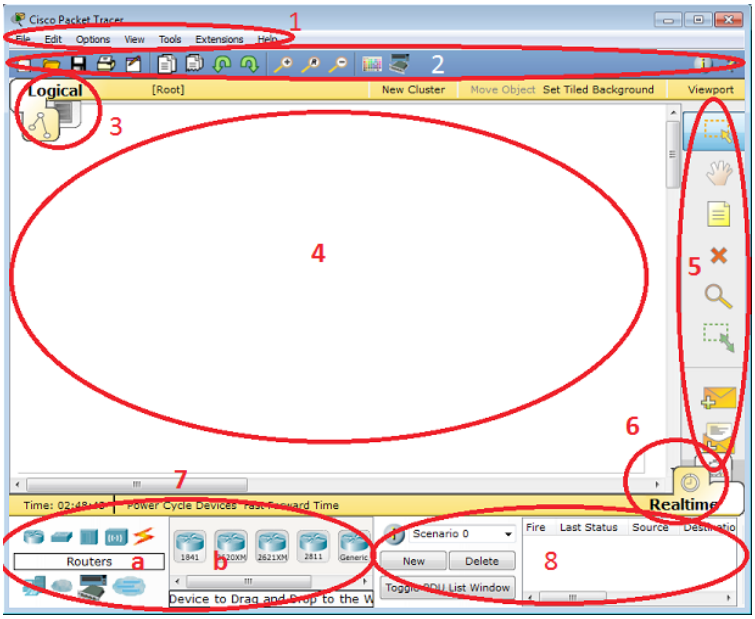
Using Packet Tracer

Reference-Packet Tracer Network Simulator-Jesin A

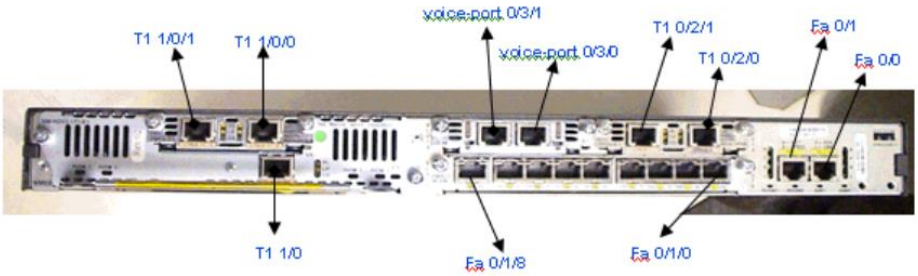
Interface overview



1	Menu bar
2	Main toolbar-Open, Save, Zoom etc.
3	Logical/Physical workspace tabs- toggle between the Logical and Physical work areas.
4	Area where topologies are created and simulations are displayed
5	**Common tools**- controls for manipulating Topologies- move layout, place note, delete, resize and **add** simple/complex **PDU**
6	**Realtime/Simulation tabs**- toggle between tabs and also buttons to control the time, and to capture the packets.
7	**Network component box**-End device (PC/ Laptop etc.), Connecting device (Hub/switch etc.), Connector- different type of wires.
8	**User-created packet box**- Users can create highly-customized packets to test their topology and the results are displayed as a list.

Switch

Figure 1 – Interface Numbering on Cisco 2811 Platform



Interface Numbering

This section lists the interface numbering details for Cisco routers.

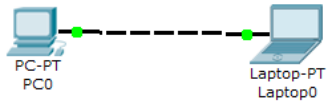
Table 1 – Interface Numbering on Cisco 1841

Slot Number	Slot Type	Slot Numbering Range	Example[1]
Onboard Ports	Fast Ethernet	0/0 and 0/1	interface fastethernet 0/0
Slot 0	HWIC/WIC/VWIC[2]	0/0/0 to 0/0/3	interface serial 0/0/0 line async 0/0/0
Slot 1	HWIC/WIC/VWIC[2]	0/1/0 to 0/1/3	interface serial 0/1/0 line async 0/1/0

[1] The interfaces listed here are examples only. Other possible interface types are not listed. [2] VWICs are data-only in a Cisco 1841 router.

