: text/html


.....Zs6...U.S'.....{&c...$! c...d5...H.%5...H...o...n.../7...=...d...0...GzKc.q.n6...<j.N?...Hk...).b...&...JS...L...w2.s.b2WtE...+6.4!
R...d...4...
o.6SKc)X<?>...p8...d...Y...S... 3...[px2...d4...[*f...w)...3.nS.#...BT%.Tif?Mo... =%...R...LrK.JJ...v...
F...l"(d.bN{R.%z.g.aE.hL...K...y.h)...7...su.XY{yd..ht.P2K.AS.Tc...>...
L.vL.TL...<E...U...F.S.n...*...L.R...{O.R0L.t7&...j.921...^
.rLF...&n.4F.N...).fLhfd.68...x...9...7...#...c...~...h;u... .isv...Dn.7?...e7!...6..."5FK)^Oa...H...$...m...p.J...xu.v
[...y.U...L.c)Fc...-IsZ;...N...#...b...F.V...<e>v^...)U...[f.
.#dT.
S...x<...X.
B.
.....
5z...%.p.no&...
uX...[o...+y...i...{...@VK~?<?>UE.SP+}...M...b...n...N...IHH... ..p...u.9jX...LX...f...Zs...1... ..Y.u.-GR ...u.NU=KJ.v-(V.^L...C...-r%.k$.
#...C.V...a#S.s)J...{V}Z...@.QI-X.h...B...0...=...@...d.#T@...;..p.shP
Kdmy.o.n.I...Z...
-C.P.8...7K...K.kp.E...&o...N?...X...@...=...IH...=Gh...K...#...J.GJ{8.Z.d...^g.fW^...^p...~y.D.2.h...{..._...t5.8...).n...f...~*...@...}.$mW...8"...i.
...0.VI.A.L...{...P...a.N.N.16K...JO.
w)...&n.N.2#...c...%F.5%...6W...+S...na2D...Q.T).6...c...{[(
1. {...}#M...s...<C...l{Jf...&d...%C.UY.u&aZ.v...B.VT.G)*.3.9.i.C...h}*7p...~i.3).F...@...~.e.[61.K.r.8C.IJ)...1!C.Sb...!@...;i...c...uK.GMh}
<RXS4...U...i...^3...0...m...s...%...s.S.d...H...N...#...p...j...4@1.u...u...f.C.R...Sv...@...L...2.0K.K.4...V^BH.0...>...WWW...d.w...j"...6...D.B6
9.W+H@...N.n...fbnqm.4.ka2...ELk...H...&...y.p...^...eqf...@T...<"G.z.t.L...1V(P3w...~E..i7z.%b?dfw.G.@)J...T...}.^X.s.T.b>x@...W>m.m.
2.5.B.M.E...HH...#...y...[...R...if...3.K...K...Hd8V^G@F.x.EI#-D...
>.Z.4S.zh...t...{E.n.W...U...qw...yl.3>M...{E1k0+E+Z^..ly.&3h.Ey...6.A0M...y/z.eC4)K.0...bn.U..U"?9.Rq!k...Pz..IQ&...3...~.B@#...J6...k...6YJ)...1.2.y.
[...@...U...Z...
[...].nqj.WW%&...<B.aA...?t.1.1
q.5...~%X.f...EOX.G...~8... ..kd.x.P...K...h.u.jz-l6y...w.1.q...x...J...[...1...FH...u.b...L...<L...H...u.Q...u[Yz...0
[...j...v...ln.8...AK%FfdG...OK.Ka.O.n.7.D...P.o.9.r.l.s.K.R...m...^v@>^f...6M?c...Xa^d.X.I.A.m.f.VPSLBxw5.E.v.

