

## **29-1 NAT Configuration - Answer Key**

In this lab you will configure static and dynamic Network Address Translation, and Port Address Translation.

The routers, servers and PCs have been configured with their network addressing settings.

R1 is the WAN edge router at your company, it has a default route pointing to the Service Provider router SP1.

You have bought the range of public IP addresses 203.0.113.0/28.  
203.0.113.1 is assigned to the Service Provider default gateway SP1,  
203.0.113.2 is assigned to the Internet facing F0/0 interface on your router R1.  
203.0.113.3 – 203.0.113.14 are your remaining available public IP addresses.

**Note that entries in the NAT translation table age out quickly. Send the traffic again if you do not see the expected results in the table.**

### **Static NAT**

- 1) Int-S1 is your company's web server. It must be reachable from external customers browsing the Internet. Configure NAT on R1 so that external customers can reach the server using the public IP address 203.0.113.3. Do not change any IP addressing or routing information.

Int-S1 needs a fixed public IP address so we must configure static NAT.  
Configure the F0/0 interface facing the Internet as the NAT outside interface.

```
R1(config)#int f0/0  
R1(config-if)#ip nat outside
```

Configure the F0/1 interface facing Int-S1 as a NAT inside interface.

```
R1(config)#int f0/1  
R1(config-if)#ip nat inside
```

Configure a static NAT rule mapping the inside local address 10.0.1.10 to the global IP address 203.0.113.3.

```
R1(config)#ip nat inside source static 10.0.1.10  
203.0.113.3
```

- 2) Ping Ext-S1 from Int-S1 to check the NAT rule is working and you have connectivity.

```
C:\>ping 203.0.113.20
```

Pinging 203.0.113.20 with 32 bytes of data:

Request timed out.

Request timed out.

Reply from 203.0.113.20: bytes=32 time<1ms TTL=126

Reply from 203.0.113.20: bytes=32 time<1ms TTL=126

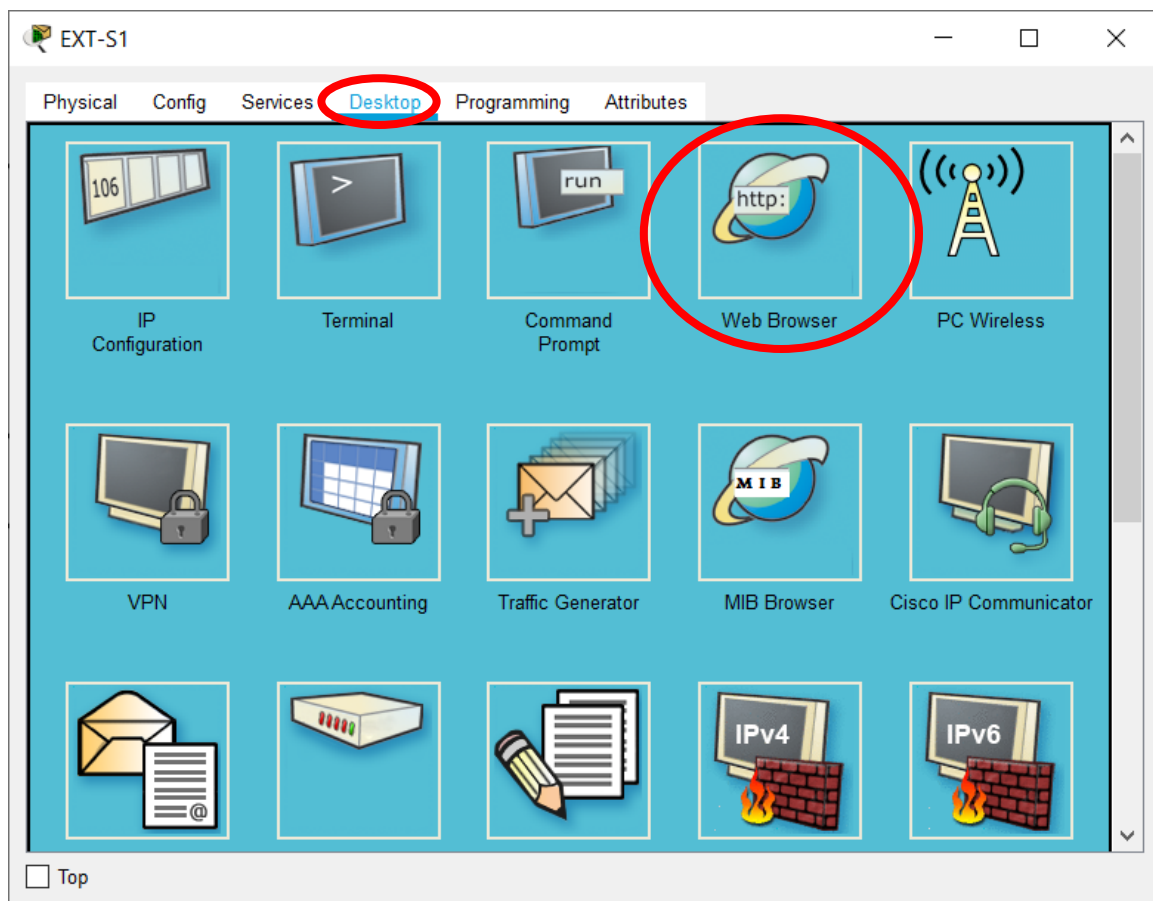
Ping statistics for 203.0.113.20:

