NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

COMPUTER NETWORKS LAB

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Lab	07
Course	Computer Networks
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IN LAB TASKS

VLANs are logical network segments that improve performance and security; inter-VLAN routing enables communication between them. Trunking and dot1q help carry multiple VLANs across switches.

1. What is VLAN and its ranges

A VLAN (Virtual Local Area Network) is a logical grouping of devices on a network, regardless of their physical location. It helps segment a network into separate broadcast domains for better security and efficiency. VLAN IDs range from 1 to 4094**,** where 1 and 4095 are reserved, and 2–1001 are standard VLANs**,** while 1006–4094 are extended VLANs .

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2. Difference between VLAN and inter-VLAN

- **VLAN** allows devices within the same group to communicate directly, isolating traffic from other groups.
- **Inter-VLAN** routing enables communication between different VLANs using a router or Layer 3 switch. So, VLANs separate traffic, while inter-VLAN connects those separate segments.

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3. Pros and cons of VLAN and inter-VLAN

VLAN Pros:

- Enhances security by isolating traffic.
- Reduces broadcast traffic.
- Improves network management.

VLAN Cons:

- Requires proper configuration.
- Can be complex in large networks.

Inter-VLAN Pros:

- Enables communication across VLANs.
- Centralizes routing and control.

Inter-VLAN Cons:

- Adds latency due to routing.
- Needs Layer 3 devices, increasing cost.

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4. Applications of VLAN and inter-VLAN

- **VLANs** are used in offices, universities, and data centers to separate departments like HR, IT, and Finance.
- **Inter-VLAN routing** is essential in enterprise networks where different departments need to share resources like servers or printers while maintaining isolation.

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5. What is Trunking and dot1q encapsulation?

Trunking is a method used to carry traffic from multiple VLANs across a single network link between switches**.** Dot1q encapsulation (IEEE 802.1Q) is the standard protocol that tags Ethernet frames with VLAN IDs, allowing switches to identify which VLAN the frame belongs to during trunking.

Task 1

By using Drag and drop draw topology diagram as Shown below and attach screenshot of each step.Basic Switch configuration.

1. en

2. Config t

3. Vlan 2

4. Name cslab4

5. Vlan 5

6. Name cslab5

7. Exit

8. Int fa0/1

9. Switchport access vlan 2

10. Exit

11. Int fa0/4

12. Switchport access vlan 5

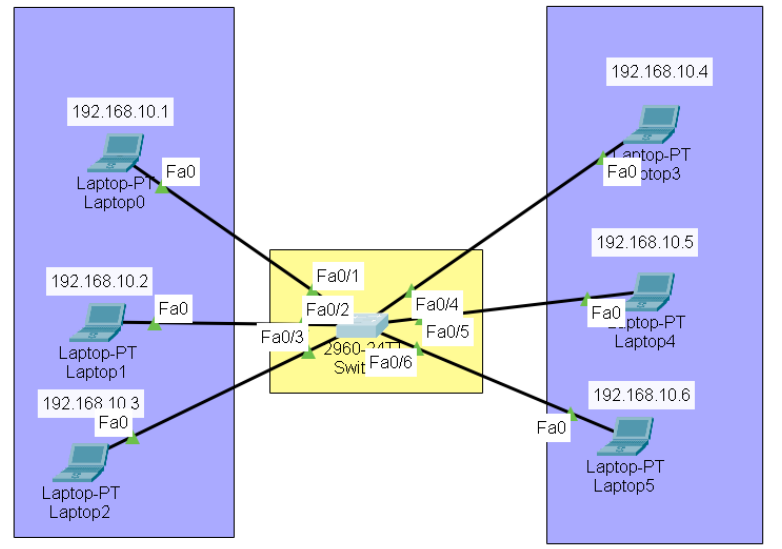
13. exit

14. exit

15. copy running-config startup-config

16. show vlan brief

Solution:



