IPv6 Application Services DHCPv6

Foreword

- The IPv6 architecture has led to the redesign of many aspects of network operation. One such design change involves Neighbor Discovery, which in itself now defines a means for Stateless Address Auto-configuration (SLAAC). DHCP for IPv6 (DHCPv6) includes a number of design changes that includes support for both SLAAC and stateful IPv6 addressing. DHCPv6 remains a client/server based application layer protocol, however includes a significant number of changes to align with the design aspects of IPv6. As such, DHCPv6 stateful and stateless implementations and characteristics are explained.

Objectives

- Upon completion of this section, you will be able to:
  - Describe the features of DHCPv6.
  - Explain the stateful and stateless behavior of DHCPv6.
  - Successfully configure DHCPv6 services.

Assegnazione degli indirizzi IPv6

Si possono utilizzare diverse strategie per assegnare indirizzi IPv6 agli hosts:

- Static Configuration;
  - Impostazione manuale degli indirizzi, come visto nelle lezioni precedenti.
- Stateful DHCP;
- SLAAC

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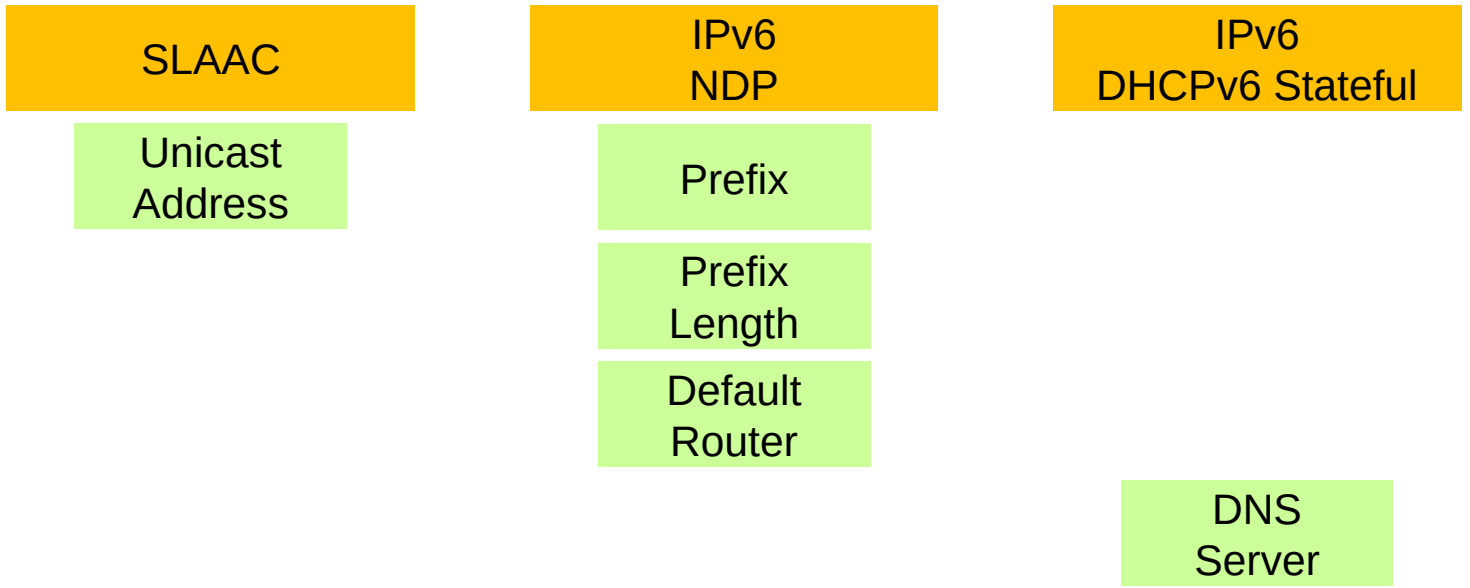
Assegnazione degli indirizzi IPv6 – SLAAC

State**L**ess **A**ddress **A**uto**C**onfiguration

- Non richiede un server per il lease degli indirizzi IPv6;
- Definisce un processo che usa NDP e DHCPv6 come servizio stateless;



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Assegnazione degli indirizzi IPv6 – Stateful DHCP

- Presenza di uno o più server DHCP nella rete;
- Hosts richiedono il lease di un IP ed altre informazioni al server;
- Il server risponde con le informazioni necessarie.