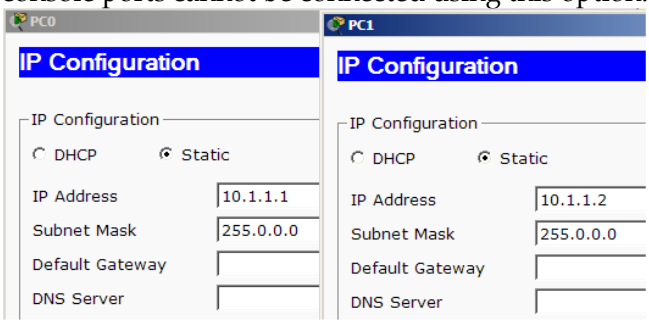
The first **0** represents the **interface card** in a router. Many routers **support multiple interface cards**, and **each card** can have **multiple connections**. So the **second number represents that actual interface** on a given interface card. So **0/1** refers to the **number 1 interface** on the **number 0 card** installed in the router. If the router has other cards, you could see interface numbers like **1/1**.

Creating a simple topology



1	From the network component box, click on End Devices (Area-7, generic PC/Generic laptop) and drag-and-drop
2	Click on the PC, go to the Desktop tab, click on IP Configuration, and enter an IP address and subnet mask. DSN/gateway not required here
3.	Connect the devices using connector (area-7 in packet tracer editor)

Automatically choose connection type: If you are confused about the cable to use, choosing this option automatically connects two devices with the best cable. We say best cable because if you have two routers with serial and Fast Ethernet interfaces on both of them and want to connect both of their Fast Ethernet interfaces, choosing this option will connect only their serial interfaces together. Similarly, console ports cannot be connected using this option.



Close the IP Configuration box, open the command prompt, and ping the IP address of the device at the end to check connectivity.

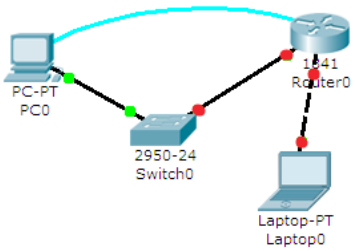
```
PC>ping 10.1.1.1

Pinging 10.1.1.1 with 32 bytes of data:

Reply from 10.1.1.1: bytes=32 time=62ms TTL=128
Reply from 10.1.1.1: bytes=32 time=31ms TTL=128
Reply from 10.1.1.1: bytes=32 time=32ms TTL=128
Reply from 10.1.1.1: bytes=32 time=31ms TTL=128

Ping statistics for 10.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 31ms, Maximum = 62ms, Average = 39ms
```

Link status

After connecting devices together, you'll find a light at each end of the cable; this indicates the state of the connection, as follows:

Bright green: This indicates that the physical link is up, but it doesn't indicate the status of the line protocol.
Blinking green: This indicates link activity.
Red: This indicates that the physical link is down. This can be caused by incorrect cables or by a port being administratively shut down.
Amber: This appears only on switches, and indicates that the port is running the **STP** (**Spanning Tree Protocol**) algorithm to detect layer 2 loops.

Let us demonstrate how to connect devices in a topology containing a PC, laptop, switch, and a router.



After adding the devices shown in the previous topology, **click on a connection type from the device-type selection box and choose a connection**. Click on a device and a context menu will list all of the interfaces available for the device. Select the interface and repeat the same steps on the other device to create a link between the two.

If a **router** is connected to any device, the **link status will be red** because routers have their **ports** in **"shutdown" status by default**. If a device is connected to a **switch**, the link is **initially amber** in color, indicating that it is **going through the states of STP**.

Testing connectivity with PDUs

Once a topology has been created, **connectivity** can be **tested** between devices by **using either simple or complex PDU**s. Although it is possible to do the **same by pinging devices** from their command-line interface, using the **PDU option** is **quicker for large topologies**.

