在Catalyst 9000交換機上配置並檢驗NAT

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簡介

本檔案介紹如何在Catalyst 9000平台上設定和驗證網路位址轉譯(NAT)。

必要條件

需求

思科建議您瞭解以下主題：

- IP定址
- 存取控制清單

背景資訊

NAT最常見的情況是將專用IP網路空間轉換為全球唯一的Internet可路由地址。

執行NAT的裝置需要有一個內部網路上的介面（本地）和一個外部網路上的介面（全域性）。

NAT裝置負責檢查源流量，以確定它是否需要基於NAT規則配置的轉換。

如果需要轉換，裝置會將本地源IP地址轉換為全域性唯一的IP地址，並在其NAT轉換表中跟蹤此地址。

當資料包使用可路由地址返回時，裝置將檢查其NAT表，檢視是否有其它轉換正在進行。

如果是，路由器會將內部全域性地址轉換回相應的內部本地地址並路由資料包。

採用元件

在Cisco IOS® XE 16.12.1 NAT中，Network Advantage許可證現在可用。在所有早期版本中，DNA Advantage許可證中均提供此功能。

平台	引入了NAT功能
C9300	Cisco IOS® XE版本16.10.1
C9400	Cisco IOS® XE版本17.1.1
C9500	Cisco IOS® XE版本16.5.1a
C9600	Cisco IOS® XE版本16.11.1

本檔案以搭載Cisco IOS® XE版本16.12.4的Catalyst 9300平台為基礎

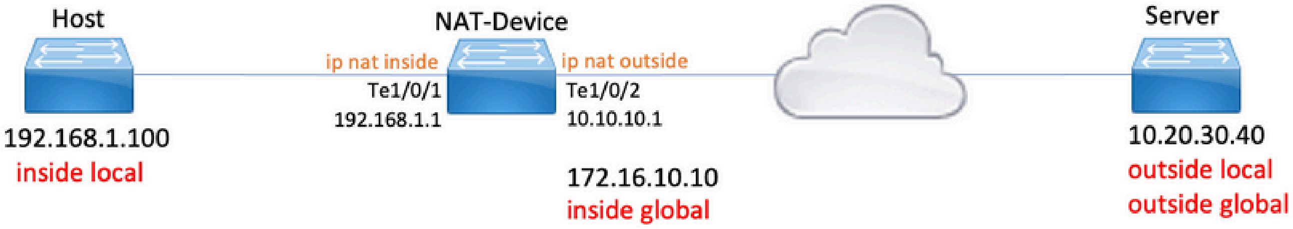
本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除（預設）的組態來啟動。如果您的網路運作中，請確保您瞭解任何指令可能造成的影響。

技術

靜態NAT	允許本地地址到全域性地址的1對1對映。
動態NAT	將本地地址對映到全域性地址池。
過載NAT	將本地地址對映到使用唯一L4埠的單個全域性地址。
內部本地	分配給內部網路中主機的IP地址。
內部全域性	這是對外部網路顯示的內部主機的IP地址。您可以將此地址視為內部本地地址轉換到的地址。
外部本地	外部主機對內部網路顯示的IP地址。
外部全域性	分配給外部網路上主機的IP地址。大多數情況下，外部本地和外部全域性地址是相同的。
FMAN-RP	功能管理器RP。這是Cisco IOS® XE 的控制平面，它將程式設計資訊傳遞到FMAN-FP。

FMAN-FP	功能管理器FP。FMAN-FP從FMAN-RP接收資訊並將其傳遞給FED。
FED	轉發引擎驅動程式。FMAN-FP使用FED將來自控制平面的資訊程式設計到統一接入資料平面(UADP)應用專用積體電路(ASIC)中。

網路圖表



設定

配置示例

靜態NAT配置，用於將192.168.1.100（內部本地）轉換為172.16.10.10（內部全域性）：

<#root>

```
NAT-Device#

show run interface te1/0/1


Building configuration...

Current configuration : 109 bytes
!
interface TenGigabitEthernet1/0/1
no switchport
ip address 192.168.1.1 255.255.255.0

ip nat inside                            <-- NAT inside interface


end

NAT-Device#

show run interface te1/0/2


Building configuration...

Current configuration : 109 bytes
!
```

```
interface TenGigabitEthernet1/0/2
no switchport
ip address 10.10.10.1 255.255.255.0

ip nat outside                           <-- NAT outside interface


end


ip nat inside source static 192.168.1.100 172.16.10.10              <-- static NAT rule



NAT-Device#

show ip nat translations


Pro Inside global       Inside local       Outside local       Outside global
icmp 172.16.10.10:4    192.168.1.100:4    10.20.30.40:4       10.20.30.40:4

<-- active NAT translation


---  172.16.10.10       192.168.1.100      ---                 ---

<-- static NAT translation added as a result of the configuration
```

用於將192.168.1.0/24轉換為172.16.10.1 - 172.16.10.30的動態NAT配置：

<#root>

```
NAT-Device#

show run interface te1/0/1


Building configuration...

Current configuration : 109 bytes
!
interface TenGigabitEthernet1/0/1
no switchport
ip address 192.168.1.1 255.255.255.0

ip nat inside                                <-- NAT inside interface


end

NAT-Device#

show run interface te1/0/2


Building configuration...

Current configuration : 109 bytes
!
```

```
interface TenGigabitEthernet1/0/2
no switchport
ip address 10.10.10.1 255.255.255.0

ip nat outside


<-- NAT outside interface


end
!

ip nat pool TAC-POOL 172.16.10.1 172.16.10.30 netmask 255.255.255.224      <-- NAT pool configuration


ip nat inside source list hosts pool TAC-POOL


<-- NAT rule configuration


!

ip access-list standard hosts                                              <-- ACL to match hosts to be


10 permit 192.168.1.0 0.0.0.255

NAT-Device#

show ip nat translations


Pro Inside global     Inside local     Outside local      Outside global
icmp 172.16.10.10:6   192.168.1.100:6  10.20.30.40:6      10.20.30.40:6
---  172.16.10.10     192.168.1.100    ---                ---
```

用於將192.168.1.0/24轉換到10.10.10.1(ip nat outside interface)的動態NAT過載(PAT)配置：

<#root>

```
NAT-Device#

show run interface te1/0/1


Building configuration...

Current configuration : 109 bytes
!
interface TenGigabitEthernet1/0/1
no switchport
ip address 192.168.1.1 255.255.255.0

ip nat inside                             <-- NAT inside interface


end
```

```
NAT-Device#

show run interface te1/0/2


Building configuration...

Current configuration : 109 bytes
!
interface TenGigabitEthernet1/0/2
no switchport
ip address 10.10.10.1 255.255.255.0

ip nat outside                          <-- NAT outside interface


end
!

ip nat inside source list hosts interface TenGigabitEthernet1/0/2 overload         <-- NAT configuratio


!

ip access-list standard hosts                                                      <-- ACL to match hos


 10 permit 192.168.1.0 0.0.0.255
```