IPv4 DHCPv4	IPv6 DHCPv6 Stateful	IPv6 NDP
Unicast Address	Unicast Address	
Subnet Mask	Prefix Length	
Default Router		Default Router
DNS Server	DNS Server	

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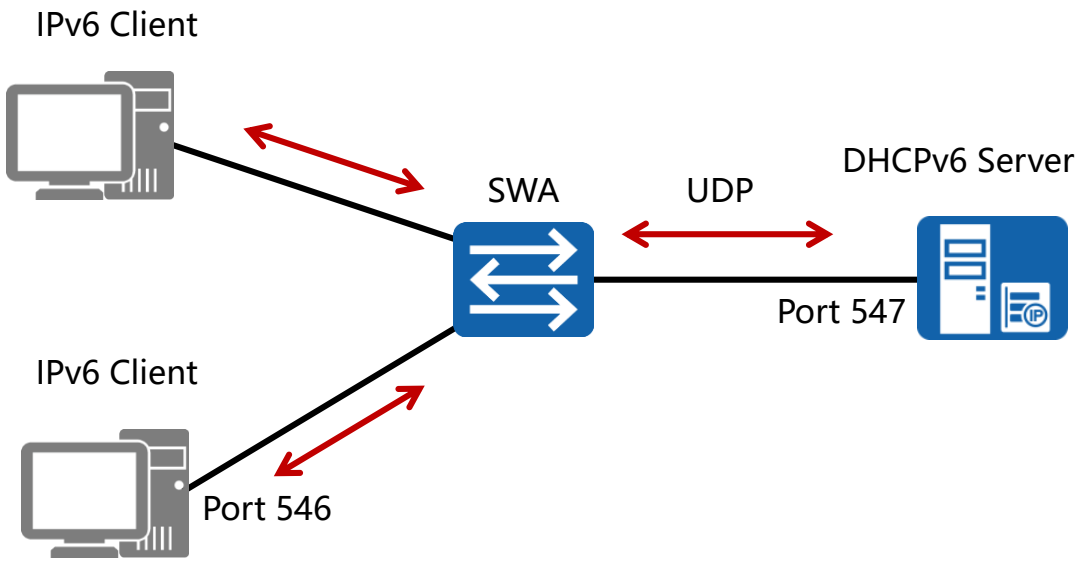
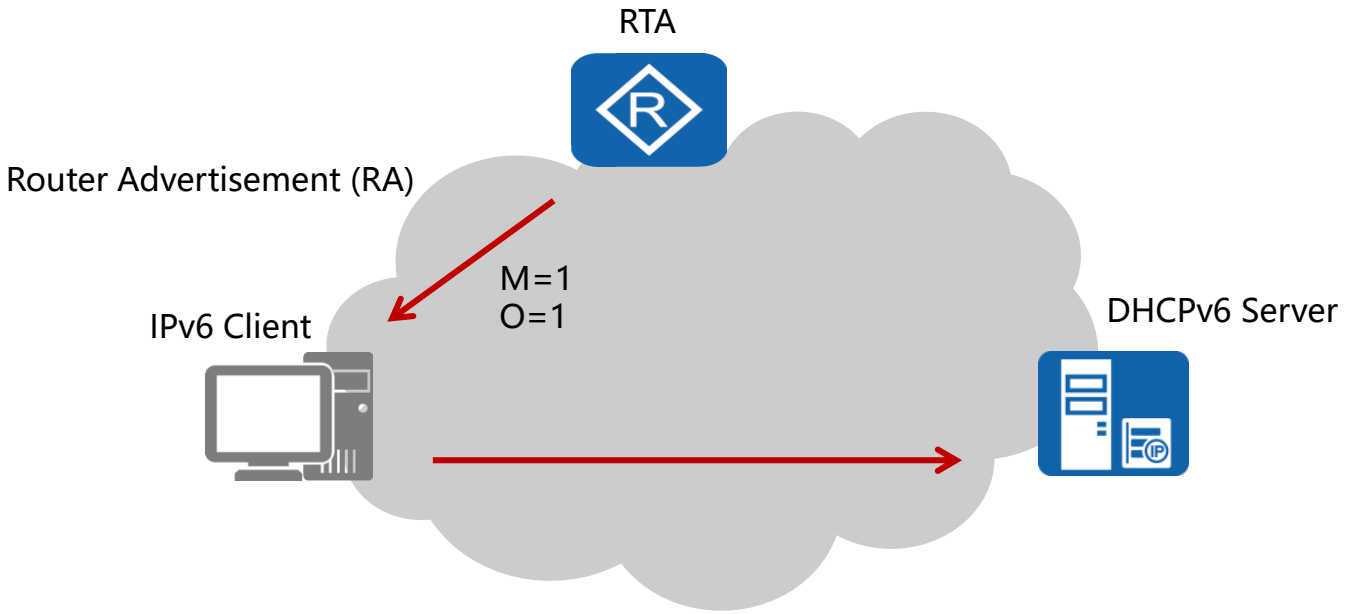
DHCPv6



