Topic	Working with Router
Class Description	Student will learn about the working of router and how to connect multiple local area networks using router.They will also learn about the default gateway.
Class	**C195**
Class time	**45 mins**
Goal	● Learn about the working of router ● Create Wide area network ● Learn about the default gateway.

Resources Required	● Teacher Resources:
	  ○ Laptop with internet connectivity
	  ○ Cisco Packet Tracer
	  ○ Earphones with mic
	  ○ Notebook and pen
	  ○ Smartphone
	
	● Student Resources:
	  ○ Laptop with internet connectivity
	  ○ Cisco Packet Tracer
	  ○ Earphones with mic
	  ○ Notebook and pen

Class structure	Warm-Up	5 mins
	Teacher - led Activity 1	15 mins
	Student - led Activity 1	20 mins
	Wrap-Up	5 mins

WARM UP SESSION - 5mins	
CONTEXT ● **Connecting Lan Network with Router.**	
Teacher Action	**Student Action**
Hello, How are you? Do you remember what we did in the last session? Yes ,That's great! We have seen how to make LAN using switches. But if we want to connect multiple switches together then we need a router. In this class we are going to learn what is a router and how to connect multiple LANs using a router. Have you seen a router? Very good! Router is a device used to connect to the internet. And nowadays the device which we have at our homes is a combination of switch and router. Because it can connect multiple devices with it such as mobile, laptop, computers etc. And it also connects us with the internet. We will learn about all this in this session. Are you excited?	**ESR**: I am good! **ESR:** We made a Local Area Network using a switch. **ESR:** We use a router to connect with internet. **ESR:** Yes
Click on the **Quiz Time** *button on the bottom right corner of your screen to start the In-Class Quiz.* *A quiz will be visible to both you and the student.*	

QnA Session	
Question	**Answer**

What is a Switch?
   a. A computer
   b. Server
   c. Networking device
   d. Router
	C

Mac address is assigned by:
   a. User
   b. Computer
   c. Manufacturer
   d. Operating system
	C

TEACHER-LED ACTIVITY - 10mins

Teacher Initiates Screen Share

CHALLENGE ● **Learn about the working of routers.**

Teacher Action	Student Action
In the last class, we learned how to create a Local Area Network using Switch.	

|	
But the information present on a LAN can not be shared with the outside world.	
For example if in a school you have 2 labs and each lab has an individual LAN which are not connected with each other, then they can not share the information.	
But why do we want to do that?	**ESR:**
Why do we want to share the information with others?	Varied
In our first class we learned that the Internet is a collection of computers and devices.	
These computers contain information which can be accessed from anywhere and anytime.	
For example all the youtube videos are stored on a computer called a server.	
Anyone can watch youtube videos.But how that actually works.	
How can I connect with a server which is present in a different country?	
Well that is where the routers come into picture.	
To simplify, Router is a device which connects Multiple Local Area networks.	
In this session we are going to learn how to Connect 2 Local Area networks using Router.	
So let's get started.	
Teacher opens the Cisco packet tracer software.	
First thing we need to do is create 2 Local Area Networks.	
That is very easy. We have done this before.	
But I am not going to create both LANs. I will create 1 lan and connect that with the router then you are going to create the other and connect that with the router.	
So what's the first thing we need to create the Local Area Network?	**ESR:**
	Varied
First of all we need a switch. And then we need 3 computers.We can use any number of computers but they should be 2 or more than 2.	.
Let's drag and drop 3 computers and a switch on the canvas.	

