

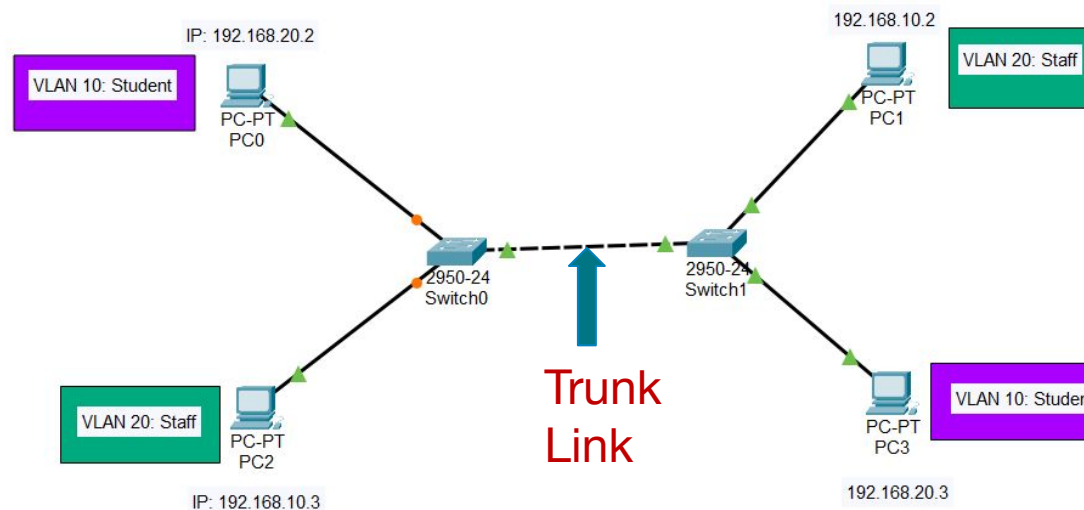


Computer Communications and Networks

Inter-VLAN Routing

Recap of Week 2

- We learned how to create VLANs to logically group devices within a network.
- Devices within the same VLAN can communicate freely, while communication between devices in different VLANs is restricted.



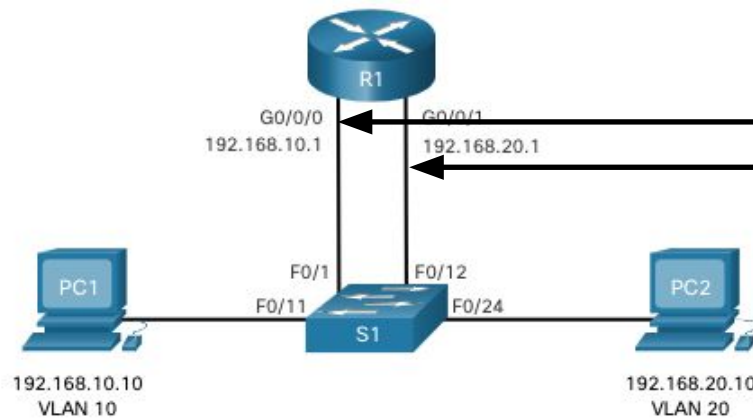
This week, we will learn to implement inter-VLAN routing to facilitate communication between VLANs.

- In Layer 2 switches, VLANs segment network devices into isolated groups, preventing direct communication between devices.
- **Inter-VLAN routing** allows communication between different VLANs within a network.
- Since VLANs are isolated by default, a Layer 3 device (**router** or **Layer 3 switch**) is required for traffic exchange.
- **Methods of Inter-VLAN Routing:**
 - **Router-on-a-Stick:** A single router interface with subinterfaces for each VLAN, using trunking to route traffic.
 - **Layer 3 Switch Routing:** A multilayer switch with SVIs (Switch Virtual Interfaces) to enable direct routing between VLANs.
 - **Legacy Routing:** Uses multiple physical router interfaces, each connected to a VLAN (less efficient).
- **Key Components: VLANs, Trunk Links, Subinterfaces, Layer 3 device.**



Legacy Inter-VLAN Routing

- Legacy inter-VLAN routing used a router with multiple Ethernet interfaces.
- Each router interface connected to a switch port in a different VLAN.
- The router acted as the default gateway for devices in each VLAN.
- This method is not scalable due to the limited number of physical interfaces on a router.
- Requiring one interface per VLAN quickly exhausts the router's capacity.
- This approach is no longer used in modern switched networks.



For two VLANs, separate links were established, connecting two ports on both the router and the switch.