Packets: Sent = 4, Received = 2, Lost = 2 (50% loss),

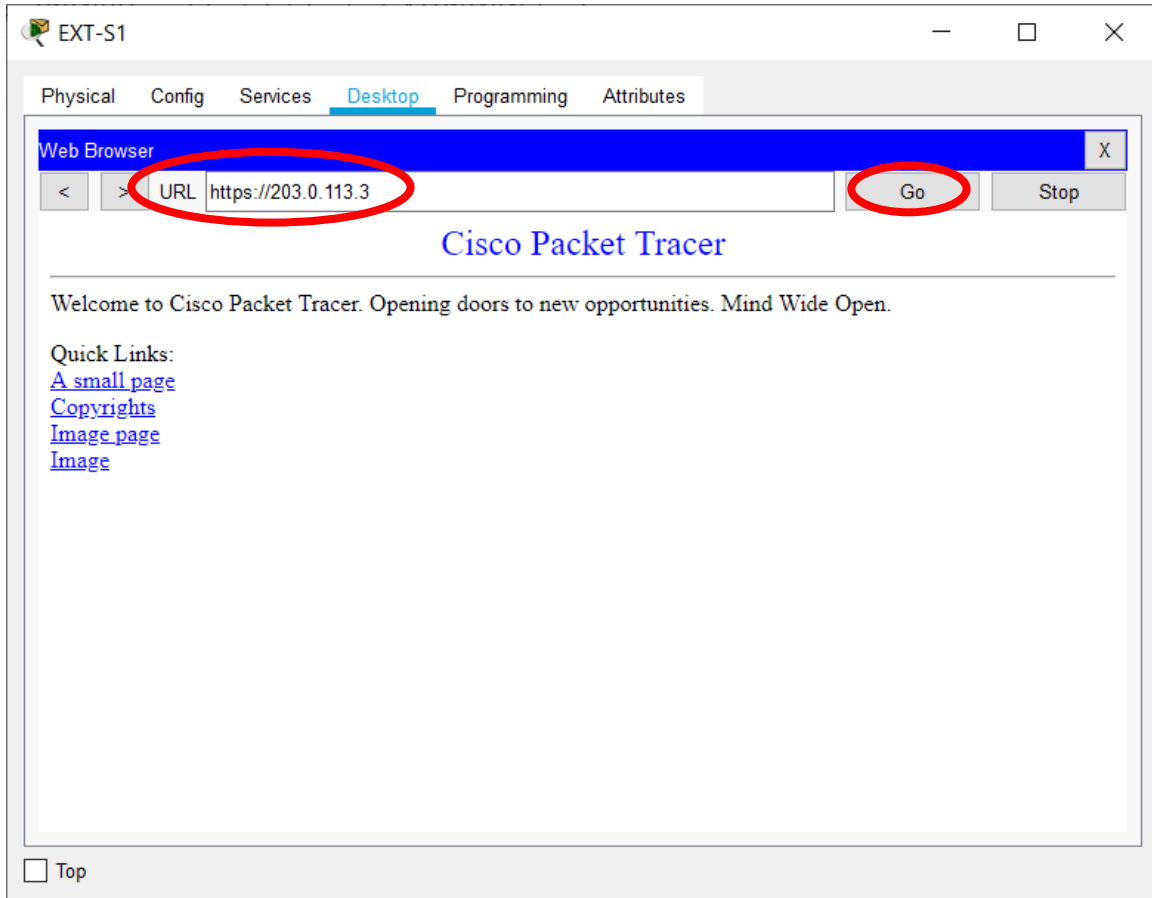
Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

