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Arquitetura e Gestão de Redes

Access and Distribution Networks

Objectives

- VLAN definition
- Inter-VLAN routing
- Usage of L2 and L3 Switches
- Access and distribution network design and interconnection
- Trunk links

Access Network (VLAN) Deployment

1. Using GNS3, assemble the depicted network. Configure 3 VLAN at the switches:
- Ports 1-2: VLAN1 (sub-network 10.1.1.0/24)
- Ports 3-4: VLAN2 (sub-network 10.2.2.0/24)
- Ports 5-6: VLAN3 (sub-network 10.3.3.0/24)
- Ports 7-8: Inter-switch/Tagged/802.1Q (native VLAN 1)

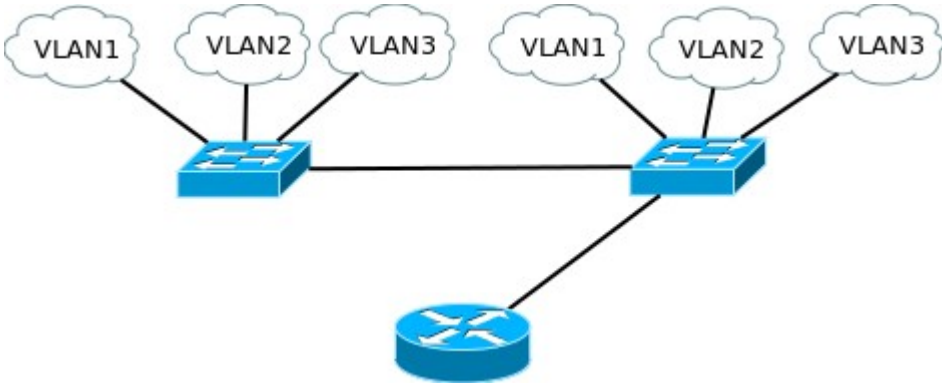
To implement a Layer2 switch you can use a GNS3 basic "Ethernet Switch" or a switching module (NM-16SW) on a Router (GNS3 EtherSwitch router) with IP routing disabled (ports f1/0 to f1/15).
Note: GNS3 basic "Ethernet Switch" do not support Spanning Tree Protocols.
To configure an "Ethernet Switch" use the GUI.
To configure an "EtherSwitch router" as a L2 Switch:

```
EtherSwitch# vlan database                                  !VLANs must be created on the
EtherSwitch(vlan)# vlan 1                                   ! equipment database
EtherSwitch(vlan)# vlan 2                                   !To remove a VLAN use:
EtherSwitch(vlan)# vlan 3                                   ! "no vlan x"
EtherSwitch(vlan)# exit
EtherSwitch# configure terminal
EtherSwitch(config)# no ip routing                          !Disables IPv4 routing
EtherSwitch(config)# interface f1/1
EtherSwitch(config-if)# switchport mode access              !Defines as an access port
EtherSwitch(config-if)# switchport access vlan 1            !Specifies the port VLAN
EtherSwitch(config-if)# interface f1/2
EtherSwitch(config-if)# switchport mode access
EtherSwitch(config-if)# switchport access vlan 1
EtherSwitch(config-if)# interface range fastEthernet 1/3 - 4      !To configure multiple ports
EtherSwitch(config-if-range)# switchport mode access
EtherSwitch(config-if-range)# switchport access vlan 2
EtherSwitch(config-if-range)# interface range fastEthernet 1/5 - 6
EtherSwitch(config-if-range)# switchport mode access
EtherSwitch(config-if-range)# switchport access vlan 3
EtherSwitch(config-if-range)# interface range fastEthernet 1/7 - 8
EtherSwitch(config-if-range)# switchport mode trunk               !Defines as Trunk port
EtherSwitch(config-if-range)# switchport trunk encapsulation dot1q     !By default all
                                                                       ! VLAN are transported
```

Note: To show the existing VLAN use the command: `show vlan-switch`
Place terminals at the different VLAN and test connectivity.
Verify the status of the Spanning-Tree Protocol with the commands:
`show spanning-tree` and `show spanning-tree brief .`

