CHAPTER 19

Configuring NAT

This chapter describes Network Address Translation, and includes the following sections:

NAT Overview

This section describes how NAT works on the security appliance, and includes the following topics:

Introduction to NAT

Address translation substitutes the real address in a packet with a mapped address that is routable on the destination network. NAT is composed of two steps: the process by which a real address is translated into a mapped address, and the process to undo translation for returning traffic.

The security appliance translates an address when a NAT rule matches the traffic. If no NAT rule matches, processing for the packet continues. The exception is when you enable NAT control. NAT control requires that packets traversing from a higher security interface (inside) to a lower security interface (outside) match a NAT rule, or processing for the packet stops. See the "Security Level Overview" section on page 8-1 for more information about security levels. See the "NAT Control" section on page 19-5 for more information about NAT control.

Note In this document, all types of translation are referred to as NAT. When describing NAT, the terms *inside* and *outside* represent the security relationship between any two interfaces. The higher security level is inside and the lower security level is outside. For example, interface 1 is at 60 and interface 2 is at 50; therefore, interface 1 is "inside" and interface 2 is "outside."

Some of the benefits of NAT are as follows:

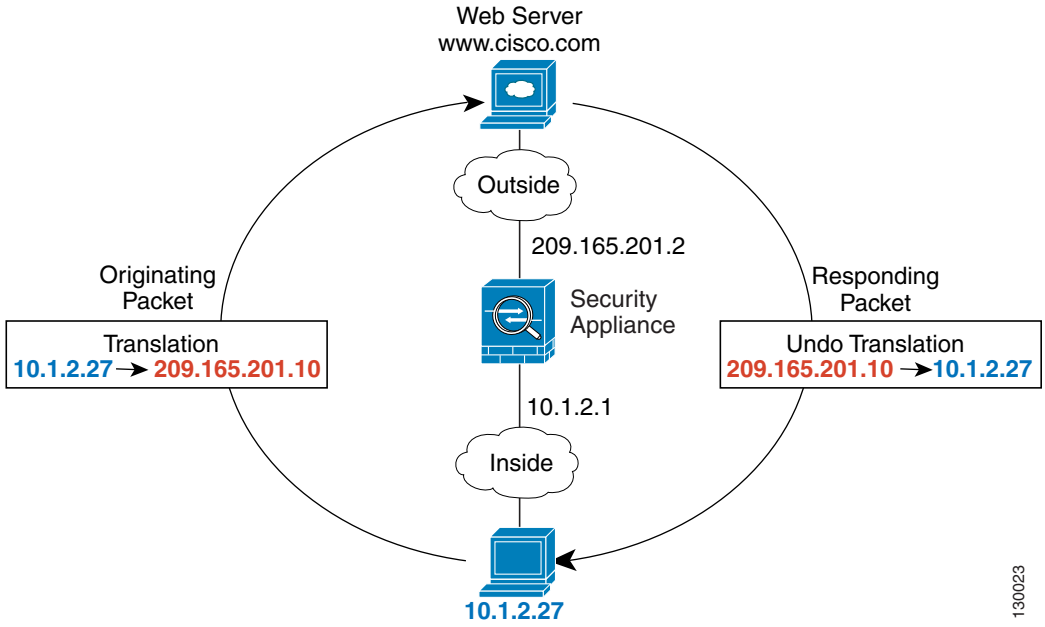
- You can use private addresses on your inside networks. Private addresses are not routable on the Internet. See the "Private Networks" section on page C-2 for more information.
- NAT hides the real addresses from other networks, so attackers cannot learn the real address of a host.
- You can resolve IP routing problems such as overlapping addresses.

See Table 26-1 on page 26-3 for information about protocols that do not support NAT.

NAT in Routed Mode

Figure 19-1 shows a typical NAT example in routed mode, with a private network on the inside. When the inside host at 10.1.2.27 sends a packet to a web server, the real source address, 10.1.2.27, of the packet is changed to a mapped address, 209.165.201.10. When the server responds, it sends the response to the mapped address, 209.165.201.10, and the security appliance receives the packet. The security appliance then changes the translation of the mapped address, 209.165.201.10 back to the real address, 10.1.2.27 before sending it to the host.

Figure 19-1 NAT Example: Routed Mode



See the following commands for this example:

```
hostname(config)# nat (inside) 1 10.1.2.0 255.255.255.0
hostname(config)# global (outside) 1 209.165.201.1-209.165.201.15
```

NAT in Transparent Mode

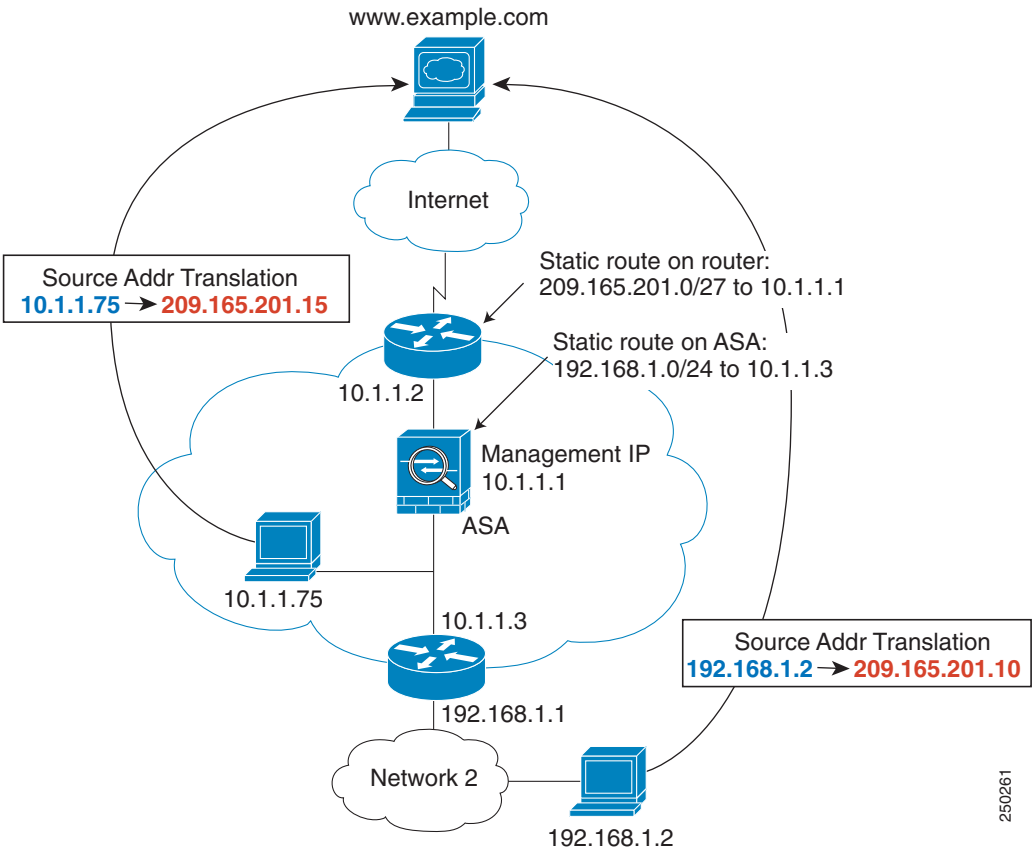
Using NAT in transparent mode eliminates the need for the upstream or downstream routers to perform NAT for their networks. For example, a transparent firewall security appliance is useful between two VRFs so you can establish BGP neighbor relations between the VRFs and the global table. However, NAT per VRF might not be supported. In this case, using NAT in transparent mode is essential.

NAT in transparent mode has the following requirements and limitations:

- When the mapped addresses are not on the same network as the transparent firewall, then on the upstream router, you need to add a static route for the mapped addresses that points to the downstream router (through the security appliance).
- When you have VoIP or DNS traffic with NAT and inspection enabled, to successfully translate the IP address inside VoIP and DNS packets, the security appliance needs to perform a route lookup. Unless the host is on a directly-connected network, then you need to add a static route on the security appliance for the real host address that is embedded in the packet.
- The **alias** command is not supported.
- Because the transparent firewall does not have any interface IP addresses, you cannot use interface PAT.
- ARP inspection is not supported. Moreover, if for some reason a host on one side of the firewall sends an ARP request to a host on the other side of the firewall, and the initiating host real address is mapped to a different address on the same subnet, then the real address remains visible in the ARP request.

Figure 19-2 shows a typical NAT scenario in transparent mode, with the same network on the inside and outside interfaces. The transparent firewall in this scenario is performing the NAT service so that the upstream router does not have to perform NAT.

Figure 19-2 NAT Example: Transparent Mode



1. When the inside host at 10.1.1.75 sends a packet to a web server, the real source address of the packet, 10.1.1.75, is changed to a mapped address, 209.165.201.15.
2. When the server responds, it sends the response to the mapped address, 209.165.201.15, and the security appliance receives the packet because the upstream router includes this mapped network in a static route directed through the security appliance.
3. The security appliance then undoes the translation of the mapped address, 209.165.201.15, back to the real address, 10.1.1.1.75. Because the real address is directly-connected, the security appliance sends it directly to the host.
4. For host 192.168.1.2, the same process occurs, except that the security appliance looks up the route in its route table and sends the packet to the downstream router at 10.1.1.3 based on the static route.

See the following commands for this example:

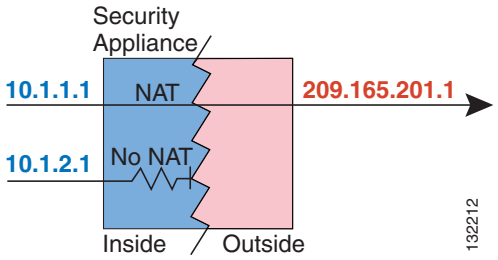
```
hostname(config)# route inside 192.168.1.0 255.255.255.0 10.1.1.3 1
hostname(config)# nat (inside) 1 10.1.1.0 255.255.255.0
hostname(config)# nat (inside) 1 192.168.1.0 255.255.255.0
hostname(config)# global (outside) 1 209.165.201.1-209.165.201.15
```

NAT Control

NAT control requires that packets traversing from an inside interface to an outside interface match a NAT rule; for any host on the inside network to access a host on the outside network, you must configure NAT to translate the inside host address, as shown in Figure 19-3.

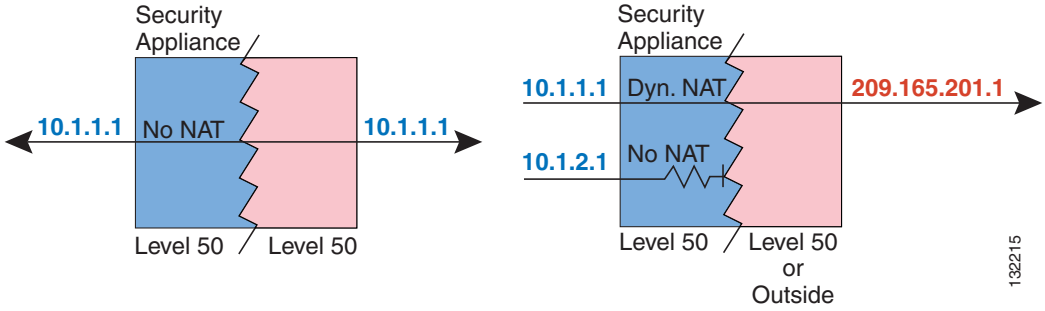
Note NAT control is used for NAT configurations defined with earlier versions of the security appliance. The best practice is to use access rules for access control instead of relying on the absence of a NAT rule to prevent traffic through the security appliance.

Figure 19-3 NAT Control and Outbound Traffic



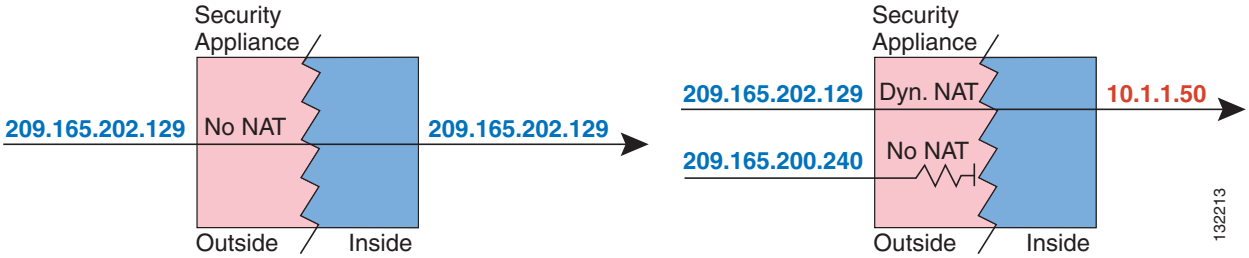
Interfaces at the same security level are not required to use NAT to communicate. However, if you configure dynamic NAT or PAT on a same security interface, then all traffic from the interface to a same security interface or an outside interface must match a NAT rule, as shown in Figure 19-4.