Simple PDU

The **Add Simple PDU** option uses only **ICMP** (**Internet Control Message Protocol**). We will create a topology with a PC and a server to demonstrate how this option works:

1. Add a PC and a server to the workspace and connect them using a copper crossover cable.
2. Assign IP addresses to both of them in the same subnet. Example, PC1: `192.168.0.1/255.255.255.0` and PC2: `192.168.0.2/255.255.255.0`.
3. From the common tools bar, click on the closed envelope icon or use the shortcut key *P*.
4. The pointer will change to an envelope symbol. Click on the PC first and then on the server. Now look at the **User Created Packet** box. You'll see the status as **Successful** and will also see the source, the destination, and the type of packet that was sent.

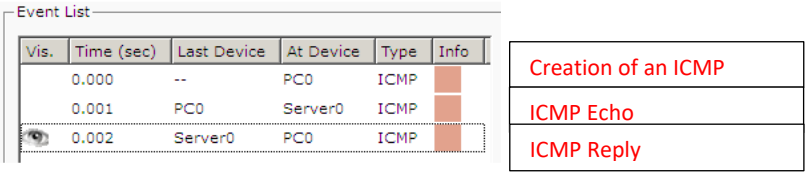
Using the simulation mode

while we were working in real-time mode, so the only indication of traffic was the link status blinking green. But, using simulation mode, you can see packets flowing from one node to another and can also click on a packet to see detailed information categorized by OSI layers.

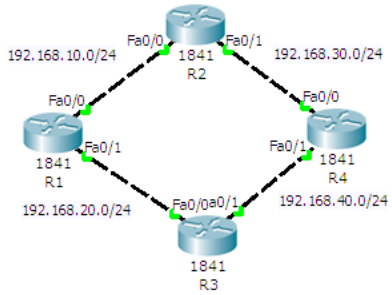
Use the real-time/simulation tab to switch to the simulation mode.

Use a **Simple PDU(ICMP)** and Click on the **Auto Capture / Play** button.

The **event list** will be populated with three entries, indicating the creation of an ICMP packet, ICMP echo sent, and ICMP reply received.



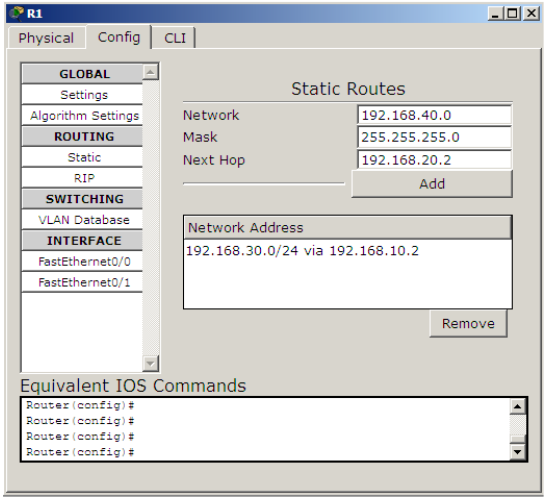
Static routing with GUI



Router	Interface	IP Address
R1	FastEthernet0/0	192.168.10.1
	FastEthernet0/1	192.168.20.1
R2	FastEthernet0/0	192.168.10.2
	FastEthernet0/1	192.168.30.1
R3	FastEthernet0/0	192.168.20.2
	FastEthernet0/1	192.168.40.1
R4	FastEthernet0/0	192.168.30.2
	FastEthernet0/1	192.168.40.2

This network has four routers in a ring topology, with no PCs or loopback interfaces. Because we will be using only the GUI here, configuration will be kept to a minimum.

