# Network Project

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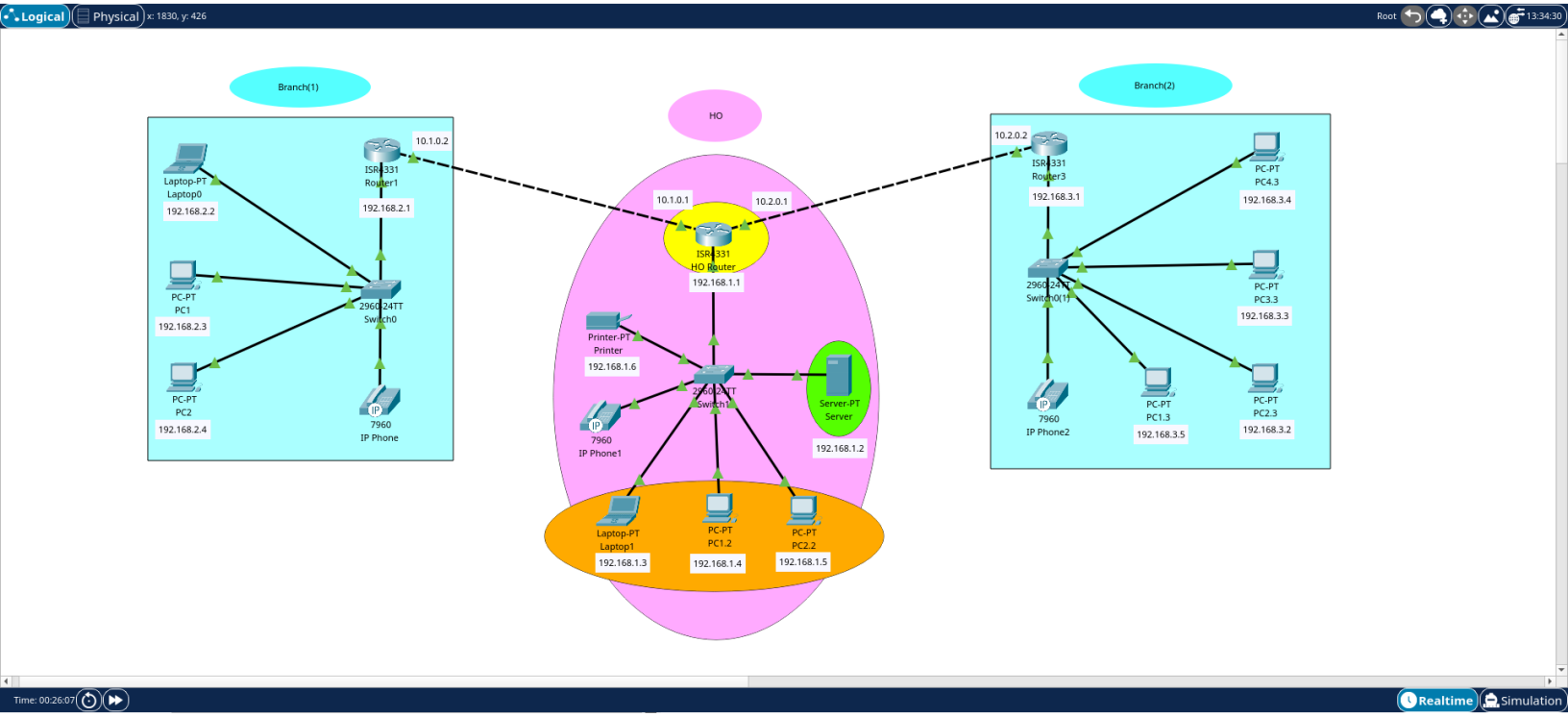
# Project Documentation

We have a Head Office (HO) , and Tow Branches , as at **figure (1).**

**Network Setup:**
HO Network: **“192.168.1.0/24” .**
Branch 1 Network: **“192.168.2.0/24”.**
Branch 2 Network: **“192.168.3.0/24” .**

