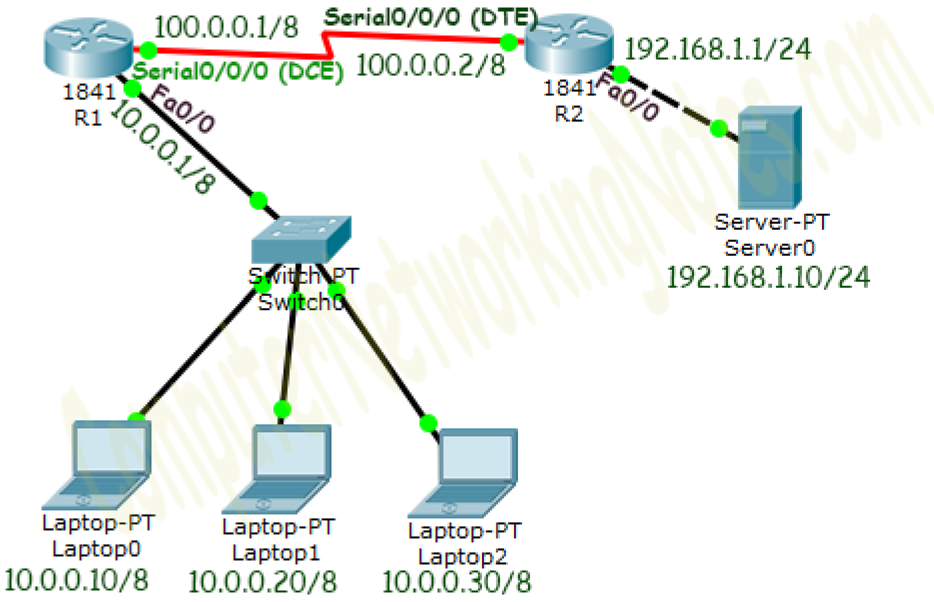
How to Configure Dynamic NAT in Cisco Router

This tutorial explains Dynamic NAT configuration (creating an access list of IP addresses which need translation, creating a pool of available IP address, mapping access list with pool and defining inside and outside interfaces) in detail. Learn how to configure, manage, verify and debug dynamic NAT step by step with packet tracer examples.

To explain Dynamic NAT configuration, I will use packet tracer network simulator software. You can use any network simulator software to follow this guide. There is no difference in output as long as your selected software contains the commands explained in this tutorial.



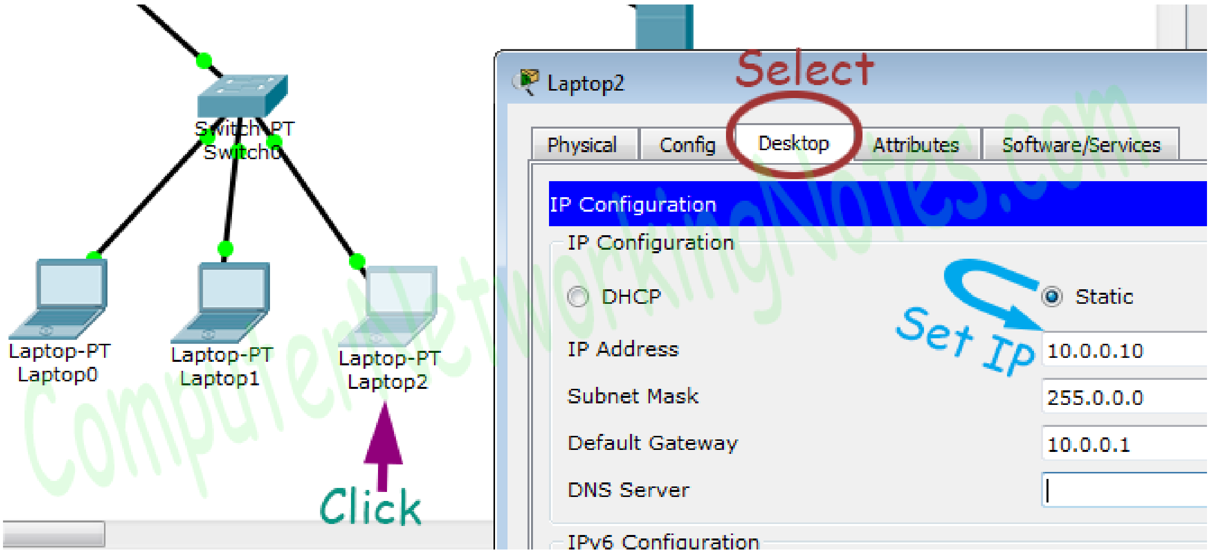
This tutorial is the third part of our article "**Learn NAT (Network Address Translation) Step by Step in Easy Language with Examples**". You can read other parts of this article here.

