| | |
|---|---|
| **Register No:** | **99220040570** |
| **Name:** | **K.Hanuman** |
| **Class/Section:** | **8501/S06** |
| **Ex.No:** | **5b** |
| **Date of Submission** | |
| **Name of the Experiment** | **Configuration of inter VLAN network using Router on Stick method** |
| **Google Drive link of the packet tracer file(give view permission):** | https://drive.google.com/drive/folders/13fvy66uGb8qc1O8OEyyEwNXlVBcHzIfl?usp=sharing |

**Objective(s):**

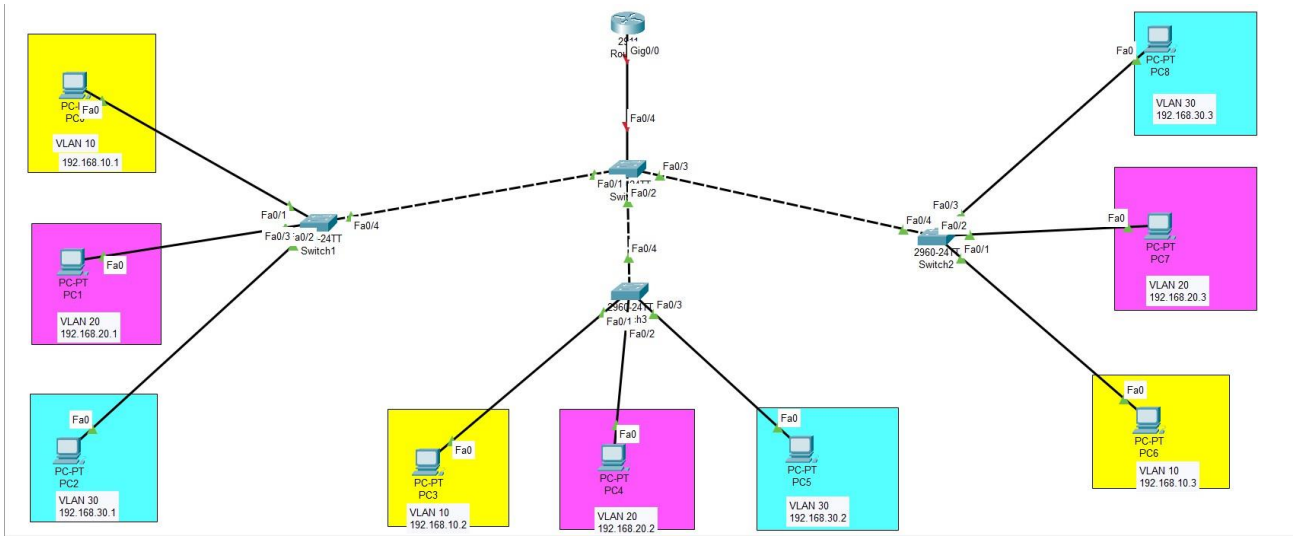
To design and implement Inter VLAN using switch configuration

**Introduction:**

'Router on a Stick' allows routing between VLANs with only one interface. Each VLAN represents a different Subnet. In general, routers can take traffic from only one subnet and transfer it to another subnet. And we can assign only one IP Address to a router interface. 'Router on a stick' allow us to create sub-interfaces, and assign IP Addresses to those sub-interfaces. To make it work, we have to create a truck connection between the switch and a router so that traffic from multiple VLANs can be sent to the router.

If we create a route between VLANs without the 'Router on a Stick' method, then we have to waste interfaces on the switches and routers. And if we enable routing between multiple VLANs then it will become practically inefficient as the switches and the routers will use those multiple interfaces.

The image below is an alternative method for allowing routing between VLANs. As you can see, we are using two interfaces on both the router and a switch to allow routing between VLANs. We have not created sub-interface in the below figure.

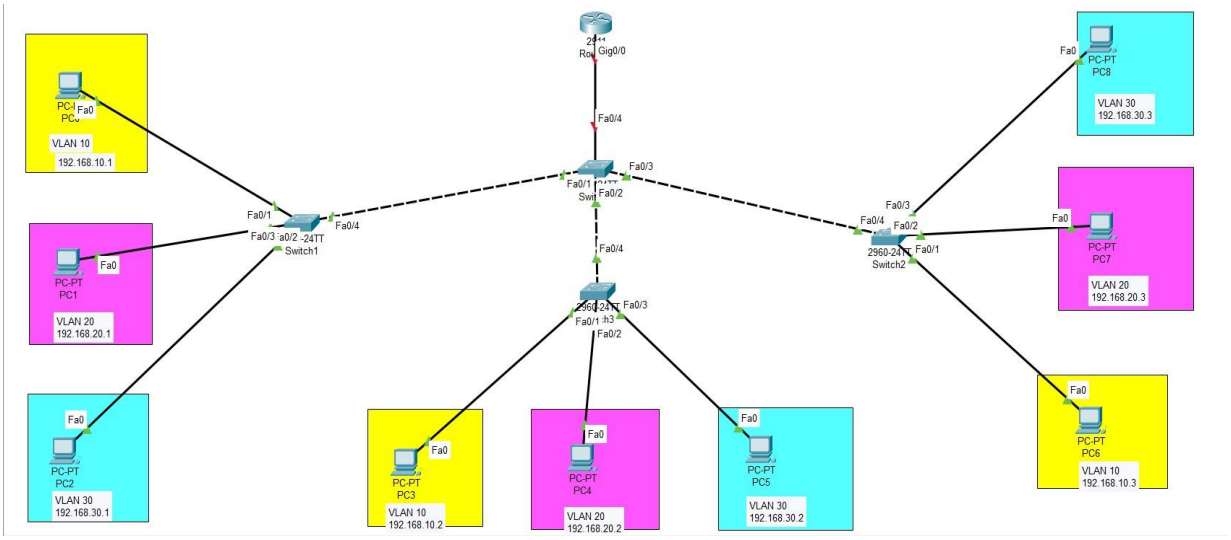


You can see that we have to use extra interfaces for each VLAN. So, it becomes practically non-efficient if we have multiple VLANs. Hence, 'Router on a Stick' is a perfect solution for routing between VLANs with just one router interface.

