



CHAPTER 16

Firewall Mode Overview

This chapter describes how the firewall works in each firewall mode. To set the firewall mode, see the [“Setting Transparent or Routed Firewall Mode”](#) section on page 2-3.



Note

In multiple context mode, you cannot set the firewall mode separately for each context; you can only set the firewall mode for the entire adaptive security appliance.

This chapter includes the following sections:

- [Routed Mode Overview, page 16-1](#)
- [Transparent Mode Overview, page 16-7](#)

Routed Mode Overview

In routed mode, the adaptive security appliance is considered to be a router hop in the network. It can use OSPF or RIP (in single context mode). Routed mode supports many interfaces. Each interface is on a different subnet. You can share interfaces between contexts.

This section includes the following topics:

- [IP Routing Support, page 16-1](#)
- [How Data Moves Through the Security Appliance in Routed Firewall Mode, page 16-1](#)

IP Routing Support

The adaptive security appliance acts as a router between connected networks, and each interface requires an IP address on a different subnet. In single context mode, the routed firewall supports OSPF, EIGRP, and RIP. Multiple context mode supports static routes only. We recommend using the advanced routing capabilities of the upstream and downstream routers instead of relying on the adaptive security appliance for extensive routing needs.

How Data Moves Through the Security Appliance in Routed Firewall Mode

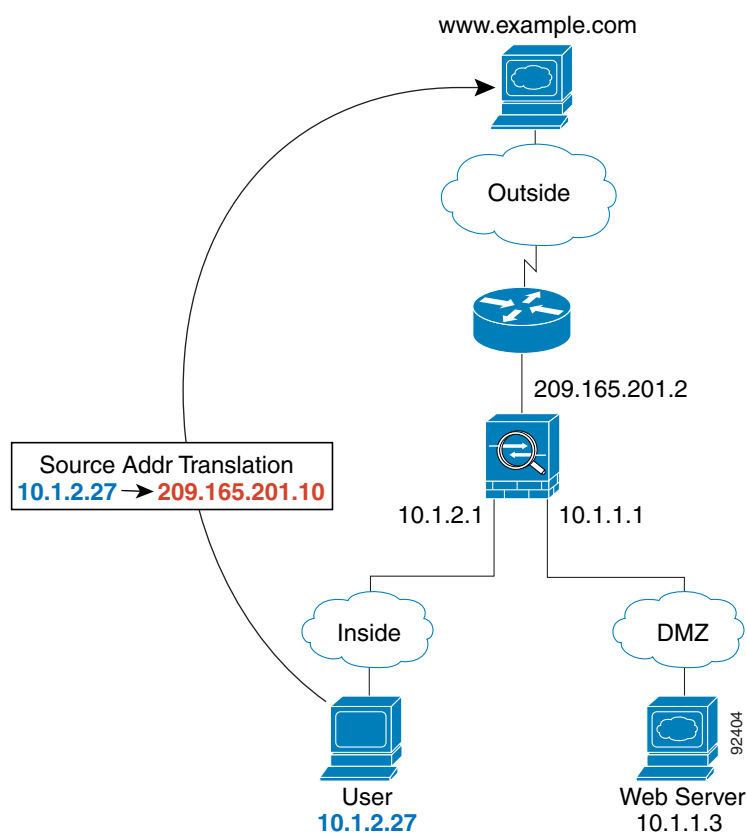
This section describes how data moves through the adaptive security appliance in routed firewall mode, and includes the following topics:

- [An Inside User Visits a Web Server, page 16-2](#)
- [An Outside User Visits a Web Server on the DMZ, page 16-3](#)
- [An Inside User Visits a Web Server on the DMZ, page 16-4](#)
- [An Outside User Attempts to Access an Inside Host, page 16-5](#)
- [A DMZ User Attempts to Access an Inside Host, page 16-6](#)

An Inside User Visits a Web Server

Figure 16-1 shows an inside user accessing an outside web server.

Figure 16-1 Inside to Outside



The following steps describe how data moves through the adaptive security appliance (see [Figure 16-1](#)):