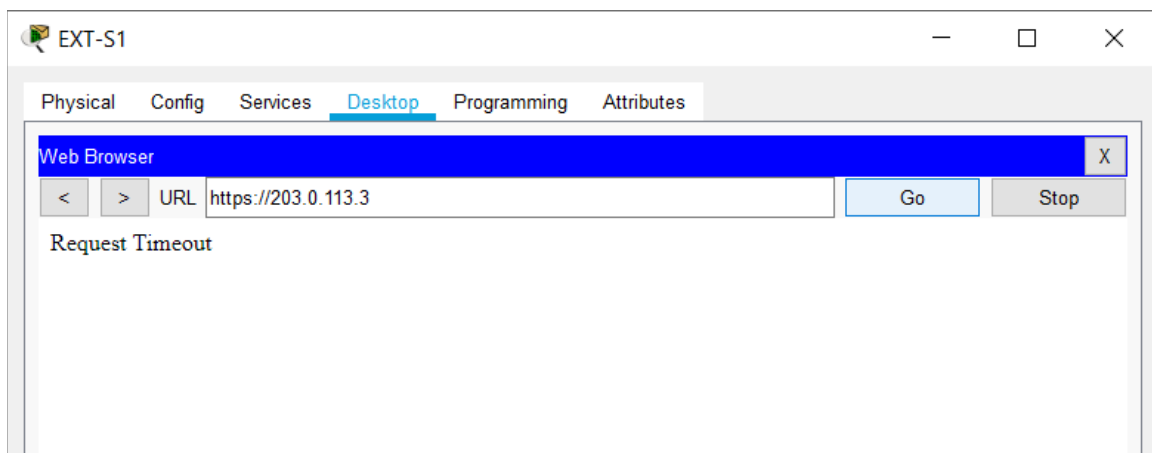
- 3) On Ext-S1, click on 'Desktop' then open 'Web Browser'. Open the NAT'd public IP address of Int-S1 at <https://203.0.113.3> in the browser to verify that external customers on the Internet can reach your web server.



You will see the output shown below if your configuration is working:



You will see a 'Request Timeout' error message if your configuration is **not** working (you need to fix it):



- 4) Verify the connection appears in the NAT translation table. Note that entries age out quickly so generate the traffic again if you did not check the table quickly enough.

Your output should look similar to below. The source port numbers may be different.

```
R1#sh ip nat translation
Pro Inside global      Inside local      Outside local      Outside global
--- 203.0.113.3        10.0.1.10        ---               ---
tcp 203.0.113.3:443    10.0.1.10:443    203.0.113.20:1027 203.0.113.20:1027
```

## **Dynamic NAT**

- 5) Configure NAT on R1 so that PCs in the 10.0.2.0/24 subnet have connectivity to external networks on a first come first served basis. Assign global addresses from the range 203.0.113.4 to 203.0.113.12. Do not enable Port Address Translation.