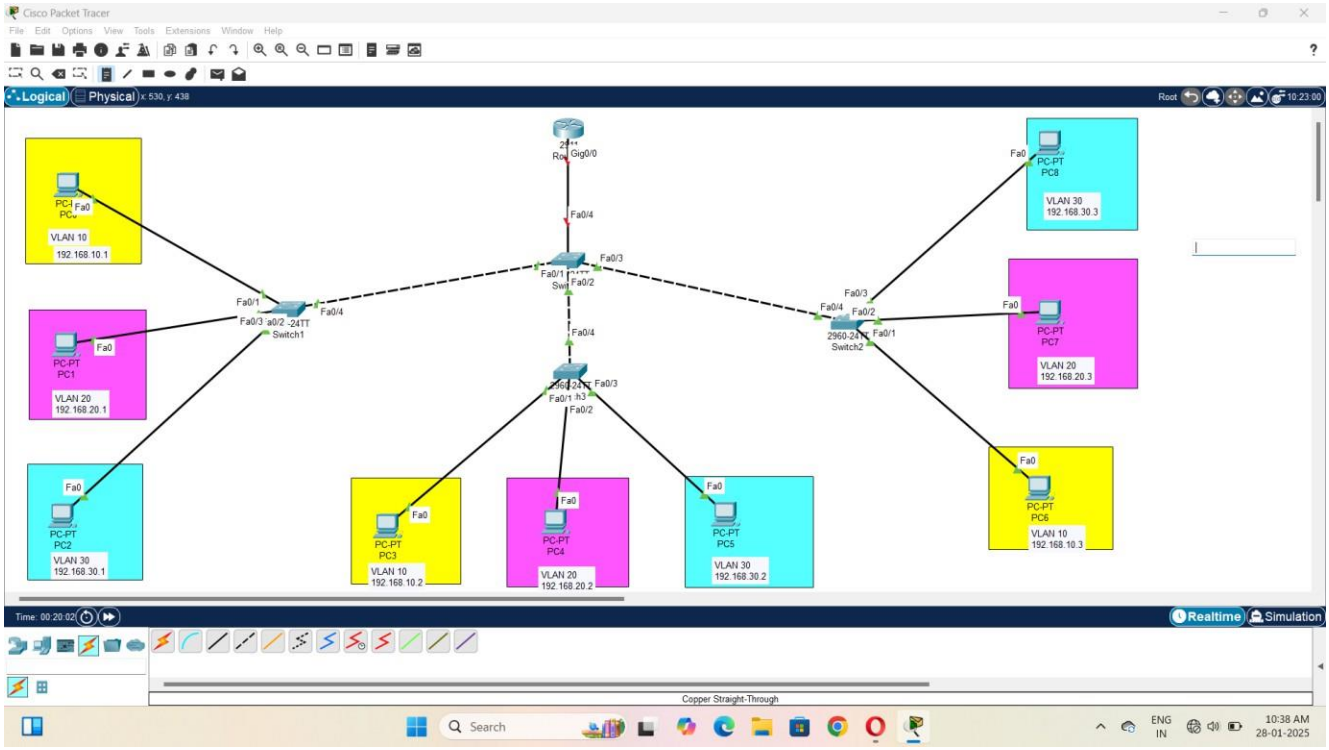
The more simple way to do routing between VLANs is by using a Layer 3 Switch. We just have to create virtual interfaces for each VLAN and assign them IP Addresses from the same network. A Layer 3 Switch will then enable routing between VLANs as it has routing capabilities as well. However, Layer 3 Switch is quite expensive so it might not be an affordable option for small office networks.

In the below lab, we will configure 'Router on a Stick' that would allow routing between the VLANs. Some of the important concepts in this lab are – to create sub-interfaces, use encapsulation dot1Q command to encapsulate the traffic, and mentioning the VLAN number to ascertain that for which VLAN the sub-interface should respond.

1. **Device Requirements:**
   1. PC0
   2. PC1
   3. PC2
   4. PC3
   5. PC4
   6. PC5
   7. PC6
   8. PC7
   9. PC8
   10. PC9
   11. SWITCH-0(2960-24TT)
   12. SWITCH-1(2960-24TT)
   13. ROUTER(2911)
2. **Network Diagram for your experiment (draw the diagram either hand drawing/ms paint or any other drawing tools)**



## 3. Network Diagram (Packet tracer diagram before configuration):




## 4. Configuration details:

| Device Name | Interface Name | IP Address | Subnet mask |
|---|---|---|---|
| PC0 | Fa0/1 | 192.168.10.1 | 255.255.255.0 |
| PC1 | Fa0/2 | 192.168.20.1 | 255.255.255.0 |
| PC2 | Fa0/3 | 192.168.30.1 | 255.255.255.0 |
| PC3 | Fa0/1 | 192.168.10.2 | 255.255.255.0 |
| PC4 | Fa0/2 | 192.168.20.2 | 255.255.255.0 |
| PC5 | Fa0/3 | 192.168.30.2 | 255.255.255.0 |
| PC6 | Fa0/1 | 192.168.10.3 | 255.255.255.0 |
| PC7 | Fa0/2 | 192.168.20.3 | 255.255.255.0 |
| PC8 | Fa0/3 | 192.168.30.3 | 255.255.255.0 |