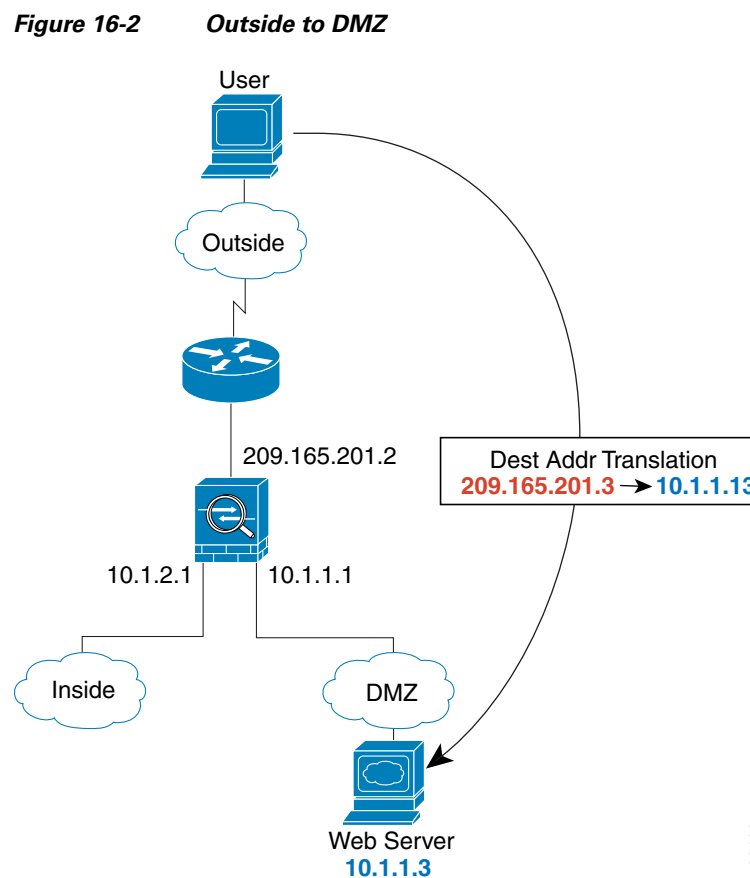
1. The user on the inside network requests a web page from [www.example.com](#).
2. The adaptive security appliance receives the packet and because it is a new session, the adaptive security appliance verifies that the packet is allowed according to the terms of the security policy (access lists, filters, AAA).

For multiple context mode, the adaptive security appliance first classifies the packet according to either a unique interface or a unique destination address associated with a context; the destination address is associated by matching an address translation in a context. In this case, the interface would be unique; the [www.example.com](#) IP address does not have a current address translation in a context.

3. The adaptive security appliance translates the local source address (10.1.2.27) to the global address 209.165.201.10, which is on the outside interface subnet.
The global address could be on any subnet, but routing is simplified when it is on the outside interface subnet.
4. The adaptive security appliance then records that a session is established and forwards the packet from the outside interface.
5. When www.example.com responds to the request, the packet goes through the adaptive security appliance, and because the session is already established, the packet bypasses the many lookups associated with a new connection. The adaptive security appliance performs NAT by translating the global destination address to the local user address, 10.1.2.27.
6. The adaptive security appliance forwards the packet to the inside user.

An Outside User Visits a Web Server on the DMZ

Figure 16-2 shows an outside user accessing the DMZ web server.



The following steps describe how data moves through the adaptive security appliance (see Figure 16-2):

1. A user on the outside network requests a web page from the DMZ web server using the global destination address of 209.165.201.3, which is on the outside interface subnet.

- The adaptive security appliance receives the packet and because it is a new session, the adaptive security appliance verifies that the packet is allowed according to the terms of the security policy (access lists, filters, AAA).

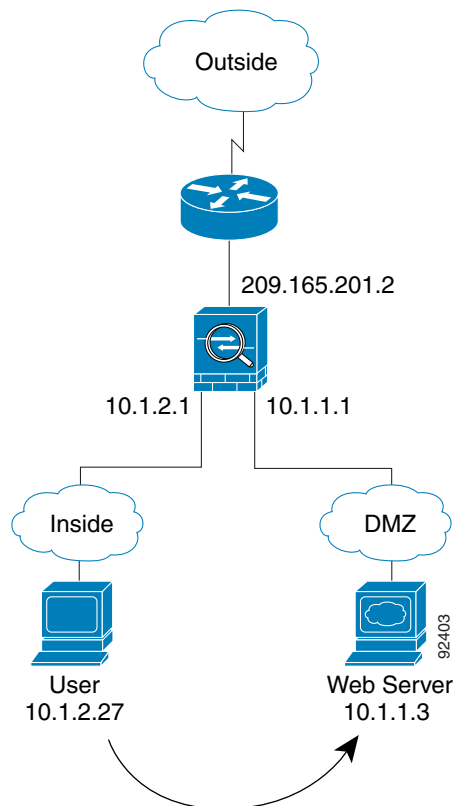
For multiple context mode, the adaptive security appliance first classifies the packet according to either a unique interface or a unique destination address associated with a context; the destination address is associated by matching an address translation in a context. In this case, the classifier “knows” that the DMZ web server address belongs to a certain context because of the server address translation.

- The adaptive security appliance translates the destination address to the local address 10.1.1.3.
- The adaptive security appliance then adds a session entry to the fast path and forwards the packet from the DMZ interface.
- When the DMZ web server responds to the request, the packet goes through the adaptive security appliance and because the session is already established, the packet bypasses the many lookups associated with a new connection. The adaptive security appliance performs NAT by translating the local source address to 209.165.201.3.
- The adaptive security appliance forwards the packet to the outside user.

