Element	Description
Environmental Sensors	Devices that monitor conditions such as temperature, humidity, and air quality, and can adjust HVAC systems to improve comfort and energy efficiency.
Intelligent Security Systems	Cameras and sensors connected to the network that monitor security in real-time and alert about possible incidents.
Intelligent Lighting	Lights that adjust according to occupancy or natural light, reducing energy consumption and improving the user experience.
Intelligent Access Management	Controlled access solutions that use smart cards or mobile devices to improve security and comfort of access to buildings and facilities.
Energy Management Systems	Integration of IoT devices with energy management systems to optimize use and reduce energy costs.
Electric Vehicle Charging Infrastructure	Intelligent charging stations that can be monitored and controlled to optimize energy use and facilitate the charging of electric vehicles.

By integrating these elements into the network, the academic institution would not only improve the efficiency and performance of its IT infrastructure, but also contribute to the creation of a safer, more sustainable, and technologically advanced campus. Additionally, the transition to IPv6 with its vast address space is essential for supporting the proliferation of IoT devices on the network.

Optimize the network from the previous phase (phase 2) with the following requirements:

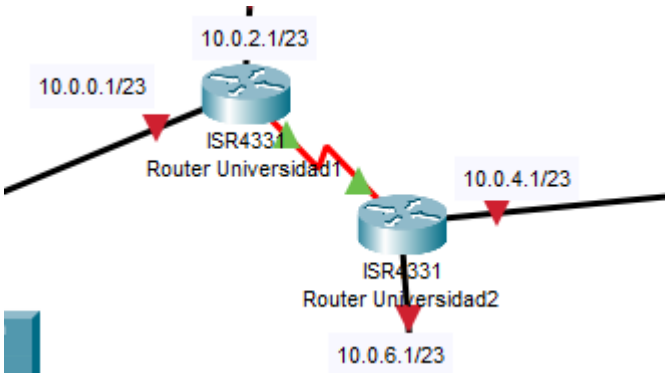
• Step-by-step calculations for IPv6 address assignment for each of the designed subnets, including the address class, the IP address, and the group planning the address or requesting the tutor to assign one.

To transform IPv4 addresses to IPv6 in a network scheme, a commonly followed approach is to reflect the internal organization of the IPv4 network within the much larger IPv6 address space. The recommended practice for local networks is to utilize /64 subnets, as this aligns with the standard for address autoconfiguration and is compatible with most network scenarios.

Supposing the network is assigned a unique global IPv6 prefix like, for instance, 2001:0db8:acad::/48, each IPv4 subnet could correspond to a /64 subnet within this block. Here's how the equivalent IPv6 addresses might look:

Another subnet was added because the previous router didn't support IPv6, and the new router only allowed for 2 gigabit interfaces while the network required 4.

Subred	IPv4 Network Address	IPv6 Network Address/64	Range of Usable IPv6 Addresses
Administration	10.0.0.0/23	2001:0db8:acad:0::/64	2001:0db8:acad:0::1 hasta 2001:0db8:acad:0:ffff:ffff:ffff:fffe
Students	10.0.2.0/23	2001:0db8:acad:1::/64	2001:0db8:acad:1::1 hasta 2001:0db8:acad:1:ffff:ffff:ffff:fffe
Teachers	10.0.4.0/23	2001:0db8:acad:2::/64	2001:0db8:acad:2::1 hasta 2001:0db8:acad:2:ffff:ffff:ffff:fffe
Wireless	10.0.6.0/23	2001:0db8:acad:3::/64	2001:0db8:acad:3::1 hasta 2001:0db8:acad:3:ffff:ffff:ffff:fffe
Router connection	10.0.8.0/30	2001:0db8:acad:4::/64	2001:0db8:acad:4::1 hasta 2001:0db8:acad:4:ffff:ffff:ffff:fffe



For a /64 subnet, the first 64 bits are used for network identification, and the last 64 bits are used for the interface or host. Given an IPv6 prefix such as 2001:db8:acad:X::/64 where X represents the subnet, the range of usable addresses is from 2001:db8:acad:X::1 to 2001:db8:acad:X:ffff:ffff:ffff:fffe.

The structure of the IPv6 address is as follows:
2001:0db8:acad:000X:0000:0000:0000:0000 /64

The last 64 bits (the last set of four blocks) are used for host addresses. So, the range would be from the first host: 2001:0db8:acad:000X:0000:0000:0000:0001

Up to the last possible host in that subnet, which would be:
2001:0db8:acad:000X:ffff:ffff:ffff:fffe

The last address, which is all bits set to one except the last bit, is the subnet multicast address, which in this case would be: 2001:0db8:acad:000X:ffff:ffff:ffff:ffff

- **Specify the type of network to use.**

The type of network to use would be an Ethernet Local Area Network (LAN) with dual-stack capability (IPv4/IPv6) for wired connections, and a Wireless Local Area Network (WLAN) with IPv6 support for wireless connectivity, thereby providing comprehensive coverage for both fixed and mobile devices on the academic campus.

• The network must contain at least 4 subnets in IPv6, one of which must be wireless.

The same networks from the previous design will be used, but now with IPv6 as well.

SubNet	Description
SubNet 1	Wired network for administration
SubNet 2	Wired network for students
SubNet 3	Wired network for teachers
SubNet 4	Wireless network for general access
SubNet 5	Connection network for the 2 routers

Subred	IPv4 Network Address	IPv6 Network Address/64	Range of Usable IPv6 Addresses
Administration	10.0.0.0/23	2001:0db8:acad:0::/64	2001:0db8:acad:0::1 hasta 2001:0db8:acad:0:ffff:ffff:ffff:fffe
Students	10.0.2.0/23	2001:0db8:acad:1::/64	2001:0db8:acad:1::1 hasta 2001:0db8:acad:1:ffff:ffff:ffff:fffe
Teachers	10.0.4.0/23	2001:0db8:acad:2::/64	2001:0db8:acad:2::1 hasta 2001:0db8:acad:2:ffff:ffff:ffff:fffe
Wireless	10.0.6.0/23	2001:0db8:acad:3::/64	2001:0db8:acad:3::1 hasta 2001:0db8:acad:3:ffff:ffff:ffff:fffe
Router connection	10.0.8.0/30	2001:0db8:acad:4::/64	2001:0db8:acad:4::1 hasta 2001:0db8:acad:4:ffff:ffff:ffff:fffe

Another subnet was added because the previous router didn't support IPv6, and the new router only allowed for 2 gigabit interfaces while the network required 4.

- **The network must contain at least one web server that displays the page of the selected location, after connecting with a device on the simulated network. This page should show information such as the location for which the network is designed, the collaborative group number, and the names of the group members. Additionally, it should include a mail server with the domain of the selected location.**

Web Server: The web server can be placed in the administration subnet to keep it secure.

An appropriate IP address for the web server could be 2001:0db8:acad:0::5/64.

