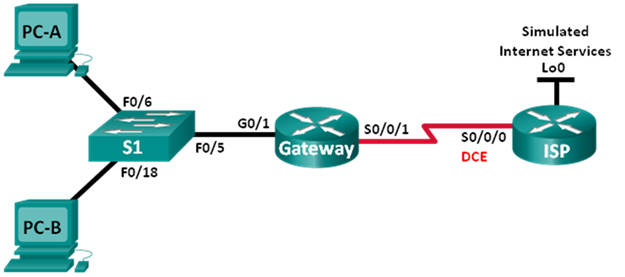
Lab - Troubleshooting NAT Configurations (Instructor Version)

**Instructor Note**: Red font color or Gray highlights indicate text that appears in the instructor copy only.

1. Topology



1. Addressing Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Device | Interface | IP Address | Subnet Mask | Default Gateway |
| Gateway | G0/1 | 192.168.1.1 | 255.255.255.0 | N/A |
|  | S0/0/1 | 209.165.200.225 | 255.255.255.252 | N/A |
| ISP | S0/0/0 (DCE) | 209.165.200.226 | 255.255.255.252 | N/A |
|  | Lo0 | 198.133.219.1 | 255.255.255.255 | N/A |
| PC-A | NIC | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |
| PC-B | NIC | 192.168.1.4 | 255.255.255.0 | 192.168.1.1 |

Objectives

Part 1: Build the Network and Configure Basic Device Settings

Part 2: Troubleshoot Static NAT

Part 3: Troubleshoot Dynamic NAT

1. Background / Scenario

In this lab, the Gateway router was configured by an inexperienced network administrator at your company. Several errors in the configuration have resulted in NAT issues. Your boss has asked you to troubleshoot and correct the NAT errors and document your work. Ensure that the network supports the following:

* PC-A acts as a web server with a static NAT and will be reachable from the outside using the 209.165.200.254 address.
* PC-B acts as a host computer and dynamically receives an IP address from the created pool of addresses called NAT\_POOL, which uses the 209.165.200.240/29 range.

**Note**: The routers used with CCNA hands-on labs are Cisco 1941 Integrated Services Routers (ISRs) with Cisco IOS Release 15.2(4)M3 (universalk9 image). The switches used are Cisco Catalyst 2960s with Cisco IOS Release 15.0(2) (lanbasek9 image). Other routers, switches and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of this lab for the correct interface identifiers.

**Note**: Make sure that the routers and switch have been erased and have no startup configurations. If you are unsure, contact your instructor.

**Instructor Note**: Refer to the Instructor Lab Manual for the procedures to initialize and reload devices.

1. Required Resources

* 2 Routers (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
* 1 Switch (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
* 2 PCs (Windows 7, Vista, or XP with terminal emulation program, such as Tera Term)
* Console cables to configure the Cisco IOS devices via the console ports
* Ethernet and serial cables as shown in the topology

1. Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and configure the routers with basic settings. Additional NAT-related configurations are provided. The NAT configurations for the Gateway router contains errors that you will identify and correct as you proceed through the lab.

* 1. Cable the network as shown in the topology.
  2. Configure PC hosts.
  3. Initialize and reload the switch and routers.
  4. Configure basic settings for each router.
     1. Disable DNS lookup.
     2. Configure device name as shown in the topology.
     3. Configure IP addresses as listed in the Address Table.
     4. Set the clock rate to **128000** for DCE serial interfaces.
     5. Assign **cisco** as the console and vty password.
     6. Assign **class** as the encrypted privileged EXEC mode password.
     7. Configure **logging synchronous** to prevent console messages from interrupting the command entry.
  5. Configure static routing.
     1. Create a static route from the ISP router to the Gateway router-assigned public network address range 209.165.200.224/27.

ISP(config)# **ip route 209.165.200.224 255.255.255.224 s0/0/0**

* + 1. Create a default route from the Gateway router to the ISP router.

Gateway(config)# **ip route 0.0.0.0 0.0.0.0 s0/0/1**

* 1. Load router configurations.

