NETWORK ARCHITECTURE-1

HOMEWORK-4

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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 RTT0 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 clinks 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 RTT0

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 2RTT0

Time taken to receive each object is 2RTT0

Total number of objects is 10

Therefore, time taken for 10 objects = 10(2RTT0) = 20 RTT0

So, total time taken = 20RTT0+2RTT0 = 22 RTT0

Hence time taken in Non-Persistent HTTP without parallel connection is 22 RTT0

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 2RTT0

Time taken to receive all the objects in parallel is 2RTT0

Total time taken for 10 objects = 2RTT0+2RTT0 is 4RTT0

Hence Time taken in Non-Persistent HTTP with parallel connection is 4RTT0

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 2RTT0

Time taken to receive each object is RTT0

Total number of objects = 10

Thus, the time taken for all the ten objects= 10RTT0

Therefore, total time taken = 10RTT0 + 2RTT0 = 12RTT0

Hence Time taken in Persistent HTTP without pipelining connections is 12 RTT0

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= 2RTT0

Time taken to receive all the ten objects through pipelining = RTT0

Hence total time taken = 2RTT0 + RTT0 = 3RTT0.

Hence Time taken in Persistent HTTP with pipelining is 3RTT0

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**

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.

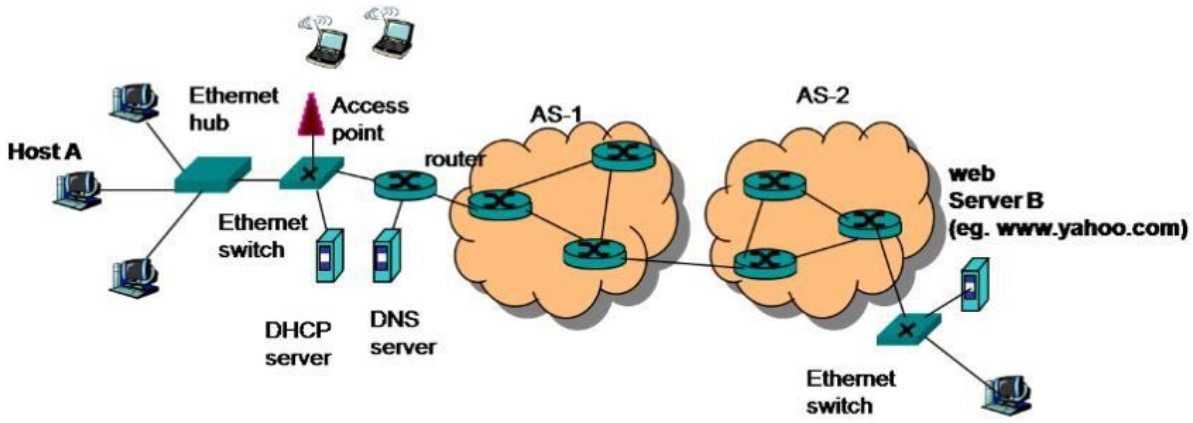
Question 4:

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



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

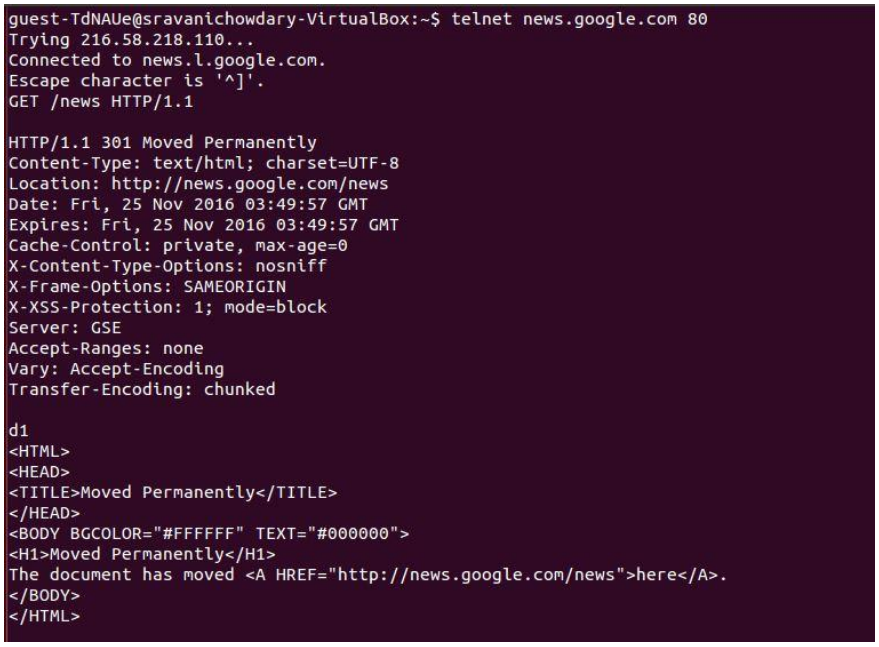
Try HTTP request (GET, HEAD, or POST) without using a web-browser. You can do this on command line using '> telnet webserver 80'. (for example, www.umkc.edu) Record the HTTP responses from the server – retrieve at least two different response status from the server.