```

### 3.5 SETTING COOKIES

- We can set cookies using a PHP script and the `setcookie(name, value, expire_time)` function
- When this file is requested by the browser a cookie will be set

CODE :

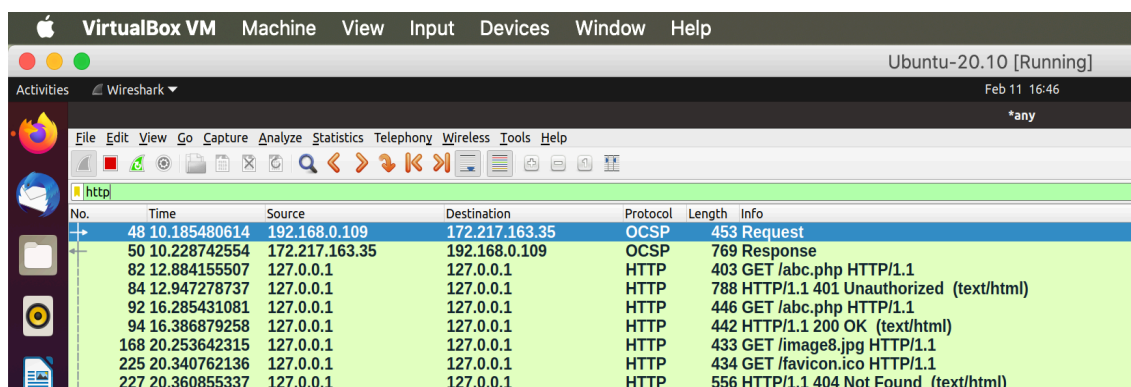


```

GNU nano 5.2                                abc.php
<html>
<?php
setcookie("NAME","Priya",time()+123);
setcookie("SRN","PES2UG19CS301");
?>

</html>
  
```

abc.php



No.	Time	Source	Destination	Protocol	Length	Info
48	10.185480614	192.168.0.109	172.217.163.35	OCSP	453	Request
50	10.228742554	172.217.163.35	192.168.0.109	OCSP	769	Response
82	12.884155507	127.0.0.1	127.0.0.1	HTTP	403	GET /abc.php HTTP/1.1
84	12.947278737	127.0.0.1	127.0.0.1	HTTP	788	HTTP/1.1 401 Unauthorized (text/html)
92	16.285431081	127.0.0.1	127.0.0.1	HTTP	446	GET /abc.php HTTP/1.1
94	16.386879258	127.0.0.1	127.0.0.1	HTTP	442	HTTP/1.1 200 OK (text/html)
168	20.253642315	127.0.0.1	127.0.0.1	HTTP	433	GET /image8.jpg HTTP/1.1
225	20.340762136	127.0.0.1	127.0.0.1	HTTP	434	GET /favicon.ico HTTP/1.1
227	20.360855337	127.0.0.1	127.0.0.1	HTTP	556	HTTP/1.1 404 Not Found (text/html)

Request to localhost/abc.php



```

Wireshark - Follow TCP Stream (tcp.stream eq 14) - any
<address>Apache/2.4.46 (Ubuntu) Server at localhost Port 80</address>
</body></html>
GET /abc.php HTTP/1.1
Host: localhost
