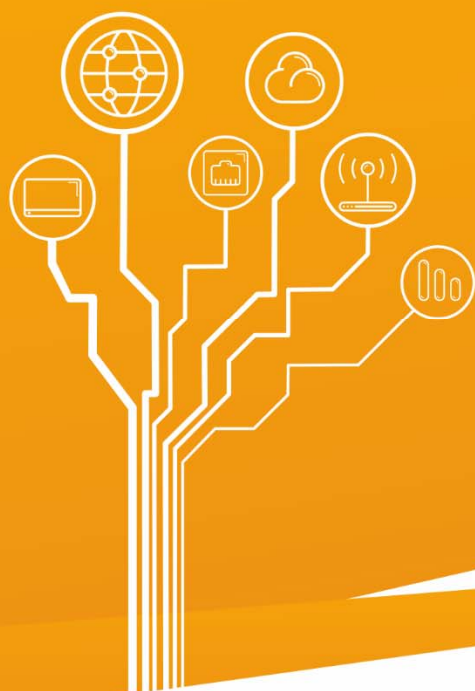


CHAPTER 13



ADDRESS TRANSLATION USING L2NAT

COMPUTER NETWORKS IN PACKET TRACER



FOR INTERMEDIATE USERS

13 ADDRESS TRANSLATION USING L2NAT

This chapter describes the **L2NAT** (*Layer 2 Network Address Translation*) technique and the basics of configuring network address translation using L2NAT.

13.1 Introduction to L2NAT

L2NAT (*Layer 2 Network Address Translation*) allows a unique public IP (global) address to be assigned to an existing private IP address, providing the ability to communicate private subnets with public subnets.

L2NAT supports two translation tables: one stores the translation definitions of private addresses to public (global) addresses, and the other stores the translation definitions of public (global) addresses to private addresses. The translations are defined based on the **physical addresses** of the end devices.

The limitations of the L2NAT service are as follows:

- Cisco IOS version 15.0 (2) EB minimum required,
- only IPv4 addresses can be translated,
- if L2NAT translation is configured for a host, it should not be configured as a DHCP client.

Requirements:

- you must use a switch that includes the L2NAT service (in Packet Tracer, this is the **IE 2000** switch),
- you must configure so-called instances that define address translations,
- L2NAT instances must be assigned to an interface or VLAN.

13.2 L2NAT Operating Diagram

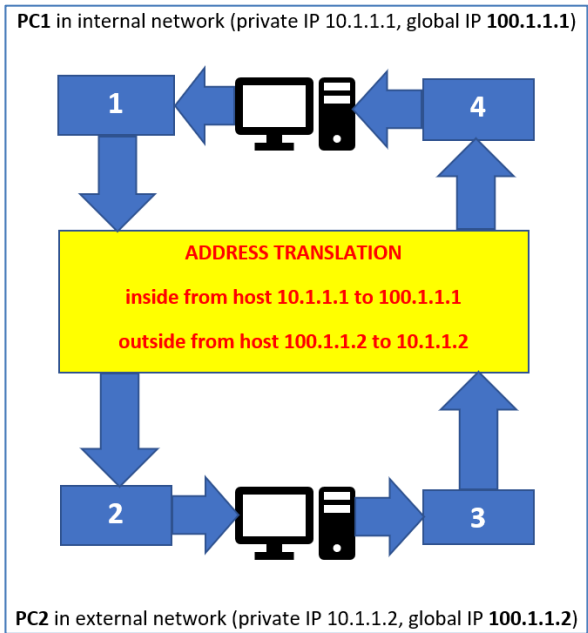


Figure 13.1 L2NAT operating diagram.

Assumption: PC1 performs a ping to the global address of PC2.

ping 10.1.1.2

Step-by-step analysis of the L2NAT translation operation:

1 – packet in the direction from PC1 to PC2 before translation

4	IHL	DSCP: 0x0	TL: 128	
ID: 0x54		0x0	0x0	
TTL: 128		PRO: 0x1	CHKSUM	
SRC IP: 10.1.1.1				
DST IP: 10.1.1.2				
OPT: 0x0			0x0	
DATA (VARIABLE LENGTH)				

Figure 13.2 Packet from PC1 to PC2 before translation is performed.

2 – Packet in the direction from PC1 to PC2 after translation

4	IHL	DSCP: 0x0	TL: 128	
ID: 0x54			0x0	0x0
TTL: 128		PRO: 0x1	CHKSUM	
SRC IP: 100.1.1.1				
DST IP: 100.1.1.2				
OPT: 0x0			0x0	
DATA (VARIABLE LENGTH)				

Figure 13.3 Packet from PC1 to PC2 after translation.

3 - Return packet in the direction from PC2 to PC1 before translation.

