

DHCPv6 – Configuración stateful

- **Auto-configuración provista por IPv6 (Stateless)**
 - **Direcciones link-local**
 - **Direcciones de otros alcances (con info de routers)**
 - **Detección de direcciones duplicadas en el link (DAD)**
 - **Router por defecto (con info de routers)**
 - **Noción de ruteo (redirect)**

- **Configuración stateful (a través de DHCPv6)**
 - **Complementa a la autoconfiguración**
 - **Permite asignar direcciones y otra info a los hosts**
 - **Permite un control centralizado de las asignaciones por parte del administrador**
 - **Permite informar dinámicamente direcciones de los servidores DNS servers**

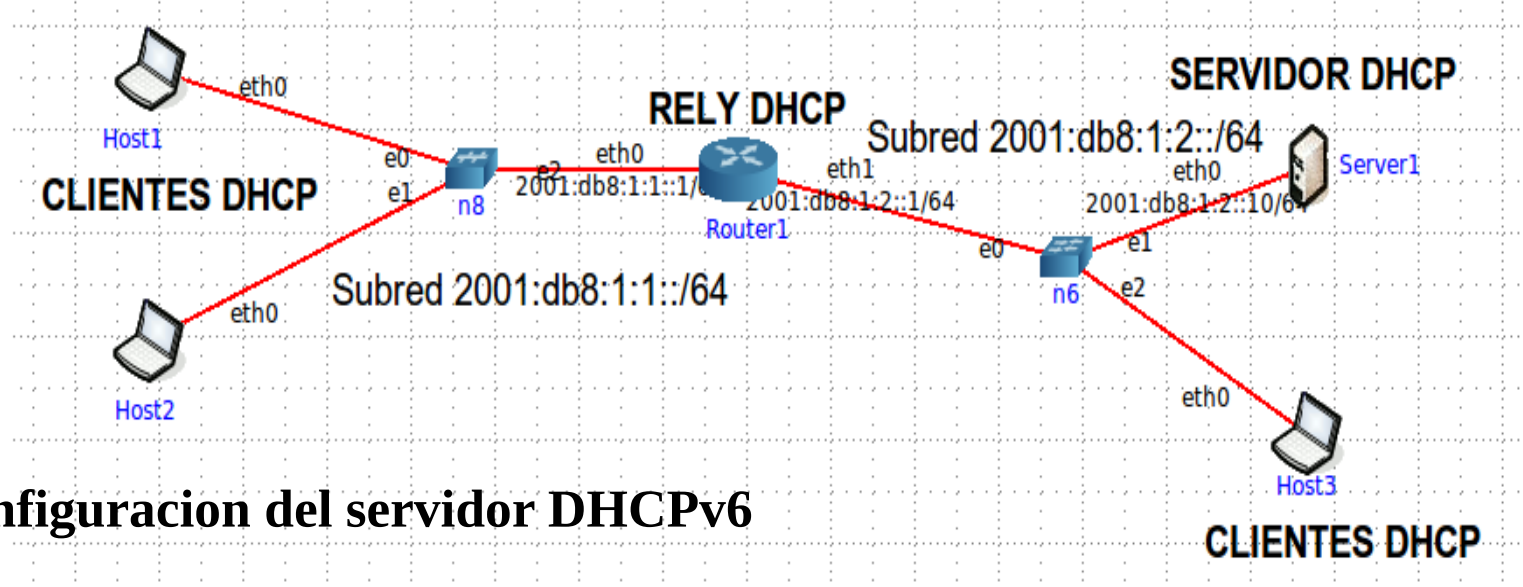
Entidades DHCPv6

- **Servidor DHCP**
 - **Administra asignacion de direcciones y otra info a los clientes**
- **Cliente DHCP**
 - **El equipo que se comunica con el server para requerir direcciones u otra informacion de configuracion**
- **Relay DHCP**
 - **Permite que uncliente consulte servidores no en el link**
- **Direcciones**
 - **All_DHCP_Relay_Agents_and_Servers**
 - **(FF02::1:2), scope link**
 - **All_DHCP_Servers**
 - **(FF05::1:3), scope site**
- **Ports**
 - **Servers y relays: UDP port 547**
 - **Cientes: UDP port 546**

