Network Address Translation (NAT)

Implementation Documentation

Router 10 Configuration

Network G Implementation

Static NAT Configuration

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Contents

1 Executive Summary

This document provides comprehensive documentation for implementing Network Address Translation (NAT) on Router 10 to enable connectivity between Network G and external networks through EIGRP 11.

1.1 Objective

The primary objective was to configure Static NAT on Router 10 to translate private IP address `192.168.1.6` to a public IP address from Network G's subnet range.

1.2 Scope

- Configure NAT on Router 10
- Mark inside and outside interfaces correctly
- Create access-list for Network G
- Implement static NAT translation
- Verify NAT functionality

2 Network Topology Overview

2.1 Network Architecture

Network Components

- **Router 10**: Central NAT device
- **Network G**: Internal network requiring NAT
- **EIGRP 11**: External routing domain
- **Laptop (Fa0/Laptop8)**: End device in Network G

2.2 IP Addressing Scheme

blue!20 **Interface/Network**	**IP Address**	**Subnet Mask**
Fa0/1 (Inside)	114.195.64.2	255.255.240.0
Se0/2/0 (Outside)	114.195.112.46	255.255.255.252
Se0/0/0 (Outside)	114.195.112.41	255.255.255.252
yellow!20 Private IP (NAT)	192.168.1.6	-
green!20 Public IP (NAT)	114.195.64.10	-

Table 1: Router 10 Interface Configuration

2.3 Network G Subnet Information

blue!20 **Parameter**	**Value**
Network Address	114.195.64.0/20
Subnet Mask	255.255.240.0
First Usable IP	114.195.64.1
Last Usable IP	114.195.79.254
Broadcast Address	114.195.79.255
Total Hosts	4,096
Usable Hosts	4,094

Table 2: Network G Subnet Details

3 Required Tasks

The following tasks were required to successfully implement NAT on Router 10:

Task 1: NAT Configuration - Configure NAT on Router 10

Task 2: Inside Interface - Mark inside interface correctly (Fa0/1)

Task 3: Outside Interfaces - Mark outside interfaces correctly (Se0/2/0, Se0/0/0)

Task 4: Access-List - Create access-list for Network G

Task 5: Verification - Verify NAT translation is working

4 Step-by-Step Implementation

4.1 Task 1: Configure Static NAT Translation

4.1.1 Purpose

Configure dynamic NAT with Port Address Translation (PAT/overload) to allow Network G devices to share the IP address 192.168.1.6 for outbound connectivity.

4.1.2 Commands

Configuration Commands

```
Router> enable
Router# configure terminal

! Configure NAT Pool
Router(config)# ip nat pool NAT-POOL 192.168.1.6 192.168.1.6
   netmask 255.255.255.0

! Configure Dynamic NAT with PAT (Overload)
Router(config)# ip nat inside source list 1 pool NAT-POOL
   overload

! Static NAT (optional - kept for reference)
Router(config)# ip nat inside source static 192.168.1.6
   114.195.64.10

Router(config)# exit
Router# write memory
```

4.1.3 Verification

Verification Commands

```
Router# show running-config | include nat
Router# show ip nat statistics
```

4.1.4 Expected Output

Command Output

```
Router# show running-config | include nat
ip nat pool NAT-POOL 192.168.1.6 192.168.1.6 netmask
   255.255.255.0
ip nat inside source static 192.168.1.6 114.195.64.10
ip nat inside source list 1 pool NAT-POOL overload
```

4.1.5 Status

COMPLETED

4.2 Task 2: Mark Inside Interface (Fa0/1)

4.2.1 Purpose

Designate FastEthernet0/1 as the NAT inside interface, connecting to Network G.

