

Universidad de León
Degree on Computer Science and Engineering
Course on Computer Networks

CN Pro Homework

Administrative details about this homework are published in the agora

The internetwork on fig. 1 was used in Lab B6 for the practicals on the IP protocol, this year. In the exercises that follow, we'll use it for improving our grasp about IP and OSPF.

Assume that OSPF has set routers with a set of routes that provide full connectivity to stub networks via transit networks by also avoiding any routing loops. Specifically, OSPF has set router R₁ to avail of **two routes** that ultimately lead to the stub network named VLAN 909. The routing table to router R₁ follows:

```
# route -n
Kernel IP routing table
Destination      Gateway         Genmask        Flags Metric Ref    Use Iface
a. 0.0.0.0         192.168.1.1    0.0.0.0        UG    0      0      0 eno1
b. 192.168.1.0    0.0.0.0        255.255.255.0  U     0      0      0 eno1
c. 192.168.2.0    0.0.0.0        255.255.255.128 U     0      0      0 enp1s0.202
d. 192.168.2.128  0.0.0.0        255.255.255.128 U     0      0      0 enp3s0.303
e. 192.168.3.128  0.0.0.0        255.255.255.192 U     0      0      0 enp1s0.707
f. 192.168.3.0    192.168.2.130  255.255.255.192 UG    0      0      0 enp3s0.303
g. 192.168.3.240  192.168.2.130  255.255.255.240 UG    20     0      0 enp3s0.303
h. 192.168.3.224  192.168.2.130  255.255.255.240 UG    20     0      0 enp2s0.202
i. 192.168.3.224  192.168.2.2    255.255.255.224 UG    1      0      0 enp2s0.202
```

Exercise 1. Read the IP numbering plan included in fig. 1 and demonstrate that the IP blocks to networks VLAN 606 and VLAN 909 are joinable.

Exercise 2. On the network diagram, the route named ROUTE 1 leads to VLANs 606 and 909 from R₁.

- a. Identify this route (Or, maybe routes) on the routing table to R₁ by using their label (Red letter) and explain their meaning.
- b. What's the value of metric that OSPF set to the preceding route to VLAN 909? (Metric, cost or priority are interchangeable names)

Exercise 3. On the network diagram, the route named ROUTE 2 leads to VLANs 909 and 606 via R₃.

- a. Identify this route (Or, maybe routes) on the routing table to R₁ by using their label (Red letter) and explain their meaning.

- b. What's the value of metric that OSPF set to the preceding route to VLAN 909, or an aggregation thereof? (Metric, cost or priority are interchangeable names)

Exercise 3. What would be the result of the following command, executed in R₁? Do this calculation by using ipcalc, for example. In other words, if a packet is received by R₁ which destination is 192.168.3.241, what would be its next hop and interface, according to the present contents of the routing table? Notice that field metric has values 1 and 20 assigned to the two routes that will eventually lead to host 192.168.3.241.

```
# ip route get 192.168.3.241
```

Exercise 4. How would you experimentally demonstrate in Lab B6 that your answer holds?

Exercise 5. How can the metric field of a routing entry be set, as it were, manually?

Exercise 6. How can the metric field of a routing entry be set, as it were, programmatically (In C, for instance)?

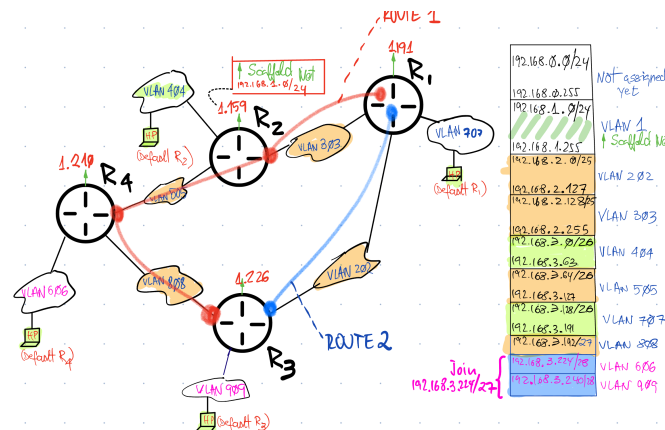


Figure 1. Internetwork used in Lab B6 for practicals on IP

Exercise 7. Make a program that identifies the fifth router on the path to 8.8.8.8.

Exercise 8. Make a program that calculates the join of two consecutive, same-sized IP blocks.

Exercise 9. Calculate the probability that an IP packet arrives at its destination successfully, i.e., without undergoing any error along the path from sender to receiver. The packet length is 1000 bits and the BER (Bit-error rate) of all of the intervening links is 0,001. Supplement this exercise so that a closed-form solution can be found.