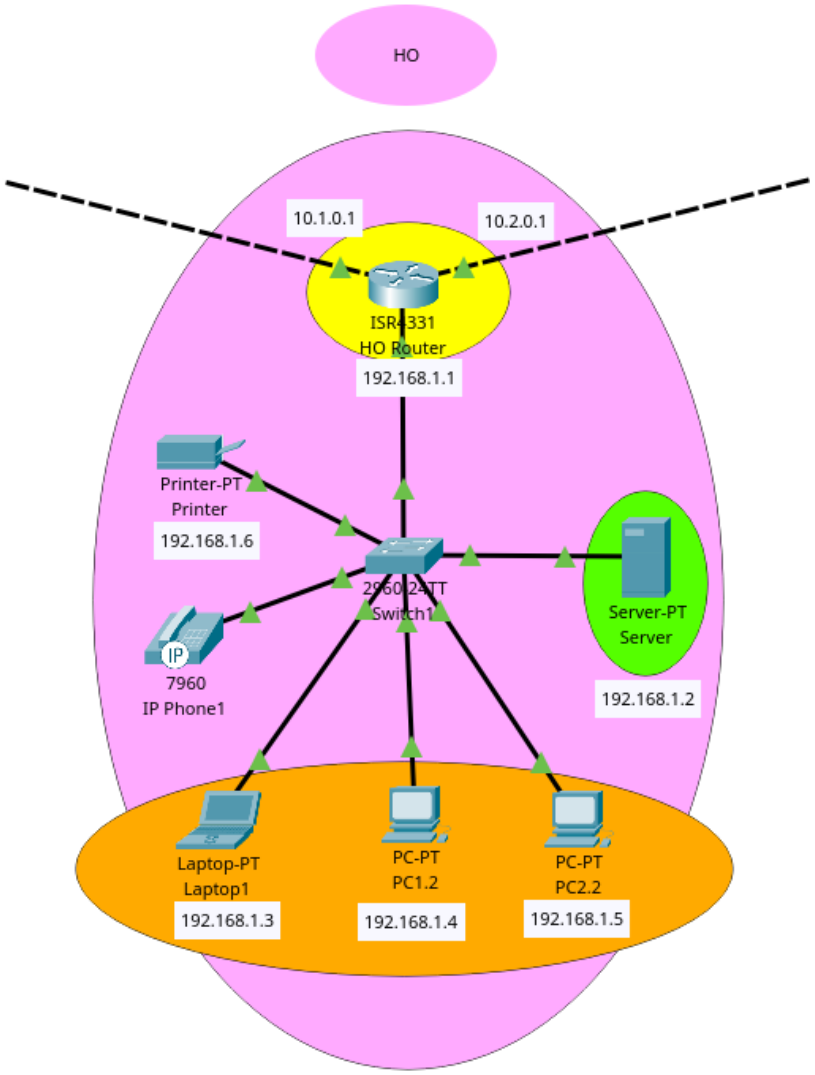
**WAN Links:**
HO to Branch 1: **10.1.0.0/24**
HO to Branch 2: **10.2.0.0/24**

figure(1)



# Head Office (HO)

figure(2)




## Components:

### Router

- **HO Router**:
  - **Purpose**: Acts as the gateway for the headquarters (HO) and facilitates communication with external networks such as Branch 1 and Branch 2.
  - **Interfaces**:
    - `10.1.0.2`: Connects to Branch 1, at figure (3).
    - `20.2.0.2`: Connects to Branch 2, at figure (4).
    - `192.168.1.1`: Serves as **the default gateway** for devices within the HO local subnet.

**Switch**

- **Switch1**:
  - **Purpose**: A layer-2 switch that connects and distributes traffic between the local devices in the HO subnet.
  - **Connectivity**:
    - Connected to the router (`192.168.1.1`) for external communication.
    - Connected to all devices in the HO network.

**Devices**

1. **Server**:
   - **IP Address**: `192.168.1.2`.
   - **Purpose**: Likely provides centralized services such as file hosting, application hosting, or database services for the HO and possibly the entire network, and we implemented the following services **(DHCP, DNS, FTP, EMAIL).**
2. **PCs**:
   - **PC1.2** (`192.168.1.4`) and **PC2.2** (`192.168.1.5`):
     - Desktop computers connected to the switch for general use.
3. **Laptop (Laptop1)**:
   - **IP Address**: `192.168.1.3`.
   - **Purpose**: A mobile device connected to the network.
4. **Printer**:
   - **IP Address**: `192.168.1.6`.
   - **Purpose**: A network printer accessible by all devices in the HO , it's allows shared access for printing tasks..
5. **IP Phone**:
   - **Purpose**: A VoIP phone connected to the network for voice communication.

