Networking

U1L3 – Filius Simple Network Creation

Create a Simple Network in Filius

- Filius is a free, open-source network simulator designed for educational purposes.
- It can be used to demonstrate fundamental networking concepts, such as:
  - IP Addressing
  - Network Topologies
  - Routing Protocols

Filius Simple Network Creation Lab

- Materials Needed
  - Windows Server 2022 Virtual Machine
- Software Tools Used
  - Filius Network Simulator

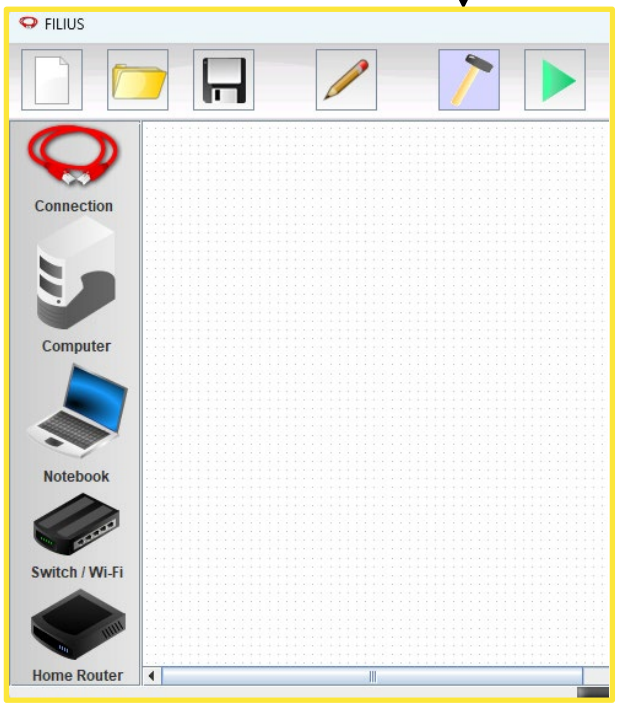
Launch Filius in Windows Server 22 VM

- In the Windows Server 22 VM at the bottom left click in the Search box (may have to click twice).

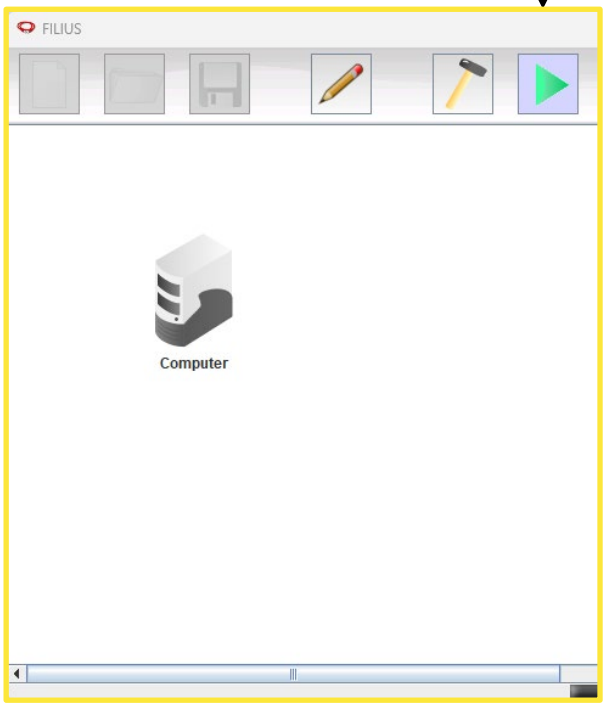
- Type **Filius** then click to select the app in the list.

