IP Addressing: NAT Configuration Guide, Cisco IOS Release 12.4

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Configuring NAT for IP Address Conservation

This module describes how to configure Network Address Translation (NAT) for IP address conservation and configure inside and outside source addresses. This module also provides information about the benefits of configuring NAT for IP address conservation.

NAT enables private IP internetworks that use nonregistered IP addresses to connect to the Internet. NAT operates on a router, usually connecting two networks, and translates the private (not globally unique) addresses in the internal network into legal addresses before packets are forwarded onto another network. NAT can be configured to advertise only one address for the entire network to the outside world. This ability provides additional security by effectively hiding the entire internal network behind that one address.

NAT is also used at the enterprise edge to allow internal users access to the Internet and to allow Internet access to internal devices such as mail servers.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring NAT for IP Address Conservation

Access Lists

All access lists required for use with the tasks in this module should be configured prior to beginning the configuration task. For information about how to configure an access list, refer to the *IP Access List Sequence Numbering* document.

Note If you specify an access list with a NAT command, NAT will not support the commonly used **permit ip any any** command in the access list.

NAT Requirements, Objectives, and Interfaces

Before configuring NAT in your network, you should know on which interfaces NAT will be configured and for what purposes. The following requirements listed will help you to decide how to configure and use NAT:

1. Define the NAT inside and outside interfaces if:
   - Users exist off multiple interfaces.
   - Multiple interfaces connect to the Internet.
2. Define what you need NAT to accomplish:
   - Allow internal users to access the Internet.
   - Allow the Internet to access internal devices such as a mail server.
   - Allow overlapping networks to communicate.
   - Allow networks with different address schemes to communicate.
   - Allow the use of an application level gateway.
   - Redirect TCP traffic to another TCP port or address.
   - Use NAT during a network transition.

Restrictions for Configuring NAT for IP Address Conservation

- NAT is not practical if large numbers of hosts in the stub domain communicate outside of the domain.
- Some applications use embedded IP addresses in such a way that translation by a NAT device is impractical. These applications may not work transparently or not work at all through a NAT device.
- NAT hides the identity of hosts, which may be an advantage or a disadvantage depending on the desired result.
- A router configured with NAT must not advertise the local networks to the outside. However, routing information that NAT receives from the outside can be advertised in the stub domain as usual.
- If you specify an access list with a NAT command, NAT will not support the commonly used **permit ip any any** command in the access list.
- NAT configuration is not supported on the access side of the Intelligent Services Gateway (ISG).

Information About Configuring NAT for IP Address Conservation

Benefits of Configuring NAT for IP Address Conservation

NAT allows organizations to resolve the problem of IP address depletion when they have existing networks and need to access the Internet. Sites that do not yet possess Network Information Center (NIC)-registered IP addresses must acquire them, and if more than 254 clients are present or planned, the scarcity of Class B addresses becomes a serious issue. Cisco IOS NAT addresses these issues by mapping thousands of hidden internal addresses to a range of easy-to-get Class C addresses.

Sites that already have registered IP addresses for clients on an internal network may want to hide those addresses from the Internet so that hackers cannot directly attack the clients. With client addresses hidden, a degree of security is established. Cisco IOS NAT gives LAN administrators complete freedom to expand Class A addressing, which is drawn from the reserve pool of the Internet Assigned Numbers Authority (RFC 1597). This expansion occurs within the organization without concern for addressing changes at the LAN or Internet interface.

Cisco IOS software can selectively or dynamically perform NAT. This flexibility allows the network administrator to use a mix of RFC 1597 and RFC 1918 addresses or registered addresses. NAT is designed for use on a variety of routers for IP address simplification and conservation. In addition, Cisco IOS NAT allows the selection of internal hosts that are available for NAT.

A significant advantage of NAT is that it can be configured without requiring any changes to hosts or routers other than those few routers on which NAT will be configured.

Purpose of NAT

NAT is a feature that allows the IP network of an organization to appear from the outside to use a different IP address space than what it is actually using. Thus, NAT allows an organization with nonglobally routable addresses to connect to the Internet by translating those addresses into a globally routable address space. NAT also allows a graceful renumbering strategy for organizations that are changing service

providers or voluntarily renumbering into classless interdomain routing (CIDR) blocks. NAT is described in RFC 1631.

Beginning with Cisco IOS Release 12.1(5)T, NAT supports all H.225 and H.245 message types, including FastConnect and Alerting as part of the H.323 Version 2 specification. Any product that makes use of these message types will be able to pass through a Cisco IOS NAT configuration without any static configuration. Full support for NetMeeting Directory (Internet Locator Service) is also provided through Cisco IOS NAT.

How NAT Works

A router configured with NAT will have at least one interface to the inside network and one to the outside network. In a typical environment, NAT is configured at the exit router between a stub domain and the backbone. When a packet leaves the domain, NAT translates the locally significant source address into a globally unique address. When a packet enters the domain, NAT translates the globally unique destination address into a local address. If more than one exit point exists, each NAT must have the same translation table. If NAT cannot allocate an address because it has run out of addresses, it drops the packet and sends an Internet Control Message Protocol (ICMP) host unreachable packet.

Uses of NAT

NAT can be used for the following applications:

- When you want to connect to the Internet, but not all of your hosts have globally unique IP addresses. NAT enables private IP internetworks that use nonregistered IP addresses to connect to the Internet. NAT is configured on the router at the border of a stub domain (referred to as the *inside network*) and a public network such as the Internet (referred to as the *outside network*). NAT translates the internal local addresses to globally unique IP addresses before sending packets to the outside network. As a solution to the connectivity problem, NAT is practical only when relatively few hosts in a stub domain communicate outside of the domain at the same time. When this is the case, only a small subset of the IP addresses in the domain must be translated into globally unique IP addresses when outside communication is necessary, and these addresses can be reused when no longer in use.
- When you must change your internal addresses. Instead of changing the internal addresses, which can be a considerable amount of work, you can translate them by using NAT.
- When you want to do basic load sharing of TCP traffic. You can map a single global IP address to many local IP addresses by using the TCP load distribution feature.

NAT Inside and Outside Addresses

The term *inside* in a NAT context refers to networks owned by an organization that must be translated. When NAT is configured, hosts within this network will have addresses in one space (known as the *local* address space) that will appear to those outside the network as being in another space (known as the *global* address space).

Similarly, the term *outside* refers to those networks to which the stub network connects, and which are generally not under the control of the organization. Hosts in outside networks can also be subject to translation, and thus have local and global addresses.

NAT uses the following definitions:

- Inside local address--The IP address that is assigned to a host on the inside network. The address is probably not a legitimate IP address assigned by the NIC or service provider.
- Inside global address--A legitimate IP address (assigned by the NIC or service provider) that represents one or more inside local IP addresses to the outside world.

- Outside local address--The IP address of an outside host as it appears to the inside network. Not necessarily a legitimate address, it is allocated from the address space routable on the inside.
- Outside global address--The IP address assigned to a host on the outside network by the owner of the host. The address is allocated from a globally routable address or network space.

This section describes the following topics:

Inside Source Address Translation

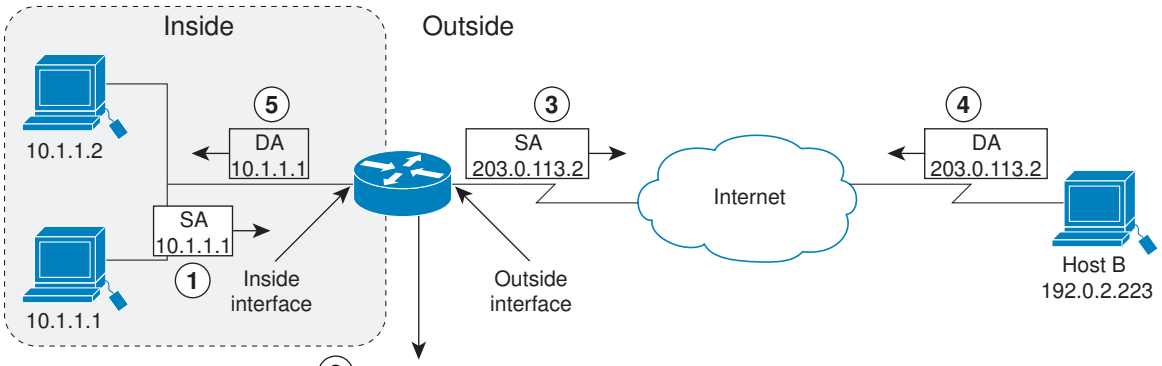
You can translate your own IP addresses into globally unique IP addresses when communicating outside of your network. You can configure static or dynamic inside source translation as follows:

- *Static translation* establishes a one-to-one mapping between your inside local address and an inside global address. Static translation is useful when a host on the inside must be accessible by a fixed address from the outside.
- *Dynamic translation* establishes a mapping between an inside local address and a pool of global addresses.

In Cisco IOS Release 15.1(3)T and later releases, when you configure the **traceroute** command, NAT returns the same inside global IP address for all inside local IP addresses.

The figure below illustrates a router that is translating a source address inside a network to a source address outside the network.

Figure 1 NAT Inside Source Translation



Protocol	Inside Local IP Address	Inside Global IP Address	Outside Global IP Address	Outside Local IP Address
-- -- -- --	10.1.1.2 10.1.1.1	203.0.113.3 203.0.113.2	-- -- -- -- -- -- -- --	-- -- -- -- -- -- -- --

The following process describes inside source address translation, as shown in the figure above:

1. The user at host 10.1.1.1 opens a connection to host B.
2. The first packet that the router receives from host 10.1.1.1 causes the router to check its NAT table:
   - If a static translation entry was configured, the router goes to Step 3.

- If no translation entry exists, the router determines that the source address (SA) 10.1.1.1 must be translated dynamically, selects a legal, global address from the dynamic address pool, and creates a translation entry. This type of entry is called a *simple entry*.

3. The router replaces the inside local source address of host 10.1.1.1 with the global address of the translation entry and forwards the packet.
4. Host B receives the packet and responds to host 10.1.1.1 by using the inside global IP destination address (DA) 203.0.113.2.
5. When the router receives the packet with the inside global IP address, it performs a NAT table lookup by using the inside global address as a key. It then translates the address to the inside local address of host 10.1.1.1 and forwards the packet to host 10.1.1.1.

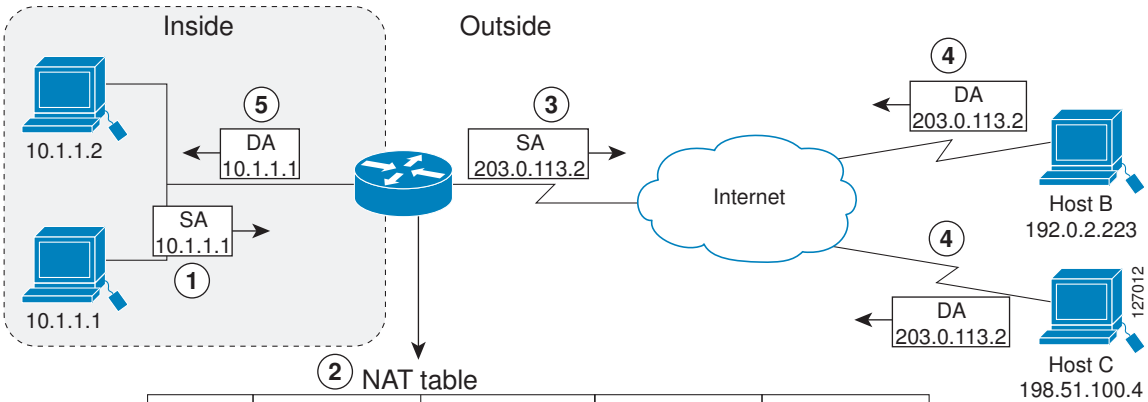
Host 10.1.1.1 receives the packet and continues the conversation. The router performs Steps 2 to 5 for each packet.

Inside Global Addresses Overloading

You can conserve addresses in the inside global address pool by allowing the router to use one global address for many local addresses. When this overloading is configured, the router maintains enough information from higher-level protocols (for example, TCP or UDP port numbers) to translate the global address back to the correct local address. When multiple local addresses map to one global address, the TCP or UDP port numbers of each inside host distinguish between the local addresses.

The figure below illustrates NAT operation when one inside global address represents multiple inside local addresses. The TCP port numbers act as differentiators.

Figure 2 NAT Overloading Inside Global Addresses



Protocol	Inside Local IP address:port	Inside Global IP address:port	Outside Global IP address:port	Outside Local IP address
TCP	10.1.1.2:1723	203.0.113.2:1723	198.51.100.4:23	198.51.100.4:23
TCP	10.1.1.1:1024	203.0.113.2:1024	192.0.2.223:23	192.0.2.223:23

The router performs the following process in overloading inside global addresses, as shown in the figure above. Both host B and host C believe that they are communicating with a single host at address 203.0.113.2. They are actually communicating with different hosts; the port number is the differentiator. In fact, many inside hosts could share the inside global IP address by using many port numbers.

1. The user at host 10.1.1.1 opens a connection to host B.
2. The first packet that the router receives from host 10.1.1.1 causes the router to check its NAT table:

- If no translation entry exists, the router determines that the address 10.1.1.1 must be translated, and sets up a translation of the inside local address 10.1.1.1 to a legal global address.
- If overloading is enabled, and another translation is active, the router reuses the global address from that translation and saves enough information to be able to translate the global address back. This type of entry is called an *extended entry*.

3 The router replaces the inside local source address 10.1.1.1 with the selected global address and forwards the packet.

4 Host B receives the packet and responds to host 10.1.1.1 by using the inside global IP address 203.0.113.2.

5 When the router receives the packet with the inside global IP address, it performs a NAT table lookup, using the protocol, the inside global address and port, and the outside address and port as keys; translates the address to the inside local address 10.1.1.1; and forwards the packet to host 10.1.1.1.

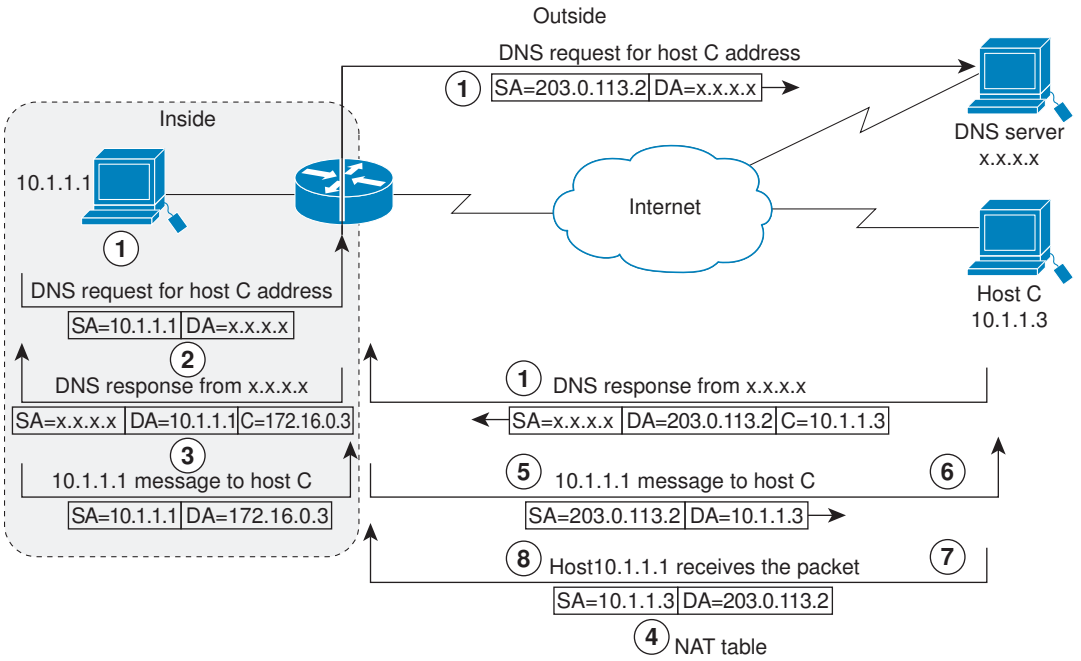
Host 10.1.1.1 receives the packet and continues the conversation. The router performs Steps 2 to 5 for each packet.

Address Translation of Overlapping Networks

NAT is used to translate your IP addresses, if your IP addresses are not legal or officially assigned IP addresses. Perhaps you chose IP addresses that officially belong to another network. When an IP address is used both illegally and legally, it is called *index overlapping*. You can use NAT to translate inside addresses that overlap with outside addresses.

The figure below shows how NAT translates overlapping networks.

Figure 3 NAT Translating Overlapping Addresses



Protocol	Inside Local IP Address	Inside Global IP Address	Outside Global IP Address	Outside Local IP Address
-- -- -- --	10.1.1.1	203.0.113.2	10.1.1.3	172.16.0.3

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The router translates overlapping addresses as follows:

1. The user at host 10.1.1.1 opens a connection to host C by name, requesting a name-to-address lookup from a Domain Name System (DNS) server.
2. The router intercepts the DNS reply and translates the returned address if there is an overlap (that is, the resulting legal address resides illegally in the inside network). To translate the return address, the router creates a simple translation entry mapping the overlapping address 10.1.1.3 to an address from a separately configured, outside local address pool.

The router examines every DNS reply, ensuring that the IP address is not in the stub network. If it is, the router translates the address as follows:

1. Host 10.1.1.1 opens a connection to 172.16.0.3.
2. The router sets up translations mapping of the inside local and global addresses to each other and the outside global and local addresses to each other.
3. The router replaces the SA with the inside global address and replaces the DA with the outside global address.
4. Host C receives the packet and continues the conversation.
5. The router does a lookup, replaces the DA with the inside local address, and replaces the SA with the outside local address.
6. Host 10.1.1.1 receives the packet and the conversation continues using this translation process.

Types of NAT

NAT operates on a router--generally connecting only two networks--and translates the private (inside local) addresses within the internal network into public (inside global) addresses before any packets are forwarded to another network. This functionality gives you the option to configure NAT so that it will advertise only a single address for your entire network to the outside world. Doing this effectively hides the internal network from the world, giving you some additional security.

NAT types include:

- Static address translation (static NAT)--allows one-to-one mapping between local and global addresses.
- Dynamic address translation (dynamic NAT)--maps unregistered IP addresses to registered IP addresses from a pool of registered IP addresses.
- Overloading--a form of dynamic NAT that maps multiple unregistered IP addresses to a single registered IP address (many to one) using different ports. This method is also known as Port Address Translation (PAT). By using PAT (NAT overload), thousands of users can be connected to the Internet using only one real global IP address.

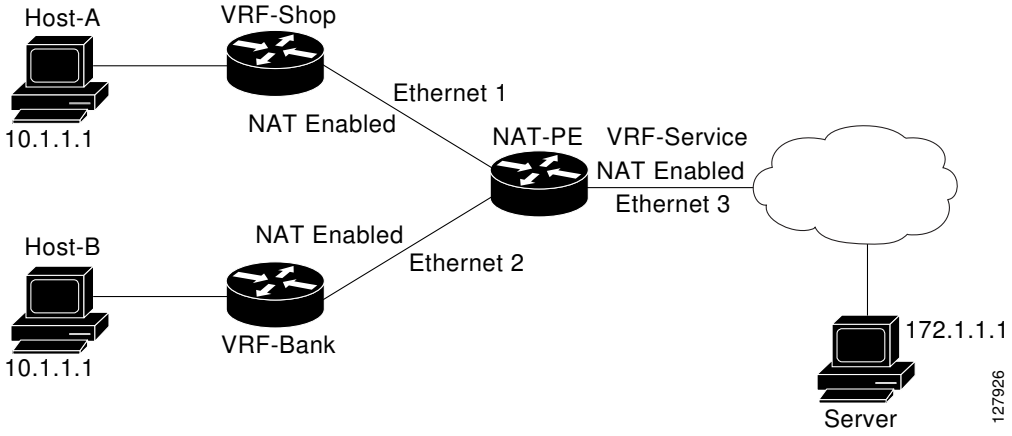
NAT Virtual Interface Design

The NAT Virtual Interface (NVI) feature allows NAT traffic flows on the virtual interface, eliminating the need to specify inside and outside domains. When a domain is specified, translation rules are applied either before or after the route decisions, depending on the traffic flow from inside to outside or outside to inside. The translation rules are applied only after the route decision for an NVI.

When a NAT pool is shared for translating packets from multiple networks connected to a NAT router, an NVI is created and a static route is configured that forwards all packets addressed to the NAT pool to the NVI. The standard interfaces connected to various networks will be configured to identify that the traffic originating from and received on the interfaces needs to be translated.

The figure below shows a typical NVI configuration.

Figure 4 NAT Virtual Interface Typical Configuration



NAT Virtual Interface has the following benefits:

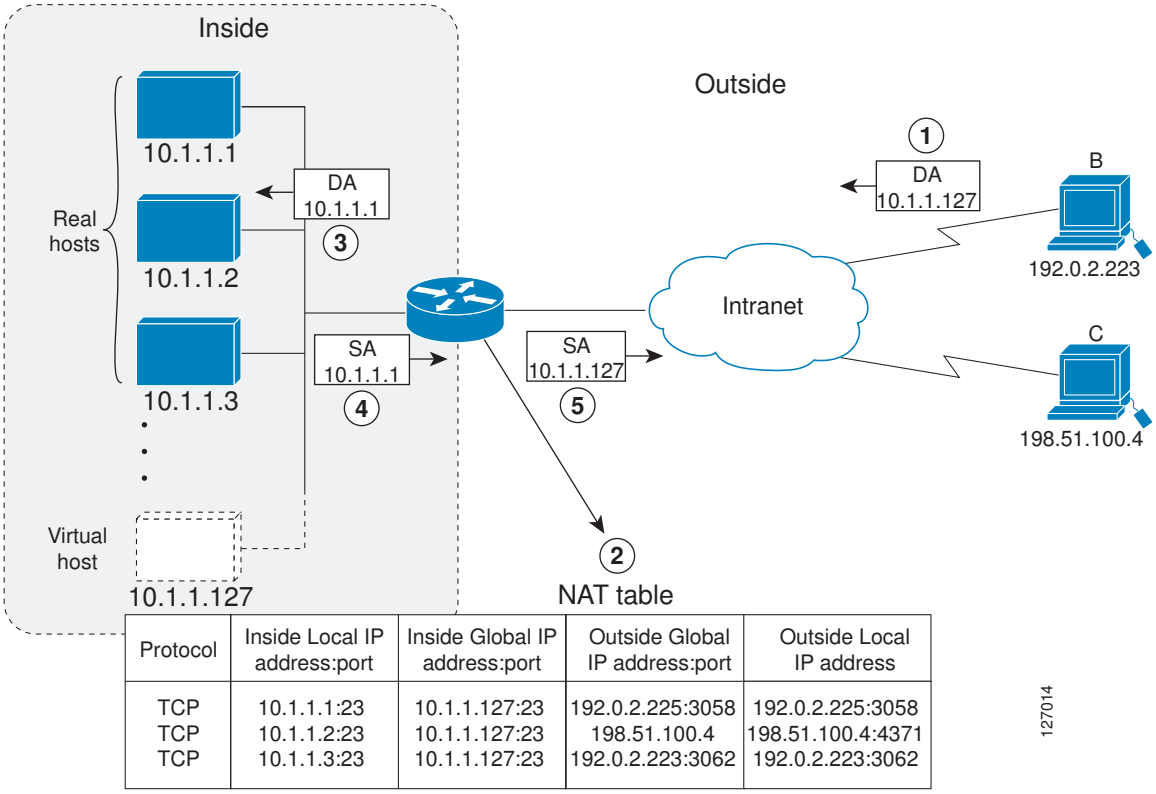
- A NAT table is maintained per interface for better performance and scalability.
- Domain-specific NAT configurations can be eliminated.

