PIX/ASA: Perform DNS Doctoring with the static Command and Three NAT Interfaces Configuration Example

Document ID: 72273

Introduction

This document provides a sample configuration to perform Domain Name System (DNS) doctoring on the ASA 5500 Series Adaptive Security Appliance or PIX 500 Series Security Appliance that uses static Network Address Translation (NAT) statements. DNS doctoring allows the security appliance to rewrite DNS A−records.

DNS rewrite performs two functions:

- Translates a public address (the routable or mapped address) in a DNS reply to a private address (the real address) when the DNS client is on a private interface.
- Translates a private address to a public address when the DNS client is on the public interface.

Note: The configuration in this document contains three NAT interfaces: inside, outside, and dmz. For an example of DNS doctoring with statics and two NAT interfaces, refer to PIX/ASA: How to Perform DNS Doctoring With the static Command and Two NAT Interfaces Configuration Example.

Refer to PIX/ASA 7.x NAT and PAT Statements and Using nat, global, static, conduit, and access−list Commands and Port Redirection(Forwarding) on PIX for more information on how to use NAT on a PIX/ASA Security Appliance.

Refer to Using nat, global, static, conduit, and access−list Commands and Port Redirection(Forwarding) on PIX for more information on the **nat**, **global**, **static**, **conduit**, and **access−list** commands and port

redirection(Forwarding) on PIX.

Prerequisites

Requirements

- DNS inspection must be enabled in order to perform DNS doctoring on the security appliance. DNS inspection is on by default. However, if it has been turned off, see the Configure DNS Inspection section later in this document to re−enable it. When DNS inspection is enabled, the security appliance performs these tasks:

    - Translates the DNS record based on the configuration completed using the **static** and **nat** commands (DNS rewrite). Translation only applies to the A−record in the DNS reply. Therefore, reverse lookups, which request the PTR record, are not affected by DNS rewrite.

      Note: DNS rewrite is not compatible with static Port Address Translation (PAT) because multiple PAT rules are applicable for each A−record, and the PAT rule to use is ambiguous.
    - Enforces the maximum DNS message length (the default is 512 bytes and the maximum length is 65535 bytes). Reassembly is performed as necessary to verify that the packet length is less than the maximum length configured. The packet is dropped if it exceeds the maximum length.

      Note: If you issue the **inspect dns** command without the maximum−length option, DNS packet size is not checked.
    - Enforces a domain−name length of 255 bytes and a label length of 63 bytes.
    - Verifies the integrity of the domain−name referred to by the pointer if compression pointers are encountered in the DNS message.
    - Checks to see if a compression pointer loop exists.
- Optional: Cisco Adaptive Security Device Manager (ASDM) release 5.2.1 or later

  Note: Refer to Allowing HTTPS Access for ASDM in order to allow the ASA to be configured by the ASDM.

Components Used

The information in this document is based on ASA 5500 Series Security Appliance, version 7.2(1).

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Related Products

This configuration can also be used with the Cisco PIX 500 Series Security Appliance, version 6.2 or later.

Note: The ASDM configuration is applicable to version 7.x only.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

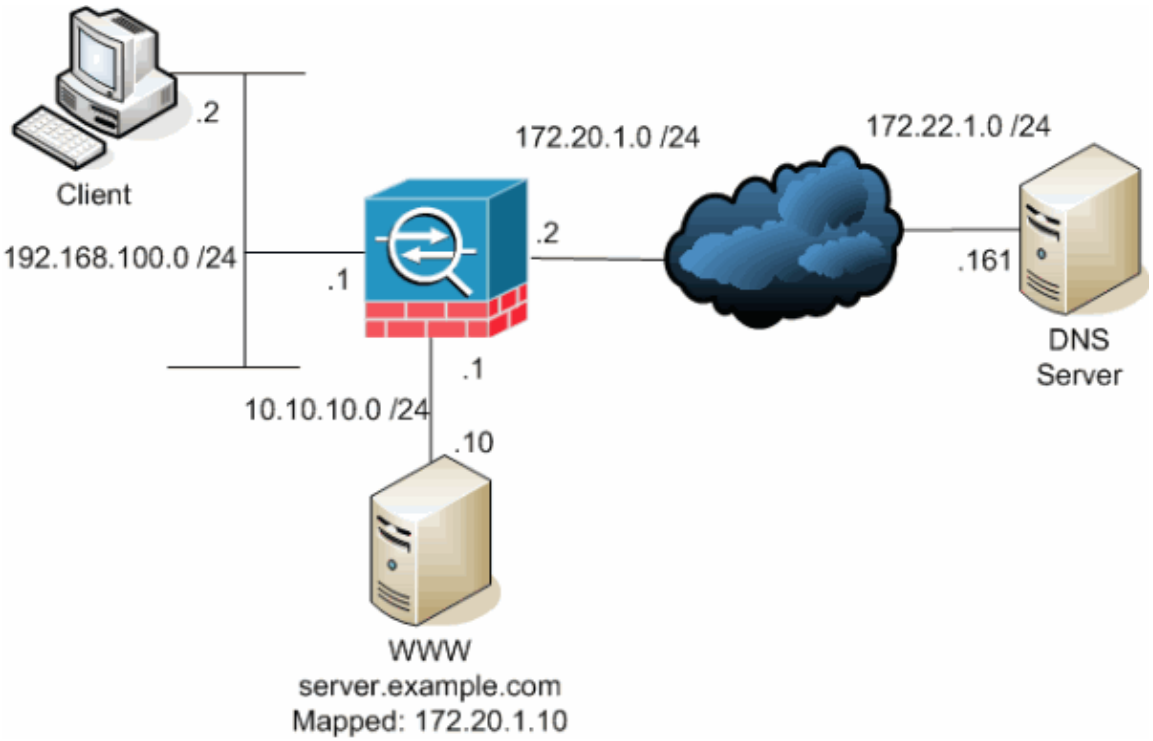
Background Information

In a typical DNS exchange a client sends a URL or hostname to a DNS server in order to determine the IP address of that host. The DNS server receives the request, looks up the name−to−IP−address mapping for that host, and then provides the A−record with the IP address to the client. While this procedure works well in many situations, problems can occur. These problems can occur when the client and the host that the client tries to reach are both on the same private network behind NAT, but the DNS server used by the client is on another public network.

Scenario: Three NAT Interfaces (inside, outside, dmz)

Topology

In this scenario, the client is located on the inside interface of the ASA. The WWW server that the client tries to reach is located on the dmz interface of the ASA. Dynamic PAT is configured to allow the client access to the Internet. Static NAT with an access−list is configured to allow the server access to the Internet, as well as allow Internet hosts to access the WWW server.



This diagram is an example of this situation. In this case, the client at 192.168.100.2 wants to use the **server.example.com** URL to access the WWW server at 10.10.10.10. DNS services for the client are provided by the external DNS server at 172.22.1.161. Because the DNS server is located on another public network, it does not know the private IP address of the WWW server. Instead, it knows the WWW server mapped address of 172.20.1.10. Thus, the DNS server contains the IP−address−to−name mapping of **server.example.com** to **172.20.1.10**.