Filius has 3 Modes

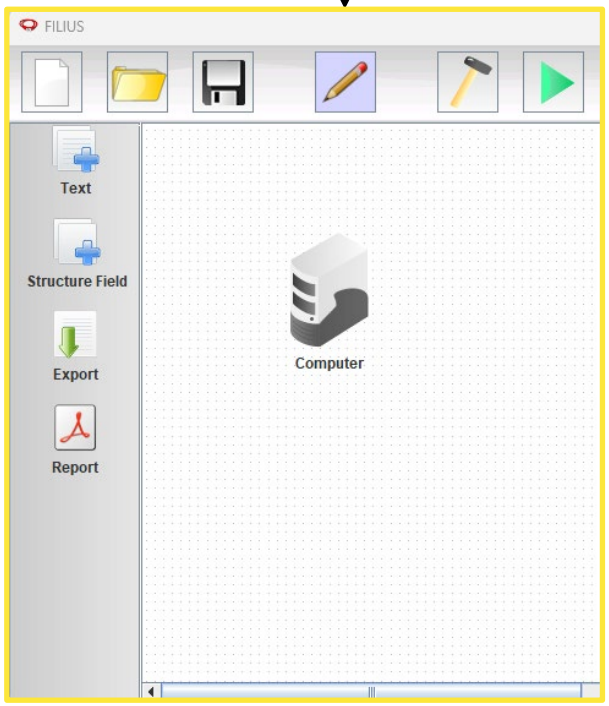
Design Mode - Default



Simulation Mode



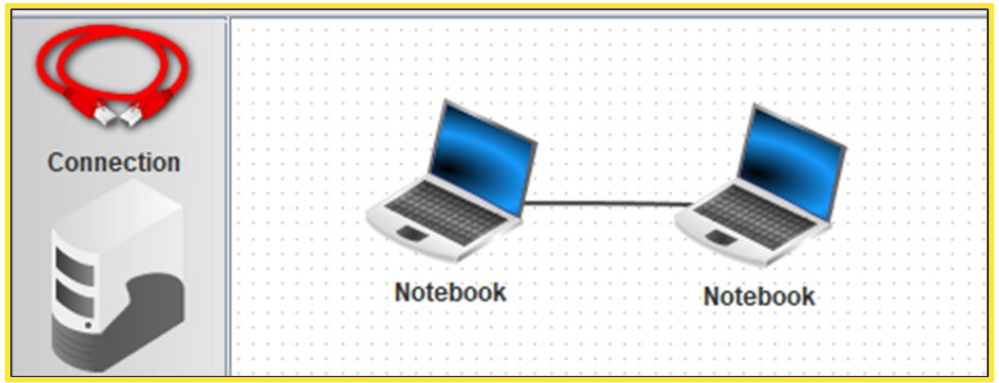
Documentation Mode



Simplest Network: 2 Devices Directly Connected

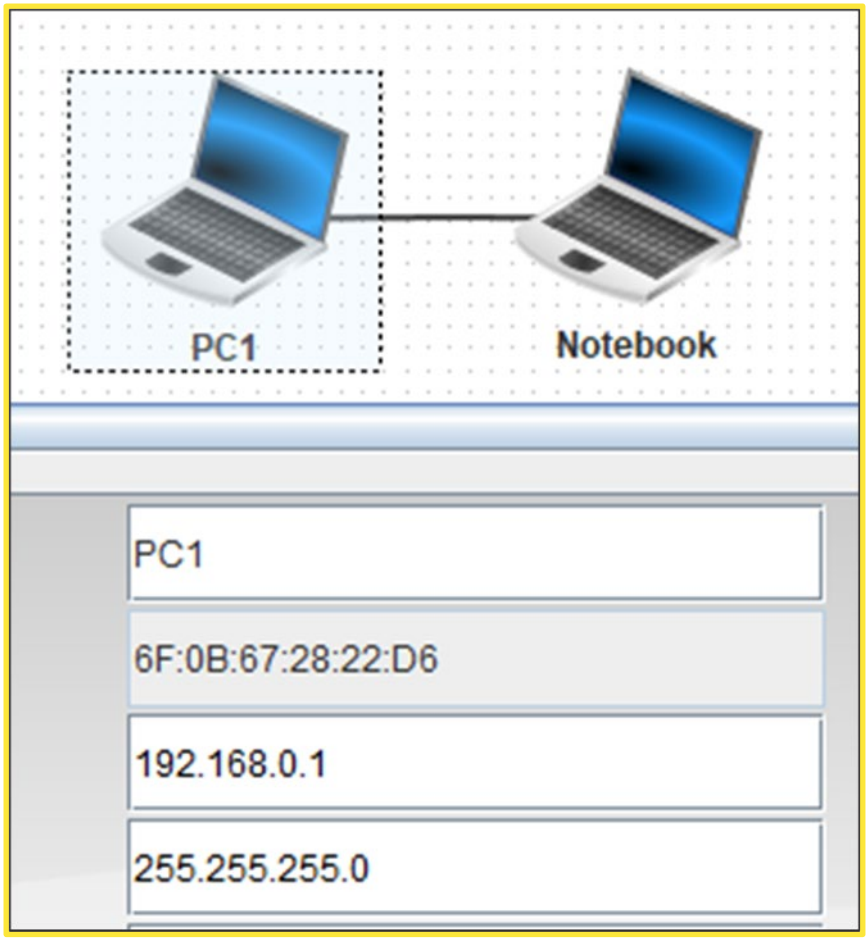
- From the left toolbar, drag two Notebooks to the build screen.

