



DEPARTMENT OF  
COMPUTER SCIENCE AND ENGINEERING

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## Title: Configuration of NAT

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COMPUTER NETWORKING LAB  
CSE 312



GREEN UNIVERSITY OF BANGLADESH

# 1 Objective(s)

- To configure NAT on network devices to facilitate seamless communication between internal and external networks while conserving public IP addresses.

## 2 Problem analysis

### 2.1 Basic Overview of NAT

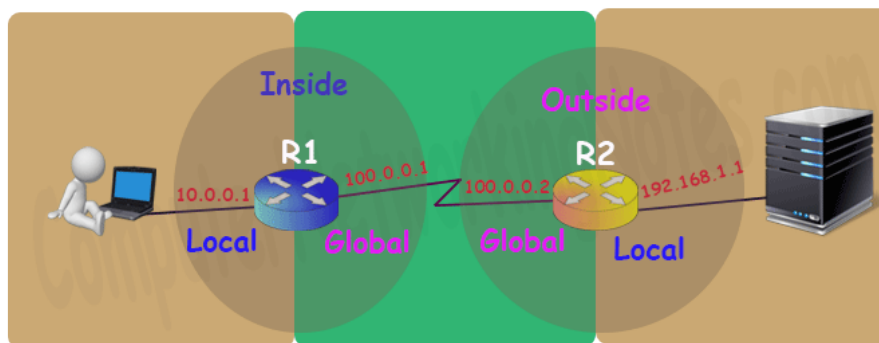
There are several situations where we need address translation such as, a network which do not have sufficient public IP addresses want to connect with the Internet, two networks which have same IP addresses want to merge or due to security reason a network want to hide its internal IP structure from the external world. NAT (Network Address Translation) is the process which translates IP address. NAT can be performed at firewall, server and router.

### 2.2 NAT Terminology

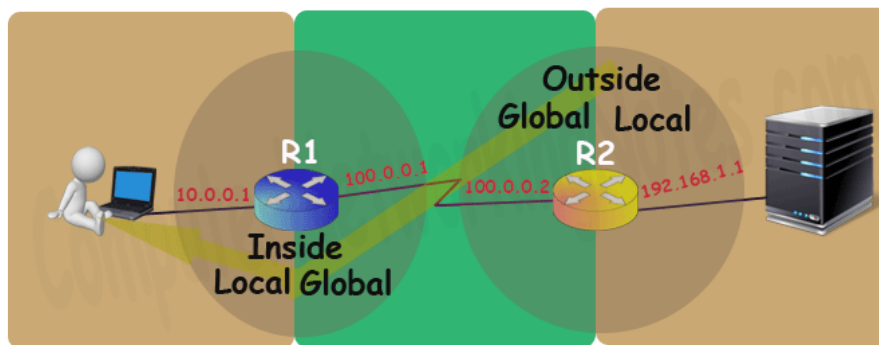
Before we understand NAT in details let's get familiar with four basic terms used in NAT.

Term	Description
Inside Local IP Address	Before translation source IP address located inside the local network.
Inside Global IP Address	After translation source IP address located outside the local network.
Outside Global IP Address	Before translation destination IP address located outside the remote network.
Outside Local IP Address	After translation destination IP address located inside the remote network

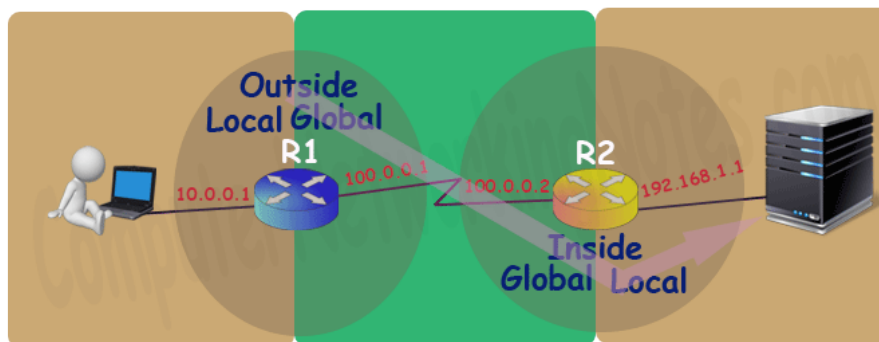
Let's understand these terms with an example. Suppose a user is browsing a website from his home computer. The network which connects his computer with internet is considered as a local network for him. Same as the network which connects the webserver where the website is located with internet is considered as a local network for webserver. The network which connects both networks on internet is considered as a global network.