## Network Subnet

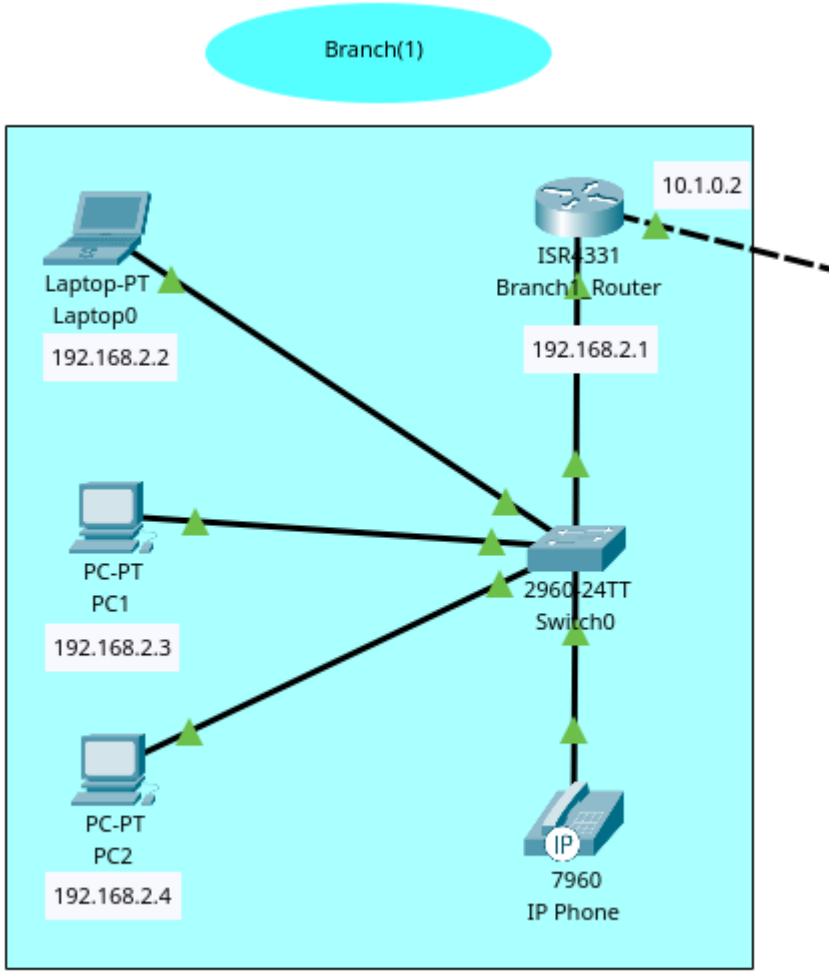
- **Subnet**: `192.168.1.0/24`
  - Network Address: `192.168.1.0`.
  - Default Gateway: `192.168.1.1` (Router interface).
  - Devices and their IP addresses fall within this subnet.

## Connectivity

- All devices within the subnet are connected through the S**witch** and communicate with the router to access external networks (Branch 1, Branch 2, or the internet).
- The **router** ensures routing between different subnets ("**`192.168.1.0/24`**", "**`10.1.0.0/24`**", and "**`10.2.0.0/24`**").

# Branch (1)

figure(3)




**Components:**

1. **Branch1_Router:**
    - **IP Address (LAN):** 192.168.2.1 .
    - **IP Address (WAN):** 10.1.0.2 (Connection to the head office or external network)
    - **Role:**
        - Provides routing functions between the local network and external networks.
        - It Serves as the **default gateway** for all internal devices in the **192.168.2.0/24** subnet.
        - Connects to the outside world (e.g., head office) through a WAN link (represented by the dashed line).

2. **Switch0:**
    - **Role:**
        - Connects all internal devices within the branch office.
        - Distributes network connectivity to laptops, PCs, and IP phones.
        - Operates at Layer 2 (Data Link Layer) and forwards data based on MAC addresses.