Solution:

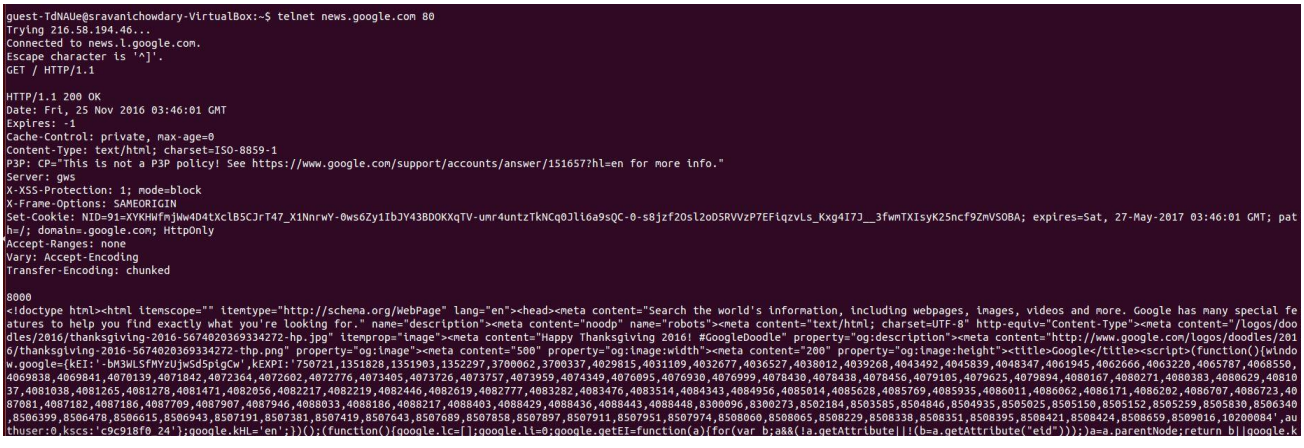
Using GET Method

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

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



GET Response 3: HTTP Status: OK Code: 200



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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: NID=91=02dyJpR0ISR0Z3q9LlmUEOAGx1LYeQIEZnnxqUXmgnhVluQxjQgc6TmkQFSyrhS7FBD9nmLw4e_RONyDJ5FDOsQrHctEK-zfSDG2PRC7dfxsBAMWi7N0LjUYD_iH-8d85gqHKAcKictoiQ; expires=Sat, 27-May-2017 03:54:10 GMT; path=/; domain=.google.com; HttpOnly
Transfer-Encoding: chunked
Accept-Ranges: none
Vary: Accept-Encoding
```

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 74.125.198.100...
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)!!1</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{backgroun