We already set the F0/0 interface facing the Internet as the NAT outside interface when we configured static NAT for Int-S1.

```
R1(config)#int f0/0
R1(config-if)#ip nat outside
```

Configure the F1/0 interface facing the PCs as a NAT inside interface.

```
R1(config)#int f1/0
R1(config-if)#ip nat inside
```

Configure the pool of global addresses.

```
R1(config)#ip nat pool Flackbox 203.0.113.4 203.0.113.12
netmask 255.255.255.240
```

Create an access list which references the internal IP addresses we want to translate.

```
R1(config)#access-list 1 permit 10.0.2.0 0.0.0.255
```

Associate the access list with the NAT pool to complete the configuration.

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

- 6) Turn on NAT debugging on R1. Ping Ext-S1 from PC1. View the debug output on R1. You should see NAT entries for the 4 pings. Which global address was PC1 translated to?

PC1 will be translated to the first available address in the pool, 203.0.113.4.

```
R1#debug ip nat
IP NAT debugging is on
```

On PC1:

```
C:\>ping 203.0.113.20
```

Pinging 203.0.113.20 with 32 bytes of data:

Request timed out.

Reply from 203.0.113.20: bytes=32 time<1ms TTL=126

Reply from 203.0.113.20: bytes=32 time<1ms TTL=126

Reply from 203.0.113.20: bytes=32 time=1ms TTL=126

Ping statistics for 203.0.113.20:

Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 1ms, Average = 0ms

```
R1#
*Mar 01, 03:19:48.1919: NAT: s=10.0.2.10->203.0.113.4, d=203.0.113.20 [1]
R1#
*Mar 01, 03:19:54.1919: NAT: s=10.0.2.10->203.0.113.4, d=203.0.113.20 [2]
*Mar 01, 03:19:54.1919: NAT*: s=203.0.113.20, d=203.0.113.4->10.0.2.10 [30]
R1#
*Mar 01, 03:19:55.1919: NAT: s=10.0.2.10->203.0.113.4, d=203.0.113.20 [3]
*Mar 01, 03:19:55.1919: NAT*: s=203.0.113.20, d=203.0.113.4->10.0.2.10 [31]
R1#
*Mar 01, 03:19:56.1919: NAT: s=10.0.2.10->203.0.113.4, d=203.0.113.20 [4]
*Mar 01, 03:19:56.1919: NAT*: s=203.0.113.20, d=203.0.113.4->10.0.2.10 [32]
```

- 7) Verify the ping connection appears in the NAT translation table.

```
R1#sh ip nat translation
Pro Inside global      Inside local      Outside local      Outside global
--- 203.0.113.3        10.0.1.10        ---              ---
icmp 203.0.113.4:1     10.0.2.10:1      203.0.113.20:1    203.0.113.20:1
--- 203.0.113.4        10.0.2.10        ---              ---
```

- 8) When all the addresses in the pool 203.0.113.4 to 203.0.113.12 have been allocated, what will happen when the next PC tries to send traffic to an external host?

It will not get a global IP address because they have all been given out. The traffic will fail. The user could try again after waiting for a translation to time out and its global address to be released back into the pool.

- 9) Enable Port Address Translation so that the last IP address in the range can be reused when all IP addresses have been allocated to clients.

```
R1#clear ip nat translation *
R1#config t
R1(config)#ip nat inside source list 1 pool Flackbox overload
```

- 10) Cleanup: Completely remove the access list and all NAT configuration from R1. Use the commands 'show run | section nat' and 'show access-list' to verify all configuration is removed.

```
R1(config)#int f0/0
R1(config-if)#no ip nat outside
R1(config-if)#int f0/1
R1(config-if)#no ip nat inside
R1(config-if)#int f1/0
R1(config-if)#no ip nat inside
R1(config-if)#no ip nat inside source static 10.0.1.10
203.0.113.3
R1(config)#end
R1#clear ip nat translation *
R1#config t
R1(config)#no ip nat inside source list 1 pool Flackbox overload
R1(config)#no ip nat pool Flackbox 203.0.113.4 203.0.113.12
netmask 255.255.255.240
R1(config)#no access-list 1
```

```
R1#show run | section nat
R1#
```

```
R1#show access-list
R1#
```

## Port Address Translation PAT

- 11) Your company no longer has a range of public IP addresses. Instead, you will receive a single public IP address via DHCP from your service provider.