2960-24TT
Switch0

PC-PT
PC0

PC-PT
PC1

PC-PT
PC2
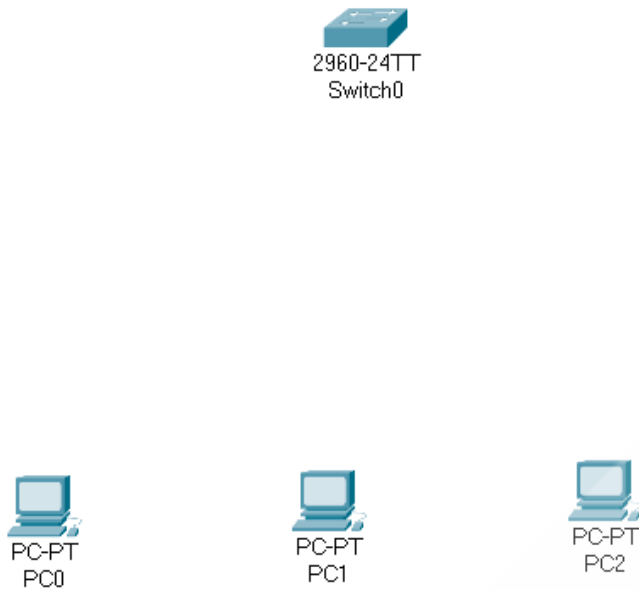
|	ESR:
Great! We have our computers and the switch now let's connect them with each other. Which type of cable do we use to connect the switch and the computer? Very good! But instead of manually selecting the cable let's click on the automatic selection. This will choose the best cable according to the device and connect it to the appropriate port. Which in our case is a fast Ethernet port. Our switch and PC both have this port.PC only has 1 FastEthernet port but switch has multiple ethernet ports. You can check how many ports a switch has by hovering the mouse above the switch.	ESR: Copper Straight through
We connected the PC's but we still have orange dots on the cable. Can you tell me why? Switch takes some time to set up.	ESR: Varied
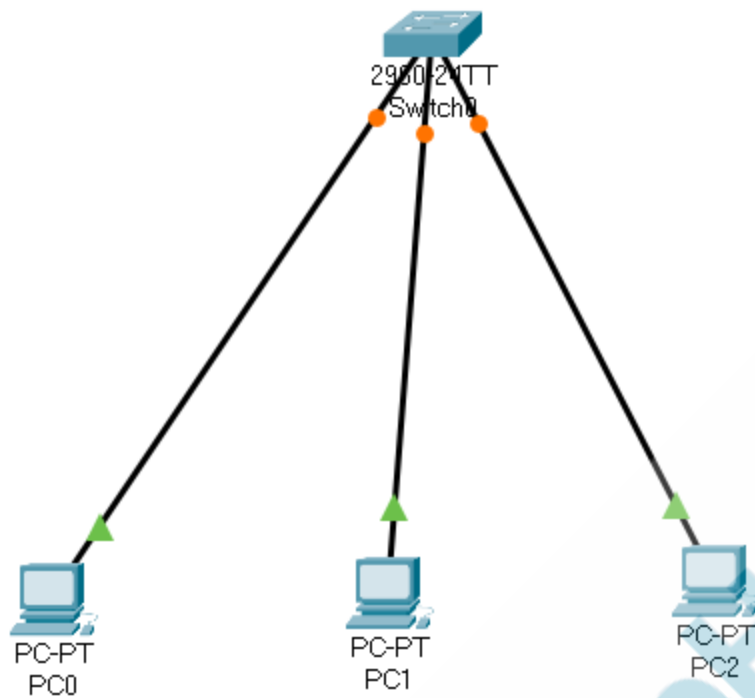
We can skip that waiting time by clicking on the fast forward button.
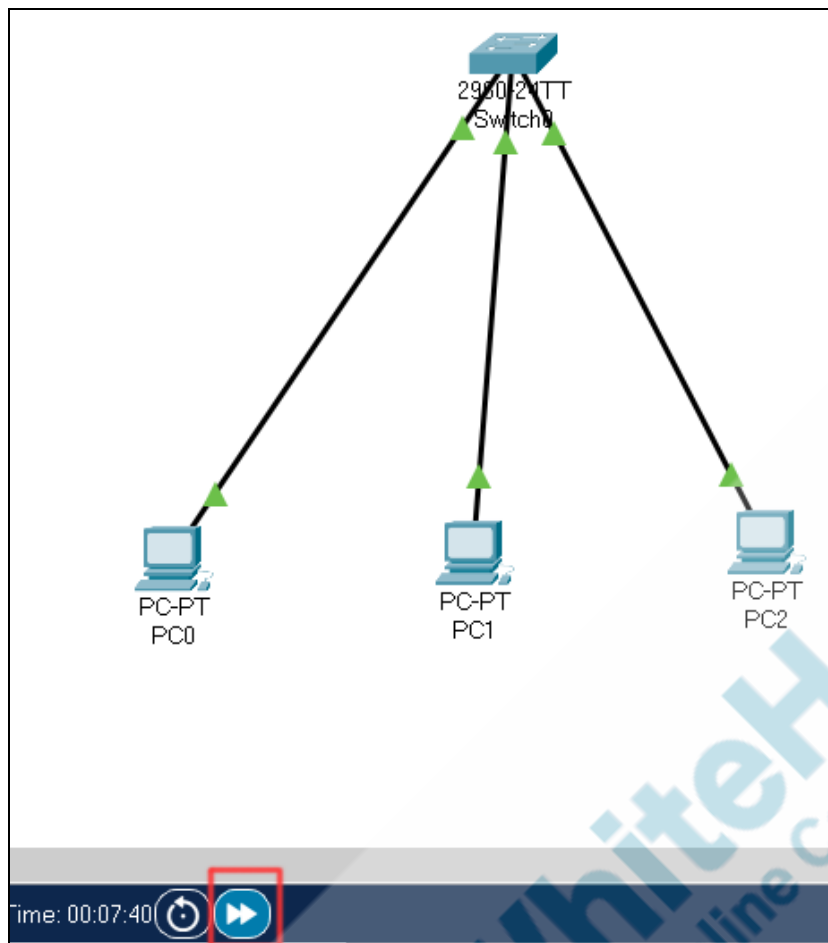
We can see that we have a successful connection here.
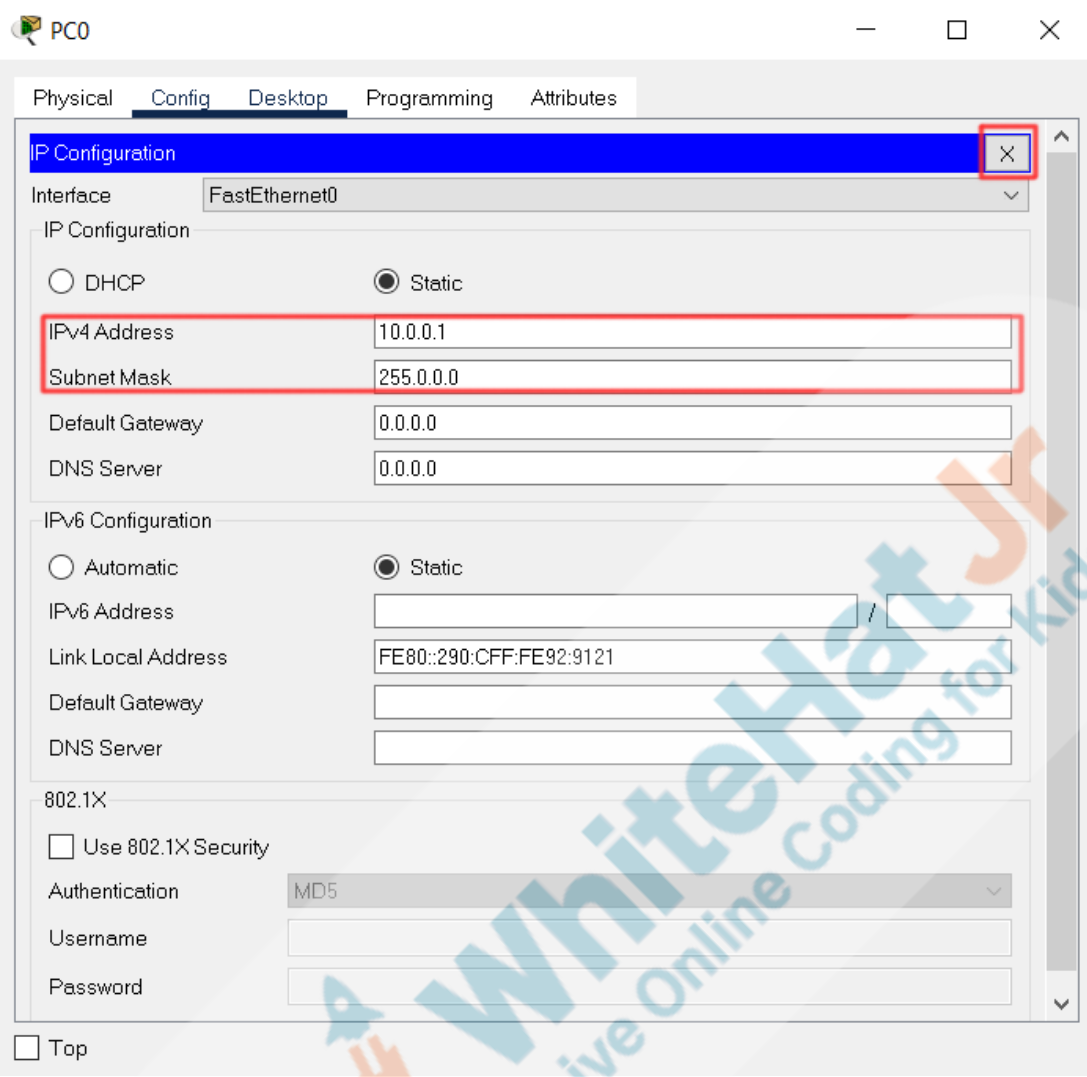What's the next step here?
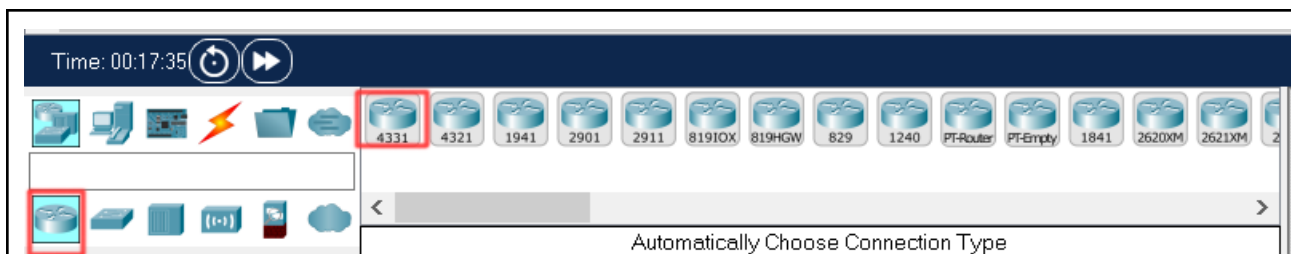Yes!
Lets assign IP addresses to all the 3 computers.
IP address for the computers on this network are going to be in order of 10.0.0.1 upto 10.0.0.3

ESR:
Assign IP address to computers

Teacher will assign the IP address to other computers as well.	
Once the IP address is assigned to all the computers in this network we can bring the Router on the screen. Router options are present in the bottom left menu. We have different options for the Routers but we are going to go with the first one.	