4.2.2 Commands

Configuration Commands

```
Router> enable
Router# configure terminal
Router(config)# interface fa0/1
Router(config-if)# ip nat inside
Router(config-if)# exit
Router(config)# exit
Router# write memory
```

4.2.3 Verification

Verification Commands

```
Router# show ip nat statistics
Router# show ip interface fa0/1 | include NAT
```

4.2.4 Expected Output

Command Output

```
Router# show ip nat statistics
Total translations: 1 (1 static, 0 dynamic, 0 extended)
Outside Interfaces:
Inside Interfaces: FastEthernet0/1
Hits: 0  Misses: 0
Expired translations: 0
Dynamic mappings:
```

4.2.5 Status

COMPLETED

4.3 Task 3: Mark Outside Interfaces

4.3.1 Purpose

Designate Serial0/2/0 and Serial0/0/0 as NAT outside interfaces, connecting to EIGRP 11 network.

4.3.2 Commands

Configuration Commands

```
Router> enable
Router# configure terminal
Router(config)# interface se0/2/0
Router(config-if)# ip nat outside
Router(config-if)# exit
Router(config)# interface se0/0/0
Router(config-if)# ip nat outside
Router(config-if)# exit
Router(config)# exit
Router# write memory
```

4.3.3 Verification

Verification Commands

```
Router# show ip nat statistics
```

4.3.4 Expected Output

Command Output

```
Router# show ip nat statistics
Total translations: 1 (1 static, 0 dynamic, 0 extended)
Outside Interfaces: Serial0/0/0 , Serial0/2/0
Inside Interfaces: FastEthernet0/1
Hits: 0  Misses: 0
Expired translations: 0
Dynamic mappings:
```

4.3.5 Status

COMPLETED

4.4 Task 4: Configure Access-List for Network G

4.4.1 Purpose

Create an access-list to permit traffic from the private IP and Network G subnet for NAT translation.

4.4.2 Commands

Configuration Commands

```
Router> enable
Router# configure terminal
Router(config)# access-list 1 permit 192.168.1.6 0.0.0.0
Router(config)# access-list 1 permit 114.195.64.0 0.0.15.255
Router(config)# exit
Router# write memory
```

4.4.3 Verification

Verification Commands

```
Router# show access-lists
```

4.4.4 Expected Output

Command Output

```
Router# show access-lists
Standard IP access list 1
    10 permit host 192.168.1.6
    20 permit 114.195.64.0 0.0.15.255
```

4.4.5 Wildcard Mask Explanation

Wildcard Mask Calculation

Network G Subnet: 114.195.64.0/20
Subnet Mask: 255.255.240.0
Wildcard Mask: 0.0.15.255 (inverse of subnet mask)

Calculation:

```
255.255.255.255 (all ones)
- 255.255.240.0 (subnet mask)
= 0.0.15.255 (wildcard mask)
```

4.4.6 Status

COMPLETED

4.5 Task 5: Verify NAT Translation

4.5.1 Purpose

Verify that NAT translation is configured correctly and is operational.

4.5.2 Verification Commands

Primary Verification

```
Router# show ip nat translations
```

4.5.3 Expected Output

NAT Translation Table

```
Router# show ip nat translations
Pro  Inside global     Inside local       Outside local
   Outside global
---  114.195.64.10     192.168.1.6        ---
   ---
```

4.5.4 Additional Verification Commands

Complete Verification Suite

```
! Check NAT statistics
Router# show ip nat statistics

! Debug NAT operations (use carefully)
Router# debug ip nat

! Turn off debugging
Router# undebug all

! Verify complete configuration
Router# show running-config
```

4.5.5 Translation Table Explanation

4.5.6 Status

COMPLETED

5 Configuration Results

blue!20 **Field**	**Description**
Pro	Protocol (— means all protocols)
Inside global	Public IP address (114.195.64.10) visible to outside
Inside local	Private IP address (192.168.1.6) on inside network
Outside local	Outside device IP as it appears to inside network
Outside global	Outside device IP on external network

Table 3: NAT Translation Table Fields

5.1 Router CLI Screenshots

The following screenshot demonstrates the complete NAT configuration process and verification on Router 10.
Figure 1 shows the complete NAT implementation including interface configuration, NAT pool setup, dynamic NAT with PAT configuration, and verification commands demonstrating successful NAT translations with active ICMP sessions.