Shutdown interface F0/0 on R1 and remove its IP address. Reconfigure it to receive its IP address via DHCP from the service provider router SP1.

```
R1(config)#int f0/0
R1(config-if)#shutdown
R1(config-if)#no ip address
R1(config-if)#ip address dhcp
```

- 12) Bring the interface back up and wait for DHCP. What IP address is it assigned?

```
R1(config)#int f0/0
R1(config-if)#no shutdown
```

```
R1#sh ip int brief
```

Interface	IP-Address	OK?	Method	Status
FastEthernet0/0	203.0.113.13	YES	DHCP	up
FastEthernet0/1	10.0.1.1	YES	NVRAM	up
FastEthernet1/0	10.0.2.1	YES	NVRAM	up
FastEthernet1/1	unassigned	YES	NVRAM	administratively down

- 13) Configure NAT on R1 so that PCs in the 10.0.2.0/24 subnet have connectivity to external networks on a first come first served basis. Allow multiple PCs to reuse the IP address on interface F0/0 on R1. Ensure that NAT continues to work if the DHCP address assigned by the provider changes.

Configure the F0/0 interface facing the Internet as the NAT outside interface.

```
R1(config)#int f0/0
R1(config-if)#ip nat outside
```

Configure the F1/0 interface facing the PCs as a NAT inside interface.

```
R1(config)#int f1/0
R1(config-if)#ip nat inside
```

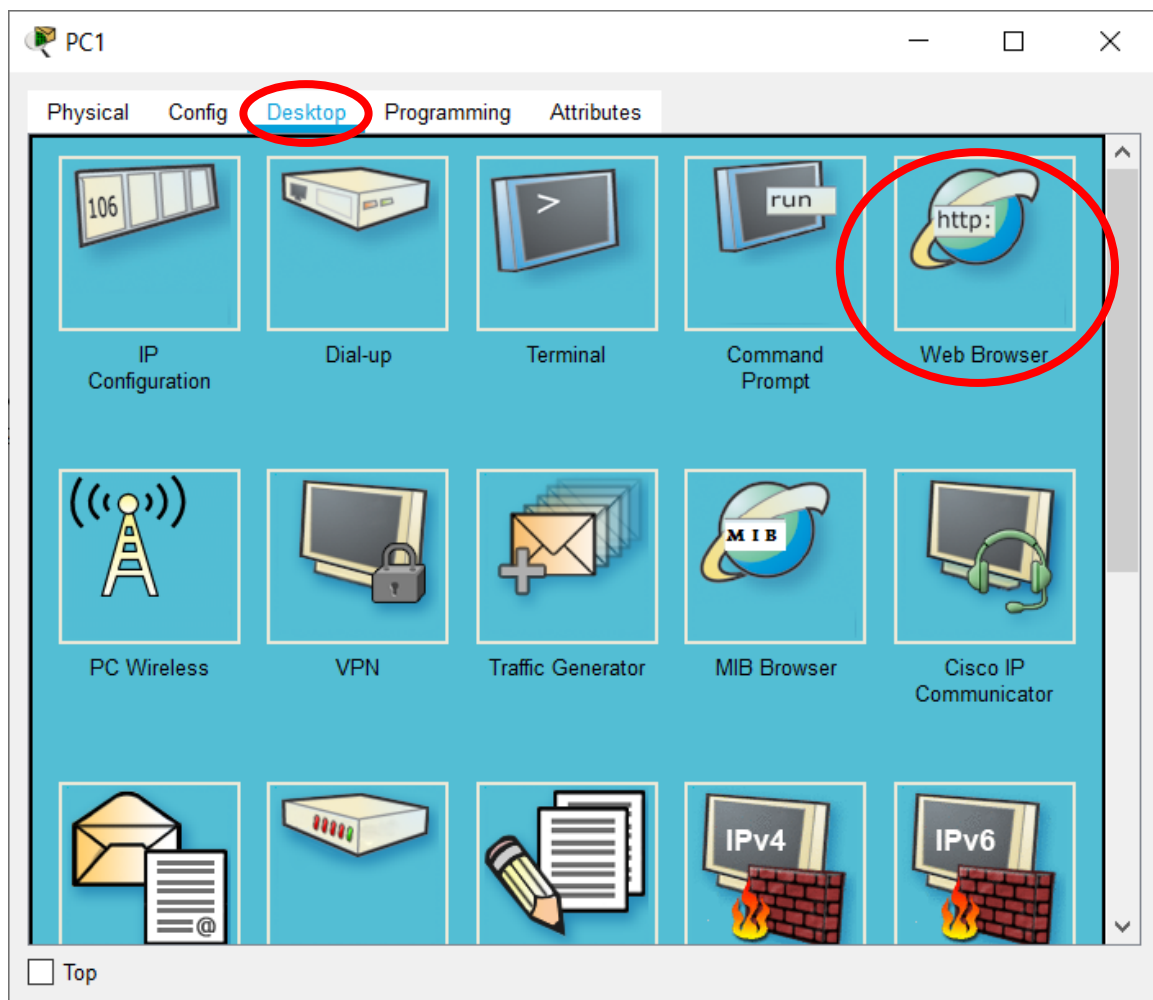
Create an access list which references the internal IP addresses we want to translate.

```
R1(config)#access-list 1 permit 10.0.2.0 0.0.0.255
```

