

Lesson End Project

Configuring Secure Network Segmentation and VLAN Isolation in Packet Tracer

Project agenda: To design and implement a segmented network infrastructure using Packet Tracer, enabling dynamic IP allocation for a 14-node network via DHCP and isolating two web servers in a 6-node network using VLANs to ensure secure and dedicated communication for research and development of web applications

Description: You are tasked with creating a segmented network infrastructure to enhance security and efficiency. This involves configuring a 14-node network with dynamic IP allocation using a DHCP server and a 6-node network with VLAN isolation for two dedicated web servers. The project ensures controlled communication within the network, enabling secure and isolated development of web applications while maintaining efficient IP address management and inter-network connectivity.

Tools required: Cisco Packet Tracer

Prerequisites: None

Expected deliverables: A fully configured network infrastructure in Packet Tracer, including a 14-node network with DHCP-enabled dynamic IP allocation and a 6-node network with VLAN-isolated web servers. This includes an operational DHCP server, router configurations to facilitate inter-network connectivity, VLAN settings isolating the web servers, and verification of communication restrictions.

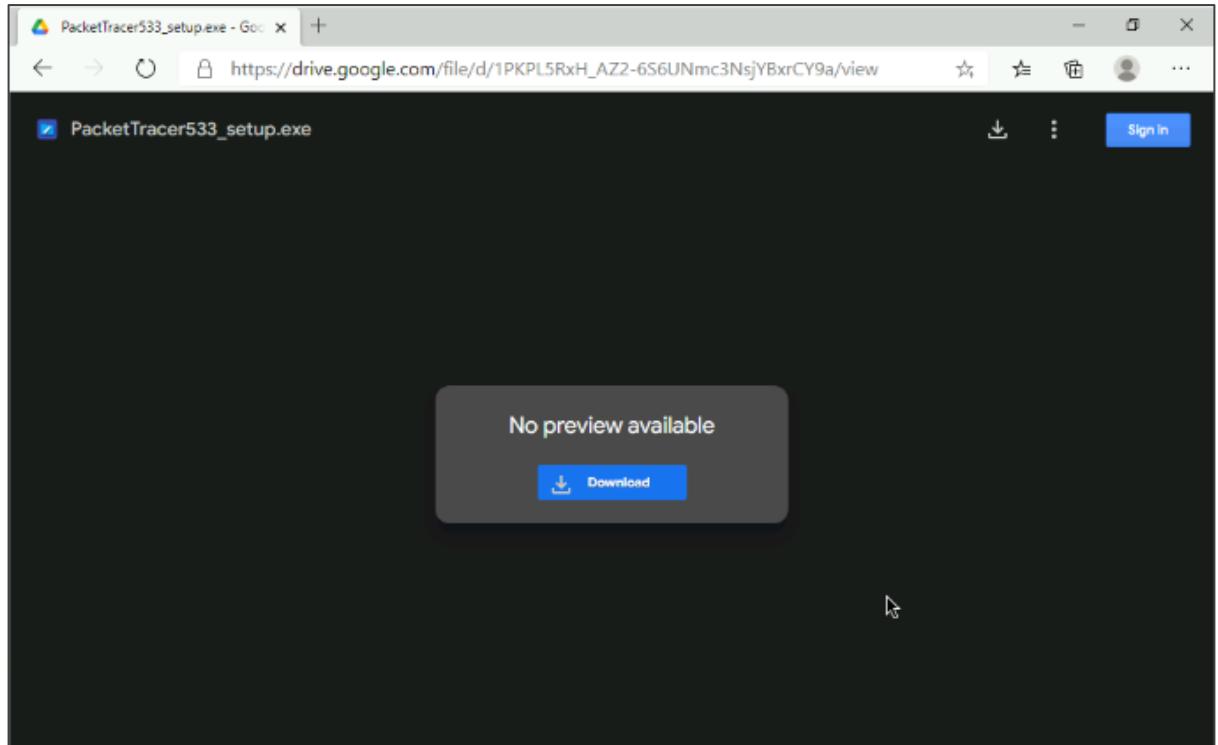
Steps to be followed:

1. Install Packet Tracer
2. Set up a 14-node network
3. Set up a 6-node network
4. Connect the 14-node and 6-node networks
5. Configure VLAN for web server isolation
6. Configure DHCP and IP address
7. Test and validate

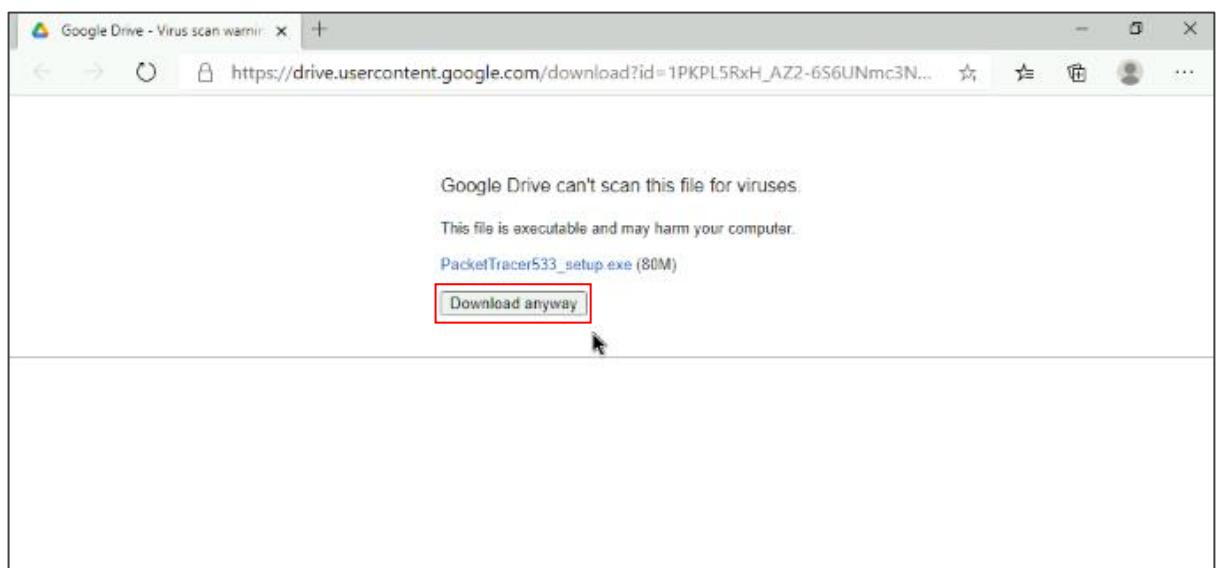
Step 1: Install Packet Tracer

1.1 Navigate to browser and paste the link given below:

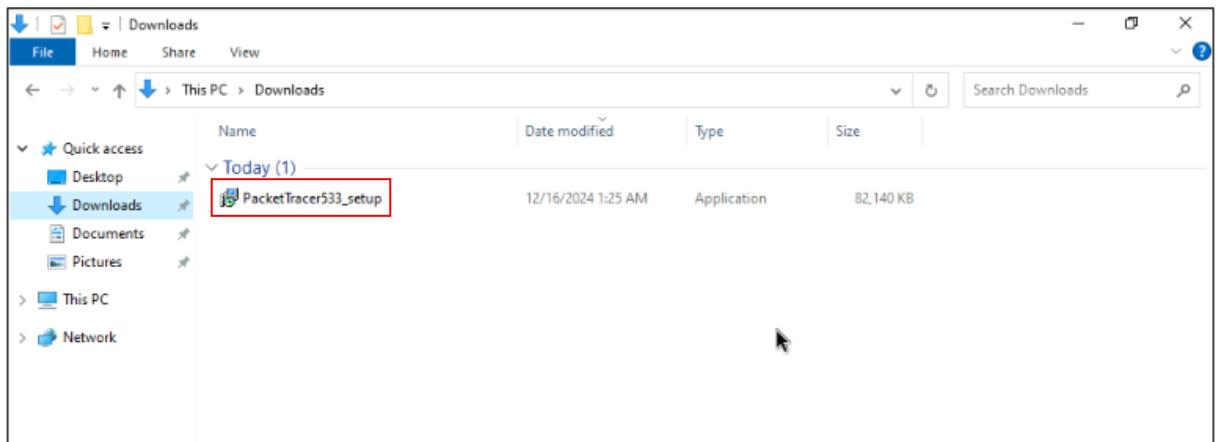
https://drive.google.com/file/d/1PKPL5RxH_AZ2-6S6UNmc3NsjYBxrCY9a/view?usp=sharing



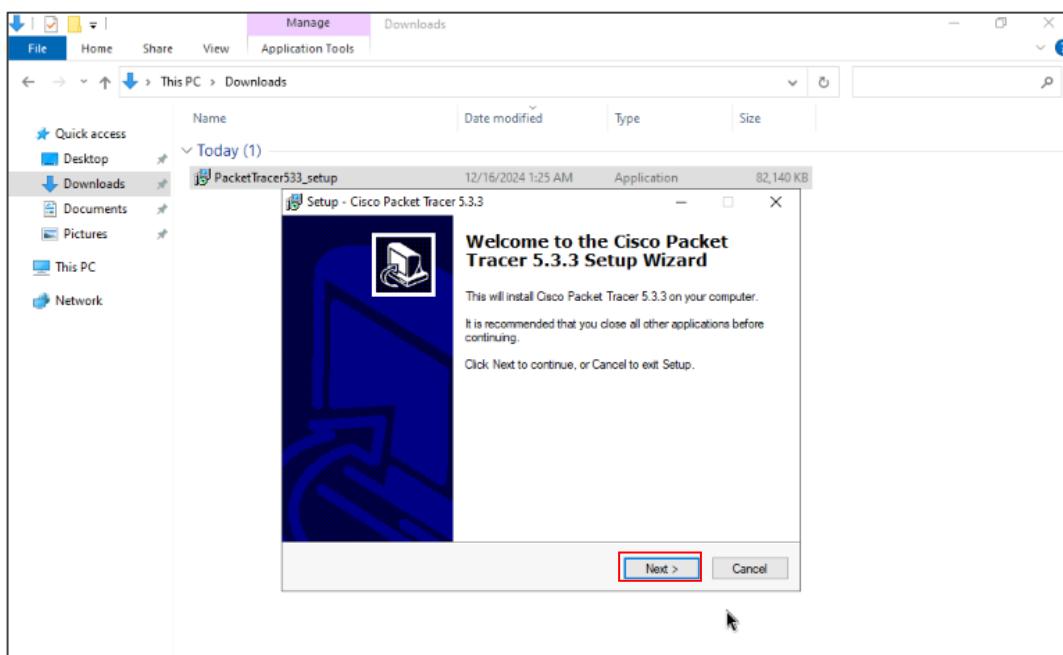
1.2 Click on **Download anyway**



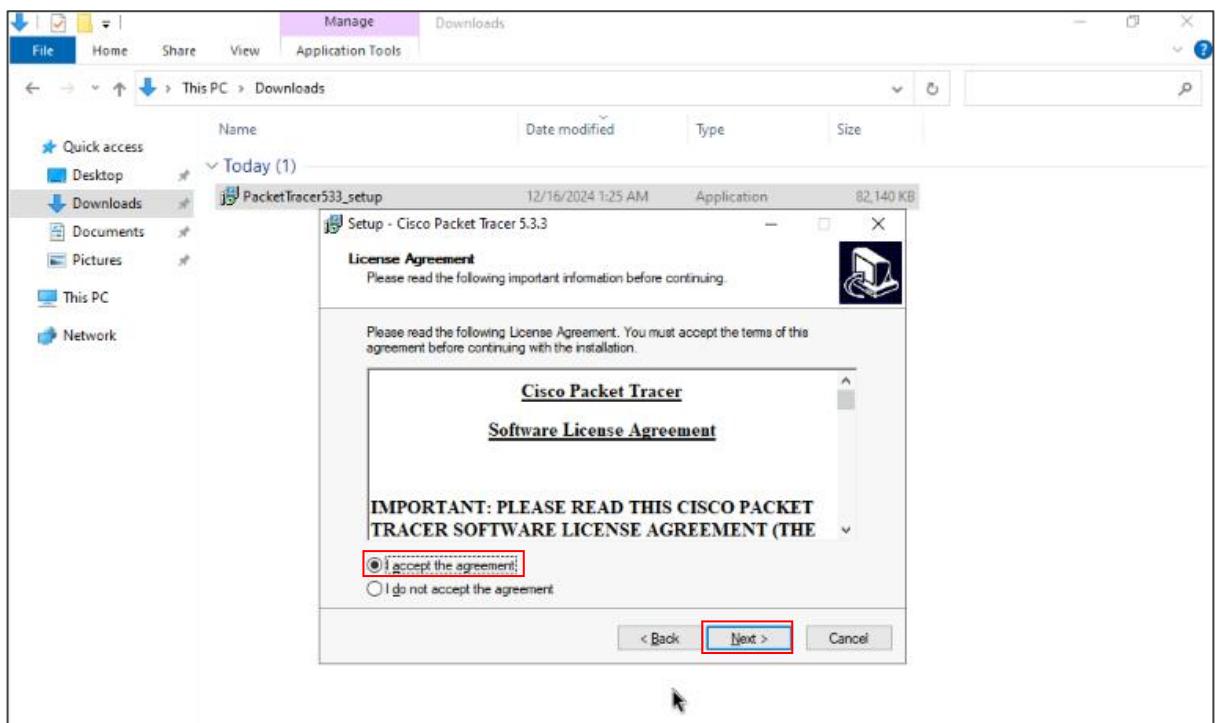
1.3 Open Downloads folder in File explorer and double-click on **PacketTracer533_setup**



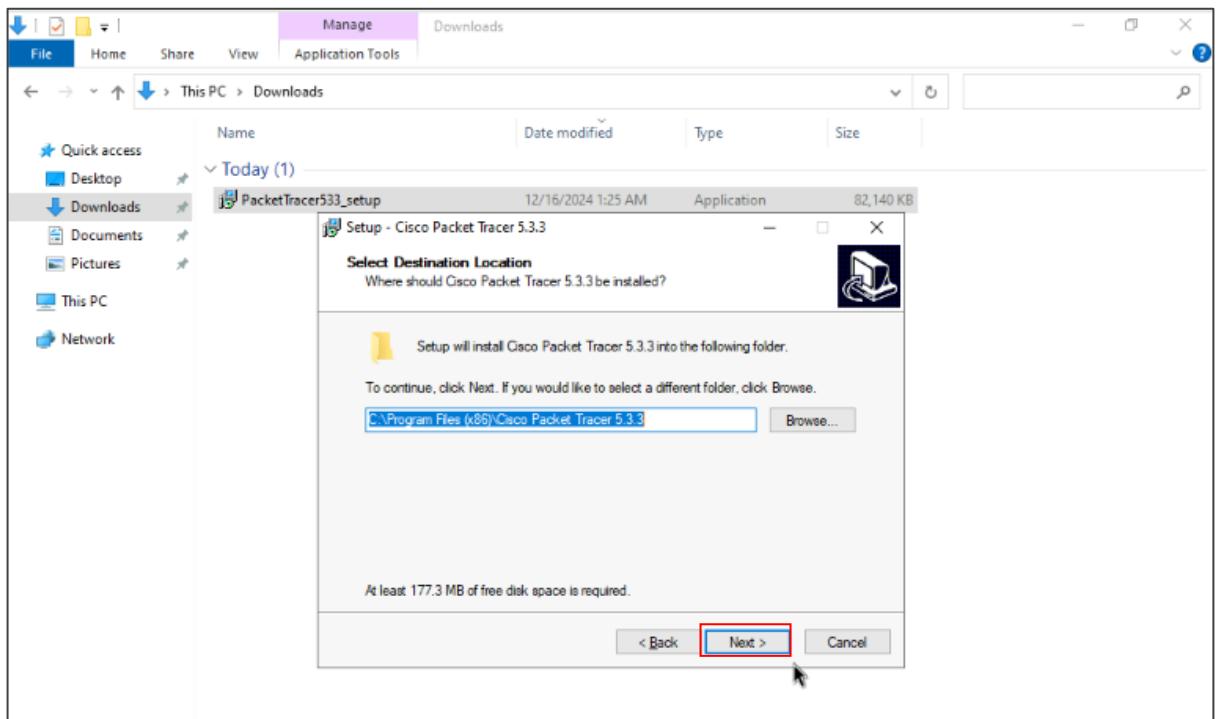
1.4 Click on **Next**



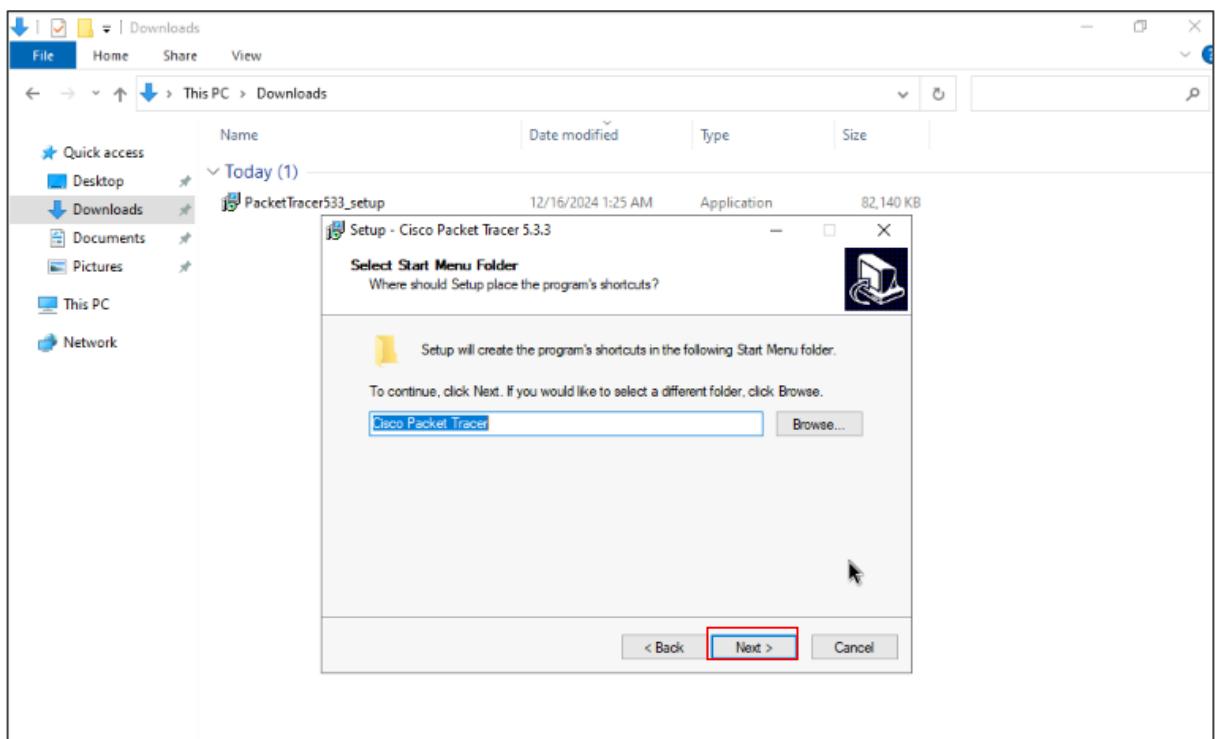
1.5 Select I accept the agreement checkbox and click on Next



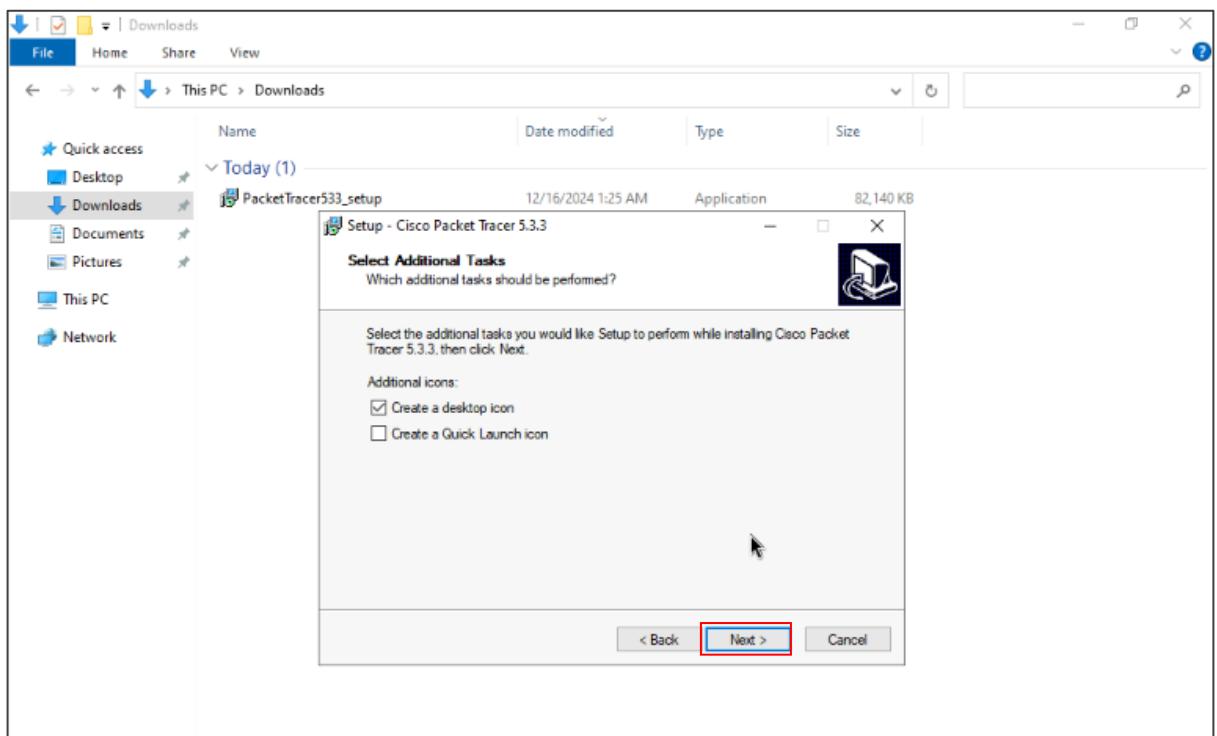
1.6 Click on Next



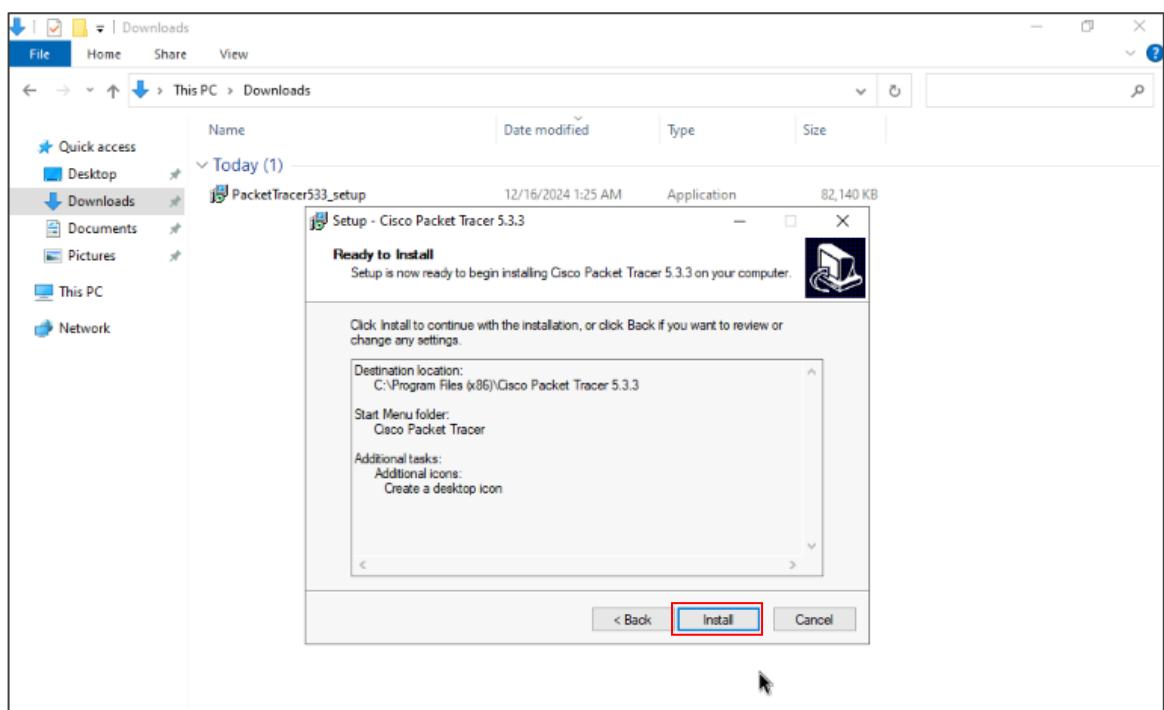
1.7 Click on Next again



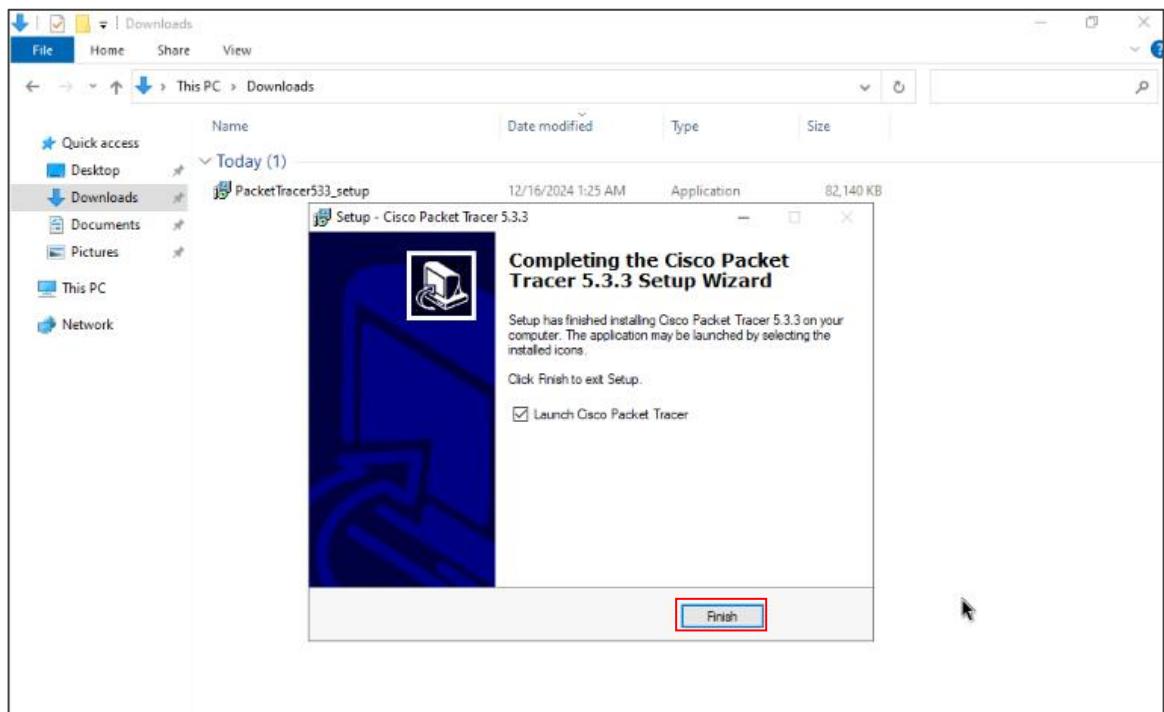
1.8 Now again click on Next



1.9 Click on Install



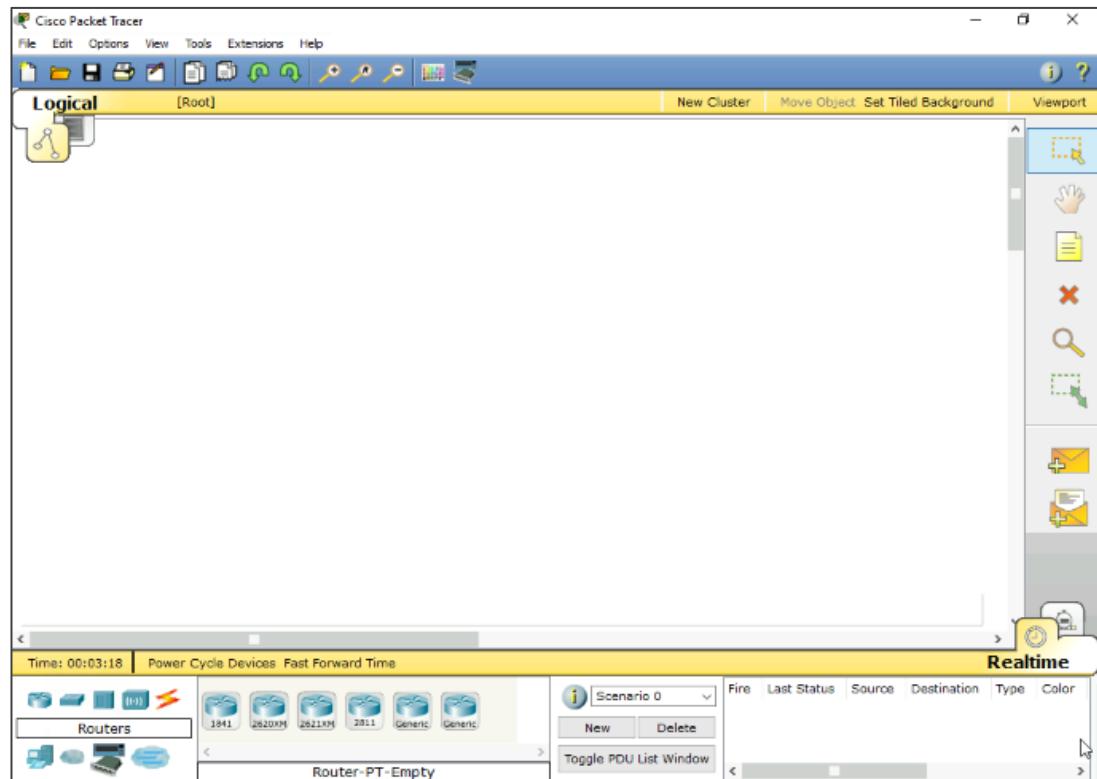
1.10 Click on Finish



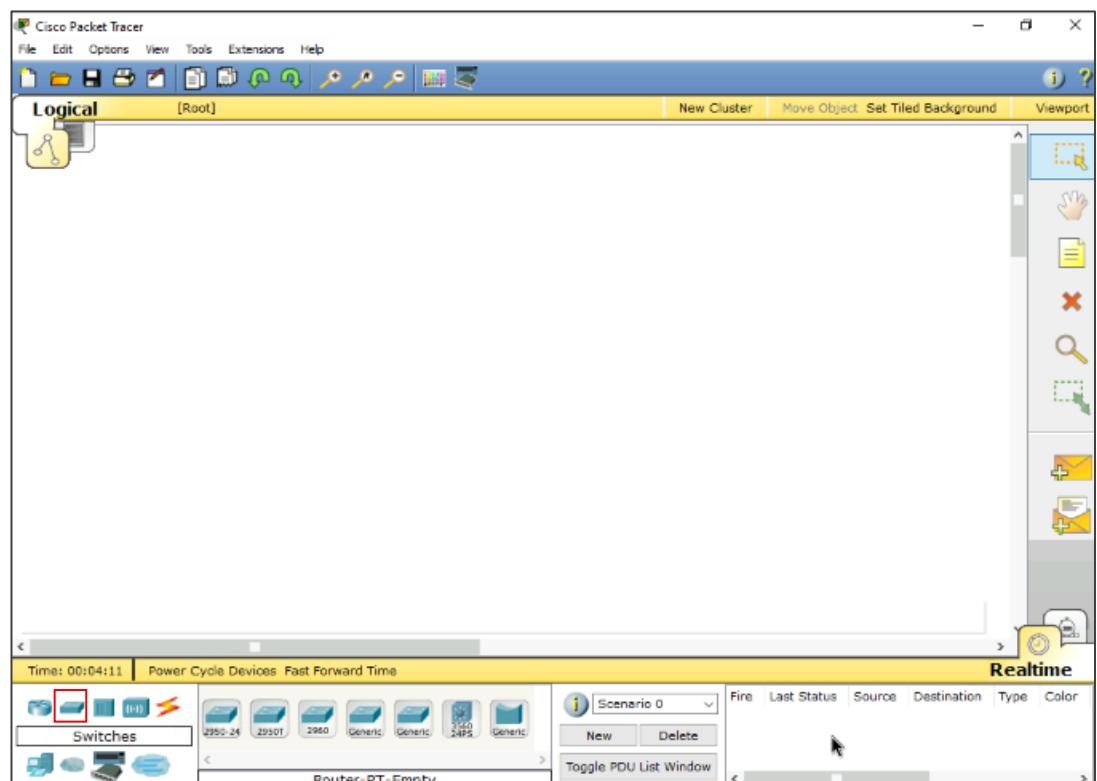
The Packet Tracer application will be launched.

Step 2: Set up a 14-node network

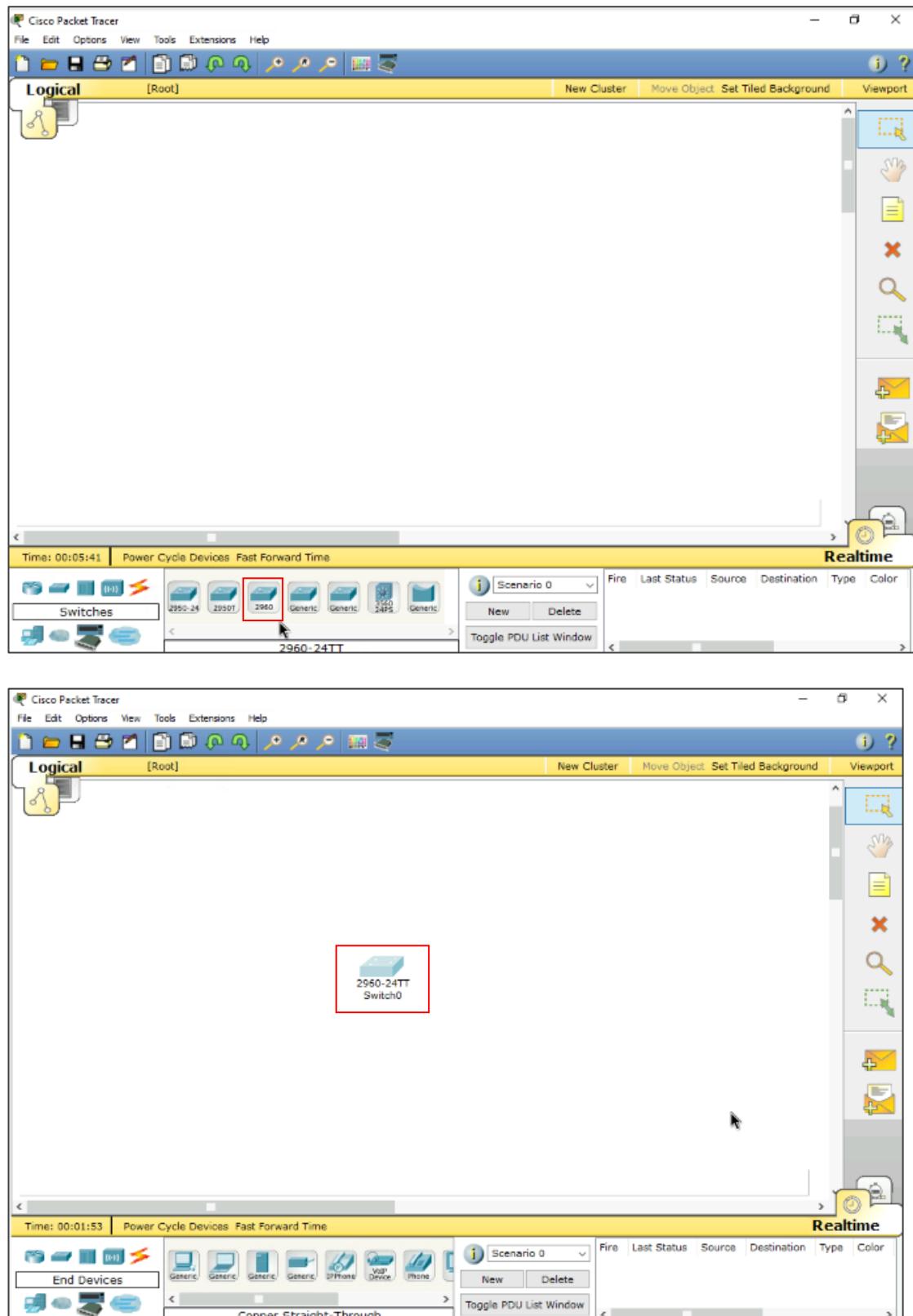
2.1 Navigate to Packet Tracer



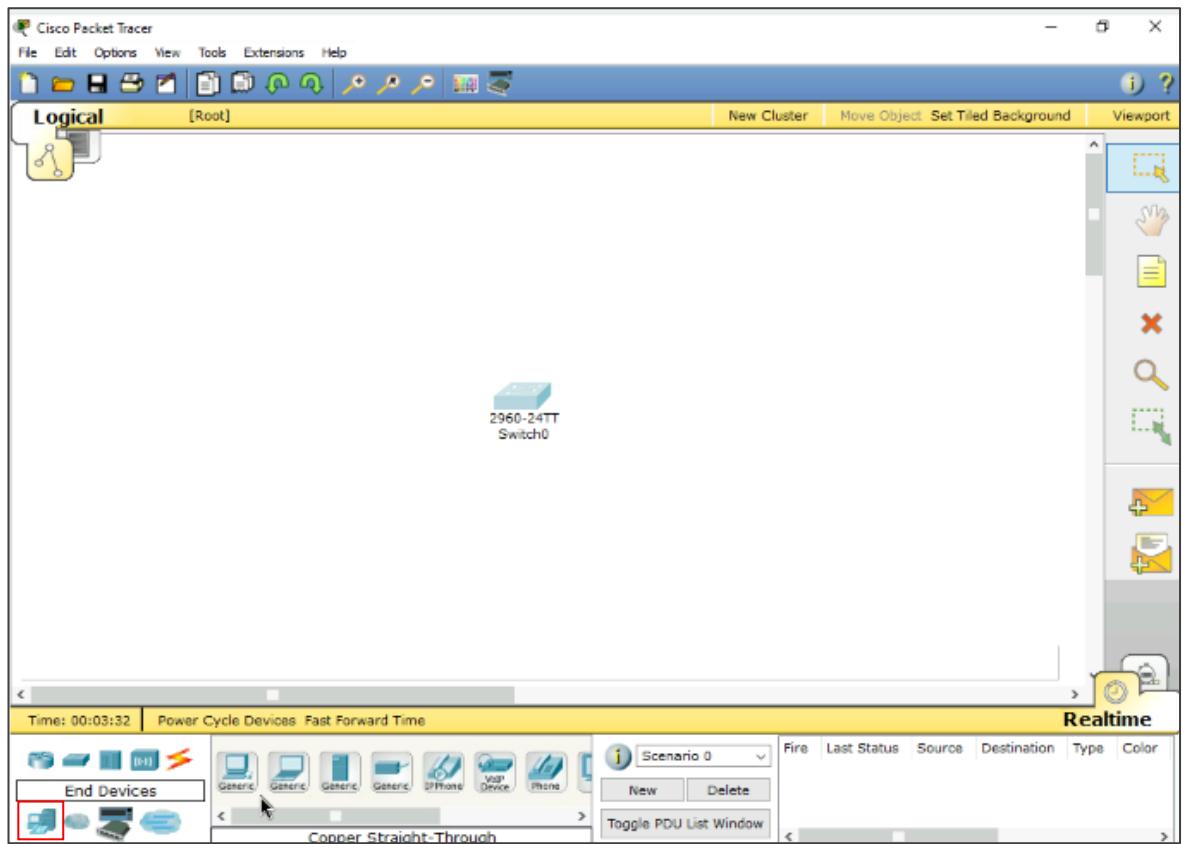
2.2 Click on Switches



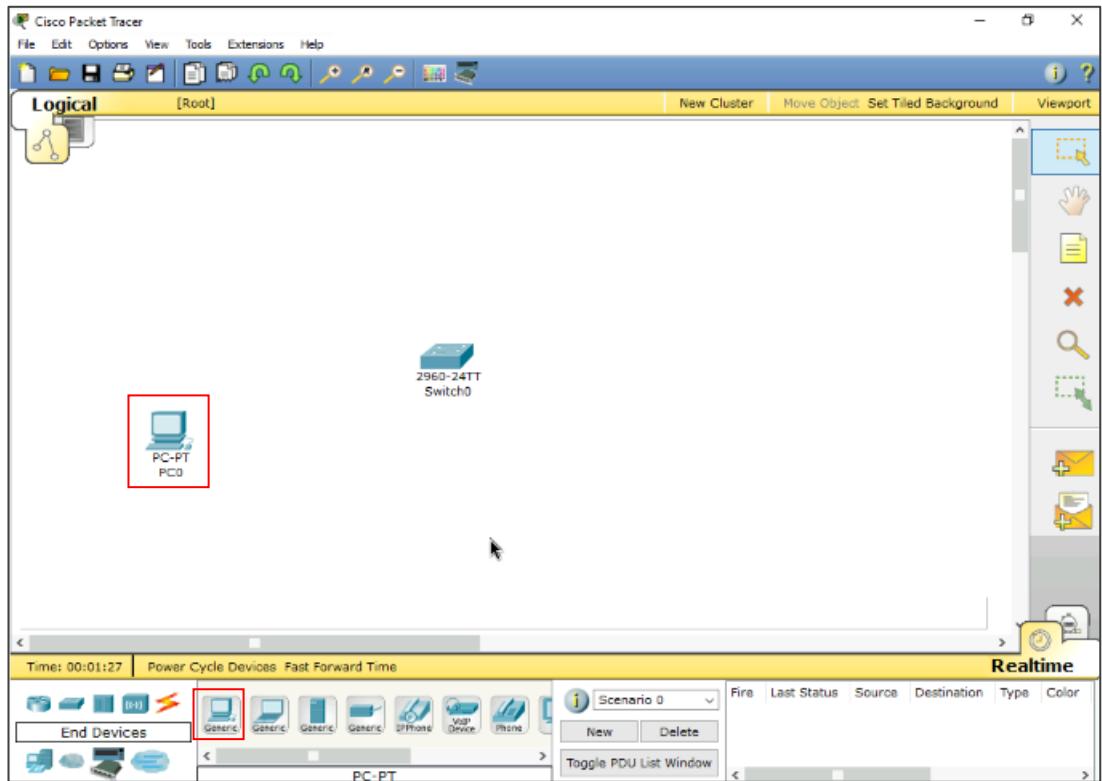
2.3 Select **2960-24TT** and drag it to the main screen