Time: 00:17:35

4331 4321 1941 2901 2911 819IOX 819HGW 829 1240 PT-Router PT-Empty 1841 2620XM 2621XM

Automatically Choose Connection Type

Next step is to connect the Router with Switch.
The cable needed for this connection is also copper straight through.
But the port will be different on the router.
Our switch has the Fast Ethernet Port as well as Gigabit Ethernet port.
But router has only Gigabit Ethernet port
Difference between these 2 ports is that gigabit Ethernet is faster than fast ethernet.
The maximum speed of data transmission on fast Ethernet is 100 MBPS but on the gigabit port it is 1000MBPS.
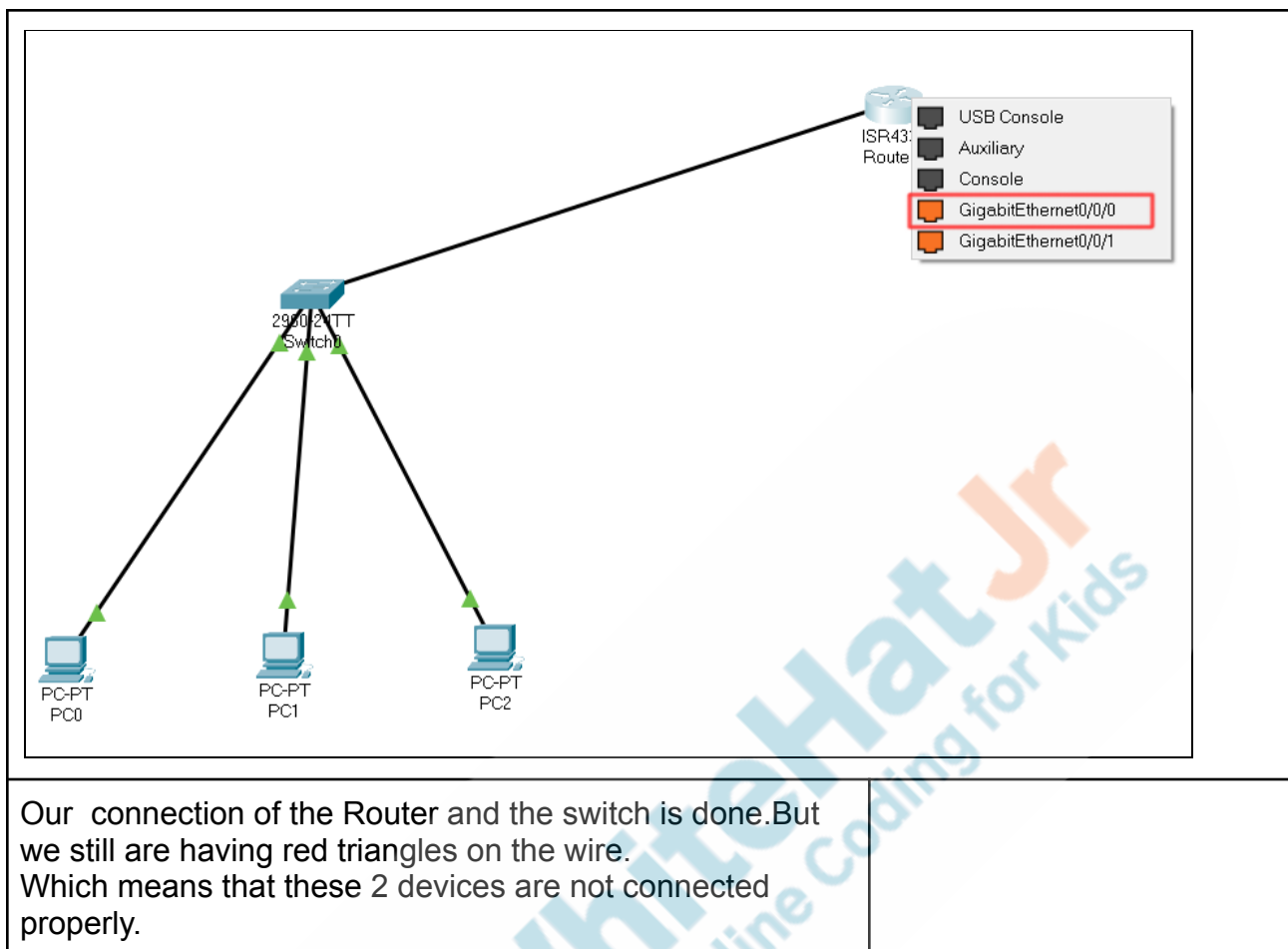But there are other differences also such as gigabit is costly and it can be used to transmit data over long range(upto 70 km).
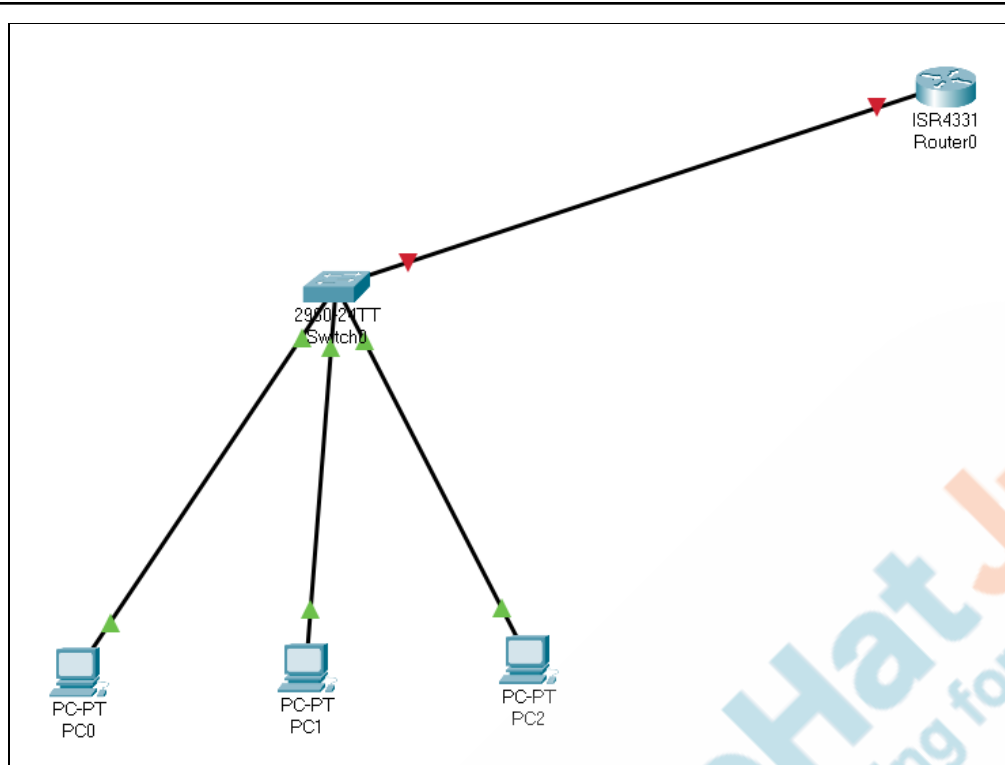But fast ethernet can transmit over short distances only upto 10 KM.