Associate the access list with the outside interface and enable PAT to complete the configuration.

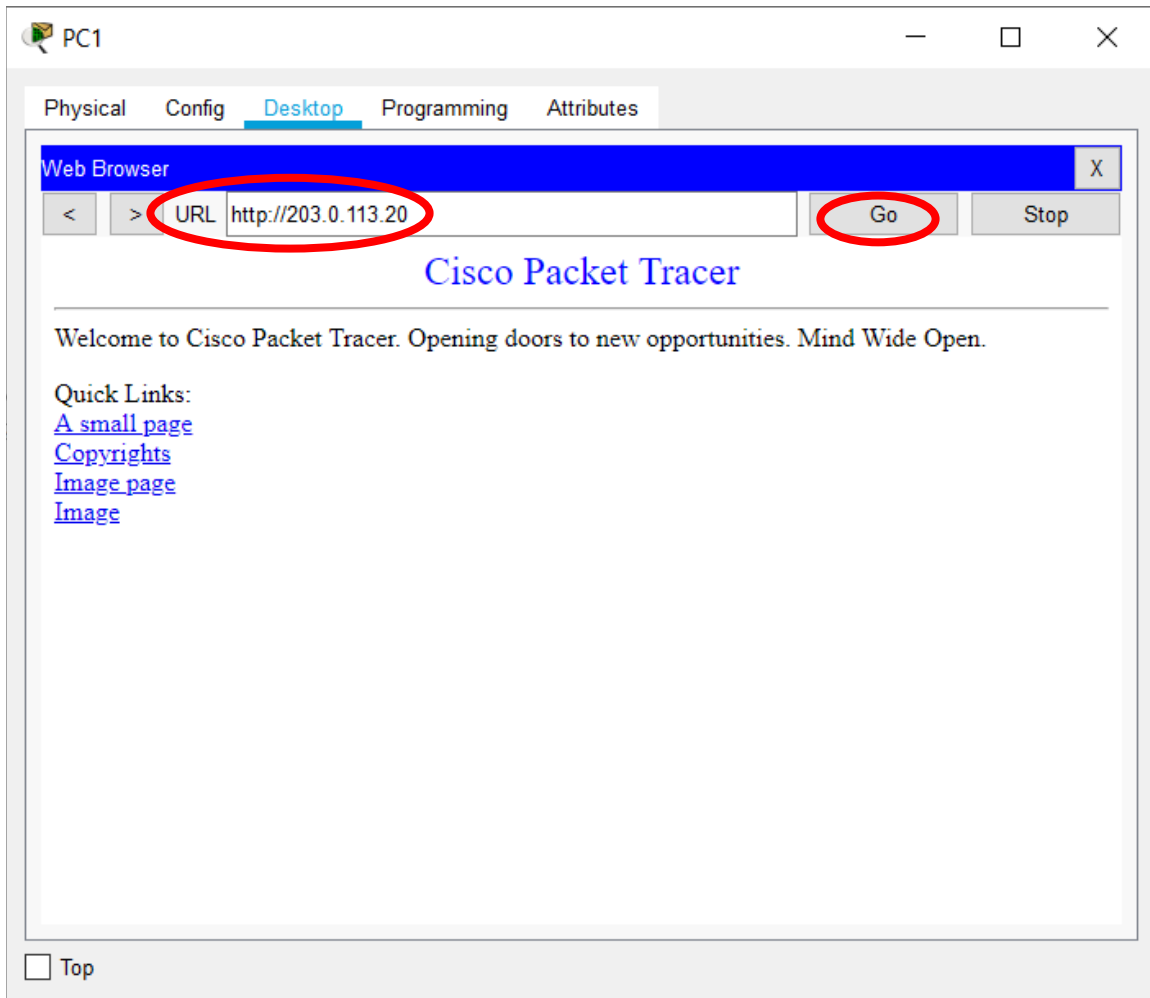
```
R1(config)#ip nat inside source list 1 interface f0/0  
overload
```

