

Nexus 9000에서 DHCP 관련 문제 해결

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소개

이 문서에서는 Nexus 9000에서 DHCP 릴레이 에이전트의 올바른 컨피그레이션을 확인하는 단계에 대해 설명합니다.

사전 요구 사항

요구 사항

Cisco NXOS®에서는 다음 항목에 대해 알고 있는 것이 좋습니다.

- DHCP
- 엘람
- 에트분석기

사용되는 구성 요소

이 문서는 Nexus 9000과 같은 특정 하드웨어로 제한됩니다.

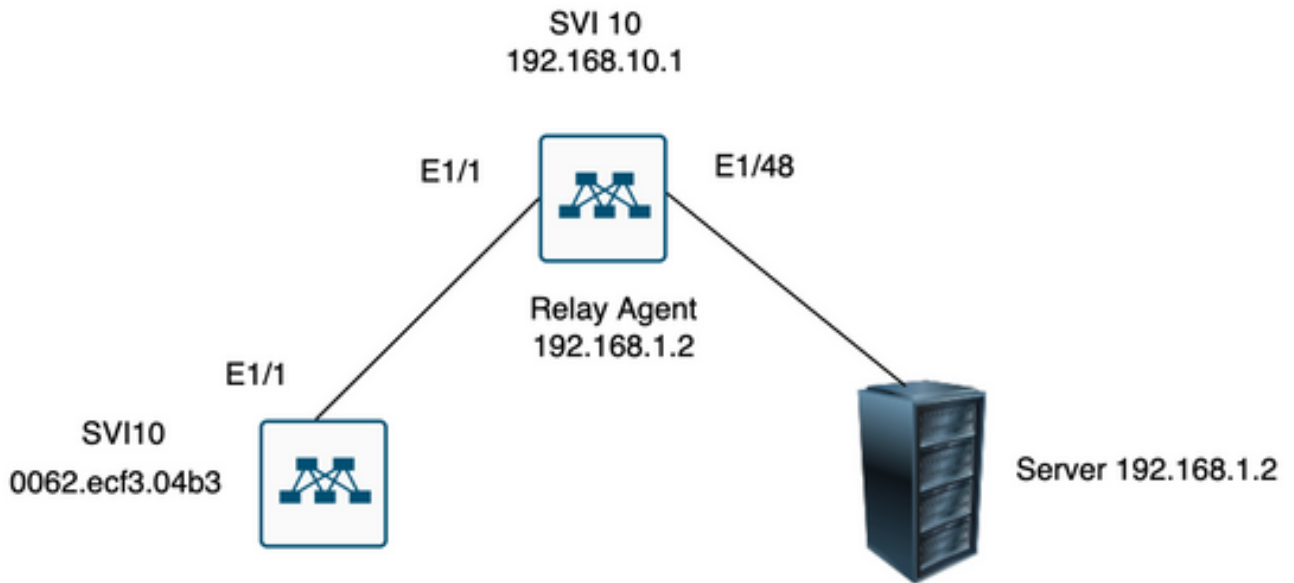
이 문서의 정보는 특정 랩 환경의 디바이스를 토대로 작성되었습니다. 이 문서에 사용된 모든 디바이스는 초기화된(기본) 컨피그레이션으로 시작되었습니다. 현재 네트워크가 작동 중인 경우 모든 명령의 잠재적인 영향을 미리 숙지하시기 바랍니다.

배경 정보

클라이언트와 서버 간에 DHCP 패킷을 전달하는 DHCP 릴레이 에이전트를 실행하도록 디바이스를 구성할 수 있습니다. 이 기능은 클라이언트와 서버가 동일한 물리적 서브넷에 없을 때 유용합니다. 릴레이 에이전트는 DHCP 메시지를 수신한 다음 다른 인터페이스에서 전송할 새 DHCP 메시지를 생성합니다.

토폴로지

Nexus 스위치는 DHCP 릴레이로 작동하여 서버에서 클라이언트에 IP를 전달합니다.



다음을 확인합니다.

1) 클라이언트의 컨피그레이션을 확인합니다(할당된 IP 주소 없음).

```
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 컨피그레이션을 확인합니다.

```
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) 서버와의 연결을 확인합니다.

```
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) DHCP의 통계를 살펴 정보가 올바르게 전송되었는지 다시 확인합니다.

```
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#

문제 해결

1) ethanalyzer를 실행하여 통계가 정확한지 확인합니다.

```
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) Ethanalyzer에는 캡처된 트래픽의 헤더를 비롯한 추가 정보를 제공하는 detail 옵션이 있습니다.

