Department of Computer Science and Engineering

Islamic University of Technology (IUT)

A subsidiary organ of OIC

Laboratory Report

CSE 4412 : Data Communication and Networking Lab

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Section : **1 (SWE)**

Semester : **Winter (4th)**

Academic Year : **2021-22**

Date of Submission : **11/04/2023**

Lab No : **10**

Title: Understanding the concept of NAT and configuration of NAT.

Objective:

1. Understand NAT
2. Configuration of NAT

Devices Used in the Experiment:

1. Virtual PCs, Switches Routers, Connection cables, Servers.

Theory:

NAT Definition

Network Address Translation (NAT) allows a single device, such as a router, to act as an **agent** between the internet (public network) and a local (private) network. This means that only a single unique IP address is required to represent an entire group of computers. This is done by **mapping** the private IP addresses of devices on the private network to a single public IP address that is used to communicate with devices on the internet.

This helps to improve security and decrease the number of IP addresses an organization needs, making the whole process cost efficient.

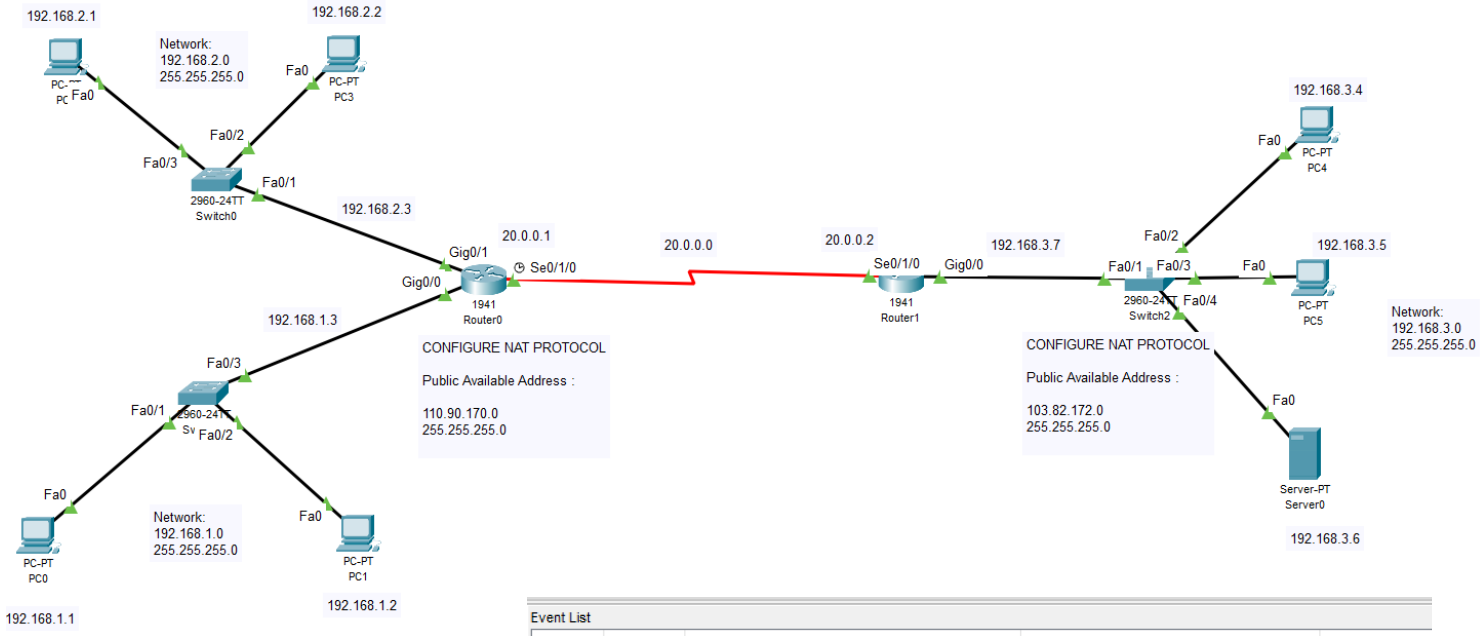
All in all, with the help of **NAT protocol**, devices on a private network can communicate with devices on the internet using a single public IP address.