- 14) Ensure NAT debugging on R1 is still enabled. On PC1, click on 'Desktop' then open 'Web Browser'. Open the public IP address of Ext-S1 at <http://203.0.113.20> in the browser to verify that PAT is working and you can reach external servers.





You will see the output shown below if your configuration is working:



You will see a 'Request Timeout' error message if your configuration is **not** working (you need to fix it).

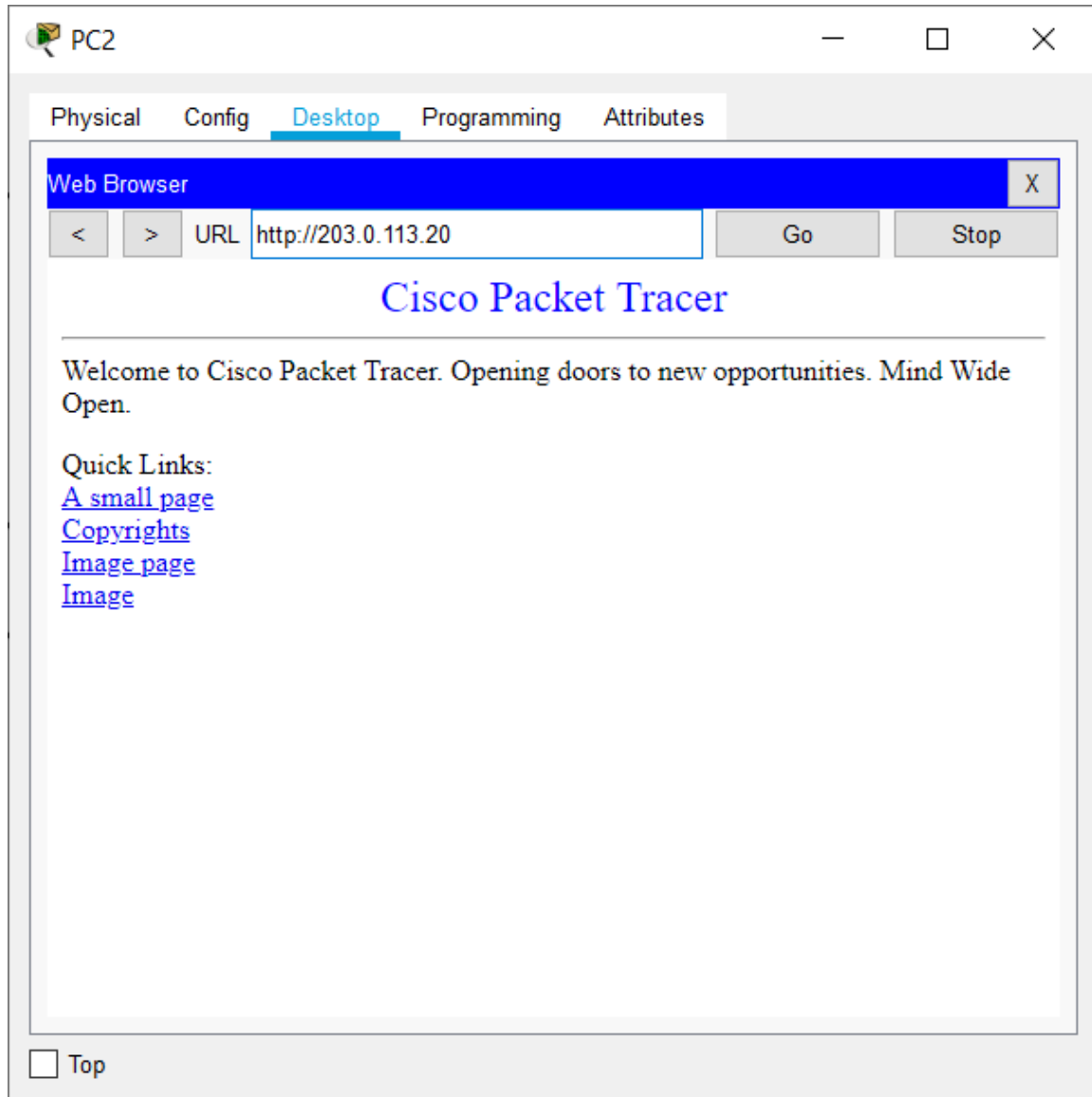
15) View the debug output on R1. Which global IP address was PC1 translated to?