Initial IP Configuration

Device / Interface	IP Address	Connected With
Laotop0	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

If you are following this tutorial on my practice topology, skip this IP configuration section as that topology is already configured with this initial IP configuration.

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



IP Configuration

IP Configuration

○ DHCP ● Static

IP Address 10.0.0.10

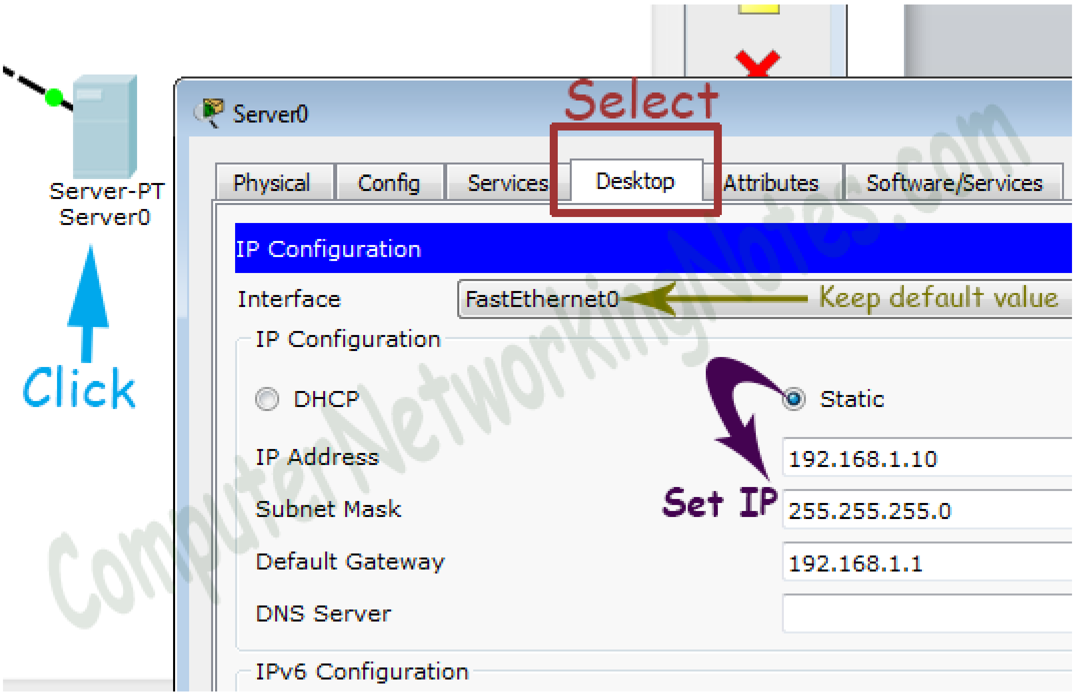
Subnet Mask 255.0.0.0

Default Gateway 10.0.0.1

DNS Server

IPv6 Configuration

Following same way configure IP address in Server.