TCP Load Distribution for NAT

Your organization may have multiple hosts that must communicate with a heavily-used host. Using NAT, you can establish a virtual host on the inside network that coordinates load sharing among real hosts. DAs that match an access list are replaced with addresses from a rotary pool. Allocation is done on a round-

robin basis, and only when a new connection is opened from the outside to the inside. Non-TCP traffic is passed untranslated (unless other translations are in effect). The figure below illustrates this feature.

Figure 5 NAT TCP Load Distribution



Protocol	Inside Local IP address:port	Inside Global IP address:port	Outside Global IP address:port	Outside Local IP address
TCP	10.1.1.1:23	10.1.1.127:23	192.0.2.225:3058	192.0.2.225:3058
TCP	10.1.1.2:23	10.1.1.127:23	198.51.100.4	198.51.100.4:4371
TCP	10.1.1.3:23	10.1.1.127:23	192.0.2.223:3062	192.0.2.223:3062

The router performs the following process when translating rotary addresses:

1. The user on host B (192.0.2.223) opens a connection to the virtual host at 10.1.1.127.
2. The router receives the connection request and creates a new translation, allocating the next real host (10.1.1.1) for the inside local IP address.
3. The router replaces the destination address with the selected real host address and forwards the packet.
4. Host 10.1.1.1 receives the packet and responds.
5. The router receives the packet and performs a NAT table lookup using the inside local address and port number, and the outside address and port number as the key. The router then translates the source address to the address of the virtual host and forwards the packet.
6. The next connection request will cause the router to allocate 10.1.1.2 for the inside local address.

Public Wireless LAN

A public wireless LAN provides users of mobile computing devices with wireless connections to a public network, such as the Internet.

Route Map Overview

For NAT, a route map must be processed instead of an access list. A route map allows you to match any combination of access list, next-hop IP address, and output interface to determine which pool to use. The ability to use route maps with static translations enables the NAT multihoming capability with static address translations. Multihomed internal networks can host common services such as the Internet and DNS, which are accessed from different outside networks. NAT processes route map-based mappings in lexicographical order. When static NAT and dynamic NAT are configured with route maps that share the same name, static NAT is given precedence over dynamic NAT. In order to ensure the precedence of static NAT over dynamic NAT, you can either configure the route map associated with static NAT and dynamic NAT to share the same name, or configure the static NAT route map name so that it is lexicographically lower than that of the dynamic NAT route map name.

Benefits of using route maps for address translation are as follows:

- The ability to configure route map statements provides the option of using IPsec with NAT.
- Translation decisions can be made based on the destination IP address when static translation entries are used.

RADIUS

RADIUS is a distributed client/server system that secures networks against unauthorized access. Communication between a network access server (NAS) and a RADIUS server is based on UDP. Generally, the RADIUS protocol is considered a connectionless service. Issues related to server availability, retransmission, and timeouts are handled by RADIUS-enabled devices rather than the transmission protocol.

RADIUS is a client/server protocol. The RADIUS client is typically a NAS, and the RADIUS server is usually a daemon process running on a UNIX or Windows NT machine. The client passes user information to designated RADIUS servers and acts on the response that is returned. RADIUS servers receive user connection requests, authenticate the user, and then return the configuration information necessary for the client to deliver the service to the user. A RADIUS server can act as a proxy client to other RADIUS servers or other kinds of authentication servers.

Viruses and Worms That Target NAT

Viruses and worms are malicious programs designed to attack computer and networking equipment. Although viruses are typically embedded in discrete applications and run only when executed, worms self-propagate and can quickly spread on their own. Although a specific virus or worm may not expressly target NAT, it might use NAT resources to propagate itself. The Rate Limiting NAT Translation feature can be used to limit the impact of viruses and worms that originate from specific hosts, access control lists, and VPN routing and forwarding (VRF) instances.

Denial-of-Service Attacks

A denial-of-service (DoS) attack typically involves the misuse of standard protocols or connection processes with the intent to overload and disable a target, such as a router or web server. DoS attacks can come from a malicious user or from a computer infected with a virus or worm. An attack that comes from many different sources at once, such as when a virus or worm has infected many computers, is known as a distributed denial-of-service (DDoS) attack. Such DDoS attacks can spread rapidly and involve thousands of systems.

Reenabling RTSP on a NAT Router

The Real Time Streaming Protocol (RTSP) is a client/server multimedia presentation control protocol that supports multimedia application delivery. Some of the applications that use RTSP include Windows Media Services (WMS) by Microsoft, QuickTime by Apple Computer, and RealSystem G2 by RealNetworks.

When the RTSP protocol passes through a NAT router, the embedded address and port must be translated in order for the connection to be successful. NAT uses Network Based Application Recognition (NBAR) architecture to parse the payload and translate the embedded information in the RTSP payload.

RTSP is enabled by default. Use the **ip nat service rtsp port** *port-number* command to reenable RTSP on a NAT router if this configuration has been disabled.

How to Configure NAT for IP Address Conservation

The tasks described in this section configure NAT for IP address conservation. No single task in this section is required; however, at least one of the tasks must be performed. More than one of the tasks may need to be performed.

Configuring Inside Source Addresses

Inside source addresses can be configured for static or dynamic translations. Perform one of the following tasks depending on your requirements:

Configuring Static Translation of Inside Source Addresses

Configure static translation of inside source addresses when you want to allow one-to-one mapping between your inside local address and an inside global address. Static translation is useful when a host on the inside must be accessible by a fixed address from the outside.

Prior to Cisco IOS Release 15.1(1)T, if the static inside source address matched the inside global address, the output of the **show ip aliases** command displayed only the static inside source address. In Cisco IOS

Release 15.1(1)T and later releases, if the static inside source address matches the inside global address, the output of the **show ip aliases** command displays both the addresses. The static inside source address is displayed as an interface address and the inside global address is displayed as a dynamic address.

Note You must configure different IP addresses for the interface on which NAT is configured and for the inside addresses that are configured by using the **ip nat inside source static** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat inside source static** *local-ip global-ip*
4. **interface** *type number*
5. **ip address** *ip-address mask* [**secondary**]
6. **ip nat inside**
7. **exit**
8. **interface** *type number*
9. **ip address** *ip-address mask*
10. **ip nat outside**
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat inside source static** *local-ip global-ip* **Example:** `Router(config)# ip nat inside source static 10.10.10.1 172.16.131.1`	Establishes static translation between an inside local address and an inside global address.

	Command or Action	Purpose
Step 4	**interface** *type number* **Example:** `Router(config)# interface ethernet 1`	Specifies an interface and enters interface configuration mode.
Step 5	**ip address** *ip-address mask* [**secondary**] **Example:** `Router(config-if)# ip address 10.114.11.39 255.255.255.0`	Sets a primary IP address for an interface.
Step 6	**ip nat inside** **Example:** `Router(config-if)# ip nat inside`	Marks the interface as connected to the inside.
Step 7	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 8	**interface** *type number* **Example:** `Router(config)# interface ethernet 0`	Specifies a different interface and enters interface configuration mode.
Step 9	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 172.31.232.182 255.255.255.240`	Sets a primary IP address for an interface.
Step 10	**ip nat outside** **Example:** `Router(config-if)# ip nat outside`	Marks the interface as connected to the outside.

	Command or Action	Purpose
Step 11	**end** **Example:** `Router(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring Dynamic Translation of Inside Source Addresses

Dynamic translation establishes a mapping between an inside local address and a pool of global addresses. Dynamic translation is useful when multiple users on a private network need to access the Internet. The dynamically configured pool IP address may be used as needed and is released for use by other users when access to the Internet is no longer required.

SUMMARY STEPS

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

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*} **Example:** `Router(config)# ip nat pool net-208 172.16.233.208 172.16.233.223 prefix-length 28`	Defines a pool of global addresses to be allocated as needed.
Step 4	**access-list** *access-list-number* **permit** *source* [*source-wildcard*] **Example:** `Router(config)# access-list 1 permit 192.168.34.0 0.0.0.255`	Defines a standard access list permitting those addresses that are to be translated.
Step 5	**ip nat inside source list** *access-list -number* **pool** *name* **Example:** `Router(config)# ip nat inside source list 1 pool net-208`	Establishes dynamic source translation, specifying the access list defined in the prior step.
Step 6	**interface** *type number* **Example:** `Router(config)# interface ethernet 1`	Specifies an interface and enters interface configuration mode.
Step 7	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 10.114.11.39 255.255.255.0`	Sets a primary IP address for the interface.
Step 8	**ip nat inside** **Example:** `Router(config-if)# ip nat inside`	Marks the interface as connected to the inside.
Step 9	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 10	**interface** *type number* **Example:** `Router(config)# interface ethernet 0`	Specifies an interface and enters interface configuration mode.

	Command or Action	Purpose
Step 11	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 172.16.232.182 255.255.255.240`	Sets a primary IP address for the interface.
Step 12	**ip nat outside** **Example:** `Router(config-if)# ip nat outside`	Marks the interface as connected to the outside.
Step 13	**end** **Example:** `Router(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Using NAT to Allow Internal Users Access to the Internet

Perform this task to allow your internal users access to the Internet and conserve addresses in the inside global address pool using overloading of global addresses.

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*} **Example:** `Router(config)# ip nat pool net-208 192.168.202.129 192.168.202.158 netmask 255.255.255.224`	Defines a pool of global addresses to be allocated as needed.
Step 4	**access-list** *access-list-number* **permit** *source* [*source-wildcard*] **Example:** `Router(config)# access-list 1 permit 192.168.201.30 0.0.0.255`	Defines a standard access list permitting those addresses that are to be translated. • The access list must permit only those addresses that are to be translated. (Remember that there is an implicit "deny all" at the end of each access list.) Use of an access list that is too permissive can lead to unpredictable results.
Step 5	**ip nat inside source list** *access-list-number* **pool** *name* **overload** **Example:** `Router(config)# ip nat inside source list 1 pool net-208 overload`	Establishes dynamic source translation with overloading, specifying the access list defined in Step 4.
Step 6	**interface** *type number* **Example:** `Router(config)# interface ethernet 1`	Specifies an interface and enters interface configuration mode.
Step 7	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 192.168.201.1 255.255.255.240`	Sets a primary IP address for the interface.

	Command or Action	Purpose
Step 8	**ip nat inside** **Example:** `Router(config-if)# ip nat inside`	Marks the interface as connected to the inside.
Step 9	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 10	**interface** *type number* **Example:** `Router(config)# interface ethernet 0`	Specifies an interface and enters interface configuration mode.
Step 11	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 192.168.201.29 255.255.255.240`	Sets a primary IP address for the interface.
Step 12	**ip nat outside** **Example:** `Router(config-if)# ip nat outside`	Marks the interface as connected to the outside.
Step 13	**end** **Example:** `Router(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring Address Translation Timeouts

You can configure address translation timeouts based on your specific configuration of NAT.

- Changing the Translation Timeout, page 19
- Changing the Timeouts When Overloading Is Configured, page 20

Changing the Translation Timeout

By default, dynamic address translations time out after some period of nonuse. You can change the default values on timeouts, if necessary. When overloading is not configured, simple translation entries time out after 24 hours. Configure the **ip nat translation timeout** *seconds* command to change the timeout value for dynamic address translations that do not use overloading.

Changing the Timeouts When Overloading Is Configured

If you have configured overloading, you can control the translation entry timeout, because each translation entry contains more context about the traffic using it.

Based on your configuration, you can change the timeouts described in this section. If you need to quickly free your global IP address for a dynamic configuration, you should configure a shorter timeout than the default timeout, by using the **ip nat translation timeout** command. However, the configured timeout should be longer than the other timeouts configured by using the commands specified in the following task. If a TCP session is not properly closed by a finish (FIN) packet from both sides or during a reset, you should change the default TCP timeout by using the **ip nat translation tcp-timeout** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat translation** *seconds*
4. **ip nat translation udp-timeout** *seconds*
5. **ip nat translation dns-timeout** *seconds*
6. **ip nat translation tcp-timeout** *seconds*
7. **ip nat translation finrst-timeout** *seconds*
8. **ip nat translation icmp-timeout** *seconds*
9. **ip nat translation syn-timeout** *seconds*
10. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat translation** *seconds* **Example:** `Router(config)# ip nat translation 300`	(Optional) Changes the amount of time after which NAT translations time out. • The default timeout is 24 hours and it applies to the aging time for half-entries.

	Command or Action	Purpose
Step 4	**ip nat translation udp-timeout** *seconds* **Example:** `Router(config)# ip nat translation udp-timeout 300`	(Optional) Changes the UDP timeout value.
Step 5	**ip nat translation dns-timeout** *seconds* **Example:** `Router(config)# ip nat translation dns-timeout 45`	(Optional) Changes the Domain Name System (DNS) timeout value.
Step 6	**ip nat translation tcp-timeout** *seconds* **Example:** `Router(config)# ip nat translation tcp-timeout 2500`	(Optional) Changes the TCP timeout value. • The default is 24 hours.
Step 7	**ip nat translation finrst-timeout** *seconds* **Example:** `Router(config)# ip nat translation finrst-timeout 45`	(Optional) Changes the finish and reset timeout value. • finrst-timeout--The aging time after a TCP session receives both finish-in (FIN-IN) and finish-out (FIN-OUT) or after the reset of a TCP session.
Step 8	**ip nat translation icmp-timeout** *seconds* **Example:** `Router(config)# ip nat translation icmp-timeout 45`	(Optional) Changes the ICMP timeout value.
Step 9	**ip nat translation syn-timeout** *seconds* **Example:** `Router(config)# ip nat translation syn-timeout 45`	(Optional) Changes the synchronous (SYN) timeout value. • The synchronous timeout or the aging time is used only when a SYN is received on a TCP session. When a synchronous acknowledgment (SYNACK) is received, the timeout changes to TCP timeout.
Step 10	**end** **Example:** `Router(config)# end`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Allowing Overlapping Networks to Communicate Using NAT

The tasks in this section are grouped because they perform the same action but are executed differently depending on the type of translation that is implemented--static or dynamic:

Perform the task that applies to the translation type that is implemented.

- Configuring Static Translation of Overlapping Networks, page 22
- Configuring Dynamic Translation of Overlapping Networks, page 24

Configuring Static Translation of Overlapping Networks

Configure static translation of overlapping networks if your IP addresses in the stub network are legitimate IP addresses belonging to another network and you want to communicate with those hosts or routers using static translation.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat inside source static** *local-ip global-ip*
4. **interface** *type number*
5. **ip address** *ip-address mask*
6. **ip nat inside**
7. **exit**
8. **interface** *type number*
9. **ip address** *ip-address mask*
10. **ip nat outside**
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat inside source static** *local-ip global-ip* **Example:** `Router(config)# ip nat inside source static 192.168.121.33 10.2.2.1`	Establishes static translation between an inside local address and an inside global address.

	Command or Action	Purpose
Step 4	**interface** *type number* **Example:** `Router(config)# interface ethernet 1`	Specifies an interface and enters interface configuration mode.
Step 5	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 10.114.11.39 255.255.255.0`	Sets a primary IP address for the interface.
Step 6	**ip nat inside** **Example:** `Router(config-if)# ip nat inside`	Marks the interface as connected to the inside.
Step 7	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 8	**interface** *type number* **Example:** `Router(config)# interface ethernet 0`	Specifies an interface and enters interface configuration mode.
Step 9	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 172.16.232.182 255.255.255.240`	Sets a primary IP address for the interface.
Step 10	**ip nat outside** **Example:** `Router(config-if)# ip nat outside`	Marks the interface as connected to the outside.
Step 11	**end** **Example:** `Router(config-if)# end`	(Optional) Exits interface configuration mode and returns to privileged EXEC mode.

Configuring Dynamic Translation of Overlapping Networks

Configure dynamic translation of overlapping networks if your IP addresses in the stub network are legitimate IP addresses belonging to another network and you want to communicate with those hosts or routers using dynamic translation.

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*} **Example:** `Router(config)# ip nat pool net-10 10.0.1.0 10.0.1.255 prefix-length 24`	Defines a pool of global addresses to be allocated as needed.

	Command or Action	Purpose
Step 4	**access-list** *access-list-number* **permit** *source* [*source-wildcard*] **Example:** `Router(config)# access-list 1 permit 10.114.11.0 0.0.0.255`	Defines a standard access list permitting those addresses that are to be translated. • The access list must permit only those addresses that are to be translated. (Remember that there is an implicit "deny all" at the end of each access list.) Use of an access list that is too permissive can lead to unpredictable results.
Step 5	**ip nat outside source list** *access-list-number* **pool** *name* **Example:** `Router(config)# ip nat outside source list 1 pool net-10`	Establishes dynamic outside source translation, specifying the access list defined in Step 4.
Step 6	**interface** *type number* **Example:** `Router(config)# interface ethernet 1`	Specifies an interface and enters interface configuration mode.
Step 7	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 10.114.11.39 255.255.255.0`	Sets a primary IP address for the interface.
Step 8	**ip nat inside** **Example:** `Router(config-if)# ip nat inside`	Marks the interface as connected to the inside.
Step 9	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 10	**interface** *type number* **Example:** `Router(config)# interface ethernet 0`	Specifies an interface and enters interface configuration mode.

	Command or Action	Purpose
Step 11	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 172.16.232.182 255.255.255.240`	Sets a primary IP address for the interface.
Step 12	**ip nat outside** **Example:** `Router(config-if)# ip nat outside`	Marks the interface as connected to the outside.
Step 13	**end** **Example:** `Router(config-if)# end`	(Optional) Exits interface configuration mode and returns to privileged EXEC mode.

Configuring the NAT Virtual Interface

The NAT Virtual Interface feature removes the requirement to configure an interface as either NAT inside or NAT outside. An interface can be configured to use or not use NAT.

Restrictions for NAT Virtual Interface

- Route maps are not supported.
- NVI is not supported in a *NAT on-a-stick* scenario. The term NAT on-a-stick implies the use of a single physical interface of a router for translation. NVI is designed for traffic from one VPN routing and forwarding (VRF) instance to another and not for routing between subnets in a global routing table. For more information on NAT on-a-stick, see http://www.cisco.com/en/US/tech/tk648/tk361/technologies_tech_note09186a0080094430.shtml.

Enabling a Dynamic NAT Virtual Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip nat enable**
5. **exit**
6. **ip nat pool** *name start-ip end-ip* **netmask** *netmask* **add-route**
7. **ip nat source list** *access-list-number* **pool** *number* **vrf** *name*
8. **ip nat source list** *access-list-number* **pool** *number* **vrf** *name* **overload**
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface FastEthernet l`	Configures an interface and enters interface configuration mode.
Step 4	**ip nat enable** **Example:** `Router(config-if)# ip nat enable`	Configures an interface that connects VPNs and the Internet for NAT.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 6	**ip nat pool** *name start-ip end-ip* **netmask** *netmask* **add-route** **Example:** `Router(config)# ip nat pool pool1 192.168.200.225 192.168.200.254 netmask 255.255.255.0 add-route`	Configures a NAT pool and the associated mappings.
Step 7	**ip nat source list** *access-list-number* **pool** *number* **vrf** *name* **Example:** `Router(config)# ip nat source list 1 pool pool1 vrf vrf1`	Configures an NVI without an inside or outside specification for the specified customer.
Step 8	**ip nat source list** *access-list-number* **pool** *number* **vrf** *name* **overload** **Example:** `Router(config)# ip nat source list 1 pool 1 vrf vrf2 overload`	Configures an NVI without an inside or outside specification for the specified customer.
Step 9	**end** **Example:** `Router(config)# end`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Enabling a Static NAT Virtual Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip nat enable**
5. **exit**
6. **ip nat source static** *local-ip global-ip* **vrf** *name*
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface FastEthernet l`	Configures an interface type and enters interface configuration mode.
Step 4	**ip nat enable** **Example:** `Router(config-if)# ip nat enable`	Configures an interface that connects VPNs and the Internet for NAT.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.
Step 6	**ip nat source static** *local-ip global-ip* **vrf** *name* **Example:** `Router(config)# ip nat source static 192.168.123.1 192.168.125.10 vrf vrf1`	Configures a static NVI.
Step 7	**end** **Example:** `Router(config)# end`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Configuring Server TCP Load Balancing

Perform this task to configure server TCP load balancing by way of destination address rotary translation. The commands specified in the task allow you to map one virtual host to many real hosts. Each new TCP session opened with the virtual host will be translated into a session with a different real host.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*} **type rotary**
4. **access-list** *access-list-number* **permit** *source* [*source-wildcard*]
5. **ip nat inside destination-list** *access-list-number* **pool** *name*
6. **interface** *type number*
7. **ip address** *ip-address mask*
8. **ip nat inside**
9. **exit**
10. **interface** *type number*
11. **ip address** *ip-address mask*
12. **ip nat outside**
13. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*} **type rotary** **Example:** `Router(config)# ip nat pool real-hosts 192.168.201.2 192.168.201.5 prefix-length 28 type rotary`	Defines a pool of addresses containing the addresses of the real hosts.
Step 4	**access-list** *access-list-number* **permit** *source* [*source-wildcard*] **Example:** `Router(config)# access-list 1 permit 192.168.201.30 0.0.0.255`	Defines an access list permitting the address of the virtual host.

	Command or Action	Purpose
Step 5	**ip nat inside destination-list** *access-list-number* **pool** *name* **Example:** `Router(config)# ip nat inside destination-list 2 pool real-hosts`	Establishes dynamic inside destination translation, specifying the access list defined in the prior step.
Step 6	**interface** *type number* **Example:** `Router(config)# interface ethernet 0`	Specifies an interface and enters interface configuration mode.
Step 7	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 192.168.201.1 255.255.255.240`	Sets a primary IP address for the interface.
Step 8	**ip nat inside** **Example:** `Router(config-if)# ip nat inside`	Marks the interface as connected to the inside.
Step 9	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 10	**interface** *type number* **Example:** `Router(config)# interface serial 0`	Specifies a different interface and enters interface configuration mode.
Step 11	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 192.168.15.129 255.255.255.240`	Sets a primary IP address for the interface.
Step 12	**ip nat outside** **Example:** `Router(config-if)# ip nat outside`	Marks the interface as connected to the outside.

	Command or Action	Purpose
Step 13	**end** **Example:** `Router(config-if)# end`	(Optional) Exits interface configuration mode and returns to privileged EXEC mode.

Enabling Route Maps on Inside Interfaces

All route maps required for use with this task should be configured before you begin the configuration task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat inside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** *local-ip global-ip* [**route-map** *map-name*]}
4. **exit**
5. **show ip nat translations** [**verbose**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat inside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** *local-ip global-ip* [**route-map** *map-name*]} **Example:** `Router(config)# ip nat inside source static 192.168.201.6 192.168.201.21 route-map isp2`	Enables route mapping with static NAT configured on the NAT inside interface.

	Command or Action	Purpose
Step 4	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode and returns to privileged EXEC mode.
Step 5	**show ip nat translations** [**verbose**] **Example:** `Router# show ip nat translations`	(Optional) Displays active NAT.

Enabling NAT Route Maps Outside-to-Inside Support

The NAT Route Maps Outside-to-Inside Support feature enables the deployment of a NAT route map configuration that will allow IP sessions to be initiated from the outside to the inside. Perform this task to enable the NAT Route Maps Outside-to-Inside Support feature.

An initial session from inside-to-outside is required to trigger a NAT. New translation sessions can then be initiated from outside to the inside host that triggered the initial translation.

When route maps are used to allocate global addresses, the global address can allow return traffic, and the return traffic is allowed only if it matches the defined route map in the reverse direction. The outside-to-inside functionality remains unchanged (by not creating additional entries to allow the return traffic for a route-map-based dynamic entry) unless you configure the **reversible** keyword with the **ip nat inside source** command.