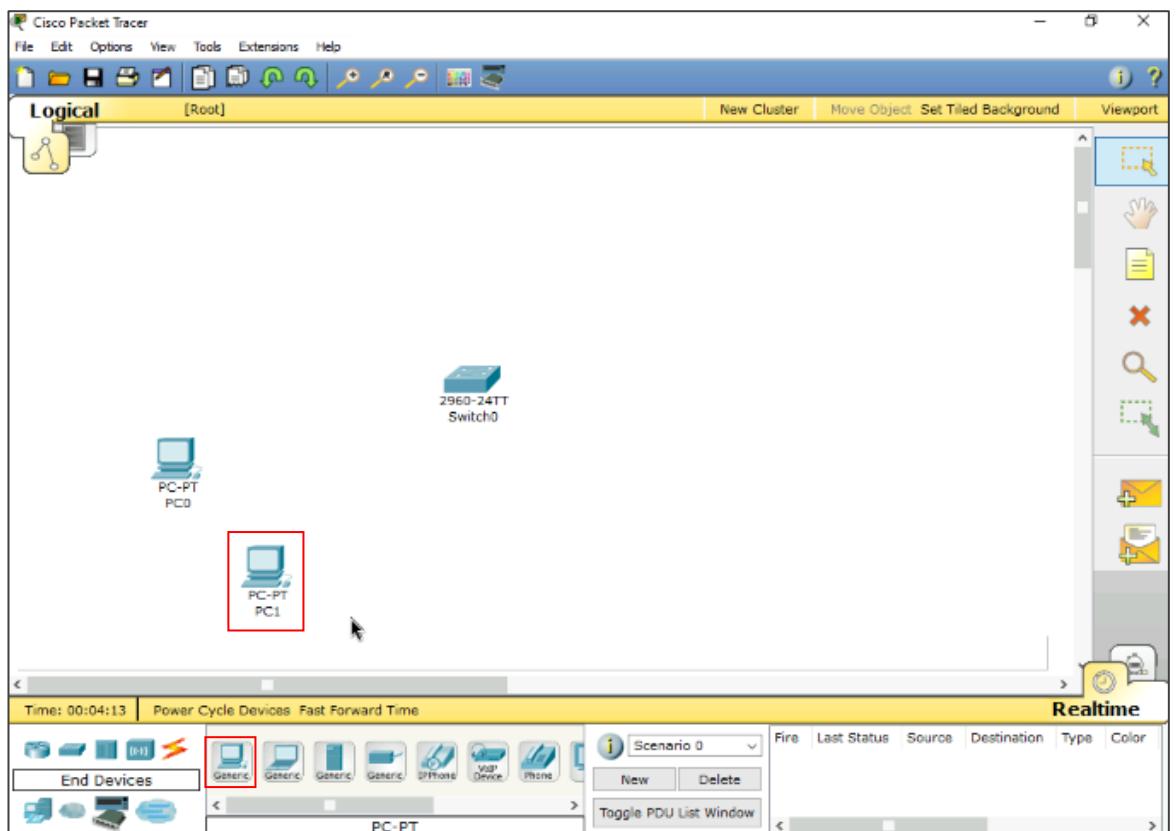
2.4 Click on End Devices



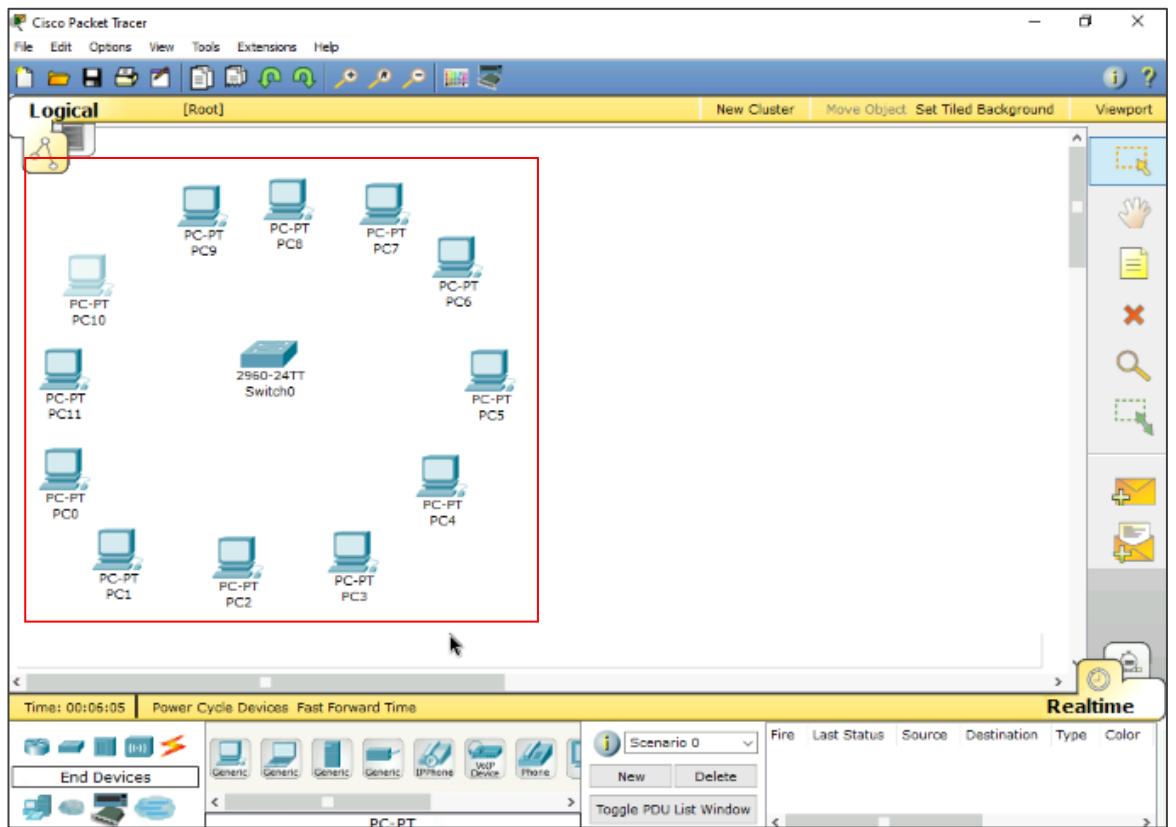
2.5 Select PC-PT and drag it to the main screen



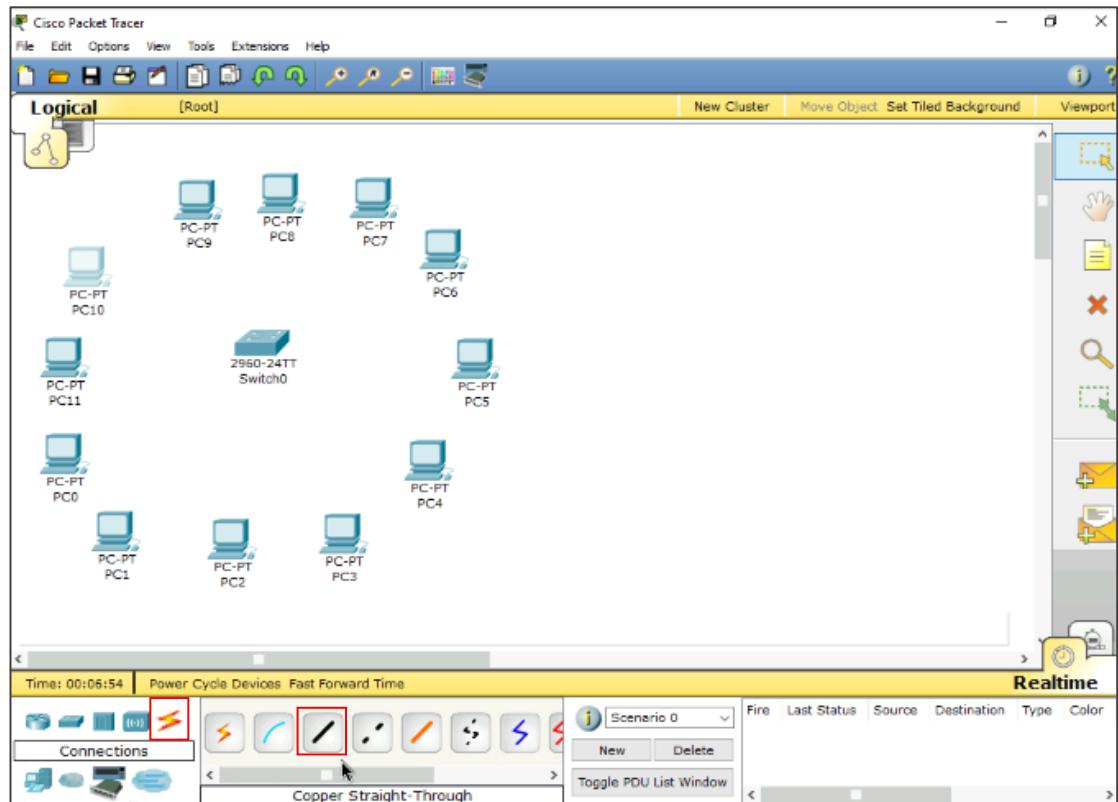
2.6 Select PC-PT and drag it to the main screen



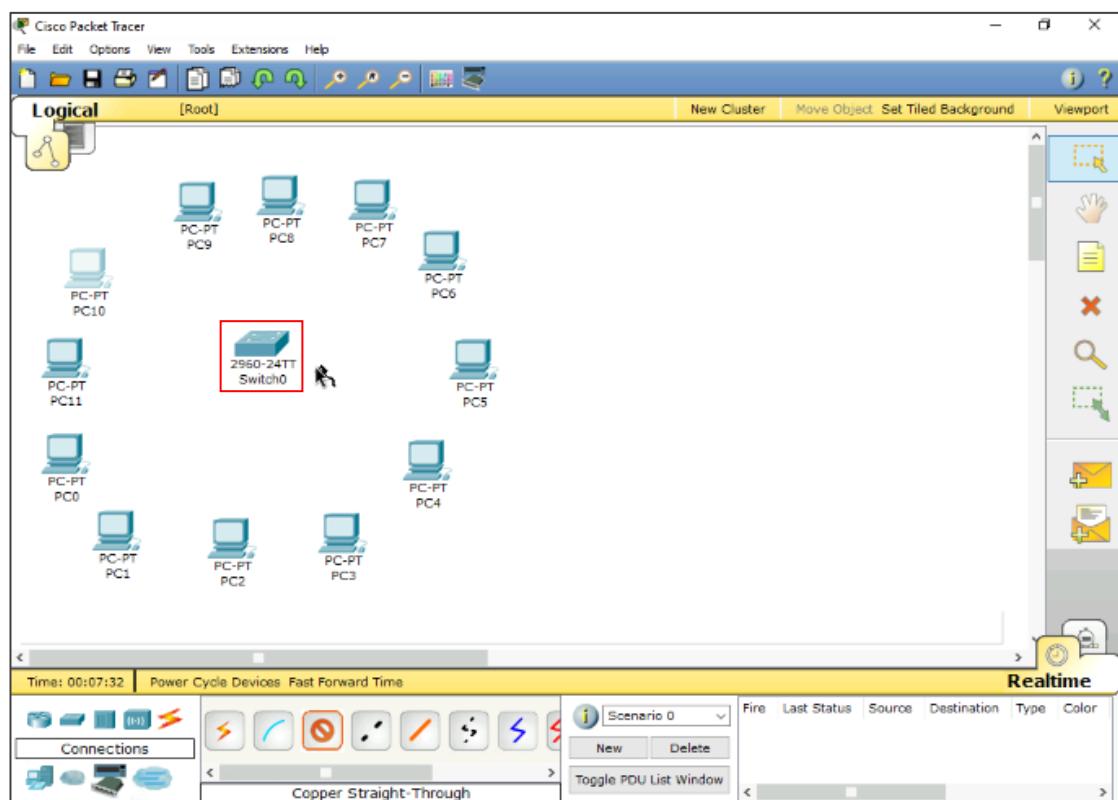
2.7 Repeat step 2.6 to add 9 more PCs



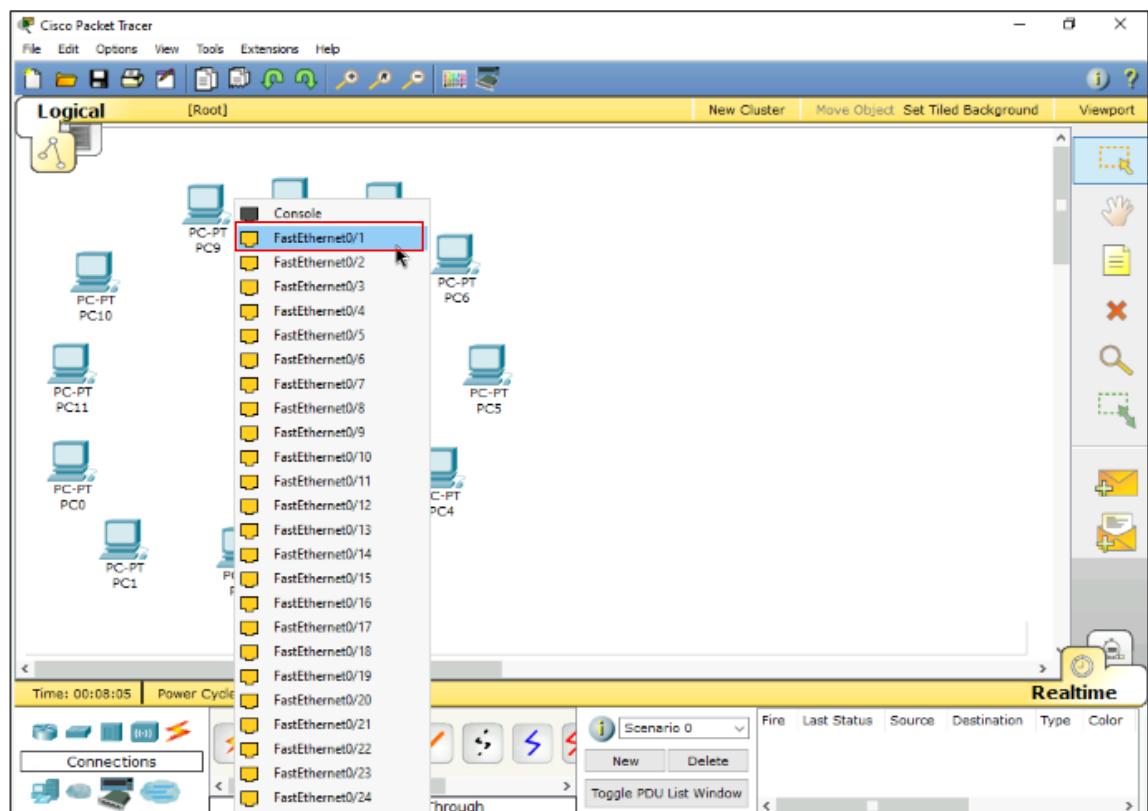
2.8 Click on Connections and select Copper Straight-Through



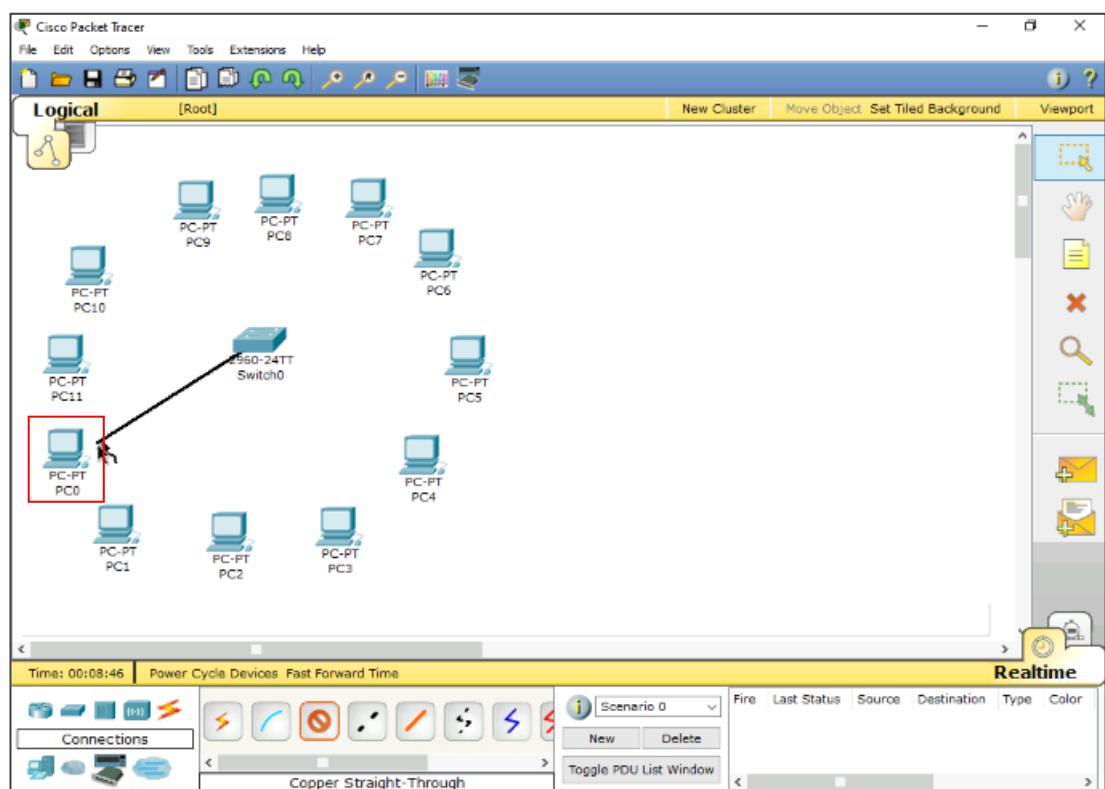
2.9 Click on Switch0



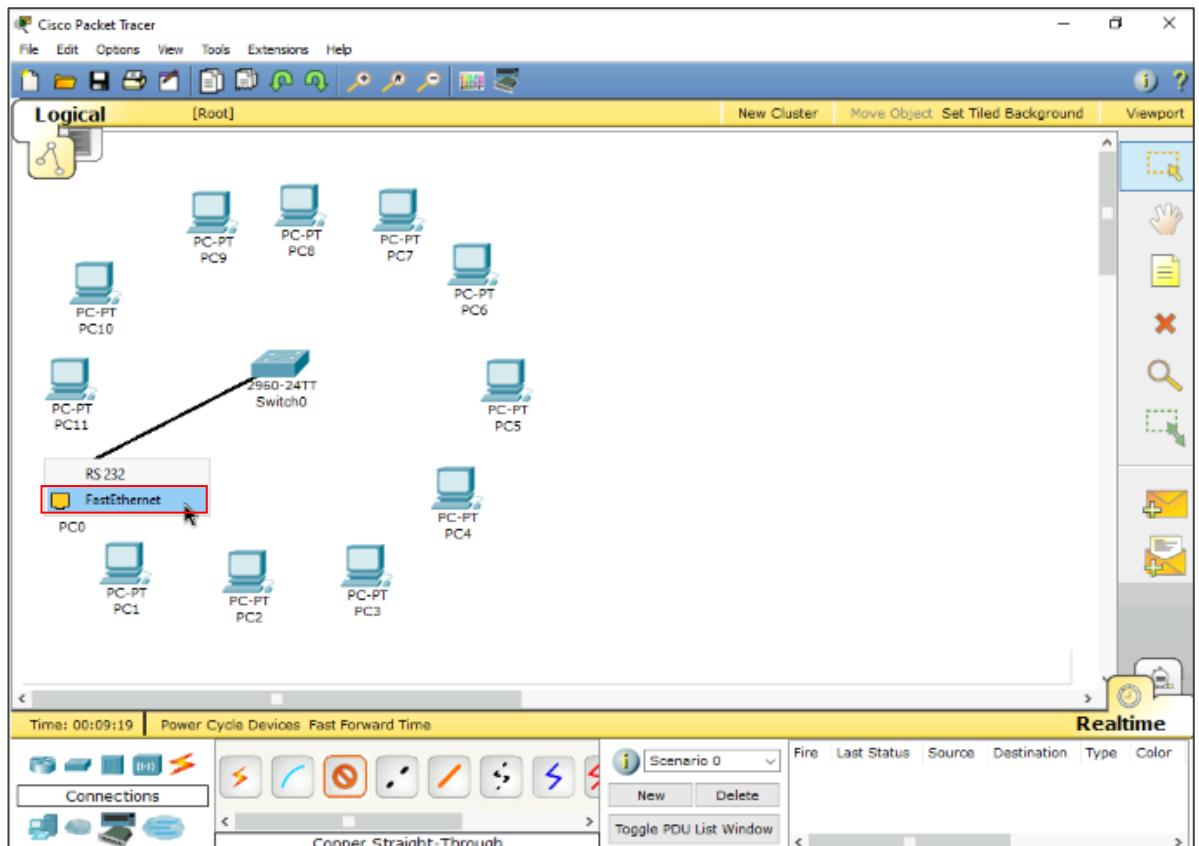
2.10 Click on FastEthernet0/1



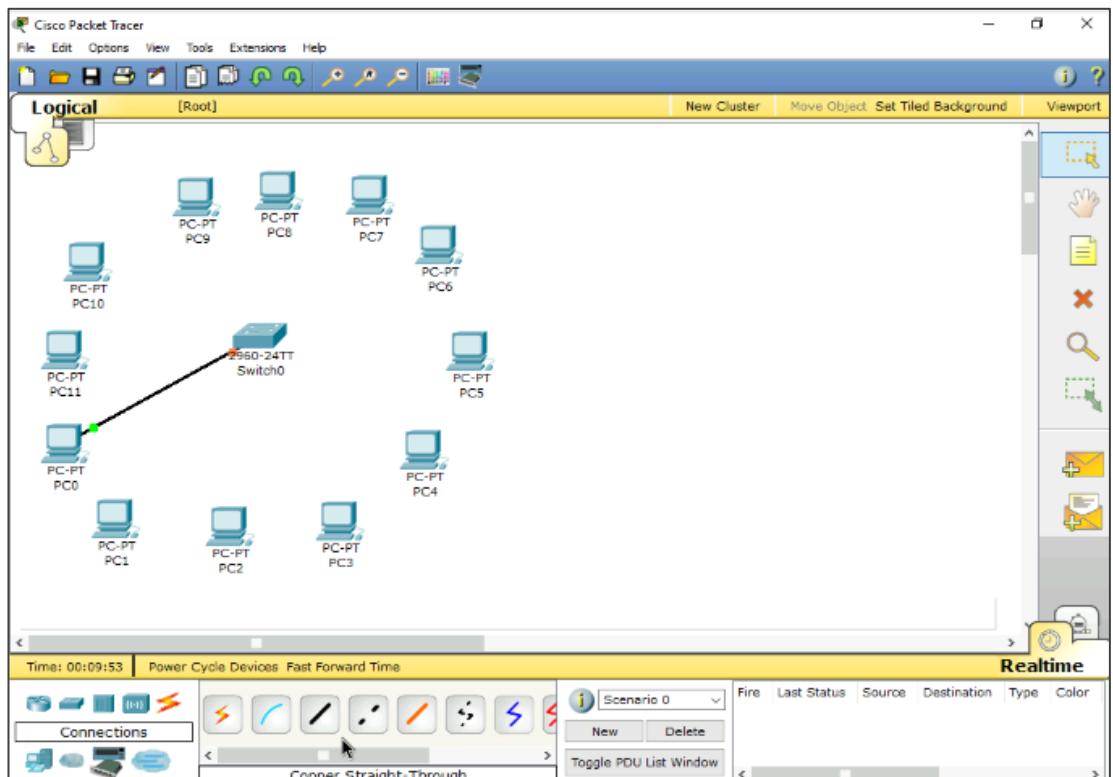
2.11 Click on PC0



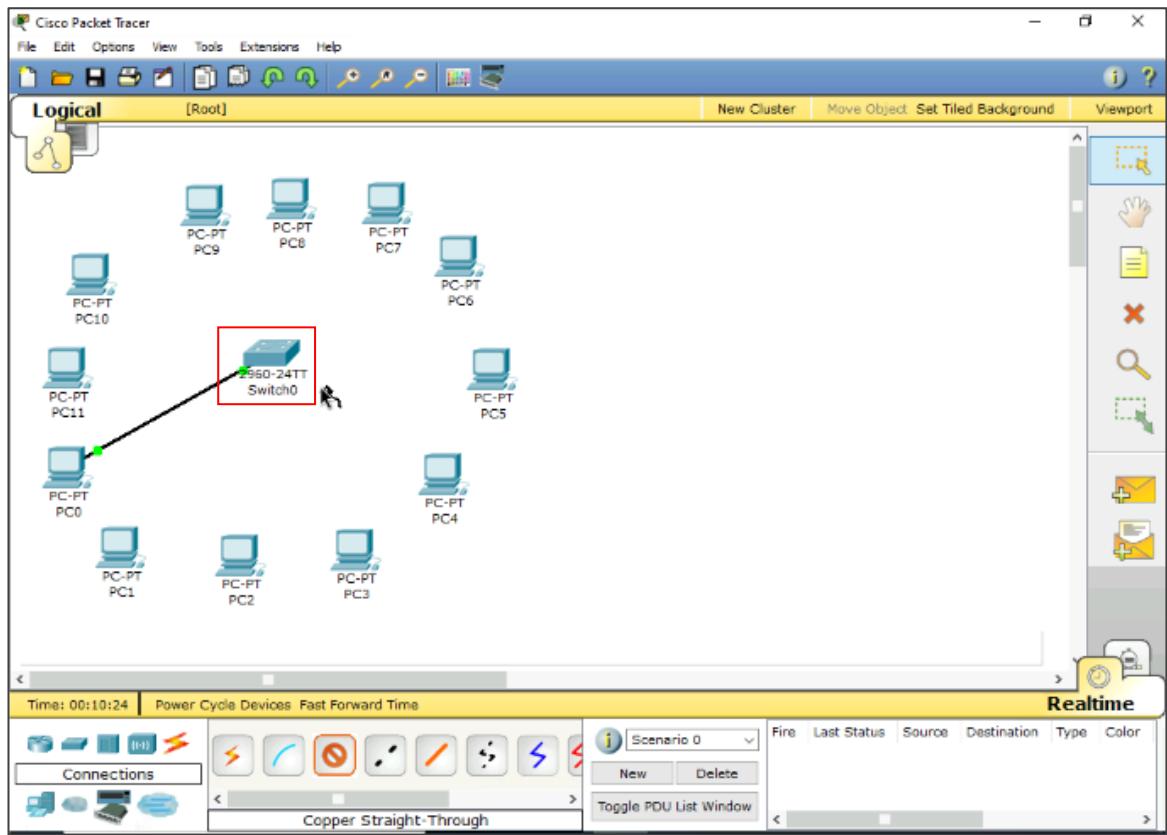
2.12 Click on FastEthernet



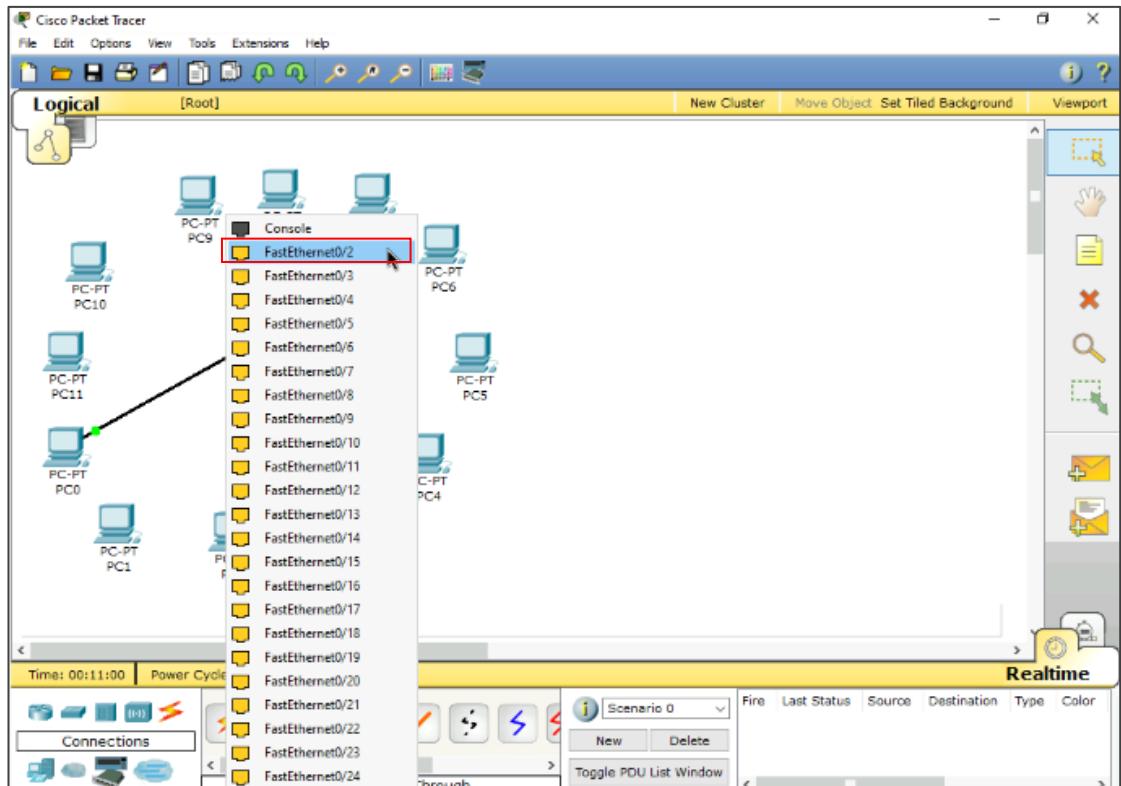
The connection has been established between PC0 and Switch0.



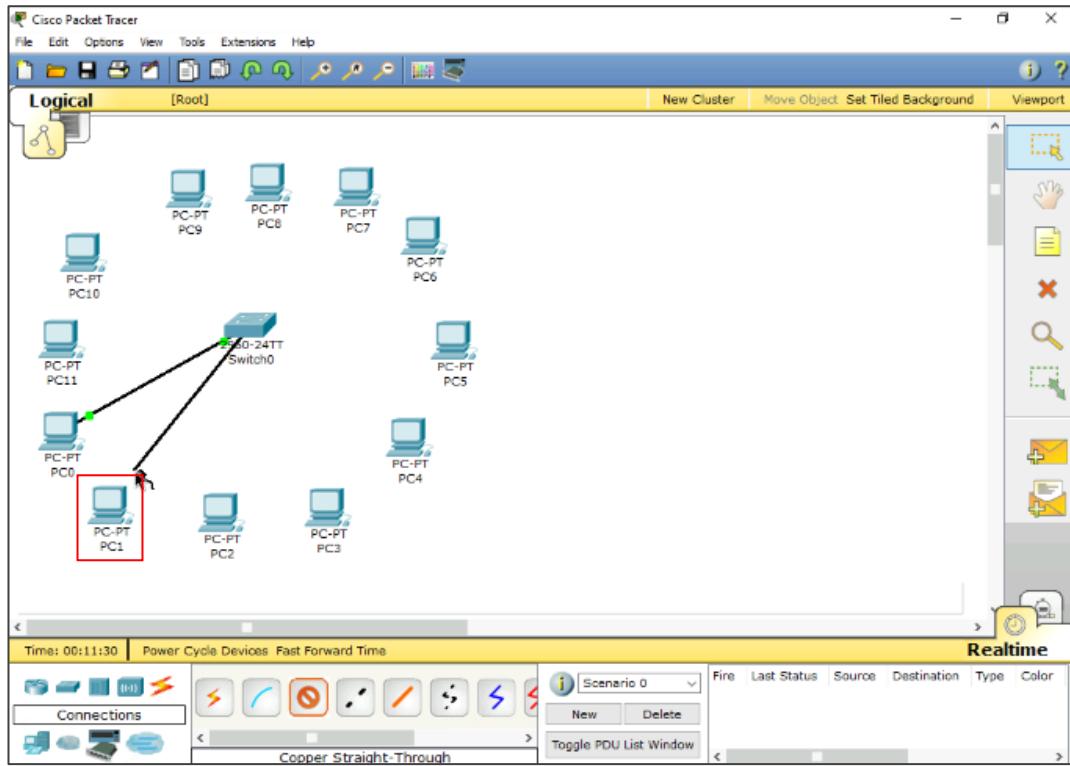
2.13 Click on Switch0



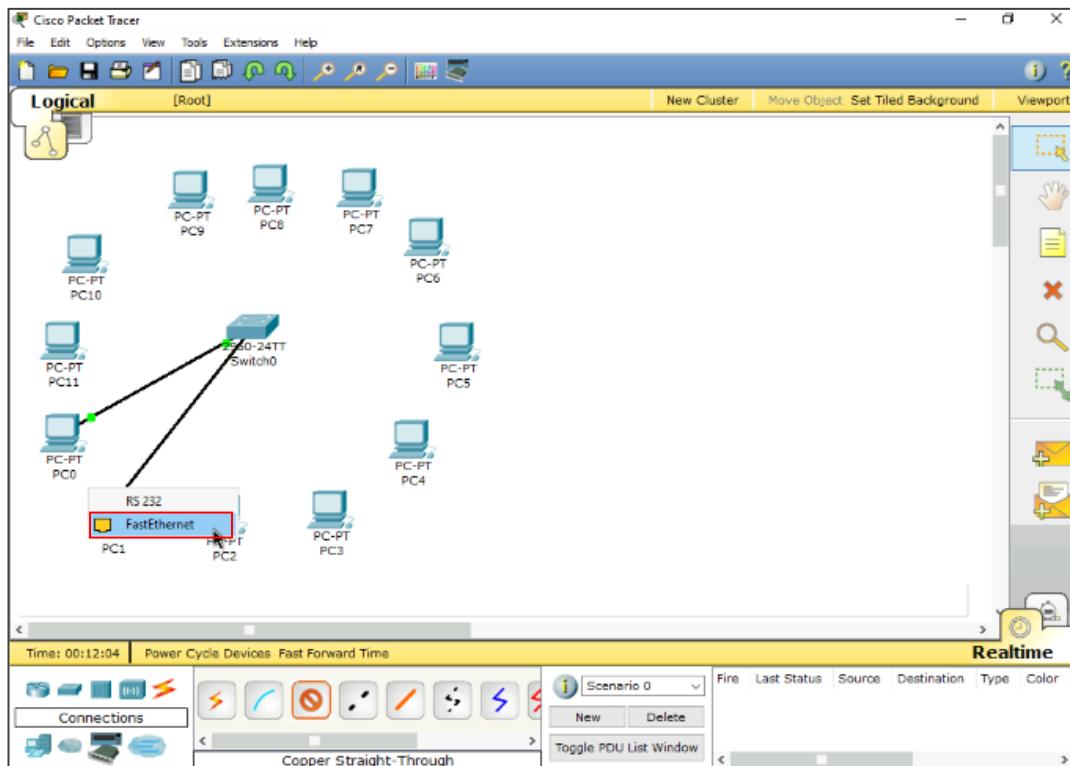
2.14 Click on FastEthernet0/2



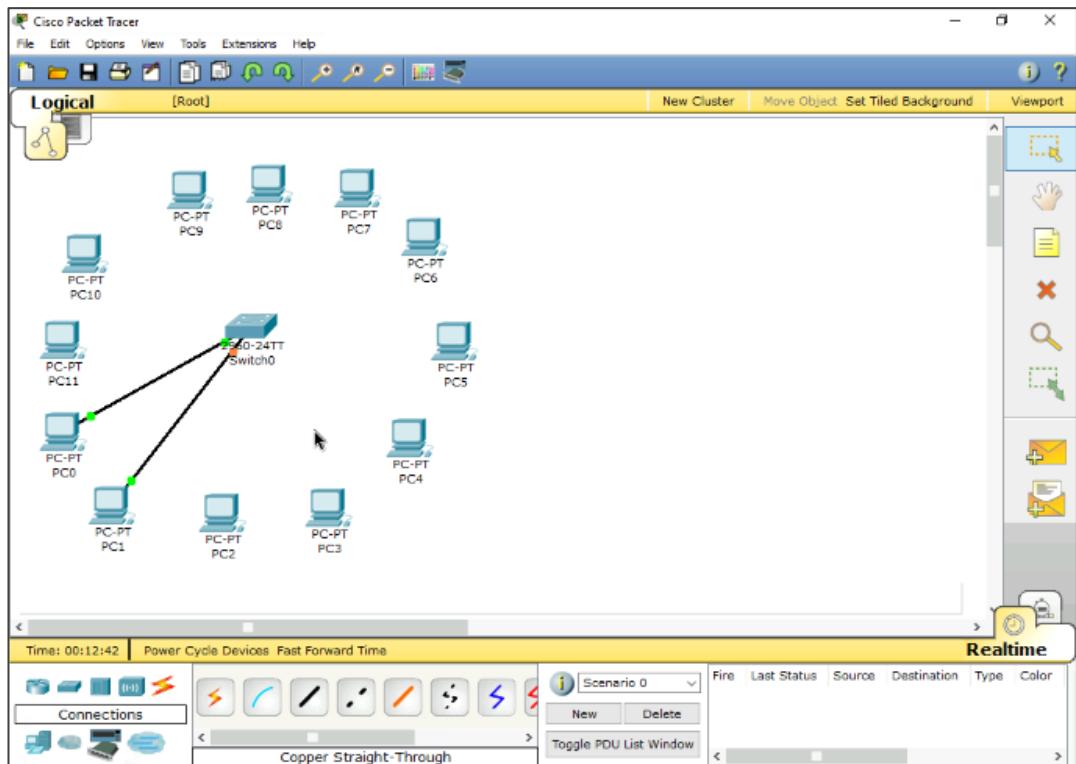
2.15 Click on PC1



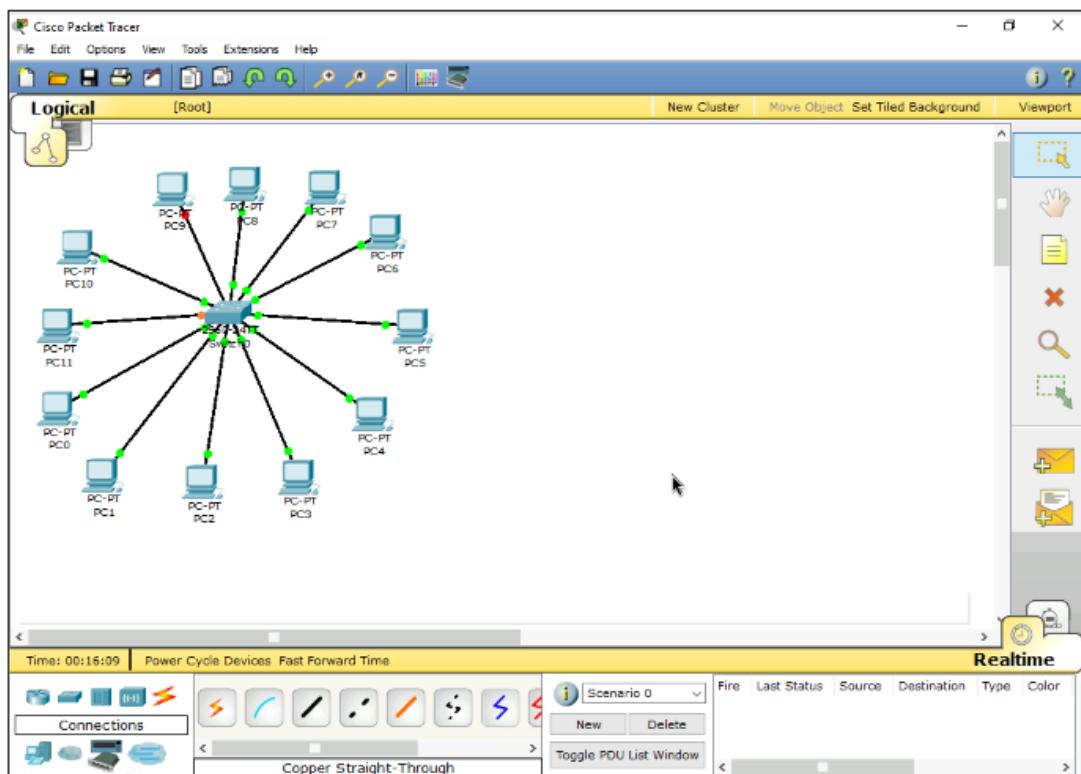
2.16 Click on FastEthernet



The connection has been established between PC1 and Switch0.

