

Ex. No: 5 Inter-VLAN Routing Using Router-on-a-Stick

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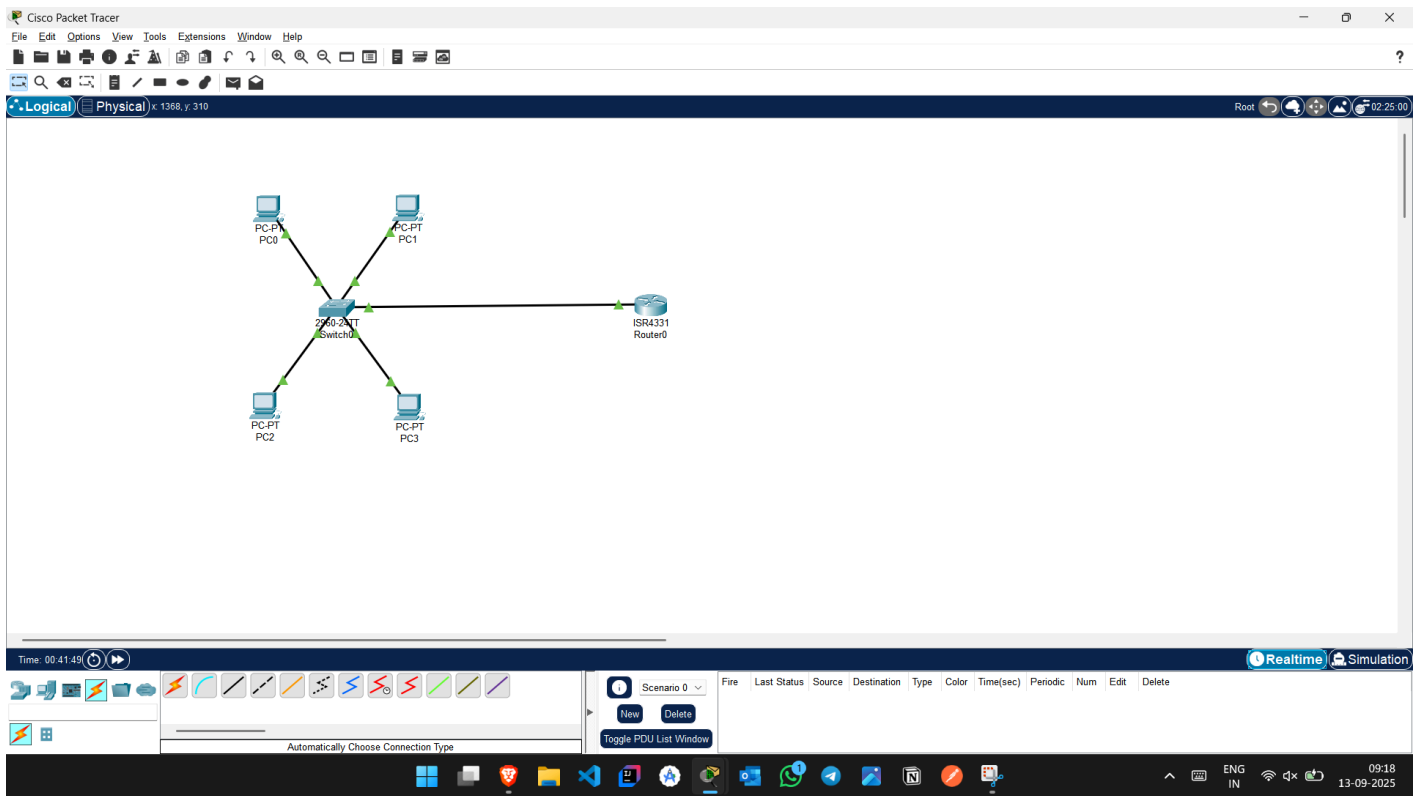
Objective

To configure Inter-VLAN routing using a single router interface with subinterfaces (Router-on-a-Stick) so that hosts in different VLANs can communicate with each other.