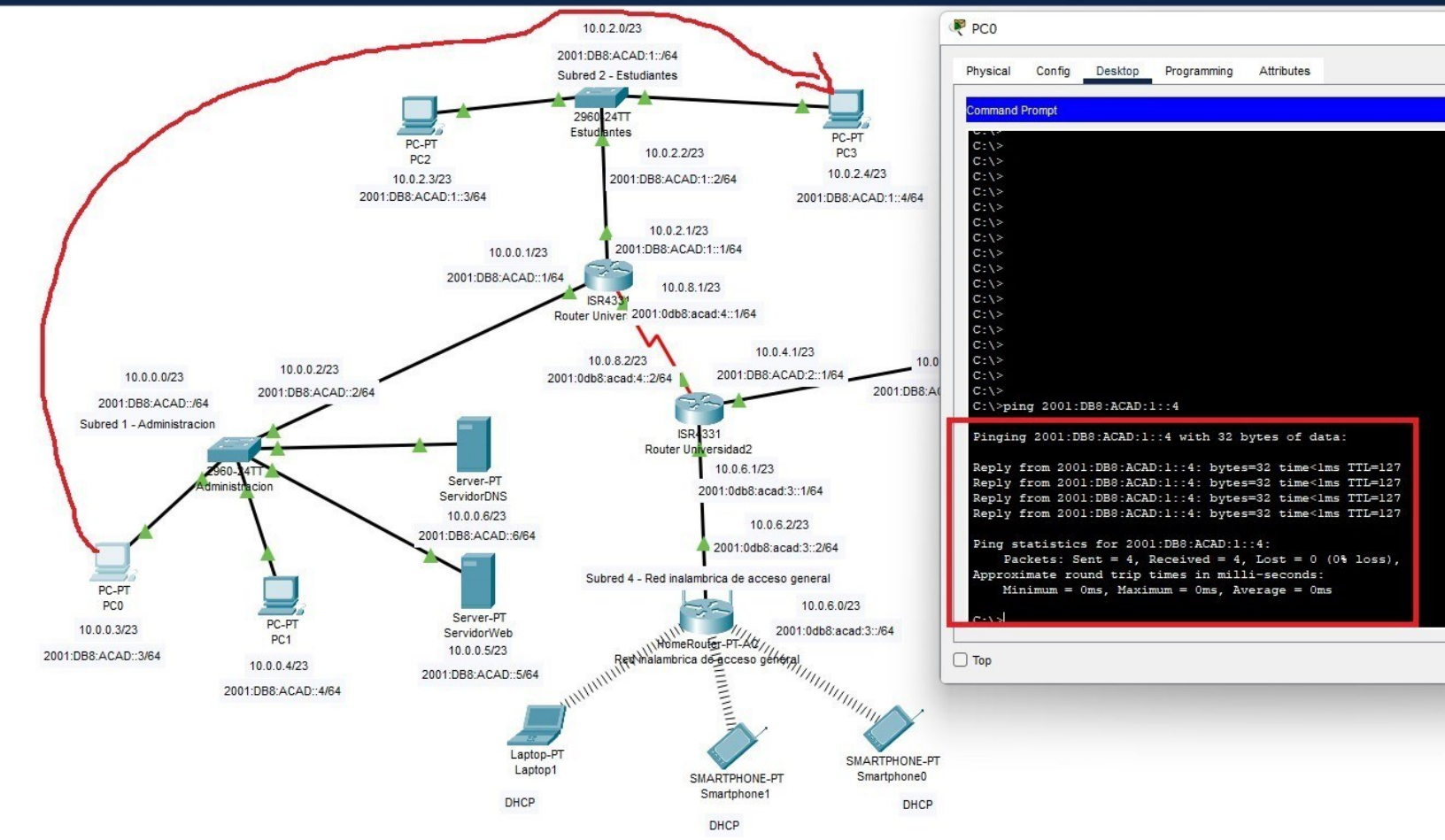
• The network must include a service for connecting users of the created network to a main headquarters, for example, the connection between medical offices in a municipality and specialist doctors' offices located in a capital city.

Connection between Users and Main Headquarters: The specific configuration will depend on the infrastructure of the main headquarters, but an address within the range of addresses of the administration subnet can be used for the VPN device or the router that handles these connections.

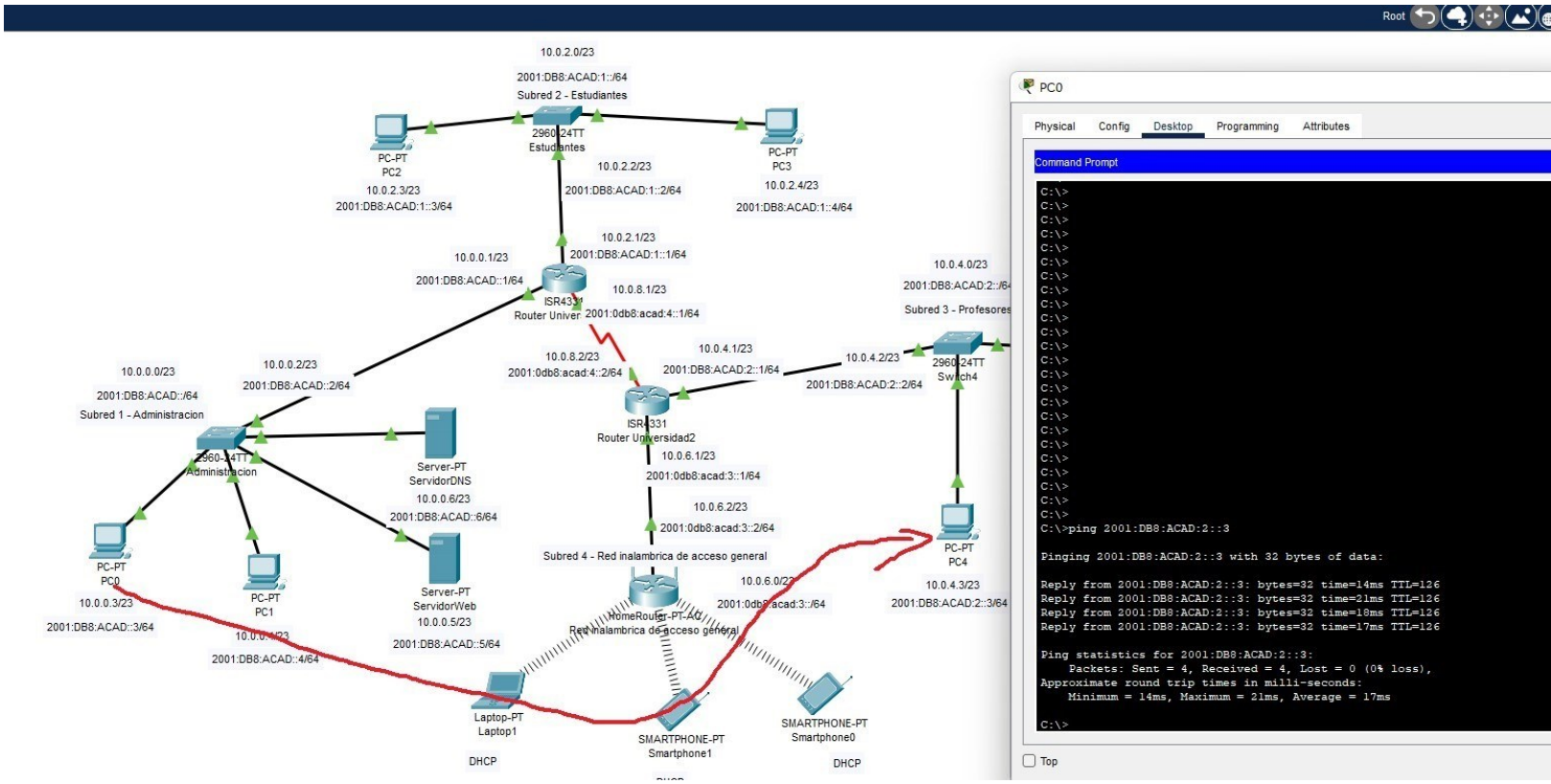
Regarding the main connection, the administration subnet was used, and the other subnet would be for teachers.

• The transmission of data packets across the entire network must be evident.