5. **Describe step by step configuration steps properly (you may copy the commands used in the configuration tab and paste it.)**
    1. **Create VLANs**
    2. **Configure interfaces**
    3. **Configure trunking**

**SWITCH – 1**

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#vlan 20
Switch(config-vlan)#vlan 30
Switch(config-vlan)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show vlan

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/4, Fa0/5, Fa0/6, Fa0/7
                                                 Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                 Fa0/12, Fa0/13, Fa0/14, Fa0/15
                                                 Fa0/16, Fa0/17, Fa0/18, Fa0/19
                                                 Fa0/20, Fa0/21, Fa0/22, Fa0/23
                                                 Fa0/24, Gig0/1, Gig0/2
10   VLAN0010                          active    Fa0/1
20   VLAN0020                          active    Fa0/2
30   VLAN0030                          active    Fa0/3
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
```

**---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------**

**1 enet 100001 1500 - - - - - 0 0**

**10 enet 100010 1500 - - - - - 0 0**

**20 enet 100020 1500 - - - - - 0 0**

**30 enet 100030 1500 - - - - - 0 0**

**1002 fddi 101002 1500 - - - - - 0 0**

**1003 tr 101003 1500 - - - - - 0 0**

**1004 fdnet 101004 1500 - - - ieee - 0 0**

**1005 trnet 101005 1500 - - - ibm - 0 0**

**VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2**

**---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------**

**Remote SPAN VLANs**

**------------------------------------------------------------------------------**

**Primary Secondary Type Ports**

**------- --------- ----------------- ------------------------------------------**

**Switch#**

**Switch#configure terminal**

**Enter configuration commands, one per line. End with CNTL/Z.