



NETWORK ARCHITECTURE-1  
HOMEWORK-4

Submitted by:

Moulika Chadalavada

16234180

## NETWORK ARCHITECTURE-1 HOMEWORK 4

STUDENT NAME: MOULIKA CHADALAVADA  
STUDENT ID: 16234180

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### Question 1:

Suppose within your Web browser you click on a link to obtain a web page. The IP address for the associated URL is cached in your local host, so a DNS look-up is not necessary to obtain the IP address. Further suppose that the Web page associated with the link references ten very small objects on the same server. Let  $RTT_0$  denote the RTTs between the local host and one of the objects. Assuming zero transmission time of the object, how much time elapses from when the client clicks on the link until the client receives the full web page with a. Nonpersistent HTTP? b. Persistent HTTP?

### Solution:

**Non-Persistent:** At most one object sent over TCP connection

**Persistent:** Multiple objects can be sent over single TCP connection between client, server

Webpage which is required to be downloaded is associated with ten very small objects.

Given that the IP address for the associated URL is cached in local host, so DNS look-up is not required and transmission time of the object is assumed to be zero.

When client wants to obtain a webpage, the total time taken to receive full webpage depends on the type of HTTP connection.

Number of objects the link references is 10

Round Trip Time between local host and one of the objects is  $RTT_0$

#### **Non-Persistent HTTP without parallel connections:**

In non-persistent HTTP as a new TCP connection has to be established for each object, the total time taken would be two round trip times.

Time taken to receive base file is  $2RTT_0$

Time taken to receive each object is  $2RTT_0$

Total number of objects is 10

Therefore, time taken for 10 objects =  $10(2RTT_0) = 20 RTT_0$

So, total time taken =  $20RTT_0 + 2RTT_0 = 22 RTT_0$

**Hence time taken in Non-Persistent HTTP without parallel connection is  $22 RTT_0$**

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### **Non-Persistent HTTP with parallel connections:**

In a non-persistent HTTP with parallel connections all the objects can be sent at a time by establishing multiple TCP connections in a parallel way (i.e. at same time). This will decrease the time required in receiving objects.

Time taken to receive base file is  $2RTT_0$

Time taken to receive all the objects in parallel is  $2RTT_0$

Total time taken for 10 objects =  $2RTT_0 + 2RTT_0$  is  $4RTT_0$

***Hence Time taken in Non-Persistent HTTP with parallel connection is  $4RTT_0$***

### **Persistent HTTP without pipelining connections:**

In a persistent TCP connection, the connection is setup first and the objects are sent through same TCP connection so, only one TCP connection is enough to send multiple objects.

Time taken to receive base file is  $2RTT_0$

Time taken to receive each object is  $RTT_0$

Total number of objects = 10

Thus, the time taken for all the ten objects =  $10RTT_0$

Therefore, total time taken =  $10RTT_0 + 2RTT_0 = 12RTT_0$

***Hence Time taken in Persistent HTTP without pipelining connections is  $12RTT_0$***

### **Persistent HTTP with pipelining:**

In persistent HTTP with pipelining all the objects are received in a single Round trip Time where parallel connections are established.

Time taken to receive the base file =  $2RTT_0$

Time taken to receive all the ten objects through pipelining =  $RTT_0$

Hence total time taken =  $2RTT_0 + RTT_0 = 3RTT_0$ .

***Hence Time taken in Persistent HTTP with pipelining is  $3RTT_0$***

## Question 2:

### Describe in detail

- i) What information should be added in which DNS servers for your own startup company (say 'networkguru.com') that has a webserver and email service to its employees.
- ii) What are companies you can contact for domain name registration and how much are the fees?

## Solution

**Domain Names** serve to identify Internet resources, such as computers, networks, and services, with a text-based label that is easier to memorize than the numerical addresses used in the Internet protocols. A domain name may represent entire collections of such resources or individual instances. Individual Internet host computers use domain names as host identifiers, also called host names. The term host name is also used for the leaf labels in the domain name system, usually without further subordinate domain name space. Host names appear as a component in Uniform Resource Locators (URLs) for Internet resources such as web sites

While starting a website for a start-up company we need to choose hosting services which are among different ones available. We can use blogspot.com which is free service or use low cost web hosting service provided by yahoo or we can launch own website on geocities.com

### Below are the Steps for Registering a domain name:

1. For registering a domain name first we need to check the availability of the domain name. Many web based tools are available which can help in verifying the availability of domain names. There are many registrars providing services of domain name verification.
2. After checking if the domain name is available, one can contact the registrar to register the domain name.
3. Registrar registers the domain name with a static IP address and names of the servers in the appropriate TLD server.

Let's assume that DNS servers has to be added for our new startup company **networkguru.com**

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To Register name networkguru.com at DNS registrar, provides names, IP addresses of authoritative name server (primary and secondary)

Registrar inserts two RRs into TLD server for webserver & mailserver

### **For webserver:**

(networkguru.com, dns1.networkguru.com, NS)

(dns1.networkguru.com, 212.212.212.2, A)

### **For mailserver:**

(mail.networkguru.com, mail1.networkguru.com, MX)

(mail1.networkguru.com, 212.212.212.2, A)

(ii) Some of the good registrars that we can contact for domain name registration are as follows:

**GoDaddy** is extremely popular registrar offers .com domain names for **\$9.99** per year. They have a web interface to manage your domains, free web redirection, free starter web page, free parked page or free "for sale" page, and an optional private domain registration where your domain is registered in the name of a proxy company.

**1&1 Internet** is primarily a large web host that is also a domain name registrar. Like all registrars, there are different charges for different domain suffixes. For example, at the time I last checked, you pay **\$0.99** for a ".com" on your first year, then \$14.99 per year thereafter.

**Namecheap** company provides .com domains for **\$10.69** per year. Along with your domain, you get free email forwarding, free web redirection, free domain name parking, etc.

**Dotster.com** is popular registrar provides cheap domain prices **\$15.75** per domain, a convenient web interface to manage your domains, an optional privacy facility where your domain name is registered in the name of a proxy company, etc.

After the domain name is registered, user can access the webpage by entering the website name from any part of the world.

### Question 3:

**What is meant by a stateful protocol? What is/are an example(s) of stateful protocol? What are the pros and cons of a stateful protocol?**

### Solution:

**Stateful Protocol** is communication protocol which requires keeping of the internal state on the server is known as a stateful protocol. It requires the server to retain session information or status about each communications partner for the duration of multiple requests. It requires dynamic allocation of storage to deal with conversations in progress. If a client session dies in mid-transaction, a part of the system needs to be responsible for cleaning up the present state of the server.

#### Examples of Stateful protocol:

- **TCP** (Transmission Control Protocol)
- **BGP** (Broad Gateway Protocol)

#### Pros and Cons of stateful protocol:

##### Pros:

1. It retains session information about each communication.
2. It uses dynamic allocation of storage.
3. It keeps the internal state on the server.

##### Cons:

1. When the client session dies in mid-transaction, a part of the system needs to be responsible for cleaning up the present state of the server.
2. Every new request is related to the previous request.