Figure 19-4 NAT Control and Same Security Traffic



Similarly, if you enable outside dynamic NAT or PAT, then all outside traffic must match a NAT rule when it accesses an inside interface (see Figure 19-5).

Figure 19-5 NAT Control and Inbound Traffic



Static NAT does not cause these restrictions.

By default, NAT control is disabled; therefore, you do not need to perform NAT on any networks unless you want to do so. If you upgraded from an earlier version of software, however, NAT control might be enabled on your system. Even with NAT control disabled, you need to perform NAT on any addresses for which you configure dynamic NAT. See the "Dynamic NAT and PAT Implementation" section on page 19-19 for more information about how dynamic NAT is applied.

If you want the added security of NAT control but do not want to translate inside addresses in some cases, you can apply a NAT exemption or identity NAT rule on those addresses. (See the "Bypassing NAT" section on page 19-32 for more information).

To configure NAT control, see the "Configuring NAT Control" section on page 19-18.

Note In multiple context mode, the packet classifier might rely on the NAT configuration to assign packets to contexts if you do not enable unique MAC addresses for shared interfaces. See the "How the Security Appliance Classifies Packets" section on page 4-3 for more information about the relationship between the classifier and NAT.

NAT Types

This section describes the available NAT types, and includes the following topics:

You can implement address translation as dynamic NAT, Port Address Translation, static NAT, static PAT, or as a mix of these types. You can also configure rules to bypass NAT; for example, to enable NAT control when you do not want to perform NAT.

Dynamic NAT

Dynamic NAT translates a group of real addresses to a pool of mapped addresses that are routable on the destination network. The mapped pool may include fewer addresses than the real group. When a host you want to translate accesses the destination network, the security appliance assigns the host an IP address from the mapped pool. The translation is added only when the real host initiates the connection. The translation is in place only for the duration of the connection, and a given user does not keep the

same IP address after the translation times out. For an example, see the **timeout xlate** command in the *Cisco Security Appliance Command Reference*. Users on the destination network, therefore, cannot initiate a reliable connection to a host that uses dynamic NAT, although the connection is allowed by an access list, and the security appliance rejects any attempt to connect to a real host address directly. See the "Static NAT" or "Static PAT" section for information on how to obtain reliable access to hosts.

Note In some cases, a translation is added for a connection, although the session is denied by the security appliance. This condition occurs with an outbound access list, a management-only interface, or a backup interface in which the translation times out normally. For an example, see the **show xlate** command in the *Cisco Security Appliance Command Reference*.

Figure 19-6 shows a remote host attempting to connect to the real address. The connection is denied, because the security appliance only allows returning connections to the mapped address.

Figure 19-6 Remote Host Attempts to Connect to the Real Address

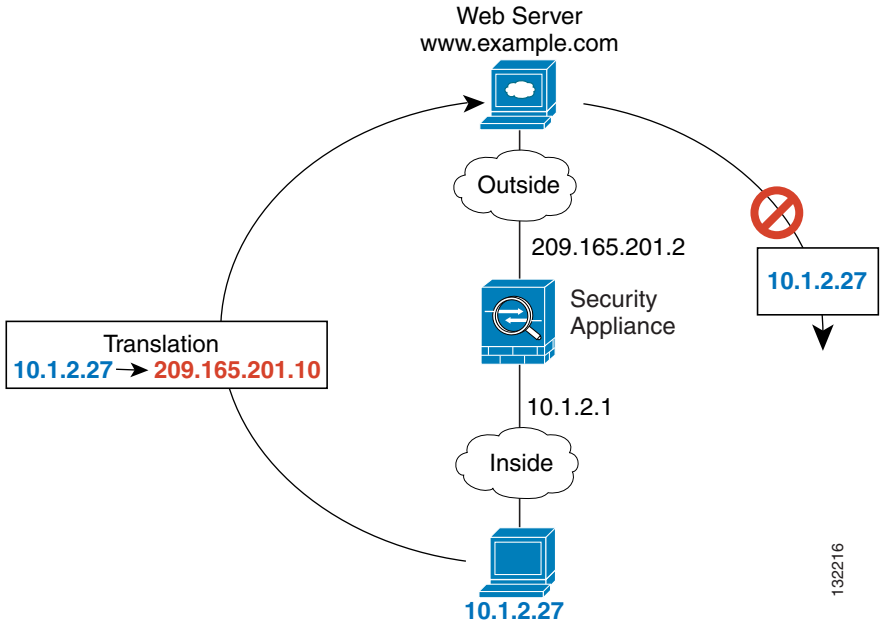
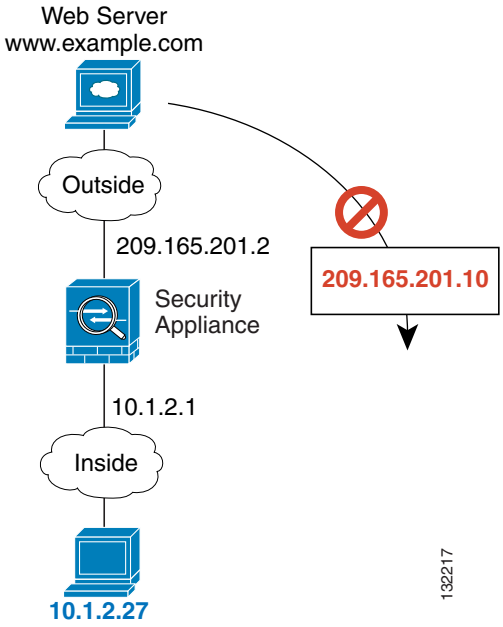


Figure 19-7 shows a remote host attempting to initiate a connection to a mapped address. This address is not currently in the translation table; therefore, the security appliance drops the packet.

Figure 19-7 Remote Host Attempts to Initiate a Connection to a Mapped Address



Note For the duration of the translation, a remote host can initiate a connection to the translated host if an access list allows it. Because the address is unpredictable, a connection to the host is unlikely. Nevertheless, in this case, you can rely on the security of the access list.

Dynamic NAT has these disadvantages:

- If the mapped pool has fewer addresses than the real group, you could run out of addresses if the amount of traffic is more than expected.

  Use PAT if this event occurs often, because PAT provides over 64,000 translations using ports of a single address.

- You have to use a large number of routable addresses in the mapped pool; if the destination network requires registered addresses, such as the Internet, you might encounter a shortage of usable addresses.

The advantage of dynamic NAT is that some protocols cannot use PAT. PAT does not work with the following:

- IP protocols that do not have a port to overload, such as GRE version 0.
- Some multimedia applications that have a data stream on one port, the control path on another port, and are not open standard.

See the "When to Use Application Protocol Inspection" section on page 26-2 for more information about NAT and PAT support.

PAT

PAT translates multiple real addresses to a single mapped IP address. Specifically, the security appliance translates the real address and source port (real socket) to the mapped address and a unique port above 1024 (mapped socket). Each connection requires a separate translation, because the source port differs for each connection. For example, 10.1.1.1:1025 requires a separate translation from 10.1.1.1:1026.

After the connection expires, the port translation also expires after 30 seconds of inactivity. The timeout is not configurable. Users on the destination network cannot reliably initiate a connection to a host that uses PAT (even if the connection is allowed by an access list). Not only can you not predict the real or mapped port number of the host, but the security appliance does not create a translation at all unless the translated host is the initiator. See the following "Static NAT" or "Static PAT" sections for reliable access to hosts.

PAT lets you use a single mapped address, thus conserving routable addresses. You can even use the security appliance interface IP address as the PAT address. PAT does not work with some multimedia applications that have a data stream that is different from the control path. See the "When to Use Application Protocol Inspection" section on page 26-2 for more information about NAT and PAT support.

Note For the duration of the translation, a remote host can initiate a connection to the translated host if an access list allows it. Because the port address (both real and mapped) is unpredictable, a connection to the host is unlikely. Nevertheless, in this case, you can rely on the security of the access list. However, policy PAT does not support time-based ACLs.

Static NAT

Static NAT creates a fixed translation of real address(es) to mapped address(es).With dynamic NAT and PAT, each host uses a different address or port for each subsequent translation. Because the mapped address is the same for each consecutive connection with static NAT, and a persistent translation rule exists, static NAT allows hosts on the destination network to initiate traffic to a translated host (if an access list exists that allows it).

The main difference between dynamic NAT and a range of addresses for static NAT is that static NAT allows a remote host to initiate a connection to a translated host (if an access list exists that allows it), while dynamic NAT does not. You also need an equal number of mapped addresses as real addresses with static NAT.

Static PAT

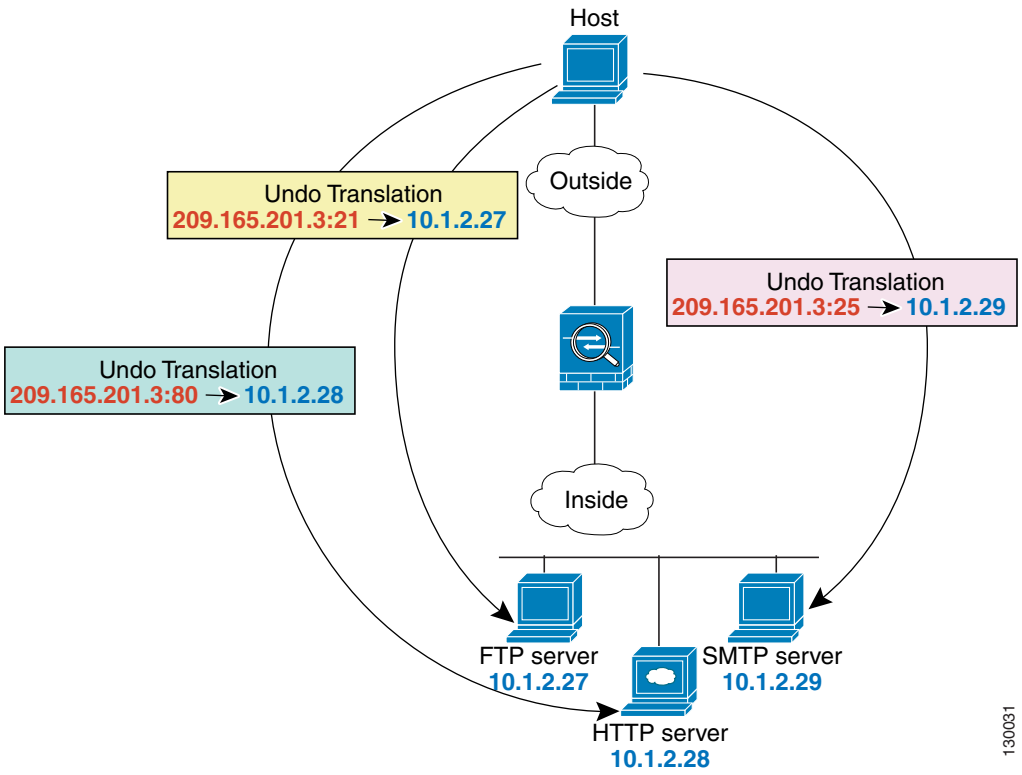
Static PAT is the same as static NAT, except that it lets you specify the protocol (TCP or UDP) and port for the real and mapped addresses.

This feature lets you identify the same mapped address across many different static statements, provided the port is different for each statement. You cannot use the same mapped address for multiple static NAT statements.

For applications that require inspection for secondary channels (for example, FTP and VoIP), the security appliance automatically translates the secondary ports.

For example, if you want to provide a single address for remote users to access FTP, HTTP, and SMTP, but these are all actually different servers on the real network, you can specify static PAT statements for each server that uses the same mapped IP address, but different ports (see Figure 19-8).

Figure 19-8 Static PAT



See the following commands for this example:

```
hostname(config)# static (inside,outside) tcp 209.165.201.3 ftp 10.1.2.27 ftp netmask
255.255.255.255
hostname(config)# static (inside,outside) tcp 209.165.201.3 http 10.1.2.28 http netmask
255.255.255.255
hostname(config)# static (inside,outside) tcp 209.165.201.3 smtp 10.1.2.29 smtp netmask
255.255.255.255
```

You can also use static PAT to translate a well-known port to a non-standard port or vice versa. For example, if inside web servers use port 8080, you can allow outside users to connect to port 80, and then undo translation to the original port 8080. Similarly, to provide extra security, you can tell web users to connect to non-standard port 6785, and then undo translation to port 80.

Bypassing NAT When NAT Control is Enabled

If you enable NAT control, then inside hosts must match a NAT rule when accessing outside hosts. If you do not want to perform NAT for some hosts, then you can bypass NAT for those hosts or you can disable NAT control. You might want to bypass NAT, for example, if you are using an application that does not support NAT. See the "When to Use Application Protocol Inspection" section on page 26-2 for information about inspection engines that do not support NAT.