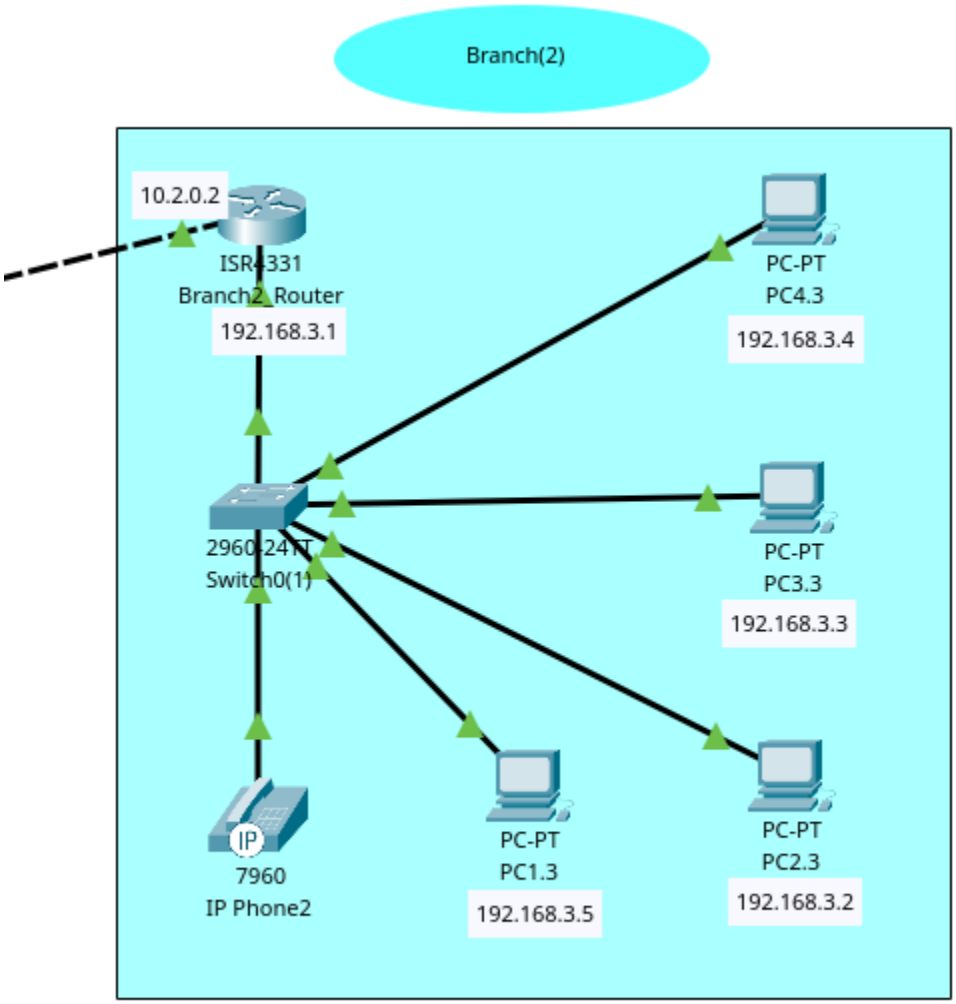
3. **End Devices:**
    - **Laptop0: with static IP – 192.168.2.2**
        - General-purpose computing device used by employees.
    - **PC1:with static IP – 192.168.2.3**
        - Desktop computer connected to the network.
    - **PC2: with static IP – 192.168.2.4**
        - Another desktop computer connected to the network.
    - **IP Phone:**
        - IP address not displayed, but connected to the switch for VoIP (Voice over IP) communication.

**Communication Flow:**

1. **Internal Communication (LAN):**
    - Devices communicate directly with each other through Switch0 (Layer 2 switching).
    - Example: PC1 can ping Laptop0 directly using IP 192.168.2.2.
2. **External Communication (WAN):**
    - When devices need to communicate outside the branch (e.g., internet or head office), they route traffic through **Router1** (192.168.2.1).
    - The router forwards the traffic to **10.1.0.2** (WAN interface) towards the head office.

# Branch (2)

figure(4)




**Components:**

1. **Branch2 Router:**
    - **IP Address (LAN):** 192.168.3.1 .
    - **IP Address (WAN):** 10.2.0.2 (Connection to external network or head office).
    - **Role:**
        - Routes traffic between the branch's local network and external destinations.
        - Serves as the **default gateway** for all internal devices in the **192.168.3.0/24** subnet.
        - Establishes WAN connectivity (represented by the dashed line) to the head office or other branches.

