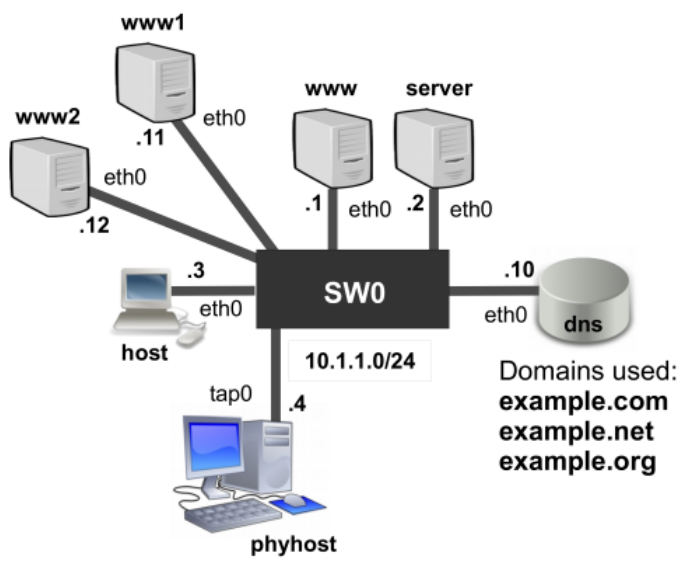
P6: WWW



Exercise 1.1– In this exercise, we are going to practice with the WEB service. To do so, start the scenario www shown in Figure 1.8 on your physical host (phyhost) by typing the following command:

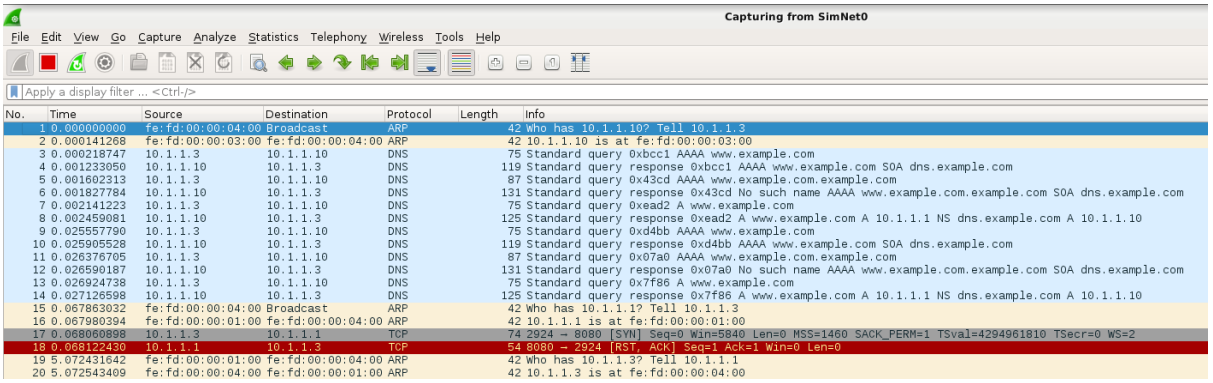
//from terminal
simctl www-new sh
start
get www

//each virtual machines
ls /etc/nginx

1. Capture the traffic on tap0 and use a lynx browser in the host virtual machine to connect to www.example.com on port 8080. Which is the IP address associated to www.example.com? Why the browser is not able to establish a TCP connection with the server? Describe the DNS and TCP traffic captured.

//from host
lynx www.example.com:8080

```
Alert!: Unable to connect to remote host.


Looking up 8080 first
Looking up 8080
Making HTTP connection to 8080
Alert!: Unable to connect to remote host.

lynx: Can't access startfile http://8080/
```



No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	fe:fd:00:00:04:00	Broadcast	ARP	42	Who has 10.1.1.10? Tell 10.1.1.3
2	0.000141268	fe:fd:00:00:03:00	fe:fd:00:00:04:00	ARP	42	10.1.1.10 is at fe:fd:00:00:03:00
3	0.000218747	10.1.1.3	10.1.1.10	DNS	75	Standard query 0xbcc1 AAAA www.example.com
4	0.001233050	10.1.1.10	10.1.1.3	DNS	119	Standard query response 0xbcc1 AAAA www.example.com SOA dns.example.com
5	0.001602313	10.1.1.3	10.1.1.10	DNS	87	Standard query 0x43cd AAAA www.example.com.example.com
6	0.001827784	10.1.1.10	10.1.1.3	DNS	131	Standard query response 0x43cd No such name AAAA www.example.com.example.com SOA dns.example.com
7	0.002141223	10.1.1.3	10.1.1.10	DNS	75	Standard query 0xead2 A www.example.com
8	0.002459081	10.1.1.10	10.1.1.3	DNS	125	Standard query response 0xead2 A www.example.com A 10.1.1.1 NS dns.example.com A 10.1.1.10
9	0.025557790	10.1.1.3	10.1.1.10	DNS	75	Standard query 0xd4bb AAAA www.example.com
10	0.025905528	10.1.1.10	10.1.1.3	DNS	119	Standard query response 0xd4bb AAAA www.example.com SOA dns.example.com
11	0.026376705	10.1.1.3	10.1.1.10	DNS	87	Standard query 0x07a0 AAAA www.example.com.example.com
12	0.026590187	10.1.1.10	10.1.1.3	DNS	131	Standard query response 0x07a0 No such name AAAA www.example.com.example.com SOA dns.example.com
13	0.026924738	10.1.1.3	10.1.1.10	DNS	75	Standard query 0x7f86 A www.example.com
14	0.027126598	10.1.1.10	10.1.1.3	DNS	125	Standard query response 0x7f86 A www.example.com A 10.1.1.1 NS dns.example.com A 10.1.1.10
15	0.067863032	fe:fd:00:00:04:00	Broadcast	ARP	42	Who has 10.1.1.1? Tell 10.1.1.3
16	0.067980394	fe:fd:00:00:01:00	fe:fd:00:00:04:00	ARP	42	10.1.1.1 is at fe:fd:00:00:01:00
17	0.068060898	10.1.1.3	10.1.1.1	TCP	74	2924 → 8080 [SYN] Seq=0 Win=5840 Len=0 MSS=1460 SACK_PERM=1 TSval=4294961810 TSecr=0 WS=2
18	0.068122430	10.1.1.1	10.1.1.3	TCP	54	8080 → 2924 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
19	5.072431642	fe:fd:00:00:01:00	fe:fd:00:00:04:00	ARP	42	Who has 10.1.1.3? Tell 10.1.1.1
20	5.072543409	fe:fd:00:00:04:00	fe:fd:00:00:01:00	ARP	42	10.1.1.3 is at fe:fd:00:00:04:00

We can observe here, that the DNS server informs the web ip is 10.1.1.1. But we cannot establish the connection because there is not a record of example.com in SOA of the dns server. And, www send rst, ack, its cause the port used by DNS is 80 and we specified port 8080.

The DNS resolves for ipv4 but not for ipv6. The ip of the machine is 10.1.1.1 and we can obtain its MAC with ARP, but we can't establish a TCP connection. That means that there is no daemon listening to that port.

2. Capture the traffic on tap0 and repeat the previous experiment, but this time execute a netcat in the www machine listening on port 8080. Which version of HTTP is using the browser? Is the connection closed? Describe the DNS and HTTP traffic and kill the netcat to finish

//from www

nc -l -p 8080

```
www:~# nc -l -p 8080
GET / HTTP/1.0
Host: www.example.com:8080
Accept: text/html, text/plain, text/css, text/sgml, */*;q=0.01
Accept-Encoding: gzip, compress, bzip2
Accept-Language: en
User-Agent: Lynx/2.8.7dev.9 libwww-FM/2.14 SSL-MM/1.4.1

Hey hola guapa
```

//from host

lynx www.example.com:8080

15	0.082498676	10.1.1.3	10.1.1.1	TCP	74	4300 → 8080 [SYN] Seq=0 Win=5840 Len=0 MSS=1460 SACK_PERM=1 TSval=15954856 TSecr=0 WS=2
16	0.082832279	10.1.1.1	10.1.1.3	TCP	74	8080 → 4300 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1460 SACK_PERM=1 TSval=15959327 TSecr=15954
17	0.083167761	10.1.1.3	10.1.1.1	TCP	66	4300 → 8080 [ACK] Seq=1 Ack=1 Win=5840 Len=0 TSval=15954856 TSecr=15959327
18	0.105545511	10.1.1.3	10.1.1.1	HTTP	294	GET / HTTP/1.0
19	0.105923973	10.1.1.1	10.1.1.3	TCP	66	8080 → 4300 [ACK] Seq=1 Ack=229 Win=6864 Len=0 TSval=15959330 TSecr=15954858
20	5.035970206	fe:fd:00:00:06:00	fe:fd:00:00:05:00	ARP	42	who has 10.1.1.10? Tell 10.1.1.3
21	5.036237512	fe:fd:00:00:05:00	fe:fd:00:00:06:00	ARP	42	10.1.1.10 is at fe:fd:00:00:05:00
22	137.061432041	10.1.1.1	10.1.1.3	TCP	66	8080 → 4300 [FIN, ACK] Seq=1 Ack=229 Win=6864 Len=0 TSval=15973026 TSecr=15954858
23	137.074160784	10.1.1.3	10.1.1.1	TCP	66	4300 → 8080 [ACK] Seq=229 Ack=2 Win=5840 Len=0 TSval=15968554 TSecr=15973026
24	140.077166755	10.1.1.3	10.1.1.1	TCP	66	4300 → 8080 [FIN, ACK] Seq=229 Ack=2 Win=5840 Len=0 TSval=15968855 TSecr=15973026
25	140.077688158	10.1.1.1	10.1.1.3	TCP	66	8080 → 4300 [ACK] Seq=2 Ack=230 Win=6864 Len=0 TSval=15973327 TSecr=15968855

Http version is HTTP/1.0.

Now we have a daemon listening to the port 8080. The connection is open because there is no http response.

A TCP connection is opened between port 4300 from the host(10.1.1.1) and the port 8080 from the server(10.1.1.3).

3. Let's take a look to the nginx web server in the www machine. How many websites are available? Is there any website enabled?

//from www

ls /etc/nginx/sites-available/

ls /etc/nginx/sites-enabled/

```
www:~# ls /etc/nginx/sites-available/
balancer  default  non-existing-sites
www:~# ls /etc/nginx/sites-enabled/
default
```

There are 3 websites available, but only default is enabled.

4. Open the default configuration. What is the virtual host name(s) for this site? Where is the website content placed?

//from www

cat /etc/nginx/sites-enabled/default

```
www:~# cat /etc/nginx/sites-enabled/default
server {
     listen       80;
     # .example.com could be used for both example.com and *.example.com
     # "" is used to attend requests with no "host" header
     server_name  www.example.com example.com "";

     location / {
         root   /var/www;
         index  index.html index.htm;
     }

     location ~ ^/cgi/ {
         # Disable gzip (it makes scripts feel slower since they have to comple$
         # before getting gzipped)
         gzip off;

         # Required to forbid default content browsing
         autoindex off;

         # Default document root
         root /var/www/cgi-bin;

         # Changing the url according to what fastcgi expects
         rewrite ^/cgi/(.*) /$1 break;

         # Fastcgi parameters, include the standard ones
         include /etc/nginx/fastcgi_params;

         # Fastcgi socket for library communication
         fastcgi_pass  unix:/tmp/cgi.sock;

         # Setting the script filename
         fastcgi_param  SCRIPT_FILENAME /var/www/cgi-bin$fastcgi_script_name;
     }

}
www:~#
```

The virtual host names are www.example.com and the website content is placed on /var/www;

5. Open the non-existing-sites configuration. What do you think the purpose of this site configuration is?

//from www

cat /etc/nginx/sites-available/non-existing-sites

```
www:~# cat /etc/nginx/sites-available/non-existing-sites
server {
    listen      80 default_server;
    server_name _ ;
    return 503  "No server is currently configured for the requested host." ;
}

www:~#
```

The purpose of this configuration is to inform about the errors. Any request to a server which is not correspondent, will arrive in this configuration and will show the message.

6. Enable the non-existing-sites by typing, from the sites-enabled folder, the following command: ln -s ../sites-available/non-existing-sites .

//from www

cd /etc/nginx/sites-enabled

ln -s /etc/nginx/sites-available/non-existing-sites

ls -la

```
www:/etc/nginx/sites-enabled# ls -la
total 8
drwxr-xr-x 2 root root 4096 Oct 28 19:15 .
drwxr-xr-x 4 root root 4096 Feb 10  2020 ..
lrwxrwxrwx 1 root root   26 Feb 10  2020 default -> ../sites-available/default
lrwxrwxrwx 1 root root   45 Oct 28 19:15 non-existing-sites -> /etc/nginx/sites-available/non-existing-sites
```

We added a soft link for non-existing-sites

7. Capture the traffic on tap0 and start the nginx Web server in the www machine. www# /etc/init.d/nginx start On the host machine, execute a netcat to connect to the nginx server that you have just started. Over the connection established with netcat and using HTTP 1.0, send an HTTP GET request for the resource “/”. Which response do you obtain? Describe the HTTP traffic captured for the GET request.

