Redes de Comunicação I

Project Recurso 2024/2025

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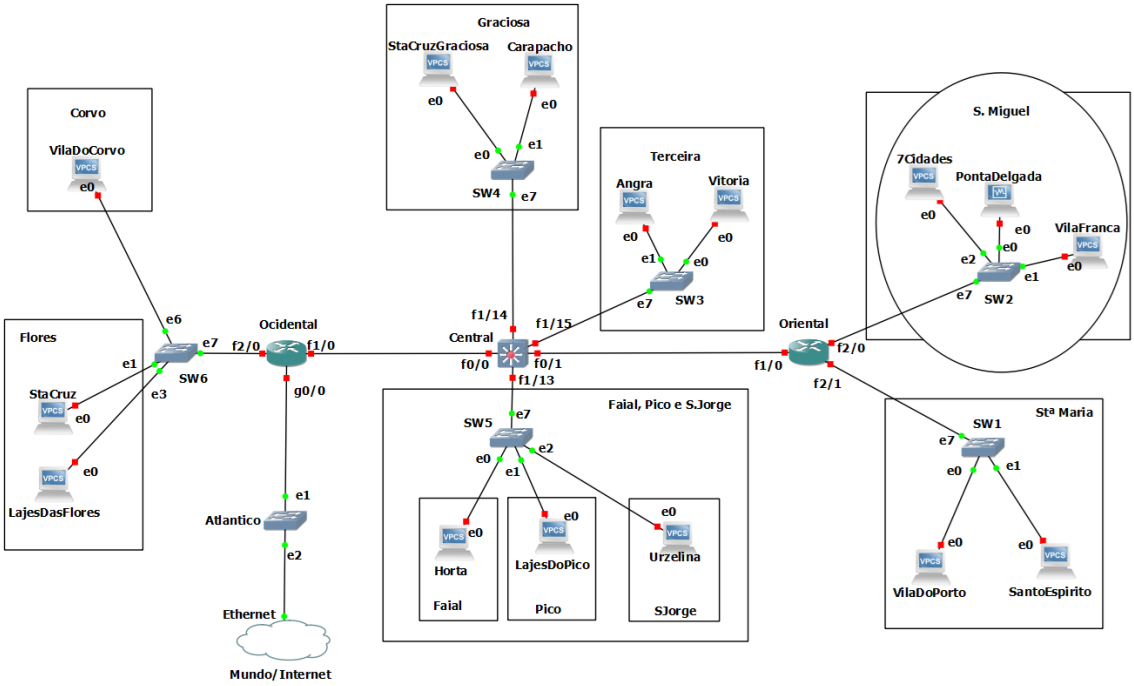


Consider that you are the manager of a network in the Azores archipelago, where each island corresponds to a VLAN. The archipelago has connectivity to the Internet, either directly (public IPv4), through NAT/PAT on the Western router, or via global IPv6. The available address ranges are as indicated in the following table.

AçoresNET **(Student University Number: $X_1X_2X_3X_4X_5X_6$)**	
Public IPv4 (sub)Network	**$20X_3.X_4X_5.X_1X_2X_6.128/25$**
Private IPv4 Network	**$172.2X_5.X_1X_6$2.0/22**
Global IPv6 Network	**$2002:ABX_1X_2:X_3X_4X_5X_6$::/52**

The address requirements are the following:

	Public IPv4	**Private IPv4**	**Global IPv6**
NAT/PAT	3		
Stª Maria	10		/64
S. Miguel	25	400	/64
Terceira	20	80	/64
Graciosa		60	/64
Fail	7		/64
Pico		70	/64
S. Jorge	8	50	/64
Flores	4		/64
Corvo		40	/64

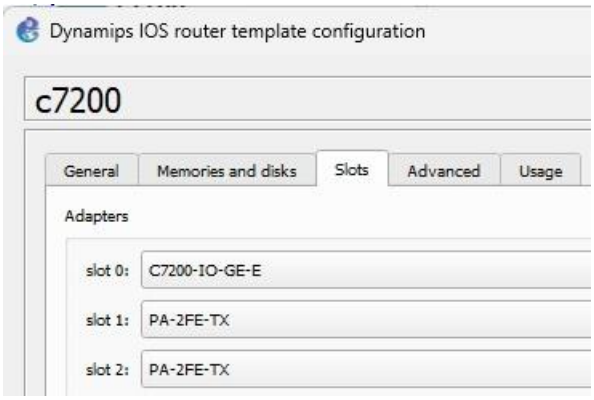
The interconnections between the routers and ESWs also use private IPv4 addressing from the same network. A DHCP server is configured to assign private and/or public addresses to the terminals.

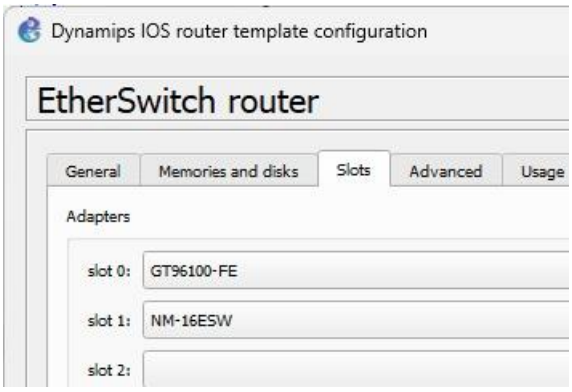
Devices with private addressing from São Miguel **cannot** access the Internet.