Usage of NAT:

Let's say a company has a private network with 100 devices that needs to access the internet. Each device on your private network requires its own IP address to communicate with the public internet. If your company were to use public IP addresses for all 100 devices, it would require purchasing 100 unique public IP addresses from your Internet Service Provider (ISP), which can be costly.
However, with **NAT**, your company **can use private IP addresses** (such as 192.168.x.x or 20.x.x.x) for all the devices on the internal network. The NAT router or firewall that sits between your private network and the internet can **map** these private IP addresses to a **single public IP address** that is used to communicate with the internet.

This allows all devices on the internal network to access the internet using a single public IP address, conserving public IP addresses and reducing the cost of internet connectivity for the company.

Diagram of the experiment:



The first attempt always fails. The packets fail on the router. But the subsequent attempts are successful.

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC1	ICMP
	0.001	PC1	Switch1	ICMP
	0.002	Switch1	PC0	ICMP
	0.002	Switch1	Router0	ICMP
	0.003	Router0	Router1	ICMP
	0.004	Router1	Switch2	ICMP
	0.005	Switch2	PC4	ICMP
	0.005	Switch2	PC5	ICMP
	0.005	Switch2	Server0	ICMP
	0.006	Server0	Switch2	ICMP
	0.007	Switch2	Router1	ICMP
	0.008	Router1	Router0	ICMP
	0.009	Router0	Switch1	ICMP
	0.010	Switch1	PC1	ICMP

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num
	Successful	PC3	Server0	ICMP		0.000	N	0
	Successful	PC1	PC4	ICMP		0.000	N	1
	Successful	PC5	PC0	ICMP		0.000	N	2

Configuration of NAT in Router:

Setting the default gateways (for 3 different networks):

```
Router>en
Router#conf
Router#configure t
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int
Router(config)#interface fa
Router(config)#interface gi
Router(config)#interface gigabitEthernet 0/0
Router(config-if)#ip a
Router(config-if)#ip add
Router(config-if)#ip address 192.168.1.3 255.255.255.0
Router(config-if)#no sh
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed
state to up
```

```
Router(config-if)#exit
Router(config)#int
Router(config)#interface gi
Router(config)#interface gigabitEthernet 0/1
Router(config-if)#ip add
Router(config-if)#ip address 192.168.2.3 255.255.255.0
Router(config-if)#no sh
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed
state to up
```

```
Router(config)#interface g
Router(config)#interface gigabitEthernet 0/0
Router(config-if)#ip address 192.168.3.7 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#
```

Configuring the network between the routers (Network: 20.0.0.0):

For Router0:

```
Router>en
Router#conf
Router#configure t
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int
Router(config)#interface se
Router(config)#interface serial 0/1/0
Router(config-if)#ip add
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no sh
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/1/0, changed state to down
Router(config-if)#
Router(config-if)#
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed st
up
```

For Router1:

```
Router#
Router#conf t
Router#conf terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int
Router(config)#interface se
Router(config)#interface serial 0/1/0
Router(config-if)#ip add
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#no sh
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

Router(config-if)#
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to
up
```

Setting NAT inside & outside for the interfaces:
(needs to be done for all routers and their interfaces)

```
Router(config)#interface gigabitEthernet 0/0
Router(config-if)#ip nat inside
Router(config-if)#exit
Router(config)#interface s0/1/0
Router(config-if)#ip nat outside
Router(config-if)#exit
```

NAT configuration for Router0 (Network 192.168.1.0):

```
Router#
Router#conf
Router#configure t
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#acces
Router(config)#access-list 1 permit 192.168.1.0 0.0.0.255
Router(config)#interface g0/0
Router(config-if)#ip nat inside
Router(config-if)#exit
Router(config)#interface se0/1/0
Router(config-if)#ip nat outside
Router(config-if)#exit
Router(config)#ip nat pool pool1 110.90.170.1 110.90.170.254 netmask 255.255.255.0
Router(config)#ip nat inside source list 1 pool pool1 overload
Router(config)#
```

```
Router(config)#ip nat inside source static 192.168.1.1 110.90.170.1
Router(config)#ip nat inside source static 192.168.1.2 110.90.170.2
Router(config)#ip nat inside source static 192.168.2.1 110.90.170.3
Router(config)#ip nat inside source static 192.168.2.2 110.90.170.4
```