//from www

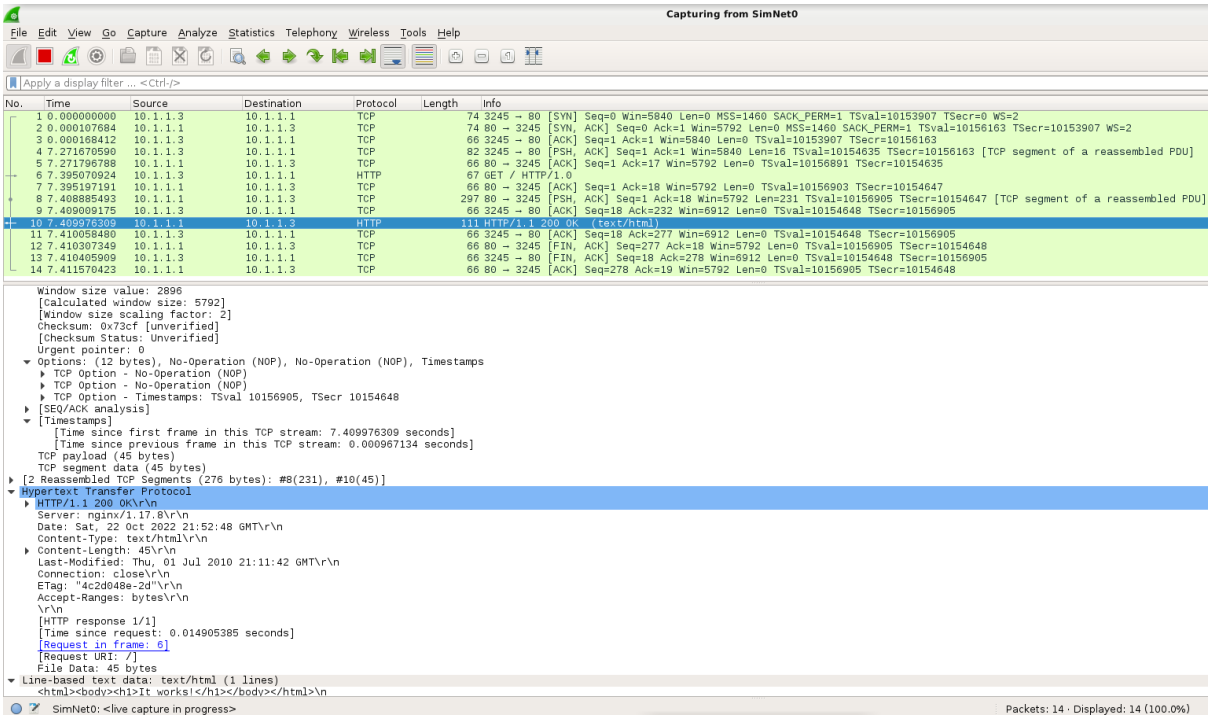
/etc/init.d/nginx start

//from host

nc 10.1.1.1 80

GET / HTTP/1.0

```
host:~# nc 10.1.1.1 80
GET / HTTP/1.0

HTTP/1.1 200 OK
Server: nginx/1.17.8
Date: Sat, 22 Oct 2022 21:52:48 GMT
Content-Type: text/html
Content-Length: 45
Last-Modified: Thu, 01 Jul 2010 21:11:42 GMT
Connection: close
ETag: "4c2d048e-2d"
Accept-Ranges: bytes

<html><body><h1>It works!</h1></body></html>
```

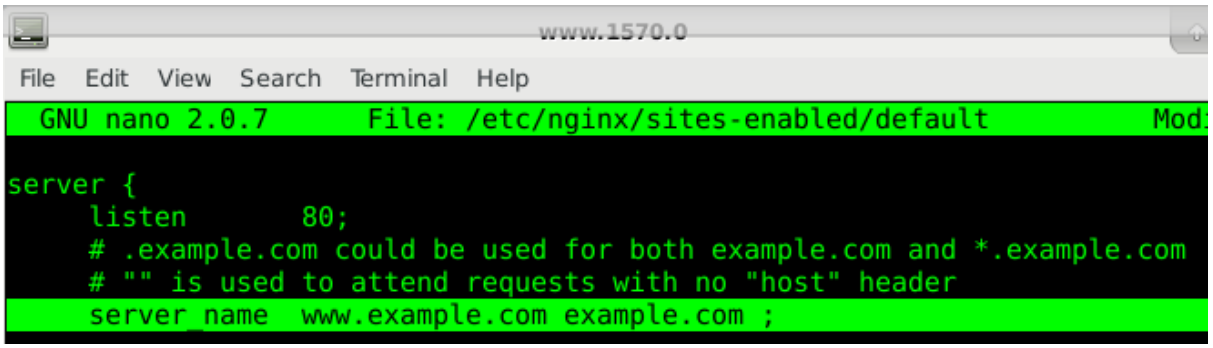


The response is ok, 200 ok.

8. Now edit the default configuration and remove the "" from the server_name section. Send again the HTTP GET request for the resource "/". Which response do you obtain now? Why? Hint: How many sites are enabled in the nginx server? What is the purpose of each of them?

//from www

nano /etc/nginx/sites-enabled/default



(we do this to attend requests without the host header)

/etc/init.d/nginx restart

//from host

nc 10.1.1.1 80

GET / HTTP/1.0

```
host:~# nc 10.1.1.1 80
GET / HTTP/1.0

HTTP/1.1 503 Service Temporarily Unavailable
Server: nginx/1.17.8
Date: Fri, 28 Oct 2022 17:44:18 GMT
Content-Type: application/octet-stream
Content-Length: 57
Connection: close

No server is currently configured for the requested host.
```

The response obtained comes from the file /etc/nginx/sites-enabled/non-existing-sites. There are two sites enabled. The non-existing-sites is for attending petitions with FQDN that don't match with our domain. Useful in case the DNS fails.
In other words, in this case as we dont specify no host headers and we drop "", then the requests are attended by non-exisiting sites.

9. Again, over the connection established with netcat and using HTTP 1.1, send an HTTP GET request for the resource "/" targeting the host www.home.com (or any other hostname you want) in www Which response do you obtain now? Why? Describe the HTTP traffic captured for the GET request.

//from host
nc 10.1.1.1 80
GET www.home.com/ HTTP/1.1
#GET / HTTP/1.1

```
host:~# nc 10.1.1.1 80
GET www.home.com/ HTTP/1.1
HTTP/1.1 400 Bad Request
Server: nginx/1.17.8
Date: Sat, 05 Nov 2022 19:48:43 GMT
Content-Type: text/html
Content-Length: 157
Connection: close

<html>
<head><title>400 Bad Request</title></head>
<body>
<center><h1>400 Bad Request</h1></center>
<hr><center>nginx/1.17.8</center>
</body>
</html>
host:~#
host:~#
```

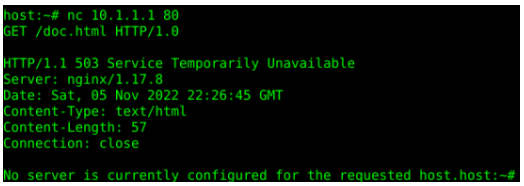
We obtain 400 Bad Request because is a bad request. As we see before, default only attend request of www.example.com and example.com (in 1.1 we have to specify the host header), but we put www.home.com for that reason we got and error message.

10. Send a GET request for the resource “/doc.html”. Which response do you obtain for each request? Is there a resource called doc.html in the www server? Describe the HTTP traffic captured for the GET request.

//from host

nc 10.1.1.1 80

GET /doc.html HTTP/1.0



As we saw before in the root file /var/www we don't have any doc.html, for that reason we received an error message, because the server www couldn’t find the file doc.html. Another interesting fact is now, in HTTP 1.1 the connection is closed after the request.

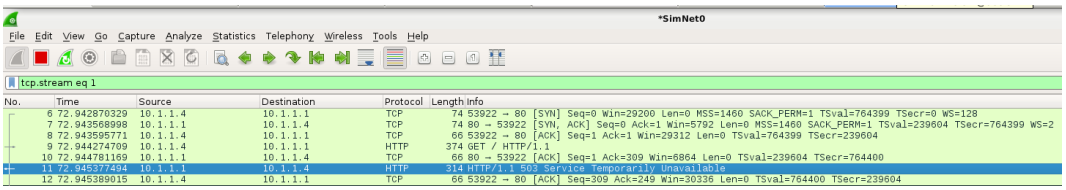
11. Configure the tap0 interface of the physical host (phyhost) with the IP address 10.1.1.4/24. After that, ask for “/” and “/doc.html” from the phyhost using a firefox browser and the IP address 10.1.1.1. Describe the HTTP traffic captured. Can you use the name www.example.com from the phyhost? why? Propose a way to reach the www machine when typing www.example.com.

//from terminal

sudo ip a add 10.1.1.4/24 dev SimNet0

//firefox

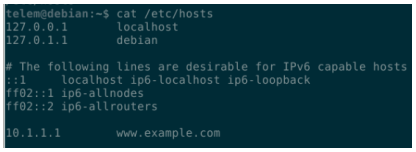
http://10.1.1.1



we got an error. 503: Service Temporarily Unavailable

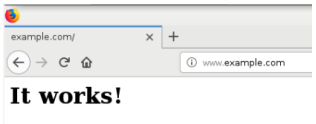
//from terminal

cat /etc/hosts



//from terminal

firefox www.example.com



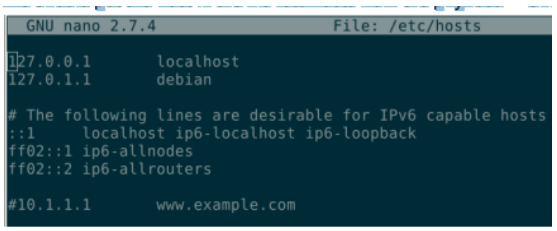
//from terminal

firefox www.example.com/doc.html

Can you use the name www.example.com from the phyhost? why? Propose a way to reach the www machine when typing www.example.com.

We really can use www.example.com because in the file /etc/hosts the name is active with the ip 10.1.1.1.

In case of other cases, you may have the last line commented, then you should uncomment this line.

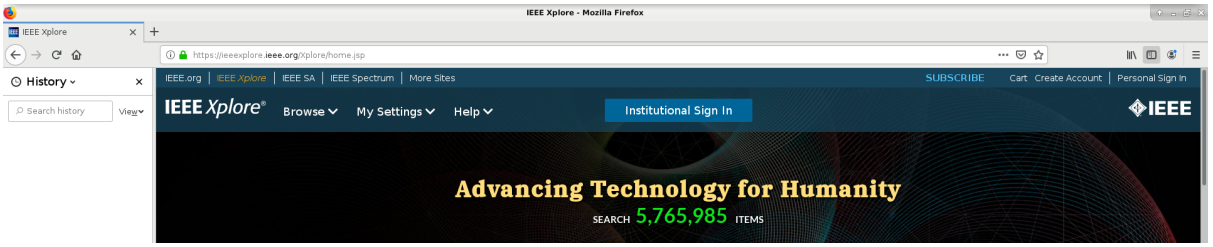


Exercise 1.2– In this exercise we are going to practice with basic HTML content and hyperlinks.

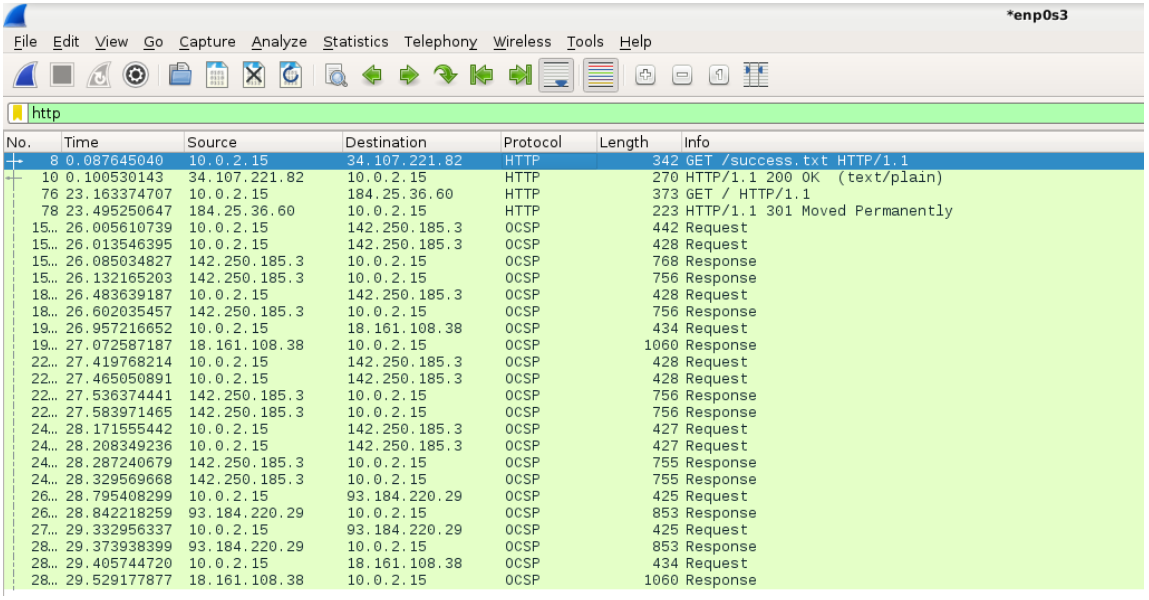
1. Start a capture on the physical NIC, i.e. enp8s0. In the phyhost open a firefox browser and request for the index of a complex webpage, such as ieeexplore.ieee.org.

