Network Address Translation (NAT)

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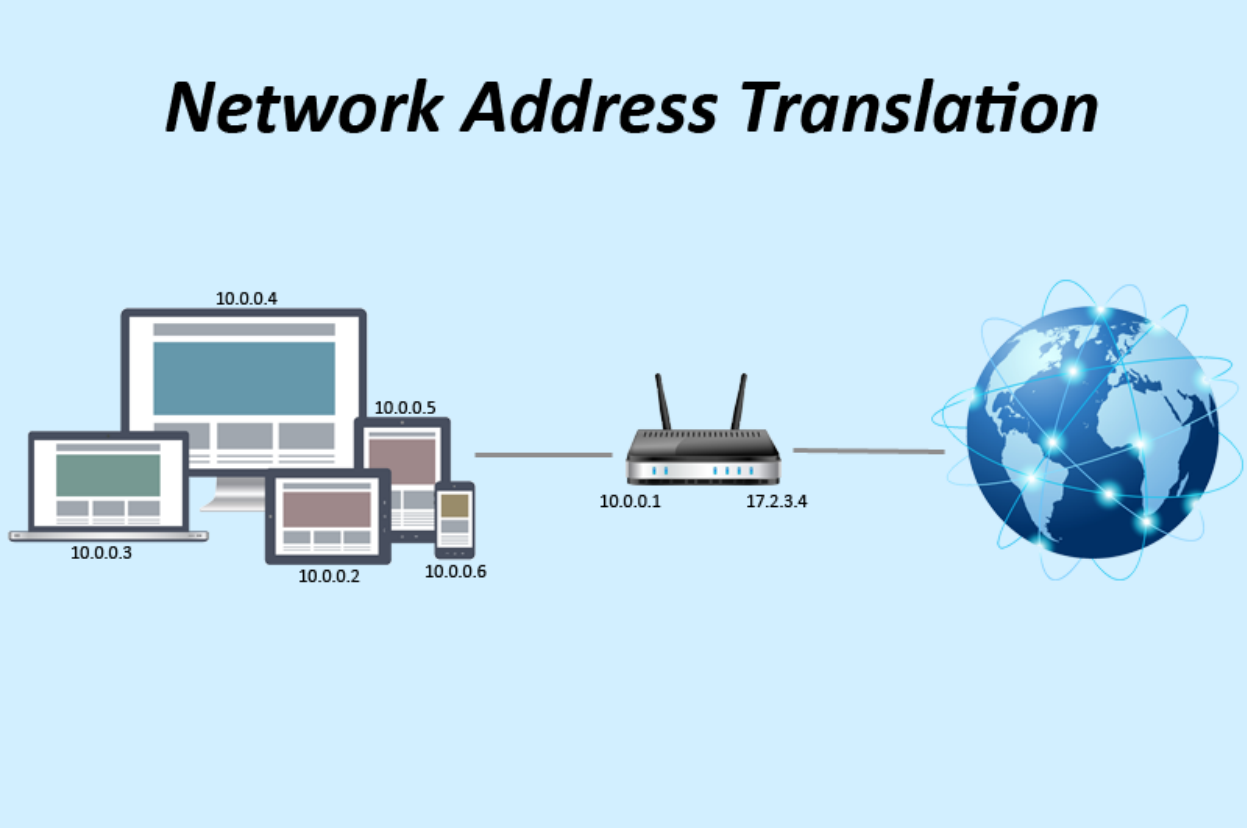

Figure 1: Network Address Translation from internal Private IP addresses to the globally unique IP address.

IPv6 was born partly due to the address space exhaustion of IPv4. One great technique that was the key to the survival of IPv4 is NAT. If not for NAT, IPv4 would be long gone by now. And that gave the world some time to adopt IPv6 on a mass

scale. In this part of the lab, you will learn about this special technique called NAT.

Basically, the idea of NAT is that there will be a set of IP addresses for the hosts in the internal network, and to the outside world, those internal hosts will be exposed using a different set of IP addresses. You know that each host is recognized through its IP address on the internet. To conform with this, each host connected to the internet must have a unique IP, which would readily become nearly impossible considering billions of connected devices.

NAT allows you to assign arbitrary IP addresses from the Private IP range to your internal hosts where these addresses are only locally significant, i.e., locally unique. Then, in the edge or gateway router of the network, you will have one or a set of IP addresses that are globally unique. That edge or gateway router will convert/translate from a globally unique address to a locally unique one or vice versa. The outside world will not know the actual IP addresses of internal hosts. Moreover, your organization can buy only a handful of global IP addresses from the ISP but can use those with much greater Private IP addresses for the internal hosts through

NAT. The following figure summarizes what we just talked about.

Now that we know the basics of NAT let us get technical. There are three types of NAT that you can define in Cisco devices: Static, Dynamic, and Overloaded or Port Address Translation (PAT).

Static NAT

It allows one-to-one mapping between local and global addresses. You will have to configure one global IP address for each internal host you want NAT to translate. The command to enable the static translation is as follows:

```
Router(config)# ip nat inside source static local_ip global_ip
```

After you have specified the translation, you must do two things — first, you need to specify the inside interface, and second, you need to specify the outside interface. The inside interface denotes that the hosts connected to it will have

their IPs translated to the global one. The outside interface denotes that the translated packets will go out to the world through it. There can be more than one inside or outside interface. After you specify these interfaces, NAT will start the specified translations. You also need to specify these inside and outside interfaces for the other two NAT types. Following are the commands to specify the inside and outside interfaces:

Router(config-if)# ip nat inside

Router(config-if)# ip nat outside

Dynamic NAT

This type of NAT establishes a mapping between a local address and a pool of global addresses.A global IP address will be selected dynamically from the pool for a single local address. When not in use, the assigned global IP will be released after a certain time-out period so other hosts can reuse it. This is more convenient than the static one as you do not need to manually configure every mapping. To configure dynamic NAT, you must create an access list that permits the local addresses to be translated. The command format for defining a numbered standard IP ACL is:

Router(config)# access-list access_list_number permit source_address source_wildcard

Then, you have to specify the pool of global IP addresses from where the IPs will be allocated. The pool is a range of IP addresses in a given network where the subnet mask will specify the corresponding network portion. The command to specify the pool is as follows:

Router(config)# ip nat pool POOL_NAME start_ip end_ip netmask subnet_mask

Then, you must establish the relation between the earlier defined access list and the NAT pool through the following command:

Router(config)# ip nat inside source list access_list_number pool POOL_NAME

After that, you must specify the inside and outside interfaces, such as the static NAT.

Port Address Translation (PAT)

In the worst case, you would need as many global IP addresses as the internal hosts for dynamic NAT. This is not plausible in most circumstances where you have limited global IP and hundreds of local hosts. It is where PAT comes in. PAT establishes a many-to-one mapping between local hosts and a global IP address. It uses the Port (TCP/UDP port) information to distinguish between different internal hosts and assign a single global IP to all those addresses, thus, significantly conserving the global address pool. The configuration of PAT is almost similar to dynamic NAT, except you have to add the overload keyword at the very end while specifying the relation between the access list and the NAT pool. The command format for the configuration of PAT is as follows:

Router(config)# ip nat inside source list access_list_number pool POOL_NAME overload

You can also configure PAT using the IP address of an interface rather than a NAT pool. In this case, the local IPs will be translated to the interface's IP address.

Router(config)# ip nat inside source list access_list_number interface Interface_NAME_Connected_to_Outside_Networks overload