

EXP-10: Implementation of Network Address Translation (NAT) on a Cisco Router

I. Aim:

Implement of Network Address Translation (NAT) on a Cisco Router.

II. Components and Tools:

Tool: Packet Tracer

Components: 2- Routers, 3-Laptops, 1-Server, and connecting wires

III. Description: NAT

IV. Diagrams / Experimental set-up:

V. Procedure:

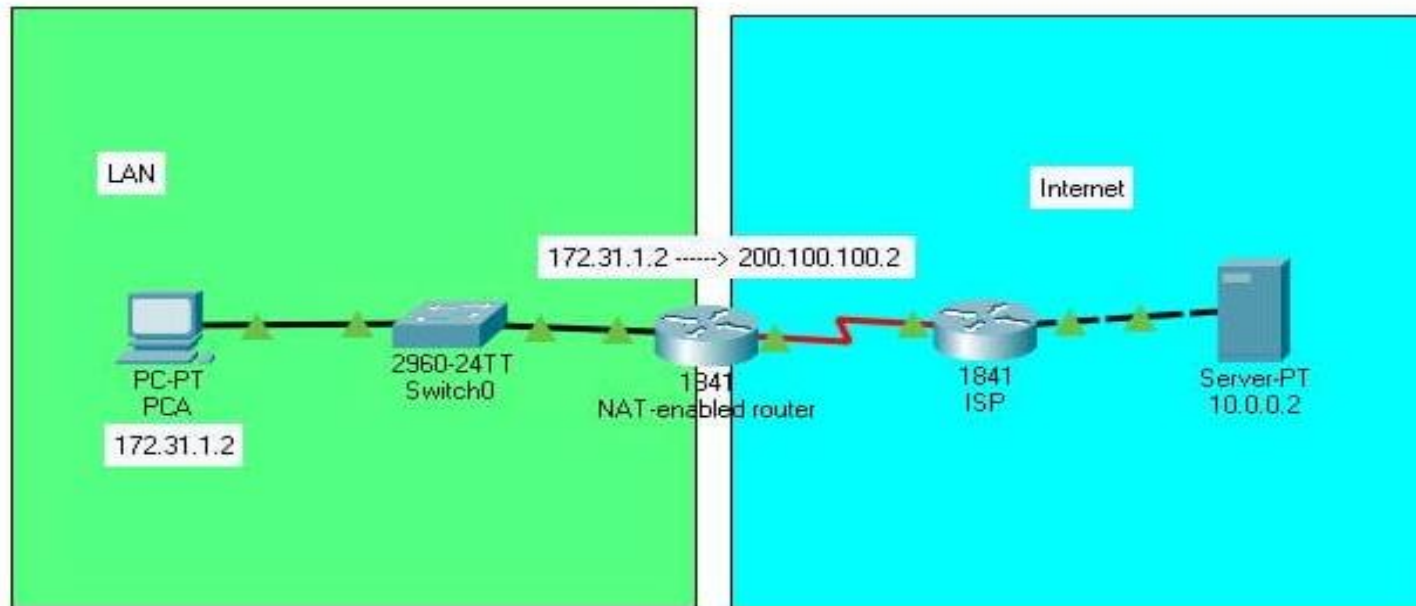
VI. Output Description/Analysis:

VII. Viva-Voce Questions:

III. Description: NAT

- The IP address can be classified as:
 - Internet Protocol version 4 (IPv4)
 - Internet Protocol version 6 (IPv6)
 - IPv4 defines an IP address as a 32-bit number, while IPv6 defines an IP address as a 128-bit number.
- Public and private IP address
 - All IPv4 addresses can be divided further into public (global) and private (local) addresses.
 - Public addresses are routable addresses that are used on the internet, these addresses allow the users to access resources on a computer network located anywhere in the world.
 - While, private addresses are not routable and no traffic can be sent to them or by them over the internet.
 - These addresses are within the range of:
 - 10.0.0.0 to 10.255.255.255
 - 172.16.0.0 to 172.255.255.255
 - 192.168.0.0 to 192.168.255.255

- The major limitation of Internet Protocol version 4 (IPv4) is its address exhaustion issue.
- As a short-term solution, various protocols such as private addressing and Network Address Translation (NAT) were introduced.
- Network Address Translation
 - Allowing organizations to assign private addresses to their internal network, while translating them to public addresses and allowing them to connect to the internet.
 - In the figure above, PCA with an IP address of 172.31.1.2 wants to reach the webserver, but because PCA's address is not routable, it cannot access the webserver directly.
 - Instead, the NAT-enabled router translates the PC's private address of 172.31.1.2 to a public address of 200.100.100.2, which is routable over the internet.