//from terminal

firefox

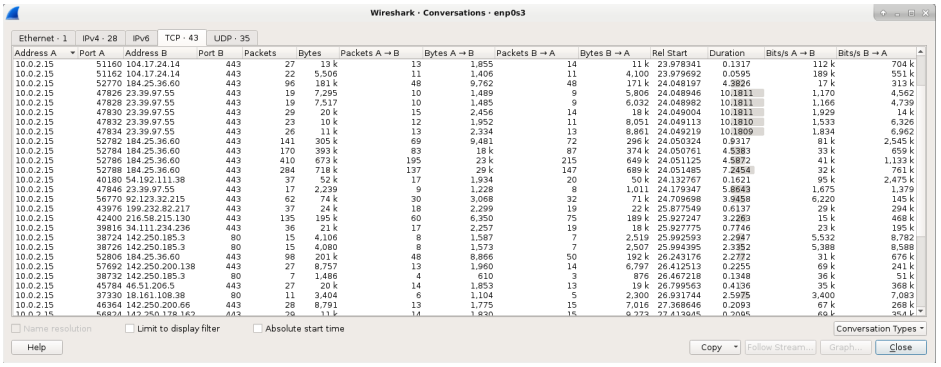


Describe the HTTP traffic captured. In particular, discuss the GET requests that you observe and the number of connections. To do this analysis easier, you can take one or combine both of the following approaches:

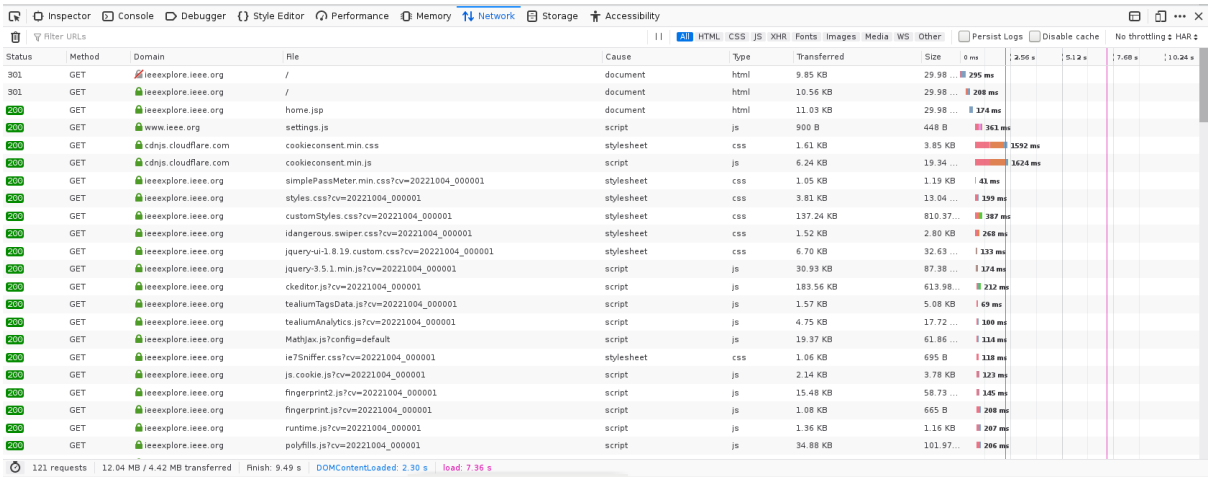


No.	Time	Source	Destination	Protocol	Length	Info
8	0.087645040	10.0.2.15	34.107.221.82	HTTP	342	GET /success.txt HTTP/1.1
10	0.100530143	34.107.221.82	10.0.2.15	HTTP	270	HTTP/1.1 200 OK (text/plain)
76	23.163374707	10.0.2.15	184.25.36.60	HTTP	373	GET / HTTP/1.1
78	23.495250647	184.25.36.60	10.0.2.15	HTTP	223	HTTP/1.1 301 Moved Permanently
15…	26.005610739	10.0.2.15	142.250.185.3	OCSP	442	Request
15…	26.013546395	10.0.2.15	142.250.185.3	OCSP	428	Request
15…	26.085034827	142.250.185.3	10.0.2.15	OCSP	768	Response
15…	26.132165203	142.250.185.3	10.0.2.15	OCSP	756	Response
18…	26.483639187	10.0.2.15	142.250.185.3	OCSP	428	Request
18…	26.602035457	142.250.185.3	10.0.2.15	OCSP	756	Response
19…	26.957216652	10.0.2.15	18.161.108.38	OCSP	434	Request
19…	27.072587187	18.161.108.38	10.0.2.15	OCSP	1060	Response
22…	27.419768214	10.0.2.15	142.250.185.3	OCSP	428	Request
22…	27.465050891	10.0.2.15	142.250.185.3	OCSP	428	Request
22…	27.536374441	142.250.185.3	10.0.2.15	OCSP	756	Response
22…	27.583971465	142.250.185.3	10.0.2.15	OCSP	756	Response
24…	28.171555442	10.0.2.15	142.250.185.3	OCSP	427	Request
24…	28.208349236	10.0.2.15	142.250.185.3	OCSP	427	Request
24…	28.287240679	142.250.185.3	10.0.2.15	OCSP	755	Response
24…	28.329569668	142.250.185.3	10.0.2.15	OCSP	755	Response
26…	28.795408299	10.0.2.15	93.184.220.29	OCSP	425	Request
26…	28.842218259	93.184.220.29	10.0.2.15	OCSP	853	Response
27…	29.332956337	10.0.2.15	93.184.220.29	OCSP	425	Request
28…	29.373938399	93.184.220.29	10.0.2.15	OCSP	853	Response
28…	29.405744720	10.0.2.15	18.161.108.38	OCSP	434	Request
28…	29.529177877	18.161.108.38	10.0.2.15	OCSP	1060	Response

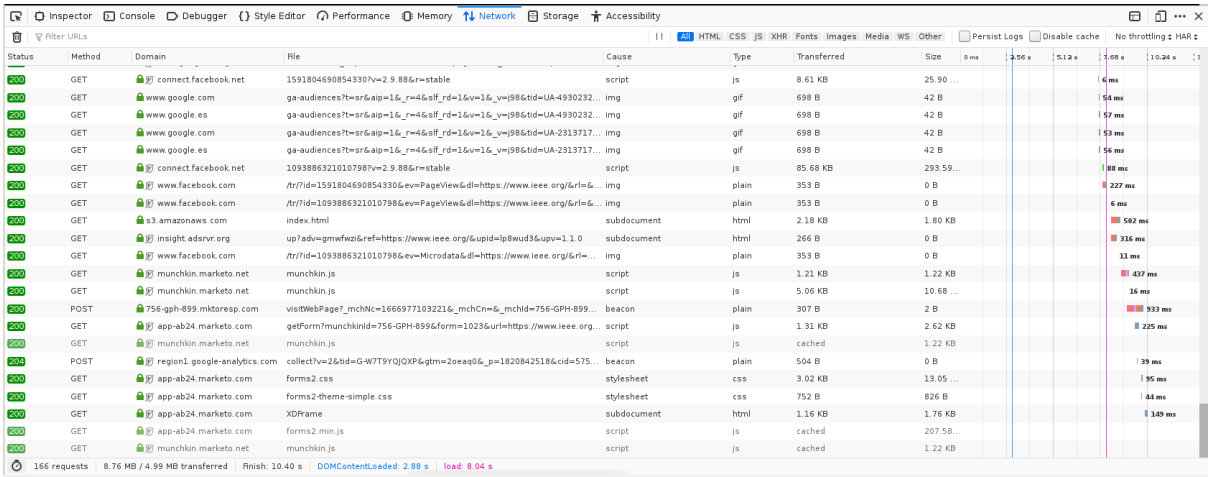
• In wireshark, you can use the option statistics . conversations, go to the label for TCP and then, use the option follow stream for analyzing the data transmitted through each TCP connection.



• Open the developer tools (e.g. push control+shift+i). A new section will show up in the bottom of the browser. There, one can analyze any matter related with the browser performance. Select the tab named Network, which is responsible for displaying the traffic being exchanged (e.g. when HTTP requests are commited).

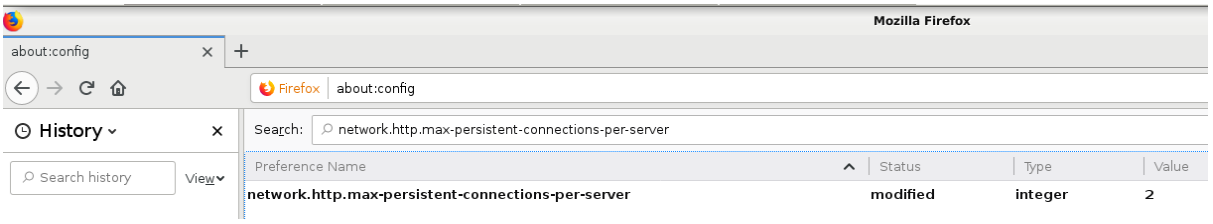


Now ask a second time for the index of the previously requested page (e.g. ieeexplore.ieee.org). Describe how this time HTTP caching works.



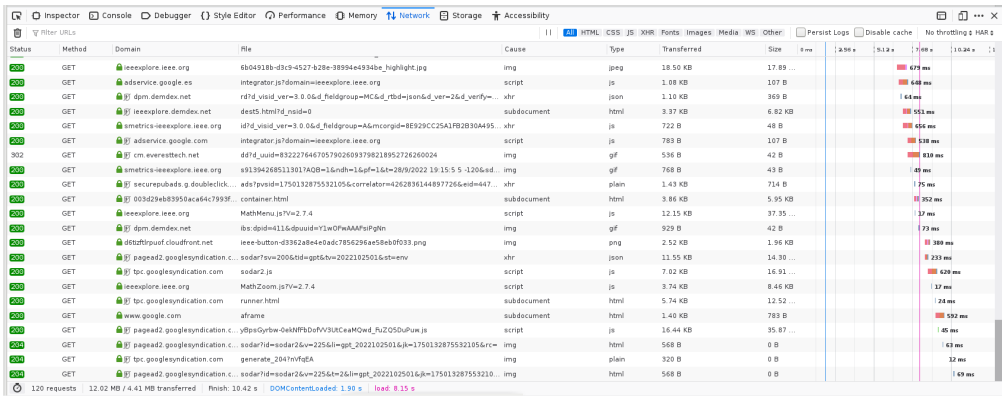
2. Remove the cache of firefox and decrease its maximum number of persistent connections per server from 6 to 2. For this purpose, use the about:config string in the URL of firefox and then, search and modify the parameter network.http.max-persistent-connections-per-server.

//from firefox
about:config
//in search
network.http.max-persistent-connections-per-server

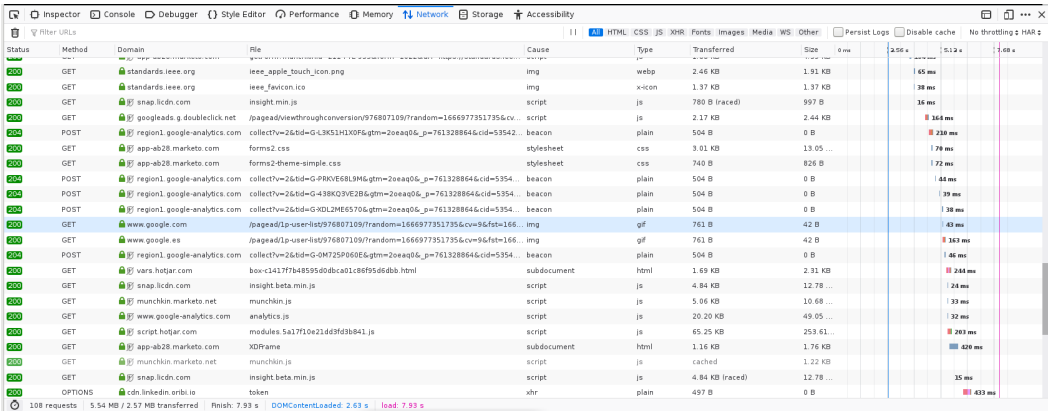


From firefox request again for the index page of the complex webpage used above (e.g. ieeexplore.ieee.org).