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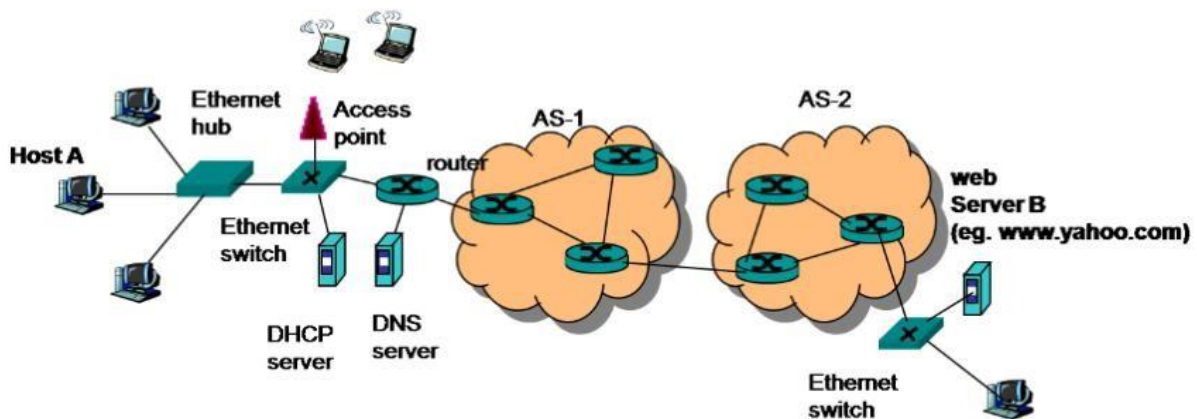
### Question 4:

Fill out the blanks below

	Stop-n-Wait	Go-Back-N	Selective Repeat
Minimum No. of Sequence number required	a) 2	b) $N+1$	c) $N+M$
Sender's buffer size	d) 1	e) $N$	f) $N$
Receiver's buffer size	g) 1	h) 1	i) $M$
No. of timers required	j) 1	k) 1	l) $N$

### Question 5:

Consider an end-to-end communication from a hosts A to webserver B. A user on host A clicks on the web page of web server B which is multiple AS hops away. All routers relate to PPP (Point-to-Point Protocol) links. Write a series of protocols used for a packet to be transferred from A to B throughout the protocol stack in data plane as well as control protocols necessary. Assume host A just gets into an Ethernet local network, thus nothing has configured initially. Host B is connected to an Ethernet LAN. Routing protocols used in each AS is not given intentionally. Assign any proper routing protocols





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### Solution:

From the above diagram, there is end to end communication between host A and webserver B. Given all routes are related to PPP links. The below are the series of protocols used for a packet to be transferred from A to B throughout the protocol stack in data plane as well as control protocols

- TCP (Application and Transport)
- IP (Network)
- HTTP with method GET/POST
- MAC addresses
- Domain Name Services
- Address Resolution Protocol
- Point-to-Point protocol
- Routing Protocol
- OSPF
- RIP
- IGRP
- iBGP
- eBGP

## Laboratory Homework

### Part 1: Telnet experiments

Try HTTP request (GET, HEAD, or POST) without using a web-browser. You can do this on command line using '> telnet webserver 80'. (for example, www.umkc.edu) Record the HTTP responses from the server – retrieve at least two different response status from the server.

**Solution:**

#### Using GET Method

**GET Response 1: HTTP Status: Not Found Code: 404**

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```
quest-TdAUe9rsvankchowdry-VirtualBox:-$ telnet news.google.com 80
Trying 216.58.218.142...
Connected to news.l.google.com.
Escape character is '^]'.
GET /welcome HTTP/1.1

HTTP/1.1 404 Not Found
Content-Type: text/html; charset=UTF-8
Content-Length: 1568
Date: Fri, 25 Nov 2016 03:51:37 GMT

<!DOCTYPE html>
<html lang=en>
<meta charset=utf-8>
<meta name=viewport content="initial-scale=1, minimum-scale=1, width=device-width">
<title>Error 404 (Not Found)!!!</title>
<style>
    @margin:0px auto;@html,color:(font-size:15px;arial,sans-serif)html{background:#fff;color:#222;padding:15px}body{margin:7% auto 0,max-width:390px,min-height:180px;padding:30px 0 15px}> > body{background
d:url(//www.google.com/images/errors/robot.png) 100% 5px no-repeat;padding-right:205px}@margin:1px 0 22px overflow:hidden;ins{color:#777;text-decoration:none}img{border:0}@media screen and (max-width:7
72px){body{background:none;margin-top:0,max-width:none;padding-right:0}}@logo{background:url(//www.google.com/images/branding/googlelogo/1x/googlelogo_color_150x54dp.png) no-repeat;margin-left:5px}@media
only screen and (min-resolution:192dpi){@logo{background:url(//www.google.com/images/branding/googlelogo/2x/googlelogo_color_150x54dp.png) no-repeat 0% 0%/100% 100%;moz-border-image:url(//www.google.com/i
mages/branding/googlelogo/2x/googlelogo_color_150x54dp.png) 0}@media only screen and (-webkit-min-device-pixel-ratio:2){@logo{background:url(//www.google.com/images/branding/googlelogo/2x/googlelogo_color
_150x54dp.png) no-repeat;-webkit-background-size:100% 100%;}@logo{display:inline-block;height:54px;width:150px}}
</style>
<!--[if !IE]><script src=/js/_goog.js?espan id=log aria-label=Google=</span></a>
</b>b404.</b></ins>That's an error.</ins>
<p>The requested URL <code>/welcome/</code> was not found on this server. <ins>That's all we know.</ins>
```

## GET Response 2: HTTP Status: Moved Permanently Code: 301

```
guest-TdNAUe@sravanichowdary-VirtualBox:~$ telnet news.google.com 80
Trying 216.58.218.110...
Connected to news.l.google.com.
Escape character is '^J'.
GET /news HTTP/1.1

HTTP/1.1 301 Moved Permanently
Content-Type: text/html; charset=UTF-8
Location: http://news.google.com/news
Date: Fri, 25 Nov 2016 03:49:57 GMT
Expires: Fri, 25 Nov 2016 03:49:57 GMT
Cache-Control: private, max-age=0
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN
X-XSS-Protection: 1; mode=block
Server: GSE
Accept-Ranges: none
Vary: Accept-Encoding
Transfer-Encoding: chunked

d1
<HTML>
<HEAD>
<TITLE>Moved Permanently</TITLE>
</HEAD>
<BODY BGCOLOR="#FFFFFF" TEXT="#000000">
<H1>Moved Permanently</H1>
The document has moved <A HREF="http://news.google.com/news">here</A>.
</BODY>
</HTML>
```

### GET Response 3: HTTP Status: OK Code: 200

```

root@kali:~# curl -v http://www.google.com
GET / HTTP/1.1
Host: www.google.com
User-Agent: curl/7.68.0
Accept: */*
Accept-Encoding: gzip, deflate
Cache-Control: no-cache
Connection: close
Content-Type: text/html; charset=ISO-8859-1
Date: Mon, 12 Nov 2018 14:00:00 GMT
Expires: -1
Server: GWS
Set-Cookie: NID=91=XKXWfjHwM4D4tCkBC5CrI47_XlNnrwY-Qws6ZyIibJ34BDOKQxV-unr4untzTKnGQC0L6ga9QC-o-sbjZr2oSl2oSRVZP7FEiqzVL_KsgdIT73_f3fmTXIsqK2SncF9ZmVSOBA; expires=Sat, 27-May-2017 03:46:01 GMT; path=/; domain=.google.com; HttpOnly
Accept-Ranges: none
Vary: Accept-Encoding
Transfer-Encoding: chunked