In order to connect the 2 devices select the copper straight through cable and click on the switch. Here select the Gigabit port.

Now click on the router and select the GIgabit port as well.	

USB Console
Auxiliary
Console
GigabitEthernet0/0/0
GigabitEthernet0/0/1

Our connection of the Router and the switch is done.But we still are having red triangles on the wire.
Which means that these 2 devices are not connected properly.

There are 2 steps we need to perform in order to bring the router online.
First is by default the port of the router is turned off.
We need to turn that On.
For that double click on the router and go to the config tab and then in the bottom left select the gigabit 0 port.
Here you have the option to turn it on.

Check the on option.
In the second setup we need to assign the IP address to this port as well. Important note is that this IP address should be in range of the IP of our LAN.
For example the IP address for the computers are 10.0.0.1 to 10.0.0.3
SO the IP should be something like 10.0.0.4 We can choose the last number of our own.

Once we assign the IP address here and turn this port on.
You can see that the cable now has the green triangles.
Which means our connection is successful.
.
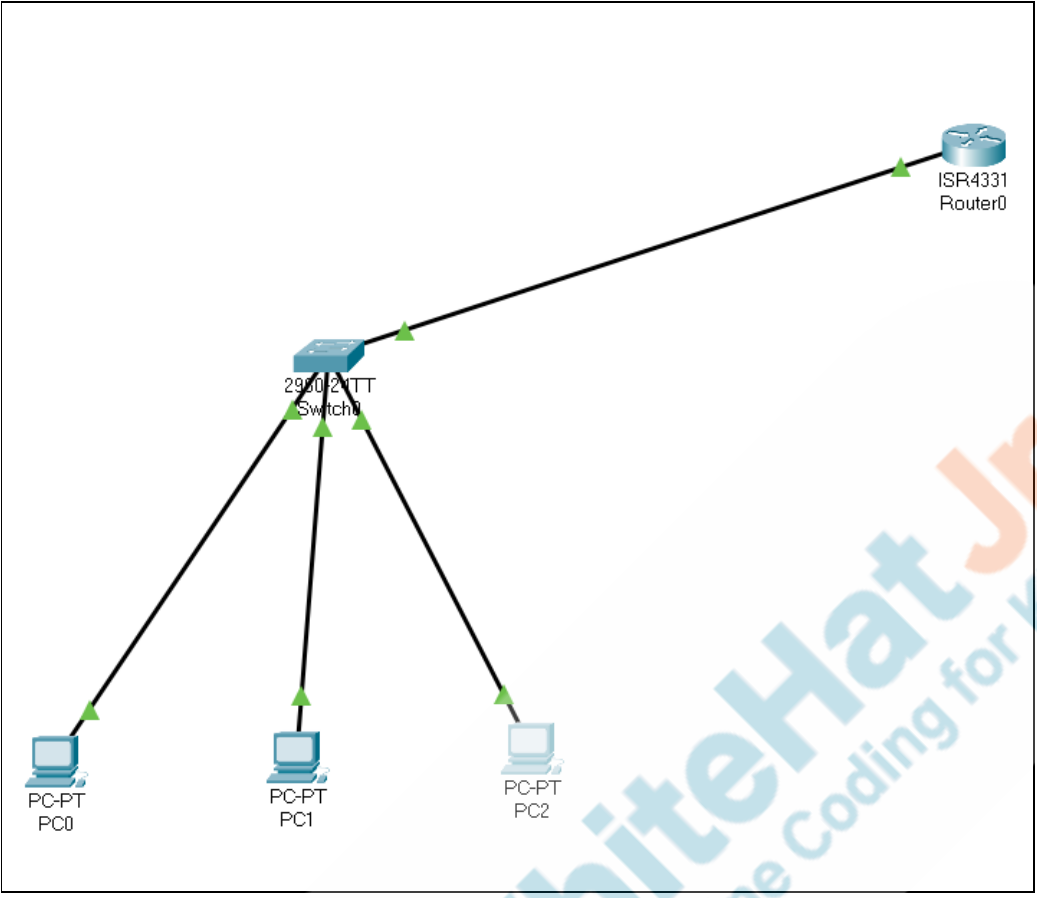
We have created the LAN and connected it with the router. But we need the other LAN as well and that lan should also be connected to the router.Then we will be able to share the information between these 2 networks.

Do you want to create another network?
Greate Please share your screen with me.

ESR:
Yes

STUDENT-LED ACTIVITY - 20mins

- **Ask the student to press the ESC key to come back to the panel.**
- **Guide the student to start Screen Share.**
- **The teacher gets into Fullscreen.**

ACTIVITY
- **Create LAN and connect with the router.**
- **Perform ping test.**

Teacher Action	Student Action
We have a LAN that is connected to a router. Let's create one more LAN first and then connect that with the router, so that both of these networks can share information with each other.	*Student downloads the Student Activity 1 file and opens it in the Cisco packet tracer.*
Drag and drop a switch and 3 computers on the canvas.	
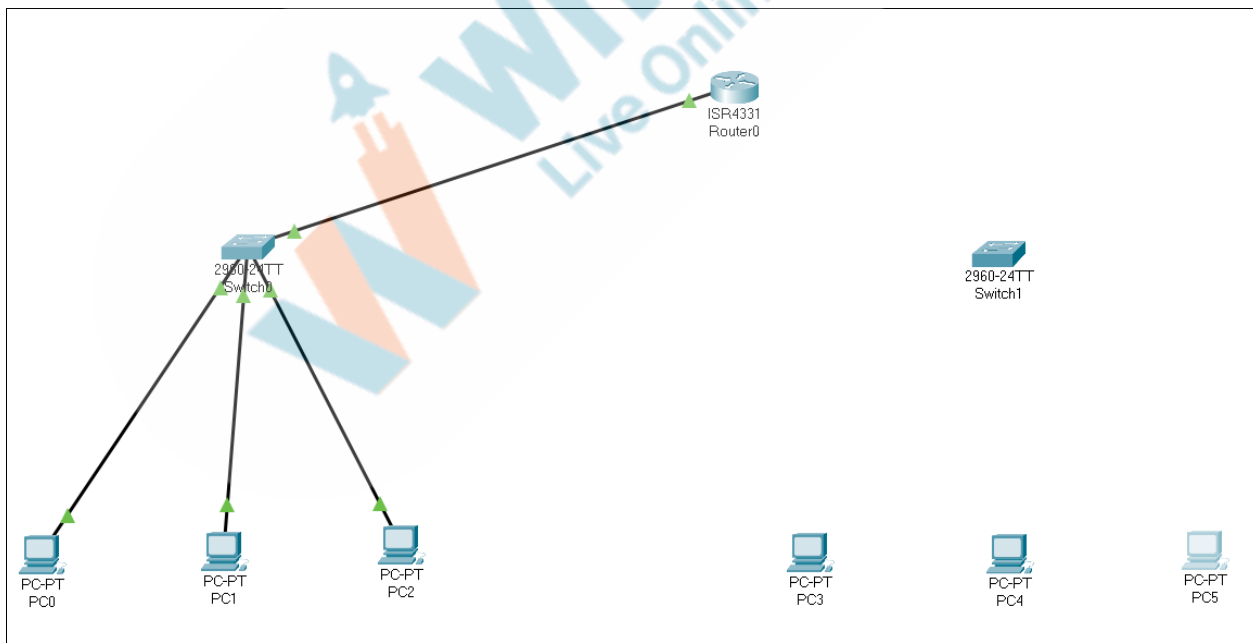
Connect the computers with Switch using copper straight through cable..	