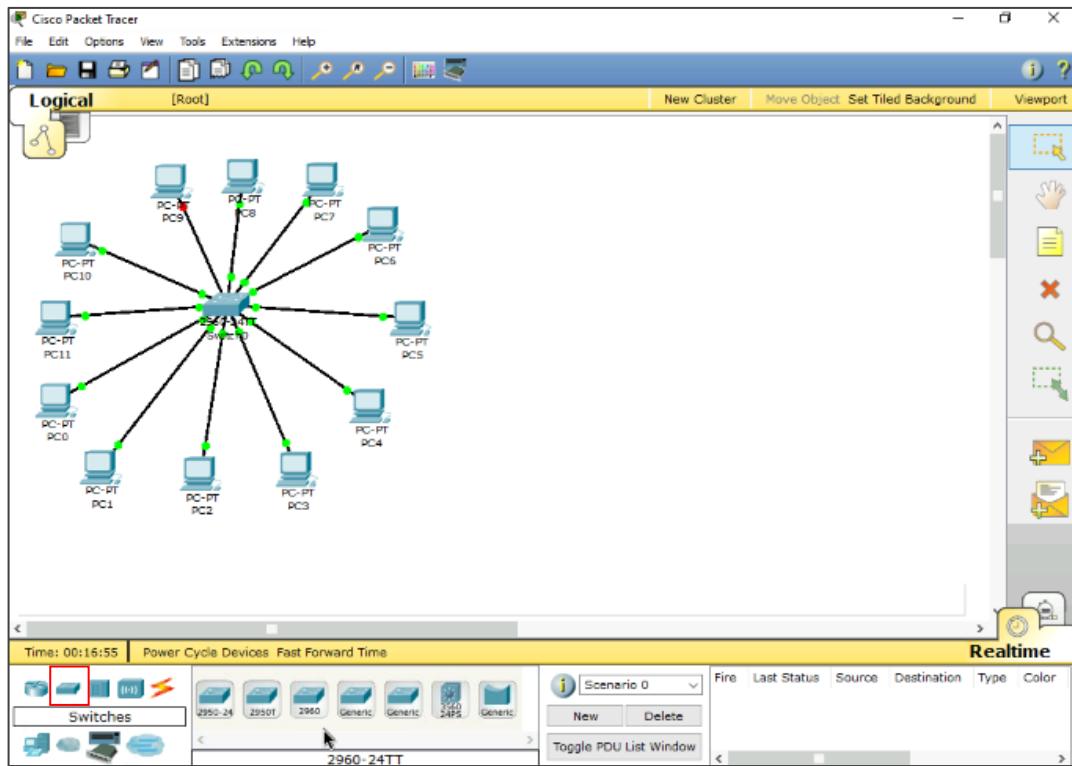


2.17 Repeat steps 2.13 to 2.16 to connect the remaining 9 PCs

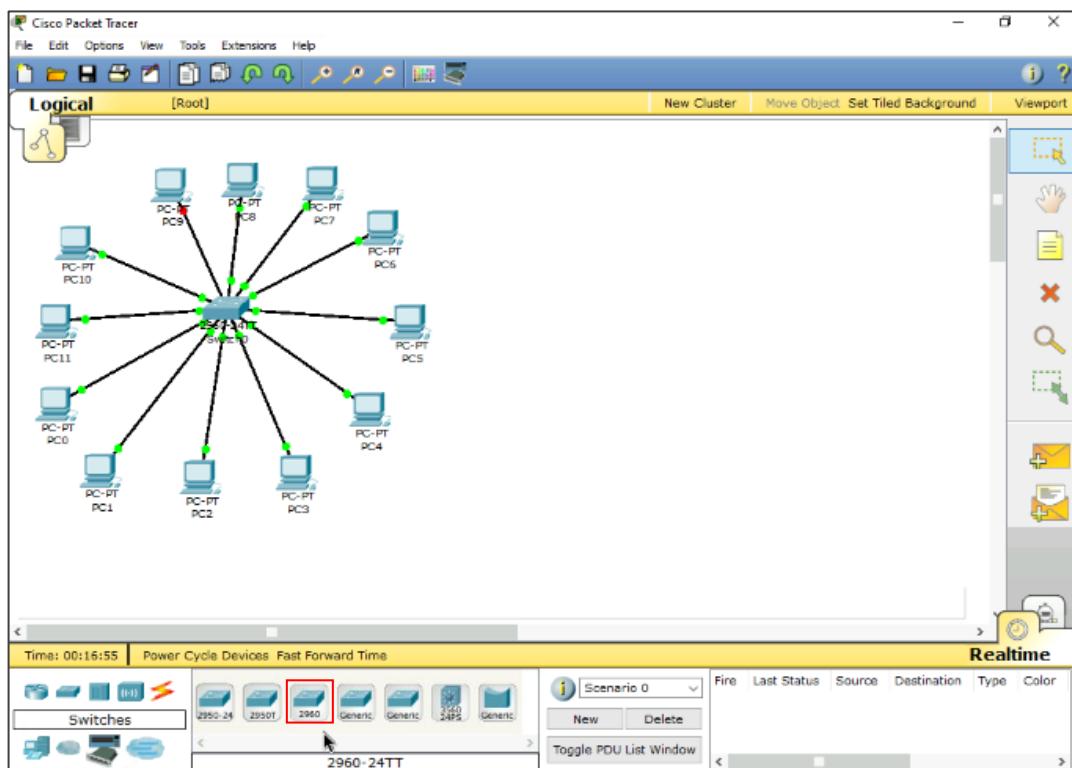


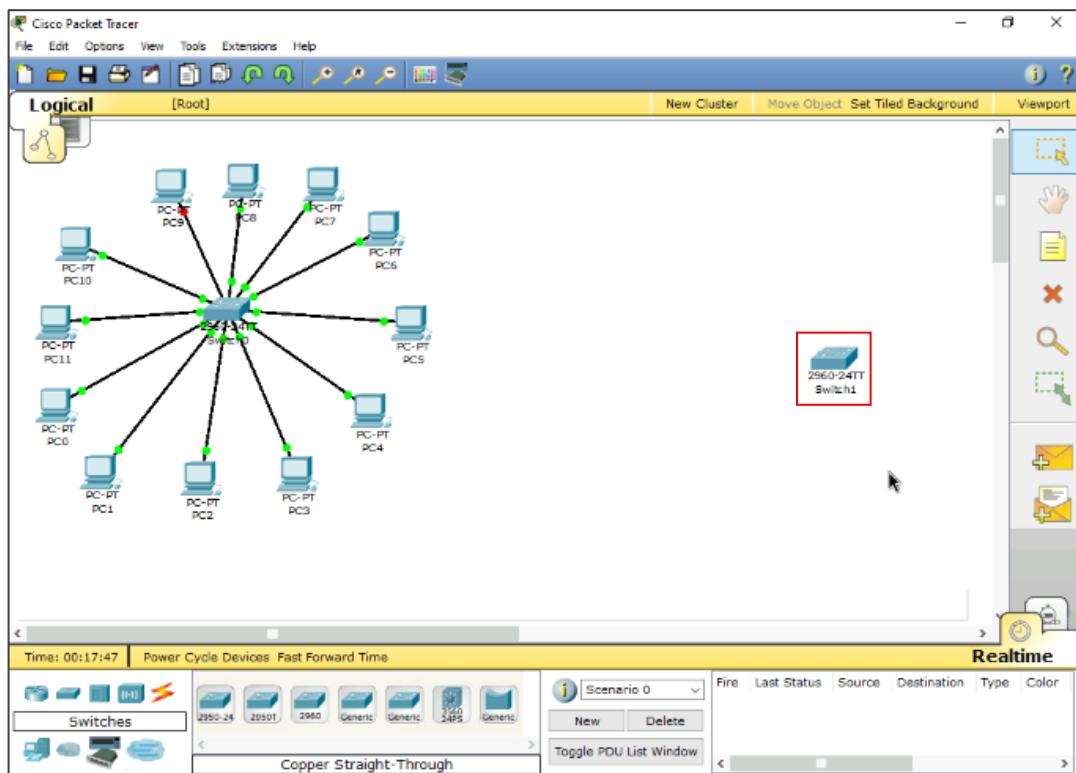
Step 3: Set up a 6-node network

3.1 Click on Switches

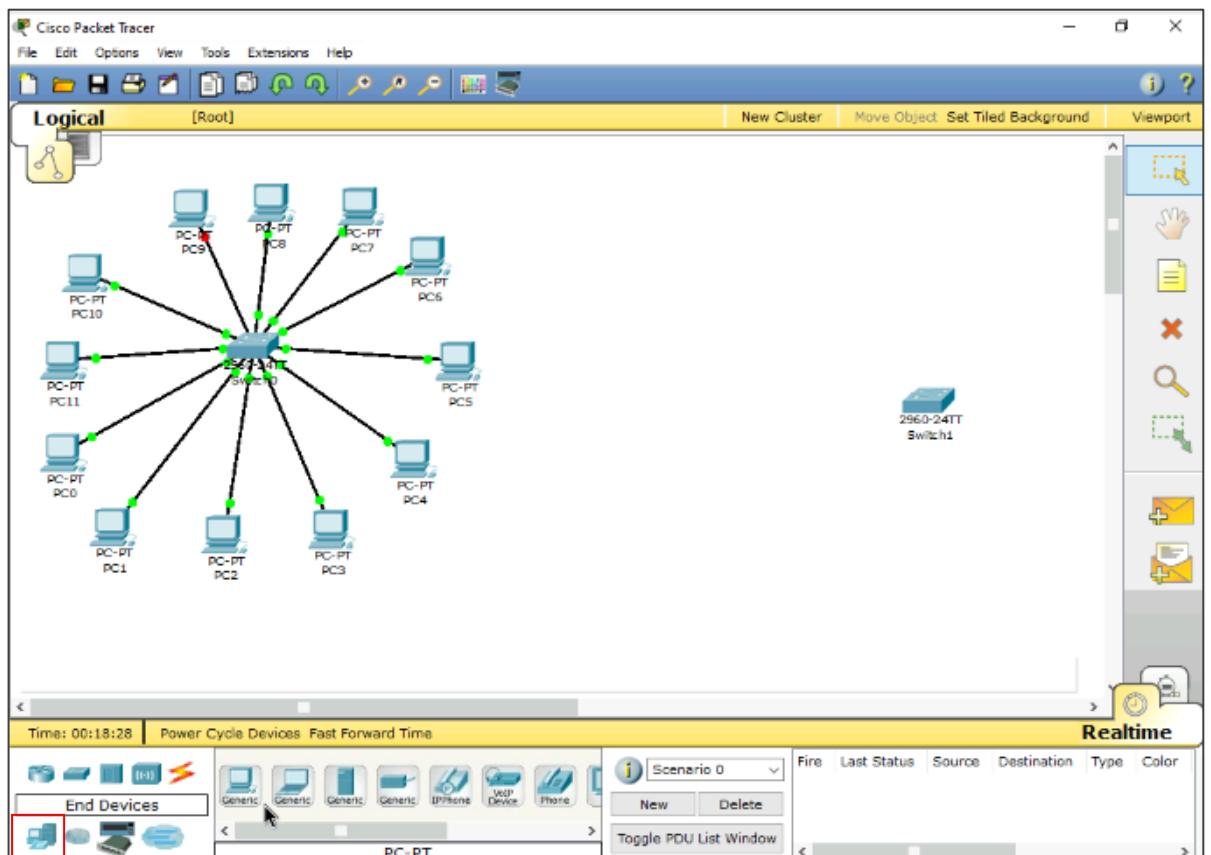


3.2 Select 2960-24TT and drag it to the main screen

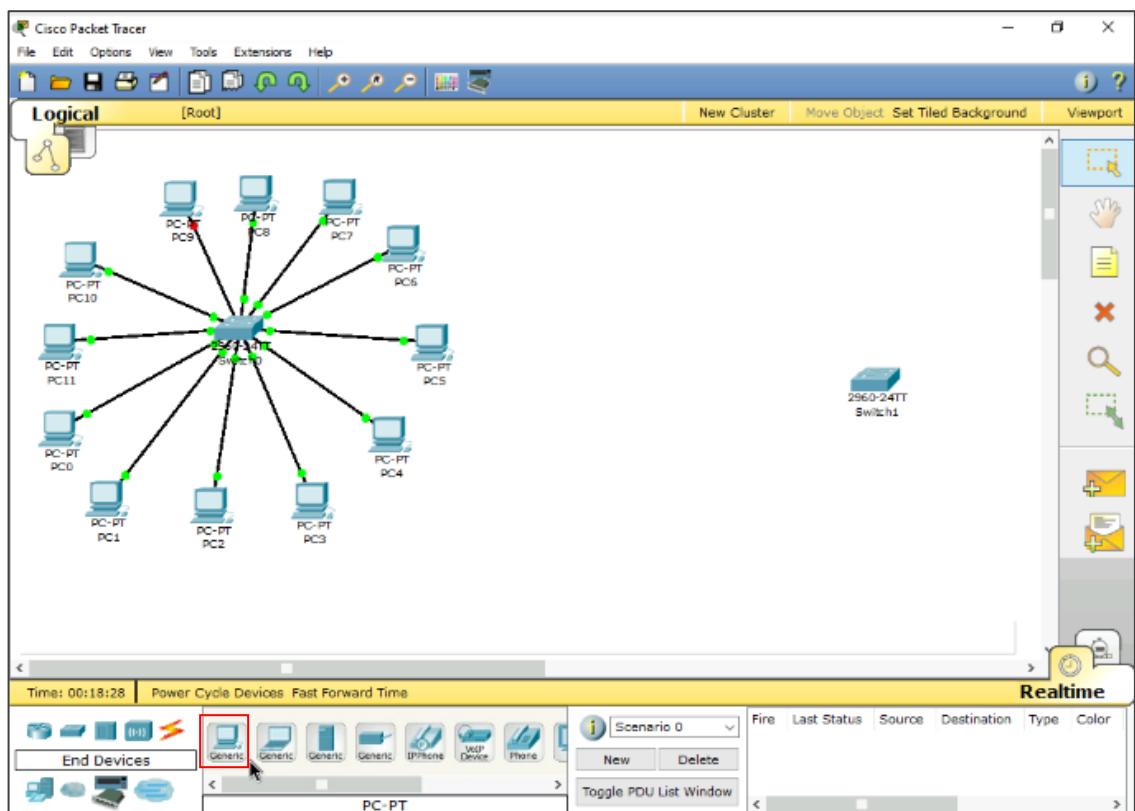




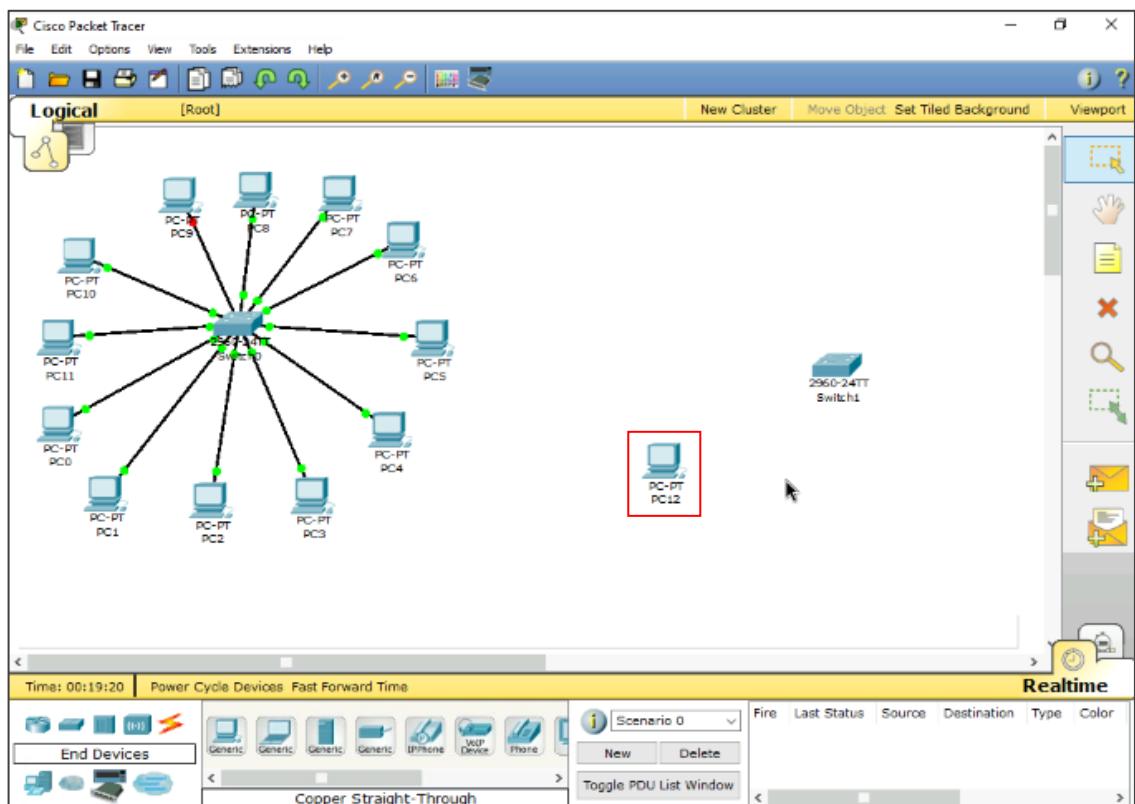
3.3 Click on End Devices



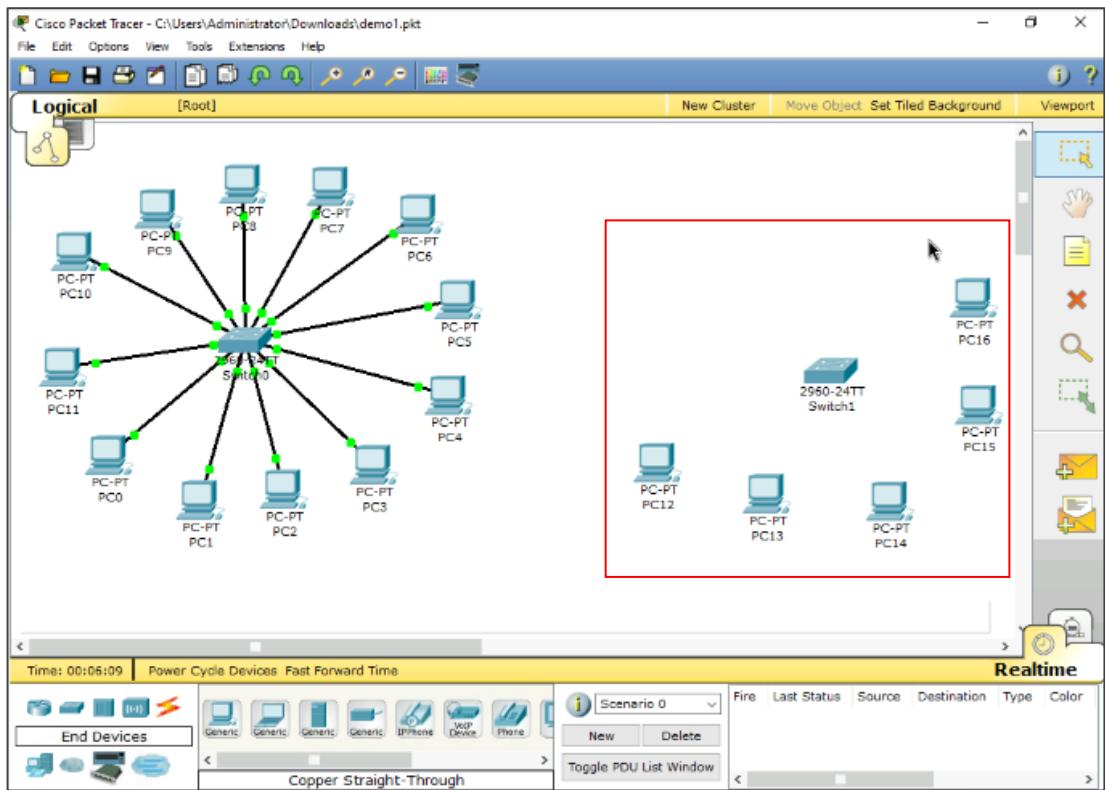
3.4 Select PC-PT and drag it to the main screen



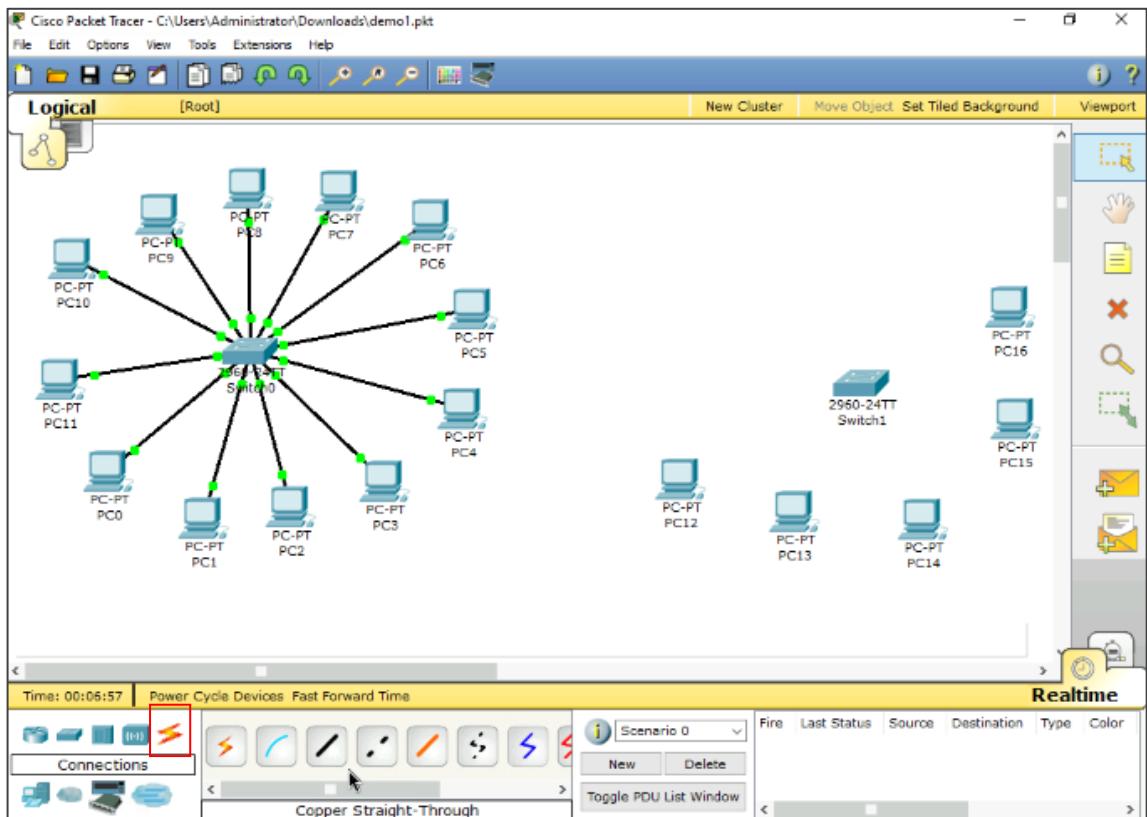
3.5 Drag PC-PT to the main screen



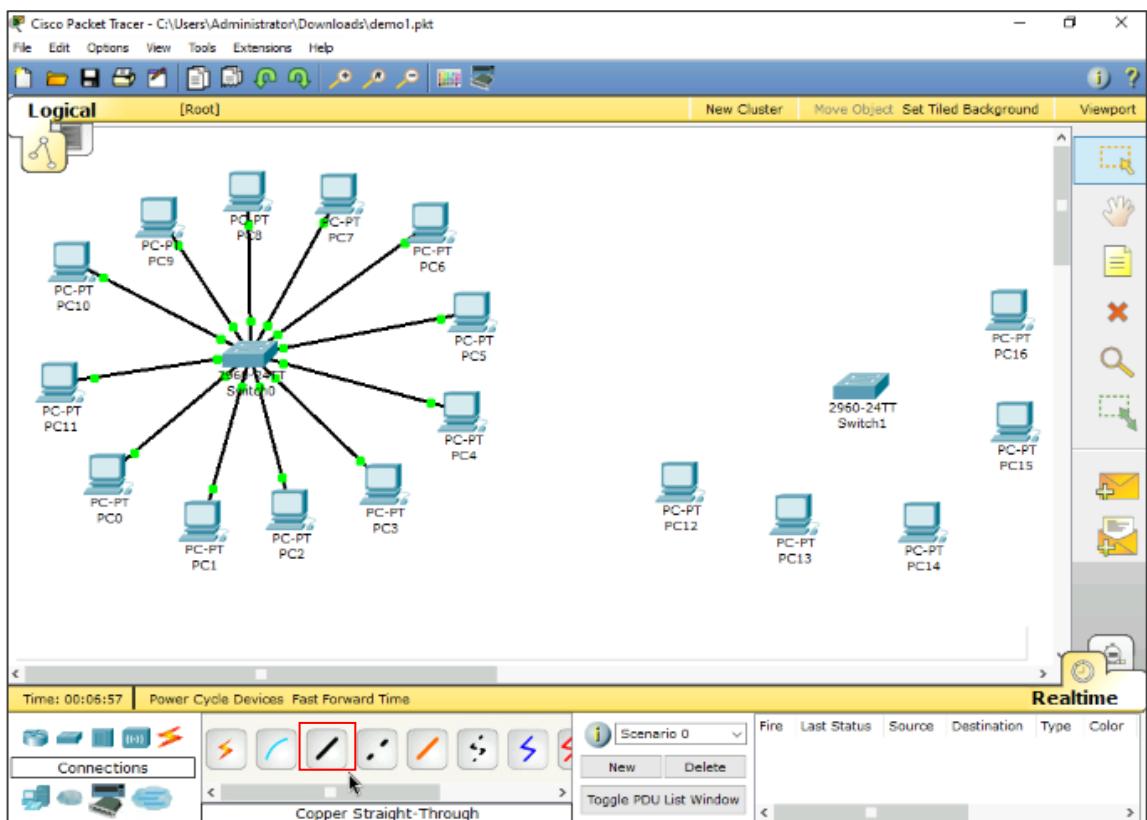
3.6 Repeat step 3.4 and step 3.5 to add 4 more PCs