IP Configuration

Interface FastEthernet0

IP Configuration

○ DHCP ● Static

IP Address 192.168.1.10

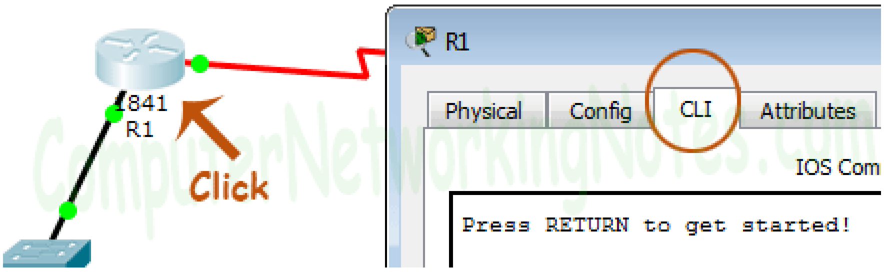
Subnet Mask 255.255.255.0

Default Gateway 192.168.1.1

DNS Server

IPv6 Configuration

To configure IP address in Router1 click **Router1** and select **CLI** and press **Enter key**.



```
Press RETURN to get started!
```

Run following commands to set IP address and hostname.

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

Same way access the command prompt of R2 and run following commands to set IP address and hostname.

```
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)#
```

That’s all initial IP configuration we need. Now this topology is ready for the practice of dynamic nat.

Configure Dynamic NAT

Dynamic NAT configuration requires four steps: -

1. Create an access list of IP addresses which need translation
2. Create a pool of all IP address which are available for translation
3. Map access list with pool
4. 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
```

Let’s understand this command and its options in detail.

Router(config)#

This command prompt indicates that we are in global configuration mode.

access-list

Through this parameter we tell router that we are creating or accessing an access list.

ACL_Identifier_number

With this parameter we specify the type of access list. We have two types of access list; standard and extended. Both lists have their own unique identifier numbers. Standard ACL uses numbers range 1 to 99 and 1300 to 1999. We can pick any number from this range to tell the router that we are working with standard ACL. This number is used in groping the conditions under a single ACL. This number is also a unique identifier for this ACL in router.

permit/deny

An ACL condition has two actions; permit and deny. If we use permit keyword, ACL will allow all packets from the source address specified in next parameter. If we use deny keyword, ACL will drop all packets from the source address specified in next parameter.

matching-parameters

This parameter allows us to specify the contents of packet that we want to match. In a standard ACL condition it could be a single source address or a range of addresses. We have three options to specify the source address.

- Any
- host
- A.B.C.D

Any

Any keyword is used to match all sources. Every packet compared against this condition would be matched.

Host

Host keyword is used to match a specific host. To match a particular host, type the keyword host and then the IP address of host.

A.B.C.D

Through this option we can match a single address or a range of addresses. To match a single address, simply type its address. To match a range of addresses, we need to use wildcard mask.

Wildcard mask

Just like subnet mask, wildcard mask is also used to draw a boundary in IP address. Where subnet mask is used to separate network address from host address, wildcard mask is used to distinguish the matching portion from the rest. Wildcard mask is the invert of Subnet mask. Wildcard can be calculated in decimal or in binary from subnet mask.

We have three hosts in lab. Let’s create a standard access list which allows two hosts and denies one host.

```
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
```

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]
```

This command accepts four options pool name, start IP address, end IP address and Subnet mask.

Pool Name: - This is the name of pool. We can choose any descriptive name here.

Start IP Address: - First IP address from the IP range which is available for translation.

End IP Address: - Last IP address from the IP range which is available for translation. There is no minimum or maximum criteria for IP range for example we can have a range of single IP address or we can have a range of all IP address from a subnet.

Subnet Mask: - Subnet mask of IP range.

Let’s create a pool named ccna with an IP range of two addresses.

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

This pool consist two class A IP address 50.0.0.1 and 50.0.0.2.