<doctype html><html ltenscope="" itentype="http://schema.org/WebPage" lang="en"><head><meta content="Search the world's information, including webpages, images, videos and more. Google has many special fe
atures to help you find exactly what you're looking for." name="description"><meta content="noop" name="robots"><meta content="text/html; charset=UTF-8" http-equiv="Content-Type"><meta content="/Logos/doo
dles/2016/thanksgiving-2016-507402309334272-hp.jpg" http-equiv="image"><meta content="Happy Thanksgiving 2016! #Googleoodle" property="og:description"><meta content="http://www.google.com/logos/doodles/201
6/thanksgiving-2016-507402309334272-hp.jpg" property="og:image"><meta content="500" property="og:image:width"><meta content="200" property="og:image:height"><title><Google->{function() {<wndo
w.h=||; domain=.google.com; &HttpOnly
Accept-Ranges: none
Vary: Accept-Encoding
Transfer-Encoding: chunked

8000
<doctype html><html ltenscope="" itentype="http://schema.org/WebPage" lang="en"><head><meta content="Search the world's information, including webpages, images, videos and more. Google has many special fe
atures to help you find exactly what you're looking for." name="description"><meta content="noop" name="robots"><meta content="text/html; charset=UTF-8" http-equiv="Content-Type"><meta content="/Logos/doo
dles/2016/thanksgiving-2016-507402309334272-hp.jpg" http-equiv="image"><meta content="Happy Thanksgiving 2016! #Googleoodle" property="og:description"><meta content="http://www.google.com/logos/doodles/201
6/thanksgiving-2016-507402309334272-hp.jpg" property="og:image"><meta content="500" property="og:image:width"><meta content="200" property="og:image:height"><title><Google->{function() {<wndo
w.h=||; domain=.google.com; &HttpOnly
Accept-Ranges: none
Vary: Accept-Encoding
Transfer-Encoding: chunked
```

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### Using HEAD Method

**HEAD Response 1: HTTP Status: Not Found Code: 404**

```
guest-TdNAUe@sravanichowdary-VirtualBox:~$ telnet news.google.com 80
Trying 216.58.218.142...
Connected to news.l.google.com.
Escape character is '^]'.
HEAD /welcome HTTP/1.1

HTTP/1.1 404 Not Found
Content-Type: text/html; charset=UTF-8
Content-Length: 1568
Date: Fri, 25 Nov 2016 03:59:07 GMT
```

**HEAD Response 2: HTTP Status: Moved Permanently Code: 301**

```
guest-TdNAUe@sravanichowdary-VirtualBox:~$ telnet news.google.com 80
Trying 216.58.194.78...
Connected to news.l.google.com.
Escape character is '^]'.
HEAD /news HTTP/1.1

HTTP/1.1 301 Moved Permanently
Content-Type: text/html; charset=UTF-8
Location: http://news.google.com/news
Date: Fri, 25 Nov 2016 03:57:53 GMT
Expires: Fri, 25 Nov 2016 03:57:53 GMT
Cache-Control: private, max-age=0
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN
X-XSS-Protection: 1; mode=block
Server: GSE
Transfer-Encoding: chunked
Accept-Ranges: none
Vary: Accept-Encoding
```

**HEAD Response 3: HTTP Status: OK Code: 200**

```
guest-TdNAUe@sravanichowdary-VirtualBox:~$ telnet news.google.com 80
Trying 216.58.194.142...
Connected to news.l.google.com.
Escape character is '^]'.
HEAD / HTTP/1.1

HTTP/1.1 200 OK
Date: Fri, 25 Nov 2016 03:54:10 GMT
Expires: -1
Cache-Control: private, max-age=0
Content-Type: text/html; charset=ISO-8859-1
P3P: CP="This is not a P3P policy! See https://www.google.com/support/accounts/answer/151657?hl=en for more info."
Server: gws
X-XSS-Protection: 1; mode=block
X-Frame-Options: SAMEORIGIN
Set-Cookie: MID=91=82dyJpR0ISR0Z3q9LlnUE0AGx1LYeQIEZnmqxUXngnhVluQxjQgc6TnkQFSyrhS7FB09nmLw4e_RONyDJSFD0sQrHctEK-zfSDG2PRC7dfxsBAMWl7N0LjUYD_IH-8d85gqHWAcKictolQ; expires=Sat, 27-May-2017 03:54:10 GMT; path=/; domain=.google.com; HttpOnly
Transfer-Encoding: chunked
Accept-Ranges: none
Vary: Accept-Encoding
```

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### Using POST Method

#### POST Response 1: HTTP Status: Bad Request Code: 400

```
guest-VmVuxo@sravanichowdary-VirtualBox:~$ telnet www.umkc.edu 80
Trying 134.193.116.82...
Connected to www.umkc.edu.
Escape character is '^]'.
POST /isa/ HTTP/1.1

HTTP/1.1 400 Bad Request
Content-Type: text/html; charset=us-ascii
Server: Microsoft-HTTPAPI/2.0
Date: Fri, 25 Nov 2016 04:06:49 GMT
Connection: close
Content-Length: 334

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01//EN" "http://www.w3.org/TR/html4/strict.dtd">
<HTML><HEAD><TITLE>Bad Request</TITLE>
<META HTTP-EQUIV="Content-Type" Content="text/html; charset=us-ascii"></HEAD>
<BODY><h2>Bad Request - Invalid Hostname</h2>
<hr><p>HTTP Error 400. The request hostname is invalid.</p>
</BODY></HTML>
Connection closed by foreign host.
```

#### POST Response 2: HTTP Status: Length Required Code: 411

```
guest-VmVuxo@sravanichowdary-VirtualBox:~$ telnet news.google.com 80
Trying 74.125.198.109...
Connected to news-l.google.com.
Escape character is '^]'.
POST /welcome HTTP/1.1

HTTP/1.0 411 Length Required
Content-Type: text/html; charset=UTF-8
Content-Length: 1564
Date: Fri, 25 Nov 2016 04:19:16 GMT

<!DOCTYPE html>
<html lang=en>
  <meta charset=utf-8>
  <meta name=viewport content="initial-scale=1, minimum-scale=1, width=device-width">
  <title>Error 411 (Length Required)!!!</title>
  <style>
    *{margin:0;padding:0}html,code{font:15px/22px arial,sans-serif}html{background:#fff;color:#222;padding:15px}body{margin:7% auto 0;max-width:390px;min-height:180px;padding:30px 0 15px}* > body{background
d: url(/www.google.com/images/errors/robot.png) 190% 5px no-repeat;padding-right:205px}p{margin:11px 0 22px;overflow:hidden}ins{color:#777;text-decoration:none}a
ing{border:0}@media screen and (max-width:7
72px){body{background:none;margin-top:0;max-width:none;padding-right:0}#logo{background:url(/www.google.com/images/branding/googlelogo/1x/googlelogo_color_150x54dp.png) no-repeat;margin-left:-5px}@media
only screen and (min-resolution:192dpi){#logo{background:url(/www.google.com/images/branding/googlelogo/2x/googlelogo_color_150x54dp.png) no-repeat 0% 0%/100% 100%;moz-border-image:url(/www.google.com/i
mages/branding/googlelogo/2x/googlelogo_color_150x54dp.png) 0}@media only screen and (-webkit-min-device-pixel-ratio:2){#logo{background:url(/www.google.com/images/branding/googlelogo/2x/googlelogo_color
_150x54dp.png) no-repeat;-webkit-background-size:100% 100%;}#logo{display:inline-block;height:54px;width:150px}}
  </style>
  <a href=/www.google.com/><span id=logo aria-label=Google</span></a>
  <p><b>411.</b><ins>That's an error.</ins>
  <p>POST requests require a <code>Content-length</code> header. <ins>That's all we know.</ins>
Connection closed by foreign host.
```

#### POST Response 3: HTTP Status: Moved Permanently Code: 301