An Inside User Visits a Web Server on the DMZ

Figure 16-3 shows an inside user accessing the DMZ web server.

Figure 16-3 Inside to DMZ



The following steps describe how data moves through the adaptive security appliance (see [Figure 16-3](#)):

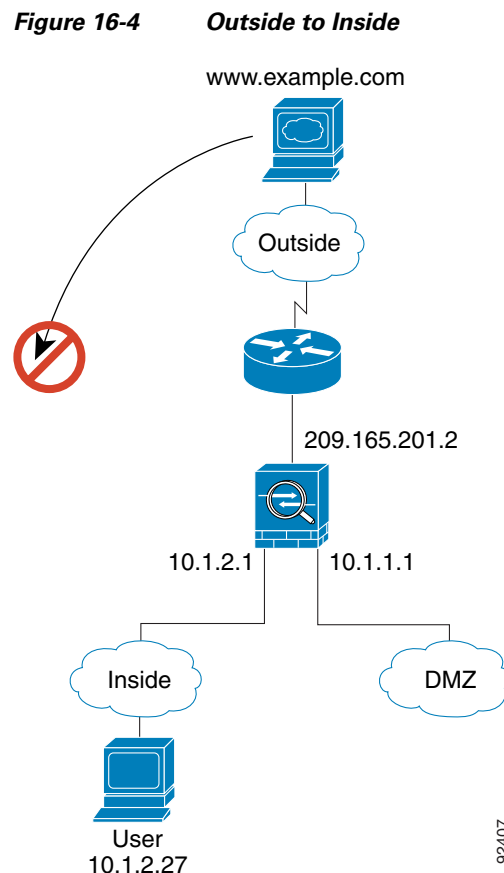
1. A user on the inside network requests a web page from the DMZ web server using the destination address of 10.1.1.3.
2. The adaptive security appliance receives the packet and because it is a new session, the adaptive security appliance verifies that the packet is allowed according to the terms of the security policy (access lists, filters, AAA).

For multiple context mode, the adaptive security appliance first classifies the packet according to either a unique interface or a unique destination address associated with a context; the destination address is associated by matching an address translation in a context. In this case, the interface is unique; the web server IP address does not have a current address translation.

3. The adaptive security appliance then records that a session is established and forwards the packet out of the DMZ interface.
4. When the DMZ web server responds to the request, the packet goes through the fast path, which lets the packet bypass the many lookups associated with a new connection.
5. The adaptive security appliance forwards the packet to the inside user.

An Outside User Attempts to Access an Inside Host

[Figure 16-4](#) shows an outside user attempting to access the inside network.



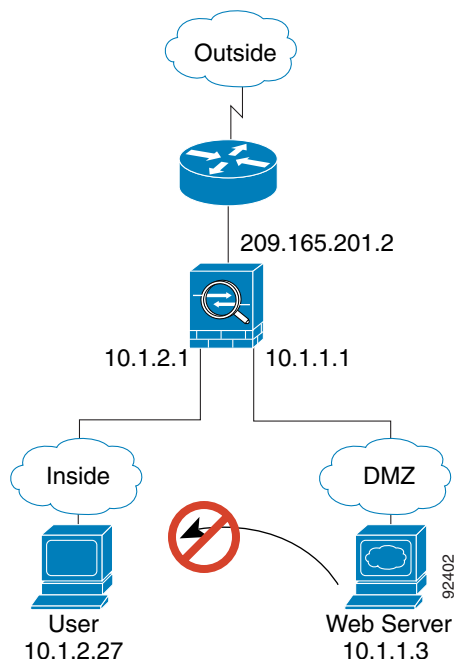
The following steps describe how data moves through the adaptive security appliance (see [Figure 16-4](#)):

1. A user on the outside network attempts to reach an inside host (assuming the host has a routable IP address).
If the inside network uses private addresses, no outside user can reach the inside network without NAT. The outside user might attempt to reach an inside user by using an existing NAT session.
2. The adaptive security appliance receives the packet and because it is a new session, the adaptive security appliance verifies if the packet is allowed according to the security policy (access lists, filters, AAA).
3. The packet is denied, and the adaptive security appliance drops the packet and logs the connection attempt.
If the outside user is attempting to attack the inside network, the adaptive security appliance employs many technologies to determine if a packet is valid for an already established session.

A DMZ User Attempts to Access an Inside Host

[Figure 16-5](#) shows a user in the DMZ attempting to access the inside network.

