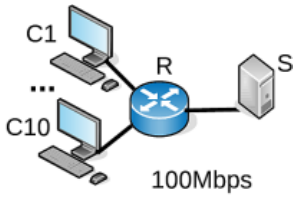
Multirespuesta (M).



1. In the network of the figure each of the 10 PCs establishes a TCP connection with the S server and sends to S at the maximum throughput allowed by the network. Assume a simplified version of TCP, as explained in class, with 64kB (64,000 bytes) TCP buffers. All links are full duplex at 100Mbps. We measure an average RTT of 51.2 ms. Say which of the following statements are plausible:

A) The router discards TCP segments

B) If we increase the line bitrate of the router-server link to 1 Gbps, we will measure a RTT aproximately 10 times lower

C) If we double the number of PCs (20 PCs) and measure the same RTT, we can deduce that the TCP average window will be reduced by about half

D) If we reduce the number of PCs by a half (5 PCs) the RTT will be approximately reduced by a half

ultirespuesta (M).

```
slookup
 set type=soa
> upc.edu.
Server: 147.83.30.71
Address: 147.83.30.71#53

Non-authoritative answer:
upc.edu
origin = ns.upc.edu
mail addr = hostmaster.upcnet.es
serial = 2019122478
refresh = 1800
retry = 900
expire = 1814400
minimum = 7200
```

2. In a name resolution, a host obtains a DNS response message as shown in the previous dump. The "Non-authoritative answer" means the response:

A) Comes from a cache

B) May have expired

C) Comes from a UPC.EDU nameserver but not its primary

D) Does not have the current serial number

Multirespuesta (M).

```
GET /index.html HTTP/1.1
Host: hserver.cualquier.com
Accept: text/html
Connection:
```

3. A Client sends an HTTP Request whose Header includes the previous fiel he Connection field is to be filled)

A) The value of the Connection field may be equal to "close"

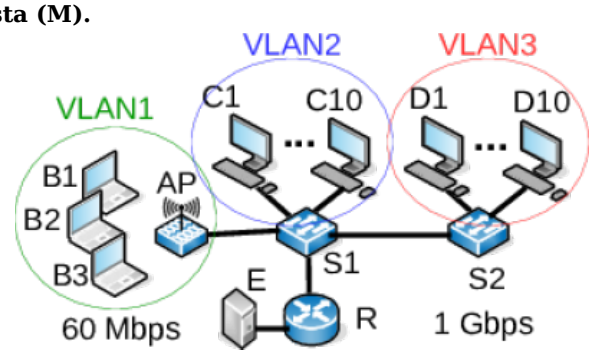
B) The client could add the field Content-Length to the header

C) The value of the Connection field may be equal to "100"

D) The value of the Connection field is only present in a Response

---

Multire esta (M).



4. The network in the figure has been configured with 3 VLANs. All ethernet links are 1 Gbps full duplex. The AP (access point) is configured in bridge mode, and has a capacity of 60 Mbps. That is, the sum of the throughput of the wifi PCs of the VLAN1 can be 60 Mbps, at most. All PCs have connectivity, at the IP layer, between each other and the E server. Suppose all PCs establish a TCP connection with the E server and send at the maximum speed allowed by the network. Say what will be, approximately, the throughput, v1, v2, v3, that will reach a P f each one of the VLAN1, VLAN2 and VLAN3, respectively.

A) v1 = 27,77 Mbps

B) v1 = 20 Mbps

C) v2 = 8,54 Mbps

D) v2 = 85,45 Mbps

E) v2 = 43,47 Mbps

F) v3 = 8,54 Mbps

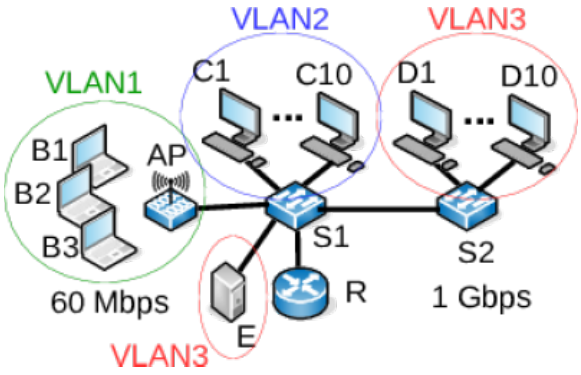
G) v3 = 85,45 Mbps

H) v3 = 43,47 Mbps

I) v2 = 47 Mbps

J) v3 = 47 Mbps

Multirespuesta (M).



5. The network in the figure has been configured with 3 VLANs. All ethernet links are 1 Gbps full duplex. The AP (access point) is configured in bridge mode, and has a capacity of 60 Mbps. That is, the sum of the throughput of the wifi PCs of the VLAN1 can be 60 Mbps, at most. All PCs have connectivity, at the IP layer, between each other and the E server. Suppose all PCs establish a TCP connection with the E server and send at the maximum speed allowed by the network. Say what will be, approximately, the throughput, v1, v2, v3, that will reach a PC of each one of the VLAN1, VLAN2 and VLAN3, respectively.

A) v1 = 15.15 Mbps

B) v1 = 20 Mbps

C) v2 = 45.45 Mbps

D) v2 = 44 Mbps

E) v2 = 50 Mbps

F) v3 = 45.45 Mbps

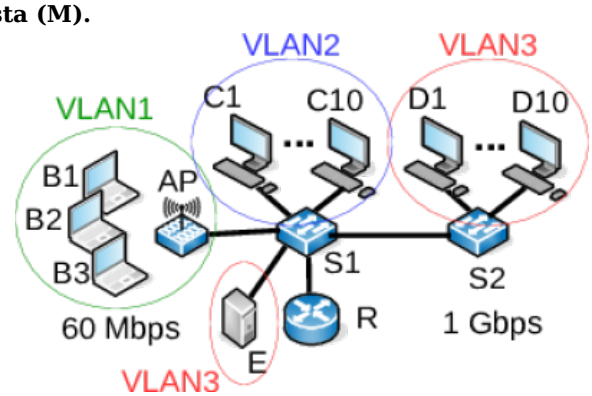
G) v3 = 50 Mbps

H) v3 = 44 Mbps

I) v2 = 47 Mbps

J) v3 = 47 Mbps

Multirespuesta (M).



6. The network in the figure has been configured with 3 VLANs. All ethernet links are 1 Gbps full duplex. The AP (access point) is configured in bridge mode, and has a capacity of 60 Mbps. That is, the

sum of the throughput of the wifi PCs of the VLAN1 is 60 Mbps, at most. All PCs have connectivity, at the IP layer, between each other and the E server. Suppose all PCs establish a TCP connection with the E server and send at the maximum speed allowed by the network. Say in which cases pause frames will be sent:

A) Switch S1 to switch S2

B) Switch S1 to router R

C) Switch S1 to PCs C1, ... C10

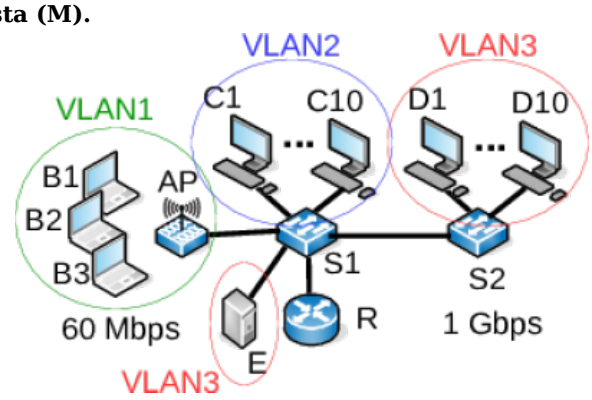
D) Switch S2 to PCs D1, ... D10

E) The AP to PCs B1, B2, B3

F) Switch S1 to the AP

G) Router R to switch S1

Multirespuesta (M).



