

CS 39006: Networks Lab

Assignment 2: Understanding the Protocols of Application Layer

Assignment Date: 18 January, 2018

Report by:

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Observations for HTTP Server:

Q 1a) Classify the different ports of the HTTP (i.e., 8100, 8110 and 8111) into these classes namely, (i) HTTP 1.1 - with persistent connections, (ii) HTTP 1.1 - without persistent connections and (iii) HTTP 1.0. Justify your answer from the observations.

Ans.

Port 8100 is HTTP 1.0,

Port 8110 is HTTP 1.1 with non-persistent connections, and

Port 8111 is HTTP 1.1 with persistent connections

Justification - WireShark provides the details regarding the distinction between HTTP 1.1 and HTTP 1.0. To distinguish between persistent and non-persistent connection, we observed that in persistent connection there was only one FIN message at the end to close the connection, whereas in non-persistent connection there were FIN messages after each GET request.

Q 1b) How many GET requests were issued to access each of the three HTTP server instances?

Ans.

17 GET requests were issued to access each of the HTTP server instances (8111, 8110, and 8100).

Justification – Number of GET requests doesn't depend on the HTTP server instance as it depends on the data being transferred.

Q 1c) Obtain the amount of time elapsed between the HTTP GET requests and their corresponding responses, while accessing each of these three HTTP server instances?

Ans.

For port 8111:

GET Request	Time (in ms)
/	1
style.css	3
Mobile.css	4
Mobile.js	1
Logo.png	1
Satellite.png	4
Project-image1.png	1
Project-image2.png	1
Project-image3.png	1
Project-image4.png	1
Mars-rover.jpg	3
Finding-planet.jpg	2
New-satellitedish.jpg	2
Bg-home.jpg	8
Bg-transparent1.png	1
Icons.png	1
audiowide-regular-webfont.woff	2

For port 8110:

GET Request	Time (in ms)
/	2
style.css	3
Mobile.css	2
Mobile.js	1
Logo.png	1
Satellite.png	6
Project-image1.png	2
Project-image2.png	2
Project-image3.png	2
Project-image4.png	1
Mars-rover.jpg	4
Finding-planet.jpg	4
New-satellitedish.jpg	3
Bg-home.jpg	8
Bg-transparent1.png	1
Icons.png	2
audiowide-regular-webfont.woff	2

For port 8100:

GET Request	Time (in ms)
/	3
style.css	3
Mobile.css	2
Mobile.js	1
Logo.png	1
Satellite.png	4
Project-image1.png	2
Project-image2.png	1
Project-image3.png	2
Project-image4.png	1
Mars-rover.jpg	4
Finding-planet.jpg	1
New-satellitedish.jpg	1
Bg-home.jpg	7
Bg-transparent1.png	1
Icons.png	1
audiowide-regular-webfont.woff	2

Q 1d) What is the total page download time from each of these three HTTP server instances?

Ans.

Total page download time for port 8111 is 191 ms, for port 8110 is 143 ms, and for port 8100 is 102 ms.

Justification – Technically total page download time using HTTP/1.1 with persistent connection should be the least but it is not the case here due to different loads in the network.

Q 1e) Check the user-agent field in the HTTP headers. What information regarding the OS and Browser can you infer from the user-agent field?

Ans.

User-agent field in the HTTP header is:

Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:57.0) Gecko/20100101 Firefox/57.0\r\n

From this we infer that the user was using Mozilla Firefox browser version 5.0 and Ubuntu Linux OS having x86_64 architecture and Gecko is the browser driver.

Observations for FTP Server:

a.) What are the sequences of FTP messages exchanged between the server and the client for (i) active mode connection, (ii) passive mode connection? Note down the message type, FTP Header fields, Source IP, Destination IP, Source port and destination port corresponding to those messages.

Ans.