User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:84.0) Gecko/20100101 Firefox/84.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Connection: keep-alive
Upgrade-Insecure-Requests: 1
Authorization: Basic cHJpeWE6YmFzYTg4MTQ=

HTTP/1.1 200 OK
Date: Thu, 11 Feb 2021 10:36:20 GMT
Server: Apache/2.4.46 (Ubuntu)
Set-Cookie: NAME=Priya; expires=Thu, 11-Feb-2021 10:38:23 GMT; Max-Age=123
Set-Cookie: SRN=PES2UG19CS301
Content-Length: 64
Keep-Alive: timeout=5, max=99
Connection: Keep-Alive
Content-Type: text/html; charset=UTF-8

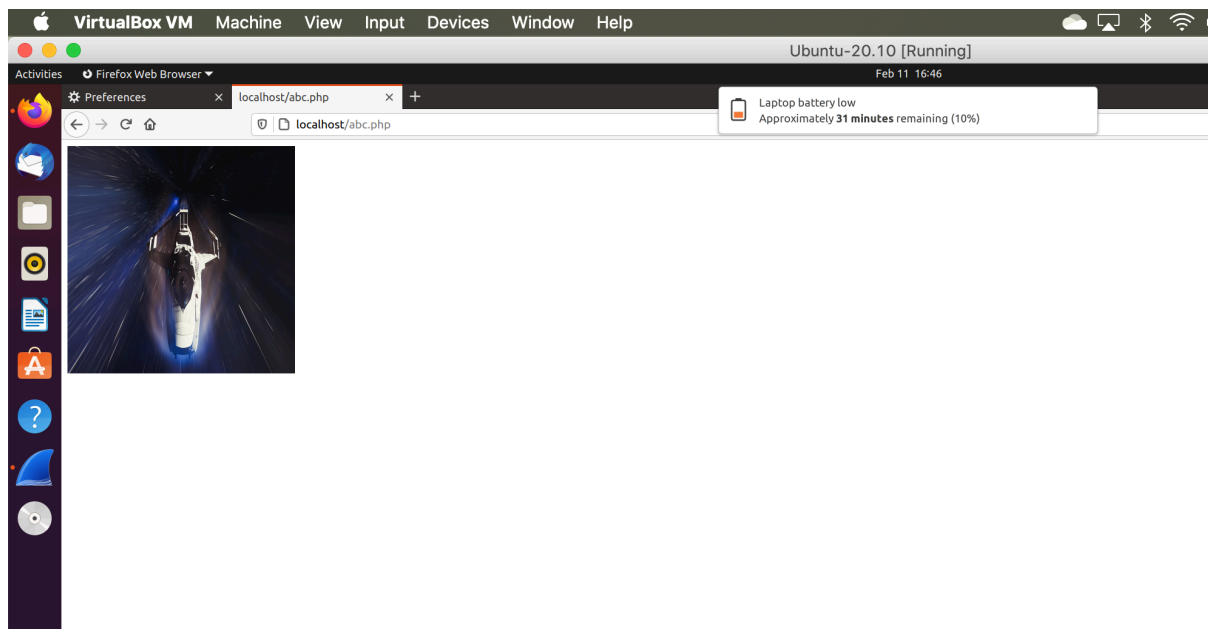
<html>

</html>
GET /image8.jpg HTTP/1.1
Host: localhost
User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:84.0) Gecko/20100101 Firefox/84.0
Accept: image/webp,*/*
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Authorization: Basic cHJpeWE6YmFzYTg4MTQ=
Connection: keep-alive
Referer: http://localhost/abc.php
Cookie: NAME=Priya; SRN=PES2UG19CS301

HTTP/1.1 200 OK
Date: Thu, 11 Feb 2021 10:36:24 GMT
Server: Apache/2.4.46 (Ubuntu)
Last-Modified: Mon, 01 Feb 2021 11:38:45 GMT
ETag: "1cffa5-5ba44cbe73906"
Accept-Ranges: bytes
Content-Length: 1900453
Keep-Alive: timeout=5, max=98
Connection: Keep-Alive
Content-Type: image/jpeg

```

The cookie is set as shown in the above screenshot.



localhost/abc.php

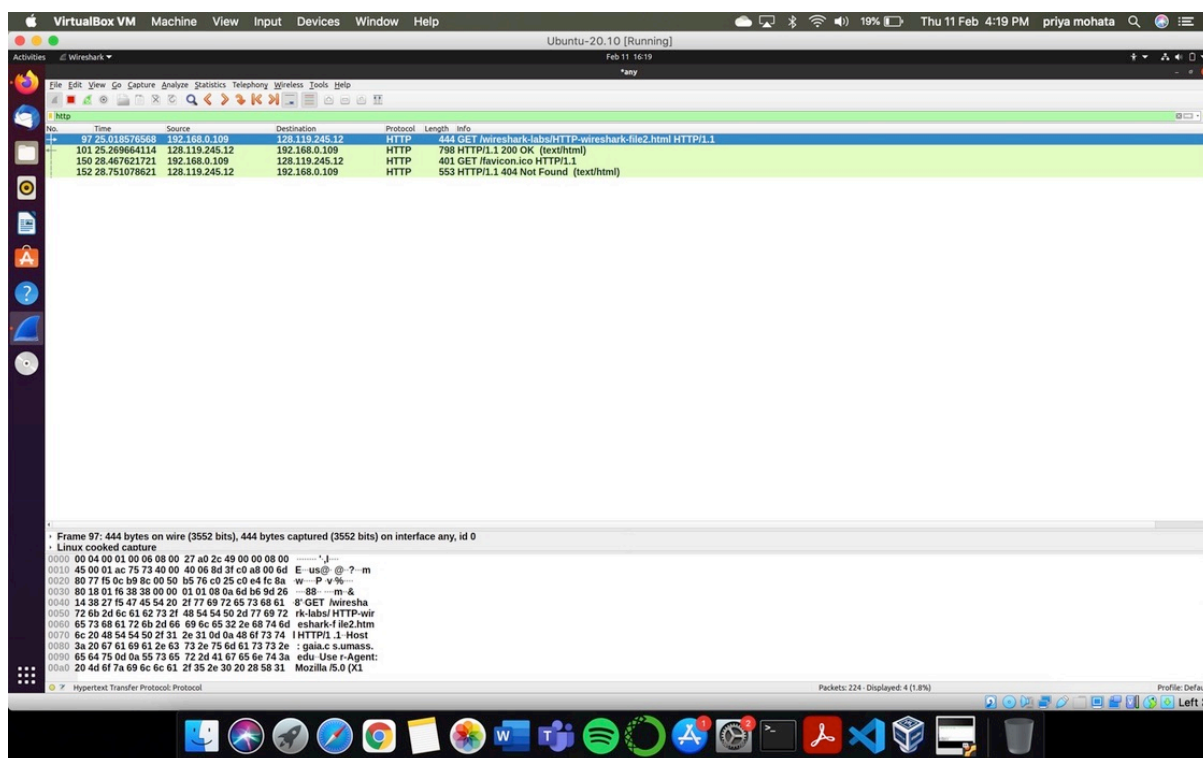
### 3.6 CONDITIONAL GET : IF-MODIFIED SINCE

- Start up your web browser, and make sure your browser's cache is cleared, as discussed above.
