



TELECOMMUNICATION NETWORKS (TCN) TC-421

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SECTION : A

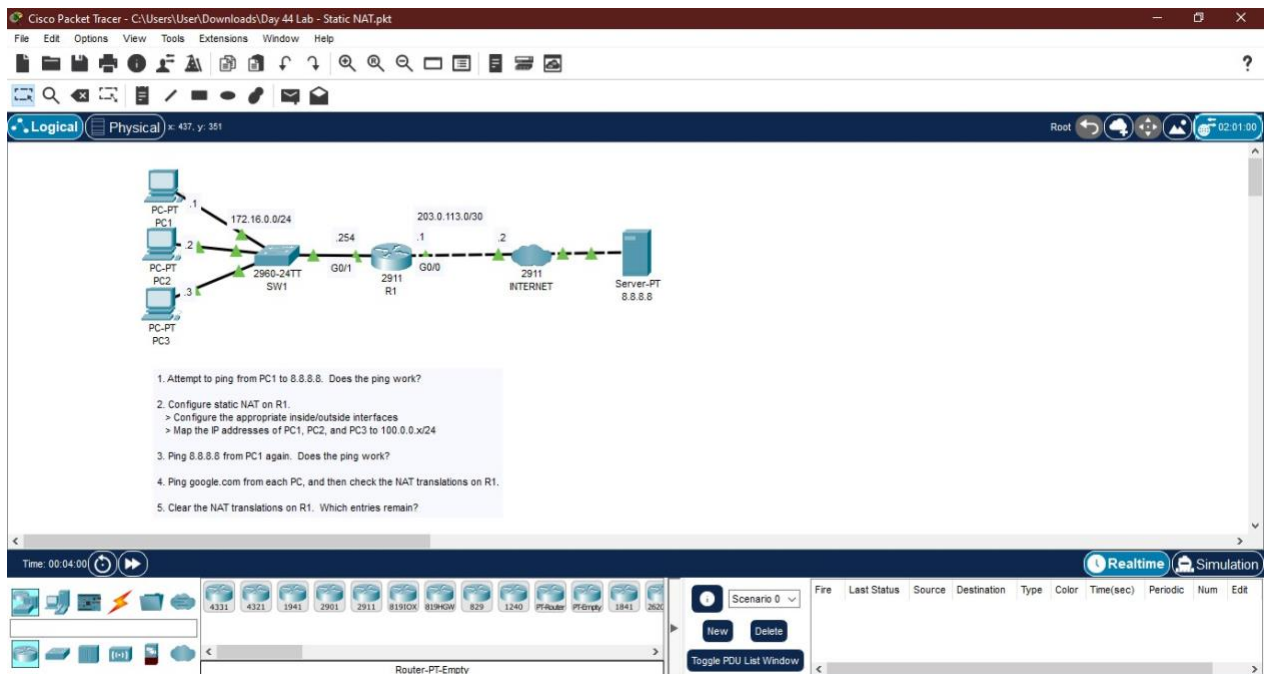
ELECTRONICS DEPARTMENT

SUBMITTED TO: SIR MUHAMMAD ABBAS

# NAT: NETWORK ADDRESS TRANSLATION

Network Address Translation (NAT) is a service that enables private IP networks to use the internet and cloud. NAT translates private IP addresses in an internal network to a public IP address before packets are sent to an external network

The following network is being created in Packet Tracer. It consists of a router R1, which is connected to 3 PCs by means of a switch.



The router is configured to have a inside local address of 172.16.0.254 which is an example of a private IP address. The inside global address is 203.0.113.1 which is a public IP address for the router to connect it to the internet.

