Nexus 9000でのDHCP関連の問題のトラブルシューティング

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概要

このドキュメントでは、Nexus 9000のDHCPリレーエージェントの適切な設定を確認する手順について説明します。

前提条件

要件

Cisco NXOS®では、次の項目に関する知識があることが推奨されます。

- DHCP
- ELAM
- Ethanalyzer

使用するコンポーネント

このドキュメントは、Nexus 9000などの特定のハードウェアに限定されます

このドキュメントの情報は、特定のラボ環境にあるデバイスに基づいて作成されました。このドキュメントで使用するすべてのデバイスは、クリアな（デフォルト）設定で作業を開始しています。本稼働中のネットワークでは、各コマンドによって起こる可能性がある影響を十分確認してください。

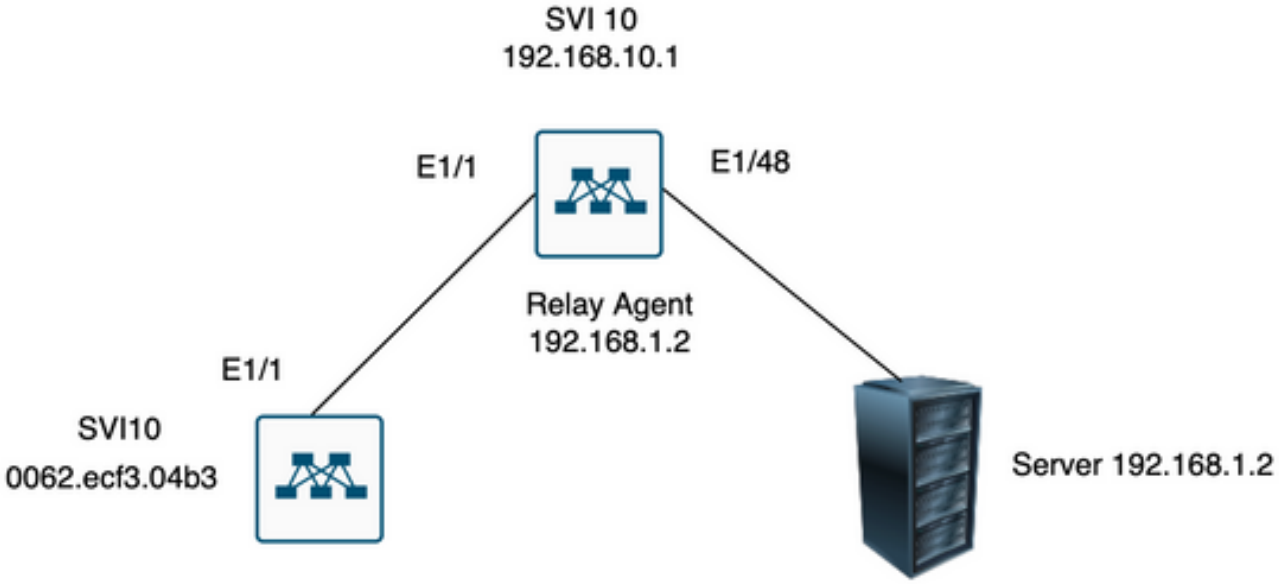
背景説明

クライアントとサーバ間でDHCPパケットを転送するDHCPリレーエージェントを実行するよう

にデバイスを設定できます。この機能は、クライアントとサーバが同じ物理サブネット上にない場合に役立ちます。リレーエージェントはDHCPメッセージを受信し、新しいDHCPメッセージを生成して別のインターフェイスに送信します。

トポロジ

NexusスイッチはDHCPリレーとして動作し、サーバからクライアントにIPを配信します。



確認

1)クライアントの設定を確認する（IPアドレスが割り当てられていない）

```
Client# show interface vlan 10
Vlan10 is up, line protocol is up, autostate enabled
Hardware is EtherSVI, address is 0062.ecf3.04b3
MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
ARP type: ARPA
Last clearing of "show interface" counters never
L3 in Switched:
ucast: 0 pkts, 0 bytes
```

2) DHCP設定を確認する

```
Switch1# show run dhcp

ip dhcp snooping
service dhcp
ip dhcp relay
ipv6 dhcp relay

interface Vlan10
  ip dhcp relay address 192.168.1.2
ip dhcp snooping vlan 1,10
```

3)サーバへの接続を確認する

```
Switch1# ping 192.168.1.2
PING 192.168.1.2 (192.168.1.2): 56 data bytes
64 bytes from 192.168.1.2: icmp_seq=0 ttl=253 time=1.678 ms
64 bytes from 192.168.1.2: icmp_seq=1 ttl=253 time=1.329 ms
64 bytes from 192.168.1.2: icmp_seq=2 ttl=253 time=1.742 ms
64 bytes from 192.168.1.2: icmp_seq=3 ttl=253 time=1.382 ms
64 bytes from 192.168.1.2: icmp_seq=4 ttl=253 time=1.241 ms
--- 192.168.1.2 ping statistics ---
5 packets transmitted, 5 packets received, 0.00% packet loss
round-trip min/avg/max = 1.241/1.474/1.742 ms
Switch1#

Switch1# show ip route 192.168.1.2
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>
192.168.1.2/32, ubest/mbest: 1/0, attached
*via 192.168.1.2, Eth1/48, [250/0], 02:13:58, am
Switch1#
```