```
guest-VmVuxo@sravanichowdary-VirtualBox:~$ telnet www.facebook.com 80
Trying 157.240.3.35...
Connected to star-mini.c10r.facebook.com.
Escape character is '^]'.
POST /HTTP/1.1

HTTP/1.1 301 Moved Permanently
Location: http://www.facebook.com/
Vary: Accept-Encoding
Content-Type: text/html
X-FB-Debug: hbE4noiG5Kyc85kwivyupPUHZUdPF/DM+q3eYNHGH2CNQ1LE7VbnJE02XQ8XqynmqBJziiXl8y+8smMh8ehng==
Date: Fri, 25 Nov 2016 04:10:10 GMT
Connection: close
Content-Length: 0

Connection closed by foreign host.
```



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## Part 2: Wireshark experiments

### Part 2-1: The Basic HTTP GET/response interaction

1. Is your browser running HTTP version 1.0 or 1.1? What version of HTTP is the server running?

**Solution:** My browser is using HTTP version 1.1 and server is also running on 1.1 HTTP version

The first screenshot shows a Wireshark packet capture of an HTTP GET request. The packet list shows a GET request from 128.119.245.12 to 192.168.0.3. The packet details pane shows the request method as GET, the URI as /wireshark-labs/HTTP-wireshark-file1.html, and the version as HTTP/1.1. The packet bytes pane shows the raw data of the request.

The second screenshot shows a Wireshark packet capture of an HTTP 200 OK response. The packet list shows a 200 OK response from 192.168.0.3 to 128.119.245.12. The packet details pane shows the response status as 200 OK, the version as HTTP/1.1, and the content type as text/html. The packet bytes pane shows the raw data of the response.

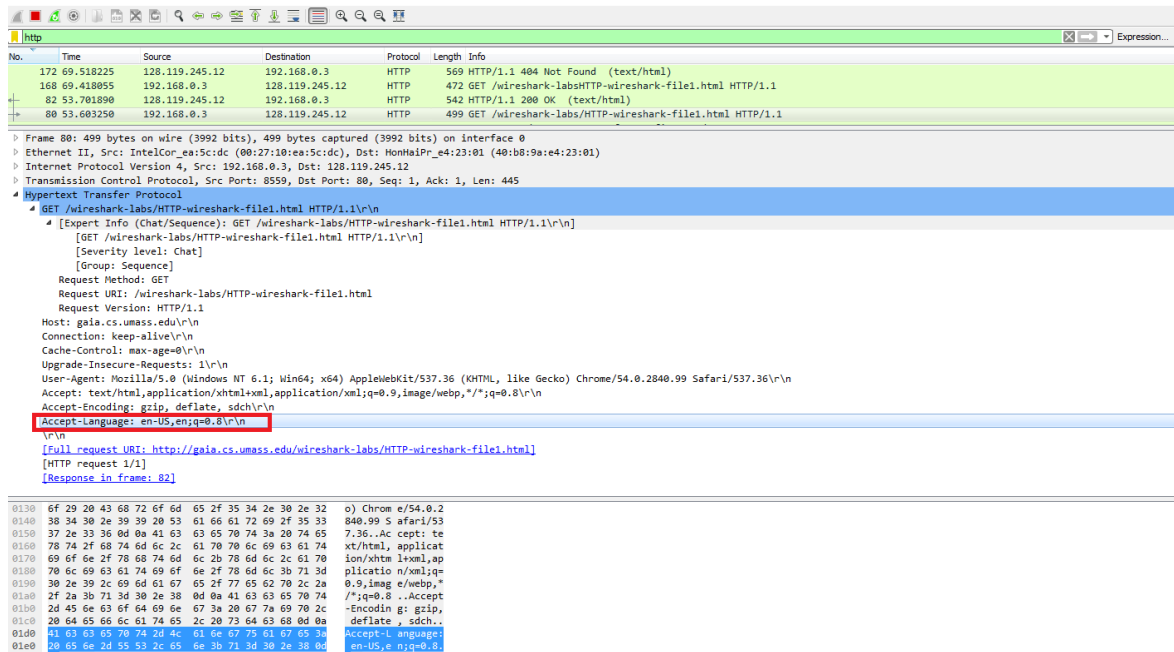
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### 2. What languages (if any) does your browser indicate that it can accept to the server?

**Solution:** The language that browser accepts is en-US



```
172 69.518225 128.119.245.12 192.168.0.3 HTTP 569 HTTP/1.1 404 Not Found (text/html)
168 69.418955 192.168.0.3 128.119.245.12 HTTP 472 GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1
82 53.701890 128.119.245.12 192.168.0.3 HTTP 542 HTTP/1.1 200 OK (text/html)
80 53.693250 192.168.0.3 128.119.245.12 HTTP 499 GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1

