Local and Metropolitan Area Network Design (LMAND)

Progettazione di Reti Locali e Comprensorio (PRLC)

Exercises: VLAN

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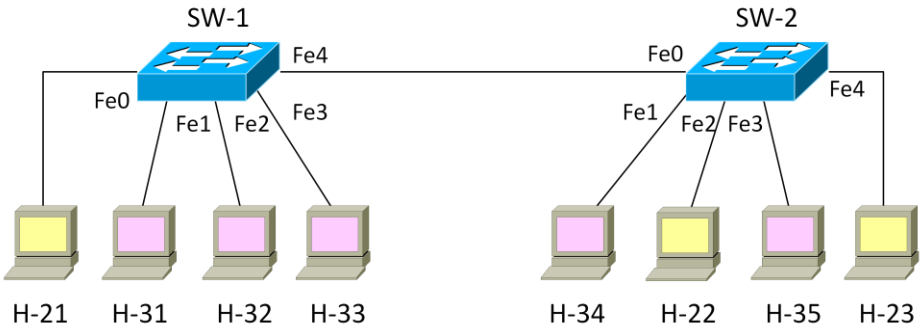
Sommario

Exercise n. 1

Referring to the network topology depicted below, configure the VLAN on the two switches (per-port assignment) in order to group all yellow hosts in the VLAN 2, and all purple hosts into VLAN 3.

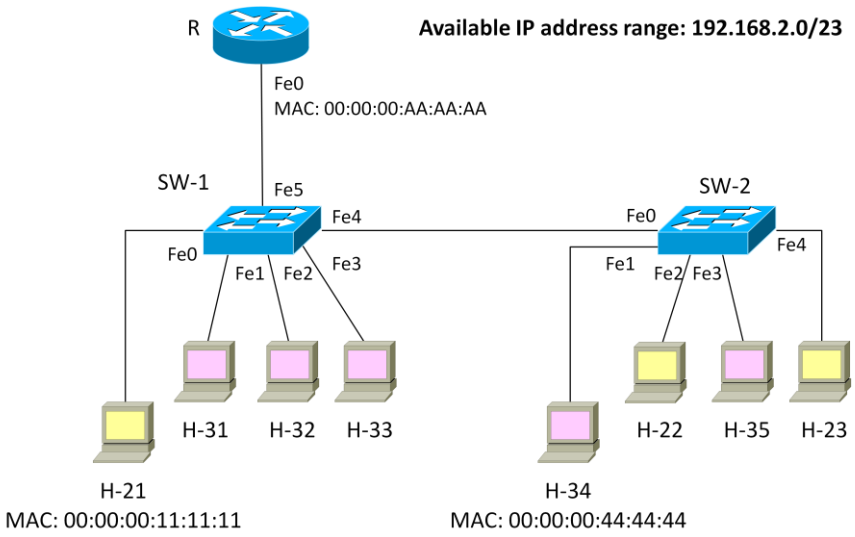


Exercise n. 2

Referring to the network topology depicted below, answer to the following questions:

1. Configure the VLAN on the two switches (per-port assignment) and on the router in order to group all yellow hosts in the VLAN 2, and all purple hosts into VLAN 3 in order to allow hosts within the same VLAN to communicate.
2. Configure the required parameters (on switches, hosts and router) in order to allow hosts belonging to different VLANs to communicate.
3. List the filtering database of the two switches when a "ping" command from Host H-21 to Host H-34 when the ping program terminates, supposing that the ARP cache of all the hosts and the router are empty and ignoring the aging time of the filtering database.

