

Communication Networks Protocol

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1 Mission 1,2 and 3

1.1 Snapshot of our topology

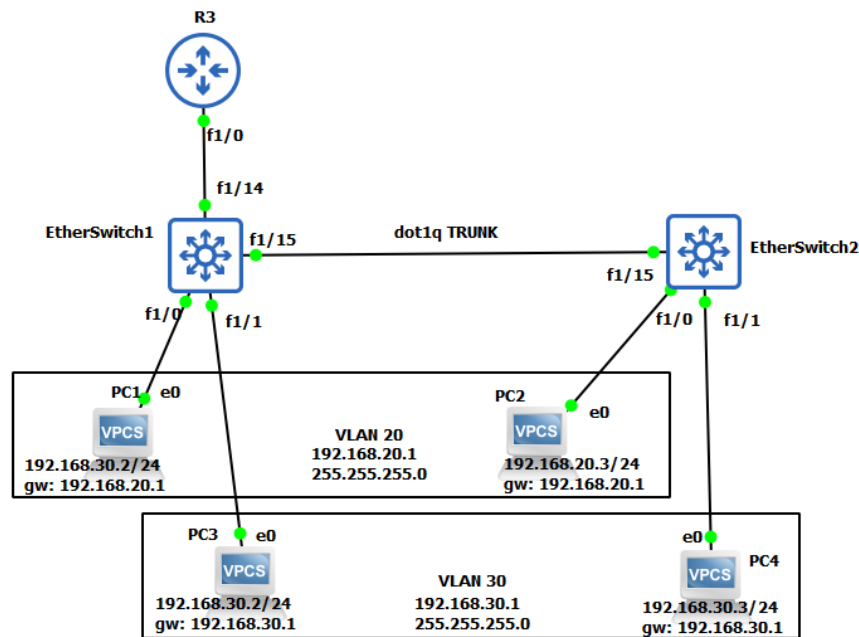


Figure 1: Inter-Vlan Topology

1.2 Configuration for Mission 1

Mission 1, here we validate that we can ping back and forth between PC1 and PC3, before vlan exits. This Requires first to adjust the subnet to 16 instead of 24 so they have same subnets. Below is how we did that.

1.3 PC3 show IP as follows

```
PC3> show ip
```

```
NAME       : PC3[1]
IP/MASK     : 192.168.30.2/24
GATEWAY     : 192.168.30.1
DNS         :
MAC         : 00:50:79:66:68:02
LPORT      : 20032
RHOST:PORT  : 127.0.0.1:20033
MTU         : 1500
```

```
PC3> ip 192.168.30.2 255.255.0.0 192.168.30.1
Checking for duplicate address...
PC3 : 192.168.30.2 255.255.0.0 gateway 192.168.30.1
```

```
PC3> show ip
```

```
NAME       : PC3[1]
IP/MASK     : 192.168.30.2/16
GATEWAY     : 192.168.30.1
DNS         :
MAC         : 00:50:79:66:68:02
LPORT      : 20032
RHOST:PORT  : 127.0.0.1:20033
MTU         : 1500
```

```
PC3> ping 192.168.20.2
```

```
84 bytes from 192.168.20.2 icmp_seq=1 ttl=64 time=1.103 ms
84 bytes from 192.168.20.2 icmp_seq=2 ttl=64 time=1.257 ms
84 bytes from 192.168.20.2 icmp_seq=3 ttl=64 time=1.349 ms
```

```
PC1> show ip
```

```
NAME       : PC1[1]
IP/MASK     : 192.168.20.2/24
GATEWAY     : 192.168.20.1
DNS         :
MAC         : 00:50:79:66:68:00
LPORT      : 20028
RHOST:PORT  : 127.0.0.1:20029
MTU         : 1500
```

```
PC1> ip 192.168.20.2 255.255.0.0 192.168.20.1
Checking for duplicate address...
PC1 : 192.168.20.2 255.255.0.0 gateway 192.168.20.1
```

```
PC1> show ip
```

```

NAME       : PC1[1]
IP/MASK    : 192.168.20.2/16
GATEWAY    : 192.168.20.1
DNS        :
MAC        : 00:50:79:66:68:00
LPORT     : 20028
RHOST:PORT : 127.0.0.1:20029
MTU        : 1500

