Introducción al snooping de DHCP para paquetes que cruzan saltos de capa 3

Contenido

Introducción

Este documento describe las interacciones de snooping DHCP y el comportamiento cuando el paquete cruza cualquier dispositivo L3 y si el paquete está encapsulado en el encabezado L3.

Prerequisites

Requirements

Cisco recomienda que tenga conocimiento sobre estos temas:

- Competencia de Cisco IOS® XE en comandos de configuración y operativos.
- Familiaridad con la arquitectura y el hardware de los switches Catalyst de Cisco serie 9000.
- Una sólida comprensión de las operaciones del protocolo DHCP y los mecanismos de detección DHCP.
- Comprensión conceptual de la opción 82 de DHCP y la función del agente de retransmisión.
- Conocimiento básico del protocolo de ruteo.

Componentes Utilizados

La información que contiene este documento se basa en las siguientes versiones de software y hardware.

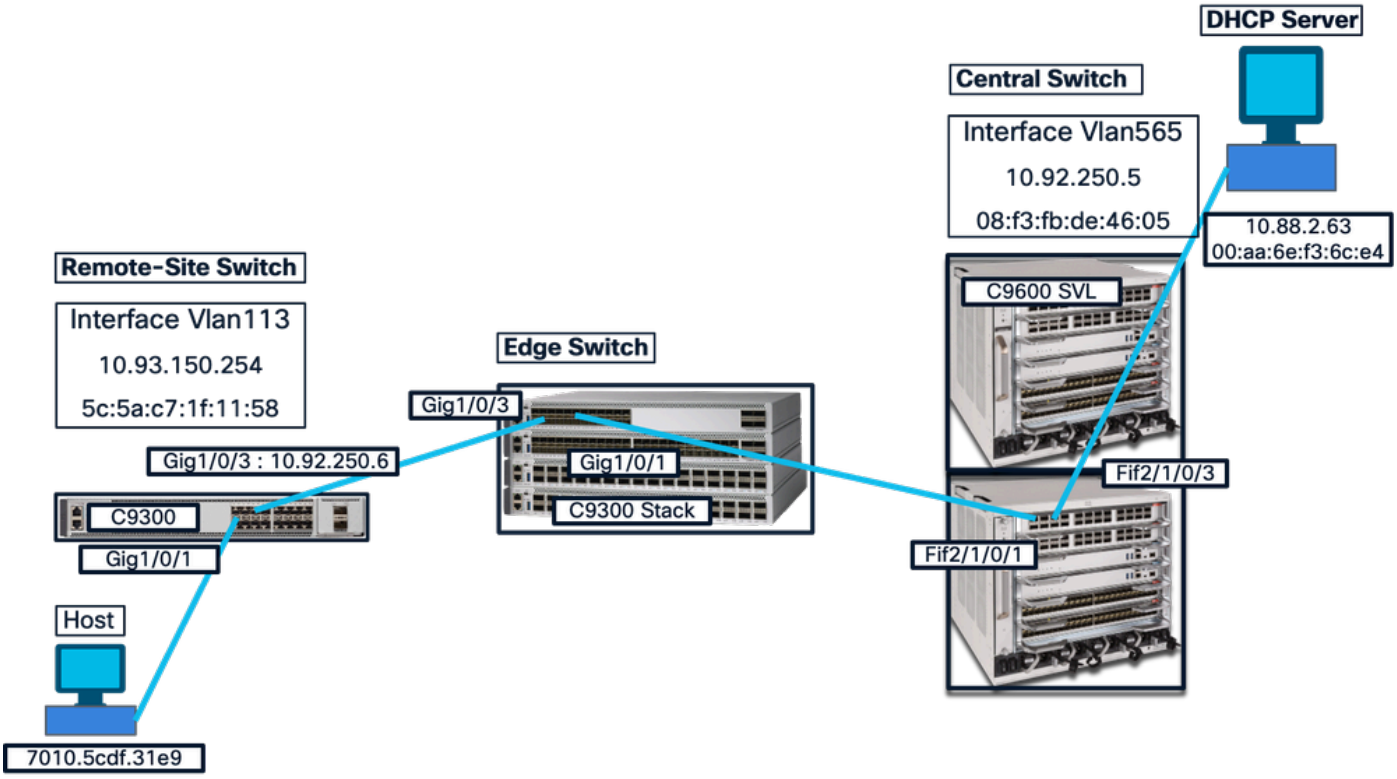
- Switch de núcleo/distribución: Cisco Catalyst serie 9600X
- Switch de acceso: Cisco Catalyst de la serie 9300
- DHCP Client: Dispositivo de host final
- Servidor DHCP: Proveedor de servicios de red centralizada

La información que contiene este documento se creó a partir de los dispositivos en un ambiente de laboratorio específico. Todos los dispositivos que se utilizan en este documento se pusieron en funcionamiento con una configuración verificada (predeterminada). Si tiene una red en vivo, asegúrese de entender el posible impacto de cualquier comando.