d:url(//www.google.com/images/errors/robot.png) 100% 5px no-repeat;padding-right:205px}p{margin:11px 0 22px;overflow:hidden}ins{color:#777;text-decoration:none}a 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>
  <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

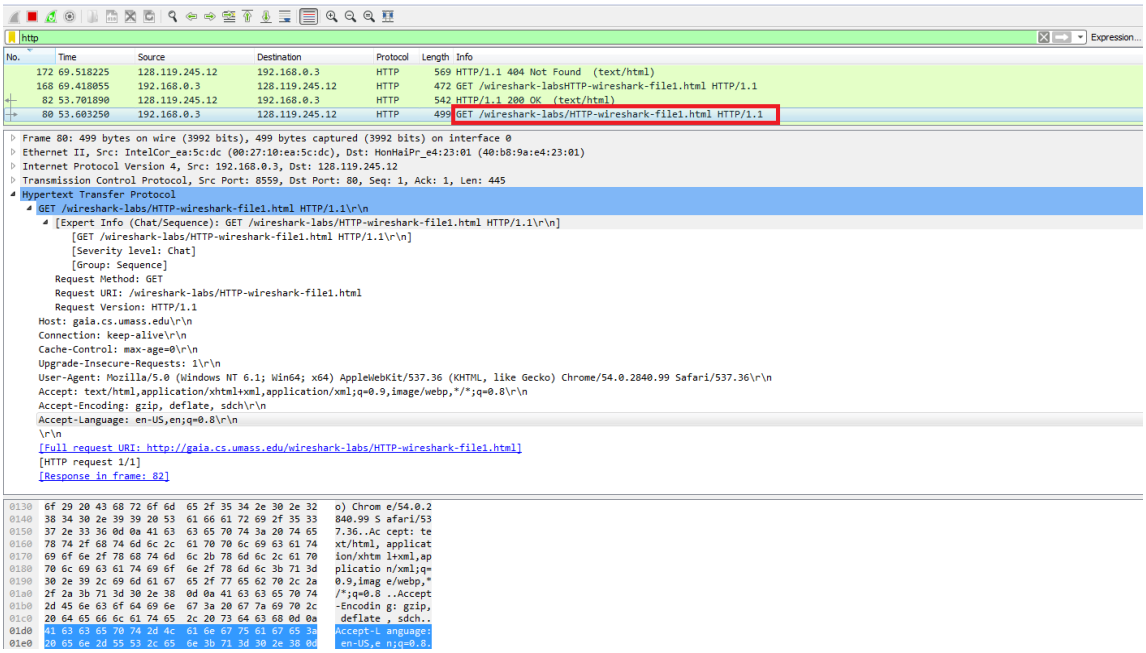
```
guest-VmvUxo@sravanichowdary-VirtualBox:~$ telnet www.facebook.com 80
Trying 157.240.3.35...
Connected to star-mini.c10r.facebook.com.
Escape character is '^]'.
POST /HTTP/1.1

HTTP/1.1 301 Moved Permanently
Location: http://www.facebook.com/
Vary: Accept-Encoding
Content-Type: text/html
X-FB-Debug: hbE4noiG5Kyc85kwivyupPUHZUdPF/DM+q3eYNHGh2CNQilE7VbmJE02xQ8XqynmqBJziiiXl8y+BsmMh8ehng==
Date: Fri, 25 Nov 2016 04:10:10 GMT
Connection: close
Content-Length: 0

