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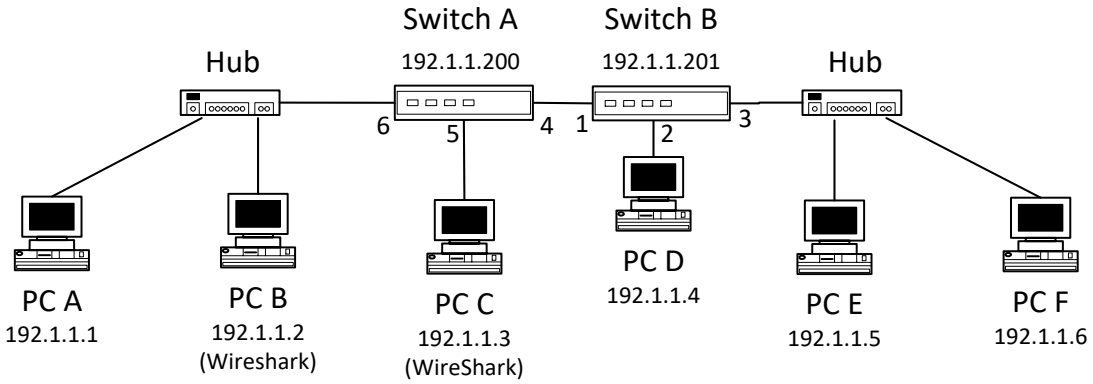
DEPARTAMENTO DE ELETRÓNICA, TELECOMUNICAÇÕES E INFORMÁTICA

LICENCIATURA EM ENGENHARIA DE COMPUTADORES E INFORMÁTICA

REDES DE COMUNICAÇÕES 1

SELF-EVALUATION

1. Consider the following network. The figure shows the assigned IP addresses to all network elements (with the netmask 255.255.255.0). The figure also indicates the number of the ports used on switches. Both PC B and PC C have WireShark permanently capturing all packets. The hub spreads everything it receives through all ports, so PC B can observe everything that traverses the links on the left part of switch A.



The current MAC address table of Switch A is:

VID	VLAN Name	MAC Address	Port	Type
1	default	00-0A-F4-3B-80-A5	6	Dynamic
1	default	00-0A-F4-3B-80-B0	4	Dynamic
1	default	00-0A-F4-42-CC-34	6	Dynamic
1	default	00-0A-F4-45-2D-23	4	Dynamic
1	default	00-0A-F4-45-2E-A7	5	Dynamic
1	default	00-0A-F4-46-2F-B5	4	Dynamic
1	default	00-1C-F0-A8-BD-C4	CPU	Self
1	default	00-1C-F0-A9-12-F3	4	Dynamic

The current MAC address table of Switch B is:

VID	VLAN Name	MAC Address	Port	Type
1	default	00-0A-F4-3B-80-A5	1	Dynamic
1	default	00-0A-F4-3B-80-B0	3	Dynamic
1	default	00-0A-F4-42-CC-34	1	Dynamic
1	default	00-0A-F4-45-2D-23	3	Dynamic
1	default	00-0A-F4-45-2E-A7	1	Dynamic
1	default	00-0A-F4-46-2F-B5	2	Dynamic
1	default	00-1C-F0-A8-BD-C4	1	Dynamic
1	default	00-1C-F0-A9-12-F3	CPU	Self

In a run of a ping command on PC A to PC F, one of the ICMP packets captured on PC B was:

```
⊞ Frame 4: 118 bytes on wire (944 bits), 118 bytes captured (944 bits)
⊞ Ethernet II, Src: 00:0a:f4:3b:80:b0 (00:0a:f4:3b:80:b0), Dst: 00:0a:f4:3b:80:a5
⊟ 802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 3
    000. .... .... .... = Priority: Best Effort (default) (0)
    ...0 .... .... .... = CFI: Canonical (0)
    .... 0000 0000 0011 = ID: 3
    Type: IP (0x0800)
⊟ Internet Protocol Version 4, Src: 192.1.1.6 (192.1.1.6), Dst: 192.1.1.1 (192.1.1
    Version: 4
    Header length: 20 bytes
  ⊞ Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-ECT (N
    Total Length: 100
    Identification: 0x0006 (6)
  ⊞ Flags: 0x00
    Fragment offset: 0
    Time to live: 255
    Protocol: ICMP (1)
  ⊞ Header checksum: 0x3989 [correct]
    Source: 192.1.1.6 (192.1.1.6)
    Destination: 192.1.1.1 (192.1.1.1)
⊞ Internet Control Message Protocol
```

1.1. With the provided information, indicate and justify the Ethernet addresses of all switches and all PCs.

R: With the switching table, it is easy to get PC C connected to port 5 of switch A and PC D connected to port 2 of switch B. Then, it is required to differentiate between A and B, E and F. Since the ping packet given is between A and F, we can get the addresses of them. Therefore, B and E are the ones that are missing in the port 6 of switch A and port 3 of switch B, respectively.