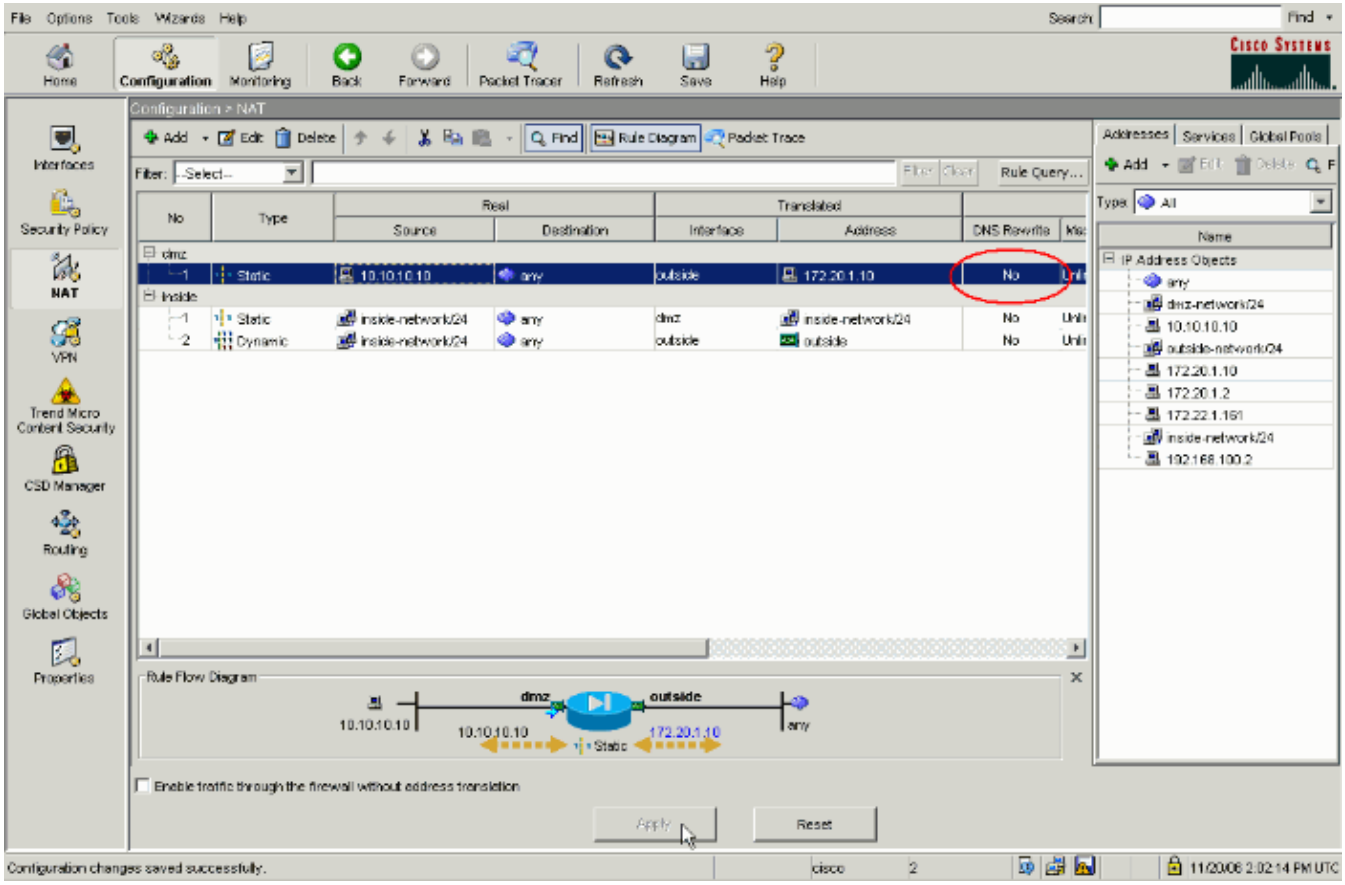
Problem: Client Cannot Access WWW Server

Without DNS doctoring or another solution enabled in this situation, if the client sends a DNS request for the IP address of **server.example.com**, it is unable to access the WWW server. This is because the client receives an A−record that contains the mapped public address of 172.20.1.10 for the WWW server. When the client tries to access this IP address, the security appliance drops the packets because it does not allow packet

redirection on the same interface. Here is what the NAT portion of the configuration looks like when DNS doctoring is not enabled:

```
ciscoasa(config)#show running-config
: Saved
:
ASA Version 7.2(1)
!
hostname ciscoasa

!--- Output suppressed.

access-list OUTSIDE extended permit tcp any host 172.20.1.10 eq www

!--- Output suppressed.

global (outside) 1 interface
nat (inside) 1 192.168.100.0 255.255.255.0
static (inside,dmz) 192.168.100.0 192.168.100.0 netmask 255.255.255.0

!--- Static translation to allow hosts on the inside access to
!--- hosts on the dmz.

static (dmz,outside) 172.20.1.10 10.10.10.10 netmask 255.255.255.255

!--- Static translation to allow hosts on the outside access
!--- to the WWW server.

access-group OUTSIDE in interface outside

!--- Output suppressed.
```

This is what the configuration looks like in the ASDM when DNS doctoring is not enabled:



Here is a packet capture of the events when DNS doctoring is not enabled:

1. The client sends the DNS query.

```
No.     Time       Source          Destination     Protocol Info
1       0.000000   192.168.100.2   172.22.1.161    DNS Standard query
                                                   A server.example.com

Frame 1 (78 bytes on wire, 78 bytes captured)
Ethernet II, Src: Cisco_c8:e4:00 (00:04:c0:c8:e4:00), Dst: Cisco_9c:c6:1f
(00:0a:b8:9c:c6:1f)
Internet Protocol, Src: 192.168.100.2 (192.168.100.2), Dst: 172.22.1.161
(172.22.1.161)
User Datagram Protocol, Src Port: 50879 (50879), Dst Port: domain (53)
Domain Name System (query)
    [Response In: 2]
    Transaction ID: 0x0004
    Flags: 0x0100 (Standard query)
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 0
    Queries
        server.example.com: type A, class IN
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
```

2. PAT is performed on the DNS query by the ASA and the query is forwarded. Note that the source address of the packet has changed to the outside interface of the ASA.

```
No.     Time       Source          Destination     Protocol Info
1       0.000000   172.20.1.2      172.22.1.161    DNS Standard query
                                                   A server.example.com
```

```
Frame 1 (78 bytes on wire, 78 bytes captured)
Ethernet II, Src: Cisco_9c:c6:1e (00:0a:b8:9c:c6:1e), Dst: Cisco_01:f1:22
(00:30:94:01:f1:22)
Internet Protocol, Src: 172.20.1.2 (172.20.1.2), Dst: 172.22.1.161
(172.22.1.161)
User Datagram Protocol, Src Port: 1044 (1044), Dst Port: domain (53)
Domain Name System (query)
    [Response In: 2]
    Transaction ID: 0x0004
    Flags: 0x0100 (Standard query)
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 0
    Queries
        server.example.com: type A, class IN
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
```