Describe the HTTP traffic captured. In particular, comment the number of persistent connections that you observe now and the GET requests through each connection. Note. When you finish the exercise, do not forget to set to 6 again the maximum number of persistent connections per server.



2n request



Comparing the captures, we observe that with 6 as a max number of persistent connections there is more spontaneous request than with the 2 max number of persistent connections. It's logic, because with 6 you can do more request than with 2.

3. Under the directory /tmp of the virtual machine www you will find files with images. In www, copy these images to a directory called "images" relative to the DocumentRoot of the NGINX's default site (named "default"). Note. You must create the "images" directory.

//from www

cd /tmp/

```
www:/tmp# ls
cgi.sock  upc1.gif  upc2.gif  upc3.png
www:/tmp#
```

cd /var/www

mkdir images

cp /tmp/upc1.gif /tmp/upc2.gif /tmp/upc3.png /var/www/images/

cd images

ls

```
www:/etc/nginx/sites-enabled# ls /tmp/
cgi.sock  upc1.gif  upc2.gif  upc3.png
www:/etc/nginx/sites-enabled# cd /var/www/
www:/var/www# ls
cgi-bin  index.html
www:/var/www# mkdir images
www:/var/www# cp /tmp/upc1.gif /tmp/upc2.gif /tmp/upc3.png /var/www/images/
www:/var/www# ls
cgi-bin  images  index.html
www:/var/www# cd images/
www:/var/www/images# ls
upc1.gif  upc2.gif  upc3.png
www:/var/www/images#
```

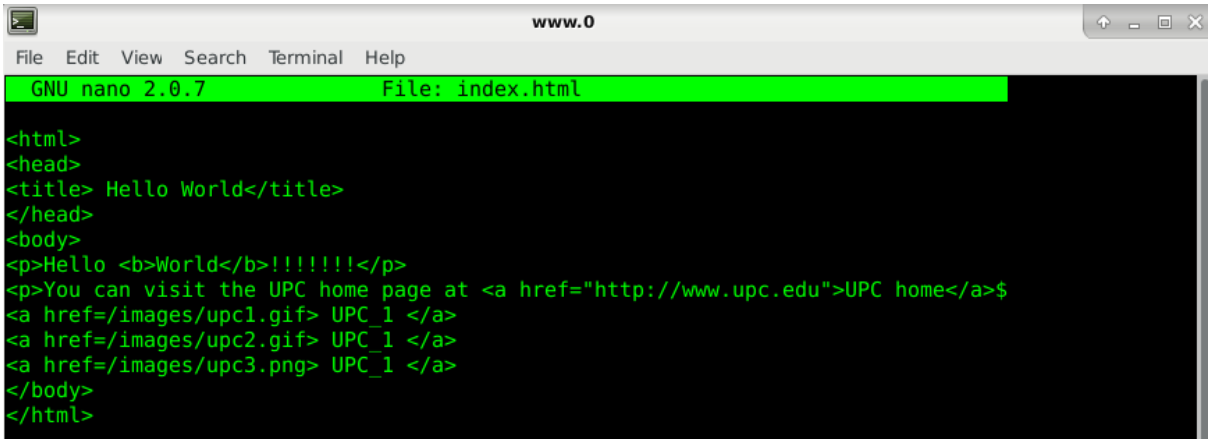
Modify the HTML index of the server and create local hyperlinks to these images. Describe how you do it.

//from www

nano index.html

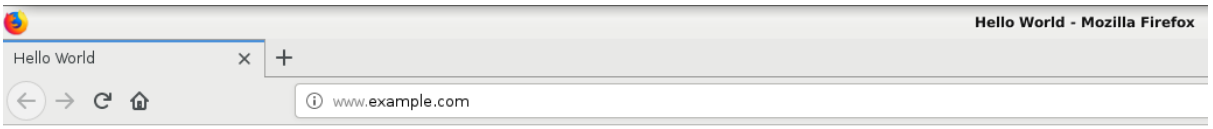
<html>

```
<head>
<title> Hello There</title>
</head>
<body>
<p> YEAAHH </p>
<p>You can visit the UPC home page at <a href='http://www.upc.edu'>UPC HOME </a>
</p>
<a href=/images/upc1.gif> UPC_1 </a>
<a href=/images/upc2.gif> UPC_2 </a>
<a href=/images/upc3.png> UPC_3 </a>
</body>
</html>
```



we edit the index file with nano and put the images with hyperlink.

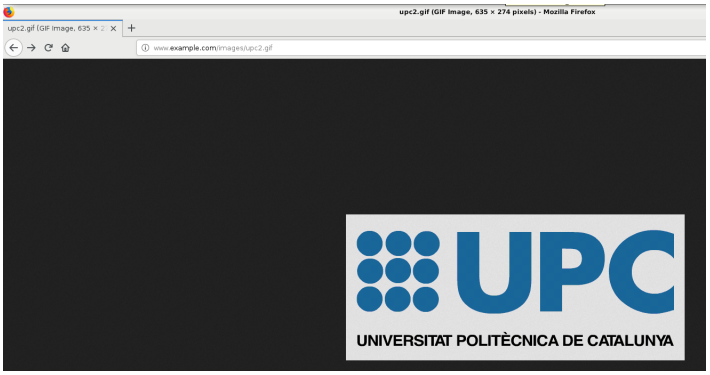
//from terminal
firefox www.example.com



Hello World!!!!!!!

You can visit the UPC home page at UPC home.

UPC_1 UPC_2 UPC_3



The hyperlink works, but its has to be connected via www.example.com and not via http://10.1.1.1 because in the pyhost, in file /etc/host the example.com is active.

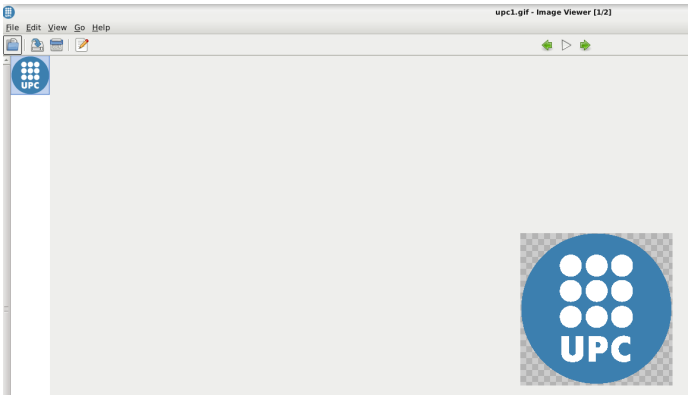
4. Start a capture on the tap0 interface. Execute a netcat in the phyhost to connect to 10.1.1.1 port 80 redirecting the output of this command to a file called response.http. Through the established connection type an HTTP request for the resource upc1.gif using HTTP 1.0.

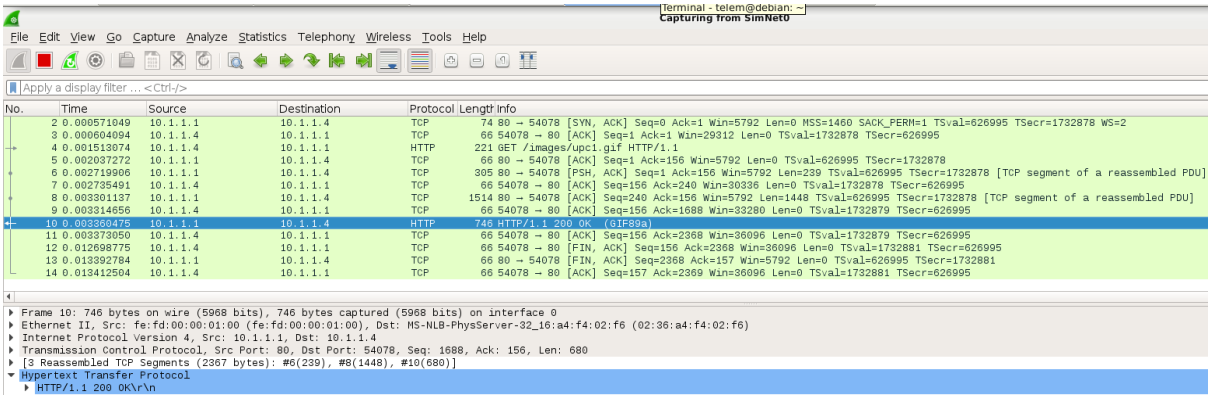
telem@debian:~$ nc 10.1.1.1 80 >response.http
GET /images/upc1.gif HTTP/1.0
invalid port >response.http
WTFFF?

Explain how you do it.
Edit appropriately the file response.http with mousepad or vi to obtain the original image upc1.gif. Save the image with the name image.gif and test that it is correct using the command display: phyhost# display image.gif You should be able to see an UPC logo. After that, repeat the process using HTTP 1.1.

5. Repeat the process to obtain upc1.gif but this time use the command wget. Explain how you do it (consult the manual page of wget if necessary). Which version of HTTP is used by wget?
//from terminal
wget http://www.example.com/images/upc1.gif

```
telem@debian:~$ wget http://www.example.com/images/upc1.gif
--2022-11-09 22:21:25--  http://www.example.com/images/upc1.gif
Resolving www.example.com (www.example.com)... 10.1.1.1
Connecting to www.example.com (www.example.com)|10.1.1.1|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 2128 (2.1K) [image/gif]
Saving to: 'upc1.gif'

upc1.gif              100%[===========================>]   2.08K  --.-KB/s    in 0s

2022-11-09 22:21:25 (120 MB/s) - 'upc1.gif' saved [2128/2128]

telem@debian:~$
```





In Wireshark we can see the HTTP version is HTTP 1.1.

6. Get a console on the the server and edit the Start nginx on the server virtual machine. On this machine, modify its HTML index to include HTTP hyperlinks to the images upc1.gif and upc2.gif that are in www. Use domain names (not IP addresses) to create these hyperlinks. Explain how you do it.

//from server

/etc/init.d/nginx start

nano /var/www/index.html

```
server:~# cat /var/www/index.html
<html>
<head>
<title> server</title>
</head>
<body>
<p>Hello <b>World</b>!!!!!!!</p>
<p>You can visit the UPC home page at <a href="http://www.upc.edu">UPC home</a>.
 </p>
<img src="http://www.example.com/images/upc1.gif">
<img src="http://www.example.com/images/upc2.gif">
<img src="http://www.example.com/images/upc3.png">
</body>
</html>
server:~#
```

Instead of hyperlinking we just specified the complete path of the images.

7. Stop the nginx server in www. Start a capture on tap0. From phyhost, use a firefox browser to request for the index page of server. Now, from host (virtual machine), use a lynx browser to request for the index page of server using the short name (server) and the fully qualified name (server.example.com).

Describe how you do it and explain the DNS, TCP and HTTP traffic captured.

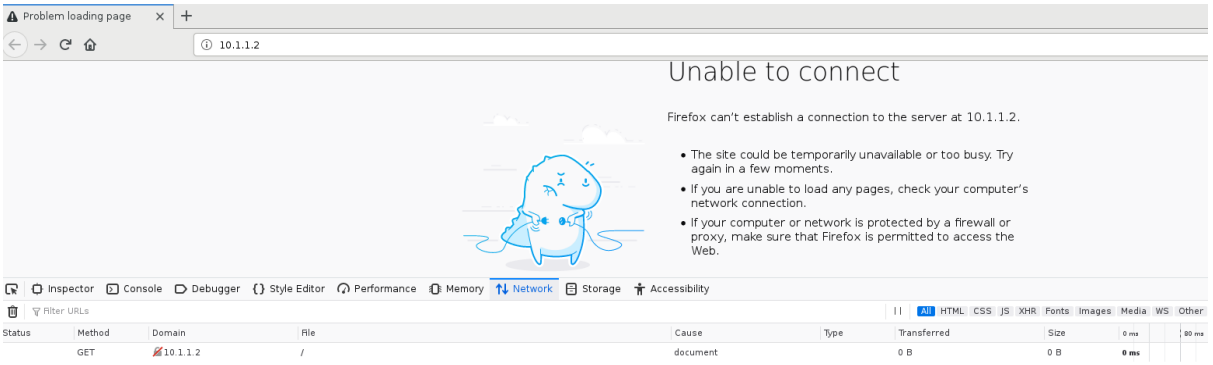
//from server

/etc/init.d/nginx stop

```
server:~# /etc/init.d/nginx stop
Stopping nginx: nginx.
```

//from terminal

firefox http://10.1.1.2



At first, the connection wasn't possible because the daemon was stopped. But after restarting the server, we can obtain the images.

DNS, FRAME???

8. Start nginx in the www machine. Start a capture on tap0. From phyhost, use a firefox browser to request for the index page of the server machine. Describe how you do it and explain the HTTP traffic captured.

//from www

/etc/init.d/nginx start

FALTA posar "DETALLS". como son tcp en cada gets, etc, etc, etc

Exercise 1.3– In this exercise we are going to practice with CGIs and HTML forms using the GET method.

1. Enable the CGI written in Bash according to the code Code 1.6, so that it can be run through the nginx server. Name the script datecgi.sh. Be careful with the written code if you cut paste the content from the PDF, since that operation often includes unwanted extra characters. Describe the steps of your configuration.