NAT Configuration for 192.168.2.0 on Router0:

```
Router(config)#interface g0/1
Router(config-if)#ip nat inside
Router(config-if)#exit
Router(config)#access-list 2 permit 192.168.2.0 0.0.0.255
Router(config)#ip nat pool pool2 110.90.170.1 110.90.170.254 netmask 255.255.255.0
Router(config)#ip nat inside source list 2 pool pool2
Router(config)#exit
```

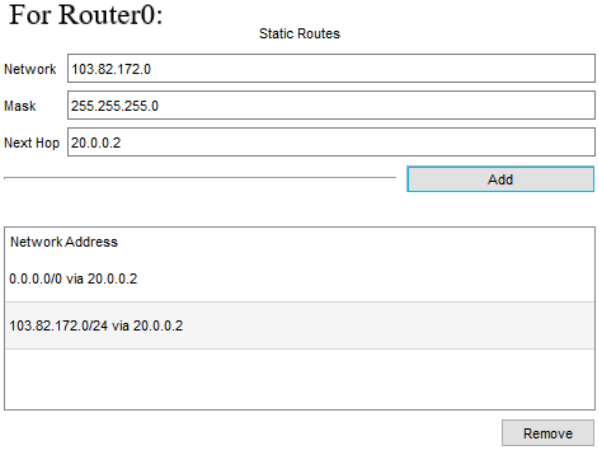
NAT configuration for 192.168.3.0 on Router1:

```
Router(config)#access-list 3 permit 192.168.3.0 0.0.0.255
Router(config)#ip nat pool pool3 103.82.172.1 103.82.172.254 netmask 255.255.255.0
Router(config)#ip nat inside source list 3 pool pool3
Router(config)#exit
```

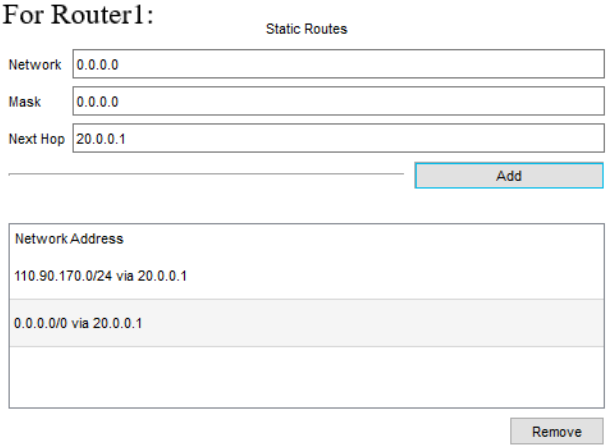
Observation:

The static routes for the Routers:

For Router0:



For Router1:




```
Router#show ip nat translations
Pro  Inside global     Inside local       Outside local      Outside global
icmp 110.90.170.1:3    192.168.2.1:3      192.168.3.5:3      192.168.3.5:3
icmp 110.90.170.3:6    192.168.1.2:6      192.168.3.6:6      192.168.3.6:6
icmp 110.90.170.4:1    192.168.1.1:1      192.168.3.4:1      192.168.3.4:1
```

Other important commands:
Router(config)# no ip nat pool <pool name>
Router(config)# no access-list <access list id>
Router(config)# no ip nat inside source list < access list id > pool <pool name>

Router(config)# ip nat inside source static 192.168.1.1 110.90.170.1
Router(config)# ip nat outside source static 192.168.1.1 103.82.172.0

Challenges:

- It took a lot of time to gather all the necessary information and compile it into a comprehensive report.
- There were two 192.168.1.0 networks. Figuring out this fault took me a lot of time.