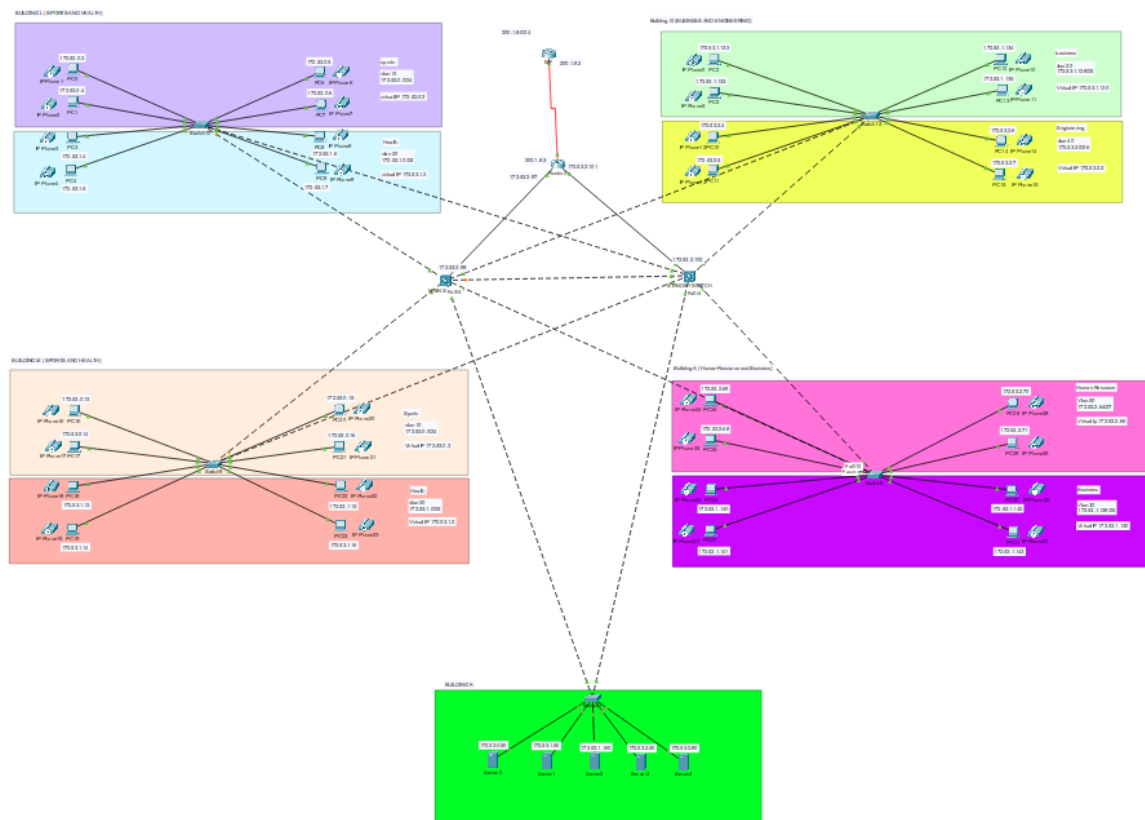1.Design and draw network topology using packet tracers (or other drawing tools). Clearly label the buildings, departments, switches and router.
(10 marks)

2.Identify how many subnets are required for your proposed topology. Design the subnets based on the given network address (172.XY.0.0/16) to optimize the address spaces (using the second approach – number of hosts needed). Note: the link between the gateway router of the university and ISP router has been assigned with network 200.1.X.0/24 (X is the first digits of your student ID).

SPORTS	
Allocated subnet/mask	255.255.255.0 - /24
Network address	172.53.0.0
Default gateway	172.53.0.2
Valid host address range	172.53.0.1-172.53.0.254
Broadcast address	172.53.0.255

HEALTH	
Allocated subnet/mask	255.255.255.128 - /25
Network address	172.53.1.0
Default gateway	172.53.1.2
Valid host address range	172.53.1.1-172.53.1.126

Broadcast address	172.53.1.127

BUSINESS	
Allocated subnet/mask	255.255.255.128 - /25
Network address	172.53.1.128
Default gateway	172.53.1.130
Valid host address range	172.53.1.129-172.53.1.254
Broadcast address	172.53.1.255

ENGINEERING	
Allocated subnet/mask	255.255.255.192 - /26
Network address	172.53.2.0
Default gateway	172.53.2.2
Valid host address range	172.53.2.1-172.53.2.62
Broadcast address	172.53.2.63