- Start up the Wireshark packet sniffer.
- Enter the following URL into your browser  
<http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file2.html>
- Your browser should display a very simple five-line HTML file.
- Quickly enter the same URL into your browser again (or simply select the refresh button on your browser)
- Stop Wireshark packet capture, and enter "http" in the display-filter-specification window, so that only captured HTTP messages will be displayed later in the packet- listing window.
- An HTML page is requested by the client and the HTML file is obtained along with a 200 OK response status

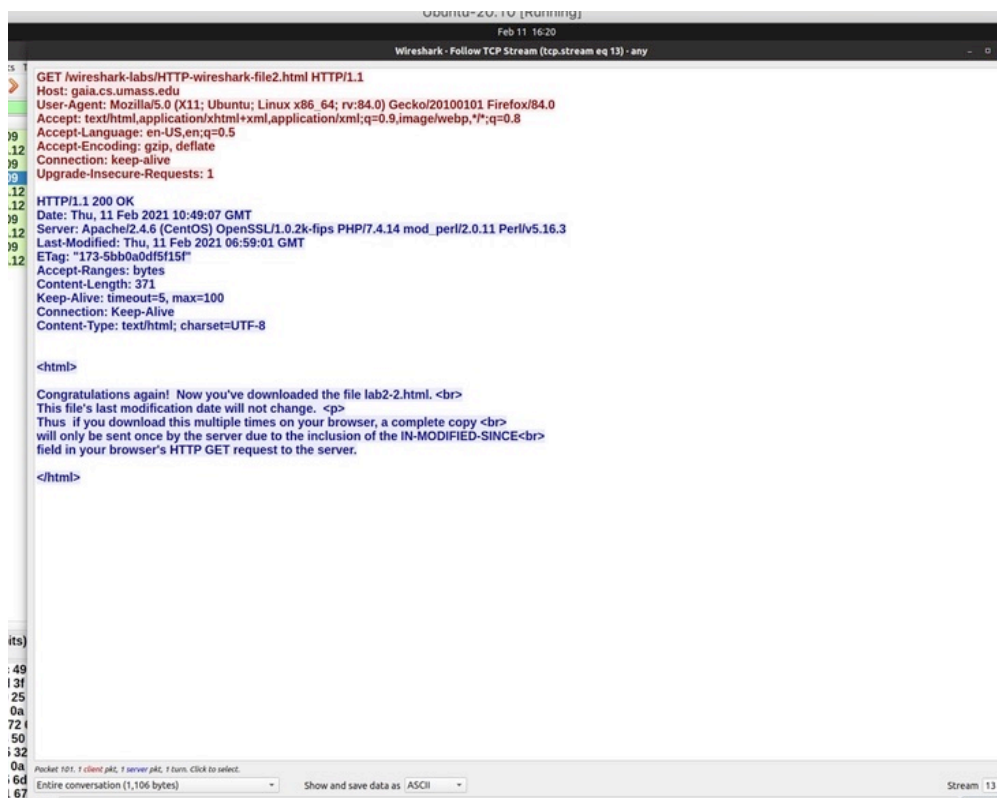


ON ENTERING <http://gaia.cs.umass.edu/wireshark-labs/HTTP-wireshark-file2.html>