7. The network in the figure has been configured with 3 VLANs. All ethernet links are 1 Gbps full duplex. The AP (access point) is configured in bridge mode, and has a capacity of 60 Mbps. That is, the sum of the throughput of the wifi PCs of the VLAN1 can be 60 Mbps, at most. All PCs have connectivity, at the IP layer, between each other and the E server. Assume that the MAC tables of switches S1 and S2 have stabilized and are no longer changing. Say which entries will be in the MAC table of S1:

A) S1: D1 MAC, VLAN3, port S1-S2

B) S1: R MAC, VLAN3, port S1-R

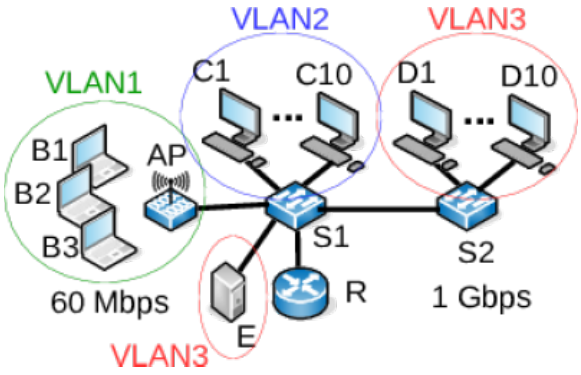
C) S1: R MAC, VLAN2, port S1-R

D) S1: R MAC, VLAN1, port S1-R

E) S1: B1 MAC, VLAN1, port S1-AP

F) S1: C1 MAC, VLAN2, port S1-R

Multirespuesta (M).



8. The network in the figure has been configured with 3 VLANs. All ethernet links are 1 Gbps full duplex. The AP (access point) is configured in bridge mode, and has a capacity of 60 Mbps. That is, the sum of the throughput of the wifi PCs of the VLAN1 can be 60 Mbps, at most. All PCs have connectivity, at the IP layer, between each other and the E server. Suppose B1 sends an ARP request message to resolve the IP of PC B2. Say which of the following devices will receive the ARP request message:

A) E

B) B3

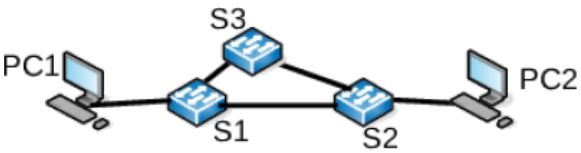
C) D1

D) R

E) B2

F) C1

Multirespuesta (M).



9. The network of the figure has been configured with CISCO switches like those of the laboratory. All ports on switches S1, S2, S3 are in the same VLAN. Say which of the following statements are plausible:

A) The STP protocol (spanning tree protocol) will block any of the ports of S1, S2, or S3 to break the loop

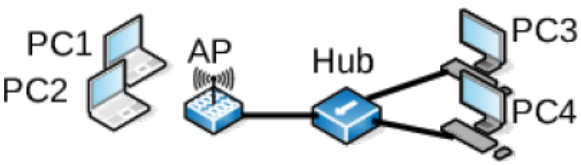
B) If PC1 sends an ethernet frame to PC2, multiple copies of the same frame can arrive due to the loop

C) If PC1 sends an ethernet frame to PC2, S1 can choose indistinctly S2 or S3 to send the frame to PC2

D) If PC1 sends a broadcast ethernet frame, multiple copies of the same frame can reach PC2 due to the loop

---

Multirespuesta (M).



10. The network in the figure has been configured. The AP (access point) is configured in bridge mode. Assume that all PCs have long been communicating with each other, so that all the tables needed are already initialized. Say which of the following statements are plausible:

A) A frame sent by PC1 can collide with a frame sent by PC2

B) A frame sent by PC1 can collide with a frame sent by PC3

C) A frame sent by PC3 can collide with a frame sent by PC4

D) A unicast frame sent by PC1 to PC2 will also reach PC3, but the PC3 network card will discard it because the destination MAC address of the frame is not PC3's MAC

Multirespuesta (M).

11. Two devices A and B are connected through a Router that has an output queue of 1 million bytes. The propagation time between A and B is 1 ms. The links have a transmission speed of 100 Mbps. A wants to transmit 1000-byte packets to B, indefinitely. We ignore the transmission time of ACK packets.

A) If there is no more traffic through the Router, the RTT is equal to 2.16 ms

B) If there is no more traffic through the Router, the RTT is less than 2 ms

C) If the Router has also traffic from other devices, the maximum RTT will be 12 ms

D) If the Router also has traffic from other devices, the maximum RTT will be greater than 15 ms

---

Multirespuesta (M).

```
1. 10.2.0.1.80 > 10.1.0.3.1059:FP 499773:500213(440) ack 93 win 32120
2. 10.1.0.3.1059 > 10.2.0.1.80: . ack 493981 win 23168
3. 10.2.0.1.80 > 10.1.0.3.1059: . 493981:495429(1448)ack 93 win 32120
4. 10.1.0.3.1059 > 10.2.0.1.80: . ack 500214 win 23168
5. 10.1.0.3.1059 > 10.2.0.1.80: F 93:93(0) ack 500214 win 23168
6. 10.2.0.1.80 > 10.1.0.3.1059: . ack 94 win 32120
```

12. About the TCP capture snippet:

A) The disconnection consists of lines 1, 4 and 5, only

B) The client sends on line 4 an ACK to the previously received segment in which the disconnection was requested, but the client does not finish the disconnection until line 5

C) No data is sent on line 5, but a sequence number is consumed

D) Line 1 is wrong because data cannot be sent when flag F is included

---

Multirespuesta (M).

```
1. 10.2.0.1.80 > 10.1.0.3.1059: . 32069:33517(1448) ack 93 win 32120
2. 10.1.0.3.1059 > 10.2.0.1.80: . ack 29173 win 23168
3. 10.2.0.1.80 > 10.1.0.3.1059: . 33517:34965(1448) ack 93 win 32120
4. 10.2.0.1.80 > 10.1.0.3.1059: . 34965:36413(1448) ack 93 win 32120
5. 10.2.0.1.80 > 10.1.0.3.1059: . 36413:37861(1448) ack 93 win 32120
6. 10.1.0.3.1059 > 10.2.0.1.80: . ack 29173 win 23168
7. 10.2.0.1.80 > 10.1.0.3.1059: . 29173:30621(1448) ack 93 win 32120
8. 10.1.0.3.1059 > 10.2.0.1.80: . ack 37861 win 23168
```

13. About the TCP capture snippet:

A) The capture has been done on the machine with IP address 10.1.0.3

B) After line 6, the congestion window becomes 1 MSS

C) At the end of the sequence, some segments remain to be confirmed, such as the 34965