2. **Switch0(1):**
    - **Role:**
        - Functions as a Layer 2 switch to connect all internal devices.
        - Provides local communication by forwarding packets between devices within the LAN.
        - Handles communication between computers, IP phones, and printers.
3. **End Devices:**
    - **PC1.3** – 192.168.3.5
    - **PC2.3** – 192.168.3.2
    - **PC3.3** – 192.168.3.3
    - **PC4.3** – 192.168.3.4
    - **IP Phone** – Connected but IP not shown (likely dynamically assigned or set through VoIP VLAN).
        - Facilitates voice-over-IP (VoIP) communication.

**IP Addressing:**

- **Subnet:** 192.168.3.0/24 (Class C network – 254 usable host addresses)
- **Router LAN IP:** 192.168.3.1 (Default gateway for the subnet)
- **Devices:**
    - PC1.3: 192.168.3.5
    - PC2.3: 192.168.3.2
    - PC3.3: 192.168.3.3
    - PC4.3: 192.168.3.4
- **WAN Link (Router to Head Office/External Network):** 10.2.0.2 (WAN Interface).

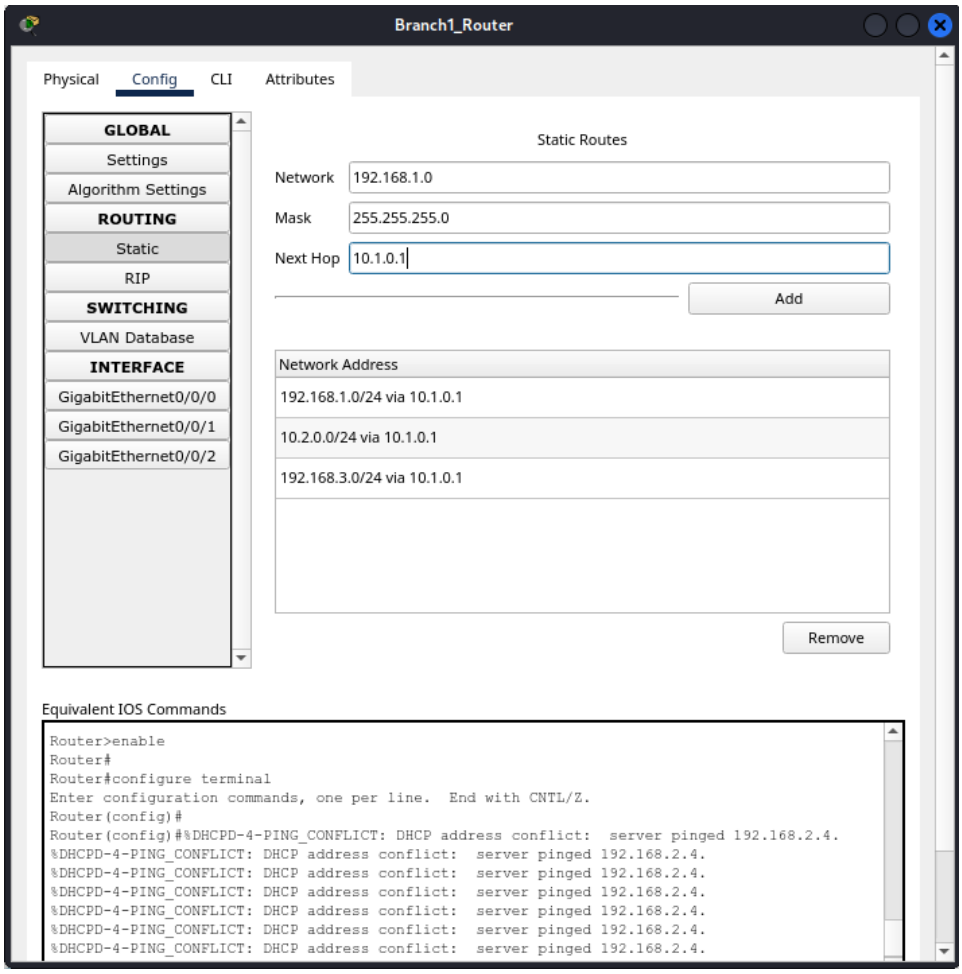
**Communication Flow:**

1. **Internal (LAN) Communication:**
    - Devices within the branch communicate through **Switch0(1)**.
    - Example: PC1.3 can share files with PC3.3 using the switch, without the router's involvement.
2. **External Communication (WAN):**
    - Traffic destined for external networks (like the internet or other branches) is routed through **Branch2 Router** (192.168.3.1).
    - The router uses **NAT (Network Address Translation)** or other routing protocols to forward packets to the external interface (10.2.0.2).