4)次に、DCHPの統計情報を見て、情報が正しく送信されていることを再確認します。

```
Switch1# show ip dhcp relay statistics interface vlan 10
------------------------------------------------------------------------
Message Type Rx Tx Drops
------------------------------------------------------------------------
Discover 1 1 0
Offer 1 1 0
Request(*) 1 1 0
```

```
Ack 1 1 0
Release(*) 0 0 0
Decline 0 0 0
Inform(*) 0 0 0
Nack 0 0 0
------------------------------------------------------------------------
Total 4 4 0
------------------------------------------------------------------------
DHCP server stats:
--------------------------------------------------------------------------------
Server Vrf Request Response
--------------------------------------------------------------------------------
192.168.1.2 2 2
------------------------------------------------------------------------
DHCP L3 FWD:
Total Packets Received : 0
Total Packets Forwarded : 0
Total Packets Dropped : 0
Non DHCP:
Total Packets Received : 0
Total Packets Forwarded : 0
Total Packets Dropped : 0
DROP:
DHCP Relay not enabled : 0
Invalid DHCP message type : 0
Interface error : 0
Tx failure towards server : 0
Tx failure towards client : 0
Unknown output interface : 0
Unknown vrf or interface for server : 0
Max hops exceeded : 0
Option 82 validation failed : 0
Packet Malformed : 0
DHCP Request dropped on MCT : 0
Relay Trusted port not configured : 0
* - These counters show correct value when switch
receives DHCP request packet with destination ip as broadcast
address. If request is unicast it is being HW switched
Switch1#

Switch1# show ip dhcp global statistics
Packets processed 130
Packets received through cfsoe 0
Packets forwarded 24
Packets forwarded on cfsoe 0
Total packets dropped 106
Packets dropped from untrusted ports 0
Packets dropped due to MAC address check failure 0
Packets dropped due to Option 82 insertion failure 0
Packets dropped due to o/p intf unknown 0
Packets dropped which were unknown 0
Packets dropped due to no trusted ports 106
Packets dropped due to dhcp relay not enabled 0
Packets dropped due to no binding entry 0
Packets dropped due to interface error/no interface 0
Packets dropped due to max hops exceeded 0
Packets dropped due to Queue full 0
Switch1#
```

トラブルシュート

1) ethanalyzerを実行して、統計情報が正しいことを確認します。

```
Switch1# ethanalyzer local interface inband display-filter bootp limit-captured-frames 0
Capturing on inband

2023-07-18 21:30:01.935789 0.0.0.0 -> 255.255.255.255 DHCP DHCP Discover - Transaction ID 0x64b6400b
2023-07-18 21:30:01.937789 192.168.10.1 -> 192.168.1.2 DHCP DHCP Discover - Transaction ID 0x64b6400b
2023-07-18 21:30:03.938596 192.168.1.2 -> 192.168.10.1 DHCP DHCP Offer - Transaction ID 0x64b6400b
2023-07-18 21:30:03.938659 192.168.1.2 -> 192.168.10.1 DHCP DHCP Offer - Transaction ID 0x64b6400b
2023-07-18 21:30:03.940103 192.168.10.1 -> 255.255.255.255 DHCP DHCP Offer - Transaction ID 0x64b6400b
2023-07-18 21:30:07.939208 0.0.0.0 -> 255.255.255.255 DHCP DHCP Request - Transaction ID 0x64b6400b
2023-07-18 21:30:07.941220 192.168.10.1 -> 192.168.1.2 DHCP DHCP Request - Transaction ID 0x64b6400b
2023-07-18 21:30:07.941848 192.168.1.2 -> 192.168.10.1 DHCP DHCP ACK - Transaction ID 0x64b6400b
2023-07-18 21:30:07.941897 192.168.1.2 -> 192.168.10.1 DHCP DHCP ACK - Transaction ID 0x64b6400b
2023-07-18 21:30:07.942693 192.168.10.1 -> 255.255.255.255 DHCP DHCP ACK - Transaction ID 0x64b6400b
```

2) Ethanalyzerには、キャプチャされたトラフィックのヘッダーを含む追加情報を提供する詳細オプションがあります。

```
ethanalyzer local interface inband display-filter "((eth.addr==<MAC_address> and bootp ))" limit-captur
```