Router-on-a-Stick

- Configure subinterfaces on the Router to enable routing between PC1 (VLAN 2) and PC2 (VLAN 4).
- Set up a trunk link to ensure the Router receives VLAN-tagged traffic for inter-VLAN routing.

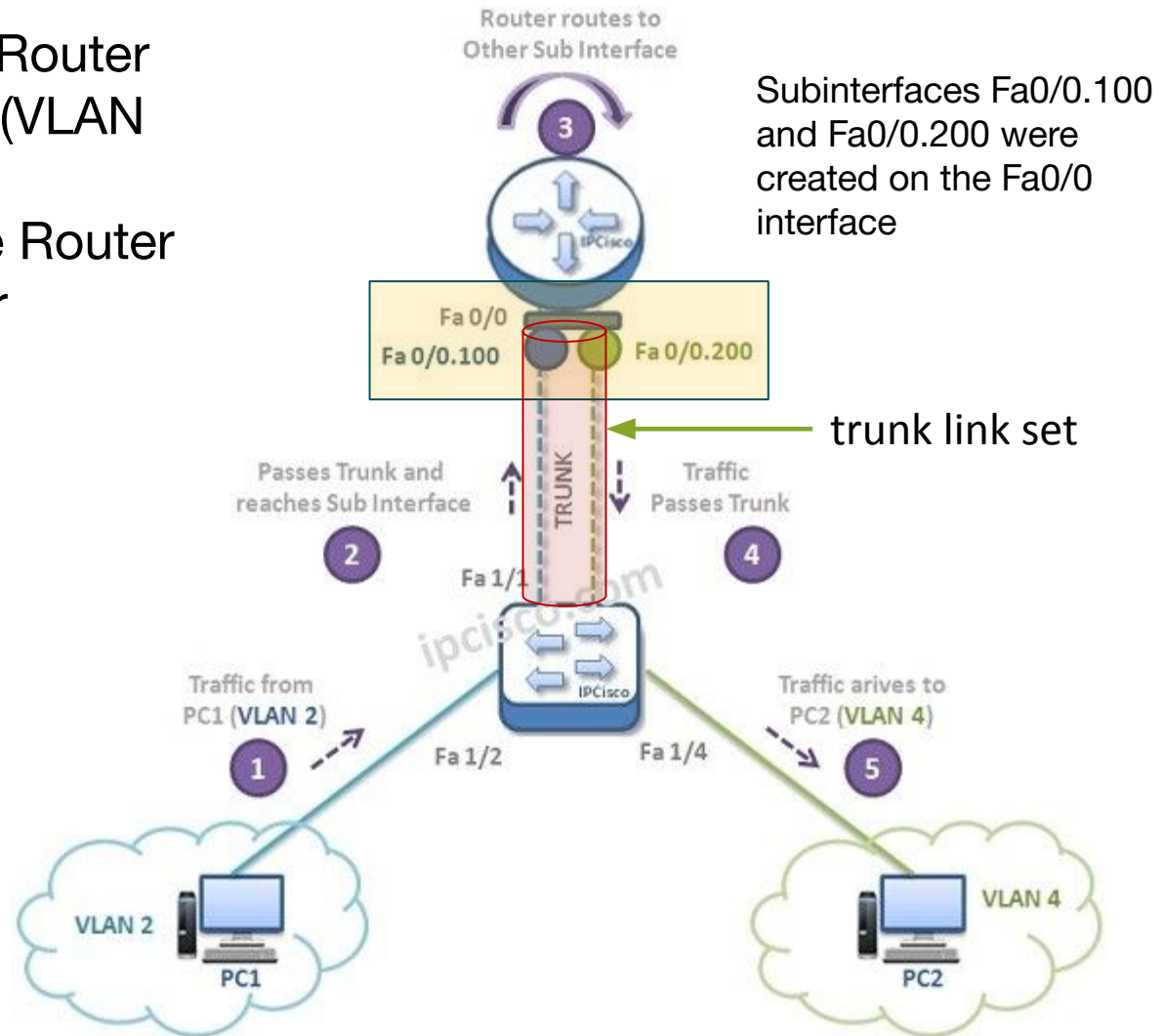
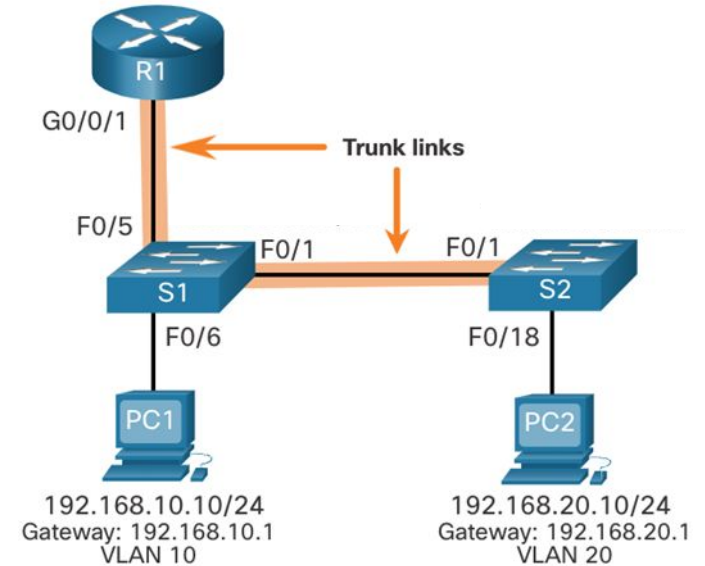