- Click on the Connections Icon, then click on the first notebook, then the second to connect a cable between them.



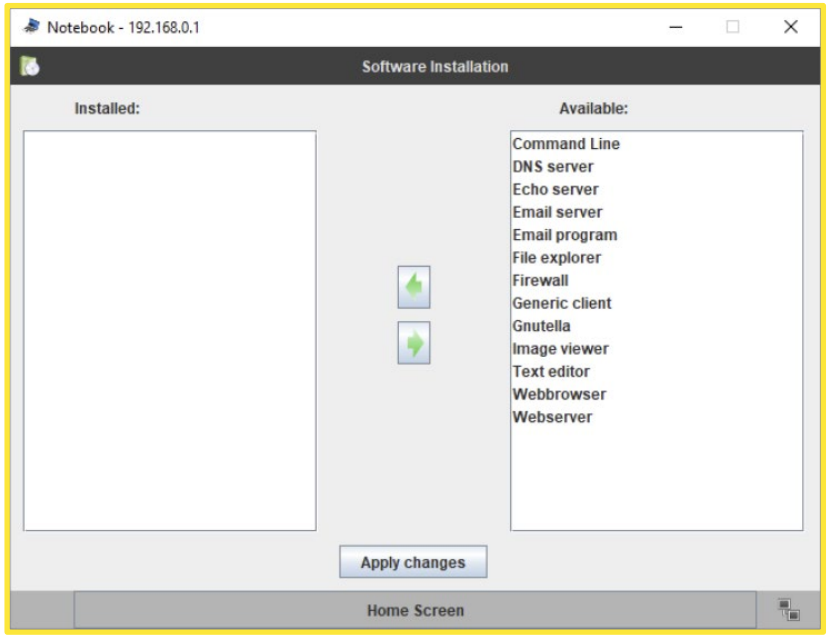
Basic Device Configuration

- Click on the left Notebook to bring up the lower properties panel for that device. (Select the Notebook icon on the left to unselect the cable option)
- Change the name to PC1. Change the IP address to **192.168.0.1**
- Click on the right Notebook.
- Change the name to PC2 and the IP address to **192.168.0.2**