**

**Switch(config)#interface fa0/1**

**Switch(config-if)#switchport mode access**

**Switch(config-if)#switchport access vlan 10**

**Switch(config-if)#exit**

**Switch(config)#interface fa0/2**

**Switch(config-if)#switchport mode access**

**Switch(config-if)#switchport access vlan 20**

**Switch(config-if)#exit**

**Switch(config)#interface fa0/3**

**Switch(config-if)#switchport mode access**

**Switch(config-if)#switchport access vlan 30**

**Switch(config-if)#exit**

**Switch(config)#**

**Switch>show interfaces trunk**

**Port Mode Encapsulation Status Native vlan**

**Fa0/4 auto n-802.1q trunking 1**

**Port Vlans allowed on trunk**
**Fa0/4 1-1005**

**Port Vlans allowed and active in management domain**
**Fa0/4 1,10,20,30**

**Port Vlans in spanning tree forwarding state and not pruned**
**Fa0/4 1,10,20,30**

**Switch>%SPANTREE-2-RECV_PVID_ERR: Received 802.1Q BPDU on non trunk FastEthernet0/4 VLAN1.**

**%SPANTREE-2-BLOCK_PVID_LOCAL: Blocking FastEthernet0/4 on VLAN0001. Inconsistent port type.**

**CENTER SWITCH-0**
**Switch>enable**
**Switch#configure terminal**
**Enter configuration commands, one per line. End with CNTL/Z.**
**Switch(config)#vlan 10**
**Switch(config-vlan)#vlan 20**
**Switch(config-vlan)#vlan 30**
**Switch(config-vlan)#exit**
**Switch(config)#interface range fa0/1-3**
**Switch(config-if-range)#switchport mode access**
**Switch(config-if-range)#switchport mode trunk**
**Switch(config-if-range)#**
**%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down**

**%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up**

**%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down**

**%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up**

**%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to down**

**%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up**

**Switch(config-if-range)#exit**

**Switch(config)#exit**

**Switch#**

**%SYS-5-CONFIG_I: Configured from console by console**

**Switch#show interfaces trunk**

| Port | Mode | Encapsulation | Status | Native vlan |