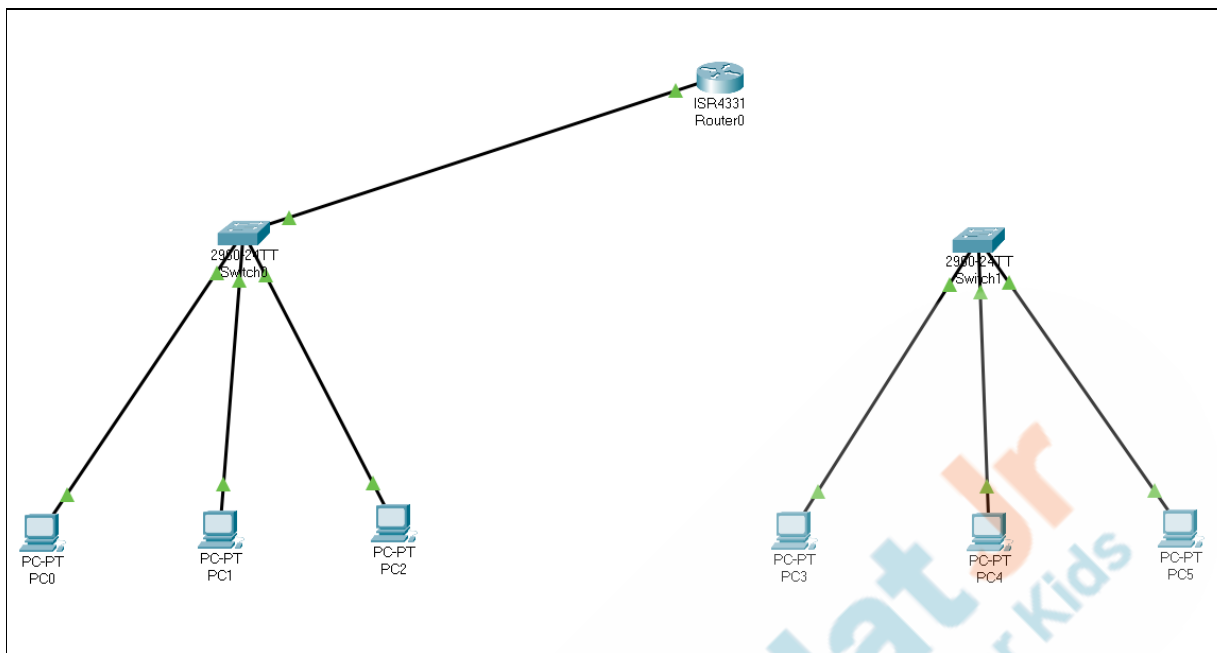|	
Now we need to assign IP addresses to these computers. For this network we are going to keep the IP address as **192.168.1.1,** **192.168.1.2,** **192.168.1.3**	
Double click on the first computer and then go to the desktop and then select the IP configuration tab. In the ipv4 address tab assign the IP as 192168.1.1	