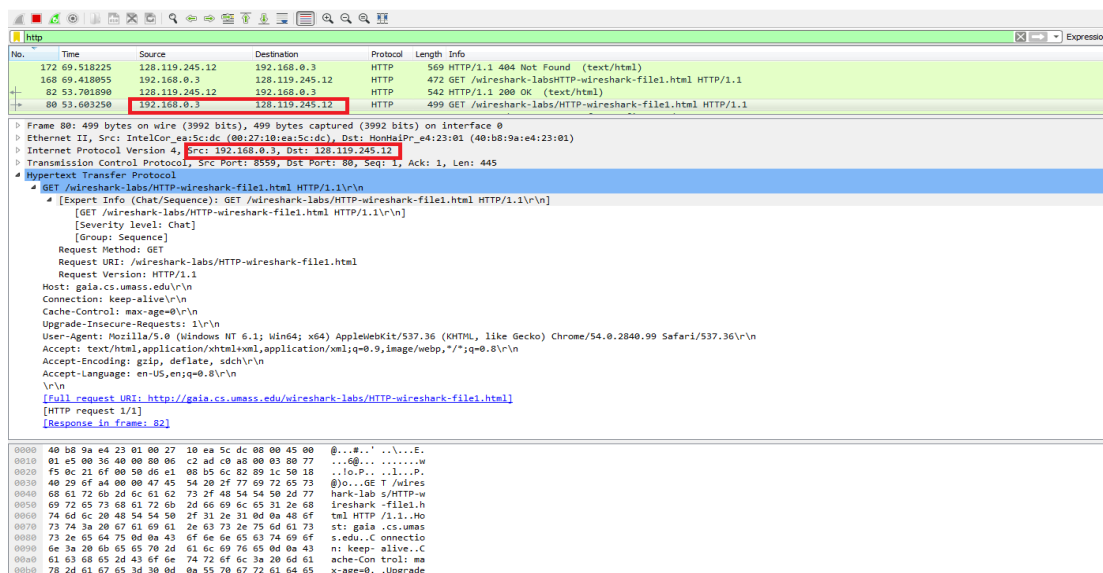
> Frame 80: 499 bytes on wire (3992 bits), 499 bytes captured (3992 bits) on interface 0
> Ethernet II, Src: IntelCor_ea:5c:dc (00:27:10:ea:5c:dc), Dst: HonHaiPr_e4:23:01 (40:b8:9a:e4:23:01)
> Internet Protocol Version 4, Src: 192.168.0.3, Dst: 128.119.245.12
> Transmission Control Protocol, Src Port: 8559, Dst Port: 80, Seq: 1, Ack: 1, Len: 445
+-----+
| Hypertext Transfer Protocol |
+-----+
| 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]
|   [GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1\r\n]
|   [Severity Level: Chat]
|   [Group: Sequence]
|   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
|   Cache-Control: max-age=0\r\n
|   Upgrade-Insecure-Requests: 1\r\n
|   User-Agent: Mozilla/5.0 (Windows NT 6.1; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.99 Safari/537.36\r\n
|   Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8\r\n
|   Accept-Encoding: gzip, deflate, sdch\r\n
|   Accept-Language: en-US,en;q=0.8\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: 82]
+-----+

0130 6f 29 20 43 68 72 6f 6d 65 2f 35 34 2e 30 2e 32 o) Chrom e/54.0.2
0140 38 34 30 2e 39 39 20 53 61 66 61 72 69 2f 35 33 840.99 S afari/53
0150 37 2e 33 36 0d 0a 41 63 63 65 70 74 3a 20 74 65 7.36..Ac cept: te
0160 78 74 2f 68 74 6d 2c 61 70 70 6c 69 63 61 74 xt/html, applicat
0170 69 6f 6e 2f 78 68 74 6d 6c 2b 78 6d 6c 2c 61 70 ion/xhtm l+xml,ap
0180 70 6c 69 63 61 74 69 6f 6e 2f 78 6d 6c 3b 71 3d plicatio n/xml;q=
0190 30 2e 39 2c 69 6d 61 67 65 2f 77 65 62 70 2c 2a 0.9,imag e/webp,"
01a0 2f 2a 30 71 3d 20 30 0d 0a 41 63 65 70 74 /*;q=0.8 ..Accept
01b0 2d 45 63 6f 64 69 6e 67 3a 20 67 7a 69 70 2c -Encoding: gzip,
01c0 20 64 65 66 6c 61 74 65 2c 20 73 64 63 68 0d 0a deflate , sdch..
01d0 41 63 65 70 74 2d 4c 61 6e 67 75 61 67 65 3a Accept-L anguage:
01e0 20 65 6e 2d 55 53 2c 65 6e 3b 71 3d 30 2e 38 0d en-US,e n;q=0.8
```

### 3. What is the IP address of your computer? Of the gaia.cs.umass.edu server?

**Solution:** IP Address of computer is 192.168.0.3

IP Address of gaia.cs.umass.edu is 128.119.245.12



```
172 69.518225 128.119.245.12 192.168.0.3 HTTP 569 HTTP/1.1 404 Not Found (text/html)
168 69.418955 192.168.0.3 128.119.245.12 HTTP 472 GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1
82 53.701890 128.119.245.12 192.168.0.3 HTTP 542 HTTP/1.1 200 OK (text/html)
80 53.693250 192.168.0.3 128.119.245.12 HTTP 499 GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1

> Frame 80: 499 bytes on wire (3992 bits), 499 bytes captured (3992 bits) on interface 0
> Ethernet II, Src: IntelCor_ea:5c:dc (00:27:10:ea:5c:dc), Dst: HonHaiPr_e4:23:01 (40:b8:9a:e4:23:01)
> Internet Protocol Version 4, Src: 192.168.0.3, Dst: 128.119.245.12
> Transmission Control Protocol, Src Port: 8559, Dst Port: 80, Seq: 1, Ack: 1, Len: 445
+-----+
| Hypertext Transfer Protocol |
+-----+
| 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]
|   [GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1\r\n]
|   [Severity Level: Chat]
|   [Group: Sequence]
|   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
|   Cache-Control: max-age=0\r\n
|   Upgrade-Insecure-Requests: 1\r\n
|   User-Agent: Mozilla/5.0 (Windows NT 6.1; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.99 Safari/537.36\r\n
|   Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8\r\n
|   Accept-Encoding: gzip, deflate, sdch\r\n
|   Accept-Language: en-US,en;q=0.8\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: 82]
+-----+