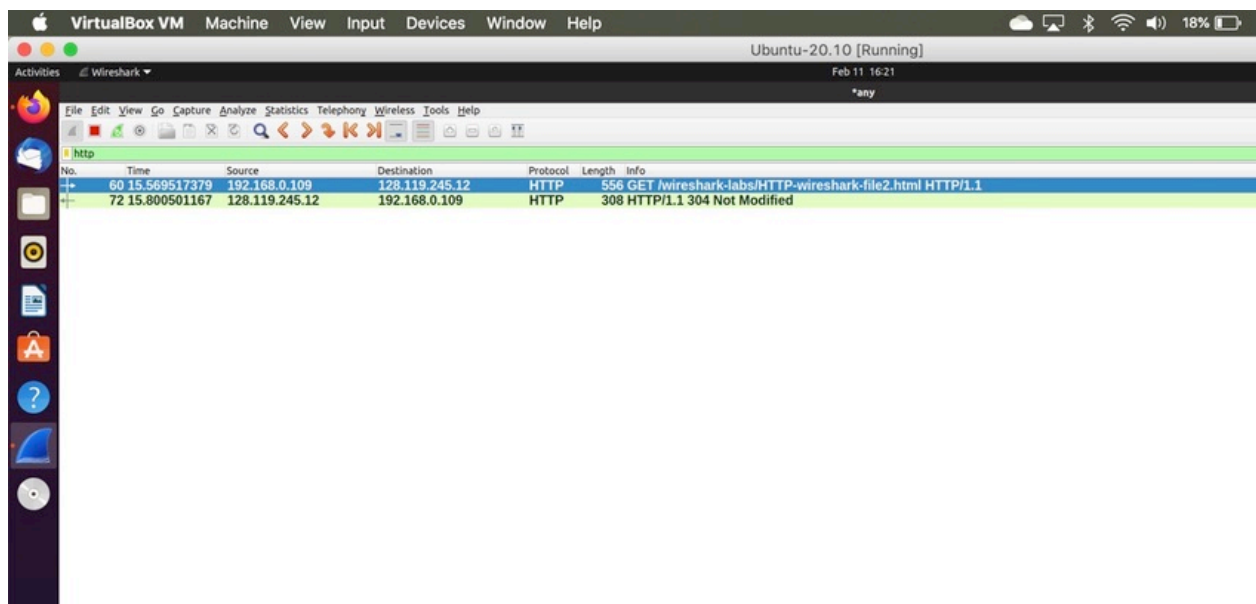


## WIRESHARK PACKET CAPTURE

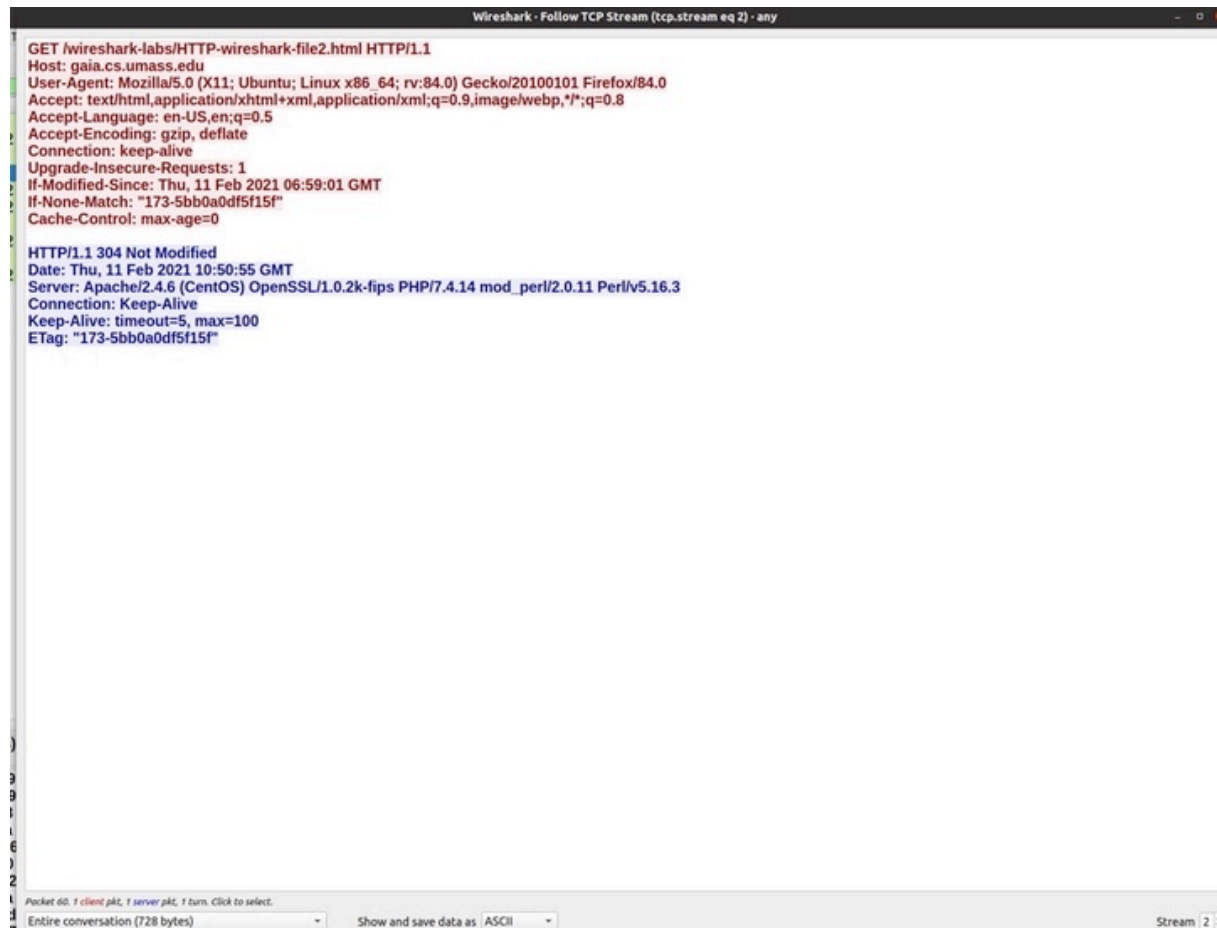


## TCP STREAM

- A conditional HTTP response is one that carries the resource only if it had been modified since the last GET request by the client.
- The HTTP header **If-Modified-Since** is one way to implement Conditional GET
- The server checks the **If-Modified-Since** header value and resends the resource only if it has been modified since the timestamp in the header
- If it has not been modified, a **304 Not Modified** status code is sent back.



ON REFRESHING THE WEBSITE



Wireshark - Follow TCP Stream (tcp.stream eq 2) - any

GET /wireshark-labs/HTTP-wireshark-file2.html HTTP/1.1  
Host: gaia.cs.umass.edu  
User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86\_64; rv:84.0) Gecko/20100101 Firefox/84.0  
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,\*/\*;q=0.8  
Accept-Language: en-US,en;q=0.5  
Accept-Encoding: gzip, deflate  
Connection: keep-alive  
Upgrade-Insecure-Requests: 1  
If-Modified-Since: Thu, 11 Feb 2021 06:59:01 GMT  
If-None-Match: "173-5bb0a0df5f15f"  
Cache-Control: max-age=0

HTTP/1.1 304 Not Modified  
Date: Thu, 11 Feb 2021 10:50:55 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  
Connection: Keep-Alive  
Keep-Alive: timeout=5, max=100  
ETag: "173-5bb0a0df5f15f"

Packet 60: 1 client pkt, 1 server pkt, 1 turn. Click to select.  