```

```
PC1> ping 192.168.30.2
```

```

84 bytes from 192.168.30.2 icmp_seq=1 ttl=64 time=0.627 ms
84 bytes from 192.168.30.2 icmp_seq=2 ttl=64 time=0.693 ms
84 bytes from 192.168.30.2 icmp_seq=3 ttl=64 time=0.649 ms

```

1.3.1 Mission 2: Trunking

This requires the configuration Etherswitch1 and Etherswitch2 to enable the ping between PC1 and PC2.

```

EtherSwitch1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
EtherSwitch1(config)#no ip routing
EtherSwitch1(config)#end
EtherSwitch1#
*Mar 1 00:01:44.215: %SYS-5-CONFIG_I: Configured from console by console
EtherSwitch1#vlan database
EtherSwitch1(vlan)#vlan 20
VLAN 20 added:
    Name: VLAN0020
EtherSwitch1(vlan)#vlan 30
VLAN 30 added:
    Name: VLAN0030
EtherSwitch1(vlan)#exit
APPLY completed.
Exiting...
EtherSwitch1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
EtherSwitch1(config)#interface fastEthernet 1/0
EtherSwitch1(config-if)#switchport mode access
EtherSwitch1(config-if)#switchport access vlan 20
EtherSwitch1(config-if)#exit
EtherSwitch1(config)#interface fastEthernet 1/1
EtherSwitch1(config-if)#switchport mode access
EtherSwitch1(config-if)#switchport access vlan 30
EtherSwitch1(config-if)#exit
EtherSwitch1(config)#interface vlan 20
EtherSwitch1(config-if)#
*Mar 1 00:05:05.239: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan20, changed state to up
EtherSwitch1(config-if)#no shutdown
EtherSwitch1(config-if)#exit
EtherSwitch1(config)#interface vlan 30
EtherSwitch1(config-if)#
*Mar 1 00:05:43.355: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan30, changed state to up
EtherSwitch1(config-if)#no shutdown
EtherSwitch1(config-if)#exit
EtherSwitch1(config)#exit
EtherSwitch1#
*Mar 1 00:06:02.083: %SYS-5-CONFIG_I: Configured from console by console
EtherSwitch1#show vlan-switch

```

VLAN	Name	Status	Ports
1	default	active	Fa1/2, Fa1/3, Fa1/4, Fa1/5 Fa1/6, Fa1/7, Fa1/8, Fa1/9 Fa1/10, Fa1/11, Fa1/12, Fa1/13 Fa1/14, Fa1/15
20	VLAN0020	active	Fa1/0
30	VLAN0030	active	Fa1/1
1002	fdi-default	active	
1003	token-ring-default	active	
1004	fdiinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	1002	1003
20	enet	100020	1500	-	-	-	-	-	0	0
30	enet	100030	1500	-	-	-	-	-	0	0
1002	fdi	101002	1500	-	-	-	-	-	1	1003
1003	tr	101003	1500	1005	0	-	-	srp	1	1002
1004	fdnet	101004	1500	-	-	1	-	ibm	0	0
1005	trnet	101005	1500	-	-	1	-	ibm	0	0