The configurations for the routers are provided for you. There are errors with the configuration for the Gateway router. Identify and correct the configurations errors.

Gateway Router Configuration

interface g0/1

ip nat outside

! ip nat inside

no shutdown

interface s0/0/0

ip nat outside

! no ip nat outside

interface s0/0/1

! ip nat outside

no shutdown

ip nat inside source static 192.168.2.3 209.165.200.254

! ip nat inside source static 192.168.1.3 209.165.200.254

ip nat pool NAT\_POOL 209.165.200.241 209.165.200.246 netmask 255.255.255.248

ip nat inside source list NAT\_ACL pool NATPOOL

! ip nat inside source list NAT\_ACL pool NAT\_POOL

ip access-list standard NAT\_ACL

permit 192.168.10.0 0.0.0.255

! permit 192.168.1.0 0.0.0.255

banner motd $AUTHORIZED ACCESS ONLY$

end

* 1. Save the running configuration to the startup configuration.

1. Troubleshoot Static NAT

In Part 2, you will examine the static NAT for PC-A to determine if it is configured correctly. You will troubleshoot the scenario until the correct static NAT is verified.

* + 1. To troubleshoot issues with NAT, use the **debug ip nat** command. Turn on NAT debugging to see translations in real-time across the Gateway router.

Gateway# **debug ip nat**

* + 1. From PC-A, ping Lo0 on the ISP router. Do any NAT debug translations appear on the Gateway router?

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No.

* + 1. On the Gateway router, enter the command that allows you to see all current NAT translations on the Gateway router. Write the command in the space below.

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**show ip nat translations**

Gateway# **show ip nat translations**

Pro Inside global Inside local Outside local Outside global

--- 209.165.200.254 192.168.2.3 --- ---

Why are you seeing a NAT translation in the table, but none occurred when PC-A pinged the ISP loopback interface? What is needed to correct the issue?

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The static translation is for an incorrect inside local address.

* + 1. Record any commands that are necessary to correct the static NAT configuration error.

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Gateway(config)# **no ip nat inside source static 192.168.2.3 209.165.200.254**

Gateway(config)# **ip nat inside source static 192.168.1.3 209.165.200.254**

* + 1. From PC-A, ping Lo0 on the ISP router. Do any NAT debug translations appear on the Gateway router?

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No

* + 1. On the Gateway router, enter the command that allows you to observe the total number of current NATs. Write the command in the space below.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**show ip nat statistics**

Gateway# **show ip nat statistics**

Total active translations: 1 (1 static, 0 dynamic; 0 extended)

Peak translations: 1, occurred 00:08:12 ago

Outside interfaces:

GigabitEthernet0/1, Serial0/0/0

Inside interfaces:

Hits: 0 Misses: 0

CEF Translated packets: 0, CEF Punted packets: 0

Expired translations: 0

Dynamic mappings:

-- Inside Source

[Id: 1] access-list NAT\_ACL pool NATPOOL refcount 0

Total doors: 0

Appl doors: 0

Normal doors: 0

Queued Packets: 0

Is the static NAT occurring successfully? Why?

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No NAT translation is occurring because both of G0/1 and S0/0/0 interfaces are configured with the **ip nat outside** command. No active interfaces area assigned as inside.

* + 1. On the Gateway router, enter the command that allows you to view the current configuration of the router. Write the command in the space below.

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**show running-config**

Gateway# **show running-config**

Building configuration...

Current configuration : 1806 bytes

!

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname Gateway

!

boot-start-marker

boot-end-marker

!