ISC Dynamic Host Configuration Server (dhcpcd)

- **dhcpcd: implementa el servidor DHCPv6**
 - **dhcpcd6.conf: contiene las asignaciones a realizar definidas por el adm de red**
 - **dhcpcd6.leases: contiene las asignaciones realizadas para preservarlas de rearranques**
- **dhclient**
 - **dhclient6.conf: comportamiento del cliente en presencia o ausencia de servers**
 - **dhclient6.leases: conserva los leases adquiridos y aun validos**
/var/lib/dhclient/dhclient6.leases
- **dhrelay**

Ejemplo funcionamiento DHCPv6 (1) (dhcpv6.imn)



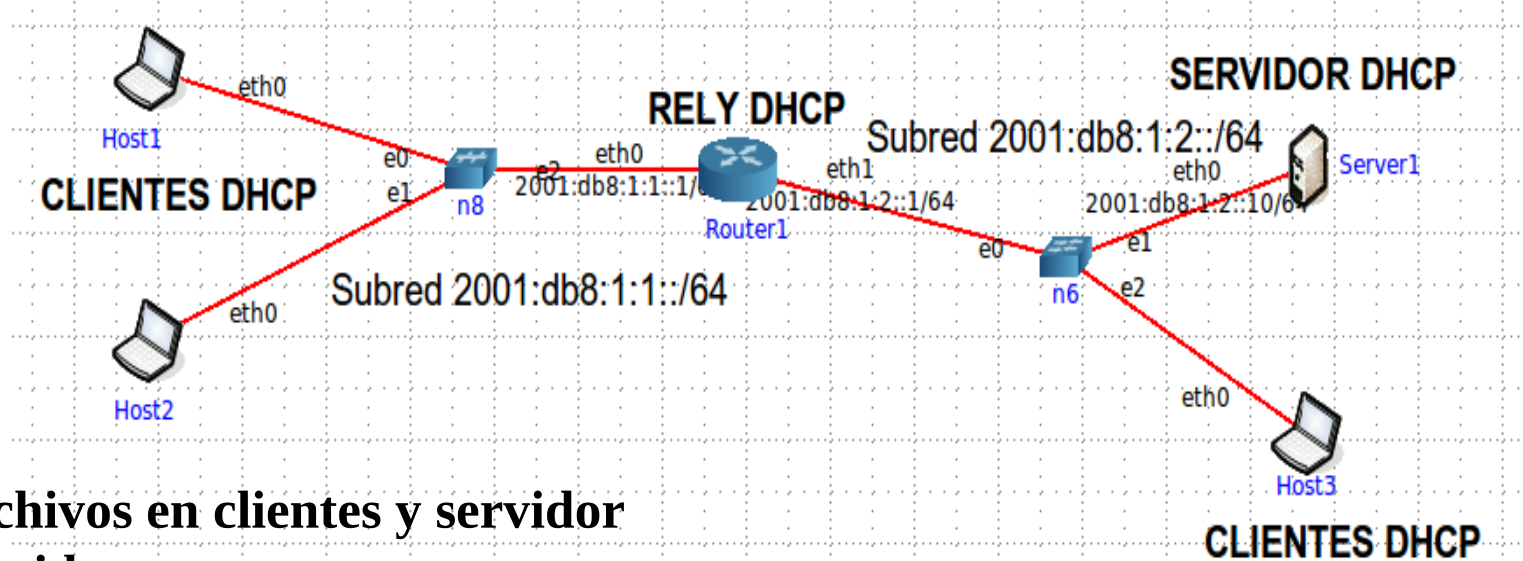
Configuracion del servidor DHCPv6

**#Tiempo maximo de asignacion de direccion - valor para prueba -
max-lease-time 240;**

**#Tiempo por defecto para asignacion de direccion - valor para prueba -
default-lease-time 120;**

```
subnet6 2001:db8:1:1::/64 {  
    # Range for clients  
    range6 2001:db8:1:1::a0 2001:db8:1:1::af;  
}  
subnet6 2001:db8:1:2::/64 {  
    # Range for clients  
    range6 2001:db8:1:2::c0 2001:db8:1:2::cf;  
}
```