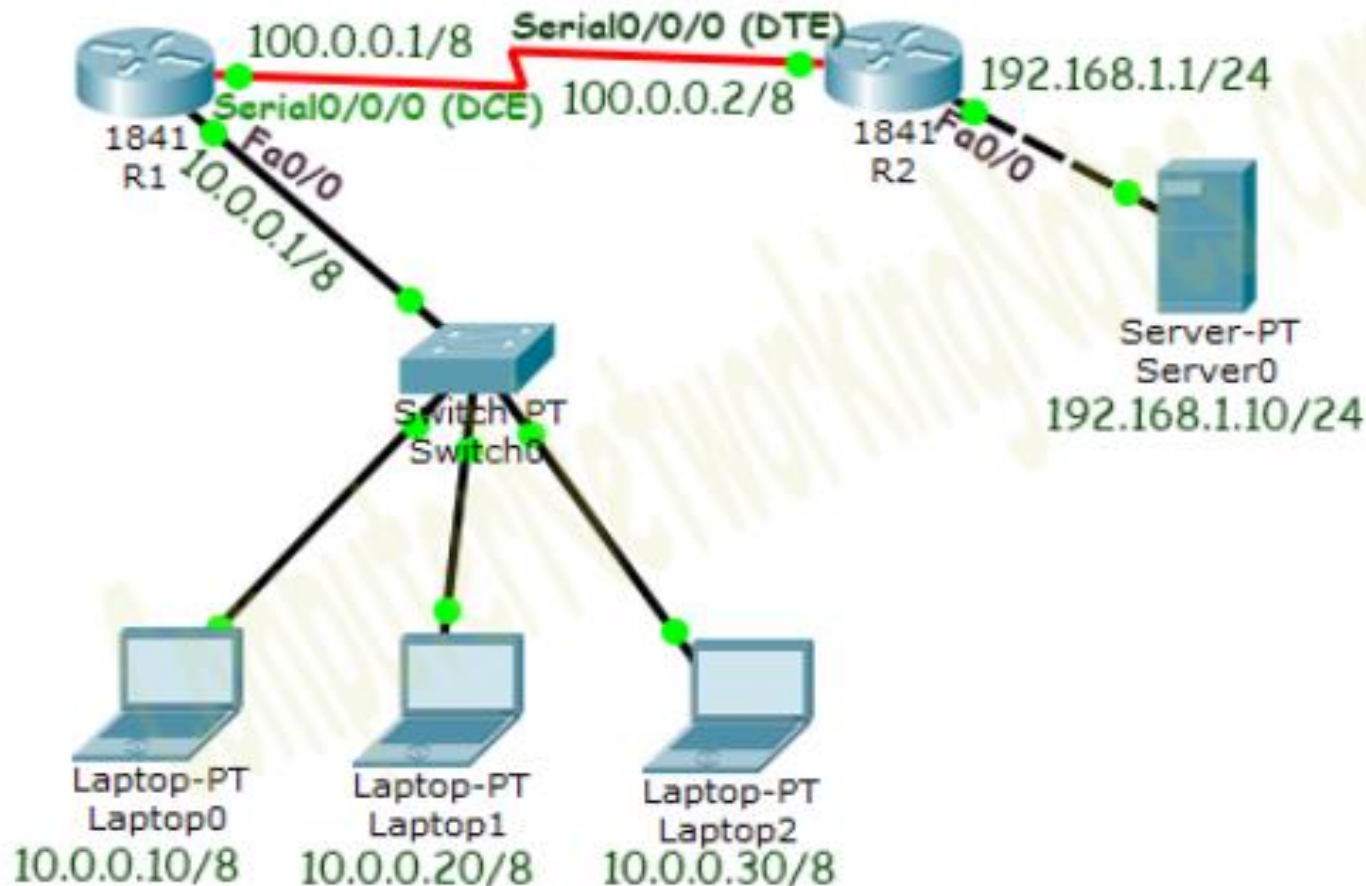
Types of NAT

They are:

- Static Network Translation (Static NAT)
- Dynamic Network Address Translation (Dynamic NAT)
- Port Address Translation (PAT)

IV. Diagrams / Experimental set-up: Static NAT Configuration

- Static NAT creates a one-to-one mapping between private and public addresses.
- Static NAT is usually configured by a network administrator, and this configuration remains constant.