```
ethanalyzer local interface inband display-filter "((eth.addr==<MAC_address> and bootp ))" limit-captured-frames 0
```

3) ethanalyzer 캡처에 detail 플래그를 추가하면 클라이언트와 서버 간의 통신에 대한 자세한 정보가 제공됩니다.

[1] 릴레이 에이전트는 클라이언트로부터 DHCP Discover를 브로드캐스트로 수신합니다.

소스 MAC이 클라이언트 MAC임: 00:62:ec:f3:04:b3

대상 MAC이 브로드캐스트됨: ff:ff:ff:ff:ff:ff

클라이언트에 아직 IP 주소가 없으므로 소스 IP는 0.0.0.0입니다.

소스 IP: 0.0.0.0

대상 IP: 255.255.255.255

소스 포트: bootpc (68)

대상 포트: bootps(67)

메시지 유형: 부팅 요청 (1)

DHCP 메시지 유형 = DHCP 검색

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: 0046444F3230323431435548566C616E3130
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] 릴레이 에이전트가 유니캐스트를 사용하여 서버에 Discover를 전송합니다.

소스 MAC이 Nexus MAC인 경우: 6c:31:0e:a3:0c:57

대상 MAC이 DHCP 서버 MAC임: c4:c6:03:09:cf:47

소스 Ip는 SVI10의 Nexus IP:192.168.10.1입니다.

대상 IP는 DHCP 서버 IP: 192.168.1.2입니다.

소스 포트: bootps(67)

대상 포트: bootps(67)

클라이언트 MAC 주소: 00:62:ec:f3:04:b3 <<<<< Client MAC은 UDP/DHCP 헤더에 포함되어 있습니다.

메시지 유형: 부팅 요청 (1)

DHCP 메시지 유형 = DHCP 검색

```
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: 0046444F3230323431435548566C616E3130
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] 서버가 릴레이 에이전트에 유니캐스트 제안에 응답합니다.

소스 MAC이 DHCP 서버 MAC임: c4:c6:03:09:cf:47

대상 MAC이 Nexus MAC인 경우: 6c:31:0e:a3:0c:57

소스 Ip는 DHCP 서버: 192.168.1.2

SVI10의 대상 IP Nexus IP: 192.168.10.1

소스 포트: bootps(67)

대상 포트: bootps(67)

메시지 유형: Boot Reply (2)

(클라이언트) IP 주소: 192.168.10.19 (192.168.10.19) <<<< 이 제안 패킷에는 클라이언트에 할당할

IP 주소가 포함되어 있습니다.

클라이언트 MAC 주소: 00:62:ec:f3:04:b3 (00:62:ec:f3:04:b3) <<<< 클라이언트의 MAC 주소

DHCP 메시지 유형 = DHCP 제안

```
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: 0046444F3230323431435548566C616E3130
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: FFFFFFF0
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] 릴레이 에이전트는 브로드캐스트를 사용하여 DHCP 서버에서 DHCP 제공을 전달하며, 이 브로드캐스트 패킷은 서브넷에서 수신하지만 클라이언트 MAC를 포함하므로 MAC 소유자만 이 패킷을 처리합니다.

소스 MAC이 Nexus MAC인 경우: 6c:31:0e:a3:0c:57

대상 MAC이 브로드캐스트됨: ff:ff:ff:ff:ff:ff

소스 Ip는 SV110의 Nexus IP:192.168.10.1입니다.

대상 IP는 브로드캐스트 주소입니다. 255.255.255.255

소스 포트: bootps(67)

대상 포트: bootpc (68)

메시지 유형: Boot Reply (2)

(클라이언트) IP 주소: 192.168.10.19

클라이언트 MAC 주소: 00:62:ec:f3:04:b3

DHCP 메시지 유형 = DHCP 제안

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: 0046444F3230323431435548566C616E3130
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: FFFFFFF0
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] 릴레이 에이전트는 클라이언트로부터 요청을 받고 브로드캐스트로 제공됩니다.

소스 MAC이 클라이언트 MAC임: 00:62:ec:f3:04:b3

대상 MAC이 브로드캐스트됨: ff:ff:ff:ff:ff:ff

이때 클라이언트에는 아직 Ip 주소가 없으며 소스 IP는 여전히 0.0.0.0입니다

소스 IP: 0.0.0.0

대상 IP: 255.255.255.255

소스 포트: bootpc (68)

대상 포트: bootps(67)

메시지 유형: Boot Request (1) <<<< 이 메시지는 IP 192.168.10.19에 대한 클라이언트의 요청입니

다.
요청된 IP 주소 = 192.168.10.19 <<<<<< DHCP 서버에서 할당한 IP를 요청하는 클라이언트
DHCP 메시지 유형 = DHCP 요청

```
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: 0046444F3230323431435548566C616E3130
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: 436973636F204E394B2D4339333373250582D45
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] 릴레이 에이전트는 클라이언트에서 DHCP 서버로 DHCP 요청을 전달합니다.
소스 MAC이 Nexus MAC인 경우: 6c:31:0e:a3:0c:57

대상 MAC이 DHCP 서버 MAC임: c4:c6:03:09:cf:47

소스 Ip는 SVI10의 Nexus IP:192.168.10.1입니다.