Ejemplo funcionamiento DHCPv6 (2)



Archivos en clientes y servidor

Servidor

- /etc/dhcp/dhcpd6.conf
- /var/lib/dhcp/dhcpd6.leases

Clientes

- /var/lib/dhcp/dhclient6.leases

Invocacion a los comandos

- 1- servidor: `dhcpd -6 -cf /etc/dhcp/dhcpd6.conf`
- 2- relay: `dhcrelay -6 -l eth0 -u eth1`
- 3- clientes: `dhclient -6 -v`

Ejemplo funcionamiento DHCPv6 (3)

```
root@Server1:/tmp/pycore.42316/Server1.conf# dhcpd -6 -cf /etc/dhcp/dhcpd6.conf
Internet Systems Consortium DHCP Server 4.2.4
Copyright 2004-2012 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/
Wrote 0 leases to leases file.
Bound to *:547
Listening on Socket/4/eth0/2001:db8:1:2::/64
Sending on Socket/4/eth0/2001:db8:1:2::/64
root@Server1:/tmp/pycore.42316/Server1.conf#
```

Time	Source	Destination	Protocol	Info
7 45.418420000	fe80::200:ff:fe00:3333	ff02::1:2	DHCPv6	Solicit XID: 0x3f7592 CID: 000100011d03b559000000003333
10 45.419830000	fe80::200:ff:fe00:1111	fe80::200:ff:fe00:3333	DHCPv6	Advertise XID: 0x3f7592 IAA: 2001:db8:1:2::c6 CID: 000100011d03b559000000003333
11 46.500495000	fe80::200:ff:fe00:3333	ff02::1:2	DHCPv6	Request XID: 0xfba66f CID: 000100011d03b559000000003333 IAA: 2001:db8:1:2::c6
12 46.501213000	fe80::200:ff:fe00:1111	fe80::200:ff:fe00:3333	DHCPv6	Reply XID: 0xfba66f IAA: 2001:db8:1:2::c6 CID: 000100011d03b559000000003333
20 106.613972000	fe80::200:ff:fe00:3333	ff02::1:2	DHCPv6	Renew XID: 0xd30bae CID: 000100011d03b559000000003333 IAA: 2001:db8:1:2::c6
21 106.614661000	fe80::200:ff:fe00:1111	fe80::200:ff:fe00:3333	DHCPv6	Reply XID: 0xd30bae IAA: 2001:db8:1:2::c6 CID: 000100011d03b559000000003333
26 166.738744000	fe80::200:ff:fe00:3333	ff02::1:2	DHCPv6	Renew XID: 0xc9a7e2 CID: 000100011d03b559000000003333 IAA: 2001:db8:1:2::c6
27 166.739435000	fe80::200:ff:fe00:1111	fe80::200:ff:fe00:3333	DHCPv6	Reply XID: 0xc9a7e2 IAA: 2001:db8:1:2::c6 CID: 000100011d03b559000000003333

Ejemplo funcionamiento DHCPv6 (4) - solicit

7 45.418420000 fe80::200:ff:fe00:3333 ff02::1:2 DHCPv6 Solicit XID: 0x3f7592 CID: 000100011d03b559000000003333 118