The following restrictions apply to the NAT Router Maps Outside-to-Inside Support feature:

- Access lists with reversible route maps must be configured to match the inside-to-outside traffic.
- In Cisco IOS Release 12.2(33)SXI5, the NAT Route Maps Outside-to-Inside Support feature is supported only on Cisco ME 6500 series Ethernet switches.
- Only IP hosts that are part of the route-map configuration will allow outside sessions.
- Outside-to-inside support is not available with PAT.
- Outside sessions must use an access list.
- The **match interface** and **match ip next-hop** commands are not supported for reversible route maps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat pool** *name start-ip end-ip* **netmask** *netmask*
4. **ip nat pool** *name start-ip end-ip* **netmask** *netmask*
5. **ip nat inside source route-map** *name* **pool** *name* [**reversible**]
6. **ip nat inside source route-map** *name* **pool** *name* [**reversible**]
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router(config)# configure terminal`	Enters global configuration mode.
Step 3	**ip nat pool** *name start-ip end-ip* **netmask** *netmask* **Example:** `Router(config)# ip nat pool POOL-A 192.168.201.4 192.168.201.6 netmask 255.255.255.128`	Defines a pool of network addresses for NAT.
Step 4	**ip nat pool** *name start-ip end-ip* **netmask** *netmask* **Example:** `Router(config)# ip nat pool POOL-B 192.168.201.7 192.168.201.9 netmask 255.255.255.128`	Defines a pool of network addresses for NAT.
Step 5	**ip nat inside source route-map** *name* **pool** *name* [**reversible**] **Example:** `Router(config)# ip nat inside source route-map MAP-A pool POOL-A reversible`	Enables outside-to-inside initiated sessions to use route maps for destination-based NAT.
Step 6	**ip nat inside source route-map** *name* **pool** *name* [**reversible**] **Example:** `Router(config)# ip nat inside source route-map MAP-B pool POOL-B reversible`	Enables outside-to-inside initiated sessions to use route maps for destination-based NAT.
Step 7	**end** **Example:** `Router(config)# end`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Configuring NAT of External IP Addresses Only

When you configure NAT of external IP addresses, NAT can be configured to ignore all embedded IP addresses for any application and traffic type. Traffic between a host and the traffic outside an enterprise's

network flows through the internal network. A router configured for NAT translates the packet to an address that can be routed inside the internal network. If the intended destination is outside an enterprise's network, the packet gets translated back to an external address and is sent out.

Note When you configure the **ip nat outside source static** command to add static routes for outside local addresses, there is a delay in the translation of packets and packets are dropped. The packets are dropped because a shortcut is not created for the initial synchronize (SYN) packet when NAT is configured for static translation. To avoid dropped packets, configure either the **ip nat outside source static add-route** command or the **ip route** command.

Benefits of Configuring NAT of External IP Addresses Only are:

- Supports public and private network architecture with no specific route updates.
- Gives the end client a usable IP address at the starting point. This address is the address used for IPsec connections and traffic.
- Allows the use of network architecture that requires only the header translation.
- Allows an enterprise to use the Internet as its enterprise backbone network.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat inside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static network** *local-ip global-ip* [**no-payload**]}
4. **ip nat inside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** {**tcp** | **udp**} *local-ip local-port global-ip global-port* [**no-payload**]}
5. **ip nat inside source** {**list** {*access-list-number* | *access-list-name}* **pool** *pool-name* [**overload**] | **static** [**network**] *local-network-mask global-network-mask* [**no-payload**]}
6. **ip nat outside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** *local-ip global-ip* [**no-payload**]}
7. **ip nat outside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** {**tcp** | **udp**} *local-ip local-port global-ip global-port* [**no-payload**]}
8. **ip nat outside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** [**network**] *local-network-mask global-network-mask* [**no-payload**]}
9. **exit**
10. **show ip nat translations** [**verbose**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat inside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static network** *local-ip global-ip* [**no-payload**]} **Example:** `Router(config)# ip nat inside source static network 10.1.1.1 192.168.251.0/24 no-payload`	Disables the network packet translation on the inside host router.
Step 4	**ip nat inside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** {**tcp** | **udp**} *local-ip local-port global-ip global-port* [**no-payload**]} **Example:** `Router(config)# ip nat inside source static tcp 10.1.1.1 2000 192.168.1.1 2000 no-payload`	Disables port packet translation on the inside host router.
Step 5	**ip nat inside source** {**list** {*access-list-number* | *access-list-name}* **pool** *pool-name* [**overload**] | **static** [**network**] *local-network-mask global-network-mask* [**no-payload**]} **Example:** `Router(config)# ip nat inside source static 10.1.1.1 192.168.1.1 no-payload`	Disables packet translation on the inside host router.
Step 6	**ip nat outside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** *local-ip global-ip* [**no-payload**]} **Example:** `Router(config)# ip nat outside source static 10.1.1.1 192.168.1.1 no-payload`	Disables packet translation on the outside host router.
Step 7	**ip nat outside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** {**tcp** | **udp**} *local-ip local-port global-ip global-port* [**no-payload**]} **Example:** `Router(config)# ip nat outside source static tcp 10.1.1.1 20000 192.168.1.1 20000 no-payload`	Disables port packet translation on the outside host router.

	Command or Action	Purpose
Step 8	**ip nat outside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name* [**overload**] | **static** [**network**] *local-network-mask global-network-mask* [**no-payload**]} **Example:** `Router(config)# ip nat outside source static network 10.1.1.1 192.168.251.0/24 no-payload`	Disables network packet translation on the outside host router.
Step 9	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode and returns to privileged EXEC mode.
Step 10	**show ip nat translations** [**verbose**] **Example:** `Router# show ip nat translations`	Displays active NAT.

Configuring the NAT Inside Server Feature

The NAT Default Inside Server feature helps forward packets from the outside to a specified inside local address. Traffic that does not match any existing dynamic translations or static port translations is redirected, and the packets are not dropped.

Dynamic mapping and interface overload can be configured for gaming devices. For online games, outside traffic comes on a different UDP port. If a packet is destined for the 806 interface from outside an enterprise's network and there no match in the NAT table for the fully extended entry or the static port entry, the packet is forwarded to the gaming device using a simple static entry.

Note

- You can use the feature to configure gaming devices with an IP address that is different from that of the PC. To avoid unwanted traffic or DoS attacks, use access lists.
- For traffic going from the PC to the outside, it is better to use a route map so that extended entries are created.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat inside source static** *local-ip* **interface** *type number*
4. **ip nat inside source static tcp** *local-ip local-port* **interface** *global-port*
5. **exit**
6. **show ip nat translations** [**verbose**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat inside source static** *local-ip* **interface** *type number* **Example:** `Router(config)# ip nat inside source static 10.1.1.1 interface Ethernet 1/1`	Enables static NAT on the interface.
Step 4	**ip nat inside source static tcp** *local-ip local-port* **interface** *global-port* **Example:** `Router(config)# ip nat inside source static tcp 10.1.1.1 23 interface 23`	(Optional) Enables the use of telnet to the router from the outside.
Step 5	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode and returns to privileged EXEC mode.
Step 6	**show ip nat translations** [**verbose**] **Example:** `Router# show ip nat translations`	(Optional) Displays active NAT.

Configuring Support for Users with Static IP Addresses

Configuring support for users with static IP addresses enables those users to establish an IP session in a public wireless LAN environment.

The NAT Static IP Support feature extends the capabilities of public wireless LAN providers to support users configured with a static IP address. By configuring a router to support users with a static IP address, public wireless LAN providers extend their services to a greater number of potential users, which can lead to greater user satisfaction and additional revenue.

Users with static IP addresses can use services of the public wireless LAN provider without changing their IP address. NAT entries are created for static IP clients and a routable address is provided.

Before configuring support for users with static IP addresses, you must first enable NAT on your router and configure a RADIUS server host.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip nat inside**
5. **exit**
6. **ip nat allow-static-host**
7. **ip nat pool** *name start-ip end-ip* **netmask** *netmask* **accounting** *list-name*
8. **ip nat inside source list** *access-list-number* **pool** *name*
9. **access-list** *access-list-number* **deny ip** *source*
10. **end**
11. **show ip nat translations verbose**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 1`	Configures an interface and enters interface configuration mode.
Step 4	**ip nat inside** **Example:** `Router(config-if)# ip nat inside`	Marks the interface as connected to the inside.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.

	Command or Action	Purpose
Step 6	**ip nat allow-static-host** **Example:** `Router(config)# ip nat allow-static-host`	Enables static IP address support. • Dynamic Address Resolution Protocol (ARP) learning will be disabled on this interface, and NAT will control the creation and deletion of ARP entries for the static IP host.
Step 7	**ip nat pool** *name start-ip end-ip* **netmask** *netmask* **accounting** *list-name* **Example:** `Router(config)# ip nat pool pool1 172.16.0.0 172.16.0.254 netmask 255.255.255.0 accounting WLAN-ACCT`	Specifies an existing RADIUS profile name to be used for authentication of the static IP host.
Step 8	**ip nat inside source list** *access-list-number* **pool** *name* **Example:** `Router(config)# ip nat inside source list 1 pool net-208`	Specifies the access list and pool to be used for static IP support. • The specified access list must permit all traffic.
Step 9	**access-list** *access-list-number* **deny ip** *source* **Example:** `Router(config)# access-list 1 deny ip 192.168.196.51`	Removes the router's own traffic from NAT. • The *source* argument is the IP address of the router that supports the NAT Static IP Support feature.
Step 10	**end** **Example:** `Router(config)# end`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 11	**show ip nat translations verbose** **Example:** `Router# show ip nat translations verbose`	(Optional) Displays active NAT translations and additional information for each translation table entry, including how long ago the entry was created and used.

Examples

The following is sample output from the **show ip nat translations verbose** command:

```
Router# show ip nat translations verbose

--- 172.16.0.0 10.1.1.1          ---               ---
create 00:05:59, use 00:03:39, left 23:56:20, Map-Id(In): 1, flags: none wlan-flags:
Secure ARP added, Accounting Start sent Mac-Address:0010.7bc2.9ff6 Input-IDB:Ethernet1/2,
use_count: 0, entry-id:7, lc_entries: 0
```

Configuring Support for ARP Ping

When the static IP client's NAT entry times out, the NAT entry and the secure ARP entry associations are deleted for the client. Reauthentication with the Service Selection Gateway (SSG) is needed for the client to reestablish WLAN services. The ARP Ping feature enables the NAT entry and the secure ARP entry to not be deleted when the static IP client exists in the network where the IP address is unchanged after authentication.

An ARP ping is necessary to determine static IP client existence and to restart the NAT entry timer.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length* [**accounting** *method-list-name*] [**arp-ping**]
4. **ip nat translation arp -ping-timeout** [*seconds*]
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length* [**accounting** *method-list-name*] [**arp-ping**] **Example:** `Router(config)# ip nat pool net-208 172.16.233.208 172.16.233.223 prefix-length 28 accounting radius1 arp-ping`	Defines a pool of IP addresses for NAT.
Step 4	**ip nat translation arp -ping-timeout** [*seconds*] **Example:** `Router(config)# ip nat translation arp-ping-timeout 600`	Changes the amount of time after each network address translation.

	Command or Action	Purpose
Step 5	**end** **Example:** `Router(config)# end`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Configuring the Rate Limiting NAT Translation Feature

Limiting the number of concurrent NAT operations using the Rate Limiting NAT Translation feature provides users more control over how NAT addresses are used. The Rate Limiting NAT Translation feature can be used to limit the effects of viruses, worms, and DoS attacks.

Because NAT is a CPU-intensive process, router performance can be adversely affected by DoS attacks, viruses, and worms that target NAT. The Rate Limiting NAT Translation feature allows you to limit the maximum number of concurrent NAT requests on a router.

Prerequisites for configuring the Rate Limiting NAT Translation feature are as follows:

- Classify current NAT usage and determine the sources of requests for NAT. A specific host, access control list, or VRF instance generating an unexpectedly high number of NAT requests may be the source of a malicious virus or worm attack.
- Once you have identified the source of excess NAT requests, you can set a NAT rate limit that contains a specific host, access control list, or VRF instance, or you can set a general limit for the maximum number of NAT requests allowed regardless of their source.

SUMMARY STEPS

1. **enable**
2. **show ip nat translations**
3. **configure terminal**
4. **ip nat translation max-entries** {*number* | **all-vrf** *number* | **host** *ip-address number* | **list** *listname number* | **vrf** *name number*}
5. **end**
6. **show ip nat statistics**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**show ip nat translations** **Example:** `Router# show ip nat translations`	(Optional) Displays active NAT. • A specific host, access control list, or VRF instance generating an unexpectedly high number of NAT requests may be the source of a malicious virus or worm attack.
Step 3	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 4	**ip nat translation max-entries** {*number* | **all-vrf** *number* | **host** *ip-address number* | **list** *listname number* | **vrf** *name number*} **Example:** `Router(config)# ip nat translation max-entries 300`	Configures the maximum number of NAT entries allowed from the specified source. • The maximum number of allowed NAT entries is 2147483647, although a typical range for a NAT rate limit is 100 to 300 entries. • When you configure a NAT rate limit for all VRF instances, each VRF instance is limited to the maximum number of NAT entries that you specify. • When you configure a NAT rate limit for a specific VRF instance, you can specify a maximum number of NAT entries for the named VRF instance that is greater than or less than that allowed for all VRF instances.
Step 5	**end** **Example:** `Router(config)# end`	Exits global configuration mode and returns to privileged EXEC mode.
Step 6	**show ip nat statistics** **Example:** `Router# show ip nat statistics`	(Optional) Displays current NAT usage information, including NAT rate limit settings. • After setting a NAT rate limit, use the **show ip nat statistics** command to verify the current NAT rate limit settings.

Configuration Examples for Configuring NAT for IP Address Conservation

Example: Configuring Static Translation of Inside Source Addresses

The following example translates between inside hosts addressed from the 10.114.11.0 network to the globally unique 172.31.233.208/28 network. Further packets from outside hosts addressed from the 10.114.11.0 network (the true 10.114.11.0 network) are translated to appear to be from the 10.0.1.0/24 network.

```
ip nat pool net-208 172.31.233.208 172.31.233.223 prefix-length 28
ip nat pool net-10 10.0.1.0 10.0.1.255 prefix-length 24
ip nat inside source list 1 pool net-208
ip nat outside source list 1 pool net-10
!
interface ethernet 0
 ip address 172.31.232.182 255.255.255.240
 ip nat outside
!
interface ethernet 1
 ip address 10.114.11.39 255.255.255.0
 ip nat inside
!
access-list 1 permit 10.114.11.0 0.0.0.255
```

The following example shows NAT configured on the provider edge (PE) router with a static route to the shared service for the vrf1 and vrf2 VPNs. NAT is configured as inside source static one-to-one translation.

```
ip nat pool outside 10.4.4.1 10.4.4.254 netmask 255.255.255.0
ip nat outside source list 1 pool mypool
access-list 1 permit 172.16.18.0 0.0.0.255
ip nat inside source static 192.168.121.33 10.2.2.1 vrf vrf1
ip nat inside source static 192.169.121.33.10.2.2.2 vrf vrf2
```

Example: Configuring Dynamic Translation of Inside Source Addresses

The following example translates between inside hosts addressed from either the 192.168.1.0 or the 192.168.2.0 network to the globally unique 172.31.233.208/28 network:

```
ip nat pool net-208 172.31.233.208 172.31.233.223 prefix-length 9
ip nat inside source list 1 pool net-208
!
interface ethernet 0
 ip address 172.31.232.182 255.255.255.240
 ip nat outside
!
interface ethernet 1
 ip address 192.168.1.94 255.255.255.0
 ip nat inside
!
access-list 1 permit 192.168.1.0 0.0.0.255
access-list 1 permit 192.168.2.0 0.0.0.255
```

The following example translates only traffic local to the provider edge device running NAT (NAT-PE):

```
ip nat inside source list 1 interface e 0 vrf vrf1 overload
ip nat inside source list 1 interface e 0 vrf vrf2 overload
!
```

```
ip route vrf vrf1 0.0.0.0 0.0.0.0 192.168.1.1
ip route vrf vrf2 0.0.0.0 0.0.0.0 192.168.1.1
!
access-list 1 permit 10.1.1.1.0 0.0.0.255
!
ip nat inside source list 1 interface e 1 vrf vrf1 overload
ip nat inside source list 1 interface e 1 vrf vrf2 overload
!
ip route vrf vrf1 0.0.0.0 0.0.0.0 172.16.1.1 global
ip route vrf vrf2 0.0.0.0 0.0.0.0 172.16.1.1 global
access-list 1 permit 10.1.1.0 0.0.0.255
```

Example: Allowing Internal Users Access to the Internet

The following example creates a pool of addresses named net-208. The pool contains addresses from 172.31.233.208 to 172.31.233.233. Access list 1 allows packets having the SA from 192.168.1.0 to 192.168.1.255. If no translation exists, packets matching access list 1 are translated to an address from the pool. The router allows multiple local addresses (192.168.1.0 to 192.168.1.255) to use the same global address. The router retains port numbers to differentiate the connections.

```
ip nat pool net-208 172.31.233.208 172.31.233.233 netmask 255.255.255.240
access-list 1 permit 192.168.1.0 0.0.0.255
ip nat inside source list 1 pool net-208 overload
interface ethernet 1
 ip address 172.31.232.182 255.255.255.240
 ip nat inside
!
interface ethernet 0
 ip address 192.168.1.94 255.255.255.0
 ip nat outside
!
```

Example: Allowing Overlapping Networks to Communicate Using NAT

Example: Configuring Static Translation of Overlapping Networks

```
ip nat inside source static 192.168.121.33 10.2.2.1!
interface ethernet 1
 ip address 10.114.11.39 255.255.255.0
 ip nat inside
!
interface ethernet 0
 ip address 172.16.232.182 255.255.255.240
 ip nat outside
```

Example: Configuring Dynamic Translation of Overlapping Networks

In the following example, the addresses in the local network are being used legitimately by someone else on the Internet. An extra translation is required to access the external network. Pool, net-10 is a pool of outside local IP addresses. The **ip nat outside source list 1 pool** *net-10* command translates the addresses of hosts from the outside overlapping network to addresses in that pool.

```
ip nat pool net-208 172.31.233.208 172.31.233.223 prefix-length 28
ip nat pool net-10 10.0.1.0 10.0.1.255 prefix-length 24
access-list 1 permit 10.114.11.0 0.0.0.255
ip nat inside source list 1 pool net-208
ip nat outside source list 1 pool net-10
!
interface ethernet 1
 ip address 10.114.11.39 255.255.255.0
 ip nat inside
!
```

```
interface ethernet 0
 ip address 172.16.232.182 255.255.255.240
 ip nat outside
```

Example: Configuring the NAT Virtual Interface

Example: Enabling a Dynamic NAT Virtual Interface

```
interface FastEthernet 1
 ip nat enable
!
ip nat pool pool1 192.168.200.225 192.168.200.254 netmask 255.255.255.0 add-route
ip nat source list 1 pool pool1 vrf vrf1
ip nat source list 1 pool 1 vrf vrf2 overload
!
```

Example: Enabling a Static NAT Virtual Interface

```
interface FastEthernet 1
 ip nat enable
!
ip nat source static 192.168.123.1 182.168.125.10 vrf vr1
!
```

Example: Configuring Server TCP Load Balancing

In the following example, the goal is to define a virtual address, connections to which are distributed among a set of real hosts. The pool defines addresses of real hosts. The access list defines the virtual address. If a translation does not already exist, TCP packets from serial interface 0 (the outside interface), whose destination matches the access list, are translated to an address from the pool.

```
ip nat pool real-hosts 192.168.15.2 192.168.15.15 prefix-length 28 type rotary
access-list 2 permit 192.168.15.1
ip nat inside destination list 2 pool real-hosts
interface ethernet 0
 ip address 192.168.15.129 255.255.255.240
 ip nat inside
!
interface serial 0
 ip address 192.168.15.17 255.255.255.240
 ip nat outside
!
```

Example: Enabling Route Maps on Inside Interfaces

```
ip nat inside source static 192.168.201.6 192.168.201.21
!
```

Example: Enabling NAT Route Maps Outside-to-Inside Support

The following example shows how to configure route map A and route map B to allow outside-to-inside translation for a destination-based NAT:

```
ip nat pool POOL-A 192.168.201.4 192.168.201.6 netmask 255.255.255.128
ip nat pool POOL-B 192.168.201.7 192.168.201.9 netmask 255.255.255.128
ip nat inside source route-map MAP-A pool POOL-A reversible
ip nat inside source route-map MAP-B pool POOL-B reversible
```

Example: Configuring NAT Translation of External IP Addresses Only

```
ip nat inside source static network 10.1.1.1 192.168.2510/24 no-payload
ip nat inside source static tcp 10.1.1.1 2000 192.168.1.1 2000 no-payload
ip nat inside source static 10.1.1.1 192.168.1.1 no-payload
ip nat outside source static 10.1.1. 192.168.1.1 no-payload
ip nat outside source static tcp 10.1.1.1 20000 192.168.1.1 20000 no-payload
ip nat outside source static network 10.1.1.1 192.168.251.0/24 no-payload
```

Example: Configuring Support for Users with Static IP Addresses

```
interface ethernet 1
 ip nat inside
!
ip nat allow-static-host
ip nat pool pool1 172.16.0.0 172.16.0.254 netmask 255.255.255.0 accounting WLAN-ACCT
ip nat inside source list 1 pool net-208
access-list 1 deny ip 192.168.196.51
```

Example: Configuring the Rate Limiting NAT Translation Feature

The following example shows how to limit the maximum number of allowed NAT entries to 300:

```
ip nat translation max-entries 300
```

The following example shows how to limit the VRF instance named “vrf1” to 150 NAT entries:

```
ip nat translation max-entries vrf vrf1 150
```

The following example shows how to limit each VRF instance to 200 NAT entries:

```
ip nat translation max-entries all-vrf 200
```

The following example shows how to limit the VRF instance named “vrf2” to 225 NAT entries, but limit all other VRF instances to 100 NAT entries each:

```
ip nat translation max-entries all-vrf 100
ip nat translation max-entries vrf vrf2 225
```

The following example shows how to limit the access control list named “vrf3” to 100 NAT entries:

```
ip nat translation max-entries list vrf3 100
```

The following example shows how to limit the host at IP address 10.0.0.1 to 300 NAT entries:

```
ip nat translation max-entries host 10.0.0.1 300
```

Where to Go Next

- To configure NAT for use with application-level gateways, see the “Using Application Level Gateways with NAT” module.
- To verify, monitor, and maintain NAT, see the “Monitoring and Maintaining NAT” module.
- To integrate NAT with Multiprotocol Label Switching (MPLS) VPNs, see the “Integrating NAT with MPLS VPNs” module.
- To configure NAT for high availability, see the “Configuring NAT for High Availability” module.