//from www

cat /etc/nginx/sites-enabled/default

```
# Default document root
root /var/www/cgi-bin;
```

cd /var/www/cgi-bin/

nano datecgi.sh

```
www.1521.0
File  Edit  View  Search  Terminal  Help
  GNU nano 2.0.7          File: /var/www/cgi-bin/datecgi.sh

#!/bin/sh/
echo "Content-type: text/html"
echo
echo "<html> <body>"
echo -n "The current date is "
date
echo "</body></html>
```

```
#!/bin/sh
echo "Content-type: text/html"
echo
echo "<html> <body>"
echo -n "The current date is "
date
echo "</body> </html>"
```

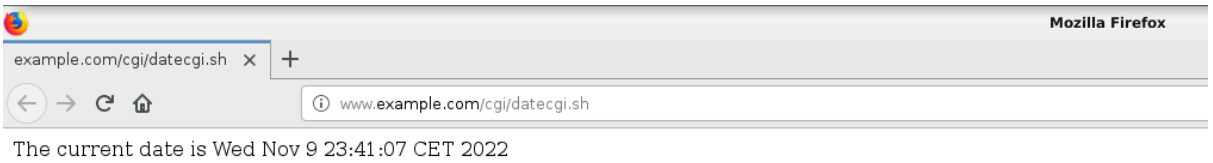
chmod +x datecgi.sh #to give permission

```
www:/var/www/cgi-bin# ls
datecgi.sh  example.sh
www:/var/www/cgi-bin# chmod +x datecgi.sh
www:/var/www/cgi-bin# ls
datecgi.sh  example.sh
www:/var/www/cgi-bin#
```

2. Using the browser at the phyhost, open the URL http://www.example.com/cgi/datecgi.sh and verify that the CGI works as expected.

//from terminal

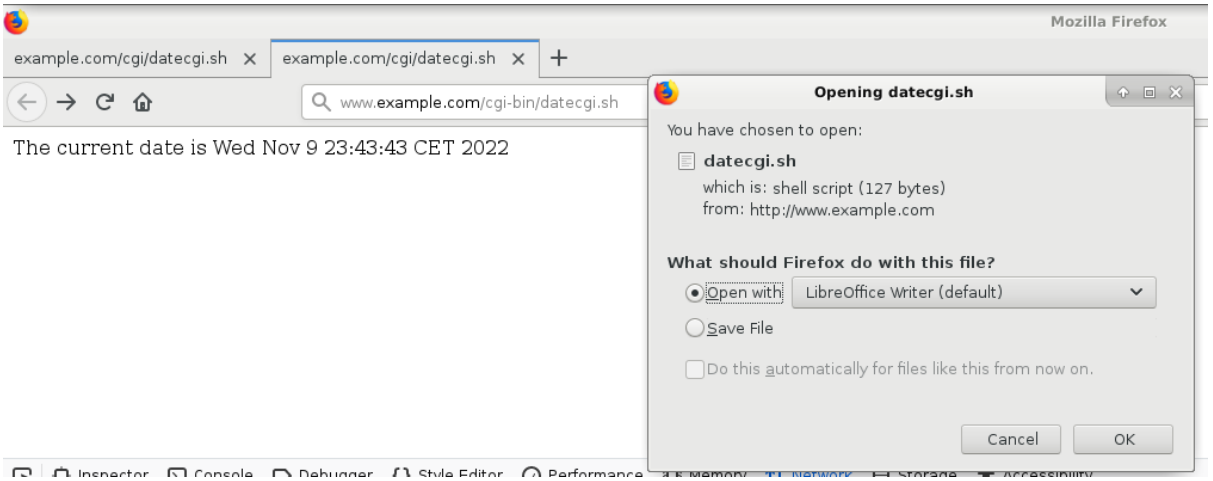
firefox http://www.example.com/cgi/datecgi.sh



3. Open the URL http://www.example.com/cgi-bin/datecgi.sh. Why does the browser try to download the file datecgi.sh instead of running the CGI? Hint: check the location sections of the default configuration.

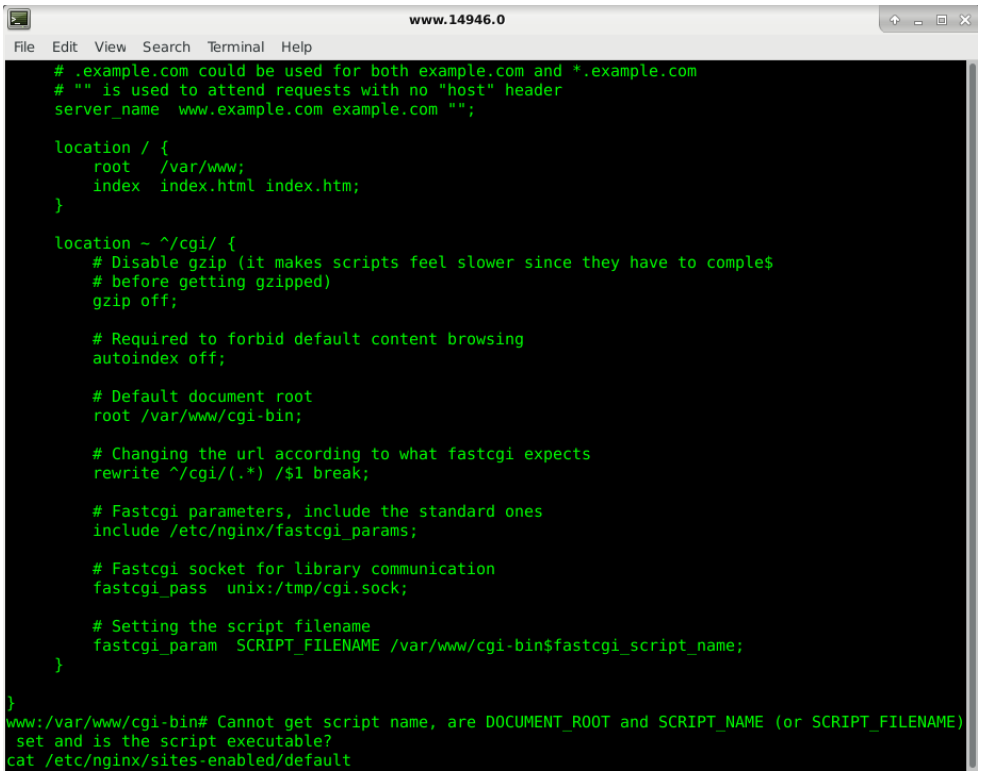
//from firefox

http://www.example.com/cgi-bin/datecgi.sh



//from www

cat /etc/nginx/sites-enabled/default

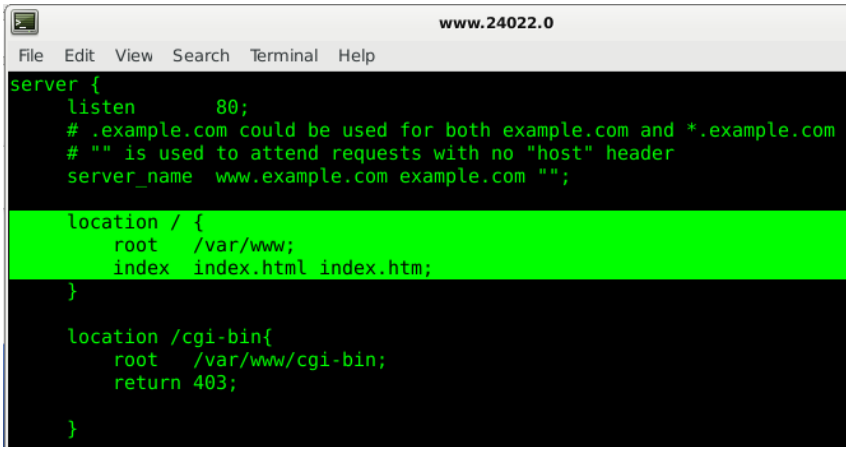


As we know, CGI are an executable program, they are used to generate resource when its requested. So, cgi-bin is an executable program and the cgi without bin is a resource.

4. Update the default configuration so that any access to the content stored in the /cgi-bin directory returns a 403 error message. Clean the browser cache before testing the solution. Hint: Look at the non-existing-sites configuration.

//from www

nano /etc/nginx/sites-available/default



/etc/init.d/nginx restart

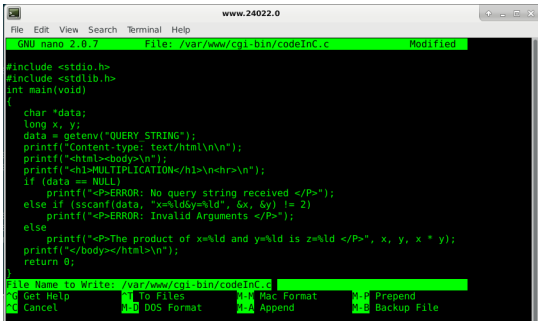
5. Enable now the CGI written in C of Code 1.7, which builds an HTML form on demand. Describe the steps of your configuration.

```
#include <stdio.h>
#include <stdlib.h>
int main(void)
{
   char *data;
   long x, y;
   data = getenv("QUERY_STRING");
   printf("Content-type: text/html\n\n");
   printf("<html><body>\n");
   printf("<h1>MULTIPLICATION</h1>\n<hr>\n");
   if (data == NULL)
       printf("<P>ERROR: No query string received </P>");
   else if (sscanf(data, "x=%ld&y=%ld", &x, &y) != 2)
       printf("<P>ERROR: Invalid Arguments </P>");
   else
       printf("<P>The product of x=%ld and y=%ld is z=%ld </P>", x, y, x * y);
   printf("</body></html>\n");
   return 0;
}
```

//from www

cd /var/www/cgi-bin/

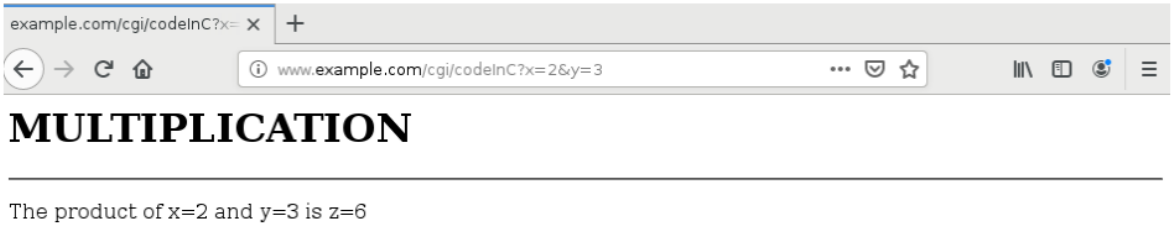
nano codeinC.c



gcc codeInC.c -o codeInC #as c file, need to compile, (memories of FO :()

chmod +x codeInC
/etc/init.d/nginx restart

http://www.example.com/cgi/codeInC?x=2&y=3

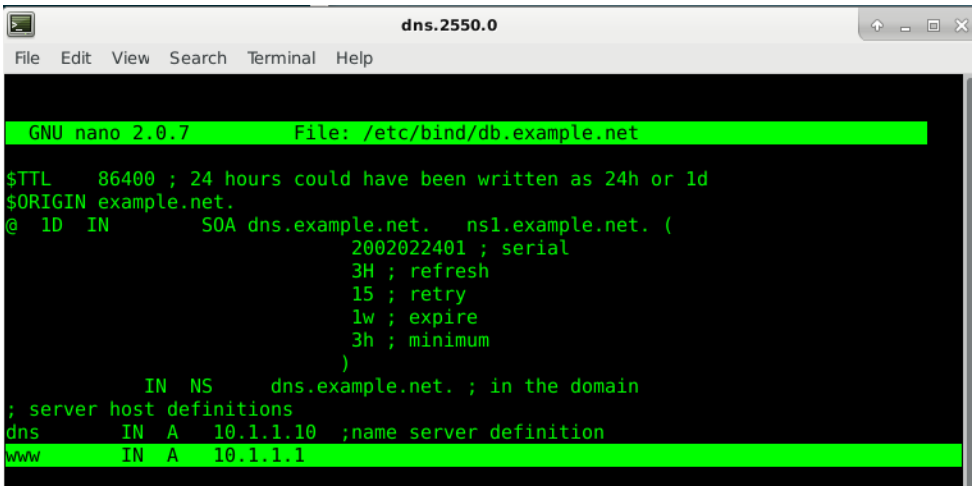


Exercise 1.4– In this exercise we are going to practice with the Web service using multiple domains and multiple IP addresses.