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]
```

This command accepts two options.

Access list name or number: - Name or number the access list which we created in first step.

Pool Name: - Name of pool which we created in second step.

In first step we created a standard access list with number **1** and in second step we created a pool named **ccna**. To configure a dynamic NAT with these options we will use following command.

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

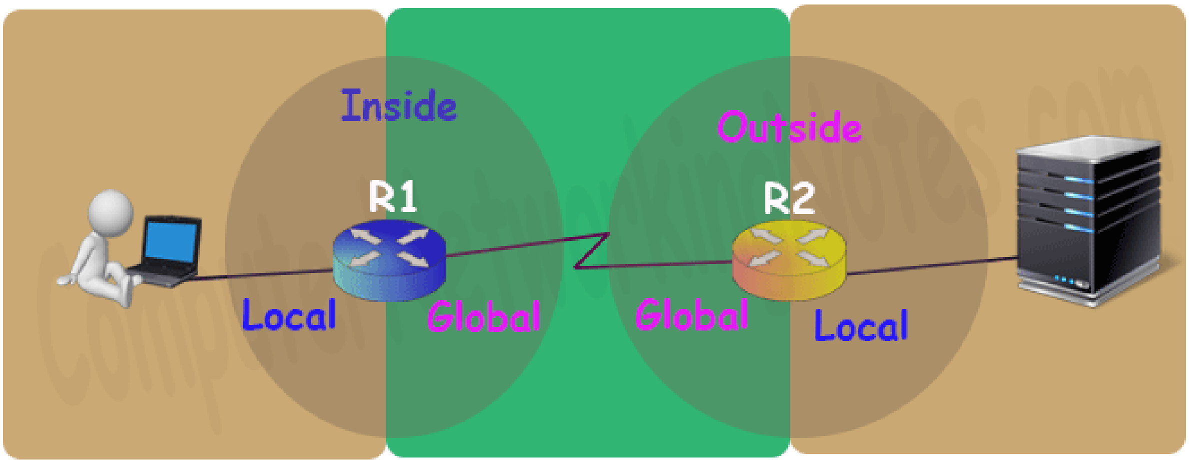
Finally we have to define which interface is connected with local network and which interface is connected with global network.

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
```



Let's implement all these commands together and configure the dynamic NAT.

R1 Dynamic NAT Configuration

```
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 Serial0/0/0
R1(config-if)#ip nat outside
R1(config-if)#exit
R1(config)#
```

For testing purpose I configured dynamic translations for two addresses only.

On R2 we can keep standard configuration or can configure dynamic NAT as we just did in R1 or can configure static NAT as we learnt in pervious part of this article.

Let’s do a quick recap of what we learnt in previous part and configure static NAT on 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 0/0/0
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)#
```

To understand above commands in detail please see the second part of this tutorial.

Before we test this lab we need to configure the IP routing. IP routing is the process which allows router to route the packet between different networks. Following tutorial explain routing in detail with examples

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
```