## Router Configuration:

R1

Physical **Config** CLI Attributes

**GLOBAL**

Settings

Algorithm Settings

**ROUTING**

Static

RIP

**SWITCHING**

VLAN Database

**INTERFACE**

GigabitEthernet0/0

GigabitEthernet0/1

GigabitEthernet0/2

**GigabitEthernet0/0**

Port Status ☒ On

Bandwidth ☒ 1000 Mbps ☐ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address 00D0.5889.7E01

IP Configuration

IPv4 Address 203.0.113.1

Subnet Mask 255.255.255.252

Tx Ring Limit 10

R1

Physical **Config** CLI Attributes

**GLOBAL**

Settings

Algorithm Settings

**ROUTING**

Static

RIP

**SWITCHING**

VLAN Database

**INTERFACE**

GigabitEthernet0/0

**GigabitEthernet0/1**

GigabitEthernet0/2

**GigabitEthernet0/1**

Port Status ☒ On

Bandwidth ☒ 1000 Mbps ☐ 100 Mbps ☐ 10 Mbps ☒ Auto

Duplex ☐ Half Duplex ☒ Full Duplex ☒ Auto

MAC Address 00D0.5889.7E02

IP Configuration

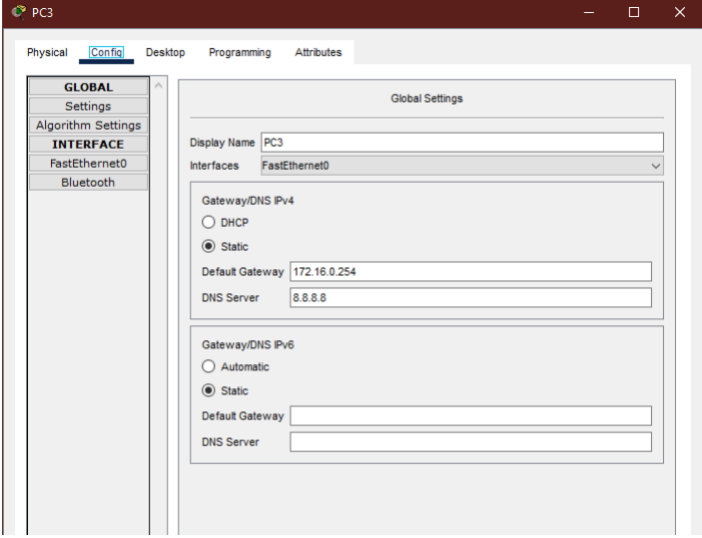
IPv4 Address 172.16.0.254

Subnet Mask 255.255.255.0

Tx Ring Limit 10

## PCs Configuration:

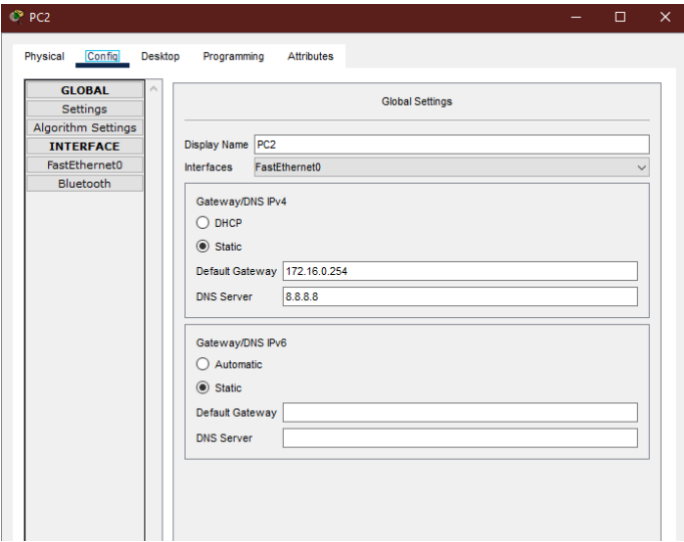
### PC1:



The screenshot shows the configuration window for PC3. The window has a title bar with 'PC3' and standard window controls. Below the title bar are tabs: 'Physical', 'Config' (selected), 'Desktop', 'Programming', and 'Attributes'. On the left is a sidebar with a tree view containing 'GLOBAL' (expanded), 'Settings', 'Algorithm Settings', 'INTERFACE', 'FastEthernet0', and 'Bluetooth'. The main area is titled 'Global Settings' and contains the following fields:

- Display Name: PC3
- Interfaces: FastEthernet0 (dropdown)
- Gateway/DNS IPv4:
  - ☐ DHCP
  - ☒ Static
  - Default Gateway: 172.16.0.254
  - DNS Server: 8.8.8.8
- Gateway/DNS IPv6:
  - ☐ Automatic
  - ☒ Static
  - Default Gateway: (empty)
  - DNS Server: (empty)

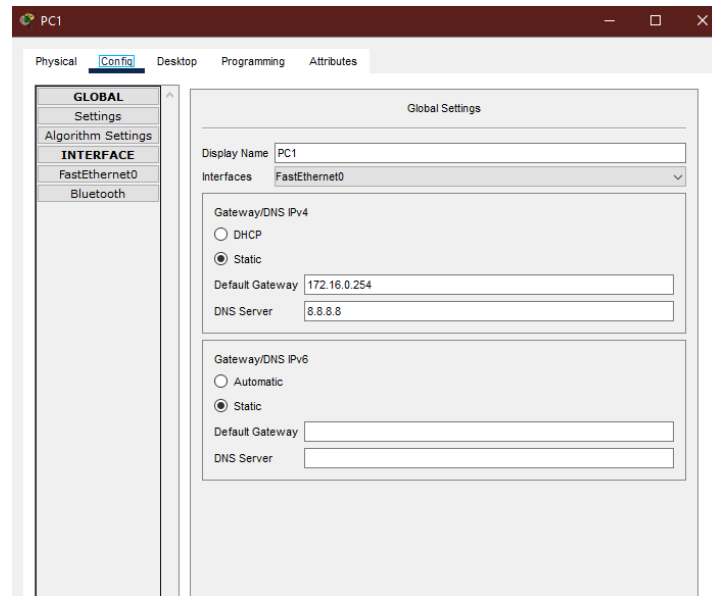
### PC 2:



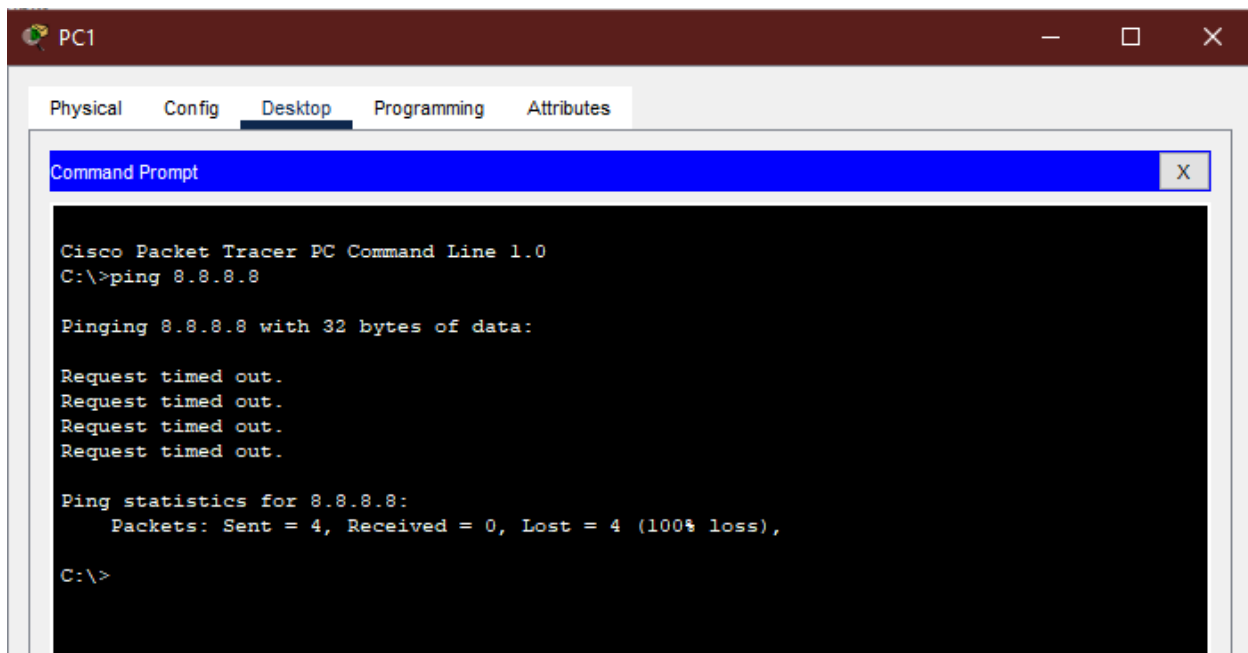
The screenshot shows the configuration window for PC2. The window has a title bar with 'PC2' and standard window controls. Below the title bar are tabs: 'Physical', 'Config' (selected), 'Desktop', 'Programming', and 'Attributes'. On the left is a sidebar with a tree view containing 'GLOBAL' (expanded), 'Settings', 'Algorithm Settings', 'INTERFACE', 'FastEthernet0', and 'Bluetooth'. The main area is titled 'Global Settings' and contains the following fields:

- Display Name: PC2
- Interfaces: FastEthernet0 (dropdown)
- Gateway/DNS IPv4:
  - ☐ DHCP
  - ☒ Static
  - Default Gateway: 172.16.0.254
  - DNS Server: 8.8.8.8
- Gateway/DNS IPv6:
  - ☐ Automatic
  - ☒ Static
  - Default Gateway: (empty)
  - DNS Server: (empty)

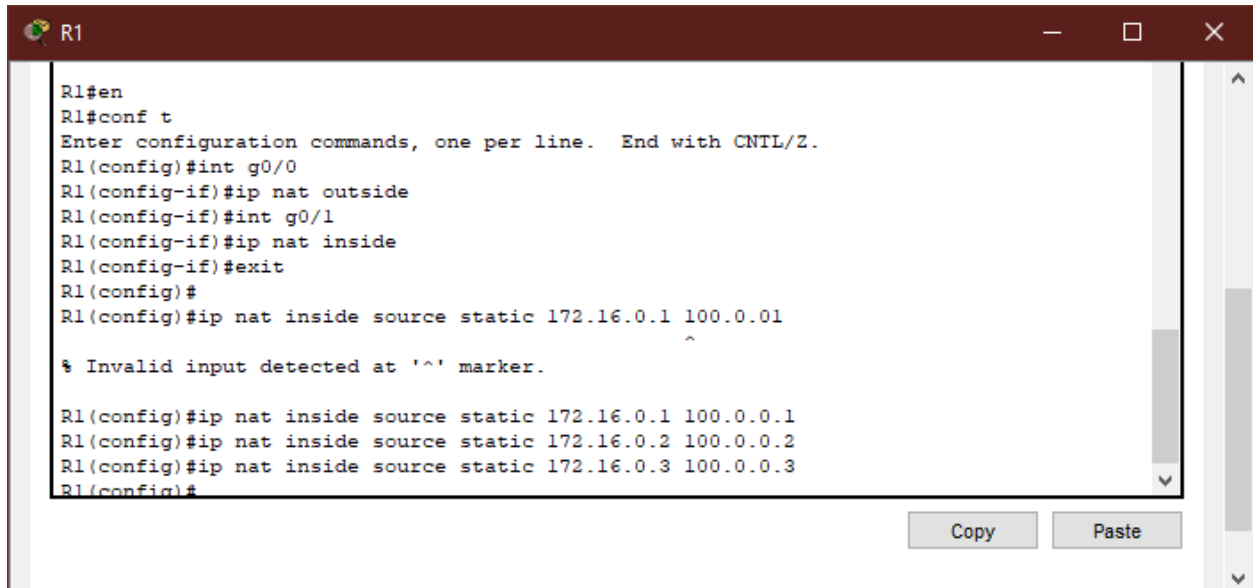
## PC 3:



Ping the ip address 8.8.8.8 by PC 1. Since it doesnot have a public ip address of its own, it will not be able to communicate with the internet.