대상 IP는 DHCP 서버 IP: 192.168.1.2입니다.

소스 포트: bootps(67)

대상 포트: bootps(67)

메시지 유형: 부팅 요청 (1)

요청된 IP 주소 = 192.168.10.19

클라이언트 MAC 주소: 00:62:ec:f3:04:b3 <<<<< Client MAC은 UDP/DHCP 헤더에 포함되어 있습니다.

DHCP 메시지 유형 = DHCP 요청

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: 0046444F3230323431435548566C616E3130
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] 서버가 릴레이 에이전트에 유니캐스트(ACK)에 응답합니다.

소스 MAC이 DHCP 서버 MAC임: c4:c6:03:09:cf:47

대상 MAC이 Nexus MAC인 경우: 6c:31:0e:a3:0c:57

소스 Ip는 DHCP 서버: 192.168.1.2

SVI10의 대상 IP Nexus IP: 192.168.10.1

소스 포트: bootps(67)

대상 포트: bootps(67)

메시지 유형: Boot Reply (2)

(클라이언트) IP 주소: 192.168.10.19

클라이언트 MAC 주소: 00:62:ec:f3:04:b3

DHCP Message Type = DHCP ACK <<<< 서버의 ACK

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)

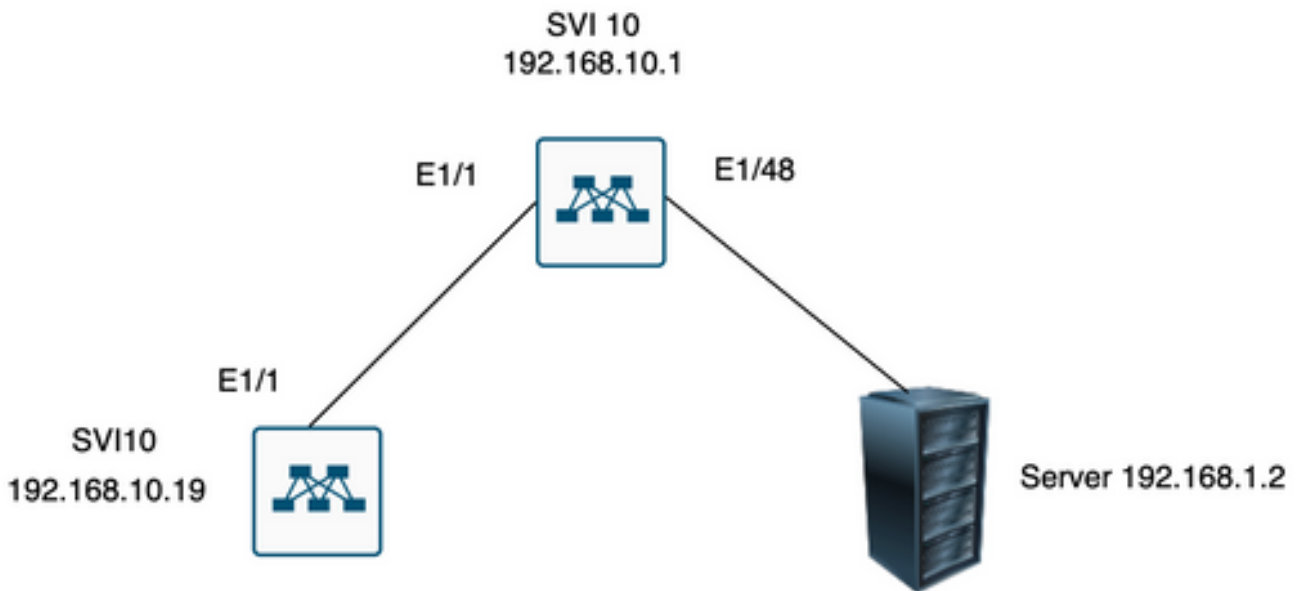
Destination port: bootps (67)

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: 0046444F3230323431435548566C616E3130
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: FFFFFFF0
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

이때 클라이언트는 IP 주소를 사용하기 시작하고 클라이언트에 할당되었는지 확인합니다.

```
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#
```



관련 정보

[DHCP 구성](#)

[에트분석기](#)

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