

Table of Contents

<i>I. Introduction to NAT</i>	
i. Description.....	2
ii. Working.....	2
iii. Types.....	3
<i>II. Static NAT using CISCO Packet Tracer</i>	
i. Step 1 : Outlining the components and their connections.....	4
ii. Step 2 : Making the topology.....	4
iii. Step 3 : Assigning IP Addresses.....	5
iv. Step 4 : Initial Configuration.....	6
v. Step 5 : Static NAT Configuration.....	9
vi. Step 6 : Configure Static Routing in R1 and R2.....	11
vii. Step 7 : Testing Static NAT Configuration.....	13
<i>III. Dynamic NAT using CISCO Packet Tracer</i>	
i. Step 1 : Outlining the components and their connections.....	17
ii. Step 2 : Making the topology.....	17
iii. Step 3 : Assigning IP Addresses.....	18
iv. Step 4 : CLI for IP Address and Hostname.....	19
v. Step 5 : Configure Dynamic NAT.....	22
vi. Step 6 : Configure Static Routing in Routers.....	25
vii. Step 7 : Testing Dynamic NAT Configuration.....	26

Introduction to NAT

Network Address Translation (NAT) is a process that enables one, unique IP address to represent an entire group of computers. In network address translation, a network device, often a router or NAT firewall, assigns a computer or computers inside a private network a public address. In this way, network address translation allows the single device to act as an intermediary or agent between the local, private network and the public network that is the internet. NAT's main purpose is to conserve the number of public IP addresses in use, for both security and economic goals.

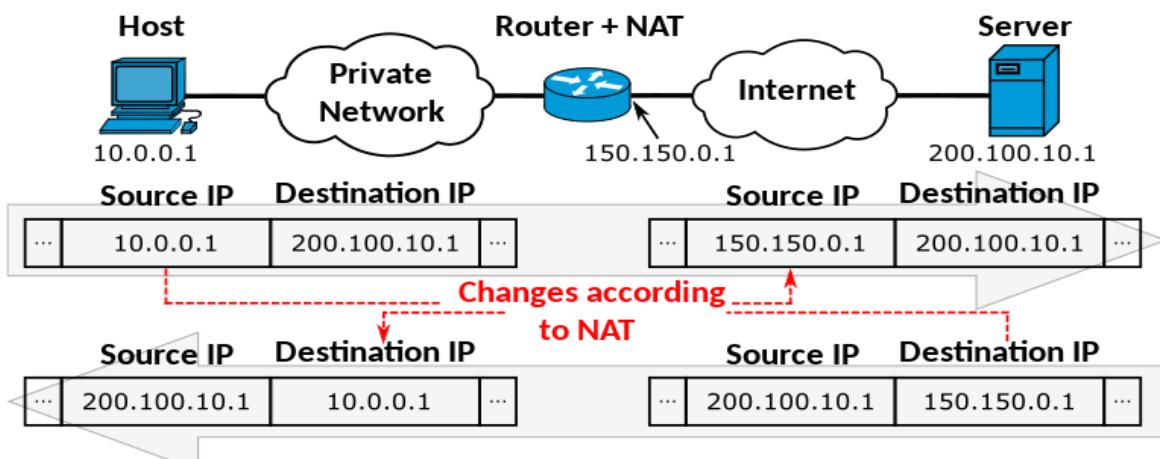
Working of NAT

A NAT works by selecting gateways that sit between two local networks: the internal network, and the outside network. Systems on the inside network are typically assigned IP addresses that cannot be routed to external networks (e.g., networks in the 10.0.0.0/8 block).

A few externally valid IP addresses are assigned to the gateway. The gateway makes outbound traffic from an inside system appear to be coming from one of the valid external addresses. It takes incoming traffic aimed at a valid external address and sends it to the correct internal system.

This helps ensure security. Because each outgoing or incoming request must go through a translation process that offers the opportunity to qualify or authenticate incoming streams and match them to outgoing requests, for example.

NAT conserves the number of globally valid IP addresses a company needs and -- in combination with Classless Inter-Domain Routing (CIDR) -- has done a lot to extend the useful life of IPv4 as a result. NAT is described in general terms in IETF RFC 1631.

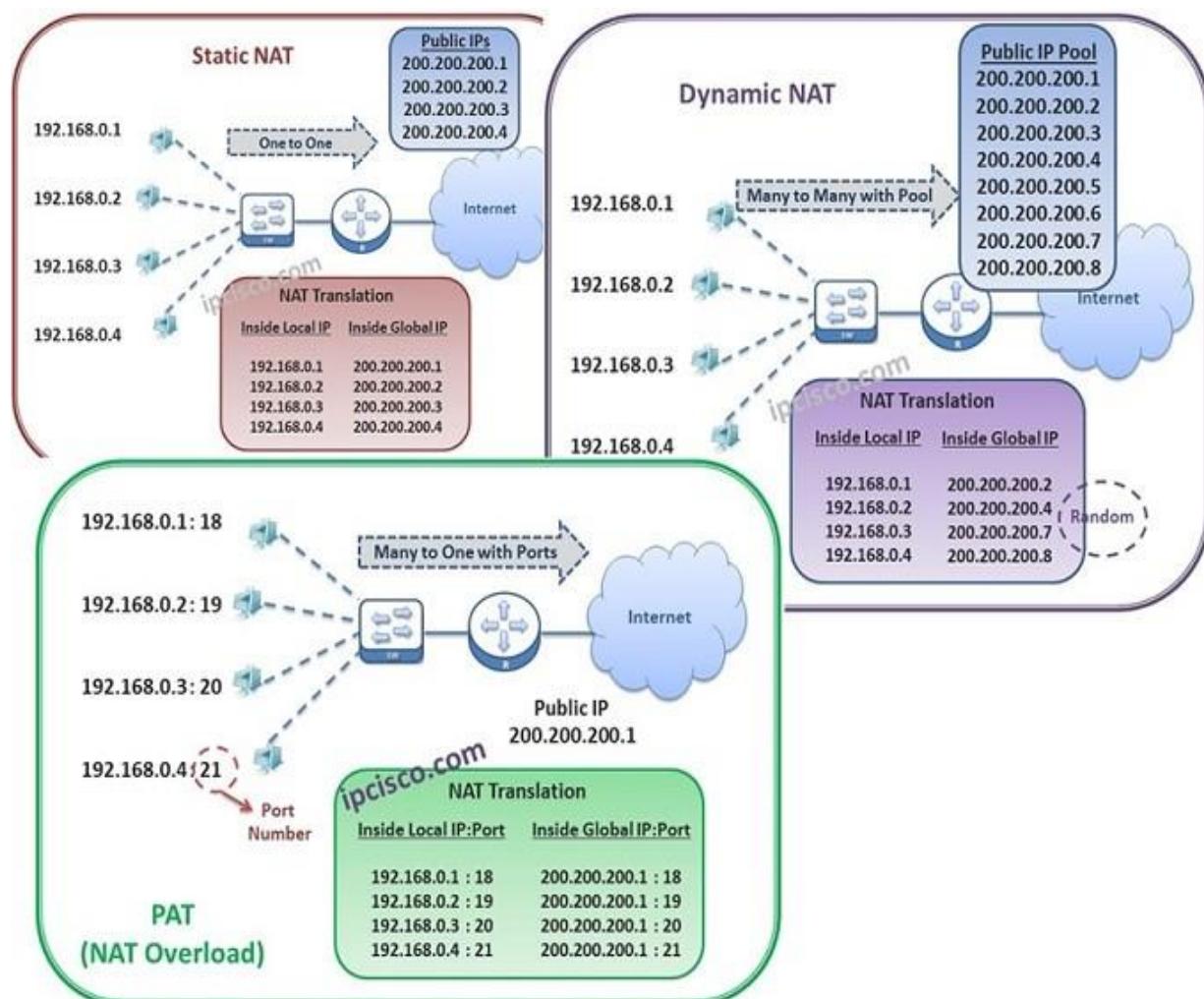


Types of NAT

NAT can be implemented in a few different ways, including:

Static NAT: Static NAT maps an internal IP address to an external one on a one-to-one basis. This doesn't help with the scalability of IPv4 but does make a system reachable from outside of the network without disrupting internal addressing schemes.

Dynamic NAT: With Dynamic NAT, a firewall has a pool of external IP addresses that it assigns to internal computers as needed. Like Static NAT, this creates a one-to-one mapping between internal and external IP addresses; however, these mappings are not permanent.

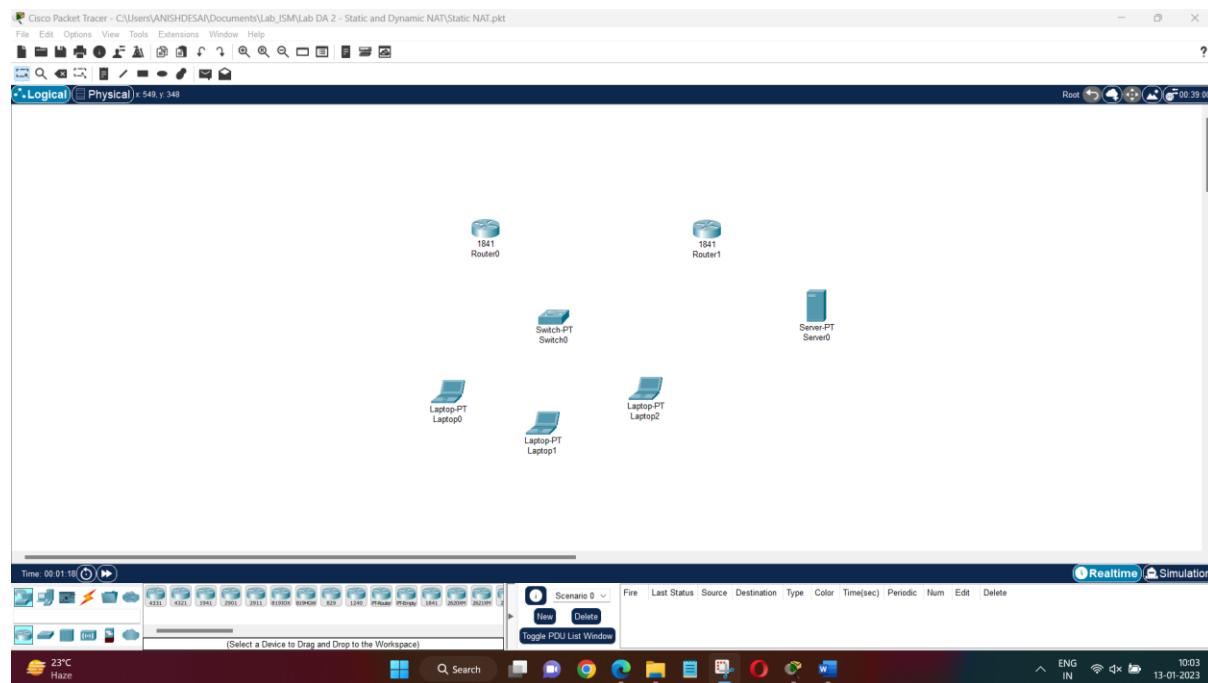


Static NAT configuration using CISCO Packet Tracer

Step 1 : Outlining the components and their connections

Components used include:

