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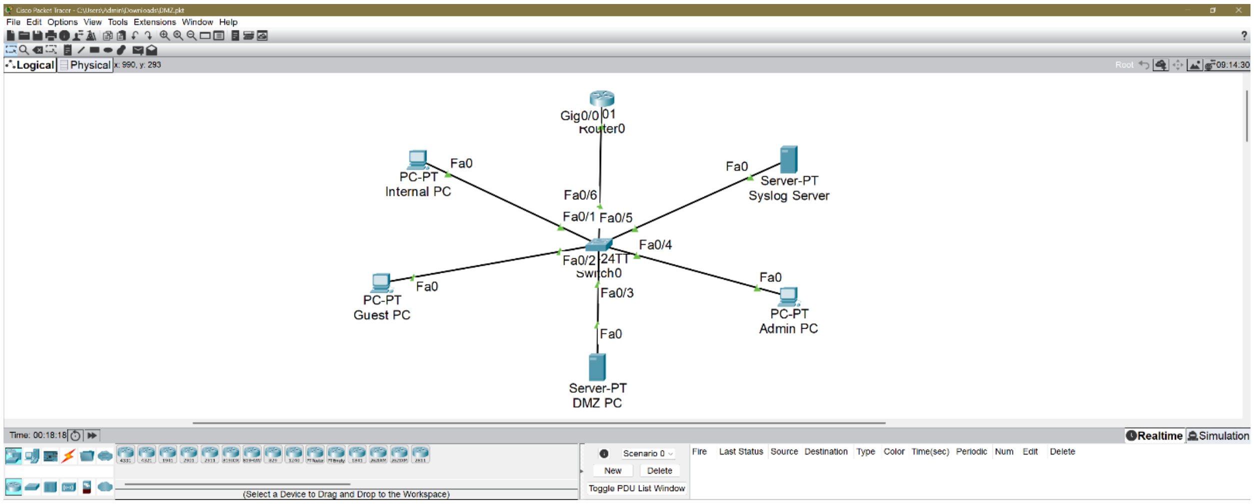
Setting Up Router-on-a-Stick (ROAS) with VLANs in Packet Tracer



This lab exercise demonstrates inter-VLAN routing in Packet Tracer using a Router-on-a-Stick (ROAS) configuration. In this setup, a single physical router interface is divided into multiple logical sub interfaces, each corresponding to a VLAN. The objective was to design a segmented network where traffic between VLANs is routed efficiently through the router.

Objective

The lab network included the following VLANs:

- **VLAN 10 – Internal PCs**
- **VLAN 20 – Guest network**
- **VLAN 30 – DMZ (Demilitarized Zone) for servers**
- **VLAN 40 – Administrative network**
- **VLAN 50 – Syslog/SIEM**

Each VLAN was assigned its own subnet, with the router providing inter-VLAN connectivity through subinterfaces.

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Step 1: VLAN Configuration on the Switch

VLANs were created on the switch and assigned descriptive names for clarity. Access ports were then allocated to the appropriate VLANs, ensuring that each device was placed in the correct segment. The uplink to the router was configured as a trunk port to carry all VLAN traffic.

Example:

enable

conf t

vlan 10

name Internal

interface fa0/1

switchport mode access

switchport access vlan 10

```
Switch>enable
Switch#show vlan br

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   Internal                         active    Fa0/1
20   Guest                            active    Fa0/2
30   DMZ                              active    Fa0/3
40   Admin                            active    Fa0/4
50   Syslog                           active    Fa0/5
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
Switch#
```

Step 2: Router Sub-interface Configuration

On the router, sub-interfaces were configured under GigabitEthernet0/0. Each sub interface was assigned:

- **A VLAN encapsulation command using IEEE 802.1Q tagging**
- **An IP address to serve as the default gateway for that VLAN**

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Example configuration:

enable

conf t

interface g0/0.10

 encapsulation dot1Q 10

 ip address 192.168.1.1 255.255.255.0

- **Additional sub-interfaces were configured for the remaining VLANs.**

```
Router>enable
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#do show ip int br
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  up                    up
GigabitEthernet0/0.1   192.168.1.1     YES manual up                    up
GigabitEthernet0/0.2   192.168.2.1     YES manual up                    up
GigabitEthernet0/0.3   192.168.3.1     YES manual up                    up
GigabitEthernet0/0.4   192.168.4.1     YES manual up                    up
GigabitEthernet0/0.5   192.168.5.1     YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
Router(config)#
```

Step 3: End Device Configuration

Each end device was assigned a static IP address in its respective VLAN subnet, along with the appropriate default gateway. For example:

- **Internal PC → 192.168.1.10 with gateway 192.168.1.1**
- **Syslog server → 192.168.5.10 with gateway 192.168.5.1**

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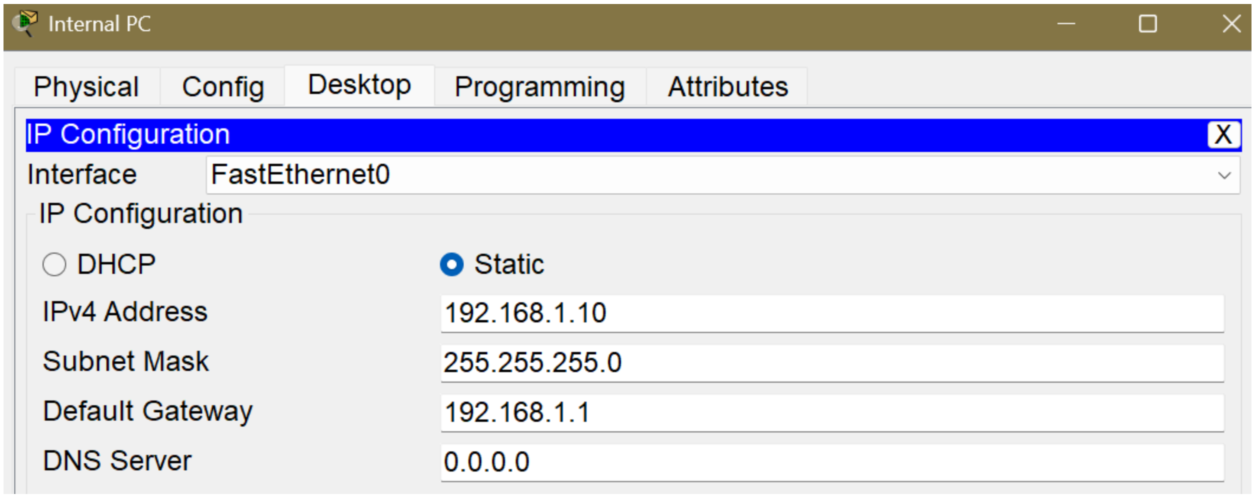


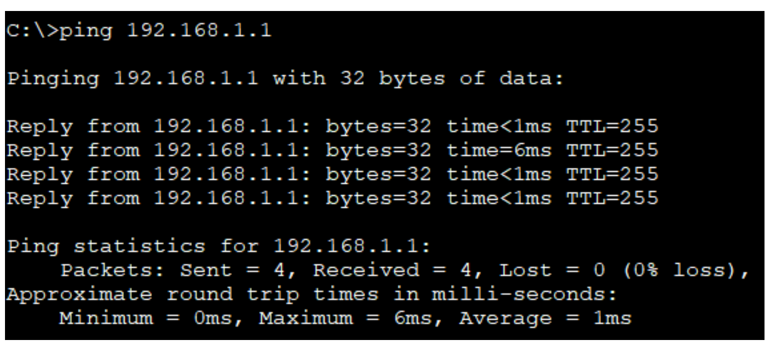
Step 4: Verification and Testing

Connectivity tests confirmed proper configuration:

- **Devices within the same VLAN communicated successfully.**
- **Cross-VLAN traffic was routed correctly by the router.**
- **Each VLAN adhered to its designated subnet and gateway.**

Example:

From Internal PC (192.168.1.10)



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From Syslog Server (192.168.1.50)

```
C:\>ping 192.168.5.1

Pinging 192.168.5.1 with 32 bytes of data:

Reply from 192.168.5.1: bytes=32 time<1ms TTL=255
Reply from 192.168.5.1: bytes=32 time<1ms TTL=255
Reply from 192.168.5.1: bytes=32 time<1ms TTL=255
Reply from 192.168.5.1: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.5.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Key Takeaways

- **Encapsulation must be configured before assigning an IP address to a sub-interface, otherwise the router will reject the configuration with an error message.**
- **ROAS is effective for lab environments and small networks, but in production networks, a Layer 3 switch is generally preferred due to reduced bottlenecks and higher performance.**
- **Packet Tracer provides a straightforward environment for practicing VLAN and inter-VLAN routing concepts without needing to have a physical environment for it.**

Conclusion

This lab exercise helped me reinforce the fundamentals of VLAN segmentation and inter-VLAN routing using ROAS. While it is less common in modern production environments, it is still a valuable tool for understanding VLAN routing principles.