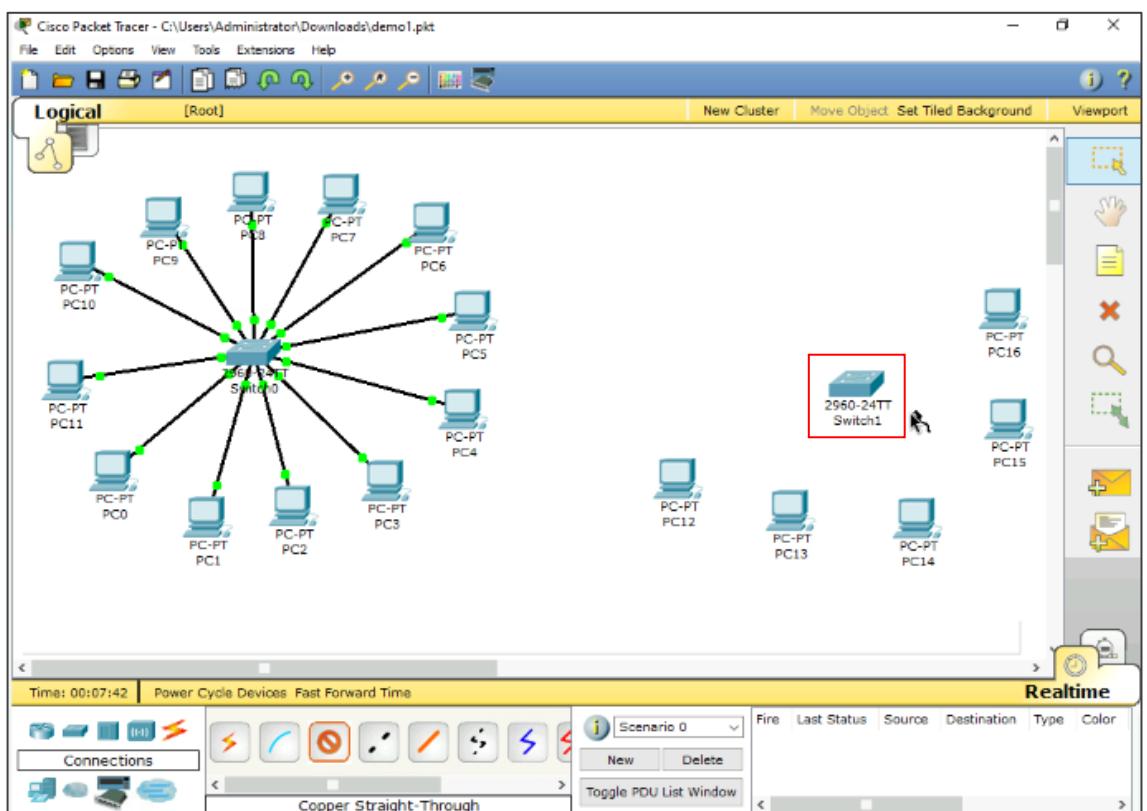
3.7 Click on Connections



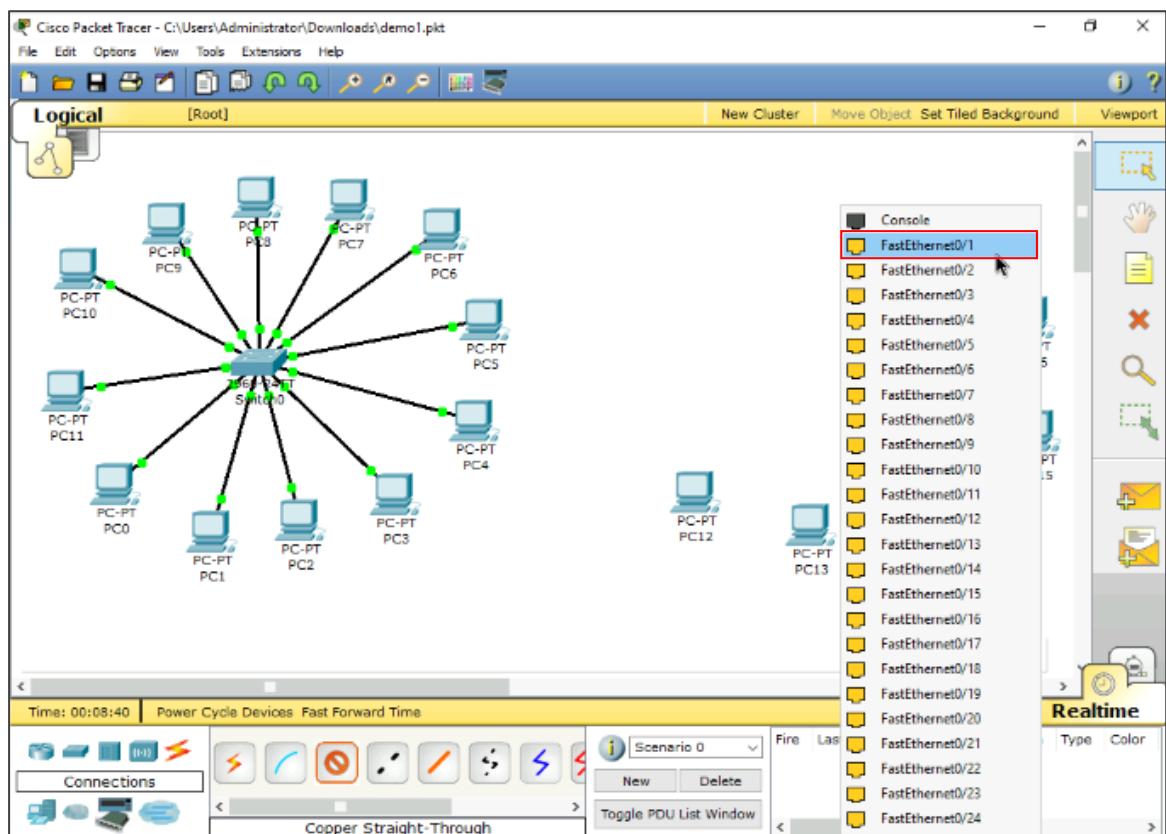
3.8 Click on Copper Straight-Through



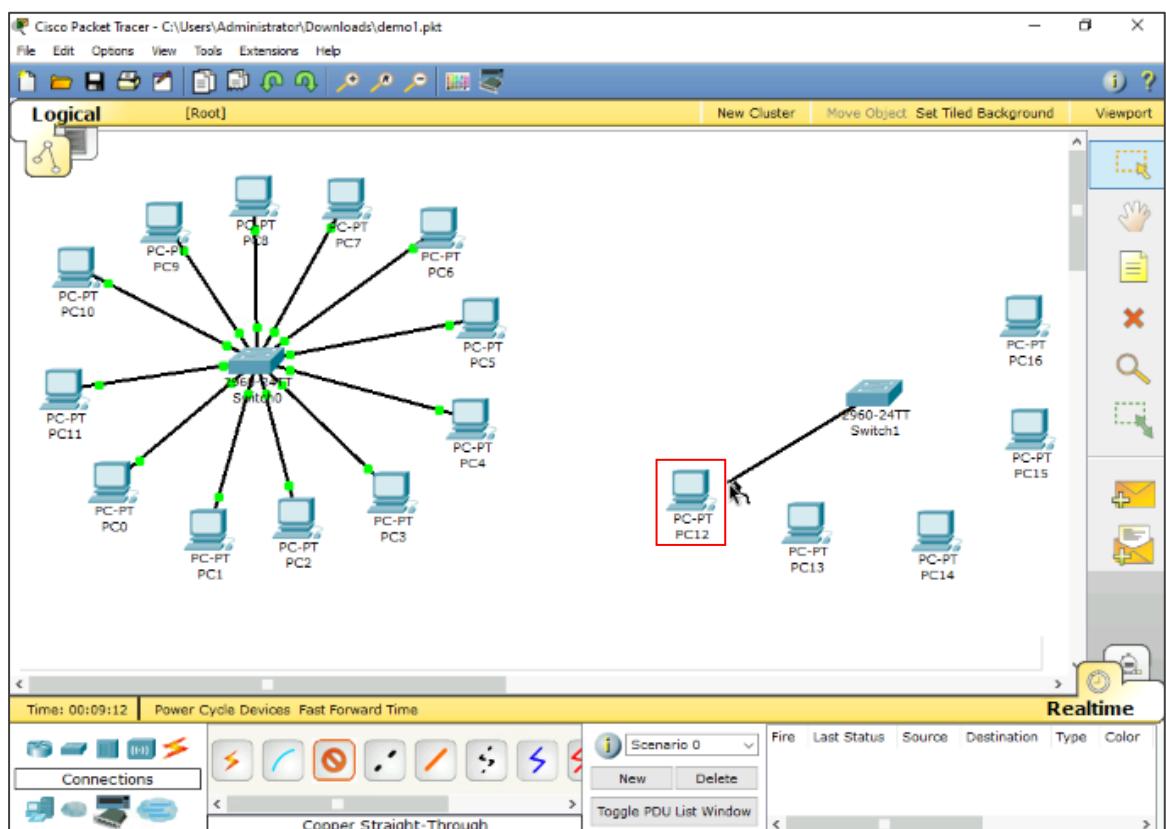
3.9 Click on Switch1



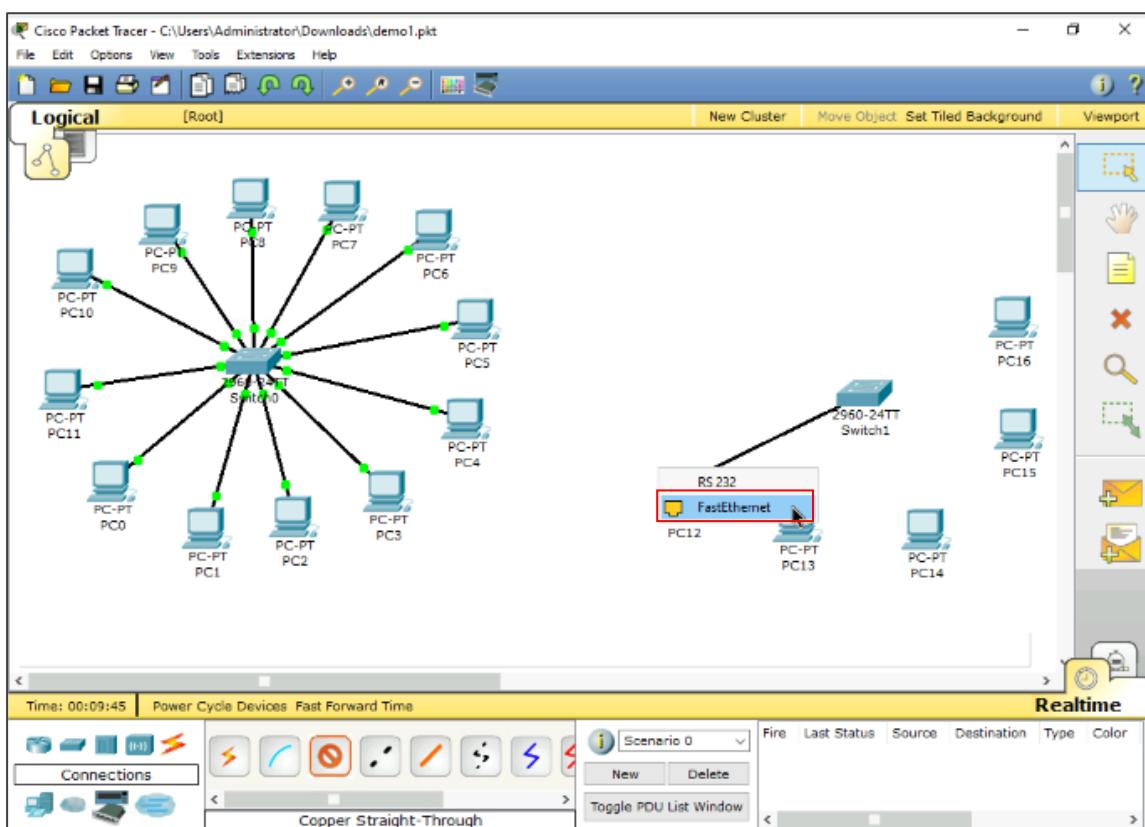
3.10 Click on FastEthernet0/1



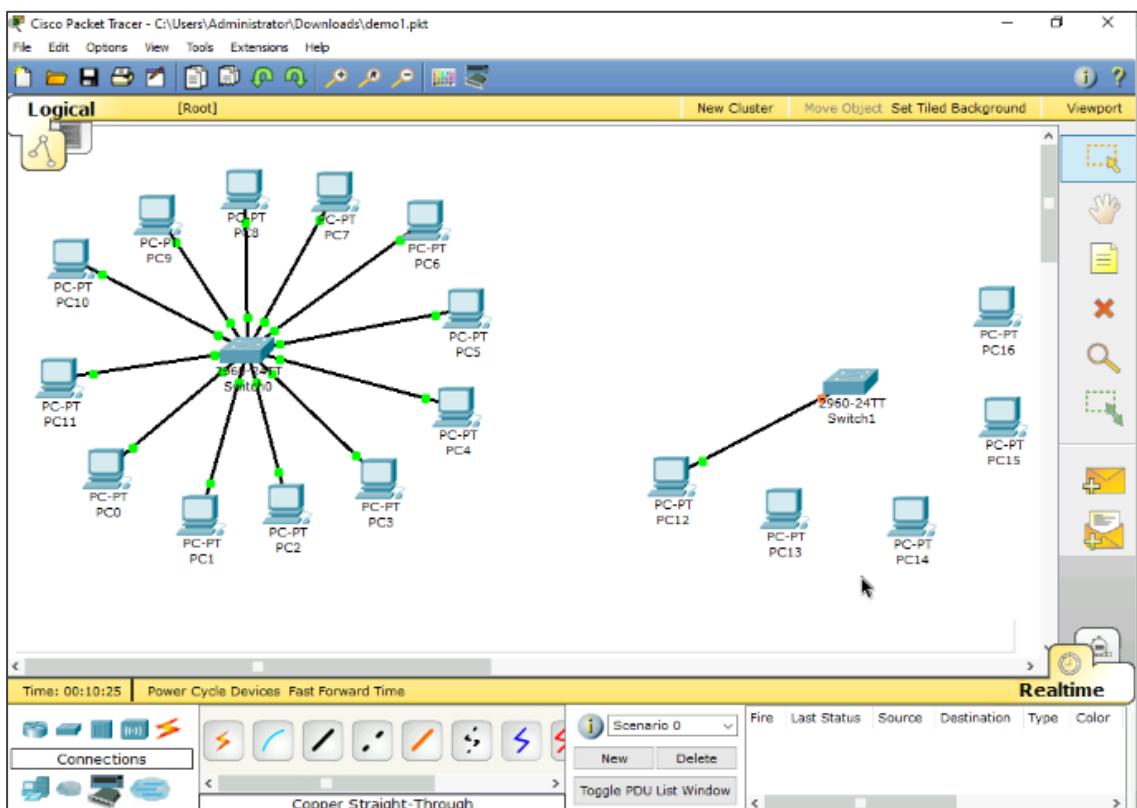
3.11 Click on PC12



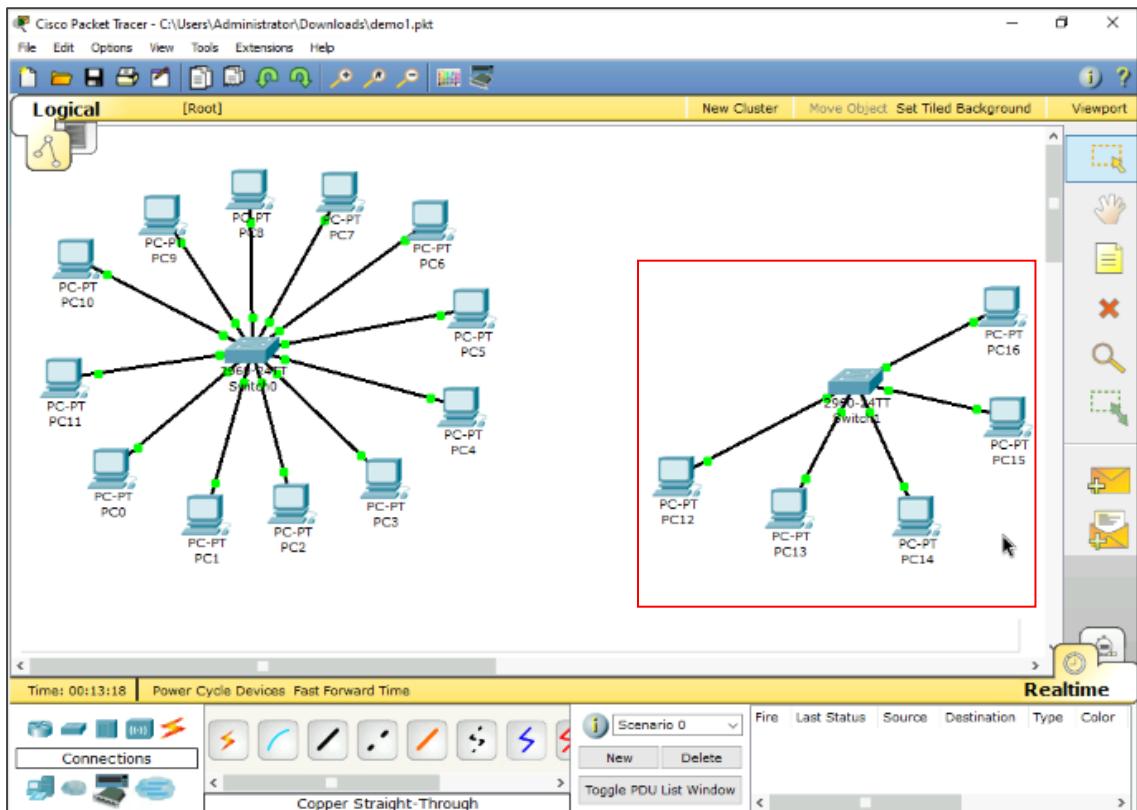
3.12 Click on FastEthernet



The connection has been established between PC12 and Switch1.

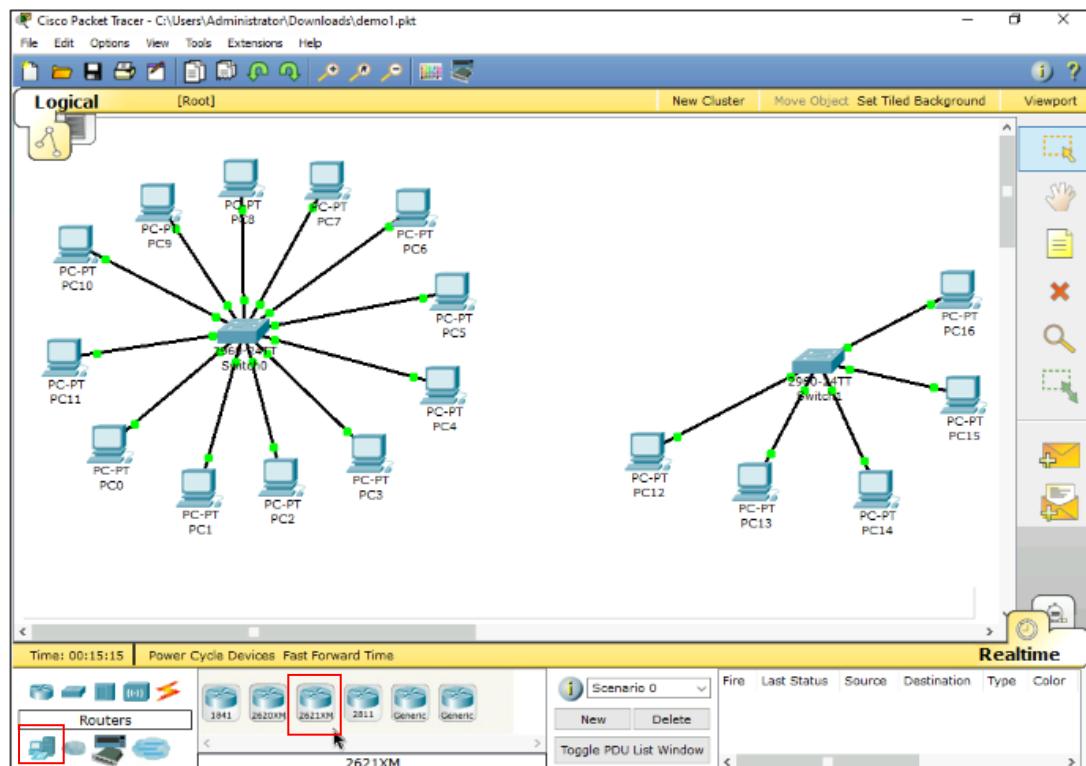


3.13 Repeat the step 3.8 to step 3.12 to connect the remaining 4 PCs

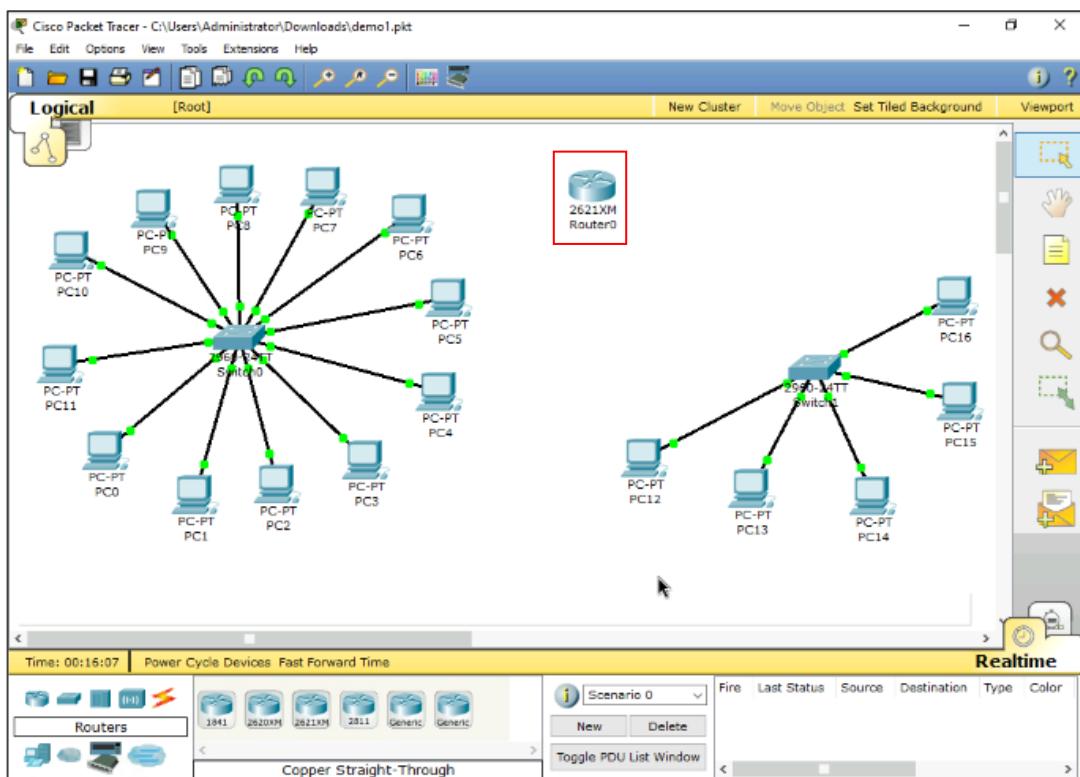


Step 4: Connect the 14-node and 6-node networks

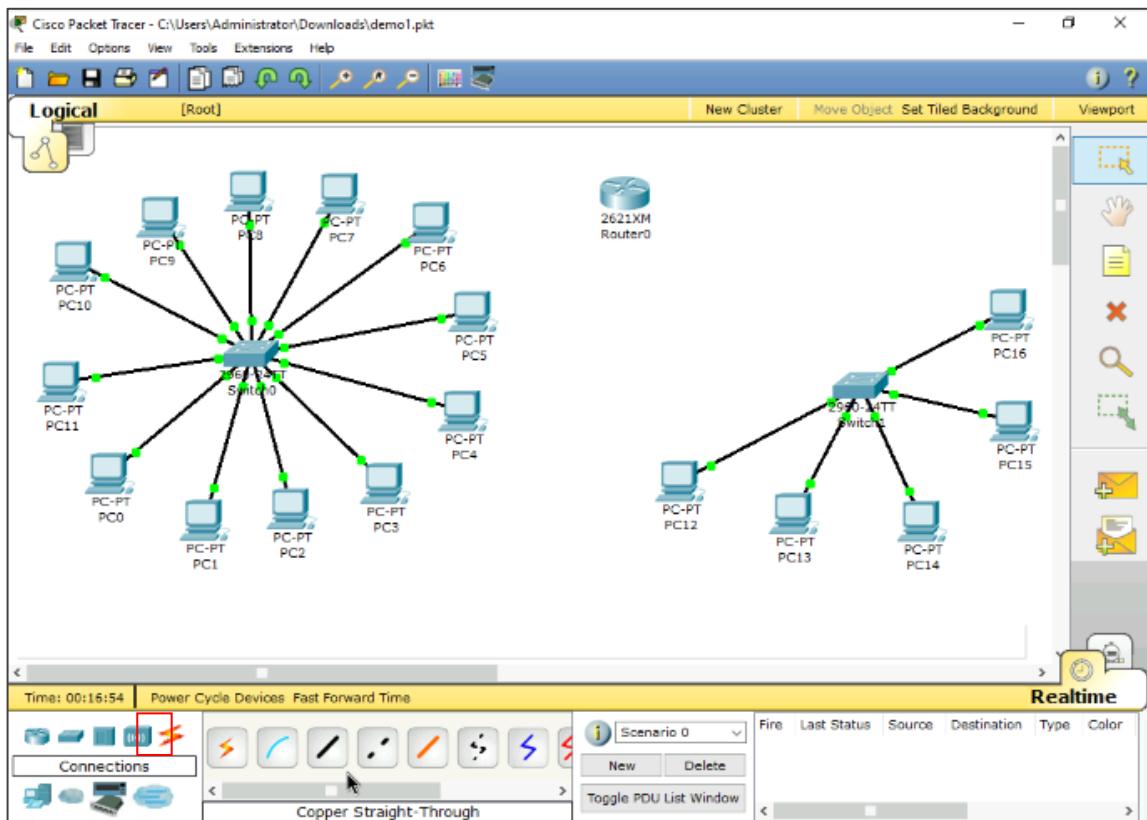
4.1 Click on Routers and select 2621XM Router



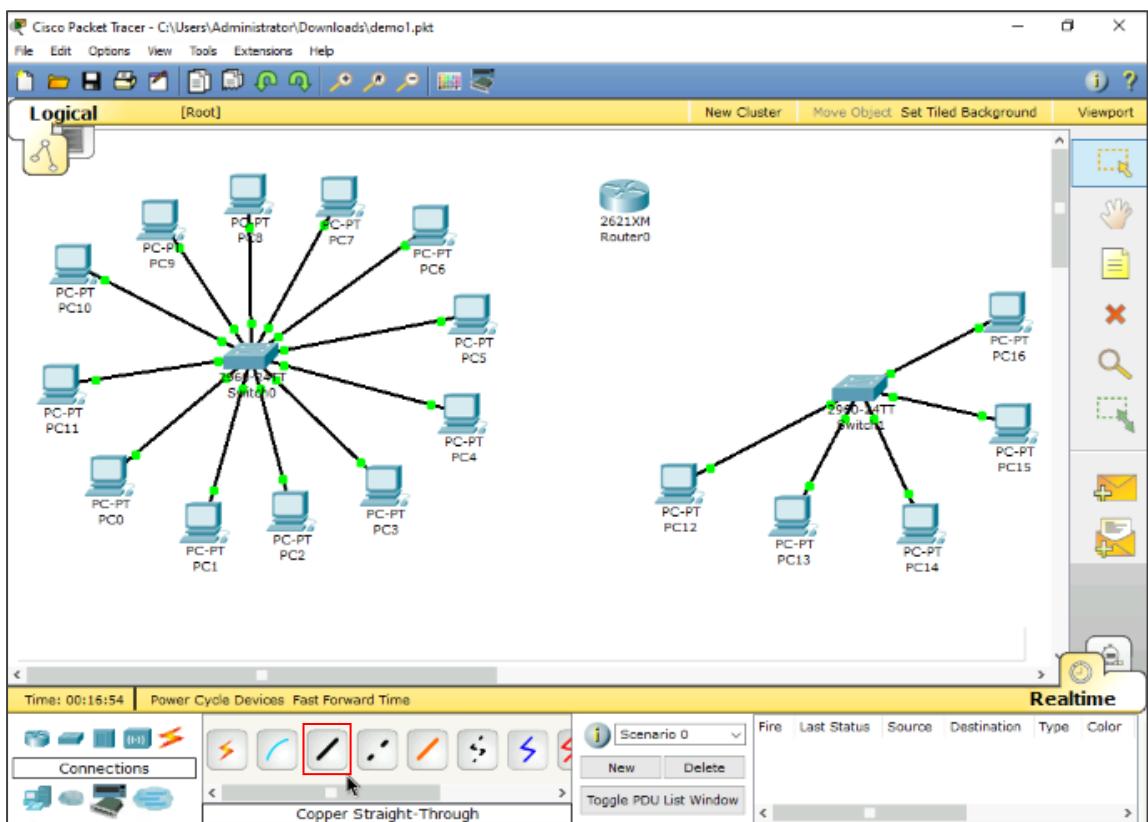
4.2 Drag the 2621XM Router to the main screen



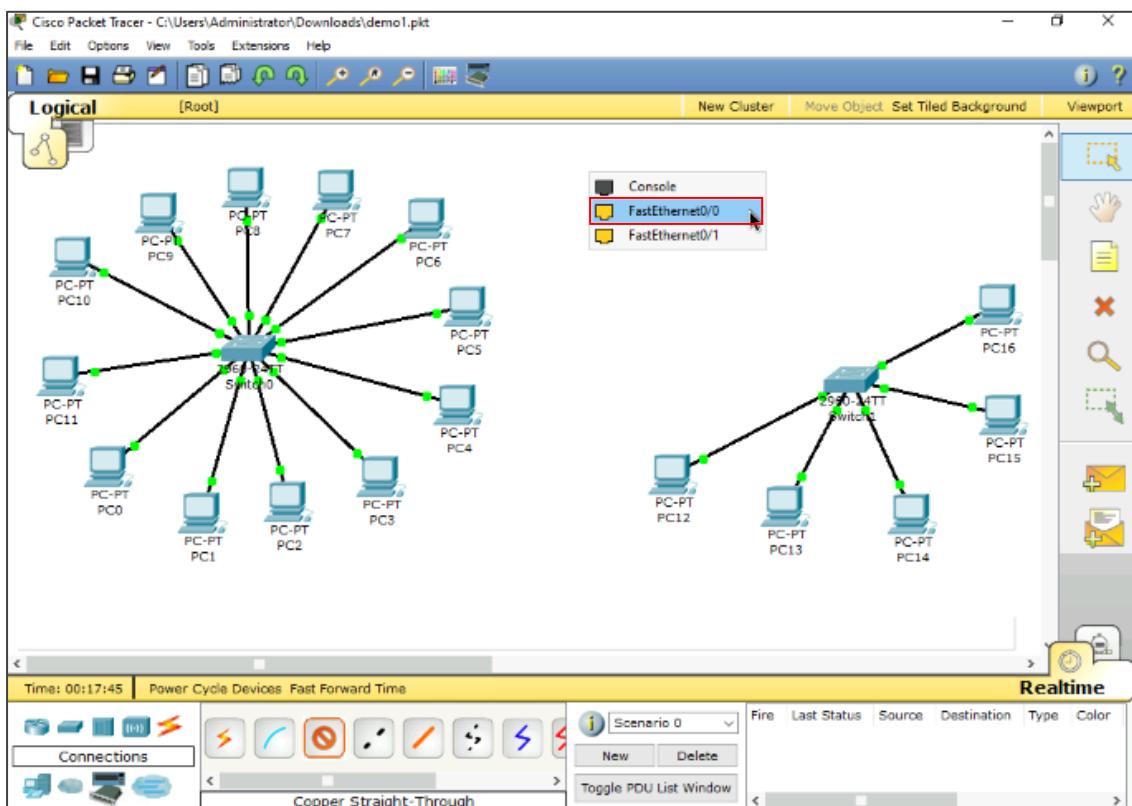
4.3 Click on Connections



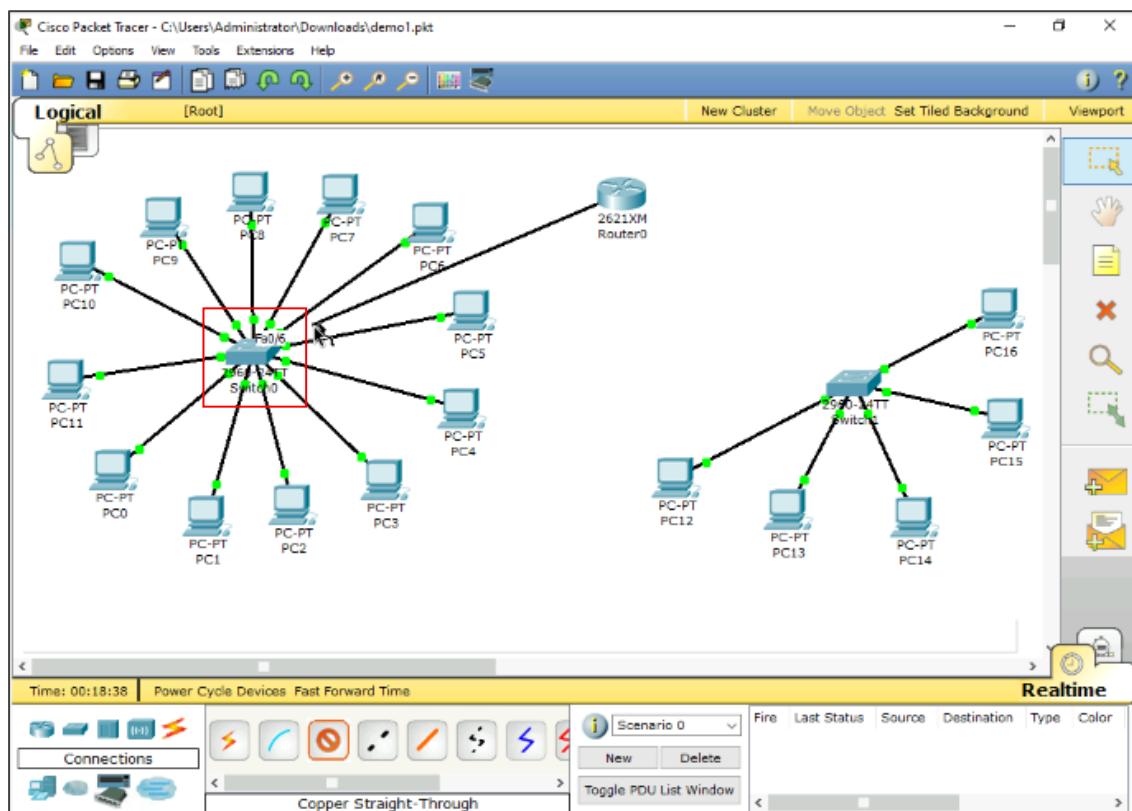
4.4 Select Copper Straight-Through



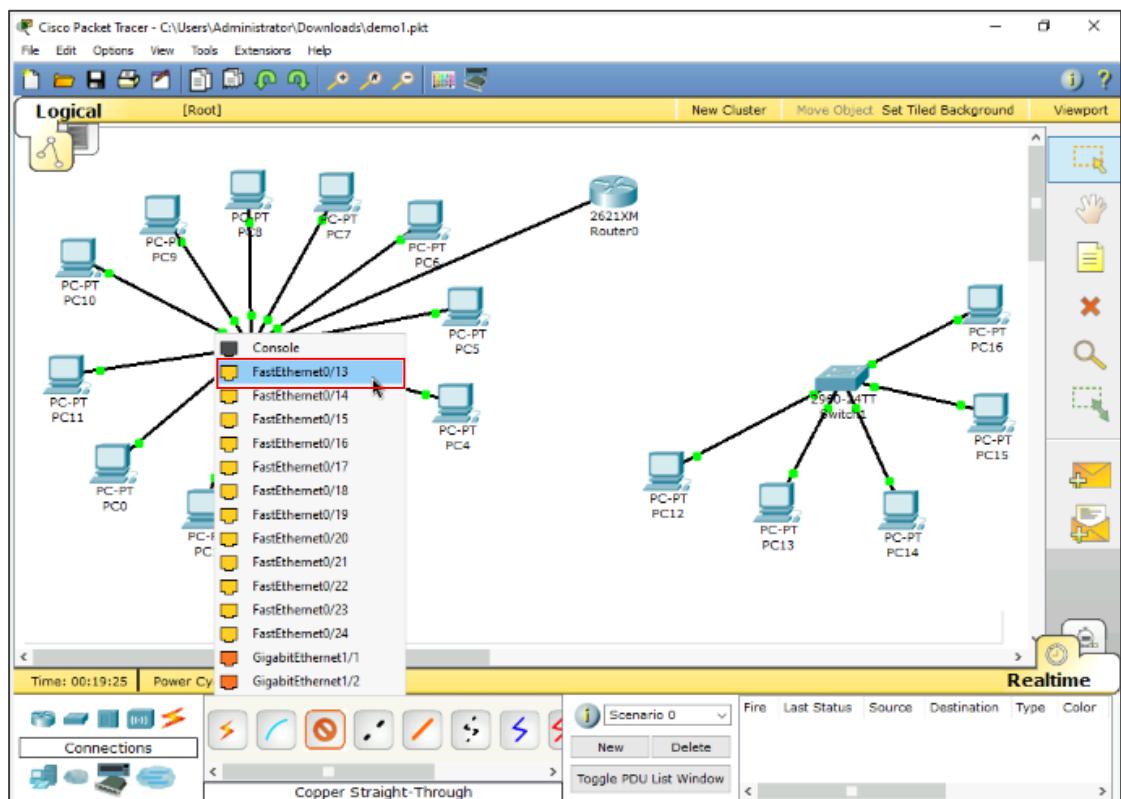
4.5 Click on 2621XM Router0 and select FastEthernet0/0



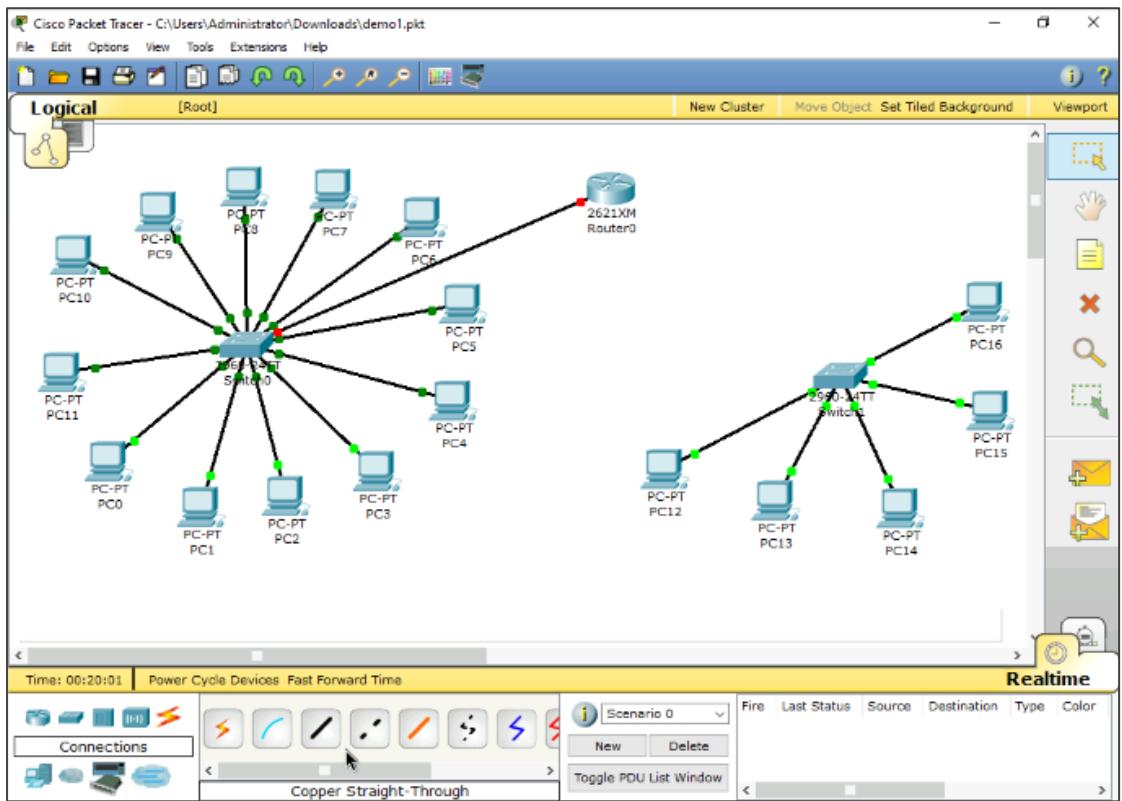
4.6 Click on Switch0



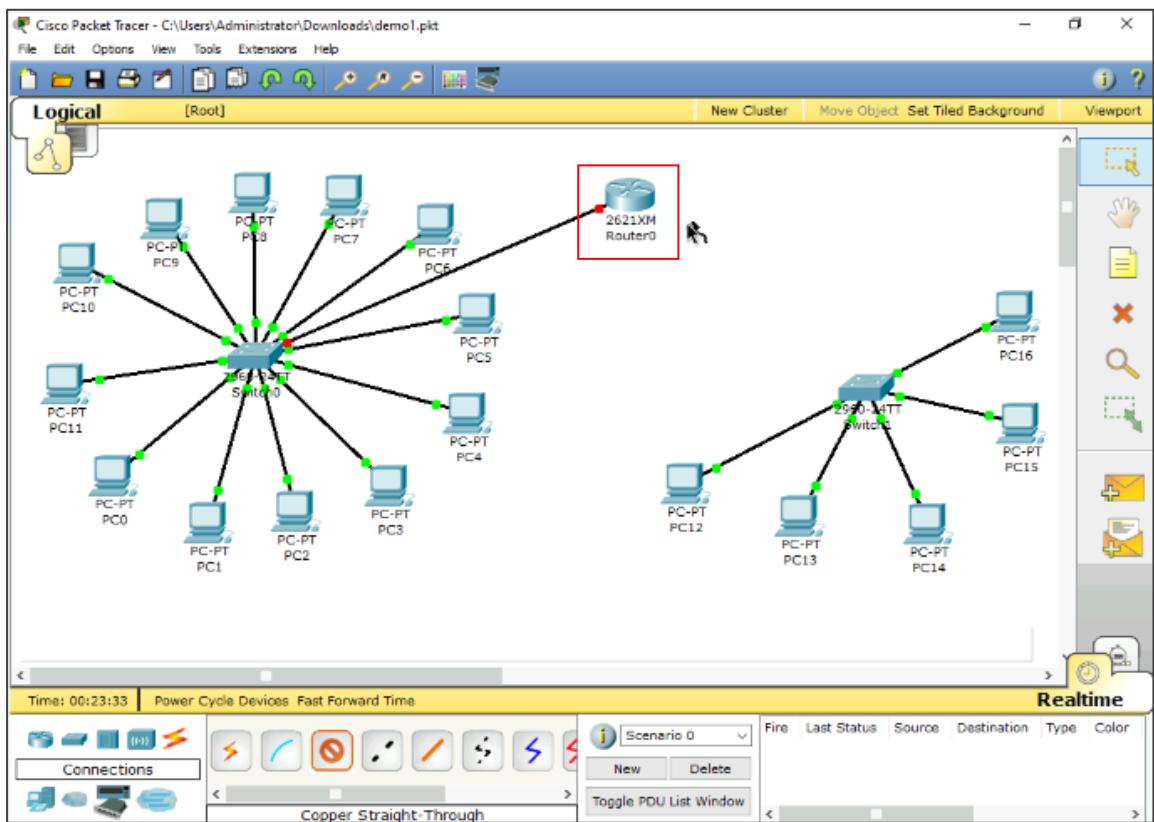
4.7 Click on FastEthernet0/13



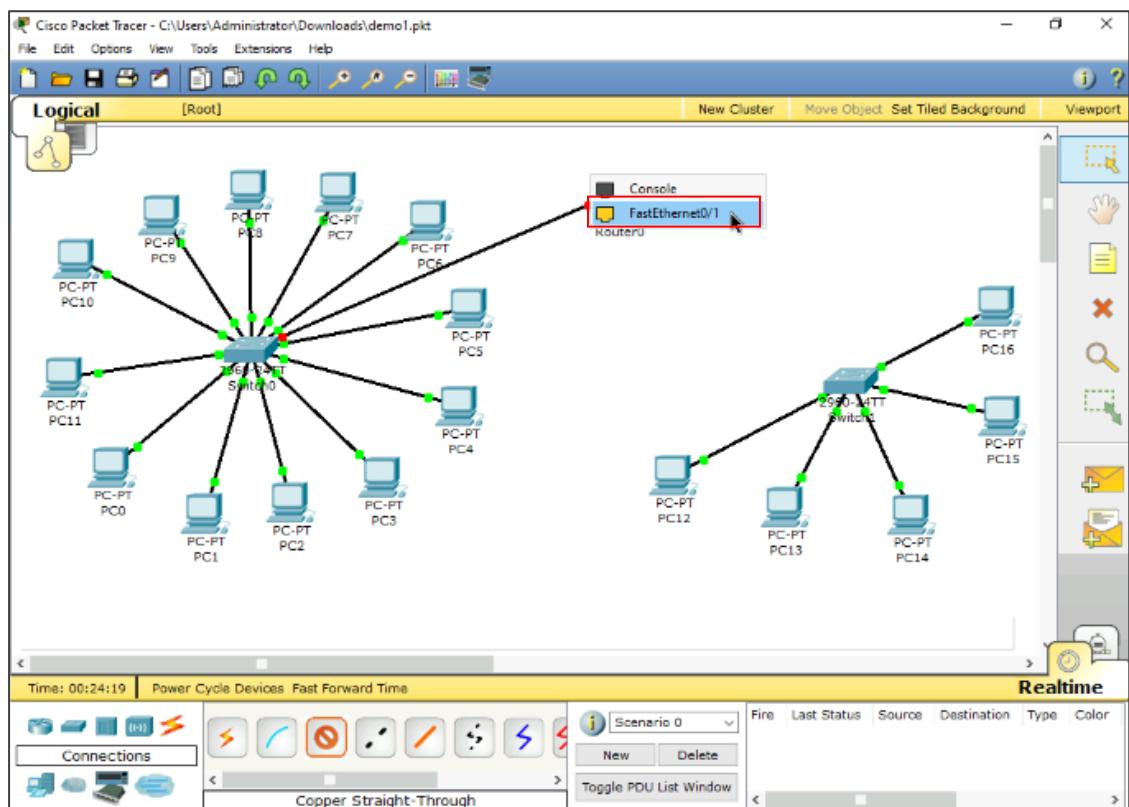
The connection has been established between Router0 and Switch0.



