

Paired-Address-Pooling Support in NAT

The ability of Network Address Translation (NAT) to consistently represent a local IP address as a single global IP address is termed paired address pooling. Paired address pooling is supported only on Port Address Translation (PAT).

Prior to the introduction of the Paired-Address-Pooling Support feature, if you have a PAT configuration, and you need a new global address or port, the next available address in the IP address pool is allocated. There was no mechanism to ensure that a local address is consistently mapped to a single global address. The Paired-Address-Pooling Support feature provides the ability to consistently map a local address to a global address.

Starting from IOS XE Polaris 16.8 release, you can specify an NAT pool for which PAP support is to be activated. This feature is helpful when you have to apply PAP support to a specific dynamic NAT traffic stream.

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Restrictions for Paired-Address-Pooling Support in NAT

Paired address pooling uses more memory, and the scaling of translations is much lower than standard Network Address Translation (NAT) configuration due to the following reasons:

- Use of a new data structure that tracks each local address.
- Use of the paired-address-pooling limit. When the number of users on a global address reaches the configured limit, the next global address is used for paired address pooling. The paired-address-pooling limit uses more memory and requires more global addresses in the address pool than standard NAT.
- Two IP address pools with same IP addresses in two different mapping is not supported.

  The following example shows two non-VRF mappings. The addresses used in these two pools mappings should not overlap.

```
ip nat pool natpool1 83.0.0.56 83.0.0.56 prefix-length 24
```

```
ip nat pool natpool2 83.0.0.56 83.0.0.56 prefix-length 24
ip nat inside source list acl2 pool natpool2 overload
ip nat inside source list acl1 pool natpool1 overload
```

This following example is a combination of non-VRF and VRF-to-global mappings. In this example as well, sharing IP addresses in pools are not supported.

```
ip nat pool natpool1 82.0.0.15 82.0.0.15 prefix-length 24
ip nat pool natpool2 82.0.0.15 82.0.0.15 prefix-length 24
ip nat inside source list acl2 pool natpool2 overload             //non-vrf mapping//
ip nat inside source list acl1 pool natpool1 vrf vrf1 overload     //vrf mapping//
```

The only case where same pools can be used in two different mapping is for the **match-in-vrf** mappings.

Information About Paired-Address-Pooling Support in NAT

Paired-Address-Pooling Support Overview

An IP address pool is a group of IP addresses. You create an IP address pool by assigning a range of IP addresses and a name to it. You allocate or assign addresses in the pool to users.

The ability of Network Address Translation (NAT) to consistently represent a local IP address as a single global IP address is termed paired address pooling. A local address is any address that appears on the inside of a network, and a global address is any address that appears on the outside of the network. You can configure paired address pooling only for Port Address Translation (PAT) because dynamic and static NAT configurations are paired configurations by default. PAT, also called overloading, is a form of dynamic NAT that maps multiple, unregistered IP addresses to a single, registered IP address (many-to-one) by using different ports. Paired address pooling is supported in both classic (default) and carrier-grade NAT (CGN) mode.

In a paired-address-pooling configuration, a local address is consistently represented as a single global address. For example, if User A is paired with the global address G1, that pairing will last as long as there are active sessions for User A. If there are no active sessions, the pairing is removed. When User A has active sessions again, the user may be paired with a different global address.

If a local address initiates new sessions, and resources (ports) are insufficient for its global address, packets are dropped. When the number of users on a global address reaches the configured limit, the next global address is used for paired address pooling. When a user who is associated with a global address through paired address pooling is unable to get a port number, then the packet is dropped, the NAT drop code is incremented, and Internet Control Message Protocol (ICMP) messages are not sent.

Paired-address-pooling uses the fill-it-up method for address selection. The fill-it-up method fits (adds) the maximum possible users into a single global address before going to the next global address.

How to Configure Paired-Address-Pooling Support

Configuring Paired-Address-Pooling Support in NAT

Note If you change the Network Address Translation (NAT) configuration mode to paired-address-pooling configuration mode and vice versa, all existing NAT sessions are removed.

To configure NAT paired-address-pooling mode, use the **ip nat settings pap** command. To remove it, use the **no ip nat settings pap** command.

After you configure paired-address-pooling mode, all pool-overload mappings will act in the paired-address-pooling manner.

Based on your NAT configuration, you can use NAT static or dynamic rules.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat settings pap** [**limit** {**1000** | **120** | **250** | **30** | **500** | **60**}]
4. **ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*}
5. **access-list** *access-list-number* **permit** *source* [*source-wildcard*]
6. **ip nat inside source list** *access-list-number* **pool** *name* **overload**
7. **interface** *type number*
8. **ip address** *ip-address mask*
9. **ip nat inside**
10. **exit**
11. **interface** *type number*
12. **ip address** *ip-address mask*
13. **ip nat outside**
14. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:**	Enters global configuration mode.