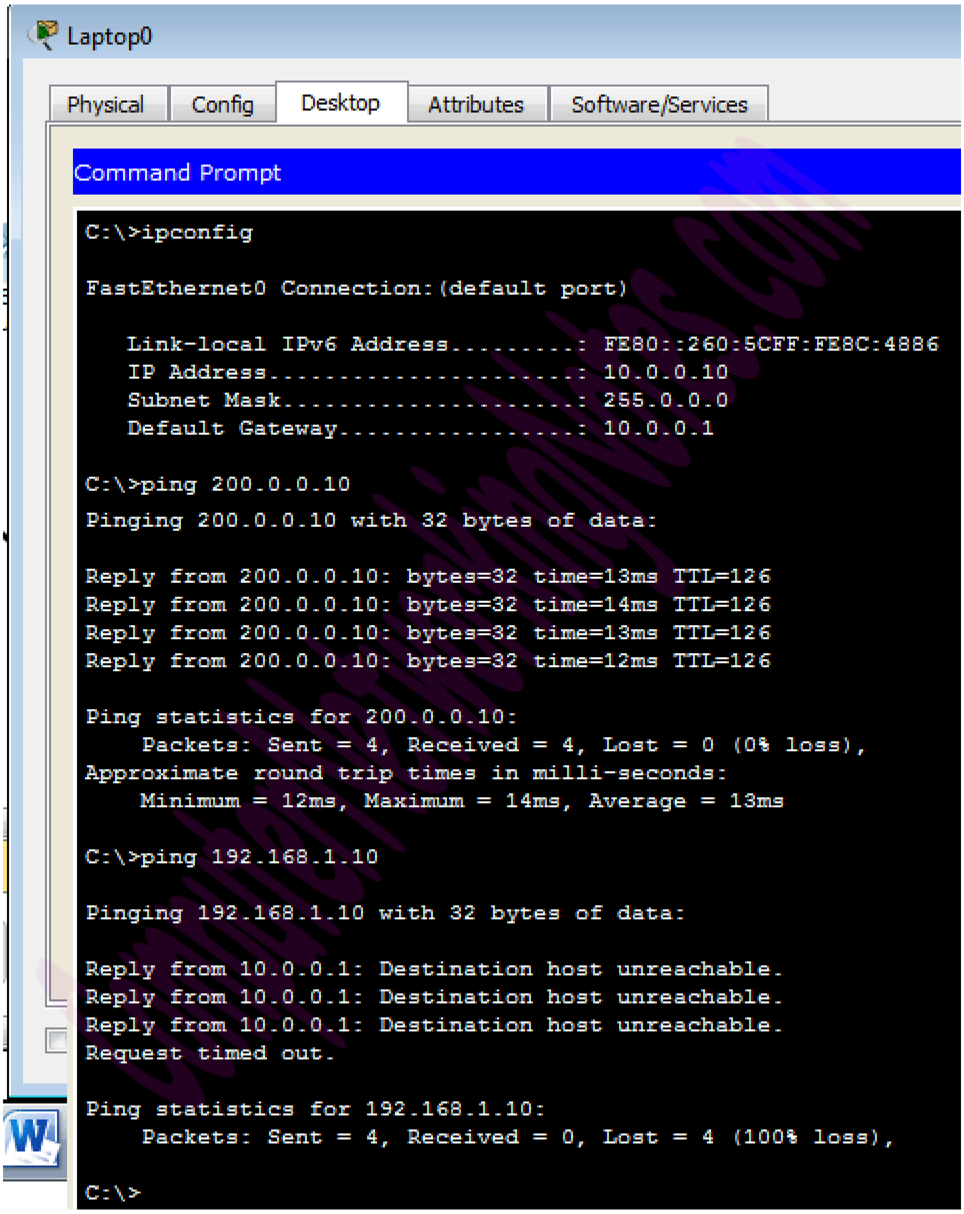
Testing Dynamic NAT Configuration

In this lab we configured dynamic NAT on R1for 10.0.0.10 and 10.0.0.20 and static NAT on R2 for 192.168.1.10.

Device	Inside Local IP Address	Inside Global IP Address
Laptop0	10.0.0.10	50.0.0.1
Laptop1	10.0.0.20	50.0.0.2
Server	192.168.1.10	200.0.0.10

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.