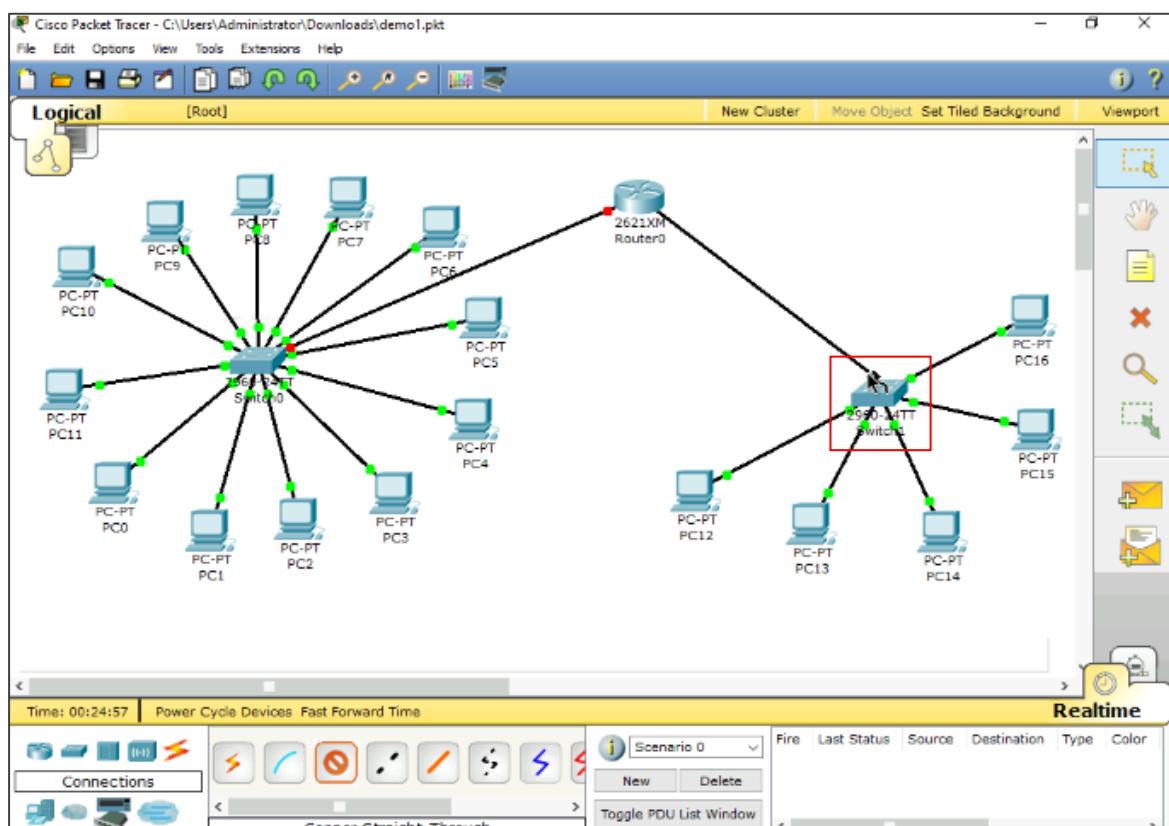
4.8 Click on 2621XM Router0



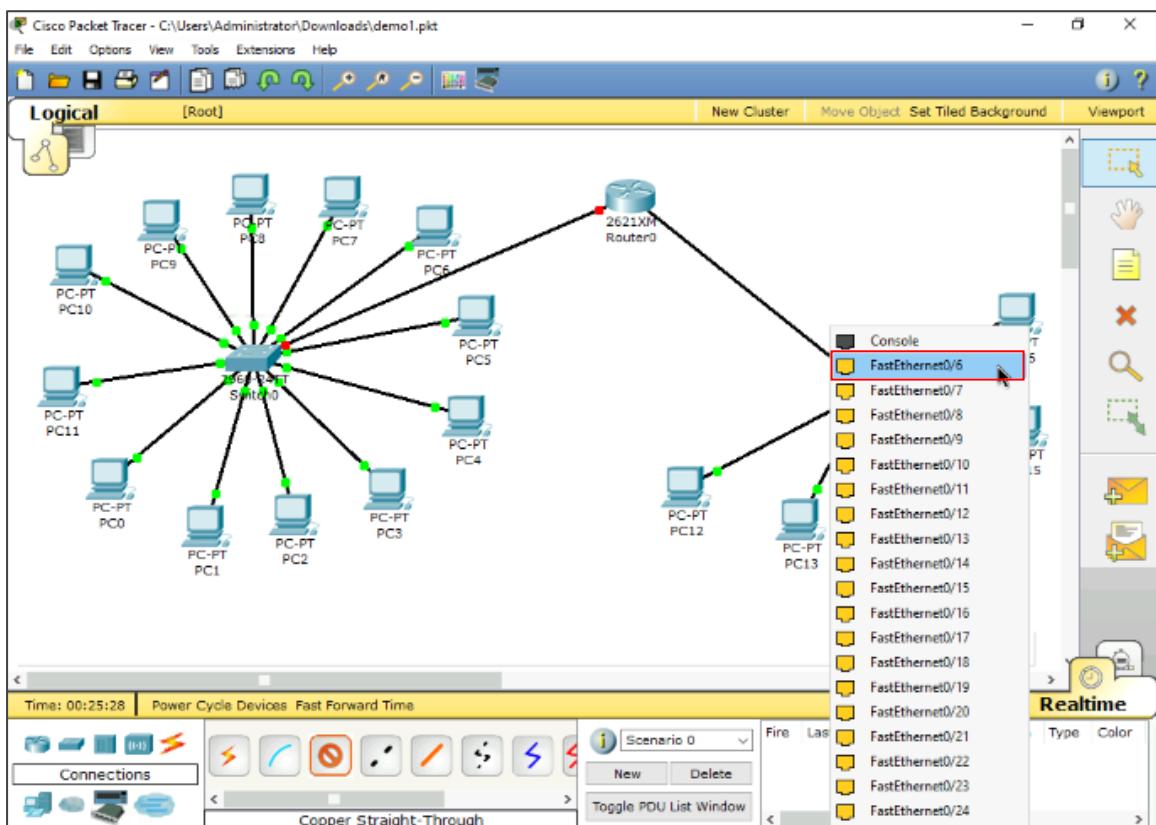
4.9 Click on FastEthernet0/1



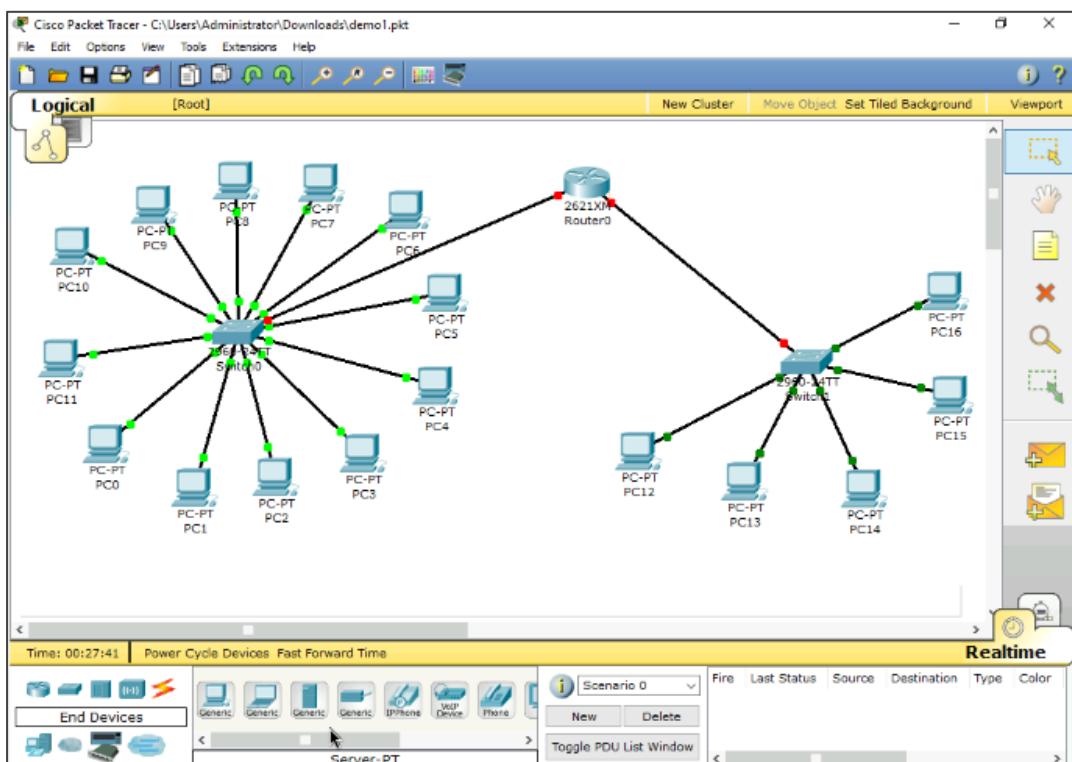
4.10 Click on Switch1



4.11 Click on FastEthernet0/6

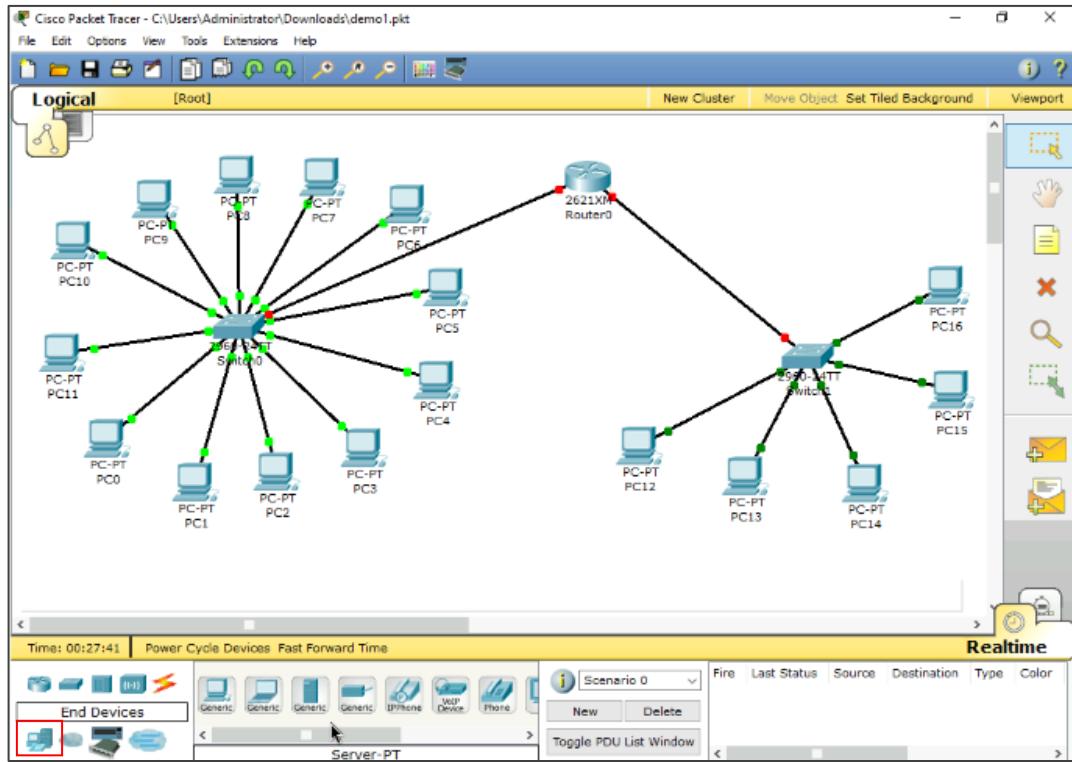


The connection has been established between Router and the switches.

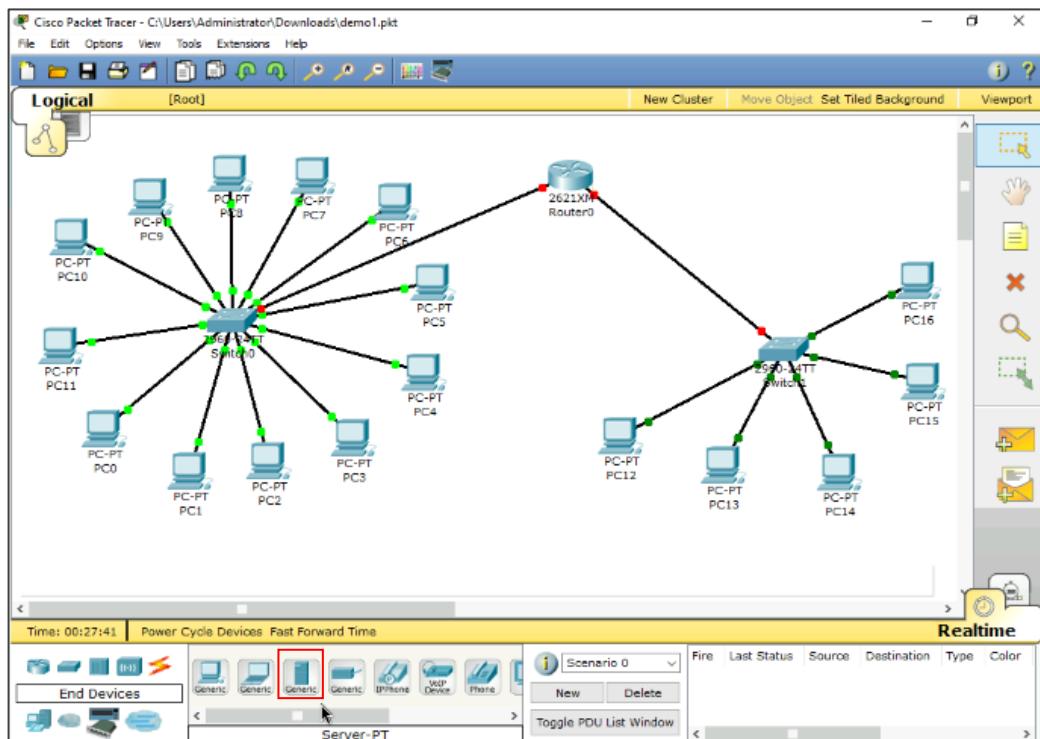


Step 5: Configure VLAN for web server isolation

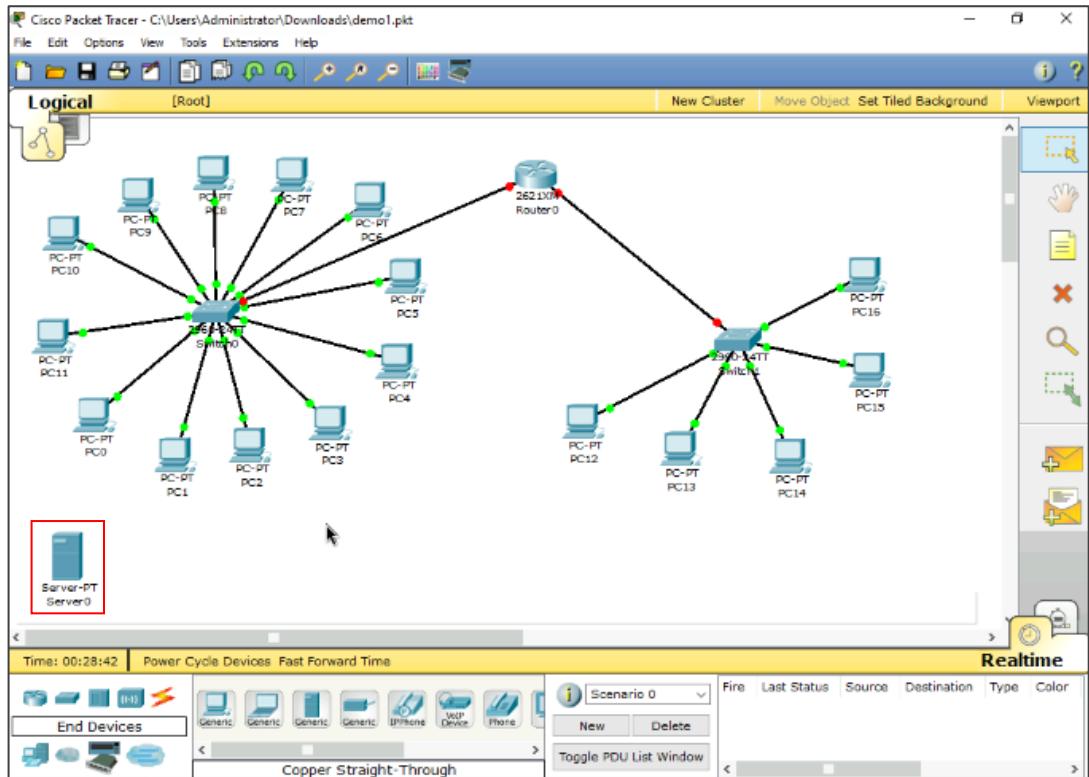
5.1 Click on End Devices



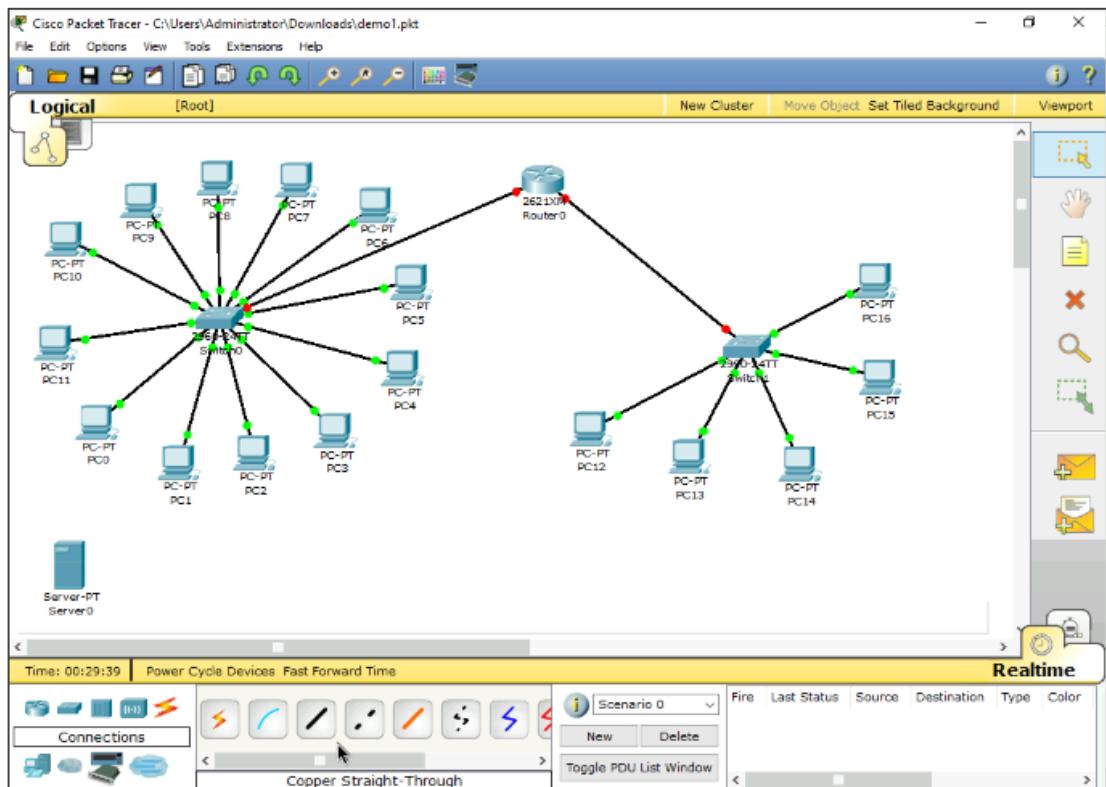
5.2 Select Server-PT



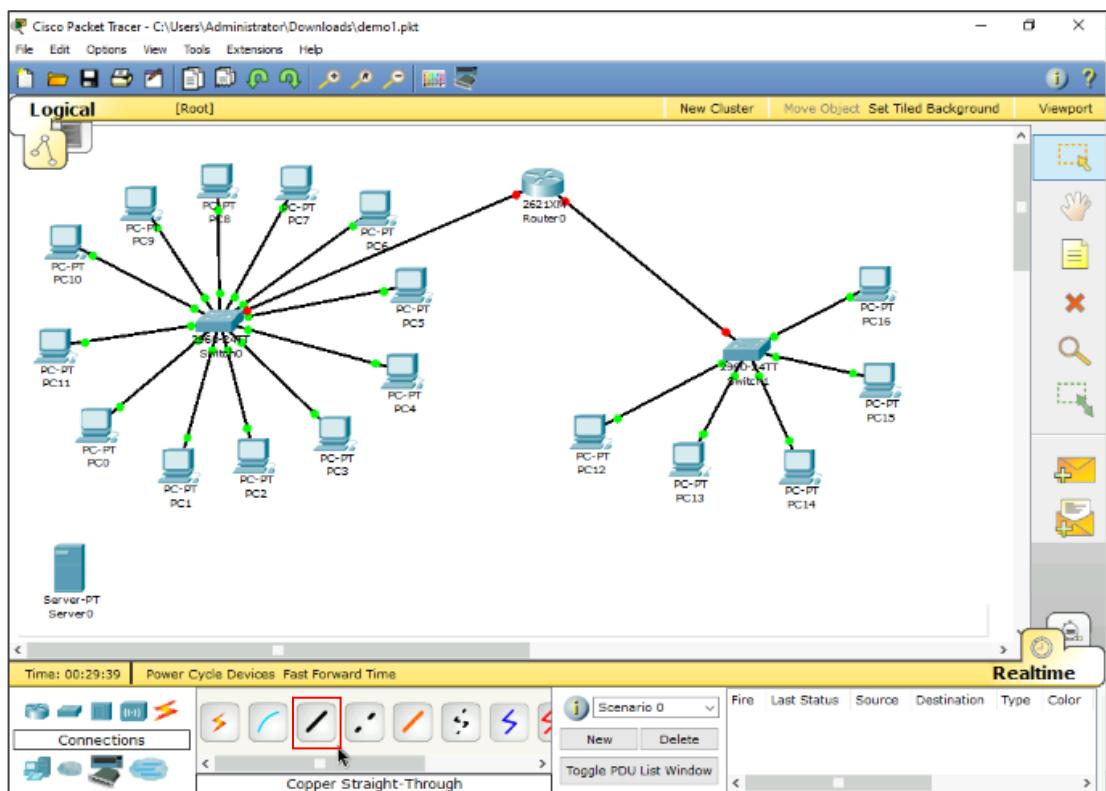
5.3 Drag the Server-PT to the main screen



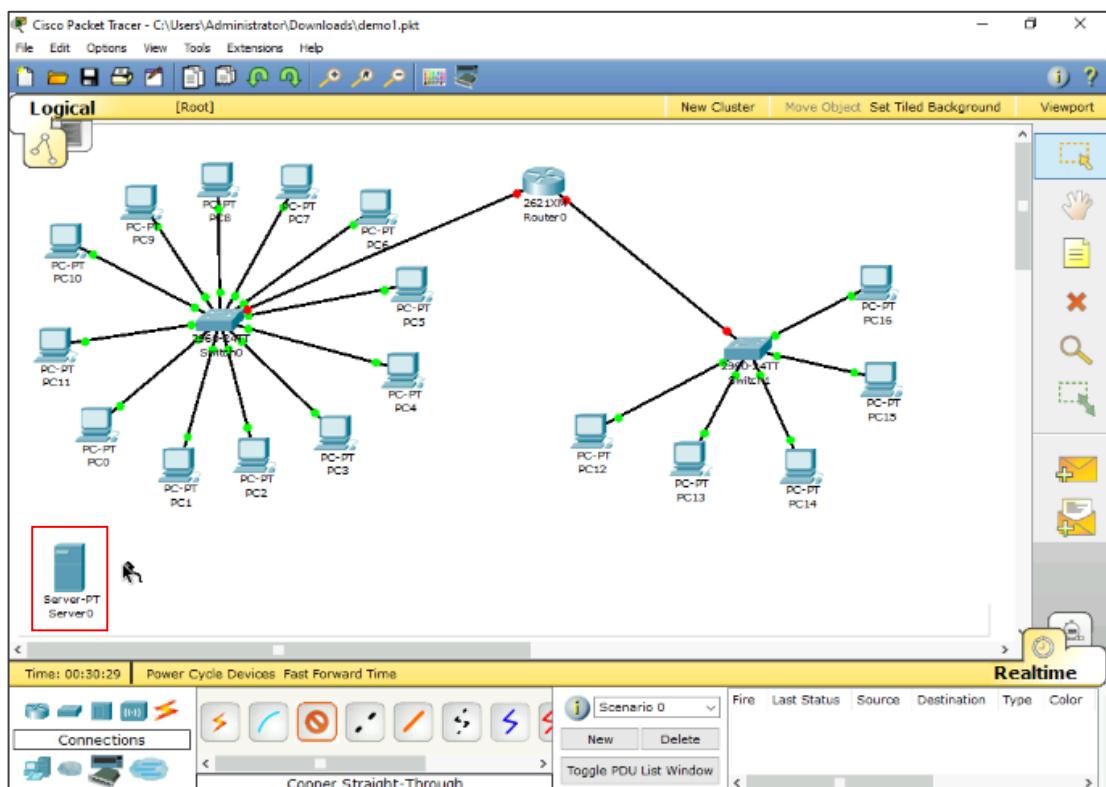
5.4 Click on Connections



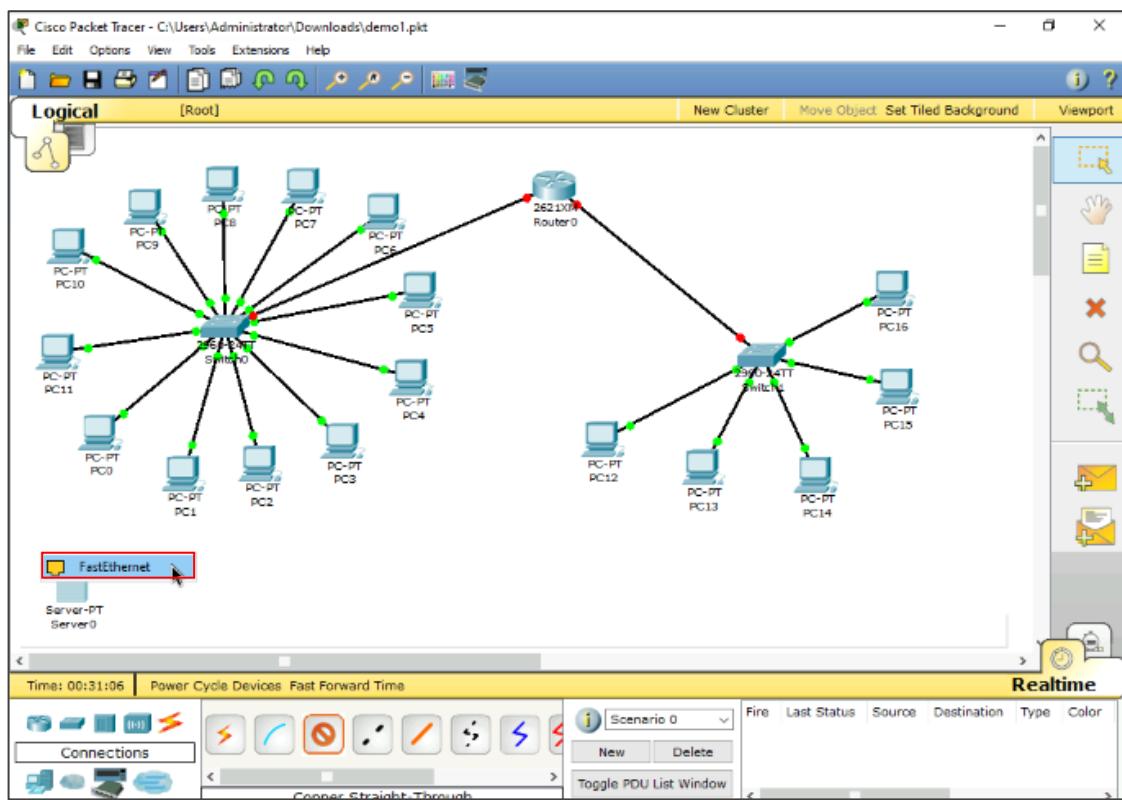
5.5 Select Copper Straight-Through



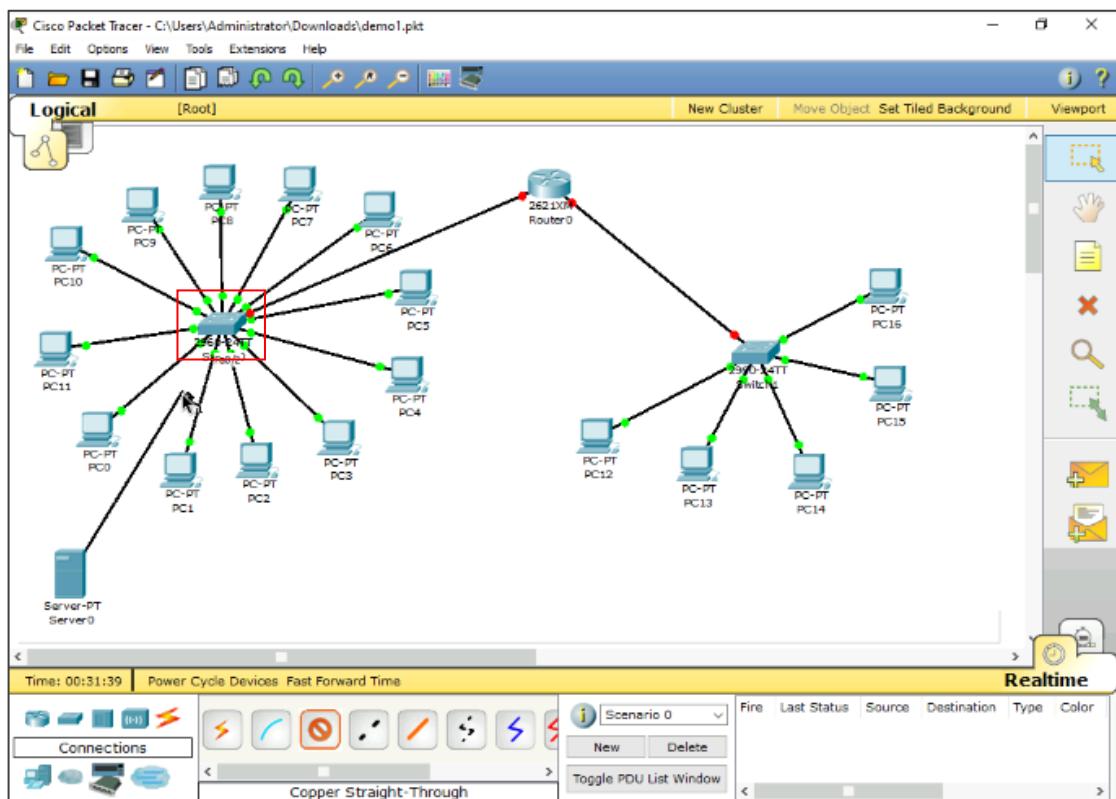
5.6 Click on Server0



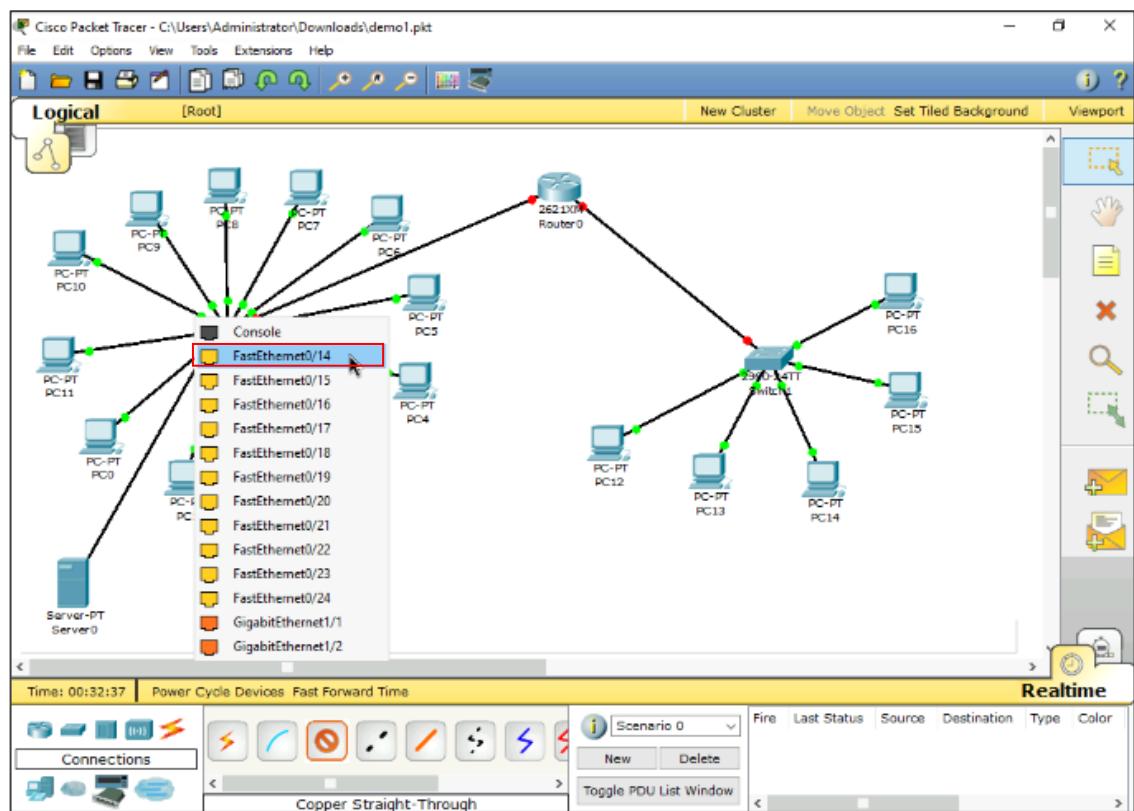
5.7 Select FastEthernet



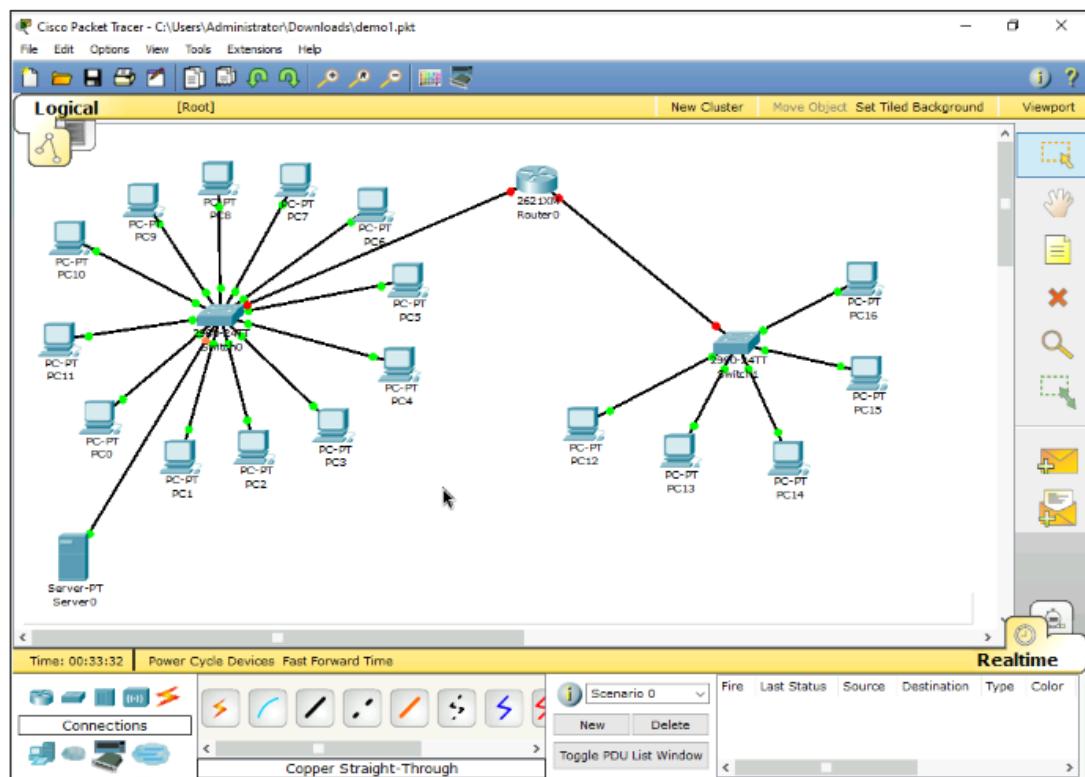
5.8 Click on Switch0



5.9 Select the FastEthernet0/14



The connection has been established between **Server0** and the **Switch0**.



5.10 In the browser, paste the link given below and press enter:

<https://www.calculator.net/ip-subnet-calculator.html>

The screenshot shows the 'Calculator.net' website with the URL <https://www.calculator.net/ip-subnet-calculator.html> in the address bar. The main content area contains two calculators: 'IPv4 Subnet Calculator' and 'IPv6 Subnet Calculator'. The 'IPv4 Subnet Calculator' section has a 'Network Class' dropdown set to 'Any', a 'Subnet' input field containing '255.255.255.252 /30', and an 'IP Address' input field containing '52.172.198.40'. Below these are 'Calculate' and 'Clear' buttons. To the right is a search bar and a sidebar titled 'Other Calculators' listing various tools like Age, Time, GPA, Height, IP Subnet, Password Generator, Conversion, Date, Hours, Grade, Concrete, Bra Size, Dice Roller, and More Other Calculators. The 'OTHER' tab is selected in the navigation bar.

5.11 Select **255.255.255.240/28** as Subnet and **192.168.110.0** as IP Address

This screenshot is identical to the previous one, but it highlights the 'Subnet' field ('255.255.255.240 /28') and the 'IP Address' field ('192.168.110.0') with red boxes, indicating they have been selected or modified by the user.

5.12 Click on Calculate

The screenshot shows the 'IP Subnet Calculator' page on calculator.net. The main section is titled 'IPv4 Subnet Calculator'. It has fields for 'Network Class' (radio buttons for Any, A, B, C, with 'Any' selected), 'Subnet' (dropdown set to 255.255.255.240 /28), and 'IP Address' (text input set to 192.168.110.0). Below these are 'Calculate' and 'Clear' buttons. To the right is a search bar and a sidebar titled 'Other Calculators' with links like Age, Time, GPA, Height, IP Subnet, Password Generator, Conversion, Date, Hours, Grade, Concrete, Bra Size, Dice Roller, More Other Calculators, Financial, Fitness and Health, Math, and Other.

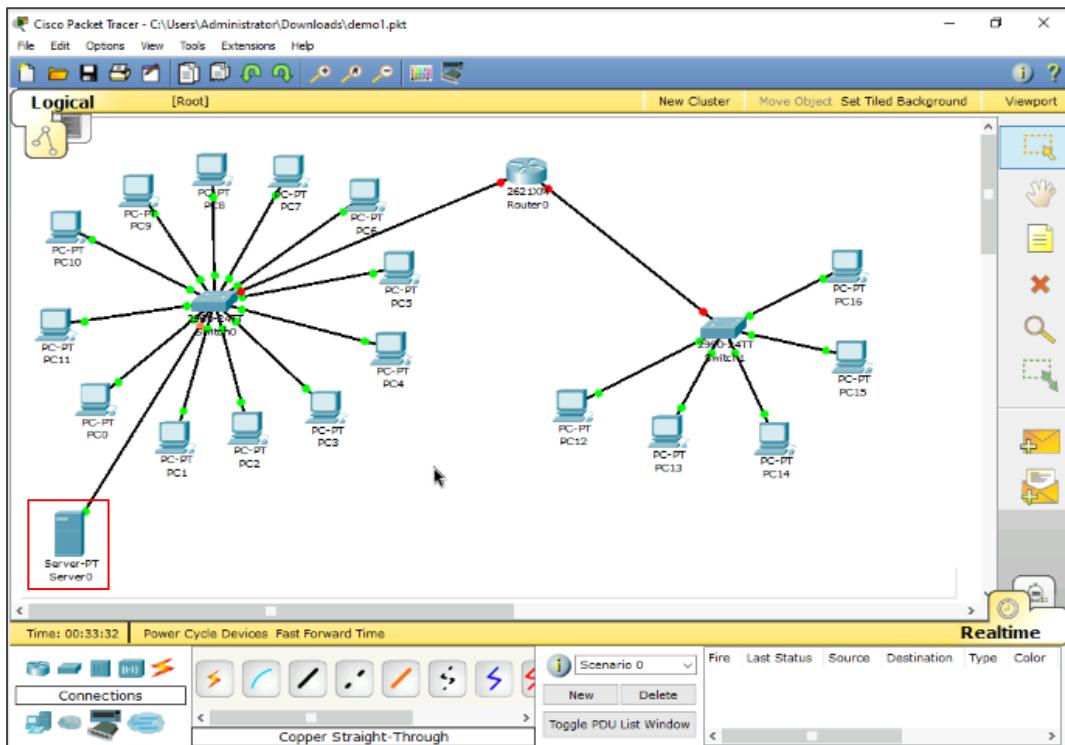
5.13 Review the Usable Host IP Range, Number of Usable Hosts, and Subnet Mask from the output

The screenshot shows the same 'IP Subnet Calculator' page after clicking 'Calculate'. A green bar at the top says 'Result'. The output table includes the following information:

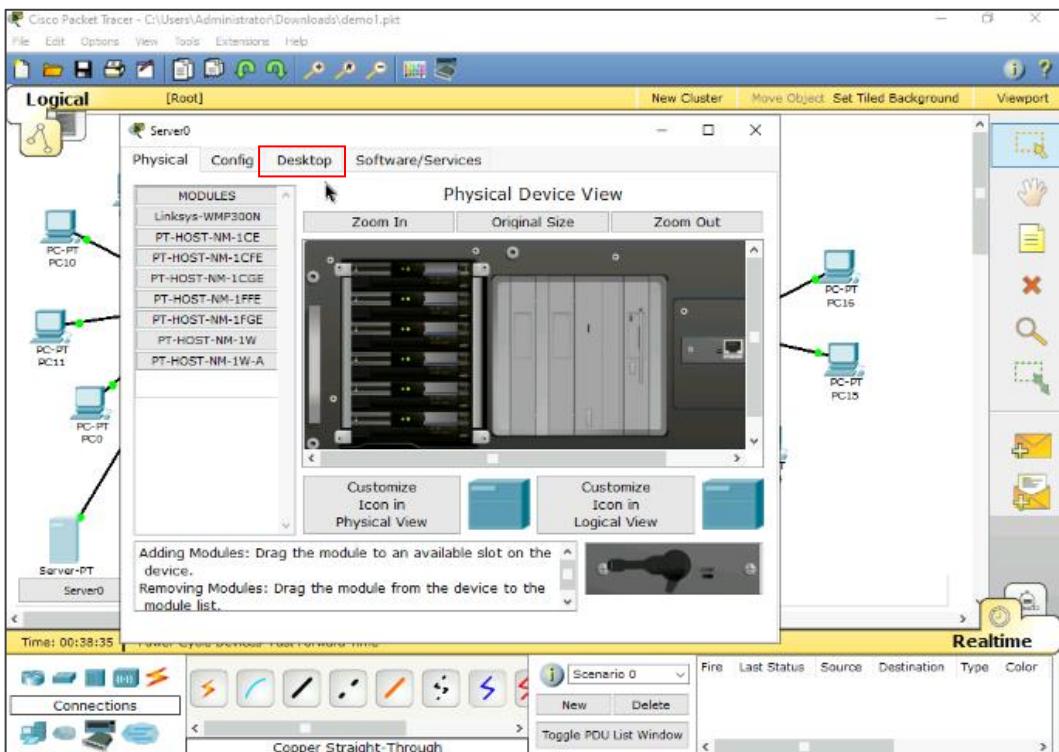
IP Address:	192.168.110.0
Network Address:	192.168.110.0
Usable Host IP Range:	192.168.110.1 - 192.168.110.14
Broadcast Address:	192.168.110.15
Total Number of Hosts:	16
Number of Usable Hosts:	14
Subnet Mask:	255.255.255.240
Wildcard Mask:	0.0.0.15
Binary Subnet Mask:	11111111.11111111.11111111.11110000
IP Class:	C
CIDR Notation:	/28
IP Type:	Private
Short:	192.168.110.0 /28

A red box highlights the 'Usable Host IP Range' and 'Subnet Mask' rows. To the right is a sidebar titled 'Other Calculators' with links like Age, Time, GPA, Height, IP Subnet, Password Generator, Conversion, Date, Hours, Grade, Concrete, Bra Size, Dice Roller, More Other Calculators, Financial, Fitness and Health, Math, and Other. There is also a large advertisement for 'PATH TO SUCCESS' with a 'LEARN MORE' button.