|---|---|---|---|---|
| Fa0/1 | on | 802.1q | trunking | 1 |
| Fa0/2 | on | 802.1q | trunking | 1 |
| Fa0/3 | on | 802.1q | trunking | 1 |

| Port | Vlans allowed on trunk |
|---|---|
| Fa0/1 | 1-1005 |
| Fa0/2 | 1-1005 |
| Fa0/3 | 1-1005 |

| Port | Vlans allowed and active in management domain |
|---|---|
| Fa0/1 | 1,10,20,30 |
| Fa0/2 | 1,10,20,30 |
| Fa0/3 | 1,10,20,30 |

| Port | Vlans in spanning tree forwarding state and not pruned |
|---|---|
| Fa0/1 | 1,10,20,30 |
| Fa0/2 | 1,10,20,30 |
| Fa0/3 | 1,10,20,30 |

**Switch>enable**

**Switch#configure terminal**

**Enter configuration commands, one per line. End with CNTL/Z.**

**Switch(config)#interface fa0/4**

**Switch(config-if)#switchport mode trunk**

**Switch(config-if)#**

**%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to down**

**%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up**

**Switch(config-if)#exit**

**Switch(config)#exit**

**Switch#**

**%SYS-5-CONFIG_I: Configured from console by console**

**Switch#show interfaces trunk**

| Port | Mode | Encapsulation | Status | Native vlan |
|---|---|---|---|---|
| Fa0/1 | on | 802.1q | trunking | 1 |
| Fa0/2 | on | 802.1q | trunking | 1 |
| Fa0/3 | on | 802.1q | trunking | 1 |
| Fa0/4 | on | 802.1q | trunking | 1 |

| Port | Vlans allowed on trunk |
|---|---|
| Fa0/1 | 1-1005 |
| Fa0/2 | 1-1005 |
| Fa0/3 | 1-1005 |
| Fa0/4 | 1-1005 |

| Port | Vlans allowed and active in management domain |
|---|---|
| Fa0/1 | 1,10,20,30 |
| Fa0/2 | 1,10,20,30 |
| Fa0/3 | 1,10,20,30 |
| Fa0/4 | 1,10,20,30 |

| Port | Vlans in spanning tree forwarding state and not pruned |
|---|---|
| Fa0/1 | 1,10,20,30 |
| Fa0/2 | 1,10,20,30 |
| Fa0/3 | 1,10,20,30 |
| Fa0/4 | 1,10,20,30 |