You can configure traffic to bypass NAT using one of three methods. All methods achieve compatibility with inspection engines. However, each method offers slightly different capabilities, as follows:

- Identity NAT (**nat 0** command)—When you configure identity NAT (which is similar to dynamic NAT), you do not limit translation for a host on specific interfaces; you must use identity NAT for connections through all interfaces. Therefore, you cannot choose to perform normal translation on real addresses when you access interface A, but use identity NAT when accessing interface B. Regular dynamic NAT, on the other hand, lets you specify a particular interface on which to translate the addresses. Make sure that the real addresses for which you use identity NAT are routable on all networks that are available according to your access lists.

  For identity NAT, even though the mapped address is the same as the real address, you cannot initiate a connection from the outside to the inside (even if the interface access list allows it). Use static identity NAT or NAT exemption for this functionality.

- Static identity NAT (**static** command)—Static identity NAT lets you specify the interface on which you want to allow the real addresses to appear, so you can use identity NAT when you access interface A, and use regular translation when you access interface B. Static identity NAT also lets you use policy NAT, which identifies the real and destination addresses when determining the real addresses to translate (see the "Policy NAT" section on page 19-11 for more information about policy NAT). For example, you can use static identity NAT for an inside address when it accesses the outside interface and the destination is server A, but use a normal translation when accessing the outside server B.

- NAT exemption (**nat 0 access-list** command)—NAT exemption allows both translated and remote hosts to initiate connections. Like identity NAT, you do not limit translation for a host on specific interfaces; you must use NAT exemption for connections through all interfaces. However, NAT exemption does let you specify the real and destination addresses when determining the real addresses to translate (similar to policy NAT), so you have greater control using NAT exemption. However unlike policy NAT, NAT exemption does not consider the ports in the access list. NAT exemption also does not support connection settings, such as maximum TCP connections.

Policy NAT

Policy NAT lets you identify real addresses for address translation by specifying the source and destination addresses in an extended access list. You can also optionally specify the source and destination ports. Regular NAT can only consider the source addresses, and not the destination. For example, with policy NAT, you can translate the real address to mapped address A when it accesses server A, but translate the real address to mapped address B when it accesses server B.

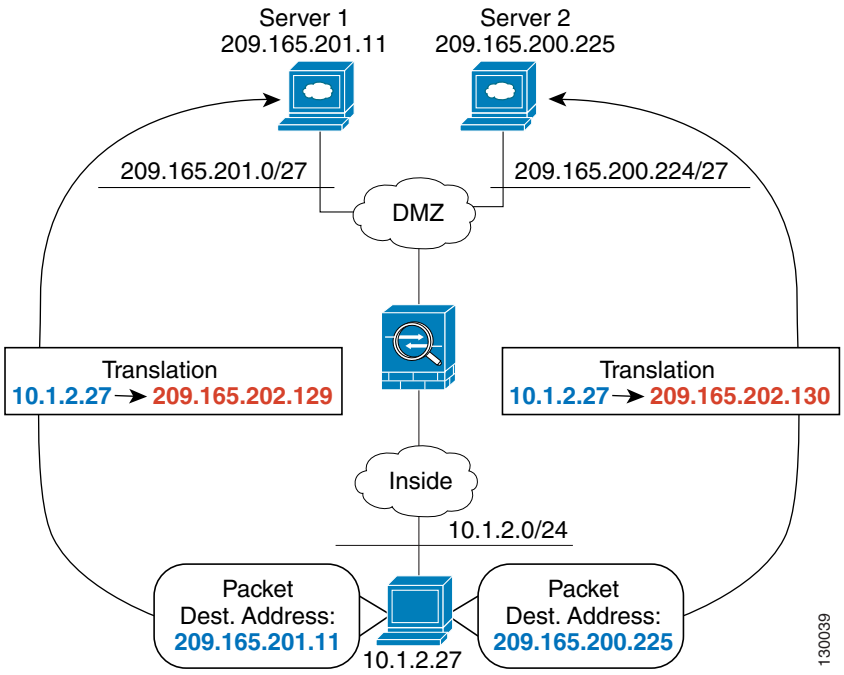
Note Policy NAT does not support time-based ACLs.

For applications that require application inspection for secondary channels (for example, FTP and VoIP), the policy specified in the policy NAT statement should include the secondary ports. When the ports cannot be predicted, the policy should specify only the IP addresses for the secondary channel. With this configuration, the security appliance translates the secondary ports.

Note All types of NAT support policy NAT, except for NAT exemption. NAT exemption uses an access list to identify the real addresses, but differs from policy NAT in that the ports are not considered. See the "Bypassing NAT" section on page 19-32 for other differences. You can accomplish the same result as NAT exemption using static identity NAT, which does support policy NAT.

Figure 19-9 shows a host on the 10.1.2.0/24 network accessing two different servers. When the host accesses the server at 209.165.201.11, the real address is translated to 209.165.202.129. When the host accesses the server at 209.165.200.225, the real address is translated to 209.165.202.130. Consequently, the host appears to be on the same network as the servers, which can help with routing.

Figure 19-9 Policy NAT with Different Destination Addresses



See the following commands for this example:

```
hostname(config)# access-list NET1 permit ip 10.1.2.0 255.255.255.0 209.165.201.0
255.255.255.224
hostname(config)# access-list NET2 permit ip 10.1.2.0 255.255.255.0 209.165.200.224
255.255.255.224
hostname(config)# nat (inside) 1 access-list NET1
hostname(config)# global (outside) 1 209.165.202.129
hostname(config)# nat (inside) 2 access-list NET2
hostname(config)# global (outside) 2 209.165.202.130
```

Figure 19-10 shows the use of source and destination ports. The host on the 10.1.2.0/24 network accesses a single host for both web services and Telnet services. When the host accesses the server for web services, the real address is translated to 209.165.202.129. When the host accesses the same server for Telnet services, the real address is translated to 209.165.202.130.

Figure 19-10 Policy NAT with Different Destination Ports

See the following commands for this example:

```
hostname(config)# access-list WEB permit tcp 10.1.2.0 255.255.255.0 209.165.201.11
255.255.255.255 eq 80
hostname(config)# access-list TELNET permit tcp 10.1.2.0 255.255.255.0 209.165.201.11
255.255.255.255 eq 23
hostname(config)# nat (inside) 1 access-list WEB
hostname(config)# global (outside) 1 209.165.202.129
hostname(config)# nat (inside) 2 access-list TELNET
hostname(config)# global (outside) 2 209.165.202.130
```

For policy static NAT (and for NAT exemption, which also uses an access list to identify traffic), you can initiate traffic to and from the real host. However, the destination address in the access list is only used for traffic initiated by the real host. For traffic *to* the real host from the destination network, the source address is not checked, and the first matching NAT rule for the real host address is used. So if you configure static policy NAT such as the following:

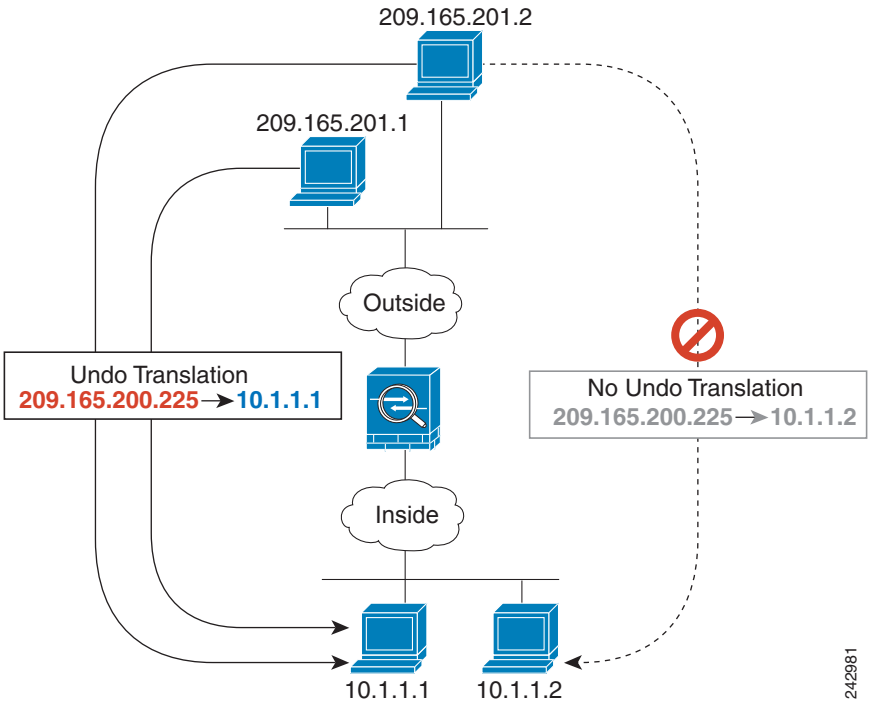
```
hostname(config)# access-list NET1 permit ip 10.1.2.0 255.255.255.224 209.165.201.0
255.255.255.224
hostname(config)# static (inside,outside) 209.165.202.128 access-list NET1
```

Then when hosts on the 10.1.2.0/27 network access 209.165.201.0/24, they are translated to corresponding addresses on the 209.165.202.128/27 network. But *any* host on the outside can access the mapped addresses 209.165.202.128/27, and not just hosts on the 209.165.201.0/24 network.

For the same reason (the source address is not checked for traffic *to* the real host), you cannot use policy static NAT to translate different real addresses to the same mapped address. For example, Figure 19-11 shows two inside hosts, 10.1.1.1 and 10.1.1.2, that you want to be translated to 209.165.200.225. When

outside host 209.165.201.1 connects to 209.165.200.225, then the connection goes to 10.1.1.1. When outside host 209.165.201.2 connects to the same mapped address, 209.165.200.225, you want the connection to go to 10.1.1.2. However, because the destination address in the access list is not checked for traffic to the real host, then the first ACE that matches the real host is used. Since the first ACE is for 10.1.1.1, then all inbound connections sourced from 209.165.201.1 and 209.165.201.2 and destined to 209.165.200.255 will have their destination address translated to 10.1.1.1.

Figure 19-11 Real Addresses Cannot Share the Same Mapped Address



See the following commands for this example. (Although the second ACE in the example does allow 209.165.201.2 to connect to 209.165.200.225, it only allows 209.165.200.225 to be translated to 10.1.1.1.)

```
hostname(config)# static (in,out) 209.165.200.225 access-list policy-nat
hostname(config)# access-list policy-nat permit ip host 10.1.1.1 host 209.165.201.1
hostname(config)# access-list policy-nat permit ip host 10.1.1.2 host 209.165.201.2
```

Note Policy NAT does not support SQL*Net, but it is supported by regular NAT. See the "When to Use Application Protocol Inspection" section on page 26-2 for information about NAT support for other protocols.

NAT and Same Security Level Interfaces

NAT is not required between same security level interfaces even if you enable NAT control. You can optionally configure NAT if desired. However, if you configure dynamic NAT when NAT control is enabled, then NAT is required. See the "NAT Control" section on page 19-5 for more information. Also,

when you specify a group of IP address(es) for dynamic NAT or PAT on a same security interface, then you must perform NAT on that group of addresses when they access any lower or same security level interface (even when NAT control is not enabled). Traffic identified for static NAT is not affected.

See the "Allowing Communication Between Interfaces on the Same Security Level" section on page 8-7 to enable same security communication.

Note The security appliance does not support VoIP inspection engines when you configure NAT on same security interfaces. These inspection engines include Skinny, SIP, and H.323. See the "When to Use Application Protocol Inspection" section on page 26-2 for supported inspection engines.

Order of NAT Commands Used to Match Real Addresses

The security appliance matches real addresses to NAT commands in the following order:

1. NAT exemption (**nat 0 access-list**)—In order, until the first match. Identity NAT is not included in this category; it is included in the regular static NAT or regular NAT category. We do not recommend overlapping addresses in NAT exemption statements because unexpected results can occur.
2. Static NAT and Static PAT (regular and policy) (**static**)—In order, until the first match. Static identity NAT is included in this category.
3. Policy dynamic NAT (**nat access-list**)—In order, until the first match. Overlapping addresses are allowed.
4. Regular dynamic NAT (**nat**)—Best match. Regular identity NAT is included in this category. The order of the NAT commands does not matter; the NAT statement that best matches the real address is used. For example, you can create a general statement to translate all addresses (0.0.0.0) on an interface. If you want to translate a subset of your network (10.1.1.1) to a different address, then you can create a statement to translate only 10.1.1.1. When 10.1.1.1 makes a connection, the specific statement for 10.1.1.1 is used because it matches the real address best. We do not recommend using overlapping statements; they use more memory and can slow the performance of the security appliance.