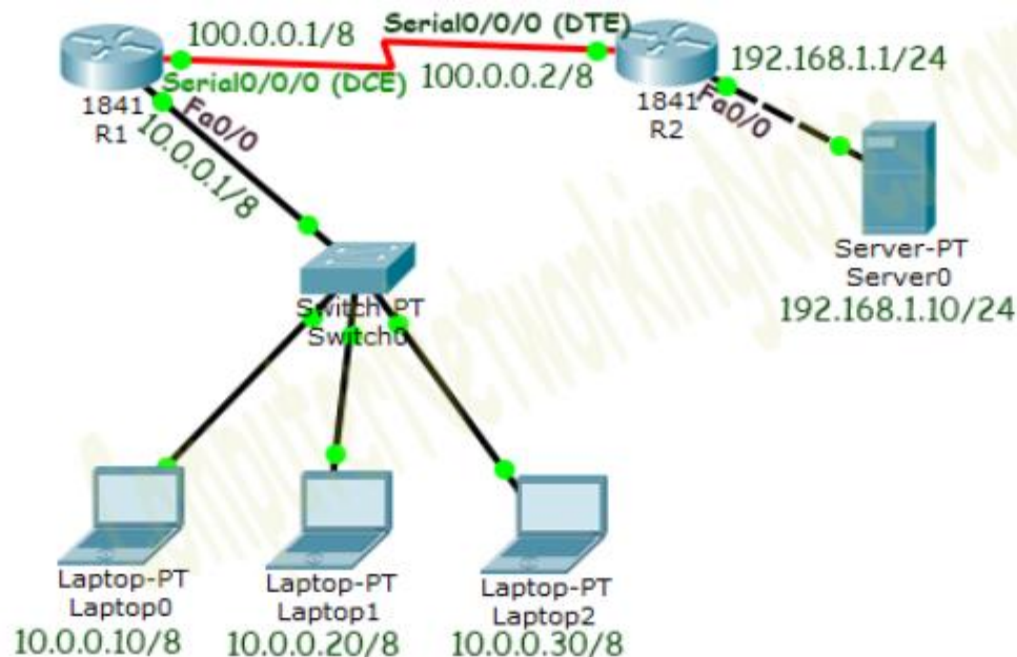


V. Procedure:

Step-1 Initial IP Configuration

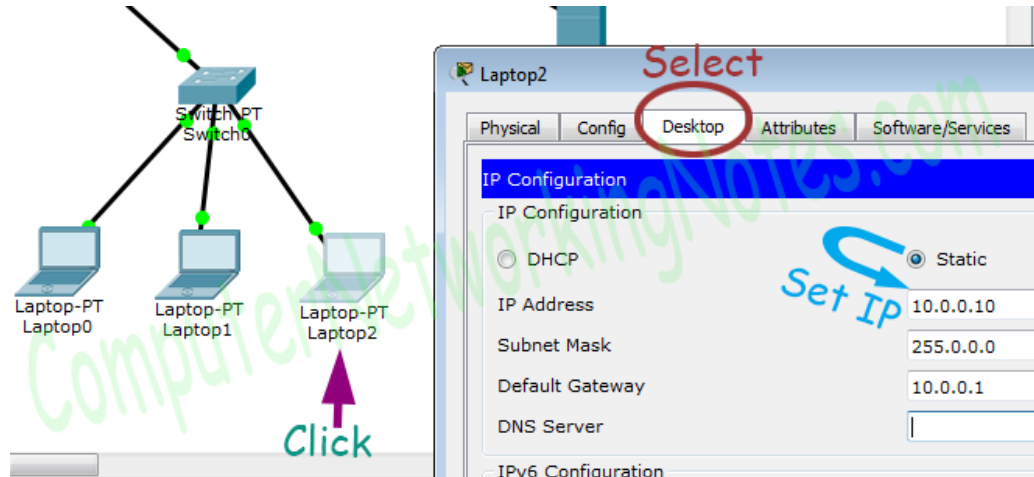
Device / Interface	IP Address	Connected With
Laptop0	10.0.0.10/8	Fa0/0 of R0
Laptop1	10.0.0.20/8	Fa0/0 of R0
Laptop2	10.0.0.30/8	Fa0/0 of R0
Server0	192.168.1.10/24	Fa0/0 of R1
Serial 0/0/0 of R1	100.0.0.1/8	Serial 0/0/0 of R2
Serial 0/0/0 of R2	100.0.0.2/8	Serial 0/0/0 of R2

assign IP address in Laptop click **Laptop** and click **Desktop** and **IP configuration** and Select **Static** and set **IP address** as given in above table.