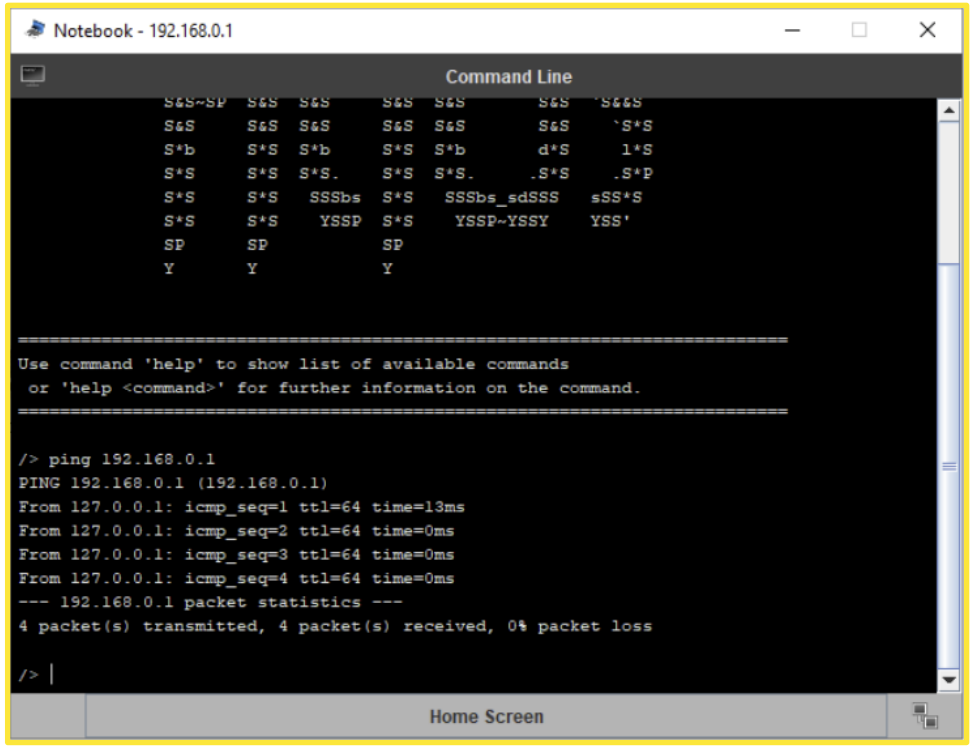
Install Command Line app on PC1

- Click on the top **Simulation Icon**.
- Click on PC1 to bring up the desktop screen.
- Click Software Installation.
- In the right Available column, select Command Line, then use the left arrow pointing to load it into the Installed column.
- Click Apply Changes and close the screen.