3) ethanalyzerキャプチャにdetailフラグを追加すると、クライアントとサーバ間の通信の詳細が表示されます。

[1]リレーエージェントは、クライアントからブロードキャストとしてDHCP Discoverを受信します。
送信元MACはクライアントMAC:00:62:ec:f3:04:b3
宛先MACはブロードキャスト：ff:ff:ff:ff:ff:ff
クライアントにはIPアドレスが割り当てられていないため、送信元IPは0.0.0.0です。
送信元IP:0.0.0.0
宛先IP:255.255.255.255
送信元ポート：bootpc(68)
宛先ポート：bootps (67)
メッセージタイプ：Boot Request (1)
DHCPメッセージタイプ= DHCPディスカバリ

```
Frame 14 (358 bytes on wire, 358 bytes captured)
Arrival Time: Jul 19, 2023 21:53:29.339064000
[Time delta from previous captured frame: 0.096490000 seconds]
```

```
[Time delta from previous displayed frame: 2.618117000 seconds]
[Time since reference or first frame: 2.618117000 seconds]
Frame Number: 14
Frame Length: 358 bytes
Capture Length: 358 bytes
[Frame is marked: False]
[Protocols in frame: eth:vlan:ip:udp:bootp]
Ethernet II, Src: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3), 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 .... .... .... .... = IG bit: Group address (multicast/broadcast)
.... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory default)
Source: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
Address: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Type: 802.1Q Virtual LAN (0x8100)
802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 10
000. .... .... .... = Priority: 0
...0 .... .... .... = CFI: 0
.... 0000 0000 1010 = ID: 10
Type: IP (0x0800)
Internet Protocol, Src: 0.0.0.0 (0.0.0.0), Dst: 255.255.255.255 (255.255.255.255)
Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
0000 00.. = Differentiated Services Codepoint: Default (0x00)
.... ..0. = ECN-Capable Transport (ECT): 0
.... ...0 = ECN-CE: 0
Total Length: 340
Identification: 0x0000 (0)
Flags: 0x00
0.. = Reserved bit: Not Set
.0. = Do not fragment: Not Set
..0 = More fragments: Not Set
Fragment offset: 0
Time to live: 255
Protocol: UDP (0x11)
Header checksum: 0xba99 [correct]
[Good: True]
[Bad : False]
Source: 0.0.0.0 (0.0.0.0)
Destination: 255.255.255.255 (255.255.255.255)
User Datagram Protocol, Src Port: bootpc (68), Dst Port: bootps (67)
Source port: bootpc (68)
Destination port: bootps (67)
Length: 320
Checksum: 0x2bbb [validation disabled]
[Good Checksum: False]
[Bad Checksum: False]
Bootstrap Protocol
Message type: Boot Request (1)
Hardware type: Ethernet
Hardware address length: 6
Hops: 0
Transaction ID: 0x64b14fa7
Seconds elapsed: 0
Bootp flags: 0x8000 (Broadcast)
1... .... .... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0 (0.0.0.0)
Your (client) IP address: 0.0.0.0 (0.0.0.0)
```

```
Next server IP address: 0.0.0.0 (0.0.0.0)
Relay agent IP address: 0.0.0.0 (0.0.0.0)
Client MAC address: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP Discover
Option: (53) DHCP Message Type
Length: 1
Value: 01
Option: (t=61,l=18) Client identifier
Option: (61) Client identifier
Length: 18
Value: 0046444F32303234314355548566C616E3130
Option: (t=51,l=4) IP Address Lease Time = 2 hours
Option: (51) IP Address Lease Time
Length: 4
Value: 00001C20
Option: (t=60,l=19) Vendor class identifier = "Cisco NXOS® N9K-C9372PX-E"
Option: (60) Vendor class identifier
Length: 19
Value: 436973636F204E394B2D433933373250582D45
Option: (t=43,l=8) Vendor-Specific Information
Option: (43) Vendor-Specific Information
Length: 8
Value: F1060062ECF304AC
Option: (t=55,l=8) Parameter Request List
Option: (55) Parameter Request List
Length: 8
Value: 010306070C424396
1 = Subnet Mask
3 = Router
6 = Domain Name Server
7 = Log Server
12 = Host Name
66 = TFTP Server Name
67 = Bootfile name
150 = TFTP server address
End Option
Padding
Frame 15 (354 bytes on wire, 354 bytes captured)
Arrival Time: Jul 19, 2023 21:53:29.340263000
[Time delta from previous captured frame: 0.001199000 seconds]
[Time delta from previous displayed frame: 0.001199000 seconds]
[Time since reference or first frame: 2.619316000 seconds]
Frame Number: 15
Frame Length: 354 bytes
Capture Length: 354 bytes
[Frame is marked: False]
[Protocols in frame: eth:ip:udp:bootp]
Ethernet II, Src: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57), Dst: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
Destination: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
Address: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Source: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
Address: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Type: IP (0x0800)
```