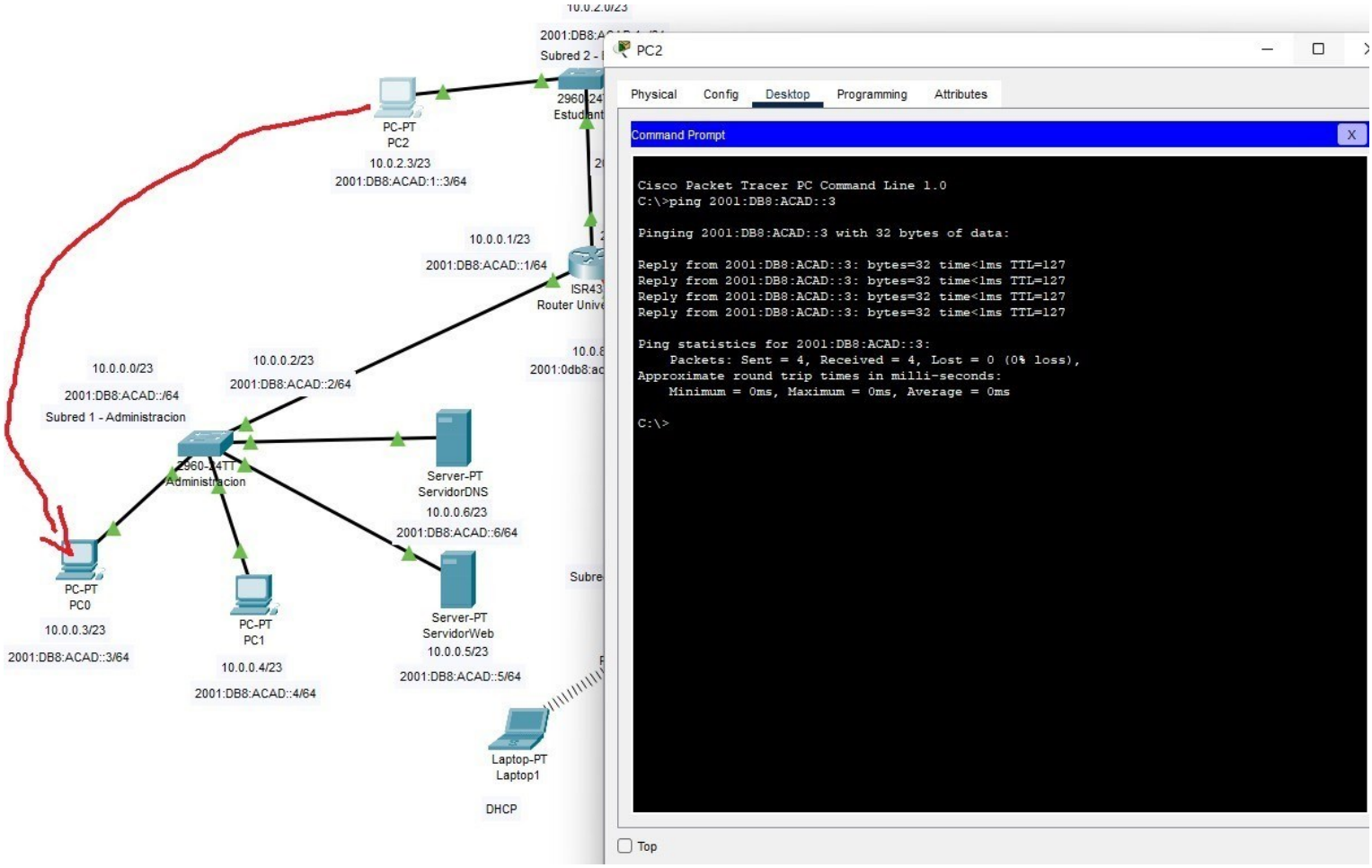
Screenshots showing successful ping and responses will be displayed for each subnet: Administration -> Students.