Figure 2: Etherswitch1 configuration

1.4 Configuration for Etherswitch2

```
add state to up
Etherswitch2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Etherswitch2(config)#no ip routing
Etherswitch2(config)#end
Etherswitch2
Mar 1 00:11:37.755: %SYS-5-CONF10_1: Configured from console by console
Etherswitch2#vlan database
Etherswitch2(vlan)#vlan 20
VLAN 20 added:
  Name: VLAN0020
Etherswitch2(vlan)#vlan 30
VLAN 30 added:
  Name: VLAN0030
Etherswitch2(vlan)#exit
WPV completed.
Exiting...
Etherswitch2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Etherswitch2(config)#interface fastEthernet 1/0
Etherswitch2(config-if)#switchport mode access
Etherswitch2(config-if)#switchport access vlan 20
Etherswitch2(config-if)#exit
Etherswitch2(config)#interface fastEthernet 1/1
Etherswitch2(config-if)#switchport mode access
Etherswitch2(config-if)#switchport access vlan 30
Etherswitch2(config-if)#exit
Etherswitch2(config)#interface vlan 20
Etherswitch2(config-if)#no
Mar 1 00:13:07.447: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan20, changed state to up
Etherswitch2(config-if)#exit
Etherswitch2(config)#interface vlan 30
Etherswitch2(config-if)#no s
Mar 1 00:13:14.830: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan30, changed state to up
Etherswitch2(config-if)#no shutdown
Etherswitch2(config-if)#exit
Etherswitch2#show vlan-switch
Etherswitch2#show vlan-switch
VLAN Name                Status    Ports
-----
1  default                active    Fa1/2, Fa1/3, Fa1/4, Fa1/5
                    Fa1/6, Fa1/7, Fa1/8, Fa1/9
                    Fa1/10, Fa1/11, Fa1/12, Fa1/13
                    Fa1/14, Fa1/15
20  VLAN0020                active    Fa1/0
30  VLAN0030                active    Fa1/1
1002 fddi-default        active
1003 token-ring-default  active
1004 fddnet-default      active
1005 trnet-default        active

VLAN Type  SAID      MTU    Parent RingNo BridgeNo Stp    BridgeMode Trans1 Trans2
-----
1  enet  100001  1500    -    -    -    -    -    1002  1005
20  enet  100020  1500    -    -    -    -    -    0      0
30  enet  100030  1500    -    -    -    -    -    0      0
1002 fddi  101001  1500    -    -    -    -    -    1  1003
1003 tr  101003  1500  1005    0    -    -    srb  1  1002
1004 fddnet 101004  1500    -    -    1    lbr  -    0      0
```

Figure 3: Etherswitch2 Configuration

1.5 Ping between PC1 and PC2 on the Vlan but different switches. We could pinged back and forth between PC1 and PC2.

No.	Time	Source	Destination	Protocol	Length	Info
28	13.111494	c4:04:13:2f:f1:0f	PVST+	STP	68	Conf. Root = 32768/0/c4:04:0a:f1:00:01 Cost = 0 Port = 0
29	13.113269	Private 66:68:00	Broadcast	ARP	68	Who has 192.168.20.3? Tell 192.168.20.2
30	13.113817	Private 66:68:00	Private 66:68:00	ARP	68	192.168.20.3 is at 00:50:79:66:68:01
31	13.115709	192.168.20.2	192.168.20.3	ICMP	102	Echo (ping) request id=0x7126, seq=1/256, ttl=64 (reply i
32	13.116340	192.168.20.3	192.168.20.2	ICMP	102	Echo (ping) reply id=0x7126, seq=1/256, ttl=64 (request
33	14.119174	192.168.20.2	192.168.20.3	ICMP	102	Echo (ping) request id=0x7226, seq=2/512, ttl=64 (reply i
34	14.119869	192.168.20.3	192.168.20.2	ICMP	102	Echo (ping) reply id=0x7226, seq=2/512, ttl=64 (request
35	14.581900	c4:04:13:2f:f1:0f	Spanning-tree-(for-...	STP	68	Conf. Root = 32768/0/c4:04:0a:f1:00:00 Cost = 0 Port = 0
36	14.591410	c4:04:13:2f:f1:0f	PVST+	STP	64	Conf. Root = 32768/0/c4:04:0a:f1:00:00 Cost = 0 Port = 0
37	15.122085	192.168.20.2	192.168.20.3	ICMP	102	Echo (ping) request id=0x7326, seq=3/768, ttl=64 (reply i
38	15.122833	192.168.20.3	192.168.20.2	ICMP	102	Echo (ping) reply id=0x7326, seq=3/768, ttl=64 (request
39	15.186571	c4:04:13:2f:f1:0f	PVST+	STP	68	Conf. Root = 32768/0/c4:04:0a:f1:00:02 Cost = 0 Port = 0
40	15.207200	c4:04:13:2f:f1:0f	PVST+	STP	68	Conf. Root = 32768/0/c4:04:0a:f1:00:01 Cost = 0 Port = 0
Frame 32: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) on interface -, id 0						
Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: Private_66:68:00 (00:50:79:66:68:00)						
802.1Q Virtual LAN, PRI: 0, DEI: 0, ID: 20						
0000 = Priority: Best Effort (default) (0)						
...0 = DEI: Ineligible						
.... 0000 0001 0100 = ID: 20						
Type: IPv4 (0x0800)						
Internet Protocol Version 4, Src: 192.168.20.3, Dst: 192.168.20.2						
Internet Control Message Protocol						