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	*Cisco IOS Master Commands List, All Releases*
NAT commands: complete command syntax, command mode command history, defaults, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference*
Application Level Gateways	"Using Application Level Gateways with NAT" module
IP Access List Sequence Numbering	*IP Access List Sequence Numbering* document
NAT on a Stick technology note	*Network Address Translation on a Stick technology note*
NAT maintenance	"Monitoring and Maintaining NAT" module
RADIUS attributes overview	"RADIUS Attributes Overview and RADIUS IETF Attributes" module
Using Hot Standby Router Protocol (HSRP) and Stateful NAT (SNAT) for high availability	"Configuring NAT for High Availability" module
Using NAT with MPLS VPNs	"Integrating NAT with MPLS VPNs" module

Standards and RFCs

Standard/RFC	Title
RFC 1597	*Internet Assigned Numbers Authority*
RFC 1631	*The IP Network Address Translation (NAT)*
RFC 1918	*Address Allocation for Private Internets*
RFC 2663	*IP Network Address Translation (NAT) Terminology and Considerations*
RFC 3022	*Traditional IP Network Address Translation (Traditional NAT)*

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring NAT for IP Address Conservation

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1 Feature Information for Configuring NAT for IP Address Conservation

Feature Name	Releases	Feature Information
NAT Ability to Use Route Maps with Static Translation	12.2.(4)T	The NAT Ability to Use Route Maps with Static Translation feature provides a dynamic translation command that can specify a route map to be processed instead of an access list. A route map allows you to match any combination of the access list, next-hop IP address, and output interface to determine which pool to use. The ability to use route maps with static translations enables NAT multihoming capability with static address translations.
NAT Translation of External IP Addresses Only	12.2(4)T 12.2(4)T2 15.0(1)S	You can use the NAT Translation of External IP Addresses Only feature, NAT can be configured to ignore all embedded IP addresses for any application and traffic type.
Rate Limiting NAT Translation	12.3(4)T 15.0(1)S	The Rate Limiting NAT Translation feature provides the ability to limit the maximum number of concurrent Network Address Translation (NAT) operations on a router. In addition to giving users more control over how NAT addresses are used, the Rate Limiting NAT Translation feature can be used to limit the effects of viruses, worms, and denial-of-service attacks.
NAT RTSP Support Using NBAR	12.3(7)T	The NAT Real Time Streaming Protocol (RTSP) Support Using NBAR feature is a client/server multimedia presentation control protocol that supports multimedia application delivery. Applications that use RTSP include Windows Media Services (WMS) by Microsoft, QuickTime by Apple Computer, and RealSystem G2 by RealNetworks.
NAT Static IP Support	12.3(7)T	The NAT Static IP Support feature provides support for users with static IP addresses, enabling those users to establish an IP session in a public wireless LAN environment.

Feature Name	Releases	Feature Information
NAT Route Maps Outside-to-Inside Support	12.2(33)SXI5 12.3(14)T	The NAT Route Maps Outside-to-Inside Support feature enables the deployment of a NAT route map configuration that allows IP sessions to be initiated from the outside to the inside.
NAT Default Inside Server	12.3(13)T	The NAT Default Inside Server feature enables forwarding of packets from outside to a specified inside local address.
NAT Virtual Interface	12.3(14)T	The NAT Virtual Interface feature removes the requirement to configure an interface as either Network Address Translation (NAT) inside or NAT outside. An interface can be configured to use or not use NAT.
Support for ARP Ping in a Public Wireless LAN	12.4(6)T	The Support for ARP Ping in a Public Wireless LAN feature ensures that the NAT entry and the secure ARP entry from removal when the static IP client exists in the network, where the IP address is unchanged after authentication.
NAT Static and Dynamic Route Map Name-Sharing	15.0(1)M	The NAT Static and Dynamic Route Map Name-Sharing feature provides the ability to configure static and dynamic NAT to share the same route map name, while enforcing precedence of static NAT over dynamic NAT.

Using Application Level Gateways with NAT

This module describes the basic tasks to configure an Application Level Gateway (ALG) with Network Address Translation (NAT). This module also provides information about the protocols that use ALG for IP header translation.

NAT performs translation service on any TCP/UDP traffic that does not carry the source and destination IP addresses in the application data stream. These protocols include HTTP, TFTP, telnet, archie, finger, Network Time Protocol (NTP), Network File System (NFS), remote login (rlogin), remote shell (rsh) protocol, and remote copy (rcp). Specific protocols that do embed IP the address information within the payload require support of an ALG.

NAT with an ALG will translate packets from applications that do not use H.323, as long as the applications use port 1720.

The Support for IPsec ESP Through NAT feature provides the ability to support multiple concurrent IPsec Encapsulating Security Payload (ESP) tunnels or connections through a Cisco IOS NAT device configured in Overload or Port Address Translation (PAT) mode.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Using Application Level Gateways with NAT

- Before performing the tasks in this module, you should be familiar with the concepts described in the "Configuring NAT for IP Address Conservation" module.
- All access lists required for use with the tasks in this module should be configured prior to beginning the configuration task. For information about how to configure an access list, see the "IP Access List Sequence Numbering" document.
- Before performing the tasks in this module, you should verify that the Session Initiation Protocol (SIP) and H.323 are not disabled. SIP and H.323 are enabled by default.

Restrictions for Using Application Level Gateways with NAT

NAT will translate only embedded IP version 4 addresses.

Information About Using Application Level Gateways with NAT

Application Level Gateway

An application level gateway is an application that translates IP address information inside the payload of an applications packet.

Benefits of Configuring NAT ALG

- NAT support for SIP adds the ability to deploy Cisco IOS NAT between VoIP solutions based on SIP.
- Customers can control their IP address scheme and include complete support for H.323 v2 gatekeeper designs.
- NAT enables customers to deploy private IP addresses within their network and perform translation to public IP addresses when connecting to the Internet or interconnecting with another corporate network.
- Normally ESP entries in the translation table are delayed from being transmitted until a reply is received from the destination. With predictable security parameter indexes (SPIs) and SPI matching, the delay can be eliminated because the SPI entries are matched. Some third-party concentrators require both the source and incoming ports to use port 500. Use of the **preserve-port** keyword with the **ip nat service** command preserves the ports rather than changing one, which is required with regular NAT.

IP Security

IPsec is a set of extensions to the IP protocol family in a framework of open standards for ensuring secure private communications over the Internet. Based on standards developed by the IETF, IPsec ensures confidentiality, integrity, and authenticity of data communications across the public network and provides cryptographic security services.

Secure tunnels between two peers, such as two routers, are provided and decisions are made as to which packets are considered sensitive and should be sent through these secure tunnels, and which parameters should be used to protect these sensitive packets by specifying characteristics of these tunnels. When the IPsec peer receives a sensitive packet, it sets up the appropriate secure tunnel and sends the packet through the tunnel to the remote peer.

IPsec using ESP can pass through a router running NAT without any specific support from it as long as Network Address Port Translation (NAPT) or address overloading is not configured.

There are a number of factors to consider when attempting an IPsec VPN connection that traverses a NAPT device that represents multiple private internal IP addresses as a single public external IP address. Such factors include the capabilities of the VPN server and client, the capabilities of the NAPT device, and whether more than one simultaneous connection is attempted across the NAPT device.

There are two possible methods for configuring IPsec on a router with NAPT:

- Encapsulate IPsec in a Layer 4 protocol such as TCP or UDP. In this case, IPsec is *sneaking* through NAT. The NAT device is unaware of the encapsulation.
- Add IPsec specific support to NAPT. IPsec works with NAT in this case as opposed to *sneaking* through NAT. The NAT Support for IPsec ESP-- Phase II feature provides support for Internet Key Exchange (IKE) and ESP without encapsulation in tunnel mode through a Cisco IOS router configured with NAPT.

The recommended protocols to use when conducting IPsec sessions that traverse a NAPT device are TCP and UDP, but not all VPN servers or clients support TCP or UDP.

SPI Matching

Security Parameter Index (SPI) matching is used to establish VPN connections between multiple pairs of destinations. NAT entries will immediately be placed in the translation table for endpoints matching the configured access list. SPI matching is available only for endpoints that choose SPIs according to the predictive algorithm implemented in Cisco IOS Release 12.2(15)T.

Voice and Multimedia over IP Networks

SIP is a protocol developed by the IETF Multiparty Multimedia Session Control (MMUSIC) Working Group. The Cisco SIP functionality equips Cisco routers to signal the setup of voice and multimedia calls over IP networks. SIP provides an alternative to H.323 within the VoIP internetworking software.

Session Description Protocol (SDP) is a protocol that describes multimedia sessions. SDP may be used in SIP message bodies to describe multimedia sessions used for creating and controlling multimedia sessions with two or more participants.

The NAT Support for SIP feature allows SIP embedded messages passing through a router configured with NAT to be translated and encoded back to the packet. An ALG is used with NAT to translate the SIP or SDP messages.

Note By default support for SIP is enabled on port 5060. Therefore, NAT-enabled devices interpret all packets on this port as SIP call messages. If other applications in the system use port 5060 to send packets, the NAT service may corrupt the packet as it attempts to interpret the packet as a SIP call message.

NAT Support of H.323 v2 RAS

Cisco IOS NAT supports all H.225 and H.245 message types, including those sent in the Registration, Admission, and Status (RAS) protocol. RAS provides a number of messages that are used by software clients and VoIP devices to register their location, request assistance in call setup, and control bandwidth. The RAS messages are directed toward an H.323 gatekeeper.

Some RAS messages include IP addressing information in the payload, typically meant to register a user with the gatekeeper or learn about another user already registered. If these messages are not known to NAT, they cannot be translated to an IP address that will be visible to the public.

In Cisco IOS Release 12.2(2)T and later releases, embedded IP addresses can be inspected for potential address translation. Prior to Cisco IOS Release 12.2(2)T, NAT did not support H.323 v2 RAS messages.

NAT Support for H.323 v3 and v4 in v2 Compatibility Mode

H.323 is an ITU-T specification for transmitting audio, video, and data across a packet network. NAT supports four versions of the H.323 protocols: v1, v2, v3, and v4. The NAT Support for H.323 v3 and v4 in v2 Compatibility Mode feature enables Cisco NAT routers to support messages coded in H.323 v3 and v4 when those messages contain fields compatible with H.323 v2. This feature does not add support for H.323 capabilities introduced in v3 and v4, such as new message types or new fields that require address translation.

NAT H.245 Tunneling Support

NAT H.245 tunneling allows H.245 tunneling in H.323 ALGs. NAT H.245 tunneling provides a mechanism for supporting the H.245 tunnel message that is needed to create a media channel setup.

In order for an H.323 call to take place, an H.225 connection on TCP port 1720 needs to be opened. When the H.225 connection is opened, the H.245 session is initiated and established. This connection can take place on a separate channel from the H.225 or it can be done using H.245 tunneling on the same H.225 channel whereby the H.245 messages are embedded in the H.225 messages and sent on the previously established H.225 channel.

If the H.245 tunneled message is not understood, the media address or port will be left untranslated by the Cisco IOS NAT, resulting in failure in media traffic. H.245 FastConnect procedures will not help because FastConnect is terminated as soon as an H.245 tunneled message is sent.

NAT Support of Skinny Client Control Protocol

Cisco IP phones use the SCCP to connect with and register to Cisco CallManager.

To be able to configure Cisco IOS NAT between the IP phone and Cisco CallManager in a scalable environment, NAT needs to be able to detect the SCCP and understand the information passed within the messages. Messages flow back and forth that include IP address and port information used to identify other IP phone users with which a call can be placed.

The SCCP client to Cisco CallManager communication typically flows from inside to outside. Domain Name System (DNS) should be used to resolve the Cisco CallManager IP address connection when the

Cisco CallManager is on the inside (behind the NAT device), or static NAT should be configured to reach the Cisco CallManager in the inside.

When an IP phone attempts to connect to the Cisco CallManager and it matches the configured NAT rules, NAT will translate the original source IP address and replace it with one from the configured pool. This new address will be reflected in the Cisco CallManager and be visible to other IP phone users.

NAT Support of SCCP Fragmentation

Skinny control messages are exchanged over TCP. If either the IP phone or Cisco CallManager has been configured to have a TCP maximum segment size (MSS) lower than the skinny control message payload, the skinny control message will be segmented across multiple TCP segments. Prior to this feature skinny control message exchanges would fail in a TCP segmentation scenario because NAT skinny ALG was not able to reassemble the skinny control messages. The NAT SCCP Fragmentation Support feature adds support for TCP segments for NAT skinny ALG. A fragmented payload that requires an IP or port translation will no longer be dropped.

Skinny control messages can also be IP fragmented but they are supported using Virtual Fragmentation Reassembly (VFR).

In Cisco IOS Release 15.1(3)T and later releases, NAT works with SCCP phones version 17 and higher.

NAT Segmentation with Layer 4 Forwarding

The NAT Segmentation with Layer 4 Forwarding feature is implemented for the H.323, SCCP, and TCP DNS protocols. NAT supports the processing of segmented H.323, SCCP, or TCP DNS messages that are split across multiple packets.

Layer 4 forwarding or TCP proxy is responsible for session handling that includes putting the sequence numbers in order, acknowledging the numbers in a packet, resegmenting the translated packet if it is larger than the MSS, and handling retransmissions in case of packet loss. Layer 4 forwarding also handles out-of-order packets. These packets are buffered and not dropped.

Layer 4 forwarding buffers the received packets and notifies NAT ALG when an in-order packet is available. It also sends acknowledgments to the end hosts for the received packets. Layer 4 forwarding also sends the translated packets that it receives from NAT ALG back into the output packet path.

Restrictions

The NAT Segmentation with Layer 4 Forwarding feature does not work when:

- Cisco IOS firewalls are configured using the **ip inspect name** command. (Zone-based firewalls are supported.)
- H.323, SCCP, or TCP DNS messages are larger than 18 KB.
- Multiprotocol Label Switching (MPLS) is configured.
- NAT and the Cisco CallManager are configured on the same device. In this case, the colocated solution in Call Manager Express (CME) is used.
- NAT Virtual Interface (NVI) is configured.
- Stateful Network Address Translation (SNAT) is enabled.
- The **match-in-vrf** keyword is configured along with the **ip nat inside source** command for packet translation.
- The packets are IPv6 packets.

How to Configure Application Level Gateways with NAT

Configuring IPsec Through NAT

To successfully configure application level gateways with NAT, you should understand the following concepts:

This section contains the following tasks related to configuring IPsec through NAT:

Configuring IPsec ESP Through NAT

IPsec ESP Through NAT provides the ability to support multiple concurrent IPsec ESP tunnels or connections through a Cisco IOS NAT device configured in Overload or PAT mode.

Perform this task to configure IPsec ESP through NAT.

Note IPsec can be configured for any NAT configuration, not just static NAT configurations.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat** [**inside** | **outside**] **source static** *local-ip global-ip* [**vrf** *vrf-name*]
4. **exit**
5. **show ip nat translations**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat** [**inside** | **outside**] **source static** *local-ip global-ip* [**vrf** *vrf-name*] **Example:** `Router(config)# ip nat inside source static 10.10.10.10 192.168.30.30`	Enables static NAT.
Step 4	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.
Step 5	**show ip nat translations** **Example:** `Router# show ip nat translations`	(Optional) Displays active NATs.

Enabling the Preserve Port

This task is used for IPsec traffic using port 500 for the source port. Perform this task to enable port 500 to be preserved for the source port.

Note This task is required by certain VPN concentrators. Cisco VPN devices generally do not use this feature.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat service list** *access-list-number* **IKE preserve-port**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat service list** *access-list-number* **IKE preserve-port** **Example:** `Router(config)# ip nat service list 10 IKE preserve-port`	Specifies IPsec traffic that matches the access list to preserve the port.

Enabling SPI Matching on the NAT Device

Note SPI matching is disabled by default.

Security parameter index (SPI) matching is used to establish VPN connections between multiple pairs of destinations. NAT entries are immediately placed in the translation table for endpoints matching the configured access list. SPI matching is available only for endpoints that choose SPIs according to the predictive algorithm implemented in Cisco IOS Release 12.2(15)T.

The generation of SPIs that are predictable and symmetric is enabled. SPI matching should be used in conjunction with NAT devices when multiple ESP connections across a NAT device are desired.

Cisco IOS software must be running on both the source router and the remote gateway enabling parallel processing.

Note SPI matching must be configured on the NAT device and both endpoint devices.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat service list** *access-list-number* **ESP spi-match**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat service list** *access-list-number* **ESP spi-match** **Example:** `Router(config)# ip nat service list 10 ESP spi-match`	Specifies an access list to enable SPI matching. • This example shows how to enter ESP traffic matching list 10 into the NAT table, making the assumption that both devices are Cisco devices and are configured to provide matchable SPIs.

Enabling SPI Matching on the Endpoints

Cisco IOS XE software must be running on both the source router and the remote gateway enabling parallel processing.

Note SPI matching must be configured on the NAT device and both endpoint devices.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **crypto ipsec nat-transparency spi-matching**
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**crypto ipsec nat-transparency spi-matching** **Example:** `Router(config)# crypto ipsec nat-transparency spi-matching`	Enables SPI matching on both endpoints.
Step 4	**end** **Example:** `Router(config)# end`	Exits global configuration mode and enters privileged EXEC mode.

Enabling MultiPart SDP Support for NAT

The MultiPart SDP Support for NAT feature provides support for multipart SDP in a SIP ALG for the Advanced NAT portfolio. MultiPart SDP support for NAT is disabled by default.

Perform this task to enable multipart SDP support for NAT.

Note NAT will translate only embedded IP version 4 addresses.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat service allow-multipart**
4. **exit**
5. **show ip nat translations**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat service allow-multipart** **Example:** `Router(config)# ip nat service allow-multipart`	Enables multipart SDP.
Step 4	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.
Step 5	**show ip nat translations** **Example:** `Router# show ip nat translations`	(Optional) Displays active NATs.

Configuring NAT Between an IP Phone and Cisco CallManager

This section describes configuring Cisco's Skinny Client Control Protocol (SCCP) for Cisco IP phone to Cisco CallManager communication. The task in this section configures NAT between an IP phone and Cisco CallManager.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat service skinny tcp port** *number*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat service skinny tcp port** *number* **Example:** `Router(config)# ip nat service skinny tcp port 20002`	Configures the skinny protocol on the specified TCP port.

Configuration Examples for Using Application Level Gateways with NAT

Example Configuring IPsec ESP Through NAT

The following example shows NAT configured on the provider edge (PE) router with a static route to the shared service for the vrf1 and vrf2 VPNs. NAT is configured as inside source static 1-to-1 translations.

```
ip nat pool outside 192.0.2.1 192.0.2.14 netmask 255.255.255.0
ip nat outside source list 1 pool mypool
access-list 1 permit 192.0.2.3 0.0.0.255
ip nat inside source static 192.0.2.23 192.0.2.22 vrf vrf1
ip nat inside source static 192.0.2.21 192.0.2.2 vrf vrf2
```

Example Enabling the Preserve Port

The following example shows how to configure TCP port 500 of the third-party concentrator. Access list 10 is configured:

```
ip nat service list 10 IKE preserve-port
access-list 10 permit 10.1.1.1
```

Example Enabling SPI Matching

The following example shows how to enable SPI matching. Access list 10 is configured:

```
ip nat service list 10 ESP spi-match
access-list 10 permit 10.1.1.1
```

Example: Enabling SPI Matching on Endpoint Routers

```
crypto ipsec nat-transparency spi-matching
```

Example Enabling MultiPart SDP Support for NAT

The following example shows how to enable multipart SDP support for NAT:

```
ip nat service allow-multipart
```

Example: Configuring NAT Between an IP Phone and Cisco CallManager

```
ip nat service skinny tcp port 20002
```

Where to Go Next

- To learn about NAT and configure NAT for IP address conservation, see the “Configuring NAT for IP Address Conservation” module.
- To verify monitor, and maintain NAT, see the “Monitoring and Maintaining NAT” module.
- To integrate NAT with MPLS VPNs, see the “Integrating NAT with MPLS VPNs” module.
- To configure NAT for high availability, see the “Configuring NAT for High Availability” module.

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

Related Topic	Document Title
NAT commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference*
IP access list sequence numbering	"IP Access List Sequence Numbering" document

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Using Application Level Gateways with NAT

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2 Feature Information for Using Application Level Gateways with NAT

Feature Name	Releases	Feature Configuration Information
MultiPart SDP Support for NAT	15.0(1)M	The MultiPart SDP Support for NAT feature adds support for multipart SDP in a SIP ALG for the Advanced NAT Portfolio. This feature is disabled by default. The following commands were modified by this feature: **debug ip nat**, **ip nat service**.
NAT H.245 Tunneling Support	12.3(11)T	The NAT H.245 Tunneling Support feature allows H.245 tunneling in H.323 Application Level Gateways (ALGs).
NAT SCCP Fragmentation Support	12.4(6)T 15.1(3)T	The NAT SCCP Fragmentation Support feature adds support for TCP segments for NAT skinny ALG. A fragmented payload that requires an IP or port translation will no longer be dropped. In Cisco IOS Release 15.1(3)T, the NAT Segmentation with Layer 4 Forwarding feature was introduced. The following command was modified by this feature: **debug ip nat**.
NAT Support for H.323 v2 RAS feature	12.2(2)T 15.0(1)S	Cisco IOS NAT supports all H. 225 and H.245 message types, including those sent in the RAS protocol.
NAT Support for H.323 v3 and v4 in v2 Compatibility Mode	12.3(2)T	The NAT Support for H.323 v3 and v4 in v2 Compatibility Mode feature enables Cisco NAT routers to support messages coded in H.323 v3 and v4 when those messages contain fields compatible with H.323 v2. This feature does not add support for H.323 capabilities introduced in v3 and v4, such as new message types or new fields that require address translation.

Feature Name	Releases	Feature Configuration Information
NAT Support for IPsec ESP--Phase II	12.2(15)T	The NAT Support for IPsec ESP-- Phase II feature provides support for Internet Key Exchange (IKE) and ESP without encapsulation in tunnel mode through a Cisco IOS router configured with NAPT.
NAT Support for SIP	12.2(8)T	NAT Support for SIP adds the ability to configure Cisco IOS NAT between VoIP solutions based on SIP.
Support for applications that do not use H.323	12.2(33)XNC	NAT with an ALG will translate packets from applications that do not use H.323, as long as the applications use port 1720.
Support for IPsec ESP Through NAT	12.2(13)T	IPsec ESP through NAT provides the ability to support multiple concurrent IPsec Encapsulating Security Payload (ESP) tunnels or connections through a Cisco IOS Network Address Translation (NAT) device configured in Overload or Port Address Translation (PAT) mode.

Configuring NAT for High Availability

This module contains procedures for configuring Network Address Translation (NAT) to support the increasing need for highly resilient IP networks. This network resiliency is required where application connectivity needs to continue unaffected by failures to links and routers at the NAT border.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring NAT for High Availability

- Before performing the tasks in this module, you should be familiar with the concepts described in the “Configuring NAT for IP Address Conservation” module.
- All access lists required for use with the tasks in this module should be configured prior to beginning the configuration tasks. For information about how to configure an access list, see the “IP Access List Sequence Numbering" document.

Note If you specify an access list to use with a NAT command, NAT does not support the commonly used **permit ip any any** command in the access list.

Restrictions for Configuring NAT for High Availability

- Cisco has announced the End-of-Sale and End-of-Life for the Cisco IOS SNAT. For more information, see the End-of-Sale and End-of-Life Announcement for the Cisco IOS Stateful Failover of Network Address Translation (SNAT) document.
- The Address Resolution Protocol (ARP) queries are always replied to by the Hot Standby Routing Protocol (HSRP) active router. If the active HSRP router fails upstream devices will point to the new HSRP active router and will not have an ARP entry pointing to the original active router, which may no longer be available.

Information About Configuring NAT for High Availability

Stateful NAT

Stateful NAT (SNAT) enables continuous service for dynamically mapped NAT sessions. Sessions that are statically defined receive the benefit of redundancy without the need for SNAT. In the absence of SNAT, sessions that use dynamic NAT mappings would be severed in the event of a critical failure and would have to be reestablished.

SNAT can be used with protocols that do not need payload translation.

NAT Stateful Failover for Asymmetric Outside-to-Inside ALG Support

NAT stateful failover for asymmetric outside-to-inside and Application Layer Gateway (ALG) support improves the ability to handle asymmetric paths by allowing multiple routing paths from outside-to-inside, and per-packet load balancing. This feature also provides seamless failover translated IP sessions with traffic that includes embedded IP addressing such as Voice over IP, FTP, and Domain Name System (DNS) applications.