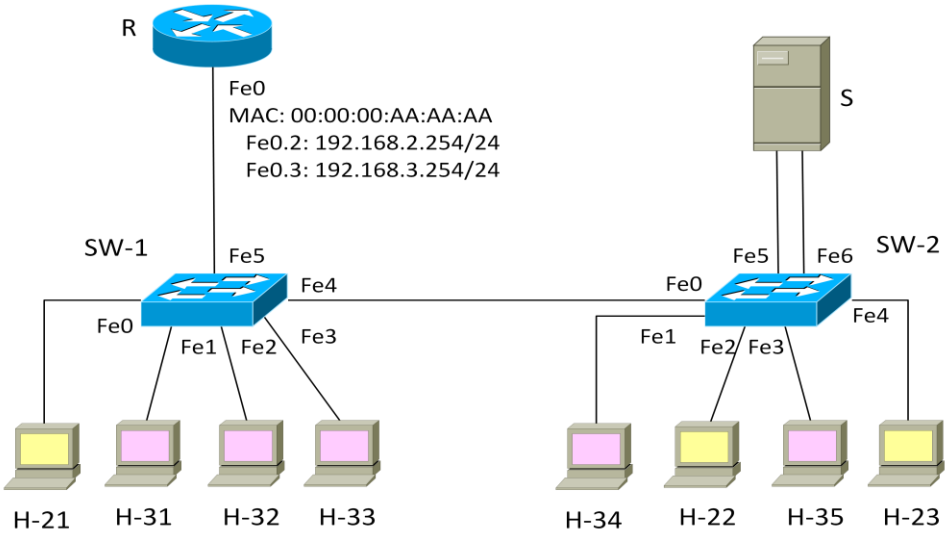
For questions 2) and 3) the user can select arbitrary IP addresses from the address range 192.168.2.0/23.



Exercise n. 3

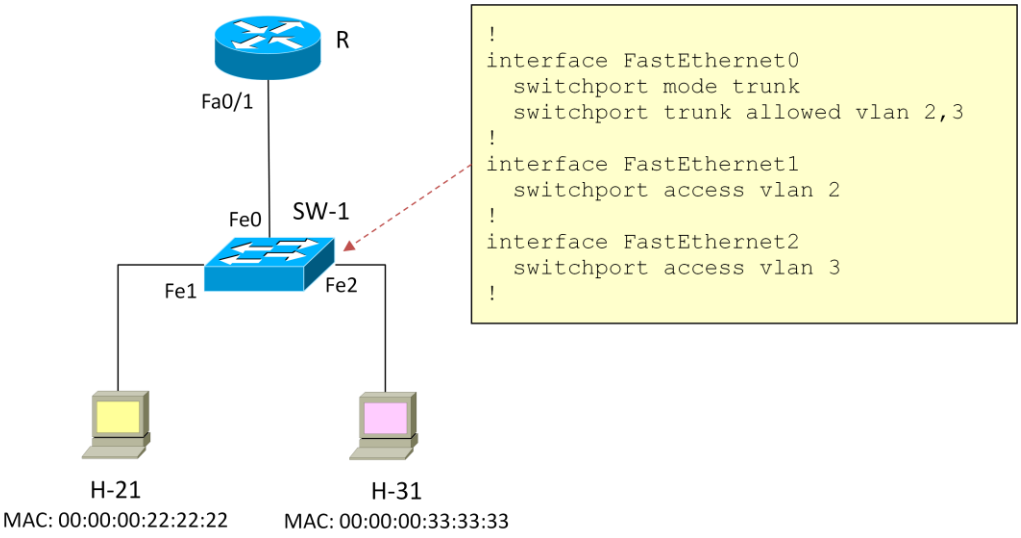
Referring to the network topology depicted below, in which a server S is connected to the switch SW-2 with two links, answer to the following questions:

1. Supposing that the server will use both links and that its network card is not 802.1Q-aware, configure the network (i.e. VLANs, IP addresses, etc) in order to allow the server to be directly reachable from the hosts belonging to the two VLANs.
2. Supposing that the server will use only one link and that its network card is fully compliant 802.1Q, configure the network (i.e. VLANs, IP addresses, etc) in order to allow the server to be directly reachable from the hosts belonging to the two VLANs.
3. Supposing that the server will use only one link and that its network card is not 802.1Q-aware, configure the network (i.e. VLANs, IP addresses, etc) in order to allow the server to be reachable from the hosts belonging to the two VLANs.
4. Supposing that the server will use both links and that its network card is fully compliant 802.1Q and supports Link Aggregation, configure the network (i.e. VLANs, IP addresses, etc) in order to allow the server to be directly reachable from the hosts belonging to the two VLANs.