Figure 4: PC1 Pings PC2

1.6 Wireshark capture on the trunk line while PC1 pings PC2

We managed to get the correct package passing through the wireshark capture as soon as ICMP echo ping packet was noticed, just as it can be seen above.

2 Mission 3: Inter-vlan Routing

2.1 Configuration for transforming router interface to a switch port

```
R3(config)#int fastEthernet 1/0
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#exit
R3#write

R3#conf t
R3(config)#int fastEthernet 1/0.20
R3(config-subif)#encapsulation dot1Q 20
R3(config-subif)#ip address 192.168.20.1 255.255.255.0
R3(config-subif)#exit
R3(config)#exit
R3#write

R3#conf t
R3(config)#int fastEthernet 1/0.30
R3(config-subif)#encapsulation dot1Q 30
R3(config-subif)#ip address 192.168.30.1 255.255.255.0
R3(config-subif)#exit
R3(config)#exit
R3#write
```

It is worthy to note that,

Vlan 20 belongs to the subinterface 1/0.20

The default gateway IP of all PC's on vlan 20, hence all PC are configured with the default gateway s

2.2 Packets were made to flow through the traffic between vlan 20 and vlan 30 by configuring the router on a stick labelled R3.

3 Mission 3: Question 1. PC1 pings the Router Interface

Mission 3: Question 2

3.1 PC1 pings PC3

```
PC3> ping 192.168.20.2
```

```
84 bytes from 192.168.20.2 icmp_seq=1 ttl=63 time=30.741 ms
84 bytes from 192.168.20.2 icmp_seq=2 ttl=63 time=19.051 ms
84 bytes from 192.168.20.2 icmp_seq=3 ttl=63 time=18.155 ms
```

```
PC1> ping 192.168.30.2
```

```
84 bytes from 192.168.30.2 icmp_seq=1 ttl=63 time=24.356 ms
84 bytes from 192.168.30.2 icmp_seq=2 ttl=63 time=12.464 ms
84 bytes from 192.168.30.2 icmp_seq=3 ttl=63 time=19.504 ms
84 bytes from 192.168.30.2 icmp_seq=4 ttl=63 time=21.439 ms
```

```

PC1>
PC1> ping 192.168.20.1

84 bytes from 192.168.20.1 icmp_seq=1 ttl=255 time=10.062 ms
84 bytes from 192.168.20.1 icmp_seq=2 ttl=255 time=4.462 ms
84 bytes from 192.168.20.1 icmp_seq=3 ttl=255 time=11.081 ms
^C
PC1> ping 192.168.30.1

84 bytes from 192.168.30.1 icmp_seq=1 ttl=255 time=2.609 ms
84 bytes from 192.168.30.1 icmp_seq=2 ttl=255 time=3.489 ms
84 bytes from 192.168.30.1 icmp_seq=3 ttl=255 time=4.313 ms
84 bytes from 192.168.30.1 icmp_seq=4 ttl=255 time=5.114 ms
^C
PC1>

```

Figure 5: PC1 Pings Router Surface

```

84 bytes from 192.168.30.2 icmp_seq=5 ttl=63 time=13.157 ms

```

Though PC1 and PC3 are on different VLANs yet they were able to ping each other.