Figure 16-5 DMZ to Inside



The following steps describe how data moves through the adaptive security appliance (see [Figure 16-5](#)):

1. A user on the DMZ network attempts to reach an inside host. Because the DMZ does not have to route the traffic on the Internet, the private addressing scheme does not prevent routing.
2. The adaptive security appliance receives the packet and because it is a new session, the adaptive security appliance verifies if the packet is allowed according to the security policy (access lists, filters, AAA).
3. The packet is denied, and the adaptive security appliance drops the packet and logs the connection attempt.

Transparent Mode Overview

Traditionally, a firewall is a routed hop and acts as a default gateway for hosts that connect to one of its screened subnets. A transparent firewall, on the other hand, is a Layer 2 firewall that acts like a “bump in the wire,” or a “stealth firewall,” and is not seen as a router hop to connected devices.

This section describes transparent firewall mode, and includes the following topics:

- [Transparent Firewall Network, page 16-7](#)
- [Allowing Layer 3 Traffic, page 16-7](#)
- [Allowed MAC Addresses, page 16-7](#)
- [Passing Traffic Not Allowed in Routed Mode, page 16-8](#)
- [BPDU Handling, page 16-8](#)
- [MAC Address vs. Route Lookups, page 16-8](#)
- [Using the Transparent Firewall in Your Network, page 16-9](#)
- [Transparent Firewall Guidelines, page 16-9](#)
- [Unsupported Features in Transparent Mode, page 16-10](#)
- [How Data Moves Through the Transparent Firewall, page 16-12](#)

Transparent Firewall Network

The adaptive security appliance connects the same network on its inside and outside interfaces. Because the firewall is not a routed hop, you can easily introduce a transparent firewall into an existing network.

Allowing Layer 3 Traffic

IPv4 traffic is allowed through the transparent firewall automatically from a higher security interface to a lower security interface, without an access list. ARPs are allowed through the transparent firewall in both directions without an access list. ARP traffic can be controlled by ARP inspection. For Layer 3 traffic travelling from a low to a high security interface, an extended access list is required on the low security interface. See the [“Adding an Extended Access List” section on page 14-6](#) for more information.

Allowed MAC Addresses

The following destination MAC addresses are allowed through the transparent firewall. Any MAC address not on this list is dropped.

- TRUE broadcast destination MAC address equal to FFFF.FFFF.FFFF
- IPv4 multicast MAC addresses from 0100.5E00.0000 to 0100.5EFE.FFFF
- IPv6 multicast MAC addresses from 3333.0000.0000 to 3333.FFFF.FFFF
- BPDU multicast address equal to 0100.0CCC.CCCD
- Appletalk multicast MAC addresses from 0900.0700.0000 to 0900.07FF.FFFF

Passing Traffic Not Allowed in Routed Mode

In routed mode, some types of traffic cannot pass through the adaptive security appliance even if you allow it in an access list. The transparent firewall, however, can allow almost any traffic through using either an extended access list (for IP traffic) or an EtherType access list (for non-IP traffic).

**Note**

The transparent mode adaptive security appliance does not pass CDP packets or IPv6 packets, or any packets that do not have a valid EtherType greater than or equal to 0x600. For example, you cannot pass IS-IS packets. An exception is made for BPDUs, which are supported.

For example, you can establish routing protocol adjacencies through a transparent firewall; you can allow OSPF, RIP, EIGRP, or BGP traffic through based on an extended access list. Likewise, protocols like HSRP or VRRP can pass through the adaptive security appliance.

Non-IP traffic (for example AppleTalk, IPX, BPDUs, and MPLS) can be configured to go through using an EtherType access list.

For features that are not directly supported on the transparent firewall, you can allow traffic to pass through so that upstream and downstream routers can support the functionality. For example, by using an extended access list, you can allow DHCP traffic (instead of the unsupported DHCP relay feature) or multicast traffic such as that created by IP/TV.

BPDUs Handling

To prevent loops using the spanning tree protocol, BPDUs are passed by default. To block BPDUs, you need to configure an EtherType access list to deny them.

MAC Address vs. Route Lookups

When the adaptive security appliance runs in transparent mode, the outgoing interface of a packet is determined by performing a MAC address lookup instead of a route lookup.

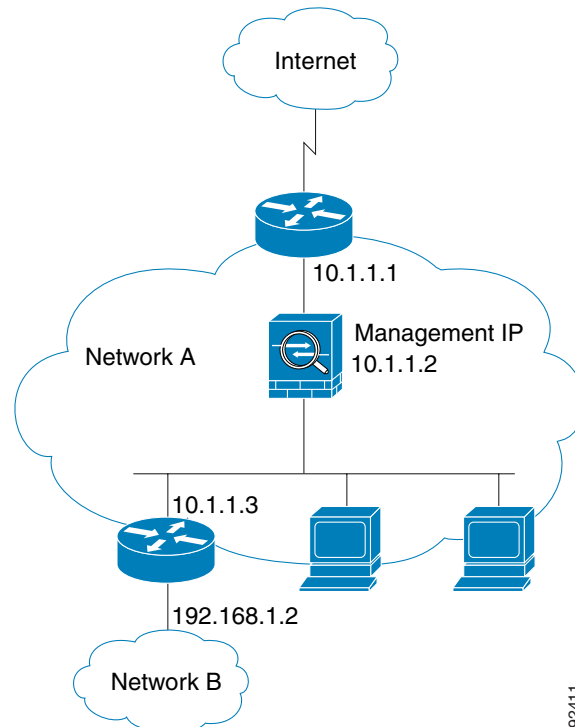
Route lookups, however, are necessary for the following traffic types:

- Traffic originating on the adaptive security appliance—For example, if your syslog server is located on a remote network, you must use a static route so the adaptive security appliance can reach that subnet.
- Voice over IP (VoIP) traffic with inspection enabled, and the endpoint is at least one hop away from the adaptive security appliance—For example, if you use the transparent firewall between a CCM and an H.323 gateway, and there is a router between the transparent firewall and the H.323 gateway, then you need to add a static route on the adaptive security appliance for the H.323 gateway for successful call completion.
- VoIP or DNS traffic with NAT and inspection enabled—To successfully translate the IP address inside VoIP and DNS packets, the adaptive 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 adaptive security appliance for the real host address that is embedded in the packet.

Using the Transparent Firewall in Your Network

Figure 16-6 shows a typical transparent firewall network where the outside devices are on the same subnet as the inside devices. The inside router and hosts appear to be directly connected to the outside router.

Figure 16-6 Transparent Firewall Network



Transparent Firewall Guidelines

Follow these guidelines when planning your transparent firewall network:

- A management IP address is required; for multiple context mode, an IP address is required for each context.

Unlike routed mode, which requires an IP address for each interface, a transparent firewall has an IP address assigned to the entire device. The adaptive security appliance uses this IP address as the source address for packets originating on the adaptive security appliance, such as system messages or AAA communications.

The management IP address must be on the same subnet as the connected network. You cannot set the subnet to a host subnet (255.255.255.255).

You can configure an IP address for the Management 0/0 management-only interface. This IP address can be on a separate subnet from the main management IP address.



Note If the management IP address is not configured, transient traffic does not pass through the transparent firewall. For multiple context mode, transient traffic does not pass through virtual contexts.

- The transparent adaptive security appliance uses an inside interface and an outside interface only. If your platform includes a dedicated management interface, you can also configure the management interface or subinterface for management traffic only.

In single mode, you can only use two data interfaces (and the dedicated management interface, if available) even if your security appliance includes more than two interfaces.



Note In transparent firewall mode, the management interface updates the MAC address table in the same manner as a data interface; therefore you should not connect both a management and a data interface to the same switch unless you configure one of the switch ports as a routed port (by default Cisco Catalyst switches share a MAC address for all VLAN switch ports). Otherwise, if traffic arrives on the management interface from the physically-connected switch, then the adaptive security appliance updates the MAC address table to use the *management* interface to access the switch, instead of the data interface. This action causes a temporary traffic interruption; the adaptive security appliance will not re-update the MAC address table for packets from the switch to the data interface for at least 30 seconds for security reasons.

- Each directly connected network must be on the same subnet.
- Do not specify the adaptive security appliance management IP address as the default gateway for connected devices; devices need to specify the router on the other side of the adaptive security appliance as the default gateway.
- For multiple context mode, each context must use different interfaces; you cannot share an interface across contexts.
- For multiple context mode, each context typically uses a different subnet. You can use overlapping subnets, but your network topology requires router and NAT configuration to make it possible from a routing standpoint.

Unsupported Features in Transparent Mode

Table 16-1 lists the features are not supported in transparent mode.

Table 16-1 *Unsupported Features in Transparent Mode*

Feature	Description
Dynamic DNS	—
DHCP relay	The transparent firewall can act as a DHCP server, but it does not support the DHCP relay commands. DHCP relay is not required because you can allow DHCP traffic to pass through using two extended access lists: one that allows DHCP requests from the inside interface to the outside, and one that allows the replies from the server in the other direction.