Entire conversation (728 bytes)    Show and save data as: ASCII    Stream 2

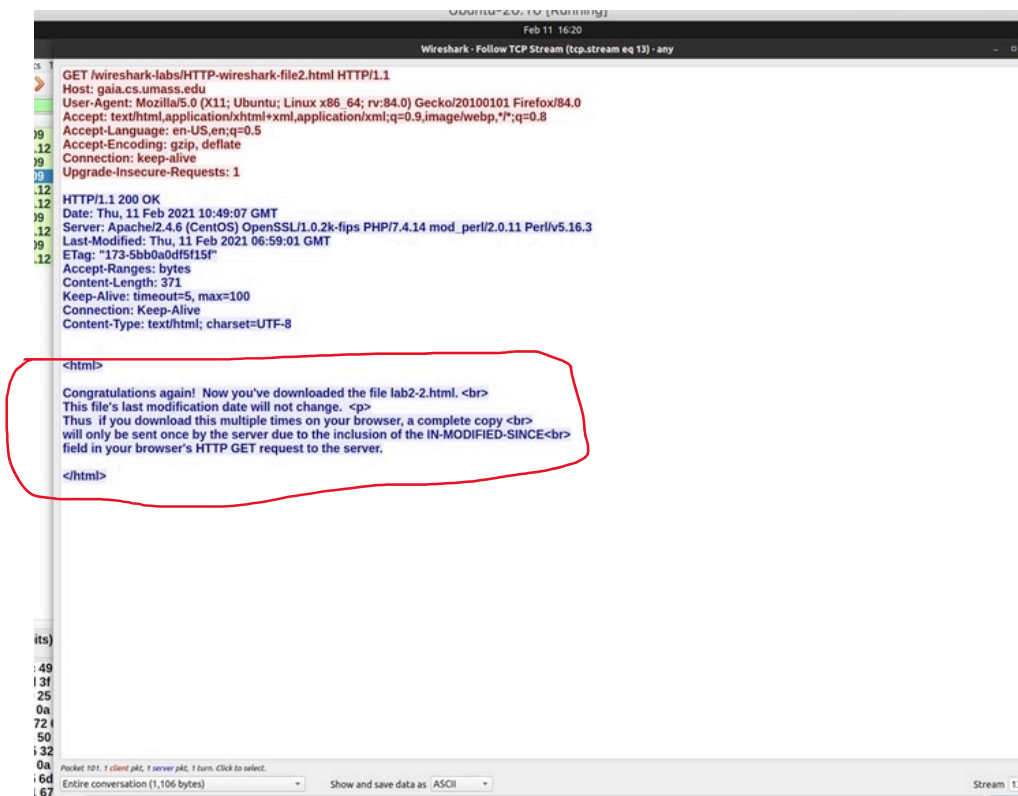
### 3.7 OBSERVATIONS

**QUESTION 1** : Inspect the contents of the first HTTP GET request from your browser to the server. Do you see an “IF-MODIFIED-SINCE” line in the HTTP GET?

**ANSWER** : No, in the first request after clearing the cache we don’t see in “IF-MODIFIED-SINCE” line in the HTTP GET.

**QUESTION 2** :Inspect the contents of the server response. Did the server explicitly return the contents of the file? How can you tell?

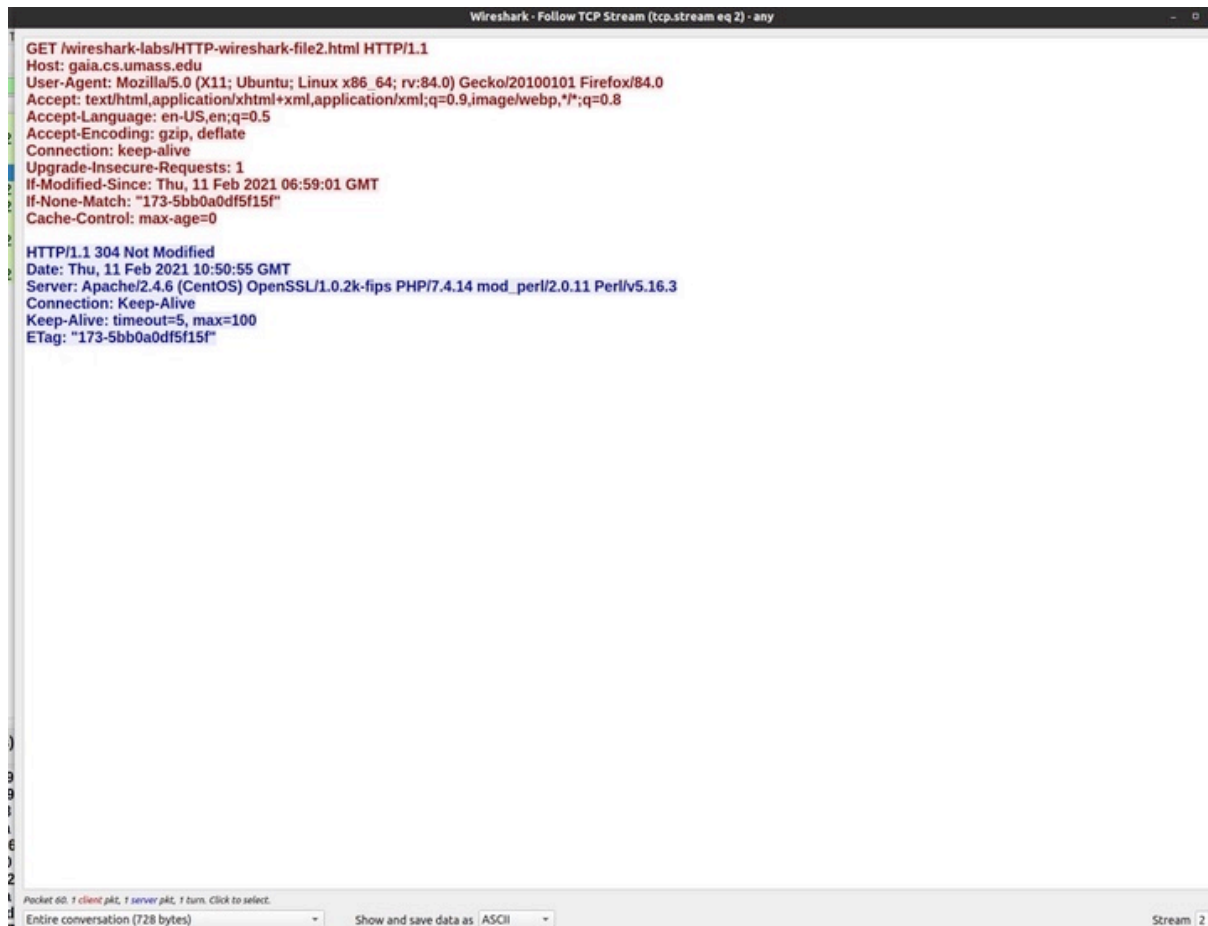
Yes, we can see from the screenshot below



**QUESTION 3** : Now inspect the contents of the second HTTP GET request from your browser to the server. Do you see an “IF-MODIFIED-SINCE:” line in the HTTP GET? If so, what information follows the “IF-MODIFIED-SINCE:” header?

**ANSWER** : IF-MODIFIED-SINCE: *date is mentioned*

Example IF-MODIFIED-SINCE:Thu,11 Feb 2021 06:59:01 GMT



The screenshot shows the Wireshark interface with the 'Follow TCP Stream' window open for 'tcp.stream eq 2'. The window displays the details of an HTTP response. The request line is 'GET /wireshark-labs/HTTP-wireshark-file2.html HTTP/1.1'. The host is 'gaia.cs.umass.edu'. The user agent is 'Mozilla/5.0 (X11; Ubuntu; Linux x86\_64; rv:84.0) Gecko/20100101 Firefox/84.0'. The response line is 'HTTP/1.1 304 Not