Step-1.1: Set IP address to Laptops

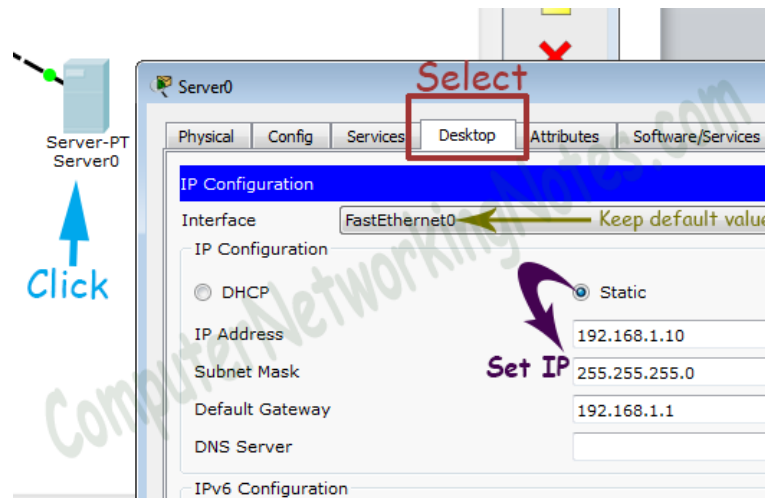
To assign IP address click **Laptop** and click **Desktop** and **IP configuration** and Select **Static** and set **IP address** as given in above table.



Repeat for other **Laptops**

Step-1.2: Set IP address to Server

Following same way configure IP address in Server.



Step-2: Configure IP address in Routers

Step-2.1: Configure IP address in Routers1

click **Router1** and select **CLI** and press **Enter key**.

Good To Remember:

There are various command modes, and following are the some of the main command modes:

- 1) User EXEC Mode Router>
- 2) Privileged EXEC Mode Router#
- 3) Global Configuration Mode Router(config)#
- 4) Interface Configuration Mode Router(config-if)#
- 5) Sub Interface Configuration Mode Router(config-subif)#

```
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)#interface Serial0/0/0
```

```
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)#
```

```
R1(config)#exit
```

```
R1#show controllers serial 0/0/0
```

```
Interface Serial0/0/0
```

```
Hardware is PowerQUICC MPC860
```

```
DCE V.35, clock rate 2000000
```

```
[Output omitted]
```


Step-2.2: Configure IP address in Router2

click **Router2** and select **CLI** and press **Enter key**.

```
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)#
```

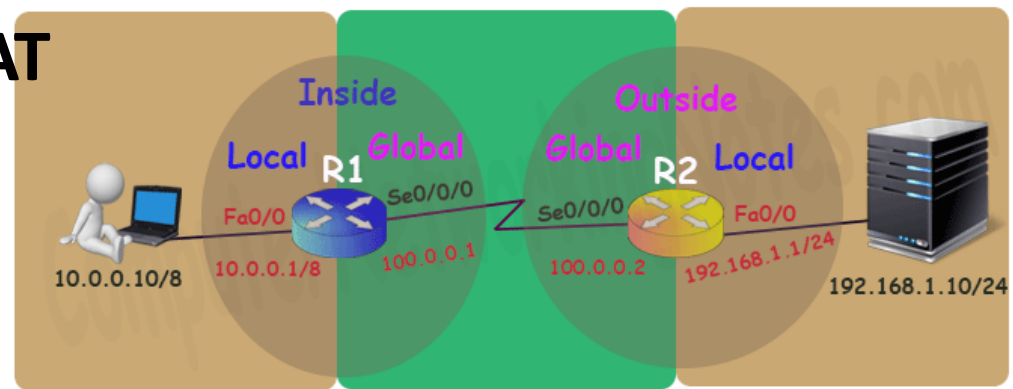
Step-3: Configure Static NAT

Static NAT configuration requires three steps: -

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

Syntax:

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



Step-3.1: R1 Static NAT Configuration

Router>enable

Router# configure terminal

R1(config)#ip nat inside source static 10.0.0.10 50.0.0.10

R1(config)#interface FastEthernet 0/0

R1(config-if)#ip nat inside

R1(config-if)#exit

R1(config)#

R1(config)#interface Serial 0/0/0

R1(config-if)#ip nat outside

R1(config-if)#exit

Device	Inside Local IP Address	Inside Global IP Address
Laptop0	10.0.0.10	50.0.0.10
Laptop1	10.0.0.20	50.0.0.20
Laptop2	10.0.0.30	50.0.0.30
Server	192.168.1.10	200.0.0.10

Configure the translation for remaining address.