D) The server has sent 92 octets, so the ACK it receives claims 93

Multirespuesta (M).

```
1. 10.1.0.3.1059 > 10.2.0.1.80: . ack 1 win 23168
2. 10.1.0.3.1059 > 10.2.0.1.80: P 1:93(92) ack 1 win 23168
3. 10.2.0.1.80 > 10.1.0.3.1059: P 1:213(212) ack 93 win 32120
4. 10.1.0.3.1059 > 10.2.0.1.80: . ack 213 win 23168
5. 10.2.0.1.80 > 10.1.0.3.1059: . 213:1661(1448) ack 93 win 32120
6. 10.1.0.3.1059 > 10.2.0.1.80: . ack 1661 win 23168
7. ..........................................................
8. 10.1.0.3.1059 > 10.2.0.1.80: . ack 26277 win 23168
9. 10.2.0.1.80 > 10.1.0.3.1059: . 26277:27725(1448) ack 93 win 32120
10. 10.2.0.1.80 > 10.1.0.3.1059: . 27725:29173(1448) ack 93 win 32120
```

14. About the TCP capture snippet:

A) Lines 1 to 3 correspond to a connection establishment

B) Before starting to receive 1448 byte segments, the client sends 304 bytes

C) Assuming no options are used, the MSS is 1448 octets

D) During the exchanges not seen on line 7, the server has sent more than 20.000 octets

---

Multirespuesta (M).

```
1. 10.1.0.3.1059 > 10.2.0.1.80: . ack 1 win 23168
2. 10.1.0.3.1059 > 10.2.0.1.80: P 1:93(92) ack 1 win 23168
3. 10.2.0.1.80 > 10.1.0.3.1059: P 1:213(212) ack 93 win 32120
4. 10.1.0.3.1059 > 10.2.0.1.80: . ack 213 win 23168
5. 10.2.0.1.80 > 10.1.0.3.1059: . 213:1661(1448) ack 93 win 32120
6. 10.1.0.3.1059 > 10.2.0.1.80: . ack 1661 win 23168
7. ..........................................................
8. 10.1.0.3.1059 > 10.2.0.1.80: . ack 26277 win 23168
9. 10.2.0.1.80 > 10.1.0.3.1059: . 26277:27725(1448) ack 93 win 32120
10. 10.2.0.1.80 > 10.1.0.3.1059: . 27725:29173(1448) ack 93 win 32120
```

15. About the TCP capture snippet:

A) The client has not sent any data

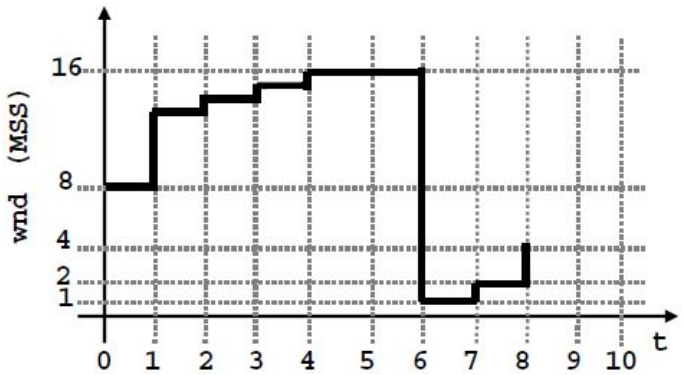
B) The server has not sent any data

C) This is the communication between a client and an HTTP server

D) If the client and the server were connected directly through a Router, and the Router's queue was 30,000 bytes, it is not plausible that there will be losses

---

Multirespuesta (M).



16. The figure shows the evolution of the transmission window of a TCP connection. The units of the horizontal axis are RTTs. The MSS is 1000 bytes, the RTT is 100 ms, the RTO is 200 ms, and the advertised window (awnd) is 16,000 bytes. Check the correct sentences.

A) At time instant 4, cwnd and awnd windows match

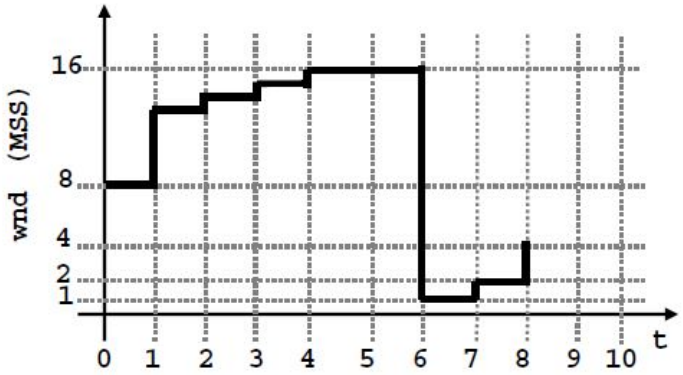
B) At time instant 10, the cwnd will be less than 16 MSS

C) At time instant 3 we are in the Slow Start phase

D) Between time instants 4 and 5, at least one ACK of the 15 segments sent is lost

---

Multirespuesta (M).



17. The figure shows the evolution of the transmission window of a TCP connection. The units of the horizontal axis are RTTs. The MSS is 500 bytes, the RTT is 5 ms, the RTO is 10 ms, and the advertised window (awnd) is 20,000 bytes. Check the correct sentences.

A) At time instant 1, 13 segments are sent

B) There is an inaccuracy in the figure (apart from the scale of the drawing) because according to the figure the RTO should be 100 ms

C) At time instant 6, even though the cwnd drops to 1 MSS, the real transmission window remains the same as the awnd

D) The value of the window at time instant 10 will be 16000 bytes

---

Multirespuesta (M).

```
12:30:37.069541 IP 147.83.34.125.17788 > 147.83.32.82.80: S 3473661146:3473661146(0) win 5840 <mss
                1460,sackOK,timestamp 296476754 0,nop,wscale 7>
12:30:37.070021 IP 147.83.32.82.80 > 147.83.34.125.17788: S 544373216:544373216(0) ack 3473661147 win 5792 <mss
                1460,sackOK,timestamp 1824770623 296476754,nop,wscale 2>
12:30:37.070038 IP 147.83.34.125.17788 > 147.83.32.82.80: . ack 1 win 46 <nop,nop,timestamp 296476754
                1824770623>
```

18. About the TCP capture snippet:

A) "wscale 7" means that the awnd value is 7 times what appears in the corresponding field of the TCP header

B) "wscale 7" means that the awnd value is 64 times what appears in the corresponding field of the TCP header

C) The time between the second and third line of the capture is much less than between the first and the second one due to congestion problems at the IP level

D) The capture corresponds to a connection establishment

Multirespuesta (M).

19. About TCP and UDP

A) UDP is better than TCP when the IP network loses many packets

B) UDP is better than TCP in terms of latency for short messages, if the IP network is not congested

C) UDP defines optional fields in its header to correct some small possible IP errors

D) UDP uses fewer bits than TCP to identify ports

Multirespuesta (M).

20. About ARQ

A) If there are no errors, Stop and Wait is as efficient as continuous transmission

B) The basic idea of ARQ is that when a packet is lost, we look for an alternative routes for it to arrive

C) In the absence of errors, the efficiency of Go back N and Selective Retransmission are the same when the number of data units being sent tends to infinity

D) The optimal window depends, among other values, on the propagation time

---

Multirespuesta (M).

21. About MIME:

A) The Content-Length header appears in mail and not in web.

B) The 'boundary' attribute appears in mail.

C) The Content-transfer-encoding header appears in web and not in mail.

D) The content type 'multipart/alternative' allows to send one body part in two alternative formats.