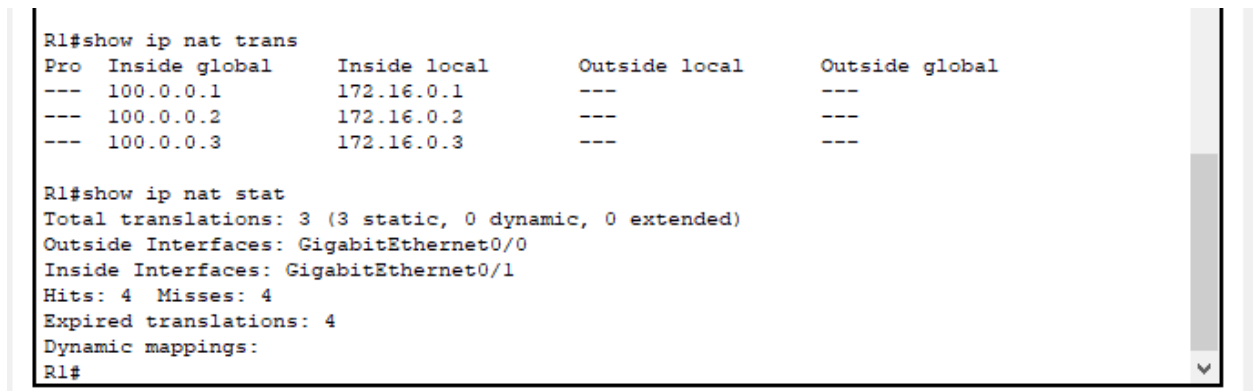
Configure the router to create NATS for the PCs using the IOS commands on the CLI.



```
R1#en
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#int g0/0
R1(config-if)#ip nat outside
R1(config-if)#int g0/1
R1(config-if)#ip nat inside
R1(config-if)#exit
R1(config)#
R1(config)#ip nat inside source static 100.0.0.1 172.16.0.1
^
% Invalid input detected at '^' marker.

R1(config)#ip nat inside source static 100.0.0.1 172.16.0.1
R1(config)#ip nat inside source static 100.0.0.2 172.16.0.2
R1(config)#ip nat inside source static 100.0.0.3 172.16.0.3
R1(config)#
```

To demonstrate the successful translations, following commands are used to check the static NATs.

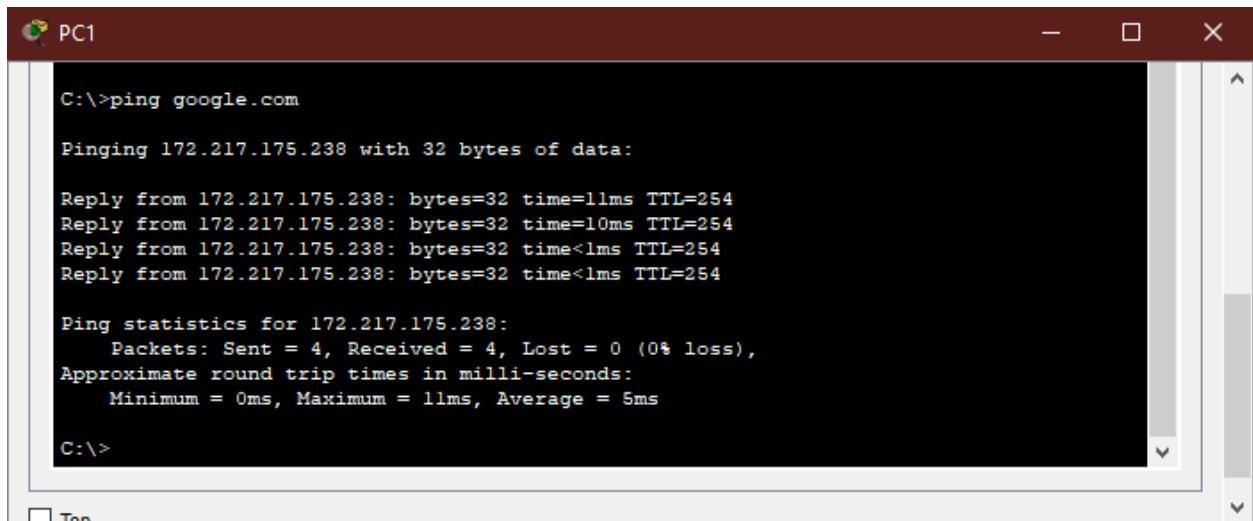


```
R1#show ip nat trans
Pro  Inside global      Inside local      Outside local     Outside global
---  ---                ---              ---              ---
---  100.0.0.1          172.16.0.1       ---              ---
---  100.0.0.2          172.16.0.2       ---              ---
---  100.0.0.3          172.16.0.3       ---              ---

R1#show ip nat stat
Total translations: 3 (3 static, 0 dynamic, 0 extended)
Outside Interfaces: GigabitEthernet0/0
Inside Interfaces: GigabitEthernet0/1
Hits: 4 Misses: 4
Expired translations: 4
Dynamic mappings:
R1#
```