1.2. What type of ICMP packet is the one shown above? Justify.

R: ICMP Reply: the source is PC F.

2. Consider the previous network. On each of the following experiments (2.1, 2.2, 2.3 and 2.4), consider an initial state where all MAC address tables and all ARP tables are empty (remember that both PC B and PC C have WireShark permanently capturing all packets). Assume that the execution of a ping command generates 5 ICMP Echo Request messages both on PCs and on switches. The hub spreads everything it receives through all ports, so PC B can observe everything that traverses the links on the left part of switch A. For each of the following experiments, indicate which packets are captured on PC B and on PC C:

2.1. Running a ping command on PC D to the address 192.1.1.3.

R: PC B observes the first packet – ARP Request (broadcast and switch flooding); PC C observes everything.

2.2. Running a ping command on PC A to the address 192.1.1.200.

R: PC B observes all packets; PC C observes the first packet (switch rebroadcasts the ARP Request broadcast packet).

2.3. Running a ping command on PC F to the address 192.1.1.4.

R: PC B and PC C observe the first packet (switch rebroadcasts the ARP Request broadcast packet).

2.4. Running a ping command on Switch A to the address 192.1.1.10.

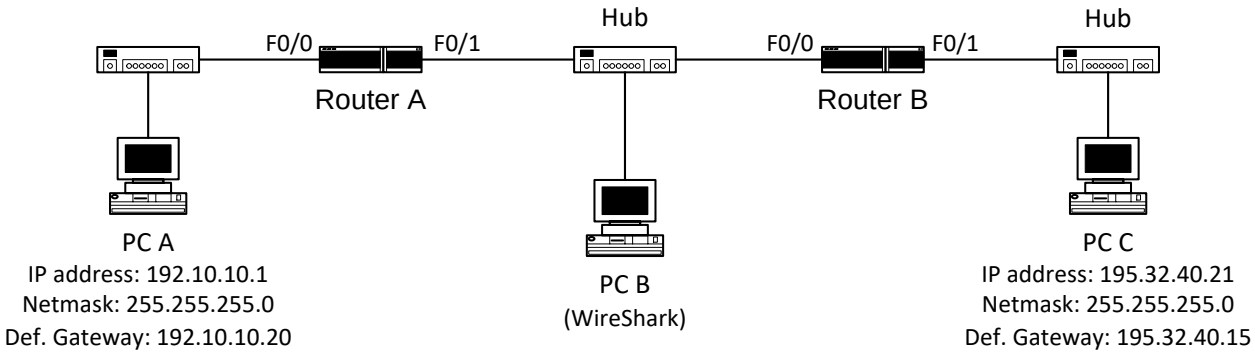
R: PC B and PC C observe the ARP Request packets.

3. Starting on the initial state (where all MAC address tables and all ARP tables are empty), consider that experiments 2.1, 2.2, 2.3 and 2.4 were all run. Indicate and justify the resulting MAC address table of Switch A.

R: 2.1: PC D port 4; PC C port 5.
2.2: PC A port 6.

2.3: PC D port 2; PC F port 3.
2.4: Clean.

4. Consider the network shown in the following figure. The figure shows all IP addressing information of PC A and PC C and the name of the interfaces used on the routers. Routers have static routing. PC B is used only to capture packets through WireShark (and it is why it is connected through a hub, to be able to observe of packets in that link).



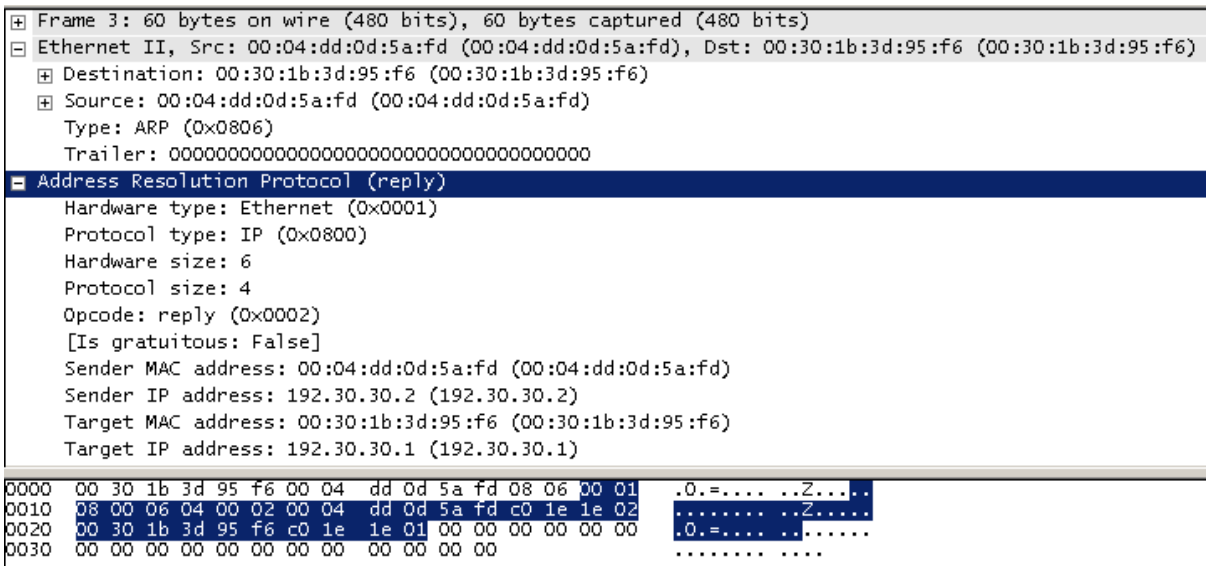
The current IP routing table of Router A is:

```
C    192.10.10.0/24 is directly connected, FastEthernet0/0
C    192.30.30.0/24 is directly connected, FastEthernet0/1
S    195.32.40.0/24 [1/0] via 192.30.30.2, FastEthernet0/1
```