0000 40 b8 9a e4 23 01 00 27 10 ea 5c dc 08 00 45 00 @...'. ....E.
0010 01 e5 00 36 40 00 06 c2 ad c0 a8 00 03 00 77 ...@... ..w
0020 f5 0c 21 6f 00 50 06 e1 00 b5 6c 82 09 1c 50 10 ..lo.P.. .l..P.
0030 40 29 6f a4 00 00 47 45 54 20 2f 77 69 72 65 73 @o...GE T /wires
0040 68 61 72 0b 2d 6c 61 62 73 2f 48 54 5a 50 2d 77 hark-lab s/HTTP-w
0050 69 72 65 73 08 61 72 0b 2d 66 69 6c 65 31 2e 68 ireshark -file1.h
0060 74 6d 6c 20 48 54 50 2f 31 2e 31 0d 0a 48 6f tml HTTP /1.1..Ho
0070 73 74 3a 20 67 61 69 61 2e 63 73 2e 75 6d 61 73 st: gaia .cs.umas
0080 73 2e 65 64 75 0d 0a 43 6f 6e 6e 65 63 74 69 6f s.edu..C connectio
0090 6e 3a 20 6b 65 70 2d 61 6c 69 76 65 0d 0a 43 n: keep-alive..C
00a0 61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20 6d 61 ache-Con trol: ma
00b0 78 2d 61 67 65 3b 30 0d 0a 55 70 67 72 61 64 65 x-age=0.. Upgrade
```

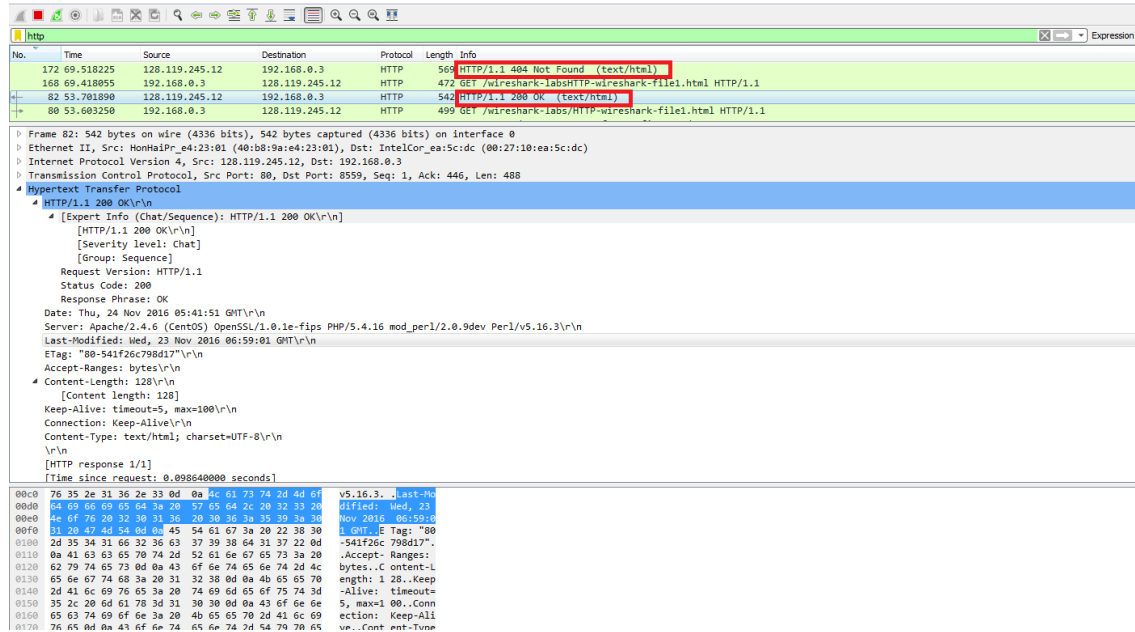
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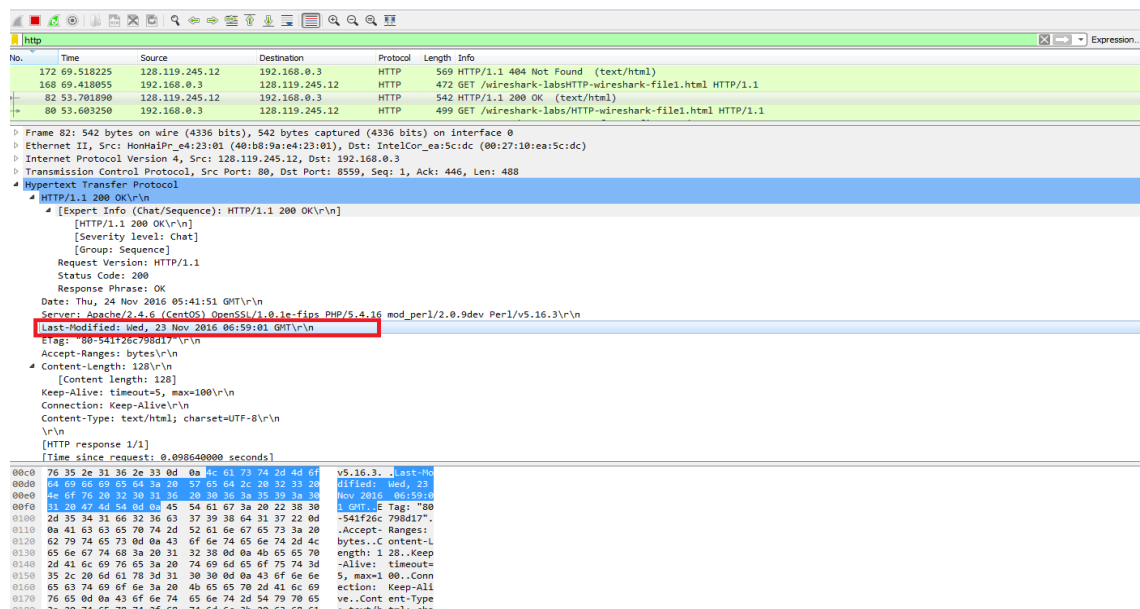
### 4. What is the status code returned from the server to your browser?

**Solution:** The status code sent by server for two responses is 200 (OK) & 404 (Not Found)



### 5. When was the HTML file that you are retrieving last modified at the server?

**Solution:** The HTML is last modified on Wed, 23 Nov 2016 06:59:01 GMT



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### 6. How many bytes of content are being returned to your browser

**Solution:** The content length received to my browser from server for two responses are 128 and 237 bytes.

The image displays two screenshots of a Wireshark packet capture. The first screenshot shows packet 168, an HTTP 200 OK response from 192.168.0.3 to 128.119.245.12. The 'Hypertext Transfer Protocol' section is expanded, and the 'Content-Length: 128' field is highlighted with a red box. The second screenshot shows packet 172, an HTTP 404 Not Found response from 192.168.0.3 to 128.119.245.12. The 'Hypertext Transfer Protocol' section is expanded, and the 'Content-Length: 237' field is highlighted with a red box. Both screenshots also show the raw packet data at the bottom.



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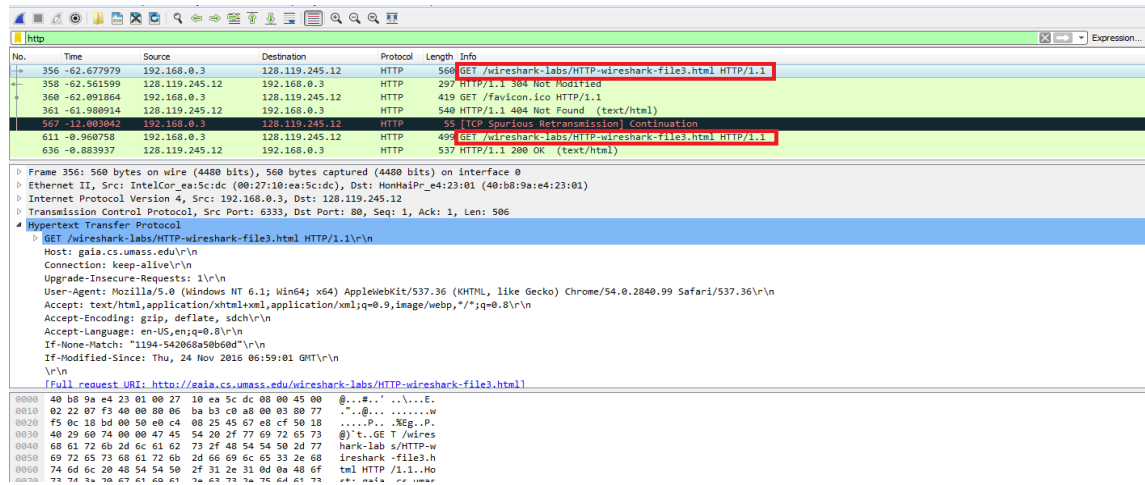
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### Part 2-2: Retrieving Long Documents

#### 1. How many HTTP GET request messages were sent by your browser?

**Solution:** Two requests are sent by my browser to server



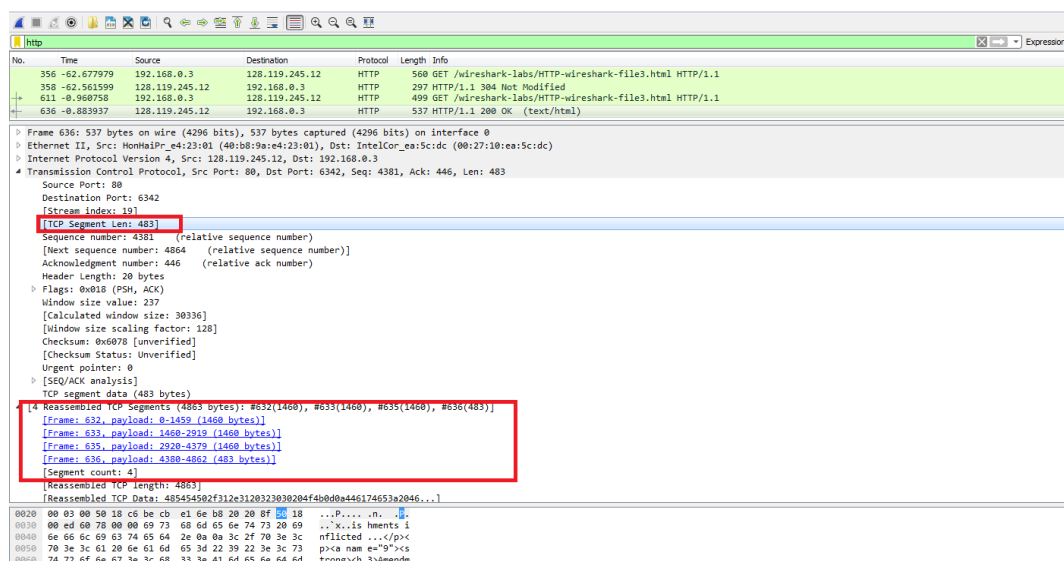
The image shows a Wireshark packet capture of an HTTP session. The packet list pane shows several packets, with two GET requests highlighted in red. The first GET request is packet 356, and the second is packet 611. The packet details pane shows the structure of the HTTP GET request, including the Host, User-Agent, and Accept headers. The packet bytes pane shows the raw data of the request.

No.	Time	Source	Destination	Protocol	Length	Info
356	-62.677979	192.168.0.3	128.119.245.12	HTTP	560	GET /wireshark-labs/HTTP-wireshark-file3.html HTTP/1.1
358	-62.561599	128.119.245.12	192.168.0.3	HTTP	297	HTTP/1.1 304 Not Modified
360	-62.891864	192.168.0.3	128.119.245.12	HTTP	419	GET /favicon.ico HTTP/1.1