[2]リレーエージェントはユニキャストを使用してDiscoverをサーバに送信します。
送信元MACはnexus MAC:6c:31:0e:a3:0c:57
宛先MACはDHCPサーバMAC:c4:c6:03:09:cf:47
送信元IPはSVI10上のNexus IP:192.168.10.1
宛先IPはDHCPサーバIP:192.168.1.2
送信元ポート：bootps(67)
宛先ポート：bootps (67)
クライアントMACアドレス：00:62:ec:f3:04:b3 <<<<<クライアントMACはUDP/DHCPヘッダーに含まれる
メッセージタイプ：Boot Request (1)
DHCPメッセージタイプ= DHCPディスカバリ

```
Frame 15 (354 bytes on wire, 354 bytes captured)
Arrival Time: Jul 19, 2023 21:53:29.340263000
[Time delta from previous captured frame: 0.001199000 seconds]
[Time delta from previous displayed frame: 0.001199000 seconds]
[Time since reference or first frame: 2.619316000 seconds]
Frame Number: 15
Frame Length: 354 bytes
Capture Length: 354 bytes
[Frame is marked: False]
[Protocols in frame: eth:ip:udp:bootp]
Ethernet II, Src: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57), Dst: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
Destination: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
Address: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Source: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
Address: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Type: IP (0x0800)


Internet Protocol, Src: 192.168.10.1 (192.168.10.1), Dst: 192.168.1.2 (192.168.1.2)
Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
0000 00.. = Differentiated Services Codepoint: Default (0x00)
.... ..0. = ECN-Capable Transport (ECT): 0
.... ...0 = ECN-CE: 0
Total Length: 340
Identification: 0xefab (61355)
Flags: 0x00
0.. = Reserved bit: Not Set
.0. = Do not fragment: Not Set
..0 = More fragments: Not Set
Fragment offset: 0
Time to live: 255
Protocol: UDP (0x11)
Header checksum: 0x3e99 [correct]
[Good: True]
[Bad : False]
Source: 192.168.10.1 (192.168.10.1)
Destination: 192.168.1.2 (192.168.1.2)
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootps (67)
Source port: bootps (67)
```

```
Destination port: bootps (67)
Length: 320
Checksum: 0xd4bc [validation disabled]
[Good Checksum: False]
[Bad Checksum: False]
Bootstrap Protocol
Message type: Boot Request (1)
Hardware type: Ethernet
Hardware address length: 6
Hops: 1
Transaction ID: 0x64b14fa7
Seconds elapsed: 0
Bootp flags: 0x8000 (Broadcast)
1... .... .... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0 (0.0.0.0)
Your (client) IP address: 0.0.0.0 (0.0.0.0)
Next server IP address: 0.0.0.0 (0.0.0.0)
Relay agent IP address: 192.168.10.1 (192.168.10.1)
Client MAC address: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP Discover
Option: (53) DHCP Message Type
Length: 1
Value: 01
Option: (t=61,l=18) Client identifier
Option: (61) Client identifier
Length: 18
Value: 0046444F32303234314355548566C616E3130
Option: (t=51,l=4) IP Address Lease Time = 2 hours
Option: (51) IP Address Lease Time
Length: 4
Value: 00001C20
Option: (t=60,l=19) Vendor class identifier = "Cisco NXOS® N9K-C9372PX-E"
Option: (60) Vendor class identifier
Length: 19
Value: 436973636F204E394B2D433933373250582D45
Option: (t=43,l=8) Vendor-Specific Information
Option: (43) Vendor-Specific Information
Length: 8
Value: F1060062ECF304AC
Option: (t=55,l=8) Parameter Request List
Option: (55) Parameter Request List
Length: 8
Value: 010306070C424396
1 = Subnet Mask
3 = Router
6 = Domain Name Server
7 = Log Server
12 = Host Name
66 = TFTP Server Name
67 = Bootfile name
150 = TFTP server address
End Option
Padding
```

[3]サーバはリレーエージェントにユニキャストOfferを応答します。
送信元MACはDHCPサーバMAC:c4:c6:03:09:cf:47

宛先MACはNexus MAC:6c:31:0e:a3:0c:57
送信元IPはDHCPサーバ：192.168.1.2
SVI10の宛先IP Nexus IP:192.168.10.1
送信元ポート：bootps(67)
宛先ポート：bootps (67)
メッセージタイプ：ブート応答(2)
（クライアント）IPアドレス：192.168.10.19 (192.168.10.19) <<<<このオファーパケットには、クライアントに割り当てるIPアドレスが含まれています
クライアントMACアドレス：00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3) <<<クライアントからのMACアドレス
DHCPメッセージタイプ= DHCPオファー

```
Frame 27 (348 bytes on wire, 348 bytes captured)
Arrival Time: Jul 19, 2023 21:53:31.340920000
[Time delta from previous captured frame: 0.097549000 seconds]
[Time delta from previous displayed frame: 2.000657000 seconds]
[Time since reference or first frame: 4.619973000 seconds]
Frame Number: 27
Frame Length: 348 bytes
Capture Length: 348 bytes
[Frame is marked: False]
[Protocols in frame: eth:ip:udp:bootp]
Ethernet II, Src: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47), Dst: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
Destination: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
Address: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Source: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
Address: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Type: IP (0x0800)
Internet Protocol, Src: 192.168.1.2 (192.168.1.2), Dst: 192.168.10.1 (192.168.10.1)
Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
0000 00.. = Differentiated Services Codepoint: Default (0x00)
.... ..0. = ECN-Capable Transport (ECT): 0
.... ...0 = ECN-CE: 0
Total Length: 334
Identification: 0x0014 (20)
Flags: 0x00
0.. = Reserved bit: Not Set
.0. = Do not fragment: Not Set
..0 = More fragments: Not Set
Fragment offset: 0
Time to live: 254
Protocol: UDP (0x11)
Header checksum: 0x2f37 [correct]
[Good: True]
[Bad : False]
Source: 192.168.1.2 (192.168.1.2)
Destination: 192.168.10.1 (192.168.10.1)
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootps (67)
Source port: bootps (67)
Destination port: bootps (67)
Length: 314
Checksum: 0x0500 [validation disabled]
```

```
[Good Checksum: False]
[Bad Checksum: False]
Bootstrap Protocol
Message type: Boot Reply (2)
Hardware type: Ethernet
Hardware address length: 6
Hops: 0
Transaction ID: 0x64b14fa7
Seconds elapsed: 0
Bootp flags: 0x8000 (Broadcast)
1... .... .... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0 (0.0.0.0)
Your (client) IP address: 192.168.10.19 (192.168.10.19)
Next server IP address: 0.0.0.0 (0.0.0.0)
Relay agent IP address: 192.168.10.1 (192.168.10.1)
Client MAC address: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP Offer
Option: (53) DHCP Message Type
Length: 1
Value: 02
Option: (t=61,l=18) Client identifier
Option: (61) Client identifier
Length: 18
Value: 0046444F32303234314355548566C616E3130
Option: (t=54,l=4) DHCP Server Identifier = 192.168.1.2
Option: (54) DHCP Server Identifier
Length: 4
Value: C0A80102
Option: (t=51,l=4) IP Address Lease Time = 1 day
Option: (51) IP Address Lease Time
Length: 4
Value: 00015180
Option: (t=58,l=4) Renewal Time Value = 12 hours
Option: (58) Renewal Time Value
Length: 4
Value: 0000A8C0
Option: (t=59,l=4) Rebinding Time Value = 21 hours
Option: (59) Rebinding Time Value
Length: 4
Value: 00012750
Option: (t=1,l=4) Subnet Mask = 255.255.255.0
Option: (1) Subnet Mask
Length: 4
Value: FFFFFF00
Option: (t=3,l=4) Router = 192.168.1.2
Option: (3) Router
Length: 4
Value: C0A80102
Option: (t=6,l=4) Domain Name Server = 8.8.8.8
Option: (6) Domain Name Server
Length: 4
Value: 08080808
End Option
```