4	IHL	DSCP: 0x0	TL: 128	
ID: 0x1d		0x0	0x0	
TTL: 128	PRO: 0x1	CHKSUM		
SRC IP: 100.1.1.2				
DST IP: 100.1.1.1				
OPT: 0x0		0x0		
DATA (VARIABLE LENGTH)				

Figure 13.4 Packet from PC2 to PC1 before translation.

4 - Return packet in PC2 to PC1 direction after translation

4	IHL	DSCP: 0x0	TL: 128	
ID: 0x1d		0x0	0x0	
TTL: 128	PRO: 0x1	CHKSUM		
SRC IP: 10.1.1.2				
DST IP: 10.1.1.1				
OPT: 0x0		0x0		
DATA (VARIABLE LENGTH)				

Figure 13.5 Packet from PC2 to PC1 after translation.

Operations in the direction from PC1 to PC2:

- A frame arrives from the **internal** network and is to be forwarded to the external network.
- The switch searches the Layer 2 NAT table.
- The Layer 2 NAT table contains an entry that matches the local source address inside from host 10.1.1.1 to 100.1.1.1
- The switch converts the local address to a global address, which is 100.1.1.1 .
- The switch searches the Layer 2 NAT table.
- The Layer 2 NAT table contains an entry that matches the global destination address outside from host 100.1.1.2 to 10.1.1.2
- The switch converts the global address to the local address, which is 10.1.1.2 .

Operations in the direction from PC2 to PC1:

- A frame arrives from the external network and is to be forwarded to the internal network.
- The switch searches the Layer2 NAT table.
- The Layer 2 NAT table contains an entry that matches the local source address
- outside from host 100.1.1.2 to 10.1.1.2
- The switch converts the local address to a global address, which is 100.1.1.2 .
- The switch searches the Layer2 NAT table.
- The Layer 2 NAT table contains an entry that matches the global destination address.
- inside from host 10.1.1.1 to 100.1.1.1
- The switch converts the global address to a local address, that is, to 10.1.1.1 .

13.2.1 Example of the Simple L2NAT Configuration

Addressing table

Device	Interface	Private IP address	Global IP address	MAC Address
PC1	Fa0	10.0.0.1/8	100.1.1.1/8	000B.BE46.A9DA
PC2	Fa0	100.1.1.2/8	10.1.1.2/8	0009.7C65.8782
IE2000	Gi1/1	-	-	-
IE2000	Gi1/2	-	-	-

Table 13.1 Addressing table.

Topology

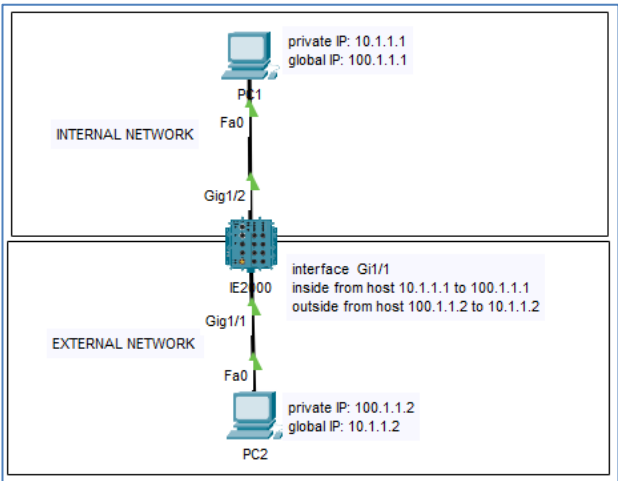


Figure 13.6 L2NAT topology.

Configuring a simple topology with L2NAT is done in the following steps.

Step 1. Connect two computers to the IE 2000 switch according to the topology.

Step 2. Configure the IP addresses of the computers according to the addressing table

Step 3. Configure an L2NAT instance named OUTSIDE on the IE 2000 switch.

```
enable
conf t
l2nat instance OUTSIDE
inside from host 10.1.1.1 to 100.1.1.1
outside from host 100.1.1.2 to 10.1.1.2
```

Step 4. Assign the OUTSIDE instance to an interface on the IE 2000

```
interface Gi1/1
l2nat OUTSIDE
```

Step 5. Check with the ping command the communication between the computers

From the command line of PC1 (global address of PC2), execute:

```
ping 10.1.1.2
```

From the command line of PC2 (global address PC1), execute:

```
ping 100.1.1.1
```

13.2.2 Handling repeating IP addresses in L2NAT

The following example shows how, using the L2NAT service, you can configure repeating IP addresses (duplicate IP addresses). Here we will use two IE **2000** switches and one **2950** switch.

Addressing table

Device	Interface	Private IP address	Internal subnetwork	MAC address
PC-A1	Fa0	192.168.1.1/24	A	000B.BEBB.383D
PC-A2	Fa0	192.168.1.2/24	A	00E0.B09B.8EBD
PC-A3	Fa0	192.168.1.3/24	A	00D0.D302.A2B0

Address Translation Using L2NAT

PC-B1	Fa0	192.168.1.1/24	B	0050.0FD7.BB14
PC-B2	Fa0	192.168.1.2/24	B	0040.0B67.3CA9
PC-B3	Fa0	192.168.1.3/24	B	0030.A39E.6A03

Table 13.2 Addressing table.