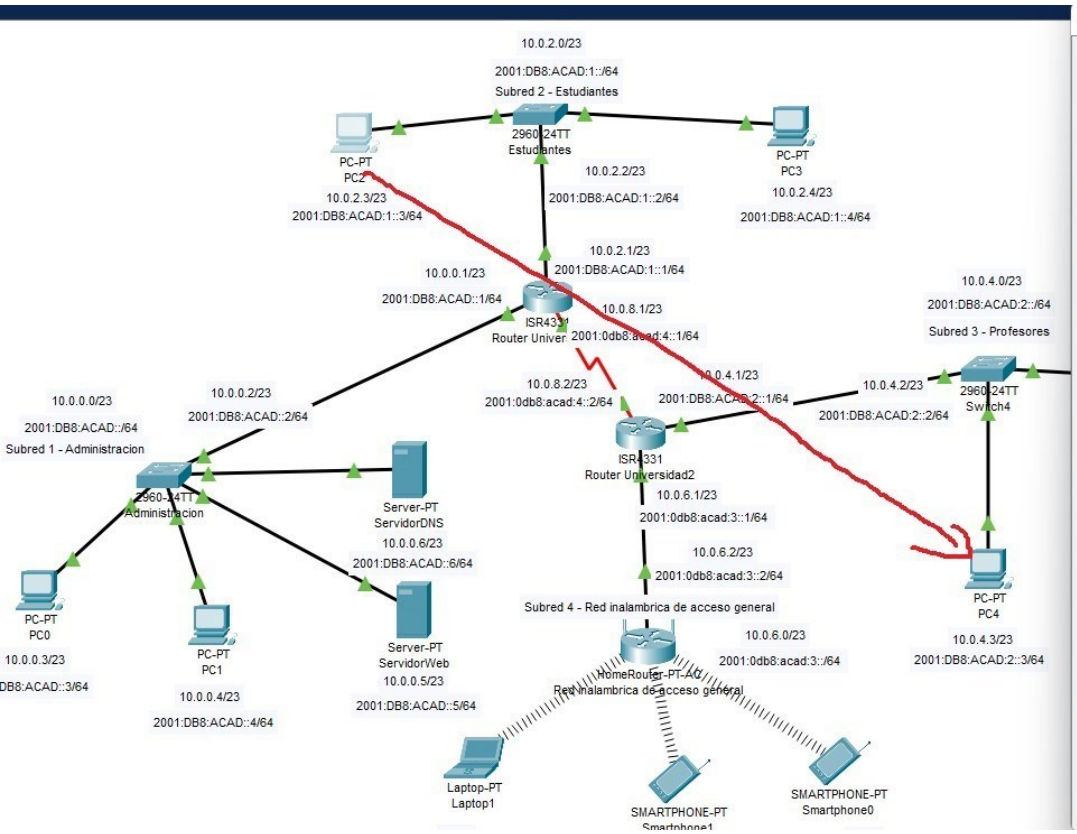
Administration -> Teachers

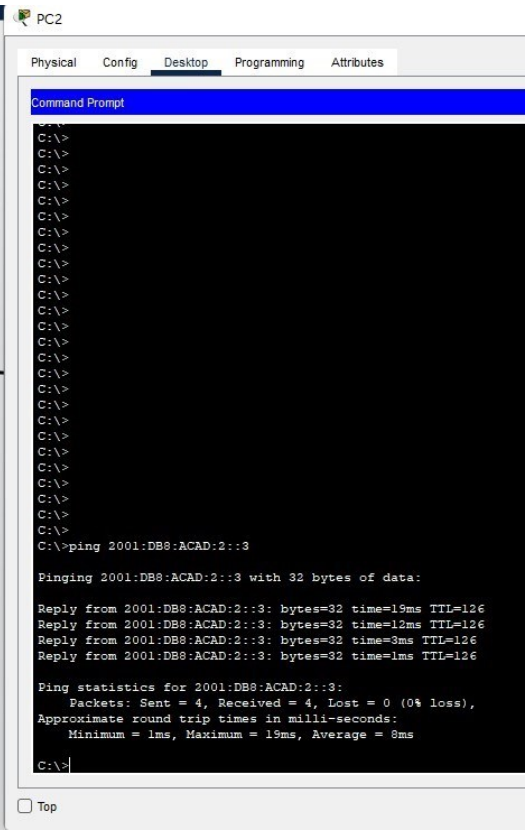


Students -> Administration

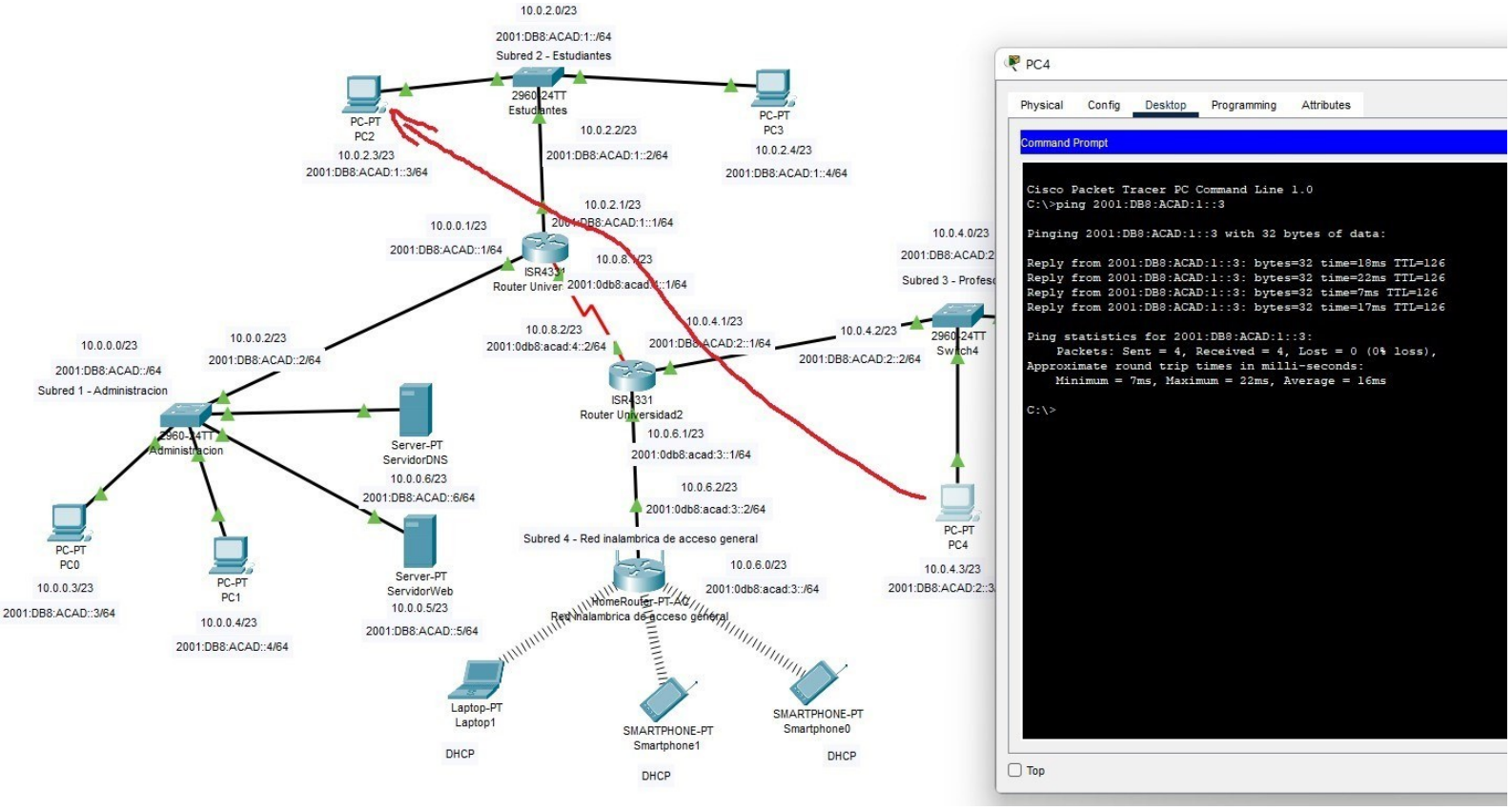


Students -> Teachers

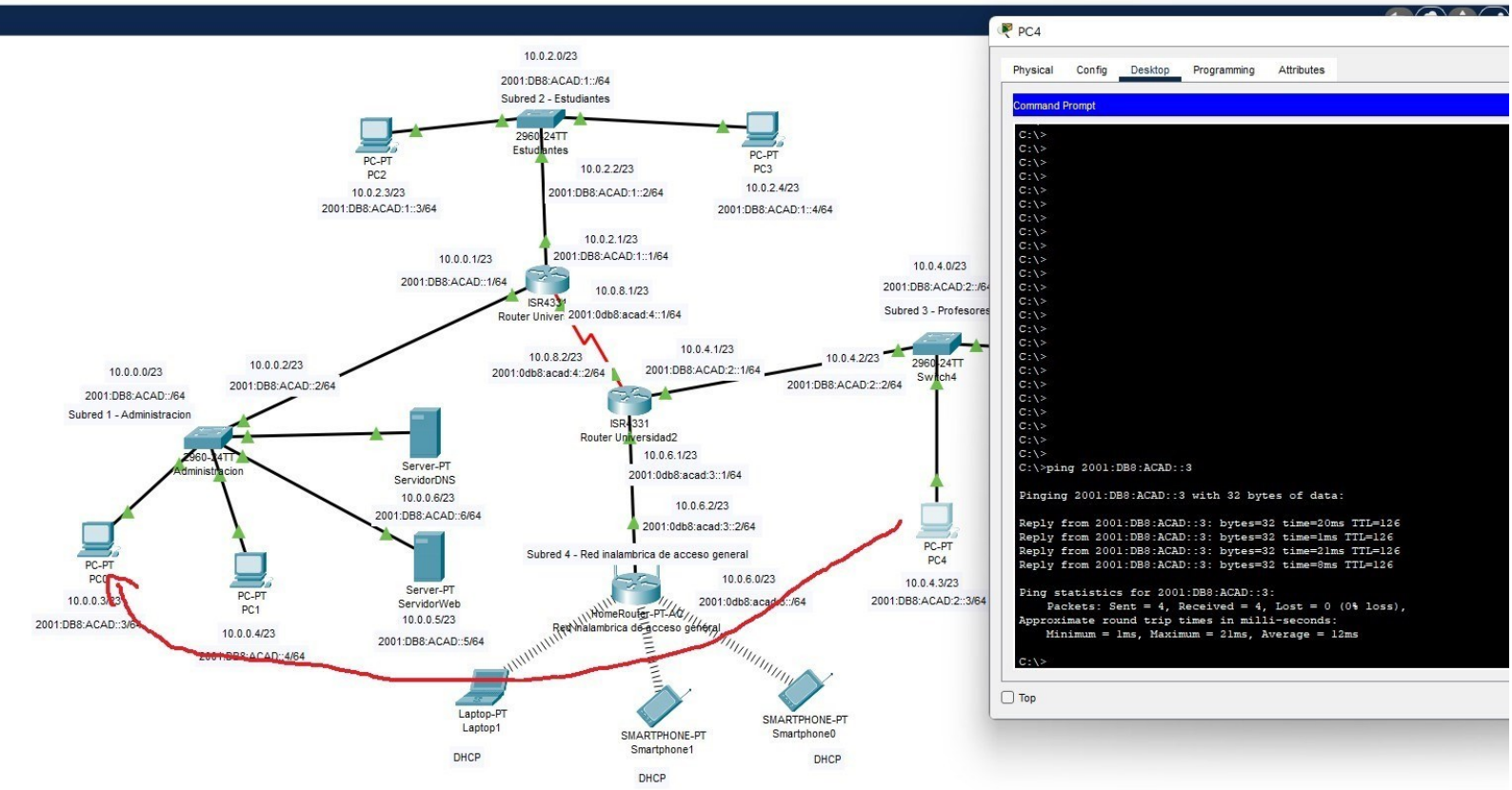




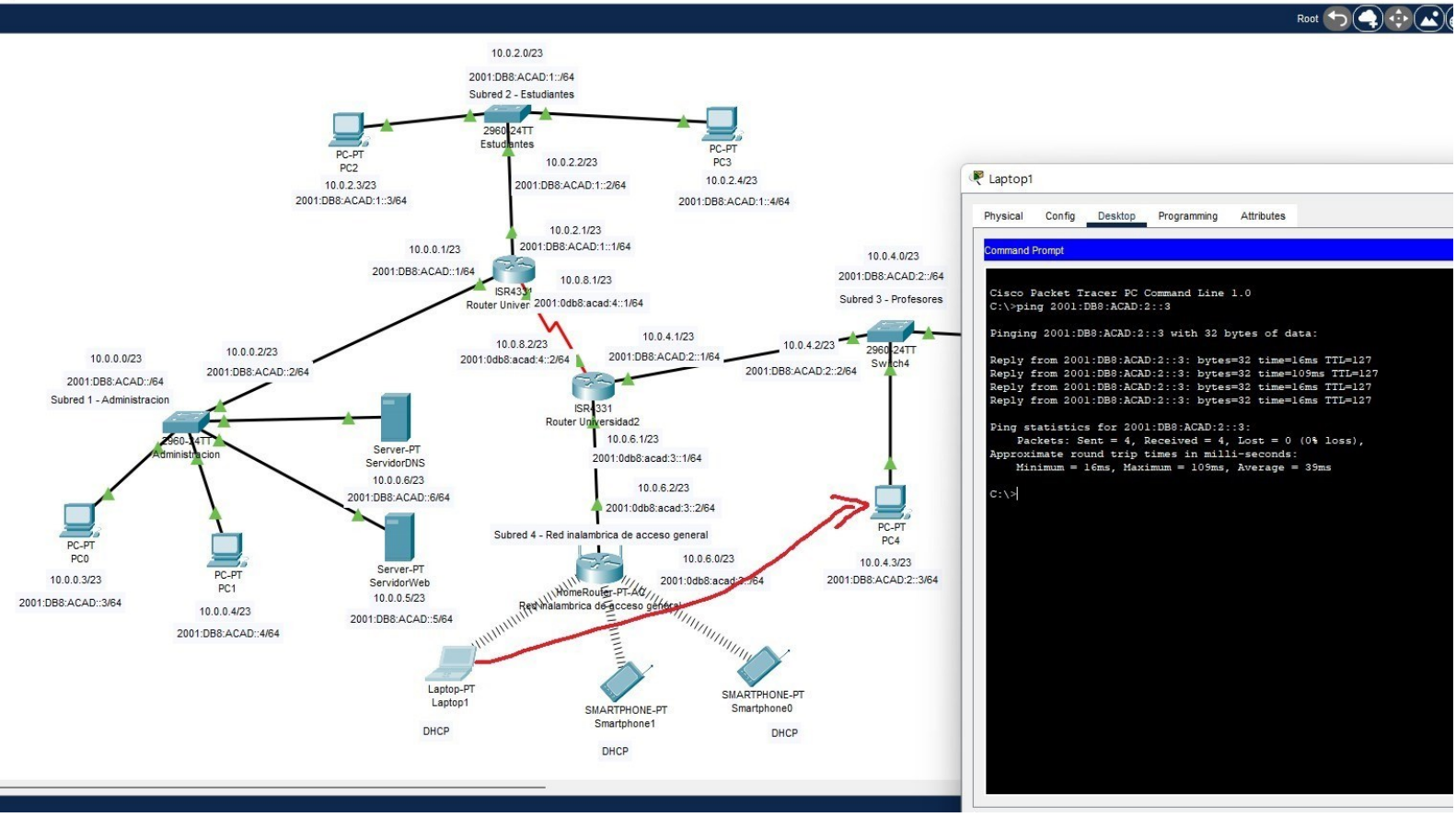
Teachers -> Students



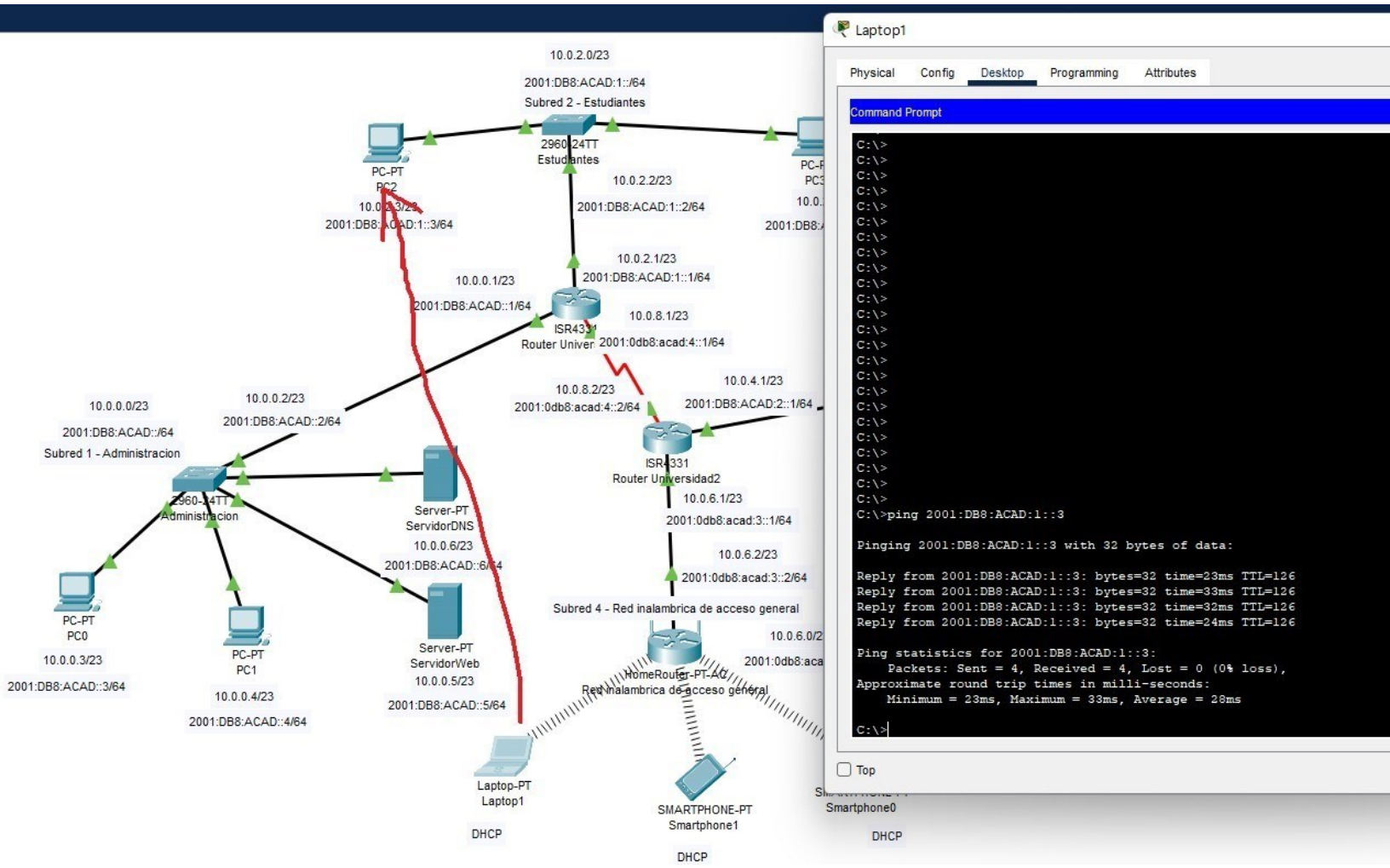
Teachers -> Administration



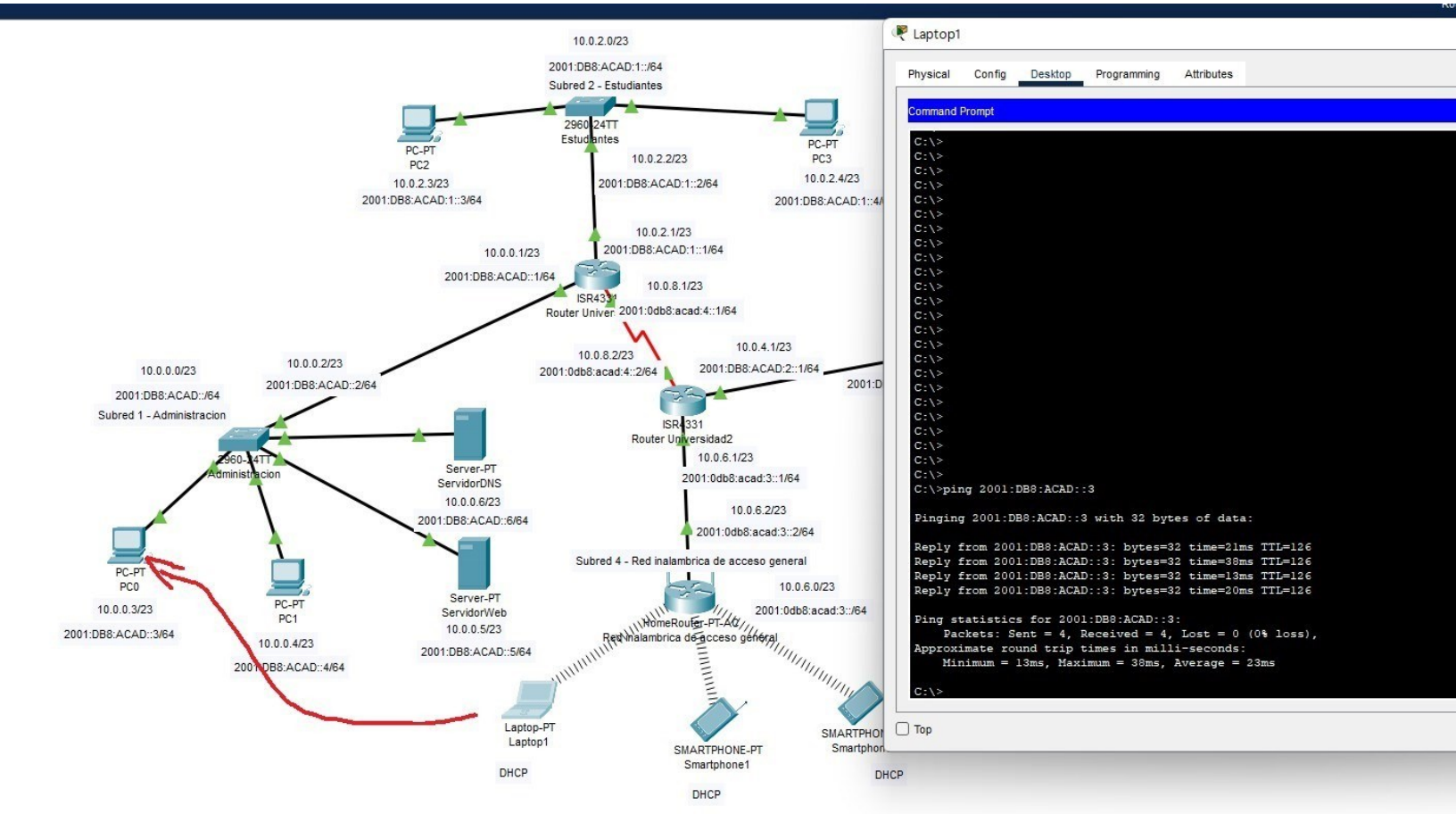
Wireless network -> Teachers



Wireless network -> Students



Wireless network -> Administration



• A description of the network's operation and how it responds to the selected requirement, along with screenshots that demonstrate the functionality, must be included in the report. Each screenshot should be described in detail within the report.