Image source: ipcisco.com



Router-on-a-Stick

- PC1 (192.168.10.10/24) is part of VLAN 10 and PC2 (192.168.20.10/24) is part of VLAN 20.
- To set up trunk links
 - In S1, Fa0/1 and Fa0/5 ports need to be set to trunk mode.
 - In S2, Fa0/1 port needs to be set to trunk mode.
- In R1, GigabitEthernet 0/0/1 interface is logically divided into two subinterfaces, as shown in the table.
 - Have you noticed any pattern in the IP addresses of the subinterfaces?
- Set PC1's default gateway to **192.168.10.1** and PC2's default gateway to **192.168.20.1**

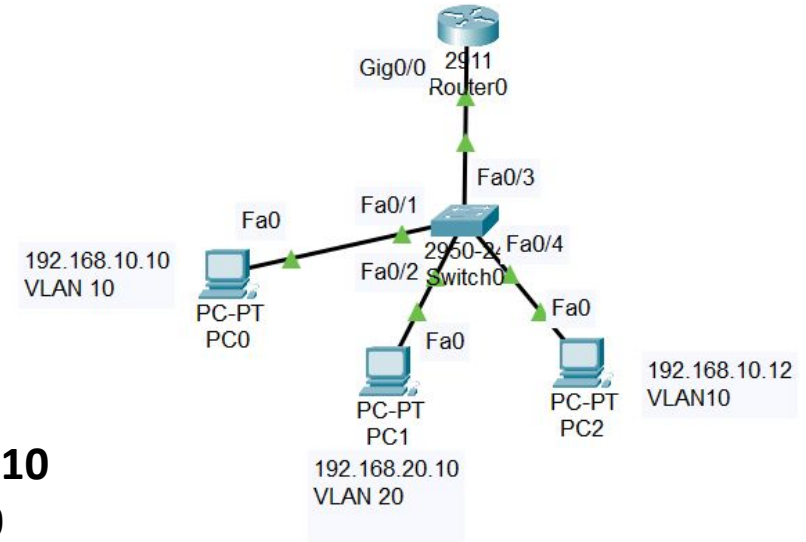


Subinterface	VLAN	IP Address
G0/0/1.10	10	192.168.10.1/24
G0/0/1.20	20	192.168.20.1/24

Image source: ipcisco.com

Consider this network

1. Create the VLANs on Switch0 and assign the correct ports to respective VLANs.
2. To create a subinterface on the router (**port Gig0/0**), first enter global configuration mode, and then execute the following commands in sequence.



Router# configure terminal

Router(config)# interface GigabitEthernet0/0.10

Router(config-subif)# encapsulation dot1Q 10

Router(config-subif)# ip address 192.168.10.1 255.255.255.0

Router(config-if)# no shutdown

Router(config-subif)# exit

Router(config)# interface GigabitEthernet0/0.20

Router(config-subif)# encapsulation dot1Q 20

Router(config-subif)# ip address 192.168.20.1 255.255.255.0

Router(config-if)# no shutdown

Router(config-subif)# exit

Image source: ipcisco.com

Commands explained

Router(config)# interface **GigabitEthernet0/0.10** → Router(config)# interface **fa0/0.10**

The interface where
the subinterface is
created

Name (number) of
the subinterface

If the router port is
fa0/0 instead of
Gig0/0, use the
command like this.