Since the PCs have inside global addresses now, each PC is used to send a ping request to google.com. The successful ping acknowledgment shows that the PCs are now connected to the Internet.

## PC 1:



```
C:\>ping google.com

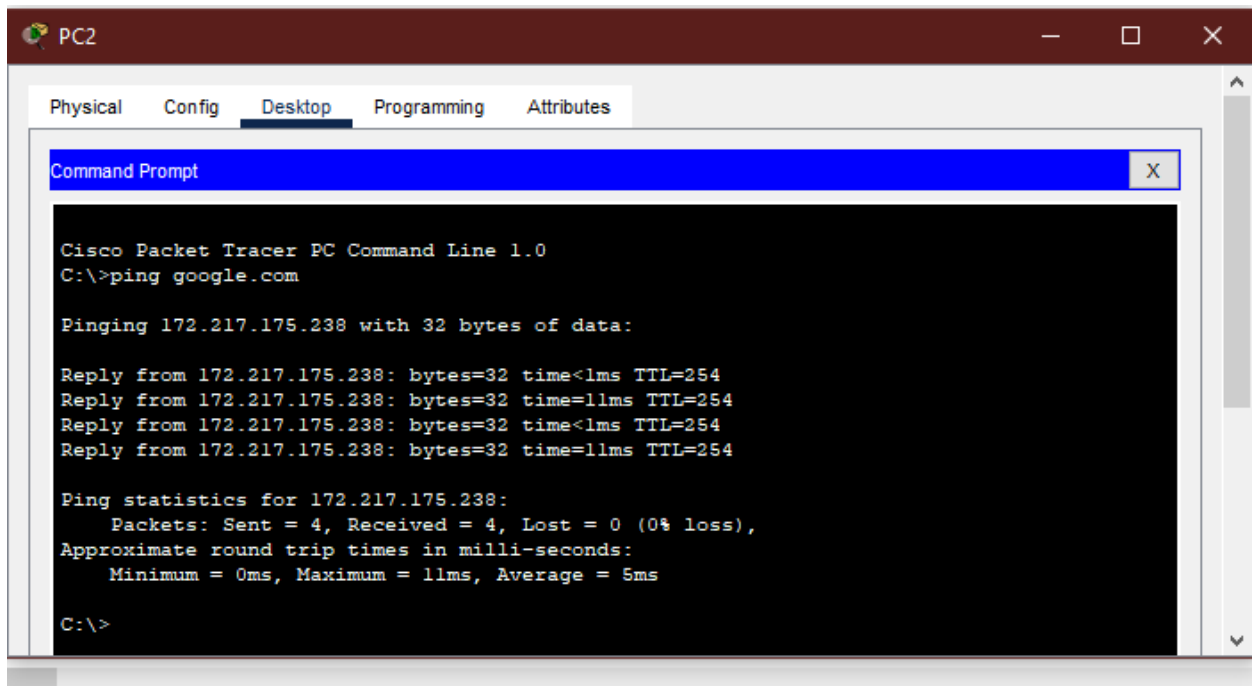
Pinging 172.217.175.238 with 32 bytes of data:

Reply from 172.217.175.238: bytes=32 time=11ms TTL=254
Reply from 172.217.175.238: bytes=32 time=10ms TTL=254
Reply from 172.217.175.238: bytes=32 time<1ms TTL=254
Reply from 172.217.175.238: bytes=32 time<1ms TTL=254

Ping statistics for 172.217.175.238:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 11ms, Average = 5ms

C:\>
```