[4]リレーエージェントはブロードキャストを使用してDHCPサーバからDHCPオファーを転送し

ます。このブロードキャストパケットはサブネットによって受信されますが、クライアントMACが含まれているため、このパケットはMACの所有者のみが処理します。
送信元MACはnexus MAC:6c:31:0e:a3:0c:57
宛先MACはブロードキャスト：ff:ff:ff:ff:ff:ff
送信元IPはSVI10上のNexus IP:192.168.10.1
宛先IPはブロードキャストアドレス：255.255.255.255
送信元ポート：bootps(67)
宛先ポート：bootpc(68)
メッセージタイプ：ブート応答(2)
（クライアント）IPアドレス：192.168.10.19
クライアントMACアドレス：00:62:ec:f3:04:b3
DHCPメッセージタイプ= DHCPオファー

```
Frame 28 (348 bytes on wire, 348 bytes captured)
Arrival Time: Jul 19, 2023 21:53:31.341325000
[Time delta from previous captured frame: 0.000405000 seconds]
[Time delta from previous displayed frame: 0.000405000 seconds]
[Time since reference or first frame: 4.620378000 seconds]
Frame Number: 28
Frame Length: 348 bytes
Capture Length: 348 bytes
[Frame is marked: False]
[Protocols in frame: eth:ip:udp:bootp]
Ethernet II, Src: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57), 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 .... .... .... .... = IG bit: Group address (multicast/broadcast)
.... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory default)
Source: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
Address: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Type: IP (0x0800)
Internet Protocol, Src: 192.168.10.1 (192.168.10.1), Dst: 255.255.255.255 (255.255.255.255)
Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
0000 00.. = Differentiated Services Codepoint: Default (0x00)
.... ..0. = ECN-Capable Transport (ECT): 0
.... ...0 = ECN-CE: 0
Total Length: 334
Identification: 0x1400 (5120)
Flags: 0x00
0.. = Reserved bit: Not Set
.0. = Do not fragment: Not Set
..0 = More fragments: Not Set
Fragment offset: 0
Time to live: 255
Protocol: UDP (0x11)
Header checksum: 0xdbf5 [correct]
[Good: True]
[Bad : False]
Source: 192.168.10.1 (192.168.10.1)
Destination: 255.255.255.255 (255.255.255.255)
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68)
Source port: bootps (67)
Destination port: bootpc (68)
Length: 314
```

```
Checksum: 0xc6a8 [validation disabled]
[Good Checksum: False]
[Bad Checksum: False]
Bootstrap Protocol
Message type: Boot Reply (2)
Hardware type: Ethernet
Hardware address length: 6
Hops: 1
Transaction ID: 0x64b14fa7
Seconds elapsed: 0
Bootp flags: 0x8000 (Broadcast)
1... .... .... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0 (0.0.0.0)
Your (client) IP address: 192.168.10.19 (192.168.10.19)
Next server IP address: 0.0.0.0 (0.0.0.0)
Relay agent IP address: 192.168.10.1 (192.168.10.1)
Client MAC address: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP Offer
Option: (53) DHCP Message Type
Length: 1
Value: 02
Option: (t=61,l=18) Client identifier
Option: (61) Client identifier
Length: 18
Value: 0046444F32303234314355548566C616E3130
Option: (t=54,l=4) DHCP Server Identifier = 192.168.1.2
Option: (54) DHCP Server Identifier
Length: 4
Value: C0A80102
Option: (t=51,l=4) IP Address Lease Time = 1 day
Option: (51) IP Address Lease Time
Length: 4
Value: 00015180
Option: (t=58,l=4) Renewal Time Value = 12 hours
Option: (58) Renewal Time Value
Length: 4
Value: 0000A8C0
Option: (t=59,l=4) Rebinding Time Value = 21 hours
Option: (59) Rebinding Time Value
Length: 4
Value: 00012750
Option: (t=1,l=4) Subnet Mask = 255.255.255.0
Option: (1) Subnet Mask
Length: 4
Value: FFFFFF00
Option: (t=3,l=4) Router = 192.168.1.2
Option: (3) Router
Length: 4
Value: C0A80102
Option: (t=6,l=4) Domain Name Server = 8.8.8.8
Option: (6) Domain Name Server
Length: 4
Value: 08080808
End Option
```