Antecedentes

Este documento examina cómo el snooping DHCP inspecciona e intercepta los paquetes DHCP a medida que atraviesan un salto de Capa 3. Mediante ejemplos prácticos de configuración y análisis de capturas de paquetes relacionadas, se demuestra la interacción de la detección DHCP en saltos de capa 3 dentro de un entorno de red Cisco Catalyst serie 9000.

Diagrama de la red



Topología

Situación de no funcionamiento

En primer lugar, se describe el escenario en el que el paquete de detección DHCP se descarta en el salto de la capa 3, específicamente en el switch central. Ahora, analice el viaje de paquetes salto a salto desde el cliente DHCP.

Procesamiento de paquetes de switch de sitio remoto

El host con dirección MAC 7010.5cdf.31e9 transmite el paquete de detección DHCP, que llega a la interfaz GigabitEthernet1/0/1 en el switch de sitio remoto.

Configuración de sitio remoto

<#root>

!
!

Remote-Site#show run int vlan 113

```
Building configuration...

Current configuration : 170 bytes
!
interface Vlan113
ip address 10.93.150.254 255.255.255.0
ip helper-address 10.88.2.63
no ip redirects
no ip proxy-arp
end
!
!
!
```

Host Access Port

Remote-Site#show run int gig1/0/1

```
Building configuration...

Current configuration : 90 bytes
!
interface GigabitEthernet1/0/1
switchport access vlan 113
switchport mode access
end
!
!
!
```

Uplink Port

Remote-Site#show run int gig1/0/3

```
Building configuration...

Current configuration : 121 bytes
!
interface GigabitEthernet1/0/3
no switchport
ip address 10.92.250.6 255.255.255.252
end
!
!
```

Remote-Site#show run | sec dhcp

```
ip dhcp snooping vlan 1-999
no ip dhcp snooping information option
```

```
ip dhcp snooping
!
!
```

Remote-Site#show cdp neighbors

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone,
D - Remote, C - CVTA, M - Two-port Mac Relay

Device ID     Local Intrfce    Holdtme      Capability    Platform       Port ID

Edge-Switch   Gig 1/0/3        153          R S I         C9300-48H      Gig 1/0/3
!
!
```

Remote-Site#show ip eigrp neighbors

```
EIGRP-IPv4 Neighbors for AS(100)
H Address Interface Hold Uptime SRTT RTO Q Seq
(sec) (ms) Cnt Num
0 10.92.250.5 Gi1/0/3 14 00:04:40 1 100 0 20
!
!
```

Remote-Site#show ip route 10.88.2.63

```
Routing entry for 10.88.2.0/24
 Known via "eigrp 100", distance 90, metric 3072, precedence routine (0), type internal
 Redistributing via eigrp 100
 Last update from 10.92.250.5 on GigabitEthernet1/0/3, 00:05:15 ago
 Routing Descriptor Blocks:
 * 10.92.250.5, from 10.92.250.5, 00:05:15 ago, via GigabitEthernet1/0/3
     Route metric is 3072, traffic share count is 1
     Total delay is 20 microseconds, minimum bandwidth is 1000000 Kbit
     Reliability 255/255, minimum MTU 1500 bytes
     Loading 1/255, Hops 1
!
!
```

Entrada de switch de sitio remoto

El paquete de detección DHCP de difusión que entra en el switch de sitio remoto.

<#root>

```
!
!
```

Remote-Site#show monitor capture tac parameter

```
     monitor capture tac control-plane BOTH
     monitor capture tac interface GigabitEthernet1/0/1 BOTH
     monitor capture tac match any
     monitor capture tac file location flash:pcport.pcap
!
!
```

Remote-Site#show monitor capture file flash:pcport.pcap packet-number 667 detailed

```
Starting the packet display ........ Press Ctrl + Shift + 6 to exit

Frame 667: 345 bytes on wire (2760 bits), 345 bytes captured (2760 bits) on interface 0
~
~
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:ip:udp:bootp]
```

Ethernet II, Src: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9), Dst: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)

```
Destination: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)
Address: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)
.... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory default)
.... ...1 .... .... .... .... = IG bit: Group address (multicast/broadcast)
Source: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)
Address: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Type: IPv4 (0x0800)
```

Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255

```
0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
0000 00.. = Differentiated Services Codepoint: Default (0)
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
Total Length: 331
Identification: 0x0405 (1029)
Flags: 0x0000
0... .... .... .... = Reserved bit: Not set
.0.. .... .... .... = Don't fragment: Not set
..0. .... .... .... = More fragments: Not set
...0 0000 0000 0000 = Fragment offset: 0
Time to live: 255
```

Protocol: UDP (17)