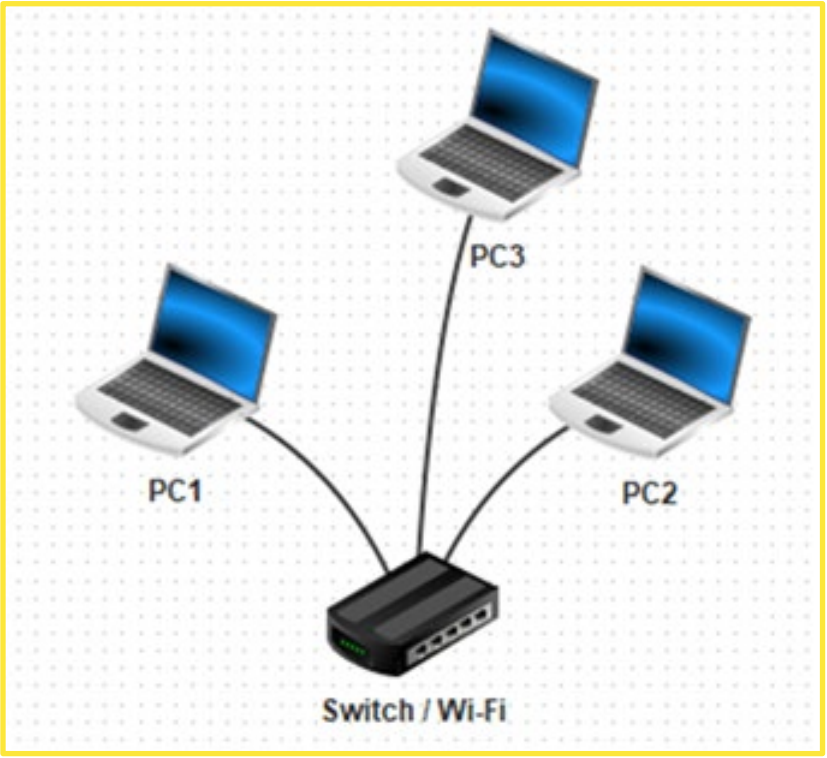
Test Connectivity with Ping Command

- On PC1 click the Command Line icon.
- Type **`ping 192.168.0.2`** and press Enter.
- You should see 4 replies confirming the connection is working.
- We have successfully created a 2-device Local Area Network.



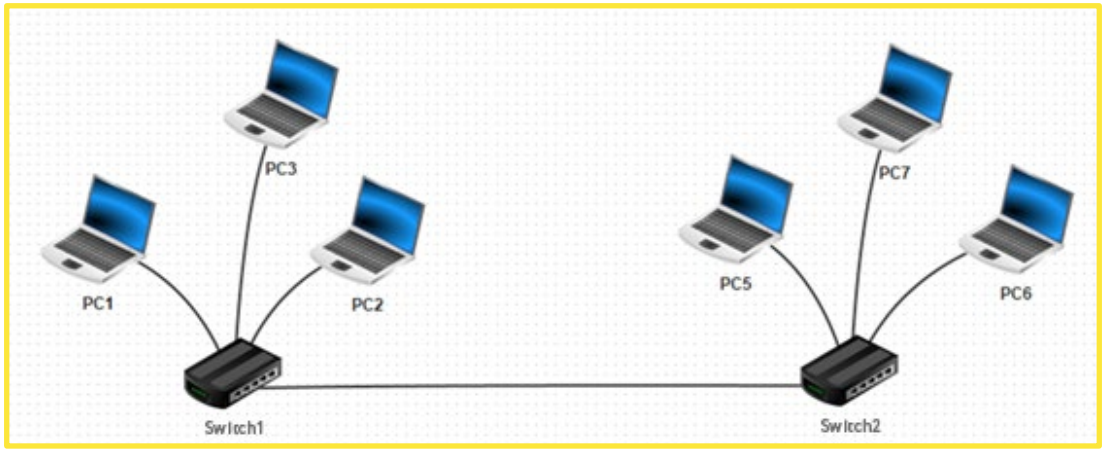
LAN with 3 Devices + a Switch

- Return to **Design Mode**. 
- Right click PC2 and select **“Remove Cable”.**
- Drag a new Notebook onto the build screen.
- Rename it PC3 and give it IP address **192.168.0.3**
- Add a Switch to the screen and name it Switch1.
- Connect all 3 PCs to Switch1.
- Go to **Simulation Mode**.
- Use PC1 Command Line to ping the other 2 PCs – confirm working connections.