[5]リレーエージェントはクライアントから要求を受信し、ブロードキャストとして送信されます。
送信元MACはクライアントMAC:00:62:ec:f3:04:b3
宛先MACはブロードキャスト：ff:ff:ff:ff:ff:ff
この時点では、クライアントにはまだIPアドレスがなく、送信元IPは0.0.0.0のままです
送信元IP:0.0.0.0
宛先IP:255.255.255.255
送信元ポート：bootpc(68)
宛先ポート：bootps (67)
メッセージタイプ：ブート要求(1) <<<<このメッセージは、IP 192.168.10.19に対するクライアントからの要求です
要求されたIPアドレス= 192.168.10.19 <<<<<<< DHCPサーバによって割り当てられたIPを要求するクライアント
DHCPメッセージタイプ= DHCP要求

```
Frame 47 (370 bytes on wire, 370 bytes captured)
Arrival Time: Jul 19, 2023 21:53:35.342380000
[Time delta from previous captured frame: 0.097649000 seconds]
[Time delta from previous displayed frame: 4.001055000 seconds]
[Time since reference or first frame: 8.621433000 seconds]
Frame Number: 47
Frame Length: 370 bytes
Capture Length: 370 bytes
[Frame is marked: False]
[Protocols in frame: eth:vlan:ip:udp:bootp]
Ethernet II, Src: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3), 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 .... .... .... .... = IG bit: Group address (multicast/broadcast)
.... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory default)
Source: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
Address: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Type: 802.1Q Virtual LAN (0x8100)
802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 10
000. .... .... .... = Priority: 0
...0 .... .... .... = CFI: 0
.... 0000 0000 1010 = ID: 10
Type: IP (0x0800)
Internet Protocol, Src: 0.0.0.0 (0.0.0.0), Dst: 255.255.255.255 (255.255.255.255)
Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
0000 00.. = Differentiated Services Codepoint: Default (0x00)
.... ..0. = ECN-Capable Transport (ECT): 0
.... ...0 = ECN-CE: 0
Total Length: 352
Identification: 0x0000 (0)
Flags: 0x00
0.. = Reserved bit: Not Set
.0. = Do not fragment: Not Set
..0 = More fragments: Not Set
Fragment offset: 0
Time to live: 255
Protocol: UDP (0x11)
Header checksum: 0xba8d [correct]
```

```
[Good: True]
[Bad : False]
Source: 0.0.0.0 (0.0.0.0)
Destination: 255.255.255.255 (255.255.255.255)
User Datagram Protocol, Src Port: bootpc (68), Dst Port: bootps (67)
Source port: bootpc (68)
Destination port: bootps (67)
Length: 332
Checksum: 0xbaae [validation disabled]
[Good Checksum: False]
[Bad Checksum: False]
Bootstrap Protocol
Message type: Boot Request (1)
Hardware type: Ethernet
Hardware address length: 6
Hops: 0
Transaction ID: 0x64b14fa7
Seconds elapsed: 0
Bootp flags: 0x8000 (Broadcast)
1... .... .... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0 (0.0.0.0)
Your (client) IP address: 0.0.0.0 (0.0.0.0)
Next server IP address: 0.0.0.0 (0.0.0.0)
Relay agent IP address: 0.0.0.0 (0.0.0.0)
Client MAC address: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP Request
Option: (53) DHCP Message Type
Length: 1
Value: 03
Option: (t=61,l=18) Client identifier
Option: (61) Client identifier
Length: 18
Value: 0046444F32303234314355548566C616E3130
Option: (t=50,l=4) Requested IP Address = 192.168.10.19
Option: (50) Requested IP Address
Length: 4
Value: C0A80A13
Option: (t=51,l=4) IP Address Lease Time = 2 hours
Option: (51) IP Address Lease Time
Length: 4
Value: 00001C20
Option: (t=54,l=4) DHCP Server Identifier = 192.168.1.2
Option: (54) DHCP Server Identifier
Length: 4
Value: C0A80102
Option: (t=60,l=19) Vendor class identifier = "Cisco NXOS® N9K-C9372PX-E"
Option: (60) Vendor class identifier
Length: 19
Value: 436973636F204E394B2D433933373250582D45
Option: (t=43,l=8) Vendor-Specific Information
Option: (43) Vendor-Specific Information
Length: 8
Value: F1060062ECF304AC
Option: (t=55,l=8) Parameter Request List
Option: (55) Parameter Request List
Length: 8
Value: 010306070C424396
```

```
1 = Subnet Mask
3 = Router
6 = Domain Name Server
7 = Log Server
12 = Host Name
66 = TFTP Server Name
67 = Bootfile name
150 = TFTP server address
End Option
Padding
```