Multirespuesta (M).

```
. 516425 IN NS a.root-servers.net.
es. 172800 IN NS a.nic.es.
es. 172800 IN NS f.nic.es.
upc.es. 86400 IN NS ns2.upc.edu.
upc.es. 86400 IN NS ns1.upc.edu.
www.upc.es. 3600 IN A 147.83.2.135
```

22. In a name resolution a host receives DNS response messages with the contents shown in the previous dump. State which of the following statements are true:

A) This is a recursive DNS resolution.

B) This is an iterative DNS resolution.

C) We get these in 4 DNS query/responses.

D) We get these in 6 DNS queries/responses.

Multirespuesta (M).

```
;; QUESTION SECTION:
;www.upc.edu.   IN   A

;; ANSWER SECTION:
www.upc.edu.  28130   IN CNAME www.upc.es.
www.upc.es.    3600   IN A 147.83.2.135
;; AUTHORITY SECTION:
upc.es.   21537 IN NS ns1.upc.edu.
upc.es.   21537 IN NS ns2.upc.edu.
upc.es.   21537 IN NS sun.rediris.es.
upc.es.   21537 IN NS chico.rediris.es.
;; ADDITIONAL SECTION:
ns1.upc.edu.      21031 IN A 147.83.0.1
ns2.upc.edu.      21031 IN A 147.83.0.2
sun.rediris.es.    4063 IN A 199.184.182.1
chico.rediris.es. 61663 IN A 162.219.54.2
```

23. In a name resolution a host receives a DNS response message with the content shown in the previous dump. State which of the following statements are true:

A) If the client repeats the same request 1000 seconds later, no further DNS query will be sent to the network.

B) If the client repeats the same request 10000 seconds later, one DNS query will be sent to the network.

C) There is not A record for www.upc.edu, only a CNAME.

D) We can send DNS requests to sun.rediris.es. for host names at upc.es.

Multirespuesta (M).

```
POST /form HTTP/1.1
Host: foo.fib.upc.edu
Content-Type: application/x-www-form-urlencoded
Content-Length: 27

field1=value1&field2=value2
```

24. A Client sends this HTTP Request:

A) The request has a header but not body.

B) The request has a header and body.

C) The client can reuse the connection to send the next request.

D) The client closes the connection at the end of this request.

Multirespuesta (M).

```
HTTP/1.1 200 OK
Date: Mon, 15 Jun 2020 10:49:34 GMT
Last-Modified: Wed, 05 Feb 2014 16:00:31 GMT
ETag: "40521bd2-286-4f1aadb3105c0"
Content-Length: 646
```

```
Connection: close
Content-Type: text/html

<html>...
```

25. A Client receives this HTTP Response:

A) The connection will close after 646 bytes of content.

B) The ETag for this page has not changed since more than 2 years.

C) The response is the consequence of the client has requested to close the connection.

D) The ETag field allows for a later conditional request.

Multirespuesta (M).

26. About charsets:

A) UTF-8 encodes each characters with a variable number of bytes.

B) UTF-8 encodes each character with 8 bits.

C) ASCII uses 7 of the 8 bits of a byte per character.

D) ISO 8859 codes use one byte per character.

Respuesta única (U).

27. When a router receives a datagram performs the following function, among other not shown here:
A) Computes the TTL: decrements by 1 the value of the TTL
B) Computes the checksum of the header
C) Transmits the datagram or datagrams (fragments)
D) Fragmentation: if needed, it generates as many fragments as required
E) Routing: performs the lookup in the routing table and finds out the next hop
F) Checks the TTL: if TTL is zero discards the datagram and generates an ICMP error message
G) Checks for fragmentation: if the datagram does not allow fragmentation it is discarded and generates an ICMP error message
H) Checksum verification and if it fails the datagram is discarded
I) Checks MTU: id the MTU (Maximum Transmission Unit) of the outgoing network is smaller than the size of the datagram then fragmentation is needed

A correct sequence in which these functions are performed is:

A) A F B G H D E I C

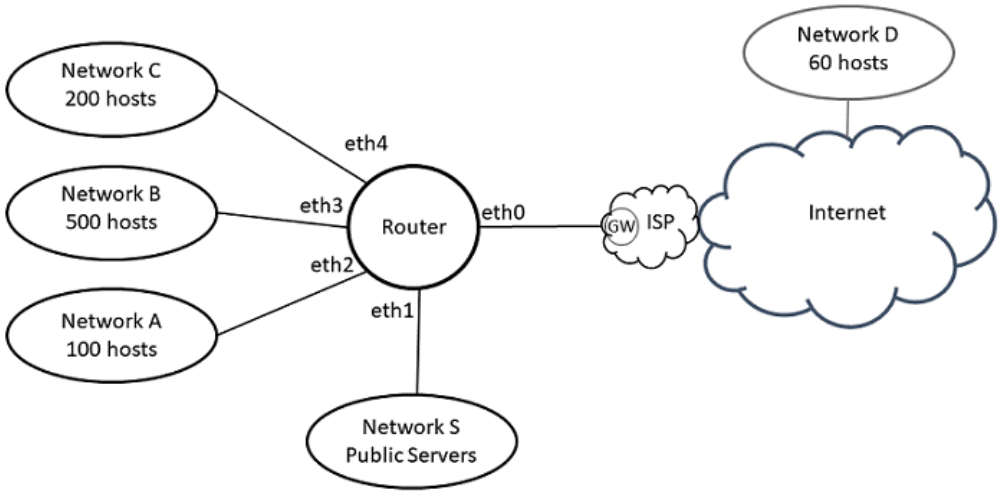
B) H E A F B I G D C

C) H F G A E B I D C

D) F H G I E A B D C

E) F G H A B E I D C

Respuesta única (U).



28. Networks A, B, C, D and S in the figure use a unique block of private addresses.
What is the longest mask required for the whole private range to fit the required number of hosts?
What is the maximum number of public servers (network S) that may be allocated with the addresses left in the range?

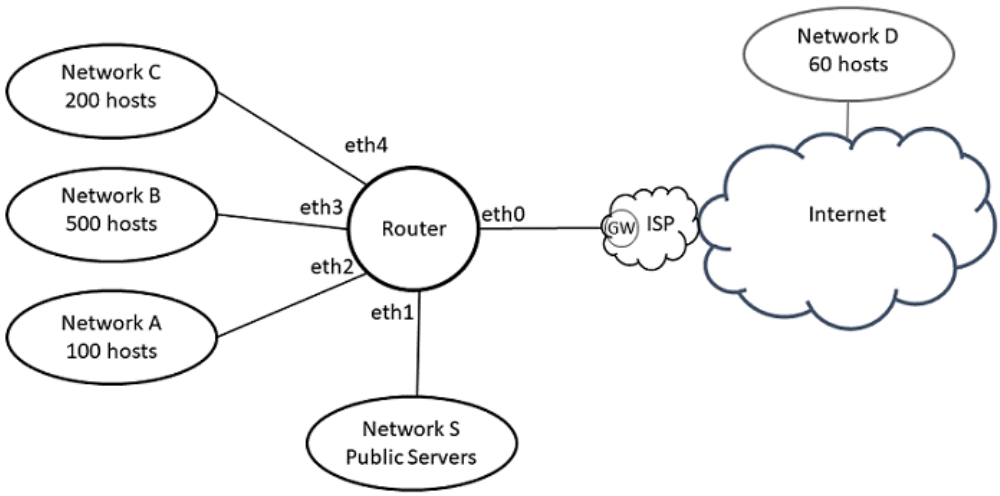
A) Mask: /22. Maximum 64 servers.

B) Mask: /20. Maximum 61 servers.

C) Mask: /23. Maximum 21 servers.