**ROUTER-0**

**Router>enable**

**Router#show ip route**

**Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP**

**D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area**

**N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2**

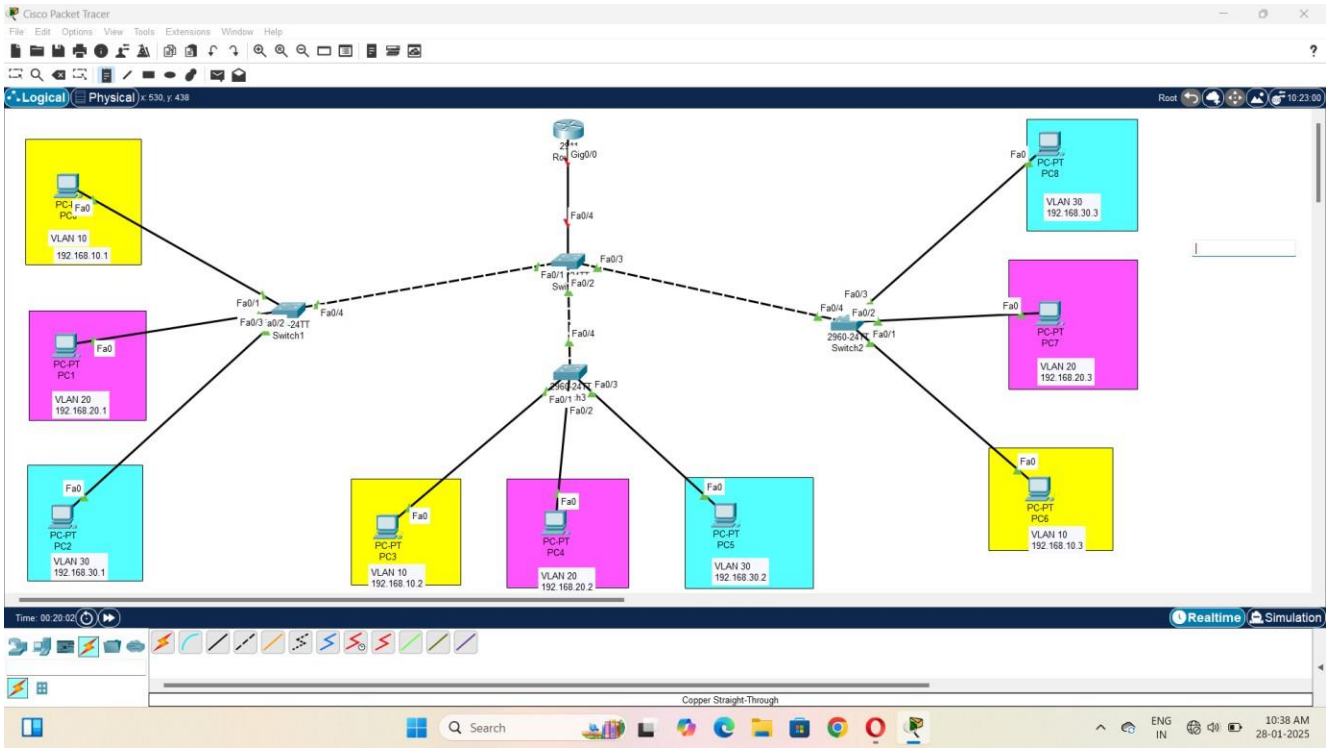
**E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP**

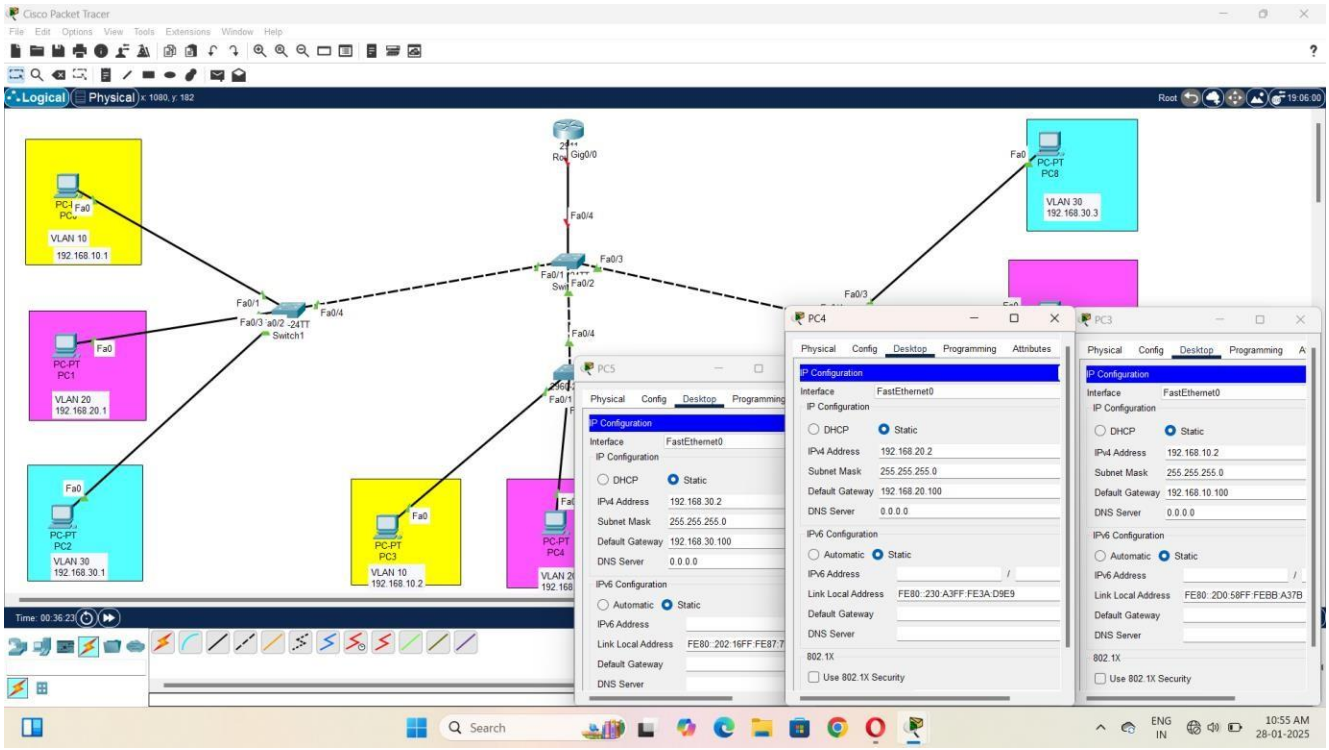
**i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area**

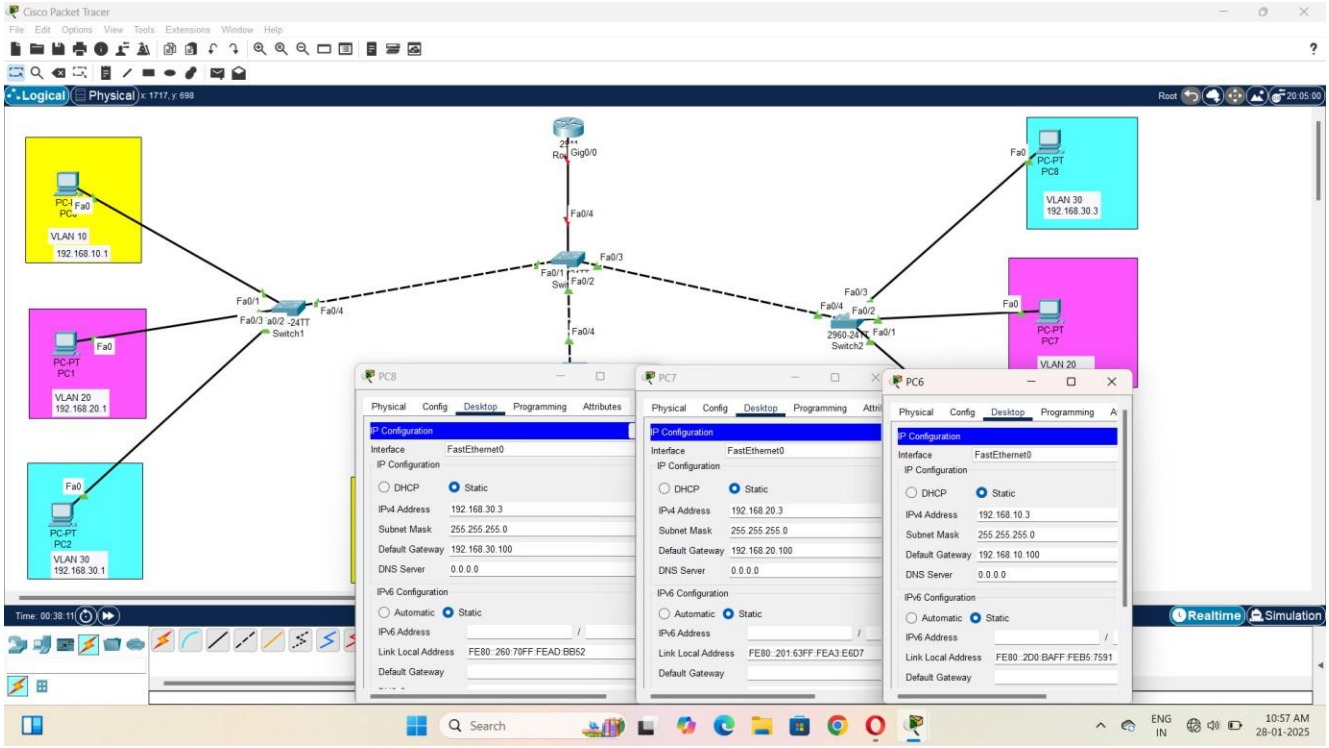
```
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is not set
Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  administratively down down
GigabitEthernet0/1     unassigned      YES unset  administratively down down
GigabitEthernet0/2     unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface gigabitEthernet 0/0.10
Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#ip address 192.168.10.100 255.255.255.0
Router(config-subif)#exit
Router(config)#interface gigabitEthernet 0/0.20
Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 192.168.20.100 255.255.255.0
Router(config-subif)#exit
Router(config)#interface gigabitEthernet 0/0.30
Router(config-subif)#encapsulation dot1Q 30
Router(config-subif)#ip address 192.168.30.100 255.255.255.0
Router(config-subif)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  administratively down down
GigabitEthernet0/0.10  192.168.10.100  YES manual administratively down down
GigabitEthernet0/0.20  192.168.20.100  YES manual administratively down down
GigabitEthernet0/0.30  192.168.30.100  YES manual administratively down down
GigabitEthernet0/1     unassigned      YES unset  administratively down down
GigabitEthernet0/2     unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
Router#
Router#configure terminal
```

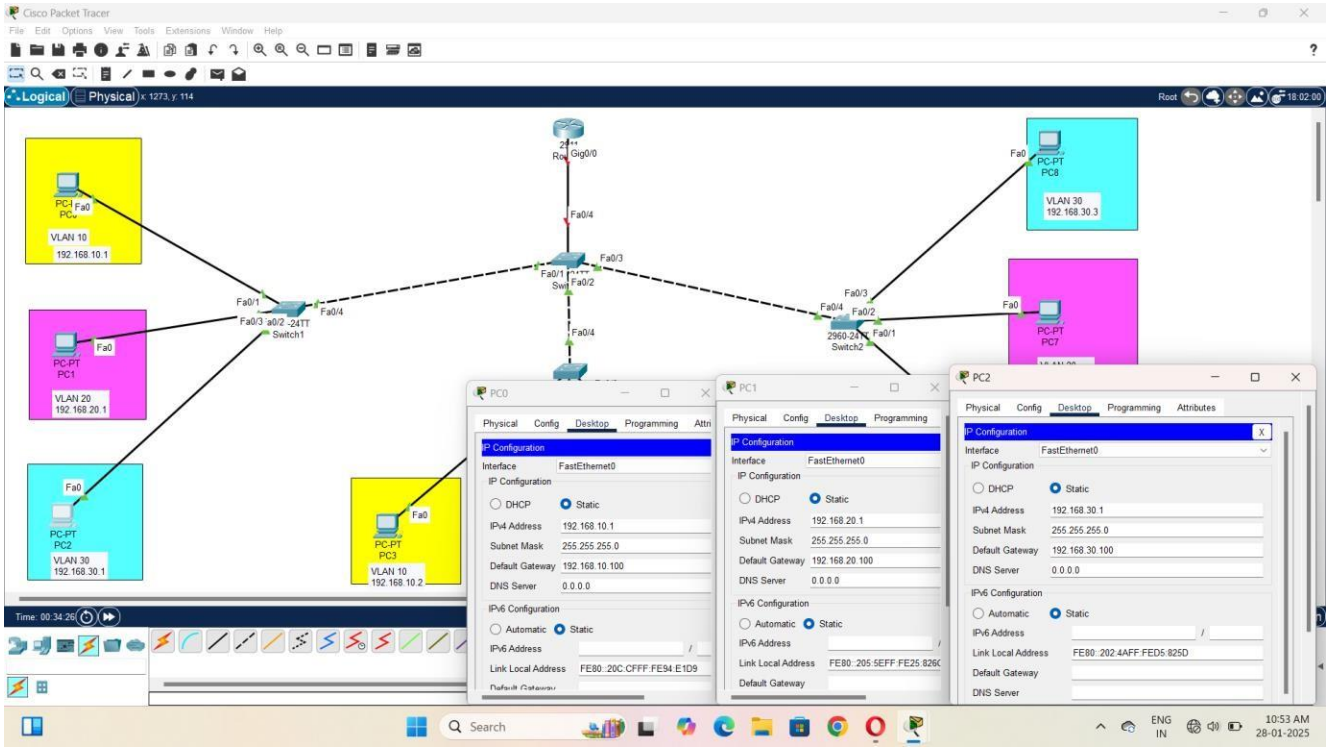
```
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface gigabitEthernet 0/0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

