

1. An HTTP dialogue made with nc program is shown in the following lines:

```
1 GET /nube.gif HTTP/1.1
2 Pragma: no-cache
3 Cache-control: no-cache
4 Accept:image/png, image/jpeg, video/x-mng, image/jp2, image/gif;q=0.5,*/*;q=0.1
5 Accept-Encoding: x-gzip, x-deflate, gzip, deflate
6 Accept-Charset: utf-8, utf-8;q=0.5, */*;q=0.5
7 Accept-Language: es, en
8 Connection: Keep-Alive
9
10 <html><body><h1>404 Not Found</h1></body></html>
```

- a) Indicate for each line if it is sent by the client or by the server.
- b) Indicate which part(s) of the dialogue does not follow the standard application protocol.
- c) Rewrite the lines above in such a way that they follow the standard protocol, add lines if you consider it necessary.

NOTE: Lines are numbered to facilitate the exercise.

Solution:

- a) Client send 1-9, Server: 10
- b) Client request is missing the Host header, which is mandatory in HTTP 1.1 version.
Server response is missing the status line, and the blank line that separates the status line and the entity body.
- c) Client -> Host: www.ejemplo.com
Server -> HTTP/1.1 404 Not Found
<CF><LF>
<html><body><h1>404 Not found</h1></body></html>

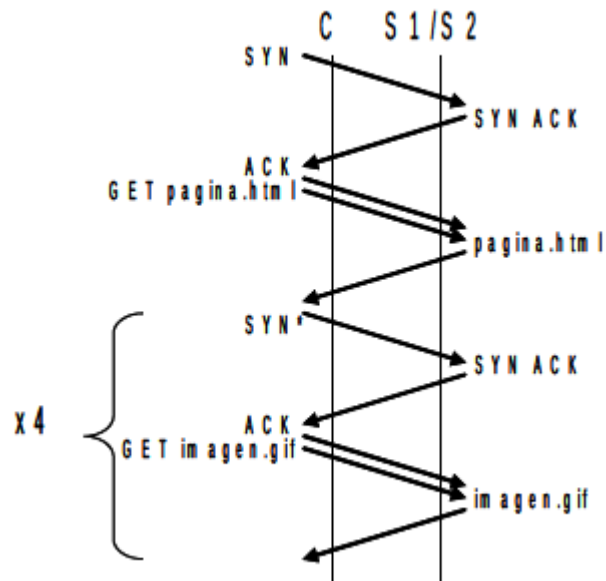
2. In the following cases:

How many RTTs are needed to retrieve a web page made up by an html document, and four images, where two of the images are situated in a different web server?

- a) Use non persistent connections without pipelining.
- b) Use non persistent connections with a maximum of two concurrent connections.
- c) Use persistent connections without concurrent connections, and pipelining. Transmission delays are negligible. Draw the segments sent between the client and the server for each case.

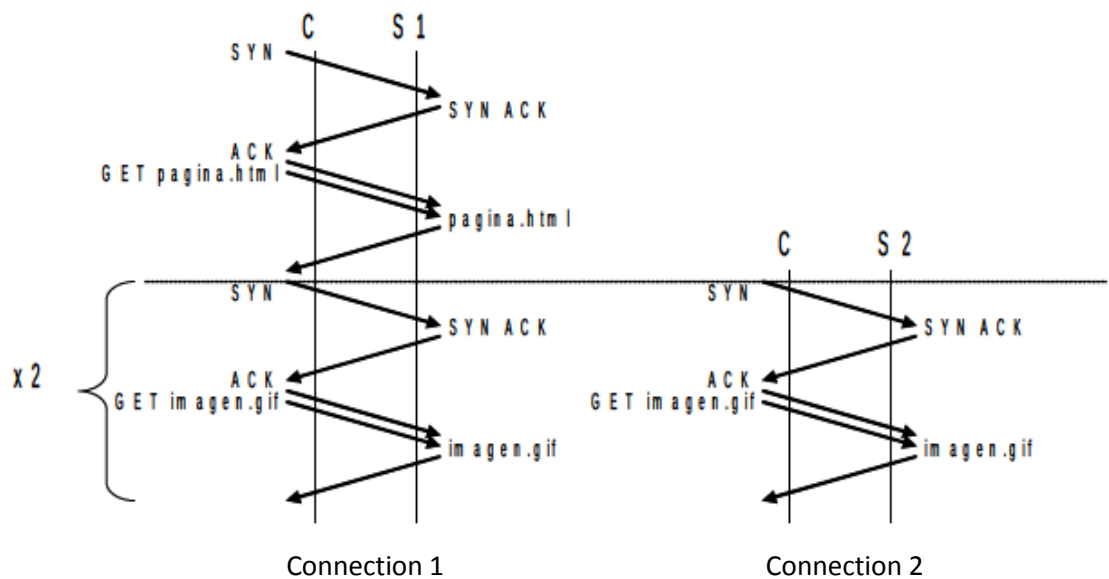
Solution:

a)