D) Mask: /22. Maximum 61 servers.

Multirespuesta (M).



29. Networks A, B, C, D and S in the figure use a unique block of private addresses.
The goal is to distribute all the addresses among the networks using the minimum number of addresses, starting by 192.168.44.0.
Possible assignments for the network of servers are:

A) 192.168.44.0/24

B) 192.168.45.0/24

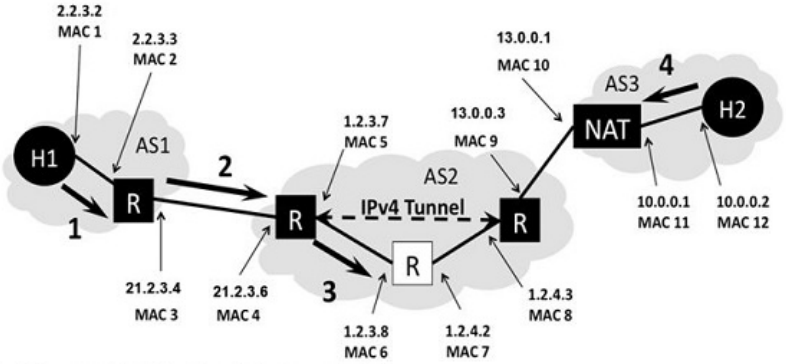
C) 192.168.44.0/26

D) 192.168.47.0/26

E) 192.168.44.128/25

F) 192.168.47.192/26

Multirespuesta (M).



Partial example of the headers for packet 1:

Header Type	*Source*	*Destination*
(T1) Ethernet	(S1) MAC 1	(D1)
(T2) IP	(S2) 2.2.3.2	(D2)
(T3)	(S3)	(D3)

Advice: There are 3 questions based on this example; it is worth spending some time to get all the details.

30. The above figure shows an Internet topology with three networks. The LAN on the left includes a host H1. The LAN on the right uses a PNAT and includes a host H2. Packets between the two endpoints are routed along the path shown, which includes an IPv4 tunnel. The various network interfaces have IP and MAC addresses as shown.
H1 and H2 have established a TCP connection and data packets are flowing between the two machines as part of that connection (1, 2, 3, and 4).
We have partially filled in the headers for packet 1 (travelling from the H1 to H2). Note that you should order your headers from "outermost" in, as shown: Ethernet should be listed before IP, because the Ethernet packet exists first on the wire.
You should fill in the header types, as well as the source and destination address for the network and datalink layer headers. The cells in the table are labelled as T1, S1, D1, T2, S2, D2, T3, S3, D3. Note: You might not need to use all the rows supplied.
Check the correct values for the following cells in the table for packets 1 and 2.

A) Packet 1 header:
T1 = Ethernet; S1 = MAC1; D1 = MAC2;
T2 = IP; S2 = 2.2.3.2; D2 = 13.0.0.1;
T3 = S3 = D3 = none

B) Packet 1 header:
T1 = Ethernet; S1 = MAC1; D1 = MAC2;
T2 = IP; S2 = 2.2.3.2; D2 = 2.2.3.3;
T3 = S3 = D3 = none

C) Packet 1 header:
T1 = Ethernet; S1 = MAC1; D1 = MAC2;
T2 = IP; S2 = 2.2.3.2; D2 = 2.2.3.3;

T3 = IP; S3 = 2.2.3.4; D3 = 13.0.0.1

D) Packet 1 header:
T1 = Ethernet; S1 = MAC1; D1 = MAC10;
T2 = IP; S2 = 2.2.3.2; D2 = 13.0.0.1;
T3 = S3 = D3 = none

E) Packet 1 header:
T1 = Ethernet; S1 = MAC1; D1 = MAC12;
T2 = IP; S2 = 2.2.3.2; D2 = 10.0.0.2;
T3 = S3 = D3 = none

F) Packet 2 header:
T1 = Ethernet; S1 = MAC3; D1 = MAC4;
T2 = IP; S2 = 2.2.3.2; D2 = 13.0.0.1;
T3 = S3 = D3 = none

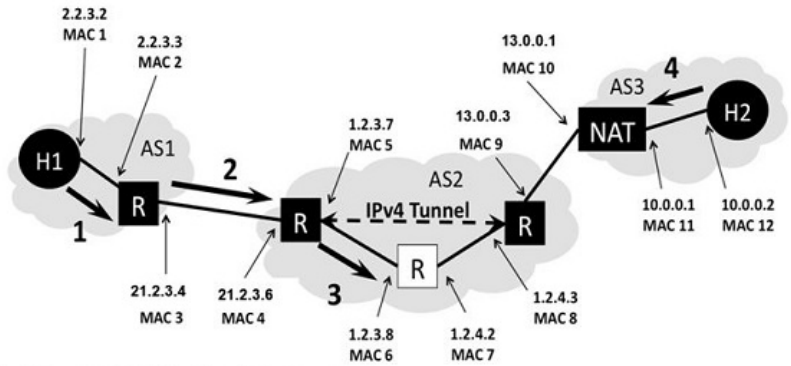
G) Packet 2 header:
T1 = Ethernet; S1 = MAC1; D1 = MAC4;
T2 = IP; S2 = 2.2.3.2; D2 = 21.2.3.6;
T3 = S3 = D3 = none

H) Packet 2 header:
T1 = Ethernet; S1 = MAC3; D1 = MAC4;
T2 = IP; S2 = 21.2.3.4; D2 = 21.2.3.6;
T3 = IP; S3 = 2.2.3.2; D3 = 13.0.0.1

I) Packet 2 header:
T1 = Ethernet; S1 = MAC1; D1 = MAC10;
T2 = IP; S2 = 2.2.3.2; D2 = 13.0.0.1;
T3 = S3 = D3 = none

J) Packet 2 header:
T1 = Ethernet; S1 = MAC1; D1 = MAC12;
T2 = IP; S2 = 2.2.3.2; D2 = 10.0.0.2;
T3 = S3 = D3 = none

Multirespuesta (M).



Partial example of the headers for packet 1:

Header Type	*Source*	*Destination*
(T1) Ethernet	(S1) MAC 1	(D1)
(T2) IP	(S2) 2.2.3.2	(D2)
(T3)	(S3)	(D3)

Advice: There are 3 questions based on this example; it is worth spending some time to get all the details.

31. The above figure shows an Internet topology with three networks. The LAN on the left includes a host H1. The LAN on the right uses a NAT and includes a host H2. Packets between the two endpoints are routed along the path shown, which includes an IPv4 tunnel. The various network interfaces have IP and MAC addresses as shown.
H1 and H2 have established a TCP connection and data packets are flowing between the two machines as part of that connection (1, 2, 3, and 4).
We have partially filled in the headers for packet 1 (travelling from the

H1 to H2). Note that you should order your headers from "outermost" in, as shown: Ethernet should be listed before IP, because the Ethernet packet exists first on the wire.
You should fill in the header types, as well as the source and destination address for the network and datalink layer headers. The cells in the table are labelled as T1, S1, D1, T2, S2, D2, T3, S3, D3. Note: You might not need to use all the rows supplied.
Check the correct values for the following cells in the table for packets 3 and 4.