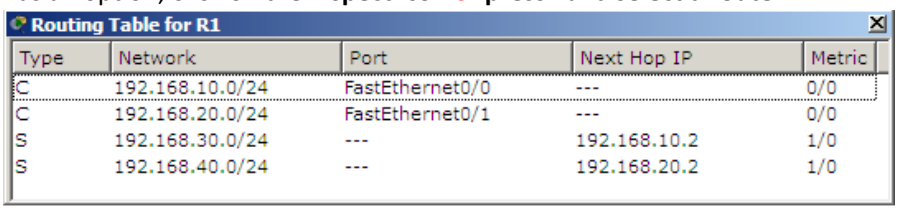
1. Click on a **router icon**, go to the **Config** tab, select an interface, and configure the IP address. Make sure that you select the On checkbox in this section to bring the port state up.
2. Under **ROUTING** section, click on **Static**. The following screenshot is displayed.



3. The following settings will be used for **configuring static routing using** the **GUI**. The concept here is to **enter all routes** that are **not directly connected to a router** and a **gateway IP that belongs to a network** that is **directly connected**.

Device	Network/Mask	Next Hop
R1	192.168.30.0 / 255.255.255.0	192.168.10.2
	192.168.40.0 / 255.255.255.0	192.168.20.2
R2	192.168.20.0 / 255.255.255.0	192.168.10.1
	192.168.40.0 / 255.255.255.0	192.168.30.2
R3	192.168.10.0 / 255.255.255.0	192.168.20.1
	192.168.30.0 / 255.255.255.0	192.168.40.2
R4	192.168.10.0 / 255.255.255.0	192.168.30.1
	192.168.20.0 / 255.255.255.0	192.168.40.1

How about taking a look at the routing table? For this, too, the GUI has an option; **click** on the **inspect icon** or **press I** and **select a router**.



Type	Network	Port	Next Hop IP	Metric
C	192.168.10.0/24	FastEthernet0/0	---	0/0
C	192.168.20.0/24	FastEthernet0/1	---	0/0
S	192.168.30.0/24	---	192.168.10.2	1/0
S	192.168.40.0/24	---	192.168.20.2	1/0

But we configured only two routes, so **why four**? The **extra two routes** are the **subnets** of the **directly-connected links**.

4. Now use simple PDU and test the connectivity between all of the routers. Then use the simulation mode to find the route taken by the packets.
In this topology, **even though there is an alternate route** to each network, only **one route is used** because this is **how we have configured it**. We'll learn more about having more than one route in the **Load Sharing** section.

Static routing with the CLI

The configuration and the topology will be same in this section. We'll only see the commands required for one device. The topology can be configured by performing the following steps:

1. Assign IP addresses to the interfaces on each router using the following commands:
```
R1(config)#interface FastEthernet0/0
R1(config-if)#ip address 192.168.10.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#interface FastEthernet0/1
R1(config-if)#ip address 192.168.20.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
```
2. Configure static routing with the ip route command, using the following syntax:

R1(config)#ip route <Destination Prefix> <Destination prefix mask> <Gateway IP>

3. For router **R1**, the following commands are used:

R1(config)#ip route 192.168.30.0 255.255.255.0 192.168.10.2
R1(config)#ip route 192.168.40.0 255.255.255.0 192.168.20.2

Use simple PDU to test the connectivity. If you get message indicating a failure, switch to simulation mode and see which router is incorrectly configured.

A routing table lists all of the preferred routes known to a router. It is **viewable** in **two ways**, one using the **inspect tool of packet tracer** and the other using the **show ip route** Cisco IOS **command**.

R1>show ip route

Dynamic routing protocols

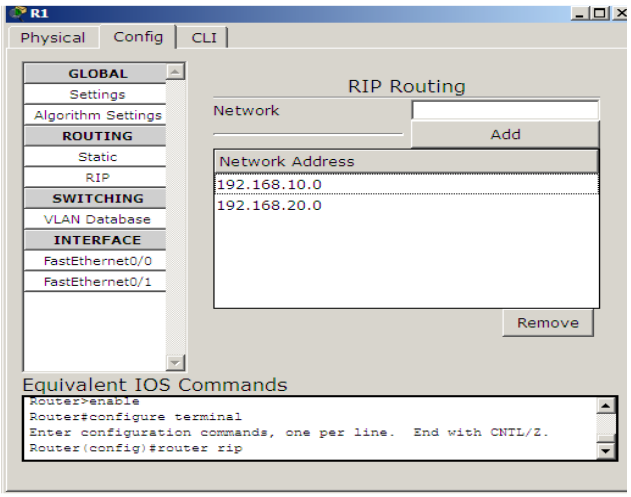
When we learned about static routing we found that a lot of manual configuration was involved and a change to the topology also required manual configuration changes. Dynamic protocols work by advertising routes to each other.
The configuration is the opposite of static routing; here, we enable dynamic routing on the required interfaces.