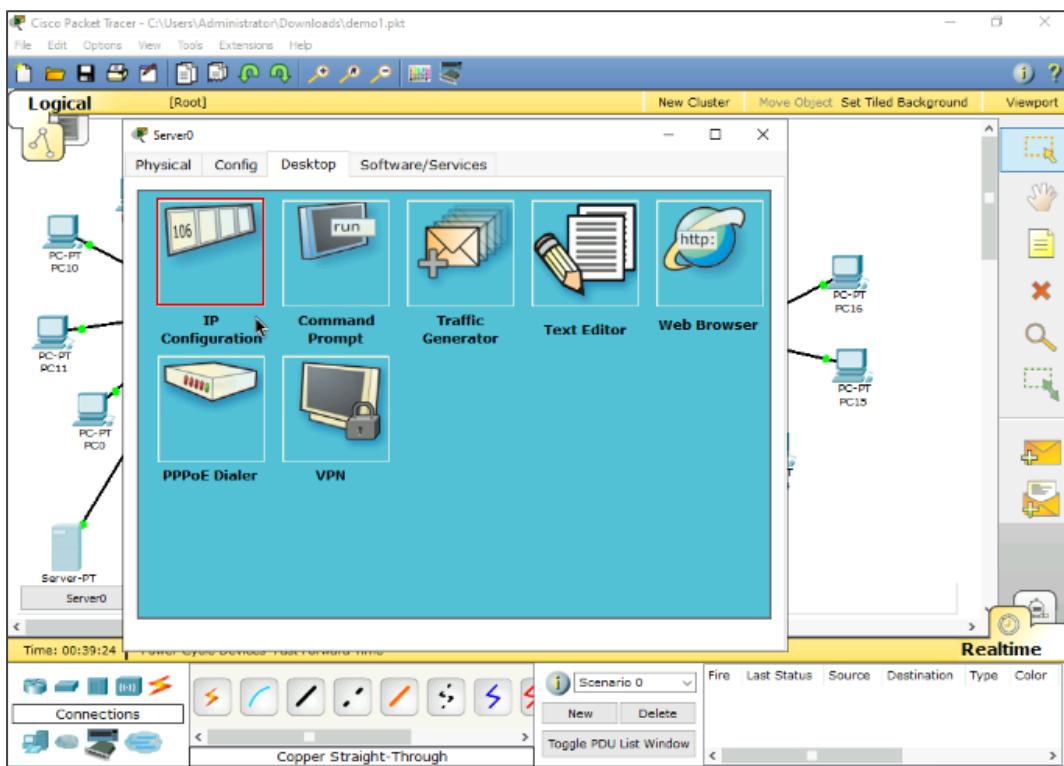
5.14 Navigate back to Packet Tracer and click on Server0



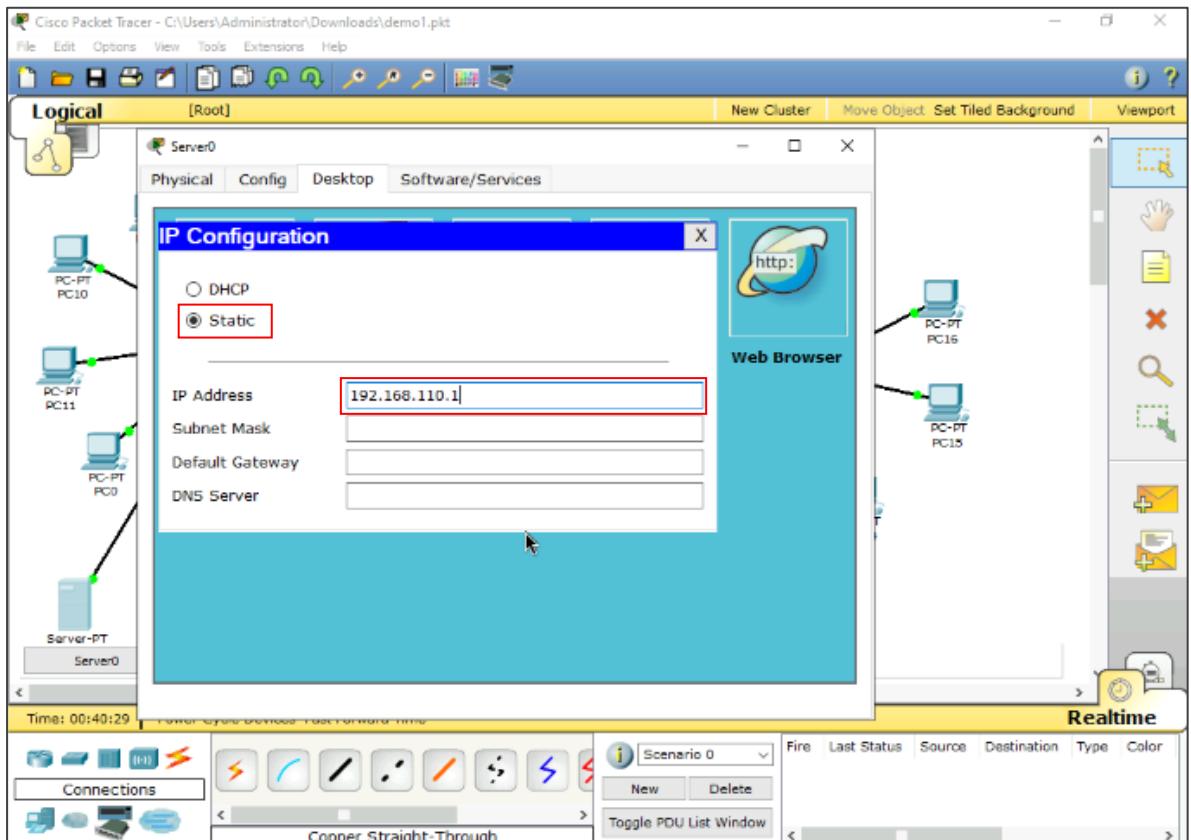
5.15 Select Desktop



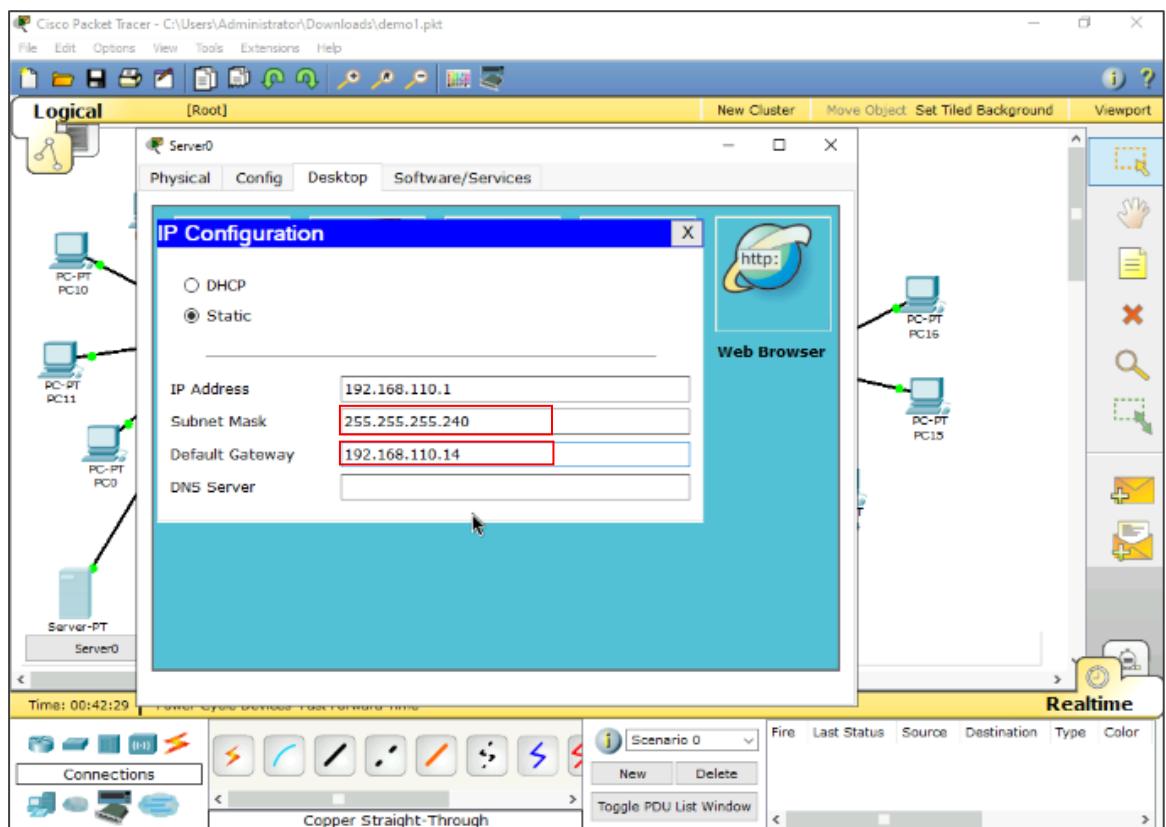
5.16 Click on IP Configuration



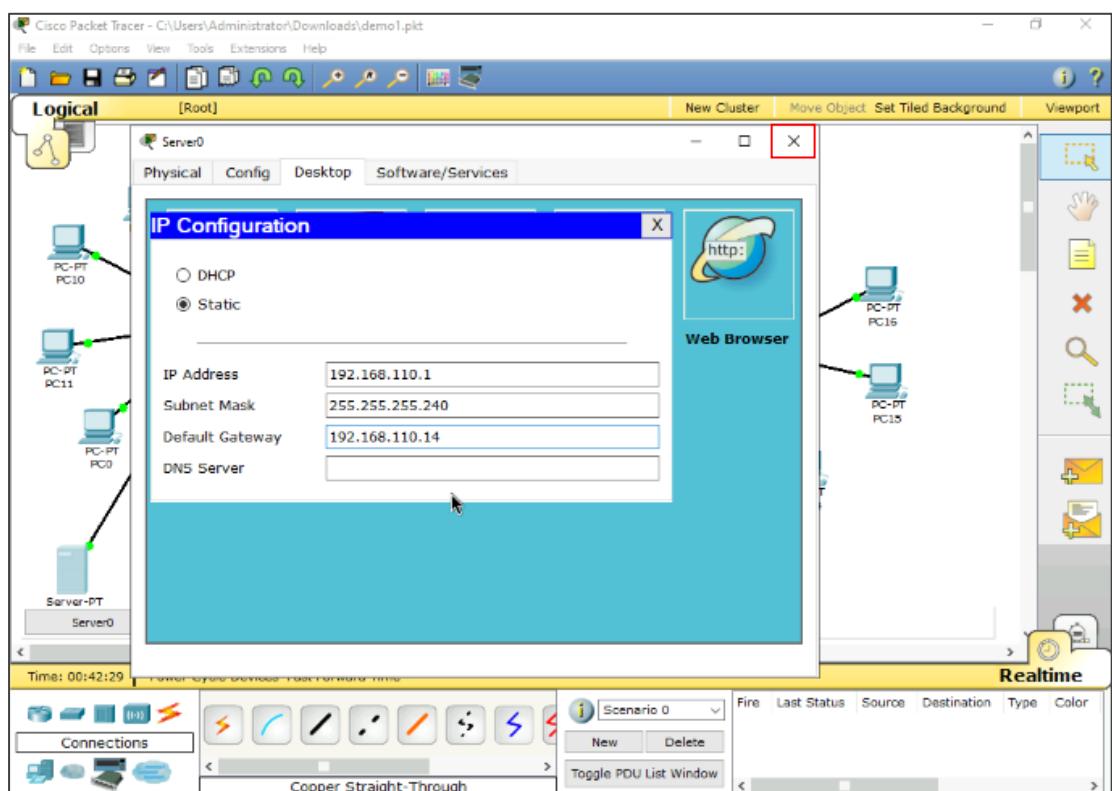
5.17 Select Static and enter 192.168.110.1 as the IP Address



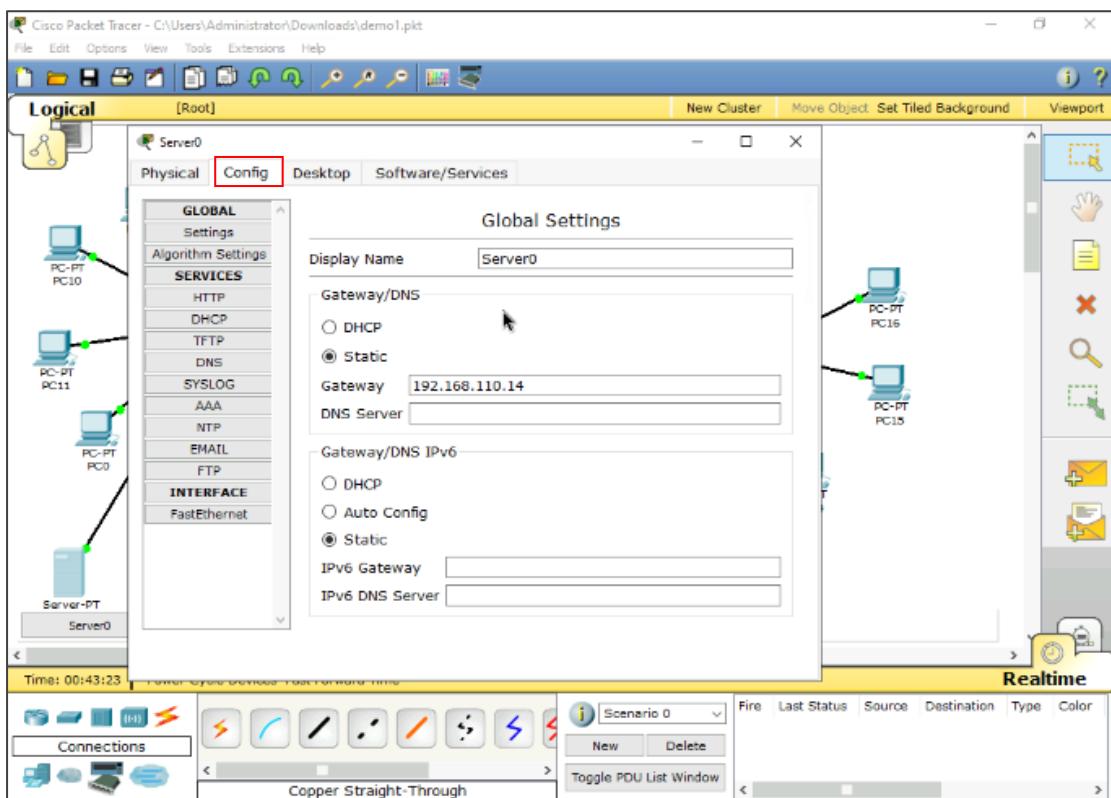
5.18 Enter **255.255.255.240** as Subnet Mask and **192.168.110.14** as Default Gateway



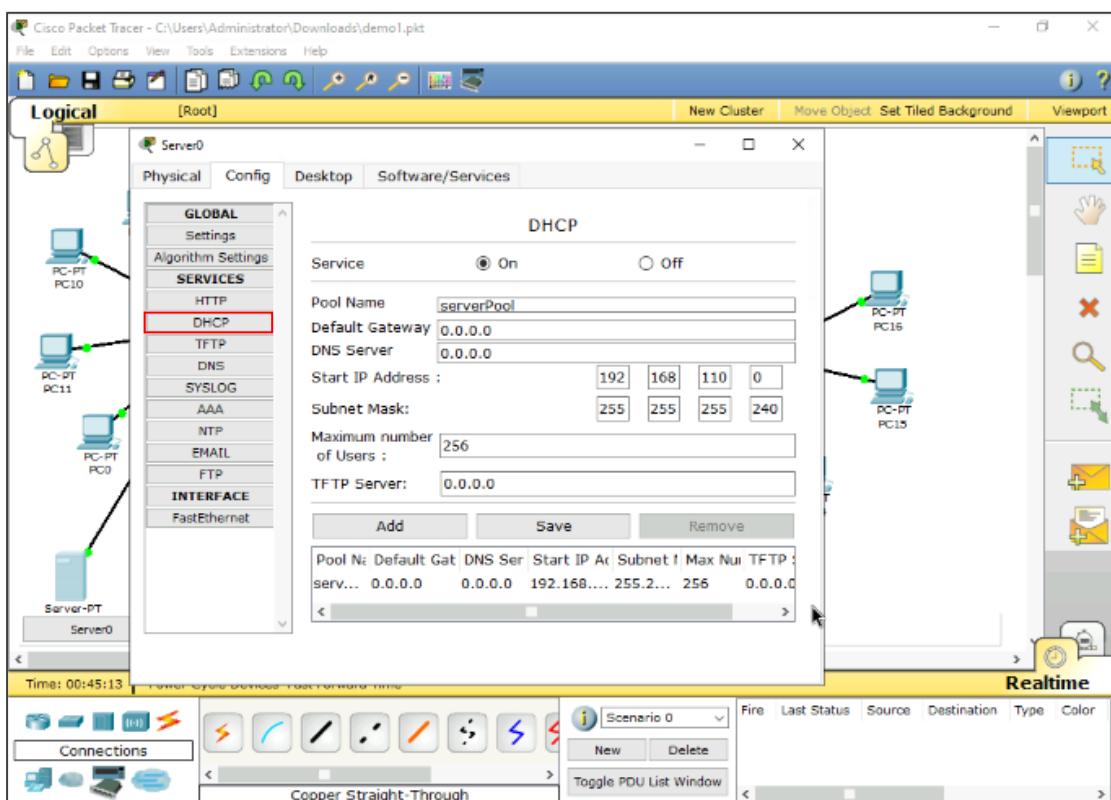
5.19 Click on Close icon



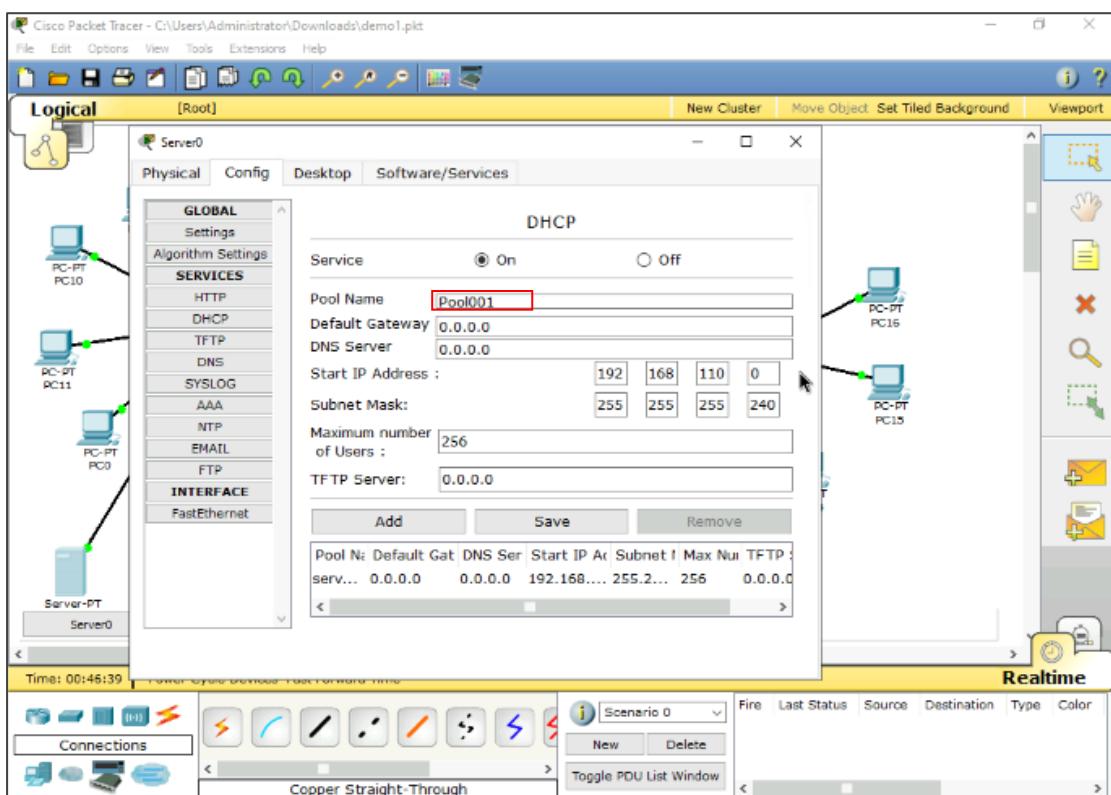
5.20 Click on Config tab



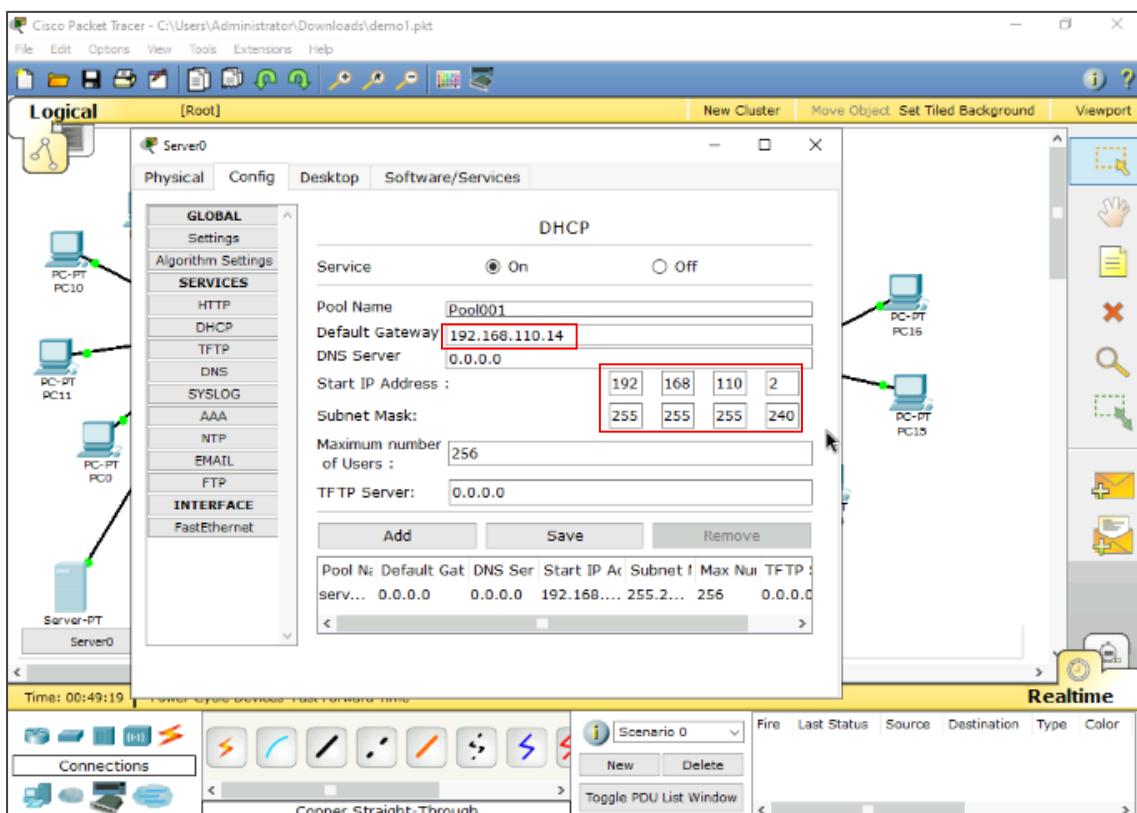
5.21 Select DHCP



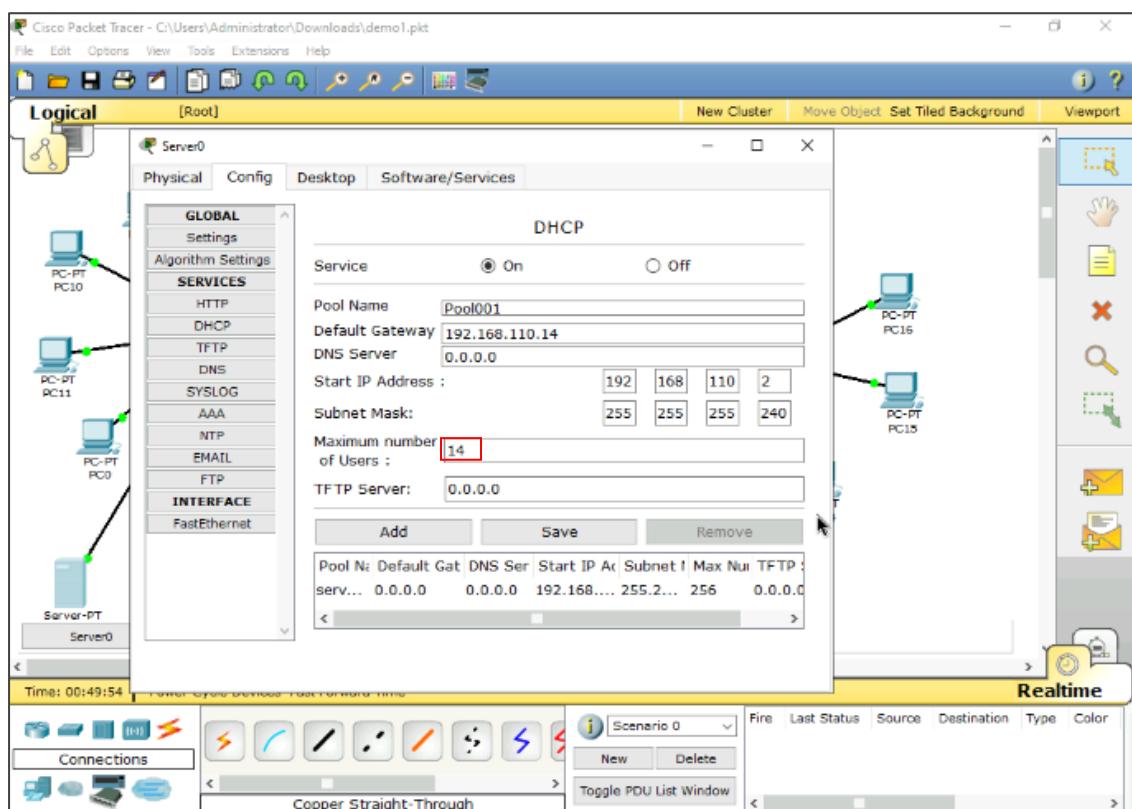
5.22 Enter Pool001 as Pool Name



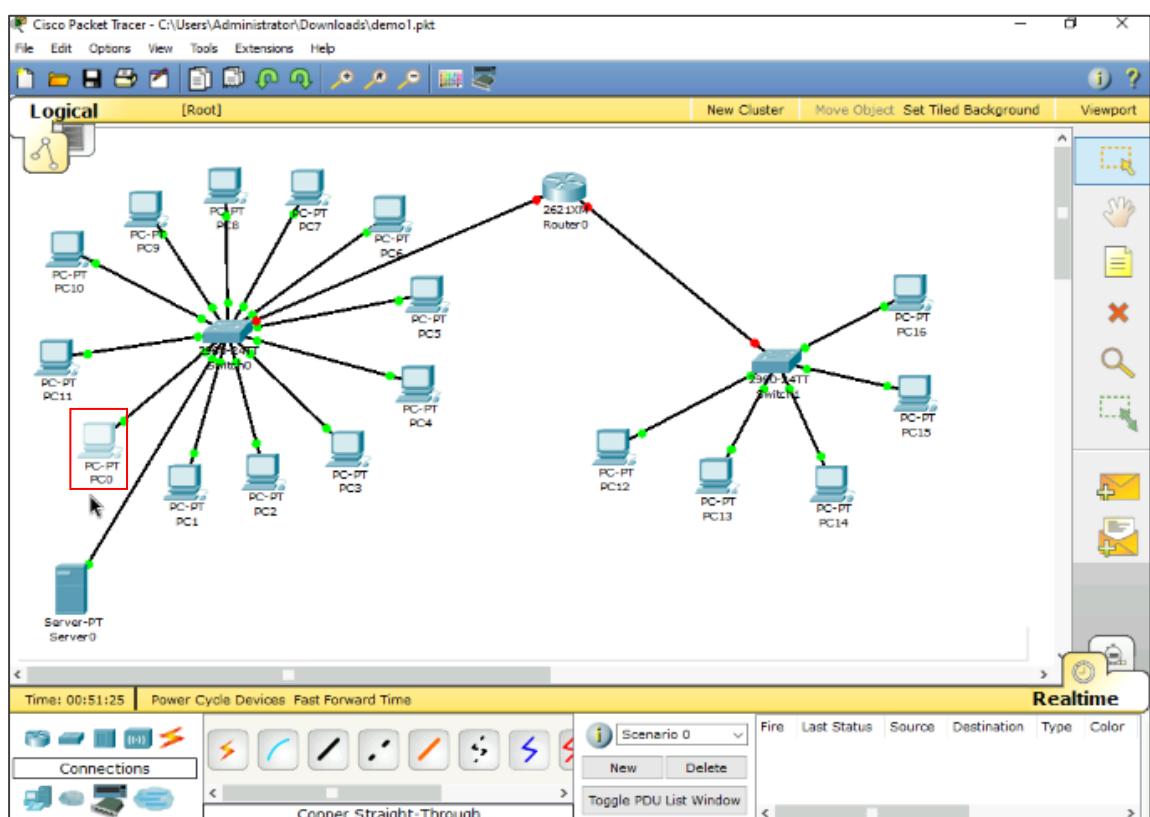
5.23 Enter 192.168.110.14 as Default Gateway, 192.168.110.2 as Start IP Address, and 255.255.255.240 as Subnet Mask



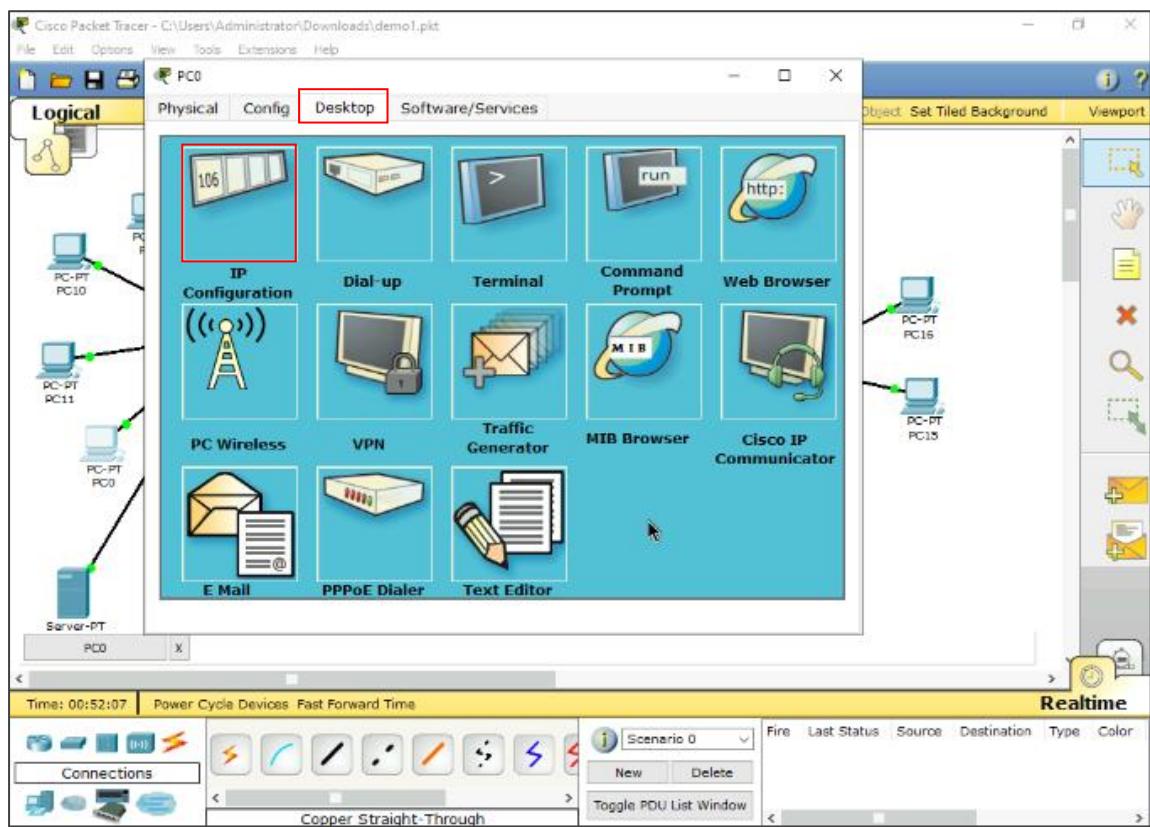
5.24 Enter 14 as Maximum number of Users



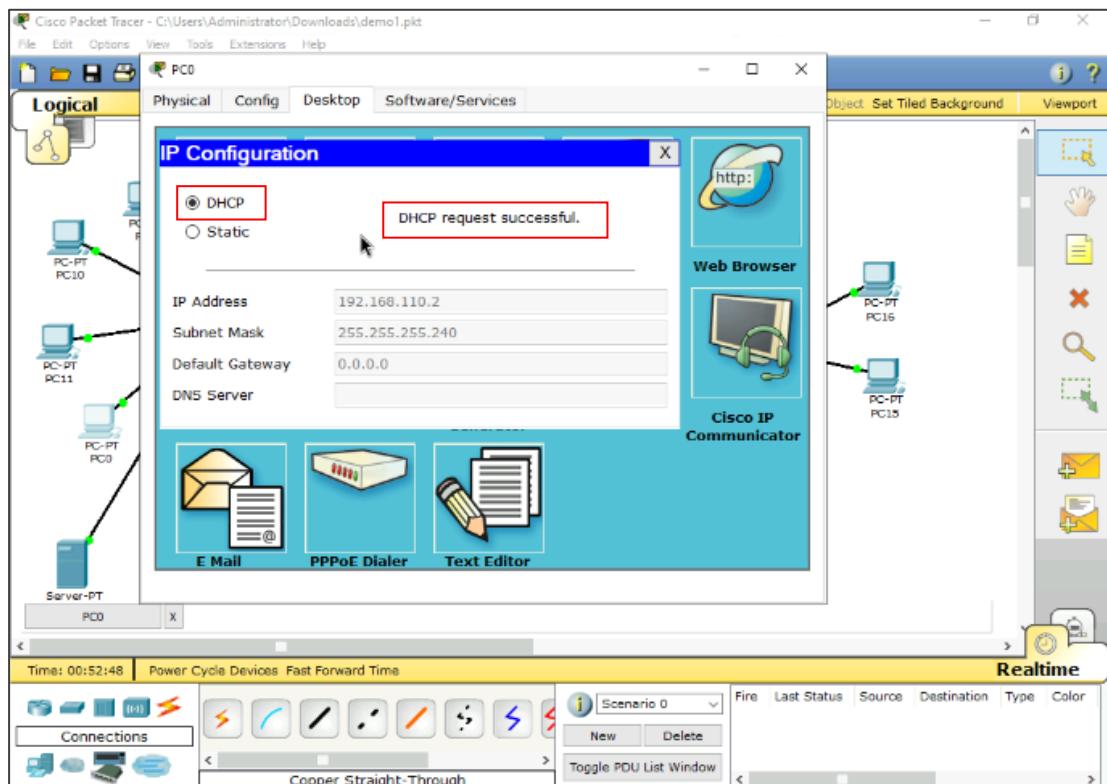
5.25 Navigate back to the main screen and click on PC0



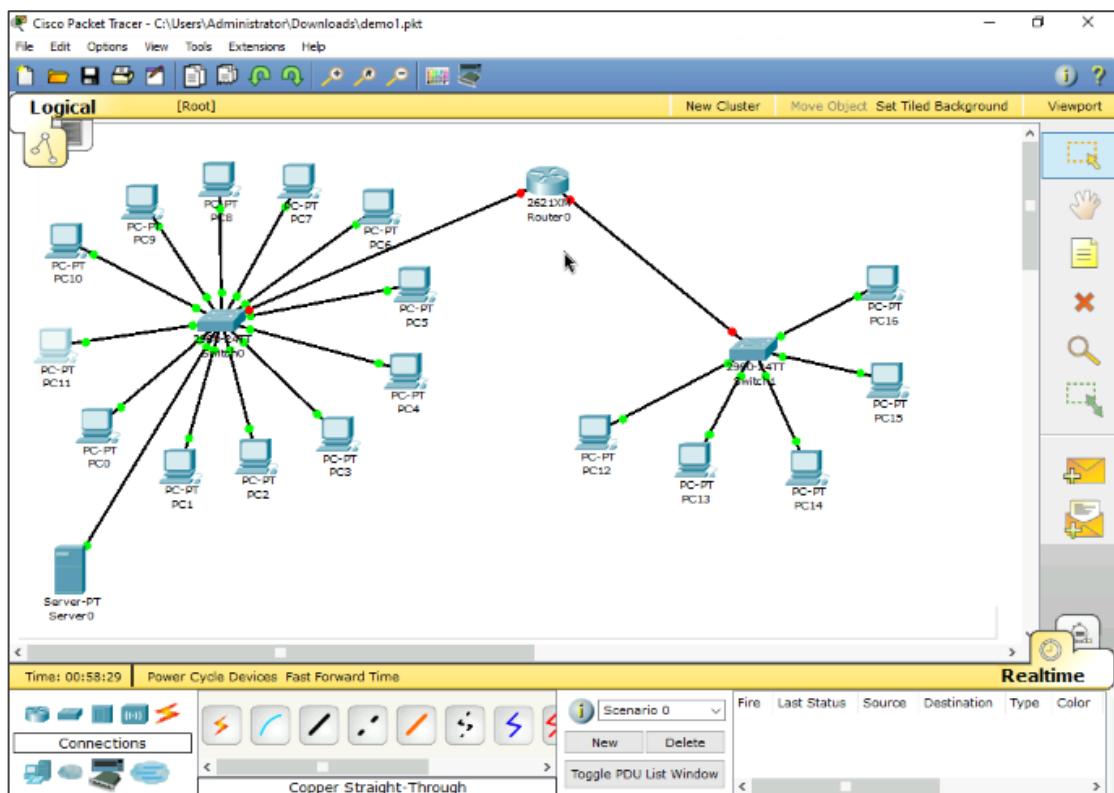
5.26 Select Desktop and click on IP Configuration