HUMAN RESOURCE	
Allocated subnet/mask	255.255.255.224 - /27
Network address	172.53.2.64
Default gateway	172.53.2.66
Valid host address range	172.53.2.65-172.53.2.94
Broadcast address	172.53.2.95

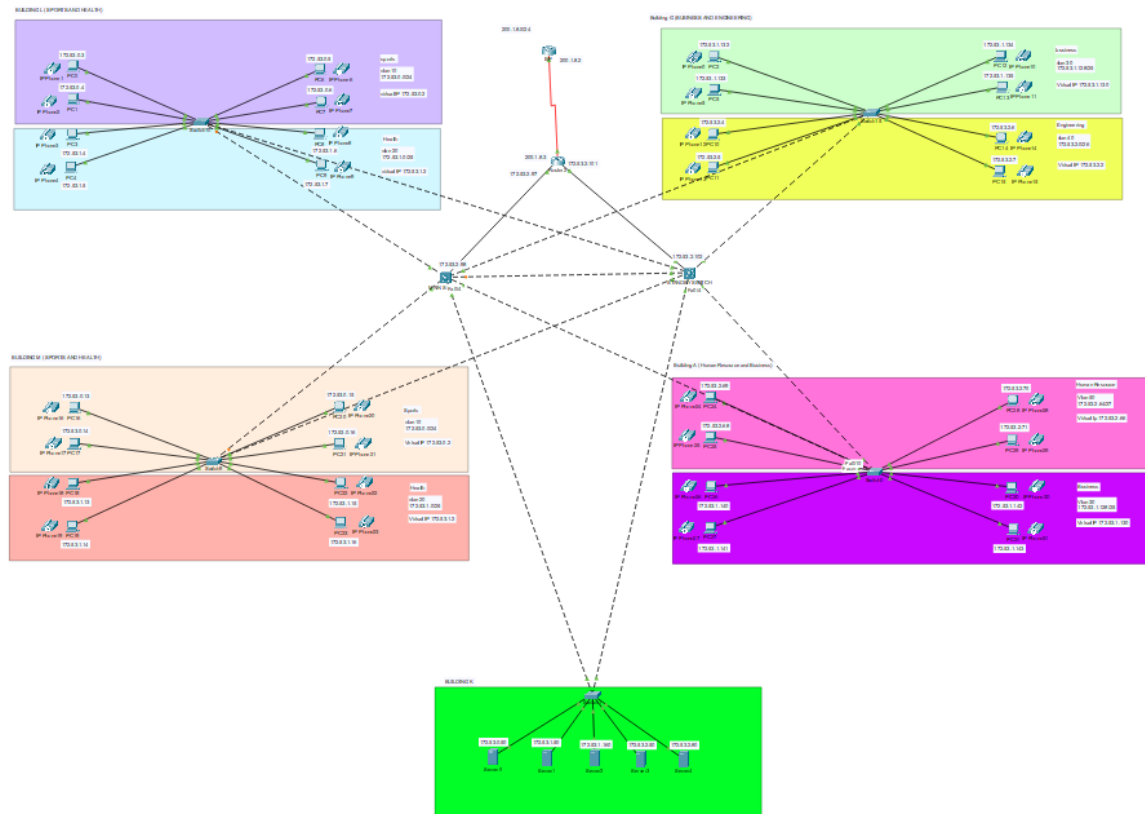| ROUTER NETWORK 1	
Allocated subnet/mask	255.255.255.252 - /30
Network address	172.53.2.96
Valid host address range	172.53.2.97-172.53.2.98
Broadcast address	172.53.2.99

ROUTER NETWORK 2	
Allocated subnet/mask	255.255.255.252 - /30
Network address	172.53.2.100
Valid host address range	172.53.2.101-172.53.2.102
Broadcast address	172.53.2.103

Default gateway network	
Allocated subnet/mask	255.255.255.0 - /24
Network address	200.1.8.0
Valid host address range	200.1.8.1-200.1.8.254

Broadcast address	200.1.8.255

3.Label the drawn network topology with corresponding subnets and ip addresses and then take screenshot
(5 marks)

4. Design appropriate configuration script for Routers and Switches to implement the proposed network. Where necessary, our configuration design should account for VLAN, Routing, NAT, and Redundancy.