Now we need to assign the IP address to other computers as well. Make sure that IP addresses are in the same order.	*Student will assign the IP address to other 2 computers well in the same order.*
Now once all the computers are assigned the IP address we can now connect the switch with the router. Can you please tell me the process to do that? First we need to connect the router and switch using the copper straight through cable and the cable is connected to Gigabit ethernet port on both ends.	**ESR:** Varied
Great, let's do that first.	
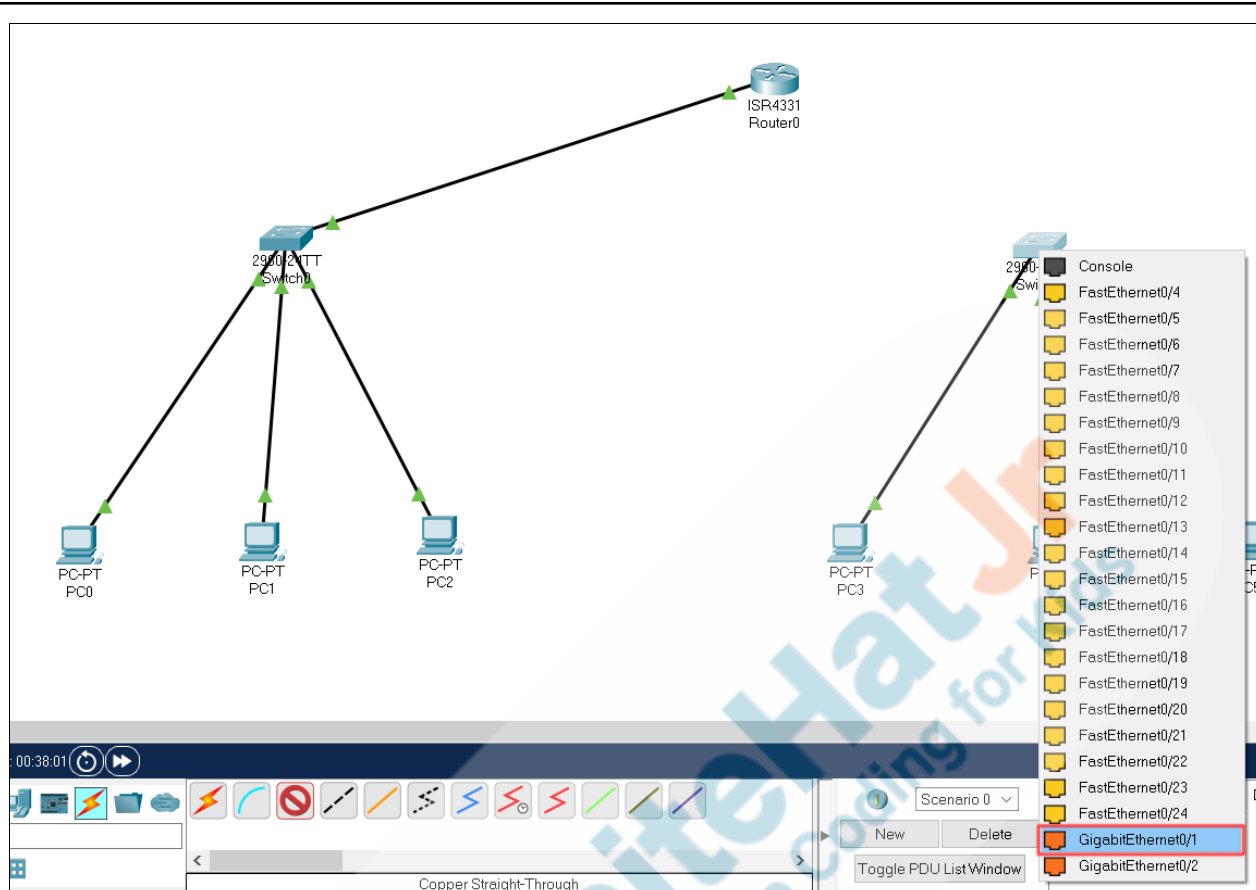
Now connect the cable on the router's gigabit ethernet port.
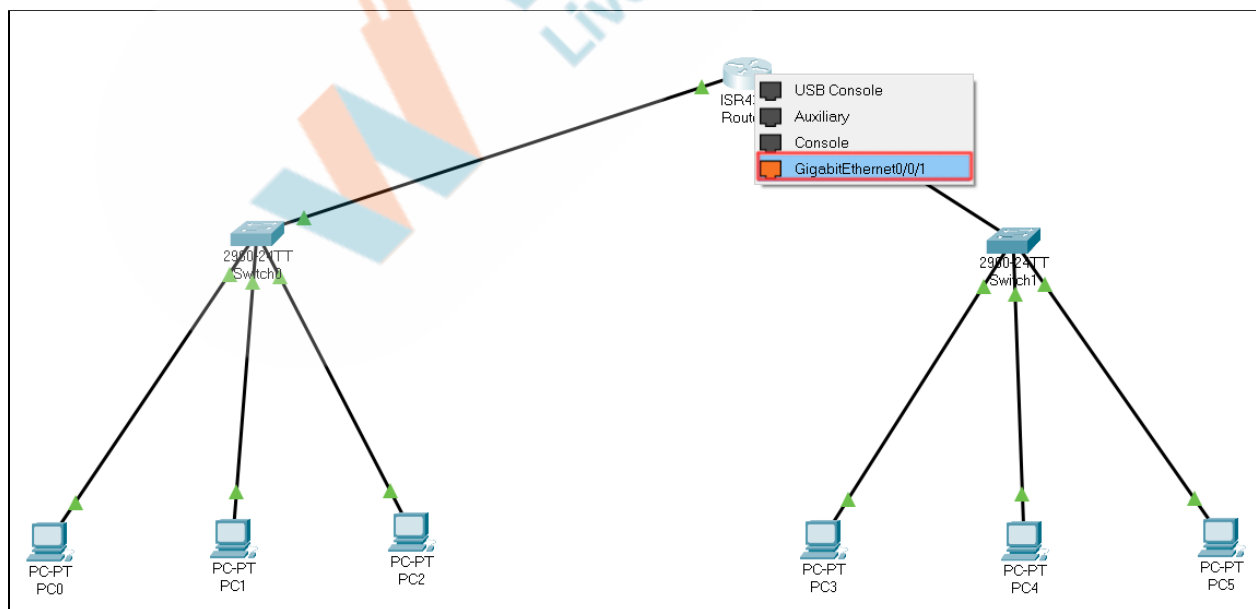
Well done! We now have a network of 2 Local Area Networks. It is called WAN. Wide Area Network.	
But our network is still not working. We can see the red triangles on the cables.	
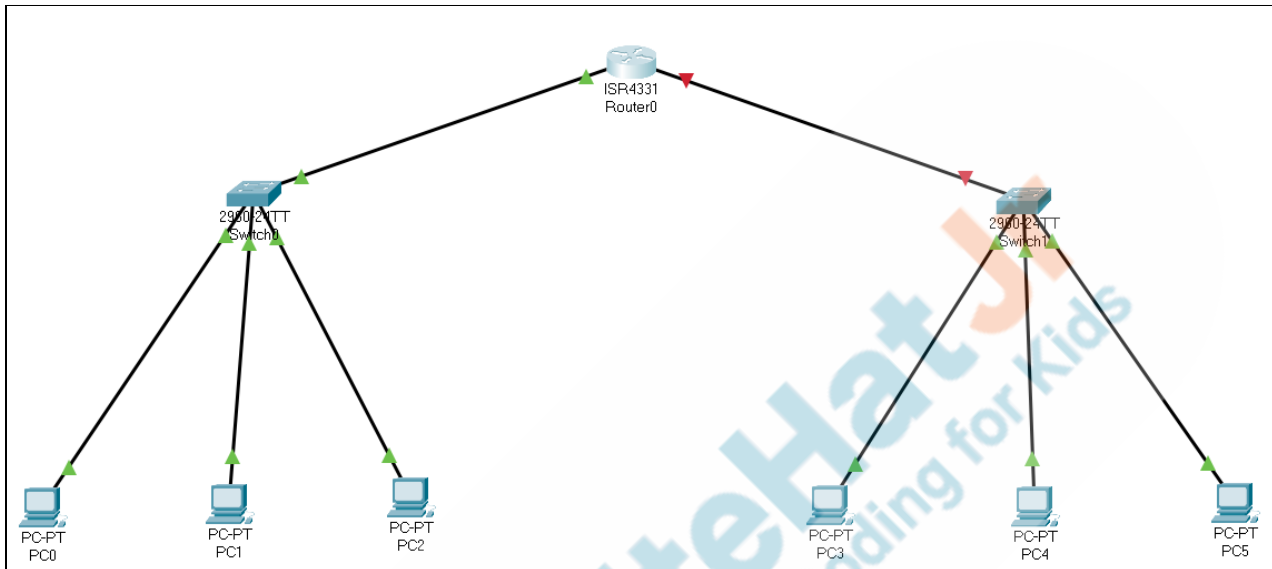
What do we need to do to sort this issue out? We need to assign the IP address to the port on the router and turn that port On. Double click on the router and then go to config Tab. Here select the gigabit ethernet port 2 and then assign the IP address as 192.168.1.4 and check the on option.	**ESR:** Varied

Once we do this we can see that all the triangles are now green which means that both of our LAN's are connected now.
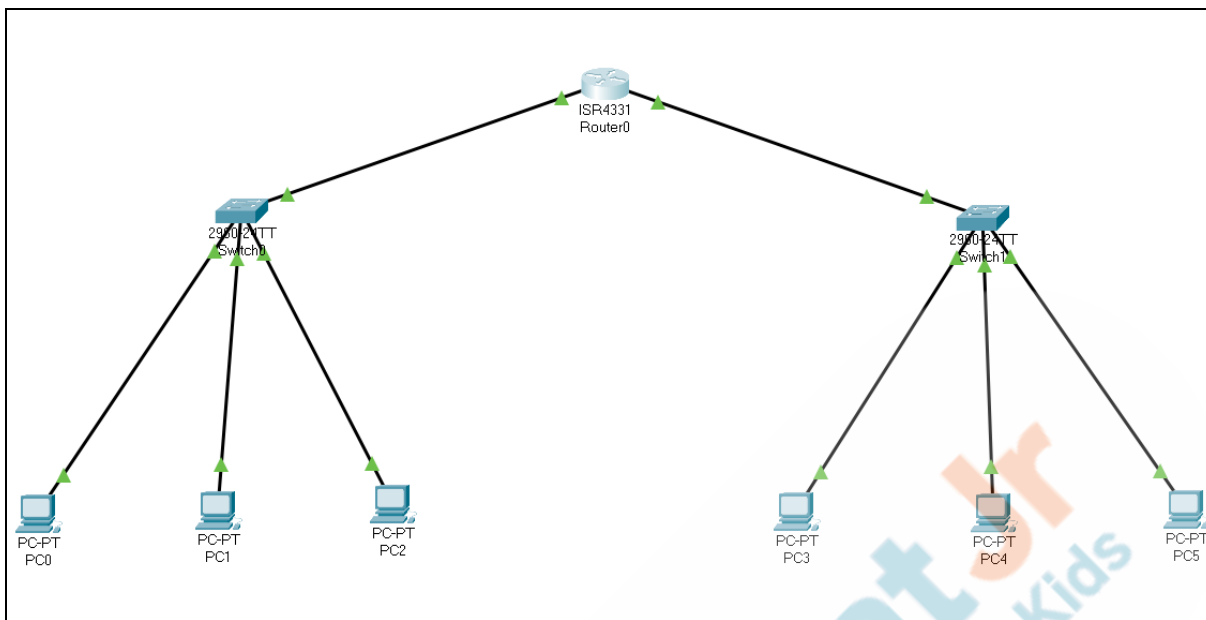
Now let's perform a ping test to see whether we can ping the computer on the right LAn from the left LAN.
Double click on any computer on the left LAN and then open the command prompt.
First we will check the IP address of this computer.
Can you tell me the command to do that?
Very good.
Let's type ipconfig and press enter. This will show us the IP address of this computer.