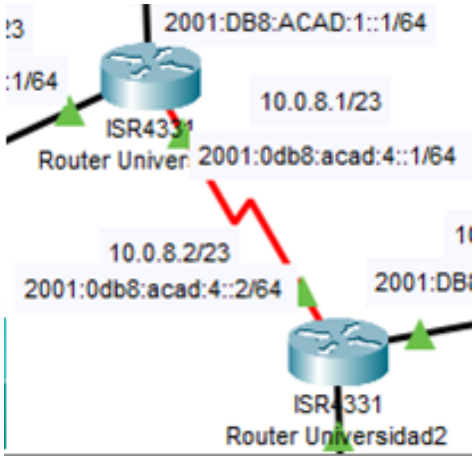
The network was designed as a university network as requested by the guidelines. Four subnets were created, including one wireless subnet, and another main network which serves as the administration subnet.

Additionally, an extra mini subnet was created to facilitate the connection between the two routers. This was necessary because a single router only contained 2 gigabit interfaces, while there were more than 2 networks in the setup.

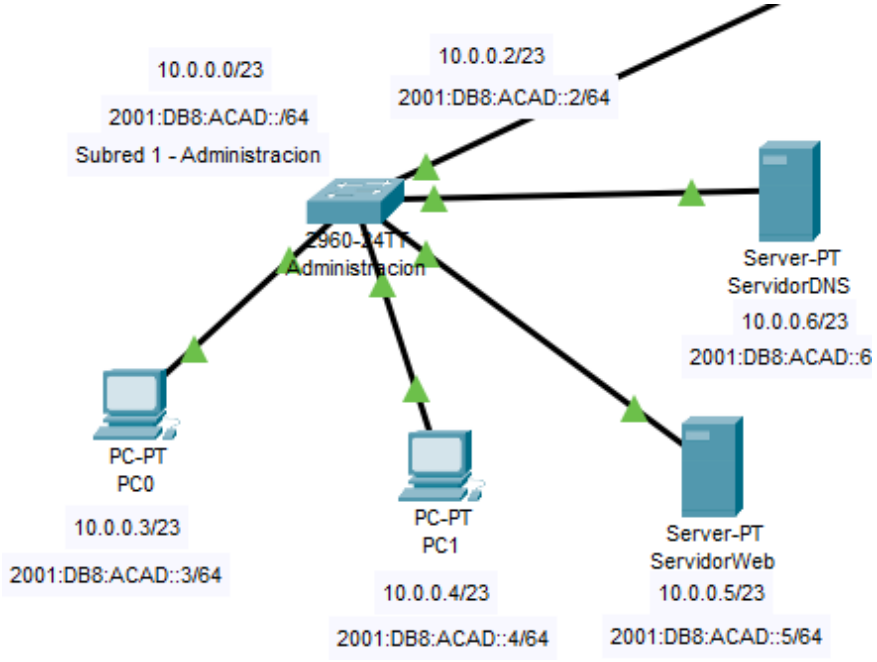
SubNet	Description
SubNet 1	Wired network for administration
SubNet 2	Wired network for students
SubNet 3	Wired network for teachers
SubNet 4	Wireless network for general access
SubNet 5	Connection network for the 2 routers