Now we must put static routing “Manually”

In Branch1_Router: open router , going to “config” and then in ROUTING select “static” , look at figure(5).

figure(5)

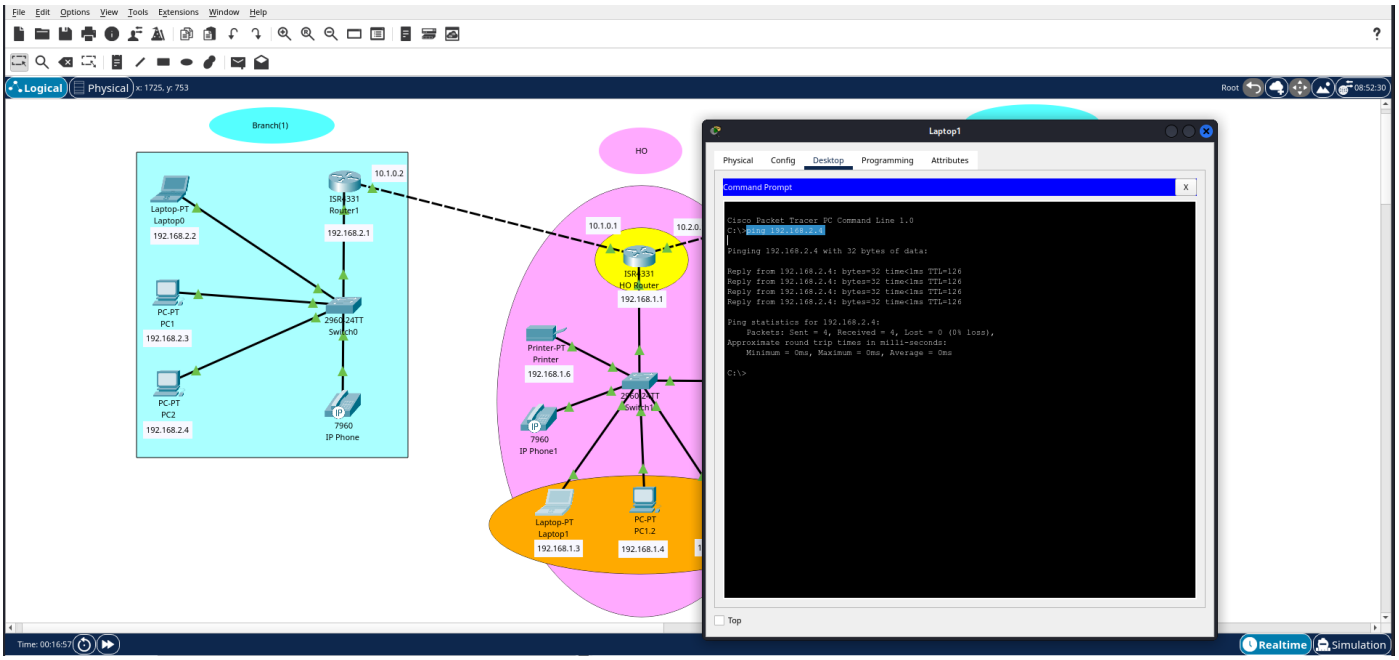



**In Network label:** insert the network to be connected
**In Mask label:** put the subnet mask of that network.
**In Next Hop:** put the last interface Branch1_Router can see.