3. The DNS server replies with the mapped address of the WWW server.

```
No.     Time       Source         Destination       Protocol Info
2       0.005005   172.22.1.161   172.20.1.2        DNS Standard query response
                                                    A 172.20.1.10

Frame 2 (94 bytes on wire, 94 bytes captured)
Ethernet II, Src: Cisco_01:f1:22 (00:30:94:01:f1:22), Dst: Cisco_9c:c6:1e
(00:0a:b8:9c:c6:1e)
Internet Protocol, Src: 172.22.1.161 (172.22.1.161), Dst: 172.20.1.2
(172.20.1.2)
User Datagram Protocol, Src Port: domain (53), Dst Port: 1044 (1044)
Domain Name System (response)
    [Request In: 1]
    [Time: 0.005005000 seconds]
    Transaction ID: 0x0004
    Flags: 0x8580 (Standard query response, No error)
    Questions: 1
    Answer RRs: 1
    Authority RRs: 0
    Additional RRs: 0
    Queries
        server.example.com: type A, class IN
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
    Answers
        server.example.com: type A, class IN, addr 172.20.1.10
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
            Time to live: 1 hour
            Data length: 4
            Addr: 172.20.1.10
```

4. The ASA undoes the translation of the destination address of the DNS response and forwards the packet to the client. Note that without DNS doctoring enabled, the **Addr** in the answer is still the mapped address of the WWW server.

```
No.     Time      Source         Destination      Protocol Info
2       0.005264  172.22.1.161   192.168.100.2    DNS Standard query response
                                                  A 172.20.1.10

Frame 2 (94 bytes on wire, 94 bytes captured)
Ethernet II, Src: Cisco_9c:c6:1f (00:0a:b8:9c:c6:1f), Dst: Cisco_c8:e4:00
(00:04:c0:c8:e4:00)
```

```
Internet Protocol, Src: 172.22.1.161 (172.22.1.161), Dst: 192.168.100.2
(192.168.100.2)
User Datagram Protocol, Src Port: domain (53), Dst Port: 50879 (50879)
Domain Name System (response)
    [Request In: 1]
    [Time: 0.005264000 seconds]
    Transaction ID: 0x0004
    Flags: 0x8580 (Standard query response, No error)
    Questions: 1
    Answer RRs: 1
    Authority RRs: 0
    Additional RRs: 0
    Queries
        server.example.com: type A, class IN
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
    Answers
        server.example.com: type A, class IN, addr 172.20.1.10
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
            Time to live: 1 hour
            Data length: 4
            Addr: 172.20.1.10
```

5. At this point, the client tries to access the WWW server at 172.20.1.10. The ASA creates a connection entry for this communication. However, because it does not allow traffic to flow from inside to outside to dmz, the connection times out. The ASA logs show this:

```
%ASA-6-302013: Built outbound TCP connection 54175 for
outside:172.20.1.10/80 (172.20.1.10/80) to inside:192.168.100.2/11001
(172.20.1.2/1024)

%ASA-6-302014: Teardown TCP connection 54175 for outside:172.20.1.10/80
to inside:192.168.100.2/11001 duration 0:00:30 bytes 0 SYN Timeout
```

Solution: "dns" Keyword

DNS Doctoring with the "dns" Keyword

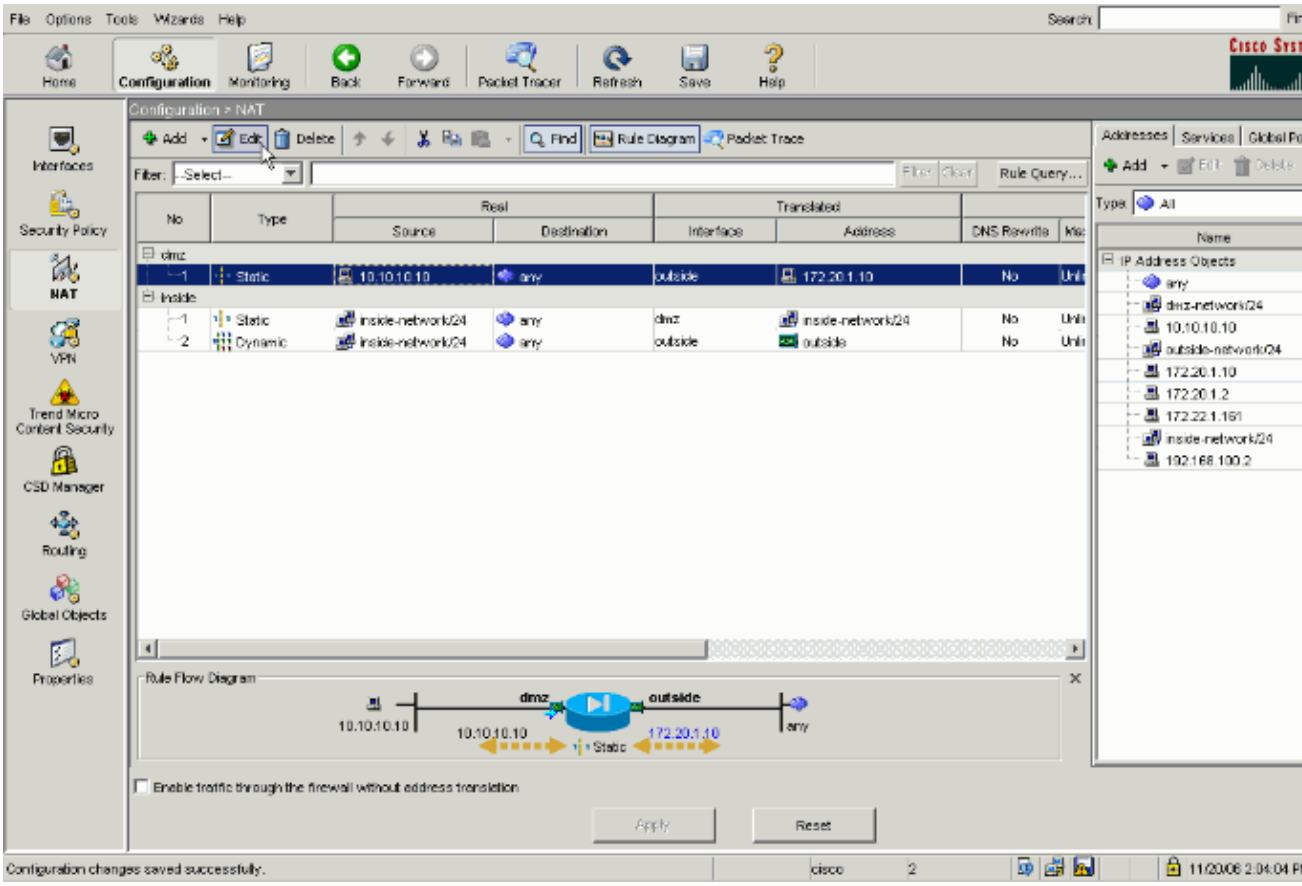
DNS doctoring with the **dns** keyword gives the security appliance the ability to intercept and rewrite the contents of the DNS server replies to the client. When properly configured, the security appliance can alter the A−record to allow the client in such a scenario as discussed in the Problem: Client Cannot Access WWW Server section to connect. In this situation, with DNS doctoring enabled, the security appliance rewrites the A−record to direct the client to 10.10.10.10, instead of 172.20.1.10. DNS doctoring is enabled when you add the **dns** keyword to a static NAT statement. Here is what the NAT portion of the configuration looks like when DNS doctoring is enabled:

```
ciscoasa(config)#show running-config
: Saved
:
ASA Version 7.2(1)
!
hostname ciscoasa

!--- Output suppressed.

access-list OUTSIDE extended permit tcp any host 172.20.1.10 eq www

!--- Output suppressed.

global (outside) 1 interface
```