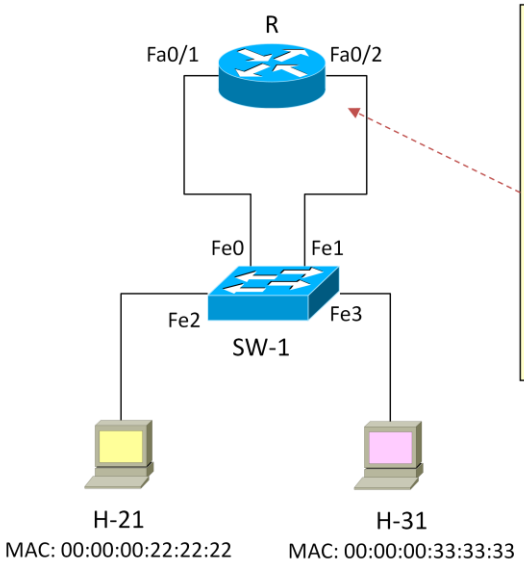
Exercise n. 4

Referring to the network topology depicted below and supposing that the switch is configured as shown in the picture, determine which port(s) on the devices H1, H2 and R1 must have the same VLAN ID of the corresponding port on the switch. Motivate your answer and explain why some port(s) do not require the same VLAN-ID on both sides.



Exercise n. 5

Referring to the network topology depicted below and supposing that the router has two “switched” interfaces connected to the switch SW-1, configured as shown in the picture, determine the configuration of the switch SW-1 required in otder to allow host H1 and H2 to communicate through the router.

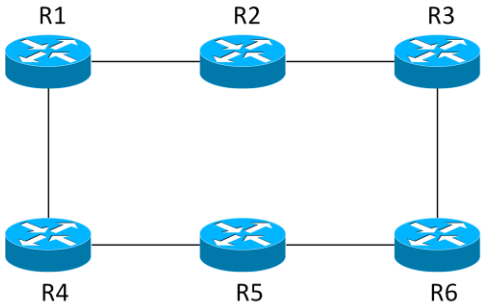



```
!
interface FastEthernet0/1
  switchport access vlan 12
!
interface FastEthernet0/2
  switchport access vlan 23
!
interface vlan 12
  ip address 192.168.2.254 255.255.255.0
!
interface vlan 23
  ip address 192.168.3.254 255.255.255.0
!
```

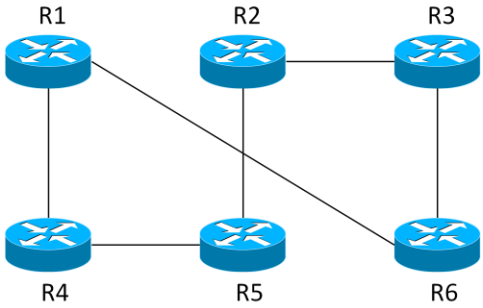
Exercise n. 6

In a research laboratory, a student has to frequently reconfigure the routers involved in some experiments according to different topologies, some indicated below. However, the student makes frequent errors in reconnecting the routers together and he would like to automate this task in order to reduce the number of times he has to deal with physical cables.

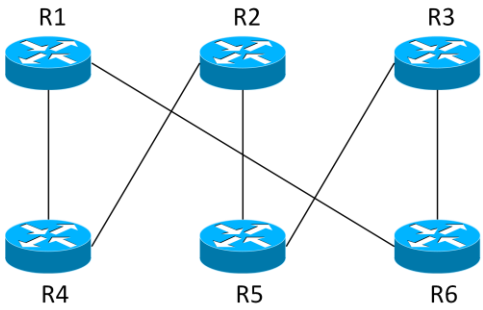
Determine a possible solution to this problem, so that the necessity to detach a cable from one router and attach it to another router is greatly reduced.