Configuring RIP with the GUI

Packet Tracer offers a GUI to configure a dynamic routing protocol called RIP (Routing Information Protocol). This GUI section is similar to the static routing section. It has only one textbox for entering the network address of the directly connected network.

In RIP, we enter the network IP addresses of the router's interfaces. By doing this, you are enabling that routing protocol on a particular interface. To configure dynamic routing with the GUI, perform the following steps:

1. Create the same four-router topology we used previously and assign the same IP addresses through the **Config** tab.
2. Click on RIP—now, configuring this is very easy, with each router requiring only the Network IP of its own interfaces, as shown in the following screenshot:



3. Enter the following network IP addresses:

Device	RIP Network
R1	192.168.10.0
	192.168.20.0
R2	192.168.10.0
	192.168.30.0
R3	192.168.20.0
	192.168.40.0
R4	192.168.30.0
	192.168.40.0

4. Once the topology is configured, use the simple PDU to check for connectivity. Let's check for two indirectly connected routers (**R1** and **R4** or **R2** and **R3**). Once the connection is successful, let's see how dynamic routing works on topology changes.
5. Use the delete tool and remove either the link between **R1** and **R2** or the link between **R1** and **R3**. Use the simulation mode and test connectivity with the simple PDU. You'll find that the packet takes the alternate, longer route and succeeds in reaching the destination.

Configuring RIP with the CLI

The commands are very simple and if you have noticed the **Equivalent IOS Commands** section under the **Config** tab, you'll know them already. To configure dynamic routing by using the **CLI** tab, perform the following steps:

1. Use the same commands used in the **Static** section to assign IP addresses to the interfaces.

2. Then, from the global configuration mode, enter into the config mode of RIP by issuing the following command:

R1(config)#router rip

3. Use the network command, followed by the network IP address. For the device **R1**, use the following commands:

R1(config-router)#network 192.168.10.0
R1(config-router)#network 192.168.20.0

4. Configure all the other routers in the same way. Use the simple PDU to test the connectivity.

Now that you know how to configure basic static and dynamic routing, let's move to the routing table.

The Routing tables

A routing table lists all of the preferred routes known to a router. It is **viewable** in **two ways**, one using the **inspect tool of packet tracer** and the other using the **show ip route** Cisco IOS **command**.

R1>show ip route

```
R1>show ip route
C    192.168.10.0/24 is directly connected, FastEthernet0/0
R    192.168.20.0/24 [120/1] via 192.168.10.1, 00:00:18,
FastEthernet0/0
C    192.168.30.0/24 is directly connected, FastEthernet0/1
R    192.168.40.0/24 [120/1] via 192.168.30.2, 00:00:08,
FastEthernet0/1
```

The first column denotes the routing protocol. The letter **C** is for **connected** and **R** is for **RIP**; if you check the routing table after **configuring static** routing, **you'll find** the letter **S**.

The **first column** denotes the routing protocol. **C**- connected; **R**- RIP , if static routing used – **S**

The **second column** is the destination network - **192.168.10.0/24(1st row) , 192.168.20.0/24(2nd row) etc.**

The **Third column** is Admirative Distance (AD) shown in square brackets **[120/1]; 1st number**(120) indicates -which routing protocol takes Priority.**2nd number** shows metric (in RIP it Is **number of hops** to reach destination). If **static routing** is used then AD values will be **1**.

So, if a **router has two routes** for the same destination network **via** both **static routing** and **RIP**, **static routing** will be **used as it has a lower AD i.e.** 1.