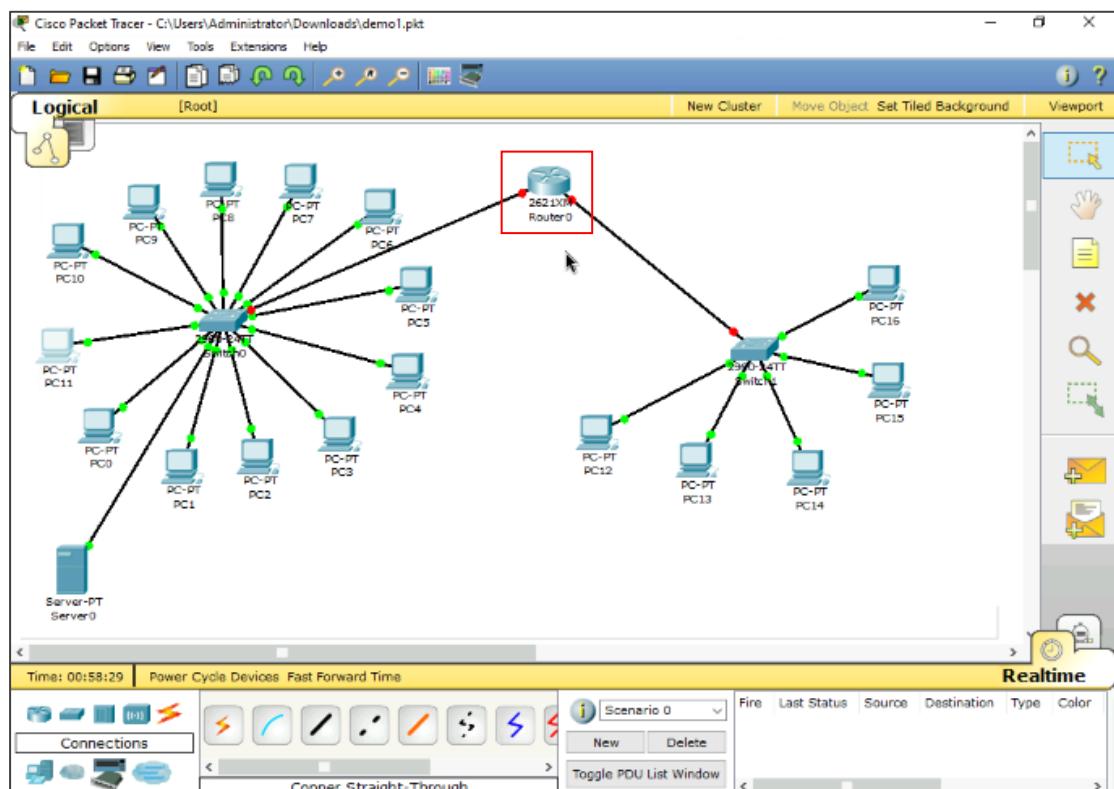
5.27 Select DHCP and confirm the successful request message



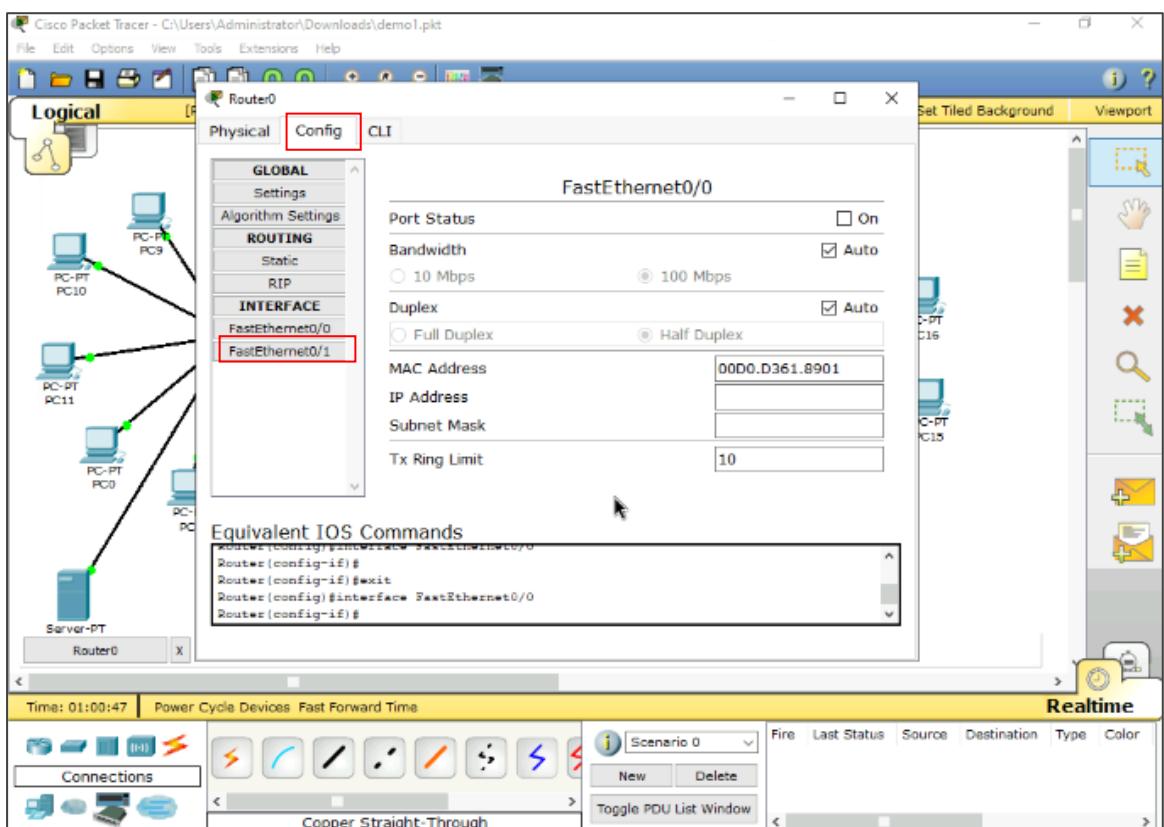
5.28 Repeat **step 5.26** and **step 5.27** for the remaining 10 PCs (PC1 – PC11)



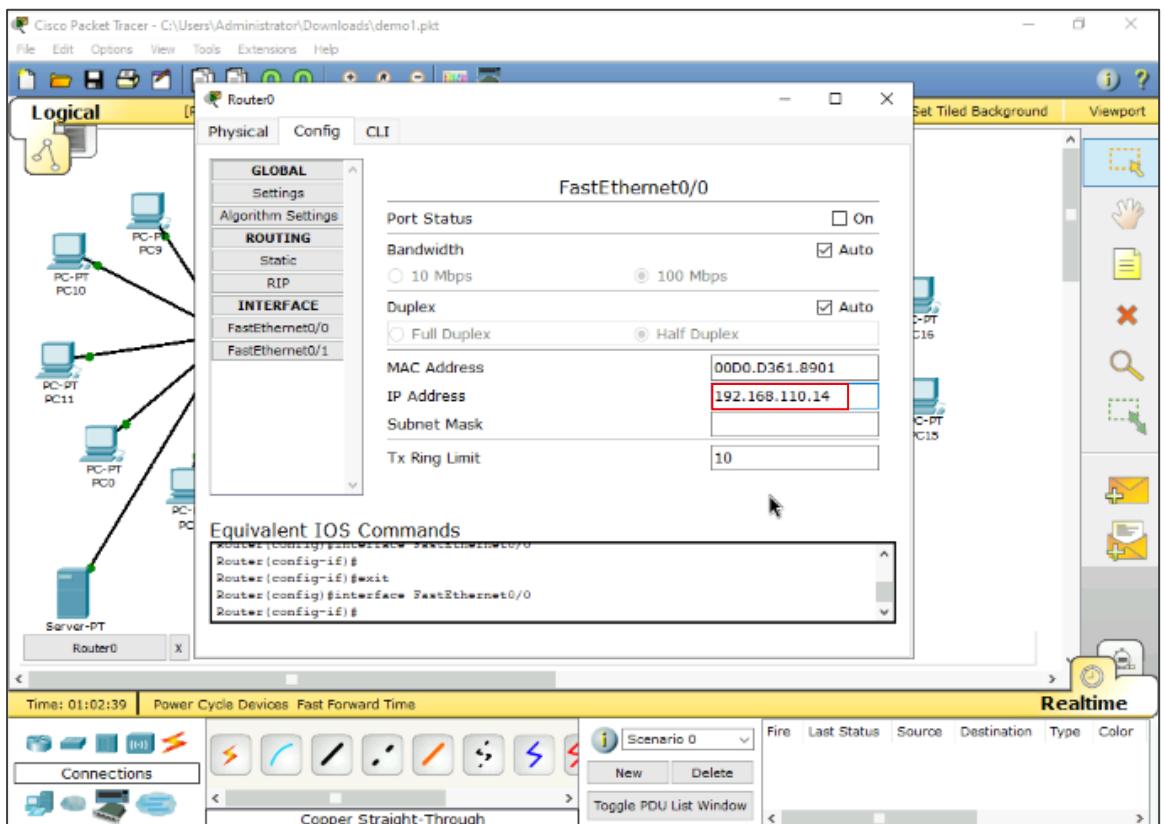
5.29 Click on Router0



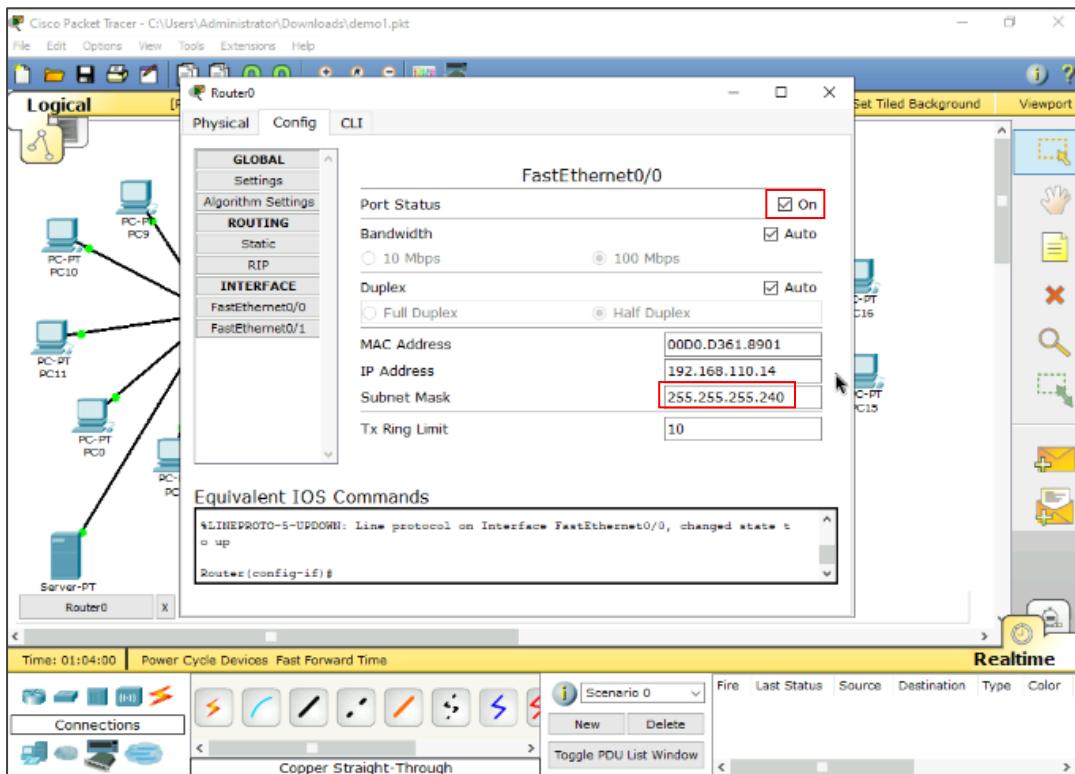
5.30 Select Config and click on FastEthernet0/0



5.31 Enter 192.168.110.14 as IP Address



5.32 Enter 255.255.255.240 as Subnet Mask and enable Port Status



Step 6: Configure DHCP and IP address

6.1 In the browser, paste the link given below and press enter:

<https://www.calculator.net/ip-subnet-calculator.html>

The screenshot shows the IP Subnet Calculator page on calculator.net. It features two main calculators: IPv4 Subnet Calculator and IPv6 Subnet Calculator. The IPv4 calculator has fields for Network Class (Any), Subnet (255.255.255.252 /30), and IP Address (52.172.198.40). The IPv6 calculator has fields for Prefix Length (/64) and IP Address (2001:db8:85a3:8a2e:370:7334). To the right, there is a sidebar titled 'Other Calculators' listing various tools like Age, Date, Time, Hours, GPA, Grade, Height, Concrete, IP Subnet, Bra Size, Password Generator, Dice Roller, Conversion, and More Other Calculators. Navigation links at the bottom include Financial, Fitness and Health, Math, and Other.

6.2 Select 255.255.255.248/29 as Subnet and enter 192.168.120.0 as IP Address

The screenshot shows a web browser window for the IP Subnet Calculator on [calculator.net](https://www.calculator.net/ip-subnet-calculator.html). The page has a dark blue header with tabs for FINANCIAL, FITNESS & HEALTH, MATH, and OTHER. The OTHER tab is selected. Below the header, there are two calculators: an IPv4 Subnet Calculator and an IPv6 Subnet Calculator. The IPv4 calculator has 'Any' selected as Network Class, '255.255.255.248 /29' in the Subnet field, and '192.168.120.0' in the IP Address field. Both fields are highlighted with a red border. Below these fields are 'Calculate' and 'Clear' buttons. To the right of the calculators is a sidebar titled 'Other Calculators' with links like Age, Time, GPA, Height, IP Subnet, Password Generator, Conversion, Date, Hours, Grade, Concrete, Bra Size, Dice Roller, More Other Calculators, Financial, Fitness and Health, Math, and Other.

6.3 Click on Calculate

This screenshot shows the same web browser window after the 'Calculate' button was clicked. The IP Address field now contains '192.168.120.0/29'. The rest of the interface remains the same, including the other calculator section and the sidebar with various other calculators.

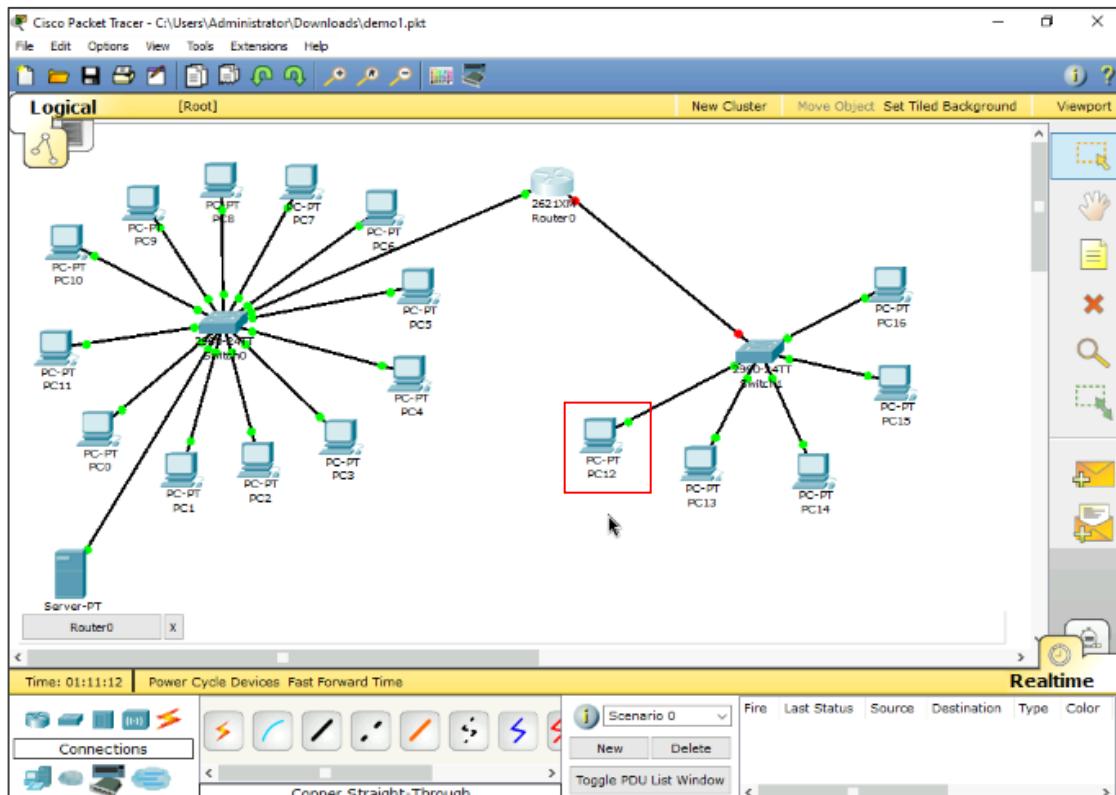
6.4 Review the Usable Host IP range, Number of Usable Hosts, and Subnet mask from the output

The screenshot shows the 'IP Subnet Calculator' page on calculator.net. The results are as follows:

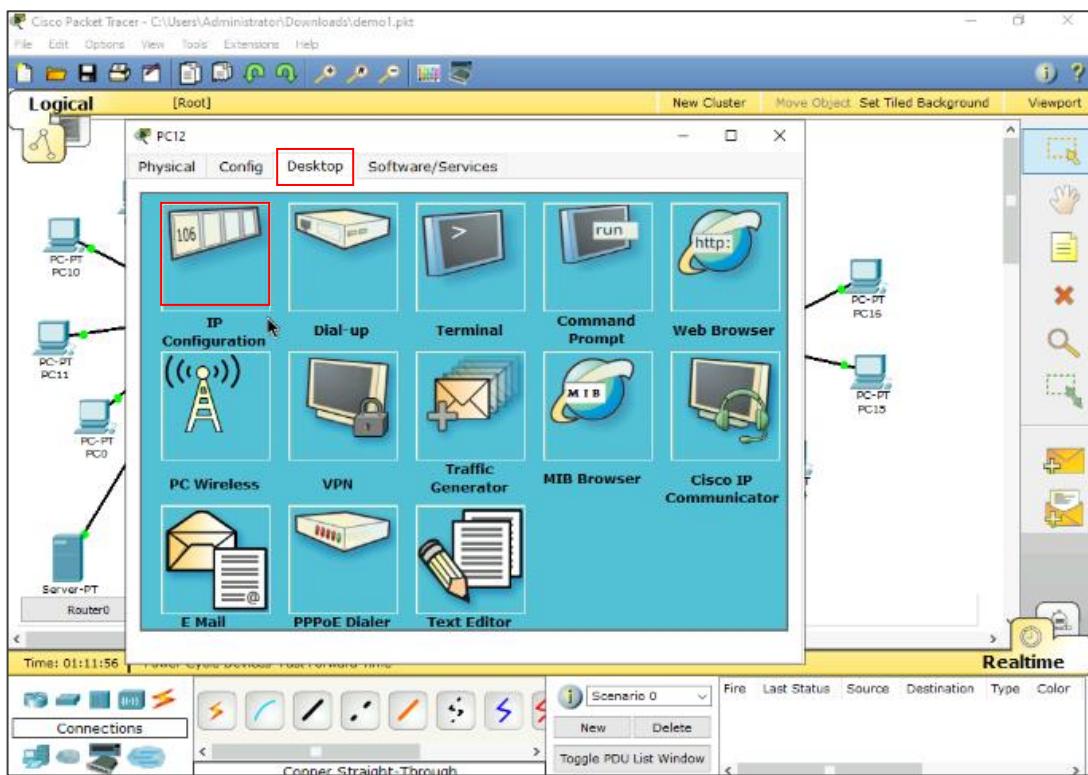
IP Address:	192.168.120.0
Network Address:	192.168.120.0
Usable Host IP Range:	192.168.120.1 - 192.168.120.6
Broadcast Address:	192.168.120.7
Total Number of Hosts:	8
Number of Usable Hosts:	6
Subnet Mask:	255.255.255.248
Wildcard Mask:	0.0.0.7
Binary Subnet Mask:	11111111.11111111.11111111.11111000
IP Class:	C
CIDR Notation:	/29
IP Type:	Private
Short:	192.168.120.0 /29

A sidebar for 'SystoByte' offers system design practice with AI-powered feedback.

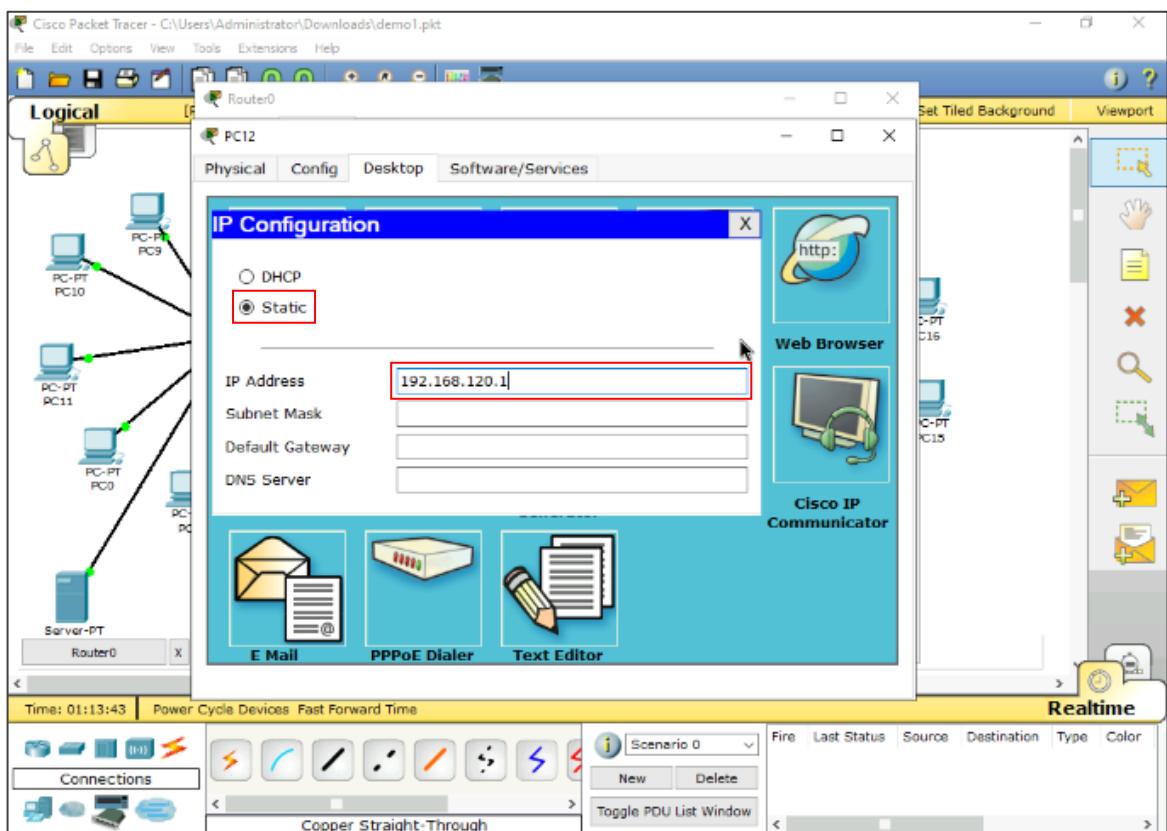
6.5 Navigate back to Packet Tracer and click on PC12



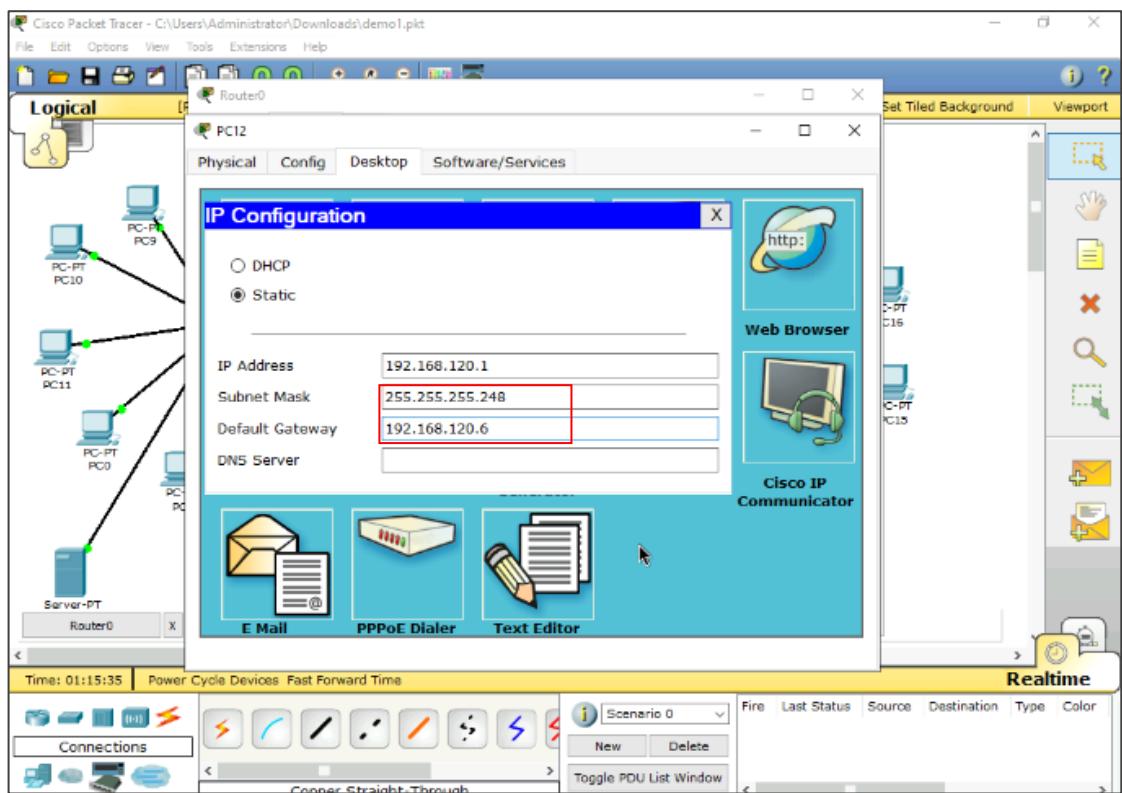
6.6 Select Desktop and click on IP Configuration



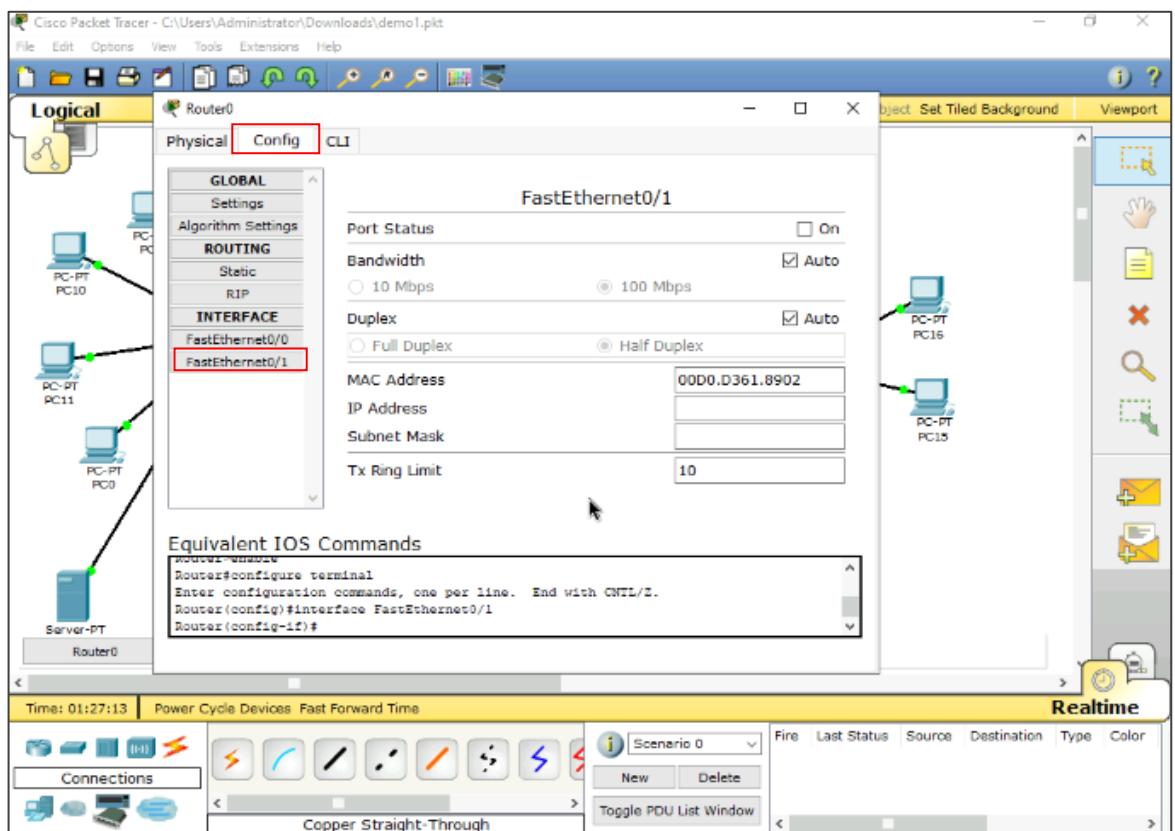
6.7 Select Static and enter 192.168.120.1 as the IP Address



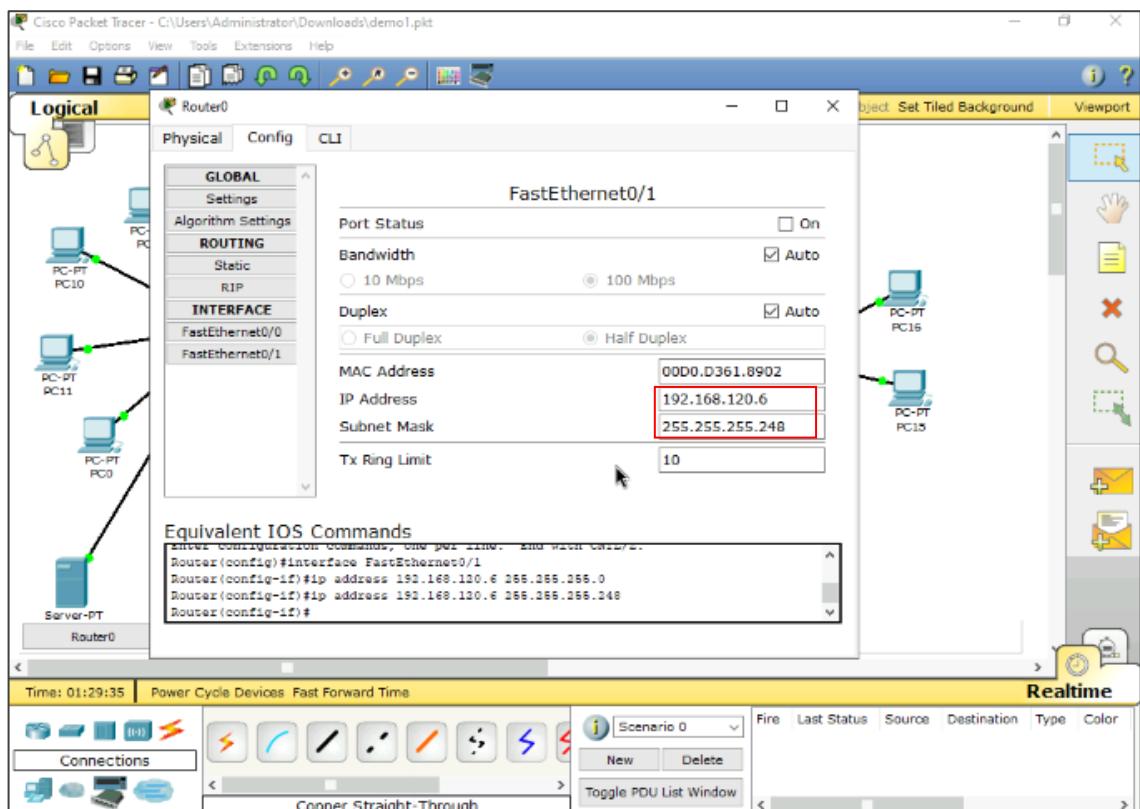
6.8 Enter 255.255.255.248 as Subnet Mask and 192.168.120.6 as Default Gateway



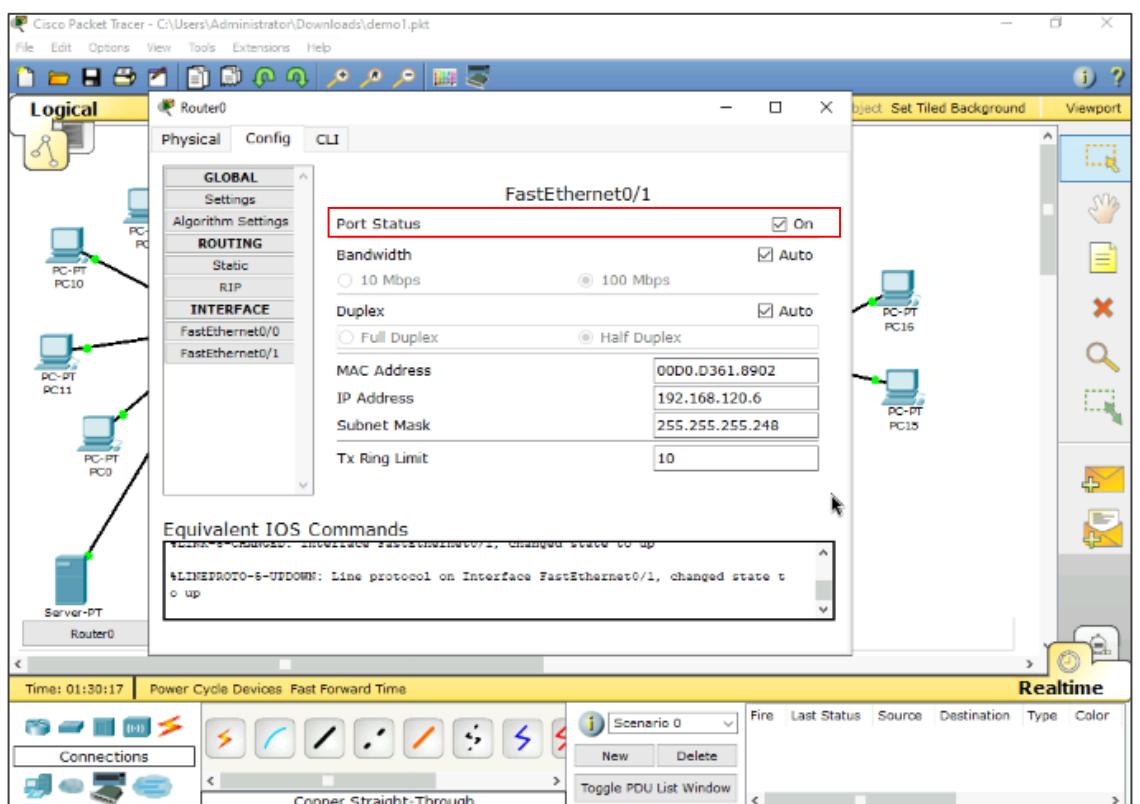
6.9 Click on Config tab and select FastEthernet0/1



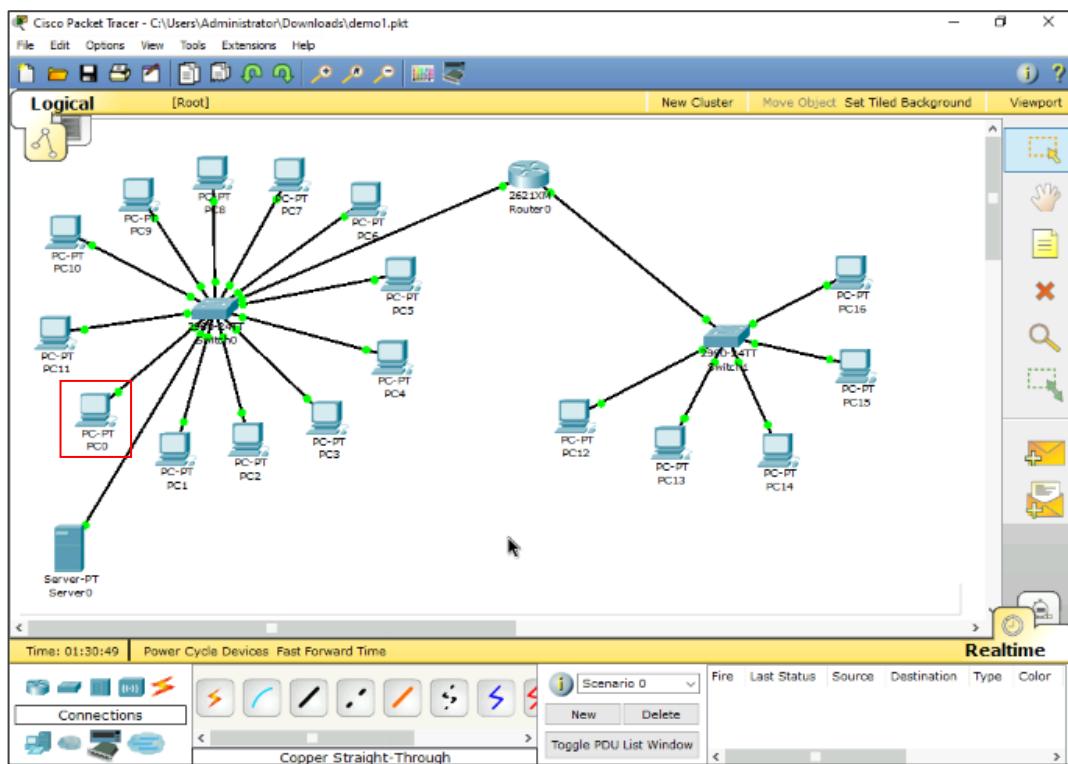
6.10 Enter 192.168.120.6 as IP Address and 255.255.255.248 as Subnet Mask