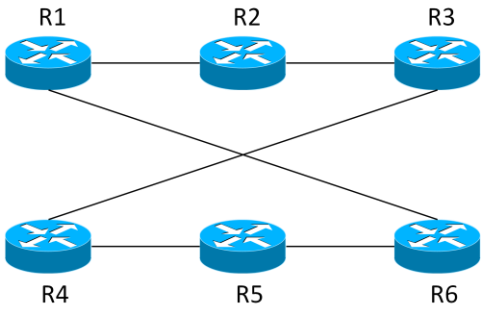
Topology 1



Topology 2



Topology 3



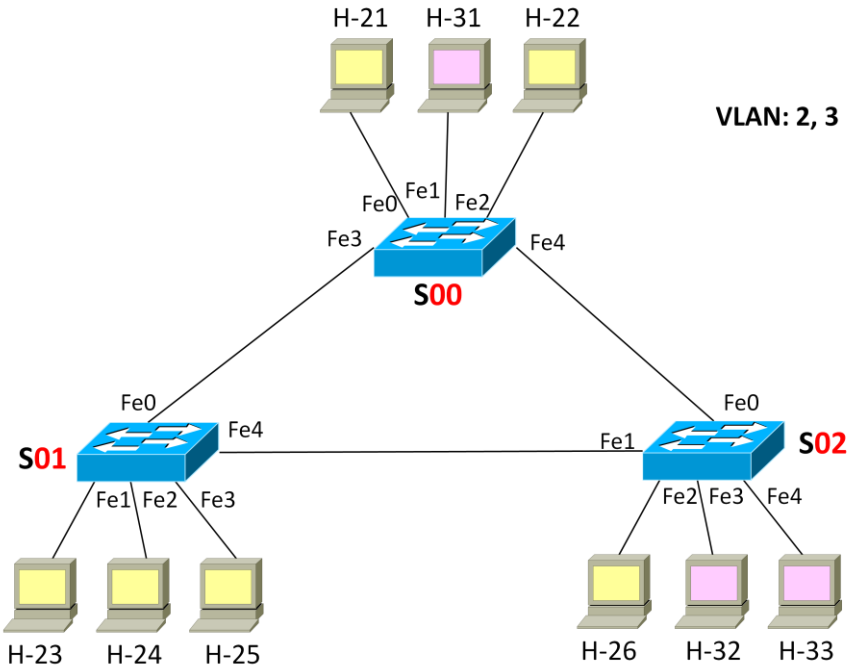
Topology 4

Exercise n. 7

Referring to the network topology depicted below, determine the final outcome of the Per-VLAN Spanning Tree Protocol (PVSTP), assuming that:

- the MAC address of the switch S*xx* is 00-00-00-AA-AA-*xx*;
- the Bridge Priority of each bridge is set to the default value, unless differently specified;
- the Port Path Cost is equal to 10 on each link, unless differently specified;
- there are 2 VLANs active on the network (VLAN-ID 2 and 3).

Repeat the exercise determining the outcome of the PVSTP in case the bridge priorities of S01 are respectively 28672 and 24578.



Solutions

Solution for exercise n. 1

The configuration of the ports on the two switches is the following:

Switch SW-1

Interface	Mode	VLAN-ID
Fe0	Access	2
Fe1	Access	3
Fe2	Access	3
Fe3	Access	3
Fe4	Trunk	2,3

Switch SW-2

Interface	Mode	VLAN-ID
Fe0	Trunk	2,3
Fe1	Access	3
Fe2	Access	2
Fe3	Access	3
Fe4	Access	2

Solution for exercise n. 2

Question 1

As long as the only requirement is communication among hosts of the same VLAN, no router is required. Therefore, the configuration of the router and of the interface Fe5 of SW-1 is irrelevant.

The configuration of the switches will be exactly the same of the previous exercise:

Switch SW-1

Interface	Mode	VLAN-ID
Fe0	Access	2
Fe1	Access	3
Fe2	Access	3
Fe3	Access	3
Fe4	Trunk	2,3

Switch SW-2

Interface	Mode	VLAN-ID
Fe0	Trunk	2,3
Fe1	Access	3
Fe2	Access	2
Fe3	Access	3
Fe4	Access	2

Question 2

The communication among hosts of different VLANs is possible only at layer 3, which means that each VLAN must be served by a router and that both the hosts within that VLAN and the router must belong to the same IP network.