Connection closed by foreign host.
```

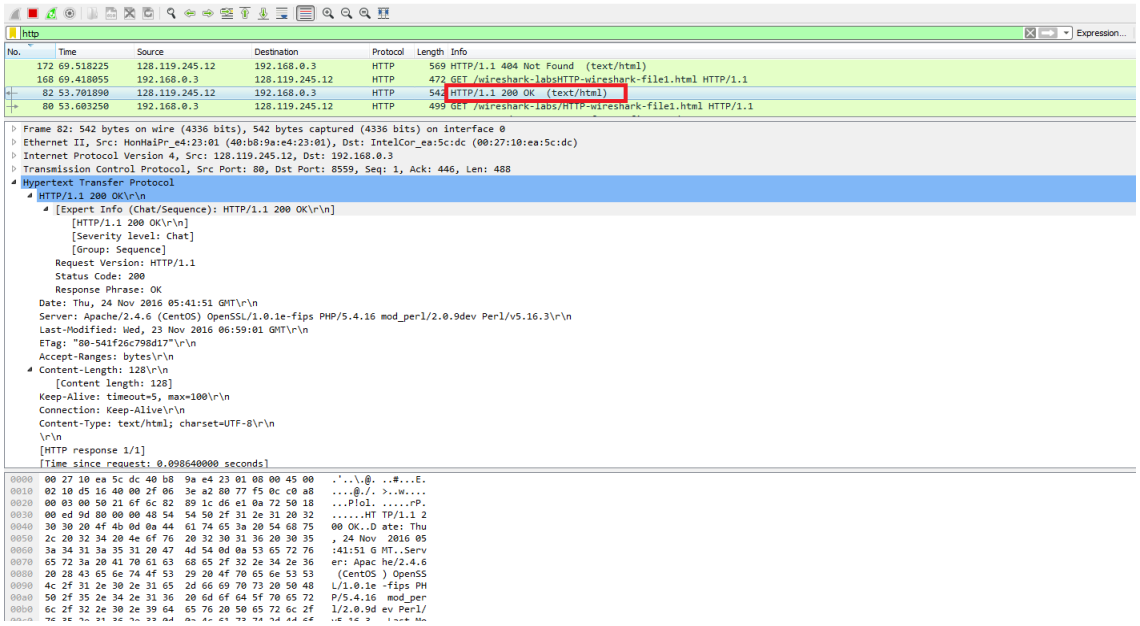
Part 2: Wireshark experiments

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?**

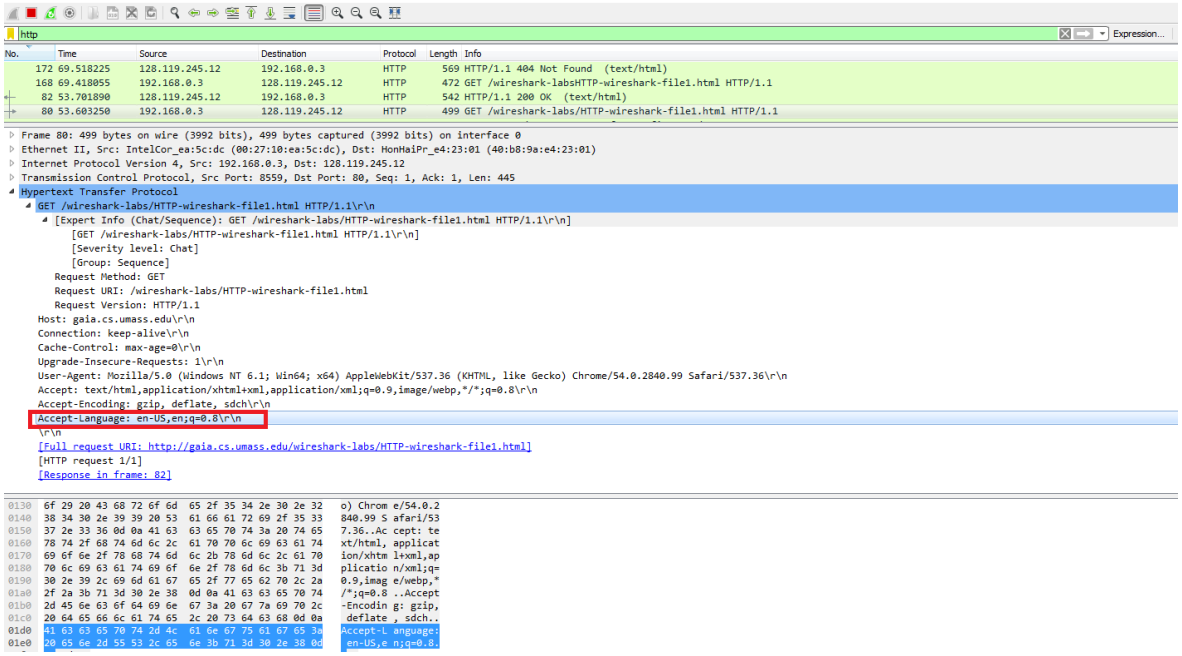
Solution: My browser is using HTTP version 1.1 and server is also running on 1.1 HTTP version





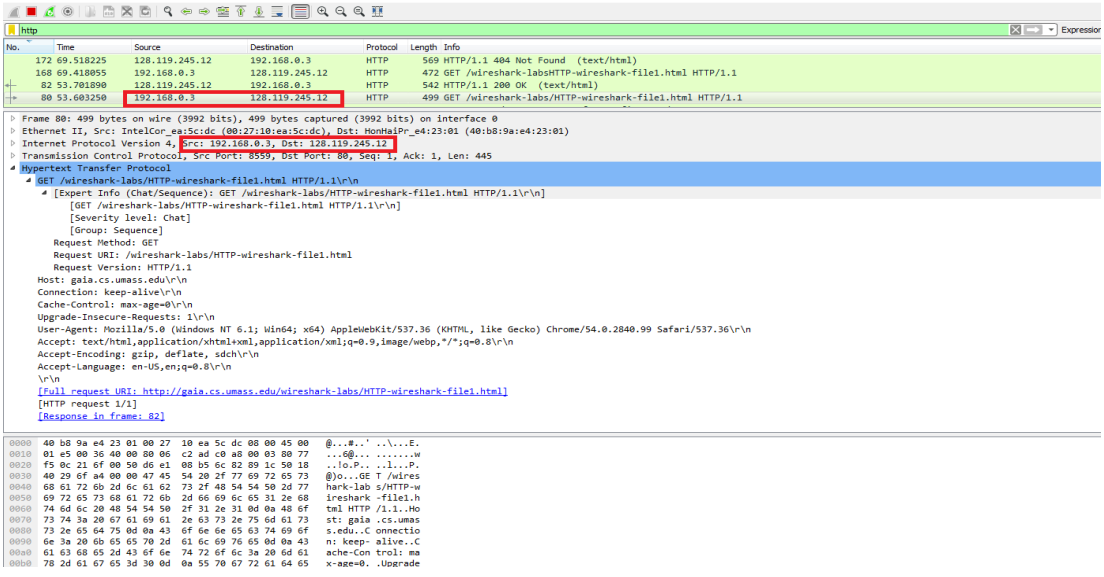