Modified'. The date is 'Thu, 11 Feb 2021 10:50:55 GMT'. The server is 'Apache/2.4.6 (CentOS) OpenSSL/1.0.2k-fips PHP/7.4.14 mod\_perl/2.0.11 Perl/5.16.3'. The connection is 'Keep-Alive'. The keep-alive timeout is 5 seconds and max is 100. The ETag is '173-5bb0a0df5f15f'. The status bar at the bottom shows 'Entire conversation (728 bytes)' and 'Show and save data as ASCII'.

```
GET /wireshark-labs/HTTP-wireshark-file2.html HTTP/1.1
Host: gaia.cs.umass.edu
User-Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:84.0) Gecko/20100101 Firefox/84.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Connection: keep-alive
Upgrade-Insecure-Requests: 1
If-Modified-Since: Thu, 11 Feb 2021 06:59:01 GMT
If-None-Match: "173-5bb0a0df5f15f"
Cache-Control: max-age=0

HTTP/1.1 304 Not Modified
Date: Thu, 11 Feb 2021 10:50:55 GMT
Server: Apache/2.4.6 (CentOS) OpenSSL/1.0.2k-fips PHP/7.4.14 mod_perl/2.0.11 Perl/5.16.3
Connection: Keep-Alive
Keep-Alive: timeout=5, max=100
ETag: "173-5bb0a0df5f15f"
```

**QUESTION 4 :** What is the HTTP status code and phrase returned from the server in response to this second HTTP GET? Did the server explicitly return the contents of the file? Explain.

**ANSWER :** The HTTP CODE that was returned from the server in response to the second HTTP GET was 304 Not Modified. No, the server didn't return the contents of the file as it is seen in the screenshot below.