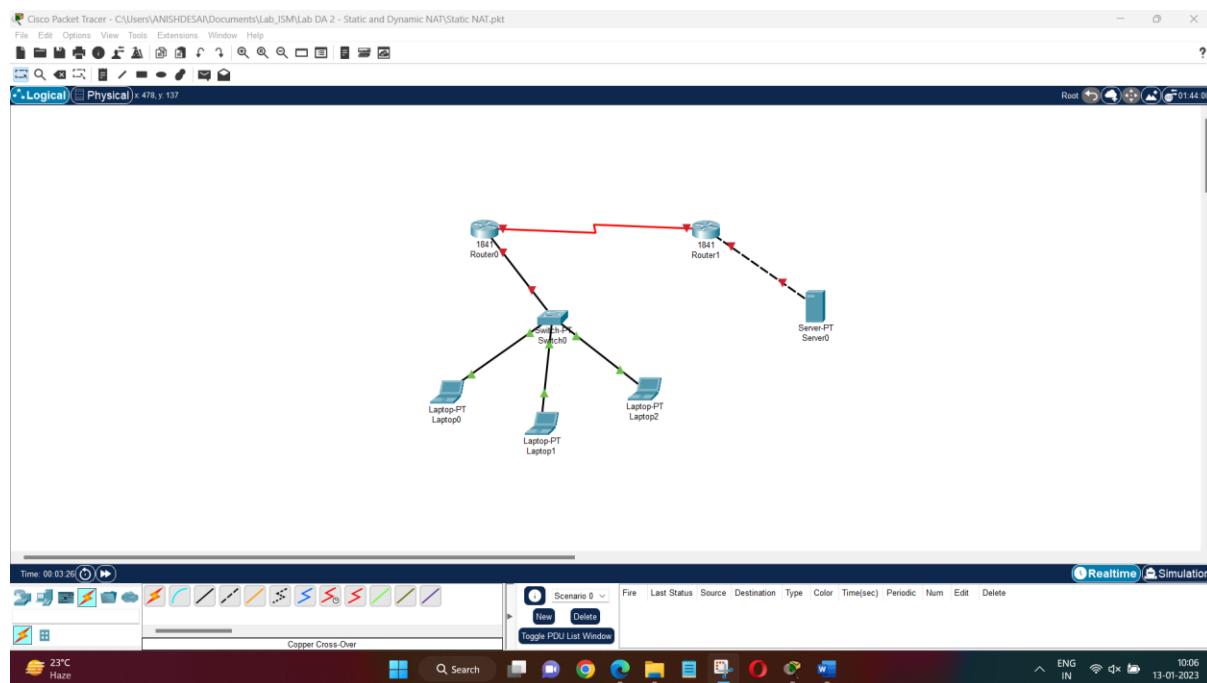
1. 1841-type Routers: Router0 and Router1
2. Switch-PT: Switch0
3. Server-PT: Server0
4. Laptop-PT: Laptop0, Laptop1 and Laptop2



Step 2 : Making the topology

In both the routers,
Switch OFF the routers and insert HWIC-2T module.
Switch the routers ON again.

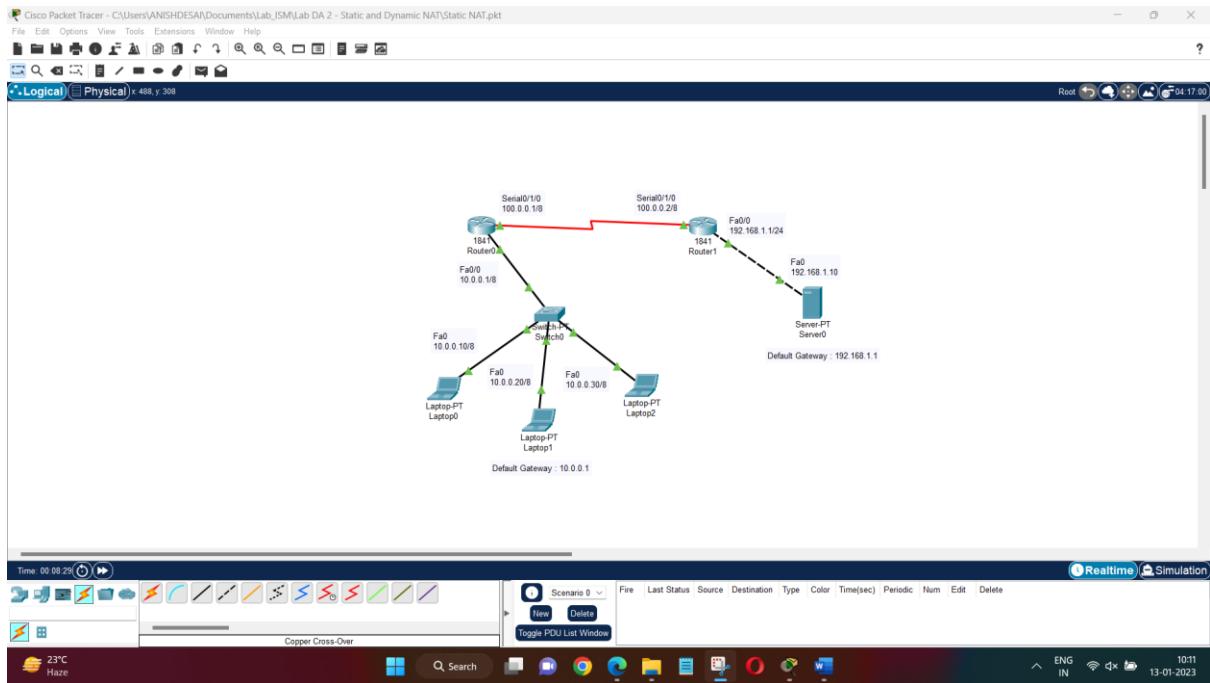
Device	Connected to	Connected with
Laptop0 – FastEthernet0	Switch0 – FastEthernet0/1	Copper Straight-through
Laptop1 – FastEthernet0	Switch0 – FastEthernet1/1	Copper Straight-through
Laptop2 – FastEthernet0	Switch0 – FastEthernet2/1	Copper Straight-through
Switch0 – FastEthernet3/1	Router0 – FastEthernet0/0	Copper Straight-through
Router0 – Serial0/1/0	Router1 – Serial0/1/0	Serial DTE
Router1 – FastEthernet0/0	Server0 – FastEthernet0	Copper Cross-Over



Step 3 : Assigning IP Addresses

Switch ON the ports of the given connections in both the routers.

Device	Connection	IP Address
Laptop0	FastEthernet0	10.0.0.10/8
Laptop1	FastEthernet0	10.0.0.20/8
Laptop2	FastEthernet0	10.0.0.30/8
Router0	FastEthernet0/0	10.0.0.1/8
Router0	Serial0/1/0	100.0.0.1/8
Router1	Serial0/1/0	100.0.0.2/8
Router1	FastEthernet0/0	192.168.1.1/24
Server0	FastEthernet0	192.168.1.10/24



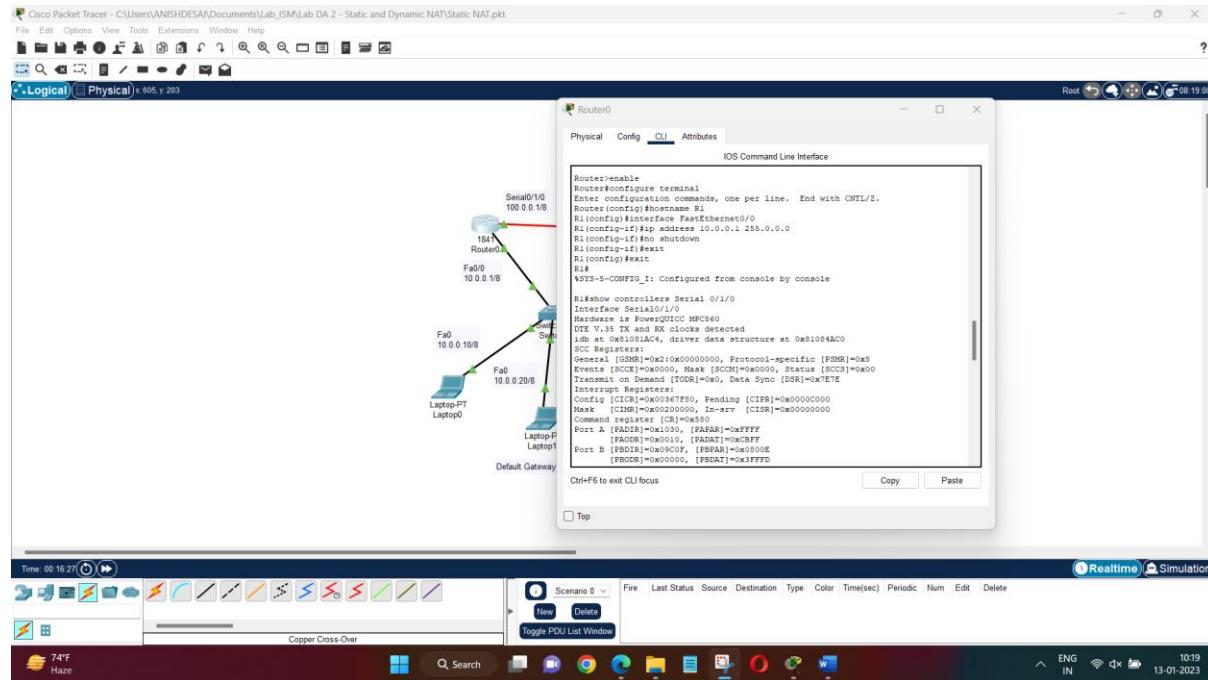
Set the Default Gateway of the Server0 as '192.168.1.1' using Server0 → Desktop → IP Configuration → Default Gateway. Also, for Laptops, set the Default Gateway as '10.0.0.1' using 'IP Configuration' in 'Desktop'.

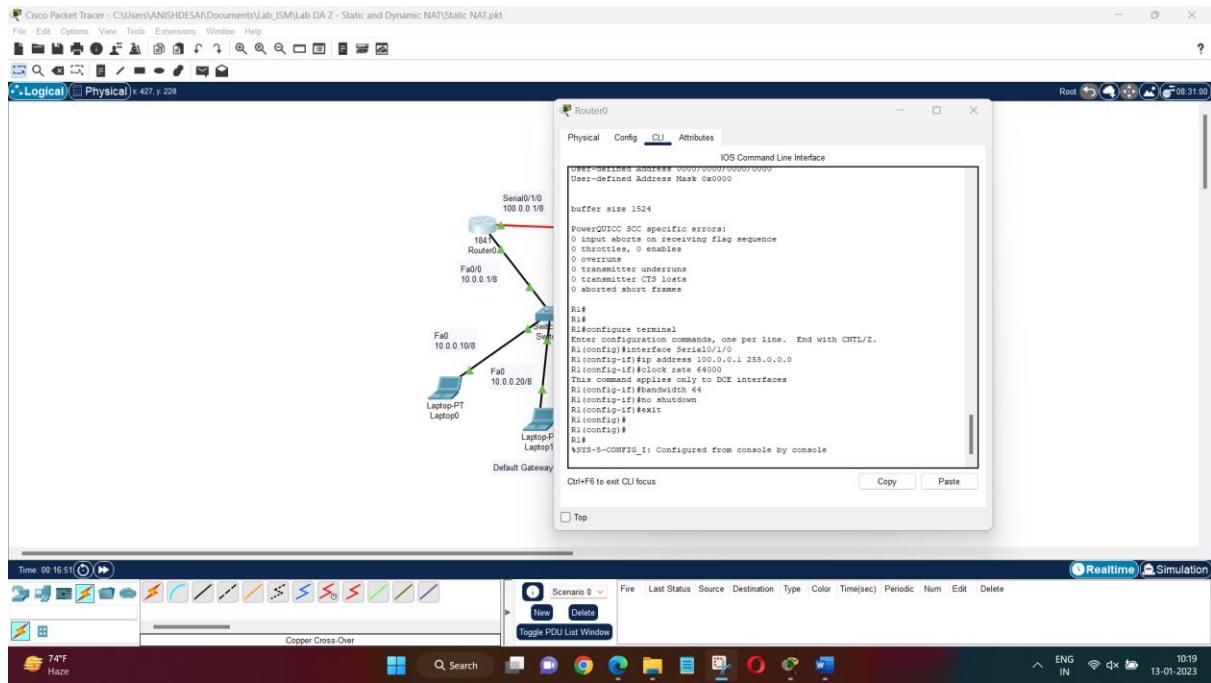
Step 4 : Initial Configuration

Enter the following commands in the CLI of the respective routers.