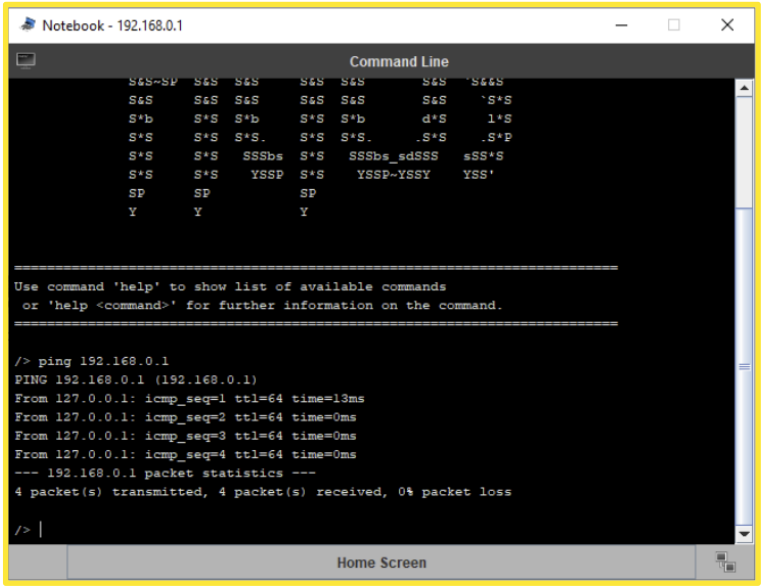
Expand LAN with 2 Connected Switches

- Return to **Design Mode**. 
- Add another LAN on the right side with 3 laptops and a switch.
- Give the new switch the name Switch2.
- Give the new PCs the following properties:
  - PC5 – **192.168.0.5** PC6 – **192.168.0.6** PC7 – **192.168.0.7**
- Go to **Simulation Mode** on PC1 try to ping PC5 at **192.168.0.5**.



MAC Address Table (or SAT Table)

- Let's see how the Switch keeps track of which PC is connected to each port.
- Click on **Switch 1** to bring up the SAT table (Switch Address Table).
- From PC 1, ping all the other PCs.
- As the SAT table fills in, notice that the PCs attached to Switch 2 are all listed as Port 4 on Switch 1.



SAT table Switch / Wi-Fi

MAC	Port	Last Update
1B:32:89:7C:E0:B5	Port 4	15:02:58
A8:A9:DB:9C:5F:54	Port 3	15:02:58
29:4D:CF:A4:53:2A	Port 2	15:02:37
7D:33:F2:60:68:0D	Port 1	15:02:16

Divide into 2 LANs

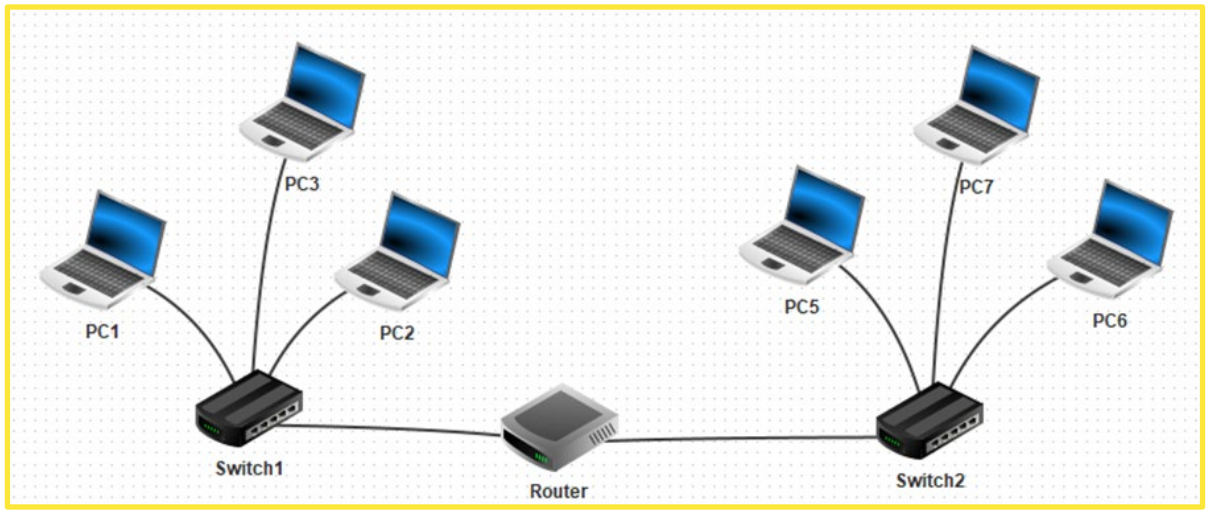
- Return to **Design Mode**. 
- Let's change this to 2 different LANs:
  - PC5 change IP address to **172.16.0.5**
  - PC6 change IP address to **172.16.0.6**
  - PC7 change IP address to **172.16.0.7**
- Return to **Simulation Mode**. 
- From PC1, try to ping the 3 new IP addresses.
  - **This will fail** because a switch cannot route packets to another network.