```
Header checksum: 0xb69d [validation disabled]
[Header checksum status: Unverified]
Source: 0.0.0.0
Destination: 255.255.255.255
User Datagram Protocol, Src Port: 68, Dst Port: 67
```

Source Port: 68
Destination Port: 67
Length: 311
Checksum: 0x33de [unverified]
[Checksum Status: Unverified]
[Stream index: 3]
Bootstrap Protocol (Discover)
Message type: Boot Request (1)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0x000026ee
Seconds elapsed: 0
Bootp flags: 0x8000, Broadcast flag (Broadcast)
1... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0

Client MAC address: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)

Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP

Option: (53) DHCP Message Type (Discover)

Length: 1
DHCP: Discover (1)
Option: (57) Maximum DHCP Message Size
Length: 2
Maximum DHCP Message Size: 1200
Option: (61) Client identifier
Length: 29
Type: 0
Client Identifier: cisco-7010.5cdf.31e9-Gi2/0/7
Option: (12) Host Name
Length: 2
Host Name: PC
Option: (55) Parameter Request List
Length: 8
Parameter Request List Item: (1) Subnet Mask
Parameter Request List Item: (6) Domain Name Server
Parameter Request List Item: (15) Domain Name
Parameter Request List Item: (44) NetBIOS over TCP/IP Name Server
Parameter Request List Item: (3) Router
Parameter Request List Item: (33) Static Route
Parameter Request List Item: (150) TFTP Server Address
Parameter Request List Item: (43) Vendor-Specific Information
Option: (60) Vendor class identifier
Length: 8
Vendor class identifier: ciscopnp
Option: (255) End
Option End: 255
!

```
!
```

Salida de switch de sitio remoto

El paquete de descubrimiento DHCP de unidifusión retransmitida que sale del switch de sitio remoto al switch de extremo.

<#root>

```
!
!

Remote-Site#show monitor capture tac1 parameter


 monitor capture tac1 control-plane BOTH
 monitor capture tac1 interface GigabitEthernet1/0/3 BOTH
 monitor capture tac1 match any
 monitor capture tac1 file location flash:remote_edge.pcap
!
!

Remote-Site#show monitor capture file flash:pcport.pcap packet-number 669 detailed


Starting the packet display ........ Press Ctrl + Shift + 6 to exit

Frame 669: 345 bytes on wire (2760 bits), 345 bytes captured (2760 bits) on interface 0
~
~
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:ip:udp:bootp]

Ethernet II, Src: 5c:5a:c7:1f:11:58 (5c:5a:c7:1f:11:58), Dst: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)


Destination: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)
Address: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Source: 5c:5a:c7:1f:11:58 (5c:5a:c7:1f:11:58)
Address: 5c:5a:c7:1f:11:58 (5c:5a:c7:1f:11:58)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Type: IPv4 (0x0800)

Internet Protocol Version 4, Src: 10.93.150.254, Dst: 10.88.2.63


0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
```

```
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
0000 00.. = Differentiated Services Codepoint: Default (0)
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
Total Length: 331
Identification: 0x001c (28)
Flags: 0x0000
0... .... .... .... = Reserved bit: Not set
.0.. .... .... .... = Don't fragment: Not set
..0. .... .... .... = More fragments: Not set
...0 0000 0000 0000 = Fragment offset: 0
Time to live: 255
Protocol: UDP (17)
Header checksum: 0x0c94 [validation disabled]
[Header checksum status: Unverified]
Source: 10.93.150.254
Destination: 10.88.2.63
User Datagram Protocol, Src Port: 67, Dst Port: 67
Source Port: 67
Destination Port: 67
Length: 311
Checksum: 0xe48f [unverified]
[Checksum Status: Unverified]
[Stream index: 4]
Bootstrap Protocol (Discover)
Message type: Boot Request (1)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 1
Transaction ID: 0x000026ee
Seconds elapsed: 0
Bootp flags: 0x8000, Broadcast flag (Broadcast)
1... .... .... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
```

Relay agent IP address: 10.93.150.254

```
Client MAC address: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
```

Option: (53) DHCP Message Type (Discover)

```
Length: 1
DHCP: Discover (1)
Option: (57) Maximum DHCP Message Size
Length: 2
Maximum DHCP Message Size: 1200
Option: (61) Client identifier
Length: 29
Type: 0
Client Identifier: cisco-7010.5cdf.31e9-Gi2/0/7
Option: (12) Host Name
Length: 2
```

```
Host Name: PC
Option: (55) Parameter Request List
Length: 8
Parameter Request List Item: (1) Subnet Mask
Parameter Request List Item: (6) Domain Name Server
Parameter Request List Item: (15) Domain Name
Parameter Request List Item: (44) NetBIOS over TCP/IP Name Server
Parameter Request List Item: (3) Router
Parameter Request List Item: (33) Static Route
Parameter Request List Item: (150) TFTP Server Address
Parameter Request List Item: (43) Vendor-Specific Information
Option: (60) Vendor class identifier
Length: 8
Vendor class identifier: ciscopnp
Option: (255) End
Option End: 255
!
!
```

Nota: El paquete que tiene 'Relay agent IP address:10.93.150.254' pero no tiene la opción DHCP 82 debido a la configuración 'no ip dhcp snooping information option' como parte de la sección DHCP.

Procesamiento de paquetes de switch perimetral

Para el flujo DHCP es una preocupación, el switch Edge es un switch L2 utilizado solamente para distribuir los paquetes hacia y desde el switch central/núcleo y los switches Remote Site. Confía en todos los paquetes DHCP.

Configuración del switch perimetral

<#root>

```
!
!
```

Edge-Switch#show run int gig1/0/3

```
Building configuration...