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

Step-3.2: R2 Static NAT Configuration

```
Router>enable
```

```
Router# configure terminal
```

```
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)#
```

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

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

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

Step-4: Configure static routing in Routers

Step-4.1: Configure static routing in R1

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

Step-4.2: Configure static routing in R2

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

Step-5: Testing Static NAT Configuration

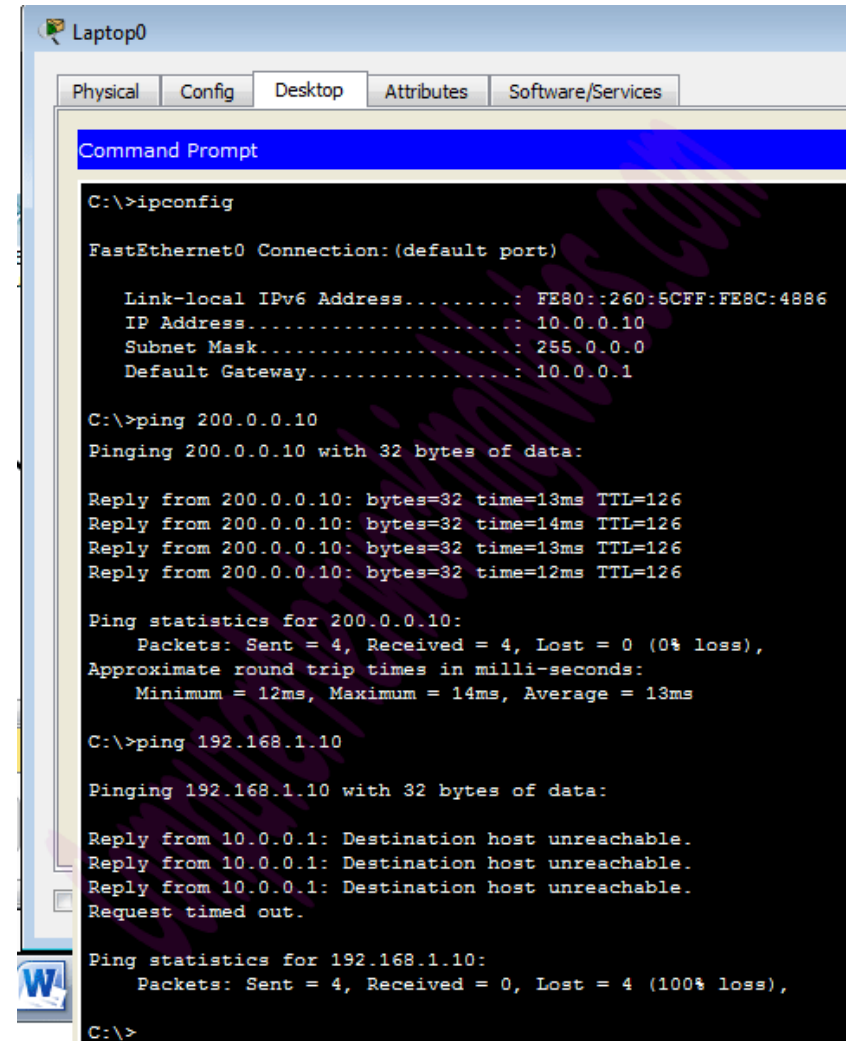
To test this setup click Laptop0 and Desktop and click Command Prompt.

Run **ipconfig** command.

Run **ping 200.0.0.10** command.

Run **ping 192.168.1.10** command.