Inter-VLAN Routing with Router

2. Assemble the depicted network by adding a router.



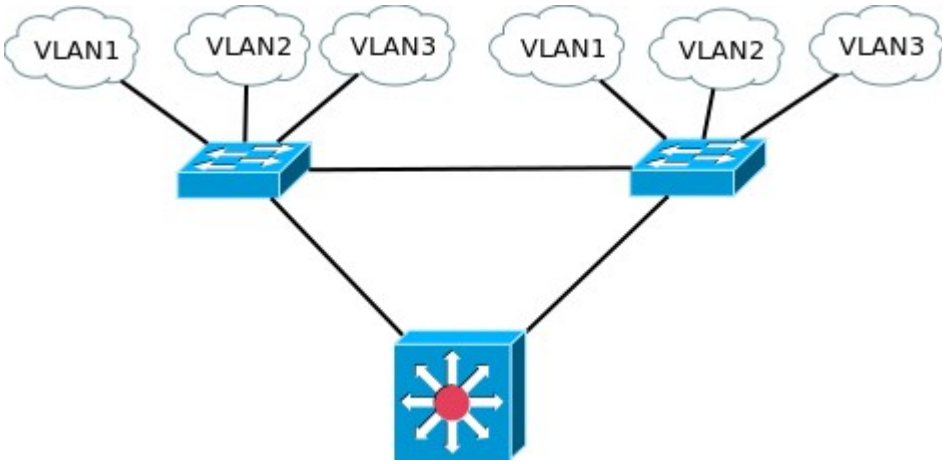
Configure the router to support sub-interfaces and Inter-VLAN (802.1Q) routing:

```
Router(config)# interface FastEthernet0/0
Router(config-if)# no shutdown
Router(config-if)# interface FastEthernet0/0.1
Router(config-if)# encapsulation dot1Q 1 native            !VLAN1
Router(config-if)# ip address 10.1.1.1 255.255.255.0
!
Router(config-if)# interface FastEthernet0/0.2
Router(config-if)# encapsulation dot1Q 2                   !VLAN2
Router(config-if)# ip address 10.2.2.1 255.255.255.0
!
Router(config-if)# interface FastEthernet0/0.3
Router(config-if)# encapsulation dot1Q 3                   !VLAN3
Router(config-if)# ip address 10.3.3.1 255.255.255.0
```

Verify the routing table. Place terminals at the different VLAN, configure the respective gateways (router sub-interfaces) and test connectivity. Capture the packets being exchanged between the Router and (right) Switch.

Inter-VLAN Routing with a L3 Switch (and redundant links)

3. Replace the Router by a L3 Switch.



Configure 3 VLAN at the L3 Switch (VLAN1 ,2 and 3):

```
RouterSW# vlan database
RouterSW(vlan)# vlan 1
RouterSW(vlan)# vlan 2
RouterSW(vlan)# vlan 3
RouterSW(vlan)# exit
```

Definir VLANs

Guarantee that the L3 switch has IPv4 routing capabilities enabled: `ip routing`.

Configure the L3 Switch's L2 ports (fastEthernet slot 1), port 0: VLAN1, ports 1-8: VLAN2, ports 9-12: VLAN3 and ports 13-15: Inter-switch/Tagged/802.1Q:

```
RouterSW(config)# interface f1/0
RouterSW(config-if)# switchport mode access
RouterSW(config-if)# switchport access vlan 1
RouterSW(config-if)# interface range fastEthernet 1/1 - 8
RouterSW(config-if-range)# switchport mode access
RouterSW(config-if-range)# switchport access vlan 2
RouterSW(config-if-range)# interface range fastEthernet 1/9 - 12
RouterSW(config-if-range)# switchport mode access
RouterSW(config-if-range)# switchport access vlan 3
RouterSW(config-if-range)# interface range fastEthernet 1/13 - 15
RouterSW(config-if-range)# switchport mode trunk
RouterSW(config-if-range)# switchport trunk encapsulation dot1q
```

Especificar o tipo!