!

enable secret 4 06YFDUHH61wAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2

!

no aaa new-model

!

no ip domain lookup

ip cef

no ipv6 cef

!

multilink bundle-name authenticated

!

redundancy

!

interface GigabitEthernet0/0

no ip address

shutdown

duplex auto

speed auto

!

interface GigabitEthernet0/1

ip address 192.168.1.1 255.255.255.0

ip nat outside

ip virtual-reassembly in

duplex auto

speed auto

!

interface Serial0/0/0

no ip address

ip nat outside

ip virtual-reassembly in

shutdown

clock rate 2000000

!

interface Serial0/0/1

ip address 209.165.200.225 255.255.255.252

!

ip forward-protocol nd

!

no ip http server

no ip http secure-server

!

ip nat pool NAT\_POOL 209.165.200.241 209.165.200.246 netmask 255.255.255.248

ip nat inside source list NAT\_ACL pool NATPOOL

ip nat inside source static 192.168.1.3 209.165.200.254

ip route 0.0.0.0 0.0.0.0 Serial0/0/1

!

ip access-list standard NAT\_ACL

permit 192.168.10.0 0.0.0.255

!

!

!

!

control-plane

!

!

banner motd ^CAUTHORIZED ACCESS ONLY^C

!

line con 0

password cisco

logging synchronous

login

line aux 0

line 2

no activation-character

no exec

transport preferred none

transport input all

transport output pad telnet rlogin lapb-ta mop udptn v120 ssh

stopbits 1

line vty 0 4

password cisco

login

transport input all

!

scheduler allocate 20000 1000

!

end

* + 1. Are there any problems with the current configuration that prevent the static NAT from occurring?

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Yes. The inside and outside NAT interfaces are incorrectly configured.

* + 1. Record any commands that are necessary to correct the static NAT configuration errors.

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Gateway(config)# **interface g0/1**

Gateway(config-if)# **no ip nat outside**

Gateway(config-if)# **ip nat inside**

Gateway(config-if)# **exit**

Gateway(config)# **interface s0/0/0**

Gateway(config-if)# **no ip nat outside**

Gateway(config-if)# **exit**

Gateway(config)# **interface s0/0/1**

Gateway(config-if)# **ip nat outside**

Gateway(config-if)# **exit**

* + 1. From PC-A, ping Lo0 on the ISP router. Do any NAT debug translations appear on the Gateway router?

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Yes

\*Mar 18 23:53:50.707: NAT\*: s=192.168.1.3->209.165.200.254, d=198.133.219.1 [187]

\*Mar 18 23:53:50.715: NAT\*: s=198.133.219.1, d=209.165.200.254->192.168.1.3 [187]

Gateway#

\*Mar 18 23:53:51.711: NAT\*: s=192.168.1.3->209.165.200.254, d=198.133.219.1 [188]

\*Mar 18 23:53:51.719: NAT\*: s=198.133.219.1, d=209.165.200.254->192.168.1.3 [188]

\*Mar 18 23:53:52.707: NAT\*: s=192.168.1.3->209.165.200.254, d=198.133.219.1 [189]

Gateway#

\*Mar 18 23:53:52.715: NAT\*: s=198.133.219.1, d=209.165.200.254->192.168.1.3 [189]

\*Mar 18 23:53:53.707: NAT\*: s=192.168.1.3->209.165.200.254, d=198.133.219.1 [190]

Gateway#

\*Mar 18 23:53:53.715: NAT\*: s=198.133.219.1, d=209.165.200.254->192.168.1.3 [190]

* + 1. Use the **show ip nat translations verbose** command to verify static NAT functionality.

**Note**: The timeout value for ICMP is very short. If you do not see all the translations in the output, redo the ping.

Gateway# **show ip nat translations verbose**

Pro Inside global Inside local Outside local Outside global

icmp 209.165.200.254:1 192.168.1.3:1 198.133.219.1:1 198.133.219.1:1

create 00:00:04, use 00:00:01 timeout:60000, left 00:00:58,

flags:

extended, use\_count: 0, entry-id: 12, lc\_entries: 0

--- 209.165.200.254 192.168.1.3 --- ---

create 00:30:09, use 00:00:04 timeout:0,

flags:

static, use\_count: 1, entry-id: 2, lc\_entries: 0

Is the static NAT translation occurring successfully? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Yes

If static NAT is not occurring, repeat the steps above to troubleshoot the configuration.