A) Packet 3 header:
T1 = Ethernet; S1 = MAC5; D1 = MAC6;
T2 = IP; S2 = 1.2.3.7; D2 = 1.2.4.3;
T3 = IP; S3 = 2.2.3.2; D3 = 13.0.0.1

B) Packet 3 header:
T1 = Ethernet; S1 = MAC5; D1 = MAC6;
T2 = IP; S2 = 1.2.3.7; D2 = 1.2.4.3;
T3 = IP; S3 = 2.2.3.2; D3 = 1.2.3.8

C) Packet 3 header:
T1 = Ethernet; S1 = MAC5; D1 = MAC6;
T2 = IP; S2 = 1.2.3.7; D2 = 1.2.3.8;
T3 = IP; S3 = 2.2.3.2; D3 = 13.0.0.1

D) Packet 3 header:
T1 = Ethernet; S1 = MAC5; D1 = MAC8;
T2 = IP; S2 = 1.2.3.7; D2 = 1.2.4.3;
T3 = IP; S3 = 2.2.3.2; D3 = 13.0.0.1

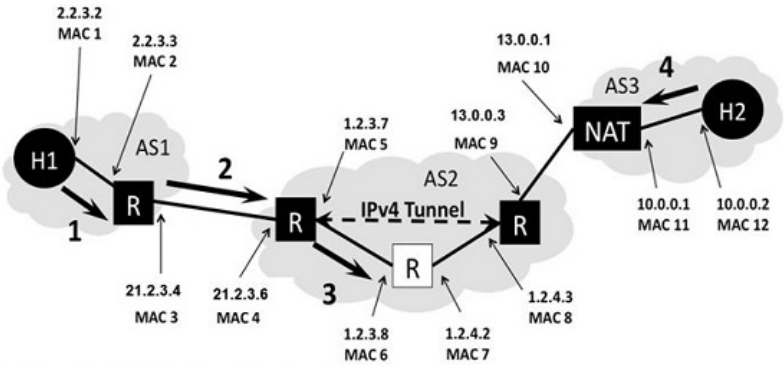
E) Packet 4 header:
T1 = Ethernet; S1 = MAC12; D1 = MAC11;
T2 = IP; S2 = 10.0.0.2; D2 = 2.2.3.2;
T3 = S3 = D3 = none

F) Packet 4 header:
T1 = Ethernet; S1 = MAC12; D1 = MAC1;
T2 = IP; S2 = 10.0.0.2; D2 = 2.2.3.2;
T3 = S3 = D3 = none

G) Packet 4 header:
T1 = Ethernet; S1 = MAC12; D1 = MAC11;
T2 = IP; S2 = 13.0.0.1; D2 = 21.2.3.4;
T3 = IP; S3 = 10.0.0.2; D3 = 2.2.3.2;

H) Packet 4 header:
T1 = Ethernet; S1 = MAC12; D1 = MAC1;
T2 = IP; S2 = 13.0.0.1; D2 = 2.2.3.2;
T3 = S3 = D3 = none

Respuesta única (U).



Partial example of the headers for packet 1:

Header Type	*Source*	*Destination*
(T1) Ethernet	(S1) MAC 1	(D1)
(T2) IP	(S2) 2.2.3.2	(D2)
(T3)	(S3)	(D3)

Advice: There are 3 questions based on this example; it is worth spending some time to get all the details.

32. Check the correct values for the following cells in the table for the packet received by the router R in the right of the figure (interface 13.0.0.3) when H2 issues a DNS request to 1.1.1.1.

A) Packet header:
T1 = Ethernet; S1 = MAC10; D1 = MAC9;
T2 = IP; S2 = 13.0.0.1; D2 = 1.1.1.1;
T3 = S3 = D3 = none

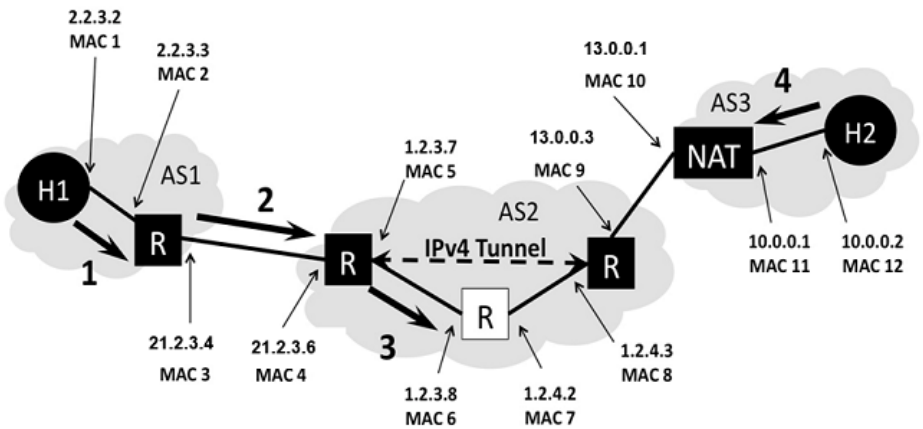
B) Packet header:
T1 = Ethernet; S1 = MAC10; D1 = MAC9;
T2 = IP; S2 = 10.0.0.2; D2 = 1.1.1.1;
T3 = S3 = D3 = none

C) Packet header:
T1 = Ethernet; S1 = MAC12; D1 = MAC9;
T2 = IP; S2 = 10.0.0.2; D2 = 1.1.1.1;
T3 = S3 = D3 = none

D) Packet header:
T1 = Ethernet; S1 = MAC10; D1 = MAC9;
T2 = IP; S2 = 13.0.0.1; D2 = 13.0.0.3;
T3 = IP; S3 = 10.0.0.2; D3 = 1.1.1.1

E) Packet header:
T1 = Ethernet; S1 = MAC8; D1 = MAC5;
T2 = IP; S2 = 13.0.0.1; D2 = 1.1.1.1;
T3 = S3 = D3 = none

Respuesta única (U).




```
H2> traceroute H1
```

33. Check the correct list of router interfaces the traceroute command will show as output.
Be aware that traffic between H1 and H2 goes through the tunnel as shown in the figure.

A) 10.0.0.1 – 13.0.0.1 – 13.0.0.3 – 1.2.4.3 – 1.2.3.7 – 21.2.3.6 – 21.2.3.4 – 2.2.3.3 – 2.2.3.2

B) 10.0.0.2 – 10.0.0.1 -13.0.0.3 – 21.2.3.4 – 2.2.3.2

C) 10.0.0.1 – 13.0.0.3 – 1.2.3.7 – 21.2.3.4 – 2.2.3.2

D) 10.0.0.1 – 13.0.0.3 – 1.2.4.2 – 1.2.3.7 – 21.2.3.4 – 2.2.3.2

Multirespuesta (M).

```
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         10.8.0.5        0.0.0.0         UG    50     0        0 tun0
0.0.0.0         192.168.1.1     0.0.0.0         UG    100    0        0 eno1
10.8.0.1        10.8.0.5        255.255.255.255 UGH   50     0        0 tun0
10.8.0.5        0.0.0.0         255.255.255.255 UH    50     0        0 tun0
147.83.0.0      10.8.0.5        255.255.0.0     UG    50     0        0 tun0
147.83.30.75    192.168.1.1     255.255.255.255 UGH   100    0        0 eno1
169.254.0.0     0.0.0.0         255.255.0.0     U     1000   0        0 eno1
192.168.1.0     0.0.0.0         255.255.255.0   U     100    0        0 eno1
192.168.1.1     0.0.0.0         255.255.255.255 UH    100    0        0 eno1
```