[6]リレーエージェントはクライアントからDHCPサーバにDHCP要求を転送します。
送信元MACはnexus MAC:6c:31:0e:a3:0c:57
宛先MACはDHCPサーバMAC:c4:c6:03:09:cf:47
送信元IPはSVI10上のNexus IP:192.168.10.1
宛先IPはDHCPサーバIP:192.168.1.2
送信元ポート：bootps(67)
宛先ポート：bootps (67)
メッセージタイプ：Boot Request (1)
要求されたIPアドレス= 192.168.10.19
クライアントMACアドレス：00:62:ec:f3:04:b3 <<<<<クライアントMACはUDP/DHCPヘッダーに含まれる
DHCPメッセージタイプ= DHCP要求

```
Frame 48 (366 bytes on wire, 366 bytes captured)
Arrival Time: Jul 19, 2023 21:53:35.343718000
[Time delta from previous captured frame: 0.001338000 seconds]
[Time delta from previous displayed frame: 0.001338000 seconds]
[Time since reference or first frame: 8.622771000 seconds]
Frame Number: 48
Frame Length: 366 bytes
Capture Length: 366 bytes
[Frame is marked: False]
[Protocols in frame: eth:ip:udp:bootp]
Ethernet II, Src: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57), Dst: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
Destination: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
Address: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Source: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
Address: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Type: IP (0x0800)
Internet Protocol, Src: 192.168.10.1 (192.168.10.1), Dst: 192.168.1.2 (192.168.1.2)
Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
0000 00.. = Differentiated Services Codepoint: Default (0x00)
.... ..0. = ECN-Capable Transport (ECT): 0
.... ...0 = ECN-CE: 0
Total Length: 352
Identification: 0xefac (61356)
Flags: 0x00
0.. = Reserved bit: Not Set
```

```
.0. = Do not fragment: Not Set
..0 = More fragments: Not Set
Fragment offset: 0
Time to live: 255
Protocol: UDP (0x11)
Header checksum: 0x3e8c [correct]
[Good: True]
[Bad : False]
Source: 192.168.10.1 (192.168.10.1)
Destination: 192.168.1.2 (192.168.1.2)
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootps (67)
Source port: bootps (67)
Destination port: bootps (67)
Length: 332
Checksum: 0x63b0 [validation disabled]
[Good Checksum: False]
[Bad Checksum: False]
Bootstrap Protocol
Message type: Boot Request (1)
Hardware type: Ethernet
Hardware address length: 6
Hops: 1
Transaction ID: 0x64b14fa7
Seconds elapsed: 0
Bootp flags: 0x8000 (Broadcast)
1... .... .... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0 (0.0.0.0)
Your (client) IP address: 0.0.0.0 (0.0.0.0)
Next server IP address: 0.0.0.0 (0.0.0.0)
Relay agent IP address: 192.168.10.1 (192.168.10.1)
Client MAC address: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP Request
Option: (53) DHCP Message Type
Length: 1
Value: 03
Option: (t=61,l=18) Client identifier
Option: (61) Client identifier
Length: 18
Value: 0046444F32303234314355485566C616E3130
Option: (t=50,l=4) Requested IP Address = 192.168.10.19
Option: (50) Requested IP Address
Length: 4
Value: C0A80A13
Option: (t=51,l=4) IP Address Lease Time = 2 hours
Option: (51) IP Address Lease Time
Length: 4
Value: 00001C20
Option: (t=54,l=4) DHCP Server Identifier = 192.168.1.2
Option: (54) DHCP Server Identifier
Length: 4
Value: C0A80102
Option: (t=60,l=19) Vendor class identifier = "Cisco N9K-C9372PX-E"
Option: (60) Vendor class identifier
Length: 19
Value: 436973636F204E394B2D433933373250582D45
Option: (t=43,l=8) Vendor-Specific Information
Option: (43) Vendor-Specific Information
```

```
Length: 8
Value: F1060062ECF304AC
Option: (t=55,l=8) Parameter Request List
Option: (55) Parameter Request List
Length: 8
Value: 010306070C424396
1 = Subnet Mask
3 = Router
6 = Domain Name Server
7 = Log Server
12 = Host Name
66 = TFTP Server Name
67 = Bootfile name
150 = TFTP server address
End Option
Padding
```

[7]サーバはリレーエージェントにユニキャスト(ACK)を応答します。
送信元MACはDHCPサーバMAC:c4:c6:03:09:cf:47
宛先MACはNexus MAC:6c:31:0e:a3:0c:57
送信元IPはDHCPサーバ：192.168.1.2
SVI10の宛先IP Nexus IP:192.168.10.1
送信元ポート：bootps(67)
宛先ポート：bootps (67)
メッセージタイプ：ブート応答(2)
（クライアント）IPアドレス：192.168.10.19
クライアントMACアドレス：00:62:ec:f3:04:b3
DHCP Message Type = DHCP ACK <<<<これはサーバからのACkです