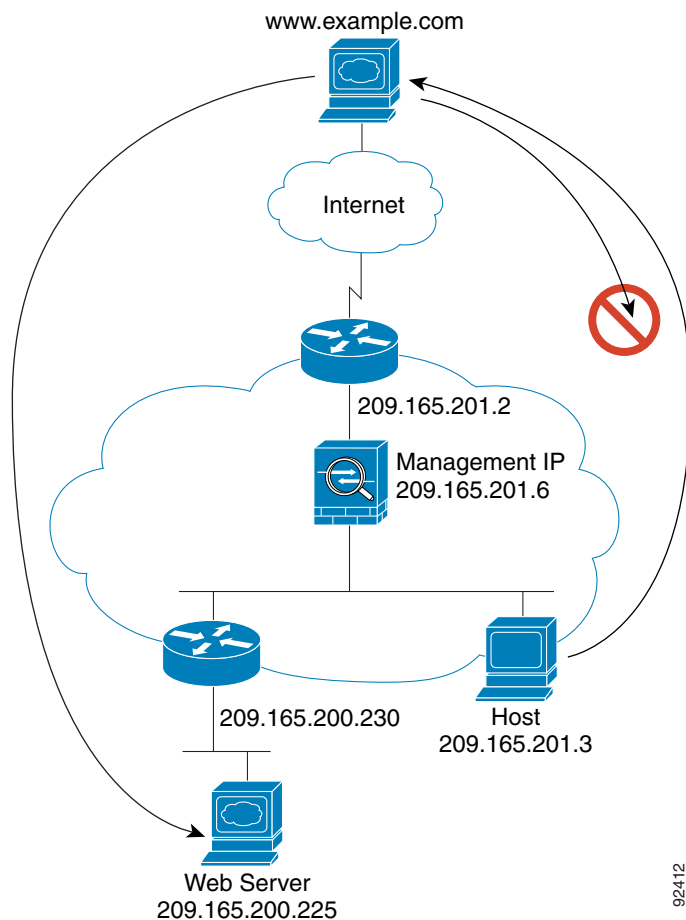
Table 16-1 *Unsupported Features in Transparent Mode (continued)*

Feature	Description
Dynamic routing protocols	You can, however, add static routes for traffic originating on the adaptive security appliance. You can also allow dynamic routing protocols through the adaptive security appliance using an extended access list.
IPv6	You also cannot allow IPv6 using an EtherType access list.
Multicast	You can allow multicast traffic through the adaptive security appliance by allowing it in an extended access list.
QoS	—
VPN termination for through traffic	The transparent firewall supports site-to-site VPN tunnels for management connections only. It does not terminate VPN connections for traffic through the adaptive security appliance. You can pass VPN traffic through the security appliance using an extended access list, but it does not terminate non-management connections. WebVPN is also not supported.

How Data Moves Through the Transparent Firewall

Figure 16-7 shows a typical transparent firewall implementation with an inside network that contains a public web server. The adaptive security appliance has an access list so that the inside users can access Internet resources. Another access list lets the outside users access only the web server on the inside network.

Figure 16-7 Typical Transparent Firewall Data Path



This section describes how data moves through the adaptive security appliance, and includes the following topics:

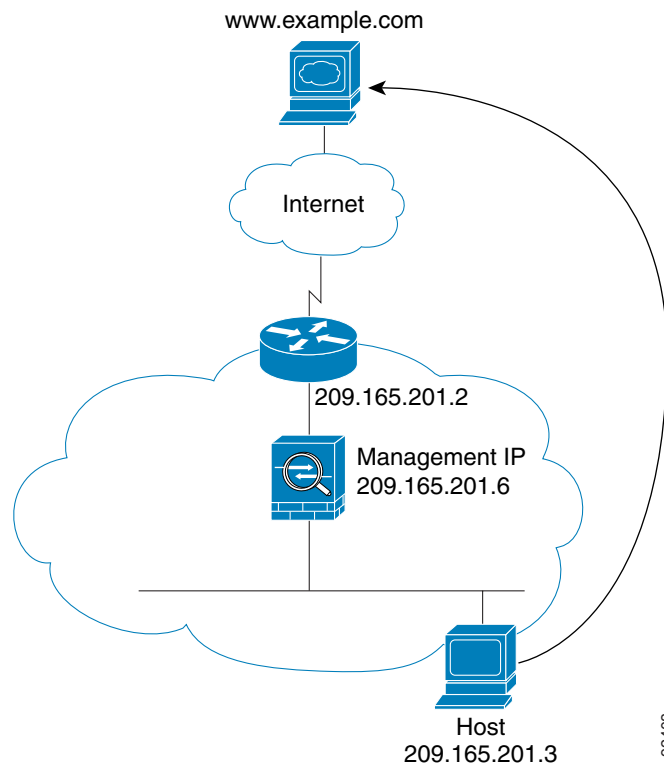
- [An Inside User Visits a Web Server, page 16-13](#)
- [An Inside User Visits a Web Server Using NAT, page 16-14](#)
- [An Outside User Visits a Web Server on the Inside Network, page 16-15](#)
- [An Outside User Attempts to Access an Inside Host, page 16-16](#)

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An Inside User Visits a Web Server

Figure 16-8 shows an inside user accessing an outside web server.

Figure 16-8 Inside to Outside



The following steps describe how data moves through the adaptive security appliance (see Figure 16-8):

1. The user on the inside network requests a web page from `www.example.com`.
2. The adaptive security appliance receives the packet and adds the source MAC address to the MAC address table, if required. Because it is a new session, it verifies that the packet is allowed according to the terms of the security policy (access lists, filters, AAA).