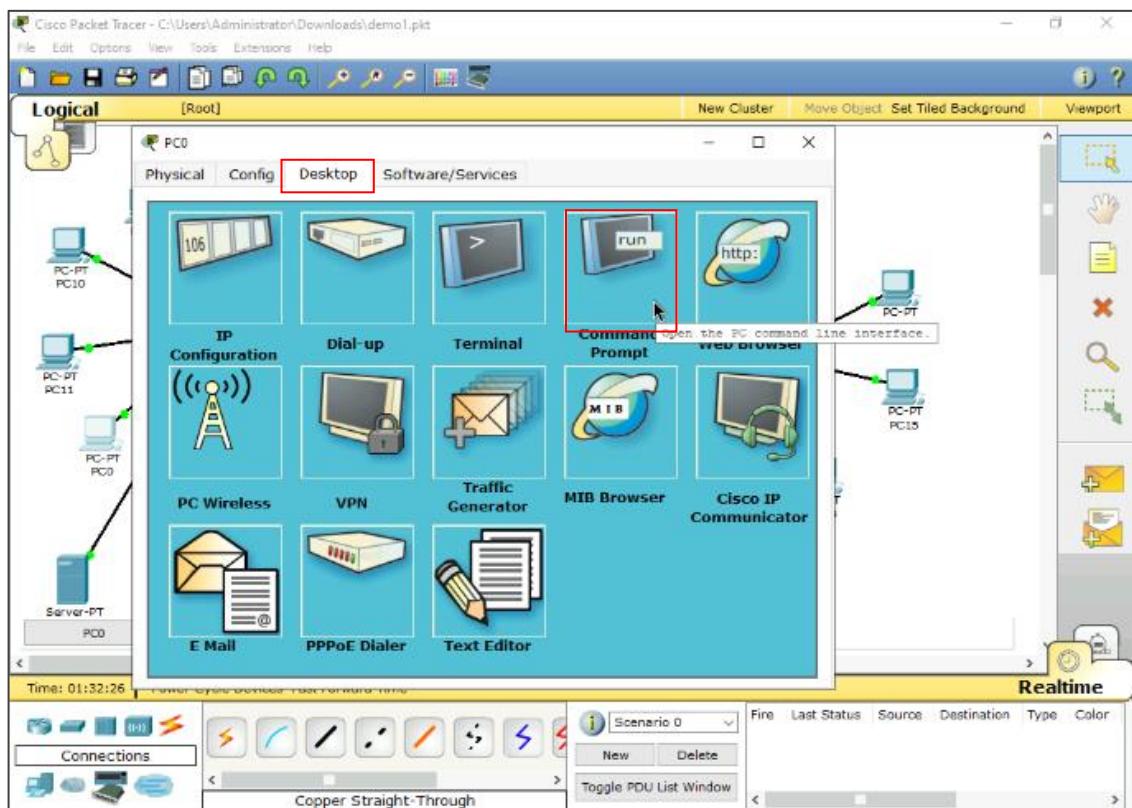
6.11 Enable Port Status



6.12 Click on PC0

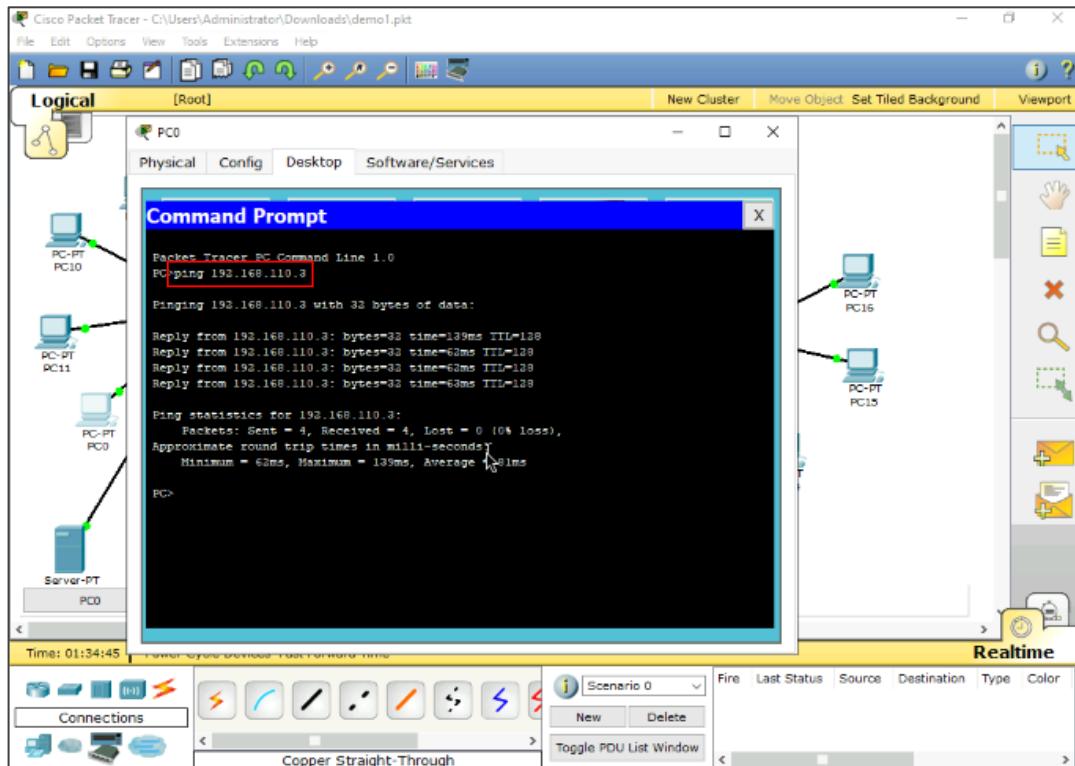


6.13 Select Desktop and click on Command Prompt



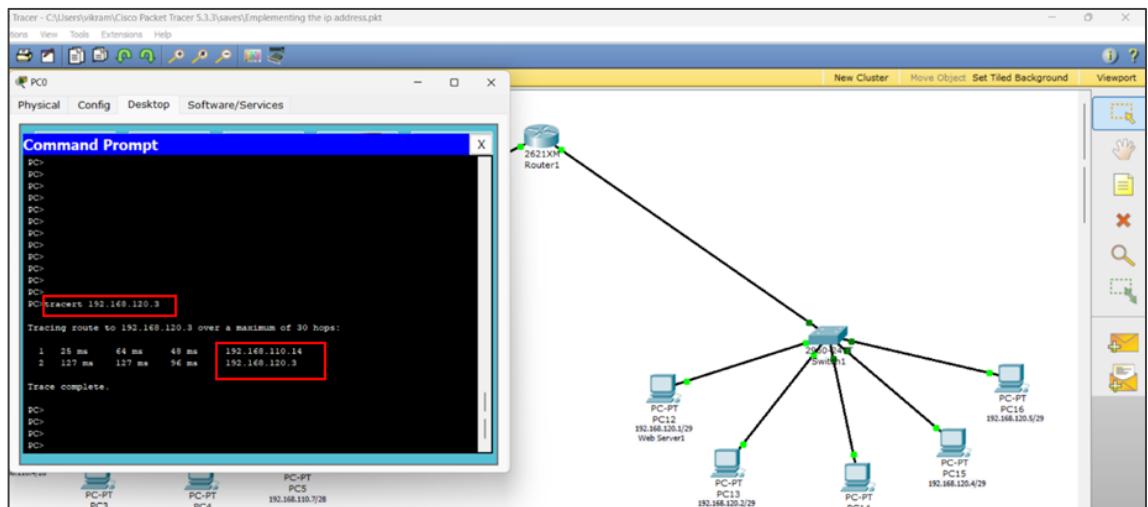
6.14 Run the following command:

ping 192.168.110.3

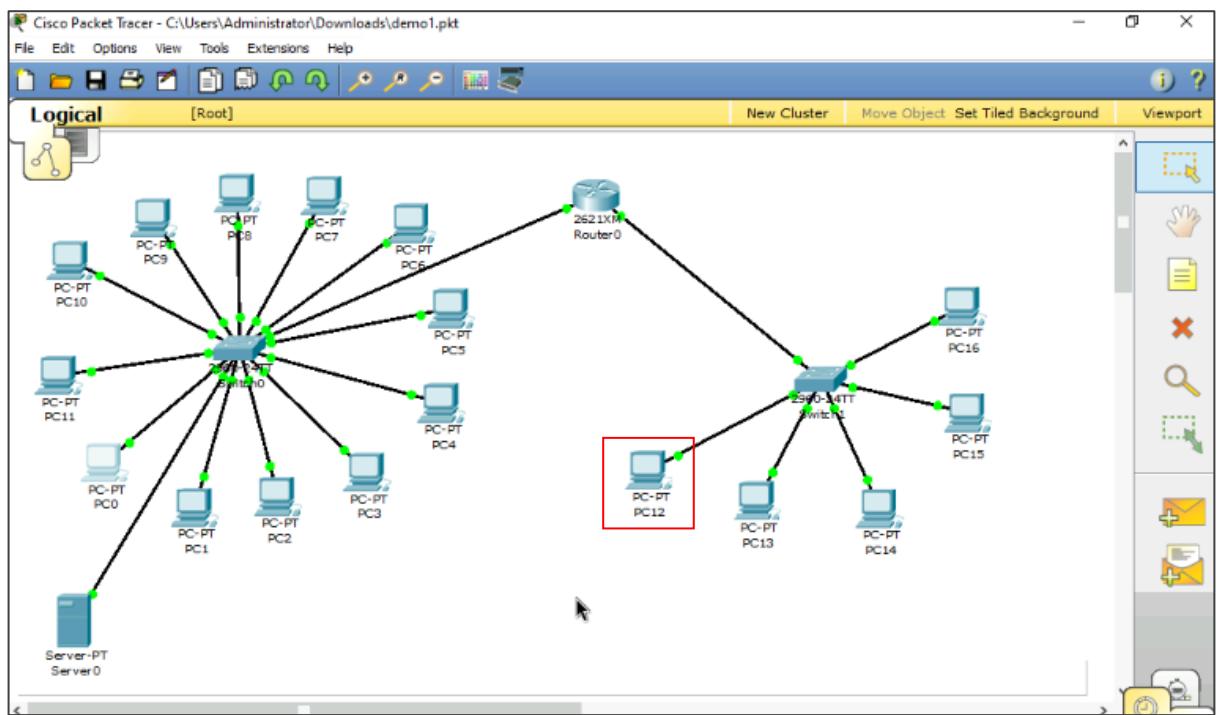


6.15 Run the following command to see the route:

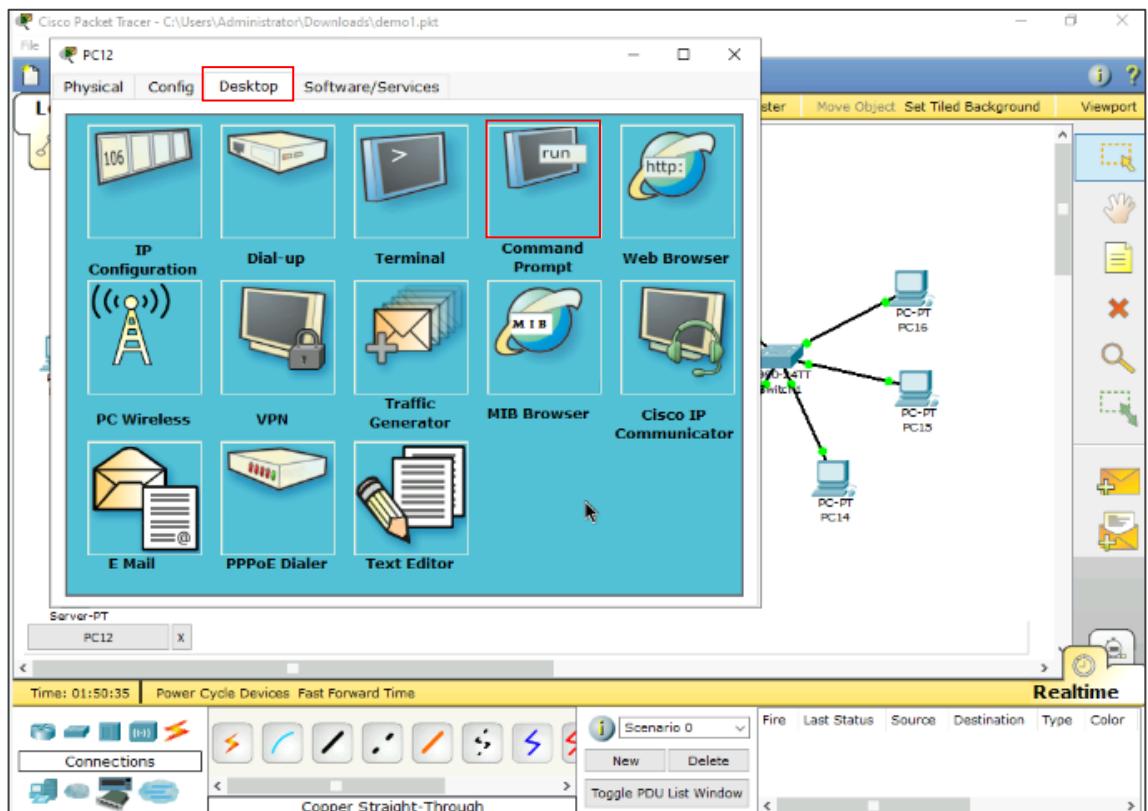
tracert 192.168.120.3



6.16 Click on PC12



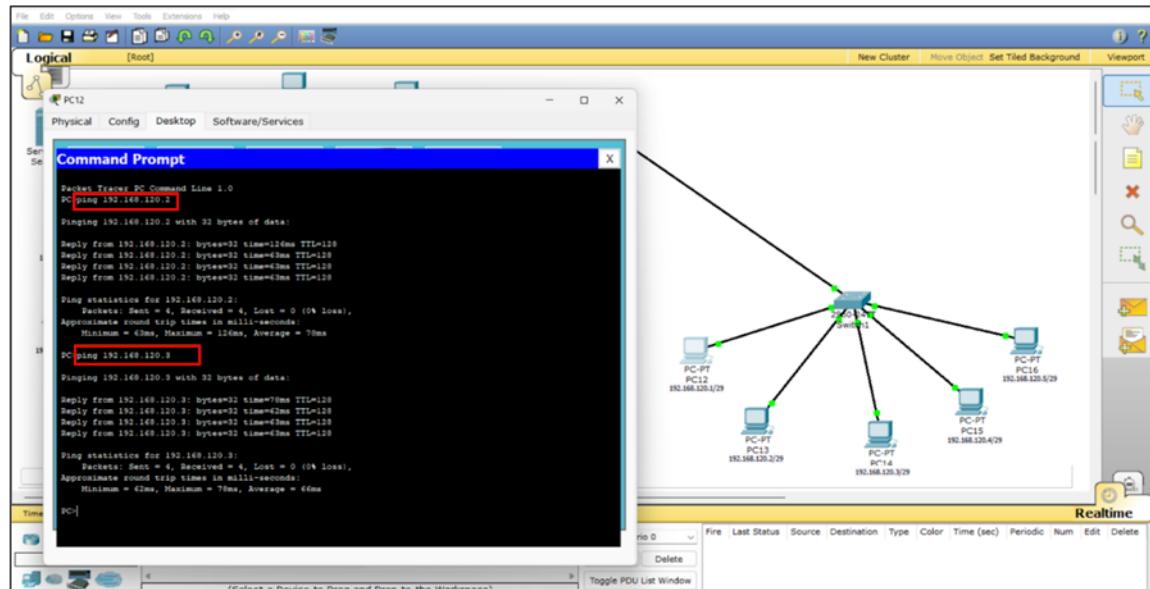
6.17 Select Desktop and click on Command Prompt



6.18 Run the following commands:

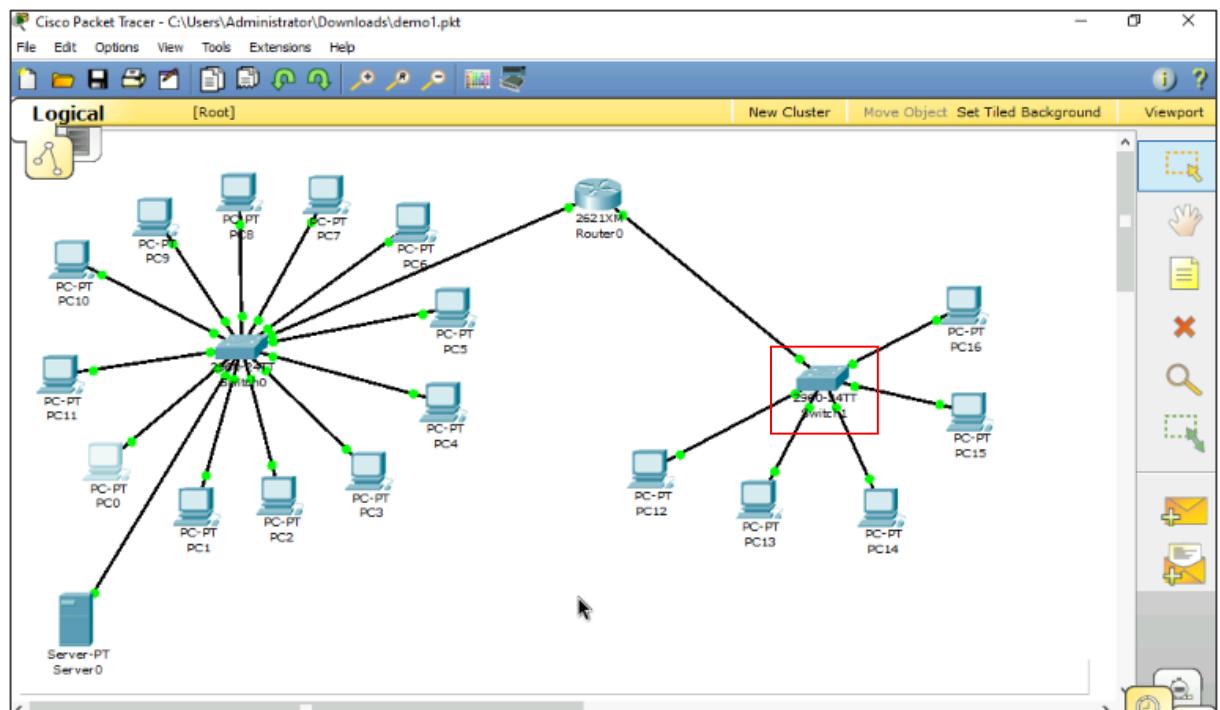
ping 192.168.120.2

ping 192.168.120.3

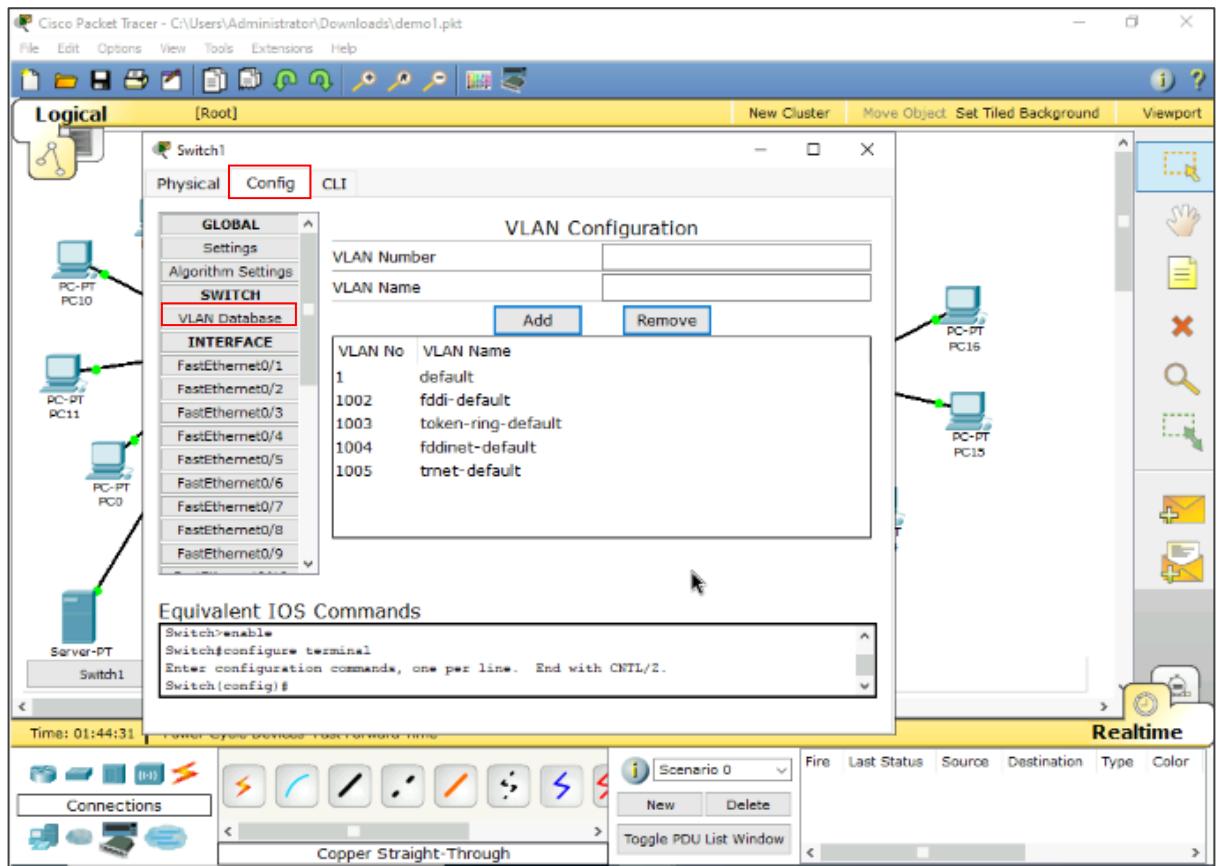


Step 7: Test and validate

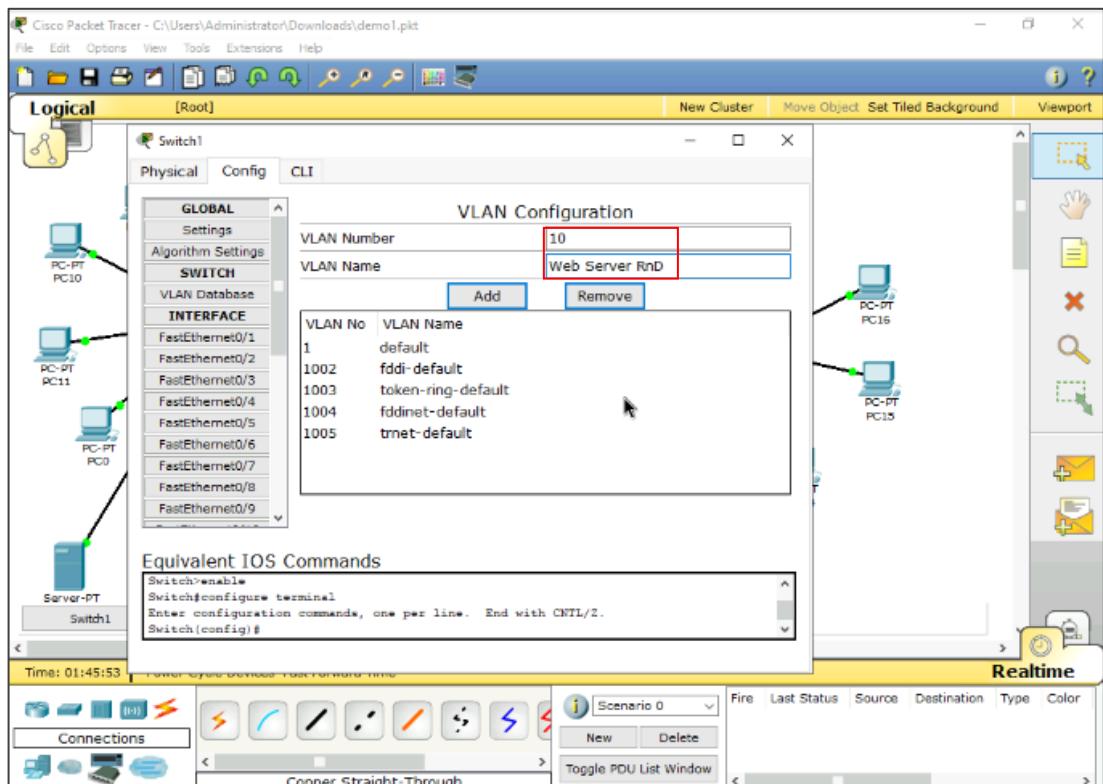
7.1 Click on Switch1



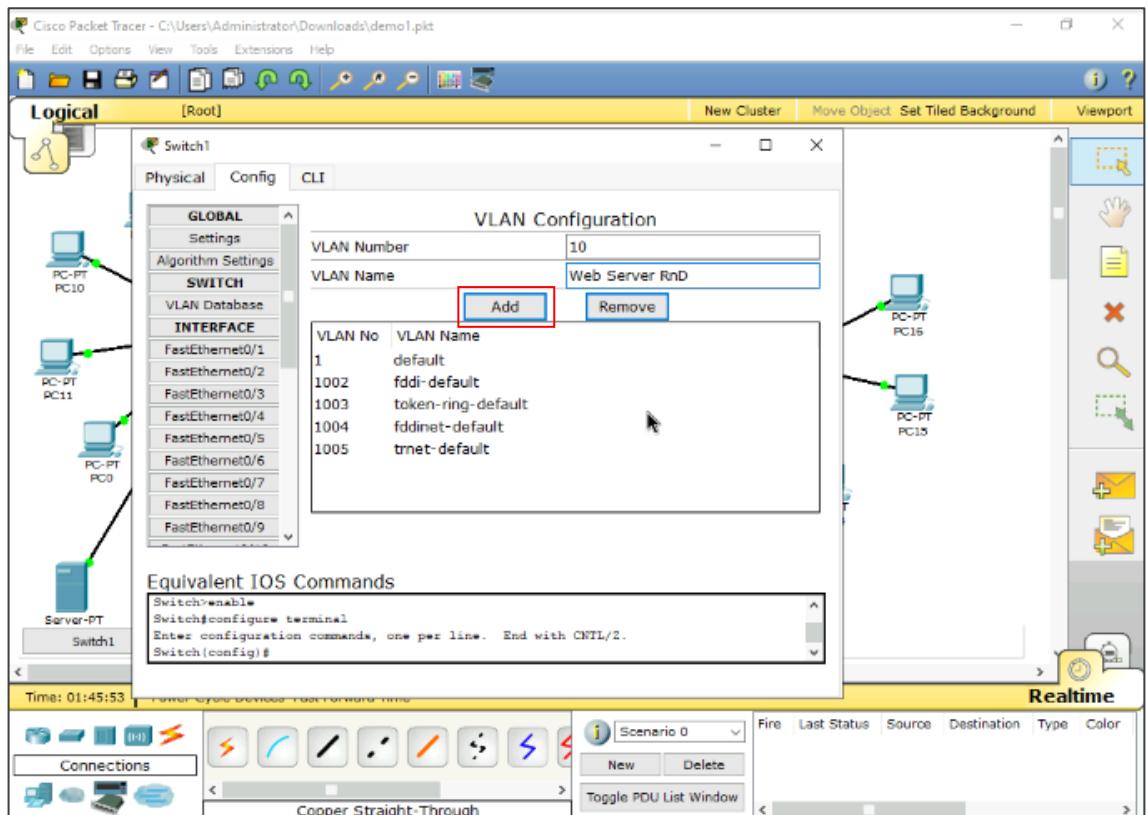
7.2 Select Config and click on VLAN Database



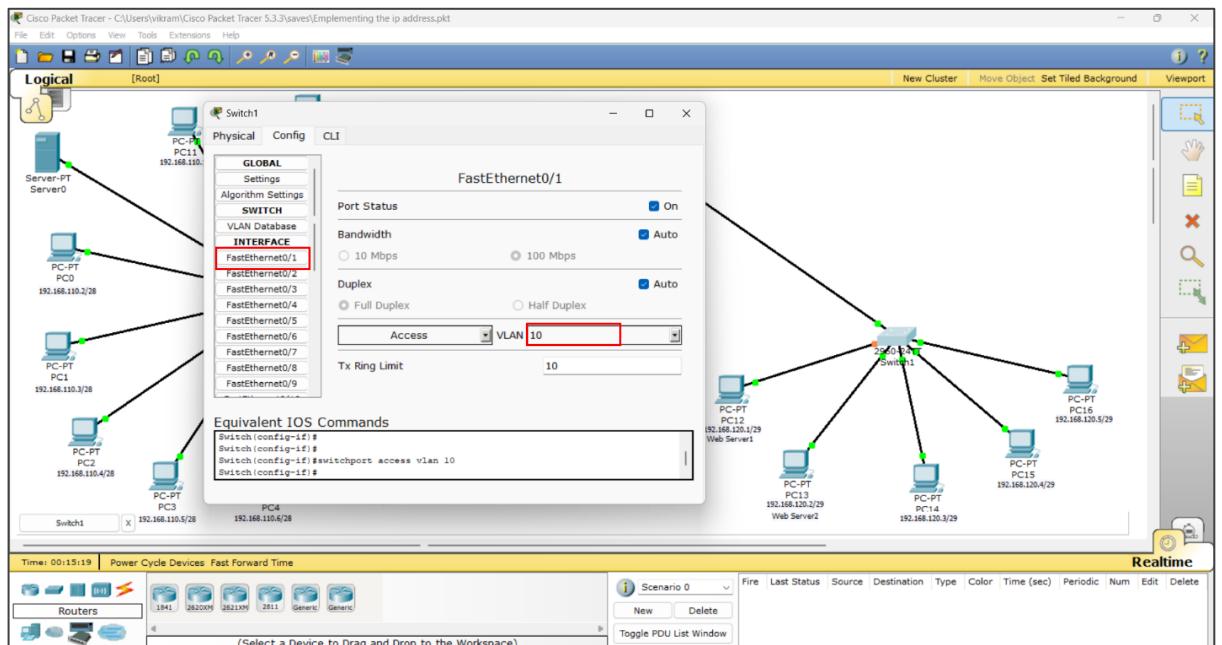
7.3 Enter 10 in VLAN Number and Web Server RnD in VLAN Name



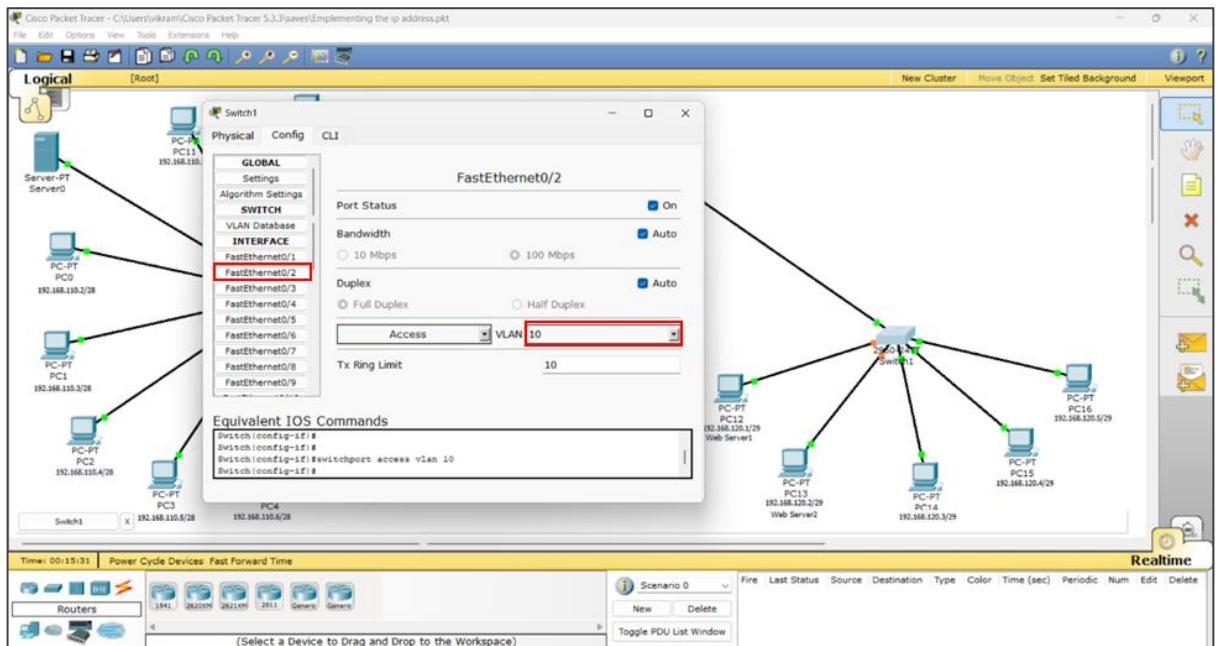
7.4 Click on Add



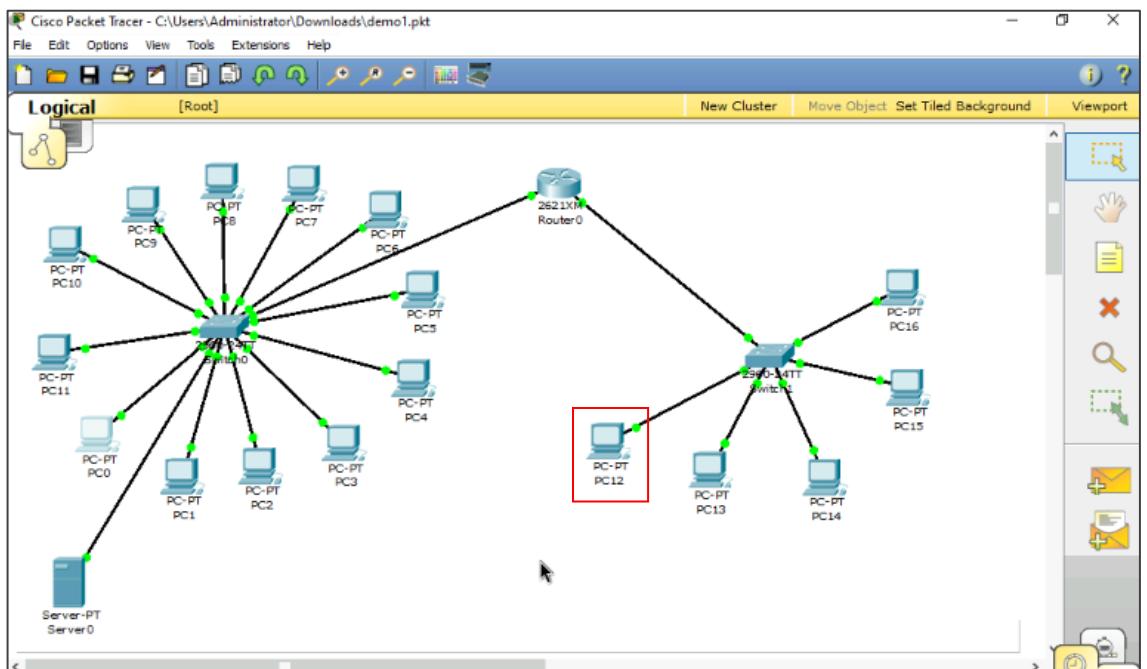
7.5 Navigate to FastEthernet0/1 and select 10 in the VLAN field



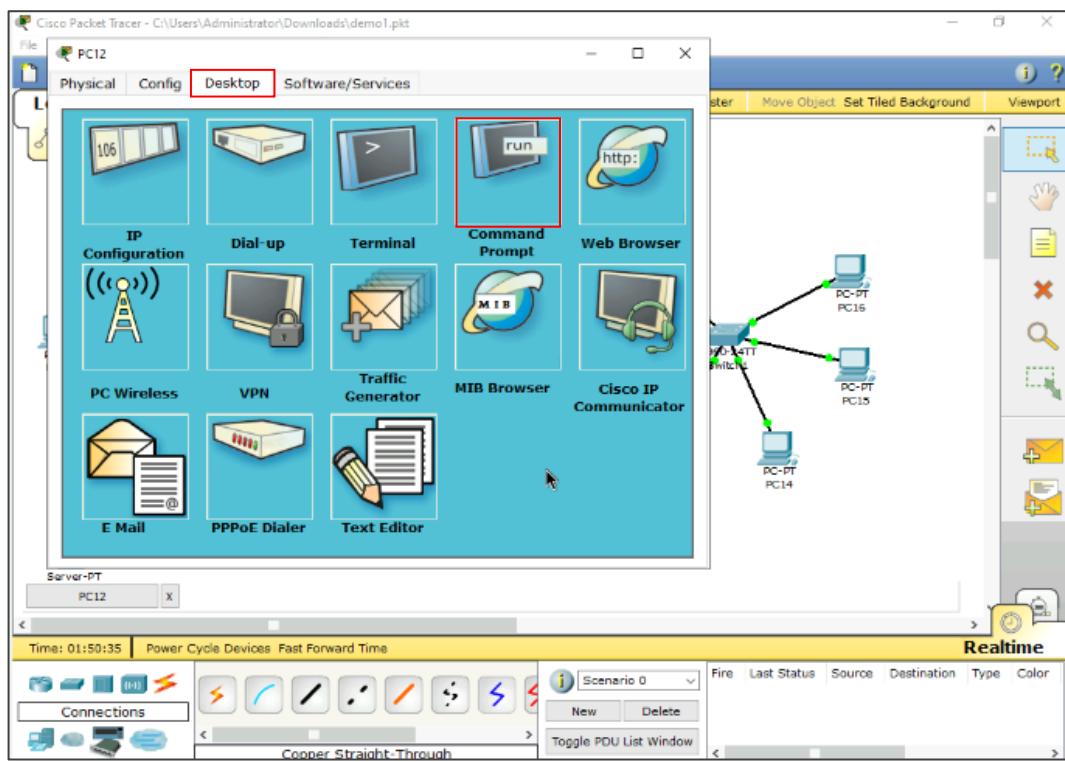
7.6 Navigate to FastEthernet0/2 and select 10 in the VLAN field



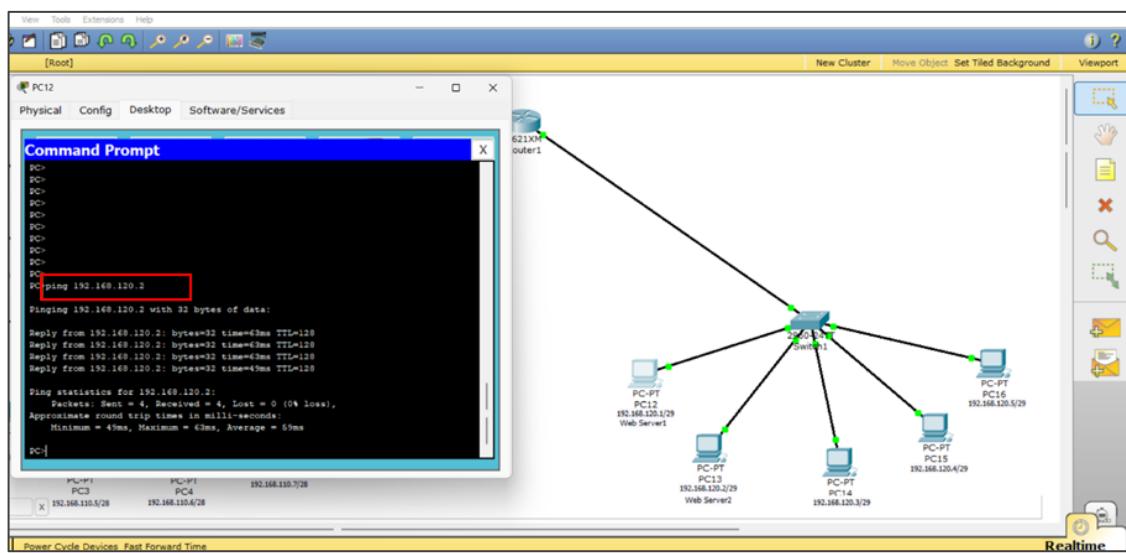
7.7 Click on PC12



7.8 Select Desktop and click on Command Prompt



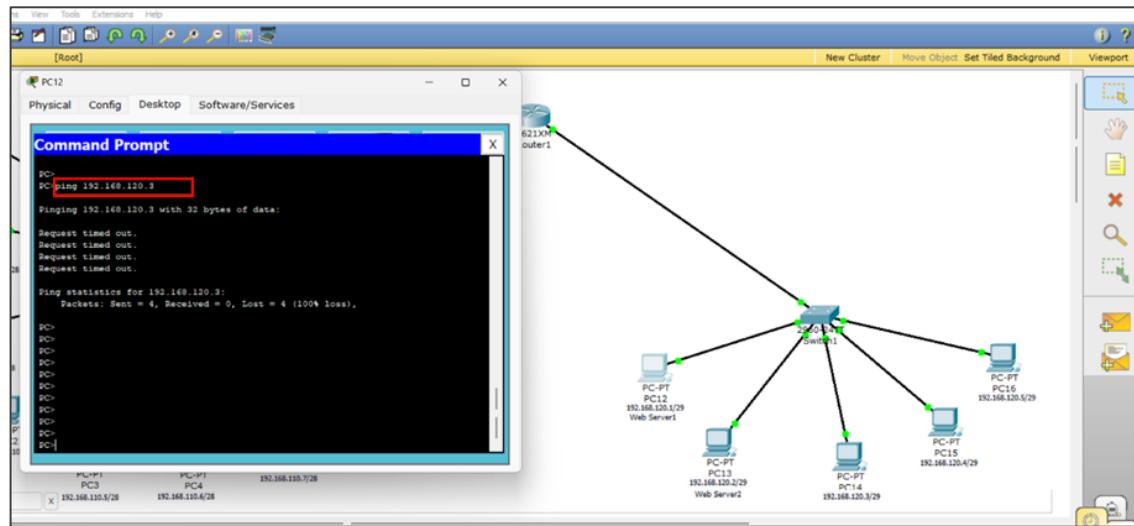
7.9 Run the following command:
ping 192.168.120.2



Note: Both are in the same VLAN, allowing them to ping each other.

7.10 Run the following command:

ping 192.168.120.3



Note: They are in different VLANs, so they will not be able to ping each other.

By following the above steps, you have successfully configured a secure network segmentation and VLAN isolation in Cisco Packet Tracer. This process involved the setup of a 14-node network, a 6-node network, and the integration of both networks using a router to ensure seamless communication.