2. What languages (if any) does your browser indicate that it can accept to the server?

Solution: The language that browser accepts is en-US



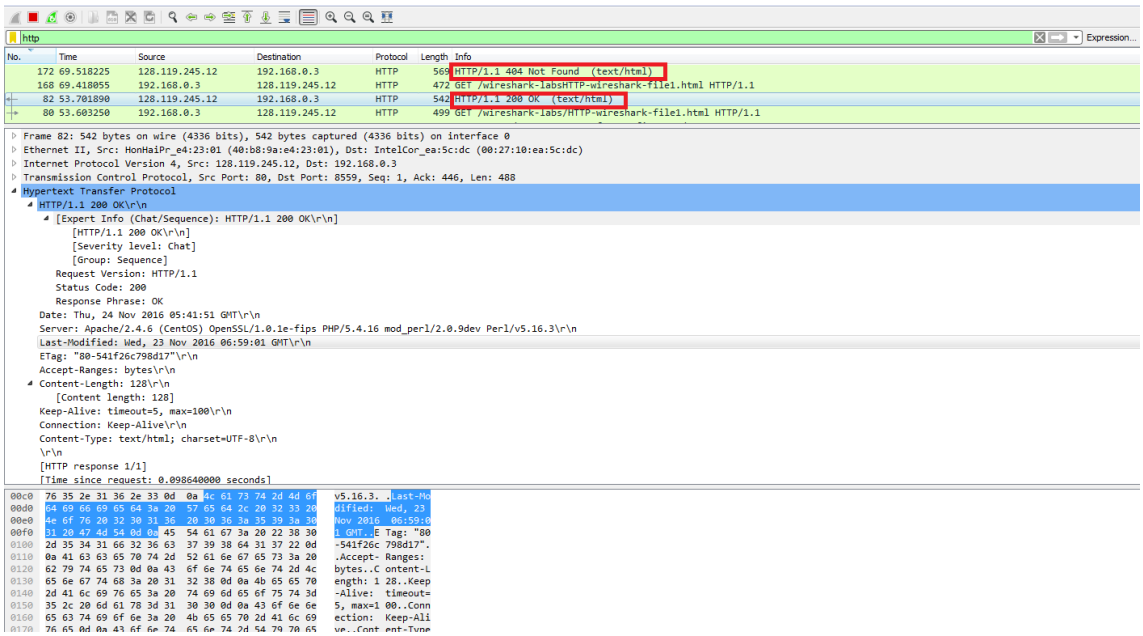
3. What is the IP address of your computer? Of the gaia.cs.umass.edu server?

Solution: IP Address of computer is **192.168.0.3**