Router(config-subif)# **encapsulation dot1Q 10**

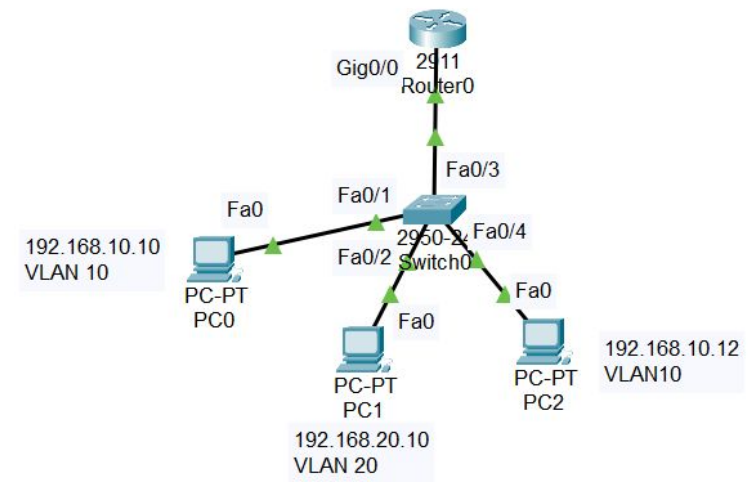
Encapsulation type

VLAN id (e.g. 10), the
VLAN this subinterface
is associated with

Router(config-subif)# ip address **192.168.10.1 255.255.255.0**

IP address assigned
to the subinterface

Subnet mask of the
IP address



Once the router sub-interfaces are configured. Update the IP configuration in the PCs by adding appropriate default gateway IP address