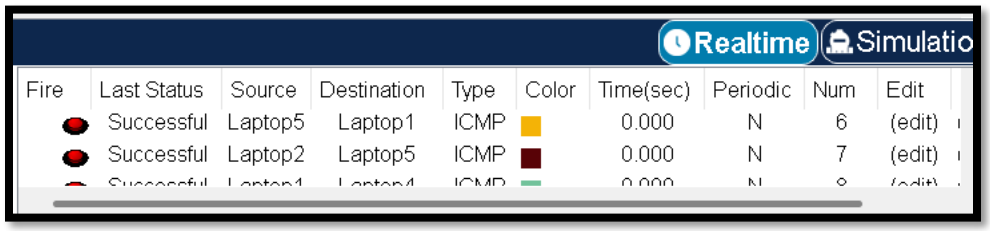
Switch Configuration:

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 2
Switch(config-vlan)#Name cslab4
Switch(config-vlan)#exit
Switch(config)#vlan 5
Switch(config-vlan)#Name cslab5
Switch(config-vlan)#exit
Switch(config)#int fa0/1
Switch(config-if)#Switchport access vlan 2
Switch(config-if)#exit
Switch(config)#int fa0/4
Switch(config-if)#Switchport access vlan 5
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

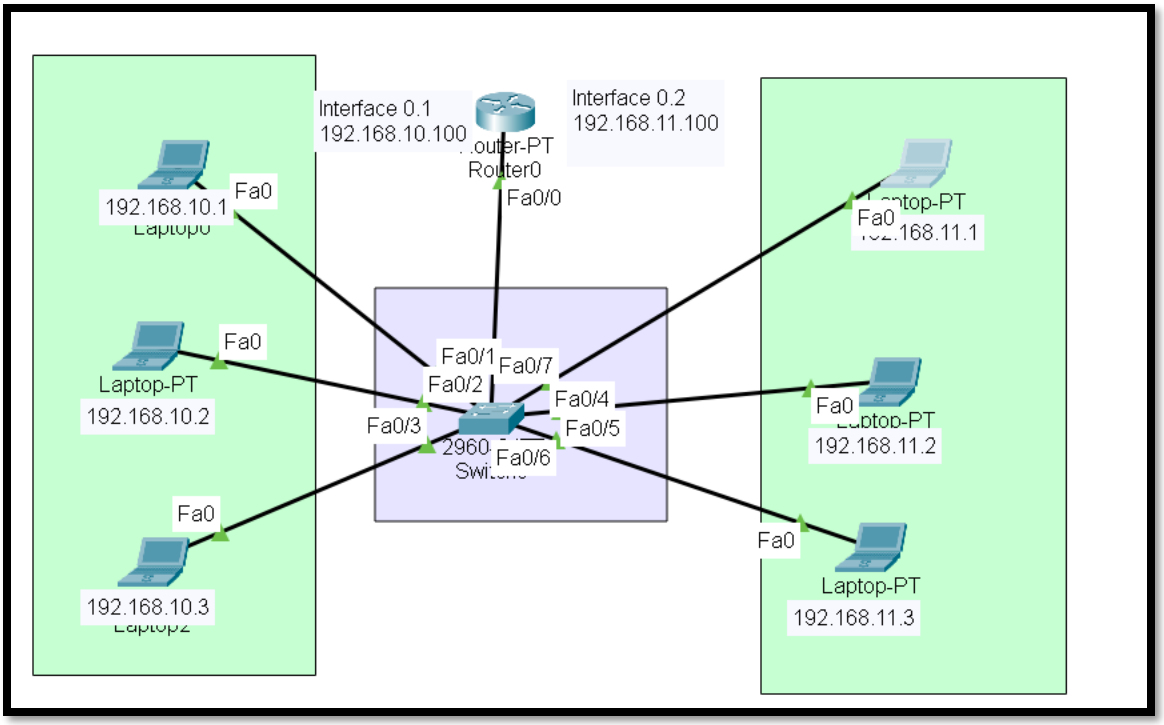
```
%SYS-5-CONFIG_I: Configured from console by console

Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#int fa0/2
Switch(config-if)#Switchport access vlan 2
Switch(config-if)#exit
Switch(config)#int fa0/3
Switch(config-if)#Switchport access vlan 2
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#int fa0/5
Switch(config-if)#Switchport access vlan 5
Switch(config-if)#exit
Switch(config)#int fa0/6
Switch(config-if)#Switchport access vlan 5
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