IP Address of gaia.cs.umass.edu is **128.119.245.12**



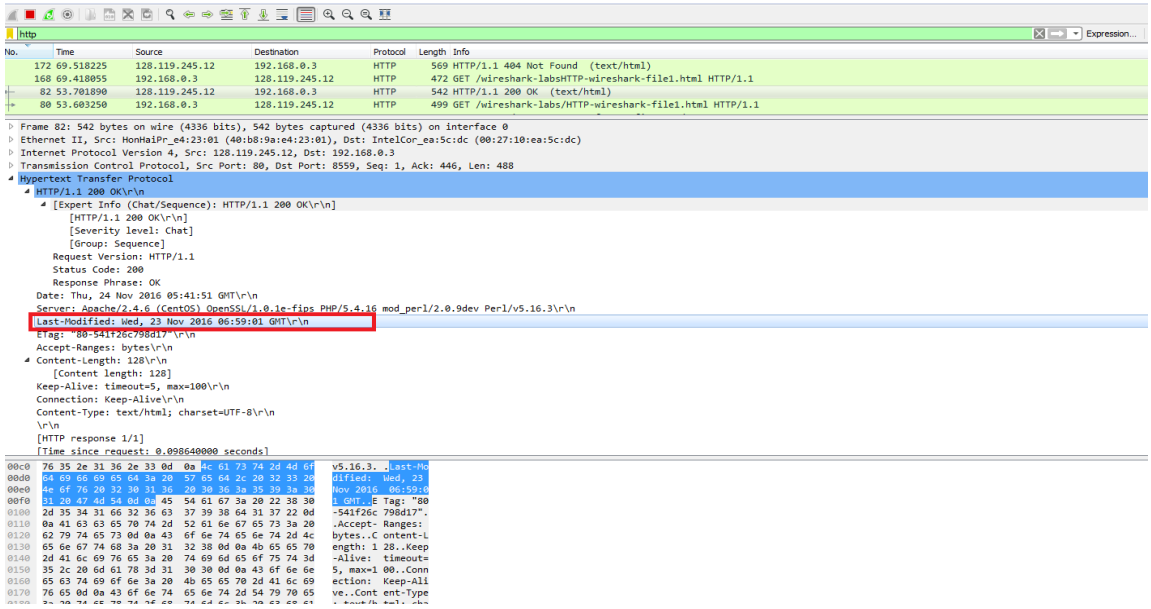
4. What is the status code returned from the server to your browser?

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



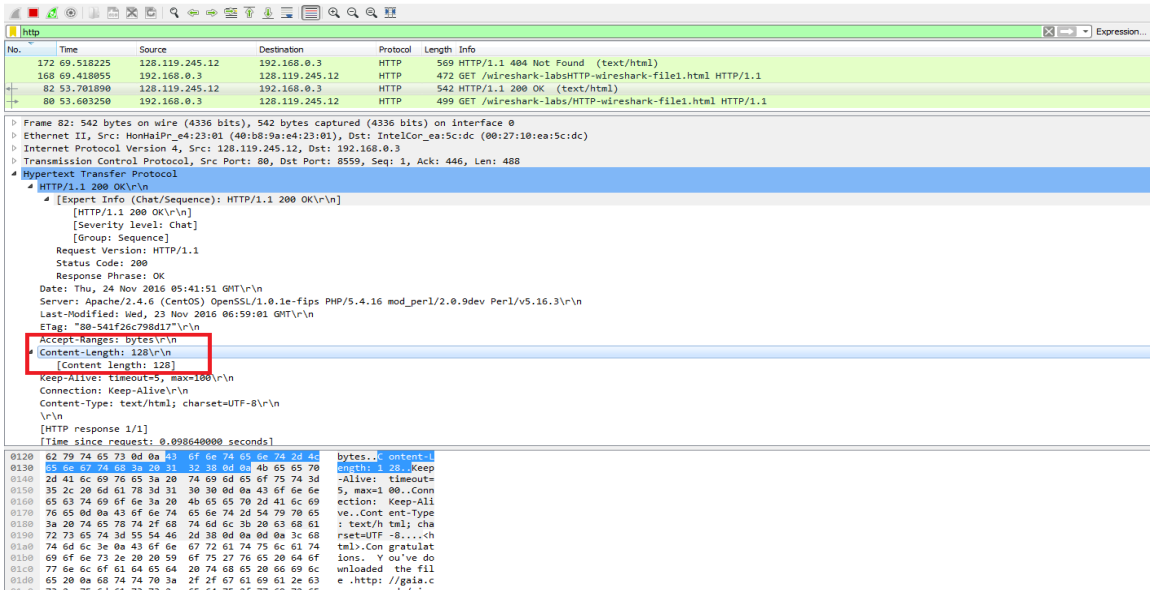
5. When was the HTML file that you are retrieving last modified at the server?