Mapped Address Guidelines

When you translate the real address to a mapped address, you can use the following mapped addresses:

- Addresses on the same network as the mapped interface.

  If you use addresses on the same network as the mapped interface (through which traffic exits the security appliance), the security appliance uses proxy ARP to answer any requests for mapped addresses, and thus intercepts traffic destined for a real address. This solution simplifies routing, because the security appliance does not have to be the gateway for any additional networks. However, this approach does put a limit on the number of available addresses used for translations.

  For PAT, you can even use the IP address of the mapped interface.

- Addresses on a unique network.

  If you need more addresses than are available on the mapped interface network, you can identify addresses on a different subnet. The security appliance uses proxy ARP to answer any requests for mapped addresses, and thus intercepts traffic destined for a real address. If you use OSPF to advertise mapped IP addresses that belong to a different subnet from the mapped interface, you need to create a static route to the mapped addresses that are destined to the mapped interface IP, and then

redistribute this static route in OSPF. If the mapped interface is passive (not advertising routes) or you are using static routing, then you need to add a static route on the upstream router that sends traffic destined for the mapped addresses to the security appliance.

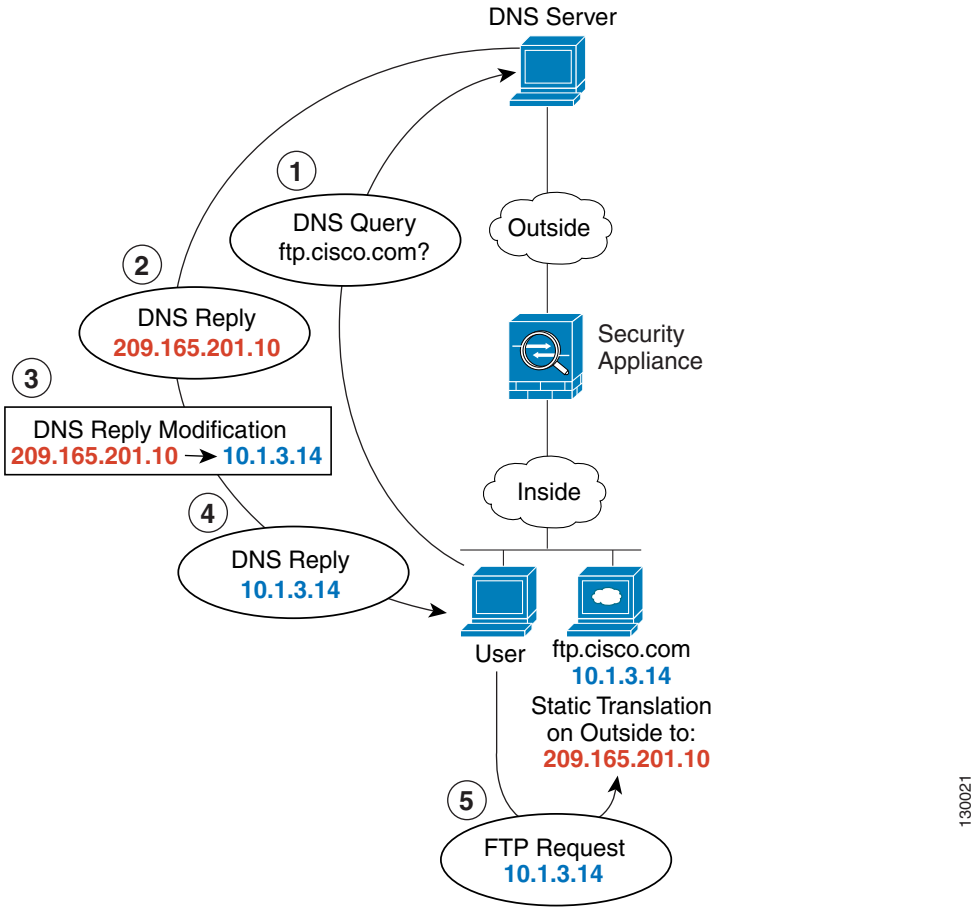
DNS and NAT

You might need to configure the security appliance to modify DNS replies by replacing the address in the reply with an address that matches the NAT configuration. You can configure DNS modification when you configure each translation.

For example, a DNS server is accessible from the outside interface. A server, ftp.cisco.com, is on the inside interface. You configure the security appliance to statically translate the ftp.cisco.com real address (10.1.3.14) to a mapped address (209.165.201.10) that is visible on the outside network (see Figure 19-12). In this case, you want to enable DNS reply modification on this static statement so that inside users who have access to ftp.cisco.com using the real address receive the real address from the DNS server, and not the mapped address.

When an inside host sends a DNS request for the address of ftp.cisco.com, the DNS server replies with the mapped address (209.165.201.10). The security appliance refers to the static statement for the inside server and translates the address inside the DNS reply to 10.1.3.14. If you do not enable DNS reply modification, then the inside host attempts to send traffic to 209.165.201.10 instead of accessing ftp.cisco.com directly.

Figure 19-12 DNS Reply Modification



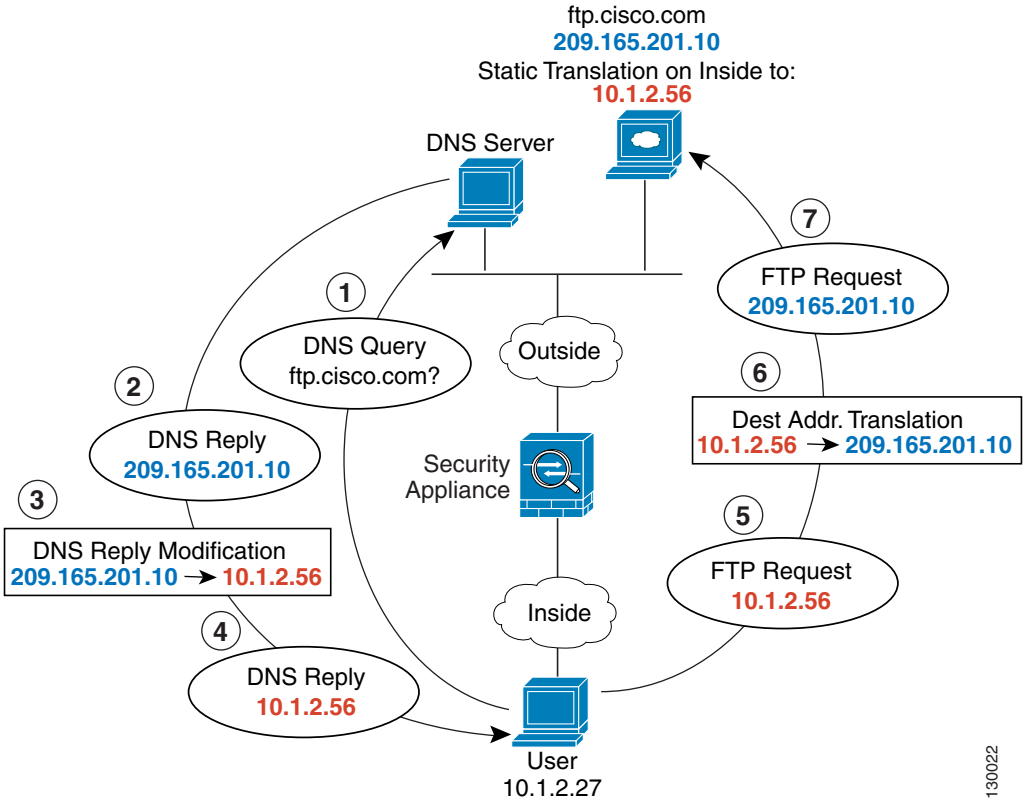
See the following command for this example:

```
hostname(config)# static (inside,outside) 209.165.201.10 10.1.3.14 netmask 255.255.255.255
dns
```

Note If a user on a different network (for example, DMZ) also requests the IP address for ftp.cisco.com from the outside DNS server, then the IP address in the DNS reply is also modified for this user, even though the user is not on the Inside interface referenced by the **static** command.

Figure 19-13 shows a web server and DNS server on the outside. The security appliance has a static translation for the outside server. In this case, when an inside user requests the address for ftp.cisco.com from the DNS server, the DNS server responds with the real address, 209.165.20.10. Because you want inside users to use the mapped address for ftp.cisco.com (10.1.2.56) you need to configure DNS reply modification for the static translation.

Figure 19-13 DNS Reply Modification Using Outside NAT



See the following command for this example:

```
hostname(config)# static (outside,inside) 10.1.2.56 209.165.201.10 netmask 255.255.255.255
dns
```

Configuring NAT Control

NAT control requires that packets traversing from an inside interface to an outside interface match a NAT rule. See the "NAT Control" section on page 19-5 for more information.

To enable NAT control, enter the following command:

```
hostname(config)# nat-control
```

To disable NAT control, enter the **no** form of the command.

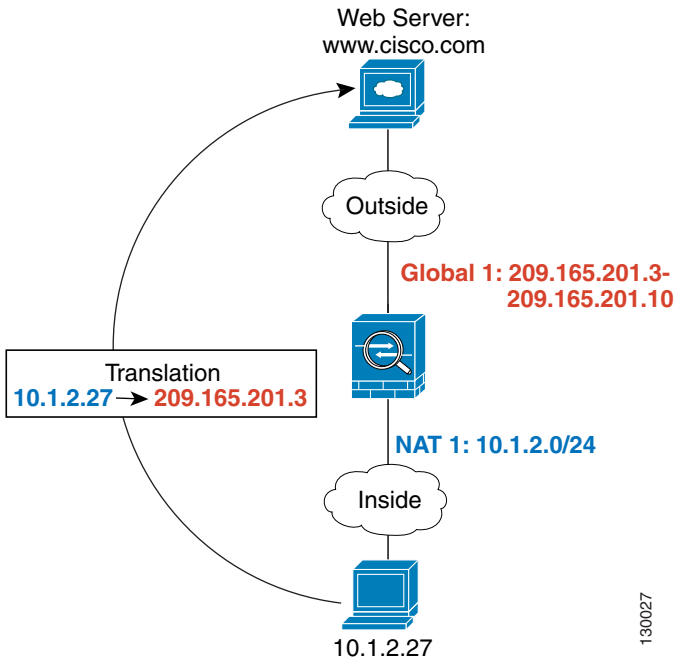
Using Dynamic NAT and PAT

This section describes how to configure dynamic NAT and PAT, and includes the following topics:

Dynamic NAT and PAT Implementation

For dynamic NAT and PAT, you first configure a **nat** command identifying the real addresses on a given interface that you want to translate. Then you configure a separate **global** command to specify the mapped addresses when exiting another interface (in the case of PAT, this is one address). Each **nat** command matches a **global** command by comparing the NAT ID, a number that you assign to each command (see Figure 19-14).

Figure 19-14 nat and global ID Matching

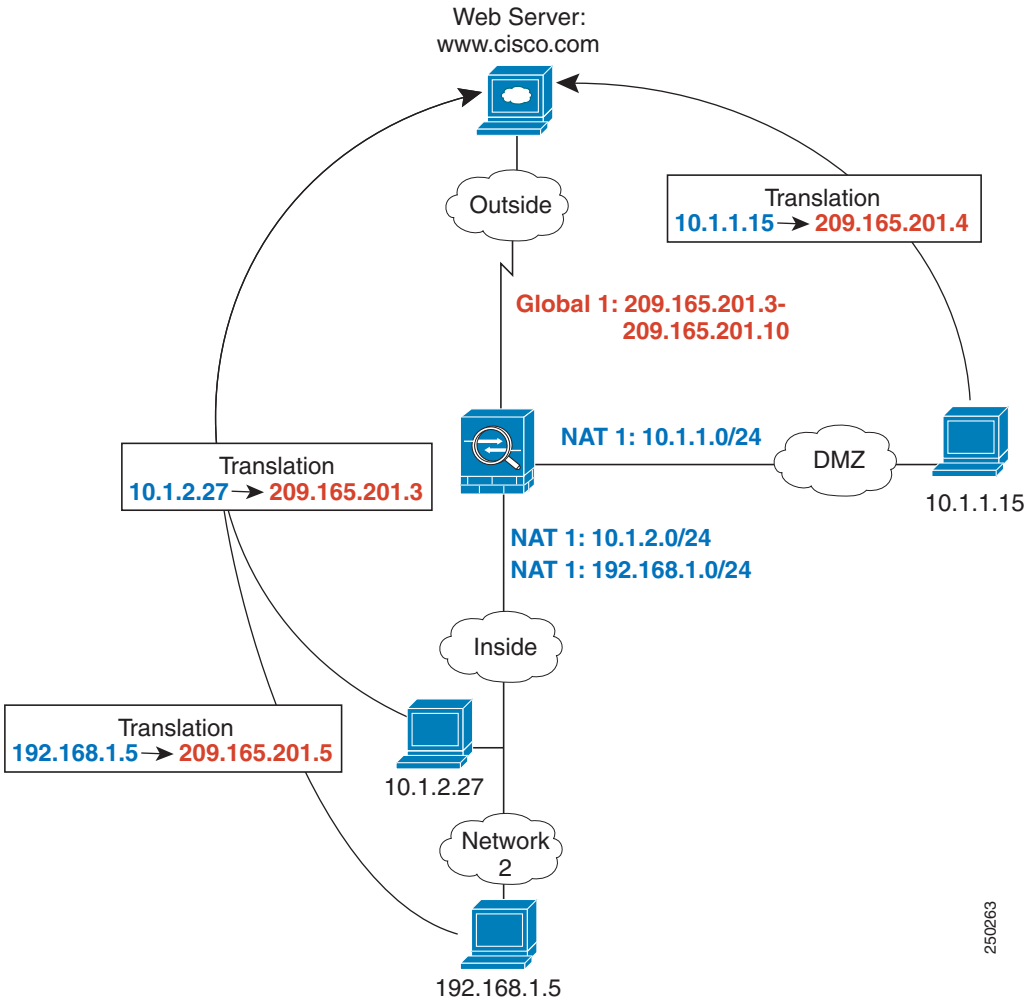


See the following commands for this example:

```
hostname(config)# nat (inside) 1 10.1.2.0 255.255.255.0
hostname(config)# global (outside) 1 209.165.201.3-209.165.201.10
```

You can enter multiple **nat** commands using the same NAT ID on one or more interfaces; they all use the same **global** command when traffic exits a given interface. For example, you can configure **nat** commands for Inside and DMZ interfaces, both on NAT ID 1. Then you configure a **global** command on the Outside interface that is also on ID 1. Traffic from the Inside interface and the DMZ interface share a mapped pool or a PAT address when exiting the Outside interface (see Figure 19-15).