Current configuration : 152 bytes
!
interface GigabitEthernet1/0/3
switchport access vlan 565
ip flow monitor IPv4_NETFLOW input
ip dhcp snooping trust
end
```

```
!
!
```

Edge-Switch#show run int gig1/0/1

```
Building configuration...

Current configuration : 119 bytes
!
interface GigabitEthernet1/0/1
switchport trunk native vlan 999
switchport mode trunk
ip dhcp snooping trust
end
!
!
```

Edge-Switch#show run | sec dhcp

```
ip dhcp snooping vlan 1-4094
no ip dhcp snooping information option
ip dhcp snooping
!
!
```

Edge-Switch#show cdp neighbors

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone,
D - Remote, C - CVTA, M - Two-port Mac Relay

Device ID        Local Intrfce   Holdtme   Capability   Platform     Port ID
Remote-Site      Gig 1/0/3       153       R S I        C9300L-48    Gig 1/0/3
Central-Switch   Gig 1/0/1       170       R S I        C9606R       Fif 2/1/0/1
!
!
```

Ingreso del switch de borde

El paquete que egresa del switch de sitio remoto está golpeando al switch perimetral tal como está.

Salida de switch perimetral

Dado que se trata de un salto de Capa 2 para el paquete, sale del switch sin cambios a medida que avanza al salto siguiente. El switch perimetral reenvía el paquete al switch central sin ninguna modificación observada en el paquete.

El paquete de salida del switch perimetral es un paquete de entrada del switch central.

<#root>

```
!
!

Edge-Switch#show monitor capture tac parameters


 monitor capture tac control-plane BOTH
 monitor capture tac interface GigabitEthernet1/0/1 BOTH
 monitor capture tac match any
 monitor capture tac file location flash:edge_central.pcap
!
!

Edge-Switch#show monitor capture file flash:edge_central.pcap packet-number 25597 detail


Starting the packet display ........ Press Ctrl + Shift + 6 to exit

Frame 25597: 345 bytes on wire (2760 bits), 345 bytes captured (2760 bits) on interface /tmp/epc_ws/wif
~
~
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:ip:udp:dhcp]

Ethernet II, Src: 5c:5a:c7:1f:11:58 (5c:5a:c7:1f:11:58), Dst: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)


Destination: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)
Address: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Source: 5c:5a:c7:1f:11:58 (5c:5a:c7:1f:11:58)
Address: 5c:5a:c7:1f:11:58 (5c:5a:c7:1f:11:58)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Type: IPv4 (0x0800)

Internet Protocol Version 4, Src: 10.93.150.254, Dst: 10.88.2.63


0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
0000 00.. = Differentiated Services Codepoint: Default (0)
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
Total Length: 331
Identification: 0x001c (28)
Flags: 0x0000
0... .... .... .... = Reserved bit: Not set
.0.. .... .... .... = Don't fragment: Not set
..0. .... .... .... = More fragments: Not set
```

Fragment offset: 0
Time to live: 255

Protocol: UDP (17)

Header checksum: 0x0c94 [validation disabled]
[Header checksum status: Unverified]
Source: 10.93.150.254
Destination: 10.88.2.63
User Datagram Protocol, Src Port: 67, Dst Port: 67
Source Port: 67
Destination Port: 67
Length: 311
Checksum: 0xe48f [unverified]
[Checksum Status: Unverified]
[Stream index: 5]
[Timestamps]
[Time since first frame: 0.000000000 seconds]
[Time since previous frame: 0.000000000 seconds]

Dynamic Host Configuration Protocol (Discover)

Message type: Boot Request (1)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 1
Transaction ID: 0x000026ee
Seconds elapsed: 0
Bootp flags: 0x8000, Broadcast flag (Broadcast)
1... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0

Relay agent IP address: 10.93.150.254

Client MAC address: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
Option: (53) DHCP Message Type (Discover)
Length: 1
DHCP: Discover (1)
Option: (57) Maximum DHCP Message Size
Length: 2
Maximum DHCP Message Size: 1200
Option: (61) Client identifier
Length: 29
Type: 0
Client Identifier: cisco-7010.5cdf.31e9-Gi2/0/7
Option: (12) Host Name
Length: 2
Host Name: PC
Option: (55) Parameter Request List

```
Length: 8
Parameter Request List Item: (1) Subnet Mask
Parameter Request List Item: (6) Domain Name Server
Parameter Request List Item: (15) Domain Name
Parameter Request List Item: (44) NetBIOS over TCP/IP Name Server
Parameter Request List Item: (3) Router
Parameter Request List Item: (33) Static Route
Parameter Request List Item: (150) TFTP Server Address
Parameter Request List Item: (43) Vendor-Specific Information
Option: (60) Vendor class identifier
Length: 8
Vendor class identifier: ciscopnp
Option: (255) End
Option End: 255
!
!
```

Procesamiento de paquetes de switch central

Configuración del switch central

<#root>

```
!
!
```

Central-Switch#show cdp neighbors

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone,
D - Remote, C - CVTA, M - Two-port Mac Relay

Device ID      Local Intrfce   Holdtme   Capability   Platform    Port ID

Edge-Switch    Fif 2/1/0/1     177       R S I        C9300-48H   Gig 1/0/1
!
!
```

Central-Switch#show run int fif2/1/0/1

```
Building configuration...