- ▶Frame 7: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface 0
- ▶Ethernet II, Src: 00:00:00_00:33:33 (00:00:00:00:33:33), Dst: IPv6mcast_00:01:00:02 (33:33:00:01:00:02)
- ▶Internet Protocol Version 6, Src: fe80::200:ff:fe00:3333 (fe80::200:ff:fe00:3333), Dst: ff02::1:2 (ff02::1:2)
- ▶User Datagram Protocol, Src Port: dhcpv6-client (546), Dst Port: dhcpv6-server (547)

▼DHCPv6

Message type: Solicit (1)

Transaction ID: 0x3f7592

- ▶Client Identifier
- ▶Option Request
- ▶Elapsed time
- ▶Identity Association for Non-temporary Address

▼DHCPv6

Message type: Solicit (1)

Transaction ID: 0x3f7592

▼Client Identifier

Option: Client Identifier (1)

Length: 14

Value: 000100011d03b559000000003333

DUID: 000100011d03b559000000003333

DUID Type: link-layer address plus time (1)

Hardware type: Ethernet (1)

DUID Time: Jun 4, 2015 22:18:17.000000000 ART

Link-layer address: 00:00:00:00:33:33

▼Option Request

Option: Option Request (6)

Length: 8

Value: 001700180027001f

Requested Option code: DNS recursive name server (23)

Requested Option code: Domain Search List (24)

Requested Option code: Fully Qualified Domain Name (39)

Requested Option code: Simple Network Time Protocol Server (31)

▶Elapsed time

▶Identity Association for Non-temporary Address

▼DHCPv6

Message type: Solicit (1)

Transaction ID: 0x3f7592

▶Client Identifier

▶Option Request

▼Elapsed time

Option: Elapsed time (8)

Length: 2

Value: 0000

Elapsed-time: 0 ms

▼Identity Association for Non-temporary Address

Option: Identity Association for Non-temporary Address (3)

Length: 12

Value: 00003333000000e1000001518

IAID: 00003333

T1: 3600

T2: 5400

Ejemplo funcionamiento DHCPv6 (5) - advertise

10 45.419830000 fe80::200:ff:fe00:1111 fe80::200:ff:fe00:3333 DHCPv6 Advertise XID: 0x3f7592 IAA: 2001:db8:1:2::c6 CID: 000100011d03b5590000000003

- ▶ Frame 10: 146 bytes on wire (1168 bits), 146 bytes captured (1168 bits) on interface 0
- ▶ Ethernet II, Src: 00:00:00_00:11:11 (00:00:00:00:11:11), Dst: 00:00:00_00:33:33 (00:00:00:00:33:33)
- ▶ Internet Protocol Version 6, Src: fe80::200:ff:fe00:1111 (fe80::200:ff:fe00:1111), Dst: fe80::200:ff:fe00:3333 (fe80::200:ff:fe00:3333)
- ▶ User Datagram Protocol, Src Port: dhcpv6-server (547), Dst Port: dhcpv6-client (546)

▼ DHCPv6

Message type: Advertise (2)

Transaction ID: 0x3f7592

- ▶ Identity Association for Non-temporary Address
- ▶ Client Identifier
- ▶ Server Identifier

▼ DHCPv6

Message type: Advertise (2)

Transaction ID: 0x3f7592

- ▼ Identity Association for Non-temporary Address
 - Option: Identity Association for Non-temporary Address (3)
 - Length: 40
 - Value: 000033330000000000000000000000005001820010db800010002...
 - IAID: 00003333
 - T1: 0
 - T2: 0
- ▼ IA Address
 - Option: IA Address (5)
 - Length: 24
 - Value: 20010db8000100020000000000000000c60000004b00000078
 - IPv6 address: 2001:db8:1:2::c6 (2001:db8:1:2::c6)
 - Preferred lifetime: 75
 - Valid lifetime: 120
- ▶ Client Identifier
- ▶ Server Identifier

DHCPv6

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Message type: Advertise (2)