PC1 is translated to the address on R1's F0/0 interface, 203.0.113.13.

```
*Mar 01, 03:40:43.4040: NAT*: s=10.0.2.10->203.0.113.13, d=203.0.113.20 [10]
*Mar 01, 03:40:43.4040: NAT*: s=203.0.113.20, d=203.0.113.13->10.0.2.10 [37]
*Mar 01, 03:40:43.4040: NAT*: s=10.0.2.10->203.0.113.13, d=203.0.113.20 [11]
*Mar 01, 03:40:43.4040: NAT*: s=10.0.2.10->203.0.113.13, d=203.0.113.20 [12]
```

- 16) On PC2, click on 'Desktop' then open 'Web Browser'. Open the public IP address of Ext-S1 at http://203.0.113.20 in the browser. Which global IP address is PC2 translated to?

PC2 is also translated to 203.0.113.13.



```
*Mar 01, 03:47:51.4747: NAT: s=10.0.2.11->203.0.113.13, d=203.0.113.20 [1]
*Mar 01, 03:47:51.4747: NAT*: s=203.0.113.20, d=203.0.113.13->10.0.2.11 [40]
*Mar 01, 03:47:51.4747: NAT*: s=10.0.2.11->203.0.113.13, d=203.0.113.20 [2]
*Mar 01, 03:47:51.4747: NAT*: s=10.0.2.11->203.0.113.13, d=203.0.113.20 [3]
```

17) Verify the connections in the NAT translation table.

PC1 and PC2 are translated to different source ports.

```
R1#sh ip nat translation
Pro Inside global      Inside local      Outside local      Outside global
tcp 203.0.113.13:1025   10.0.2.10:1025    203.0.113.20:80    203.0.113.20:80
tcp 203.0.113.13:1024   10.0.2.11:1025    203.0.113.20:80    203.0.113.20:80
```

18) Show the NAT statistics on R1.

The numbers in your output may be different.

```
R1#sh ip nat statistics
Total translations: 2 (0 static, 2 dynamic, 2 extended)
Outside Interfaces: FastEthernet0/0
Inside Interfaces: FastEthernet1/0
Hits: 41 Misses: 32
Expired translations: 16
Dynamic mappings:
```