1. Troubleshoot Dynamic NAT
   * 1. From PC-B, ping Lo0 on the ISP router. Do any NAT debug translations appear on the Gateway router?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ No

* + 1. On the Gateway router, enter the command that allows you to view the current configuration of the router. Are there any problems with the current configuration that prevent dynamic NAT from occurring?

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Yes. The NAT pool is incorrectly identified in the source statement. The NAT access list has an incorrect network statement.

* + 1. Record any commands that are necessary to correct the dynamic NAT configuration errors.

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Gateway(config)# **no ip nat inside source list NAT\_ACL pool NATPOOL**

Gateway(config)# **ip nat inside source list NAT\_ACL pool NAT\_POOL**

Gateway(config)# **ip access-list standard NAT\_ACL**

Gateway(config-std-nacl)# **no permit 192.168.10.0 0.0.0.255**

Gateway(config-std-nacl)# **permit 192.168.1.0 0.0.0.255**

* + 1. From PC-B, ping Lo0 on the ISP router. Do any NAT debug translations appear on the Gateway router?

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Yes

\*Mar 19 00:01:17.303: NAT\*: s=192.168.1.4->209.165.200.241, d=198.133.219.1 [198]

\*Mar 19 00:01:17.315: NAT\*: s=198.133.219.1, d=209.165.200.241->192.168.1.4 [198]

Gateway#

\*Mar 19 00:01:18.307: NAT\*: s=192.168.1.4->209.165.200.241, d=198.133.219.1 [199]

\*Mar 19 00:01:18.315: NAT\*: s=198.133.219.1, d=209.165.200.241->192.168.1.4 [199]

\*Mar 19 00:01:19.303: NAT\*: s=192.168.1.4->209.165.200.241, d=198.133.219.1 [200]

Gateway#

\*Mar 19 00:01:19.315: NAT\*: s=198.133.219.1, d=209.165.200.241->192.168.1.4 [200]

\*Mar 19 00:01:20.303: NAT\*: s=192.168.1.4->209.165.200.241, d=198.133.219.1 [201]

\*Mar 19 00:01:20.311: NAT\*: s=198.133.219.1, d=209.165.200.241->192.168.1.4 [201]

* + 1. Use the **show ip nat statistics** to view NAT usage.

Gateway# **show ip nat statistics**

Total active translations: 2 (1 static, 1 dynamic; 0 extended)

Peak translations: 3, occurred 00:02:58 ago

Outside interfaces:

Serial0/0/1

Inside interfaces:

GigabitEthernet0/1

Hits: 24 Misses: 0

CEF Translated packets: 24, CEF Punted packets: 0

Expired translations: 3

Dynamic mappings:

-- Inside Source

[Id: 2] access-list NAT\_ACL pool NAT\_POOL refcount 1

pool NAT\_POOL: netmask 255.255.255.248

start 209.165.200.241 end 209.165.200.246

type generic, total addresses 6, allocated 1 (16%), misses 0

Total doors: 0

Appl doors: 0

Normal doors: 0

Queued Packets: 0

Is the NAT occurring successfully? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Yes

What percentage of dynamic addresses has been allocated? \_\_\_\_\_\_\_\_\_\_ 16%

* + 1. Turn off all debugging using the **undebug all** command.

1. Reflection
   1. What is the benefit of a static NAT?

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A static NAT translation allows users from outside the LAN access to the computer or server on the internal network.

* 1. What issues would arise if 10 host computers in this network were attempting simultaneous Internet communication?

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Not enough public addresses exist in the NAT pool to satisfy 10 simultaneous user sessions, but as hosts drop off different hosts will be able to claim the pool addresses to access the Internet.