(i) Active Mode:

Sequence of Messages:

Stream 0:

```
220 ProFTPD 1.3.5a Server (Debian) [::ffff:10.5.20.222]
USER anonymous
331 Anonymous login ok, send your complete email address as your password
PASS
230-Welcome, archive user anonymous@10.117.8.245 !
230-
230-The local time is: Thu Jan 25 10:45:06 2018
230-
230-This is an experimental FTP server. If you have any unusual problems,
230-please report them via e-mail to <root@localhost>.
230-
230 Anonymous access granted, restrictions apply
SYST
215 UNIX Type: L8
PORT 10,117,8,245,136,149
200 PORT command successful
LIST
150 Opening ASCII mode data connection for file list
226 Transfer complete
```

Stream 1:

```
-rw-r--r-- 1 ftp ftp 6146 Apr 4 2017 aboutme.html
-rw-r--r-- 1 ftp ftp 4840 Jan 10 2015 acad.html
-rw-r--r-- 1 ftp ftp 8627 Jan 18 2016 achievements.html
-rw-r--r-- 1 ftp ftp 4804 Jul 22 2016 assorted.html
-rw-r--r-- 1 ftp ftp 5555 Nov 16 2015 colproj.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 Courses
-rw-r--r-- 1 ftp ftp 7938 Jan 8 04:18 courses.html
-rw-r--r-- 1 ftp ftp 15353 Aug 13 2016 cproj.html
-rw-r--r-- 1 ftp ftp 4575 Jan 10 2015 expr.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 images
-rw-r--r-- 1 ftp ftp 10600 Aug 29 15:00 index.html
-rw-r--r-- 1 ftp ftp 4904 Jan 10 2015 links.html
-rw-r--r-- 1 ftp ftp 5418 Jan 10 2015 member.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 paper
-rw-r--r-- 1 ftp ftp 33697 Nov 16 13:44 pconf.html
-rw-r--r-- 1 ftp ftp 4634 Jan 10 2015 photography.html
-rw-r--r-- 1 ftp ftp 15958 Jan 2 03:31 pjour.html
-rw-r--r-- 1 ftp ftp 20717 Sep 18 2015 pproj.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 presentations
-rw-r--r-- 1 ftp ftp 6458 Jan 10 2015 presentations.html
-rw-r--r-- 1 ftp ftp 21833 Nov 16 12:33 proj.html
-rw-r--r-- 1 ftp ftp 5974 Jan 10 2015 pvol.html
-rw-r--r-- 1 ftp ftp 7222 Dec 19 2016 stud.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 styles
-rw-r--r-- 1 ftp ftp 28885 Jan 10 2015 travel.html
-rw-r--r-- 1 ftp ftp 170 Apr 5 2016 welcome.msg
```

Messages:

We ran the following commands:

open 10.5.20.222

ls

S. no.	Message Type	Source IP	Destination IP	Source port	Destination port	FTP Header field
1	Response - 220	10.5.20.222	10.117.8.245	21	54698	Response code: Service ready for new user (220)

						Response arg: ProFTPD 1.3.5a Server (Debian) [::ffff:10.5.20.222]
2	Request	10.117.8.245	10.5.20.222	54698	21	Request command: USER Request arg: anonymous
3	Response - 331	10.5.20.222	10.117.8.245	21	54698	Response code: User name okay, need password (331) Response arg: Anonymous login ok, send your complete email address as your password
4	Request	10.117.8.245	10.5.20.222	54698	21	Request command: PASS
5	Response - 230	10.5.20.222	10.117.8.245	21	54698	Response code: User logged in, proceed (230) Response arg: Welcome, archive user anonymous@10.117.8.245 !
6	Response - 230	10.5.20.222	10.117.8.245	21	54698	Response code: User logged in, proceed (230) 230-The local time is: Thu Jan 25 10:45:06 2018\r\n 230-\r\n 230-This is an experimental FTP server. If you have any unusual problems,\r\n 230-please report them via e-mail to <root@localhost>.\r\n 230-\r\n 230 Anonymous access granted, restrictions apply\r\n
7	Request	10.117.8.245	10.5.20.222	54698	21	Request command: SYST
8	Response- 215	10.5.20.222	10.117.8.245	21	54698	Response code: NAME system type (215) Response arg: UNIX Type: L8
9	Request	10.117.8.245	10.5.20.222	54698	21	Request command:

						PORT Request arg: 10,117,8,245,136,149 Active IP address: 10.117.8.245 Active port: 34965
10	Response-200	10.5.20.222	10.117.8.245	21	54698	Response code: Command okay (200) Response arg: PORT command successful
11	Request	10.117.8.245	10.5.20.222	54698	21	Request command: LIST
12	Response - 150	10.5.20.222	10.117.8.245	21	54698	Response code: File status okay; about to open data connection (150) Response arg: Opening ASCII mode data connection for file list
13	FTP Data	10.5.20.222	10.117.8.245	20	34965	FTP Data: 1757 bytes
14	Response - 226	10.5.20.222	10.117.8.245	21	54698	Response code: Closing data connection (226) Response arg: Transfer complete