- First command verifies that we are testing from correct NAT device.
- Second command 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.
- Third command 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.



```
C:\>ipconfig

FastEthernet0 Connection: (default port)

    Link-local IPv6 Address . . . . . : FE80::260:5CFF:FE8C:4886
    IP Address. . . . . : 10.0.0.10
    Subnet Mask . . . . . : 255.0.0.0
    Default Gateway . . . . . : 10.0.0.1

C:\>ping 200.0.0.10

Pinging 200.0.0.10 with 32 bytes of data:

Reply from 200.0.0.10: bytes=32 time=13ms TTL=126
Reply from 200.0.0.10: bytes=32 time=14ms TTL=126
Reply from 200.0.0.10: bytes=32 time=13ms TTL=126
Reply from 200.0.0.10: bytes=32 time=12ms TTL=126

Ping statistics for 200.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 12ms, Maximum = 14ms, Average = 13ms

C:\>ping 192.168.1.10

Pinging 192.168.1.10 with 32 bytes of data:

Reply from 10.0.0.1: Destination host unreachable.
Reply from 10.0.0.1: Destination host unreachable.
Reply from 10.0.0.1: Destination host unreachable.
Request timed out.

Ping statistics for 192.168.1.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

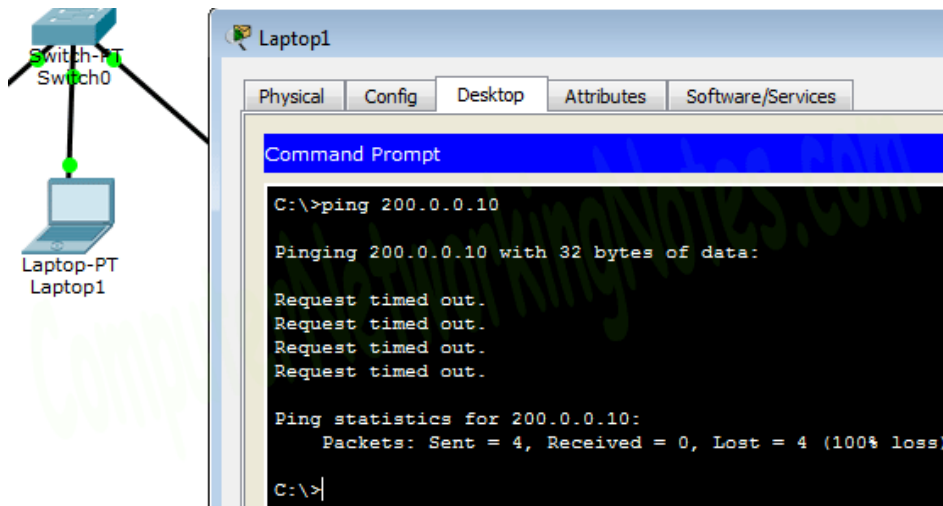
C:\>
```

Let's do one more testing. Click **Laptop0** and click **Desktop** and click **Web Browser** and access 200.0.0.10.



Above figure confirms that host 10.0.0.10 is able to access the 200.0.0.10.

Now run **ping 200.0.0.10** command from Laptop1



Why we are not able to connect with the remote device from this host?

Because we configured NAT only for one host (Laptop0) which IP address is 10.0.0.10. So only the host 10.0.0.10 will be able to access the remote device.

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

Following figure illustrate this translation on router R1.

```
R1#show ip nat translations
```

Pro	Inside global	Inside local	Outside local	Outside global
icmp	50.0.0.10:13	10.0.0.10:13	200.0.0.10:13	200.0.0.10:13
icmp	50.0.0.10:14	10.0.0.10:14	200.0.0.10:14	200.0.0.10:14
icmp	50.0.0.10:15	10.0.0.10:15	200.0.0.10:15	200.0.0.10:15
icmp	50.0.0.10:16	10.0.0.10:16	200.0.0.10:16	200.0.0.10:16
tcp	50.0.0.10:1030	10.0.0.10:1030	200.0.0.10:80	200.0.0.10:80
tcp	50.0.0.10:1031	10.0.0.10:1031	200.0.0.10:80	200.0.0.10:80

```
R1#
```

Following figure illustrate this translation on router R2

```
R2#show ip nat translations
```

Pro	Inside global	Inside local	Outside local	Outside global
icmp	200.0.0.10:13	192.168.1.10:13	50.0.0.10:13	50.0.0.10:13
icmp	200.0.0.10:14	192.168.1.10:14	50.0.0.10:14	50.0.0.10:14
icmp	200.0.0.10:15	192.168.1.10:15	50.0.0.10:15	50.0.0.10:15
icmp	200.0.0.10:16	192.168.1.10:16	50.0.0.10:16	50.0.0.10:16
tcp	200.0.0.10:80	192.168.1.10:80	50.0.0.10:1030	50.0.0.10:1030
tcp	200.0.0.10:80	192.168.1.10:80	50.0.0.10:1031	50.0.0.10:1031

```
R2#
```