6 Final Configuration Summary

6.1 Complete NAT Configuration

Router 10 NAT Configuration

```
! Static NAT Translation
ip nat inside source static 192.168.1.6 114.195.64.10

! Inside Interface
interface FastEthernet0/1
 ip address 114.195.64.2 255.255.240.0
 ip nat inside

! Outside Interface 1
interface Serial0/2/0
 ip address 114.195.112.46 255.255.255.252
 ip nat outside

! Outside Interface 2
interface Serial0/0/0
 ip address 114.195.112.41 255.255.255.252
 ip nat outside

! Access-List for Network G
access-list 1 permit 192.168.1.6 0.0.0.0
access-list 1 permit 114.195.64.0 0.0.15.255
```

6.2 Task Completion Checklist

blue!20 **Task**	**Status**	**Verification Method**
NAT configured on Router 10	■	show running-config — include nat
Inside interface marked	■	show ip nat statistics
Outside interfaces marked	■	show ip nat statistics
Access-list configured	■	show access-lists
NAT translation working	■	show ip nat translations

Table 4: NAT Implementation Task Status

7 Verification Results

7.1 NAT Statistics Output

Final NAT Statistics

```
Router# show ip nat statistics
Total translations: 1 (1 static, 0 dynamic, 0 extended)
Outside Interfaces: Serial0/0/0 , Serial0/2/0
Inside Interfaces: FastEthernet0/1
Hits: 0  Misses: 0
Expired translations: 0
Dynamic mappings:
```

7.2 Access-List Output

Access-List Configuration

```
Router# show access-lists
Standard IP access list 1
    10 permit host 192.168.1.6
    20 permit 114.195.64.0 0.0.15.255
```

7.3 NAT Translation Table

Active NAT Translations

```
Router# show ip nat translations
Pro  Inside global     Inside local       Outside local
   Outside global
---  114.195.64.10     192.168.1.6        ---
   ---
```

8 Technical Details

8.1 NAT Translation Process

1. **Outbound Traffic Flow:**
   - Device in Network G (e.g., 114.195.64.1) sends packet to external network
   - Packet arrives at Router 10's Fa0/1 interface (inside)
   - Router 10 translates source IP and assigns unique port number
   - Translation: 114.195.64.1:random_port → 192.168.1.6:assigned_port
   - Packet forwarded out through outside interfaces to EIGRP 11 network
2. **Inbound Traffic Flow (Response):**
   - External device sends response to 192.168.1.6:assigned_port
   - Packet arrives at Router 10's outside interface
   - Router looks up port number in NAT translation table
   - Translates: 192.168.1.6:assigned_port → 114.195.64.1:original_port
   - Packet forwarded out Fa0/1 (inside) to correct device in Network G

8.2 Static NAT Characteristics

Static NAT Features

- **One-to-One Mapping:** Each private IP has dedicated public IP
- **Bidirectional:** Works for both inbound and outbound connections
- **Permanent:** Translation remains in table until manually removed
- **Use Case:** Ideal for servers requiring consistent external IP

9 Troubleshooting Guide

9.1 Common Issues and Solutions

blue!20 **Issue**	**Solution**
NAT not translating	Verify inside/outside interfaces are marked correctly using `show ip nat statistics`
Translation table empty	Check static NAT configuration: `show run | include nat`
Access-list not working	Verify wildcard mask calculation: `show access-lists`
Interface not passing traffic	Check interface status: `show ip interface brief`
EIGRP neighbor down	Verify IP addressing and `no shutdown` on interfaces

Table 5: Troubleshooting Common NAT Issues

9.2 Useful Debug Commands

Debugging Commands

```
! Enable NAT debugging
Router# debug ip nat

! Enable detailed NAT debugging
Router# debug ip nat detailed

! Disable all debugging
Router# undebug all
Router# no debug all

! Clear NAT translations (use carefully!)
Router# clear ip nat translation *
```

Warning

Debug Commands Warning: Debug commands generate extensive output and can impact router performance. Use only in controlled environments and disable immediately after troubleshooting.