In Router0,

```
Router>enable  
Router# configure terminal  
Router(config)#hostname R1  
R1(config)#interface FastEthernet0/0  
R1(config-if)#ip address 10.0.0.1 255.0.0.0  
R1(config-if)#no shutdown  
R1(config-if)#exit  
R1(config)#exit  
R1#show controllers serial 0/1/0  
R1#configure terminal  
R1(config)#interface Serial0/1/0  
R1(config-if)#ip address 100.0.0.1 255.0.0.0  
R1(config-if)#clock rate 64000  
R1(config-if)#bandwidth 64  
R1(config-if)#no shutdown  
R1(config-if)#exit
```





In Router1,

```
Router>enable
```

```
Router#configure terminal
```

```
Router(config)#hostname R2
```

```
R2(config)#interface FastEthernet0/0
```

```
R2(config-if)#ip address 192.168.1.1 255.255.255.0
```

```
R2(config-if)#no shutdown
```

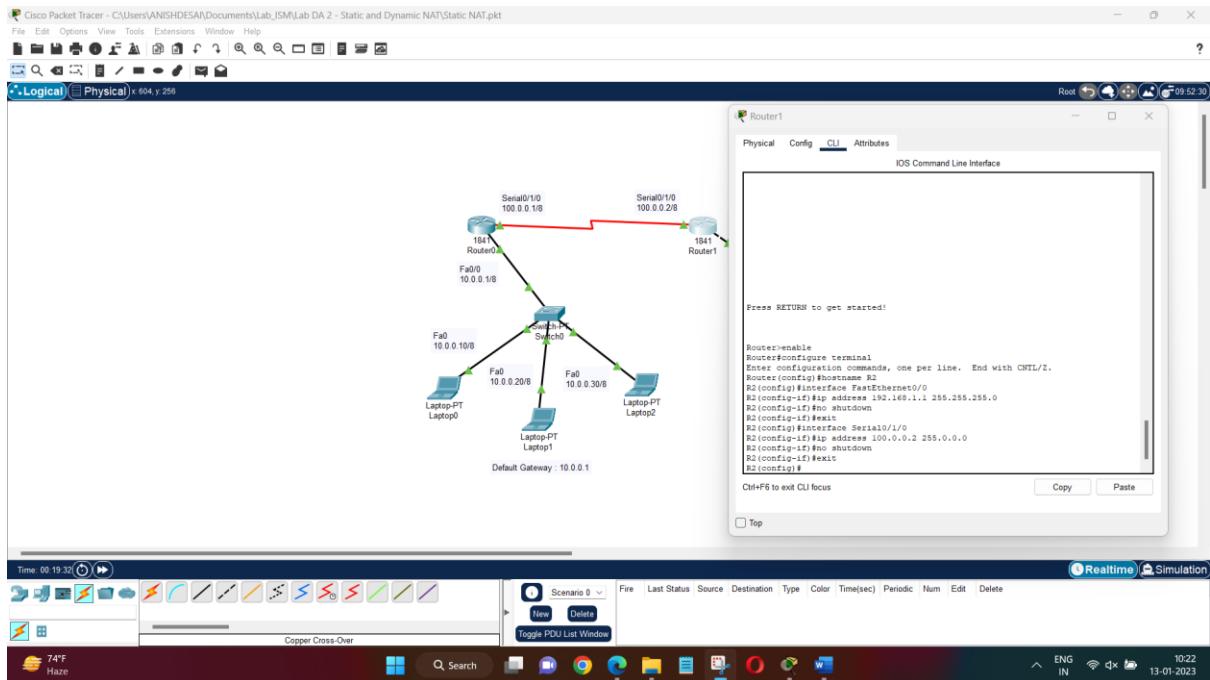
```
R2(config-if)#exit
```

```
R2(config)#interface Serial0/1/0
```

```
R2(config-if)#ip address 100.0.0.2 255.0.0.0
```

```
R2(config-if)#no shutdown
```

```
R2(config-if)#exit
```



Thus, IP Configurations have been set and the routers Router0 and Router1 have been named R1 and R2 respectively.

Step 5 : Static NAT Configuration

Static NAT configuration requires three steps: -

- Define IP address mapping
- Define inside local interface
- Define inside global interface

Since static NAT use manual translation, we have to map each inside local IP address (which needs a translation) with inside global IP address. Following command is used to map the inside local IP address with inside global IP address.

`Router(config)#ip nat inside source static [inside local ip address] [inside global IP address]`

For example, in our lab Laptop1 is configured with IP address 10.0.0.10. To map it with 50.0.0.10 IP address we will use following command

`Router(config)#ip nat inside source static 10.0.0.10 50.0.0.10`

In second step we have to define which interface is connected with local the network. On both routers interface Fa0/0 is connected with the local network which need IP translation. Following command will define interface Fa0/0 as inside local.

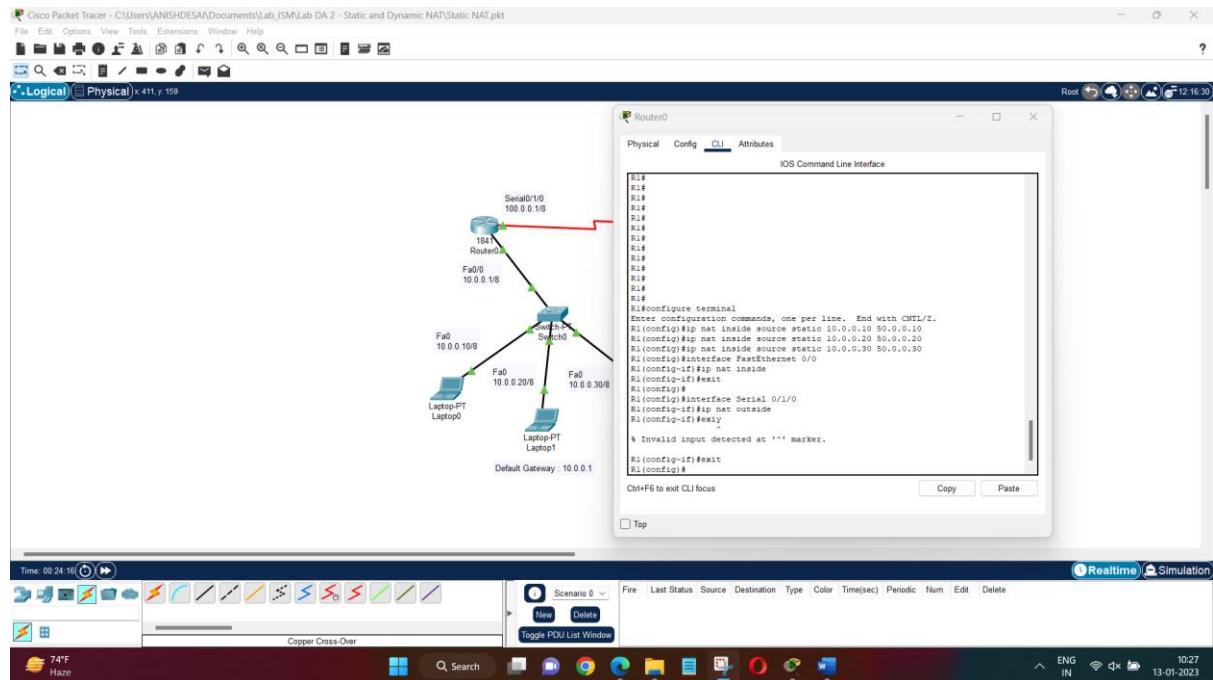
Router(config-if)#ip nat inside

In third step we have to define which interface is connected with the global network. On both routers serial 0/0/0 interface is connected with the global network. Following command will define interface Serial0/0/0 as inside global.

Router(config-if)#ip nat outside

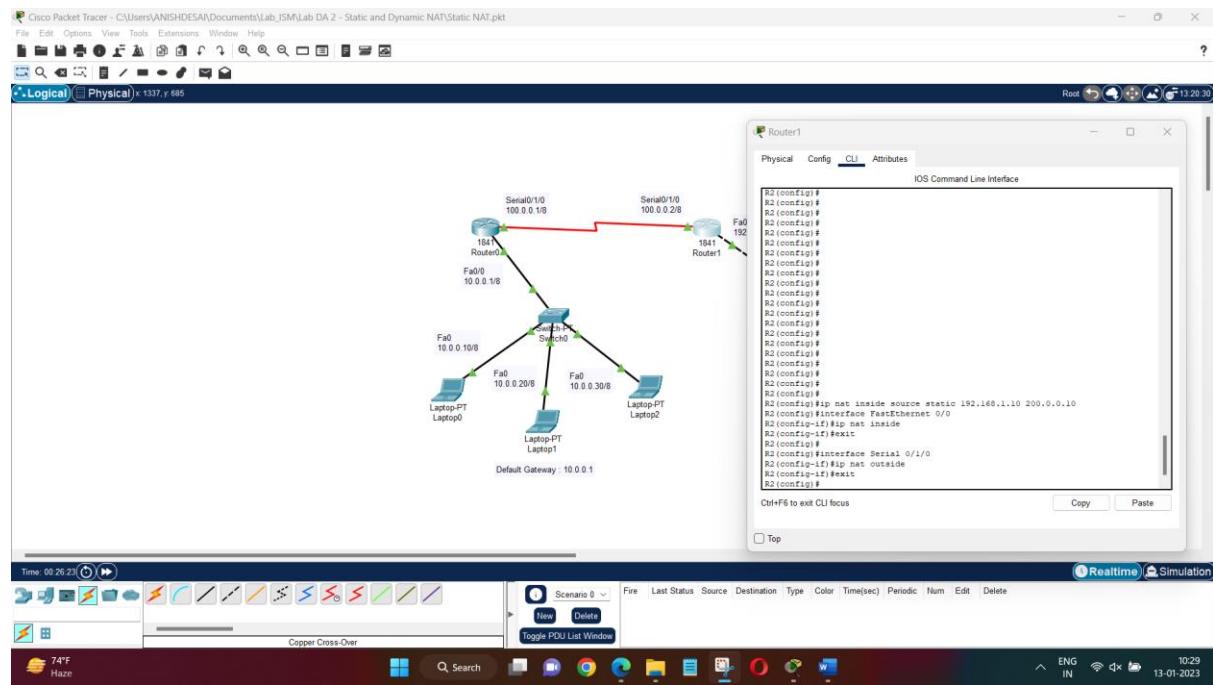
R1 Static NAT Configuration commands:

```
R1(config)#ip nat inside source static 10.0.0.10 50.0.0.10
R1(config)#ip nat inside source static 10.0.0.20 50.0.0.20
R1(config)#ip nat inside source static 10.0.0.30 50.0.0.30
R1(config)#interface FastEthernet 0/0
R1(config-if)#ip nat inside
R1(config-if)#exit
R1(config)#interface Serial 0/1/0
R1(config-if)#ip nat outside
R1(config-if)#exit
```



R2 Static NAT Configuration commands:

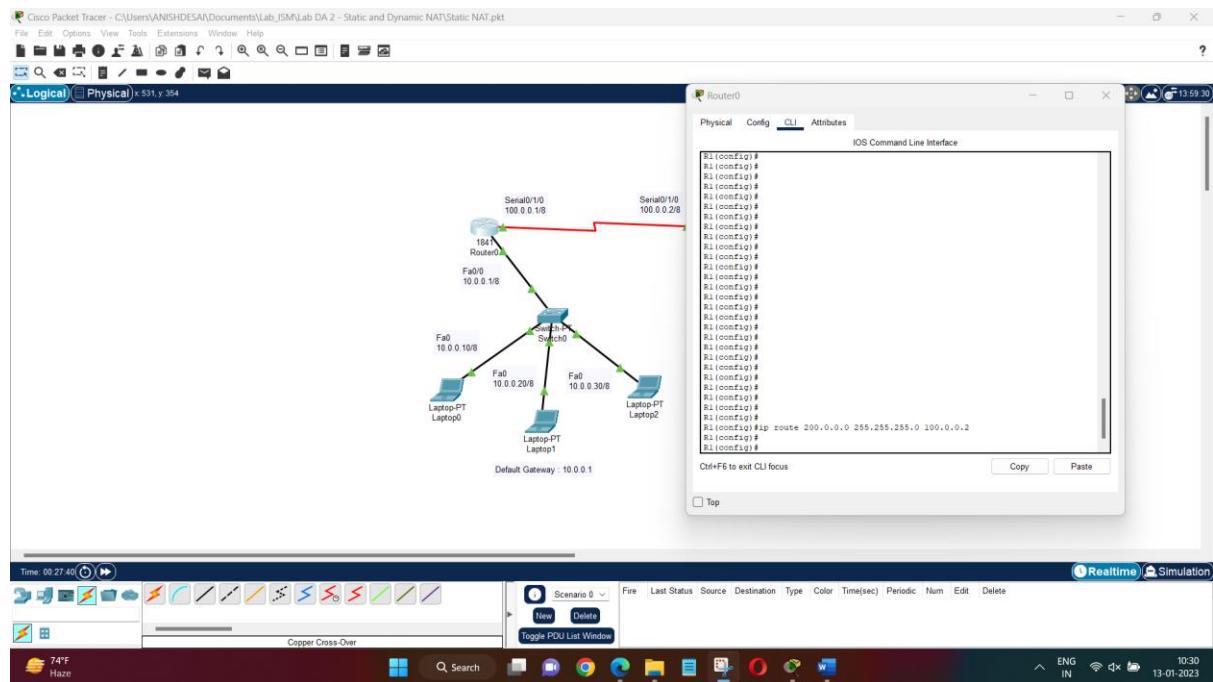
```
R2(config)#ip nat inside source static 192.168.1.10 200.0.0.10
R2(config)#interface FastEthernet 0/0
R2(config-if)#ip nat inside
R2(config-if)#exit
R2(config)#interface Serial 0/1/0
R2(config-if)#ip nat outside
R2(config-if)#exit
```



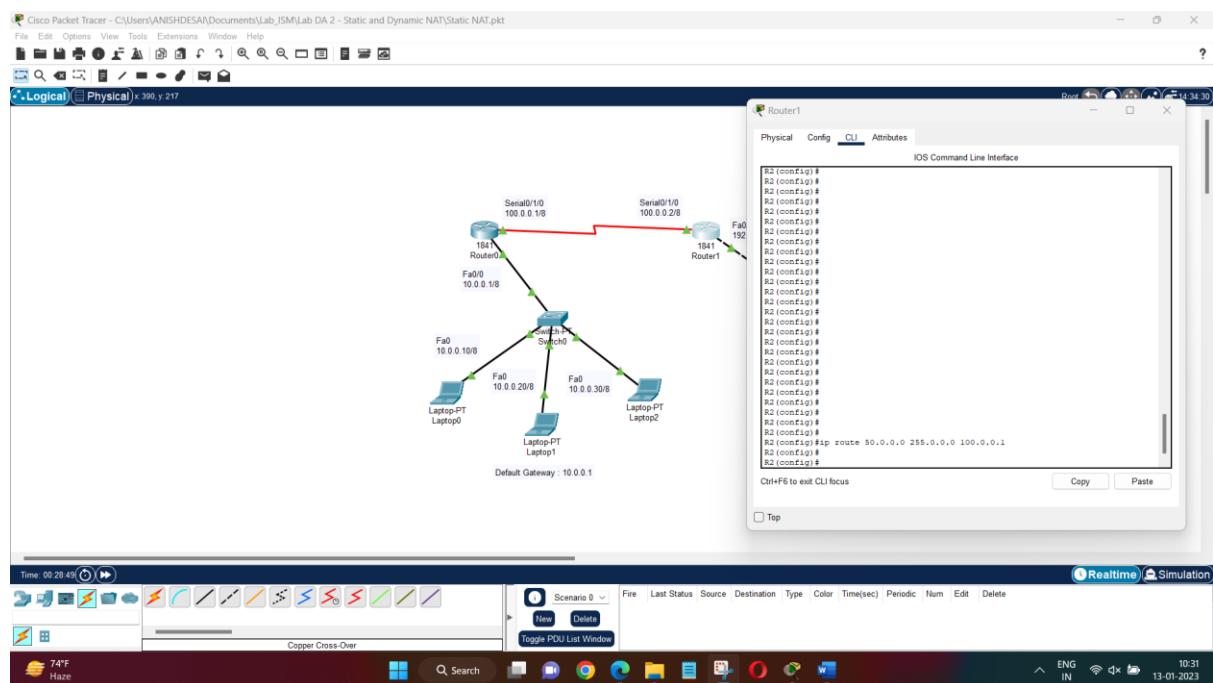
Step 6 : Configure Static Routing in R1 and R2

This is done using the following command.

```
R1(config)#ip route 200.0.0.0 255.255.255.0 100.0.0.2
```



```
R2(config)#ip route 50.0.0.0 255.0.0.0 100.0.0.1
```



Step 7 : Testing Static NAT Configuration

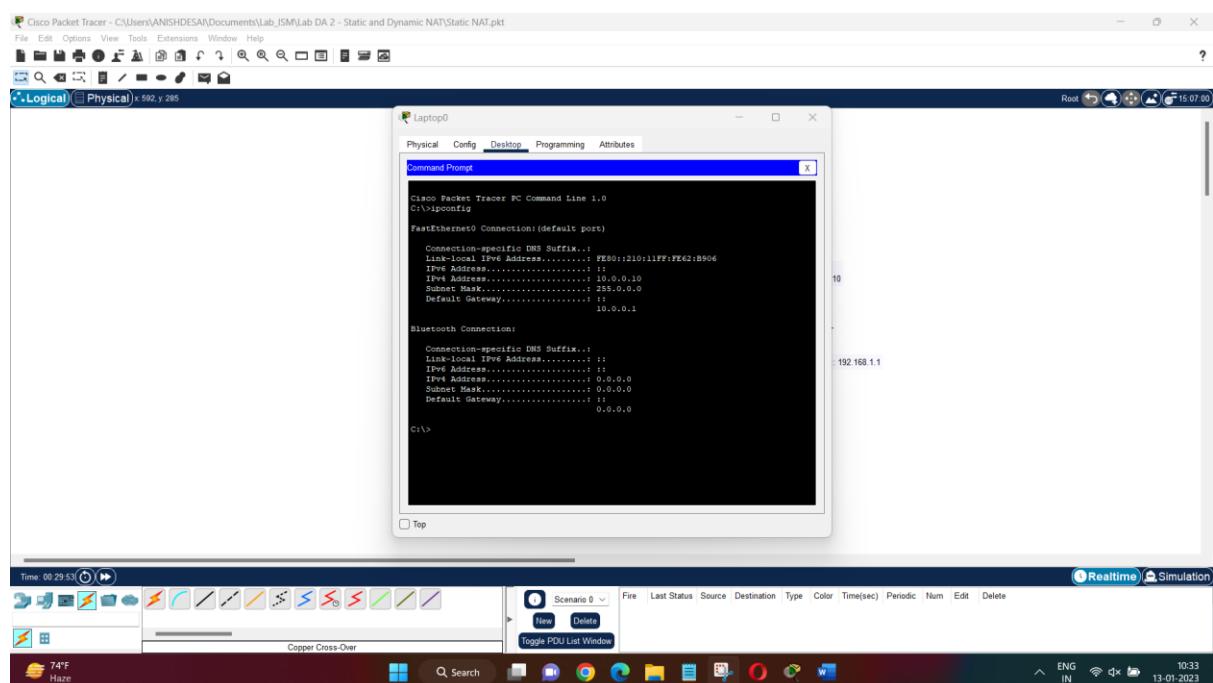
We have configured Static NAT on R1 and R2. On R1 we mapped inside local IP address 10.0.0.10 with inside global address 50.0.0.10 while on R2 we mapped inside local IP address 192.168.1.10 with inside global IP address 200.0.0.10.

To test this setup, click on Laptop0 → Desktop → Command Prompt. Enter the following commands.

```
#ipconfig  
#ping 200.0.0.10  
#ping 192.168.1.10
```

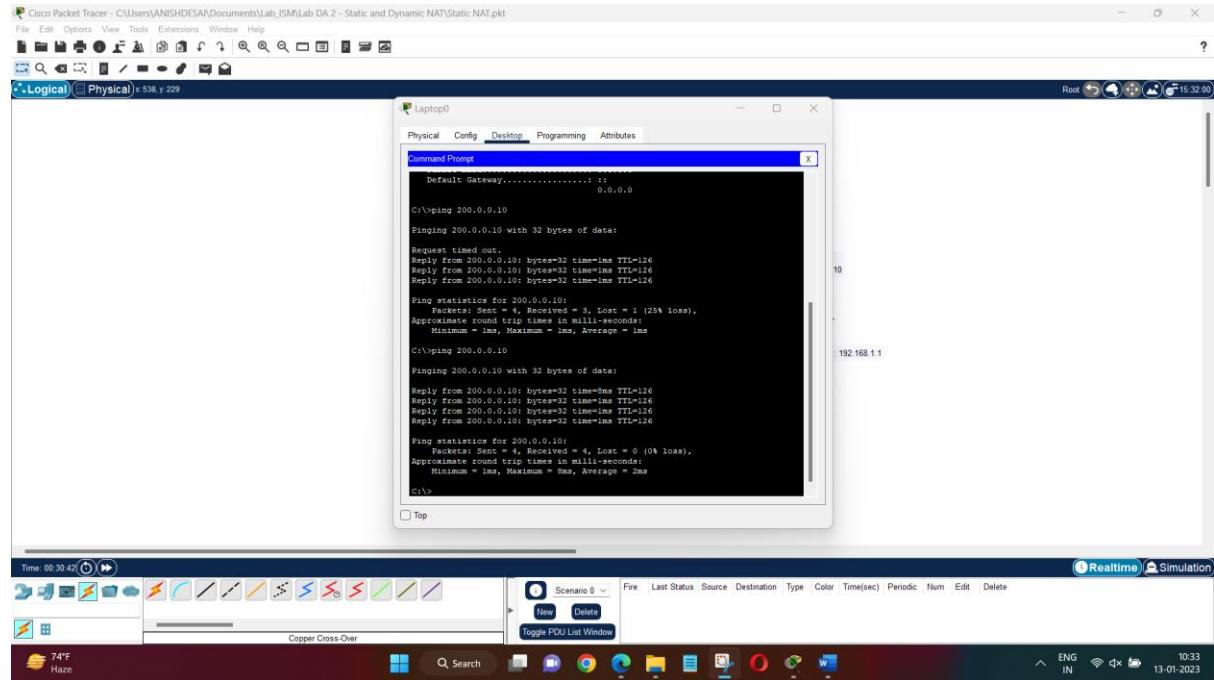
ipconfig

Verifies that we are testing from correct NAT device.