請注意，內部全域性地址上的埠每轉換增加1:

<#root>

```
NAT-Device#

show ip nat translations


Pro Inside global      Inside local      Outside local      Outside global

icmp 10.10.10.1:1024   192.168.1.100:1   10.20.30.40:1       10.20.30.40:1024



<-- Notice layer 4 port increments



icmp 10.10.10.1:1025   192.168.1.100:2   10.20.30.40:2       10.20.30.40:1025



<-- Notice layer 4 port increments


icmp 10.10.10.1:1026   192.168.1.100:3   10.20.30.40:3       10.20.30.40:1026
icmp 10.10.10.1:1027   192.168.1.100:4   10.20.30.40:4       10.20.30.40:1027
icmp 10.10.10.1:1028   192.168.1.100:5   10.20.30.40:5       10.20.30.40:1028
icmp 10.10.10.1:1029   192.168.1.100:6   10.20.30.40:6       10.20.30.40:1029
icmp 10.10.10.1:1030   192.168.1.100:7   10.20.30.40:7       10.20.30.40:1030
icmp 10.10.10.1:1031   192.168.1.100:8   10.20.30.40:8       10.20.30.40:1031
```

```
10.10.10.1:1024 = inside global


192.168.1.100:1 = inside local
```

檢驗靜態NAT

軟體驗證

如果沒有轉換活動流，預計會看到使用靜態NAT轉換的一半。 當流變為活動狀態時，將建立動態轉換

```
<#root>

NAT-Device#

show ip nat translations

Pro Inside global      Inside local      Outside local      Outside global

icmp 172.16.10.10:10   192.168.1.100:10  10.20.30.40:10     10.20.30.40:10


<-- dynamic translation


---  172.16.10.10      192.168.1.100     ---                ---


<-- static configuration from NAT rule configuration
```

使用show ip nat translations verbose命令，您可以確定建立流的時間和轉換剩餘的時間。

```
<#root>

NAT-Device#

show ip nat translations verbose

Pro Inside global Inside local Outside local Outside global
icmp 172.16.10.10:10 192.168.1.100:10 10.20.30.40:10 10.20.30.40:10

create 00:00:13, use 00:00:13, left 00:00:46,


<-- NAT timers

flags:
```

```
extended, use_count: 0, entry-id: 10, lc_entries: 0
--- 172.16.10.10 192.168.1.100 --- ---
create 00:09:47, use 00:00:13,
flags:
static, use_count: 1, entry-id: 9, lc_entries: 0
```

檢查NAT統計資訊。當流量與NAT規則匹配並建立時，NAT命中計數器會遞增。

當流量與規則匹配但無法建立轉換時，NAT未命中計數器會增加。

```
<#root>

NAT-DEVICE#

show ip nat statistics


Total active translations: 1 (

1 static,

 0 dynamic; 0 extended)

<-- 1 static translation


Outside interfaces:

TenGigabitEthernet1/0/1           <-- NAT outside interface


Inside interfaces:

TenGigabitEthernet1/0/2           <-- NAT inside interface



Hits: 0 Misses: 0                 <-- NAT hit and miss counters.


CEF Translated packets: 0, CEF Punted packets: 0
Expired translations: 0
Dynamic mappings:
-- Inside Source
[Id: 1] access-list hosts interface TenGigabitEthernet1/0/1 refcount 0
```

要進行轉換，需要與NAT流的源和目標建立鄰接關係。記下鄰接關係ID。

```
<#root>

NAT-Device#

show ip route 10.20.30.40


Routing entry for 10.20.30.40/32
Known via "static", distance 1, metric 0
Routing Descriptor Blocks:
```

```
* 10.10.10.2
Route metric is 0, traffic share count is 1

NAT-Device#

show platform software adjacency switch active f0



Adjacency id:

0x29(41)



<-- adjacency ID


Interface: TenGigabitEthernet1/0/1, IF index: 52, Link Type: MCP_LINK_IP
Encap: 0:ca:e5:27:3f:e4:70:1f:53:0:b8:e4:8:0
Encap Length: 14, Encap Type: MCP_ET_ARPA, MTU: 1500
Flags: no-l3-inject
Incomplete behavior type: None
Fixup: unknown
Fixup_Flags_2: unknown
Nexthop addr:

192.168.1.100



<-- source adjacency


IP FRR MCP_ADJ_IPFRR_NONE 0
aom id: 464, HW handle: (nil) (created)

Adjacency id:

0x24 (36)



<-- adjacency ID


Interface: TenGigabitEthernet1/0/2, IF index: 53, Link Type: MCP_LINK_IP
Encap: 34:db:fd:ee:ce:e4:70:1f:53:0:b8:d6:8:0
Encap Length: 14, Encap Type: MCP_ET_ARPA, MTU: 1500
Flags: no-l3-inject
Incomplete behavior type: None
Fixup: unknown
Fixup_Flags_2: unknown
Nexthop addr:

10.10.10.2



<-- next hop to 10.20.30.40


IP FRR MCP_ADJ_IPFRR_NONE 0
aom id: 452, HW handle: (nil) (created)
```

可以啟用NAT調試，以驗證交換機是否收到流量以及是否建立NAT流

> 注意：請注意，受NAT約束的ICMP流量始終在軟體中處理，因此平台調試不會顯示ICMP流量的日誌。

<#root>

```
NAT-Device#

debug ip nat detailed


IP NAT detailed debugging is on
NAT-Device#
*Mar 8 23:48:25.672: NAT: Entry assigned id 11

<-- receive traffic and flow created


*Mar 8 23:48:25.672: NAT: i: icmp (192.168.1.100, 11) -> (10.20.30.40, 11) [55]
*Mar 8 23:48:25.672: NAT:

s=192.168.1.100->172.16.10.10

, d=10.20.30.40 [55]NAT: dyn flow info download suppressed for flow 11

<-- source is translated


*Mar 8 23:48:25.673: NAT: o: icmp (10.20.30.40, 11) -> (172.16.10.10, 11) [55]
*Mar 8 23:48:25.674: NAT: s=10.20.30.40,

d=172.16.10.10->192.168.1.100

 [55]NAT: dyn flow info download suppressed for flow 11

<-- return source is translated


*Mar 8 23:48:25.675: NAT: i: icmp (192.168.1.100, 11) -> (10.20.30.40, 11) [56]
```