Apparatus/Tools Required

- Cisco Packet Tracer
- 1 Router (e.g., 2911)
- 1 Managed Switch (e.g., 2960)
- 4 PCs
- Straight-through Ethernet cables

Network Topology Diagram



Description:

- PC0 and PC1 belong to VLAN 10 (192.168.10.0/24)
 - PC2 and PC3 belong to VLAN 20 (192.168.20.0/24)
 - Switch connected to Router via a trunk port (FastEthernet0/1 on switch → GigabitEthernet0/0 on router)
 - Router subinterfaces handle VLAN routing
- (Insert screenshot of your Packet Tracer setup here)

IP Addressing Table

Device	VLAN	IP Address	Subnet Mask	Port/Interface
PC0	10	192.168.10.1	255.255.255.0	FastEthernet0/1
PC1	10	192.168.10.2	255.255.255.0	FastEthernet0/2
PC2	20	192.168.20.1	255.255.255.0	FastEthernet0/3
PC3	20	192.168.20.2	255.255.255.0	FastEthernet0/4
Router	G0/0.10	10 192.168.10.254	255.255.255.0	Subinterface VLAN 10
Router	G0/0.20	20 192.168.20.254	255.255.255.0	Subinterface VLAN 20

Procedure

1. Setup devices in Packet Tracer: Place 4 PCs, 1 switch, and 1 router.

2. Cabling:
 - o PCs to switch ports (PC0–F0/1, PC1–F0/2, PC2–F0/3, PC3–F0/4)
 - o Switch F0/5 to Router G0/0
3. Assign IP addresses to each PC as per the IP table.
4. Switch Configuration:
 - o Create VLAN 10 and VLAN 20
 - o Assign ports F0/1–F0/2 to VLAN 10, ports F0/3–F0/4 to VLAN 20
 - o Configure trunk on port F0/5 to the router
5. Router Configuration (Router-on-a-Stick):
 - o Enable subinterfaces G0/0.10 and G0/0.20
 - o Assign encapsulation dot1q for each VLAN ID
 - o Assign IP addresses to each subinterface (default gateway for respective VLANs)
6. Testing:
 - o Ping from PC0 to PC2 (should succeed after routing is configured)
 - o Ping between PCs in the same VLAN (should succeed)

Commands Used

Switch Configuration:

python

CopyEdit

Switch> enable

Switch# configure terminal

Switch(config)# vlan 10

Switch(config-vlan)# name STAFF

Switch(config-vlan)# exit

Switch(config)# vlan 20

Switch(config-vlan)# name STUDENTS

Switch(config-vlan)# exit

Switch(config)# interface range fastethernet0/1 - 2

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

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

Switch(config-if-range)# exit

Switch(config)# interface range fastethernet0/3 - 4

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

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

Switch(config-if-range)# exit

Switch(config)# interface fastethernet0/5

Switch(config-if)# switchport mode trunk

Switch(config-if)# exit

Router Configuration:

arduino

CopyEdit

Router> enable

Router# configure terminal

Router(config)# interface gigabitethernet0/0.10

Router(config-subif)# encapsulation dot1Q 10

Router(config-subif)# ip address 192.168.10.254 255.255.255.0

Router(config-subif)# no shutdown

Router(config)# interface gigabitethernet0/0.20

Router(config-subif)# encapsulation dot1Q 20

Router(config-subif)# ip address 192.168.20.254 255.255.255.0

Router(config-subif)# no shutdown

Router(config)# interface gigabitethernet0/0

Router(config-if)# no shutdown

Output (Screenshots)

• VLAN configuration on the switch

Switch0

```

IOS Command Line Interface

%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

Switch>enable
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vian 10
Switch(config-vlan)#name STAFF
Switch(config-vlan)#exit
Switch(config)#vian 20
Switch(config-vlan)#name STUDENTS
Switch(config-vlan)#exit
Switch(config)#interface range fastethernet0/1-2
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#exit
Switch(config)#interface range fastethernet0/3-4
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#exit
Switch(config)#interface range fastethernet0/5
Switch(config-if-range)#switchport mode trunk
Switch(config-if-range)#exit
Switch(config)#
% Invalid input detected at '^' marker.

Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#exit
Switch(config)#interface range fastethernet0/5
Switch(config-if-range)#switchport mode trunk
Switch(config-if-range)#exit
Switch(config)#
%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up
  
```

• Router subinterface configuration

Router0

```

--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]:
Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface gigabitethernet0/0/10
%Invalid interface type and number
Router(config)#interface gigabitethernet0/0/0.10
Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#ip address 192.168.10.254 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#interface gigabitethernet0/0/0.20
Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 192.168.20.254 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#interface gigabitethernet0/0/0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0.10, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0.10, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0.20, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0.20, changed state to up
  