Switch configuration table - Part 1

Device	Device type	Interface(s)	VLAN	Address	Notes
SW-0	2950-24	Vlan1	1	10.1.1.254/24	-
SW-A	IE-2000	Vlan1	1	10.1.1.100/8	-
SW-B	IE-2000	Vlan1	1	10.1.1.101/8	-
Subnet-a	2950-24	Fa0/1, Fa0/2, Fa0/3	-	-	connected to computers
Subnet-a	2950-24	Fa0/4	-	-	connected to SW-A
Subnet-b	2950-24	Fa0/1, Fa0/2, Fa0/3	-	-	connected to computers
Subnet-b	2950-24	Fa0/4	-	-	connected to SW-B

Table 13.3 Switch configuration table - Part 1.

Switch configuration table – Part 2

Device	Installation name	Interface	Working port mode	Translations for internal subnetwork	Translations for external subnetwork
SW-A	-	Fa1/1	trunk	-	-
SW-A	Subnet-a	Gi1/1	trunk	inside from network 192.168.1.0 to 10.1.1.16 mask 255.255.255.240	outside from host 10.1.1.254 to 192.168.1.254 outside from network 10.1.1.32 to 192.168.1.32 mask 255.255.255.240
SW-B	-	Fa1/1	trunk	-	-
SW-B	Subnet-b	Gi1/1	trunk	inside from network 192.168.1.0 to 10.1.1.32 mask 255.255.255.240	outside from host 10.1.1.254 to 192.168.1.254 outside from network 10.1.1.32 to 192.168.1.0

					mask 255.255.255.240 outside from network 10.1.1.16 to 192.168.1.16 mask 255.255.255.240
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Table 13.4 Switch configuration table - Part 2.

Topology

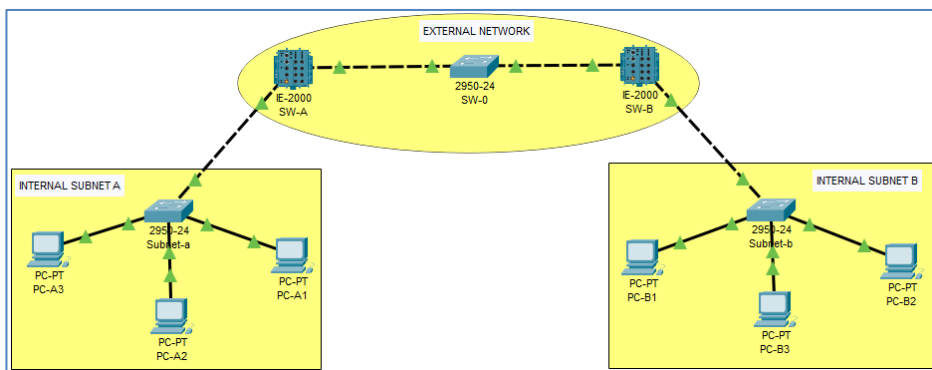


Figure 13.7 Network topology.

Configuring the above topology with L2NAT is done in the following steps.

Step 1. Connect the devices according to the topology.

Step 2. Configure the IP addresses of the computers according to the addressing table, switch configuration tables (Part 1, 2).

Step 3. Configure the L2NAT service named A-Subnet on the SW-A switch according to the switch configuration table (Part 2).

```
enable
```

```
conf t
```

```
l2nat instance A-Subnet
```

```
inside from network 192.168.1.0 to 10.1.1.16 mask  
255.255.255.240
```

```
outside from host 0.1.1.254 to 192.168.1.254
```

```
outside from network 10.1.1.32 to 192.168.1.32 mask  
255.255.255.240
```

Step 4. Assign the A-Subnet instance to an interface on the SW-A switch.

```
interface Gi 1/1
l2nat A-Subnet
```

Step 5. Configure the L2NAT service named B-Subnet on switch SW-B according to the switch configuration table (Part 2).

```
en
conf t
l2nat instance B-Subnet
inside from network 192.168.1.0 to 10.1.1.32 mask
255.255.255.240
outside from host 10.1.1.254 to 192.168.1.254
outside from network 10.1.1.32 to 192.168.1.0 mask
255.255.255.240
outside from network 10.1.1.16 to 192.168.1.16 mask
255.255.255.240
```

Step 6. Assign the B-Subnet instance to an interface on switch SW-B.

```
interface Gi1/1
l2nat B-Subnet
```

Step 7. Check that PC-A1 → PC-B1, PC-A2 → PC-B2, PC-A3 → PC-B3, can ping each other.