當流到期或被刪除時，您將在調試中看到DELETE操作：

<#root>

```
*Mar 31 17:58:31.344: FMANRP-NAT: Received flow data, action:

DELETE



<-- action is delete
```

```
*Mar 31 17:58:31.344: id 2, flags 0x1, domain 0
src_local_addr 192.168.1.100, src_global_addr 172.16.10.10, dst_local_addr 10.20.30.40,
dst_global_addr 10.20.30.40, src_local_port 31783, src_global_port 31783,
dst_local_port 23, dst_global_port 23,
proto 6, table_id 0 inside_mapping_id 0,
outside_mapping_id 0, inside_mapping_type 0,
outside_mapping_type 0
```

硬體驗證

配置NAT規則後，裝置將在NAT區域5下的TCAM中對此規則進行程式設計。確認規則已程式設計到TCAM中。

輸出是十六進位制的，因此需要轉換為IP地址。

<#root>

```
NAT-Device#

show platform hardware fed switch active fwd-asic resource tcam table pbr record 0 format 0 | begin NAT_


Printing entries for region NAT_1 (370) type 6 asic 3
========================================================
Printing entries for region NAT_2 (371) type 6 asic 3
========================================================
Printing entries for region NAT_3 (372) type 6 asic 3
========================================================
Printing entries for region NAT_4 (373) type 6 asic 3
========================================================

Printing entries for region NAT_5 (374) type 6 asic 3               <-- NAT Region 5


========================================================
TAQ-2 Index-128 (A:1,C:1) Valid StartF-1 StartA-1 SkipF-0 SkipA-0
Mask1 3300f000:00000000:00000000:00000000:00000000:00000000:00000000:ffffffff
Key1 21009000:00000000:00000000:00000000:00000000:00000000:00000000:

c0a80164



<--



inside local IP address 192.168.1.100 in hex (c0a80164)


AD 10087000:00000073

TAQ-2 Index-129 (A:1,C:1) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Mask1 0300f000:00000000:00000000:00000000:00000000:00000000:ffffffff:00000000
Key1 02009000:00000000:00000000:00000000:00000000:00000000:

ac100a0a

:00000000
```

```
<-- inside global IP address 172.16.10.10 in hex (ac100a0a)

AD 10087000:00000073
```

最後，當資料流活躍時，可以通過NAT區域1下的TCAM驗證來確認硬體程式設計。

<#root>

```
NAT-Device#

show platform hardware fed switch active fwd-asic resource tcam table pbr record 0 format 0 | begin NAT_


Printing entries for region

NAT_1

 (370) type 6 asic 1

<-- NAT Region 1

========================================================
TAQ-2 Index-32 (A:0,C:1) Valid StartF-1 StartA-1 SkipF-0 SkipA-0
Mask1 0000f000:ff00ffff:00000000:0000ffff:00000000:00000000:ffffffff:ffffffff
Key1 00009000:06005ac9:00000000:00000017:00000000:00000000:

0a141e28:c0a80164


AD 10087000:000000b0

TAQ-2 Index-33 (A:0,C:1) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Mask1 0000f000:ff00ffff:00000000:0000ffff:00000000:00000000:ffffffff:ffffffff
Key1 00009000:06000017:00000000:00005ac9:00000000:00000000:

ac100a0a:0a141e28


AD 10087000:000000b1

Starting at Index-32 Key1 from right to left:


c0a80164

 = 192.168.1.100 (Inside Local)

0a141e28

 = 10.20.30.40 (Outside Global)

00000017

 = 23 (TCP destination port)

06005ac9

 = 06 for TCP and 5ac9 is 23241 which is source port from "show ip nat translations" of the inside host

Repeat the same for Index-33 which is the reverse translation:
```

```
0a141e28
 = 10.20.30.40 (Outside Global)
ac100a0a
 = 172.16.10.10 (Inside Global)
00005ac9
 = 23241 TCP Destination port
06000017
 = 06 for TCP and 17 for TCP source port 23
```

檢驗動態NAT

軟體驗證

確認已配置要將內部IP地址轉換為的地址池。

此配置允許將網路192.168.1.0/24轉換為地址172.16.10.1到172.16.10.254

<#root>

```
NAT-Device#
show run | i ip nat

ip nat inside

<-- ip nat inside on inside interface

ip nat outside

<-- ip nat outside on outside interface

ip nat pool MYPOOL 172.16.10.1 172.16.10.254 netmask 255.255.255.0   <-- Pool of addresses to translate

ip nat inside source list hosts pool MYPOOL                          <-- Enables hosts that match ACL "h

NAT-Device#
show ip access-list 10 <-- ACL to match hosts to be translated
```

```
Standard IP access list 10
10 permit 192.168.1.0, wildcard bits 0.0.0.255
NAT-Device#
```

請注意，對於動態NAT，它不會僅使用配置建立任何條目。需要在填充轉換表之前建立活動流。

<#root>

```
NAT-Device#

show ip nat translations


<...empty...>
```

檢查NAT統計資訊。當流量與NAT規則匹配並建立時，NAT命中計數器會遞增。

當流量與規則匹配但無法建立轉換時，NAT未命中計數器會增加。

<#root>

```
NAT-DEVICE#

show ip nat statistics

Total active translations: 3794 (1 static,

3793 dynamic

; 3793 extended)

<-- dynamic translations

Outside interfaces:

TenGigabitEthernet1/0/1           <-- NAT outside interface

Inside interfaces:

TenGigabitEthernet1/0/2           <-- NAT inside interface


Hits: 3793

 Misses: 0

<-- 3793 hits

CEF Translated packets: 0, CEF Punted packets: 0
Expired translations: 0

Dynamic mappings:                 <-- rule for dynamic mappings
```

```
-- Inside Source
[Id: 1]

access-list hosts interface TenGigabitEthernet1/0/1

 refcount 3793

<-- NAT rule displayed
```

確認存在與源和目標的鄰接關係

<#root>

```
NAT-Device#

show platform software adjacency switch active f0


Number of adjacency objects: 4

Adjacency id:

0x24(36)


 <-- adjacency ID


Interface: TenGigabitEthernet1/0/2, IF index: 53, Link Type: MCP_LINK_IP
Encap: 34:db:fd:ee:ce:e4:70:1f:53:0:b8:d6:8:0
Encap Length: 14, Encap Type: MCP_ET_ARPA, MTU: 1500
Flags: no-l3-inject
Incomplete behavior type: None
Fixup: unknown
Fixup_Flags_2: unknown
Nexthop addr:

10.10.10.2


<-- adjacency to destination


IP FRR MCP_ADJ_IPFRR_NONE 0
aom id: 449, HW handle: (nil) (created)

Adjacency id:

0x25 (37)


<-- adjacency ID


Interface: TenGigabitEthernet1/0/1, IF index: 52, Link Type: MCP_LINK_IP
Encap: 0:ca:e5:27:3f:e4:70:1f:53:0:b8:e4:8:0
Encap Length: 14, Encap Type: MCP_ET_ARPA, MTU: 1500
Flags: no-l3-inject
Incomplete behavior type: None
```

```
Fixup: unknown
Fixup_Flags_2: unknown
Nexthop addr:

192.168.1.100



<-- source adjacency


IP FRR MCP_ADJ_IPFRR_NONE 0
aom id: 451, HW handle: (nil) (created)
```