1. First, be sure that nginx is running properly, by checking which software is actually managing the port 80. Now we are going add the name www.example.net in the dns server to be translated to the IP address 10.1.1.1. To do so, add an A register in the file /etc/bind/db.example.net of the dns machine and restart bind:
Notice that after this configuration, www.example.com and www.example.net both are translated to the same IP address (10.1.1.1). Check that the configuration is correct with pings from host.
//form www
/etc/init.d/nginx start
netstat -tnlp | grep nginx

```
www:~# netstat -tnlp | grep nginx
tcp        0      0 0.0.0.0:80              0.0.0.0:*               LISTEN
1178/nginx
```

//from dns
nano /etc/bind/db.example.net
www IN A 10.1.1.1



/etc/init.d/bind9 restart
#as we know of previous labs, after editing .conf files we need to restart

//from host
ping -f www.example.net
ping -f www.example.com

```
host:~# ping -f www.example.com
PING www.example.com (10.1.1.1) 56(84) bytes of data.

[1]+  Stopped                 ping -f www.example.com
host:~# ping -f www.example.net
PING www.example.net (10.1.1.1) 56(84) bytes of data.
.
[2]+  Stopped                 ping -f www.example.net
```

As we can see the webs have ip 10.1.1.1

2. For the previous domain names, we are going to create and activate two sites (or ”virtual hosts“) in nginx. To do so, type the following:

//form www
cd /etc/nginx/sites-available/
cp default www.example.com
cp default www.example.net
sed -i "s/\/var\/www/\/var\/www\/com/g" www.example.com
sed -i "s/\/var\/www/\/var\/www\/net/g" www.example.net
sed -i "s/server_name.*/server_name www.example.com;/" www.example.com
sed -i "s/server_name.*/server_name www.example.net;/" www.example.net

```
www:/etc/nginx/sites-available# cd /etc/nginx/sites-available/
www:/etc/nginx/sites-available# cp default www.example.com
cp: overwrite `www.example.com'?
www:/etc/nginx/sites-available# sed -i "s/\/var\/www/\/var\/www\/com/g" www.example.com
www:/etc/nginx/sites-available# sed -i "s/\/var\/www/\/var\/www\/net/g" www.example.net
www:/etc/nginx/sites-available# sed -i "s/server_name.*/server_name www.example.com;/" www.example.com
www:/etc/nginx/sites-available# sed -i "s/server_name.*/server_name www.example.net;/" www.example.net
www:/etc/nginx/sites-available#
```

Open the text files and verify that both, document root and server name have been properly changed. Now, we need to enable these sites.

//from www
cat /etc/nginx/sites-available/www.example.com
cat /etc/nginx/sites-available/www.example.net

```
www.31371.0
File  Edit  View  Search  Terminal  Help

www:/etc/nginx/sites-available# cat www.example.com
server {
     listen       80;
     # .example.com could be used for both example.com and *.example.com
     # "" is used to attend requests with no "host" header
     server_name www.example.com;

     location / {
         root   /var/www/com/com;
         index  index.html index.htm;
     }

     location ~ ^/cgi/ {
         # Disable gzip (it makes scripts feel slower since they have to comple$
         # before getting gzipped)
         gzip off;
```

First we need to disable the default website, as it attended requests to any address in the domains example.com and example.net. To do so, type:

//from www (hacer uno por uno, no todo seguido)
cd /etc/nginx/sites-enabled/
rm default
ln -s ../sites-available/www.example.com #s= set a softlink
ln -s ../sites-available/www.example.net
/etc/init.d/nginx reload

```
www:/etc/nginx/sites-enabled# ls
default
www:/etc/nginx/sites-enabled# sudo rm -r default
www:/etc/nginx/sites-enabled# ls
www:/etc/nginx/sites-enabled# ln -s ../sites-available/www.example.com #s=  softlink
www:/etc/nginx/sites-enabled# ln -s ../sites-available/www.example.net
www:/etc/nginx/sites-enabled# ls
www.example.com  www.example.net
www:/etc/nginx/etc/nginx/sites-enabled# sed -i "s/\/var\/www/\/var\/www\/cowww:/etc/nginx/sites-enabled#
www# /etc/init.d/nginx reload                -bash: www#: command not found
www:/etc/nginx/sites-enabled# /etc/init.d/nginx reload
Reloading nginx configuration: nginx.
```

Generate two different index.html files for each domain and put them on the right place. Remember, contents of www.example.com and www.example.net must be placed in the folders /var/www/com
and /var/www/ned respectively. These folders need to be created in advance by typing:

//from www
mkdir /var/www/com
mkdir /var/www/net
nano com/index.html
(crear fichero html)
nano net/index.html
(crear fichero html)

```
www:/var/www# ls
cgi-bin  com  index.html  net
www:/var/www# cat com/index.html
<html><body><h1>Hello des de www.example.com!</h1></body></html>
www:/var/www# cat net/index.html
<html><body><h1>Hello des de www.example.net!</h1></body></html>
www:/var/www#
```

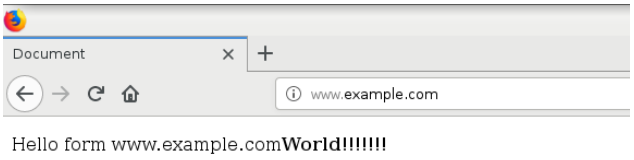
/etc/init.d/nginx reload

Capture on tap0 and describe how you test this configuration. Try also to connect directly with the IP address 10.1.1.1. Discuss the results.

//from terminal
nc 10.1.1.1 80
GET / HTTP/1.1
host: www.example.com:80
 # per comprar q et surt el html del net, host: www.example.net:80

```
telem@debian:~$ nc 10.1.1.1 80
GET / HTTP/1.1
host: www.example.com:80

HTTP/1.1 200 OK
Server: nginx/1.17.8
Date: Thu, 10 Nov 2022 15:56:39 GMT
Content-Type: text/html
Content-Length: 321
Last-Modified: Thu, 10 Nov 2022 15:50:13 GMT
Connection: keep-alive
ETag: "636d1db5-141"
Accept-Ranges: bytes

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Document</title>
    <p>Hello form www.example.com<b>World</b>!!!!!!!</p>
</head>
<body>

</body>
</html>
```

//from firefox



if we put another host, or we didn't put the host, we will receive 400 error.

```
telem@debian:~$ nc 10.1.1.1 80
GET / HTTP/1.1

HTTP/1.1 400 Bad Request
Server: nginx/1.17.8
Date: Thu, 10 Nov 2022 16:06:11 GMT
Content-Type: text/html
Content-Length: 157
Connection: close

<html>
<head><title>400 Bad Request</title></head>
<body>
<center><h1>400 Bad Request</h1></center>
<hr><center>nginx/1.17.8</center>
</body>
</html>
telem@debian:~$
```

3. Now we are going to test a configuration where the domain www.example.org is translated by the dns server to two different IP addresses: 10.1.1.1 and 10.1.1.2. The bind9 server uses a round robin strategy for translating names with multiple IP addresses (a different IP address for each query in a cyclic way). So, add the A registers that you consider necessary in the file /etc/bind/db.example.org in dns and reload the server.
Then, activate this domain in www and server with the following commands:

//from dns

nano /etc/bind/db.example.org

www IN A 10.1.1.1
www IN A 10.1.1.2

```
dns:~# cat /etc/bind/db.example.org
$TTL    86400 ; 24 hours could have been written as 24h or 1d
$ORIGIN example.org.
@  1D  IN        SOA dns.example.org.   ns1.example.org. (
                                2002022401 ; serial
                                3H ; refresh
                                15 ; retry
                                1w ; expire
                                3h ; minimum
                               )
            IN  NS     dns.example.org. ; in the domain
; server host definitions
dns       IN  A   10.1.1.10  ;name server definition
www       IN  A   10.1.1.1
WWW       IN  A   10.1.1.2
```

Create the same index.html file in both web servers (remember to place it properly), test the configuration and discuss the results. For what do you think that this configuration is useful?

//from www

cd /etc/nginx/sites-available/

cp default www.example.org

sed -i "s/\/var\/www/\/var\/www\/org/g" www.example.org

sed -i "s/server_name.*/server_name www.example.org;/" www.example.org

cd /etc/nginx/sites-enabled/

rm default 2> /dev/null

ln -s ../sites-available/www.example.org

/etc/init.d/nginx reload

mkdir /var/www/org

nano index.html

```
www:/var/www/org# cat index.html
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Document</title>
    <p>Hello form www.example.com<b>AVER SI FUNCIONA COÑOO</b>!!!!!!!</p>
</head>
<body>

</body>
</html>
www:/var/www/org#  /etc/init.d/nginx reload
Reloading nginx configuration: nginx.
```

//from terminal
nc 10.1.1.1 80
GET / HTTP/1.1
host: www.example.org:80

```
telem@debian:~$ nc 10.1.1.1 80
GET / HTTP/1.1
host: www.example.org:80

HTTP/1.1 200 OK
Server: nginx/1.17.8
Date: Thu, 10 Nov 2022 16:26:49 GMT
Content-Type: text/html
Content-Length: 339
Last-Modified: Thu, 10 Nov 2022 16:25:54 GMT
Connection: keep-alive
ETag: "636d2612-153"
Accept-Ranges: bytes

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Document</title>
    <p>Hello form www.example.com<b>AVER SI FUNCIONA COÑOO</b>!!!!!!!</p>
</head>
<body>

</body>
</html>
```

This configuration is very useful when there a huge traffic, so with this configuration the traffic is distributed better.

Exercise 1.5– Let's do something similar to what we've done in the last exercise, but taking a different approach.
Instead of modifying the DNS server, which is often a time-consuming and error-prone task, we are going to use a reverse proxy (i.e. this is what the nginx server actually is) to distribute the traffic to several web servers. In other words, we are going to build a load balancer.

1. In the machine www, go to the sites-available folder and open the balancer configuration file. Check it out and figure out what each code section does.
//from www
cat /etc/nginx/sites-available/balancer

```
www:~# cat /etc/nginx/sites-available/balancer
upstream tcgi-app {
    server www1.example.com;
    server www2.example.com;
}

server {
    listen 80;
    server_name www.example.com;

    location / {
        proxy_set_header X-Real-IP $remote_addr;
        proxy_set_header X-Forwarded-For $remote_addr;
        proxy_set_header Host $host;
        proxy_pass http://tcgi-app$request_uri;
    }
}
```

We can observer in the balancer configuration, in the server section, balancer is attending requests of www.example.com form port 80. and pass those requests to http://tgci-app$...(url request).
And in the first line we can see the link is loaded in 2 servers. And by default, nginx balances the traffic using a round-robin approach, i.e., iteratively moves from the first server to the second and then to the third and so on, until all the servers are visited.

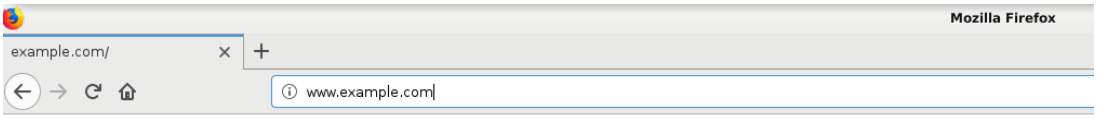
2. Still in the machine www, setup the nginx configuration so that only the balancer configuration is run. Reload the nginx server so that all the changes are applied. From a browser (either in the phyhost or in the host), try to access the url www.example.com. Is it working?
//from www
cd /etc/nginx/sites-enabled
rm www.example.org www.example.net www.example.com
ln -s ../sites-available/balancer
/etc/init.d/nginx reload

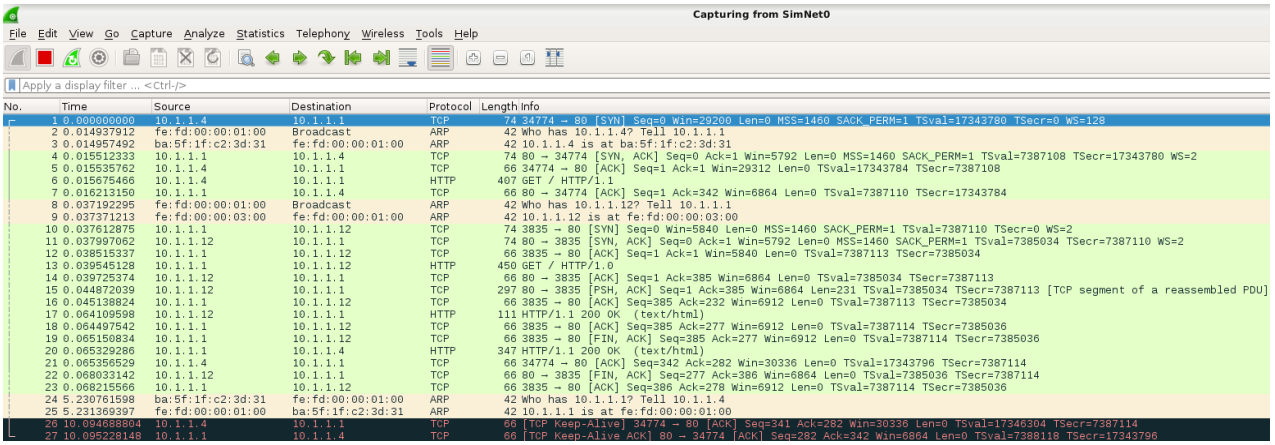
```
www:/etc/nginx/sites-enabled# ls
www.example.com  www.example.net  www.example.org
www:/etc/nginx/sites-enabled#
www:/etc/nginx/sites-enabled# www:~# cat /etc/nginx/sites-available/balancer
www:/etc/nginx/sites-enabled# rm www.example.org www.example.net www.example.com
rm: remove symbolic link `www.example.org'? yorg www.example.net www.example.com
rm: remove symbolic link `www.example.net'? y
rm: remove symbolic link `www.example.com'? y
www:/etc/nginx/sites-enabled# ls
www:/etc/nginx/sites-enabled# ln -s ../sites-available/balancer
www:/etc/nginx/sites-enabled# ls
balancer
www:/etc/nginx/sites-enabled# /etc/init.d/nginx reload
Reloading nginx configuration: nginx.
www:/etc/nginx/sites-enabled#
```

It doesn't work, because the server of balancer ww1 and ww2 aren't active.