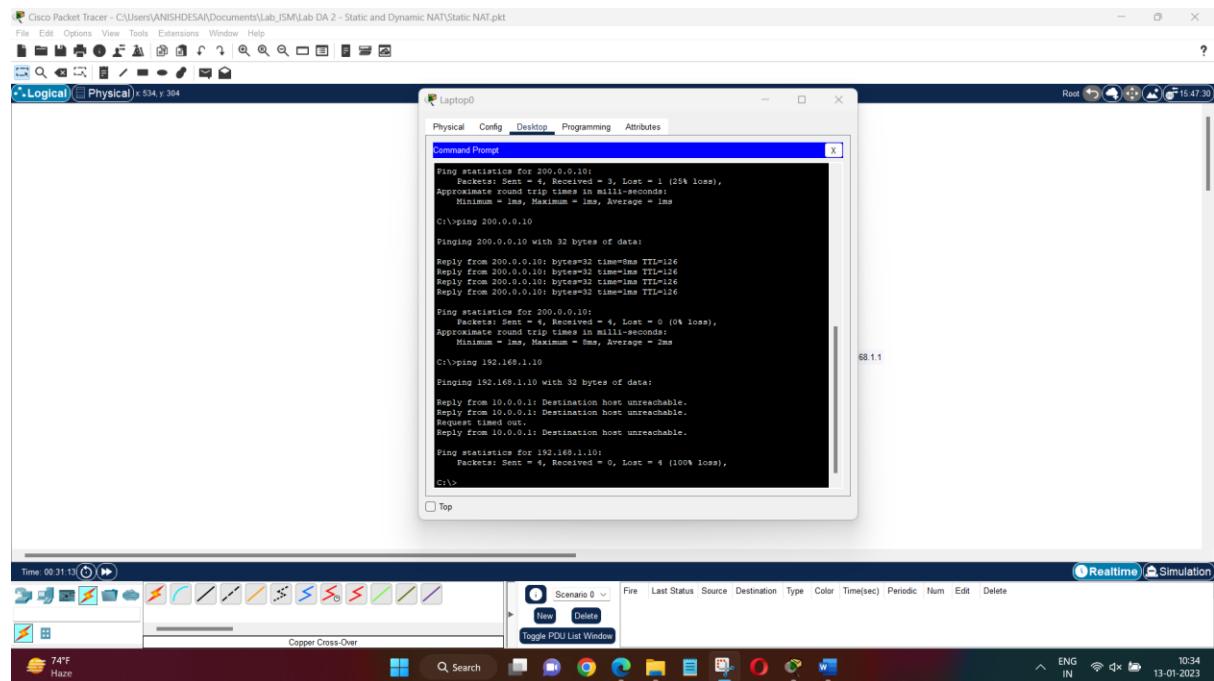
ping 200.0.0.10

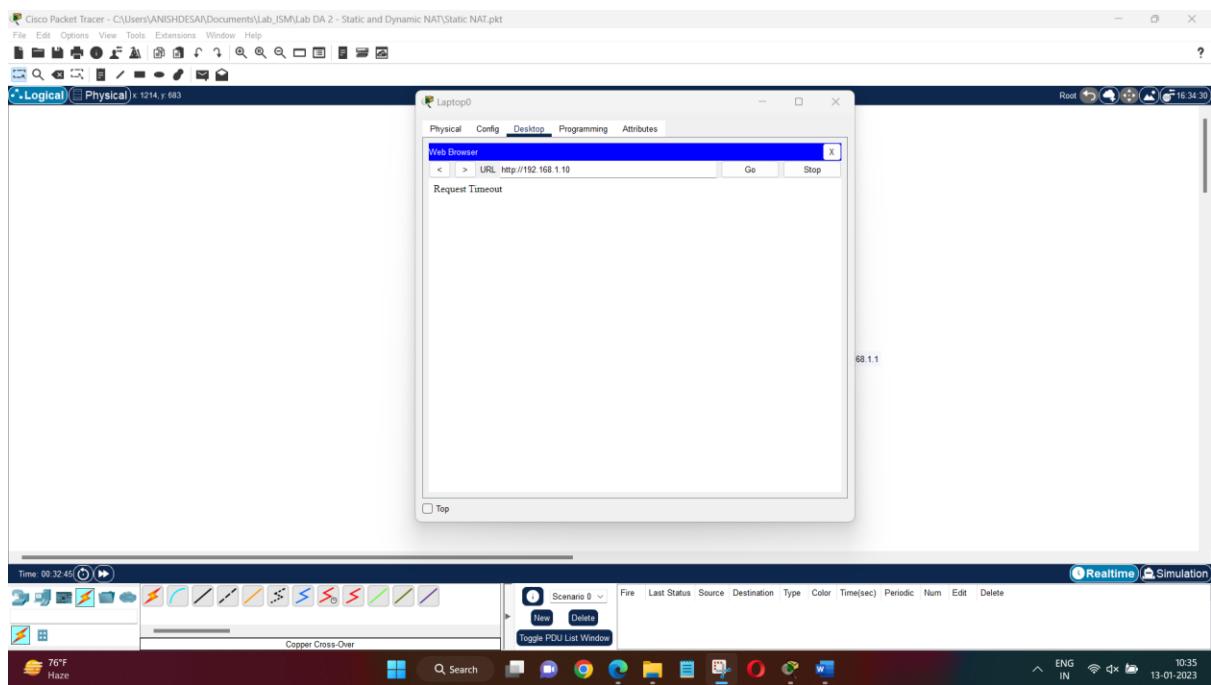
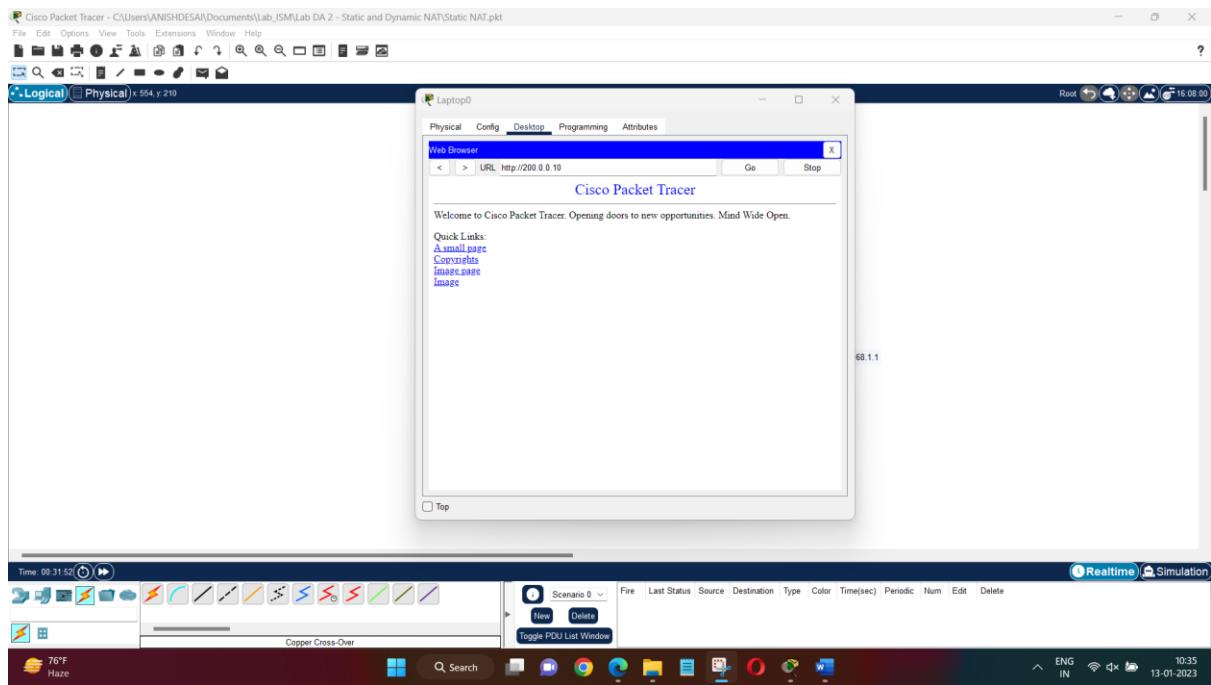
Checks whether we are able to access the remote device or not. A ping reply confirms that we are able to connect with remote device on this IP address.



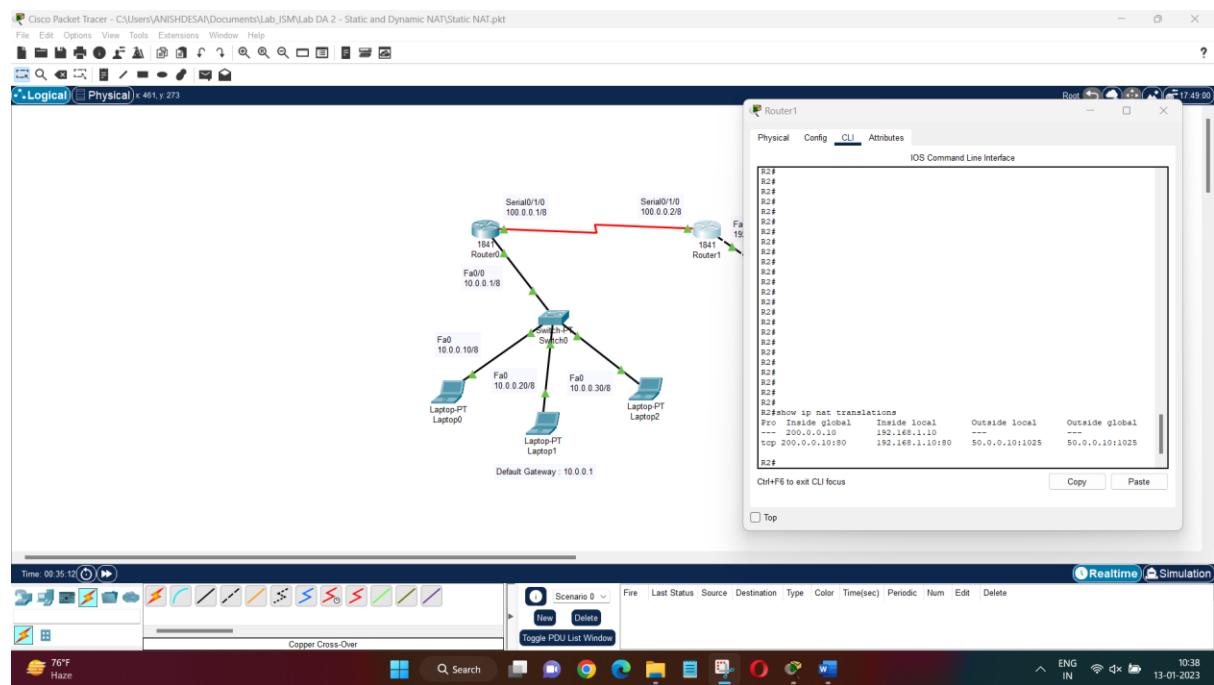
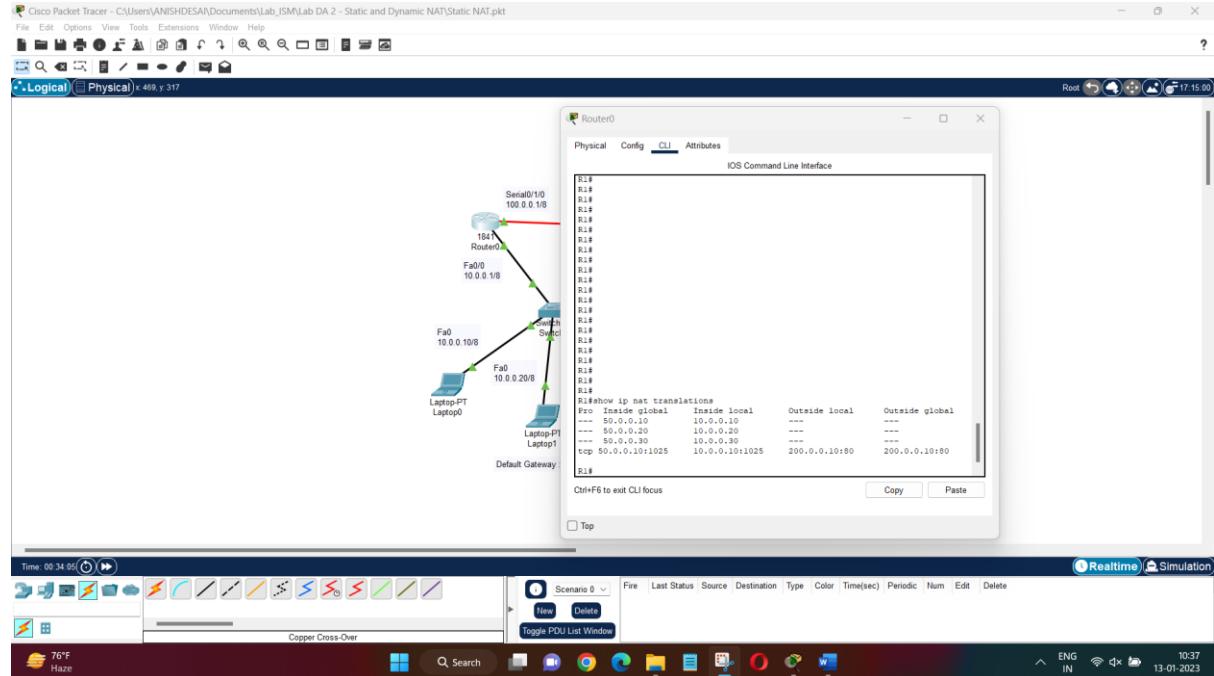
Ping 192.168.1.10

Checks whether we are able to access the remote device on its actual IP address or not. A ping error confirms that we are not able to connect with remote device on this IP address.