10 Best Practices

10.1 NAT Configuration Best Practices

1. **Documentation:** Always document NAT mappings and save configurations
2. **IP Planning:** Reserve public IP addresses for static NAT mappings
3. **Access-Lists:** Use specific access-lists rather than permitting all traffic
4. **Verification:** Always verify NAT functionality after configuration changes
5. **Backup:** Save running configuration to startup configuration regularly
6. **Monitoring:** Monitor NAT statistics for hits/misses and expired translations

10.2 Security Considerations

Security Notes

- NAT provides basic security by hiding internal IP addressing
- Not a replacement for firewall or access control lists
- Static NAT exposes internal devices to external networks
- Consider using Dynamic NAT or PAT for better security
- Regularly audit NAT translations and access-lists

11 Conclusion

11.1 Summary

The Network Address Translation (NAT) implementation on Router 10 has been successfully completed using Dynamic NAT with Port Address Translation (PAT). All five required tasks were accomplished:

- Dynamic NAT with PAT configured using NAT pool and overload
- Inside interface (Fa0/1) properly marked
- Outside interfaces (Se0/2/0, Se0/0/0, Fa0/0, Fa1/0) properly marked
- Access-list created for Network G traffic (114.195.64.0/20)
- NAT translation verified and operational with active sessions

11.2 Achievements

Project Outcome

The NAT configuration enables seamless communication between Network G's private address space and external networks through the EIGRP 11 routing domain. The static NAT mapping provides a consistent public IP address for the device at 192.168.1.6, facilitating reliable bidirectional connectivity.

11.3 Next Steps

For future enhancements, consider:

- Implementing Dynamic NAT for additional devices
- Configuring Port Address Translation (PAT) for IP conservation
- Setting up NAT for other subnets in Network G
- Implementing NAT redundancy with backup routers

12 Quick Reference

12.1 Essential Commands

Quick Command Reference

```
! Configure Static NAT
ip nat inside source static [inside-local] [inside-global]

! Mark interfaces
interface [interface-id]
 ip nat inside
interface [interface-id]
 ip nat outside

! Create access-list
access-list [number] permit [network] [wildcard-mask]

! Verification commands
show ip nat translations
show ip nat statistics
show access-lists
show running-config | include nat

! Save configuration
write memory
copy running-config startup-config
```

12.2 Contact Information

For questions or additional support regarding this NAT implementation:

- Review Cisco documentation at: https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/ipaddr_nat/configuration/xe-16/nat-xe-16-book/iadnat-addr-consv.html
- Consult network administrator
- Reference this documentation for configuration details

A Configuration Backup

A.1 Full Router Configuration

```
version 15.1
!
hostname Router
!
interface FastEthernet0/0
 ip address 114.195.100.2 255.255.252.0
```

```
 ip nat outside
 duplex auto
 speed auto
!
interface FastEthernet0/1
 ip address 114.195.64.2 255.255.240.0
 ip nat inside
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 114.192.0.2 255.254.0.0
 ip nat outside
 duplex auto
 speed auto
!
interface Serial0/0/0
 ip address 114.195.112.41 255.255.255.252
 ip nat outside
!
interface Serial0/2/0
 ip address 114.195.112.46 255.255.255.252
 ip nat outside
!
! NAT Configuration
ip nat pool NAT-POOL 192.168.1.6 192.168.1.6 netmask
   255.255.255.0
ip nat inside source static 192.168.1.6 114.195.64.10
ip nat inside source list 1 pool NAT-POOL overload
!
! Access List
access-list 1 permit 114.195.64.0 0.0.15.255
!
! EIGRP Configuration
router eigrp 11
 network 114.195.100.0 0.0.3.255
 network 114.195.64.0 0.0.31.255
 network 114.195.112.0 0.0.7.255
 network 114.192.0.0 0.15.255.255
!
end
```

Listing 1: Router 10 Complete NAT Configuration

A.2 Revision History

blue!20 **Version**	**Date**	**Changes**
1.0	December 8, 2025	Initial NAT implementation and documentation