Following IP addresses were assigned to each network, providing a wide range for devices.

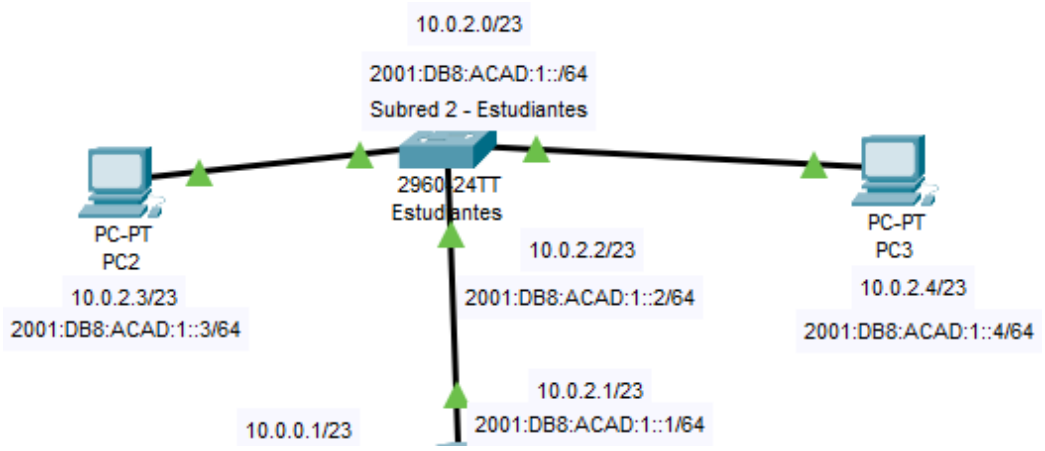
Subred	IPv4 Network Address	IPv6 Network Address/64	Range of Usable IPv6 Addresses
Administration	10.0.0.0/23	2001:0db8:acad:0::/64	2001:0db8:acad:0::1 hasta 2001:0db8:acad:0:ffff:ffff:ffff:fffe
Students	10.0.2.0/23	2001:0db8:acad:1::/64	2001:0db8:acad:1::1 hasta 2001:0db8:acad:1:ffff:ffff:ffff:fffe
Teachers	10.0.4.0/23	2001:0db8:acad:2::/64	2001:0db8:acad:2::1 hasta 2001:0db8:acad:2:ffff:ffff:ffff:fffe
Wireless	10.0.6.0/23	2001:0db8:acad:3::/64	2001:0db8:acad:3::1 hasta 2001:0db8:acad:3:ffff:ffff:ffff:fffe
Router connection	10.0.8.0/30	2001:0db8:acad:4::/64	2001:0db8:acad:4::1 hasta 2001:0db8:acad:4:ffff:ffff:ffff:fffe