Interaction with HSRP

SNAT can be configured to operate with the Hot Standby Routing Protocol (HSRP) to provide redundancy. Active and Standby state changes are managed by HSRP.

SNAT applies a more global context to the task of forwarding a particular datagram. Consideration is given to understanding the application state along with forwarding. Devices can take action to avoid potential failures that will have less impact on the flow and to the application that is transmitting data. Multiple NAT routers that share stateful context can work cooperatively and thereby increase service availability.

Translation Group

Two or more network address translators function as a translation group. One member of the group handles traffic requiring translation of IP address information. It also informs the backup translator of active flows as they occur. The backup translator can then use information from the active translator to prepare duplicate translation table entries, and in the event that the active translator is hindered by a critical failure, the traffic can rapidly be switched to the backup. The traffic flow continues since the same network address translations are used, and the state of those translations has been previously defined.

Address Resolution with ARP

A device in IP can have both a local address (which uniquely identifies the device on its local segment or LAN) and a network address (which identifies the network to which the device belongs). The local address is more properly known as a data link address because it is contained in the data link layer (Layer 2 of the OSI model) part of the packet header and is read by data-link devices (bridges and all device interfaces, for example). The local address is referred to as the MAC address, because the MAC sub-layer within the data link layer processes addresses for the layer.

To communicate with a device on Ethernet, for example, the Cisco IOS software first must determine the 48-bit MAC or local data-link address of that device. The process of determining the local data-link address from an IP address is called address resolution. The process of determining the IP address from a local data-link address is called reverse address resolution.

The software uses three forms of address resolution: Address Resolution Protocol (ARP), proxy ARP, and Probe (similar to ARP). The software also uses the Reverse Address Resolution Protocol (RARP). ARP, proxy ARP, and RARP are defined in RFCs 826, 1027, and 903, respectively. Probe is a protocol developed by the Hewlett-Packard Company (HP) for use on IEEE-802.3 networks.

ARP is used to associate IP addresses with media or MAC addresses. Taking an IP address as input, ARP determines the associated media address. Once a media or MAC address is determined, the IP address or media address association is stored in an ARP cache for rapid retrieval. Then the IP datagram is encapsulated in a link-layer frame and sent over the network. Encapsulation of IP datagrams and ARP requests and replies on IEEE 802 networks other than Ethernet is specified by the Subnetwork Access Protocol (SNAP).

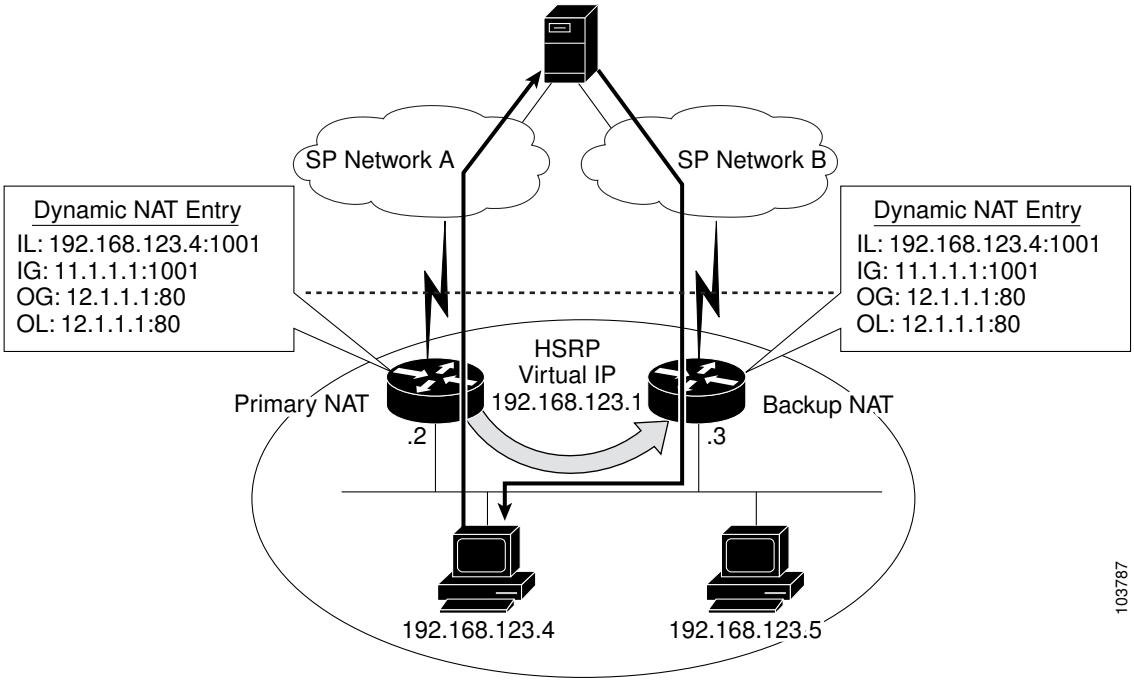
Stateful Failover for Asymmetric Outside-to-Inside Support

Stateful failover for asymmetric outside-to-inside support enables two NAT routers to participate in a primary/backup design. One of the routers is elected as the primary NAT router and a second router acts as the backup router. As traffic is actively translated by the primary NAT router it updates the backup NAT router with the NAT translation state from NAT translation table entries. If the primary NAT router fails or is out of service, the backup NAT router will automatically take over. When the primary comes back into service it will take over and request an update from the backup NAT router. Return traffic is handled by either the primary or the backup NAT translator and NAT translation integrity is preserved.

When the backup NAT router receives asymmetric IP traffic and performs NAT of the packets, it will update the primary NAT router to ensure both the primary and backup NAT translation tables remain synchronized.

The figure below shows a typical configuration that uses the NAT Stateful Failover for Asymmetric Outside-to-Inside and ALG Support feature.

Figure 6 Stateful NAT Asymmetric Outside-to-Inside Support



Stateful Failover for ALGs

The stateful failover embedded addressing enhancement allows the secondary or backup NAT router to properly handle NAT and delivery of IP traffic. NAT inspects all IP traffic entering interfaces that have been configured with the NAT feature. The inspection consists of matching the incoming traffic against a set of translations rules and performs an address translation if a match occurs. The following are examples:

- Matching a source address range
- Matching a specific destination address range
- Matching a list of applications known to NAT that might require a specific source port for control plane negotiation, or embedded source IP addresses within the application protocol

Some of the applications and protocols that embed source port or IP address information include:

- H.323 Registration, Admission, and Status (RAS) Protocol
- DNS queries
- NetMeeting Internet Locator Server (ILS)
- Internet Control Message Protocol (ICMP)
- Simple Mail Transfer Protocol (SMTP)
- Point-to-Point Tunneling Protocol (PPTP)
- Network File System (NFS)

A complete list of current ALG protocols supported by Cisco IOS NAT can be found at

http://www.cisco.com/en/US/tech/tk648/tk361/tech_brief09186a00801af2b9.html

How to Configure NAT for High Availability

Configuring the Stateful Failover of NAT

The NAT Stateful Failover of Network Address Translation feature represents Phase 1 of the stateful failover capability. It introduces support for two or more network address translators to function as a translation group. A backup router running NAT provides translation services in the event the active translator fails. Protocols that do not need payload translations, such as HTTP and telnet, are supported by stateful NAT (SNAT).

This section contains the following procedures:

Restrictions for Configuring Stateful Failover of NAT

The following applications and protocols are not supported in Phase I:

- Application Level Gateway (ALG)
- FTP
- NetMeeting Directory (ILS)
- RAS
- SIP
- Skinny
- TFTP
- Asymmetrical routing

SNAT features are not backward compatible. See "Feature Information for Configuring NAT for High Availability" and “Scalability for Stateful NAT” for information on SNAT features and the releases in which they were introduced.

Configuring SNAT with HSRP

Perform this task to configure Stateful NAT using HSRP to provide router backup facilities.

Note This task must be performed on both the **active** and the **standby** routers.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **standby** [*group-name*] **ip**[*ip-address*[**secondary**]]
5. **exit**
6. **ip nat stateful id** *id-number* {**redundancy** *name* **mapping-id** *map-number*}
7. **ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length*
8. **ip nat inside source** {**route-map** *name* **pool** *pool-name* **mapping-id** *map-number*} [**overload**]
9. **exit**
10. **show ip snat distributed verbose**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 1/1`	Enters interface configuration mode.
Step 4	**standby** [*group-name*] **ip**[*ip-address*[**secondary**]] **Example:** `Router(config-if)# standby SNATHSRP ip 10.1.1.1`	Enables the HSRP protocol.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 6	**ip nat stateful id** *id-number* {**redundancy** *name* **mapping-id** *map-number*} **Example:** `Router(config)# ip nat stateful id 1 redundancy snathsrp mapping-id 10`	Specifies SNAT on routers configured for HSRP.
Step 7	**ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length* **Example:** `Router(config)# ip nat pool snatpool1 10.1.1.1 10.1.1.9 prefix-length 24`	Defines a pool of IP addresses.
Step 8	**ip nat inside source** {**route-map** *name* **pool** *pool-name* **mapping-id** *map-number*} [**overload**] **Example:** `Router(config)# ip nat inside source route-map rm-101 pool snatpool1 mapping-id 10 overload`	Enables stateful NAT for the HSRP translation group.
Step 9	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.
Step 10	**show ip snat distributed verbose** **Example:** `Router# show ip snat distributed verbose`	(Optional) Displays active stateful NAT translations.

Configuring SNAT on the Primary (Active) Router

Perform this task to manually configure your primary SNAT router. When you have completed this task, perform the steps in "Configuring SNAT on the Backup (Standby) Router".

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat stateful id** *id-number* **primary** *ip-address* **peer** *ip-address* **mapping-id** *map-number*
4. **ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length*
5. **ip nat inside source route-map** *name* **pool** *pool-name* **mapping-id** *map-number* [**overload**]
6. **exit**
7. **show ip snat distributed verbose**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat stateful id** *id-number* **primary** *ip-address* **peer** *ip-address* **mapping-id** *map-number* **Example:** `Router(config)# ip nat stateful id 1 primary 10.10.10.10 peer 10.22.22.22 mapping-id 10`	Specifies stateful NAT on the primary router.
Step 4	**ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length* **Example:** `Router(config)# ip nat pool SNATPOOL1 10.1.1.1 10.1.1.9 prefix-length 24`	Defines a pool of IP addresses.
Step 5	**ip nat inside source route-map** *name* **pool** *pool-name* **mapping-id** *map-number* [**overload**] **Example:** `Router(config)# ip nat inside source route-map rm-101 pool snatpool1 mapping-id 10 overload`	Enables stateful NAT for the HSRP translation group.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.
Step 7	**show ip snat distributed verbose** **Example:** `Router# show ip snat distributed verbose`	(Optional) Displays active stateful NAT translations.

Configuring SNAT on the Backup (Standby) Router

Perform this task to manually configure your backup (standby) SNAT router.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat stateful id** *id-number* **backup** *ip-address* **peer** *ip-address* **mapping-id** *map-number*
4. **ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length*
5. **ip nat inside source route-map** *name* **pool** *pool-name* **mapping-id** *map-number* [**overload**]
6. **exit**
7. **show ip snat distributed verbose**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**ip nat stateful id** *id-number* **backup** *ip-address* **peer** *ip-address* **mapping-id** *map-number* **Example:** `Router(config)# ip nat stateful id 1 backup 10.2.2.2 peer 10.10.10.10 mapping-id 10`	Specifies stateful NAT on the backup router.
Step 4	**ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length* **Example:** `Router(config)# ip nat pool SNATPOOL1 10.1.1.1 10.1.1.9 prefix-length 24`	Defines a pool of IP addresses.
Step 5	**ip nat inside source route-map** *name* **pool** *pool-name* **mapping-id** *map-number* [**overload**] **Example:** `Router(config)# ip nat inside source route-map rm-101 pool snatpool1 mapping-id 10 overload`	Enables stateful NAT for the HSRP translation group.
Step 6	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.
Step 7	**show ip snat distributed verbose** **Example:** `Router# show ip snat distributed verbose`	(Optional) Displays active stateful NAT translations.

Configuring NAT Stateful Failover for Asymmetric Outside-to-Inside and ALG Support

Stateful NAT Phase I required all sessions to pass through the primary NAT router that controlled the NAT translation entries unless the primary NAT router was unavailable. This requirement assured integrity of the translation information by guarding against the possibility of some packets relevant to NAT session control from traversing the backup without the primary being aware of it. Without synchronized IP sessions NAT eventually times out the IP session entries and the result is IP session states that are out of sequence.

This section contains the following procedures:

- Prerequisites for Configuring the NAT Stateful Failover for Asymmetric Outside-to-Inside and ALG Support Feature, page 79

Prerequisites for Configuring the NAT Stateful Failover for Asymmetric Outside-to-Inside and ALG Support Feature

Each router must have the same Network Address Translation (NAT) configurations.

The stateful failover asymmetric outside-to-inside enhancement provides the following benefits:

- Ability to support multiple routing paths from outside-to-inside
- Ability to handle per-packet load balancing of asymmetric routing from outside-to-inside

Configuring SNAT with HSRP

To configure your Hot Standby Router Protocol (HSRP) router with Stateful Network Address Translation (SNAT), use the following commands:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **standby** [*group-name]* **ip**[*ip-address*[**secondary**]]
5. **exit**
6. **ip nat stateful id** *ip-address* **redundancy** *group-name* **mapping-id** *map-id*
7. **ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length*
8. **ip nat inside source static route-map** *name* **pool** *pool-name* **mapping-id** *map-id* [**overload**]
9. **ip nat inside destination list** *number* **pool** *name* **mapping-id** *map-id*
10. **ip nat outside source static** *global-ip local-ip* **extendable mapping-id** *map-id*
11. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 1/1`	Enters interface configuration mode.
Step 4	**standby** [*group-name]* **ip**[*ip-address*[**secondary**]] **Example:** `Router(config-if)# standby SNATHSRP ip 11.1.1.1 secondary`	Enables the HSRP protocol.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.
Step 6	**ip nat stateful id** *ip-address* **redundancy** *group-name* **mapping-id** *map-id* **Example:** `Router(config)# ip nat stateful id 1 redundancy snathsrp mapping-id 10`	Specifies SNAT on routers configured for HSRP.
Step 7	**ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length* **Example:** `Router(config)# ip nat pool snatpool1 11.1.1.1 11.1.1.9 prefix-length 24`	Defines a pool of IP addresses.
Step 8	**ip nat inside source static route-map** *name* **pool** *pool-name* **mapping-id** *map-id* [**overload**] **Example:** `Router(config)# ip nat inside source static route-map rm-101 pool snatpool2 mapping-id 10 overload`	Enables stateful NAT for the HSRP translation group.
Step 9	**ip nat inside destination list** *number* **pool** *name* **mapping-id** *map-id* **Example:** `Router(config)# ip nat inside destination list 1 pool snatpool2 mapping-id 10`	Enables the local SNAT router to distribute a particular set of locally created entries to a peer SNAT router.

	Command or Action	Purpose
Step 10	**ip nat outside source static** *global-ip local-ip* **extendable mapping-id** *map-id* **Example:** `Router(config)# ip nat outside source static 1.1.1.1 2.2.2.2 extendable mapping-id 10`	Enables stateful NAT for the HSRP translation group.
Step 11	**end** **Example:** `Router(config)# end`	Exits global configuration mode. • Use the **end** command to save your configuration and leave configuration mode.

Configuring SNAT Primary Backup

Use the following commands to enable the NAT Stateful Failover for Asymmetric Outside-to-Inside and ALG Support feature:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat stateful id** *id-number* **primary** *ip-address* **peer** *ip-address* **mapping-id** *map-id*
4. **ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length*
5. **ip nat inside source static route-map** *name* **pool** *pool-name* **mapping-id** *map-id* [**overload**]
6. **ip nat inside destination list** *number* **pool** *name* **mapping-id** *map-id*
7. **ip nat outside source Static** *global-ip local-ip* **extendable mapping-id** *map-id*
8. **end**

DETAILED STEPS

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

Command or Action	Purpose
Step 3 **ip nat stateful id** *id-number* **primary** *ip-address* **peer** *ip-address* **mapping-id** *map-id* **Example:** `Router(config)# ip nat stateful id 1 primary 1.1.1.1 peer 2.2.2.2 mapping-id 10`	Specifies stateful NAT on the primary router.
Step 4 **ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length* **Example:** `Router(config)# parser config cache interface`	Defines a pool of IP addresses.
Step 5 **ip nat inside source static route-map** *name* **pool** *pool-name* **mapping-id** *map-id* [**overload**] **Example:** `Router(config)# ip nat inside source static route-map rm-101 pool snatpool2 mapping-id 10 overload`	Enables stateful NAT of the inside source address to distribute a particular set of locally created entries to a peer SNAT router.
Step 6 **ip nat inside destination list** *number* **pool** *name* **mapping-id** *map-id* **Example:** `Router(config)# ip nat inside destination list 1 pool snatpool2 mapping-id 10 overload`	Defines the inside destination address that enables the local SNAT router to distribute locally created entries to a peer SNAT router.
Step 7 **ip nat outside source Static** *global-ip local-ip* **extendable mapping-id** *map-id* **Example:** `Router(config)# ip nat outside source static 1.1.1.1 2.2.2.2 extendable mapping-id 10`	Enables stateful NAT of the outside source address to distribute a particular set of locally created entries to a peer SNAT router.
Step 8 **end** **Example:** `Router(config)# end`	Exits global configuration mode. • Use the **end** command to save your configuration and leave configuration mode.

Configuring NAT Static Mapping Support for HSRP

When an Address Resolution Protocol (ARP) query is triggered for an address that is configured with NAT static mapping and owned by the router, NAT responds with the burned in MAC (BIA MAC) address on the interface to which the ARP is pointing. Two routers are acting as HSRP active and standby. Their NAT inside interfaces must be enabled and configured to belong to a group.

Benefits of Configuring Static Mapping Support for HSRP are the following:

- Using static mapping support for HSRP, failover is ensured without having to time out and repopulate upstream ARP caches in a high-availability environment, where HSRP router pairs have identical NAT configuration for redundancy.
- Static mapping support for HSRP allows the option of having only the HSRP active router respond to an incoming ARP for a router configured with a NAT address.

Both of the following tasks are required and must be performed on both the active and standby routers to configure NAT static mapping support for HSRP:

- Restrictions for Configuring Static Mapping Support for HSRP, page 83
- Enabling HSRP on the NAT Interface, page 83
- Enabling Static NAT in an HSRP Environment, page 85

Restrictions for Configuring Static Mapping Support for HSRP

- Configuring static mapping support for HSRP provides NAT support in the presence of HSRP using static mapping configuration only.
- Static NAT mappings must be mirrored on two or more HSRP routers, because NAT state will not be exchanged between the routers running NAT in an HSRP group.
- Behavior will be unpredictable if both HSRP routers have the same static NAT and are not configured with the **hsrp** keyword linking them to the same HSRP group.

Enabling HSRP on the NAT Interface

Perform this task to enable HSRP on the NAT interface of both the active and standby routers.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask*
5. **no ip redirects**
6. **ip nat** {**inside** | **outside**}
7. **standby** [*group-number*] **ip** [*ip-address* [**secondary**]]
8. **standby** [*group-number*] **name** [*group-name*]
9. **end**
10. **show standby**
11. **show ip nat translations** [**verbose**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 1/1`	Enters interface configuration mode.
Step 4	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 192.168.1.27 255.255.255.0`	Sets the primary IP address on the interface.
Step 5	**no ip redirects** **Example:** `Router(config-if)# no ip redirects`	Disables the sending of redirect messages
Step 6	**ip nat** {**inside** | **outside**} **Example:** `Router(config)# ip nat inside`	Marks the interface as connected to the inside or outside.
Step 7	**standby** [*group-number*] **ip** [*ip-address* [**secondary**]] **Example:** `Router(config-if)# standby 10 ip 192.168.5.30`	Enables the HSRP protocol.

	Command or Action	Purpose
Step 8	**standby** [*group-number*] **name** [*group-name*] **Example:** `Router(config-if)# standby 10 name HSRP1`	Sets the HSRP group name.
Step 9	**end** **Example:** `Router(config-if)# exit`	Returns to privileged EXEC mode.
Step 10	**show standby** **Example:** `Router# show standby`	(Optional) Displays HSRP information
Step 11	**show ip nat translations** [**verbose**] **Example:** `Router# show ip nat translations verbose`	(Optional) Displays active NAT translations.

- What to Do Next, page 85

What to Do Next

Go to the next section and enable static NAT in the HSRP environment.

Enabling Static NAT in an HSRP Environment

To enable static mapping support with HRSP for high availability, perform this task on both the active and standby routers.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat inside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name*} [**overload**] | **static** *local-ip global-ip* **redundancy** *group-name*}
4. **ip nat outside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name*} [**overload**] | **static** *local-ip global-ip* **redundancy** *group-name*}
5. **exit**
6. **show ip nat translations** [**verbose**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat inside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name*} [**overload**] | **static** *local-ip global-ip* **redundancy** *group-name*} **Example:** `Router(config)# ip nat inside source static 192.168.5.33 10.10.10.5 redundancy HSRP1`	Enables the router to respond to ARP queries using BIA MAC, if HSRP is configured on the NAT inside interface.
Step 4	**ip nat outside source** {**list** {*access-list-number* | *access-list-name*} **pool** *pool-name*} [**overload**] | **static** *local-ip global-ip* **redundancy** *group-name*} **Example:** `Router(config)# ip nat outside source static 192.168.5.33 10.10.10.5 redundancy HSRP1`	Enables the router to respond to ARP queries using BIA MAC, if HSRP is configured on the NAT outside interface.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Returns to privileged EXEC mode.
Step 6	**show ip nat translations** [**verbose**] **Example:** `Router# show ip nat translations verbose`	(Optional) Displays active NAT translations.

Configuration Example for NAT for High Availability

Examples Configuring Stateful NAT

The following examples show configuring stateful NAT with HSRP and configuring stateful NAT primary and backup routers.

SNAT with HSRP Example

```
ip nat Stateful id 1
redundancy SNATHSRP
mapping-id 10
ip nat pool SNATPOOL1 10.1.1.1 10.1.1.9 prefix-length 24
ip nat inside source route-map rm-101 pool SNATPOOL1 mapping-id 10 overload
ip classless
ip route 10.1.1.0 255.255.255.0 Null0
no ip http server
ip pim bidir-enable
```

Configuring SNAT Primary/Backup Example

```
ip nat Stateful id 1
primary 10.88.194.17
peer 10.88.194.18
mapping-id 10
!
ip nat Stateful id 2
backup 10.88.194.18
peer 10.88.194.17
mapping-id 10
```

Configuration Examples for NAT Stateful Failover for Asymmetric Outside-to-Inside and ALG Support

This section contains the following examples:

Example Configuring SNAT with HSRP

The following example shows how to configure SNAT with HSRP.

```
ip nat Stateful id 1
redundancy SNATHSRP
mapping-id 10
ip nat pool SNATPOOL1 11.1.1.1 11.1.1.9 prefix-length 24
ip nat inside source route-map rm-101 pool SNATPOOL1 mapping-id 10 overload
ip classless
```

```
ip route 11.1.1.0 255.255.255.0 Null0
no ip http server
ip pim bidir-enable
```

Example Configuring SNAT Primary Backup

The following example shows how to configure SNAT on the primary/backup router.

```
ip nat Stateful id 1
primary 10.88.194.17
peer 10.88.194.18
mapping-id 10
!
ip nat Stateful id 2
backup 10.88.194.18
peer 10.88.194.17
mapping-id 10
```

Examples Configuring Static NAT in an HSRP Environment

The following example shows support for NAT with a static configuration in an HSRP environment. Two routers are acting as HSRP active and standby, and the NAT inside interfaces are HSRP enabled and configured to belong to the group HSRP1.