For multiple context mode, the adaptive security appliance first classifies the packet according to a unique interface.

3. The adaptive security appliance records that a session is established.
4. If the destination MAC address is in its table, the adaptive security appliance forwards the packet out of the outside interface. The destination MAC address is that of the upstream router, `209.186.201.2`.

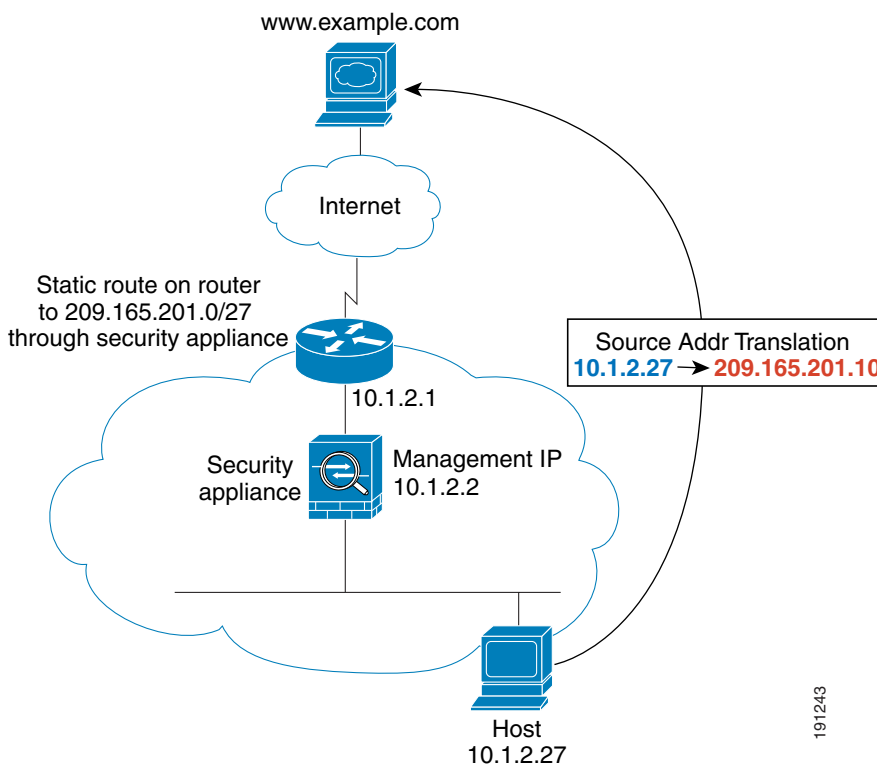
If the destination MAC address is not in the adaptive security appliance table, the adaptive security appliance attempts to discover the MAC address by sending an ARP request or a ping. The first packet is dropped.

5. The web server responds to the request; because the session is already established, the packet bypasses the many lookups associated with a new connection.
6. The adaptive security appliance forwards the packet to the inside user.

An Inside User Visits a Web Server Using NAT

Figure 16-8 shows an inside user accessing an outside web server.

Figure 16-9 Inside to Outside with NAT



The following steps describe how data moves through the adaptive security appliance (see Figure 16-8):

1. The user on the inside network requests a web page from www.example.com.
2. The adaptive security appliance receives the packet and adds the source MAC address to the MAC address table, if required. Because it is a new session, it verifies that the packet is allowed according to the terms of the security policy (access lists, filters, AAA).

For multiple context mode, the adaptive security appliance first classifies the packet according to a unique interface.

3. The adaptive security appliance translates the real address (10.1.2.27) to the mapped address 209.165.201.10.
Because the mapped address is not on the same network as the outside interface, then be sure the upstream router has a static route to the mapped network that points to the adaptive security appliance.
4. The adaptive security appliance then records that a session is established and forwards the packet from the outside interface.
5. If the destination MAC address is in its table, the adaptive security appliance forwards the packet out of the outside interface. The destination MAC address is that of the upstream router, 10.1.2.1.