Why? The ping between PC1 and PC3 is made possible through inter-Vlan routing which is enabled by t

3.2 Impact on the bandwidth

The bandwidth becomes saturated with time due to the traffic from multiple Vlans. Whenever more devices are added to the broadcast domain, more broadcast start to saturate the network while keeping the VLAN identification and segment untouched.

3.3 Opportunities in terms of security offered by inter-Vlan

Inter-vlan allows a good security system configuration to be achieved in the sense that it allows filtering through different subnets by giving access to or block certain subnets while keeping the ID tag of the packet being sent until it arrived at the desired destination.

4 With Wireshark monitor the stick line i.e the connection between EtherSwicth1 and the router when pinging from PC1 to PC3 with the packet observed

68	23.749263	c4:06:0a:8c:00:10	c4:06:0a:8c:00:10	LOOP	60	Reply
69	24.416049	192.168.20.2	192.168.30.2	ICMP	102	Echo (ping) request id=0x2502, seq=5/1280, ttl=64 (no response found!)
70	24.423944	192.168.20.2	192.168.30.2	ICMP	102	Echo (ping) request id=0x2502, seq=5/1280, ttl=63 (reply in 71)
71	24.424872	192.168.30.2	192.168.20.2	ICMP	102	Echo (ping) reply id=0x2502, seq=5/1280, ttl=64 (request in 70)
72	24.434158	192.168.30.2	192.168.20.2	ICMP	102	Echo (ping) reply id=0x2502, seq=5/1280, ttl=63
73	25.586930	c4:05:09:0a:f1:0e	Spanning-tree-(for...	STP	68	Conf. Root = 32768/0/c4:04:0a:f1:00:00 Cost = 19 Port = 0x8037
74	25.597268	c4:05:09:0a:f1:0e	PVST+	STP	64	Conf. Root = 32768/0/c4:04:0a:f1:00:00 Cost = 19 Port = 0x8037
75	25.628878	c4:05:09:0a:f1:0e	PVST+	STP	68	Conf. Root = 32768/0/c4:04:0a:f1:00:02 Cost = 19 Port = 0x8037
76	25.649439	c4:05:09:0a:f1:0e	PVST+	STP	68	Conf. Root = 32768/0/c4:04:0a:f1:00:01 Cost = 19 Port = 0x8037

>	Frame 70: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) on interface -, id 0
>	Ethernet II, Src: c4:06:0a:8c:00:10 (c4:06:0a:8c:00:10), Dst: Private_66:68:02 (00:50:79:66:68:02)
▼	802.1Q Virtual LAN, PRI: 0, DEI: 0, ID: 30
	000. = Priority: Best Effort (default) (0)
	...0 = DEI: Ineligible
 0000 0001 1110 = ID: 30
	Type: IPv4 (0x8000)
▼	Internet Protocol Version 4, Src: 192.168.20.2, Dst: 192.168.30.2
	0100 = Version: 4
 0101 = Header Length: 20 bytes (5)
>	Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
	Total Length: 84
	Identification: 0x0225 (549)
>	Flags: 0x00
	...0 0000 0000 0000 = Fragment Offset: 0
	Time to Live: 63
	Protocol: ICMP (1)
	Header Checksum: 0xc62f [validation disabled]
	[Header checksum status: Unverified]
	Source Address: 192.168.20.2
	Destination Address: 192.168.30.2

Figure 6: PC1 Pings Router Surface