Current configuration : 115 bytes
!
interface FiftyGigE2/1/0/1
switchport trunk native vlan 999
switchport mode trunk
end
!
!
```

Central-Switch#show run int fif2/1/0/3

Building configuration...

Current configuration : 87 bytes
!
interface FiftyGigE2/1/0/3
no switchport
ip address 10.88.2.254 255.255.255.0
end
!
!

interface Vlan565

ip address 10.92.250.5 255.255.255.252
!
!
!

Central-Switch#show run | sec dhcp

ip dhcp snooping vlan 1-4094
no ip dhcp snooping information option
ip dhcp snooping
!
!

Central-Switch#show ip eigrp neighbors

EIGRP-IPv4 Neighbors for AS(100)
H Address Interface Hold Uptime SRTT RTO Q Seq
(sec) (ms) Cnt Num
0

10.92.250.6

Vl565 11 00:10:32 3 100 0 19
~
~
!
!

router eigrp 100

  network 10.0.0.0
  network 10.88.0.0 0.0.255.255
  passive-interface default
  no passive-interface Vlan565
  eigrp router-id 10.255.255.254
!
!

Entrada de switch central

Como se mencionó anteriormente, el paquete de salida del switch de borde es un paquete de entrada del switch central.

Cuando el paquete llega a la interfaz fif 2/1/0/1, se observará este registro.

```
%DHCP_SNOOPING-5-DHCP_SNOOPING_NONZERO_GIADDR: DHCP_SNOOPING drop message with non-zero giaddr or optio
```

La interfaz Fif 2/1/0/1 está configurada como un puerto no confiable para la indagación DHCP.

Un paquete de detección DHCP retransmitido de Capa 3 ingresa a través de este puerto. Aunque el paquete se retransmite y encapsula en la Capa 3, el snooping DHCP todavía lo inspecciona en el puerto de la Capa 2. Dado que este puerto no es de confianza y el paquete contiene una dirección IP (Agente de retransmisión) de puerta de enlace sin la opción 82, la detección DHCP descartará el paquete en este puerto no fiable. Se espera este comportamiento y por diseño.

Nota: En muchos de los casos, se observa que la detección de DHCP se descarta en el tránsito debido a la detección de DHCP.

Salida de switch central

En este caso, el switch central descartará el paquete de detección de DHCP y no habrá ningún paquete de detección de DHCP iniciado por el host con dirección MAC 70:10:5c:df:31:e9 egresando de la interfaz Fif 2/1/0/3.

¿Cómo se soluciona el problema?

1. Active la opción 82 en el primer salto del cliente DHCP.
En el ejemplo actual, configure el comando ip dhcp snooping information option en Remote-Switch.

2. La confianza de indagación DHCP debe estar habilitada en toda la ruta DHCP desde el cliente DHCP al servidor DHCP.

En el ejemplo actual, configure el comando ip dhcp snooping trust en la interfaz fif2/1/0/1 del switch central.

<#root>

Central-Switch#show run int fif2/1/0/1

```
Building configuration...

Current configuration : 115 bytes
!
interface FiftyGigE2/1/0/1
switchport trunk native vlan 999
switchport mode trunk
```

ip dhcp snooping trust

```
end
```

Después de estos cambios, el paquete Discover comenzará a salir del switch central al servidor DHCP.

<#root>

Frame 9: 345 bytes on wire (2760 bits), 345 bytes captured (2760 bits) on interface 0

```
~
~
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:ip:udp:dhcp]
```

Ethernet II, Src: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05), Dst: 00:aa:6e:f3:6c:e4 (00:aa:6e:f3:6c:e4)

```
Destination: 00:aa:6e:f3:6c:e4 (00:aa:6e:f3:6c:e4)
Address: 00:aa:6e:f3:6c:e4 (00:aa:6e:f3:6c:e4)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Source: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)
Address: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Type: IPv4 (0x0800)
```

Internet Protocol Version 4, Src: 10.93.150.254, Dst: 10.88.2.63

0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
0000 00.. = Differentiated Services Codepoint: Default (0)
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
Total Length: 331
Identification: 0x02ff (767)
Flags: 0x0000
0... .... = Reserved bit: Not set
.0.. .... = Don't fragment: Not set
..0. .... = More fragments: Not set
...0 0000 0000 0000 = Fragment offset: 0
Time to live: 254
Protocol: UDP (17)
Header checksum: 0x0ab1 [validation disabled]
[Header checksum status: Unverified]
Source: 10.93.150.254
Destination: 10.88.2.63
User Datagram Protocol, Src Port: 67, Dst Port: 67
Source Port: 67
Destination Port: 67
Length: 311
Checksum: 0x061b [unverified]
[Checksum Status: Unverified]
[Stream index: 0]
[Timestamps]
[Time since first frame: 0.000000000 seconds]
[Time since previous frame: 0.000000000 seconds]

Dynamic Host Configuration Protocol (Discover)

Message type: Boot Request (1)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 1
Transaction ID: 0x00000563
Seconds elapsed: 0
Bootp flags: 0x8000, Broadcast flag (Broadcast)
1... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
Relay agent IP address: 10.93.150.254

Client MAC address: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)

Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
Option: (53) DHCP Message Type (Discover)
Length: 1
DHCP: Discover (1)
Option: (57) Maximum DHCP Message Size
Length: 2
Maximum DHCP Message Size: 1200