34. Check the correct conclusions we may extract from the previous routing table.

A) The IP address of the host where the command was executed is 147.83.30.75

B) Interface eno1 is wrong

C) The IP address of the host where the command was executed is 192.168.1.1

D) The local end of the tunnel interface is 10.8.0.1

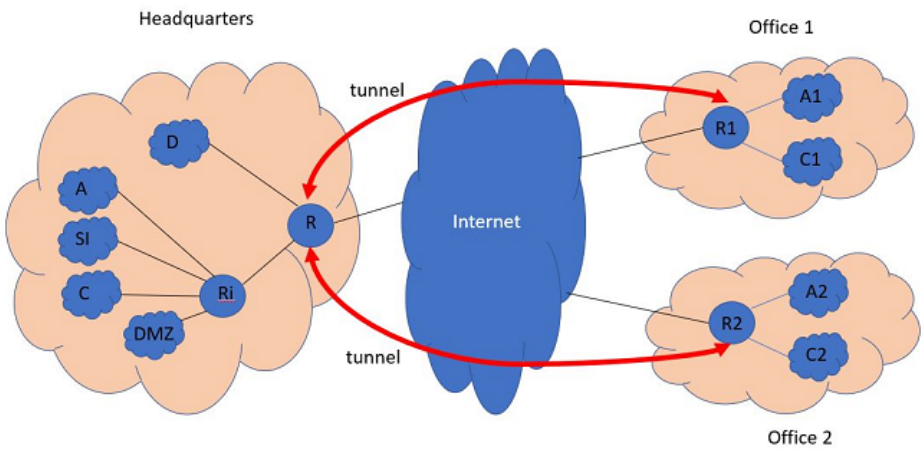
E) The local end of the tunnel interface is 10.8.0.5

F) The local network is 192.168.1.0/26

G) The block of addresses 147.83.0.0/16 is routed through the tunnel

---

Multirespuesta (M).



35. All routers run RIPv2. The headquarters and the two remote offices form a single network (using the tunnels). Check the correct sentences.

A) R receives an update from R1 with the routes to A1, C1, A2 and C2 when split horizon is enabled.

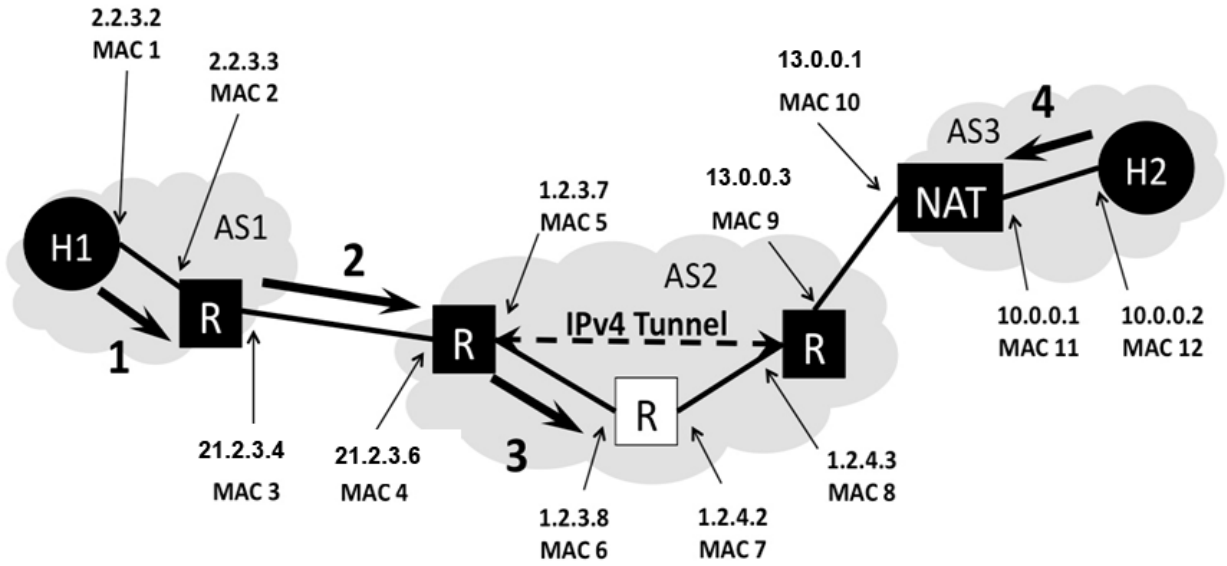
B) R receives an update from R1 with the routes to A1 and C1 when split horizon is enabled.

C) Some of the routes R will send in the updates to R1 and R2 are:
A with metric 2
D with metric 1

D) Being R the main router it will announce all the routes (A, C ,D, SI, DMZ, A1, C1, A2, C2) to R1, R2 and Ri if split horizon is enabled.

E) R will announce the routes A, C ,D, SI, DMZ, A1 and C1 to R2 if split horizon is enabled.

Respuesta única (U).



36. H1 sends a UDP datagram to H2 with a TTL value of 64.
Network AS2 includes the configuration of an IP tunnel (see figure) and the traffic between H1 and H2 goes through the tunnel.
Check the correct sentences:

A) H2 receives the datagram with TTL = 60

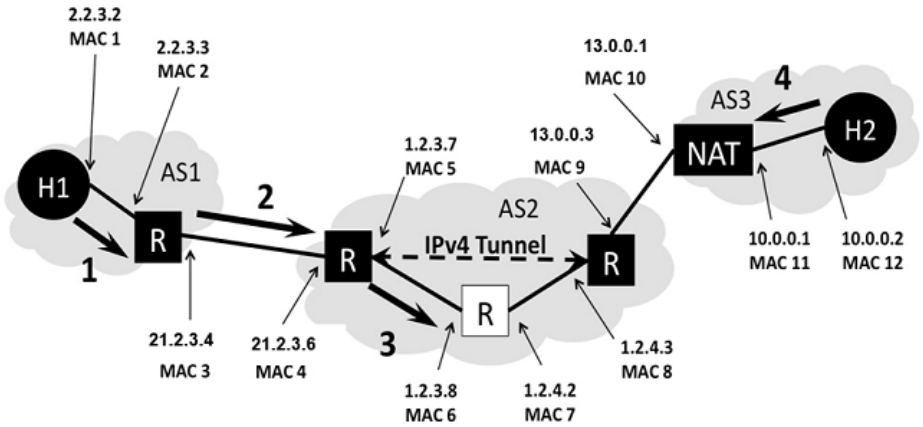
B) H2 receives the datagram with TTL = 59

C) H2 receives the datagram with TTL = 64

D) H1 receives an error message because the datagram cannot go through the tunnel

---

Multirespuesta (M).



37. All networks in the figure have an MTU of 1500 bytes.
Network AS2 includes the configuration of an IP tunnel (see figure) and the traffic between H1 and H2 goes through the tunnel.
When H2 performs an MTU path discovery, check the correct sentences.