361	-61.988914	128.119.245.12	192.168.0.3	HTTP	540	HTTP/1.1 404 Not Found (text/html)
567	-12.003042	192.168.0.3	128.119.245.12	HTTP	55	[TCP Spurious Retransmission] Continuation
611	-0.960758	192.168.0.3	128.119.245.12	HTTP	499	GET /wireshark-labs/HTTP-wireshark-file3.html HTTP/1.1
636	-0.883937	128.119.245.12	192.168.0.3	HTTP	537	HTTP/1.1 200 OK (text/html)

#### 2. How many data-containing TCP segments were needed to carry the single HTTP response?

**Solution:**

For response 1 with HTTP status code OK, 4 data-containing TCP segments were needed for carrying single HTTP response and TCP segment length is 483



The image shows a Wireshark packet capture of an HTTP session. The packet list pane shows several packets, with the HTTP response packet 636 highlighted in red. The packet details pane shows the structure of the TCP segment, including the sequence number, acknowledgment number, and window size. The packet bytes pane shows the raw data of the response, which is divided into four segments of 483 bytes each.

No.	Time	Source	Destination	Protocol	Length	Info
356	-62.677979	192.168.0.3	128.119.245.12	HTTP	560	GET /wireshark-labs/HTTP-wireshark-file3.html HTTP/1.1
358	-62.561599	128.119.245.12	192.168.0.3	HTTP	297	HTTP/1.1 304 Not Modified
611	-0.960758	192.168.0.3	128.119.245.12	HTTP	499	GET /wireshark-labs/HTTP-wireshark-file3.html HTTP/1.1
636	-0.883937	128.119.245.12	192.168.0.3	HTTP	537	HTTP/1.1 200 OK (text/html)

Frame 636: 537 bytes on wire (4296 bits), 537 bytes captured (4296 bits) on interface 0  
Ethernet II, Src: HonHaiPr\_e4:23:01 (40:b8:9a:e4:23:01), Dst: IntelCor\_ea:5c:dc (08:27:10:ea:5c:dc)  
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.0.3  
Transmission Control Protocol, Src Port: 80, Dst Port: 6342, Seq: 4381, Ack: 446, Len: 483  
Source Port: 80  
Destination Port: 6342  
Stream index: 101  
[TCP Segment Len: 483]  
Sequence number: 4381 (relative sequence number)  
[Next sequence number: 4864 (relative sequence number)]  
Acknowledgment number: 446 (relative ack number)  
Header Length: 20 bytes  
Flags: 0x018 (PSH, ACK)  
Window size value: 237  
[Calculated window size: 30336]  
[Window size scaling factor: 128]  
Checksum: 0x6078 [unverified]  
[Checksum Status: Unverified]  
Urgent pointer: 0  
[SEQ/ACK analysis]  
TCP segment data (483 bytes)  
[4 Reassembled TCP Segments (4863 bytes): #632(1460), #633(1460), #635(1460), #636(483)]  
[Frame: 632, payload: 0-1459 (1460 bytes)]  
[Frame: 633, payload: 1460-2919 (1460 bytes)]  
[Frame: 635, payload: 2920-4379 (1460 bytes)]  
[Frame: 636, payload: 4380-4862 (483 bytes)]  
[Segment count: 4]  
[Reassembled TCP length: 4863]  
[Reassembled TCP Data: 435454592f312e312032303020464b0d0e446174653a2046...]

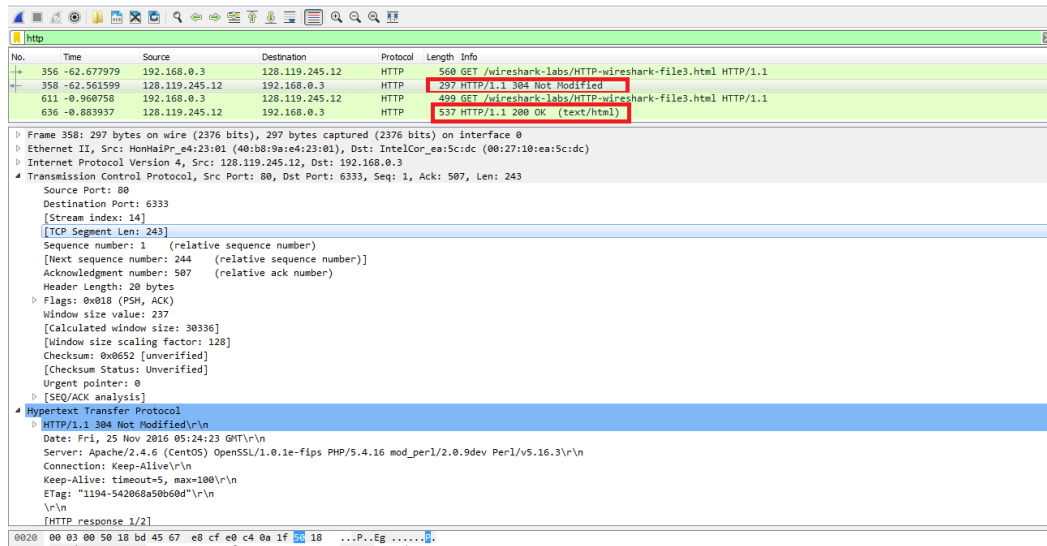
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### 3. What is the status code and phrase associated with the response to the HTTP GET request?

**Solution:** As there are two requests sent from my browser, the responses to requests will be two and the status codes are 304 (Not Modified) and 200 (OK)

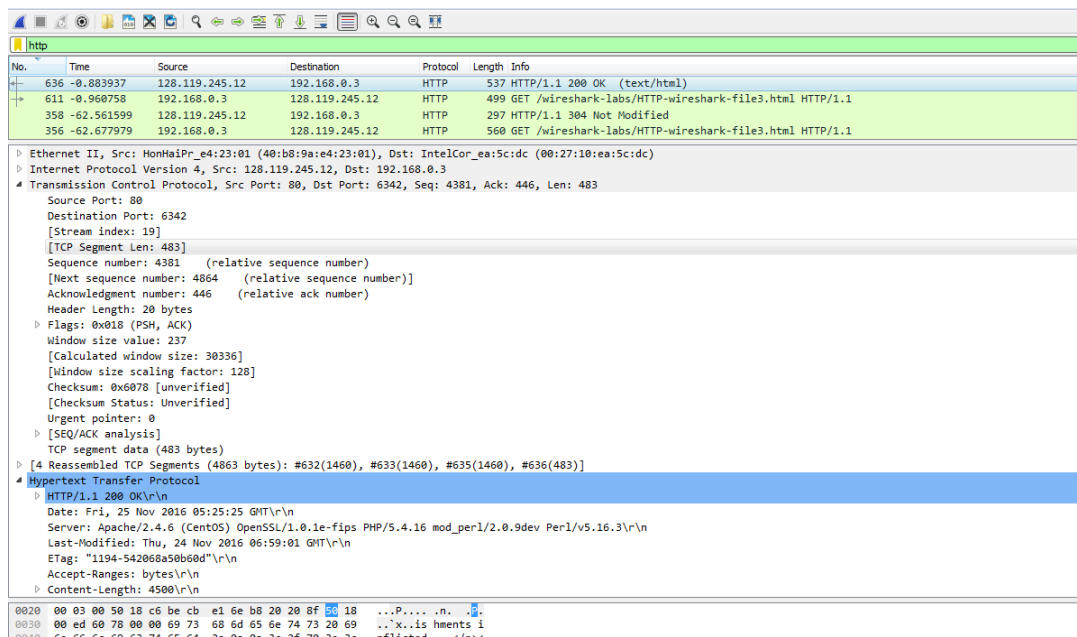


No.	Time	Source	Destination	Protocol	Length	Info
356	-62.677979	192.168.0.3	128.119.245.12	HTTP	560	GET /wireshark-labs/HTTP-wireshark-file3.html HTTP/1.1