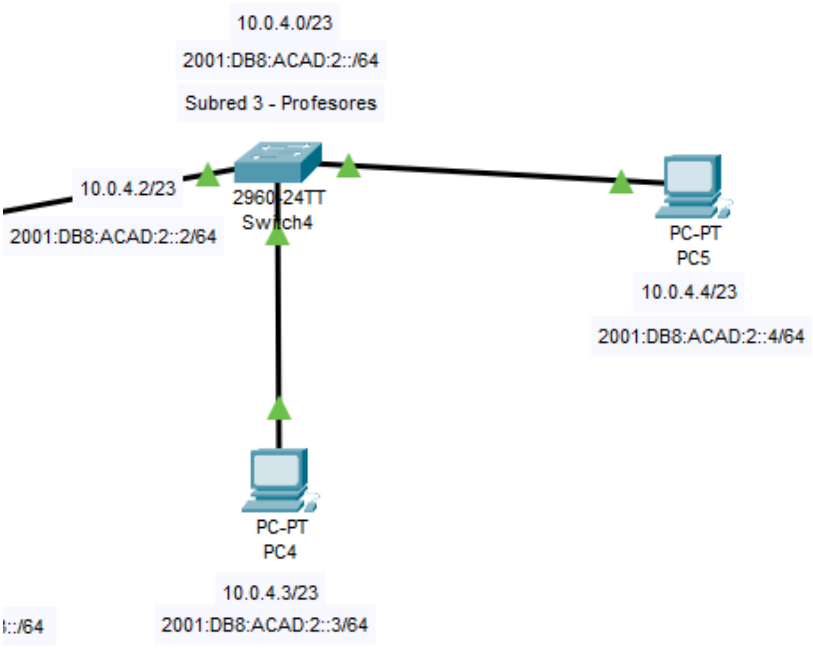
Switch Administration		
Interface	Ipv4	Ipv4
Gig0/1	10.0.0.2/23	2001:DB8:ACAD::2/64
Fa0/1	10.0.0.3/23	2001:DB8:ACAD::3/64
Fa0/2	10.0.0.4/23	2001:DB8:ACAD::4/64
Fa0/3	10.0.0.5/23	2001:DB8:ACAD::5/64
Fa0/4	10.0.0.6/23	2001:DB8:ACAD::6/64



Switch Students		
Interface	Ipv4	Ipv4
Gig0/1	10.0.2.2/23	2001:DB8:ACAD:1::2/64
Fa0/1	10.0.2.3/23	2001:DB8:ACAD:1::3/64
Fa0/2	10.0.2.4/23	2001:DB8:ACAD:1::4/64

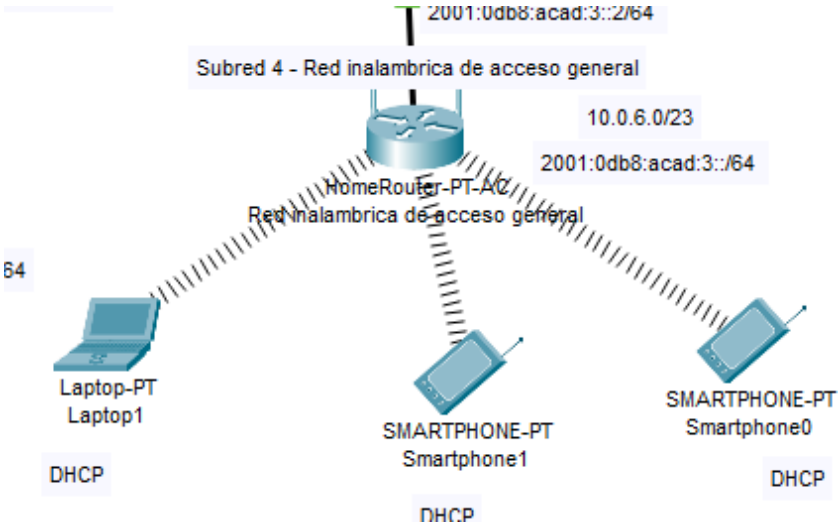


Switch Teachers		
Interface	Ipv4	Ipv4
Gig0/1	10.0.4.2/23	2001:DB8:ACAD:2::2/64
Fa0/1	10.0.4.3/23	2001:DB8:ACAD:2::3/64
Fa0/2	10.0.4.4/23	2001:DB8:ACAD:2::4/64



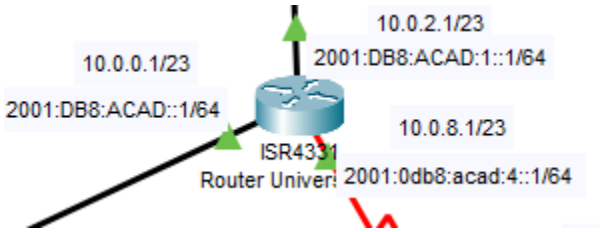
Wireless Networ Router		
Interface	Ipv4	Ipv4
Gig0/1	10.0.6.2/23	2001:0db8:acad:3::2/64

In this network, devices connect using DHCP, which means the router automatically assigns them an IP address. This is common in real life, as when connecting a cellphone to a wireless network, it's unlikely that the IP address would be assigned manually.