```
Option: (61) Client identifier
Length: 29
Type: 0
Client Identifier: cisco-7010.5cdf.31e9-Gi2/0/7
Option: (12) Host Name
Length: 2
Host Name: PC
Option: (55) Parameter Request List
Length: 8
Parameter Request List Item: (1) Subnet Mask
Parameter Request List Item: (6) Domain Name Server
Parameter Request List Item: (15) Domain Name
Parameter Request List Item: (44) NetBIOS over TCP/IP Name Server
Parameter Request List Item: (3) Router
Parameter Request List Item: (33) Static Route
Parameter Request List Item: (150) TFTP Server Address
Parameter Request List Item: (43) Vendor-Specific Information
Option: (60) Vendor class identifier
Length: 8
Vendor class identifier: ciscopnp
Option: (255) End
Option End: 255
```

Discover alcanzará el servidor DHCP y el servidor DHCP responderá a la oferta DHCP.

Paquete de oferta de DHCP:

<#root>

Frame 128: 353 bytes on wire (2824 bits), 353 bytes captured (2824 bits) on interface 0

```
~
~
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:ip:udp:bootp]
```

Ethernet II, Src: 00:aa:6e:f3:6c:e4 (00:aa:6e:f3:6c:e4), Dst: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)

```
Destination: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)
Address: 08:f3:fb:de:46:05 (5c:5a:c7:1f:11:58)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Source: 00:aa:6e:f3:6c:e4 (00:aa:6e:f3:6c:e4)
Address: 00:aa:6e:f3:6c:e4 (00:aa:6e:f3:6c:e4)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Type: IPv4 (0x0800)
```

Internet Protocol Version 4, Src: 10.88.2.63, Dst: 10.93.150.254

0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
0000 00.. = Differentiated Services Codepoint: Default (0)
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
Total Length: 339
Identification: 0x0006 (6)
Flags: 0x0000
0... .... = Reserved bit: Not set
.0.. .... = Don't fragment: Not set
..0. .... = More fragments: Not set
...0 0000 0000 0000 = Fragment offset: 0
Time to live: 252
Protocol: UDP (17)
Header checksum: 0x0fa2 [validation disabled]
[Header checksum status: Unverified]
Source: 10.88.2.63
Destination: 10.93.150.254
User Datagram Protocol, Src Port: 67, Dst Port: 67
Source Port: 67
Destination Port: 67
Length: 319
Checksum: 0x9c4c [unverified]
[Checksum Status: Unverified]
[Stream index: 2]
Bootstrap Protocol (Offer)
Message type: Boot Reply (2)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0x00000563
Seconds elapsed: 0
Bootp flags: 0x8000, Broadcast flag (Broadcast)
1... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0

Your (client) IP address: 10.93.150.11

Next server IP address: 0.0.0.0

Relay agent IP address: 10.93.150.254

Client MAC address: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)

Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP

Option: (53) DHCP Message Type (Offer)

```
Length: 1
DHCP: Offer (2)
Option: (61) Client identifier
Length: 29
Type: 0
Client Identifier: cisco-7010.5cdf.31e9-Gi2/0/7
Option: (54) DHCP Server Identifier
Length: 4
```

DHCP Server Identifier: 10.88.2.63

```
Option: (51) IP Address Lease Time
Length: 4
IP Address Lease Time: (73119s) 20 hours, 18 minutes, 39 seconds
Option: (58) Renewal Time Value
Length: 4
Renewal Time Value: (36559s) 10 hours, 9 minutes, 19 seconds
Option: (59) Rebinding Time Value
Length: 4
Rebinding Time Value: (63973s) 17 hours, 46 minutes, 13 seconds
Option: (1) Subnet Mask
Length: 4
Subnet Mask: 255.255.255.0
Option: (6) Domain Name Server
Length: 4
Domain Name Server: 8.8.8.8
Option: (255) End
Option End: 255
```

El paquete de oferta respondido por el servidor DHCP alcanzará la interfaz fif2/1/0/3 del switch central/CORE.

<#root>

Central-Switch#show run int fif2/1/0/3

```
Building configuration...