確認鄰接關係後，如果存在NAT問題，您可以開始進行獨立於平台的NAT調試

<#root>

```
NAT-Device#

debug ip nat


IP NAT debugging is on
NAT-Device#

debug ip nat detailed


IP NAT detailed debugging is on

NAT-Device#

show logging



*May 13 01:00:41.136: NAT: Entry assigned id 6
*May 13 01:00:41.136: NAT: Entry assigned id 7
*May 13 01:00:41.136: NAT: i:

tcp (192.168.1.100, 48308)

 -> (10.20.30.40, 23) [30067]

<-- first packet ingress without NAT


*May 13 01:00:41.136: NAT: TCP Check for Limited ALG Support
*May 13 01:00:41.136: NAT:

s=192.168.1.100->172.16.10.10

, d=10.20.30.40 [30067]NAT: dyn flow info download suppressed for flow 7

<-- confirms source address translation


*May 13 01:00:41.136: NAT: attempting to setup alias for 172.16.10.10 (redundancy_name , idb NULL, flag
*May 13 01:00:41.139: NAT: o:

tcp (10.20.30.40, 23)
```

```
 -> (172.16.10.10, 48308) [40691]

<-- return packet from destination to be translated


*May 13 01:00:41.139: NAT: TCP Check for Limited ALG Support
*May 13 01:00:41.139: NAT: s=10.20.30.40,

d=172.16.10.10->192.168.1.100

 [40691]NAT: dyn flow info download suppressed for flow 7

<-- return packet is translated


*May 13 01:00:41.140: NAT: i: tcp (192.168.1.100, 48308) -> (10.20.30.40, 23) [30068]
```

您還可以調試FMAN-RP NAT操作：

<#root>

```
NAT-Device#

debug platform software nat all


NAT platform all events debugging is on

Log Buffer (100000 bytes):

*May 13 01:04:16.098: FMANRP-NAT: Received flow data, action:

ADD



<-- first packet in flow so we ADD an entry


*May 13 01:04:16.098: id 9, flags 0x1, domain 0

src_local_addr 192.168.1.100, src_global_addr 172.16.10.10, dst_local_addr 10.20.30.40

,

<-- verify inside local/global and outside local/global


dst_global_addr 10.20.30.40, src_local_port 32529, src_global_port 32529,

dst_local_port 23, dst_global_port 23

,

<-- confirm ports, in this case they are for Telnet


proto 6, table_id 0 inside_mapping_id 1,
outside_mapping_id 0, inside_mapping_type 2,
outside_mapping_type 0
*May 13 01:04:16.098: FMANRP-NAT: Created TDL message for flow info:
ADD id 9
*May 13 01:04:16.098: FMANRP-NAT: Sent TDL message for flow data config:
```

```
ADD id 9

*May 13 01:04:16.098: FMANRP-NAT: Received flow data, action:

 MODIFY            <-- subsequent packets are MODIFY


*May 13 01:04:16.098: id 9, flags 0x1, domain 0
src_local_addr 192.168.1.100, src_global_addr 172.16.10.10, dst_local_addr 10.20.30.40,
dst_global_addr 10.20.30.40, src_local_port 32529, src_global_port 32529,
dst_local_port 23, dst_global_port 23,
proto 6, table_id 0 inside_mapping_id 1,
outside_mapping_id 0, inside_mapping_type 2,
outside_mapping_type 0
*May 13 01:04:16.098: FMANRP-NAT: Created TDL message for flow info:
MODIFY id 9
*May 13 01:04:16.098: FMANRP-NAT: Sent TDL message for flow data config:
MODIFY id 9
```

如果由於任何原因（如到期或手動刪除）而刪除規則，則會執行DELETE操作：

<#root>

```
*May 13 01:05:20.276: FMANRP-NAT: Received flow data, action:

DELETE           <-- DELETE action


*May 13 01:05:20.276: id 9, flags 0x1, domain 0
src_local_addr 192.168.1.100, src_global_addr 172.16.10.10, dst_local_addr 10.20.30.40,
dst_global_addr 10.20.30.40, src_local_port 32529, src_global_port 32529,
dst_local_port 23, dst_global_port 23,
proto 6, table_id 0 inside_mapping_id 0,
outside_mapping_id 0, inside_mapping_type 0,
outside_mapping_type 0
```

硬體驗證

檢查是否在NAT區域5下的硬體中正確新增了與要轉換的流量匹配的NAT規則：

<#root>

```
NAT-Device#

show platform hardware fed switch active fwd-asic resource tcam table pbr record 0 format 0 | begin NAT_



Printing entries for region

NAT_1

 (370) type 6 asic 1

<<<< empty due to no active flow
```

```
========================================================
Printing entries for region NAT_2 (371) type 6 asic 1
========================================================
Printing entries for region NAT_3 (372) type 6 asic 1
========================================================
Printing entries for region NAT_4 (373) type 6 asic 1
========================================================
Printing entries for region NAT_5 (374) type 6 asic 1
========================================================
TAQ-2 Index-128 (A:0,C:1) Valid StartF-1 StartA-1 SkipF-0 SkipA-0
Mask1 0300f000:00000000:00000000:00000000:00000000:00000000:fffffff8:00000000
Key1 02009000:00000000:00000000:00000000:00000000:00000000:ac100a00:00000000
AD 10087000:00000073

TAQ-2 Index-129 (A:0,C:1) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Mask1 3300f000:00000000:00000000:00000000:00000000:00000000:00000000:

ffffff00


Key1 21009000:00000000:00000000:00000000:00000000:00000000:00000000:

c0a80100


AD 10087000:00000073


ffffff00 = 255.255.255.0 in hex


c0a80100 = 192.168.1.0 in hex which matches our network in the NAT ACL
```