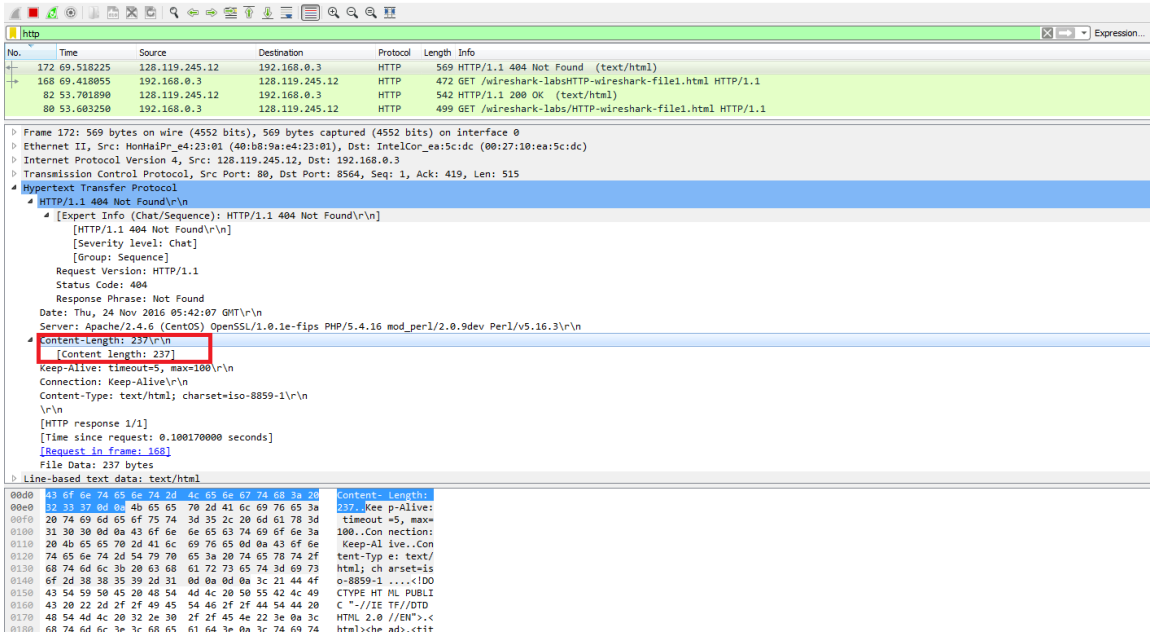
Solution: The HTML is last modified on Wed, 23 Nov 2016 06:59:01 GMT



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.

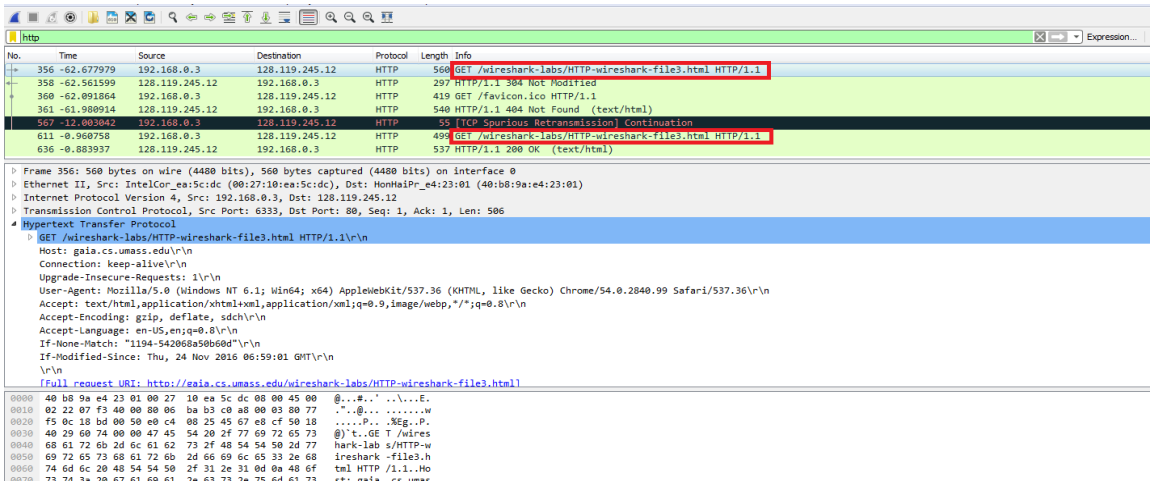




Part 2-2: Retrieving Long Documents

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

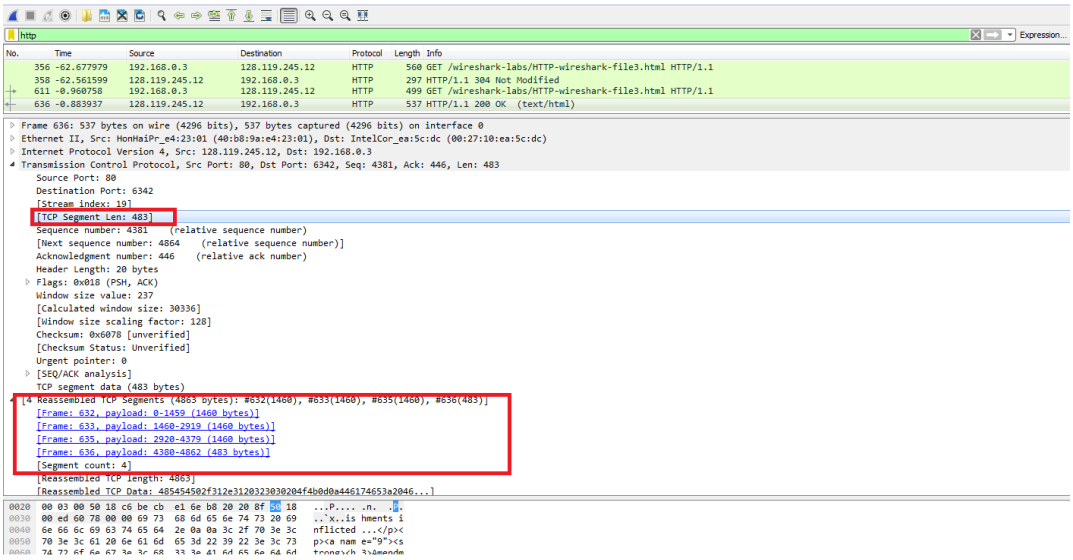