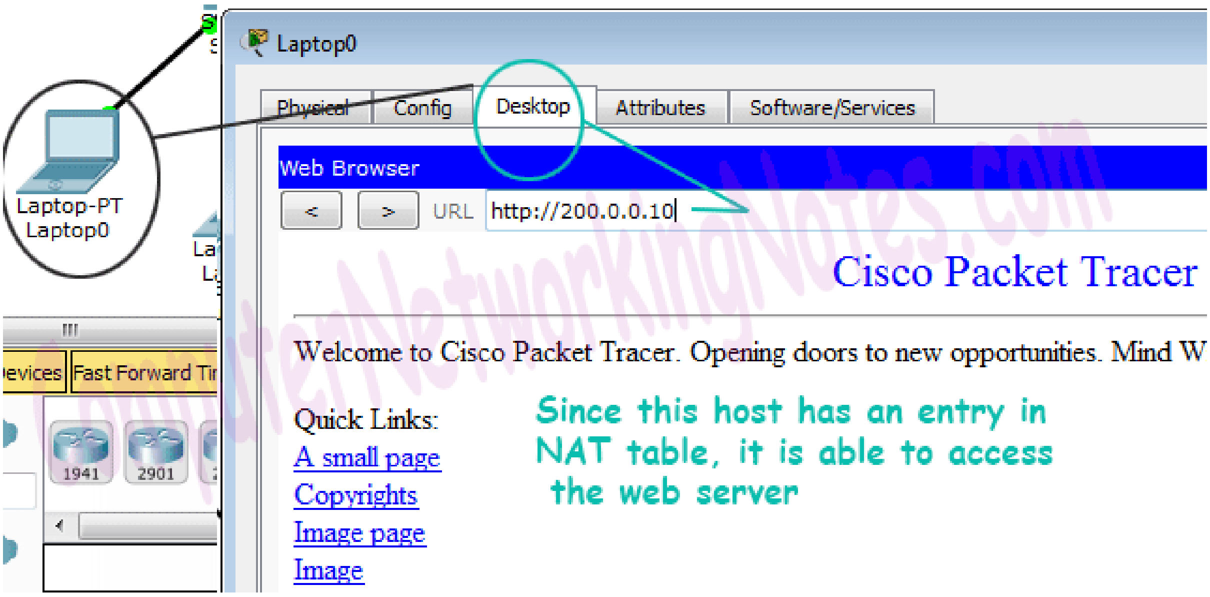
```
C:\>ipconfig

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:\>
```

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.

Let’s do one more testing. Close the command prompt and click web server and access 200.0.0.10.



http://200.0.0.10

Cisco Packet Tracer

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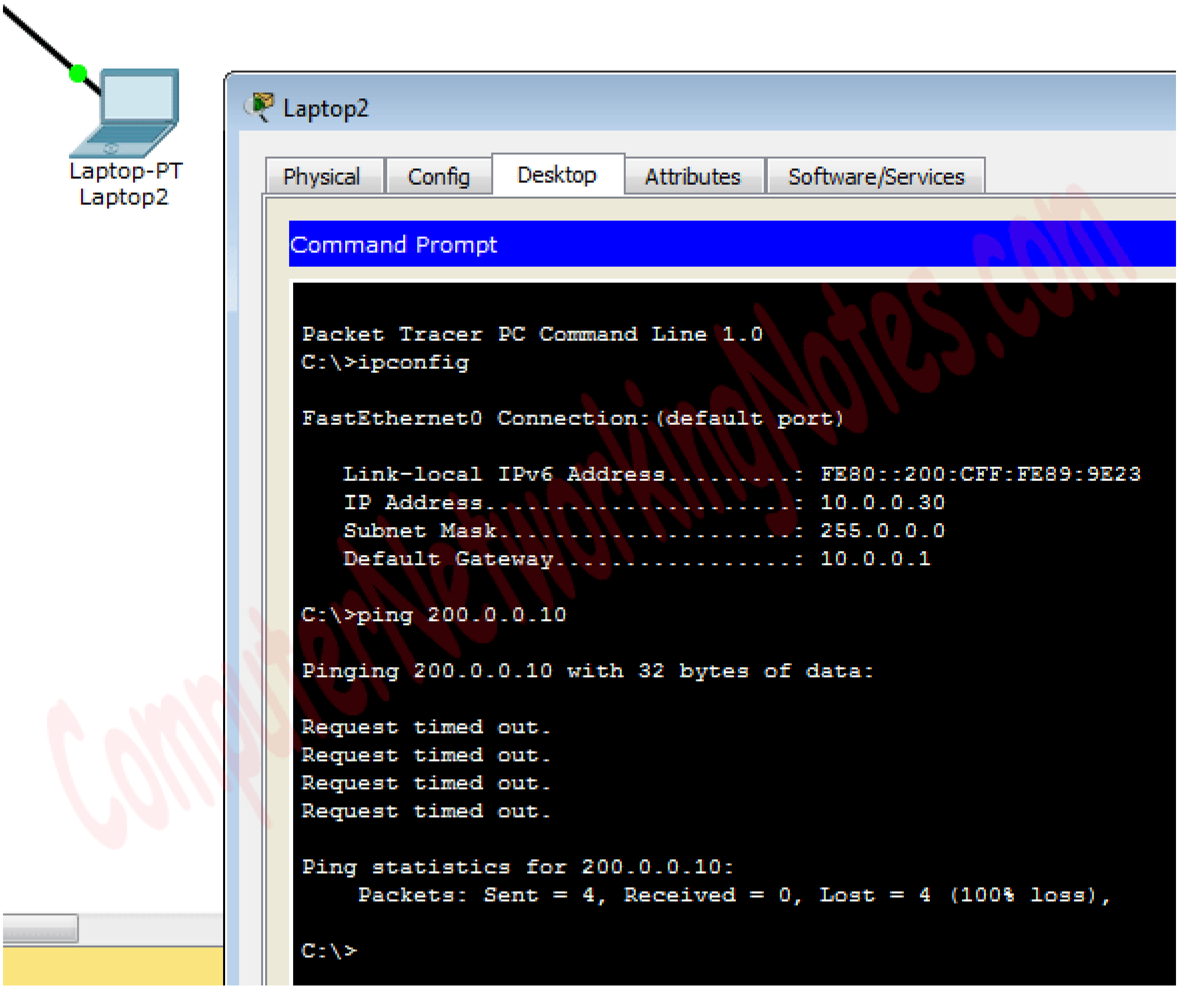
Since this host has an entry in NAT table, it is able to access the web server