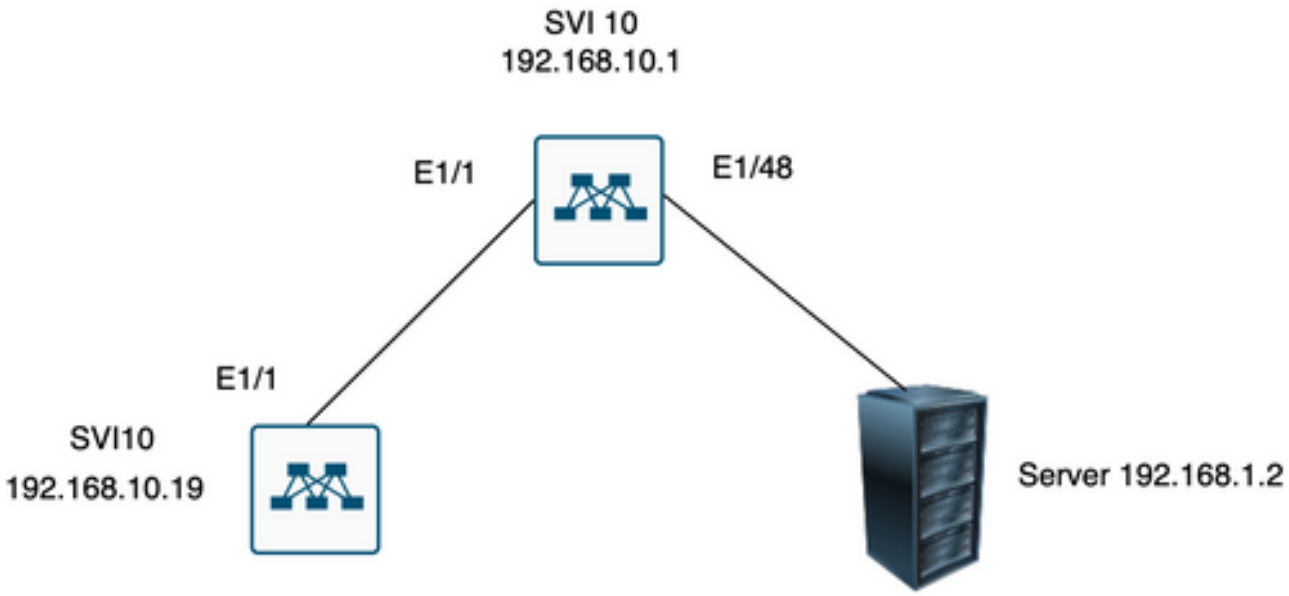
```
Frame 49 (348 bytes on wire, 348 bytes captured)
Arrival Time: Jul 19, 2023 21:53:35.344310000
[Time delta from previous captured frame: 0.000592000 seconds]
[Time delta from previous displayed frame: 0.000592000 seconds]
[Time since reference or first frame: 8.623363000 seconds]
Frame Number: 49
Frame Length: 348 bytes
Capture Length: 348 bytes
[Frame is marked: False]
[Protocols in frame: eth:ip:udp:bootp]
Ethernet II, Src: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47), Dst: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
Destination: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
Address: 6c:31:0e:a3:0c:57 (6c:31:0e:a3:0c:57)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Source: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
Address: c4:c6:03:09:cf:47 (c4:c6:03:09:cf:47)
.... ...0 .... .... .... .... = IG bit: Individual address (unicast)
.... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
Type: IP (0x0800)
Internet Protocol, Src: 192.168.1.2 (192.168.1.2), Dst: 192.168.10.1 (192.168.10.1)
Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
0000 00.. = Differentiated Services Codepoint: Default (0x00)
.... ..0. = ECN-Capable Transport (ECT): 0
```

```
.... ...0 = ECN-CE: 0
Total Length: 334
Identification: 0x0015 (21)
Flags: 0x00
0.. = Reserved bit: Not Set
.0. = Do not fragment: Not Set
..0 = More fragments: Not Set
Fragment offset: 0
Time to live: 254
Protocol: UDP (0x11)
Header checksum: 0x2f36 [correct]
[Good: True]
[Bad : False]
Source: 192.168.1.2 (192.168.1.2)
Destination: 192.168.10.1 (192.168.10.1)
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootps (67)
Source port: bootps (67)
Destination port: bootps (67)
Length: 314
Checksum: 0x0200 [validation disabled]
[Good Checksum: False]
[Bad Checksum: False]
Bootstrap Protocol
Message type: Boot Reply (2)
Hardware type: Ethernet
Hardware address length: 6
Hops: 0
Transaction ID: 0x64b14fa7
Seconds elapsed: 0
Bootp flags: 0x8000 (Broadcast)
1... .... .... .... = Broadcast flag: Broadcast
.000 0000 0000 0000 = Reserved flags: 0x0000
Client IP address: 0.0.0.0 (0.0.0.0)
Your (client) IP address: 192.168.10.19 (192.168.10.19)
Next server IP address: 0.0.0.0 (0.0.0.0)
Relay agent IP address: 192.168.10.1 (192.168.10.1)
Client MAC address: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP ACK
Option: (53) DHCP Message Type
Length: 1
Value: 05
Option: (t=61,l=18) Client identifier
Option: (61) Client identifier
Length: 18
Value: 0046444F32303234314355485566C616E3130
Option: (t=54,l=4) DHCP Server Identifier = 192.168.1.2
Option: (54) DHCP Server Identifier
Length: 4
Value: C0A80102
Option: (t=51,l=4) IP Address Lease Time = 1 day
Option: (51) IP Address Lease Time
Length: 4
Value: 00015180
Option: (t=58,l=4) Renewal Time Value = 12 hours
Option: (58) Renewal Time Value
Length: 4
Value: 0000A8C0
Option: (t=59,l=4) Rebinding Time Value = 21 hours
```

```
Option: (59) Rebinding Time Value
Length: 4
Value: 00012750
Option: (t=1,l=4) Subnet Mask = 255.255.255.0
Option: (1) Subnet Mask
Length: 4
Value: FFFFFF00
Option: (t=3,l=4) Router = 192.168.1.2
Option: (3) Router
Length: 4
Value: C0A80102
Option: (t=6,l=4) Domain Name Server = 8.8.8.8
Option: (6) Domain Name Server
Length: 4
Value: 08080808
End Option
```

この時点で、クライアントはIPアドレスの使用を開始し、IPアドレスがクライアントに割り当てられていることを確認します。

```
Client# show interface vlan 10
Vlan10 is up, line protocol is up, autostate enabled
Hardware is EtherSVI, address is 0062.ecf3.04b3
Internet Address is 192.168.10.19/24 <<<<<<< It is using the IP address
MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
ARP type: ARPA
Last clearing of "show interface" counters never
L3 in Switched:
ucast: 0 pkts, 0 bytes
Client#
```



関連情報

DHCP の設定

Ethanalyzer

翻訳について
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