Current configuration : 87 bytes
!
interface FiftyGigE2/1/0/3
no switchport
ip address 10.88.2.254 255.255.255.0
end
```

Aquí no hay confianza de DHCP snooping end y OFFER está entrando, entonces ¿por qué no se descarta la oferta en un puerto no confiable?

Como sabe, en una red en la que la función DHCP Snooping está activada, los puertos se clasifican como fiables o no fiables.

Los puertos de confianza están conectados a servidores DHCP legítimos u otros switches de confianza. Todos los mensajes DHCP están permitidos en él.
Los puertos no fiables suelen estar conectados a dispositivos de usuario final (clientes). Están restringidos para evitar ataques de "suplantación de DHCP" o "servidor DHCP no autorizado".
La oferta DHCP y los paquetes ACK DHCP se consideran mensajes del "lado del servidor". De acuerdo con las reglas de seguridad, estos mensajes solo deben originarse en un servidor legítimo.
Cuando un agente de retransmisión DHCP o cualquier router/switch de nivel 3 recibe una oferta DHCP en un puerto de nivel 2 configurado como no fiable, el mecanismo de detección DHCP identifica esto como una infracción de seguridad. Se supone que un servidor DHCP no autorizado está intentando proporcionar direcciones IP no autorizadas a los clientes de la red.
Aunque el paquete sea de unidifusión (dirigido específicamente al agente de retransmisión), el estado de confianza del puerto físico o lógico tiene prioridad. La comprobación de seguridad se realiza en el nivel de puerto independientemente de si el paquete es de difusión o unidifusión.
Dado que el puerto no es de confianza, el sistema bloqueará la oferta de DHCP para proteger la red frente a datos de configuración potencialmente malintencionados o incorrectos procedentes de una fuente no autorizada.

Un puerto L3 (una interfaz ruteada) funciona en la Capa 3. Debido a que es una interfaz ruteada, no observa las reglas de confianza/desconfianza de L2 DHCP Snooping que se aplican a los puertos de switch.
Un cliente envía una solicitud de difusión. El agente de retransmisión (el dispositivo L3) intercepta esto y envía una solicitud de unidifusión al servidor DHCP.
El servidor DHCP devuelve una oferta DHCP de unidifusión a la dirección IP del agente de retransmisión (en concreto, a la dirección IP de la puerta de enlace o del gateway).
Cuando el paquete llega al puerto L3 del Agente de retransmisión o en cualquier salto L3 de la trayectoria del paquete, el dispositivo acepta el paquete como tráfico de ruteo legítimo.
A diferencia del escenario anterior (un puerto no confiable L2), donde el switch busca mensajes del 'lado del servidor' que provienen de un puerto orientado al cliente, el puerto L3 actúa como el destino deseado o salto L3 legítimo para la respuesta del servidor.
Si los puertos L3 descartan las ofertas de DHCP de unidifusión, el mecanismo de retransmisión de DHCP nunca funcionará, ya que el servidor nunca podrá comunicarse con el agente de retransmisión.

Por último, el paquete de oferta atravesará hasta llegar al cliente.

El host/cliente responderá con la solicitud DHCP.

Frame 20: 363 bytes on wire (2904 bits), 363 bytes captured (2904 bits) on interface 0

~
~
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:ip:udp:bootp]

Ethernet II, Src: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9), Dst: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)

Destination: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)
Address: ff:ff:ff:ff:ff:ff (ff:ff:ff:ff:ff:ff)
.... ..1. .... = LG bit: Locally administered address (this is NOT the factory default)
....1 .... = IG bit: Group address (multicast/broadcast)
Source: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)
Address: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)
.... ..0. .... = LG bit: Globally unique address (factory default)
....0 .... = IG bit: Individual address (unicast)
Type: IPv4 (0x0800)

Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255

0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
0000 00.. = Differentiated Services Codepoint: Default (0)
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
Total Length: 349
Identification: 0x3be5 (15333)
Flags: 0x0000
0... .... = Reserved bit: Not set
.0.. .... = Don't fragment: Not set
..0. .... = More fragments: Not set
...0 0000 0000 0000 = Fragment offset: 0
Time to live: 255
Protocol: UDP (17)
Header checksum: 0x7eab [validation disabled]
[Header checksum status: Unverified]
Source: 0.0.0.0
Destination: 255.255.255.255
User Datagram Protocol, Src Port: 68, Dst Port: 67
Source Port: 68
Destination Port: 67
Length: 329
Checksum: 0xed98 [unverified]
[Checksum Status: Unverified]
[Stream index: 1]
Bootstrap Protocol (Request)

Message type: Boot Request (1)

Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0x00000563

Seconds elapsed: 0
Bootp flags: 0x8000, Broadcast flag (Broadcast)
1... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0

Client MAC address: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)

Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP

Option: (53) DHCP Message Type (Request)

Length: 1
DHCP: Request (3)
Option: (57) Maximum DHCP Message Size
Length: 2
Maximum DHCP Message Size: 1200
Option: (61) Client identifier
Length: 29
Type: 0
Client Identifier: cisco-7010.5cdf.31e9-Gi2/0/7
Option: (54) DHCP Server Identifier
Length: 4

DHCP Server Identifier: 10.88.2.63

Option: (50) Requested IP Address
Length: 4

Requested IP Address: 10.93.150.11

Option: (51) IP Address Lease Time
Length: 4
IP Address Lease Time: (73119s) 20 hours, 18 minutes, 39 seconds
Option: (12) Host Name
Length: 2
Host Name: PC
Option: (55) Parameter Request List
Length: 8
Parameter Request List Item: (1) Subnet Mask
Parameter Request List Item: (6) Domain Name Server
Parameter Request List Item: (15) Domain Name
Parameter Request List Item: (44) NetBIOS over TCP/IP Name Server
Parameter Request List Item: (3) Router
Parameter Request List Item: (33) Static Route
Parameter Request List Item: (150) TFTP Server Address
Parameter Request List Item: (43) Vendor-Specific Information
Option: (60) Vendor class identifier