```
Switch# show vlan brief

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/2, Fa0/3, 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
2    cslab4                            active    Fa0/1
5    cslab5                            active    Fa0/4
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
Switch#
```

Real Time Packets :



Task 2



By using Drag and drop draw topology diagram as Shown below and attach screenshot of each step. Configuration for inter-Vlan

Step1: Configure switch for Vlan

Switch configuration for Vlan:

1. en

2. Config t

3. Int fa0/7(switch interface connected with router)

4. Switchport mode trunk

5. Exit

6. Exit

```
Switch>enable
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#Vlan 2
Switch(config-vlan)#Name cslab4
Switch(config-vlan)#exit
Switch(config)#Vlan 5
Switch(config-vlan)#Name cslab5
Switch(config-vlan)#exit
Switch(config)#int fa0/1
Switch(config-if)#Switchport access Vlan 2
Switch(config-if)#exit
Switch(config)#int fa0/2
Switch(config-if)#Switchport access Vlan 2
Switch(config-if)#exit
Switch(config)#int fa0/3
Switch(config-if)#Switchport access Vlan 3
% Access VLAN does not exist. Creating vlan 3
Switch(config-if)#exit
Switch(config)# int fa0/3
Switch(config-if)# Switchport access Vlan 2
Switch(config-if)#exit
Switch(config)#int fa0/4
Switch(config-if)#Switchport access Vlan 5
Switch(config-if)#exit
Switch(config)#int fa0/5
Switch(config-if)#Switchport access Vlan 5
Switch(config-if)#exit
Switch(config)#int fa0/6
Switch(config-if)#Switchport access Vlan 5
Switch(config-if)#exit
Switch(config)# int fa0/7
Switch(config-if)#Switchport mode trunk
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

Step2: After creating Vlan connect a router to switch through fast Ethernet interface

Step3: Router configuration for Vlan

1. en

2. Show ip interface brief

3. Config t

4. Int fa0/0(router interface connected with switch)

5. No shutdown

6. Exit

7. Exit

8. Show ip interface brief

```
Router>enable
Router#Show ip interface brief
Interface              IP-Address      OK? Method Status
Protocol
FastEthernet0/0        unassigned      YES unset
administratively down down
FastEthernet1/0        unassigned      YES unset
administratively down down
Serial2/0              unassigned      YES unset
administratively down down
Serial3/0              unassigned      YES unset
administratively down down
FastEthernet4/0        unassigned      YES unset
administratively down down
FastEthernet5/0        unassigned      YES unset
administratively down down
Router# config t
Enter configuration commands, one per line.  End with CNTL/
Z.
Router(config)# int fa0/0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to
up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip interface brief
```