Active Router Configuration

```
interface BVI10
 ip address 192.168.5.54 255.255.255.255.0
 no ip redirects
 ip nat inside
 standby 10 priority 105 preempt
 standby 10 name HSRP1
 standby 10 ip 192.168.5.30
 standby 10 track Ethernet2/1
!
!
 ip default-gateway 10.0.18.126
 ip nat inside source static 192.168.5.33 10.10.10.5 redundancy HSRP1
 ip classless
 ip route 10.10.10.0 255.255.255.0 Ethernet2/1
 ip route 172.22.33.0 255.255.255.0 Ethernet2/1
 no ip http server
```

Standby Router Configuration

```
interface BVI10
 ip address 192.168.5.56 255.255.255.255.0
 no ip redirects
 ip nat inside
 standby 10 priority 100 preempt
 standby 10 name HSRP1
 standby 10 ip 192.168.5.30
 standby 10 track Ethernet3/1
!
 ip default-gateway 10.0.18.126
 ip nat inside source static 192.168.5.33 3.3.3.5 redundancy HSRP1
 ip classless
 ip route 10.0.32.231 255.255.255 Ethernet3/1
 ip route 10.10.10.0 255.255.255.0 Ethernet3/1
 no ip http server
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
NAT commands: complete command syntax, command mode, command history, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference*
IP Access List Sequence Numbering	*IP Access List Sequence Numbering* document
NAT configuration tasks	"Configuring NAT for IP Address Conservation" module
NAT maintenance	"Monitoring and Maintaining NAT" module
Using NAT with MPLS VPNs	"Integrating NAT with MPLS VPNs" module

Standards

Standards	Title
None	

MIBs

MIBs	MIBs Link
• None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
RFC 903	*Reverse Address Resolution Protocol*
RFC 826	*Ethernet Address Resolution Protocol: Or converting network protocol addresses to 48.bit Ethernet address for transmission on Ethernet hardware*
RFC 1027	*Using ARP to implement transparent subnet gateways*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring NAT for High Availability

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 3 Feature Information for Configuring NAT for High Availability

Feature Name	Releases	Feature Configuration Information
NAT Stateful Failover for Asymmetric Outside-to-Inside ALG Support	12.3(7)T	The NAT Stateful Failover for Asymmetric Outside-to-Inside and Application Layer Gateway (ALG) Support feature improves the ability to handle asymmetric paths by allowing multiple routing paths from outside-to-inside, and per-packet load balancing. This feature also provides seamless failover translated IP sessions with traffic that includes embedded IP addressing such as Voice over IP, FTP, and Domain Name System (DNS) applications.

Feature Name	Releases	Feature Configuration Information
NAT Stateful Failover of Network Address Translation	12.2(13)T	The NAT Stateful Failover of Network Address Translation feature represents Phase 1 of the stateful failover capability. It introduces support for two or more network address translators to function as a translation group.
NAT--Static Mapping Support with HSRP for High Availability	12.2(4)T 12.2(4)T2 Cisco IOS XE Release 2.1	Static mapping support for HSRP allows the option of having only the HSRP active router respond to an incoming ARP for a router configured with a NAT address.

Scalability for Stateful NAT

The Scalability for Stateful NAT feature allows Stateful Network Address Translation (SNAT) to control the Hot Standby Router Protocol (HSRP) state change until the NAT information is completely exchanged. The ability to change the default TCP mode to User Datagram Protocol (UDP) mode, and the ability to disable asymmetric queuing have been added. When UDP mode is used, SNAT will send messages over UDP mode using a proprietary acknowledgement/retransmit mechanism.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for the Scalability for Stateful NAT Feature

The Scalability for Stateful NAT feature is not available in Primary/Backup mode.

SNAT features are not backward compatible. See “Configuring NAT for High Availability” for information on SNAT features introduced in other releases of Cisco IOS software.

Information About Scalability for Stateful NAT

SNAT Feature Design

Two or more Network Address Translators function as a translation group. One member of the group handles traffic requiring translation of IP address information. It also informs the backup translator of active flows as they occur. The backup translator can then use information from the active translator to prepare duplicate translation table entries, and in the event that the active translator is hindered by a critical failure, the traffic can rapidly be switched to the backup. The traffic flow continues since the same network address translations are used, and the state of those translations has been previously defined.

Only sessions that are statically defined already receive the benefit of redundancy without the need for this feature. In the absence of SNAT, sessions that use dynamic NAT mappings would be severed in the event of a critical failure and would have to be reestablished. Stateful NAT enables continuous service for dynamically mapped NAT sessions.

SNAT can be configured to operate with HSRP to provide redundancy and the active and standby state changes are managed by HSRP.

Benefits of SNAT Scalability

This feature enables SNAT control of the HSRP state change until the NAT information is completely exchanged.

- The TCP default transport mode can be switched to UDP mode with acknowledgement/retransmit support.
- Queuing during asymmetric routing can be disabled to avoid delay in the data path for the creation of new entries and traffic on special ports (Application Layer Gateway (ALG) support).

How to Configure SNAT in HSRP Mode

- Configuring SNAT in HSRP Mode, page 94

Configuring SNAT in HSRP Mode

Perform this task to configure an HSRP router with SNAT.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface ethernet** *interface-number port-number*
4. **standby** *group-name* **ip** [*ip-address*[**secondary**]]
5. **standby delay reload** *seconds*
6. **standby** *group-number* **preempt delay minimum** *seconds* **reload** *seconds* **sync** *seconds*
7. **exit**
8. **ip nat stateful id** *id-number* **redundancy** *name* **mapping-id** *map-number* [**protocol udp**] [**as-queuing disable**]
9. **ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length*
10. **ip nat inside source route-map** *name* **pool** *pool-name* **mapping-id** *map-number* [**overload**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface ethernet** *interface-number port-number* **Example:** `Router(config)# interface ethernet 1/1`	Enters interface configuration mode.
Step 4	**standby** *group-name* **ip** [*ip-address*[**secondary**]] **Example:** `Router(config-if)# standby SNATHSRP ip 10.1.1.1 secondary`	Enables the HSRP protocol.
Step 5	**standby delay reload** *seconds* **Example:** `Router(config-if)# standby delay reload 60`	This command must be configured in order for SNAT to control HSRP state change until NAT information is completely exchanged.
Step 6	**standby** *group-number* **preempt delay minimum** *seconds* **reload** *seconds* **sync** *seconds* **Example:** `Router(config-if)# standby 1 preempt delay minimum 60 reload 60 sync 60`	This command must be configured in order for SNAT to control HSRP state change until NAT information is completely exchanged.
Step 7	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 8	**ip nat stateful id** *id-number* **redundancy** *name* **mapping-id** *map-number* [**protocol udp**] [**as-queuing disable**] **Example:** `Router(config)# ip nat stateful id 1 redundancy snathsrp mapping-id 10 protocol udp as-queuing disable`	Specifies SNAT on routers configured for HSRP. The optional UDP protocol and disabling of asymmetic queuing is also configured.
Step 9	**ip nat pool** *name start-ip end-ip* **prefix-length** *prefix-length* **Example:** `Router(config)# ip nat pool snatpool1 10.1.1.1 10.1.1.9 prefix-length 24`	Defines a pool of IP addresses.
Step 10	**ip nat inside source route-map** *name* **pool** *pool-name* **mapping-id** *map-number* [**overload**] **Example:** `Router(config)# ip nat inside source route-map rm-101 pool snatpool1 mapping-id 10 overload`	Enables stateful NAT for the HSRP translation group.

Configuration Examples for SNAT in HSRP Mode

Configuring SNAT in HSRP Mode Example

The following example shows how to configure SNAT in HSRP mode with asymmetric queuing disabled and UDP enabled:

```
!
standby delay minimum 30 reload 60
standby 1 ip 10.1.1.1
standby 1 name SNATHSRP
standby 1 preempt delay minimum 60 reload 60 sync 60
!
ip nat Stateful id 1
redundancy SNATHSRP
mapping-id 10
as-queuing disable
protocol udp
ip nat pool SNATPOOL1 10.1.1.1 10.1.1.9 prefix-length 24
ip nat inside source route-map rm-101 pool SNATPOOL1 mapping-id 10 overload
ip classless
ip route 10.1.1.0 255.255.255.0 Null0
no ip http server
ip pim bidir-enable
```

Additional References

Related Documents

Related Topic	Document Title
Using HSRP and SNAT for high availability configuration tasks	"Configuring NAT for High Availability" module
NAT commands: complete command syntax, command mode command history, defaults, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference*

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Scalability for Stateful NAT

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 4 Feature Information for <Phrase Based on Module Title>

Feature Name	Releases	Feature Information
Scalability for Stateful NAT	12.4(3) 12.4(4)T	The Scalability for Stateful NAT feature allows Stateful Network Address Translation (SNAT) to control the Hot Standby Router Protocol (HSRP) state change until the NAT information is completely exchanged. The ability to change the default TCP mode to User Datagram Protocol (UDP) mode, and the ability to disable asymmetric queuing have been added. When UDP mode is used, SNAT will send messages over UDP mode using a proprietary acknowledgement/ retransmit mechanism.

Integrating NAT with MPLS VPNs

Network Address Translation (NAT) Integration with MPLS VPNs feature allows multiple Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) to be configured on a single device to work together. NAT can differentiate which MPLS VPN it receives IP traffic from even if the MPLS VPNs are all using the same IP addressing scheme. This enhancement enables multiple MPLS VPN customers to share services while ensuring that each MPLS VPN is completely separate from the other.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Integrating NAT with MPLS VPNs

- Before performing the tasks in this module, you should be familiar with the concepts described in the "Configuring NAT for IP Address Conservation" module.
- All access lists required for use with the tasks in this module should be configured prior to beginning the configuration task. For information about how to configure an access list, see the *IP Access List Sequence Numbering* document at the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/fsaclseq.htm

Note If you specify an access list to use with a NAT command, NAT does not support the commonly used **permit ip any any** command in the access list.

Restrictions for Integrating NAT with MPLS VPNs

Inside VPN to VPN with NAT is not supported.

Information About Integrating NAT with MPLS VPNs

Benefits of NAT Integration with MPLS VPNs

MPLS service providers would like to provide value-added services such as Internet connectivity, domain name servers (DNS), and voice over IP (VoIP) service to their customers. The providers require that their customers; IP addresses be different when reaching the services. Because MPLS VPN allows customers to use overlapped IP addresses in their networks, NAT must be implemented to make the services possible.

Implementation Options for Integrating Nat with MPLS VPNs

There are two approaches to implementing NAT in the MPLS VPN network. NAT can be implemented on the customer edge (CE) router, which is already supported by NAT, or it can be implemented on a provider edge (PE) router. The NAT Integration with MPLS VPNs feature enables the implementation of NAT on a PE router in an MPLS cloud.

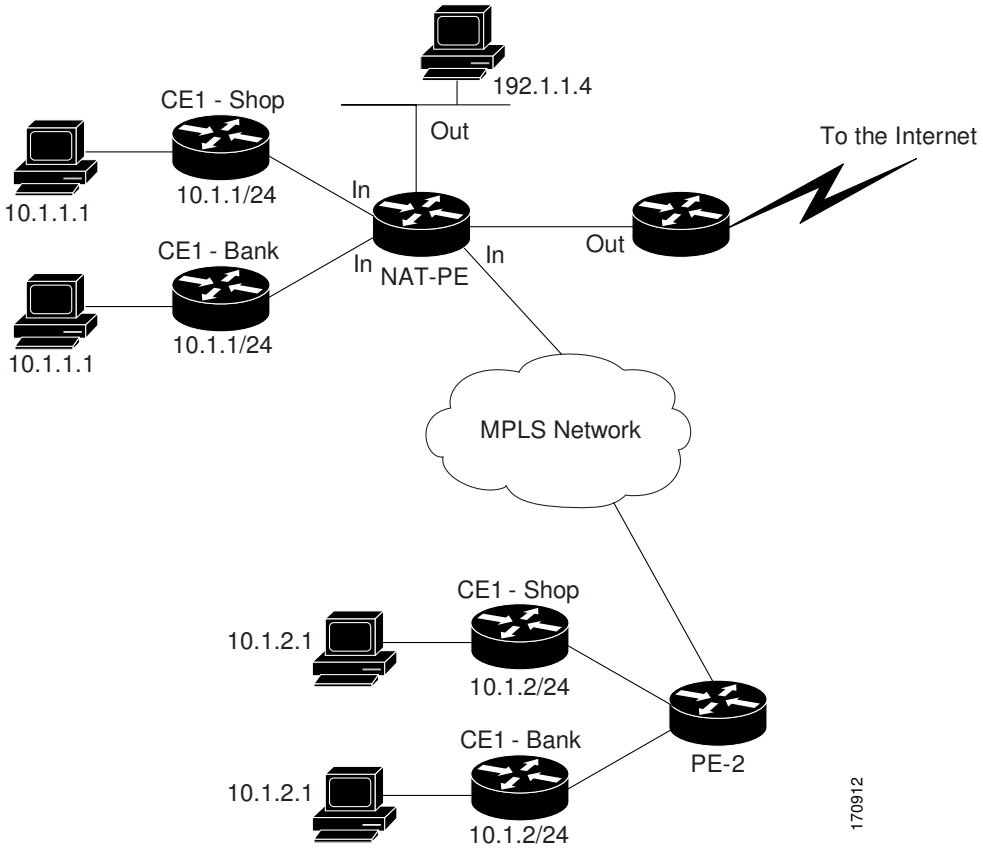
Scenarios for Implementing NAT on the PE Router

NAT could be implemented on the PE router in the following scenarios:

- Service point--Shared access can be from a generic interface or from a VPN interface.
- NAT point--NAT can be configured on the PE router that is directly connected to the shared access gateway, or on the PE router that is not directly connected to the shared access gateway.
- NAT interface--The shared access gateway interface most often is configured as the outside interface of NAT. The inside interface of NAT can be either the PE-CE interface of a VPN, the interface to the MPLS backbone, or both. The shared access gateway interface can also be configured as the inside interface.
- Routing type--Common service can be Internet connectivity or a common server. For Internet connectivity, a default route should be propagated to all the VPN customers that use the service. For common server access, a static or dynamically learned route should be propagated to the VPN customers.
- NAT configuration--NAT can have different configurations: static, dynamic, pool/interface overloading, and route-map.

The figure below shows a typical NAT integration with MPLS VPNs. The PE router connected to the internet and centralized mail service is employed to do the address translation.

Figure 7 Typical NAT Integration with MPLS VPNs



How to Integrate NAT with MPLS VPNs

Perform one or more of the following tasks depending on the type of translation you wish to configure for your network:

- Configuring Inside Dynamic NAT with MPLS VPNs, page 101
- Configuring Inside Static NAT with MPLS VPNs, page 103
- Configuring Outside Dynamic NAT with MPLS VPNs, page 105
- Configuring Outside Static NAT with MPLS VPNs, page 106

Configuring Inside Dynamic NAT with MPLS VPNs

Perform this task to configure your NAT PE router for dynamic translations to integrate with MPLS VPNs.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat pool** *name start-ip end-ip* **netmask** *netmask*
4. **ip nat** [**inside** | **outside**] **source** [**list** {*access-list-number* | *access-list-name*} | **route-map** *name*] [**interface** *type number* | **pool** *pool-name*] **vrf** *vrf-name*[**overload**]
5. Repeat Step 4 for each VPN being configured
6. **ip route vrf** *vrf-name prefix mask interface-type interface-number next-hop-address*
7. Repeat Step 6 for each VPN being configured.
8. **exit**
9. **show ip nat translations vrf** *vrf-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat pool** *name start-ip end-ip* **netmask** *netmask* **Example:** `Router(config)# ip nat pool inside 2.2.2.10 2.2.2.10 netmask 255.255.255.0`	Defines a pool of IP addresses for NAT.
Step 4	**ip nat** [**inside** | **outside**] **source** [**list** {*access-list-number* | *access-list-name*} | **route-map** *name*] [**interface** *type number* | **pool** *pool-name*] **vrf** *vrf-name*[**overload**] **Example:** `Router(config)# ip nat inside source list 1 pool mypool vrf shop overload`	Allows NAT to be configured on a particular VPN.
Step 5	Repeat Step 4 for each VPN being configured	--

	Command or Action	Purpose

Step 6	**ip route vrf** *vrf-name prefix mask interface-type interface-number next-hop-address*
	
	Example:
	`Router(config)#`
	`ip route vrf shop 0.0.0.0 0.0.0.0 ethernet 0 168.58.88.2`
		Allows NAT to be configured on a particular VPN.

Step 7	Repeat Step 6 for each VPN being configured.	--
Step 8	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.
Step 9	**show ip nat translations vrf** *vrf-name* **Example:** `Router# show ip nat translations vrf shop`	(Optional) Displays the settings used by virtual routing/forwarding (VRF) table translations.

Configuring Inside Static NAT with MPLS VPNs

Perform this task to configure your NAT PE router for static translations to integrate with MPLS VPNs.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat inside source** {**static** {**esp** *local-ip* **interface** *type number* | *local-ip global-ip*}} [**extendable** | **mapping-id** *map-id*| **no-alias** | **no-payload** | **redundancy** *group-name* | **route-map** | **vrf** *name*]
4. Repeat Step 3 for each VPN being configured.
5. **ip route vrf** *vrf-name* **prefix** *prefix mask next-hop-address* **global**
6. Repeat Step 5 for each VPN being configured.
7. **exit**
8. **show ip nat translations vrf** *vrf-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Step 3	**ip nat inside source** {**static** {**esp** *local-ip* **interface** *type number* | *local-ip global-ip*}} [**extendable** | **mapping-id** *map-id*| **no-alias** | **no-payload** | **redundancy** *group-name* | **route-map** | **vrf** *name*]
	
	Example:
	`Router(config)#`
	`ip nat inside source static 192.168.121.113 2.2.2.1 vrf shop`
		Enables inside static translation on the VRF.

Step 4	Repeat Step 3 for each VPN being configured.	--

Step 5	**ip route vrf** *vrf-name* **prefix** *prefix mask next-hop-address* **global**
	
	Example:
	`Router(config)#`
	`ip route vrf shop 0.0.0.0 0.0.0.0 168.58.88.2 global`
		Allows the route to be shared by several customers.

Step 6	Repeat Step 5 for each VPN being configured.	--
Step 7	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.
Step 8	**show ip nat translations vrf** *vrf-name* **Example:** `Router# show ip nat translations vrf shop`	(Optional) Displays the settings used by VRF translations.

Configuring Outside Dynamic NAT with MPLS VPNs

Perform this step to configure your NAT PE router for dynamic outside translations to integrate with MPLS VPNs.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat pool outside** *global-ip local-ip* **netmask** *netmask*
4. **ip nat inside source static** *local-ip global-ip* **vrf** *vrf-name*
5. Repeat Step 4 for each VRF being configured.
6. **ip nat outside source static** *global-ip local-ip* **vrf** *vrf-name*
7. **exit**
8. **show ip nat translations vrf** *vrf-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Step 3	**ip nat pool outside** *global-ip local-ip* **netmask** *netmask*
	
	Example:
	`Router(config)#`
	`ip nat pool outside 4.4.4.1 4.4.4.254 netmask 255.255.255.00`
		Allows the configured VRF to be associated with the NAT translation rule.

Step 4	**ip nat inside source static** *local-ip global-ip* **vrf** *vrf-name*
	
	Example:
	`Router(config)#`
	`ip nat inside source static 192.168.121.113 2.2.2.1 vrf shop`
		Allows the route to be shared by several customers.

Step 5	Repeat Step 4 for each VRF being configured.	Allows the route to be shared by several customers.

	Command or Action	Purpose

Step 6	**ip nat outside source static** *global-ip local-ip* **vrf** *vrf-name*
	
	Example:
	
	`Router(config)#`
	`ip nat outside source static 168.58.88.2 4.4.4.1 vrf shop`
		Enables NAT translation of the outside source address.

Step 7	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.
Step 8	**show ip nat translations vrf** *vrf-name* **Example:** `Router# show ip nat translations vrf shop`	(Optional) Displays the settings used by VRF translations.

Configuring Outside Static NAT with MPLS VPNs

Perform this task to configure your NAT PE router for static outside translations to integrate with MPLS VPNs.

SUMMARY STEPS

1. **enable**
2. **configure** {**terminal** | **memory** | **network**}
3. **ip nat pool inside** *global-ip local-ip* **netmask** *netmask*
4. Repeat Step 3 for each pool being configured.
5. **ip nat inside source list** *access-list-number* **pool** *pool-name* **vrf** *vrf-name*
6. Repeat Step 5 for each pool being configured.
7. **ip nat outside source static** *global-ip local-ip* vrf *vrf-name*
8. Repeat Step 7 for all VPNs being configured.
9. **exit**
10. **show ip nat translations vrf** *vrf-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure** {**terminal** | **memory** | **network**} **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat pool inside** *global-ip local-ip* **netmask** *netmask* **Example:** `Router(config)# ip nat pool inside1 2.2.1.1 2.2.1.254 netmask 255.255.255.0`	Allows the configured VRF to be associated with the NAT translation rule.
Step 4	Repeat Step 3 for each pool being configured.	--

Step 5	**ip nat inside source list** *access-list-number* **pool** *pool-name* **vrf** *vrf-name*
	
	Example:
	`Router(config)#`
	`ip nat inside source list 1 pool inside2 vrf shop`
		Allows the route to be shared by several customers.

Step 6	Repeat Step 5 for each pool being configured.	Defines the access list.

Step 7	**ip nat outside source static** *global-ip local-ip* vrf *vrf-name*
	
	Example:
	`Router(config)#`
	`ip nat outside source static 168.58.88.2 4.4.4.1 vrf shop`
		Allows the route to be shared by several customers.

Step 8	Repeat Step 7 for all VPNs being configured.	--
Step 9	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.

Command or Action	Purpose
Step 10 **show ip nat translations vrf** *vrf-name* **Example:** `Router# show ip nat translations vrf shop`	(Optional) Displays the settings used by VRF translations.

Configuration Examples for Integrating NAT with MPLS VPNs

Configuring Inside Dynamic NAT with MPLS VPNs Example

The following example shows configuring inside Dynamic NAT with MPLS VPNs.

```
!
ip nat pool inside 2.2.2.10 2.2.2.10 netmask 255.255.255.0
ip nat inside source list 1 pool inside vrf bank overload
ip nat inside source list 1 pool inside vrf park overload
ip nat inside source list 1 pool inside vrf shop overload
!
ip route vrf shop 0.0.0.0 0.0.0.0 Ethernet1/3 168.58.88.2
ip route vrf bank 0.0.0.0 0.0.0.0 Ethernet1/3 168.58.88.2
ip route vrf park 0.0.0.0 0.0.0.0 Ethernet1/3 168.58.88.2
!
access-list 1 permit 192.168.0.0 0.0.255.255
```

Configuring Inside Static NAT with MPLS VPNs Example

The following example shows configuring inside static NAT with MPLS VPNs.