On router the interface which is connected with local network will be configured with inside local IP address and the interface which is connected with global network will be configured with inside global IP address. Inside and outside depend on where we are standing right now. For example in above network for user router R1 is inside and router R2 is outside.



While for webserver router R2 is inside and router R1 is outside.



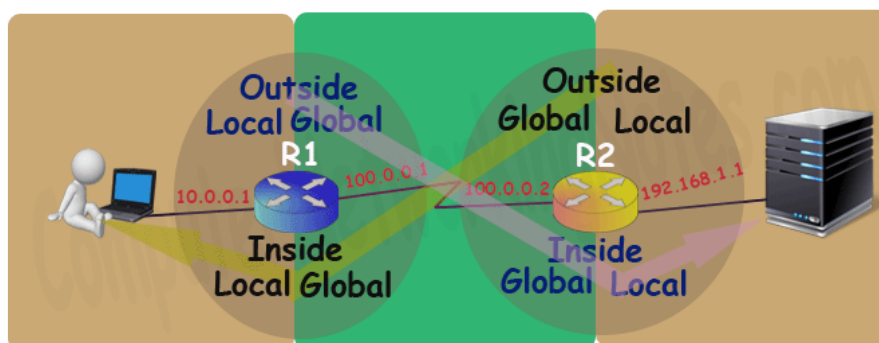
Basically on a NAT enabled router there are two types of interface inside local and inside global.

So, what about outside global and outside local? Well... these terms are used to explain the NAT process theoretically. Practically we never need to configure the outside local and outside global as they sound. For example let's discuss above example once again.

On R1 we will configure inside local address (10.0.0.1) and inside global address (100.0.0.1) which will become outside local address (10.0.0.1) and outside global address (100.0.0.1) for R2 respectively.

Same way on R2 we will configure inside local address (192.168.1.1) and inside global address (100.0.0.2) which will become outside local address (192.168.1.1) and outside global address (100.0.0.2) for R1 respectively.

So practically we only configure inside local and inside global. What is inside for one side is the outside for other side.



## 2.3 Types of NAT

### Static NAT

In this type we manually map each inside local IP address with inside global IP address. Since this type uses one to one mapping we need exactly same number of IP address on both sides.

### Dynamic NAT

In this type we create a pool of inside global IP addresses and let the NAT device to map inside local IP address

with the available outside global IP address from the pool automatically.

### PAT

In this type a single inside global IP address is mapped with multiple inside local IP addresses using the source port address. This is also known as PAT (Port Address Translation) or NAT over load.