Transaction ID: 0x3f7592

- ▶ Identity Association for Non-temporary Address
- ▼ Client Identifier
 - Option: Client Identifier (1)
 - Length: 14
 - Value: 000100011d03b5590000000003333
 - DUID: 000100011d03b5590000000003333
 - DUID Type: link-layer address plus time (1)
 - Hardware type: Ethernet (1)
 - DUID Time: Jun 4, 2015 22:18:17.000000000 ART
 - Link-layer address: 00:00:00:00:33:33
- ▼ Server Identifier
 - Option: Server Identifier (2)
 - Length: 14
 - Value: 000100011d03b53e000000001111
 - DUID: 000100011d03b53e000000001111
 - DUID Type: link-layer address plus time (1)
 - Hardware type: Ethernet (1)
 - DUID Time: Jun 4, 2015 22:17:50.000000000 ART
 - Link-layer address: 00:00:00:00:11:11

Ejemplo funcionamiento DHCPv6 (6) - request

11 46.500495000 fe80::200:ff:fe00:3333 ff02::1:2 DHCPv6 Request XID: 0xfba66f CID: 000100011d03b559000000003333 IAA: 2001:db8:1:2::c6 164

▶Frame 11: 164 bytes on wire (1312 bits), 164 bytes captured (1312 bits) on interface 0
▶Ethernet II, Src: 00:00:00_00:33:33 (00:00:00:00:33:33), Dst: IPv6mcast_00:01:00:02 (33:33:00:01:00:02)
▶Internet Protocol Version 6, Src: fe80::200:ff:fe00:3333 (fe80::200:ff:fe00:3333), Dst: ff02::1:2 (ff02::1:2)
▶User Datagram Protocol, Src Port: dhcpv6-client (546), Dst Port: dhcpv6-server (547)

▼DHCPv6

Message type: Request (3)
Transaction ID: 0xfba66f
▶Client Identifier
▶Server Identifier
▶Option Request
▶Elapsed time
▶Identity Association for Non-temporary Address

▼DHCPv6

Message type: Request (3)
Transaction ID: 0xfba66f
▼Client Identifier
Option: Client Identifier (1)
Length: 14
Value: 000100011d03b559000000003333
DUID: 000100011d03b559000000003333
DUID Type: link-layer address plus time (1)
Hardware type: Ethernet (1)
DUID Time: Jun 4, 2015 22:18:17.000000000 ART
Link-layer address: 00:00:00:00:33:33
▼Server Identifier
Option: Server Identifier (2)
Length: 14
Value: 000100011d03b53e000000001111
DUID: 000100011d03b53e000000001111
DUID Type: link-layer address plus time (1)
Hardware type: Ethernet (1)
DUID Time: Jun 4, 2015 22:17:50.000000000 ART
Link-layer address: 00:00:00:00:11:11
▶Option Request

▼DHCPv6

Message type: Request (3)
Transaction ID: 0xfba66f
▶Client Identifier
▶Server Identifier
▼Option Request
Option: Option Request (6)
Length: 8
Value: 001700180027001f
Requested Option code: DNS recursive name server (23)
Requested Option code: Domain Search List (24)
Requested Option code: Fully Qualified Domain Name (39)
Requested Option code: Simple Network Time Protocol Server (31)
▼Elapsed time
Option: Elapsed time (8)
Length: 2
Value: 0000
Elapsed-time: 0 ms
▼Identity Association for Non-temporary Address
Option: Identity Association for Non-temporary Address (3)
Length: 40
Value: 0000333300000e10000015180005001820010db800010002...
IAID: 00003333
T1: 3600
T2: 5400
▼IA Address
Option: IA Address (5)
Length: 24
Value: 20010db80001000200000000000000c600001c2000001d4c
IPv6 address: 2001:db8:1:2::c6 (2001:db8:1:2::c6)
Preferred lifetime: 7200
Valid lifetime: 7500

Ejemplo funcionamiento DHCPv6 (7) - replay

Ejemplo funcionamiento DHCPv6 (4)