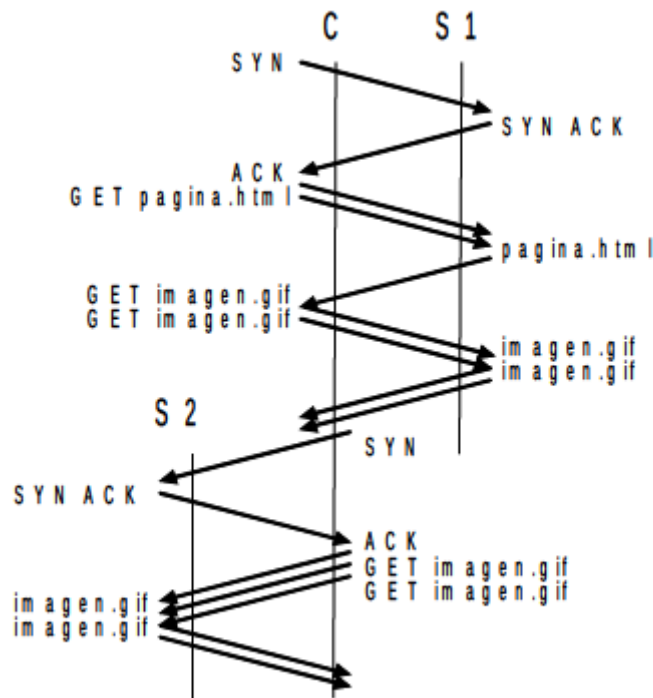
RTTs = 2(TCP+html) + 4*2 (4 images, 2 RTTs each image (TCP+html)) = 10 RTTs

b)



RTTs = 2 (TCP+html) + 2*2 (2 images on each server S1 and S2 concurrently, 2RTTs each image (TCP+image)) = 6 RTTs

c)



RTTs = 2 (TCP+html) + 1 (images on S1) + 2 (images on S2 (TCP+images)) = 5RTTs

3. In the following client/server dialogue:

```

220 out.telefonica.net ESMTP Service (7.2.056.6) ready
EHLO [192.168.1.33]
250-out.telefonica.net
250-DSN
250-8BITMIME
250-PIPELINING
250-HELP
250-X-CP-DELIVER-AFTER
250-DELIVERBY 300
250 SIZE 52428800
MAIL FROM:<pepu@telefonica.net> SIZE=376
250 MAIL FROM:<pepu@telefonica.net> OK
RCPT TO:<luis@telefonica.net>
250 RCPT TO:<luis@telefonica.net> OK
DATA
354 Start mail input; end with <CRLF>.<CRLF>
Message-ID: <47985FC8.30504@telefonica.net>
Date: Thu, 24 Jan 2008 10:52:08 +0100
From: <pepu@telefonica.net>
User-Agent: Mozilla Thunderbird 2.0.2 (Linux/20070317)
X-Accept-Language: en-us, en
MIME-Version: 1.0
To: luis@telefonica.net
Subject: prueba
Content-Type: text/plain; charset=ISO-8859-1; format=flowed
Content-Transfer-Encoding: 7bit
prueba 2
.
250 <4797C7CB0000E186> Mail accepted
QUIT
221 t.telefonica.net QUIT
  
```

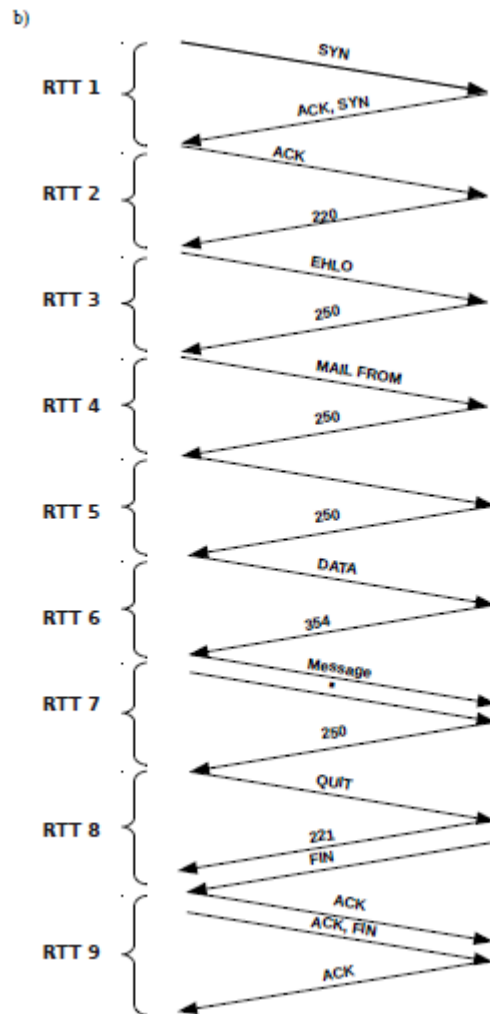
- a) Indicate the DNS query/queries that will be sent before to establish the TCP connection if the DNS cache is empty (indicate type, source and destination of the DNS query, and what is asked in the DNS query).
- b) Indicate how many RTTs are needed to carry out the previous dialogue, if each client request- server response need only one RTT, and the whole email message (lines between "354 Start mail input; end with <CRLF>.<CRLF>" and "250 <4797C7CB0000E186> Mail accepted") needs only one RTT. Draw the segments exchanged between client and server, showing also the RTTs.