A) The router with NAT cannot accept MTU path discovery datagrams

B) The result is MTU = 1500 as all the networks accept datagrams of 1500 bytes

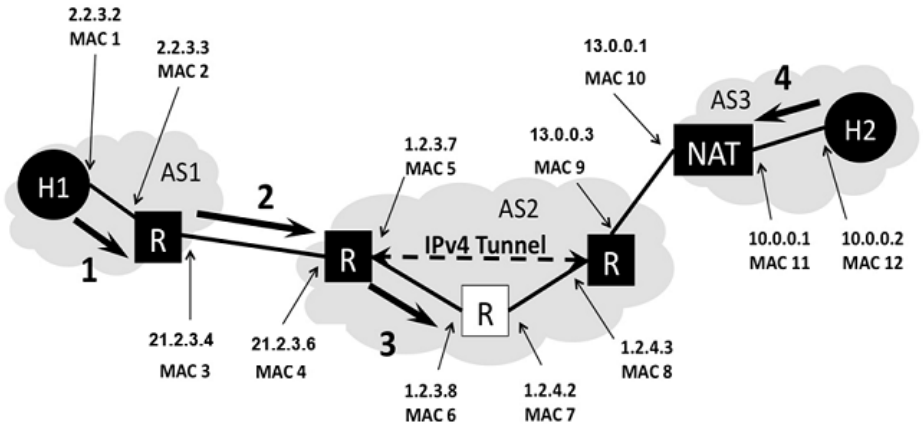
C) H2 will receive an ICMP error message from the router with IP = 1.2.4.2

D) H2 will receive an ICMP error message from the router with IP = 13.0.0.3

E) H2 will receive an ICMP error message from the router with IP = 13.0.0.1

F) H2 will receive an ICMP error message from the router with IP = 13.0.0.3 and another from IP = 1.2.3.7

Multirespuesta (M).



38. H1 and H2 establish a TCP connection with a MSS of 1460 bytes. Segments go through the tunnel (see figure). All the networks have an MTU of 1500 bytes and the datagrams carry flag DF=0. The TCP connection is already established. The figure shows part of the path a data segment from H1 follows towards H2 (1, 2, 3).
Check the correct sentences referred to a data segment that goes from H1 to H2.

A) At 1, the data segment may carry 1460 bytes of data and the IP packet will have a length of 1500 bytes.

B) At 1, the data segment may carry a maximum of 1440 bytes of data.

C) At link 2 the data segment will carry a maximum of 1440 bytes of data.

D) The application PDU cannot exceed 1460 bytes.

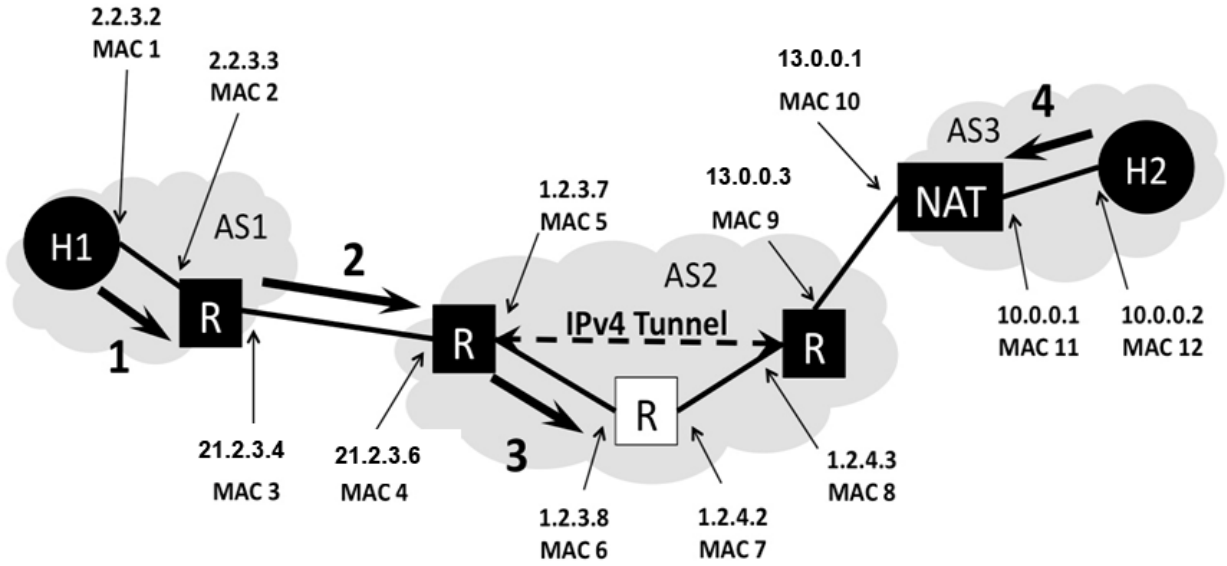
E) At 1, if the segment has the maximum allowed length, there will be two segments in 2 because fragmentation is needed.

F) If segment in 1 has the maximum allowed length, there will be two segments in 3 because fragmentation is needed.

G) If fragmentation occurs, H2 will receive two datagrams for the data segment.

H) If fragmentation occurs, once H2 has received the data segment it will send an ACK segment (4).

Multirespuesta (M).



39. Consider that H1 and H2 are shut down and get their configuration using DHCP. Check the correct sentences.

A) When H1 is turned on, the first packet it sends (1) is a HELLO message.

B) When H1 is turned on, the first packet it sends (1) is a broadcast IP datagram.

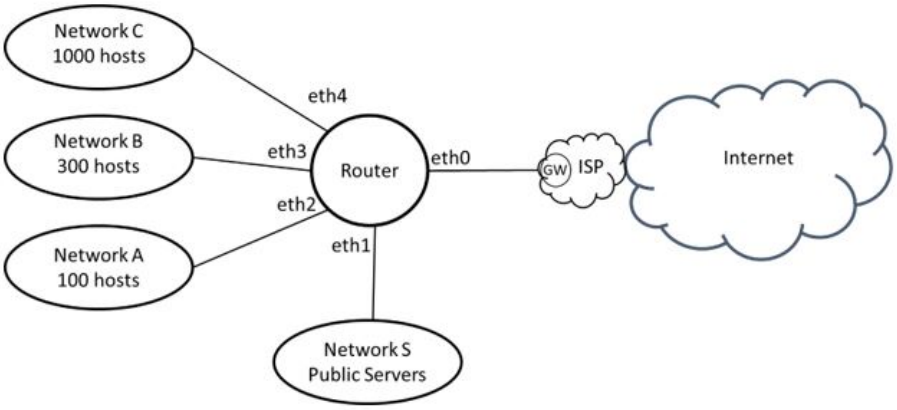
C) When H1 is turned on, the first packet it sends (1) is a DHCP Discovery message.

D) When H1 is turned on, the first it sends (1) is an ARP Request message.

E) When H1 is turned on, the first packet it sends (1) is an ARP Request message.

F) When H1 is turned on, the first packet it sends (1) is the response to the DHCP configuration received from the router.

Multirespuesta (M).



Rule	Iface	In/Out	IP src	src port	IP dst	dst port	Protocol	Action
1	eth0	in	any	<1024	A,B,C	>=1024	TCP	Accept
2	eth0	out	A,B,C	>=1024	any	<1024	TCP	Accept
3	eth0	in	any		any		IP	Accept
4	eth0	out	any		any		IP	Accept
5	eth2	out	B,C		any		IP	Deny
	eth0	any	any	any	any	any	any	Deny

40. Check the correct sentences for the ACL table.

A) Rules 1 and 2 allow access to servers in networks A, B and C

B) Rule 2 allow clients in A, B and C to send to external servers (in the Internet)

C) Rule 2 allow clients in networks A, B and C to send to both external ans internal (S) servers

D) Rule 2 allow clients in networks A, B and C to receive from external servers (in the Internet)

E) Rules 3 and 4 are incomplete and they are not executed

F) ICMP messages to and from external devices are allowed for all devices in A, B, C and S

G) Response ICMP messages are allowed for all the devices except for servers in network S

H) Any communication between networks A and C is blocked