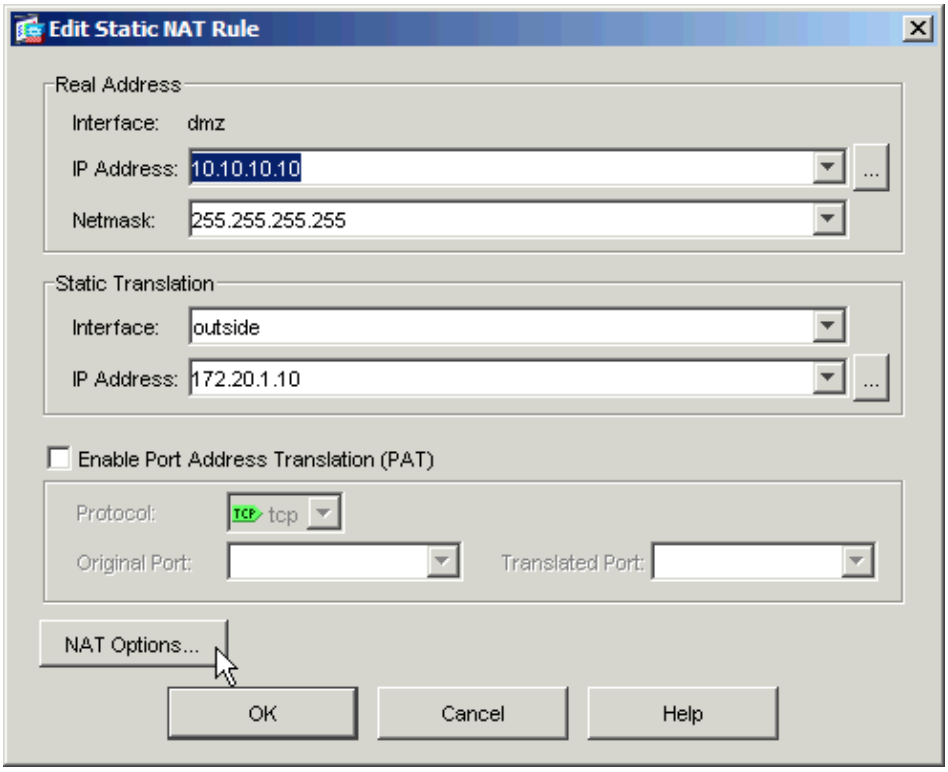
```
nat (inside) 1 192.168.100.0 255.255.255.0
static (inside,dmz) 192.168.100.0 192.168.100.0 netmask 255.255.255.0

!--- Static translation to allow hosts on the inside access to
!--- hosts on the dmz.

static (dmz,outside) 172.20.1.10 10.10.10.10 netmask 255.255.255.255 dns

!--- The "dns" keyword is added to instruct the security appliance
!--- to modify DNS records related to this entry.

access-group OUTSIDE in interface outside

!--- Output suppressed.
```

Complete these steps in order to configure DNS doctoring in the ASDM:

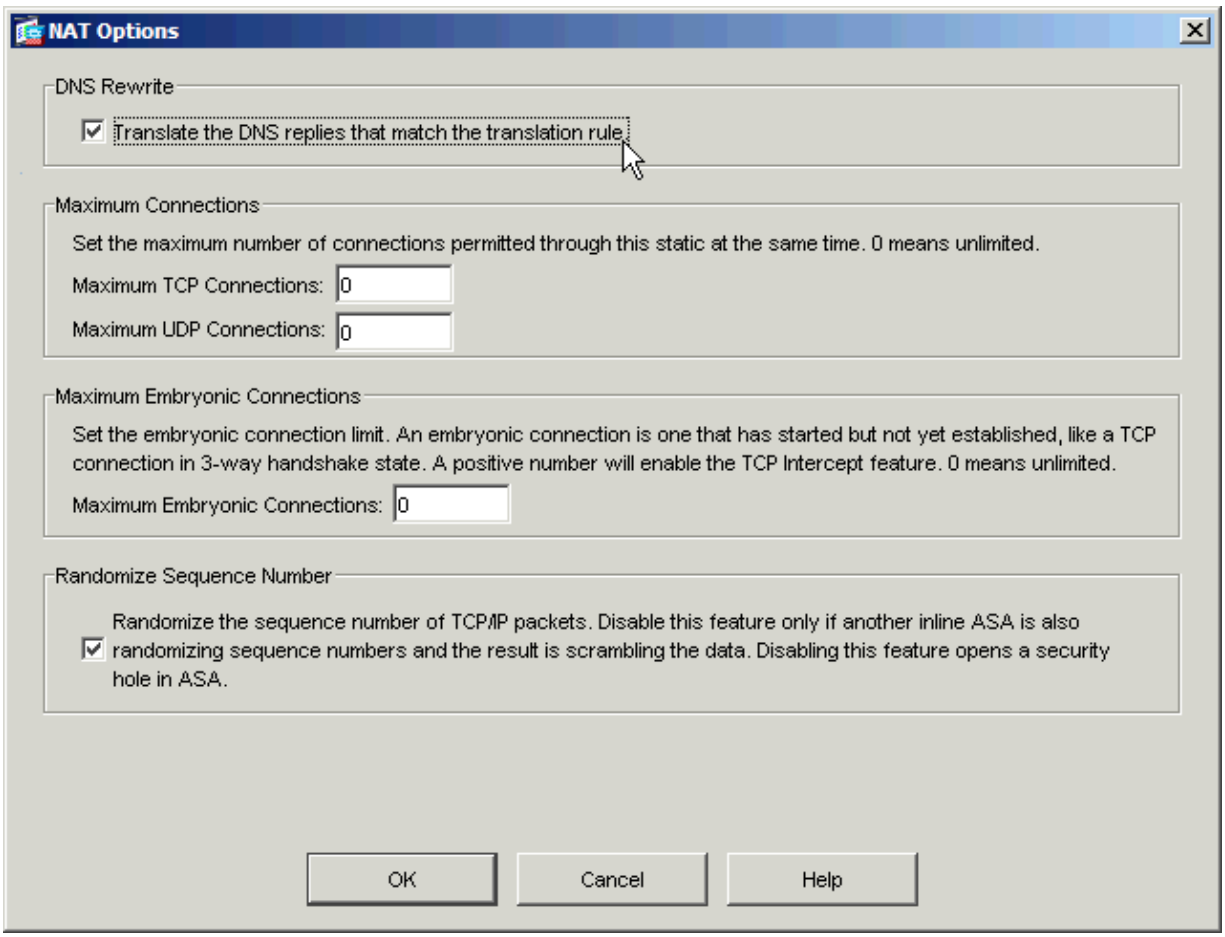
1. Navigate to **Configuration > NAT** and choose the static NAT rule to be modified. Click **Edit**.