```
!
ip nat inside source static 192.168.121.113 2.2.2.1 vrf shop
ip nat inside source static 192.168.122.49 2.2.2.2 vrf shop
ip nat inside source static 192.168.121.113 2.2.2.3 vrf bank
ip nat inside source static 192.168.22.49 2.2.2.4 vrf bank
ip nat inside source static 192.168.121.113 2.2.2.5 vrf park
ip nat inside source static 192.168.22.49 2.2.2.6 vrf park
ip nat inside source static 192.168.11.1 2.2.2.11 vrf shop
ip nat inside source static 192.168.11.3 2.2.2.12 vrf shop
ip nat inside source static 140.48.5.20 2.2.2.13 vrf shop
!
ip route 2.2.2.1 255.255.255.255 Ethernet1/0 192.168.121.113
ip route 2.2.2.2 255.255.255.255 Ethernet1/0 192.168.121.113
ip route 2.2.2.3 255.255.255.255 Serial2/1.1 192.168.121.113
ip route 2.2.2.4 255.255.255.255 Serial2/1.1 192.168.121.113
ip route 2.2.2.5 255.255.255.255 FastEthernet0/0 192.168.121.113
ip route 2.2.2.6 255.255.255.255 FastEthernet0/0 192.168.121.113
ip route 2.2.2.11 255.255.255.255 Ethernet1/0 192.168.121.113
ip route 2.2.2.12 255.255.255.255 Ethernet1/0 192.168.121.113
ip route 2.2.2.13 255.255.255.255 Ethernet1/0 192.168.121.113
```

Configuring Outside Dynamic NAT with MPLS VPNs Example

The following example shows configuring outside dynamic NAT with MPLS VPNs.

```
!
ip nat pool outside 4.4.4.1 4.4.4.254 netmask 255.255.255.0
ip nat inside source static 192.168.121.113 2.2.2.1 vrf shop
ip nat inside source static 192.168.122.49 2.2.2.2 vrf shop
ip nat inside source static 192.168.121.113 2.2.2.3 vrf bank
ip nat inside source static 192.168.22.49 2.2.2.4 vrf bank
ip nat inside source static 192.168.121.113 2.2.2.5 vrf park
ip nat inside source static 192.168.22.49 2.2.2.6 vrf park
ip nat outside source list 1 pool outside
!
```

Configuring Outside Static NAT with MPLS VPNs Example

The following example shows configuring outside static NAT with MPLS VPNs.

```
!
ip default-gateway 10.1.15.1
ip nat pool inside1 2.2.1.1 2.2.1.254 netmask 255.255.255.0
ip nat pool inside2 2.2.2.1 2.2.2.254 netmask 255.255.255.0
ip nat pool inside3 2.2.3.1 2.2.3.254 netmask 255.255.255.0
ip nat inside source list 1 pool inside2 vrf bank
ip nat inside source list 1 pool inside3 vrf park
ip nat inside source list 1 pool inside1 vrf shop
ip nat outside source static 168.58.88.2 4.4.4.1 vrf bank
ip nat outside source static 18.68.58.1 4.4.4.2 vrf park
ip nat outside source static 168.58.88.1 4.4.4.3 vrf shop
ip classless
ip route 192.170.10.0 255.255.255.0 Ethernet1/0 192.168.121.113
ip route 192.170.11.0 255.255.255.0 Serial2/1.1 192.168.121.113
ip route 192.170.12.0 255.255.255.0 FastEthernet0/0 192.168.121.113
ip route vrf shop 0.0.0.0 0.0.0.0 168.58.88.2 global
ip route vrf bank 0.0.0.0 0.0.0.0 168.58.88.2 global
ip route vrf park 0.0.0.0 0.0.0.0 168.58.88.2 global
no ip http server
!
access-list 1 permit 192.168.0.0 0.0.255.255
```

Where to Go Next

- To learn about Network Address Translation and configure NAT for IP address conservation, see the "Configuring NAT for IP Address Conservation" module.
- To verify, monitor, and maintain NAT, see the "Monitoring and Maintaining NAT" module.
- To use NAT with application level gateways, see the "Using Application Level Gateways with NAT" module.
- To configure NAT for high availability, see the "Configuring NAT for High Availability" module.

Additional References

Related Documents

Related Topic	Document Title
NAT commands: complete command syntax, command mode, command history, defaults, usage guidelines and examples	*Cisco IOS IP Addressing Services Command Reference*
NAT high availability	"Configuring NAT for High Availability" module
Application Level Gateways	"Using Application Level Gateways with NAT"
Maintain and monitor NAT	"Monitoring and Maintaining NAT" module
IP Address Conservation	"Configuring NAT for IP Address Conservation" module

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
• None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs[1]	Title
RFC 2547	*BGP/MPLS VPNs*

1 Not all supported RFCs are listed.

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Integrating NAT with MPLS VPNs

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 5 Feature Information for Integrating NAT with MPLS VPNs

Feature Name	Releases	Feature Configuration Information
Network Address Translation (NAT) Integration with MPLS VPNs feature	12.1(13)T	This feature allows multiple Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) to be configured on a single device to work together.

Configuring Hosted NAT Traversal for Session Border Controller

The Cisco IOS Hosted NAT Traversal for Session Border Controller Phase-1 feature enables a Cisco IOS Network Address Translation (NAT) Session Initiation Protocol (SIP) Application Level Gateway (ALG) router to act as a Session Border Controller (SBC) on a Cisco Multiservice IP-to-IP gateway, ensuring a seamless delivery of VoIP services.

The Cisco IOS Hosted NAT Traversal for Session Border Controller Phase-2 feature provides registration throttling, media flow-through, and Stateful NAT (SNAT) support.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring Cisco IOS Hosted NAT Traversal for Session Border Controller

- Before you configure the Cisco IOS Hosted NAT Traversal for Session Border Controller feature, you should understand the concepts documented in "Cisco IOS Hosted NAT Traversal for Session Border Controller Overview" section.
- All access lists required for use with the tasks in this module should be configured prior to beginning the configuration task. For information about how to configure an access list, see the "Creating an IP Access List and Applying It to an Interface" module in the *Securing the Data Plane Configuration Guide*.
- Before performing the tasks in this module, you should verify that SIP has not been disabled. SIP is enabled by default.

Restrictions for Configuring Cisco IOS Hosted NAT Traversal for Session Border Controller

- Phase 1 supports flow-around mode for inside to inside media calls and flow-through for inside to outside media calls.
- If the intermediate routers between the inside phones and the NAT SBC are configured for Port Address Translation (PAT), the user agents (phones and proxy) must support symmetric signaling and symmetric and early media. The override port must be configured on the NAT SBC router. In the absence of support for symmetric signaling and symmetric and early media, the intermediate routers must be configured for non-PAT and the override address should be configured in the NAT SBC.

Information About Configuring Cisco IOS Hosted NAT Traversal for Session Border Controller

Voice and Multimedia over IP Networks

SIP is a protocol developed by the IETF Multiparty Multimedia Session Control (MMUSIC) Working Group. The Cisco SIP functionality equips Cisco routers to signal the setup of voice and multimedia calls over IP networks. SIP provides an alternative to the H.323 protocol within the VoIP internetworking software.

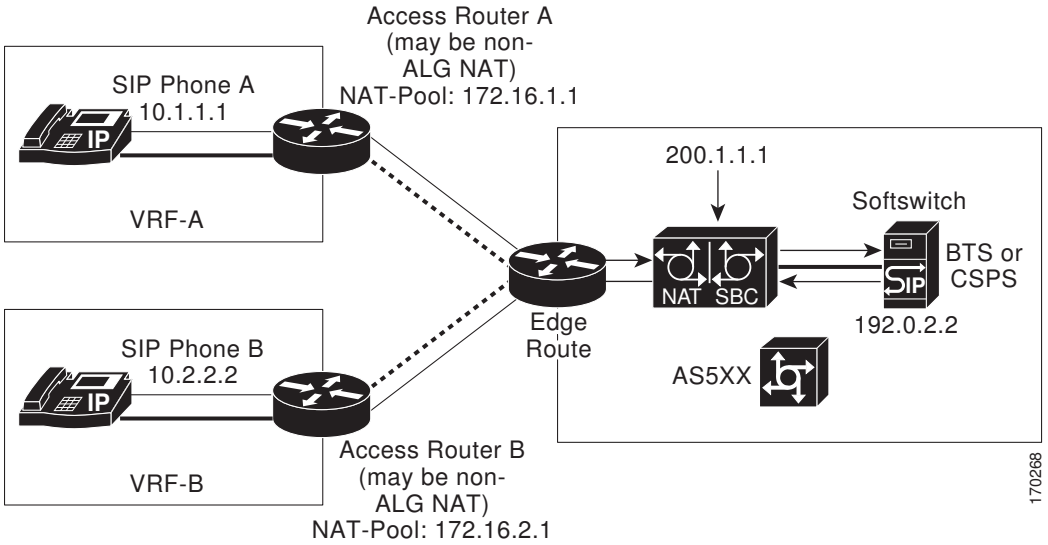
Session Description Protocol (SDP) describes multimedia sessions. SDP may be used in SIP message bodies to describe the multimedia sessions that are used for creating and controlling the multimedia sessions with two or more participants.

Cisco IOS Hosted NAT Traversal for Session Border Controller Overview

Private IP addresses and ports inserted in the packet payload by client devices, such as IP phones and video conferencing stations, are not routable in public networks using NAT. In addition, intermediate routers between the inside phones and the NAT SBC can have the non-ALG functionality. The hosted NAT traversal handles the signaling and the media streams involved in the setting up, conducting, and tearing down of calls that traverse these intermediate routers.

The figure below illustrates how the NAT SBC handles embedded SIP/SDP information for the address and port allocation by differentiating the overlapped embedded information.

Figure 8 NAT as a SIP Session Border Controller



The inside phones have the proxy configured as the NAT SBC's preconfigured address and port. NAT SBC has the Softswitch's address and port preconfigured as the proxy. The NAT SBC intercepts the packets destined from the inside phones to itself and translates the inside hosts and other information in the SIP/SDP payload and the IP/UDP destination address or port to the Softswitch's address and port, and vice versa.

SIP/SDP information is either a NAT or a PAT in order for the Real-Time Transport Protocol (RTP) flow to be directly between the phones in the NAT SBC inside domain.

The address-only fields are not translated by the NAT SIP ALG. The address-only fields are handled by the NAT SBC, except for the proxy-authorization and authorization translation, because these will break the authentication.

If the intermediate routers between the inside phones and the NAT SBC are configured to do a PAT, the user agents (phones and proxy) must support symmetric signaling and symmetric and early media. You must configure the override port on the NAT SBC router. In the absence of support for symmetric signaling and symmetric and early media, the intermediate routers must be configured without PAT and the override address should be configured in the NAT SBC.

The registration throttling support enables you to define the parameters in the Expires: header and the expires= parameter. It allows you to elect to not forward certain registration messages to the Softswitch.

How to Configure Cisco IOS Hosted NAT for Session Border Controller

Configuring Cisco IOS Hosted NAT for Session Border Controller

Perform this task to configure NAT for SBC.

Note When you use the NAT SBC feature and you want the call IDs to be translated, you must configure two address pools in such a way that the pool for SBC is accessed before the pool for the call IDs. Use the **ip nat pool** command to configure the address pools. Access lists are chosen in ascending order, so you should assign the list associated with the SBC pool a lower number than the list associated with the call ID pool.

Note The proxy of the inside phones must be set to 200.1.1.1. The VPN routing and forwarding (VRF) instance configuration as shown is optional.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip nat inside**
5. **exit**
6. **interface** *type number*
7. **ip nat outside**
8. **exit**
9. **ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*}
10. **ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*}
11. **ip nat inside source list** *access-list-number* **pool** *name* [**vrf** *vrf-name*] [**overload**]
12. **ip nat outside source list** *access-list-number* **pool** *name*
13. **ip nat sip-sbc**
14. **proxy** *inside-address inside-port outside-address outside-port* **protocol udp**
15. **vrf-list**
16. **vrf-name** *vrf - name*
17. **exit**
18. **ip nat sip-sbc**
19. **call-id-pool** *call -id-pool*
20. **session -timeout** *seconds*
21. **mode allow -flow-around**
22. **override address**
23. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 1/1`	Specifies an interface and returns to interface configuration mode.
Step 4	**ip nat inside** **Example:** `Router(config-if)# ip nat inside`	Connects the interface to the inside network (the network subject to NAT translation).
Step 5	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and enters global configuration mode.
Step 6	**interface** *type number* **Example:** `Router(config)# interface ethernet 1/3`	Specifies an interface and enters interface configuration mode.
Step 7	**ip nat outside** **Example:** `Router(config-if)# ip nat outside`	Connects the interface to the outside network.
Step 8	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 9	**ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*} **Example:** `Router(config)# ip nat pool inside-pool-A 172.16.0.1 172.16.0.10 prefix-length 16`	Defines a pool of global addresses to be allocated for the inside network. **Note** You must configure two address pools when you are using the NAT SBC feature and you want to translate the call IDs. In this step you are configuring the first address pool.

	Command or Action	Purpose
Step 10	**ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*} **Example:** `Router(config)# ip nat pool outside-pool 203.0.113.1 203.0.113.10 prefix-length 24`	Defines a pool of global addresses to be allocated for the outside network. **Note** You must configure two address pools when you are using the NAT SBC feature and you want to translate the call IDs. In this step, you are configuring the second address pool.
Step 11	**ip nat inside source list** *access-list-number* **pool** *name* [**vrf** *vrf-name*] [**overload**] **Example:** `Router(config)# ip nat inside source list 1 pool inside-pool-A vrf vrfA overload`	Enables NAT of the inside source address and configures the access list for translation.
Step 12	**ip nat outside source list** *access-list-number* **pool** *name* **Example:** `Router(config)# ip nat outside source list 3 pool outside-pool`	Enables NAT of the outside source address and configures the access list for translation.
Step 13	**ip nat sip-sbc** **Example:** `Router(config)# ip nat sip-sbc`	Enters IP NAT SBC configuration mode.
Step 14	**proxy** *inside-address inside-port outside-address outside-port* **protocol udp** **Example:** `Router(config-ipnat-sbc)# proxy 200.1.1.1 5060 192.0.2.2 5060 protocol udp`	Configures the address or port that the inside phones will be referring to, and the outside proxy's address and port to which the NAT SBC translates the destination IP address and port.
Step 15	**vrf-list** **Example:** `Router(config-ipnat-sbc)# vrf-list`	(Optional) Enters IP NAT SBC VRF configuration mode.

	Command or Action	Purpose
Step 16	**vrf-name** *vrf - name* **Example:** `Router(config-ipnat-sbc-vrf)# vrf-name vrf1`	(Optional) Defines SBC VRF list names.
Step 17	**exit** **Example:** `Router(config-ipnat-sbc-vrf)# exit`	Exits IP NAT SBC VRF configuration mode and enters global configuration mode.
Step 18	**ip nat sip-sbc** **Example:** `Router(config)# ip nat sip-sbc`	Enters IP NAT SBC configuration mode.
Step 19	**call-id-pool** *call -id-pool* **Example:** `Router(config-ipnat-sbc)# call-id-pool pool-name`	Specifies a dummy pool name for the in to out SIP signaling packet's call ID that it will be translated to, and that a 1:1 association will be maintained rather than using the regular NAT pool. • This pool can be used in an overload scenario: ◦ NAT mapping with an appropriate access control list (ACL) and a NAT pool matching the pool name must be configured. ◦ This pool is not used for any other NAT processing except for call ID processing.
Step 20	**session -timeout** *seconds* **Example:** `Router(config-ipnat-sbc)# session-timeout 300`	Configures the timeout duration for NAT entries pertaining to SIP signaling flows. • The default is 5 minutes.
Step 21	**mode allow -flow-around** **Example:** `Router(config-ipnat-sbc)# mode allow-flow-around`	Enables flow-around for RTP. • This flow applies to traffic between phones in the inside domain.

	Command or Action	Purpose
Step 22	**override address** **Example:** `Router(config-ipnat-sbc)# override address`	Allows the NAT SBC to override the out to in traffic's destination IP during signaling or RTP traffic, or to override the address and port.
Step 23	**end** **Example:** `Router(config-ipnat-sbc)# end`	Exits IP NAT SBC configuration mode and enters privileged EXEC mode.

Configuration Examples for Configuring Cisco IOS Hosted NAT for Session Border Controller

Example Configuring Cisco IOS Hosted NAT Traversal for Session Border Controller

The following example shows how to configure the Cisco IOS Hosted NAT Traversal as Session Border Controller feature:

```
interface ethernet1/1
 ip nat inside
!
interface ethernet1/2
 ip nat inside
!
interface ethernet1/3
 ip nat outside
!
ip nat pool inside-pool-A 172.16.0.1 172.16.0.10 prefix-length 16
ip nat pool inside-pool-B 192.168.0.1 192.168.0.10 prefix-length 24
ip nat pool outside-pool 203.0.113.1 203.0.113.10 prefix-length 24
ip nat inside source list 1 pool inside-pool-A vrf vrfA overload
ip nat inside source list 2 pool inside-pool-B vrf vrfB overload
ip nat outside source list 3 pool outside-pool
!
! Access-list for VRF-A inside phones
access-list 1 permit 172.16.0.0 255.255.0.0
!
! Access-list for VRF-B inside phones
access-list 2 permit 192.0.2.0 255.255.255.0
!
access-list 3 permit 203.0.113.0 255.255.255.0
ip nat sip-sbc
 proxy 200.1.1.1 5060 192.0.2.2 5060 protocol udp
 vrf-list
  vrf-name vrfA
  vrf-name vrfB
```

```
 exit
call-id-pool pool-name
session-timeout 300
mode allow-flow-around
override address
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
NAT commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference*
Configuring an IP access list	"Creating an IP Access List and Applying It to an Interface" module in the *Securing the Data Plane Configuration Guide*

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring Hosted NAT Traversal for Session Border Controller

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 6 Feature Information for Configuring Hosted NAT Traversal for Session Border Controller

Feature Name	Releases	Feature Information
Cisco IOS Hosted NAT Traversal for Session Border Controller Phase-1	12.4(9)T	The Cisco IOS Hosted NAT Traversal for Session Border Controller feature provides transparency with the use of a proxy device on the NAT outside domain.
Hosted NAT Support for Session Border Controller Phase-2	12.4(15)T	The Hosted NAT Support for Session Border Controller Phase-2 feature provides registration throttling, media flow-through, and SNAT support.
NAT as SIP Session Border Controller Media Flow	12.4(9)T	The NAT as SIP Session Border Controller Media Flow feature provides support for media flow-around for RTP or RTCP exchanges between phones on the inside domain of the SBC.
NAT as SIP Session Border Controller Support for Address-Only Fields	12.4(9)T	The NAT as SIP Session Border Controller Support for Address-Only Fields feature provides support for the translation of SIP address-only fields.

and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

User Defined Source Port Ranges for PAT

The User Defined Source Port Ranges for PAT feature enables the specification of source port ranges for Port Address Translation (PAT) for SIP, H.323, and Skinny Real-Time Transport Protocol (RTP) and RTP Control Protocol (RTCP).

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for User Defined Source Port Ranges for PAT

- The size of port range that can be reserved is limited to a multiple of 64.
- The start port for the port range should also be a multiple of 64.

Information About User Defined Source Port Ranges for PAT

User Defined Source Port Ranges for PAT Overview

In order for VoIP traffic to not be in violation of the RTP standards and best practices, even/odd pairing of ports for RTP and RTCP traffic for SIP ALG, Skinny and H.323 has been made available.

Following is a scenario of what happens to VoIP traffic translated using PAT without user defined ports.

The first VoIP traffic getting translated using PAT, would request for port 16384 and would get to use port 16384 for its RTP traffic.

The second VoIP traffic stream getting translated using PAT would also request 16384 for its RTP. Since this port number is already in use by the first call, PAT would translate the 16384 source port for the second phone to 1024 (assuming the port was free) and this would be in violation of the RTP standards/best practices.

A third call would end up using port 1025 and others would increment from there.

Each call after the first call would end up having its inside source port translated to an external port assignment that is out of specifications for RTP, and this would continue until PAT binding fir the first call expires.

Problems associated with RTP traffic being assigned to a non-standard port by PAT:

- Inability for compressed RTP (cRTP) to be invoked in the return direction, as it only operates on RTP flows with compliant port numbers.
- Difficulty in properly classifying voice traffic for corresponding QoS treatment.
- Violation of standard firewall policies that specifically account for RTP/TRCP traffic by specified standard port range.

Even Port Parity

Cisco IOS NAT SIP gateways normally select the next available port+1 for SIP fixup in the NAT translations. The NAT gateway does not check for even/odd pair for RTP/TRCP port numbers, and as a result issues may arise with SIP user agents that are strictly following the encouraged even/odd parity for RTP/RTCP port numbers.

Even port parity for SIP, H.323, and skinny is supported by default and it can be turned off forcing the odd RTP ports allocation.

How to Configure User Defined Source Port Ranges for PAT

Configuring Source Port Ranges for PAT

Perform this task to assign a set of ports and associate a map to them.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat portmap** *mapname* **application** *application* **startport** *startport* **size** *size*
4. **ip nat inside source list** *list - name* **pool** *pool - name* **overload portmap** *portmap - name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat portmap** *mapname* **application** *application* **startport** *startport* **size** *size* **Example:** `Router(config)# ip nat portmap NAT-1 application sip-rtp startport 32128 size 128`	Defines the port map.
Step 4	**ip nat inside source list** *list - name* **pool** *pool - name* **overload portmap** *portmap - name* **Example:** `Router(config)# ip nat inside source list 1 pool A overload portmap NAT-1`	Associates the port map to the NAT configuration.

Configuring Even Port Parity

Even port parity for H.323, SIP, and skinny is supported by default and can be turned off forcing the odd ports allocation.

Perform this task to enable even port parity.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat service allow-h323-even-rtp-ports** | **allow-sip-even-rtp-ports**| **allow-skinny-even-rtp-ports**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat service allow-h323-even-rtp-ports** | **allow-sip-even-rtp-ports**| **allow-skinny-even-rtp-ports** **Example:** `Router(config)# ip nat service allow-h323-even-rtp-ports`	Establishes even port parity for H323, the SIP protocol, or the skinny protocol.

Configuration Examples for User Defined Source Port Ranges for PAT

Example User Defined Source Port Ranges for PAT

The following examples shows how to assign a set of ports and associate a map to them.

```
ip nat portmap NAT-I
 cisco-rtp-h323-low
 appl sip-rtp startport 32128 size 128
 appl sip-rtp startport 32000 size 64
ip nat inside source list 1 pool A overload portmap NAT-I
```

Macros have been defined to make port map configuration easier. The table below lists the name of the macros and the ports.