ESR:
ipconfig

Command Prompt

```
Packet Tracer PC Command Line 1.0
C:\>
C:\>ipconfig

FastEthernet0 Connection:(default port)

   Connection-specific DNS Suffix..:
   Link-local IPv6 Address.........: FE80::20C:85FF:FEDE:DB60
   IPv6 Address....................: ::
   IPv4 Address....................: 10.0.0.1
   Subnet Mask.....................: 255.0.0.0
   Default Gateway.................: ::
                                     0.0.0.0

Bluetooth Connection:

   Connection-specific DNS Suffix..:
   Link-local IPv6 Address.........: ::
   IPv6 Address....................: ::
   IPv4 Address....................: 0.0.0.0
   Subnet Mask.....................: 0.0.0.0
   Default Gateway.................: ::
                                     0.0.0.0

C:\>
```

We have the IP of this computer as 10.0.0.1
Now lets ping the first computer from the other network.
Write **ping 192.168.1.1**
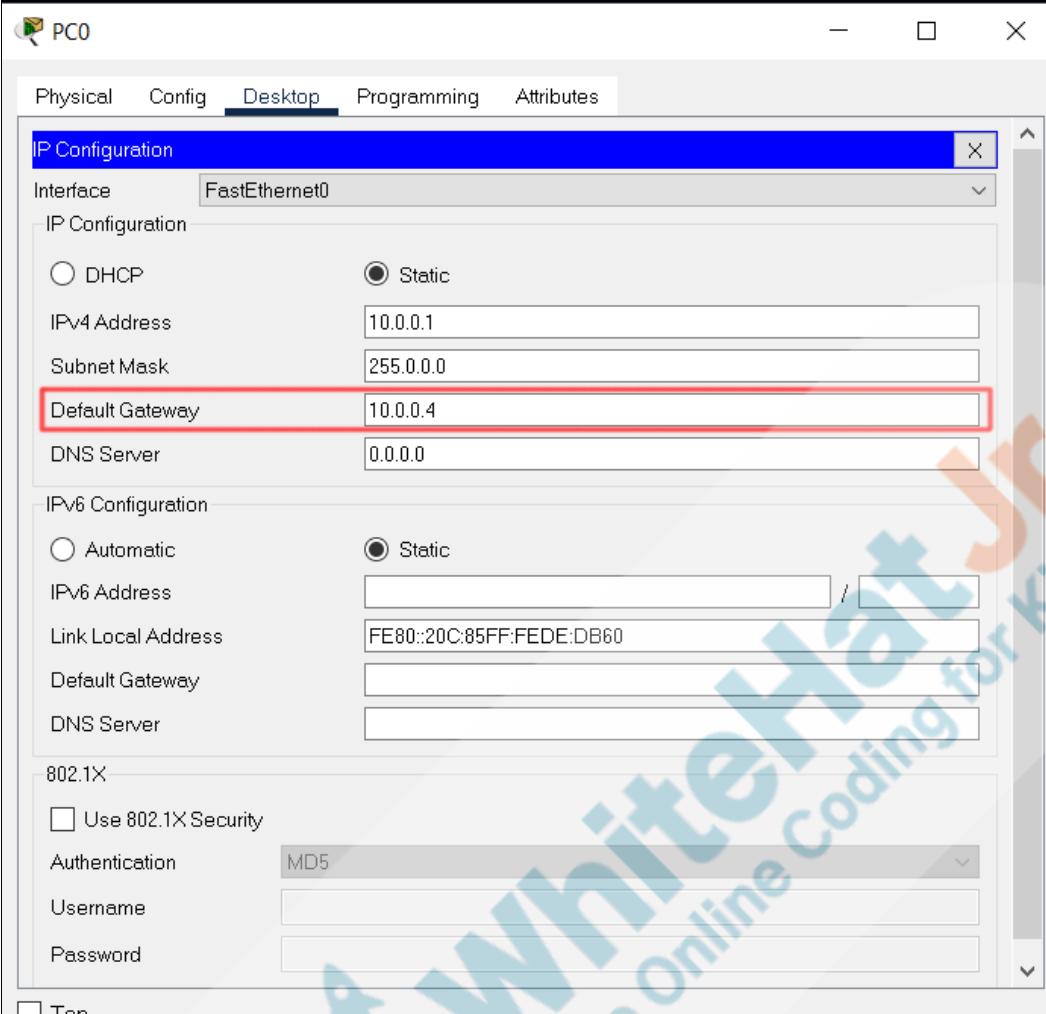
```
C:\>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Request timed out.
```
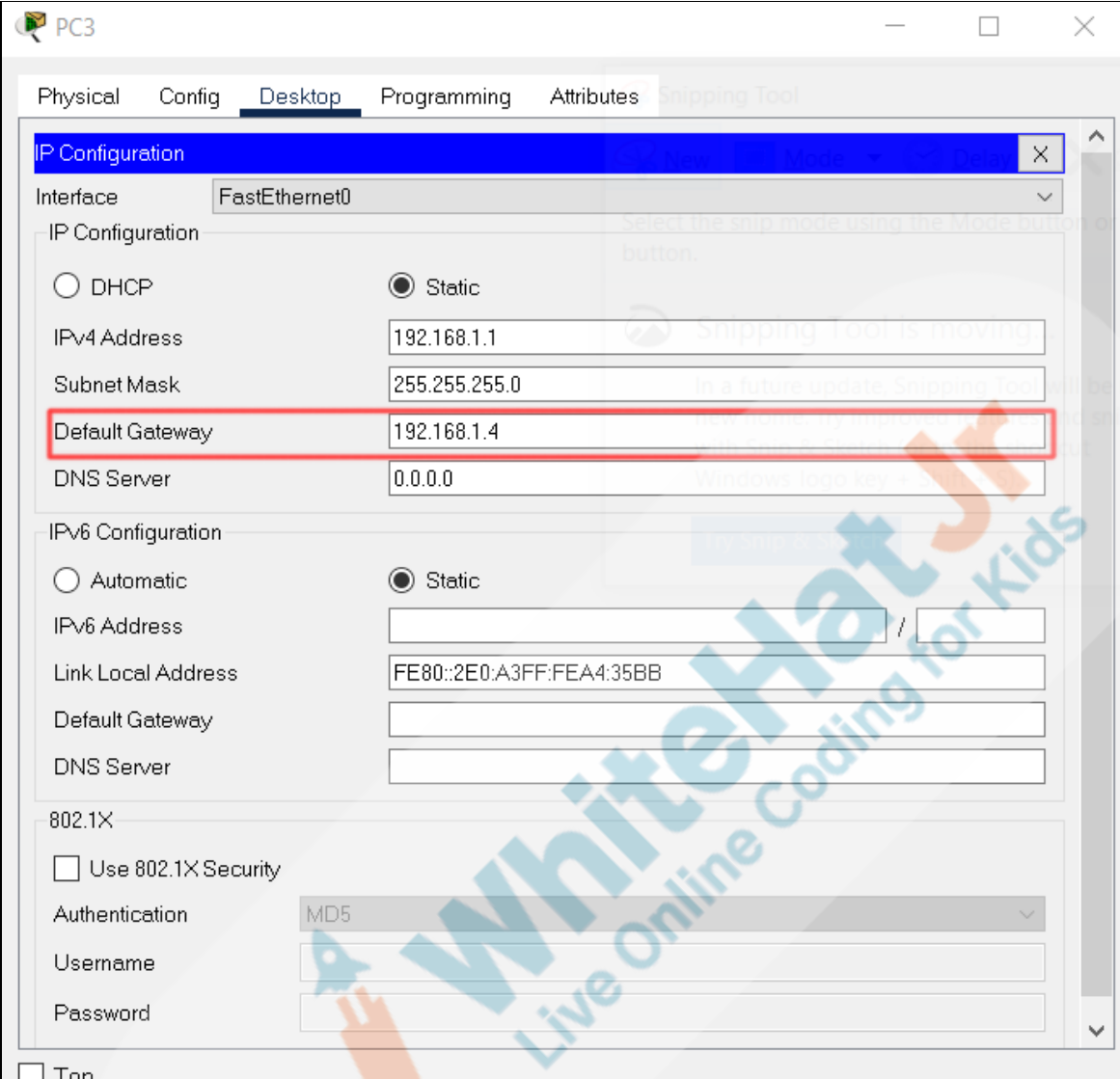
We tried to ping other computers. But this is not working.
This shows request time out.
This happens when the computers are not connected with each other.
But we have connected all the computers and the switch