The current IP routing table of Router B is:

```
R    192.10.10.0/24 [1/0] via 192.30.30.1, FastEthernet0/0
C    192.30.30.0/24 is directly connected, FastEthernet0/0
C    195.32.40.0/24 is directly connected, FastEthernet0/1
```

In a run of a ping command on PC A to PC C, one of the packets captured on PC B was:



4.1. With the provided information, indicate and justify the IP addresses of all router interfaces.

R: Router A: 192.10.10.20, 192.30.30.1; Router B: 195.32.40.15, 192.30.30.2.

4.2. What type of packet is the one shown above? Give an explanation for the reason why this packet was captured.

R: ARP Reply. ARP between routers to get the physical address of router B. ARP Request (Router A to Router B); ARP Reply (Router B to Router A).

5. Consider the previous network. Assume that the execution of a ping command generates 5 ICMP Echo Request messages both on PCs and on routers. Assume also that the ARP tables of all PCs and all routers are complete. On each of the following experiments, indicate which ARP and ICMP packets are captured on PC B (for the ICMP packets, indicate the IP origin and destination addresses):

5.1. Running a ping command on PC A to the address 192.10.10.20.

R: Clean.

5.2. Running a ping command on PC A to the address 192.30.30.1.

R: Clean.

5.3. Running a ping command on PC A to the address 192.30.30.10.

R: ARP Requests.

5.4. Running a ping command on PC A to the address 192.30.30.2.

R: ICMP Requests and Replies (PC A - Router B interface).

5.5. Running a ping command on PC A to the address of PC C.

R: ICMP Requests and Replies (PC A – PC C).

5.6. Running a ping command on Router A to the address of PC C.

R: ICMP Requests and Replies (RA interface – PC C).

6. Consider the previous network. Consider that you run ping commands on PC A. For each of the following alternatives, indicate a possible ping command whose run generates the following answers:

6.1. `Reply from 192.30.30.2: TTL expired in transit.`

R: ping PC C with TTL 2.

6.2. `Reply from 192.10.10.20: Destination host unreachable.`

R: ping 192.40.40.1 as example (Router A has no route to this network).

6.3. `Request timed out.`

R: ping 192.30.30.3 as example (Router A sends ARP Requests with no reply).

7. Consider the previous network again. Consider that PCA has now only a private address, 192.168.1.1 with a default gateway to the router 192.168.1.254. With a pool for NAT public addressing of 193.1.1.128/29 to be used by Router A for the communication to the outside (from its interface F0/1), answer as true or false:

7.1. The NAT pool has 16 addresses. F

7.2. A translation table in the router can be: F

```
Inside global | inside local | outside global | outside local
193.1.1.139 | 192.168.1.1 | 195.32.40.15 | 195.32.40.15
```

7.3. A translation table in the router can be: F

```
Inside global | inside local | outside global | outside local
192.168.1.1 | 192.168.1.1 | 195.32.40.15 | 195.32.40.15
```

7.4. A translation table in the router can be: F

```
Inside global | inside local | outside global | outside local
193.1.1.131 | 193.1.1.131 | 195.32.40.15 | 195.32.40.15
```

7.5. A translation table in the router can be: T

```
Inside global | inside local | outside global | outside local
193.1.1.131 | 192.168.1.1 | 195.32.40.15 | 195.32.40.15
```

7.6. With NAT/PAT only 8 PCs can reach the Internet. F

8. Still in the previous network and with the PC A in a private network, 1) is it possible to allocate IPs through DHCP? Yes. 2) What can be the pool of addresses? 192.168.1.1 - 192.168.1.100 as example. 3) What is the source address used by the PC A to contact the DHCP server? 0.0.0.0 (no address).

9. Considering IPv6 in the previous network, answer as true or false:

9.1. PC A has always a local IPv6 address FE80::/10. T

9.2. PC A has always a global IPv6 address, such as 2001::/16. F

9.3. PC A can have an IPv6 address without the help of the router. T

9.4. PC A can have several global IPv6 addresses. T

9.5. PC A needs its MAC address to generate the local IPv6 address. F

9.6. PC A needs its IPv4 address to generate the local IPv6 address. F