No.	Time	Source	Destination	Protocol	Length	Info
4	0.060717246	10.5.20.222	10.117.8.245	FTP	133	Response: 220 ProFTPD 1.3.5a Server (Debian) (::ffff:10.5.20.222)
6	0.214007258	10.117.8.245	10.5.20.222	FTP	62	Request: USER anonymous
8	0.275758468	10.5.20.222	10.117.8.245	FTP	141	Response: 331 Anonymous login ok, send your complete email address as your password
10	0.618716163	10.117.8.245	10.5.20.222	FTP	73	Request: PASS
11	0.621027317	10.5.20.222	10.117.8.245	FTP	118	Response: 230-Welcome, archive user anonymous@10.117.8.245 !
13	0.621858986	10.5.20.222	10.117.8.245	FTP	315	Response: 230-
15	0.621984389	10.117.8.245	10.5.20.222	FTP	72	Request: SYST
16	0.622574452	10.5.20.222	10.117.8.245	FTP	85	Response: 215 UNIX Type: L8
18	0.896478473	10.117.8.245	10.5.20.222	FTP	93	Request: PORT 10,117,8,245,136,149
19	0.897362958	10.5.20.222	10.117.8.245	FTP	95	Response: 200 PORT command successful
21	0.897485357	10.117.8.245	10.5.20.222	FTP	72	Request: LIST
25	0.8988457138	10.5.20.222	10.117.8.245	FTP	120	Response: 150 Opening ASCII mode data connection for file list
28	0.919589988	10.5.20.222	10.117.8.245	FTP-DATA	1823	FTP Data: 1757 bytes
30	0.911711669	10.5.20.222	10.117.8.245	FTP	89	Response: 226 Transfer complete

(ii) Passive Mode:

Sequence of messages:

Stream 0:

```

220 ProFTPD 1.3.5a Server (Debian) [::ffff:10.5.20.222]
USER anonymous
331 Anonymous login ok, send your complete email address as your password
PASS
230-Welcome, archive user anonymous@10.117.8.245 !
230-
230-The local time is: Thu Jan 25 12:00:26 2018
230-
230-This is an experimental FTP server. If you have any unusual problems,
230-please report them via e-mail to <root@localhost>.
230-
230 Anonymous access granted, restrictions apply
SYST
215 UNIX Type: L8
PASV
227 Entering Passive Mode (10,5,20,222,166,47).
LIST
150 Opening ASCII mode data connection for file list
226 Transfer complete

```

Stream 1:

```
-rw-r--r-- 1 ftp ftp 6146 Apr 4 2017 aboutme.html
-rw-r--r-- 1 ftp ftp 4840 Jan 10 2015 acad.html
-rw-r--r-- 1 ftp ftp 8627 Jan 18 2016 achievements.html
-rw-r--r-- 1 ftp ftp 4804 Jul 22 2016 assorted.html
-rw-r--r-- 1 ftp ftp 5555 Nov 16 2015 colproj.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 Courses
-rw-r--r-- 1 ftp ftp 7938 Jan 8 04:18 courses.html
-rw-r--r-- 1 ftp ftp 15353 Aug 13 2016 cproj.html
-rw-r--r-- 1 ftp ftp 4575 Jan 10 2015 expr.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 images
-rw-r--r-- 1 ftp ftp 10680 Aug 29 15:00 index.html
-rw-r--r-- 1 ftp ftp 4994 Jan 10 2015 links.html
-rw-r--r-- 1 ftp ftp 5418 Jan 10 2015 member.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 paper
-rw-r--r-- 1 ftp ftp 33697 Nov 16 13:44 pconf.html
-rw-r--r-- 1 ftp ftp 4634 Jan 10 2015 photography.html
-rw-r--r-- 1 ftp ftp 15958 Jan 2 03:31 pjour.html
-rw-r--r-- 1 ftp ftp 20717 Sep 18 2015 pproj.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 presentations
-rw-r--r-- 1 ftp ftp 6458 Jan 10 2015 presentations.html
-rw-r--r-- 1 ftp ftp 21833 Nov 16 12:33 proj.html
-rw-r--r-- 1 ftp ftp 5974 Jan 10 2015 pvol.html
-rw-r--r-- 1 ftp ftp 7222 Dec 19 2016 stud.html
drwxr-xr-x 2 ftp ftp 4096 Jan 16 19:42 styles
-rw-r--r-- 1 ftp ftp 28885 Jan 10 2015 travel.html
-rw-r--r-- 1 ftp ftp 170 Apr 5 2016 welcome.msg
```