Switch 10
Enable Conf t Vlan 10 Vlan 20 Exit Int fa0/1 Switchport mode access Switchport access vlan 10

Exit
Int fa0/2
Switchport mode access
Switchport access vlan 10
Exit
Int fa0/8
Switchport mode access
Switchport access vlan 10
Exit
Int fa0/7
Switchport mode access
Switchport access vlan 10
Exit
Int fa0/3
Switchport mode access
Switchport access vlan 20
Exit
Int fa0/4
Switchport mode access
Switchport access vlan 20
Exit
Int fa0/9
Switchport mode access
Switchport access vlan 20
Exit
Int fa0/10
Switchport mode access
Switchport access vlan 20
Exit

Int fa0/5
Switchport mode trunk
Exit
Int fa0/6
Switchport mode trunk
Exit

Switch 9
Enable Conf t Vlan 10 Vlan 20 Exit Int fa0/1

```
Switchport mode access
Switchport access vlan 10
Exit
Int fa0/2
Switchport mode access
Switchport access vlan 10
Exit
Int fa0/8
Switchport mode access
Switchport access vlan 10
Exit
Int fa0/7
Switchport mode access
Switchport access vlan 10
Exit
Int fa0/3
Switchport mode access
Switchport access vlan 20
Exit
Int fa0/4
Switchport mode access
Switchport access vlan 20
Exit
Int fa0/9
Switchport mode access
Switchport access vlan 20
Exit
Int fa0/10
Switchport mode access
Switchport access vlan 20
Exit

Int fa0/5
Switchport mode trunk
Exit
Int fa0/6
Switchport mode trunk
Exit
```

Switch 0
Enable
Conf t
Vlan 50

```
Vlan 30
Exit
Int fa0/1
Switchport mode access
Switchport access vlan 50
Exit
Int fa0/2
Switchport mode access
Switchport access vlan 50
Exit
Int fa0/5
Switchport mode access
Switchport access vlan 50
Exit
Int fa0/6
Switchport mode access
Switchport access vlan 50
Exit
Int fa0/3
Switchport mode access
Switchport access vlan 30
Exit
Int fa0/4
Switchport mode access
Switchport access vlan 30
Exit
Int fa0/7
Switchport mode access
Switchport access vlan 30
Exit
Int fa0/8
Switchport mode access
Switchport access vlan 30
Exit

Int fa0/9
Switchport mode trunk
Exit
Int fa0/10
Switchport mode trunk
Exit

```

Switch 15
Enable

```
Conf t
Vlan 30
Vlan 40
Exit
Int fa0/1
Switchport mode access
Switchport access vlan 30
Exit
Int fa0/2
Switchport mode access
Switchport access vlan 30
Exit
Int fa0/8
Switchport mode access
Switchport access vlan 30
Exit
Int fa0/7
Switchport mode access
Switchport access vlan 30
Exit
Int fa0/3
Switchport mode access
Switchport access vlan 40
Exit
Int fa0/4
Switchport mode access
Switchport access vlan 40
Exit
Int fa0/9
Switchport mode access
Switchport access vlan 40
Exit
Int fa0/10
Switchport mode access
Switchport access vlan 40
Exit

Int fa0/5
Switchport mode trunk
Exit
Int fa0/6
Switchport mode trunk
Exit
```

MAIN SWITCH
Enable
Config t
Ip rounting
Vlan 10
Exit
Int vlan 10
Ip address 172.53.0.17 255.255.255.0
Standby 10 ip 172.53.0.2
Standby 10 priority 110
No shutdown
Exit
Vlan 20
Exit
Int vlan 20
Ip address 172.53.1.17 255.255.255.128
Standby 20 ip 172.53.1.2
Standby 20 priority 110
No shutdown
Exit
Vlan 30
Exit
Int vlan 30
Ip address 172.53.1.144 255.255.255.128
Standby 30 ip 172.53.1.130
Stanby 30 ip priority 110
No shutdown
Exit
Vlan 40
Exit
Int vlan 40
Ip address 172.53.1.9 255.255.255.192
Standby 40 ip 172.53.2.2
Standby 40 priority 110
No shutdown
Exit
Vlan 50
Exit
Int vlan 50
Ip address 172.53.2.72 255.255.255.224
Standby 50 ip 172.53.2.66
Standby 50 priority 110
No shutdown
Exit

```
Int fa0/1
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit
Int fa0/3
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit
Int fa0/6
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit

Int fa0/ 4
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit
Int fa0/5
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit
```