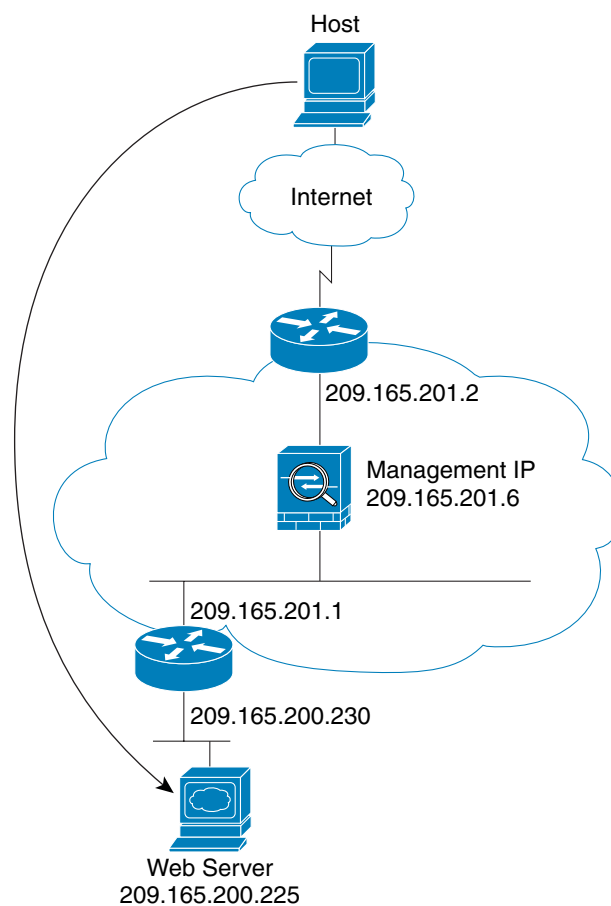
If the destination MAC address is not in the adaptive security appliance table, the adaptive security appliance attempts to discover the MAC address by sending an ARP request and a ping. The first packet is dropped.

6. The web server responds to the request; because the session is already established, the packet bypasses the many lookups associated with a new connection.
7. The adaptive security appliance performs NAT by translating the mapped address to the real address, 10.1.2.27.

An Outside User Visits a Web Server on the Inside Network

Figure 16-10 shows an outside user accessing the inside web server.

Figure 16-10 Outside to Inside



The following steps describe how data moves through the adaptive security appliance (see Figure 16-10):

1. A user on the outside network requests a web page from the inside web server.
2. The adaptive security appliance receives the packet and adds the source MAC address to the MAC address table, if required. Because it is a new session, it verifies that the packet is allowed according to the terms of the security policy (access lists, filters, AAA).

For multiple context mode, the adaptive security appliance first classifies the packet according to a unique interface.

3. The adaptive security appliance records that a session is established.
4. If the destination MAC address is in its table, the adaptive security appliance forwards the packet out of the inside interface. The destination MAC address is that of the downstream router, 209.165.201.1.

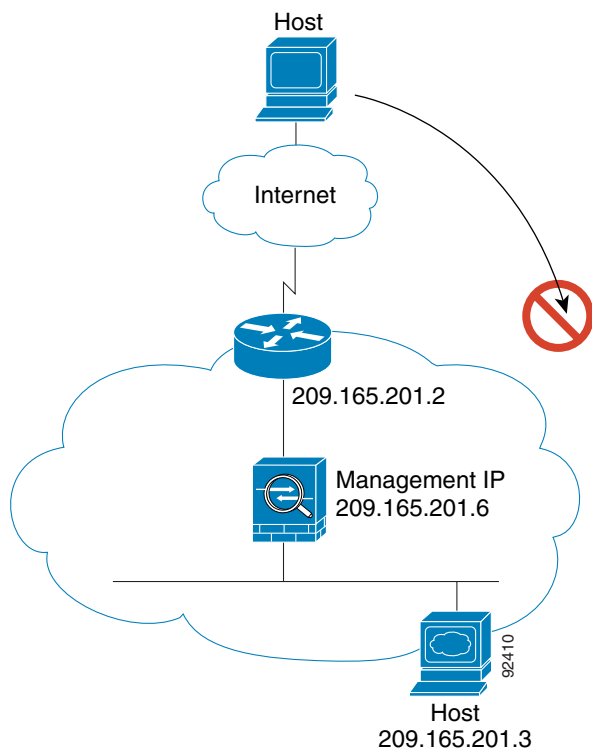
If the destination MAC address is not in the adaptive security appliance table, the adaptive security appliance attempts to discover the MAC address by sending an ARP request and a ping. The first packet is dropped.

5. The web server responds to the request; because the session is already established, the packet bypasses the many lookups associated with a new connection.
6. The adaptive security appliance forwards the packet to the outside user.

An Outside User Attempts to Access an Inside Host

Figure 16-11 shows an outside user attempting to access a host on the inside network.

Figure 16-11 Outside to Inside



The following steps describe how data moves through the adaptive security appliance (see Figure 16-11):

1. A user on the outside network attempts to reach an inside host.
2. The adaptive security appliance receives the packet and adds the source MAC address to the MAC address table, if required. Because it is a new session, it verifies if the packet is allowed according to the terms of the security policy (access lists, filters, AAA).

For multiple context mode, the adaptive security appliance first classifies the packet according to a unique interface.

3. The packet is denied because there is no access list permitting the outside host, and the adaptive security appliance drops the packet.
4. If the outside user is attempting to attack the inside network, the adaptive security appliance employs many technologies to determine if a packet is valid for an already established session.

