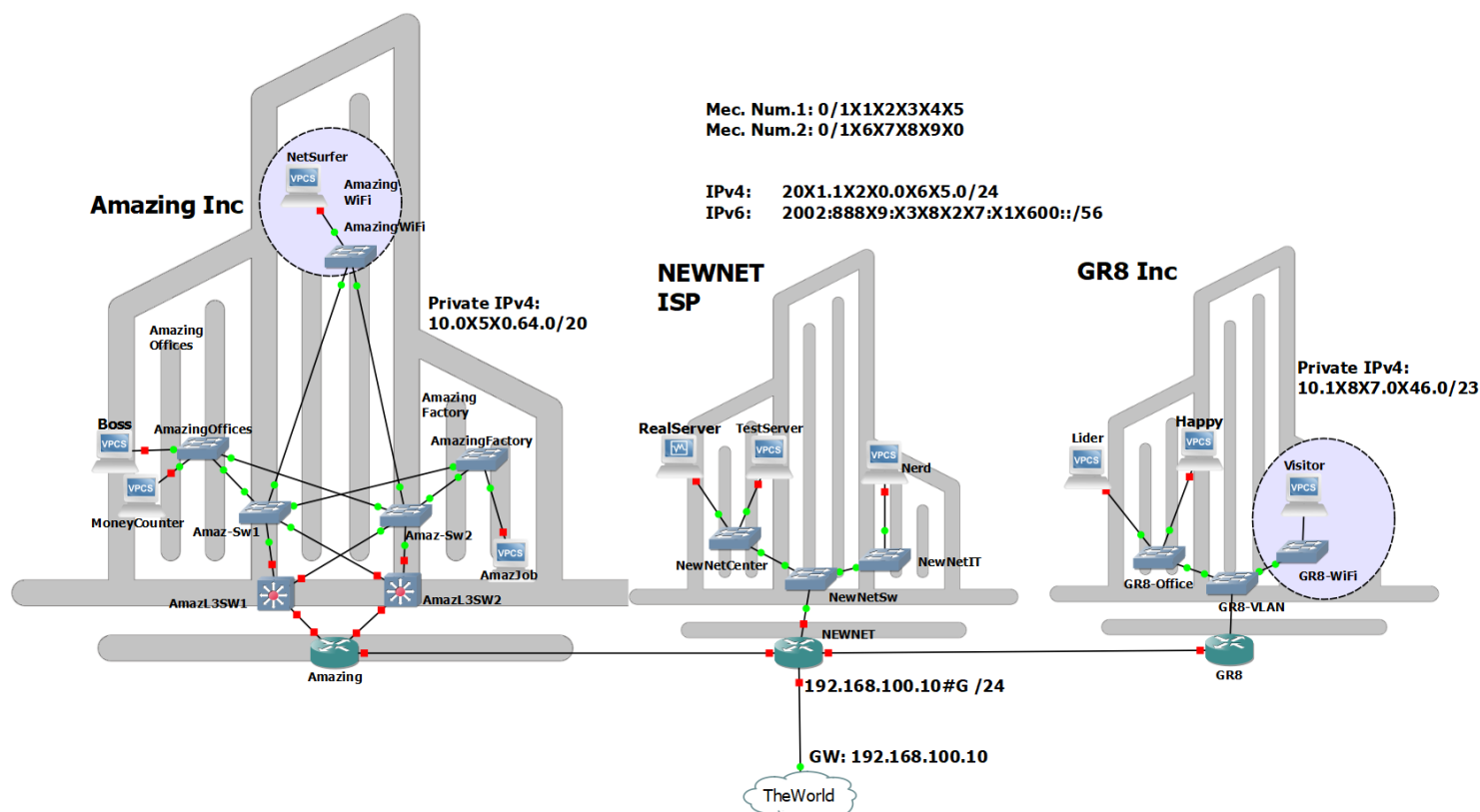


Redes de Comunicação I

Project 2023/2024

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Description:

At Networking Paradise Village, there is an ISP (Internet Service Provider), the NEWNET, that is currently providing service to two companies: Amazing Inc and GR8 Inc.

The NEWNET, besides providing Internet connectivity to the companies, it also hosts services like DNS and HTTP on its NewNetCenter.

The NEWNET is responsible for managing some IPv4 and IPv6 networks, providing address space to its customers, according to their needs.

Currently, the NEWNET is allocating addresses (to itself and its two network costumers and interconnection links) from the following networks:

Carlos (Mec. Num.1: 0/1X₁X₂X₃X₄X₅ Mec. Num.2: 0/1X₆X₇X₈X₉X₀)¹
1 4 5 9 7 1 2 9 1 1

IPv4: 20X₁.1X₂X₀.0X₆X₅.0/24 – This class C network will be used for all Public IPv4 addressing
1 4 1 1 7

IPv6: 2002:888X₉:X₃X₈X₂X₇:X₁X₆00::/56 – This /56 will be used to provide addresses to all needs
1 5 9 4 2 1 1

¹ In case of a single student doing the project, consider Mec Num.2: 0/1X₅X₄X₃X₂X₁ that is, X₆=X₅, X₇=X₄, X₈=X₃, X₉=X₂ and X₀=X₁

The NEWNET has address needs for its networks:

- $2^6 - 2 = 62$ hosts 201.141.017.1/26 --> até 201.141.017.63
 50 servers using public IPv4 addresses for NewNetCenter
- $2^5 - 2 = 30$ hosts 201.141.017.65/27 --> até 201.141.017.96/27
 16 PCs using public IPv4 addresses for its NewNetIT department
- A /64 IPv6 network to provide addresses to NewNetCenter
- A /64 IPv6 network to provide addresses to NewNetIT department

→ The NEWNET delegates /60 IPv6 address space to their customers (GR8 and Amazing).