最後，您需要確認活動轉換在NAT TCAM區域1中程式設計正確

<#root>

```
NAT-Device#

show ip nat translations


Pro Inside global       Inside local        Outside local      Outside global
tcp 172.16.10.10:54854  192.168.1.100:54854 10.20.30.40:23     10.20.30.40:23
--- 172.16.10.10        192.168.1.100       ---                ---

NAT-Device#

show platform hardware fed switch active fwd-asic resource tcam table pbr record 0 format 0 | begin NAT_



Printing entries for region

 NAT_1

 (370) type 6 asic 1
========================================================
TAQ-2 Index-32 (A:0,C:1) Valid StartF-1 StartA-1 SkipF-0 SkipA-0
Mask1 0000f000:ff00ffff:00000000:0000ffff:00000000:00000000:ffffffff:ffffffff
```

```
Key1 00009000:0600d646:00000000:00000017:00000000:00000000:
```

0a141e28

```
:
```

c0a80164

```
AD 10087000:000000b0

TAQ-2 Index-33 (A:0,C:1) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Mask1 0000f000:ff00ffff:00000000:0000ffff:00000000:00000000:ffffffff:ffffffff
Key1 00009000:06000017:00000000:0000d646:00000000:00000000:
```

ac100a0a

```
:
```

0a141e28

```
AD 10087000:000000b1

Printing entries for region NAT_2 (371) type 6 asic 1
========================================================
Printing entries for region NAT_3 (372) type 6 asic 1
========================================================
Printing entries for region NAT_4 (373) type 6 asic 1
========================================================
Printing entries for region NAT_5 (374) type 6 asic 1
========================================================
```

Starting at Index-32 Key 1 from right to left:

c0a80164

- 192.168.1.100 (inside local)

0a141e28

- 10.20.30.40 (outside local/global)

00000017

- TCP port 23

0600d646

- 6 for TCP protocol and 54854 for TCP source port

Starting at Index-33 Key 1 from right to left

0a141e28

- 10.20.30.40 destination address

ac100a0a

- 172.16.10.10 (inside global source IP address)

0000d646

- TCP source port

06000017

```
 - TCP protocol 6 and 23 for the TCP destination port
```

檢驗動態NAT過載(PAT)

軟體驗證

用於驗證PAT的日誌進程與動態NAT相同。您只需要確認正確的埠轉換以及在硬體中正確程式設計埠。

PAT是通過附加到NAT規則的「overload」關鍵字實現的。

```
<#root>

NAT-Device#

show run | i ip nat


ip nat inside


<-- ip nat inside on NAT inside interface


ip nat outside


<-- ip nat outside on NAT outside interface


ip nat pool MYPOOL 172.16.10.1 172.16.10.254 netmask 255.255.255.0  <-- Address pool to translate to


ip nat inside source list hosts pool MYPOOL overload                <-- Links ACL hosts to address pool
```

確認存在與源和目標的鄰接關係

```
<#root>

NAT-Device#

show ip route 10.20.30.40


Routing entry for 10.20.30.40/32
Known via "static", distance 1, metric 0
Routing Descriptor Blocks:
*

10.10.10.2
```

```
Route metric is 0, traffic share count is 1

NAT-Device#

show platform software adjacency switch active f0


Number of adjacency objects: 4

Adjacency id:

0x24



(36)



<-- adjacency ID


Interface: TenGigabitEthernet1/0/2, IF index: 53, Link Type: MCP_LINK_IP
Encap: 34:db:fd:ee:ce:e4:70:1f:53:0:b8:d6:8:0
Encap Length: 14, Encap Type: MCP_ET_ARPA, MTU: 1500
Flags: no-l3-inject
Incomplete behavior type: None
Fixup: unknown
Fixup_Flags_2: unknown
Nexthop addr:

10.10.10.2             <-- adjacency to destination


IP FRR MCP_ADJ_IPFRR_NONE 0
aom id: 449, HW handle: (nil) (created)

Adjacency id:

 0x25



(37)



<-- adjacency ID


Interface: TenGigabitEthernet1/0/1, IF index: 52, Link Type: MCP_LINK_IP
Encap: 0:ca:e5:27:3f:e4:70:1f:53:0:b8:e4:8:0
Encap Length: 14, Encap Type: MCP_ET_ARPA, MTU: 1500
Flags: no-l3-inject
Incomplete behavior type: None
Fixup: unknown
Fixup_Flags_2: unknown
Nexthop addr:

192.168.1.100          <--  source adjacency


IP FRR MCP_ADJ_IPFRR_NONE 0
aom id: 451, HW handle: (nil) (created)
```

確認在流處於活動狀態時轉換已新增到轉換表中。請注意，使用PAT時，不會像使用動態NAT時一樣建立半條目。

跟蹤內部本地地址和內部全域性地址上的埠號。

<#root>

```
NAT-Device#

show ip nat translations


Pro Inside global      Inside local         Outside local      Outside global
tcp 172.16.10.10:1024  192.168.1.100:52448 10.20.30.40:23     10.20.30.40:23
```

檢查NAT統計資訊。當流量與NAT規則匹配並建立時，NAT命中計數器會遞增。

當流量與規則匹配但無法建立轉換時，NAT未命中計數器會增加。

<#root>

```
NAT-DEVICE#

show ip nat statistics


Total active translations: 3794 (1 static,

3793 dynamic

; 3793 extended)

<-- dynamic translations


Outside interfaces:

TenGigabitEthernet1/0/1                          <-- NAT outside interface


Inside interfaces:

TenGigabitEthernet1/0/2                          <-- NAT inside interface



Hits: 3793

 Misses: 0

<-- 3793 hits


CEF Translated packets: 0, CEF Punted packets: 0
Expired translations: 0

Dynamic mappings:
```

```
<-- rule for dynamic mappings


-- Inside Source
[Id: 1]

access-list hosts interface TenGigabitEthernet1/0/1

 refcount 3793

<-- NAT rule displayed
```