Figure 19-15 nat Commands on Multiple Interfaces

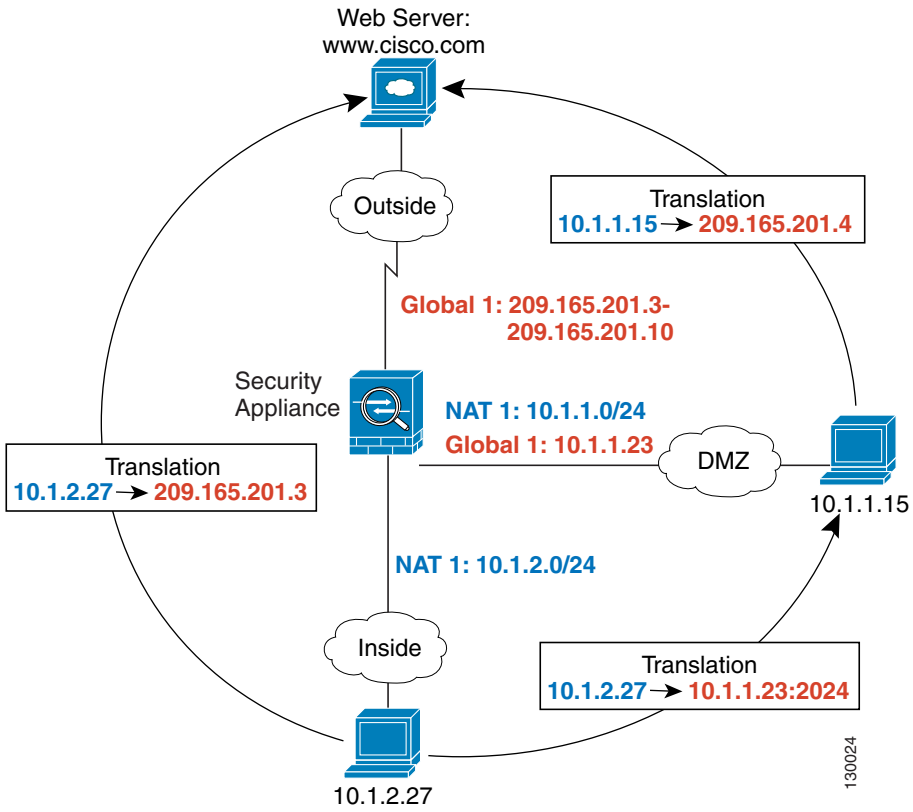


See the following commands for this example:

```
hostname(config)# nat (inside) 1 10.1.2.0 255.255.255.0
hostname(config)# nat (inside) 1 192.168.1.0 255.255.255.0
hostname(config)# nat (dmz) 1 10.1.1.0 255.255.255.0
hostname(config)# global (outside) 1 209.165.201.3-209.165.201.10
```

You can also enter a **global** command for each interface using the same NAT ID. If you enter a **global** command for the Outside and DMZ interfaces on ID 1, then the Inside **nat** command identifies traffic to be translated when going to both the Outside and the DMZ interfaces. Similarly, if you also enter a **nat** command for the DMZ interface on ID 1, then the **global** command on the Outside interface is also used for DMZ traffic. (See Figure 19-16).

Figure 19-16 global and nat Commands on Multiple Interfaces

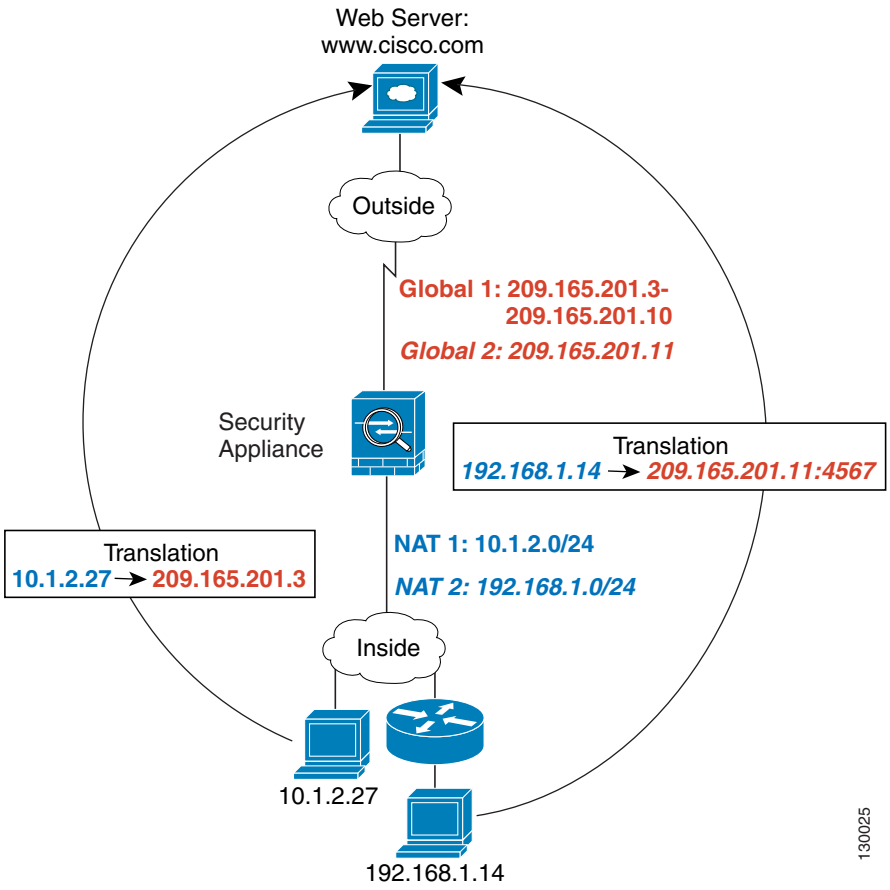


See the following commands for this example:

```
hostname(config)# nat (inside) 1 10.1.2.0 255.255.255.0
hostname(config)# nat (dmz) 1 10.1.1.0 255.255.255.0
hostname(config)# global (outside) 1 209.165.201.3-209.165.201.10
hostname(config)# global (dmz) 1 10.1.1.23
```

If you use different NAT IDs, you can identify different sets of real addresses to have different mapped addresses. For example, on the Inside interface, you can have two **nat** commands on two different NAT IDs. On the Outside interface, you configure two **global** commands for these two IDs. Then, when traffic from Inside network A exits the Outside interface, the IP addresses are translated to pool A addresses; while traffic from Inside network B are translated to pool B addresses (see Figure 19-17). If you use policy NAT, you can specify the same real addresses for multiple **nat** commands, as long as the the destination addresses and ports are unique in each access list.

Figure 19-17 Different NAT IDs

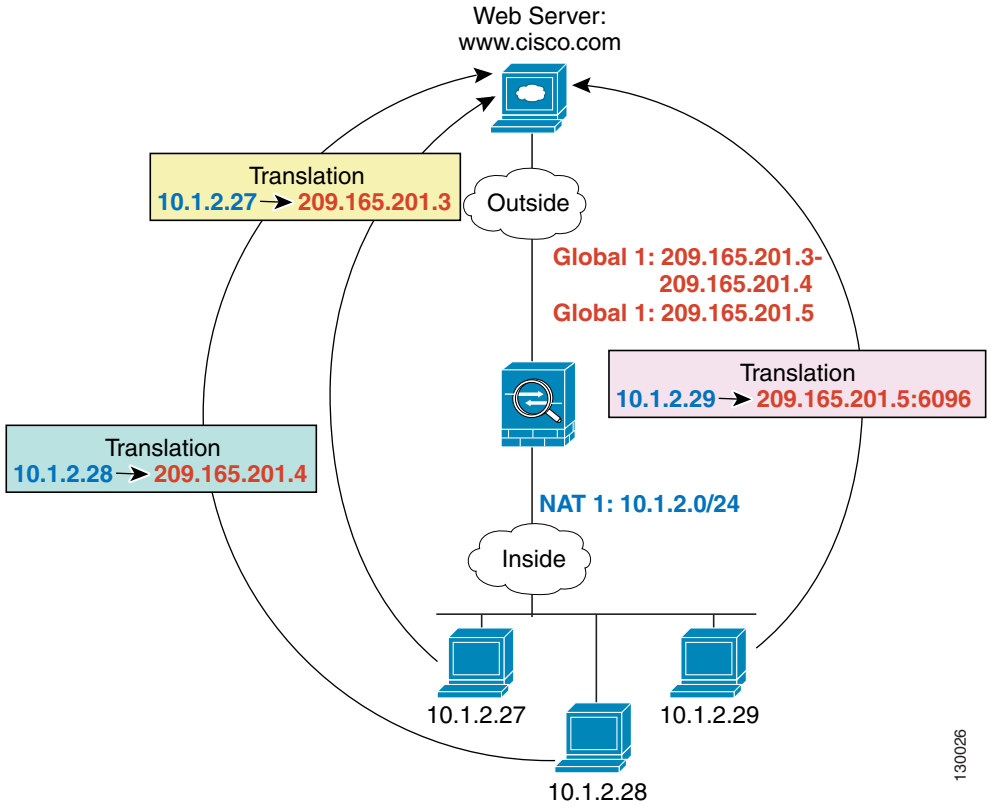


See the following commands for this example:

```
hostname(config)# nat (inside) 1 10.1.2.0 255.255.255.0
hostname(config)# nat (inside) 2 192.168.1.0 255.255.255.0
hostname(config)# global (outside) 1 209.165.201.3-209.165.201.10
hostname(config)# global (outside) 2 209.165.201.11
```

You can enter multiple **global** commands for one interface using the same NAT ID; the security appliance uses the dynamic NAT **global** commands first, in the order they are in the configuration, and then uses the PAT **global** commands in order. You might want to enter both a dynamic NAT **global** command and a PAT **global** command if you need to use dynamic NAT for a particular application, but want to have a backup PAT statement in case all the dynamic NAT addresses are depleted. Similarly, you might enter two PAT statements if you need more than the approximately 64,000 PAT sessions that a single PAT mapped statement supports (see Figure 19-18).