Solution: Two requests are sent by my browser to server



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

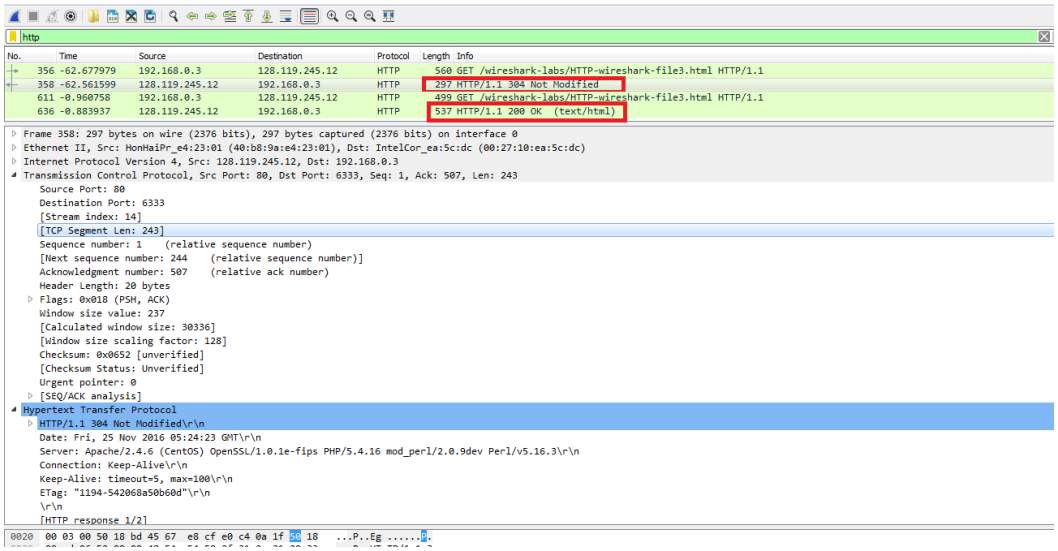
Solution:

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



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)



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"