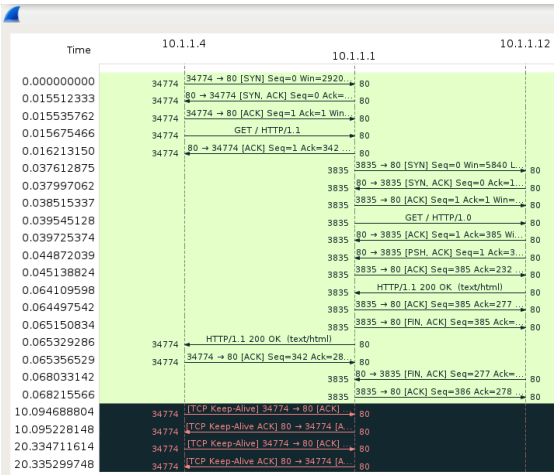
3. Start the nginx servers at the www1 and www2 machines. Try again to access the url www.example.com. Check the HTTP response received by the client. According to that response, who attended the request? Who actually attended the request? Analyze the data flow and discuss the results.

//from ww1
/etc/init.d/nginx start
//from ww2
/etc/init.d/nginx start



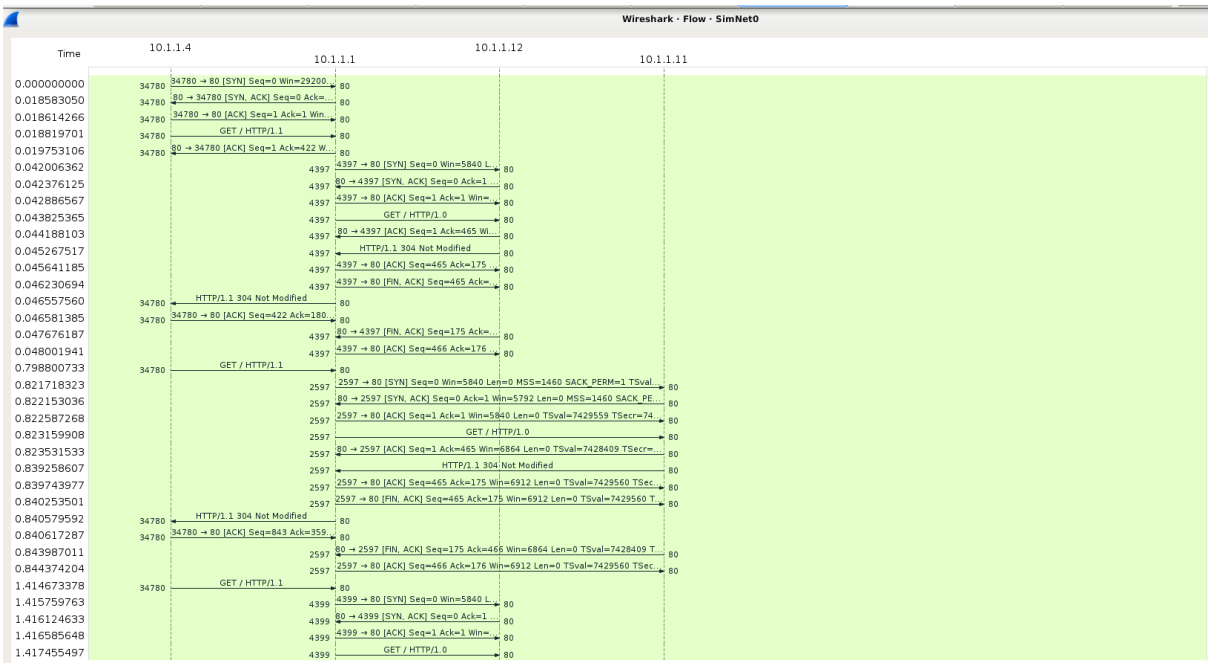


No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.1.1.4	10.1.1.1	TCP	74	34774 → 80 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=17343780 TSecr=0 WS=128
2	0.014937912	fe:fd:00:00:01:00	Broadcast	ARP	42	Who has 10.1.1.4? Tell 10.1.1.1
3	0.014957492	ba:5f:1f:c2:3d:31	fe:fd:00:00:01:00	ARP	42	10.1.1.4 is at ba:5f:1f:c2:3d:31
4	0.015512333	10.1.1.1	10.1.1.4	TCP	74	80 → 34774 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1460 SACK_PERM=1 TSval=7387108 TSecr=17343780 WS=2
5	0.015535762	10.1.1.4	10.1.1.1	TCP	66	34774 → 80 [ACK] Seq=1 Ack=1 Win=29312 Len=0 TSval=17343784 TSecr=7387108
6	0.015675466	10.1.1.4	10.1.1.1	HTTP	407	GET / HTTP/1.1
7	0.016213150	10.1.1.1	10.1.1.4	TCP	66	80 → 34774 [ACK] Seq=1 Ack=342 Win=6864 Len=0 TSval=7387110 TSecr=17343784
8	0.037192295	fe:fd:00:00:01:00	Broadcast	ARP	42	Who has 10.1.1.12? Tell 10.1.1.1
9	0.037371213	fe:fd:00:00:03:00	fe:fd:00:00:01:00	ARP	42	10.1.1.12 is at fe:fd:00:00:03:00
10	0.037612875	10.1.1.1	10.1.1.12	TCP	74	3835 → 80 [SYN] Seq=0 Win=5840 Len=0 MSS=1460 SACK_PERM=1 TSval=7387110 TSecr=0 WS=2
11	0.037997062	10.1.1.12	10.1.1.1	TCP	74	80 → 3835 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1460 SACK_PERM=1 TSval=7385034 TSecr=7387110 WS=2
12	0.038515337	10.1.1.1	10.1.1.12	TCP	66	3835 → 80 [ACK] Seq=1 Ack=1 Win=5840 Len=0 TSval=7387113 TSecr=7385034
13	0.039545128	10.1.1.1	10.1.1.12	HTTP	450	GET / HTTP/1.0
14	0.039725374	10.1.1.12	10.1.1.1	TCP	66	80 → 3835 [ACK] Seq=1 Ack=385 Win=6864 Len=0 TSval=7385034 TSecr=7387113
15	0.044872039	10.1.1.12	10.1.1.1	TCP	297	80 → 3835 [PSH, ACK] Seq=1 Ack=385 Win=6864 Len=231 TSval=7385034 TSecr=7387113 [TCP segment of a reassembled PDU]
16	0.045138824	10.1.1.1	10.1.1.12	TCP	66	3835 → 80 [ACK] Seq=385 Ack=232 Win=6912 Len=0 TSval=7387113 TSecr=7385034
17	0.064109598	10.1.1.12	10.1.1.1	HTTP	111	HTTP/1.1 200 OK (text/html)
18	0.064497542	10.1.1.1	10.1.1.12	TCP	66	3835 → 80 [ACK] Seq=385 Ack=277 Win=6912 Len=0 TSval=7387114 TSecr=7385036
19	0.065150834	10.1.1.1	10.1.1.12	TCP	66	3835 → 80 [FIN, ACK] Seq=385 Ack=277 Win=6912 Len=0 TSval=7387114 TSecr=7385036
20	0.065329286	10.1.1.1	10.1.1.4	HTTP	347	HTTP/1.1 200 OK (text/html)
21	0.065356529	10.1.1.4	10.1.1.1	TCP	66	34774 → 80 [ACK] Seq=342 Ack=282 Win=30336 Len=0 TSval=17343796 TSecr=7387114
22	0.068033142	10.1.1.12	10.1.1.1	TCP	66	80 → 3835 [FIN, ACK] Seq=277 Ack=386 Win=6864 Len=0 TSval=7385036 TSecr=7387114
23	0.068215566	10.1.1.1	10.1.1.12	TCP	66	3835 → 80 [ACK] Seq=386 Ack=278 Win=6912 Len=0 TSval=7387114 TSecr=7385036
24	5.230761598	ba:5f:1f:c2:3d:31	fe:fd:00:00:01:00	ARP	42	Who has 10.1.1.1? Tell 10.1.1.4
25	5.231369397	fe:fd:00:00:01:00	ba:5f:1f:c2:3d:31	ARP	42	10.1.1.1 is at fe:fd:00:00:01:00
26	10.094688804	10.1.1.4	10.1.1.1	TCP	66	[TCP Keep-Alive] 34774 → 80 [ACK] Seq=341 Ack=282 Win=30336 Len=0 TSval=17346304 TSecr=7387114
27	10.095228148	10.1.1.1	10.1.1.4	TCP	66	[TCP Keep-Alive ACK] 80 → 34774 [ACK] Seq=282 Ack=342 Win=6864 Len=0 TSval=7388118 TSecr=17343796



The request is attending by www, but www ask to www2 to response the request from the hosts. (10.1.1.1= www, 10.1.1.12=ww2).

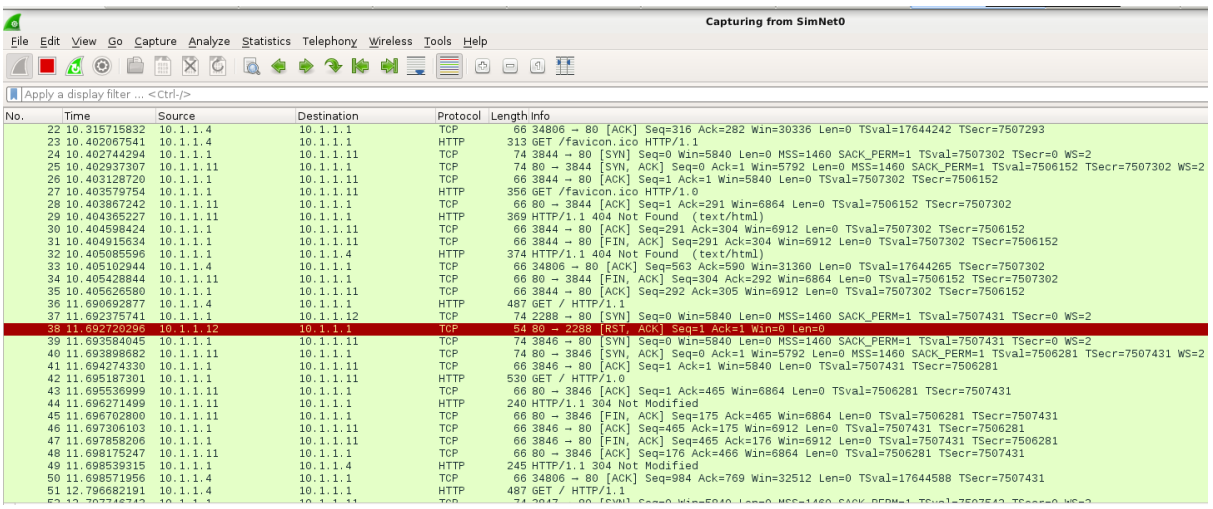
4. Access again the url www.example.com. Do it several times. Discuss the results.



Now the request is forwarded to ww1 also. ww2 and ww1 attend requests alternating.

5. Let's simulate a service failure by stopping the nginx server at the www2 machine.
Try to access the url www.example.com from a browser (either in the phyhost or in the host). Do it several times. Check the nginx logs and discuss the results. Restart the nginx server at the www2 machine. Send a few requests and discuss the results.