Creation of sub Interface and route

1. en

2. Show ip interface brief

3. Config t

4. Int fa0/0.1 (router interface connected with switch)

5. Encapsulation dot1Q 2

6. Ip address 192.168.10.100 255.255.255.0

7. Exit

8. Int fa0/0.2 (router interface connected with switch)

9. Encapsulation dot1Q 5

10. Ip address 192.168.11.100 255.255.255.0

11. Exit

12. Exit

13. Show ip interface brief

14. Router rip

15. Network 192.168.10.0

16. Network 192.168.11.0

17. exit

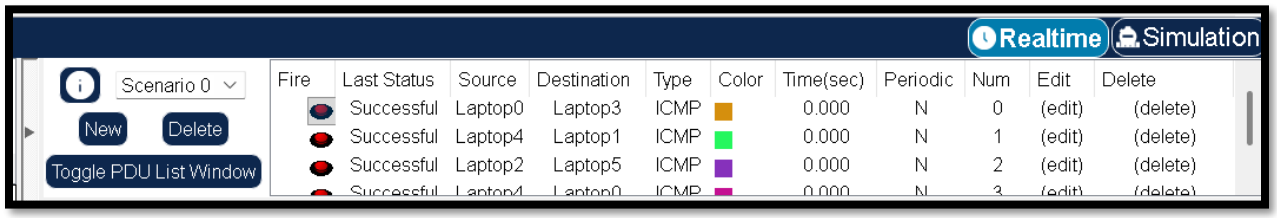
```
Router#config t
Enter configuration commands, one per line.  End with CNTL/
Z.
Router(config)#int fa0/0.1
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.1, changed state
to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/0.1, changed state to up
Encapsulation dot1Q 2
Router(config-subif)#Ip address 192.168.10.100 255.255.255.
Router(config-subif)#exit
Router(config)#int fa0/0.2
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.2, changed state
to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/0.2, changed state to up
Encapsulation dot1Q 5
Router(config-subif)#Ip address 192.168.11.100 255.255.255.
Router(config-subif)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip interface brief
Interface              IP-Address      OK? Method Status
Protocol
FastEthernet0/0        unassigned      YES unset  up
up
FastEthernet0/0.1      192.168.10.100  YES manual up
up
FastEthernet0/0.2      192.168.11.100  YES manual up
up
FastEthernet1/0        unassigned      YES unset
administratively down down
Serial2/0              unassigned      YES unset
administratively down down
Serial3/0              unassigned      YES unset
administratively down down
FastEthernet4/0        unassigned      YES unset
```

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/
Z.
Router(config)#Router rip
Router(config-router)#Network 192.168.10.0
Router(config-router)#Network 192.168.11.0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Step4:

Assign interface0/0.1 ip address as default gateway to responding Vlan end User Devices and so on.

Real Time packets send:

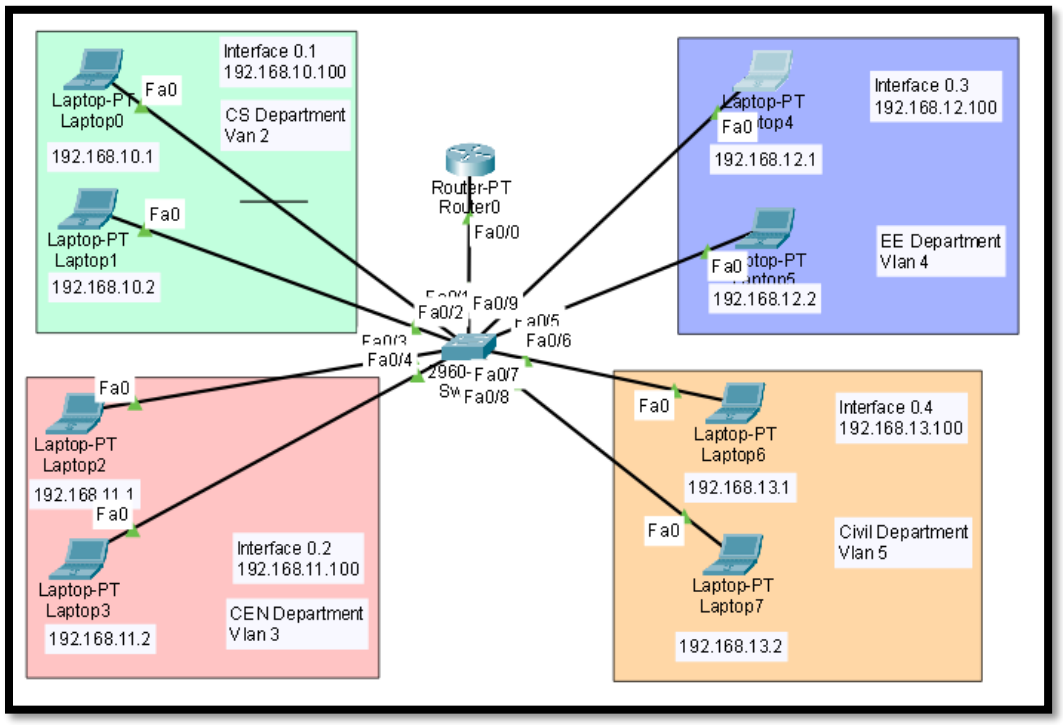


Task 3: Draw given topology diagrams and attach screen shots of Pcs communication

- **Label each device with unique IP address.**
- **Highlight different sections**

- **Divide given topology in four different networks**
- **Ping different Vlans laptops.**
- **Send packets (Real time).**
- **Send packets(Simulation).**
- **Take screen shots of every step**

Note*All screen shots and topology labeling must be clearly visible.