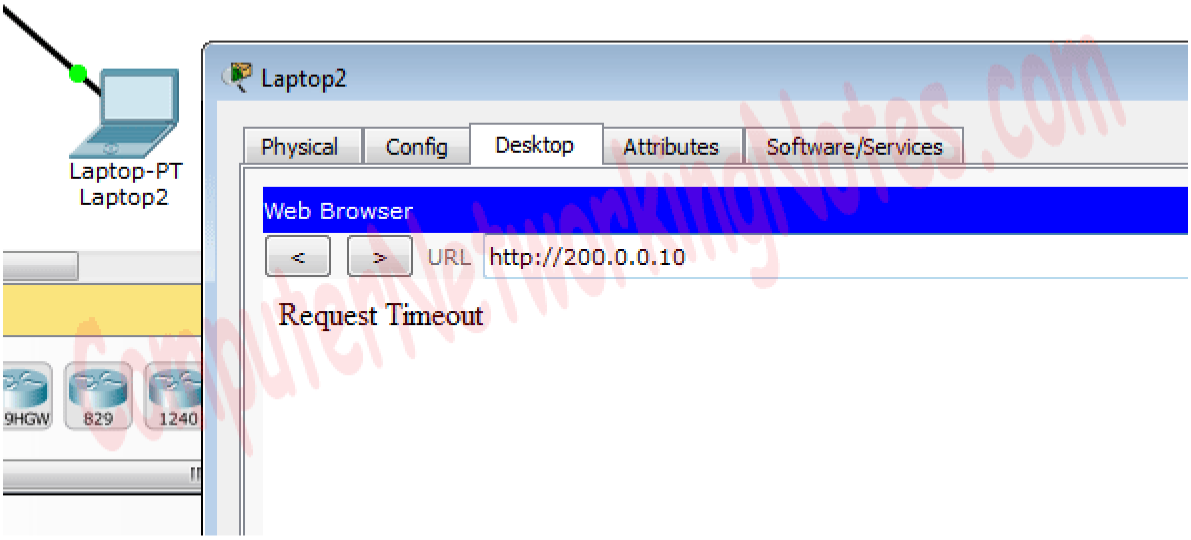
Above figure confirms that host 10.0.0.10 is able to access the 200.0.0.10. You can also do the same testing from Laptop1, result will be same.

Now run ping 200.0.0.10 command from Laptop2.