Solution:

a.

Source Host	Destination Host	Application Protocol	Objective (Request/Response, Type of register)
1. pc.telefonica.net	dns.telefonica.net	DNS	- DNS query to get the out.telefonica.net server IP - Record A
2. dns.telefonica.net	pc.telefonica.net	DNS	- DNS response with the out.telefonica.net server IP - Record A

The client needs to know the IP address of out.telefonica.net to establish a TCP connection with it. Due to the email addresses (source and destination) belong to the same email domain, we can think that the client is in telefonica.net domain, being its local dns server dns.telefonica.net, so that this domain server is able to resolve the out.telefonica.net domain.



4. In the following client/server dialogue:

```

220 hamburger.edu
HELO crepes.fr
250 Hello crepes.fr, pleased to meet you
MAIL FROM: <alice@crepes.fr>
250 alice@crepes.fr... Sender ok
RCPT TO: <bob@hamburger.edu>
250 bob@hamburger.edu ... Recipient ok
DATA
354 Enter mail, end with "." on a line by itself
Te apetece ir al cine?
A ver dos policias rebeldes II?
.
250 Message accepted for delivery
QUIT
221 hamburger.edu closing connection
  
```

- Which is protocol used by client and server?
- What is this protocol used for?
- Indicate who (client/server) sends each line

Solution:

- a) SMTP (Simple Mail Transfer Protocol)
 - b) SMTP transfer mail from the sender's mail server to the recipient's mail server.
 - c)
 - (S) 220 hamburger.edu
 - (C) HELO crepes.fr
 - (S) 250 Hello crepes.fr, pleased to meet you
 - (C) MAIL FROM: <alice@crepes.fr>
 - (S) 250 alice@crepes.fr... Sender ok
 - (C) RCPT TO: <bob@hamburger.edu>
 - (S) 250 bob@hamburger.edu ... Recipient ok
 - (C) DATA
 - (S) 354 Enter mail, end with "." on a line by itself
 - (C) Te apetece ir al cine?
 - (C) A ver dos policias rebeldes II?
 - (C) .
 - (S) 250 Message accepted for delivery
 - (C) QUIT
 - (S) 221 hamburger.edu closing connection
-

5. The user sender@upv.es configure his mail agent to send and receive emails through two servers: imap.upv.es and smtp.upv.es, both at the upv LAN (Local Area Network). sender@upv.es wants to send an email to receiver@ya.com (that belongs to another mail domain).
Fill in the following table indicating the client/server messages send until the email goes out the UPV.

Note:

- The DNS server of the upv domain (dns.upv.es) has the mapping information (domains-IP address) for all the TLD servers needed in the queries that it will make. However, the DNS caches of other hosts have not the needed information.
- If you need to name other servers, you can name them with the protocol that they use, and the domain where they are, i.e. protocol: dns, domain: upv.es, name of the server: dns.upv.es)

Source Host	Destination Host	Applicati on Protocol	Objective (Request/Response, Type of register)
1.pc.upv.es	dns.upv.es	DNS	- DNS query to get the smtp.upv.es server IP

			- Record A
2. dns.upv.es	pc.upv.es	DNS	- DNS response with the smtp.upv.es server IP - Record A
3. pc.upv.es	smtp.upv.es	SMTP	-Source sends the email
4. smtp.upv.es	dns.upv.es	DNS	- DNS query to get the smtp server name mapped to ya.com domain - Record MX
5. dns.upv.es	TLD.com	DNS	- DNS query to get the smtp server name mapped to ya.com domain - Record MX
6. TLD.com	dns.upv.es	DNS	- DNS response with the authoritative DNS name server and IP of to ya.com domain - Record NS + Record A
7. dns.upv.es	dns.ya.com	DNS	- DNS query to get the smtp server name mapped to ya.com domain - Record MX
8. dns.ya.com	dns.upv.es	DNS	- DNS response with the smtp name server and its IP mapped to ya.com domain - Record MX + Record A
9. dns.upv.es	smtp.upv.es	DNS	- DNS response with the smtp name server and its IP mapped to ya.com domain - Record MX + Record A
10. smtp.upv.es	smtp.ya.com	SMTP	- Source sends the email

6. Fill in the following table indicating the sequence of DNS messages (query and response) send when a user in ONO domain, with dns.ono.com as local dns server, try to download the index.html web page from www.redes.upv.es web server. In this web page, is reference an image with the link <http://www.upv.es/image/logo.gif>

Note:

- The DNS server of the ono domain (dns.ono.com) has the mapping information (domains-IP address) for all the TLD servers needed in the queries that it will make. However, the DNS caches of other hosts have not the needed information.