```

Simulation Panel

Vis.	Time(sec)	Last Device
20.650	--	
20.651	Switch0	
20.651	Switch0	
20.651	Switch0	
20.788	--	
20.789	Switch0	
20.789	--	
20.790	Switch0	
22.530	--	
22.531	Switch0	
22.531	Switch0	
22.531	Switch0	

Play Controls

Event List Filters - Visible Events

ACL Filter, ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPsec, ISAKMP, IoT, IoT TCP, LACP, LLDP, Meraki, NDP, NETFLOW, NTP, OSPF, OSPFv6, PaGP, POP3, PPP, PPPoE, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, USB, VTP

• PC IP settings

The screenshot shows the Cisco Packet Tracer interface. In the center, a network diagram features a central switch connected to five PCs (PC0-PC4) and a router (ISR4331). A pop-up window for PC3 is displayed, showing its configuration details:

Port	Link	IP Address	IPv6 Address	MAC Address
FastEthernet0	Up	192.168.20.2/24	<not set>	<not set>
Bluetooth	Down	<not set>	<not set>	0050.0F2C.15D3

Additional settings for PC3 include: Gateway: 192.168.20.254, DNS Server: <not set>, and Line Number: <not set>. The physical location is listed as Intercity > Home City > Corporate Office > PC3.

On the right, the Simulation Panel shows an Event List with various network events and their timestamps. Below the Event List, there are Play Controls and a list of visible events including ACL Filter, ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPsec, ISAKMP, IoT, IoT TCP, LACP, LLDP, Meraki, NDP, NETFLOW, NTP, OSPF, OSPFv6, PaGP, POP3, PPP, PPPoE, PTP, RADIUS, RFP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, USB, and VTP.

• Successful ping between PCs in different VLANs after routing

The screenshot shows the Cisco Packet Tracer interface with a network diagram similar to the previous one. A Command Prompt window for PC1 is open, displaying the results of a ping command:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.20.1

Pinging 192.168.20.1 with 32 bytes of data:

Request timed out.
Reply from 192.168.20.1: bytes=32 time=8ms TTL=127
Reply from 192.168.20.1: bytes=32 time=8ms TTL=127

Ping statistics for 192.168.20.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 8ms, Maximum = 8ms, Average = 8ms

C:\>ping 192.168.20.1

Pinging 192.168.20.1 with 32 bytes of data:

Reply from 192.168.20.1: bytes=32 time=8ms TTL=127
Reply from 192.168.20.1: bytes=32 time=8ms TTL=127
Reply from 192.168.20.1: bytes=32 time=8ms TTL=127
Reply from 192.168.20.1: bytes=32 time=8ms TTL=127

Ping statistics for 192.168.20.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 8ms, Maximum = 8ms, Average = 8ms

C:\>
```

The Command Prompt window also shows the 'Physical' tab selected, and the 'Desktop' tab is active. The network diagram shows the same topology as before, with the switch and router connected to the PCs.

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- The screenshot displays the Cisco Packet Tracer interface. The main workspace shows a network topology with four PCs (PC-PT PC0, PC-PT PC1, PC-PT PC2, PC-PT PC3) connected to a central switch (2902-24T Switch). The switch is also connected to a router (ISR4331 Router0). The interface is set to 'Physical' mode. A command prompt window is open, showing the output of a ping command from PC0 to 192.168.10.2. The output indicates successful connectivity with 4 packets sent and received, 0% loss, and an average round trip time of 5ms.
- Network Topology:**
- Four PCs (PC-PT PC0, PC-PT PC1, PC-PT PC2, PC-PT PC3) are connected to a central switch (2902-24T Switch).
 - The switch is connected to a router (ISR4331 Router0).
- Command Prompt Output:**
- ```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.10.2

Pinging 192.168.10.2 with 32 bytes of data:

Reply from 192.168.10.2: bytes=32 time=5ms TTL=128
Reply from 192.168.10.2: bytes=32 time=4ms TTL=128
Reply from 192.168.10.2: bytes=32 time=4ms TTL=128
Reply from 192.168.10.2: bytes=32 time=4ms TTL=128

Ping statistics for 192.168.10.2:
 Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
 Approximate round trip times in milli-seconds:
 Minimum = 4ms, Maximum = 5ms, Average = 5ms

C:\>
```

Inter-VLAN routing was successfully configured using the Router-on-a-Stick method. PCs in different VLANs could communicate through the router.