Regarding IPv6, the Azores archipelago received a /52 IPv6 network from its ISP, that is managed as follows:

- Each router (including the ESW) manages a different /56 subnet from the /52.
- Each island/VLAN must have a /64 network, from the router/ESW network that provides connectivity.
- The interconnections between routers use global IPv6 /126 addresses, from a different /56 network (distinct from the /56 network associated with the routers).

This network uses Cisco 7200 and Cisco EtherSwitch (ESWs) Routers. The Cisco 7200 routers and the EtherSwitchs (ESW) are equipped with the following interface cards:





All the remaining network is composed of simple Ethernet Switches capable of handling VLANs.

Distribute the addresses (Public and private IPv4 and IPv6) according to the specifications provided

1. Identify the network address and broadcast address (if applicable) for all networks/sub-networks, both for IPv4 and IPv6. Do not forget the addresses of the routers interfaces on each (sub)network.
2. Identify the range of IP addresses for the devices (PCs, routers, etc.) for each network/sub-network.
3. Identify the NAT/PAT networks and range.
4. Choose/identify the gateway and/or default gateway address(es) for each network/sub-network, when applicable.

Routing

1 – Static Routing must be configured to allow full connectivity between all devices on the network.

2 – Default routes must be used when possible

3 – The Classroom has a router with IP 192.168.101.11, which provides Internet Access. Configure your network to make use of the router.

4 – The ClassRoom router has the IPv6 Address 2002:5755::1/64 and Ocidental Router must have the 2002:5755::02$\mathbf{X_4X_6}$ /64 address on its g0/0 interface.

Private IPv4					
	Network	Mask	Broadcast	Gateway Addr.	Available Address Space
NAT/PAT					-
Stª Maria					-
S. Miguel					-
Terceira					-
Graciosa					-
Fail					-
Pico					-
S. Jorge					-
Flores					-
Corvo					-

Public IPv4					
	Network	Mask	Broadcast	Gateway Addr.	Available Address Space
NAT/PAT					-
Stª Maria					-
S. Miguel					-
Terceira					-
Graciosa					-
Fail					-
Pico					-
S. Jorge					-
Flores					-
Corvo					-

Global IPv6			
	Network/mask	Gateway Addr.	Available Address Space
NAT/PAT			-
Stª Maria			-
S. Miguel			-
Terceira			-
Graciosa			-
Fail			-
Pico			-
S. Jorge			-
Flores			-
Corvo			-

Interconnections (Ocidental-Central- Oriental)			
	NET/MASK	**Default GW**	**Other Router**
Ocidental - Central (IPv4)			
Ocidental - Central (IPv6)			
Central – Oriental (IPv4)			
Central – Oriental (IPv6)			

Internet Connectivity			
	NET/MASK	**Internet Router (default GW)**	**Ocidental (g0/0)**
IPv4	192.168.101.0/24	192.168.101.11	
IPv6	2002:5755::/64	2002:5755::1/64	

Address Configuration

With respect to VLANs, terminals correspondence and IP address configuration strategy, they are as follows:

Terminal	VLAN id	Private IPv4	Public IPv4	Global IPv6
VilaDoPorto	2		Fixed	Auto
SantoEspírito	2		DHCP	Auto
7Cidades	4	Fixed		Auto
PontaDelgada (VM)	4		Fixed	Fixed
VilaFranca	4	DHCP		Auto
Angra	6		Fixed	Auto
Vitoria	6	DHCP		Auto
StaCruzGraciosa	8	Fixed		Auto
Carapacho	8	DHCP		Auto
Urzelina	12		Fixed	Auto
LajesDoPico	14	Fixed		Auto
Horta	16		Fixed	Auto
LajesDasFlores	18		Fixed	Auto
StaCruz	18		DHCP	Auto
VilaDoCorvo	20	Fixed		Auto

All VLANs must have a DHCP pool. When there is only private or public IPv4 for a specific VLAN, the pool must be according to that. When there are public and private addresses available for that VLAN, the DHCP pool must be for the private addresses.

Configure the network in GNS3 and add services and applications

1 Build the Network using the same exact devices and interfaces as presented in the network diagram.
2 Configure the routers interfaces and verify point-to-point connectivity between them.
3 Configure the Ethernet Switches to have them with the correct VLAN configuration (when appliable).
4 Configure the static routes to allow full connectivity inside the project. Configure the Internet Access.
5 Configure DHCP pools on Oriental Router. Use the “ip helper-address” on the other Router/ESW to redirect the DHCP request to the server. Include the DNS server option on the DHCP pool. Use **PontaDelgada** (VM) as DNS server.
6 Configure NAT/PAT mechanisms in Oriental. Use the defined ranges of public IPv4 addresses to configure the translation with the private network.
7 Place the PontaDelgada VM and interconnect it in the network.
8 Configure DNS on that server. Every terminal with fixed IP must have its name resolved by DNS.
9 Configure a Web/HTTP Server on that VM. Add **two sites with names resolved by DNS** on that server.
10 Develop a Client/Server application (using sockets) that allows 2 clients to contact the server and play Tic Tac Toe (jogo do galo). When the clients connect to the server, they play the game. The server controls the game and the information between clients for each one to know what the other client has played, and announces the final result and asks if they want to keep playing or quit, storing and presenting the final results when they quit. The server application must run on the **PontaDelgada** VM, and at least one of the clients’ Application should run from a real PC on the “Internet”.

Good Luck