Figure 19-18 NAT and PAT Together

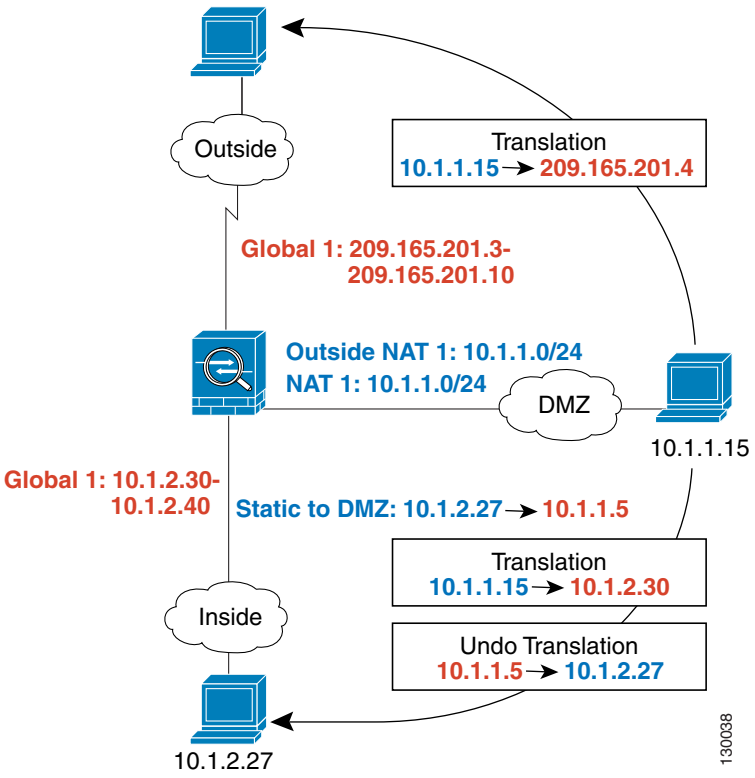


See the following commands for this example:

```
hostname(config)# nat (inside) 1 10.1.2.0 255.255.255.0
hostname(config)# global (outside) 1 209.165.201.3-209.165.201.4
hostname(config)# global (outside) 1 209.165.201.5
```

For outside NAT (from outside to inside), you need to use the **outside** keyword in the **nat** command. If you also want to translate the same traffic when it accesses an outside interface (for example, traffic on a DMZ is translated when accessing the Inside and the Outside interfaces), then you must configure a separate **nat** command without the **outside** option. In this case, you can identify the same addresses in both statements and use the same NAT ID (see Figure 19-19). Note that for outside NAT (DMZ interface to Inside interface), the inside host uses a **static** command to allow outside access, so both the source and destination addresses are translated.

Figure 19-19 Outside NAT and Inside NAT Combined



See the following commands for this example:

```
hostname(config)# nat (dmz) 1 10.1.1.0 255.255.255.0 outside
hostname(config)# nat (dmz) 1 10.1.1.0 255.255.255.0
hostname(config)# static (inside,dmz) 10.1.1.5 10.1.2.27 netmask 255.255.255.255
hostname(config)# global (outside) 1 209.165.201.3-209.165.201.4
hostname(config)# global (inside) 1 10.1.2.30-1-10.1.2.40
```

When you specify a group of IP address(es) in a **nat** command, then you must perform NAT on that group of addresses when they access any lower or same security level interface; you must apply a **global** command with the same NAT ID on each interface, or use a **static** command. NAT is not required for that group when it accesses a higher security interface, because to perform NAT from outside to inside, you must create a separate **nat** command using the **outside** keyword. If you do apply outside NAT, then the NAT requirements preceding come into effect for that group of addresses when they access all higher security interfaces. Traffic identified by a **static** command is not affected.

Configuring Dynamic NAT or PAT

This section describes how to configure dynamic NAT or dynamic PAT. The configuration for dynamic NAT and PAT are almost identical; for NAT you specify a range of mapped addresses, and for PAT you specify a single address.

Figure 19-20 shows a typical dynamic NAT scenario. Only translated hosts can create a NAT session, and responding traffic is allowed back. The mapped address is dynamically assigned from a pool defined by the **global** command.

Figure 19-20 Dynamic NAT

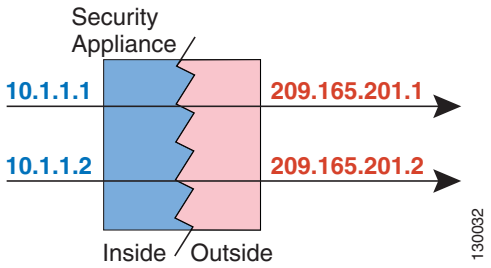
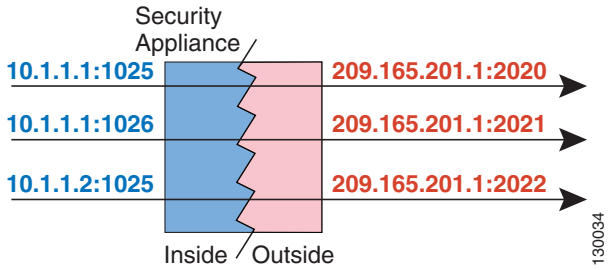


Figure 19-21 shows a typical dynamic PAT scenario. Only translated hosts can create a NAT session, and responding traffic is allowed back. The mapped address defined by the **global** command is the same for each translation, but the port is dynamically assigned.

Figure 19-21 Dynamic PAT



For more information about dynamic NAT, see the "Dynamic NAT" section on page 19-6. For more information about PAT, see the "PAT" section on page 19-8.

Note If you change the NAT configuration, and you do not want to wait for existing translations to time out before the new NAT information is used, you can clear the translation table using the **clear xlate** command. However, clearing the translation table disconnects all current connections that use translations.

To configure dynamic NAT or PAT, perform the following steps:

Step 1 To identify the real addresses that you want to translate, enter one of the following commands:

- Policy NAT:

```
hostname(config)# nat (real_interface) nat_id access-list acl_name [dns] [outside]
[norandomseq] [[tcp] tcp_max_conns [emb_limit]] [udp udp_max_conns]
```

You can identify overlapping addresses in other **nat** commands. For example, you can identify 10.1.1.0 in one command, but 10.1.1.1 in another. The traffic is matched to a policy NAT command in order, until the first match, or for regular NAT, using the best match.

The options for this command are as follows:

  - **access-list** *acl_name*—Identify the real addresses and destination addresses using an extended access list. Create the extended access list using the **access-list extended** command (see the "Adding an Extended Access List" section on page 18-6). This access list should include only **permit** ACEs. You can optionally specify the real and destination ports in the access list using the **eq** operator. Policy NAT considers the **inactive** and **time-range** keywords, but it does not support ACL with all **inactive** and **time-range** ACEs.
  - *nat_id*—An integer between 1 and 65535. The NAT ID should match a **global** command NAT ID. See the "Dynamic NAT and PAT Implementation" section on page 19-19 for more information about how NAT IDs are used. **0** is reserved for NAT exemption. (See the "Configuring NAT Exemption" section on page 19-35 for more information about NAT exemption.)
  - **dns**—If your **nat** command includes the address of a host that has an entry in a DNS server, and the DNS server is on a different interface from a client, then the client and the DNS server need different addresses for the host; one needs the mapped address and one needs the real address. This option rewrites the address in the DNS reply to the client. The translated host needs to be on the same interface as either the client or the DNS server. Typically, hosts that need to allow access from other interfaces use a static translation, so this option is more likely to be used with the **static** command. (See the "DNS and NAT" section on page 19-16 for more information.)
  - **outside**—If this interface is on a lower security level than the interface you identify by the matching **global** statement, then you must enter **outside** to identify the NAT instance as outside NAT.
  - **norandomseq**, **tcp** *tcp_max_conns*, **udp** *udp_max_conns*, and *emb_limit*—These keywords set connection limits. However, we recommend using a more versatile method for setting connection limits; see the "Configuring Connection Limits and Timeouts" section on page 24-17.

- Regular NAT:

```
hostname(config)# nat (real_interface) nat_id real_ip [mask [dns] [outside]
[norandomseq] [[tcp] tcp_max_conns [emb_limit]] [udp udp_max_conns]]
```

The *nat_id* argument is an integer between 1 and 2147483647. The NAT ID must match a **global** command NAT ID. See the "Dynamic NAT and PAT Implementation" section on page 19-19 for more information about how NAT IDs are used. **0** is reserved for identity NAT. See the "Configuring Identity NAT" section on page 19-33 for more information about identity NAT.

See the preceding policy NAT command for information about other options.

Step 2 To identify the mapped address(es) to which you want to translate the real addresses when they exit a particular interface, enter the following command:

```
hostname(config)# global (mapped_interface) nat_id {mapped_ip[-mapped_ip] | interface}
```

This NAT ID should match a **nat** command NAT ID. The matching **nat** command identifies the addresses that you want to translate when they exit this interface.

You can specify a single address (for PAT) or a range of addresses (for NAT). The range can go across subnet boundaries if desired. For example, you can specify the following "supernet":

```
192.168.1.1-192.168.2.254
```

For example, to translate the 10.1.1.0/24 network on the inside interface, enter the following command:

```
hostname(config)# nat (inside) 1 10.1.1.0 255.255.255.0
hostname(config)# global (outside) 1 209.165.201.1-209.165.201.30
```

To identify a pool of addresses for dynamic NAT as well as a PAT address for when the NAT pool is exhausted, enter the following commands:

```
hostname(config)# nat (inside) 1 10.1.1.0 255.255.255.0
hostname(config)# global (outside) 1 209.165.201.5
hostname(config)# global (outside) 1 209.165.201.10-209.165.201.20
```

To translate the lower security dmz network addresses so they appear to be on the same network as the inside network (10.1.1.0), for example, to simplify routing, enter the following commands:

```
hostname(config)# nat (dmz) 1 10.1.2.0 255.255.255.0 outside dns
hostname(config)# global (inside) 1 10.1.1.45
```

To identify a single real address with two different destination addresses using policy NAT, enter the following commands (see Figure 19-9 on page 19-12 for a related figure):

```
hostname(config)# access-list NET1 permit ip 10.1.2.0 255.255.255.0 209.165.201.0
255.255.255.224
hostname(config)# access-list NET2 permit ip 10.1.2.0 255.255.255.0 209.165.200.224
255.255.255.224
hostname(config)# nat (inside) 1 access-list NET1 tcp 0 2000 udp 10000
hostname(config)# global (outside) 1 209.165.202.129
hostname(config)# nat (inside) 2 access-list NET2 tcp 1000 500 udp 2000
hostname(config)# global (outside) 2 209.165.202.130
```

To identify a single real address/destination address pair that use different ports using policy NAT, enter the following commands (see Figure 19-10 on page 19-13 for a related figure):

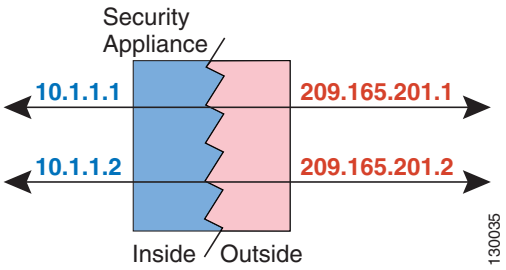
```
hostname(config)# access-list WEB permit tcp 10.1.2.0 255.255.255.0 209.165.201.11
255.255.255.255 eq 80
hostname(config)# access-list TELNET permit tcp 10.1.2.0 255.255.255.0 209.165.201.11
255.255.255.255 eq 23
hostname(config)# nat (inside) 1 access-list WEB
hostname(config)# global (outside) 1 209.165.202.129
hostname(config)# nat (inside) 2 access-list TELNET
hostname(config)# global (outside) 2 209.165.202.130
```

Using Static NAT

This section describes how to configure a static translation.

Figure 19-22 shows a typical static NAT scenario. The translation is always active so both translated and remote hosts can originate connections, and the mapped address is statically assigned by the **static** command.

Figure 19-22 Static NAT



You cannot use the same real or mapped address in multiple **static** commands between the same two interfaces unless you use static PAT (see the "Using Static PAT" section on page 19-30). Do not use a mapped address in the **static** command that is also defined in a **global** command for the same mapped interface.

For more information about static NAT, see the "Static NAT" section on page 19-9.

Note If you remove a **static** command, existing connections that use the translation are not affected. To remove these connections, enter the **clear local-host** command.

You cannot clear static translations from the translation table with the **clear xlate** command; you must remove the **static** command instead. Only dynamic translations created by the **nat** and **global** commands can be removed with the **clear xlate** command.

To configure static NAT, enter one of the following commands.

- For policy static NAT, enter the following command:

```
hostname(config)# static (real_interface,mapped_interface) {mapped_ip | interface}
access-list acl_name [dns] [norandomseq] [[tcp] tcp_max_conns [emb_limit]]
[udp udp_max_conns]
```

  Identify the real addresses and destination/source addresses using an extended access list. Create the extended access list using the **access-list extended** command (see the "Adding an Extended Access List" section on page 18-6). The first address in the access list is the real address; the second address is either the source or destiniation address, depending on where the traffic originates. For example, to translate the real address 10.1.1.1 to the mapped address 192.168.1.1 when 10.1.1.1 sends traffic to the 209.165.200.224 network, the **access-list** and **static** commands are:

```
hostname(config)# access-list TEST extended ip host 10.1.1.1 209.165.200.224
255.255.255.224
hostname(config)# static (inside,outside) 192.168.1.1 access-list TEST
```

In this case, the second address is the destination address. However, the same configuration is used for hosts to originate a connection to the mapped address. For example, when a host on the 209.165.200.224/27 network initiates a connection to 192.168.1.1, then the second address in the access list is the source address.