We arbitrarily choose 2 different private IP ranges for the network configuration:

- Network address for VLAN 2 (yellow): 192.168.2.0/24
- Network address for VLAN 4 (purple): 192.168.3.0/24

Since the Router R must communicate with each VLAN, the router has to create two virtual interfaces on its Fe0 port, associating each interface to a different VLAN. Please note that the sub-interfaces Fe0.2 and Fe0.4 (i.e., the virtual interfaces) are created automatically on the router when multiple VLANs are created and associated to different VLAN-ID. Those interfaces will accept the IP addresses associated to the different VLANs.

Finally, the link between the router R and the switch SW-1 has to be set in trunk mode and associated to both VLANs.

Switch SW-1

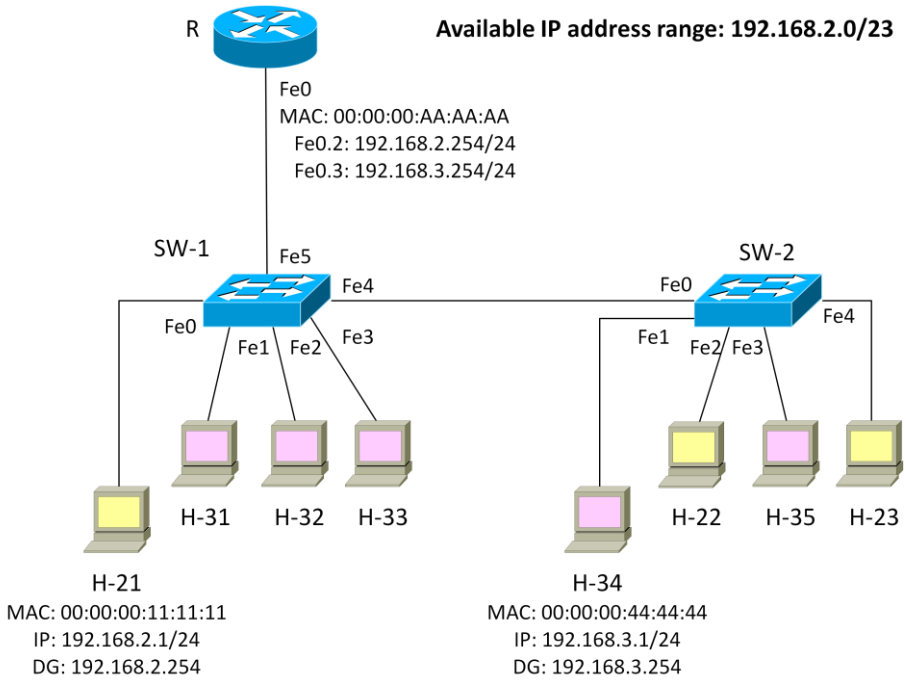
Interface	Mode	VLAN-ID
Fe0	Access	2
Fe1	Access	3
Fe2	Access	3
Fe3	Access	3
Fe4	Trunk	2,3
Fe5	Trunk	2,3

Router R

Interface	Mode	VLAN-ID	IP configuration
Fe0	Trunk	2,3	
Sub-interface Fe0.2	Access	2	192.168.2.254/24
Sub-interface Fe0.3	Access	3	192.168.3.254/24

Question 3

We assume that the configuration of the network at the IP level will be the following:



Please note how virtual interfaces will have the same MAC address of the physical interface, and therefore they appear on the network with the same identifier (although belonging to different VLANs).

The filtering database of the two switches will be the following:

Switch SW-1

MAC Address	VLAN	Interface
00:00:00:11:11:11	2	Fe0
00:00:00:AA:AA:AA	2	Fe5
00:00:00:44:44:44	3	Fe4
00:00:00:AA:AA:AA	3	Fe5

Switch SW-2

MAC Address	VLAN	Interface
00:00:00:11:11:11	2	Fe0
00:00:00:AA:AA:AA	2	Fe0
00:00:00:44:44:44	3	Fe1
00:00:00:AA:AA:AA	3	Fe0