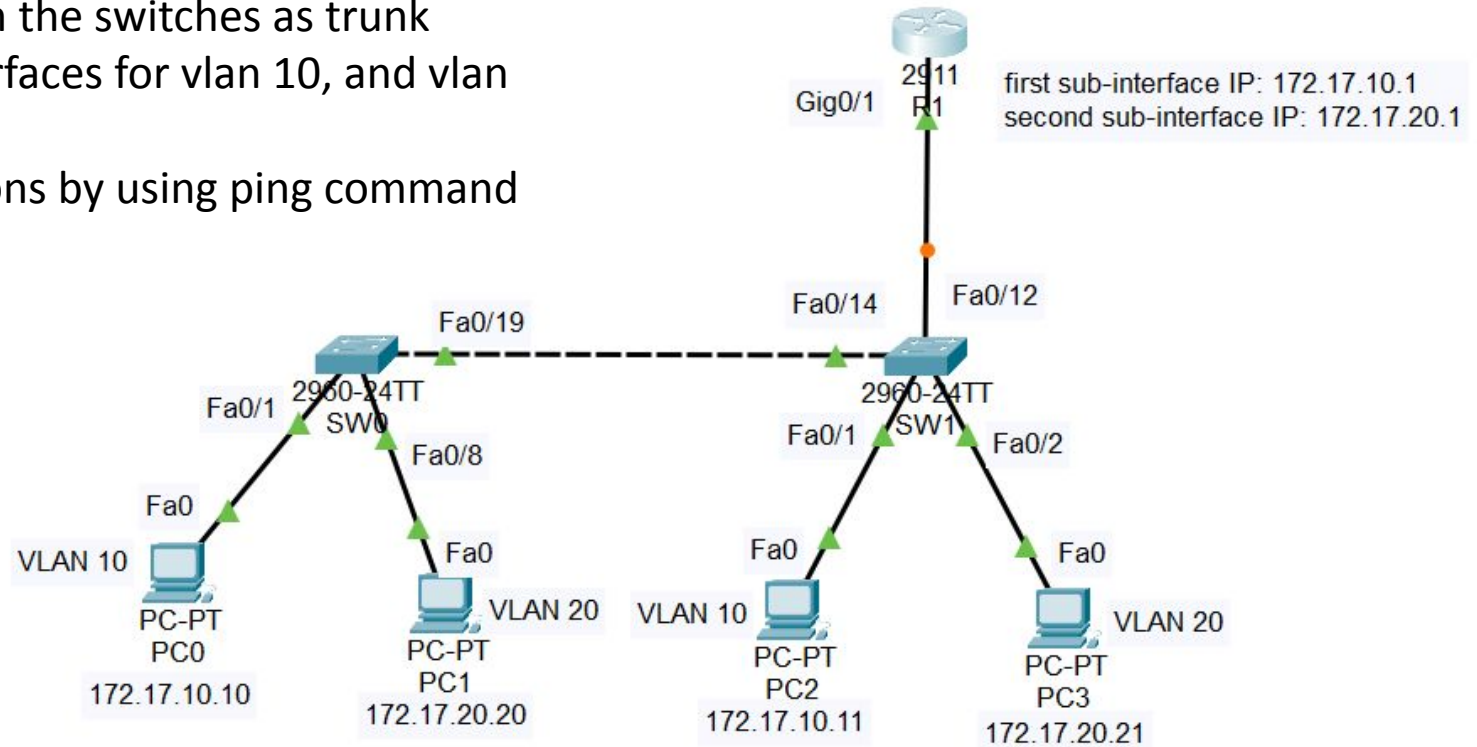
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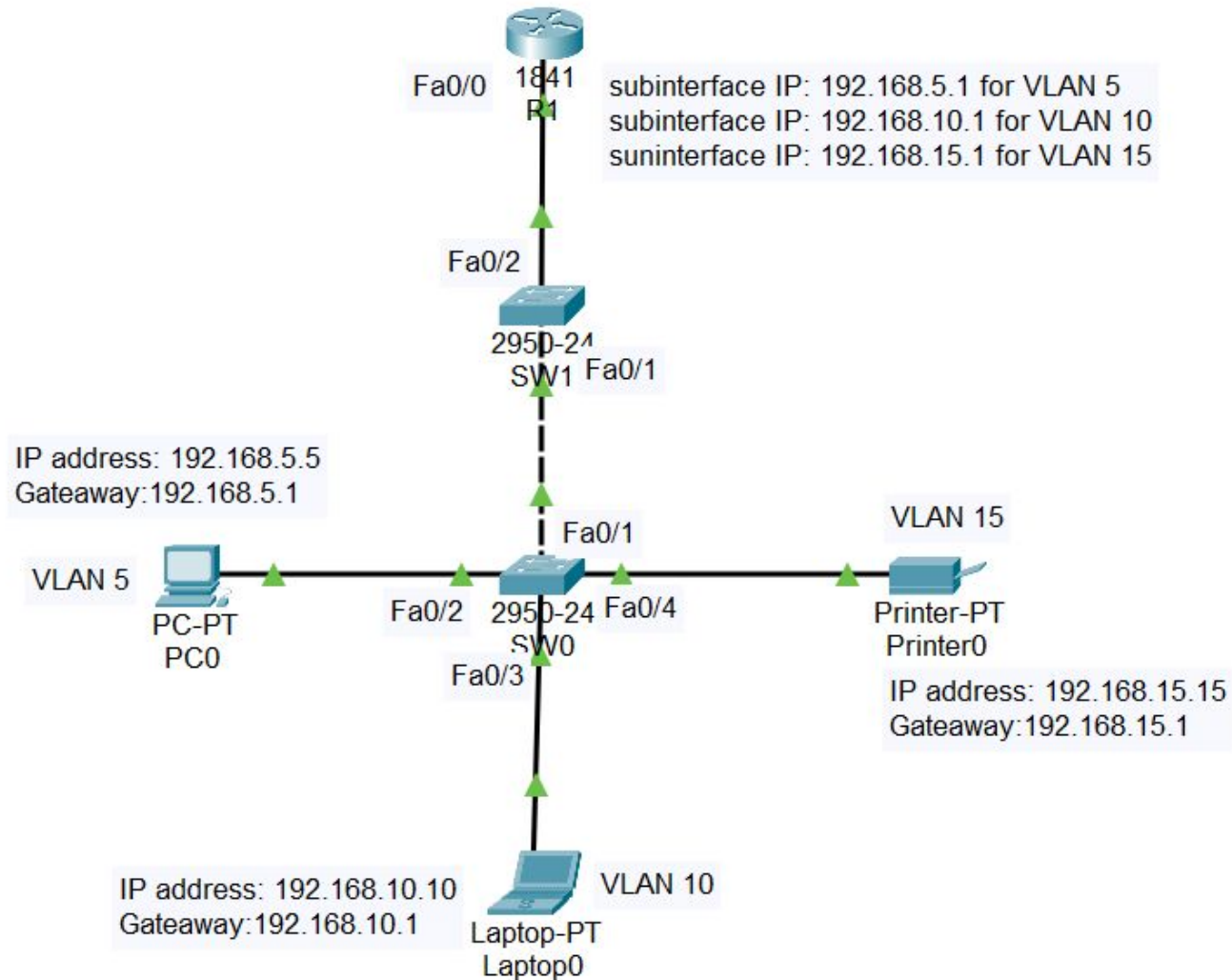
Router-on-a-Stick: Exercise 1