平台無關的NAT調試顯示發生埠轉換：

<#root>

```
NAT-Device#

debug ip nat detailed


IP NAT detailed debugging is on
NAT-Device#

debug ip nat


IP NAT debugging is on

NAT-device#

show logging



Log Buffer (100000 bytes):

*May 18 23:52:20.296: NAT: address not stolen for 192.168.1.100, proto 6 port 52448
*May 18 23:52:20.296: NAT: Created portlist for proto tcp globaladdr 172.16.10.10
*May 18 23:52:20.296: NAT: Allocated Port for 192.168.1.100 -> 172.16.10.10:

wanted 52448 got 1024<-- confirms PAT is used


*May 18 23:52:20.296: NAT: Entry assigned id 5
*May 18 23:52:20.296: NAT: i: tcp (192.168.1.100, 52448) -> (10.20.30.40, 23) [63338]
*May 18 23:52:20.296: NAT: TCP Check for Limited ALG Support
*May 18 23:52:20.296: NAT: TCP

s=52448->1024

, d=23

 <-- confirms NAT overload with PAT


*May 18 23:52:20.296: NAT:

s=192.168.1.100->172.16.10.10, d=10.20.30.40

 [63338]NAT: dyn flow info download suppressed for flow 5

<-- shows inside translation
```

```
*May 18 23:52:20.297: NAT: attempting to setup alias for 172.16.10.10 (redundancy_name , idb NULL, flag
*May 18 23:52:20.299: NAT: o: tcp (10.20.30.40, 23) -> (172.16.10.10, 1024) [55748]
*May 18 23:52:20.299: NAT: TCP Check for Limited ALG Support
*May 18 23:52:20.299: NAT: TCP s=23,

d=1024->52448


 <-- shows PAT on return traffic


*May 18 23:52:20.299: NAT: s=10.20.30.40, d=172.16.10.10->192.168.1.100 [55748]NAT: dyn flow info downl
```

<#root>

```
NAT-Device#

debug platform software nat all


NAT platform all events debugging is on
NAT-Device#

*May 18 23:52:20.301: FMANRP-NAT: Received flow data, action:

ADD               <-- first packet in flow ADD operation


*May 18 23:52:20.301: id 5, flags 0x5, domain 0

src_local_addr 192.168.1.100, src_global_addr 172.16.10.10

, dst_local_addr 10.20.30.40,

<-- source translation


dst_global_addr 10.20.30.40,

src_local_port 52448, src_global_port 1024

,

<-- port translation


dst_local_port 23, dst_global_port 23,
proto 6, table_id 0 inside_mapping_id 1,
outside_mapping_id 0, inside_mapping_type 2,
outside_mapping_type 0
<snip>
```

硬體驗證

確認NAT規則已正確安裝在NAT區域5下的硬體中

<#root>

```
NAT-Device#

show platform hardware fed switch active fwd-asic resource tcam table pbr record 0 format 0 | begin NAT_



Printing entries for region

NAT_1

 (370) type 6 asic 1

<-- NAT_1 empty due to no active flow


========================================================
Printing entries for region NAT_2 (371) type 6 asic 1
========================================================
Printing entries for region NAT_3 (372) type 6 asic 1
========================================================
Printing entries for region NAT_4 (373) type 6 asic 1
========================================================
Printing entries for region NAT_5 (374) type 6 asic 1
========================================================
TAQ-2 Index-128 (A:0,C:1) Valid StartF-1 StartA-1 SkipF-0 SkipA-0
Mask1 0300f000:00000000:00000000:00000000:00000000:00000000:fffffffc:00000000
Key1 02009000:00000000:00000000:00000000:00000000:00000000:ac100a00:00000000
AD 10087000:00000073

TAQ-2 Index-129 (A:0,C:1) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Mask1 3300f000:00000000:00000000:00000000:00000000:00000000:00000000:

ffffff00


Key1 21009000:00000000:00000000:00000000:00000000:00000000:00000000:

c0a80100


AD 10087000:00000073


ffffff00 = 255.255.255.0 in hex for our subnet mask in NAT ACL



c0a80100 = 192.168.1.0 in hex for our network address in NAT ACL
```

最後，您可以檢查NAT流處於活動狀態時是否已程式設計到NAT_Region 1下的硬體TCAM

<#root>

```
NAT-Device#

show ip nat translations


Pro Inside global      Inside local        Outside local  Outside global
tcp 172.16.10.10:1024  192.168.1.100:20027 10.20.30.40:23 10.20.30.40:23

NAT-Device#
```

```
show platform hardware fed switch active fwd-asic resource tcam table pbr record 0 format 0 | begin NAT_
```

```
Printing entries for region

NAT_1

 (370) type 6 asic 1

<-- NAT region 1


========================================================
TAQ-2 Index-32 (A:0,C:1) Valid StartF-1 StartA-1 SkipF-0 SkipA-0
Mask1 0000f000:ff00ffff:00000000:0000ffff:00000000:00000000:ffffffff:ffffffff
Key1 00009000:

06004e3b

:00000000:

00000017

:00000000:00000000:

0a141e28

:

c0a80164


AD 10087000:000000b0

TAQ-2 Index-33 (A:0,C:1) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Mask1 0000f000:ff00ffff:00000000:0000ffff:00000000:00000000:ffffffff:ffffffff
Key1 00009000:

06000017

:00000000:

00000400

:00000000:00000000:

0a141e28

:

0a141e28


AD 10087000:000000b1
```

Starting at Index-32 Key1 from right to left:

c0a80164

- 192.168.1.100 (inside local source address)

0a141e28

- 10.20.30.40 (inside global address/outside local address)

00000017

```
- 23 (TCP destination port)

06004e3b

- TCP source port 20027 (4e3b) and TCP protocol 6



Starting at Index-33 Key1 from right to left:

0a141e28

 - 10.20.30.40 (outside global address/outside local address)

ac100a0a

 - 172.16.10.10 (inside global)

00000400

 - TCP inside global source port 1024

06000017

 - TCP protocol 6 and TCP source port 23
```

封包層級偵錯

必須將流中與硬體中的NAT規則匹配的第一個資料包傳送到要處理的裝置CPU。若要檢視與點點路徑相關的調試輸出，可以啟用指向調試級別的FED點點路徑跟蹤，以確保資料包被點點。需要CPU資源的NAT流量進入傳輸流量CPU隊列。

檢查傳輸流量CPU隊列是否看到資料包主動被轉發到它。

```
<#root>

NAT-DEVICE#

show platform software fed switch active punt cpuq clear <-- clear statistics



NAT-DEVICE#

show platform software fed switch active punt cpuq 18    <-- transit traffic queue

Punt CPU Q Statistics
===========================================

CPU Q Id :

18

CPU Q Name :

CPU_Q_TRANSIT_TRAFFIC
```

```
Packets received from ASIC : 0                                      <-- no punt traffic for NAT


Send to IOSd total attempts : 0
Send to IOSd failed count : 0
RX suspend count : 0
RX unsuspend count : 0
RX unsuspend send count : 0
RX unsuspend send failed count : 0
RX consumed count : 0
RX dropped count : 0
RX non-active dropped count : 0
RX conversion failure dropped : 0
RX INTACK count : 0
RX packets dq'd after intack : 0
Active RxQ event : 0
RX spurious interrupt : 0
RX phy_idb fetch failed: 0
RX table_id fetch failed: 0
RX invalid punt cause: 0

Replenish Stats for all rxq:
-------------------------------------------
Number of replenish : 0
Number of replenish suspend : 0
Number of replenish un-suspend : 0
-------------------------------------------

NAT-DEVICE#

show platform software fed switch active punt cpuq 18     <-- after new translation


Punt CPU Q Statistics
===========================================

CPU Q Id : 18
CPU Q Name : CPU_Q_TRANSIT_TRAFFIC

Packets received from ASIC : 5                                       <-- confirms the UADP ASIC punts to


Send to IOSd total attempts : 5
Send to IOSd failed count : 0
RX suspend count : 0
RX unsuspend count : 0
RX unsuspend send count : 0
RX unsuspend send failed count : 0
RX consumed count : 0
RX dropped count : 0
RX non-active dropped count : 0
RX conversion failure dropped : 0
RX INTACK count : 5
RX packets dq'd after intack : 0
Active RxQ event : 5
RX spurious interrupt : 0
RX phy_idb fetch failed: 0
RX table_id fetch failed: 0
RX invalid punt cause: 0

Replenish Stats for all rxq:
-------------------------------------------
```

```
Number of replenish : 18
Number of replenish suspend : 0
Number of replenish un-suspend : 0
-------------------------------------------
```