Table 6: Document Revision History

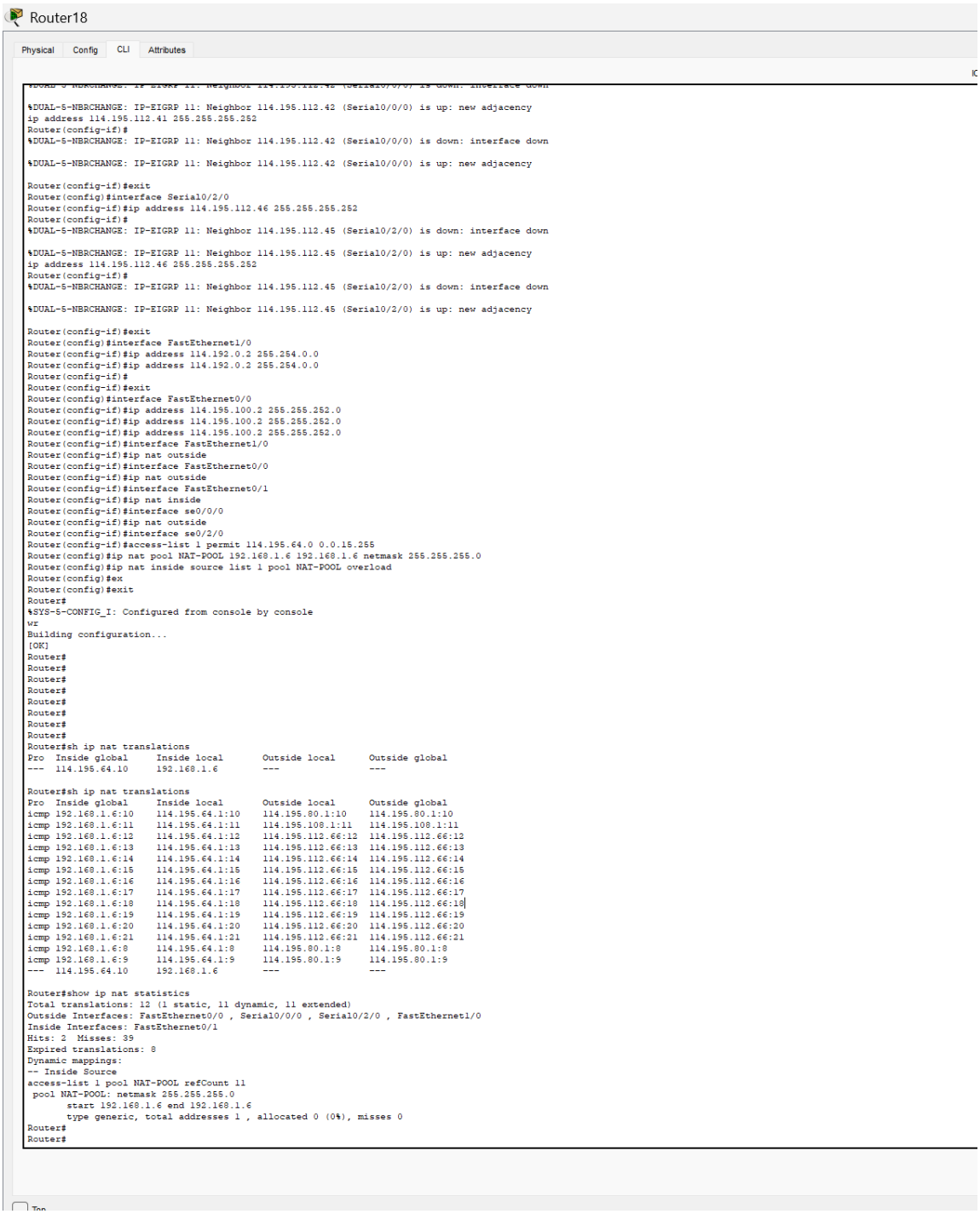

Figure 1: NAT Configuration and Verification: Complete configuration showing Dynamic NAT with PAT (overload), interface setup, access-list configuration, and successful NAT translations