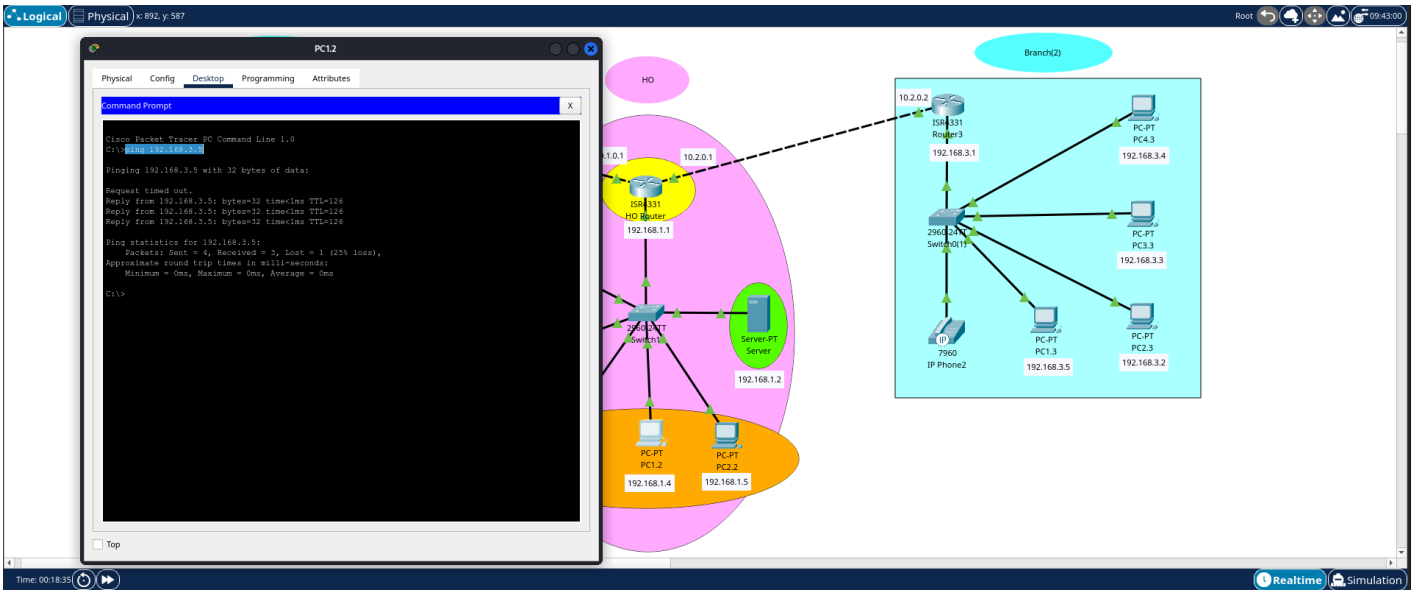
Repeat this for Networks ( 10.2.0.0/24 , 192.168.3.0/24 ) , as at figure(5)