Messages:

We ran the following commands:

open 10.5.20.222

ls

S. no.	Message Type	Source IP	Destination IP	Source port	Destination port	FTP Header field
1	Response - 220	10.5.20.222	10.117.8.245	21	56060	Response code: Service ready for new user (220) Response arg: ProFTPD 1.3.5a Server (Debian) [::ffff:10.5.20.222]
2	Request	10.117.8.245	10.5.20.222	56060	21	Request command: USER Request arg: anonymous
3	Response - 331	10.5.20.222	10.117.8.245	21	56060	Response code: User name okay, need password (331) Response arg: Anonymous login ok, send your complete email address as your password
4	Request	10.117.8.245	10.5.20.222	56060	21	Request command: PASS
5	Response - 230	10.5.20.222	10.117.8.245	21	56060	Response code: User logged in, proceed (230) Response arg: Welcome, archive user anonymous@10.117.8.245 !
6	Response - 230	10.5.20.222	10.117.8.245	21	56060	Response code: User logged in, proceed (230) 230-The local time is: Thu Jan 25 10:45:06 2018\r\n 230-\r\n 230-This is an experi-

						mental FTP server. If you have any unusual problems,\r\n230-please report them via e-mail to <root@localhost>.\r\n230-\r\n230 Anonymous access granted, restrictions apply\r\n
7	Request	10.117.8.245	10.5.20.222	56060	21	Request command: SYST
8	Re- sponse- 215	10.5.20.222	10.117.8.245	21	56060	Response code: NAME system type (215) Response arg: UNIX Type: L8
9	Request	10.117.8.245	10.5.20.222	56060	21	Request command: PASV
10	Re- sponse- 227	10.5.20.222	10.117.8.245	21	56060	Response code: Entering Passive Mode (227) Response arg: Entering Passive Mode (10,5,20,222,166,47). Passive IP address: 10.5.20.222 Passive port: 42543
11	Request	10.117.8.245	10.5.20.222	56060	21	Request command: LIST
12	Response - 150	10.5.20.222	10.117.8.245	21	56060	Response code: File status okay; about to open data connection (150) Response arg: Opening ASCII mode data connection for file list
13	FTP Data	10.5.20.222	10.117.8.245	42543	43042	FTP Data: 1757 bytes
14	Response - 226	10.5.20.222	10.117.8.245	21	56060	Response code: Closing data connection (226) Response arg: Transfer complete

No.	Time	Source	Destination	Protocol	Length	Info
4	8.886440402	10.5.20.222	10.117.8.245	FTP	123	Response: 226 ProFTPD 1.3.5a Server (Debian) [::ff...
6	3.991892818	10.117.8.245	10.5.20.222	FTP	82	Request: USER anonymous
8	3.992943177	10.5.20.222	10.117.8.245	FTP	141	Response: 331 Anonymous login ok, send your comple...
10	5.511711574	10.117.8.245	10.5.20.222	FTP	73	Request: PASS
11	5.514768443	10.5.20.222	10.117.8.245	FTP	118	Response: 230-Welcome, archive user anonymous@10.1...
13	5.514991616	10.5.20.222	10.117.8.245	FTP	315	Response: 230-
15	5.515108379	10.117.8.245	10.5.20.222	FTP	72	Request: SYST
16	5.515717712	10.5.20.222	10.117.8.245	FTP	85	Response: 215 UNIX Type: L8
18	8.483889589	10.117.8.245	10.5.20.222	FTP	72	Request: PASV
19	8.484665167	10.5.20.222	10.117.8.245	FTP	115	Response: 227 Entering Passive Mode (10,5,20,222,1...
24	8.485278931	10.117.8.245	10.5.20.222	FTP	72	Request: LIST
25	8.486053674	10.5.20.222	10.117.8.245	FTP	120	Response: 150 Opening ASCII mode data connection f...
26	8.487577693	10.5.20.222	10.117.8.245	FTP-D	1823	FTP Data: 1757 bytes
30	8.488638619	10.5.20.222	10.117.8.245	FTP	89	Response: 226 Transfer complete

Q 2b) Distinguish between the command channel and data channel of the communication for active and passive mode FTP. Who initiates the data channel connection for (i) active mode, (ii) passive mode of FTP?