```
Length: 8
Vendor class identifier: ciscopnp
Option: (255) End
Option End: 255
```

El servidor DHCP finalmente ACEPTARÁ la asignación de dirección IP.

<#root>

Frame 25: 353 bytes on wire (2824 bits), 353 bytes captured (2824 bits) on interface 0

```
~
~
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:ip:udp:bootp]
```

Ethernet II, Src: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05), Dst: 5c:5a:c7:1f:11:58 (5c:5a:c7:1f:11:58)

```
Destination: 5c:5a:c7:1f:11:58 (5c:5a:c7:1f:11:58)
Address: 5c:5a:c7:1f:11:58 (5c:5a:c7:1f:11:58)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Source: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)
Address: 08:f3:fb:de:46:05 (08:f3:fb:de:46:05)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Type: IPv4 (0x0800)
```

Internet Protocol Version 4, Src: 10.88.2.63, Dst: 10.93.150.254

```
0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
0000 00.. = Differentiated Services Codepoint: Default (0)
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
Total Length: 339
Identification: 0x0007 (7)
Flags: 0x0000
0... .... .... .... = Reserved bit: Not set
.0.. .... .... .... = Don't fragment: Not set
..0. .... .... .... = More fragments: Not set
...0 0000 0000 0000 = Fragment offset: 0
Time to live: 252
Protocol: UDP (17)
Header checksum: 0x0fa1 [validation disabled]
[Header checksum status: Unverified]
Source: 10.88.2.63
Destination: 10.93.150.254
User Datagram Protocol, Src Port: 67, Dst Port: 67
```

Source Port: 67
Destination Port: 67
Length: 319
Checksum: 0x1e0f [unverified]
[Checksum Status: Unverified]
[Stream index: 2]

Bootstrap Protocol (ACK)

Message type: Boot Reply (2)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0x00000563
Seconds elapsed: 0
Bootp flags: 0x8000, Broadcast flag (Broadcast)
1... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0

Your (client) IP address: 10.93.150.11

Next server IP address: 0.0.0.0

Relay agent IP address: 10.93.150.254

Client MAC address: 70:10:5c:df:31:e9 (70:10:5c:df:31:e9)

Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP

Option: (53) DHCP Message Type (ACK)

Length: 1
DHCP: ACK (5)
Option: (61) Client identifier
Length: 29
Type: 0
Client Identifier: cisco-7010.5cdf.31e9-Gi2/0/7
Option: (54) DHCP Server Identifier
Length: 4

DHCP Server Identifier: 10.88.2.63

Option: (51) IP Address Lease Time
Length: 4
IP Address Lease Time: (86400s) 1 day

```
Option: (58) Renewal Time Value
Length: 4
Renewal Time Value: (43200s) 12 hours
Option: (59) Rebinding Time Value
Length: 4
Rebinding Time Value: (75600s) 21 hours
Option: (1) Subnet Mask
Length: 4
Subnet Mask: 255.255.255.0
Option: (6) Domain Name Server
Length: 4
Domain Name Server: 8.8.8.8
Option: (255) End
Option End: 255
```

DORA se completa y el host recibirá la dirección IP correctamente.

Summary

Consulte esta tabla para comprender los escenarios de reenvío de paquetes.

Tipo de puerto	Estado de confianza	Tipo de paquete transmitido	Resultado	Motivo
Puerto L2	No confiable	Oferta/confirmación de unidifusión de DHCP	Suprimidos	La detección DHCP evita los mensajes del servidor en puertos L2 no fiables.
Puerto L3	N/D (enrutado)	Oferta/confirmación de unidifusión de DHCP	Aceptado	Los puertos enrutados son los nodos previstos para la comunicación del agente de retransmisión.
Puerto L2	De confianza	Detección de DHCP unidifusión con la opción 82	Aceptado	El puerto de confianza permite todas las señales DHCP.
Puerto L2	No confiable	Detección de DHCP unidifusión con la opción 82	Aceptado	El paquete con la dirección IP del agente de retransmisión y la opción 82 es legítimo.
Puerto L2	De confianza	Unicast DHCP Discover sin opción 82	Aceptado	El puerto de confianza permite todas las señales DHCP.

Puerto L2	No confiable	Unicast DHCP Discover sin opción 82	Suprimidos	El paquete con la dirección IP del agente de retransmisión y ninguna opción 82 es no fiable.

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