## 3 Procedure

1. Create a network topology as Figure 1 in Cisco Packet Tracer and configure initial IP addresses.

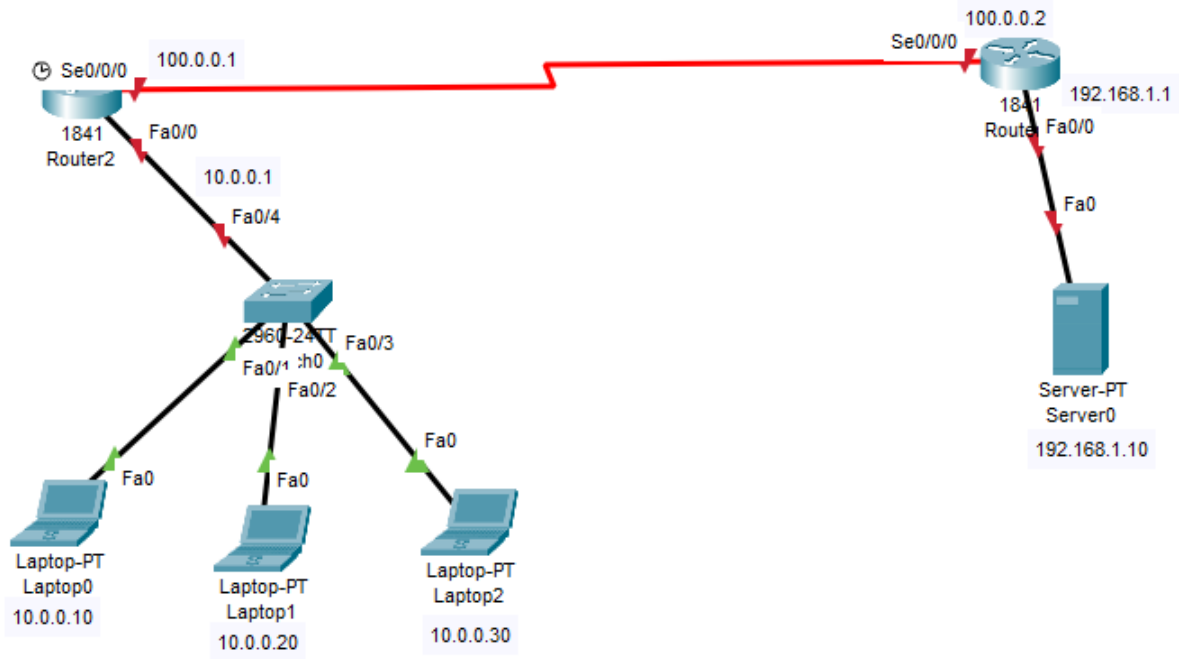


Figure 1: Build the network

2. To assign IP address in Laptop and server, click Laptop/server and click Desktop and IP configuration and Select Static and set IP address as given in figure 1.
3. Two interfaces of Router1 are used in topology; FastEthernet0/0 and Serial 0/0/0. To configure IP address in FastEthernet0/0, click Router1 and click Config and Click FastEthernet0/0 and configure IP address as given in figure 1 and finally click the port status to bring the interface on. To configure IP address in Serial 0/0/0, click Router1 and click Config and Click Serial0/0/0 and configure IP address as given in figure 1 and fill the clock rate with 64000 (In real life environment clock rate parameter controls the data flow between serial links and need to be set at service provider's end. In lab environment we need not to worry about this value. We can use any valid rate here) and finally click the port status to bring the interface on.

Now, follow same steps to assign IP addresses on interfaces of Router2.

4. **Configure Static NAT:** Static NAT configuration requires three steps: -
  - (a) Define IP address mapping
  - (b) Define inside local interface
  - (c) Define inside global interface
5. 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.

```
ip nat inside source static [inside local ip address] [inside global IP address]
```

For example in our lab Laptop0 is configured with IP address 10.0.0.10. To map it with 50.0.0.10 IP address we will use following steps-

Click Router1 and select CLI and press ENTER and finally write following commands-

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip nat inside source static 10.0.0.10 50.0.0.10
Router(config)#interface FastEthernet 0/0
Router(config-if)#ip nat inside
Router(config-if)#exit
Router(config)#interface Serial 0/0/0
Router(config-if)#ip nat outside
Router(config-if)#exit
```

Similarly for Laptop1, map 10.0.0.20 with 50.0.0.20 and for Laptop2, map 10.0.0.30 with 50.0.0.30. Also, For Server0, map 192.168.1.10 with 200.0.0.10.

- Now, we need to configure the IP routing. IP routing is the process which allows router to route the packet between different networks. For routing, click router, click config, click Static and then add the destination network address, subnet mask and next hops. In our lab example, for transferring the message from left network to right network, select left router and set 200.0.0.0 as the destination network address, 255.255.255.0 as subnet mask and 100.0.0.2 as next hop. For transferring the message from right network to left network, set 50.0.0.0 as the destination network address, 255.0.0.0 as subnet mask and 100.0.0.1 as next hop (Figure 2).

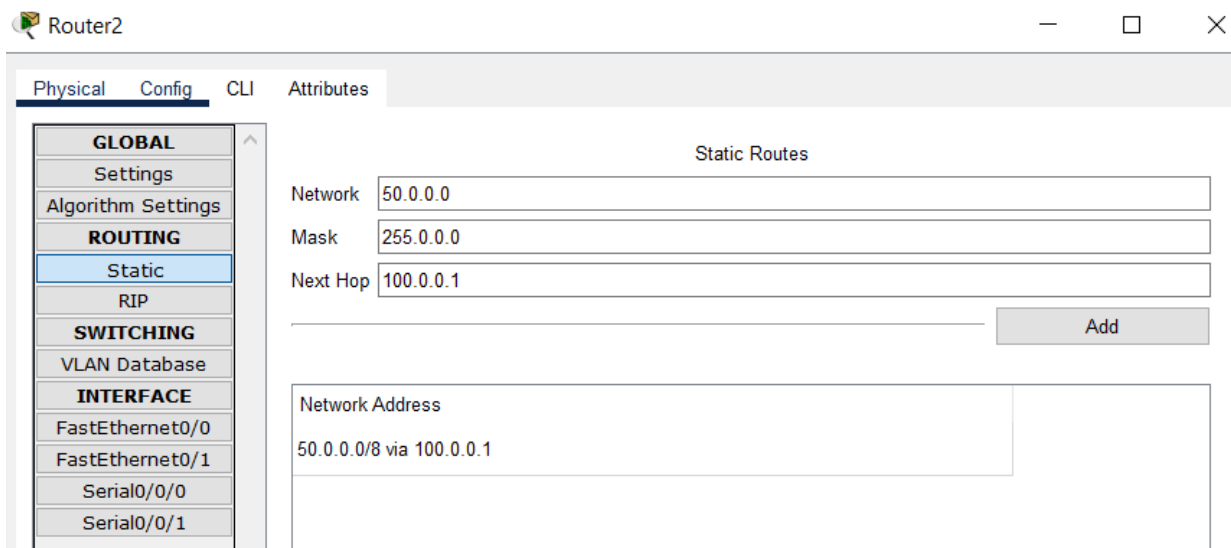


Figure 2: Routing

- Testing Static NAT Configuration** In this lab we 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.

Device	Inside Local IP Address	Inside Global IP Address
Laptop0	10.0.0.10	50.0.0.10
Server	192.168.1.10	200.0.0.10

To test the setup click Laptop0 and Desktop and click Command Prompt and Run ping 200.0.0.10 command and ping 192.168.1.10 command.

First 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. Second 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:\>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),