This access list should include only **permit** ACEs. You can optionally specify the real and destination ports in the access list using the **eq** operator. Policy NAT does not consider the **inactive** or **time-range** keywords; all ACEs are considered to be active for policy NAT configuration. See the "Policy NAT" section on page 19-11 for more information.

If you specify a network for translation (for example, 10.1.1.0 255.255.255.0), then the security appliance translates the .0 and .255 addresses. If you want to prevent access to these addresses, be sure to configure an access list to deny access.

See the "Configuring Dynamic NAT or PAT" section on page 19-25 for information about the other options.

Note An embryonic limit applied using static NAT is applied to all connections to or from the real IP address, and not just connections between the specified interfaces. To apply limits to specific flows, see the "Configuring Connection Limits and Timeouts" section on page 24-17.

- To configure regular static NAT, enter the following command:

```
hostname(config)# static (real_interface,mapped_interface) {mapped_ip | interface}
real_ip [netmask mask] [dns] [norandomseq] [[tcp] tcp_max_conns [emb_limit]]
[udp udp_max_conns]
```

See the "Configuring Dynamic NAT or PAT" section on page 19-25 for information about the options.

Note An embryonic limit applied using static NAT is applied to all connections to or from the real IP address, and not just connections between the specified interfaces. To apply limits to specific flows, see the "Configuring Connection Limits and Timeouts" section on page 24-17.

For example, the following policy static NAT example shows a single real address that is translated to two mapped addresses depending on the destination address (see Figure 19-9 on page 19-12 for a related figure):

```
hostname(config)# access-list NET1 permit ip host 10.1.2.27 209.165.201.0 255.255.255.224
hostname(config)# access-list NET2 permit ip host 10.1.2.27 209.165.200.224
255.255.255.224
hostname(config)# static (inside,outside) 209.165.202.129 access-list NET1
hostname(config)# static (inside,outside) 209.165.202.130 access-list NET2
```

The following command maps an inside IP address (10.1.1.3) to an outside IP address (209.165.201.12):

```
hostname(config)# static (inside,outside) 209.165.201.12 10.1.1.3 netmask 255.255.255.255
```

The following command maps the outside address (209.165.201.15) to an inside address (10.1.1.6):

```
hostname(config)# static (outside,inside) 10.1.1.6 209.165.201.15 netmask 255.255.255.255
```

The following command statically maps an entire subnet:

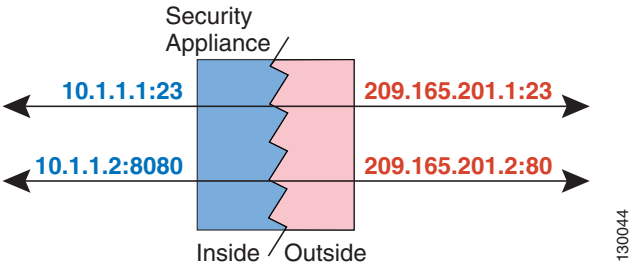
```
hostname(config)# static (inside,dmz) 10.1.1.0 10.1.2.0 netmask 255.255.255.0
```

Using Static PAT

This section describes how to configure a static port translation. Static PAT lets you translate the real IP address to a mapped IP address, as well as the real port to a mapped port. You can choose to translate the real port to the same port, which lets you translate only specific types of traffic, or you can take it further by translating to a different port.

Figure 19-23 shows a typical static PAT scenario. The translation is always active so both translated and remote hosts can originate connections, and the mapped address and port is statically assigned by the **static** command.

Figure 19-23 Static PAT



For applications that require application inspection for secondary channels (for example, FTP and VoIP), the security appliance automatically translates the secondary ports.

Do not use a mapped address in the **static** command that is also defined in a **global** command for the same mapped interface.

For more information about static PAT, see the "Static PAT" section on page 19-9.

Note If you remove a **static** command, existing connections that use the translation are not affected. To remove these connections, enter the **clear local-host** command.

You cannot clear static translations from the translation table with the **clear xlate** command; you must remove the **static** command instead. Only dynamic translations created by the **nat** and **global** commands can be removed with the **clear xlate** command.

To configure static PAT, enter one of the following commands.

- For policy static PAT, enter the following command:

```
hostname(config)# static (real_interface,mapped_interface) {tcp | udp}
{mapped_ip | interface} mapped_port access-list acl_name [dns] [norandomseq]
[[tcp] tcp_max_conns [emb_limit]] [udp udp_max_conns]
```

  Identify the real addresses and destination/source addresses using an extended access list. Create the extended access list using the **access-list extended** command (see the "Adding an Extended Access List" section on page 18-6). The protocol in the access list must match the protocol you set in this command. For example, if you specify **tcp** in the **static** command, then you must specify **tcp** in the access list. Specify the port using the **eq** operator.

The first address in the access list is the real address; the second address is either the source or destiniation address, depending on where the traffic originates. For example, to translate the real address 10.1.1.1/Telnet to the mapped address 192.168.1.1/Telnet when 10.1.1.1 sends traffic to the 209.165.200.224 network, the **access-list** and **static** commands are:

```
hostname(config)# access-list TEST extended tcp host 10.1.1.1 eq telnet
209.165.200.224 255.255.255.224
hostname(config)# static (inside,outside) tcp 192.168.1.1 telnet access-list TEST
```

In this case, the second address is the destination address. However, the same configuration is used for hosts to originate a connection to the mapped address. For example, when a host on the 209.165.200.224 network initiates a Telnet connection to 192.168.1.1, then the second address in the access list is the source address.

This access list should include only **permit** ACEs. Policy NAT does not consider the **inactive** or **time-range** keywords; all ACEs are considered to be active for policy NAT configuration. See the "Policy NAT" section on page 19-11 for more information.

If you specify a network for translation (for example, 10.1.1.0 255.255.255.0), then the security appliance translates the .0 and .255 addresses. If you want to prevent access to these addresses, be sure to configure an access list to deny access.

See the "Configuring Dynamic NAT or PAT" section on page 19-25 for information about the other options.

Note An embryonic limit applied using static NAT is applied to all connections to or from the real IP address, and not just connections between the specified interfaces. To apply limits to specific flows, see the "Configuring Connection Limits and Timeouts" section on page 24-17.

- To configure regular static PAT, enter the following command:

```
hostname(config)# static (real_interface,mapped_interface) {tcp | udp} {mapped_ip |
interface} mapped_port real_ip real_port [netmask mask] [dns] [norandomseq] [[tcp]
tcp_max_conns [emb_limit]] [udp udp_max_conns]
```

See the "Configuring Dynamic NAT or PAT" section on page 19-25 for information about the options.

Note An embryonic limit applied using static NAT is applied to all connections to or from the real IP address, and not just connections between the specified interfaces. To apply limits to specific flows, see the "Configuring Connection Limits and Timeouts" section on page 24-17.

Note When configuring static PAT with FTP, you need to add entries for both TCP ports 20 and 21. You must specify port 20 so that the source port for the active transfer is not modified to another port, which may interfere with other devices that perform NAT on FTP traffic.

For example, for Telnet traffic initiated from hosts on the 10.1.3.0 network to the security appliance outside interface (10.1.2.14), you can redirect the traffic to the inside host at 10.1.1.15 by entering the following commands:

```
hostname(config)# access-list TELNET permit tcp host 10.1.1.15 eq telnet 10.1.3.0
255.255.255.0
hostname(config)# static (inside,outside) tcp 10.1.2.14 telnet access-list TELNET
```

For HTTP traffic initiated from hosts on the 10.1.3.0 network to the security appliance outside interface (10.1.2.14), you can redirect the traffic to the inside host at 10.1.1.15 by entering:

```
hostname(config)# access-list HTTP permit tcp host 10.1.1.15 eq http 10.1.3.0
255.255.255.0
hostname(config)# static (inside,outside) tcp 10.1.2.14 http access-list HTTP
```

To redirect Telnet traffic from the security appliance outside interface (10.1.2.14) to the inside host at 10.1.1.15, enter the following command:

```
hostname(config)# static (inside,outside) tcp 10.1.2.14 telnet 10.1.1.15 telnet netmask
255.255.255.255
```

If you want to allow the preceding real Telnet server to initiate connections, though, then you need to provide additional translation. For example, to translate all other types of traffic, enter the following commands. The original **static** command provides translation for Telnet to the server, while the **nat** and **global** commands provide PAT for outbound connections from the server.

```
hostname(config)# static (inside,outside) tcp 10.1.2.14 telnet 10.1.1.15 telnet netmask
255.255.255.255
hostname(config)# nat (inside) 1 10.1.1.15 255.255.255.255
hostname(config)# global (outside) 1 10.1.2.14
```

If you also have a separate translation for all inside traffic, and the inside hosts use a different mapped address from the Telnet server, you can still configure traffic initiated from the Telnet server to use the same mapped address as the **static** statement that allows Telnet traffic to the server. You need to create a more exclusive **nat** statement just for the Telnet server. Because **nat** statements are read for the best match, more exclusive **nat** statements are matched before general statements. The following example shows the Telnet **static** statement, the more exclusive **nat** statement for initiated traffic from the Telnet server, and the statement for other inside hosts, which uses a different mapped address.

```
hostname(config)# static (inside,outside) tcp 10.1.2.14 telnet 10.1.1.15 telnet netmask
255.255.255.255
hostname(config)# nat (inside) 1 10.1.1.15 255.255.255.255
hostname(config)# global (outside) 1 10.1.2.14
hostname(config)# nat (inside) 2 10.1.1.0 255.255.255.0
hostname(config)# global (outside) 2 10.1.2.78
```

To translate a well-known port (80) to another port (8080), enter the following command:

```
hostname(config)# static (inside,outside) tcp 10.1.2.45 80 10.1.1.16 8080 netmask
255.255.255.255
```

Bypassing NAT

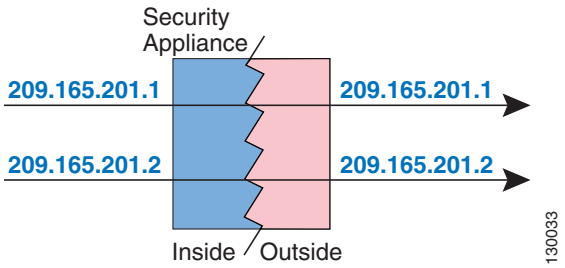
This section describes how to bypass NAT. You might want to bypass NAT when you enable NAT control. You can bypass NAT using identity NAT, static identity NAT, or NAT exemption. See the "Bypassing NAT When NAT Control is Enabled" section on page 19-10 for more information about these methods. This section includes the following topics:

Configuring Identity NAT

Identity NAT translates the real IP address to the same IP address. Only "translated" hosts can create NAT translations, and responding traffic is allowed back.

Figure 19-24 shows a typical identity NAT scenario.

Figure 19-24 Identity NAT



Note If you change the NAT configuration, and you do not want to wait for existing translations to time out before the new NAT information is used, you can clear the translation table using the **clear xlate** command. However, clearing the translation table disconnects all current connections that use translations.

To configure identity NAT, enter the following command:

```
hostname(config)# nat (real_interface) 0 real_ip [mask [dns] [outside] [norandomseq]
[[tcp] tcp_max_conns [emb_limit]] [udp udp_max_conns]
```

See the "Configuring Dynamic NAT or PAT" section on page 19-25 for information about the options.

For example, to use identity NAT for the inside 10.1.1.0/24 network, enter the following command:

```
hostname(config)# nat (inside) 0 10.1.1.0 255.255.255.0
```

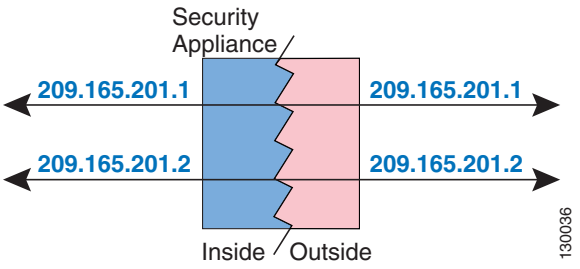
Configuring Static Identity NAT

Static identity NAT translates the real IP address to the same IP address. The translation is always active, and both "translated" and remote hosts can originate connections. Static identity NAT lets you use regular NAT or policy NAT. Policy NAT lets you identify the real and destination addresses when determining the real addresses to translate (see the "Policy NAT" section on page 19-11 for more

information about policy NAT). For example, you can use policy static identity NAT for an inside address when it accesses the outside interface and the destination is server A, but use a normal translation when accessing the outside server B.

Figure 19-25 shows a typical static identity NAT scenario.

Figure 19-25 Static Identity NAT



Note If you remove a **static** command, existing connections that use the translation are not affected. To remove these connections, enter the **clear local-host** command.