358	-62.561599	128.119.245.12	192.168.0.3	HTTP	297	HTTP/1.1 304 Not Modified
611	-0.960758	192.168.0.3	128.119.245.12	HTTP	499	GET /wireshark-labs/HTTP-wireshark-file3.html HTTP/1.1
636	-0.883937	128.119.245.12	192.168.0.3	HTTP	537	HTTP/1.1 200 OK (text/html)

Frame 358: 297 bytes on wire (2376 bits), 297 bytes captured (2376 bits) on interface 0  
Ethernet II, Src: HonHaiPr\_e4:23:01 (40:b8:9a:e4:23:01), Dst: IntelCor\_ea:5c:dc (00:27:10:ea:5c:dc)  
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.0.3  
Transmission Control Protocol, Src Port: 80, Dst Port: 6333, Seq: 1, Ack: 507, Len: 243  
Source Port: 80  
Destination Port: 6333  
[Stream index: 14]  
[TCP Segment Len: 243]  
Sequence number: 1 (relative sequence number)  
[Next sequence number: 244 (relative sequence number)]  
Acknowledgment number: 507 (relative ack number)  
Header Length: 20 bytes  
Flags: 0x018 (PSH, ACK)  
Window size value: 237  
[Calculated window size: 30336]  
[Window size scaling factor: 128]  
Checksum: 0x8652 [unverified]  
[Checksum Status: Unverified]  
Urgent pointer: 0  
[SEQ/ACK analysis]  
Hypertext Transfer Protocol  
HTTP/1.1 304 Not Modified  
Date: Fri, 25 Nov 2016 05:24:23 GMT  
Server: Apache/2.4.6 (CentOS) OpenSSL/1.0.1e-fips PHP/5.4.16 mod\_perl/2.0.9dev Perl/v5.16.3  
Connection: Keep-Alive  
Keep-Alive: timeout=5, max=100  
ETag: "1194-542068a50b60d"  
[HTTP response 1/2]

### 4. Are there any HTTP status lines in the transmitted data associated with a TCP induced "Continuation"?

**Solution:** There is no HTTP status lines in transmitted data with TCP induced "Continuation"



No.	Time	Source	Destination	Protocol	Length	Info
636	-0.883937	128.119.245.12	192.168.0.3	HTTP	537	HTTP/1.1 200 OK (text/html)
611	-0.960758	192.168.0.3	128.119.245.12	HTTP	499	GET /wireshark-labs/HTTP-wireshark-file3.html HTTP/1.1
358	-62.561599	128.119.245.12	192.168.0.3	HTTP	297	HTTP/1.1 304 Not Modified
356	-62.677979	192.168.0.3	128.119.245.12	HTTP	560	GET /wireshark-labs/HTTP-wireshark-file3.html HTTP/1.1

Ethernet II, Src: HonHaiPr\_e4:23:01 (40:b8:9a:e4:23:01), Dst: IntelCor\_ea:5c:dc (00:27:10:ea:5c:dc)  
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.0.3  
Transmission Control Protocol, Src Port: 80, Dst Port: 6342, Seq: 4381, Ack: 446, Len: 483  
Source Port: 80  
Destination Port: 6342  
[Stream index: 19]  
[TCP Segment Len: 483]  
Sequence number: 4381 (relative sequence number)  
[Next sequence number: 4864 (relative sequence number)]  
Acknowledgment number: 446 (relative ack number)  
Header Length: 20 bytes  
Flags: 0x018 (PSH, ACK)  
Window size value: 237  
[Calculated window size: 30336]  
[Window size scaling factor: 128]  
Checksum: 0x6078 [unverified]  
[Checksum Status: Unverified]  
Urgent pointer: 0  
[SEQ/ACK analysis]  
TCP segment data (483 bytes)  
[4 Reassembled TCP Segments (4863 bytes): #632(1460), #633(1460), #635(1460), #636(483)]  
Hypertext Transfer Protocol  
HTTP/1.1 200 OK  
Date: Fri, 25 Nov 2016 05:25:25 GMT  
Server: Apache/2.4.6 (CentOS) OpenSSL/1.0.1e-fips PHP/5.4.16 mod\_perl/2.0.9dev Perl/v5.16.3  
Last-Modified: Thu, 24 Nov 2016 06:59:01 GMT  
ETag: "1194-542068a50b60d"  
Accept-Ranges: bytes  
Content-Length: 4500