NAT擴展故障排除

當前硬體支援的最大NAT TCAM條目數，如下表所示：

注意：每個活動NAT轉換都需要2個TCAM條目。

平台	最大TCAM條目數
Catalyst 9300	5000
Catalyst 9400	14000
Catalyst 9500	14000
Catalyst 9500高效能	15500
Catalyst 9600	15500

如果懷疑存在擴展問題，您可以確認要檢查平台限制的TCP/UDP NAT轉換總數。

<#root>

```
NAT-Device#

show ip nat translations | count tcp


Number of lines which match regexp =

621             <-- current number of TCP translations


NAT-Device#

show ip nat translations | count udp


Number of lines which match regexp =

4894            <-- current number of UDP translations
```

如果耗盡了NAT TCAM空間，則交換機硬體中的NAT模組無法處理這些轉換。在此案例中，需要進行NAT轉換的流量會被傳送到要處理的裝置CPU。

這可能導致延遲，並且可以通過控制平面策略器隊列中遞增的丟棄確認，控制平面策略器隊列負責NAT突發流量。NAT流量進入的CPU隊列是「傳輸流量」。

<#root>

```
NAT-Device#

show platform hardware fed switch active qos queue stats internal cpu policer



                         CPU Queue Statistics
============================================================================================
                                                     (default) (set)     Queue        Queue
QId PlcIdx  Queue Name                      Enabled   Rate      Rate      Drop(Bytes)  Drop(Frames)
--------------------------------------------------------------------------------------------
<snip>
14   13      Sw forwarding                    Yes      1000      1000      0             0
15   8       Topology Control                 Yes      13000     16000     0             0
16   12      Proto Snooping                   Yes      2000      2000      0             0
17   6       DHCP Snooping                    Yes      500       500       0             0

18   13      Transit Traffic                  Yes      1000      1000      34387271      399507



<-- drops for NAT traffic headed towards the CPU



19   10      RPF Failed                       Yes      250       250       0             0
20   15      MCAST END STATION                Yes      2000      2000      0             0
<snip>
```

確認17.x代碼中可用的NAT TCAM空間。此輸出來自啟用NAT模板的9300，以便最大化空間。

<#root>

```
NAT-DEVICE#

show platform hardware fed switch active fwd-asic resource tcam utilization


Codes: EM - Exact_Match, I - Input, O - Output, IO - Input & Output, NA - Not Applicable

CAM Utilization for ASIC [0]
Table                  Subtype      Dir      Max     Used    %Used       V4       V6     MPLS    Other
------------------------------------------------------------------------------------------------------
Mac Address Table      EM           I       32768      22    0.07%        0        0        0       22
Mac Address Table      TCAM         I        1024      21    2.05%        0        0        0       21
L3 Multicast           EM           I        8192       0    0.00%        0        0        0        0
L3 Multicast           TCAM         I         512       9    1.76%        3        6        0        0
L2 Multicast           EM           I        8192       0    0.00%        0        0        0        0
L2 Multicast           TCAM         I         512      11    2.15%        3        8        0        0
IP Route Table         EM           I       24576      16    0.07%       15        0        1        0
IP Route Table         TCAM         I        8192      25    0.31%       12       10        2        1
QOS ACL                TCAM         IO       1024      85    8.30%       28       38        0       19
Security ACL           TCAM         IO       5120     148    2.89%       27       76        0       45
Netflow ACL            TCAM         I         256       6    2.34%        2        2        0        2

PBR ACL                TCAM         I        5120      24    0.47%       18        6        0        0


Netflow ACL            TCAM         O         768       6    0.78%        2        2        0        2
Flow SPAN ACL          TCAM         IO       1024      13    1.27%        3        6        0        4
Control Plane          TCAM         I         512     281   54.88%      130      106        0       45
Tunnel Termination     TCAM         I         512      18    3.52%        8       10        0        0
```

```
Lisp Inst Mapping      TCAM         I         512          1    0.20%       0        0         0        1
Security Association   TCAM         I         256          4    1.56%       2        2         0        0
Security Association   TCAM         O         256          5    1.95%       0        0         0        5
CTS Cell Matrix/VPN
Label                  EM           O        8192          0    0.00%       0        0         0        0
CTS Cell Matrix/VPN
Label                  TCAM         O         512          1    0.20%       0        0         0        1
Client Table           EM           I        4096          0    0.00%       0        0         0        0
Client Table           TCAM         I         256          0    0.00%       0        0         0        0
Input Group LE         TCAM         I        1024          0    0.00%       0        0         0        0
Output Group LE        TCAM         O        1024          0    0.00%       0        0         0        0
Macsec SPD             TCAM         I         256          2    0.78%       0        0         0        2
```

確認16.x代碼中可用的NAT TCAM空間。此輸出來自帶有SDM Access模板的9300，因此NAT TCAM條目的可用空間並未最大化。

<#root>

```
NAT-DEVICE#

show platform hardware fed switch active fwd-asic resource tcam utilization


CAM Utilization for ASIC [0]
 Table                                              Max Values        Used Values
--------------------------------------------------------------------------------
Unicast MAC addresses                                32768/1024        20/21
L3 Multicast entries                                  8192/512          0/9
L2 Multicast entries                                  8192/512          0/11
Directly or indirectly connected routes              24576/8192         5/23
QoS Access Control Entries                            5120             85
Security Access Control Entries                       5120            145
Ingress Netflow ACEs                                   256              8

Policy Based Routing ACEs                             1024            24 <-- NAT usage in PRB TCAM


Egress Netflow ACEs                                    768              8
Flow SPAN ACEs                                        1024             13
Control Plane Entries                                  512            255
Tunnels                                                512             17
Lisp Instance Mapping Entries                         2048              3
Input Security Associations                            256              4
SGT_DGT                                               8192/512          0/1
CLIENT_LE                                             4096/256          0/0
INPUT_GROUP_LE                                        1024              0
OUTPUT_GROUP_LE                                       1024              0
Macsec SPD                                             256              2
```