We can also verify this translation on router with show ip nat translation command.

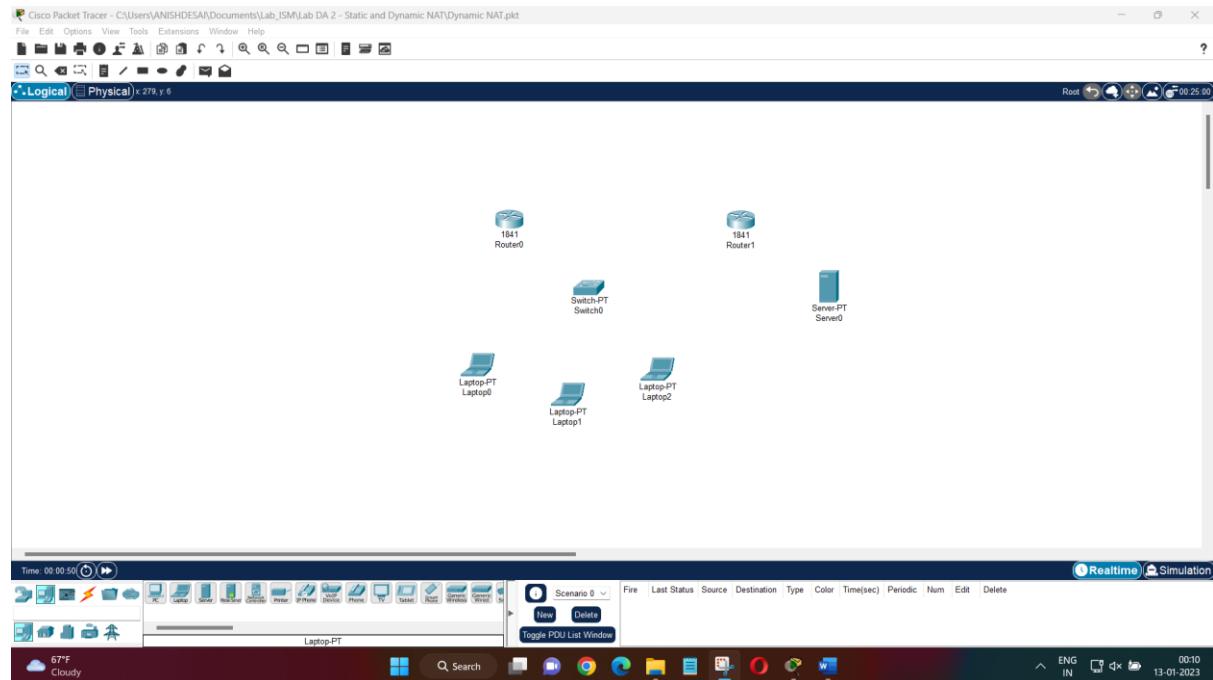


Dynamic NAT configuration using CISCO Packet Tracer

Step 1 : Outlining the components and their connections

Components used include:

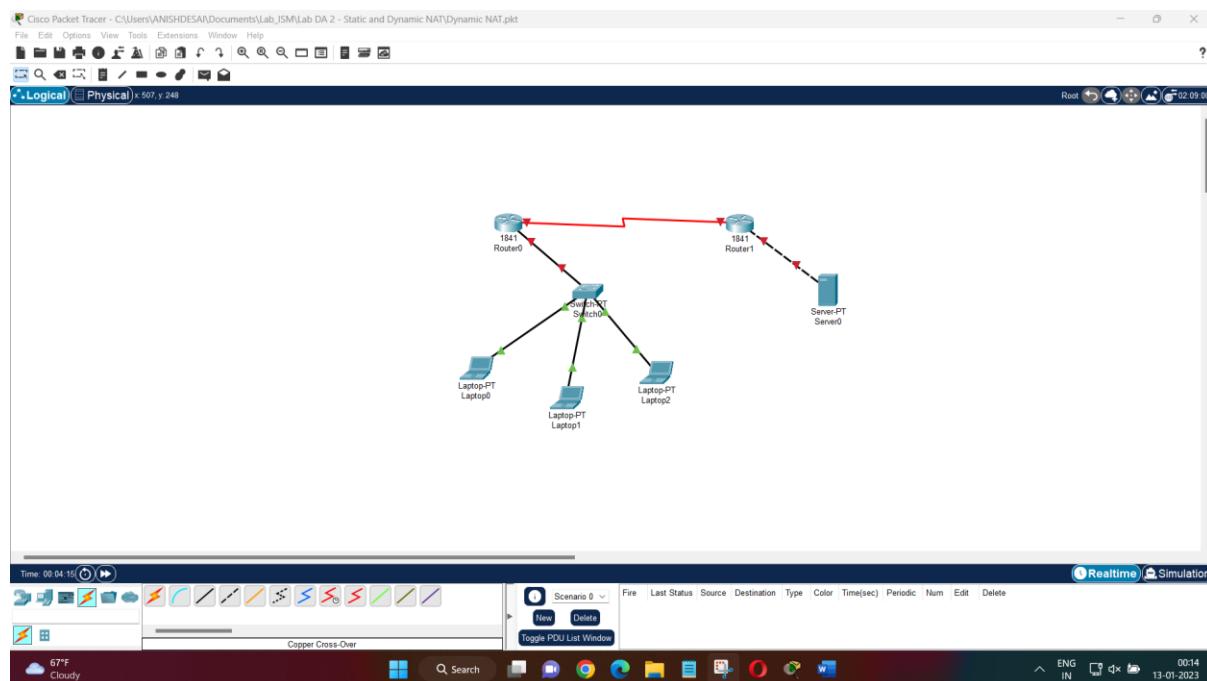
1. 1841-type Routers: Router0 and Router1
2. Switch-PT: Switch0
3. Server-PT: Server0
4. Laptop-PT: Laptop0, Laptop1 and Laptop2



Step 2 : Making the topology

In both the routers,
Switch OFF the routers and insert HWIC-2T module.
Switch the routers ON again.

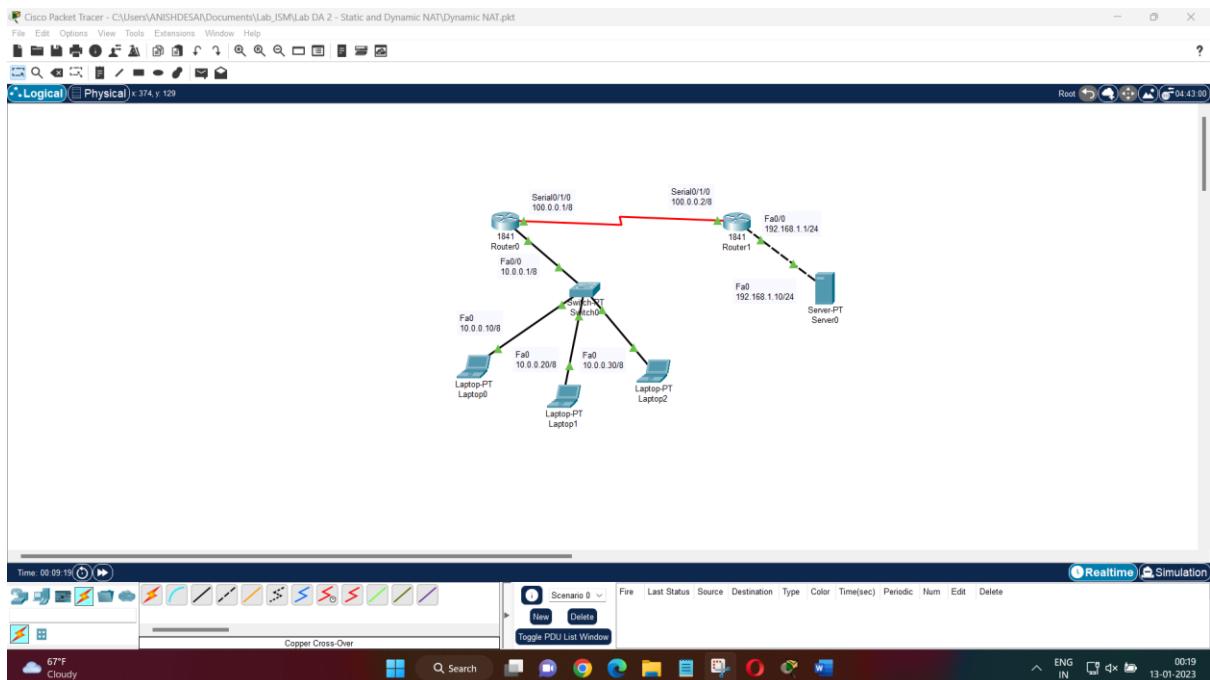
Device	Connected to	Connected with
Laptop0 – FastEthernet0	Switch0 – FastEthernet0/1	Copper Straight-through
Laptop1 – FastEthernet0	Switch0 – FastEthernet1/1	Copper Straight-through
Laptop2 – FastEthernet0	Switch0 – FastEthernet2/1	Copper Straight-through
Switch0 – FastEthernet3/1	Router0 – FastEthernet0/0	Copper Straight-through
Router0 – Serial0/1/0	Router1 – Serial0/1/0	Serial DTE
Router1 – FastEthernet0/0	Server0 – FastEthernet0	Copper Cross-Over



Step 3 : Assigning IP Addresses

Switch ON the ports of the given connections in both the routers.