You cannot clear static translations from the translation table with the **clear xlate** command; you must remove the **static** command instead. Only dynamic translations created by the **nat** and **global** commands can be removed with the **clear xlate** command.

To configure static identity NAT, enter one of the following commands:

- To configure policy static identity NAT, enter the following command:

  ```
  hostname(config)# static (real_interface,mapped_interface) real_ip access-list acl_id
  [dns] [norandomseq] [[tcp] tcp_max_conns [emb_limit]] [udp udp_max_conns]
  ```

  Create the extended access list using the **access-list extended** command (see the "Adding an Extended Access List" section on page 18-6). This access list should include only **permit** ACEs. Make sure the source address in the access list matches the *real_ip* in this command. Policy NAT does not consider the **inactive** or **time-range** keywords; all ACEs are considered to be active for policy NAT configuration. See the "Policy NAT" section on page 19-11 for more information.

  See the "Configuring Dynamic NAT or PAT" section on page 19-25 for information about the other options.

- To configure regular static identity NAT, enter the following command:

  ```
  hostname(config)# static (real_interface,mapped_interface) real_ip real_ip [netmask
  mask] [dns] [norandomseq] [[tcp] tcp_max_conns [emb_limit]] [udp udp_max_conns]
  ```

  Specify the same IP address for both *real_ip* arguments.

  See the "Configuring Dynamic NAT or PAT" section on page 19-25 for information about the other options.

For example, the following command uses static identity NAT for an inside IP address (10.1.1.3) when accessed by the outside:

```
hostname(config)# static (inside,outside) 10.1.1.3 10.1.1.3 netmask 255.255.255.255
```

The following command uses static identity NAT for an outside address (209.165.201.15) when accessed by the inside:

```
hostname(config)# static (outside,inside) 209.165.201.15 209.165.201.15 netmask
255.255.255.255
```

The following command statically maps an entire subnet:

```
hostname(config)# static (inside,dmz) 10.1.2.0 10.1.2.0 netmask 255.255.255.0
```

The following static identity policy NAT example shows a single real address that uses identity NAT when accessing one destination address, and a translation when accessing another:

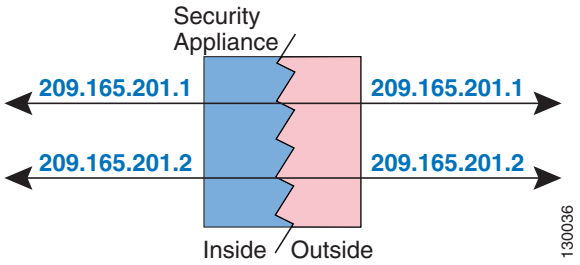
```
hostname(config)# access-list NET1 permit ip host 10.1.2.27 209.165.201.0 255.255.255.224
hostname(config)# access-list NET2 permit ip host 10.1.2.27 209.165.200.224
255.255.255.224
hostname(config)# static (inside,outside) 10.1.2.27 access-list NET1
hostname(config)# static (inside,outside) 209.165.202.130 access-list NET2
```

Configuring NAT Exemption

NAT exemption exempts addresses from translation and allows both real and remote hosts to originate connections. NAT exemption lets you specify the real and destination addresses when determining the real traffic to exempt (similar to policy NAT), so you have greater control using NAT exemption than identity NAT. However unlike policy NAT, NAT exemption does not consider the ports in the access list. Use static identity NAT to consider ports in the access list.

Figure 19-26 shows a typical NAT exemption scenario.

Figure 19-26 NAT Exemption



Note If you remove a NAT exemption configuration, existing connections that use NAT exemption are not affected. To remove these connections, enter the **clear local-host** command.

To configure NAT exemption, enter the following command:

```
hostname(config)# nat (real_interface) 0 access-list acl_name [outside]
```

Create the extended access list using the **access-list extended** command (see the "Adding an Extended Access List" section on page 18-6). This access list can include both **permit** ACEs and **deny** ACEs. Do not specify the real and destination ports in the access list; NAT exemption does not consider the ports. NAT exemption considers the **inactive** and **time-range** keywords, but it does not support ACL with all **inactive** and **time-range** ACEs.

By default, this command exempts traffic from inside to outside. If you want traffic from outside to inside to bypass NAT, then add an additional **nat** command and enter **outside** to identify the NAT instance as outside NAT. You might want to use outside NAT exemption if you configure dynamic NAT for the outside interface and want to exempt other traffic.

For example, to exempt an inside network when accessing any destination address, enter the following command:

```
hostname(config)# access-list EXEMPT permit ip 10.1.2.0 255.255.255.0 any
hostname(config)# nat (inside) 0 access-list EXEMPT
```

To use dynamic outside NAT for a DMZ network, and exempt another DMZ network, enter the following command:

```
hostname(config)# nat (dmz) 1 10.1.2.0 255.255.255.0 outside dns
hostname(config)# global (inside) 1 10.1.1.45
hostname(config)# access-list EXEMPT permit ip 10.1.3.0 255.255.255.0 any
hostname(config)# nat (dmz) 0 access-list EXEMPT
```

To exempt an inside address when accessing two different destination addresses, enter the following commands:

```
hostname(config)# access-list NET1 permit ip 10.1.2.0 255.255.255.0 209.165.201.0
255.255.255.224
hostname(config)# access-list NET1 permit ip 10.1.2.0 255.255.255.0 209.165.200.224
255.255.255.224
hostname(config)# nat (inside) 0 access-list NET1
```

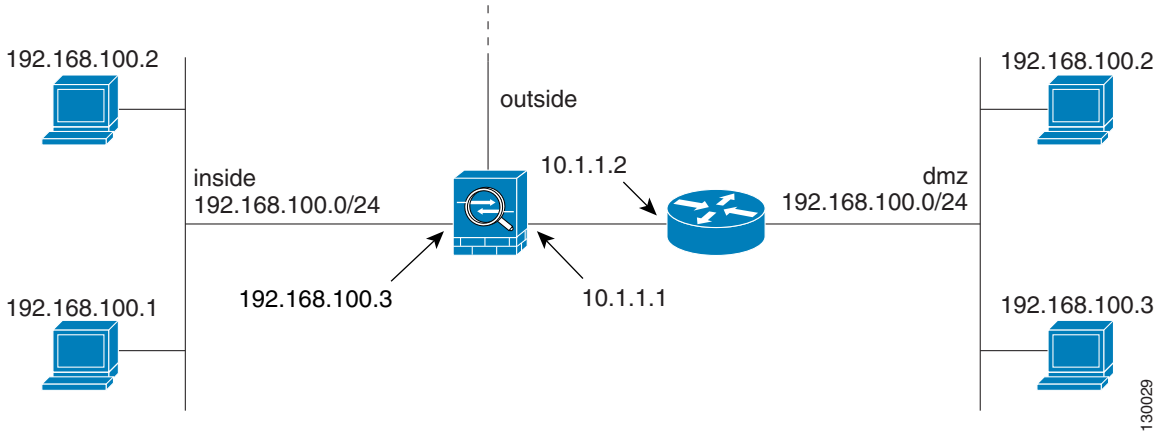
NAT Examples

This section describes typical scenarios that use NAT solutions, and includes the following topics:

Overlapping Networks

In Figure 19-27, the security appliance connects two private networks with overlapping address ranges.

Figure 19-27 Using Outside NAT with Overlapping Networks



Two networks use an overlapping address space (192.168.100.0/24), but hosts on each network must communicate (as allowed by access lists). Without NAT, when a host on the inside network tries to access a host on the overlapping DMZ network, the packet never makes it past the security appliance, which sees the packet as having a destination address on the inside network. Moreover, if the destination address is being used by another host on the inside network, that host receives the packet.

To solve this problem, use NAT to provide non-overlapping addresses. If you want to allow access in both directions, use static NAT for both networks. If you only want to allow the inside interface to access hosts on the DMZ, then you can use dynamic NAT for the inside addresses, and static NAT for the DMZ addresses you want to access. This example shows static NAT.

To configure static NAT for these two interfaces, perform the following steps. The 10.1.1.0/24 network on the DMZ is not translated.

Step 1 Translate 192.168.100.0/24 on the inside to 10.1.2.0/24 when it accesses the DMZ by entering the following command:

```
hostname(config)# static (inside,dmz) 10.1.2.0 192.168.100.0 netmask 255.255.255.0
```

Step 2 Translate the 192.168.100.0/24 network on the DMZ to 10.1.3.0/24 when it accesses the inside by entering the following command:

```
hostname(config)# static (dmz,inside) 10.1.3.0 192.168.100.0 netmask 255.255.255.0
```

Step 3 Configure the following static routes so that traffic to the dmz network can be routed correctly by the security appliance:

```
hostname(config)# route dmz 192.168.100.128 255.255.255.128 10.1.1.2 1
hostname(config)# route dmz 192.168.100.0 255.255.255.128 10.1.1.2 1
```

The security appliance already has a connected route for the inside network. These static routes allow the security appliance to send traffic for the 192.168.100.0/24 network out the DMZ interface to the gateway router at 10.1.1.2. (You need to split the network into two because you cannot create a static route with the exact same network as a connected route.) Alternatively, you could use a more broad route for the DMZ traffic, such as a default route.

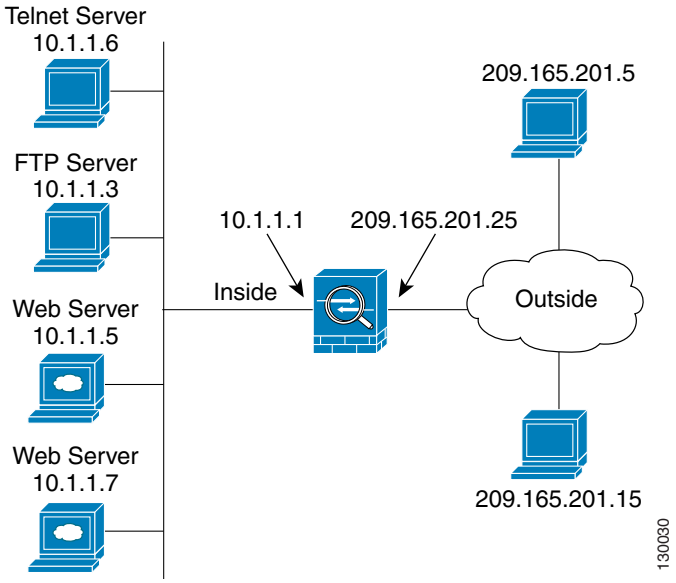
If host 192.168.100.2 on the DMZ network wants to initiate a connection to host 192.168.100.2 on the inside network, the following events occur:

1. The DMZ host 192.168.100.2 sends the packet to IP address 10.1.2.2.
2. When the security appliance receives this packet, the security appliance translates the source address from 192.168.100.2 to 10.1.3.2.
3. Then the security appliance translates the destination address from 10.1.2.2 to 192.168.100.2, and the packet is forwarded.

Redirecting Ports

Figure 19-28 shows an example of a network configuration in which the port redirection feature might be useful.

Figure 19-28 Port Redirection Using Static PAT



In the configuration described in this section, port redirection occurs for hosts on external networks as follows:

- Telnet requests to IP address 209.165.201.5 are redirected to 10.1.1.6.
- FTP requests to IP address 209.165.201.5 are redirected to 10.1.1.3.
- HTTP request to an security appliance outside IP address 209.165.201.25 are redirected to 10.1.1.5.
- HTTP port 8080 requests to PAT address 209.165.201.15 are redirected to 10.1.1.7 port 80.

To implement this configuration, perform the following steps:

Step 1 Configure PAT for the inside network by entering the following commands:

```
hostname(config)# nat (inside) 1 0.0.0.0 0.0.0.0 0 0
hostname(config)# global (outside) 1 209.165.201.15
```

Step 2 Redirect Telnet requests for 209.165.201.5 to 10.1.1.6 by entering the following command:

```
hostname(config)# static (inside,outside) tcp 209.165.201.5 telnet 10.1.1.6 telnet netmask
255.255.255.255
```

Step 3 Redirect FTP requests for IP address 209.165.201.5 to 10.1.1.3 by entering the following command:

```
hostname(config)# static (inside,outside) tcp 209.165.201.5 ftp 10.1.1.3 ftp netmask
255.255.255.255
```

Step 4 Redirect HTTP requests for the security appliance outside interface address to 10.1.1.5 by entering the following command:

```
hostname(config)# static (inside,outside) tcp interface www 10.1.1.5 www netmask
255.255.255.255
```

Step 5 Redirect HTTP requests on port 8080 for PAT address 209.165.201.15 to 10.1.1.7 port 80 by entering the following command:

```
hostname(config)# static (inside,outside) tcp 209.165.201.15 8080 10.1.1.7 www netmask
255.255.255.255
```