Standby switch
Enable
Config t
Ip rounting
Vlan 10
Exit
Int vlan 10
Ip address 172.53.0.18 255.255.255.0
Standby 10 ip 172.53.0.2
Standby 10 priority 90
No shutdown
Exit
Vlan 20
Exit
Int vlan 20
Ip address 172.53.1.18 255.255.255.128

```
Standby 20 ip 172.53.1.2
Standby 20 priority 90
No shutdown
Exit
Vlan 30
Exit
Int vlan 30
Ip address 172.53.1.145 255.255.255.128
Standby 30 ip 172.53.1.130
Stanby 30 ip priority 90
No shutdown
Exit
Vlan 40
Exit
Int vlan 40
Ip address 172.53.1.10 255.255.255.192
Standby 40 ip 172.53.2.2
Standby 40 priority 90
No shutdown
Exit
Vlan 50
Exit
Int vlan 50
Ip address 172.53.2.73 255.255.255.224
Standby 50 ip 172.53.2.66
Standby 50 priority 90
No shutdown
Exit


Int fa0/1
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit
Int fa0/2
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit
Int fa0/3
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit

Int fa0/ 4
```

```
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit
Int fa0/5
Switchport trunk encapsulation dot1q
Switchport mode trunk
No shutdown
exit
```

Switch 1
Enable
Conf t
Vlan 10
Vlan 20
Vlan 30
Vlan 40
Vlan 50
Exit
Int fa0/1
Switchport mode access
Switchport access vlan 10
Exit
Int fa0/2
Switchport mode access
Switchport access vlan 20
Exit
Int fa0/3
Switchport mode access
Switchport access vlan 30
Exit
Int fa0/4
Switchport mode access
Switchport access vlan 40
Exit
Int fa0/5
Switchport mode access
Switchport access vlan 50
Exit
Int fa0/7
Switchport mode trunk
Exit

```
Int fa0/6
Switchport mode trunk
Exit
```

```
ROUTER 2

Enable
Config t
Int gig0/0/0
Ip address 172.53.1.97 255.255.255.252
Ip nat inside
No shutdown
Exit
Int gig0/0/1
Ip address 172.53.2.101 255.255.255.252
Ip nat inside
No shutdown
Exit
Int s0/0/2
Ip address 200.1.8.3 255.255.255.0
Ip nat outside
No shutdown
Exit
ip access-list standard NT-INSIDE
permit 172.53.0.0 0.0.0.255
permit 172.53.1.0 0.0.0.127
permit 172.53.1.128 0.0.0.127
permit 172.53.2.0 0.0.0.63
permit 172.53.2.64 0.0.0.31
ip nat inside source list NAT-INSIDE interface se0/0/2 overload
ip route 0.0.0.0 0.0.0.0 200.1.8.2

ip route 172.53.0.0 255.255.0.0 172.53.2.98 1
ip route 172.53.0.0 255.255.0.0 172.53.2.102 5
exit

Exit
```

```
ISP
```

```
Enable
Conf t
Int Se0/2/0
Ip address 200.1.8.2 255.255.255.0
No shutdown
Exit
Ip route 172.53.0.0 255.255.0.0 200.1.8.3
Exit
```

5. Perform necessary verification to test the performance of the proposed network. All computers should be able to ping to any other computers on different networks and to the port on router. If either of the Layer 3 switches fails, the network should still be functional.
Use necessary screenshots of ping and show commands on computers, switches and routers to show the status and performance of your network

```
Command Prompt                                                          X

Cisco Packet Tracer PC Command Line 1.0
C:\>ping 172.53.2.71

Pinging 172.53.2.71 with 32 bytes of data:

Request timed out.
Reply from 172.53.2.71: bytes=32 time=24ms TTL=127

Ping statistics for 172.53.2.71:
    Packets: Sent = 3, Received = 1, Lost = 2 (67% loss),
Approximate round trip times in milli-seconds:
    Minimum = 24ms, Maximum = 24ms, Average = 24ms

Control-C
^C
C:\>ping 172.53.2.71

Pinging 172.53.2.71 with 32 bytes of data:

Reply from 172.53.2.71: bytes=32 time=16ms TTL=127
Reply from 172.53.2.71: bytes=32 time=16ms TTL=127
Reply from 172.53.2.71: bytes=32 time<1ms TTL=127
Reply from 172.53.2.71: bytes=32 time<1ms TTL=127

Ping statistics for 172.53.2.71:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 16ms, Average = 8ms

C:\>ping 172.53.2.71

Pinging 172.53.2.71 with 32 bytes of data:

Reply from 172.53.2.71: bytes=32 time<1ms TTL=127
Reply from 172.53.2.71: bytes=32 time<1ms TTL=127
Reply from 172.53.2.71: bytes=32 time<1ms TTL=127
Reply from 172.53.2.71: bytes=32 time=1ms TTL=127

Ping statistics for 172.53.2.71:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>

☐ Top
```

```
C:\>ping 172.53.1.14

Pinging 172.53.1.14 with 32 bytes of data:

Reply from 172.53.1.14: bytes=32 time=1ms TTL=128
Reply from 172.53.1.14: bytes=32 time<1ms TTL=128
Reply from 172.53.1.14: bytes=32 time=1ms TTL=128
Reply from 172.53.1.14: bytes=32 time<1ms TTL=128

Ping statistics for 172.53.1.14:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