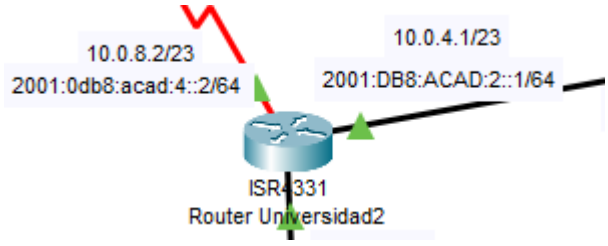


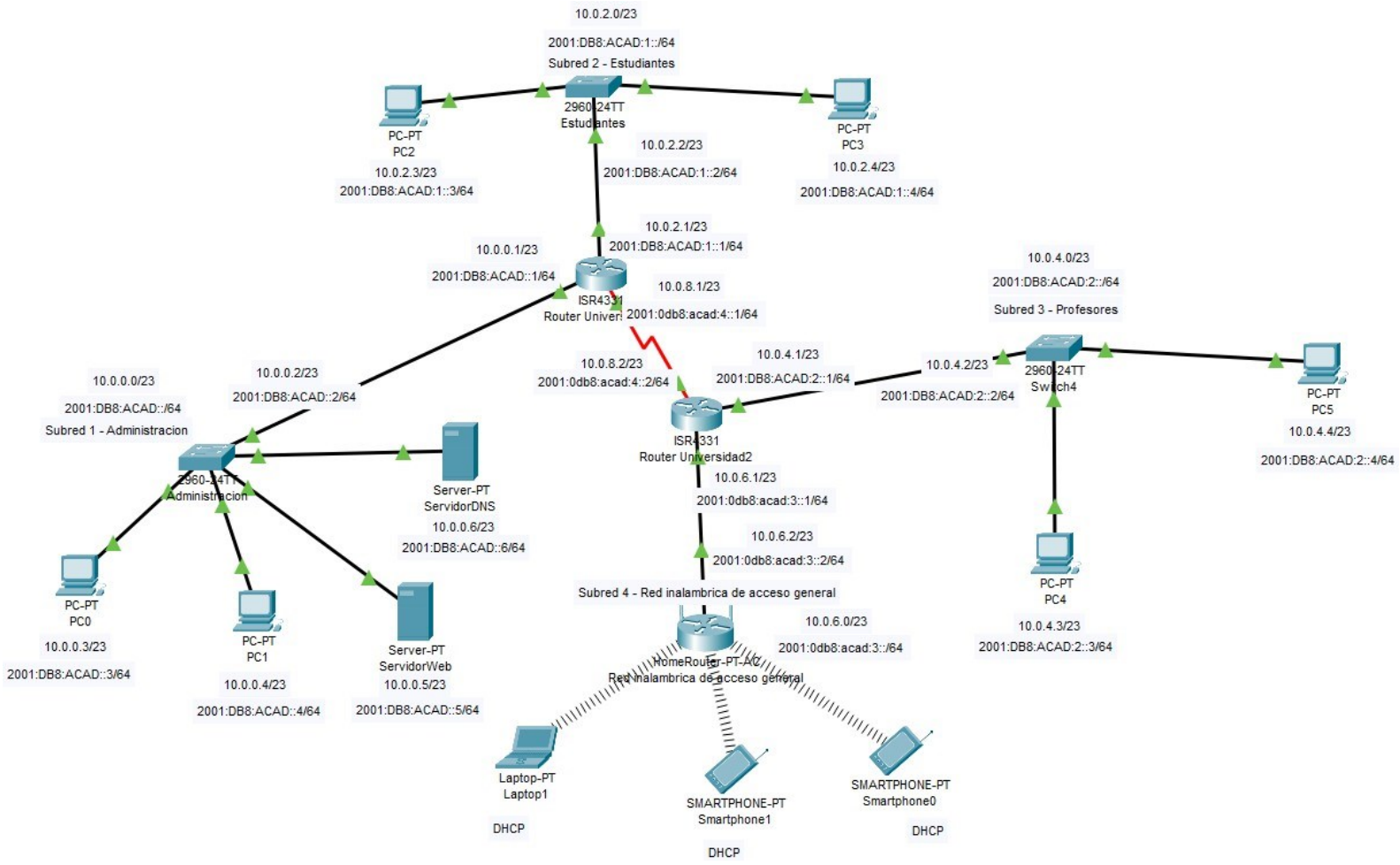
University Router 1		
Interface	Ipv4	Ipv4
Gig0/0/0	10.0.0.1/23	2001:DB8:ACAD::1/64
Gig0/0/1	10.0.2.1/23	2001:DB8:ACAD:1::1/64
Serial0/1/0	10.0.8.1/23	2001:0db8:acad:4::1/64

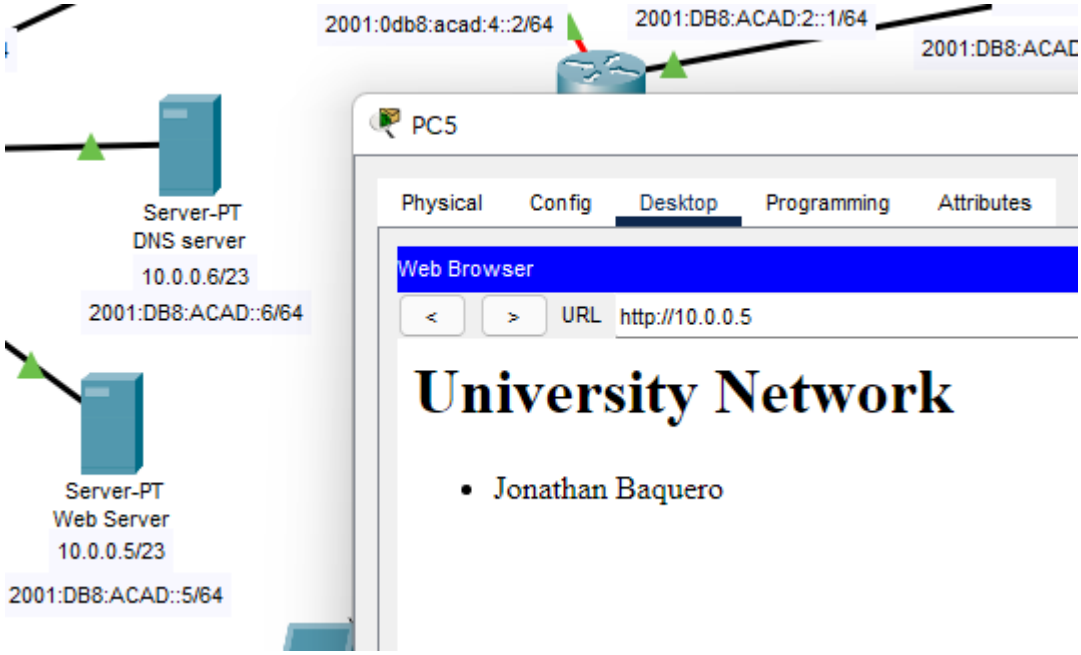
Two routers were set up because the router from the previous activity didn't support IPv6, and this new router only supports 2 gigabit ports. It's possible to add another port through the simulator, but this port cannot be assigned an IP address.



University Router 2		
Interface	Ipv4	Ipv4
Gig0/0/0	10.0.4.1/23	2001:DB8:ACAD:2::1/64
Gig0/0/1	10.0.6.1/23	2001:DB8:ACAD:1::1/64
Serial0/1/0	10.0.8.2/23	2001:0db8:acad:3::1/64




10.0.2.0/23
2001:DB8:ACAD:1::/64
Subred 2 - Estudiantes
2960-24TT
Estudiantes
PC-PT
PC2
10.0.2.3/23
2001:DB8:ACAD:1::3/64
10.0.2.2/23
2001:DB8:ACAD:1::2/64
PC-PT
PC3
10.0.2.4/23
2001:DB8:ACAD:1::4/64
10.0.2.1/23
2001:DB8:ACAD:1::1/64
10.0.0.1/23
2001:DB8:ACAD::1/64
ISR4331
Router Univer
10.0.8.1/23
2001:0db8:acad:4::1/64
10.0.4.0/23
2001:DB8:ACAD:2::/64
Subred 3 - Profesores
10.0.8.2/23
2001:0db8:acad:4::2/64
10.0.4.1/23
2001:DB8:ACAD:2::1/64
10.0.4.2/23
2001:DB8:ACAD:2::2/64
2960-24TT
Switch4
PC-PT
PC5
10.0.4.4/23
2001:DB8:ACAD:2::4/64
10.0.0.0/23
2001:DB8:ACAD::/64
Subred 1 - Administracion
10.0.0.2/23
2001:DB8:ACAD::2/64
ISR4331
Router Universidad2
2960-24TT
Administracion
Server-PT
ServidorDNS
10.0.0.6/23
2001:DB8:ACAD::6/64
10.0.6.1/23
2001:0db8:acad:3::1/64
10.0.6.2/23
2001:0db8:acad:3::2/64
PC-PT
PC4
10.0.4.3/23
2001:DB8:ACAD:2::3/64
PC-PT
PC0
10.0.0.3/23
2001:DB8:ACAD::3/64
PC-PT
PC1
10.0.0.4/23
2001:DB8:ACAD::4/64
Server-PT
ServidorWeb
10.0.0.5/23
2001:DB8:ACAD::5/64
Subred 4 - Red inalambrica de acceso general
10.0.6.0/23
2001:0db8:acad:3::/64
HomeRouter-PT-AC
Red inalambrica de acceso general
Laptop-PT
Laptop1
DHCP
SMARTPHONE-PT
Smartphone1
DHCP
SMARTPHONE-PT
Smartphone0
DHCP


2001:0db8:acad:4::2/64
2001:DB8:ACAD:2::1/64
2001:DB8:ACAD
Server-PT
DNS server
10.0.0.6/23
2001:DB8:ACAD::6/64
Server-PT
Web Server
10.0.0.5/23
2001:DB8:ACAD::5/64
PC5
Physical
Config
Desktop
Programming
Attributes
Web Browser
<
>
URL
http://10.0.0.5
University Network
Jonathan Baquero