properly. Then set the IP address to the router as well. Then why is this not working? When our computer connects with the internet.The first device it connects with is our router. Our router has an IP address which we also assigned here. But our computer doesn't know about this IP address of the router. They don't know that this router exists. To overcome this problem we need to tell our computers about the router and it's IP address. This is called the default gateway.This is the first device in the way to connect with the internet. Usually in the real world when you connect with your router. It will automatically assign the IP address and the default gateway. But since we are in a simulated environment. We have to do this manually.	
Double click on the first computer on the left network and go to the IP configuration window. There is a tab named default gateway. In this write the IP address we assigned in the router. Which is **10.0.0.4** **Note: Default Gateway should be same as the IP address assigned to the router.**	

We need this for the other 2 computers as well.	*Student assigns the default gateway address to other 2 computers of this network.*
Now we need to perform the same operation on the other LAN as well double click on the first computer in the right LAN and open the Ip configuration tab and then set the default gateway as 192.168.1.4 Because this was the IP address we assigned to the router when we connected this network. You can understand it this way. You have a router and your router assigns you a different default gateway. In your friend's home they have a router and their router assigns a different default gateway.	

We need to assign this same default gateway address to other 2 computers as well. Once we are done. We can perform the ping test.	*Student will assign this default gateway to other computers on this network.*
Double click on any computer and then open the command prompt. First let's test the IP address of this computer. Using **ipconfig**	

Packet Tracer PC Command Line 1.0
C:\>ipconfig

FastEthernet0 Connection:(default port)

    Connection-specific DNS Suffix..:
    Link-local IPv6 Address.........: FE80::2E0:A3FF:FEA4:35BB
    IPv6 Address....................: ::
    IPv4 Address....................: 192.168.1.1
    Subnet Mask.....................: 255.255.255.0
    Default Gateway.................: ::
                                      192.168.1.4

Bluetooth Connection:

    Connection-specific DNS Suffix..:
    Link-local IPv6 Address.........: ::
    IPv6 Address....................: ::
    IPv4 Address....................: 0.0.0.0
    Subnet Mask.....................: 0.0.0.0
    Default Gateway.................: ::
                                      0.0.0.0

C:\>

| Lets ping the first computer from the other network ping 10.0.0.1 | |

```
C:\>ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Request timed out.
Reply from 10.0.0.1: bytes=32 time<1ms TTL=127
Reply from 10.0.0.1: bytes=32 time<1ms TTL=127
Reply from 10.0.0.1: bytes=32 time<1ms TTL=127

Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

And here we can see that our first data packet failed but rest 3 came through.
This is very common when we set up the network. We lose the data packet on our first ping.
So let's ping one more time to see if everything is working fine or not.

```
C:\>ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time<1ms TTL=127
Reply from 10.0.0.1: bytes=32 time<1ms TTL=127
Reply from 10.0.0.1: bytes=32 time=11ms TTL=127
Reply from 10.0.0.1: bytes=32 time<1ms TTL=127

Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 11ms, Average = 2ms

C:\>
```

On our second ping we can see that all the packets are sent and received. It means our network is working fine.
What we have created here is a Wide Area Network. If we connect a lot of networks like this we will have something called as INTERNET

In this we have learned how to set up a router and connect multiple LAN's with it.
We also learned about the default gateway and how it plays an important role in connecting the computer to the

internet.

Teacher Guides Student to Stop Screen Share	
Quiz time - Click on in-class quiz	
Question	**Answer**

How many data packets do we send when we ping a computer?
   A. 3
   B. 4
   C. 6
   D. 1
	b

What is the default gateway?
   A. Address of switch
   B. Mac address of router
   C. IP address of router.
   D. Mac address of switch
	c

Default gateway is assigned by?
   A. PC
   B. Router
   C. Switch
   D. User
	B

End the quiz panel	
WRAP UP SESSION - 5 Mins	
Activity details	**Solution/Guidelines**

Run the presentation from slide to slide
 	
Following are the warm up session deliverables:
   ● **Explain the facts and trivias**
   ● **Next class challenge**
   ● **Project for the day**
	Guide the student to develop the project and share with us

● **Additional Activity**	

<table>
<tr><td colspan="2" style="background-color:#f5d5b8"><p align="center">**FEEDBACK**</p>● **Appreciate the student for their efforts in the class.**
● **Ask the student to make notes for the reflection journal along with the code they wrote in today's class.**</td></tr>
<tr><td>

Let's wrap up today's class.

What did we learn?

Amazing work!

In the next class we are going to learn about the different topologies of the network, which means how our devices are connected in a network.

You get Hats Off for your excellent work!

I will see you in the next class.

</td><td>

ESR:
- We learned about the routers.
- Gigabit ethernet ports
- How to set default gateway.
- How to connect 2 switches with a router.

Make sure you have given at least 2 Hats Off during the class for:

Creatively Solved Activities +10

Great Question +10

Strong Concentration +10

</td></tr>
</table>

<p align="center">**Teacher Clicks**   ✖ End Class</p>

Additional Activities *Encourage the student to write reflection notes in their reflection journal using markdown.* Use these as guiding questions: ● What happened today? ○ Describe what happened.	*The student uses the markdown editor to write her/his reflections in the reflection journal.*

○ The code I wrote.
● How did I feel after the class?
● What have I learned about programming and developing games?
● What aspects of the class helped me? What did I find difficult?

Activity Name	Description	Link
Student Activity 1	Template	https://drive.google.com/file/d/1OPtf_JSJpv51TVOnSsjQ9kJl6nf31peU/view?usp=sharing
Solution	Solution Link	https://drive.google.com/file/d/1ip5PIS5dOUAMxEl6cdQGLc-ksrXAwTfd/view?usp=sharing
In class quiz	In class Quiz	https://docs.google.com/document/d/1LDyDaGdy00OXZooLwFHdGqo4BockJKttGt0p6tsCLvA/edit