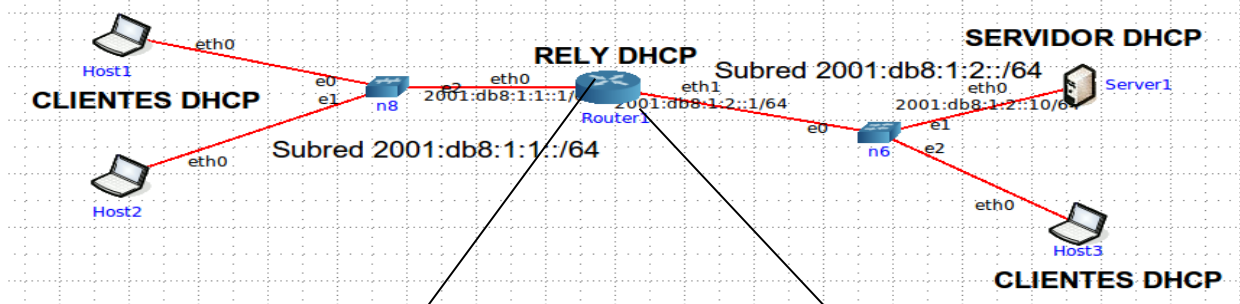
```
root@Host3:/tmp/pycore.42316/Host3.conf# dhclient -6 -v
Internet Systems Consortium DHCP Client 4.2.4
Copyright 2004-2012 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/
```

```
Bound to *:546
Listening on Socket/eth0
Sending on Socket/eth0
PRC: Soliciting for leases (INIT).
XMT: Forming Solicit, 0 ms elapsed.
XMT: X-- IA_NA 00:00:33:33
XMT: | X-- Request renew in +3600
XMT: | X-- Request rebind in +5400
XMT: Solicit on eth0, interval 1080ms.
RCV: Advertise message on eth0 from fe80::200:ff:fe00:1111.
RCV: X-- IA_NA 00:00:33:33
RCV: | X-- starts 1433467097
RCV: | X-- t1 - renew +0
RCV: | X-- t2 - rebind +0
RCV: | X-- [Options]
RCV: | | X-- IAADDR 2001:db8:1:2::c6
RCV: | | | X-- Preferred lifetime 75.
RCV: | | | X-- Max lifetime 120.
RCV: X-- Server ID: 00:01:00:01:1d:03:b5:3e:00:00:00:00:11:11
RCV: Advertisement recorded.
PRC: Selecting best advertised lease.
PRC: Considering best lease.
PRC: X-- Initial candidate 00:01:00:01:1d:03:b5:3e:00:00:00:00:11:11 (s: 153, p: 0).
```

```
XMT: Forming Request, 0 ms elapsed.
XMT: X-- IA_NA 00:00:33:33
XMT: | X-- Requested renew +3600
XMT: | X-- Requested rebind +5400
XMT: | | X-- IAADDR 2001:db8:1:2::c6
XMT: | | | X-- Preferred lifetime +7200
XMT: | | | X-- Max lifetime +7500
XMT: V IA_NA appended.
XMT: Request on eth0, interval 990ms.
RCV: Reply message on eth0 from fe80::200:ff:fe00:1111.
RCV: X-- IA_NA 00:00:33:33
RCV: | X-- starts 1433467098
RCV: | X-- t1 - renew +0
RCV: | X-- t2 - rebind +0
RCV: | X-- [Options]
RCV: | | X-- IAADDR 2001:db8:1:2::c6
RCV: | | | X-- Preferred lifetime 75.
RCV: | | | X-- Max lifetime 120.
RCV: X-- Server ID: 00:01:00:01:1d:03:b5:3e:00:00:00:00:11:11
PRC: Bound to lease 00:01:00:01:1d:03:b5:3e:00:00:00:00:11:11.
root@Host3:/tmp/pycore.42316/Host3.conf#
```

```
root@Host3:/tmp/pycore.42316/Host3.conf# cat /var/lib/dhcp/dhclient6.leases
default-duid "\000\001\000\001\035\003\265Y\000\000\000\00033";
lease6 {
    interface "eth0";
    ia-na 00:00:33:33 {
        starts 1433468358;
        renew 0;
        rebind 0;
        iaaddr 2001:db8:1:2::c6 {
            starts 1433468358;
            preferred-life 75;
            max-life 120;
        }
    }
    option dhcp6.client-id 0:1:0:1:1d:3:b5:59:0:0:0:0:33:33;
    option dhcp6.server-id 0:1:0:1:1d:3:b5:3e:0:0:0:0:11:11;
}
```