%LINK-5-CHANGED: Interface GigabitEthernet0/0.10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.10, changed state to up

%LINK-5-CHANGED: Interface GigabitEthernet0/0.20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.20, changed state to up

%LINK-5-CHANGED: Interface GigabitEthernet0/0.30, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.30, changed state to up

Router(config-if)#
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  up                    up
GigabitEthernet0/0.10  192.168.10.100  YES manual up                    up
GigabitEthernet0/0.20  192.168.20.100  YES manual up                    up
GigabitEthernet0/0.30  192.168.30.100  YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
GigabitEthernet0/2     unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
Router#
```

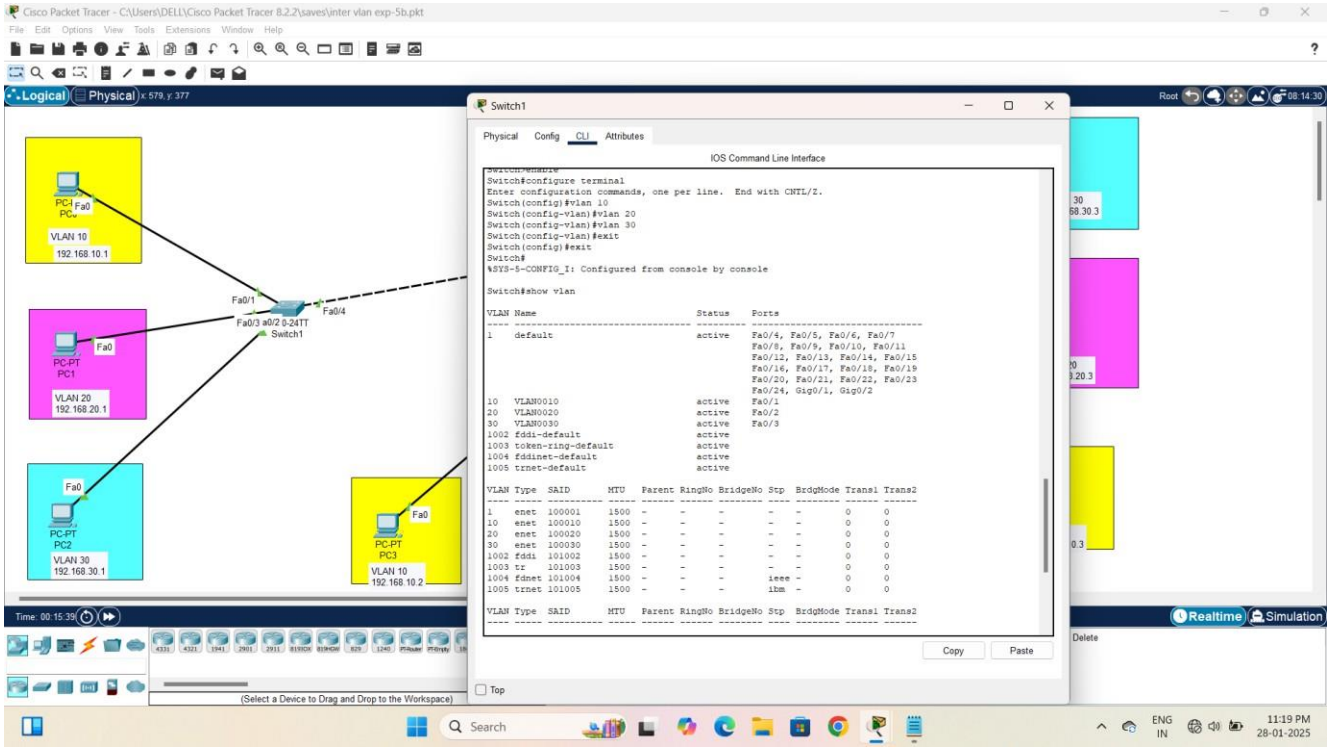
## 6. Output Diagram (Minimum 3 screenshot):

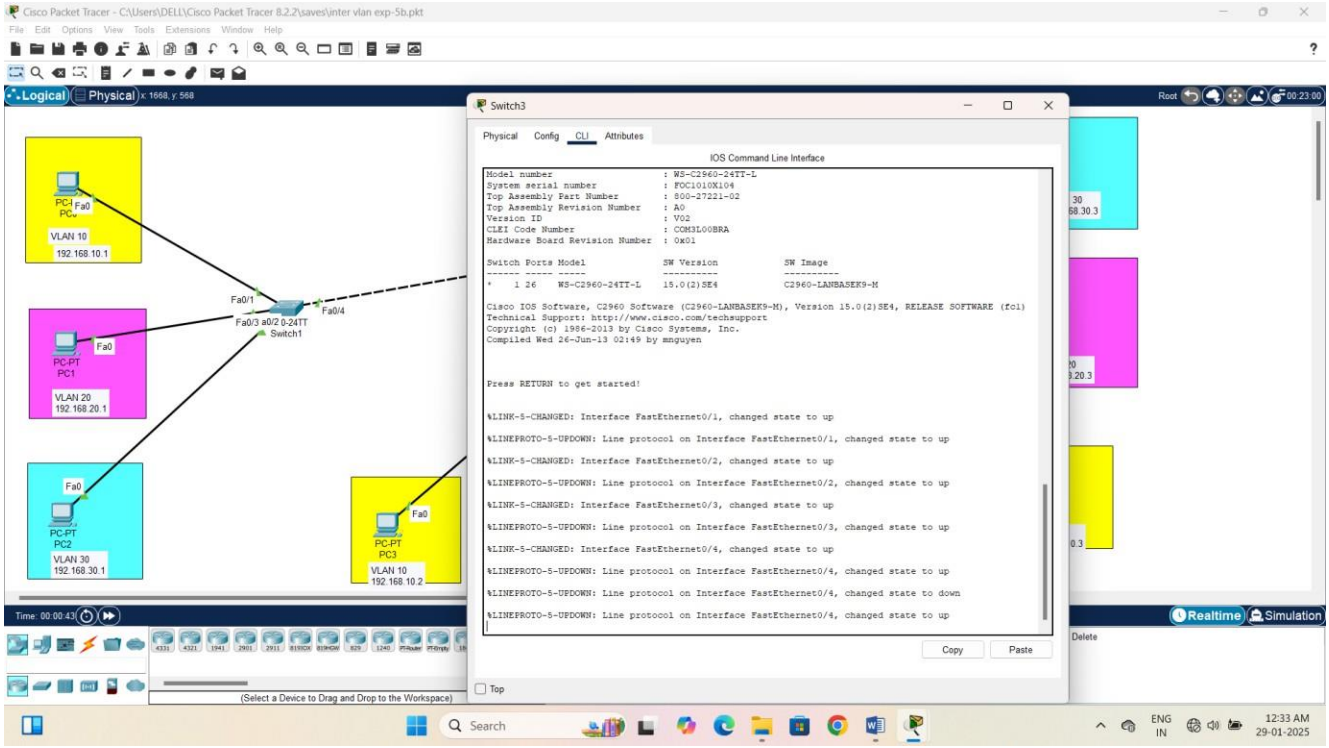



Cisco Packet Tracer
Logical
Physical
PC8
PC7
PC6
IP Configuration
Interface FastEthernet0
DHCP
Static
IPv4 Address 192.168.30.3
Subnet Mask 255.255.255.0
Default Gateway 192.168.30.100
DNS Server 0.0.0.0
IPv6 Configuration
Automatic
Static
Link Local Address FE80::260:70FF:FEAD:BB52
IPv4 Address 192.168.20.3
Default Gateway 192.168.20.100
Link Local Address FE80::201:63FF:FEA3:E6D7
IPv4 Address 192.168.10.3
Default Gateway 192.168.10.100
Link Local Address FE80::2D0:BAFF:FEB5:7591
Realtime
Simulation
Search
10:57 AM
28-01-2025


Cisco Packet Tracer
Logical
Physical
PC0
PC1
PC2
IP Configuration
Interface FastEthernet0
DHCP
Static
IPv4 Address 192.168.10.1
Subnet Mask 255.255.255.0
Default Gateway 192.168.10.100
DNS Server 0.0.0.0
IPv6 Configuration
Automatic
Static
Link Local Address FE80::20C:CFFF:FE94:E1D9
IPv4 Address 192.168.20.1
Default Gateway 192.168.20.100
Link Local Address FE80::205:5EFF:FE25:826
IPv4 Address 192.168.30.1
Default Gateway 192.168.30.100
Link Local Address FE80::202:4AFF:FED5:825D
Search
10:53 AM
28-01-2025


Switch1
Physical
Config
CLI
Attributes
IOS Command Line Interface
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#vlan 20
Switch(config-vlan)#vlan 30
Switch(config-vlan)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
Switch#show vlan
VLAN Name Status Ports
1 default active Fa0/4, Fa0/5, Fa0/6, Fa0/7, Fa0/8, Fa0/9, Fa0/10, Fa0/11, Fa0/12, Fa0/13, Fa0/14, Fa0/15, Fa0/16, Fa0/17, Fa0/18, Fa0/19, Fa0/20, Fa0/21, Fa0/22, Fa0/23, Fa0/24, Gig0/1, Gig0/2
10 VLAN0010 active Fa0/1
20 VLAN0020 active Fa0/2
30 VLAN0030 active Fa0/3
1002 fddi-default active
1003 token-ring-default active
1004 fddinet-default active
1005 trnet-default active
VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2
1 enet 100001 1500 - - - - - 0 0
10 enet 100010 1500 - - - - - 0 0
20 enet 100020 1500 - - - - - 0 0
30 enet 100030 1500 - - - - - 0 0
1002 fddi 101002 1500 - - - - - 0 0
1003 tr 101003 1500 - - - - - 0 0
