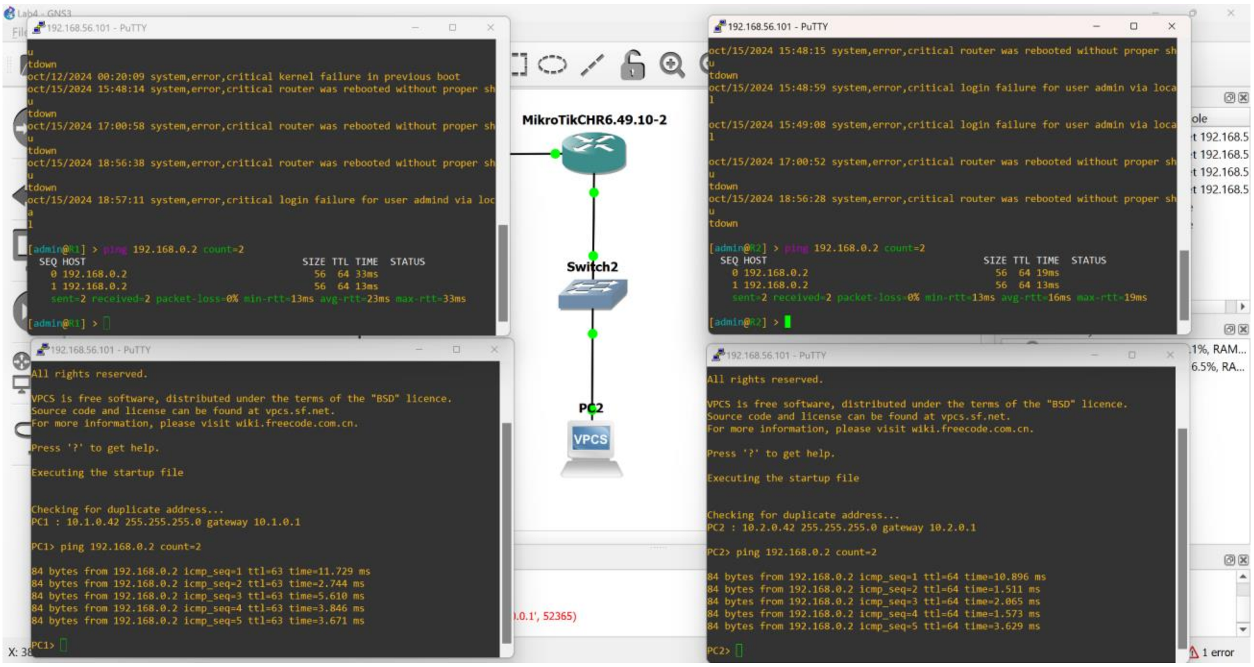
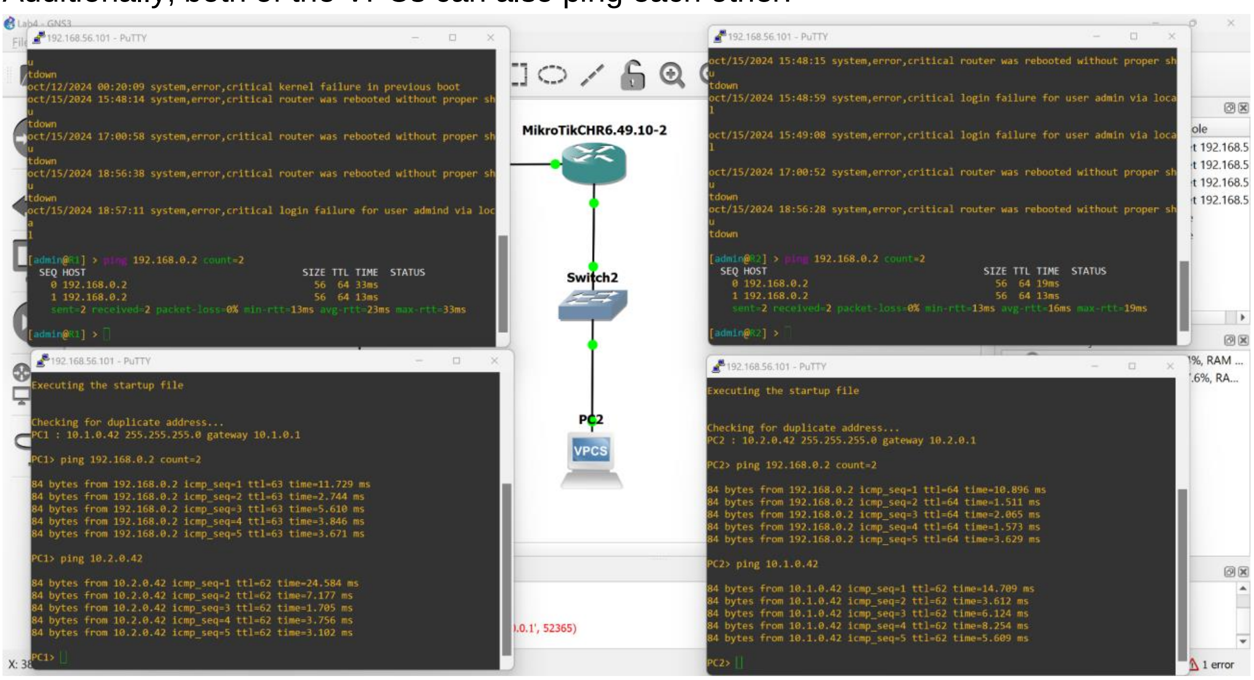
Lab 3 - Network Routing:

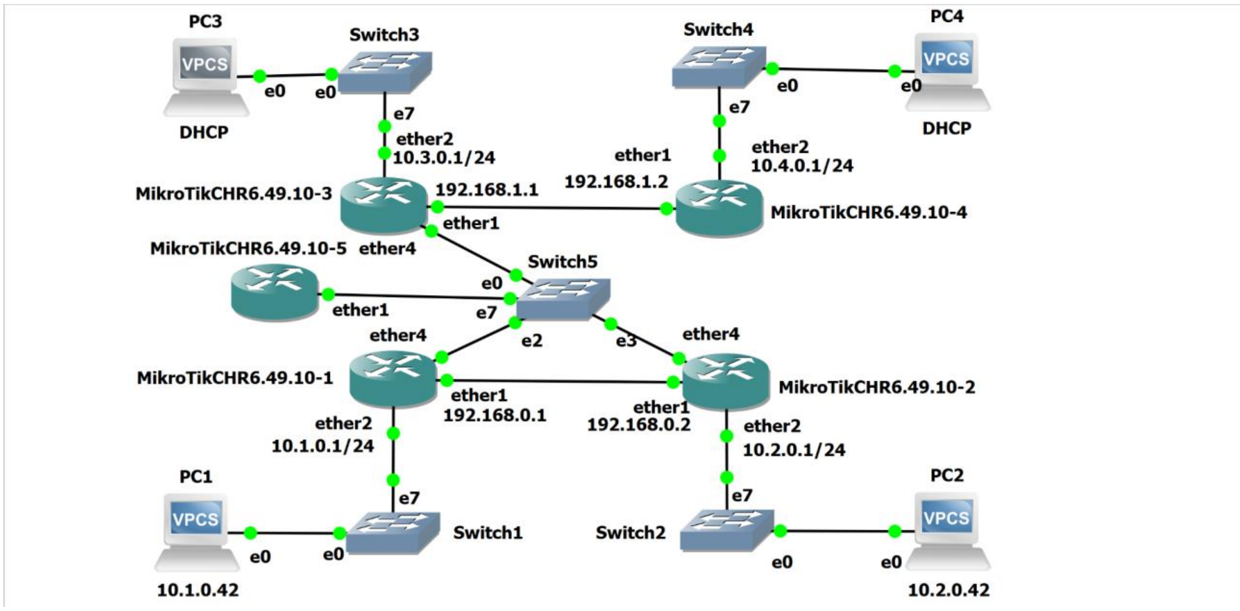
In this lab, I have set up two routers which are connected to a VPC through a switch. The routers are also connected to each other directly. After setting the IPs of the VPCs and configuring the routes on the routers as initially specified in the instructions, I tested to see which devices could ping where. The results show both the routers with successful pings, as well as both VPCs:



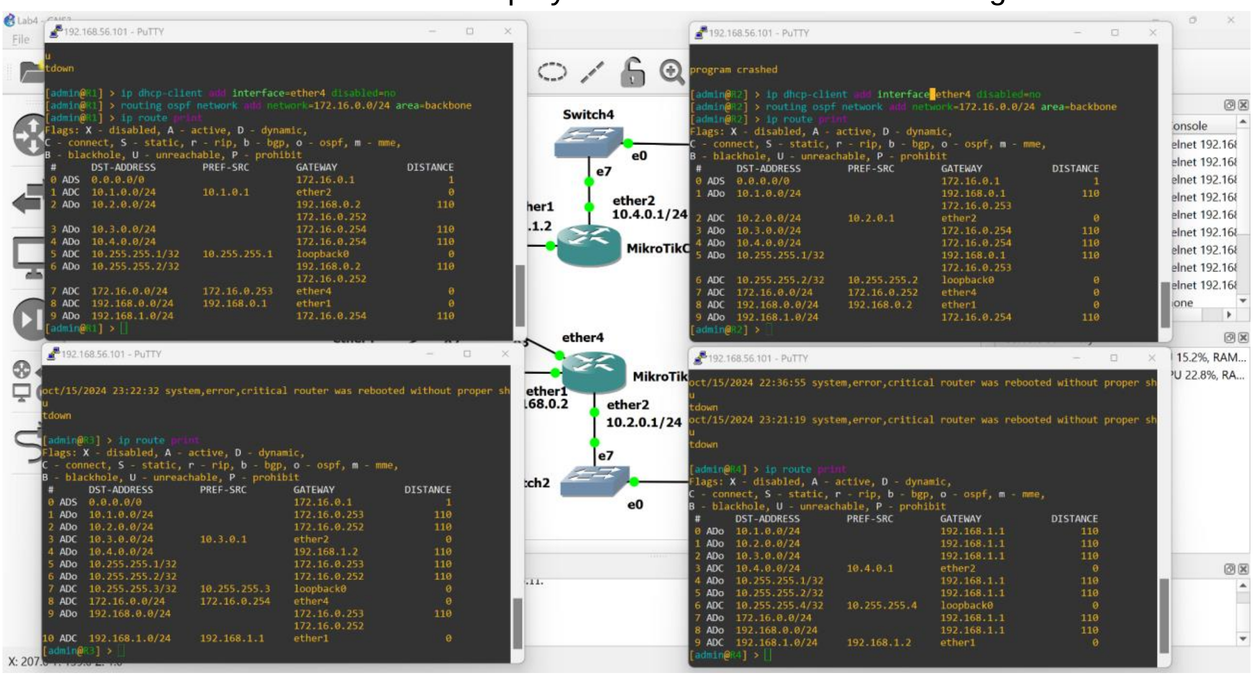
Additionally, both of the VPCs can also ping each other:



After I did this, I expanded the network to look like this:



Then, I configured the routers (with exception to router 5) as they are in the instructions. Here are the routes displayed on each of them after configuration:



Based on this initial configuration, here are the results of pinging every computer from each of the other computers:

- **PC1:**
  - Ping PC2: Fail

  - Ping PC3: Success
  - Ping PC4: Fail
- **PC2:**
  - Ping PC1: Fail
  - Ping PC3: Fail
  - Ping PC4: Fail
- **PC3:**
  - Ping PC1: Success
  - Ping PC2: Success
  - Ping PC4: Success
- **PC4:**
  - Ping PC1: Success
  - Ping PC2: Success
  - Ping PC3: Success

Based on these results, I knew that I needed to do some troubleshooting to figure out how I could get PC1 and PC2 to communicate better with the other VPCs. So, I added the following addresses to Routers 1 and 2:

- 10.255.255.3/32
- 10.255.255.4/32

After doing this, I retested pings from PC1 and PC2, Here are the results:

- **PC1:**
  - Ping PC2: Success
  - Ping PC3: Success
  - Ping PC4: Success
- **PC2:**
  - Ping PC1: Success
  - Ping PC3: Success
  - Ping PC4: Success

Finally, after I got each of the VPCs to be able to talk to each other, I traced the address **10.4.0.1** from PC2. Here is the path that it found:

```
PC2> trace 10.4.0.1
trace to 10.4.0.1, 8 hops max, press Ctrl+C to stop
 1   10.2.0.1   29.506 ms  7.188 ms  14.487 ms
 2   172.16.0.254   22.029 ms  9.345 ms  6.030 ms
 3   *10.4.0.1   25.284 ms (ICMP type:3, code:3, Destination port unreachable)
```

After doing this, I removed the connection between Router 2 and the central switch. Then, I traced **10.4.0.1** from PC2 once again. Here is the new path that it found:

```
PC2> trace 10.4.0.1
trace to 10.4.0.1, 8 hops max, press Ctrl+C to stop
 1   10.2.0.1   8.078 ms  0.778 ms  0.458 ms
 2   192.168.0.1   49.174 ms  5.501 ms  1.815 ms
 3   172.16.0.254   26.189 ms  3.508 ms  10.761 ms
 4   *10.4.0.1   26.896 ms (ICMP type:3, code:3, Destination port unreachable)
```

As you can see, PC2 traced a new path to **10.4.0.1** that goes through Router 1. This occurs on step 2, where the path goes through address **192.168.0.1**.

1. **OSPF vs BGP Routing: What are the differences, and when would you use one over the other?:**

    OSPF (Open Shortest Path First) is an intra-domain routing protocol that uses link-state routing, where the routing operation is performed inside a system. On the other hand, BGP (Border Gateway Protocol) is an inter-domain routing protocol that uses path vector routing, where the routing operation is performed between two systems. Another notable difference is that OSPF is easily configured, whereas BGP is more complex, and is not easily configured. Finally, OSPF works to determine the fastest route, whereas BGP focuses on determining the “best” path.

    When it comes to deciding when each routing protocol is the best to use, OSPF is the best to use when working with internal networks, such as the network within a company, campus, or other organization. BGP is best to use in bigger networks that reach across to many smaller networks- an example is internet service providers, who need to reach many home networks, as well as various networks of organizations.

2. **What would you need to add to the routers if you want traffic to go through Router 5?:**

    In order to get traffic to flow through router 5, I would need to configure router 5 for OSPF routing, by executing the command ‘routing ospf network add network=172.16.0.0/24 area=backbone’. Additionally, I would also need to add addresses in router 5’s “neighboring” routers (routers 1 and 3) to connect them to router 5.

3. **What would you need to do if you added another network to Switch 5?:**

   If I were to add another network to switch 5, I would need to come up with a new subnet address to assign to the devices in that network. Then, I would need to add addresses to each of the routers in a way that allows each of them to communicate with their neighboring routers, therefore allowing traffic to flow through the new network.

References:

Moris. "OSPF VS BGP: Which Routing Protocol to Use?: FS Community." *Knowledge*, community.fs.com/article/ospf-vs-bgp-routing-protocol-choice.html. Accessed 17 Oct. 2024.