Instructions

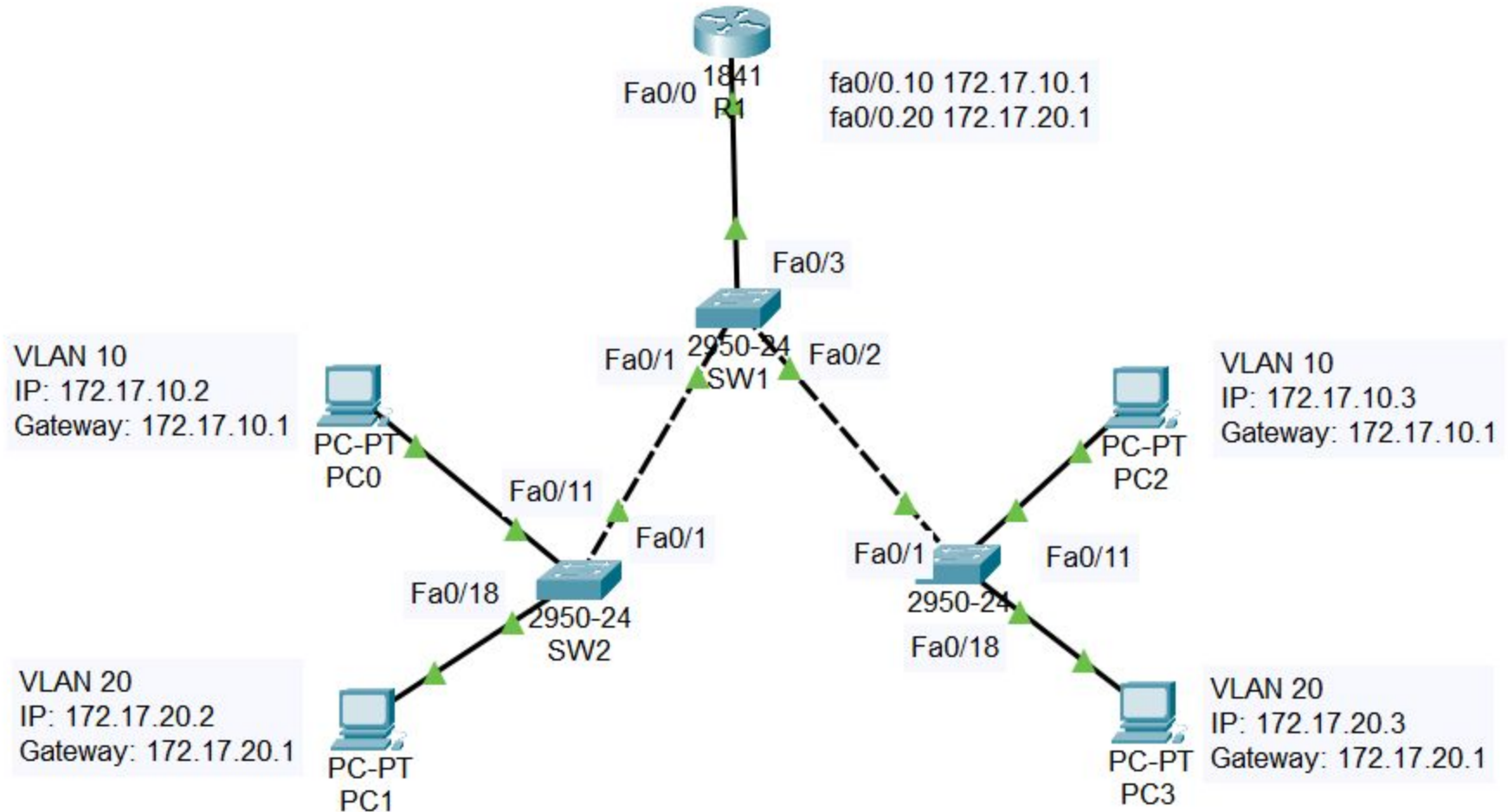
1. Set the IP addresses and Gateways to the PCs
2. Create vlan 10 and vlan 20 on each switch
3. Set the link between the switches as trunk
4. Create two sub interfaces for vlan 10, and vlan 20 on the Router
5. Check the connections by using ping command



Router-on-a-Stick: Exercise 2



Router-on-a-Stick: Exercise 3





Router-on-a-Stick: Exercise 4