1004 fdnet 101004 1500 - - - ieee - 0 0
1005 trnet 101005 1500 - - - ibm - 0 0
Copy
Paste
Top
Logical
Physical
Root
PC-PT PC0
Fa0
VLAN 10
192.168.10.1
Fa0/1
Fa0/3 a0/2 0-24TT
Fa0/4
Switch1
PC-PT PC1
VLAN 20
192.168.20.1
PC-PT PC2
VLAN 30
192.168.30.1
PC-PT PC3
VLAN 10
192.168.10.2
Realtime
Simulation
Delete
(Select a Device to Drag and Drop to the Workspace)
Search
ENG IN
11:19 PM
28-01-2025


Switch3
Physical
Config
CLI
Attributes
IOS Command Line Interface
Model number : WS-C2960-24TT-L
System serial number : FOC1010X104
Top Assembly Part Number : 800-27221-02
Top Assembly Revision Number : A0
Version ID : V02
CLEI Code Number : COM3L00BRA
Hardware Board Revision Number : 0x01
Switch Ports Model SW Version SW Image
* 1 26 WS-C2960-24TT-L 15.0(2)SE4 C2960-LANBASEK9-M
Cisco IOS Software, C2960 Software (C2960-LANBASEK9-M), Version 15.0(2)SE4, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2013 by Cisco Systems, Inc.
Compiled Wed 26-Jun-13 02:49 by mnguyen
Press RETURN to get started!
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up
Copy
Paste
Top
Logical
Physical
Root
PC-PT PC0
Fa0
VLAN 10
192.168.10.1
Fa0/1
Fa0/3 a0/2 0-24TT
Fa0/4
Switch1
PC-PT PC1
VLAN 20
192.168.20.1
PC-PT PC2
VLAN 30
192.168.30.1
PC-PT PC3
VLAN 10
192.168.10.2
Realtime
Simulation
Delete
(Select a Device to Drag and Drop to the Workspace)
Search
ENG IN
12:33 AM
29-01-2025

**Google Drive link of the packet tracer file (give view permission):**

**Link: https://drive.google.com/drive/folders/13fvy66uGb8qc1O8OEyyEwNXlVBcHz Ifl?usp=sharing**

**CONCLUSION (provide conclusion about this experiment):**

a router is used in inter-VLAN routing to enable communication between different VLANs by acting as a Layer 3 device that directs traffic based on IP addresses, allowing devices in separate broadcast domains to exchange data while maintaining network segmentation and security benefits provided by VLANs

**Rubrics for Experiment Assessment:**

| Rubrics | Good | Normal | Poor | Marks |
|---|---|---|---|---|
| **Creation of Topology (4)** | Created the topology, Identify the proper devices and making the connections **(4)** | Created the topology, Identify the proper devices, making the connections But missing some features **(3)** | Created wrong topology, Failed to Identify the proper devices and making connections **(1)** | |
| **Verify the connectivity (4)** | Verified the connectivity in all the levels **(4)** | Verified the connectivity at some levels (only some nodes) **(2)** | Verified the connectivity is not done. **(1)** | |
| **Timely Completion (2)** | Completed the lab before the allotted time **(2)** | Completed the lab after the deadline **(1)** | Did not submitted before grading **(0)** | |
| | | | **Total** | |

**RESULT:**

**Thus, the implementation of configuration of inter VLAN using Router on stick method has been successfully implemented by using the cisco packet.**