Ejemplo funcionamiento DHCPv6 (5) -dhcp relay-



```

root@Router1:/tmp/pycore.48677/Router1.conf# dhcrelay -6 -l eth0 -u eth1
Internet Systems Consortium DHCP Relay Agent 4.2.4
Copyright 2004-2012 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/
Bound to *:547
Listening on Socket/eth1
Sending on Socket/eth1
Listening on Socket/eth0
Sending on Socket/eth0
root@Router1:/tmp/pycore.48677/Router1.conf#
    
```

Time	Source	Destination	Protocol	Info
11 228.736218000	fe80::200:ff:fe00:2222	ff02::1:2	DHCPv6	Solicit XID: 0xb69280 CID: 000100011d03c364000000002222
12 228.739690000	fe80::200:ff:fe00:101	fe80::200:ff:fe00:222	DHCPv6	Advertise XID: 0xb69280 IAA: 2001:db8:1:1::ad CID: 000100011d03c364000000002222
13 229.768207000	fe80::200:ff:fe00:2222	ff02::1:2	DHCPv6	Request XID: 0xb59096 CID: 000100011d03c364000000002222 IAA: 2001:db8:1:1::ad
14 229.770348000	fe80::200:ff:fe00:101	fe80::200:ff:fe00:222	DHCPv6	Reply XID: 0xb59096 IAA: 2001:db8:1:1::ad CID: 000100011d03c364000000002222
22 289.940233000	fe80::200:ff:fe00:2222	ff02::1:2	DHCPv6	Renew XID: 0x96cb CID: 000100011d03c364000000002222 IAA: 2001:db8:1:1::ad
23 289.942403000	fe80::200:ff:fe00:101	fe80::200:ff:fe00:222	DHCPv6	Reply XID: 0x96cb IAA: 2001:db8:1:1::ad CID: 000100011d03c364000000002222

Time	Source	Destination	Protocol	Info
9 196.685004000	2001:db8:1:2::1	ff05::1:3	DHCPv6	Relay-forw L: 2001:db8:1:1::1 Solicit XID: 0xb69280 CID: 000100011d03c364000000002222
12 196.687076000	2001:db8:1:2::10	2001:db8:1:2::1	DHCPv6	Relay-reply L: 2001:db8:1:1::1 Advertise XID: 0xb69280 IAA: 2001:db8:1:1::ad CID: 000100011d03c364000000002222
13 197.716454000	2001:db8:1:2::1	ff05::1:3	DHCPv6	Relay-forw L: 2001:db8:1:1::1 Request XID: 0xb59096 CID: 000100011d03c364000000002222 IAA: 2001:db8:1:1::ad
14 197.717828000	2001:db8:1:2::10	2001:db8:1:2::1	DHCPv6	Relay-reply L: 2001:db8:1:1::1 Reply XID: 0xb59096 IAA: 2001:db8:1:1::ad CID: 000100011d03c364000000002222
21 257.888519000	2001:db8:1:2::1	ff05::1:3	DHCPv6	Relay-forw L: 2001:db8:1:1::1 Renew XID: 0x96cb CID: 000100011d03c364000000002222 IAA: 2001:db8:1:1::ad
22 257.889577000	2001:db8:1:2::10	2001:db8:1:2::1	DHCPv6	Relay-reply L: 2001:db8:1:1::1 Reply XID: 0x96cb IAA: 2001:db8:1:1::ad CID: 000100011d03c364000000002222