2. Click **NAT Options...**.



3. Check the **Translate DNS replies that match the translation rule** check box.



4. Click **OK** to leave the NAT Options window. Click **OK** to leave the Edit Static NAT Rule window. Click **Apply** to send your configuration to the security appliance.

Here is a packet capture of the events when DNS doctoring is enabled:

1. The client sends the DNS query.

```
No.     Time       Source           Destination     Protocol Info
1       0.000000   192.168.100.2    172.22.1.161    DNS Standard query
                                                    A server.example.com

Frame 1 (78 bytes on wire, 78 bytes captured)
Ethernet II, Src: Cisco_c8:e4:00 (00:04:c0:c8:e4:00), Dst: Cisco_9c:c6:1f
(00:0a:b8:9c:c6:1f)
Internet Protocol, Src: 192.168.100.2 (192.168.100.2), Dst: 172.22.1.161
(172.22.1.161)
User Datagram Protocol, Src Port: 52985 (52985), Dst Port: domain (53)
Domain Name System (query)
    [Response In: 2]
    Transaction ID: 0x000c
    Flags: 0x0100 (Standard query)
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 0
    Queries
        server.example.com: type A, class IN
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
```

2. PAT is performed on the DNS query by the ASA and the query is forwarded. Note that the source address of the packet has changed to the outside interface of the ASA.

```
No.     Time       Source          Destination       Protocol Info
1       0.000000   172.20.1.2      172.22.1.161      DNS  Standard query
                                                     A server.example.com

Frame 1 (78 bytes on wire, 78 bytes captured)
Ethernet II, Src: Cisco_9c:c6:1e (00:0a:b8:9c:c6:1e), Dst: Cisco_01:f1:22
(00:30:94:01:f1:22)
Internet Protocol, Src: 172.20.1.2 (172.20.1.2), Dst: 172.22.1.161
(172.22.1.161)
User Datagram Protocol, Src Port: 1035 (1035), Dst Port: domain (53)
Domain Name System (query)
    [Response In: 2]
    Transaction ID: 0x000c
    Flags: 0x0100 (Standard query)
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 0
    Queries
        server.example.com: type A, class IN
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
```

3. The DNS server replies with the mapped address of the WWW server.

```
No.     Time       Source          Destination     Protocol Info
2       0.000992   172.22.1.161    172.20.1.2      DNS Standard query response
                                                   A 172.20.1.10

Frame 2 (94 bytes on wire, 94 bytes captured)
Ethernet II, Src: Cisco_01:f1:22 (00:30:94:01:f1:22), Dst: Cisco_9c:c6:1e
(00:0a:b8:9c:c6:1e)
Internet Protocol, Src: 172.22.1.161 (172.22.1.161), Dst: 172.20.1.2
(172.20.1.2)
User Datagram Protocol, Src Port: domain (53), Dst Port: 1035 (1035)
Domain Name System (response)
    [Request In: 1]
```

```
[Time: 0.000992000 seconds]
Transaction ID: 0x000c
Flags: 0x8580 (Standard query response, No error)
Questions: 1
Answer RRs: 1
Authority RRs: 0
Additional RRs: 0
Queries
    server.example.com: type A, class IN
        Name: server.example.com
        Type: A (Host address)
        Class: IN (0x0001)
Answers
    server.example.com: type A, class IN, addr 172.20.1.10
        Name: server.example.com
        Type: A (Host address)
        Class: IN (0x0001)
        Time to live: 1 hour
        Data length: 4
        Addr: 172.20.1.10
```

4. The ASA undoes the translation of the destination address of the DNS response and forwards the packet to the client. Note that with DNS doctoring enabled, the **Addr** in the answer is rewritten to be the real address of the WWW server.

```
No.     Time       Source         Destination     Protocol Info
6       2.507191   172.22.1.161   192.168.100.2   DNS Standard query response
                                                  A 10.10.10.10

Frame 6 (94 bytes on wire, 94 bytes captured)
Ethernet II, Src: Cisco_9c:c6:1f (00:0a:b8:9c:c6:1f), Dst: Cisco_c8:e4:00
(00:04:c0:c8:e4:00)
Internet Protocol, Src: 172.22.1.161 (172.22.1.161), Dst: 192.168.100.2
(192.168.100.2)
User Datagram Protocol, Src Port: domain (53), Dst Port: 50752 (50752)
Domain Name System (response)
    [Request In: 5]
    [Time: 0.002182000 seconds]
    Transaction ID: 0x0004
    Flags: 0x8580 (Standard query response, No error)
    Questions: 1
    Answer RRs: 1
    Authority RRs: 0
    Additional RRs: 0
    Queries
        server.example.com: type A, class IN
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
    Answers
        server.example.com: type A, class IN, addr 10.10.10.10
            Name: server.example.com
            Type: A (Host address)
            Class: IN (0x0001)
            Time to live: 1 hour
            Data length: 4
            Addr: 10.10.10.10
```

5. At this point, the client tries to access the WWW server at 10.10.10.10. The connection succeeds.

Final Configuration with the "dns" Keyword

This is the final configuration of the ASA to perform DNS doctoring with the **dns** keyword and three NAT interfaces.