NOTE: By using different IP address schemes, the devices are no longer in the same network.

WE NEED A ROUTER! 

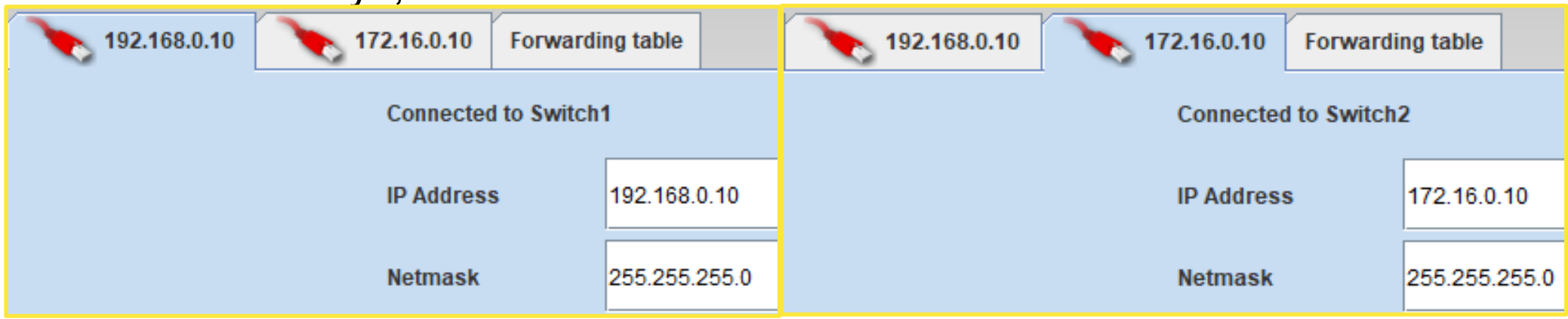
Connect LANs with a Router

- Return to **Design Mode**. 
- Drag a Router to the build screen and place between the switches.
- Accept the popup “Choose number of NIC of the router!” = 2
- Right click the cable connecting the switches and remove cable.
- Connect the switches to the router.



Tell the Router about each LAN

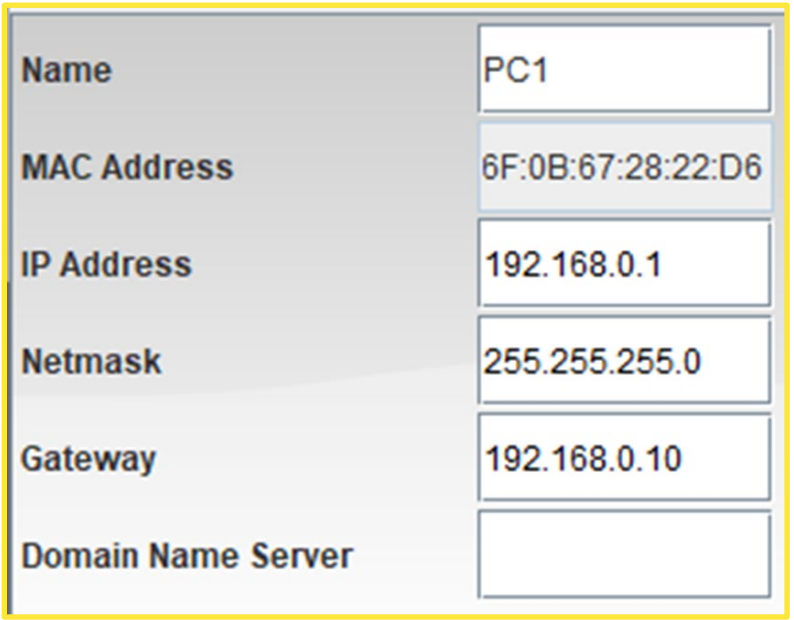
- Now we need to configure the router to recognize each network.
- Click on the router to bring up its configuration interface.
- On the 1st tab, set the IP address to **192.168.0.10**, Netmask **255.255.255.0**
  - Make sure it says, “Connected to Switch 1”.
- On the 2nd tab, set the IP address to **172.16.0.10**, Netmask **255.255.255.0**
  - Make sure it says, “Connected to Switch 2”.