	Command or Action	Purpose
	`Device# configure terminal`	
Step 3	**ip nat settings pap** [**limit** {**1000** | **120** | **250** | **30** | **500** | **60**}] **Example:** `Device(config)# ip nat settings pap`	Configures NAT paired address pooling configuration mode. • Use the **limit** keyword to limit of the number of local addresses you can use per global address. The default is 120.
Step 4	**ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*} **Example:** `Device(config)# ip nat pool net-208 192.168.202.129 192.168.202.158 netmask 255.255.255.240`	Defines a pool of global addresses to be allocated as needed.
Step 5	**access-list** *access-list-number* **permit** *source* [*source-wildcard*] **Example:** `Device(config)# access-list 1 permit 192.168.34.0 0.0.0.255`	Defines a standard access list permitting addresses that are to be translated.
Step 6	**ip nat inside source list** *access-list-number* **pool** *name* **overload** **Example:** `Device(config)# ip nat inside source list 1 pool net-208 overload`	Establishes dynamic Port Address Translation (PAT) or NAT overload and specifies the access list and the IP address pool defined in Step 4 and Step 5.
Step 7	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet 0/0/1`	Specifies an interface and enters interface configuration mode.
Step 8	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip address 10.114.11.39 255.255.255.0`	Sets a primary IP address for the interface.
Step 9	**ip nat inside** **Example:** `Device(config-if)# ip nat inside`	Connects the interface to the inside network, which is subject to NAT.
Step 10	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 11	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet 0/1/2`	Specifies an interface and enters interface configuration mode.

	Command or Action	Purpose
Step 12	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip address 172.16.232.182 255.255.255.240`	Sets a primary IP address for the interface.
Step 13	**ip nat outside** **Example:** `Device(config-if)# ip nat outside`	Connects the interface to the outside network.
Step 14	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

How to Configure Paired-Address-Pooling Support For a NAT Pool

Configuring Paired-Address-Pooling Support For a NAT Pool

Note If you change the Network Address Translation (NAT) configuration mode to paired-address-pooling configuration mode and vice versa, all existing NAT sessions are removed.

To configure NAT paired-address-pooling mode, use the **ip nat settings pap** command. To remove it, use the **no ip nat settings pap** command.

After you configure paired-address-pooling mode, all pool-overload mappings will act in the paired-address-pooling manner.

Based on your NAT configuration, you can use NAT static or dynamic rules.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat settings pap** [**limit** {**1000** | **120** | **250** | **30** | **500** | **60**}]
4. **ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*}
5. **access-list** *access-list-number* **permit** *source* [*source-wildcard*]
6. **ip nat inside source list** *access-list-number* **pool** *name* **overload**
7. **interface** *type number*
8. **ip address** *ip-address mask*
9. **ip nat inside**
10. **exit**

11. **interface** *type number*
12. **ip address** *ip-address mask*
13. **ip nat outside**
14. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip nat settings pap** [**limit** {**1000** | **120** | **250** | **30** | **500** | **60**}] **Example:** `Device(config)# ip nat settings pap`	Configures NAT paired address pooling configuration mode. • Use the **limit** keyword to limit of the number of local addresses you can use per global address. The default is 120.
Step 4	**ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*} **Example:** `Device(config)# ip nat pool net-208 192.168.202.129 192.168.202.158 netmask 255.255.255.240`	Defines a pool of global addresses to be allocated as needed.
Step 5	**access-list** *access-list-number* **permit** *source* [*source-wildcard*] **Example:** `Device(config)# access-list 1 permit 192.168.34.0 0.0.0.255`	Defines a standard access list permitting addresses that are to be translated.
Step 6	**ip nat inside source list** *access-list-number* **pool** *name* **overload** **Example:** `Device(config)# ip nat inside source list 1 pool net-208 overload`	Establishes dynamic Port Address Translation (PAT) or NAT overload and specifies the access list and the IP address pool defined in Step 4 and Step 5.
Step 7	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet 0/0/1`	Specifies an interface and enters interface configuration mode.

	Command or Action	Purpose
Step 8	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip address 10.114.11.39 255.255.255.0`	Sets a primary IP address for the interface.
Step 9	**ip nat inside** **Example:** `Device(config-if)# ip nat inside`	Connects the interface to the inside network, which is subject to NAT.
Step 10	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 11	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet 0/1/2`	Specifies an interface and enters interface configuration mode.
Step 12	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip address 172.16.232.182 255.255.255.240`	Sets a primary IP address for the interface.
Step 13	**ip nat outside** **Example:** `Device(config-if)# ip nat outside`	Connects the interface to the outside network.
Step 14	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuration Examples for Paired-Address-Pooling Support in NAT

Example: Configuring Paired Address Pooling Support in NAT

The following example shows how to configure paired address pooling along with Network Address Translation (NAT) rules. This example shows a dynamic NAT configuration with access lists and address pools. Based on your NAT configuration, you can configure static or dynamic NAT rules.

```
Device# configure terminal
Device(config)# ip nat settings pap
Device(config)# ip nat pool net-208 192.168.202.129 192.168.202.158 netmask 255.255.255.240
Device(config)# access-list 1 permit 192.168.34.0 0.0.0.255
```

```
Device(config)# ip nat inside source list 1 pool net-208 overload
Device(config)# interface gigabitethernet 0/0/1
Device(config-if)# ip address 10.114.11.39 255.255.255.0
Device(config-if)# ip nat inside
Device(config-if)# exit
Device(config)# interface gigabitethernet 0/1/2
Device(config-if)# ip address 172.16.232.182 255.255.255.240
Device(config-if)# ip nat outside
Device(config-if)# end
```

Additional References for Paired-Address-Pooling Support in NAT

Related Documents

Related Topic	Document Title
Cisco IOS Commands	Cisco IOS Master Command List, All Releases
NAT commands	Cisco IOS IP Addressing Services Command Reference

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature Information for Paired-Address-Pooling Support in NAT

Table 1: Feature Information for Paired-Address-Pooling Support in NAT

Feature Name	Releases	Feature Information
Paired-Address-Pooling Support in NAT	Cisco IOS XE Release 3.9S	The ability of Network Address Translation (NAT) to consistently represent a local IP address as a single global IP address is termed paired address pooling. Paired address pooling is supported only on Port Address Translation (PAT). The following command was introduced or modified: **ip nat settings pap**.