```
C:\>ping 200.1.8.2

Pinging 200.1.8.2 with 32 bytes of data:

Reply from 200.1.8.2: bytes=32 time=30ms TTL=253
Reply from 200.1.8.2: bytes=32 time=1ms TTL=253
Reply from 200.1.8.2: bytes=32 time=1ms TTL=253
Reply from 200.1.8.2: bytes=32 time=4ms TTL=253

Ping statistics for 200.1.8.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 30ms, Average = 9ms

C:\>
```

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 172.53.1.15

Pinging 172.53.1.15 with 32 bytes of data:

Reply from 172.53.1.15: bytes=32 time<1ms TTL=127
Reply from 172.53.1.15: bytes=32 time<1ms TTL=127
Reply from 172.53.1.15: bytes=32 time<1ms TTL=127
Reply from 172.53.1.15: bytes=32 time=1ms TTL=127

Ping statistics for 172.53.1.15:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

```
Switch#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    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
20   VLAN0020                         active
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN0050                         active
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

Switch#show interface trunk
Port         Mode         Encapsulation  Status        Native vlan
Fa0/1        auto         n-802.1q       trunking      1
Fa0/3        auto         n-802.1q       trunking      1
Fa0/4        auto         n-802.1q       trunking      1
Fa0/5        auto         n-802.1q       trunking      1
Fa0/6        on           802.1q         trunking      1

Port         Vlans allowed on trunk
Fa0/1        1-1005
Fa0/3        1-1005
Fa0/4        1-1005
Fa0/5        1-1005
Fa0/6        1-1005

Port         Vlans allowed and active in management domain
Fa0/1        1,10,20,30,40,50
Fa0/3        1,10,20,30,40,50
Fa0/4        1,10,20,30,40,50
Fa0/5        1,10,20,30,40,50
Fa0/6        1,10,20,30,40,50
```

Copy   Paste

Physical   Config   CLI   Attributes

IOS Command Line Interface

```
Switch#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    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
20   VLAN0020                         active
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN0050                         active
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

Switch#show interface trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/1       on           802.1q         trunking      1
Fa0/2       auto         n-802.1q       trunking      1
Fa0/3       auto         n-802.1q       trunking      1
Fa0/4       auto         n-802.1q       trunking      1
Fa0/5       auto         n-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
Fa0/5       1-1005

Port        Vlans allowed and active in management domain
Fa0/1       1,10,20,30,40,50
Fa0/2       1,10,20,30,40,50
Fa0/3       1,10,20,30,40,50
Fa0/4       1,10,20,30,40,50
Fa0/5       1,10,20,30,40,50
```

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```
Switch#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    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
20   VLAN0020                         active
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN0050                         active
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

Switch#show interface trunk
Port        Mode        Encapsulation  Status        Native vlan
Fa0/1       auto        n-802.1q       trunking      1
Fa0/3       auto        n-802.1q       trunking      1
Fa0/4       auto        n-802.1q       trunking      1
Fa0/5       auto        n-802.1q       trunking      1
Fa0/6       on          802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/1       1-1005
Fa0/3       1-1005
Fa0/4       1-1005
Fa0/5       1-1005
Fa0/6       1-1005

Port        Vlans allowed and active in management domain
Fa0/1       1,10,20,30,40,50
Fa0/3       1,10,20,30,40,50
Fa0/4       1,10,20,30,40,50
Fa0/5       1,10,20,30,40,50
Fa0/6       1,10,20,30,40,50
```

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