Set Default Gateway on Devices

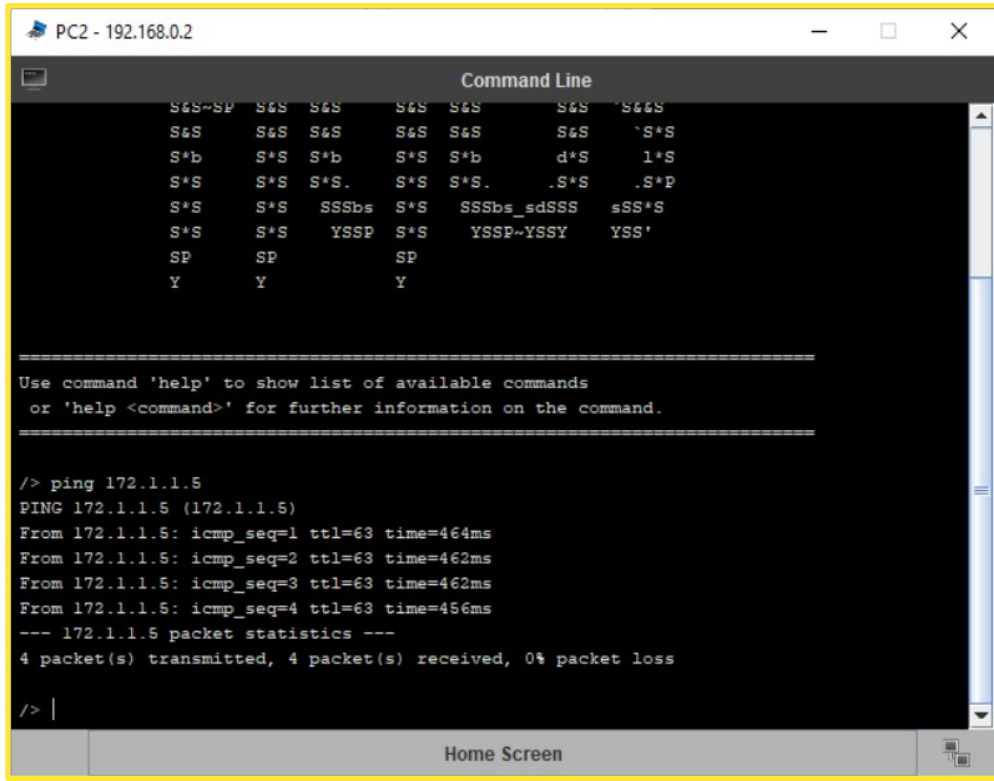
Still need one more step before we can send packets between the networks! Each device needs to know how to get out of their LAN so we give them the IP address of their connected router = default gateway address.

- Click PC1 to bring up the configuration interface.
- For the Gateway, add the router's IP address: **192.168.0.10**.
- Do this for PC2 and PC3 as well.
- Click PC5 – for the Gateway, add the router's IP address: **172.16.0.10**.
- Do this for PC6 and PC7 as well.



Test Connectivity between LANs

- Go to **Simulation mode**.
- Ping from PC1 to PC5 at **172.16.0.5**.
- **SUCCESS!**
- We have built two LANS and connected



Lab Roundup

- Switches connect devices into a LAN.
- Connect switches to each other to handle more devices in a LAN.
- A switch can only forward packets to devices that have the LAN IP address scheme.
- Add a Router to forward packets between two LANS with different IP address schemes.

NOTE: In Unit 3 we will look at IP addressing, subnet masks and default gateways in more detail.