Final ASA 7.2(1) Configuration

```
ciscoasa(config)#show running-config
: Saved
:
ASA Version 7.2(1)
!
hostname ciscoasa
enable password 9jNfZuG3TC5tCVH0 encrypted
names
dns-guard
!
interface Ethernet0/0
 nameif outside
 security-level 0
 ip address 172.20.1.2 255.255.255.0
!
interface Ethernet0/1
 nameif inside
 security-level 100
 ip address 192.168.100.1 255.255.255.0
!
interface Ethernet0/2
 nameif dmz
 security-level 50
 ip address 10.10.10.1 255.255.255.0
!
interface Management0/0
 shutdown
 no nameif
 no security-level
 no ip address
 management-only
!
passwd 2KFQnbNIdI.2KYOU encrypted
ftp mode passive
access-list OUTSIDE extended permit tcp any host 172.20.1.10 eq www

!--- Simple access-list that permits HTTP access to the mapped
!--- address of the WWW server.

pager lines 24
logging enable
logging buffered debugging
mtu outside 1500
mtu inside 1500
mtu dmz 1500
asdm image disk0:/asdm512-k8.bin
no asdm history enable
arp timeout 14400
global (outside) 1 interface
nat (inside) 1 192.168.100.0 255.255.255.0
static (inside,dmz) 192.168.100.0 192.168.100.0 netmask 255.255.255.0
static (dmz,outside) 172.20.1.10 10.10.10.10 netmask 255.255.255.255 dns

!--- PAT and static NAT configuration. The DNS keyword instructs
!--- the security appliance to rewrite DNS records related to this entry.

access-group OUTSIDE in interface outside

!--- The Access Control List (ACL) that permits HTTP access to the
!--- WWW server is applied to the outside interface.

route outside 0.0.0.0 0.0.0.0 172.20.1.1 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 icmp 0:00:02
```

```
timeout sunrpc 0:10:00 h323 0:05:00 h225 1:00:00 mgcp 0:05:00 mgcp-pat 0:05:00
timeout sip 0:30:00 sip_media 0:02:00 sip-invite 0:03:00 sip-disconnect 0:02:00
timeout uauth 0:05:00 absolute
username cisco password ffIRPGpDSOJh9YLq encrypted
http server enable
no snmp-server location
no snmp-server contact
snmp-server enable traps snmp authentication linkup linkdown coldstart
telnet timeout 5
ssh timeout 5
console timeout 0
!
class-map inspection_default
 match default-inspection-traffic
!
!
policy-map type inspect dns MY_DNS_INSPECT_MAP
 parameters
  message-length maximum 512
policy-map global_policy
 class inspection_default
  inspect ftp
  inspect h323 h225
  inspect h323 ras
  inspect rsh
  inspect rtsp
  inspect esmtp
  inspect sqlnet
  inspect skinny
  inspect sunrpc
  inspect xdmcp
  inspect sip
  inspect netbios
  inspect tftp
  inspect dns MY_DNS_INSPECT_MAP

!--- DNS inspection is enabled using the configured map.

  inspect icmp
policy-map type inspect dns migrated_dns_map_1
 parameters
  message-length maximum 512
!
service-policy global_policy global
prompt hostname context
Cryptochecksum:d6637819c6ea981daf20d8c7aa8ca256
: end
```

Alternative Solution: Destination NAT

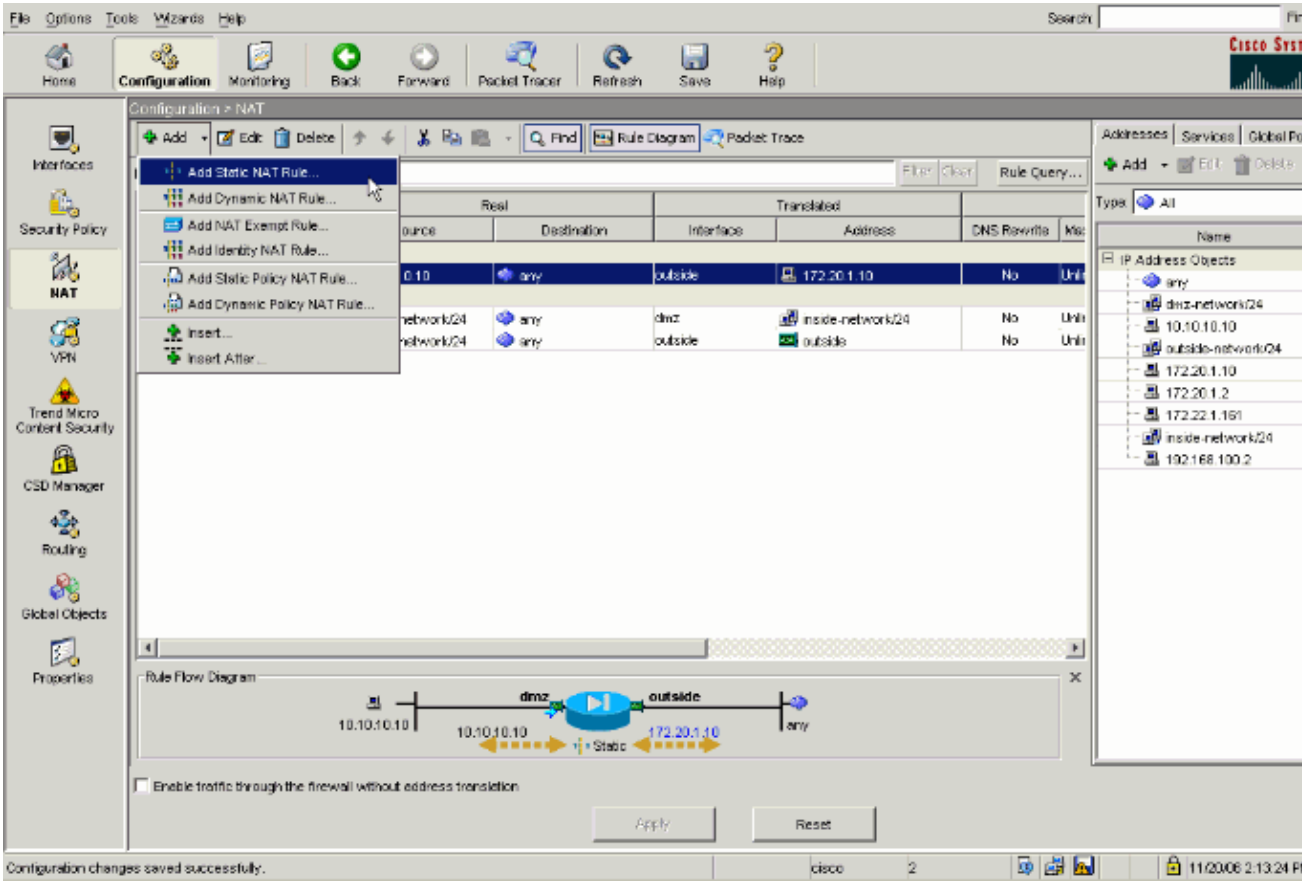
Destination NAT can provide an alternative to DNS doctoring. The use of destination NAT in this situation requires that a static NAT translation is created between the WWW server public address on the inside and real address on the dmz. Destination NAT does not change the contents of the DNS A−record that is returned from the DNS server to the client. Instead, when you use destination NAT in a scenario such as discussed in this document, the client can use the public IP address **172.20.1.10** that is returned by the DNS server in order to connect to the WWW server. The static translation allows the security appliance to translate the destination address from **172.20.1.10** to **10.10.10.10**. Here is the relevant portion of the configuration when destination NAT is used:

```
ciscoasa(config)#show running-config
: Saved
:
ASA Version 7.2(1)
```

```
!
hostname ciscoasa

!--- Output suppressed.

access-list OUTSIDE extended permit tcp any host 172.20.1.10 eq www

!--- Output suppressed.

global (outside) 1 interface
nat (inside) 1 192.168.100.0 255.255.255.0

!--- The nat and global commands allow
!--- clients access to the Internet.

static (inside,dmz) 192.168.100.0 192.168.100.0 netmask 255.255.255.0

!--- Static translation to allow hosts on the inside access to
!--- hosts on the dmz.

static (dmz,outside) 172.20.1.10 10.10.10.10 netmask 255.255.255.255

!--- Static translation to allow hosts on the outside access
!--- to the WWW server.

static (dmz,inside) 172.20.1.10 10.10.10.10 netmask 255.255.255.255

!--- Static translation to allow hosts on the inside access
!--- to the WWW server via its outside address.

access-group OUTSIDE in interface outside

!--- Output suppressed.
```