Table 7 Macro Names and Ports

Macro Name	Ports	Application
cisco-rtp-h323-low	16384-32767	H.323

Macro Name	Ports	Application
cisco-rtp-h323-high	49152-65535	H.323
cisco-rtp-skinny-low	16384-32767	Skinny
cisco-rtp-skinny-high	49152-65535	Skinny
cisco-rtp-sip-low	16384-32767	SIP
cisco-rtp-sip-high	49152-65535	SIP

Example Even Port Parity

The following example enables even port parity for H.323.

```
ip nat service allow-h323-even-rtp-ports
```

The following example enables even port parity for SIP.

```
ip nat service allow-sip-even-rtp-ports
```

The following example enables even port parity for the skinny protocol.

```
ip nat service allow-skinny-even-rtp-ports
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
NAT commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference*

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
•	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for User Defined Source Port Ranges for PAT

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 8 Feature Information for User Defined Source Port Ranges for PAT

Feature Name	Releases	Feature Information
User Defined Source Port Ranges for PAT	12.4(11)T	The User Defined Source Port Ranges for PAT feature enables the specification of source port ranges for Port Address Translation (PAT) for SIP, H.323, and Skinny Real-Time Transport Protocol (RTP) and RTP Control Protocol (RTCP).

FPG Endpoint Agnostic Port Allocation

When the Endpoint Agnostic Port Allocation feature is configured, an entry is added to the Symmetric Port Database. If the entry is already available, the port listed in the Symmetric Port Database is used and the packet is sent. This feature is only required if you need to configure NAT with pool overload or interface overload. Endpoint Agnostic Port Allocation is also known as Symmetric Port Allocation.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Endpoint Agnostic Port Allocation

When a packet is being transmitted, the Symmetric Port Database is checked to see if the requested port is already allocated. If it has been allocated, it is checked if the source computer entry in the database matches the computer requesting the port. If this is true, the port listed in the Symmetric Port Database is used and the packet is sent.

If the computers do not match or if the requested port is not in the Symmetric Port Database, the feature continues checks to the NAT Port database for an entry matching the requested port. If no entry is found, this means that the port is available. A new entry is added to the NAT Port database, and to the existing NAT database, allocating the port to the requesting computer, and the packet is sent.

If no matching entry in the NAT Port database is found, it means that the port is busy, or otherwise unavailable. The next available port is found, which is allocated to the requesting computer. An entry is added to the NAT Port database with the requesting computer and the available port. An entry is added to the Symmetric Port database, with the requesting computer, the allocated port and the requested port and the packet is sent.

This feature is only required if you need to configure NAT with pool overload or interface overload. This feature is not applicable for other NAT configurations.

How to Configure Endpoint Agnostic Port Allocation

Configuring Endpoint Agnostic Port Allocation

Perform this task to configure NAT to support the Endpoint Agnostic Port Allocation feature.

Note This feature must be enabled by the user. It should be enabled before NAT is enabled. If it is enabled later, it will not translate the previously established connection. When this feature is disabled, it will not be seen in the output of the **show running-config**command.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface interface name**
4. **ip nat inside**
5. **exit**
6. **access list 1 permit** *ip address mask*
7. **ip nat inside source list 1 interface interface name**
8. **ip nat service enable-sym-port**
9. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface interface name** **Example:** `Router (config)# interface Ethernet 0/0`	Configures the Ethernet 0/0 interface.
Step 4	**ip nat inside** **Example:** `Router (config-if)# ip nat inside`	Enables Network Address Translation (NAT) for the inside address.
Step 5	**exit** **Example:** `Router (config-if)# exit`	Exits interface configuration mode.
Step 6	**access list 1 permit** *ip address mask* **Example:** `Router (config)# access list 1 permit 172.18.192.0.0.0.255`	Creates an access list called 1.
Step 7	**ip nat inside source list 1 interface interface name** **Example:** `Router (config)# ip nat inside source list 1 interface Ethernet 0/0`	Enables NAT for the inside source for access list 1 which is attached to the Ethernet interface.
Step 8	**ip nat service enable-sym-port** **Example:** `Router (config)# ip nat service enable-sym-port`	Enables the symmetric port allocation.

	Command or Action	Purpose
Step 9	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode.

Verifying Endpoint Agnostic Port Support

To verify the Endpoint Agnostic Port Support feature, use the following command.

SUMMARY STEPS

1. **show ip nat translations**

DETAILED STEPS

show ip nat translations

Example:

```
Router# show ip nat translations

NAT Symmetric Port Database: 1 entries
public ipaddr:port [tableid] | port# [refcount][syscount] | localaddr:localport [flags]
172.18.192.69:1024 [0] | 1025 [1] [0] | 172.18.192.69:1024 [0]
```

Configuration Examples for Endpoint Agnostic Port Allocation

Configuring Endpoint Allocation Example

```
interface Ethernet0/0
    ip nat inside
    exit
access list 1 permit 172.18.192.0.0.0.255
ip nat inside source list 1 interface Ethernet0/0
ip nat service enable-sym-port
end
```

Additional References

Related Documents

Related Topic	Document Title
NAT configuration tasks	"Configuring NAT for IP Address Conservation" module
NAT maintenance	"Monitoring and Maintaining NAT" module
NAT commands: complete command syntax, command mode, command history, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	_

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	_

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Endpoint Agnostic Port Allocation

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 9 Feature Information for NAT Endpoint Agnostic Port Allocation

Feature Name	Releases	Feature Information
FPG: Endpoint Agnostic Port Allocation	12.4(24)T	This feature was introduced.

NAT Optimized SIP Media Path Without SDP

The NAT Optimized SIP Media Path Without SDP feature provides the ability to optimize the media path taken by a SIP VoIP session when NAT is used. NAT forces the VoIP traffic to take at least one extra hop in the network, which usually results in several additional hops being added to the path between two IP hosts.

The Message Digest 5 (MD5) algorithm is supported.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About the NAT Optimized SIP Media Path Without SDP Feature

Benefits of NAT Optimized SIP Media Path Without SDP

- The media path can be shortened, decreasing voice delay.
- More control of voice policy is possible because the media path is closer to the customer domain and not deep within the service provider cloud.

- Processes all packets sent through the NAT-enabled router, even those without the Session Description Protocol (SDP).

NAT Optimized SIP Media Path Without SDP Feature Design

Cisco IOS NAT will add the relevant translation information per SIP session within the SIP protocol messages. The SIP Application Layer Gateway support within Cisco IOS NAT will extract this translation information from the SIP packets and create NAT table entries.

The “piggybacking” of NAT translation information within the SIP call flows, the design of how users interact with the application when they talk to it, will allow the media path of a SIP VoIP session between two calling parties to take the optimized routing path between each other.

How to Configure NAT Optimized SIP Media Path Without SDP

- Configuring a NAT Optimized SIP Media Path Without SDP Messages Including MD5 Authentication, page 140
- Configuring a NAT Optimized SIP Media Path Without SDP Messages, page 141

Configuring a NAT Optimized SIP Media Path Without SDP Messages Including MD5 Authentication

Perform this task to configure messages with a NAT optimized SIP Media path including MD5 authentication.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat piggyback-support sip-alg all-messages router** *router-id* [**md5-authentication** *md5-authentication-key*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat piggyback-support sip-alg all-messages router** *router-id* [**md5-authentication** *md5-authentication-key*] **Example:** `Router(config)# ip nat piggyback-support sip-alg all-messages router 100 md5-authentication md5-key`	Enables messages with a NAT optimized SIP Media path including MD5 authentication.

Configuring a NAT Optimized SIP Media Path Without SDP Messages

Perform this task to configure SDP messages with a NAT optimized SIP Media path without MD5 authentication.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat piggyback-support sip-alg all-messages router** *router-id*

DETAILED STEPS

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

Command or Action	Purpose
Step 3 **ip nat piggyback-support sip-alg all-messages router** *router-id* **Example:** `Router(config)# ip nat piggyback-support sip-alg all-messages router 100`	Enables messages with a NAT optimized SIP Media path without MD5 authentication.

Configuration Examples for NAT Optimized SIP Media Path Without SDP

Configuring a NAT Optimized SIP Media Path Without SDP Including MD5 Authentication Example

The following example shows how to configure a NAT optimized SIP media path without SDP including MD5 authentication:

```
ip nat piggyback-support sip-alg all-messages router 100 md5-authentication md5-key
```

Configuring a NAT Optimized SIP Media Path Without SDP or MD5 Authentication Example

The following example shows how to configure a NAT optimized SIP media path without SDP or MD5 authentication:

```
ip nat piggyback-support sip-alg all-messages router 100
```

Additional References

Related Documents

Related Topic	Document Title
NAT commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference*

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for NAT Optimized SIP Media Path Without SDP

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 10 Feature Information for NAT Optimized SIP Media Path Without SDP

Feature Name	Releases	Feature Information
NAT Optimized SIP Media Path Without SDP	12.4(2)T	The NAT Optimized SIP Media Path Without SDP feature provides the ability to optimize the media path taken by a SIP VoIP session when NAT is used. NAT forces the VoIP traffic to take at least one extra hop in the network, which usually results in several additional hops being added to the path between two IP hosts.

NAT Optimized SIP Media Path with SDP

The NAT Optimized SIP Media Path with SDP feature allows the creation of a shorter path for Session Initiation Protocol (SIP) media channels by distributing endpoint IP addressing information with Session Description Protocol (SDP) of SIP messages. This feature allows endpoints to communicate directly by using standard routing and eliminates the need for them to traverse through upstream NAT routers.

The Message Digest 5 (MD5) algorithm is supported.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About the NAT Optimized SIP Media Path with SDP Feature

Restrictions for NAT Optimized SIP Media Path with SDP

SIP messages may or may not have SDP. This feature processes SIP messages with SDP only. If a call exchange with SDP is certain to occur, this feature should be used.

Use the “NAT - Optimized SIP Media without SPD” feature for SIP messages without SPD. This feature processes all packets sent through the NAT-enabled router but is more CPU intensive than processing SIP messages with SPD.

Benefits of NAT Optimized SIP Media Path with SDP

- The media path can be shortened, decreasing voice delay.
- More control of voice policy is possible because the media path is closer to the customer domain and not deep within the service provider cloud.

NAT Optimized SIP Media Path with SDP Feature Design

The NAT Optimized SIP Media Path with SDP feature provides the ability to optimize the media path taken by a SIP VoIP session when NAT is used. NAT forces the VoIP traffic to take at least one extra hop in the network, which usually results in several additional hops being added to the path between two IP hosts.

Cisco IOS NAT will add the relevant translation information per SIP session within the SIP protocol messages. The SIP Application Layer Gateway support within Cisco IOS NAT will extract this translation information from the SIP packets and create NAT table entries.

The “piggybacking” of NAT translation information within the SIP call flows, the design of how users interact with the application when they talk to it, will allow the media path of a SIP VoIP session between two calling parties to take the optimized routing path between each other.

How to Configure NAT Optimized SIP Media Path with SDP

- Configuring a NAT Optimized SIP Media Path with SDP Messages Including MD5 Authentication, page 146
- Configuring a NAT Optimized SIP Media Path with SDP Messages Without MD5 Authentication, page 147

Configuring a NAT Optimized SIP Media Path with SDP Messages Including MD5 Authentication

Perform this task to configure SDP messages with a NAT optimized SIP Media path including MD5 authentication.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat piggyback-support sip-alg sdp-only router** *router-id* **md5 -authentication** *md5-authentication-key*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat piggyback-support sip-alg sdp-only router** *router-id* **md5 -authentication** *md5-authentication-key* **Example:** `Router(config)# ip nat piggyback-support sip-alg sdp-only router 100 md5-authentication md5-key`	Enables SDP messages with a NAT optimized SIP Media path including MD5 authentication.

Configuring a NAT Optimized SIP Media Path with SDP Messages Without MD5 Authentication

Perform this task to configure SDP messages with a NAT optimized SIP Media path without MD5 authentication.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat piggyback-support sip-alg sdp-only router** *router-id*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip nat piggyback-support sip-alg sdp-only router** *router-id* **Example:** `Router(config)# ip nat piggyback-support sip-alg sdp-only router 100`	Enables SDP messages with a NAT optimized SIP Media path without MD5 authentication.

Configuration Examples for NAT Optimized SIP Media Path with SDP

Configuring a NAT Optimized SIP Media Path with SDP Including MD5 Authentication Example

The following example shows how to configure a NAT optimized SIP media path with SDP including MD5 authentication:

```
ip nat piggyback-support sip-alg sdp-only router 100 md5-authentication md5-key
```

Configuring a NAT Optimized SIP Media Path with SDP Without MD5 Authentication Example

The following example shows how to configure a NAT optimized SIP media path with SDP without MD5 authentication:

```
ip nat piggyback-support sip-alg sdp-only router 100
```

Additional References

Related Documents

Related Topic	Document Title
NAT commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference*
NAT Optimized SIP Media Path without SDP configuration tasks and conceptual information	"NAT - Optimized SIP Media without SPD" module

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for NAT Optimized SIP Media Path with SDP

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 11 Feature Information for <Phrase Based on Module Title>

Feature Name	Releases	Feature Information
NAT Optimized SIP Media Path with SDP	12.4(2)T	The NAT Optimized SIP Media Path with SDP feature allows the creation of a shorter path for Session Initiation Protocol (SIP) media channels by distributing endpoint IP addressing information with Session Description Protocol (SDP) of SIP messages. This feature allows endpoints to communicate directly by using standard routing and eliminates the need for them to traverse through upstream NAT routers.

Monitoring and Maintaining NAT

This module describes how to:

- Monitor Network Address Translation (NAT) using translation information and statistics displays.
- Maintain NAT by clearing NAT translations before the timeout has expired.
- Enable logging of NAT translation by way of syslog to log and track system error messages, exceptions, and other information.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Monitoring and Maintaining NAT

Before performing the tasks in this module, you must be familiar with the concepts described in the "Configuring NAT for IP Address Conservation" module and have NAT configured in your network.

Information About Monitoring and Maintaining NAT

NAT Display Contents

There are two basic types of IP NAT translation information:

Translation Entries

Translation entry information includes the following:

- The protocol of the port identifying the address.
- The legitimate IP address that represents one or more inside local IP addresses to the outside world.
- The IP address assigned to a host on the inside network; probably not a legitimate address assigned by the NIC or service provider.
- The IP address of an outside host as it appears to the inside network; probably not a legitimate address assigned by the NIC or service provider.
- The IP address assigned to a host on the outside network by its owner.
- The time since the entry was created (in hours:minutes:seconds).
- The time since the entry was last used (in hours:minutes:seconds).
- Flags indicating the type of translation. Possible flags are:
  - extended--Extended translation
  - static--Static translation
  - destination--Rotary translation
  - outside--Outside translation
  - timing out--Translation will no longer be used, due to a TCP finish (FIN) or reset (RST) flag.

Statistical Information

Statistical information includes the following:

- The total number of translations active in the system. This number is incremented each time a translation is created and is decremented each time a translation is cleared or times out.
- A list of interfaces marked as outside with the **ip nat outside** command.
- A list of interfaces marked as inside with the **ip nat inside** command.
- The number of times the software does a translations table lookup and finds an entry.
- The number of times the software does a translations table lookup, fails to find an entry, and must try to create one.
- A cumulative count of translations that have expired since the router was booted.
- Information about dynamic mappings.
- Information about an inside source translation.
- The access list number being used for the translation.
- The name of the pool.
- The number of translations using this pool.
- The IP network mask being used in the pool.
- The starting IP address in the pool range.
- The ending IP address in the pool range.
- The type of pool. Possible types are generic or rotary.

- The number of addresses in the pool available for translation.
- The number of addresses being used.
- The number of failed allocations from the pool.

NAT does not support ACL with the log option. The same functionality can be achieved by using one of the following options:

- By having a physical interface or VLAN with the logging option
- By using NetFlow
- By using the syslog feature

Syslog Usage

Syslog Analysis lets you centrally log and track system error messages, exceptions, and other information (such as device configuration changes). You can use the logged error message data to analyze router and network performance. You can customize Syslog Analysis to produce the information and message reports important to your operation.

For more information see the *Resource Manager Essentials and Syslog Analysis: How-To*document*:*

http://www.cisco.com/warp/public/477/RME/rme_syslog.html

How to Monitor and Maintain NAT

Displaying NAT Translation Information

SUMMARY STEPS

1. **enable**
2. **show ip nat translations** [**verbose**]
3. **show ip nat statistics**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**show ip nat translations** [**verbose**] **Example:** `Router# show ip nat translations`	(Optional) Displays active NAT translations.
Step 3	**show ip nat statistics** **Example:** `Router# show ip nat statistics`	(Optional) Displays active NAT translation statistics.

- Examples, page 154

Examples

This section contains the following examples:

Displaying NAT Translations

The following is sample output from the **show ip nat translations** command. Without overloading, two inside hosts are exchanging packets with some number of outside hosts.

```
Router# show ip nat translations
Pro Inside global      Inside local       Outside local      Outside global
--- 192.168.2.1                      192.168.2.12
---                 ---
--- 192.168.2.21                      192.168.2.89
---                 --
```

With overloading, a translation for a Domain Name Server (DNS) transaction is still active, and translations for two Telnet sessions (from two different hosts) are also active. Note that two different inside hosts appear on the outside with a single IP address.

```
Router# show ip nat translations
Pro Inside global        Inside local       Outside local      Outside global
udp 192.168.2.20:1220                  192.168.2.95:1220
192.168.2.22:53                        192.168.2.20:53
tcp 192.168.2.20:11012 192.168.2.209:11012 192.168.1.220:23 192.168.2.20:23
tcp 192.168.2.20:1067 192.168.2.20:1067 192.168.2.20:23 192.168.2.20:23
```

The following is sample output that includes the **verbose** keyword:

```
Router# show ip nat translations verbose
Pro Inside global        Inside local       Outside local      Outside global
udp 192.168.2.20:1220 192.168.2.23:1220 192.168.2.24:53 192.168.2.25:53
        create 00:00:02, use 00:00:00, flags: extended
tcp 192.168.2.23:11012 192.168.2.30:11012 192.168.2.20:23 192.168.2.28:23
        create 00:01:13, use 00:00:50, flags: extended
tcp 192.168.2.24:1067 192.168.2.29:1067 192.168.2.20:23 192.168.2.50:23
        create 00:00:02, use 00:00:00, flags: extended
```

Displaying NAT Statistics

The following is sample output from the **show ip nat statistics** command:

```
Router# show ip nat statistics
Total translations: 2 (0 static, 2 dynamic; 0 extended)
Outside interfaces: Serial0
Inside interfaces: Ethernet1
Hits: 135  Misses: 5
Expired translations: 2
Dynamic mappings:
-- Inside Source
access-list 1 pool net-208 refcount 2
 pool net-208: netmask 255.255.255.240
        start 192.168.0.0 end 192.168.255.255
        type generic, total addresses 14, allocated 2 (14%), misses 0
```

Clearing NAT Entries Before the Timeout

By default, dynamic address translations will time out from the NAT translation table at some point. Perform this task to clear the entries before the timeout.

SUMMARY STEPS

1. **enable**
2. **clear ip nat translation inside** *global-ip local-ip* **outside** *local-ip global-ip*
3. **clear ip nat translation outside** *global-ip local-i* **p**
4. **clear ip nat translation** *protocol* **inside** *global-ip global-port local-ip local-port* **outside** *local-ip local-port-global-ip global-port*
5. **clear ip nat translation** {* | [**forced**] | [**inside** *global-ip local-ip*] [**outside** *local-ip global-ip*]}
6. **clear ip nat translation inside** *global-ip local-ip* [**forced**]
7. **clear ip nat translation outside** *local-ip global-ip* [**forced**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

Command or Action	Purpose

Step 2 **clear ip nat translation inside** *global-ip local-ip* **outside** *local-ip global-ip*
 	
Example:
`Router# clear ip nat translation inside 192.168.2.209 1220 192.168.2.95 1220`
 	
Example:
`outside 192.168.2.100 53 192.168.2.101 53`
	(Optional) Clears a single dynamic half-entry containing an inside translation, or both inside and outside translation created in a dynamic configuration.
	• A dynamic half-entry will be cleared only if it does not have any child translations.

Step 3 **clear ip nat translation outside** *global-ip local-i* **p** **Example:** `Router# clear ip nat translation outside 192.168.2.100 1220 192.168.2.80`	(Optional) Clears a single dynamic half-entry containing an outside translation created in a dynamic configuration. • A dynamic half-entry will be cleared only if it does not have any child translations.

Step 4 **clear ip nat translation** *protocol* **inside** *global-ip global-port local-ip local-port* **outside** *local-ip local-port-global-ip global-port*
 	
Example:
`Router# clear ip nat translation udp inside 192.168.2.209 1220 192.168.2.195 1220`
 	
Example:
`outside 192.168.2.13 53 192.168.2.132 53`
	(Optional) Clears a UDP translation entry.

Step 5 **clear ip nat translation** {* | [**forced**] | [**inside** *global-ip local-ip*] [**outside** *local-ip global-ip*]} **Example:** `Router# clear ip nat translation *`	(Optional) Clears either all dynamic translations (with the ***** or **forced** keyword), a single dynamic half-entry containing an inside translation, or a single dynamic half-entry containing an outside translation. • When clearing a single dynamic half-entry, it will be cleared only if it does not have any child translations.
Step 6 **clear ip nat translation inside** *global-ip local-ip* [**forced**] **Example:** `Router# clear ip nat translation *`	(Optional) Forces the clearing of a single dynamic half-entry and its child translations containing an inside translation created in a dynamic configuration, with or without its corresponding outside translation. • A dynamic half-entry will always be cleared, regardless of whether it has any child translations.

	Command or Action	Purpose
Step 7	**clear ip nat translation outside** *local-ip global-ip* [**forced**] **Example:** `Router# clear ip nat translation *`	(Optional) Forces the clearing of a single dynamic half-entry and its child translations containing an outside translation created in a dynamic configuration. • A dynamic half-entry will always be cleared, regardless of whether it has any child translations.

Enabling Syslog for Logging NAT Translations

The logging of NAT translations can be enabled and disabled by way of the **syslog** command.

Syslog Analysis lets you centrally log and track system error messages, exceptions, and other information (such as NAT translations). You can use the logged error message data to analyze router and network performance. You can customize Syslog Analysis to produce the information and message reports important to your operation.

Prior to performing this task, you must specify the necessary **syslog** commands such as making sure that logging is enabled, configuring the server's IP address, and establishing the level of messages to be trapped.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nat log translations syslog**
4. **no logging console**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**ip nat log translations syslog** **Example:** `Router(config)# ip nat log translations syslog`	Enables the syslog for logging NAT translations.
Step 4	**no logging console** **Example:** `Router(config)# no logging console`	(Optional) Disables the log display to the console. • Logging to the console is enable by default.

Examples for Monitoring and Maintaining NAT

Clearing UDP NAT Translations Example

The following example shows the NAT entries before and after the User Datagram Protocol (UDP) entry is cleared:

```
Router# show ip nat translation


Pro Inside global        Inside local       Outside local      Outside global
udp 192.168.2.20:1220                  192.168.2.95:1220
192.168.2.22:53                            192.168.2.20:53
tcp 192.168.2.20:11012 192.168.2.209:11012 171.69.1.220:23 192.168.2.20:23
tcp 192.168.2.20:1067 192.168.2.20:1067 192.168.2.20:23 192.168.2.20:23
Router# clear ip nat translation udp inside 192.168.2.20:1067 192.168.2.20:1067 outside
192.168.2.20:23 192.168.2.20:23
Router# show ip nat translation

Pro Inside global      Inside local       Outside local      Outside global
udp 192.168.2.20:1220                  192.168.2.95:1220
192.168.2.22:53                            192.168.2.20:53
tcp 192.168.2.20:11012 192.168.2.209:11012 171.69.1.220:23 192.168.2.20:23
```

Enabling Syslog Example

The following example shows how to NAT entries into syslog.

```
Router(config)# logging on
Router(config)# logging 1.1.1.1
Router(config)# logging trap informational
Router(Config)# ip nat log translations syslog
```

The format of NAT information logged (for example, for ICMP Ping via NAT Overload configurations) will be as follows:

```
Apr 25 11:51:29 [10.0.19.182.204.28] 1: 00:01:13: NAT:Created icmp
135.135.5.2:7 171 12.106.151.30:7171 54.45.54.45:7171
54.45.54.45:7171
Apr 25 11:52:31 [10.0.19.182.204.28] 8: 00:02:15: NAT:Deleted icmp
135.135.5.2:7 172 12.106.151.30:7172 54.45.54.45:7172
54.45.54.45:7172
```

Where to Go Next

- To configure NAT for use with application level gateways, see the “Using Application Level Gateways with NAT” module.
- To integrate NAT with MPLS VPNs, see the “Integrating NAT with MPLS VPNs” module.
- To configure NAT for high availability, see the “Configuring NAT for High Availability” module.

Additional References

The following sections provide references related to Monitoring and Maintaining NAT.

Related Documents

Related Topic	Document Title
NAT commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	"IP Addressing Commands" chapter in the *Cisco IOS IP Command Reference, Volume 1 of 3: Addressing and Services*, Release 12.3.

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Monitoring and Maintaining NAT

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 12 Feature Information for Monitoring and Maintaining NAT

Feature Name	Releases	Feature Information
NAT--Forced Clear of Dynamic NAT Half-Entries	Cisco IOS 12.2 (33) XND	A second forced keyword was added to the **clear ip nat translation** command to enable the removal of half-entries regardless of whether they have any child translations.