Ans.

Data channel of the communication is used to transfer any type of file/data in FTP, whereas the command channel is used for sending and receiving FTP requests and responses from the server.

Initiation of the data channel connection for:

- (i) Active mode - The client issues a PORT command to the server signaling that it will “actively” provide an IP and port number to open the Data Connection back to the client.
- (ii) Passive mode - The client issues a PASV command to indicate that it will wait “passively” for the server to supply an IP and port number, after which the client will create a Data Connection to the server.

Q 2c) What is the port used for data communication (for both the active mode and passive mode FTP connections)? What is the difference when the passive mode is enabled by the client?

Ans.

Data port used for passive mode is: 42543

Data port used for active mode is: 20

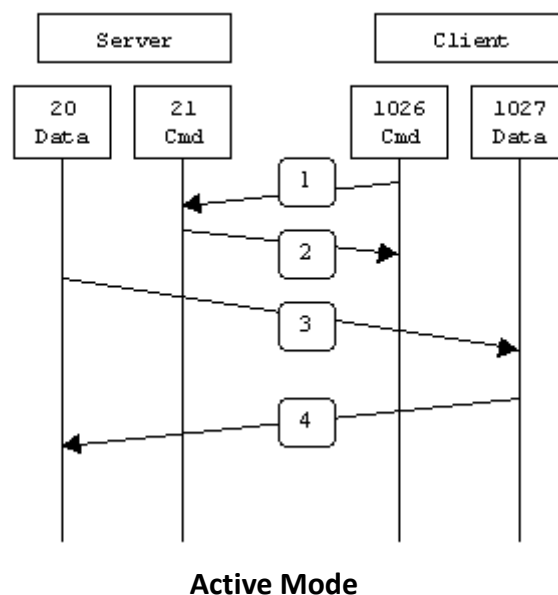
In active mode, client establishes the command channel whereas the data channel is established by the server.

In passive mode, both the channels are established by the client.

The procedure applied for both the modes are as follows:

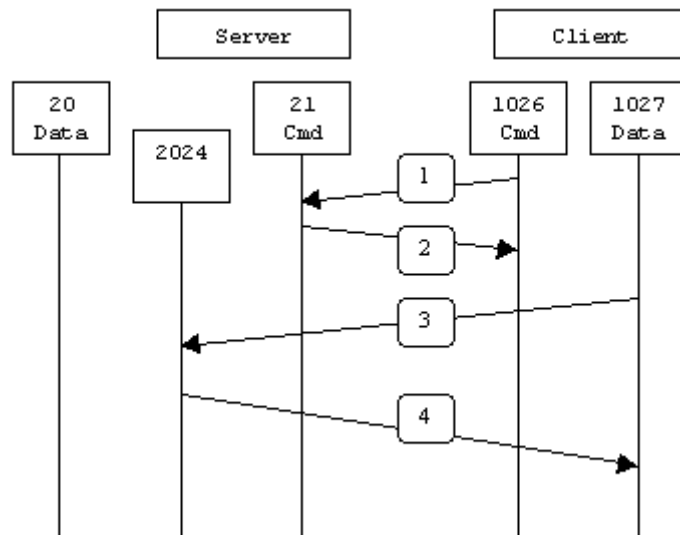
Active mode:

- (i) The clients command port contacts the servers command port and sends its data port.
- (ii) The server then sends an ACK back to the clients command port.
- (iii) The server initiates a connection on its local data port to the data port the client specified earlier.
- (iv) The client sends an ACK back on data channel.



Passive Mode:

- (i) The client contacts the server on the command port and issues the PASV command.
- (ii) The server then replies with its port, telling the client which port it is listening to for the data connection.
- (iii) The client then initiates the data connection from its data port to the specified server data port.
- (iv) The server sends back an ACK to client's data port.



Passive Mode