## PC 2:



```
PC2
Physical Config Desktop Programming Attributes

Cisco Packet Tracer PC Command Line 1.0
C:\>ping google.com

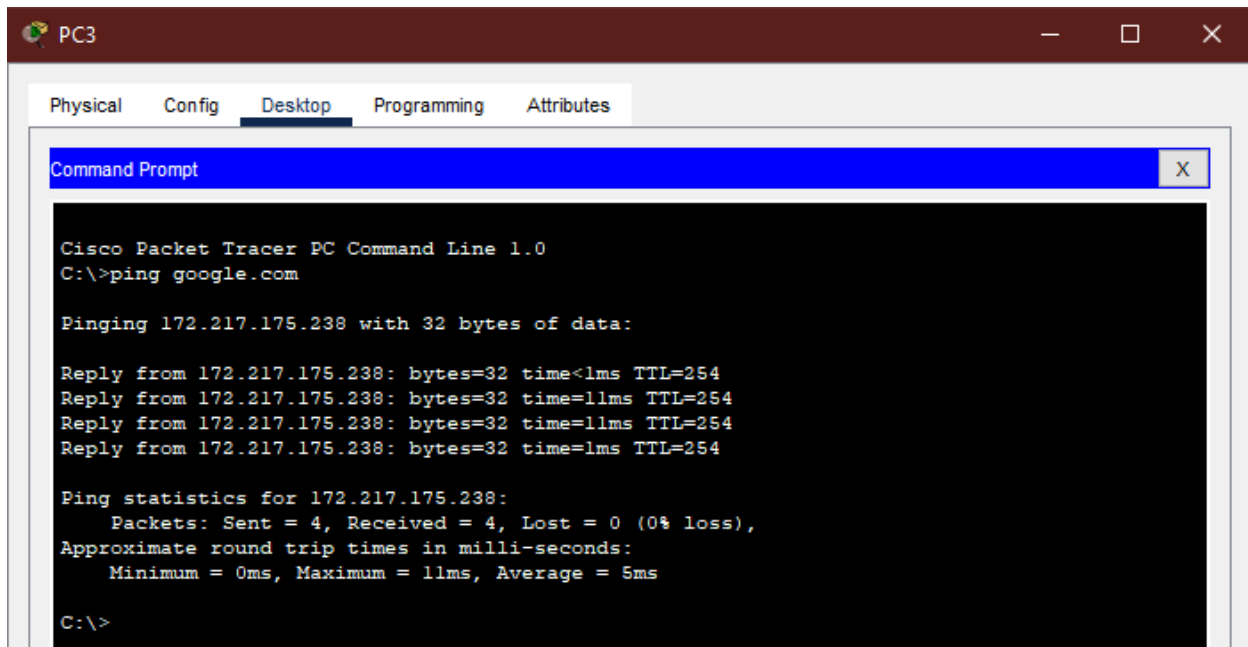
Pinging 172.217.175.238 with 32 bytes of data:

Reply from 172.217.175.238: bytes=32 time<1ms TTL=254
Reply from 172.217.175.238: bytes=32 time=11ms TTL=254
Reply from 172.217.175.238: bytes=32 time<1ms TTL=254
Reply from 172.217.175.238: bytes=32 time=11ms TTL=254

Ping statistics for 172.217.175.238:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 11ms, Average = 5ms

C:\>
```

## PC 3:



Finally, the “*show ip nat translation*” command is used to display the translations. Notice that the last two translations are udp, because they are using dns to search for the ip of google.com with port number 53.

Lastly, “*clear ip nat translation \**” is used to clear all the dynamic translations.