```

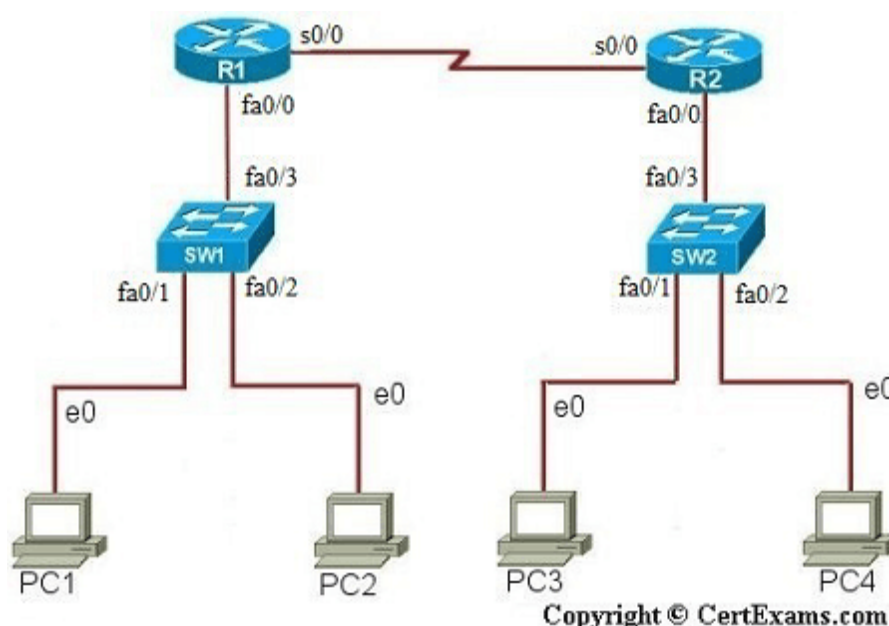
Figure 3: Test

## 4 Discussion & Conclusion

Based on the focused objective(s) to learn the step-by-step configuration of static network address translation. The NAT is used for translating public and private ip address. The additional lab exercise will help us to be confident towards the fulfilment of the objectives(s).

## 5 Lab Task (Please implement yourself and show the output to the instructor)

The purpose of this exercise is to configure NAT on the source router (NAT inside source) and test for connectivity by pinging a remote router.



Device	Interface	IP Address	Mask
R1	S0/0 & Fa0/0	200.200.200.1 & 192.168.1.13	255.255.255.0 & 255.255.0.0
R2	S0/0 & Fa0/0	200.200.200.2 & 10.1.1.4	255.255.255.0 & 255.0.0.0
PC1		192.168.1.10	255.255.0.0
PC2		192.168.1.11	255.255.0.0
PC3		10.1.1.1	2255.0.0.0
PC4		10.1.1.2	255.0.0.0
SW1		192.168.1.12	255.255.0.0
SW2		10.1.1.3	255.0.0.0

**NAT Mapping Table for Inside Source**

Inside Local	Inside Global
192.168.1.10	200.200.200.3
192.168.1.11	200.200.200.4

**Instructions:**

1. Assign IP addresses on all the devices as per the above table
2. Enable routing on all routers (you can use RIP/EIGRP/OSPF routing)
3. Create IP NAT Mapping (Hint: use inside source static command) on R1
4. Define IP NAT Inside and IP NAT Outside on R1
5. Test for Connectivity from PC1 to R2 by issuing ping command

## 6 Lab Exercise (Submit as a report)

Write a lab report on Configuring Dynamic NAT in Cisco Router. The lab report will be given in the next class.

## 7 Policy

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