//from ww2
/etc/init.d/nginx stop



No.	Time	Source	Destination	Protocol	Length	Info
22	10.315715832	10.1.1.4	10.1.1.1	TCP	66	34806 → 80 [ACK] Seq=316 Ack=282 Win=30336 Len=0 TSval=17644242 TSecr=7507293
23	10.402067541	10.1.1.4	10.1.1.1	HTTP	313	GET /favicon.ico HTTP/1.1
24	10.402744294	10.1.1.1	10.1.1.11	TCP	74	3844 → 80 [SYN] Seq=0 Win=5840 Len=0 MSS=1460 SACK_PERM=1 TSval=7507302 TSecr=0 WS=2
25	10.402937307	10.1.1.11	10.1.1.1	TCP	74	80 → 3844 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1460 SACK_PERM=1 TSval=7506152 TSecr=7507302 WS=2
26	10.403128720	10.1.1.1	10.1.1.11	TCP	66	3844 → 80 [ACK] Seq=1 Ack=1 Win=5840 Len=0 TSval=7507302 TSecr=7506152
27	10.403579754	10.1.1.1	10.1.1.11	HTTP	356	GET /favicon.ico HTTP/1.0
28	10.403867242	10.1.1.11	10.1.1.1	TCP	66	80 → 3844 [ACK] Seq=1 Ack=291 Win=6864 Len=0 TSval=7506152 TSecr=7507302
29	10.404365227	10.1.1.11	10.1.1.1	HTTP	369	HTTP/1.1 404 Not Found (text/html)
30	10.404598424	10.1.1.1	10.1.1.11	TCP	66	3844 → 80 [ACK] Seq=291 Ack=304 Win=6912 Len=0 TSval=7507302 TSecr=7506152
31	10.404915634	10.1.1.1	10.1.1.11	TCP	66	3844 → 80 [FIN, ACK] Seq=291 Ack=304 Win=6912 Len=0 TSval=7507302 TSecr=7506152
32	10.405085596	10.1.1.1	10.1.1.4	HTTP	374	HTTP/1.1 404 Not Found (text/html)
33	10.405102944	10.1.1.4	10.1.1.1	TCP	66	34806 → 80 [ACK] Seq=563 Ack=590 Win=31360 Len=0 TSval=17644265 TSecr=7507302
34	10.405428844	10.1.1.11	10.1.1.1	TCP	66	80 → 3844 [FIN, ACK] Seq=304 Ack=292 Win=6864 Len=0 TSval=7506152 TSecr=7507302
35	10.405626580	10.1.1.1	10.1.1.11	TCP	66	3844 → 80 [ACK] Seq=292 Ack=305 Win=6912 Len=0 TSval=7507302 TSecr=7506152
36	11.690692877	10.1.1.4	10.1.1.1	HTTP	487	GET / HTTP/1.1
37	11.692375741	10.1.1.1	10.1.1.12	TCP	74	2288 → 80 [SYN] Seq=0 Win=5840 Len=0 MSS=1460 SACK_PERM=1 TSval=7507431 TSecr=0 WS=2
38	11.692720296	10.1.1.12	10.1.1.1	TCP	54	80 → 2288 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
39	11.693584045	10.1.1.1	10.1.1.11	TCP	74	3846 → 80 [SYN] Seq=0 Win=5840 Len=0 MSS=1460 SACK_PERM=1 TSval=7507431 TSecr=0 WS=2
40	11.693898682	10.1.1.11	10.1.1.1	TCP	74	80 → 3846 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1460 SACK_PERM=1 TSval=7506281 TSecr=7507431 WS=2
41	11.694274330	10.1.1.1	10.1.1.11	TCP	66	3846 → 80 [ACK] Seq=1 Ack=1 Win=5840 Len=0 TSval=7507431 TSecr=7506281
42	11.695187301	10.1.1.1	10.1.1.11	HTTP	530	GET / HTTP/1.0
43	11.695536999	10.1.1.11	10.1.1.1	TCP	66	80 → 3846 [ACK] Seq=1 Ack=465 Win=6864 Len=0 TSval=7506281 TSecr=7507431
44	11.696271499	10.1.1.11	10.1.1.1	HTTP	240	HTTP/1.1 304 Not Modified
45	11.696702800	10.1.1.11	10.1.1.1	TCP	66	80 → 3846 [FIN, ACK] Seq=175 Ack=465 Win=6864 Len=0 TSval=7506281 TSecr=7507431
46	11.697306103	10.1.1.1	10.1.1.11	TCP	66	3846 → 80 [ACK] Seq=465 Ack=175 Win=6912 Len=0 TSval=7507431 TSecr=7506281
47	11.697858206	10.1.1.1	10.1.1.11	TCP	66	3846 → 80 [FIN, ACK] Seq=465 Ack=176 Win=6912 Len=0 TSval=7507431 TSecr=7506281
48	11.698175247	10.1.1.11	10.1.1.1	TCP	66	80 → 3846 [ACK] Seq=176 Ack=466 Win=6864 Len=0 TSval=7506281 TSecr=7507431
49	11.698539315	10.1.1.1	10.1.1.4	HTTP	245	HTTP/1.1 304 Not Modified
50	11.698571956	10.1.1.4	10.1.1.1	TCP	66	34806 → 80 [ACK] Seq=984 Ack=769 Win=32512 Len=0 TSval=17644588 TSecr=7507431
51	12.796682191	10.1.1.4	10.1.1.1	HTTP	487	GET / HTTP/1.1

At the beginning, the connection is the same as previous, host->www, www->ww1/2. But now, as the www2 is stop, we obtain RTS(disconnected), after that, the requests are attended by only www1.

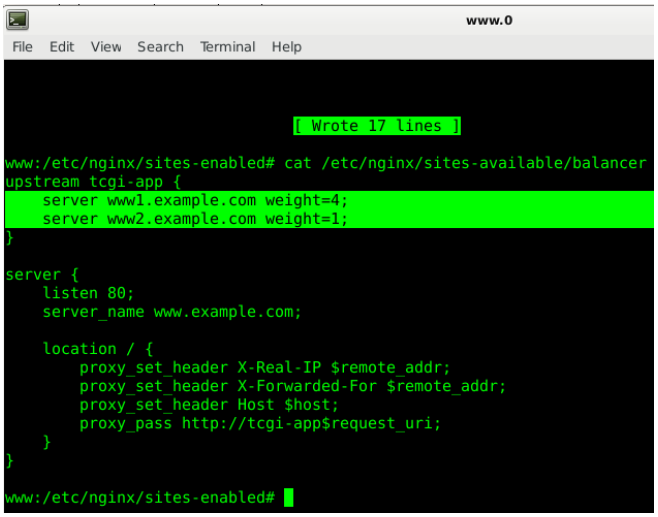
6. The nginx reverse proxy can take several approaches on load balancing. One of them is to weight the balance, so that not all the servers receive the same amount of requests. This is achieved by typing weight=value next to a server forwarding indication, such as
which indicates that www1 will receive twice the requests recieved by www2.
Modify the balancer configuration in the www machine to make www1 machine attend the 75% of the web traffic addressed to the www machine. Check the results by requesting the index web page several times. Discuss the results.

//from www2

/etc/init.d/nginx start

//from www

nano /etc/nginx/sites-available/balancer



/etc/init.d/nginx reload

Wireshark · Conversations · SimNet0

Ethernet · 3 | IPv4 · 3 | IPv6 | TCP · 7 | UDP

Address A	Port A	Address B	Port B	Packets	Bytes	Packets A → B	Bytes A → B	Packets B → A	Bytes B → A	Rel Start	Duration	Bits/s A → B	Bits/s B → A
10.1.1.1	4778	10.1.1.11	80	12	1,442	6	762	6	680	0.004082	0.0053	1,141 k	1,018 k
10.1.1.1	4779	10.1.1.11	80	10	1,269	5	628	5	641	0.113986	0.0023	—	—
10.1.1.1	4780	10.1.1.11	80	10	1,314	5	802	5	512	1.136253	0.0047	—	—
10.1.1.1	4781	10.1.1.11	80	10	1,314	5	802	5	512	1.995992	0.0045	—	—
10.1.1.1	4782	10.1.1.11	80	10	1,314	5	802	5	512	2.725685	0.0053	1,219 k	778 k
10.1.1.1	3893	10.1.1.12	80	10	1,314	6	868	4	446	3.653683	0.0192	360 k	185 k
10.1.1.4	34814	10.1.1.1	80	37	6,009	21	3,640	16	2,369	0.000000	68.6763	424	275

As we can see, the traffic is distributed by their weight. the first 4th requests are attended by www1 and the last one is attended by www2.
(hay 5 de www1 pero deberían ser 4 xd).

Exercise 1.6– Now we are going to test an encrypted http connection, i.e. an https connection.

1. To do so, first we need to set up a certificate. Thus, build a self-signed certificate according to the instructions provided in the theory section. If you're in a hurry, you can use the testing certificate provided by the ssl package, located at:
hacerlo !)
//from www
openssl genrsa -des3 -out mycakey.pem 2048 #to generate key
openssl req -new -x509 -days 2000 -key mycakey.pem -out mycacert.pem

#generate certificate
openssl x509 -in mycacert.pem -text -noout #check the certificate

```
enerate keyinx/sites-available# openssl genrsa -des3 -out mycakey.pem 2048 #to g
Generating RSA private key, 2048 bit long modulus
......+++
.......................+++
e is 65537 (0x10001)
Enter pass phrase for mycakey.pem:
Verifying - Enter pass phrase for mycakey.pem:
em -out mycacert.pem available# openssl req -new -x509 -days 2000 -key mycakey.p
Enter pass phrase for mycakey.pem:
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:spain
string is too long, it needs to be less than  2 bytes long
Country Name (2 letter code) [AU]:ES
State or Province Name (full name) [Some-State]:BARCELONA
Locality Name (eg, city) []:HOSPI
Organization Name (eg, company) [Internet Widgits Pty Ltd]:UPC
Organizational Unit Name (eg, section) []:TELEM
Common Name (eg, YOUR name) []:Mclovin
Email Address []:mclovin@gmail.com
```

openssl genrsa -out myserverkey.pem 2048 #server key pair
chmod 400 myserverkey.pem #give permission cz its not encrypted
openssl req -new -key myserverkey.pem -out myservercert.csr #creat the certificate
(here in common name= www.example.com)
openssl x509 -req -in myservercert.csr -CA mycacert.pem -CAkey mycakey.pem -CAcreateserial \-days 360 -out myservercert.pem
#to sign the certificate
rm myservercert.csr #remove the certificate

2. Generate a new configuration for the https protocol in the virtualhost www.example.com served in the machine www. You can use the default configuration as the base for the new configuration. The key elements that should be included in the server section are:
Enable the new configuration and try to access to https://www.example.com. Remember to restart the nginx server each time you change any piece of configuration. Analyze the traffic exchanged between the browser and the server and comment the result

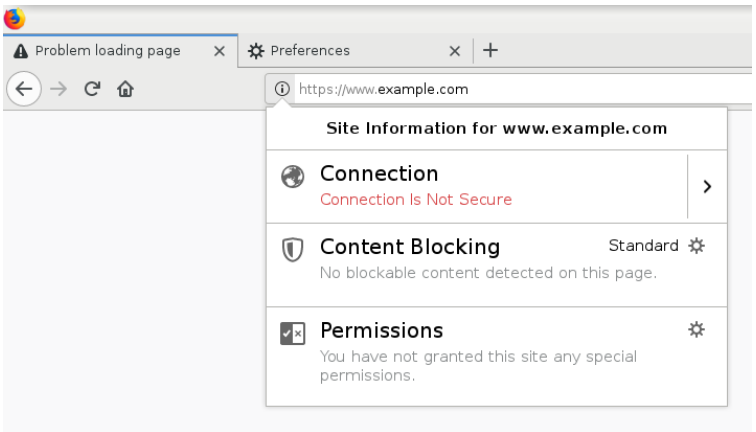
//from www
cd /etc/nginx/sites-available
cp default www.example.com
nano www.example.com
/etc/ssl/certs/ssl-cert-snakeoil.pem
/etc/ssl/private/ssl-cert-snakeoil.key

```
server {
    listen       433 ssl;
    server_name  www.example.com;


    ssl_certificate             mycacert.pem;
    ssl_certificate_key         mycaker.pem;
    location / {
        root   /var/www;
        index  index.html index.htm;
    }

    location ~ ^/cgi/ {
        # Disable gzip (it makes scripts feel slower since they have to comple$
        # before getting gzipped)
```

cd /etc/nginx/sites-enabled/
ln -s ../sites-available/www.example.com

```
www:/etc/nginx/sites-available# cd /etc/nginx/sites-enabled/
www:/etc/nginx/sites-enabled# ln -s ../sites-available/www.example.com
www:/etc/nginx/sites-enabled# ls
default  www.example.com
```

/etc/init.d/nginx start



Se deberia conectar y en whireshark tendiramos q ver el protocolo TSL

3. Now we want to redirect all the requests received in the virtualhost www.example.com, from the protocol http to the protocol https. With that, we want to force that all the requests to the virtual host www.example.com are carried by an encrypted https connection instead of the regular http one, independently of what protocol the user typed in the browser when the request was made. To do so, first create the following configuration and name it as https-redirection:

Then disable de default configuration and enable the https-redirection one. From the host, generate a request to the http://www.example.com URL and describe the result. Describe the message exchange. Where does the redirection actually happen? Comment the results.

Exercise 1.7– Now we are going to test an http2 connection. Get default https configuration and create a new one supporting the http2 protocol. To support the http2 protocol, just add the keyword http2 next to the ssl keyword, as:

After that, enable the configuration and disable the regular HTTPS configuration. Restart the nginx server so that the changes become active, and send a request to the https://www.example.com URL. Check the captured data. How does the client inform the server that it supports the HTTP2 protocol? Look at the ALPN section of the Client Hello TLS packet. Comment the results