## check connectivity:

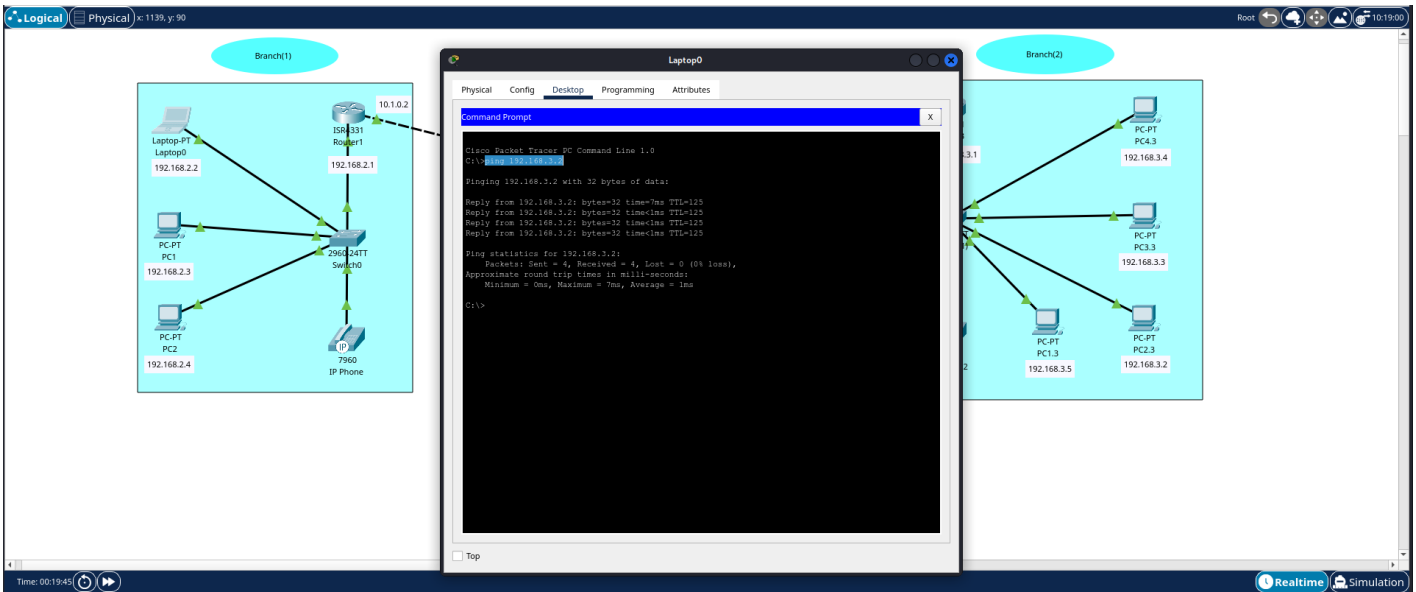
### From HO to Branch 1




### From HO to Branch 2




### From Branch 1 to Branch 2

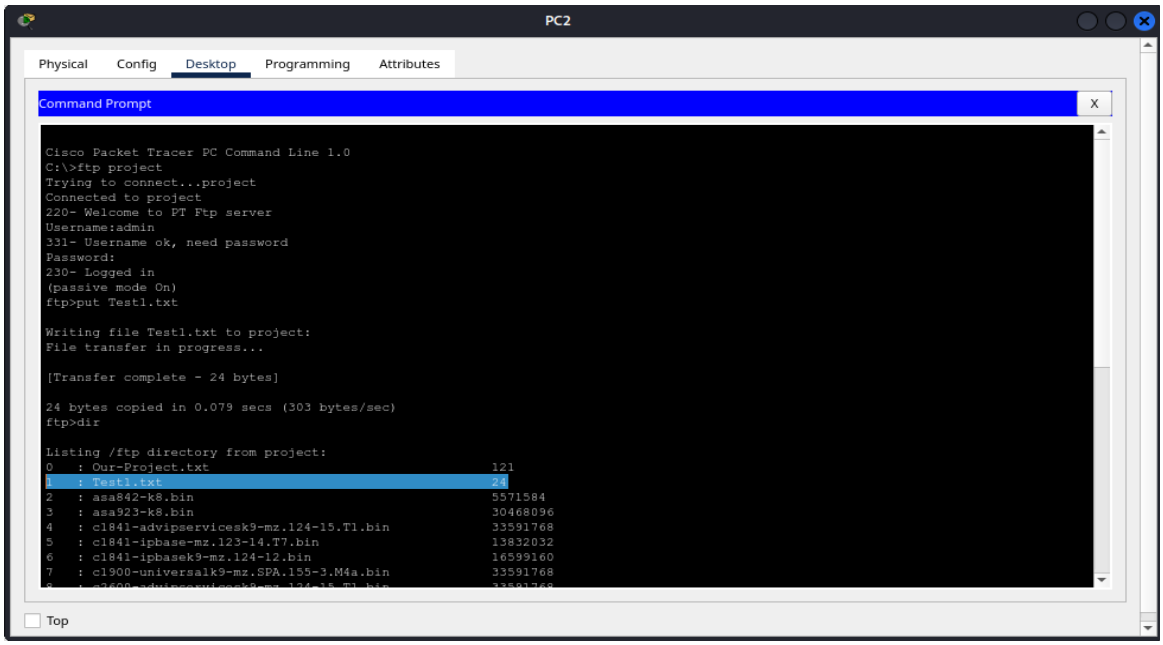


## Using FTP service:

In the HO Server we created two users , “**admin**” & “**user1**” in FTP service.
The “**admin**” user has all accesses (Write, Read, Delete, Rename, List). , but the “**user1**” just has two accesses (Read & List).
The Domain name of server is “**project**”

In Branch (1) , we created a file in PC2 , file name “ **Test1** ” .
and we uploaded the file to the server of “HO” using “**admin**” user, look at figure(6).

figure(6)




Now we can Download that file from server to any device.
Ex: Let’s go to PC2.3 in Branch (2) , open the command prompt , and then connect to FTP as in figure(7), so we can download the file using “**get**” command, #we logged in by “**user1**” , after this we can exit from FTP using “**quit**” command, and then write “**dir**” to see all files on PC3.3, as at figure(7) we can see the Test1 file downloaded on PC3.3 .

figure(7)