802.1q → Protocolo de Trunking

Configure the Switch L3 virtual (Vlan) interfaces:

```
RouterSW(config)# interface Vlan 1
RouterSW(config-if)# ip address 10.1.1.1 255.255.255.0
RouterSW(config-if)# no autostate                    !forces the port to be always up
RouterSW(config)# interface Vlan 2
RouterSW(config-if)# ip address 10.2.2.1 255.255.255.0
RouterSW(config-if)# no autostate                    !forces the port to be always up
RouterSW(config)# interface Vlan 3
RouterSW(config-if)# ip address 10.3.3.1 255.255.255.0
RouterSW(config-if)# no autostate                    !forces the port to be always up
```

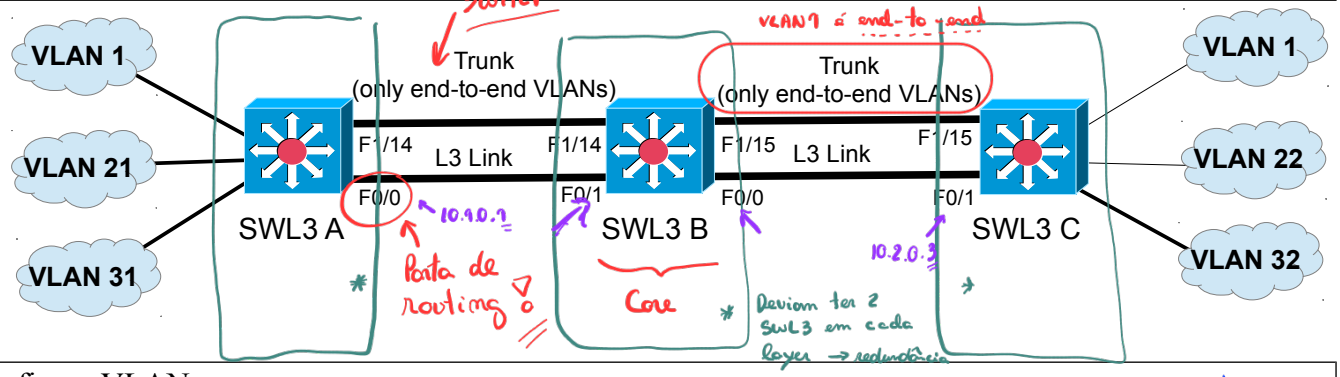
Endereço IP

Cada VLAN tem um endereço IP

Verify the routing table. Place terminals at the different VLAN, configure the respective gateways (Vlan virtual interfaces) and test connectivity. Capture the packets being exchanged between the Router and L3 Switch.

Restricted trunk links

4. Assemble the following network with L3 Switches. VLAN 1 is end-to-end and all other VLAN are local. Use as L3 interfaces standard Ethernet interfaces or L2 interfaces (switching module) converted to L3 interfaces with the command `no switchport`.
Configure VLAN on the three Layer 3 switches: SWL3 A should have VLAN 1, 21, and 31; SWL3 B should have VLAN 1 only; and SWL3 C should have VLAN 1, 22, and 32.
Note: By default Cisco equipments have default VLANs that must be considered end-to-end (1002-1005) and cannot be deleted.



Configure VLANs
Assuming that trunk ports are f1/14 and f1/15 in all three Layer 3 switches:

```
SWL3*(config-if-range)# interface range fastEthernet 1/14 - 15
SWL3*(config-if-range)# switchport mode trunk
SWL3*(config-if-range)# switchport trunk allowed vlan 1,1002-1005
```

Guarantee that all L3 switches have IPv4 routing capabilities enabled: `ip routing`.
Configure interfaces IP addresses assuming that VLANs have the network 10.0.<#vlan>.0/24, the IP network between SWL3A and SWL3B is 10.1.0.0/24 and the network between SWL3B and SWL3C is 10.2.0.0/24. Configure a routing protocol.

```
SWL3*(config)# router rip
SWL3*(config-router)# version 2                !Required because of subnets
SWL3*(config-router)# network 10.0.0.0
SWL3*(config-router)# passive-interface vlan 1    !Does not use VLAN1 to route L3 traffic
```

Analyze the routing tables, test connectivity and capture/analyze the captures on the trunk and L3 links.
Remember this:
To perform a ping from VLAN1 interface on SWL3A (e.g., 10.0.1.1) to VLAN22 interface on SWL3C (e.g., 10.0.22.3), use the ping command defining its source:

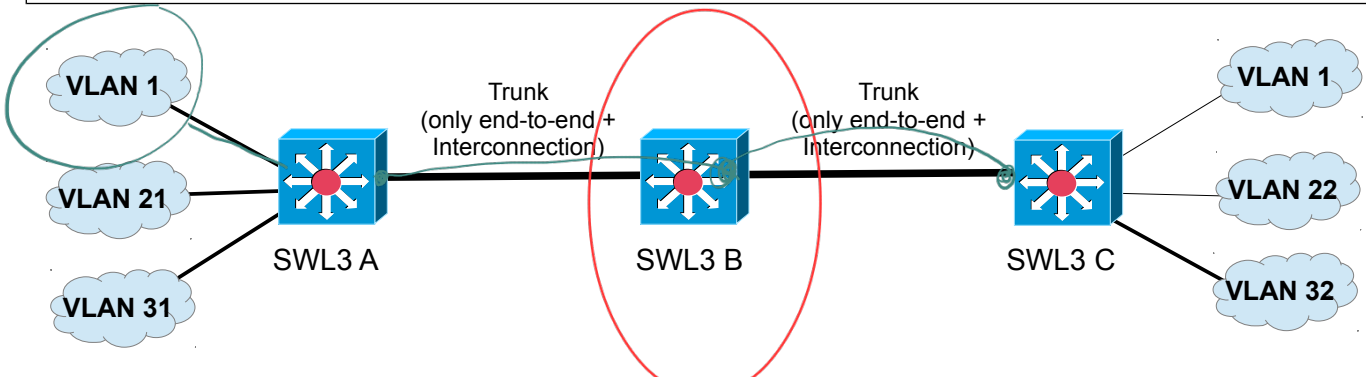
```
SWL3A# ping 10.0.22.3 source 10.0.1.1
```

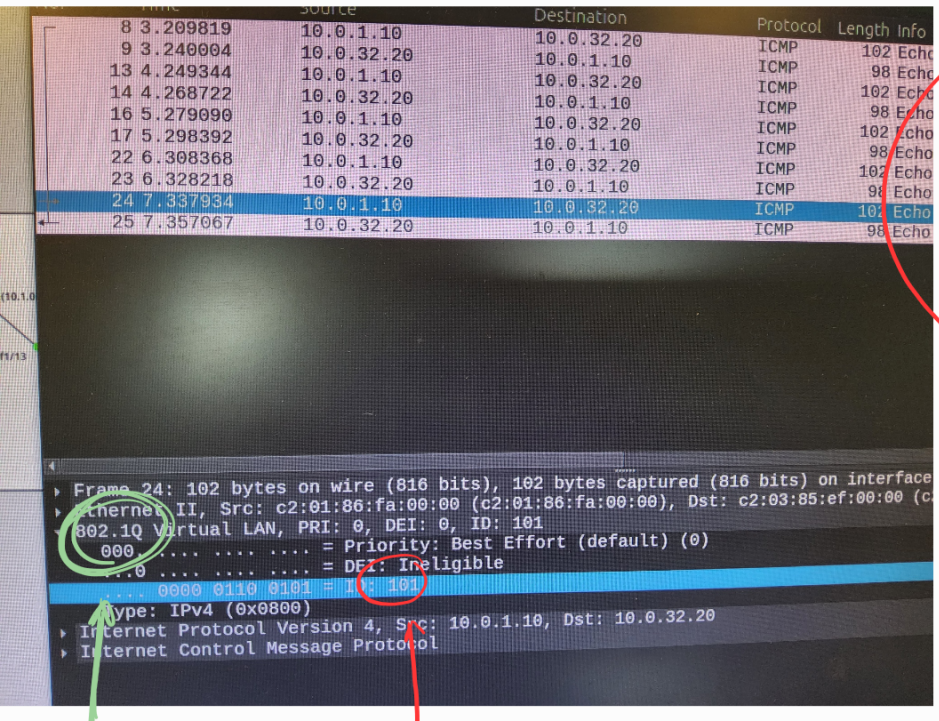
Without `source` the ping source IP address is the output interface address defined by the routing table.

5. Remove the L3 link, create an interconnection VLAN (e.g., VLAN 101) and reconfigure the network to have full connectivity between the VLAN. Start by changing the trunks restrictions:

```
SWL3*(config-if-range)# switchport trunk allowed vlan 1,101,1002-1005
```

Analyze the routing tables, test connectivity and capture/analyze the captures on the trunk links.





Mas atenção!

→ quando o destino é a VLAN1... ele vai por switching e não usa o 802.1Q

Por cima do IP

ID = 101

Agora para fazer routing ele usa a VLAN 101