NAT TCAM的可用硬體空間可通過更改SDM模板以首選NAT來增加。這將為最大數量的TCAM條目分配硬體支援。

<#root>

```
NAT-Device#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
NAT-Device(config)#

sdm prefer nat
```

如果在轉換前後將SDM與NAT範本進行比較，您可以確認是否已將可用的TCAM空間交換為QoS存取控制專案與基於原則的路由(PBR)ACE。

PBR TCAM是對NAT進行程式設計的地方。

<#root>

```
NAT-Device#

show sdm prefer


Showing SDM Template Info

This is the Access template.
Number of VLANs: 4094
Unicast MAC addresses: 32768
Overflow Unicast MAC addresses: 1024
L2 Multicast entries: 8192
Overflow L2 Multicast entries: 512
L3 Multicast entries: 8192
Overflow L3 Multicast entries: 512
Directly connected routes: 24576
Indirect routes: 8192
Security Access Control Entries: 5120
QoS Access Control Entries: 5120

Policy Based Routing ACEs: 1024         <-- NAT


<...snip...>



NAT-Device#

show sdm prefer


Showing SDM Template Info

This is the NAT template.
Number of VLANs: 4094
Unicast MAC addresses: 32768
Overflow Unicast MAC addresses: 1024
L2 Multicast entries: 8192
Overflow L2 Multicast entries: 512
L3 Multicast entries: 8192
Overflow L3 Multicast entries: 512
Directly connected routes: 24576
Indirect routes: 8192
Security Access Control Entries: 5120
QoS Access Control Entries: 1024
```

```
Policy Based Routing ACEs: 5120       <-- NAT

<snip>
```

僅地址轉換(AOT)

AOT是一種機制，當對NAT的要求是只轉換IP地址欄位，而不是轉換流的第4層埠時可以使用。如果這滿足要求，則AOT可以大大增加硬體中要轉換和轉發的流的數量。

- 當大部分NAT流都以單個或少量目標集為目的地時，AOT最有效。
- 預設情況下禁用AOT。啟用後，需要清除當前的NAT轉換。

註：只有靜態NAT和不包括PAT的動態NAT才支援AOT。

這表示允許AOT的唯一可能的NAT配置為：

```
#ip nat inside source static <source> <destination>
#ip nat inside source list <list> pool <pool name>
```

您可以使用以下命令啟用AOT:

```
<#root>

NAT-Device(config)#

no ip nat create flow-entries
```

確認AOT NAT規則已正確程式設計。此輸出來自靜態NAT轉換。

```
<#root>

NAT-DEVICE#

show running-config | include ip nat

ip nat outside
ip nat inside

no ip nat create flow-entries                                <-- AOT enabled


ip nat inside source static 10.10.10.100 172.16.10.10      <-- static NAT enabled
```

```
NAT-DEVICE#

show platform hardware fed switch active fwd-asic resource tcam table pbr record 0 format 0 | begin NAT_


Printing entries for region NAT_1 (376) type 6 asic 1
========================================================
Printing entries for region NAT_2 (377) type 6 asic 1
========================================================
Printing entries for region NAT_3 (378) type 6 asic 1
========================================================
Printing entries for region NAT_4 (379) type 6 asic 1
========================================================
Printing entries for region NAT_5 (380) type 6 asic 1
========================================================
TAQ-1 Index-864 (A:0,C:1) Valid StartF-1 StartA-1 SkipF-0 SkipA-0
Mask1 3300f000:00000000:00000000:00000000:00000000:00000000:00000000:ffffffff
Key1 21009000:00000000:00000000:00000000:00000000:00000000:00000000:

0a0a0a64


AD 10087000:00000073

TAQ-1 Index-865 (A:0,C:1) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Mask1 0300f000:00000000:00000000:00000000:00000000:00000000:ffffffff:00000000
Key1 02009000:00000000:00000000:00000000:00000000:00000000:

ac100a0a

:00000000
AD 10087000:00000073


0a0a0a64 = 10.10.10.100 (inside local)
ac100a0a = 172.16.10.10 (inside global)
```

通過確認當流變為活動狀態時，僅對源和目標IP地址進行程式設計，驗證TCAM中的AOT條目。

```
<#root>

NAT-DEVICE#

show platform hardware fed switch active fwd-asic resource tcam table pbr record 0 format 0 | begin NAT_


Printing entries for region NAT_1 (376) type 6 asic 1
========================================================
Printing entries for region NAT_2 (377) type 6 asic 1
========================================================
TAQ-1 Index-224 (A:0,C:1) Valid StartF-1 StartA-1 SkipF-0 SkipA-0
Mask1 0000f000:00000000:00000000:00000000:00000000:00000000:ffffffff:ffffffff
Key1 00009000:00000000:00000000:00000000:00000000:00000000:

c0a80164:0a0a0a64 <-- no L4 ports, only source and destination IP is programmed


AD 10087000:000000b2

TAQ-1 Index-225 (A:0,C:1) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Mask1 0000f000:00000000:00000000:00000000:00000000:00000000:ffffffff:00000000
```

```
Key1 00009000:00000000:00000000:00000000:00000000:00000000:

ac100a0a

:00000000
AD 10087000:000000b3


0a0a0a64 = 10.10.10.100 in hex (inside local IP address)



c0a80164 = 192.168.1.100 in hex (outside local/outside global)
ac100a0a = 172.16.10.10 (inside global)
```

相關資訊

- Catalyst 9300 17.3.x NAT配置指南
- Catalyst 9400 17.3.x NAT配置指南
- Catalyst 9500 17.3.x NAT配置指南
- Catalyst 9600 17.3.x NAT配置指南
- 技術支援與文件 - Cisco Systems

思科內部 資訊

CSCvz46804 增強功能，在NAT TCAM資源耗盡或無法成功程式設計NAT條目時新增系統日誌
。

關於此翻譯

思科已使用電腦和人工技術翻譯本文件，讓全世界的使用者能夠以自己的語言理解支援內容。請注意，即使是最佳機器翻譯，也不如專業譯者翻譯的內容準確。Cisco Systems, Inc. 對這些翻譯的準確度概不負責，並建議一律查看原始英文文件（提供連結）。