Device	Connection	IP Address
Laptop0	FastEthernet0	10.0.0.10/8
Laptop1	FastEthernet0	10.0.0.20/8
Laptop2	FastEthernet0	10.0.0.30/8
Router0	FastEthernet0/0	10.0.0.1/8
Router0	Serial0/1/0	100.0.0.1/8
Router1	Serial0/1/0	100.0.0.2/8
Router1	FastEthernet0/0	192.168.1.1/24
Server0	FastEthernet0	192.168.1.10/24



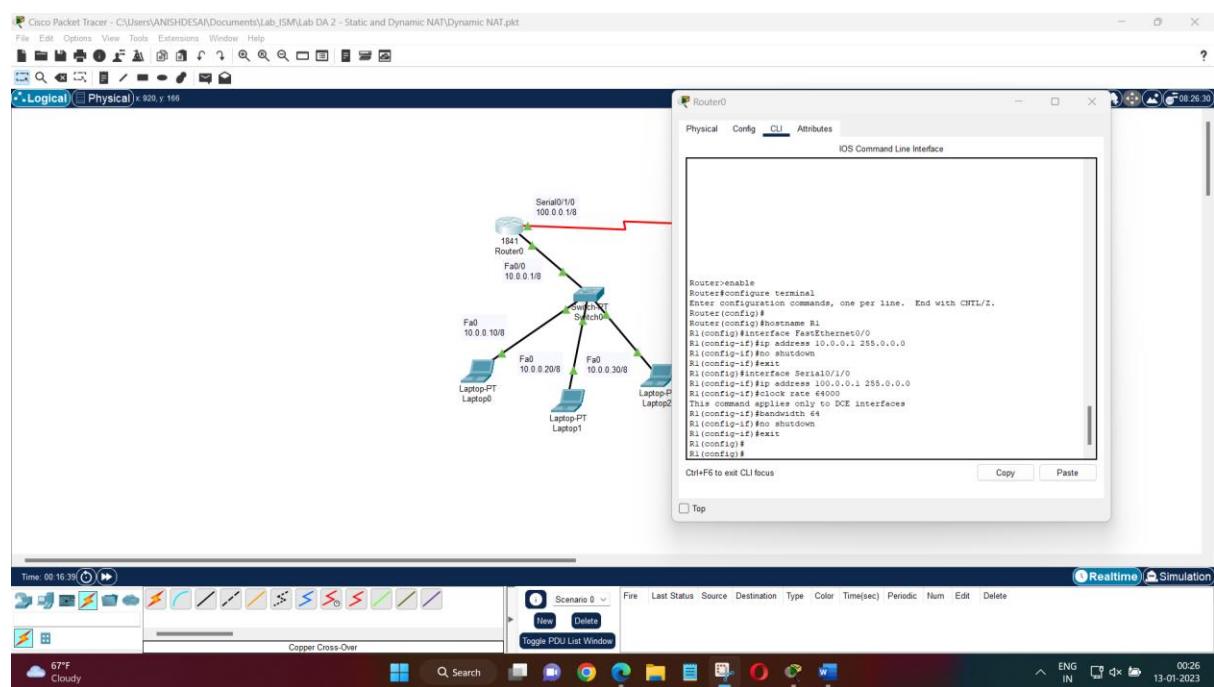
Set the Default Gateway of the Server0 as '192.168.1.1' using Server0 → Desktop → IP Configuration → Default Gateway. Also, for Laptops, set the Default Gateway as '10.0.0.1' using IP Configuration.

Step 4 : CLI for IP Address and Hostname

Run the following commands.

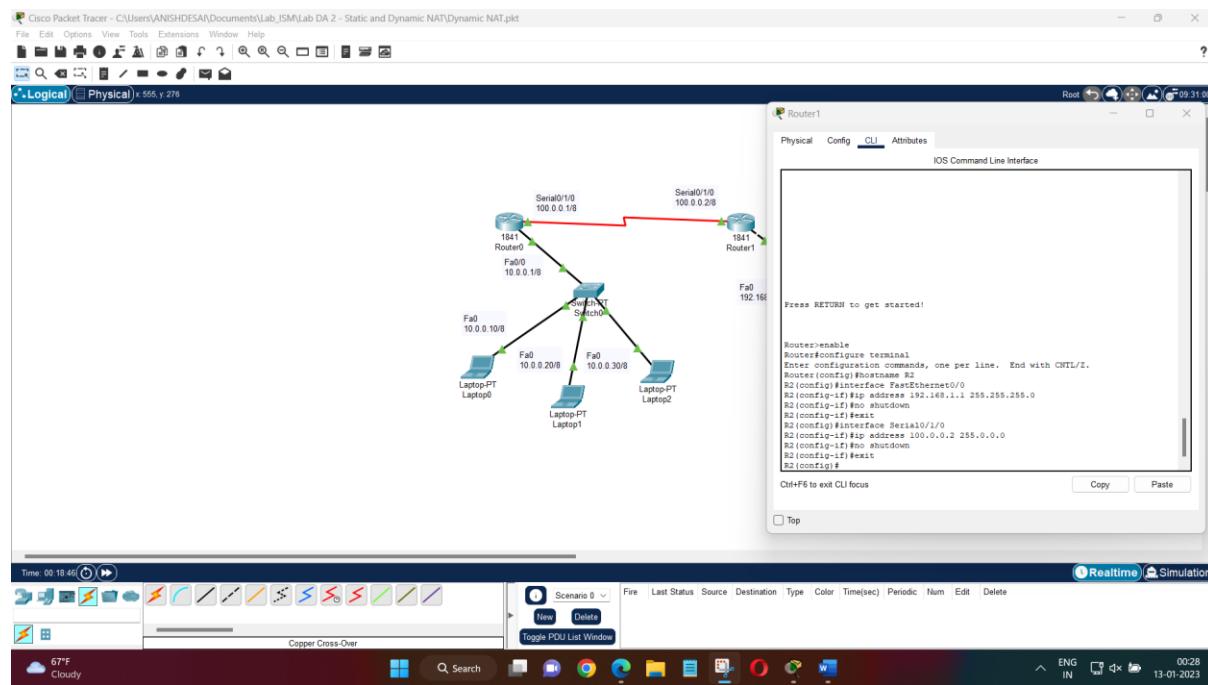
In Router0,

```
Router>enable  
Router# configure terminal  
Router(config)#  
Router(config)#hostname R1  
R1(config)#interface FastEthernet0/0  
R1(config-if)#ip address 10.0.0.1 255.0.0.0  
R1(config-if)#no shutdown  
R1(config-if)#exit  
R1(config)#interface Serial0/1/0  
R1(config-if)#ip address 100.0.0.1 255.0.0.0  
R1(config-if)#clock rate 64000  
R1(config-if)#bandwidth 64  
R1(config-if)#no shutdown  
R1(config-if)#exit  
R1(config)#[/pre>
```



In Router1,

```
Router>enable  
Router#configure terminal  
Router(config)#hostname R2  
R2(config)#interface FastEthernet0/0  
R2(config-if)#ip address 192.168.1.1 255.255.255.0  
R2(config-if)#no shutdown  
R2(config-if)#exit  
R2(config)#interface Serial0/0/0  
R2(config-if)#ip address 100.0.0.2 255.0.0.0  
R2(config-if)#no shutdown  
R2(config-if)#exit  
R2(config)#
```



Step 5 : Configure Dynamic NAT

Dynamic NAT configuration requires four steps: -

Create an access list of IP addresses which need translation

Create a pool of all IP address which are available for translation

Map access list with pool

Define inside and outside interfaces

In first step we will create a standard access list which defines which inside local addresses are permitted to map with inside global address.

To create a standard numbered ACL following global configuration mode command is used:-

```
Router(config)# access-list ACL_Identifier_number permit/deny matching-parameters
```

In second step we define a pool of inside global addresses which are available for translation.

Following command is used to define the NAT pool.

```
Router(config)#ip nat pool [Pool Name] [Start IP address] [End IP address] netmask [Subnet mask]
```

In third step we map access list with pool. Following command will map the access list with pool and configure the dynamic NAT.

```
Router(config)#ip nat inside source list [access list name or number] pool [pool name]
```

Finally, we have to define which interface is connected with local network and which interface is connected with global network.

To define an inside local we use following command

```
Router(config-if)#ip nat inside
```

Following command defines inside global

```
Router(config-if)#ip nat outside
```

In Router R1,

R1#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

```
R1(config)#access-list 1 permit 10.0.0.10 0.0.0.0
```

```
R1(config)#access-list 1 permit 10.0.0.20 0.0.0.0
```

```
R1(config)#access-list 1 deny any
```

```
R1(config)#ip nat pool ccna 50.0.0.1 50.0.0.2 netmask 255.0.0.0
```

```
R1(config)#ip nat inside source list 1 pool ccna
```

```
R1(config)#interface FastEthernet 0/0
```

```
R1(config-if)#ip nat inside
```

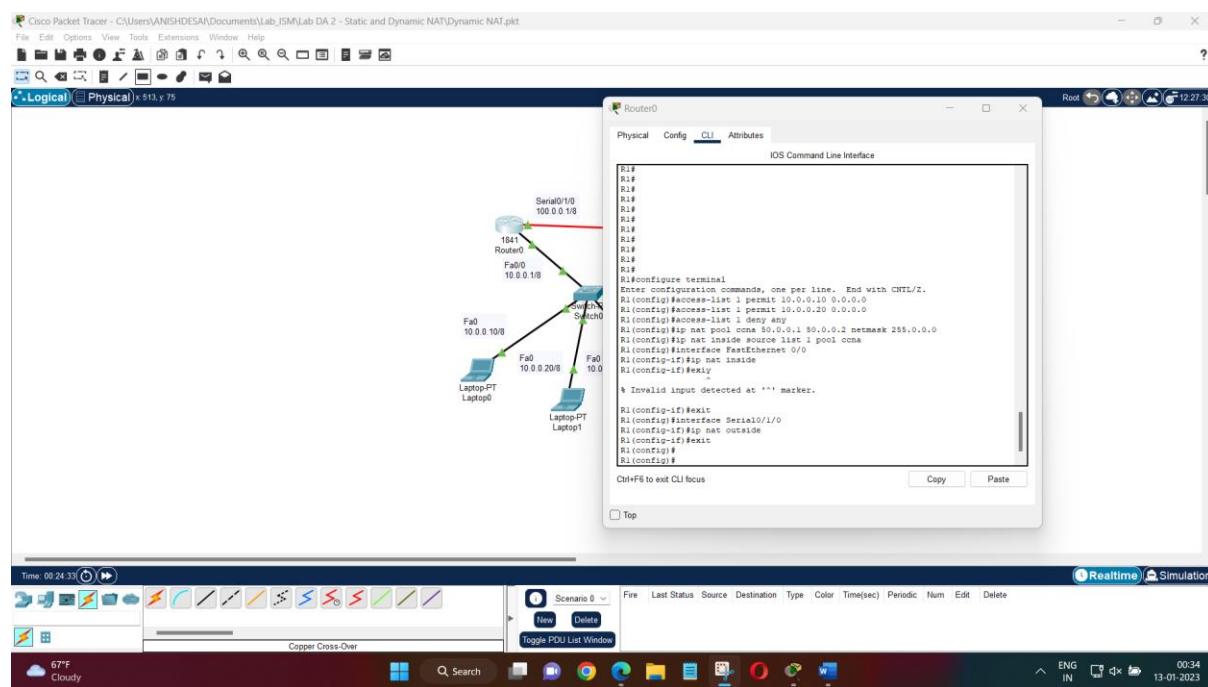
```
R1(config-if)#exit
```

```
R1(config)#interface Serial0/1/0
```

```
R1(config-if)#ip nat outside
```

```
R1(config-if)#exit
```

```
R1(config)#{}
```



In Router R2,

```
R2>enable
```

```
R2#configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