The GR8 Inc has its network split in two parts:

- The GR8 Office network for PCs, Laptops, printers and other servers that connect through Ethernet cables. This network uses 22 public IPv4 address fixed servers/PCs and it uses private IPv4 addresses for the remaining machines. All machines have global IPv6 addresses.
- The WiFi network only uses private IPv4 and global IPv6 addresses (there are no public IPv4 addresses on the WiFi).

Additionally, the GR8 Inc uses 9 public IPv4 addresses for NAT/PAT to enable all machines with private IPv4 to have Internet access.

The GR8 Inc uses $10.1X_8X_7.0X_46.0/23$ for the private addressing. One /24 for the GR8 Office network and a second /24 to the GR8 WiFi network.

The AMAZING Inc has its network split in three parts:

- The Offices network for PCs, Laptops, printers and other servers that connect through Ethernet cables. This network uses 60 public IPv4 address fixed servers/PCs and it uses private IPv4 addresses for the remaining machines. All machines have global IPv6 addresses.
- The WiFi network only uses private IPv4 and global IPv6 addresses (there are no public IPv4 addresses on the WiFi).
- The Factory network only uses private IPv4 (no public IPv4, neither global IPv6).

Additionally, the AMAZING Inc uses 20 public IPv4 addresses for NAT/PAT to enable machines with private IPv4 from the Offices and from the WiFi to have Internet access. The Factory PCs/machines are NOT allowed to access the Internet.

The AMAZING Inc uses $10.0X_5X_0.64.0/20$ for the private addressing. The Amazing Factory network needs more than 1100 and less than 2000 private IPv4 addresses. The Amazing WiFi needs more than 600 and less than 1000 and the Amazing Offices network needs less than 500.

- ⇒ The networks between the AMAZING router and the AmazL3SW1 and AmazingL3SW2 must use /30 sub-networks with private IPv4 addresses and /126 with link-local (fe80::/10) IPv6 addresses.
- ⇒ The networks between the GR8 router and the NEWNET router and between the AMAZING router and the NEWNET must use /30 sub-networks with public IPv4 addresses and /126 with global IPv6 from the same address space that the NEWNET is allocating to itself, GR8 and Amazing.

Objective A: Define the addressing. Deadline: 10 November 2023.

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. Justify/explain the network division and how those values were achieved/calculated/defined. Do not forget the networks between the companies and the NEWNET.
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.

Objective B: build, test and run the network in GNS3. Deadline: 1 December 2023.

Configure in the switches Layer 2 and Layer 3 the respective VLANs and the access and inter-switch/trunk ports.

1. Configure the IPv4 and IPv6 addressing on the several devices (routers) to comply with the requirements.
2. Configure static routing inside the Amazing Inc with to allow full IPv4 and IPv6 connectivity
3. Configure DHCP pools on the AMAZING and GR8 routers for the private IPv4 addressing.
4. Include and configure the necessary number of VPCs on each VLAN, with the IP addresses and gateways or with DHCP, to cover all connectivity possibilities
 - a. Public IPv4 + Global IPv6 (where applicable)
 - b. Private IPv4 + Global IPv6 (where applicable)
 - c. Private IPv4 only (where applicable)
 - d. Public IPv4 only (where applicable)

➤ For the WiFi/Wireless Lan networks, instead of using access points (that do not exist in GNS3), use VPCs instead.
5. Configure NAT/PAT mechanisms in an appropriate way (AMAZING and GR8 routers). Use the range of public IPv4 addresses to configure the translation with the private network.
6. Configure static routing between NEWNET, Amazing and GR8. Keep in mind that private networks are only known inside each company.
7. Configure one interface of the NEWNET router like this:

```
NEWNET(config)# interface GigabitEthernet0/0 #replace by the correct interface of your router  
ip address 192.168.100.11#G 255.255.255.0  
no shutdown
```

Attach that NEWNET router interface to a GNS3 Cloud (not the NAT cloud) and select your PC Ethernet adapter to attach the cloud.

Test the connectivity to the classroom router (ping 192.168.100.11)

Configure a default GW on the NEWNET router to allow connectivity to “The World”

Objective C: build, test and run the network in GNS3. Deadline: 17 December 2023.

8. Place a VM on the NewNetCenter network (Real Server) and a DNS server to provide name resolution to all VPCs and routers of the project that have public IPv4.
9. Configure a Web/HTTP Server on the same VM.
10. Create a Web page for the GR8 Inc and one for the NewNet ISP
11. Develop a client-server application (using sockets) that allows a client to contact the server and send messages to all clients connected to the server (with its hostname and IP address). Additionally, the server also stores the number of times it received requests from each client (via comparing the IP of the request).
 - a. Basic: run this application on PCs/VMs outside GNS3.
 - b. Extra: run this application on two VMs in different networks/companies, inside GNS3.

Extras:

1. Place a second VM on “Amazing Offices” network and provide it with a public IPv4 address. Register this machine name and IP address on the NewNet DNS server. Enable a Web site for the Amazing Inc on this VM.