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

FastEthernet0 Connection:(default port)

   Link-local IPv6 Address.........: FE80::200:CFF:FE89:9E23
   IP Address......................: 10.0.0.30
   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:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 200.0.0.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

Close the command prompt and access web server from this host.



http://200.0.0.10

Request Timeout

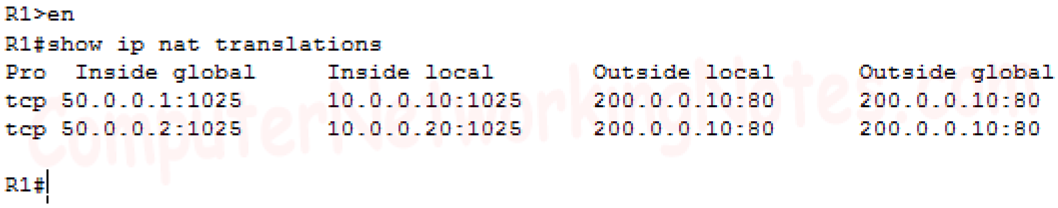
Why we are not able to connect with the remote device from this host?

Because we configured NAT only for two hosts (Laptop0 and Laptop1) which IP addresses are 10.0.0.10 and 10.0.0.20. So only the host 10.0.0.10 and 10.0.0.20 will be able to access the remote device.

If you followed this tutorial step by step, you should get the same output of testing. Although it's very rare but some time you may get different output. To figure out what went wrong you can use my practice topology with all above configuration.

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

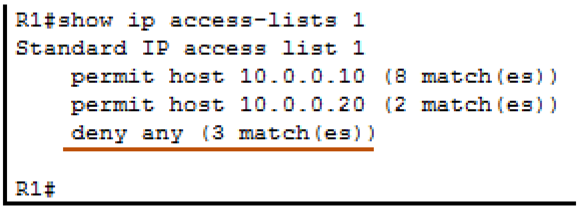
Following figure illustrates this translation on router R1.



```
R1>en
R1#show ip nat translations
Pro  Inside global     Inside local       Outside local      Outside global
tcp 50.0.0.1:1025      10.0.0.10:1025     200.0.0.10:80      200.0.0.10:80
tcp 50.0.0.2:1025      10.0.0.20:1025     200.0.0.10:80      200.0.0.10:80

R1#
```

We did three tests one from each host, but why only two tests are listed here? Remember in first step we created an access list. Access list filters the unwanted traffic before it reaches to the NAT. We can see how many packets are blocked by ACL with following command

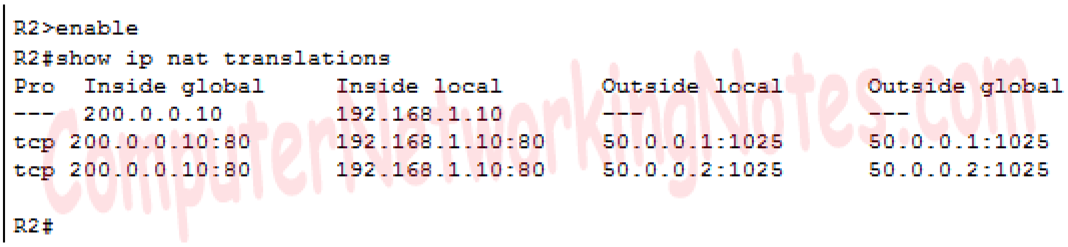
```
R1#show ip access-lists 1
```



```
R1#show ip access-lists 1
Standard IP access list 1
    permit host 10.0.0.10 (8 match(es))
    permit host 10.0.0.20 (2 match(es))
    deny any (3 match(es))

R1#
```

Basically it is access list which filters the traffic. NAT does not filter any traffic it only translate the address.

Following figure illustrate NAT translation on router R2



```
R2>enable
R2#show ip nat translations
Pro  Inside global      Inside local       Outside local      Outside global
---  200.0.0.10         192.168.1.10       ---                ---
tcp 200.0.0.10:80      192.168.1.10:80    50.0.0.1:1025      50.0.0.1:1025
tcp 200.0.0.10:80      192.168.1.10:80    50.0.0.2:1025      50.0.0.2:1025

R2#
```