- The UPV DNS server, dns.upv.es, is the authoritative dns server for the upv.es domain, and any subdomain included in the upv.es domain.
- If you need to name other servers, you can name them with the protocol that they use, and the domain where they are, i.e. protocol: dns, domain: upv.es, name of the server: dns.upv.es) or the TLD for the .es domain will be TLD.es

Source Host	Destination Host	DNS Record Type	Recursive/ Iterative	Objective
1.user.ono.com	dns.ono.com	A	Recursive	- DNS query to get the www.redes.upv.es IP address
2. dns.ono.com	TLD.es	A	Iterative	- DNS query to get the www.redes.upv.es IP address
3. TLD.es	dns.ono.com	NS,A	Iterative	- DNS response with the name of the authoritative dns server of upv.es domain and its IP address
4. dns.ono.com	dns.upv.es	A	Iterative	- DNS query to get the www.redes.upv.es IP address
5. dns.upv.es	dns.ono.com	A	Iterative	- DNS response with the www.redes.upv.es IP address
6. dns.ono.com	user.ono.com	A	Recursive	- DNS response with the www.redes.upv.es IP address
7.user.ono.com	dns.ono.com	A	Recursive	- DNS query to get the www.upv.es IP address
8. dns.ono.com	dns.upv.es	A	Iterative	- DNS query to get the www.upv.es IP address
9. dns.upv.es	dns.ono.com	A	Iterative	DNS response with the www.upv.es IP address
10. dns.ono.com	user.ono.com	A	Recursive	DNS response with the www.upv.es IP address

7. What is MIME used for?

Solution:

Multipurpose Internet Mail Extensions (MIME) is an Internet protocol used to send non-ASCII data as audio, video, programs, graphics and other binary files. MIME specifies how to convert the non-ASCII data into ASCII allowing it to remain compatible with existing email protocols.

MIME defines three additional email header fields: MIME-Version, Content-Transfer-Encoding, and Content-Type, to do it.

8. How many connections are needed to retrieve a web page made up by an html document, and three images, if all the objects are in the same web server, and the HTTP version is 1.1 with pipelining? And if the images are in a different web server?

Solution:

In HTTP 1.1 version, by default the connections are persistent, therefore only one connection will be needed to retrieve all the objects, because all the objects are in the same server.

If the images will be in a different server, two connections will be needed, one for the html, and another for the images.

9. What is the information in a dns server record of type MX? What is the server that makes queries of type MX and why are they made?

Solution:

MX Record -> **Name:** mail domain, **Value:** name of mail server associated with **Name**.

SMTP servers need to make a dns query of type MX each time they have to send an email to a recipient in another mail domain.

10. What is a Web proxy server? Which are the advantages that Web proxies provide?

Solution:

A caching Web proxy provides a nearby cache of Web pages and files available on remote Web servers, allowing local network clients to access them more quickly. When it receives a request for a Web resource (specified by a URL), a caching proxy looks for the resulting URL in its local cache. If it finds, it returns the document immediately. Otherwise it fetches it from the remote server, returns it to the requester and saves a copy in the cache.

Some of advantages of the caching Web proxies are to reduce response time for client request, reduce traffic on an institution's access link, so that it can enable "poor" content providers to effectively deliver content.

11. What is POP3 protocol used for? Which are the alternative protocols to get the same result?

Solution:

Allows the users to see (read)/retrieve their email previously received and stored their local mail server.

IMAP and HTTP also allow the users to see (read) their emails.

12. SMTP protocol doesn't require client authentication. Should external clients of the organization that manages the SMTP server be allowed to open a SMTP session on it? Why? Which are the actions that should be allowed to carry out to these external clients?

Solution:

Yes, external clients of the organization should be allowed to open a SMTP session in the server. It is needed to let other SMTP servers send their messages destined to users of the organization.

These external users only should be allowed to use our server to send messages destined to users of the organization, and not to send/forward messages to other users that don't belong to our organization.

13. How can a web server know the browser (Chrome, Firefox, Internet Explorer, etc.) used by the client? Can a web server know it always?

Solution:

Web server can know the browser used by the client reading the header

User-Agent: .

This header is not mandatory, so that the Web server only can know it when this header is sent by the client.