Step1: Configure switch for Vlan

```
Switch>enable
Switch#config t
Enter configuration commands, one per line.  End with
CNTL/Z.
Switch(config)#Vlan 2
Switch(config-vlan)#Name CS Department
                           ^
% Invalid input detected at '^' marker.

Switch(config-vlan)#Name CSdepartment
Switch(config-vlan)#exit
Switch(config)#Vlan 3
Switch(config-vlan)#Name CENdepartment
Switch(config-vlan)#exit
Switch(config)#Vlan 4
Switch(config-vlan)#Name EEdepartment
Switch(config-vlan)#exit
Switch(config)#Vlan 5
Switch(config-vlan)#Name Civildepartment
Switch(config-vlan)#exit
Switch(config)#
```

```
Switch(config)#
Switch(config)#int fa0/1
Switch(config-if)#Switchport access Vlan 2
Switch(config-if)#exit
Switch(config)#int fa0/2
Switch(config-if)#Switchport access Vlan 2
Switch(config-if)#exit
Switch(config)#int fa0/3
Switch(config-if)#Switchport access Vlan 3
Switch(config-if)#exit
Switch(config)# int fa0/4
Switch(config-if)#Switchport access Vlan 3
Switch(config-if)#exit
Switch(config)#int fa0/5
Switch(config-if)#Switchport access Vlan 4
Switch(config-if)#exit
Switch(config)#int fa0/6
Switch(config-if)#Switchport access Vlan 4
Switch(config-if)#exit
Switch(config)#int fa0/7
Switch(config-if)#Switchport access Vlan 5
Switch(config-if)#exit
Switch(config)#int fa0/8
Switch(config-if)#Switchport access Vlan 5
Switch(config-if)#exit
Switch(config)#
```

Step2: After creating Vlan connect a router to switch through fast Ethernet interface

```
Switch>
Switch>enable
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#int fa0/9
Switch(config-if)#Switchport mode trunk
Switch(config-if)#exit
Switch(config)#exit
Switch#
```

Step3: Router configuration for Vlan

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#no shutdown
```

Creation of sub Interface and route:

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0.1
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.1, changed
state to up

Router(config-subif)#Encapsulation dot1Q 2
Router(config-subif)#Ip address 192.168.10.100 255.255.255.0
Router(config-subif)#exit
Router(config)#int fa0/0.2
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.2, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.2, changed
state to up

Router(config-subif)#Encapsulation dot1Q 3
Router(config-subif)# ip address 192.168.11.100 255.255.255.0
Router(config-subif)#exit
Router(config)#int fa0/0.3
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.3, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.3, changed
state to up

Router(config-subif)#Encapsulation dot1Q 4
Router(config-subif)#ip address 192.168.12.100 255.255.255.0
Router(config-subif)#exit
Router(config)#int fa0/0.4
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.4, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.4, changed
state to up
```