1. Router Interface Summary Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Router Interface Summary | | | | |
| Router Model | Ethernet Interface #1 | Ethernet Interface #2 | Serial Interface #1 | Serial Interface #2 |
| 1800 | Fast Ethernet 0/0 (F0/0) | Fast Ethernet 0/1 (F0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 1900 | Gigabit Ethernet 0/0 (G0/0) | Gigabit Ethernet 0/1 (G0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 2801 | Fast Ethernet 0/0 (F0/0) | Fast Ethernet 0/1 (F0/1) | Serial 0/1/0 (S0/1/0) | Serial 0/1/1 (S0/1/1) |
| 2811 | Fast Ethernet 0/0 (F0/0) | Fast Ethernet 0/1 (F0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| 2900 | Gigabit Ethernet 0/0 (G0/0) | Gigabit Ethernet 0/1 (G0/1) | Serial 0/0/0 (S0/0/0) | Serial 0/0/1 (S0/0/1) |
| **Note**: To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface. | | | | |

1. Device Config
2. Router Gateway

Gateway#show run

Building configuration...

Current configuration : 1805 bytes

!

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname Gateway

!

boot-start-marker

boot-end-marker

!

!

enable secret 4 06YFDUHH61wAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2

!

no aaa new-model

!

!

no ip domain lookup

ip cef

no ipv6 cef

!

multilink bundle-name authenticated

!

!

redundancy

!

!

!

!

interface Embedded-Service-Engine0/0

no ip address

shutdown

!

interface GigabitEthernet0/0

no ip address

shutdown

duplex auto

speed auto

!

interface GigabitEthernet0/1

ip address 192.168.1.1 255.255.255.0

ip nat inside

ip virtual-reassembly in

duplex auto

speed auto

!

interface Serial0/0/0

no ip address

shutdown

!

interface Serial0/0/1

ip address 209.165.200.225 255.255.255.252

ip nat outside

ip virtual-reassembly in

!

ip forward-protocol nd

!

no ip http server

no ip http secure-server

!

ip nat pool NAT\_POOL 209.165.200.241 209.165.200.246 netmask 255.255.255.248

ip nat inside source list NAT\_ACL pool NAT\_POOL

ip nat inside source static 192.168.1.3 209.165.200.254

ip route 0.0.0.0 0.0.0.0 Serial0/0/1

!

ip access-list standard NAT\_ACL

permit 192.168.1.0 0.0.0.255

!

!

!

!

control-plane

!

!

banner motd ^CAUTHORIZED ACCESS ONLY^C

!

line con 0

password cisco

logging synchronous

login

line aux 0

line 2

no activation-character

no exec

transport preferred none

transport input all

transport output pad telnet rlogin lapb-ta mop udptn v120 ssh

stopbits 1

line vty 0 4

password cisco

login

transport input all

!

scheduler allocate 20000 1000

!

end

1. Router ISP

ISP#show run

Building configuration...

Current configuration : 1482 bytes

!

version 15.2

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname ISP

!

boot-start-marker

boot-end-marker

!

!

enable secret 4 06YFDUHH61wAE/kLkDq9BGho1QM5EnRtoyr8cHAUg.2

!

no aaa new-model

memory-size iomem 15

!

no ip domain lookup

ip cef

!

!

!

!

!

!

no ipv6 cef

multilink bundle-name authenticated

!

!

!

!

!

!

!

!

interface Loopback0

ip address 198.133.219.1 255.255.255.255

!

interface Embedded-Service-Engine0/0

no ip address

shutdown

!

interface GigabitEthernet0/0

no ip address

shutdown

duplex auto

speed auto

!

interface GigabitEthernet0/1

no ip address

shutdown

duplex auto

speed auto

!

interface Serial0/0/0

ip address 209.165.200.226 255.255.255.252

clock rate 128000

!

interface Serial0/0/1

no ip address

shutdown

!

ip forward-protocol nd

!

no ip http server

no ip http secure-server

!

ip route 209.165.200.224 255.255.255.224 Serial0/0/0

!

!

!

!

control-plane

!

!

!

line con 0

password cisco

logging synchronous

login

line aux 0

line 2

no activation-character

no exec

transport preferred none

transport input all

transport output pad telnet rlogin lapb-ta mop udptn v120 ssh

stopbits 1

line vty 0 4

password cisco

login

transport input all

line vty 5 15

password cisco

login

transport input all

!

scheduler allocate 20000 1000

!

end