```
R2(config)#ip nat inside source static 192.168.1.10 200.0.0.10
```

```
R2(config)#interface Serial 0/1/0
```

```
R2(config-if)#ip nat outside
```

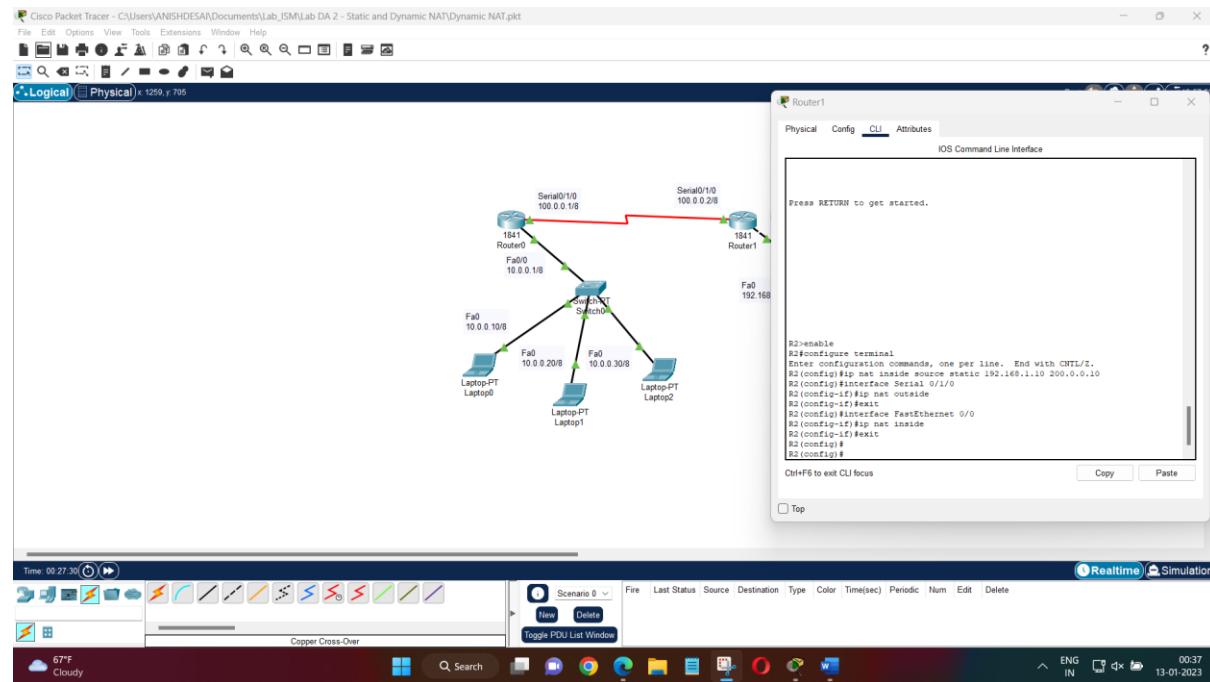
```
R2(config-if)#exit
```

```
R2(config)#interface FastEthernet 0/0
```

```
R2(config-if)#ip nat inside
```

```
R2(config-if)#exit
```

```
R2(config)#
```



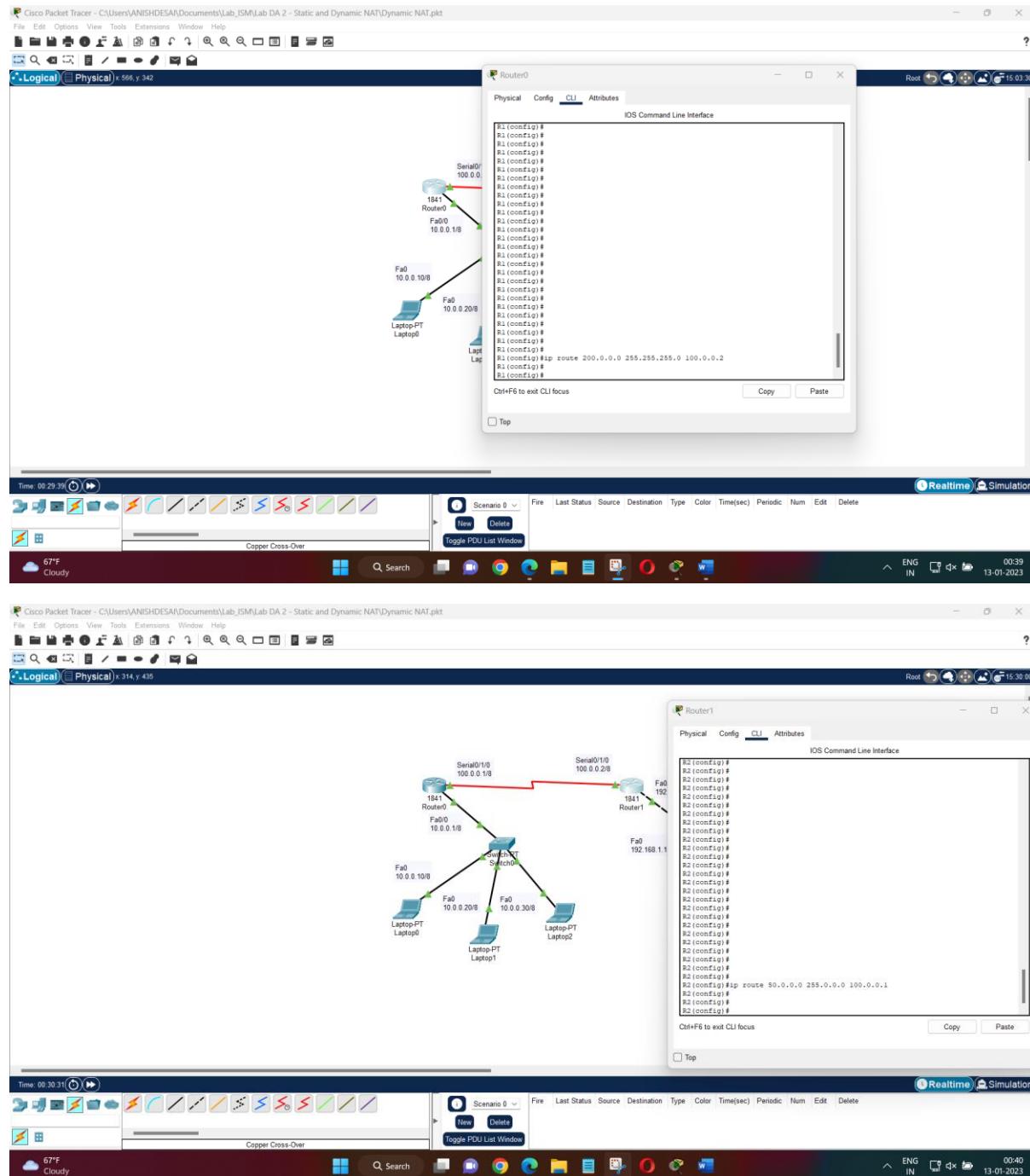
Step 6 : Configure Static Routing in Routers

Configure static routing in R1

```
R1(config)#ip route 200.0.0.0 255.255.255.0 100.0.0.2
```

Configure static routing in R2

```
R2(config)#ip route 50.0.0.0 255.0.0.0 100.0.0.1
```



Step 7 : Testing Dynamic NAT Configuration

We have configured dynamic NAT on R1 for 10.0.0.10 and 10.0.0.20 and static NAT on R2 for 192.168.1.10.

To test this setup, click Laptop0 and Desktop and click Command Prompt.

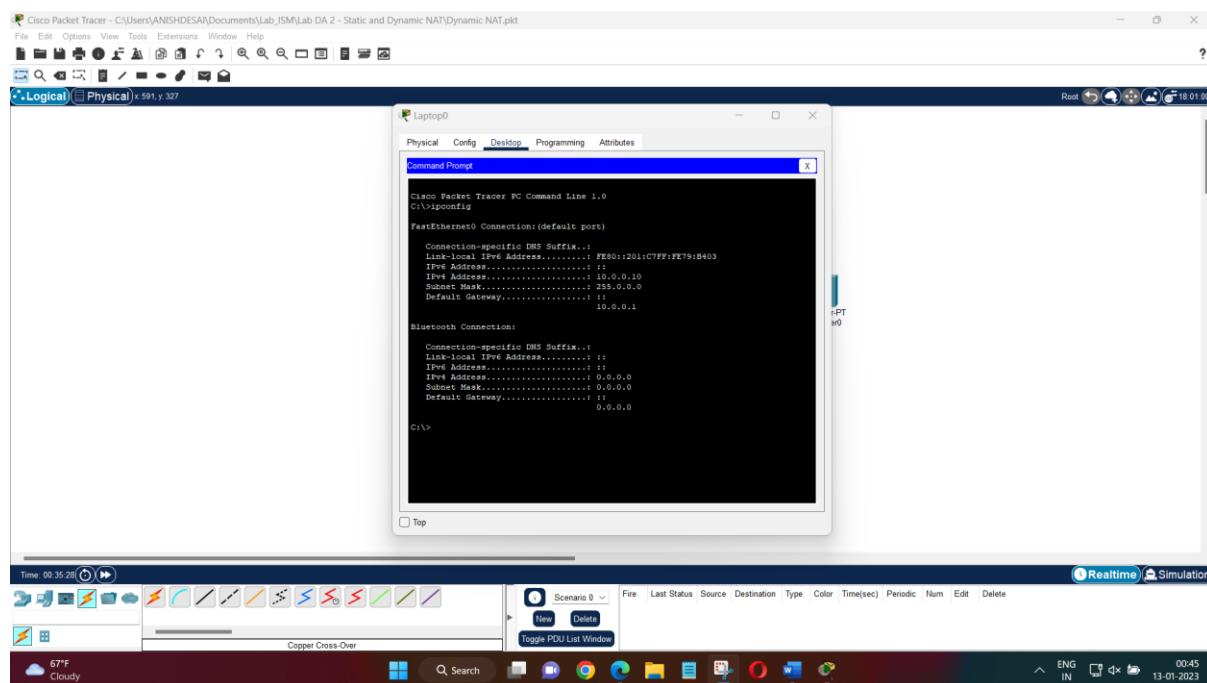
Run ipconfig command.

Run ping 200.0.0.10 command.

Run ping 192.168.1.10 command.

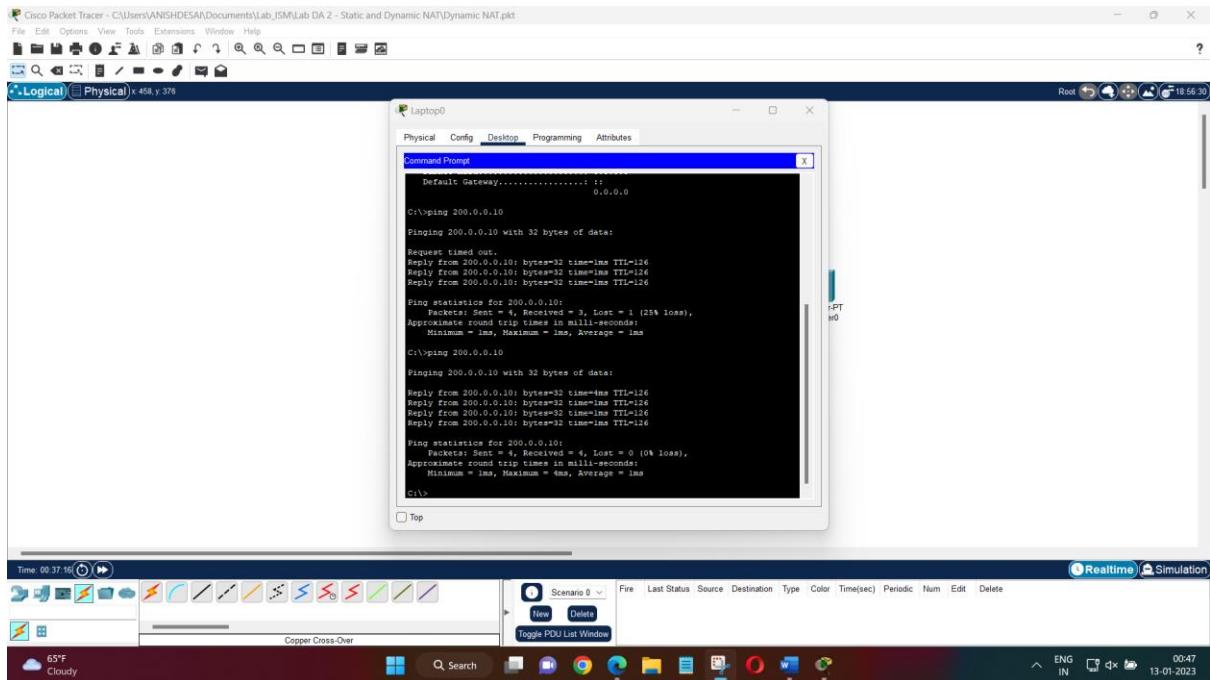
ipconfig

Verifies that we are testing from correct NAT device.



ping 200.0.0.10

Checks whether we are able to access the remote device or not. A ping reply confirms that we are able to connect with remote device on this IP address.



ping 192.168.1.10

Checks whether we are able to access the remote device on its actual IP address or not. A ping error confirms that we are not able to connect with remote device on this IP address.