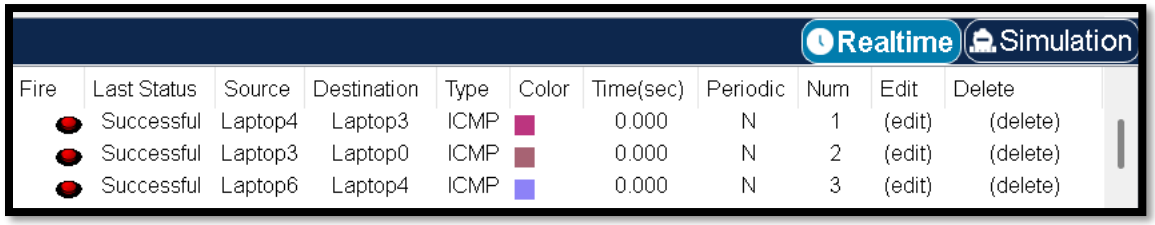
```
Router(config-subif)#Encapsulation dot1Q 5
Router(config-subif)#ip address 192.168.13.100 255.255.255.0
Router(config-subif)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router# show ip interface brief
Interface              IP-Address      OK? Method Status
Protocol
FastEthernet0/0        unassigned      YES unset  up                    up
FastEthernet0/0.1      192.168.10.100  YES manual up                    up
FastEthernet0/0.2      192.168.11.100  YES manual up                    up
FastEthernet0/0.3      192.168.12.100  YES manual up                    up
FastEthernet0/0.4      192.168.13.100  YES manual up                    up
FastEthernet1/0        unassigned      YES unset  administratively down down
Serial2/0              unassigned      YES unset  administratively down down
Serial3/0              unassigned      YES unset  administratively down down
FastEthernet4/0        unassigned      YES unset  administratively down down
FastEthernet5/0        unassigned      YES unset  administratively down down
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#Network 192.168.10.0
Router(config-router)#Network 192.168.11.0
Router(config-router)#Network 192.168.12.0
Router(config-router)#Network 192.168.13.0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Router#
```

- **Ping different Vlans laptops.**

Pinging EE department laptop with one of every other department:

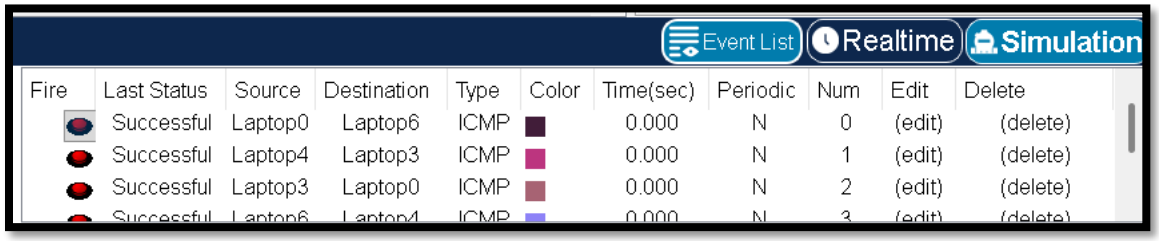
```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.10.1

Pinging 192.168.10.1 with 32 bytes of data:

Reply from 192.168.10.1: bytes=32 time<1ms TTL=127
Reply from 192.168.10.1: bytes=32 time<1ms TTL=127
Reply from 192.168.10.1: bytes=32 time=8ms TTL=127
Reply from 192.168.10.1: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.10.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 8ms, Average = 2ms

C:\>ping 192.168.11.2

Pinging 192.168.11.2 with 32 bytes of data:

Reply from 192.168.11.2: bytes=32 time<1ms TTL=127
Reply from 192.168.11.2: bytes=32 time=1ms TTL=127
Reply from 192.168.11.2: bytes=32 time<1ms TTL=127
Reply from 192.168.11.2: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.11.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.13.1

Pinging 192.168.13.1 with 32 bytes of data:

Reply from 192.168.13.1: bytes=32 time<1ms TTL=127
Reply from 192.168.13.1: bytes=32 time<1ms TTL=127
Reply from 192.168.13.1: bytes=32 time<1ms TTL=127
Reply from 192.168.13.1: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.13.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

- **Send packets (Real time).**



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop4	Laptop3	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Laptop3	Laptop0	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Laptop6	Laptop4	ICMP		0.000	N	3	(edit)	(delete)

- **Send packets(Simulation).**



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop0	Laptop6	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Laptop4	Laptop3	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Laptop3	Laptop0	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Laptop6	Laptop4	ICMP		0.000	N	3	(edit)	(delete)