Complete these steps in order to configure destination NAT in the ASDM:

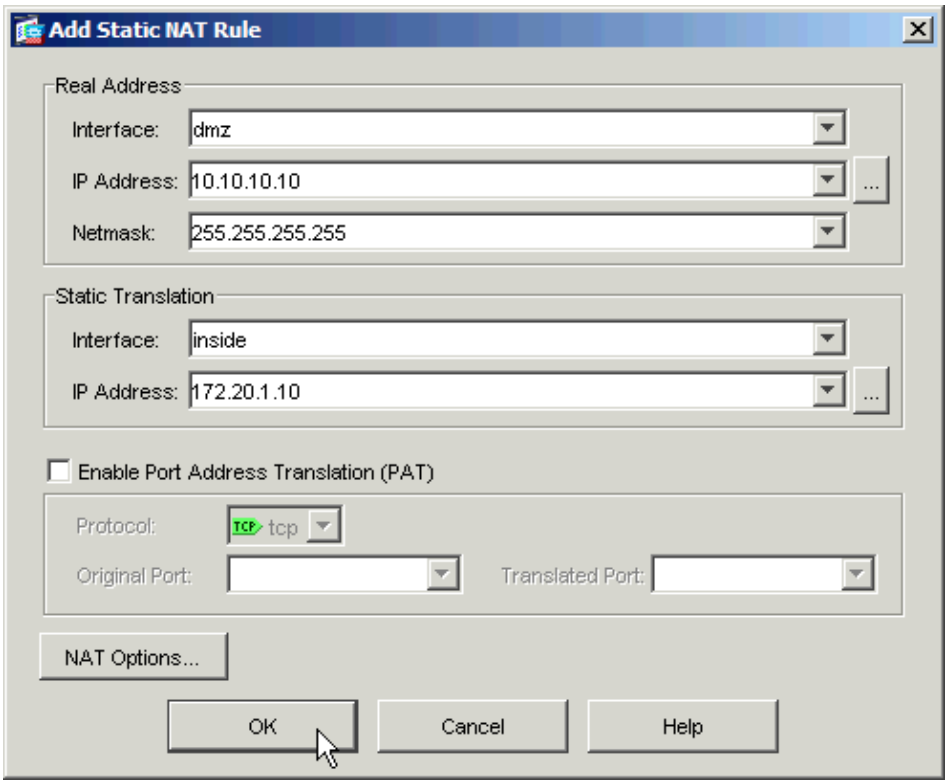
1. Navigate to **Configuration > NAT** and choose **Add > Add Static NAT Rule...**.



2. Fill in the configuration for the new static translation.

    a. Populate the **Real Address** area with the WWW server information.
    b. Populate the **Static Translation** area with the address and interface that you want to map the WWW server to.

In this case, the inside interface is chosen to allow hosts on the inside interface to access the WWW server via the mapped address 172.20.1.10.



3. Click **OK** to leave the Add Static NAT Rule window.
4. Click **Apply** to send the configuration to the security appliance.

Here is the sequence of events that take place when destination NAT is configured. Assume that the client has already queried the DNS server and received a reply of **172.20.1.10** for the WWW server address:

1. The client attempts to contact the WWW server at 172.20.1.10.

   ```
   %ASA-7-609001: Built local-host inside:192.168.100.2
   ```
2. The security appliance sees the request and recognizes that the WWW server is 10.10.10.10.

   ```
   %ASA-7-609001: Built local-host dmz:10.10.10.10
   ```
3. The security appliance creates a TCP connection between the client and the WWW server. Note the mapped addresses of each host in parentheses.

   ```
   %ASA-6-302013: Built outbound TCP connection 67956 for dmz:10.10.10.10/80
   (172.20.1.10/80) to inside:192.168.100.2/11001 (192.168.100.2/11001)
   ```
4. The **show xlate** command on the security appliance verifies that the client traffic translates through the security appliance. In this case, the first static translation is in use.

   ```
   ciscoasa#show xlate
   3 in use, 9 most used
   Global 192.168.100.0 Local 192.168.100.0
   Global 172.20.1.10 Local 10.10.10.10
   Global 172.20.1.10 Local 10.10.10.10
   ```
5. The **show conn** command on the security appliance verifies that the connection has succeeded between the client and the WWW server through the security appliance. Note the real address of the WWW server in parentheses.

   ```
   ciscoasa#show conn
   TCP out 172.20.1.10(10.10.10.10):80 in 192.168.100.2:11001
   idle 0:01:38 bytes 1486 flags UIO
   ```

Final Configuration with Destination NAT

This is the final configuration of the ASA to perform DNS doctoring with destination NAT and three NAT interfaces.

Final ASA 7.2(1) Configuration

```
ciscoasa#show running-config
: Saved
:
ASA Version 7.2(1)
!
hostname ciscoasa
enable password 9jNfZuG3TC5tCVH0 encrypted
names
dns-guard
!
interface Ethernet0/0
 nameif outside
 security-level 0
 ip address 172.20.1.2 255.255.255.0
!
interface Ethernet0/1
 nameif inside
 security-level 100
 ip address 192.168.100.1 255.255.255.0
!
interface Ethernet0/2
 nameif dmz
 security-level 50
 ip address 10.10.10.1 255.255.255.0
!
interface Management0/0
 shutdown
 no nameif
 no security-level
 no ip address
 management-only
!
passwd 2KFQnbNIdI.2KYOU encrypted
ftp mode passive
access-list OUTSIDE extended permit tcp any host 172.20.1.10 eq www

!--- Simple access-list that permits HTTP access to the mapped
!--- address of the WWW server.

pager lines 24
logging enable
logging buffered debugging
mtu outside 1500
mtu inside 1500
mtu dmz 1500
asdm image disk0:/asdm512-k8.bin
no asdm history enable
arp timeout 14400
global (outside) 1 interface
nat (inside) 1 192.168.100.0 255.255.255.0

!--- The nat and global commands
!--- allow clients access to the Internet.

static (inside,dmz) 192.168.100.0 192.168.100.0 netmask 255.255.255.0

!--- Static translation to allow hosts on the inside access to
!--- hosts on the dmz.
```

```
static (dmz,outside) 172.20.1.10 10.10.10.10 netmask 255.255.255.255

!--- Static translation to allow hosts on the outside access
!--- to the WWW server.

static (dmz,inside) 172.20.1.10 10.10.10.10 netmask 255.255.255.255

!--- Static translation to allow hosts on the inside access
!--- to the WWW server via its outside address.

access-group OUTSIDE in interface outside

!--- The ACL that permits HTTP access to the WWW server is applied
!--- to the outside interface.

route outside 0.0.0.0 0.0.0.0 172.20.1.1 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 icmp 0:00:02
timeout sunrpc 0:10:00 h323 0:05:00 h225 1:00:00 mgcp 0:05:00 mgcp-pat 0:05:00
timeout sip 0:30:00 sip_media 0:02:00 sip-invite 0:03:00 sip-disconnect 0:02:00
timeout uauth 0:05:00 absolute
username cisco password ffIRPGpDSOJh9YLq encrypted
http server enable
no snmp-server location
no snmp-server contact
snmp-server enable traps snmp authentication linkup linkdown coldstart
telnet timeout 5
ssh timeout 5
console timeout 0
!
class-map inspection_default
 match default-inspection-traffic
!
!
policy-map type inspect dns MY_DNS_INSPECT_MAP
 parameters
  message-length maximum 512
policy-map global_policy
 class inspection_default
  inspect ftp
  inspect h323 h225
  inspect h323 ras
  inspect rsh
  inspect rtsp
  inspect esmtp
  inspect sqlnet
  inspect skinny
  inspect sunrpc
  inspect xdmcp
  inspect sip
  inspect netbios
  inspect tftp
  inspect dns MY_DNS_INSPECT_MAP
  inspect icmp
policy-map type inspect dns migrated_dns_map_1
 parameters
  message-length maximum 512
!
service-policy global_policy global
prompt hostname context
Cryptochecksum:d6637819c6ea981daf20d8c7aa8ca256
: end
```

Configure DNS Inspection

Complete these steps in order to enable DNS inspection (if it has been previously disabled). In this example, DNS inspection is added to the default global inspection policy, which is applied globally by a **service−policy** command as though the ASA began with a default configuration. Refer to Using Modular Policy Framework for more information on service policies and inspection.

1. Create an inspection policy map for DNS.

```
ciscoasa(config)#policy−map type inspect dns MY_DNS_INSPECT_MAP
```

2. From the policy−map configuration mode, enter parameter configuration mode to specify parameters for the inspection engine.

```
ciscoasa(config−pmap)#parameters
```

3. In policy−map parameter configuration mode, specify the maxiumum message length for DNS messages to be 512.

```
ciscoasa(config−pmap−p)#message−length maximum 512
```

4. Exit out of policy−map parameter configuration mode and policy−map configuration mode.

```
ciscoasa(config−pmap−p)#exit
ciscoasa(config−pmap)#exit
```

5. Confirm that the inspection policy−map was created as desired.

```
ciscoasa(config)#show run policy−map type inspect dns
!
policy−map type inspect dns MY_DNS_INSPECT_MAP
 parameters
  message−length maximum 512
!
```

6. Enter policy−map configuration mode for the **global_policy**.

```
ciscoasa(config)#policy−map global_policy
ciscoasa(config−pmap)#
```

7. In policy−map configuration mode, specify the default layer 3/4 class map, **inspection_default**.

```
ciscoasa(config−pmap)#class inspection_default
ciscoasa(config−pmap−c)#
```

8. In policy−map class configuration mode, specify that DNS should be inspected using the inspection policy map created in steps 1−3.

```
ciscoasa(config−pmap−c)#inspect dns MY_DNS_INSPECT_MAP
```

9. Exit out of policy−map class configuration mode and policy−map configuration mode.

```
ciscoasa(config−pmap−c)#exit
ciscoasa(config−pmap)#exit
```

10. Verify that the **global_policy** policy−map is configured as desired.

```
ciscoasa(config)#show run policy−map
!

!−−− The configured DNS inspection policy map.

policy−map type inspect dns MY_DNS_INSPECT_MAP
 parameters
  message−length maximum 512
policy−map global_policy
 class inspection_default
  inspect ftp
```

```
  inspect h323 h225
  inspect h323 ras
  inspect rsh
  inspect rtsp
  inspect esmtp
  inspect sqlnet
  inspect skinny
  inspect sunrpc
  inspect xdmcp
  inspect sip
  inspect netbios
  inspect tftp
  inspect dns MY_DNS_INSPECT_MAP

!--- DNS application inspection enabled.

!
```

11. Verify that the global_policy is applied globally by a service−policy.

```
ciscoasa(config)#show run service−policy
service−policy global_policy global
```

Verify

Use this section to confirm that your configuration works properly.

The Output Interpreter Tool (registered customers only) (OIT) supports certain **show** commands. Use the OIT to view an analysis of **show** command output.

Capture DNS Traffic

One method to verify that the security appliance rewrites DNS records correctly is to capture the packets in question, as discussed in the previous example. Complete these steps in order to capture traffic on the ASA:

1. Create an access list for each capture instance you want to create.

   The ACL should specify the traffic that you want to capture. In this example, two ACLs have been created.

   - The ACL for traffic on the outside interface:

     ```
     access−list DNSOUTCAP extended permit ip host 172.22.1.161 host 172.20.1.2

     !--- All traffic between the DNS server and the ASA.

     access−list DNSOUTCAP extended permit ip host 172.20.1.2 host 172.22.1.161

     !--- All traffic between the ASA and the DNS server.
     ```

   - The ACL for traffic on the inside interface:

     ```
     access−list DNSINCAP extended permit ip host 192.168.100.2 host 172.22.1.161

     !--- All traffic between the client and the DNS server.

     access−list DNSINCAP extended permit ip host 172.22.1.161 host 192.168.100.2

     !--- All traffic between the DNS server and the client.
     ```

2. Create the capture instance(s):

```
ciscoasa#capture DNSOUTSIDE access-list DNSOUTCAP interface outside

!--- This capture collects traffic on the outside interface that matches
!--- the ACL DNSOUTCAP.

ciscoasa# capture DNSINSIDE access-list DNSINCAP interface inside

!--- This capture collects traffic on the inside interface that matches
!--- the ACL DNSINCAP.
```

3. View the capture(s).

   Here is what the example captures look like after some DNS traffic has been passed:

```
ciscoasa#show capture DNSOUTSIDE
2 packets captured
   1: 14:07:21.347195 172.20.1.2.1025 > 172.22.1.161.53:  udp 36
   2: 14:07:21.352093 172.22.1.161.53 > 172.20.1.2.1025:  udp 93
2 packets shown
ciscoasa#show capture DNSINSIDE
2 packets captured
   1: 14:07:21.346951 192.168.100.2.57225 > 172.22.1.161.53:  udp 36
   2: 14:07:21.352124 172.22.1.161.53 > 192.168.100.2.57225:  udp 93
2 packets shown
```

4. (Optional) Copy the capture(s) to a TFTP server in pcap format for analysis in another application.

   Applications that can parse the pcap format can show additional details such as the name and IP address in DNS A records.

```
ciscoasa#copy /pcap capture:DNSINSIDE tftp
...
ciscoasa#copy /pcap capture:DNSOUTSIDE tftp
```

Troubleshoot

This section provides information you can use to troubleshoot your configuration.

DNS Rewrite Is Not Performed

Make sure that you have DNS inspection configured on the security appliance. See the Configure DNS Inspection section.

Translation Creation Failed

If a connection cannot be created between the client and the WWW server, it might be due to a NAT misconfiguration. Check the security appliance logs for messages which indicate that a protocol failed to create a translation through the security appliance. If such messages appear, verify that NAT has been configured for the desired traffic and that no addresses are incorrect.

```
%ASA-3-305006: portmap translation creation failed for tcp src
inside:192.168.100.2/11000 dst inside:192.168.100.10/80
```

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