- Represents a stateful address auto-configuration protocol.
- UDP based communication between client and server.

Stateful Addressing



- RA contains managed (M) and other (O) configuration flags.
- Stateful addressing (DHCPv6) used where flags are set to ‘1’.

Enabling DHCPv6 Communication

- Link-local addresses are used as source address by clients, and DHCP servers reached via the multicast address FF02::1:2.

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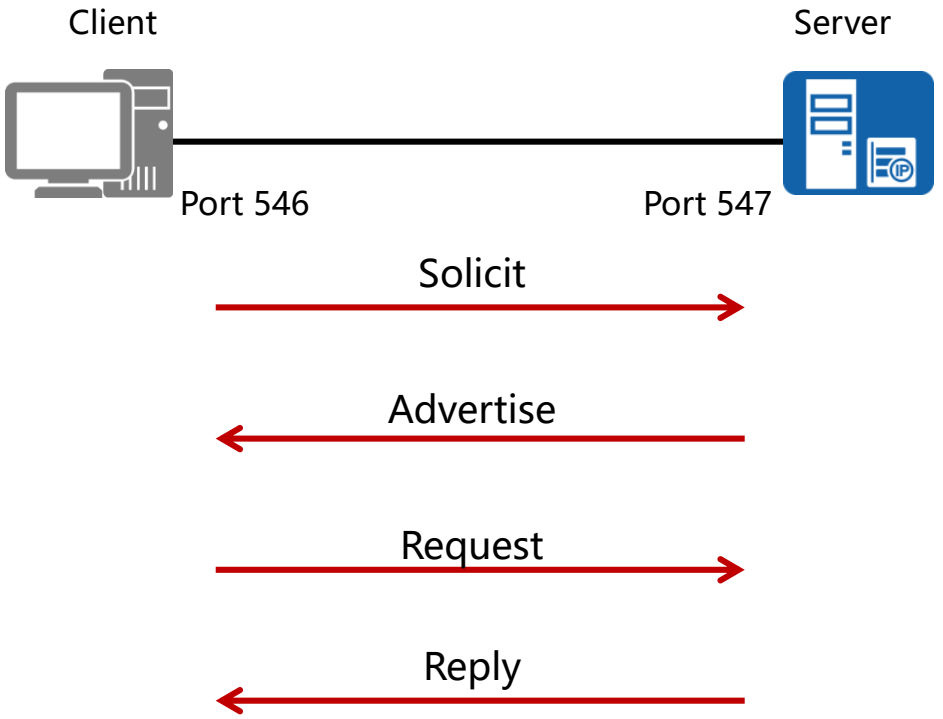
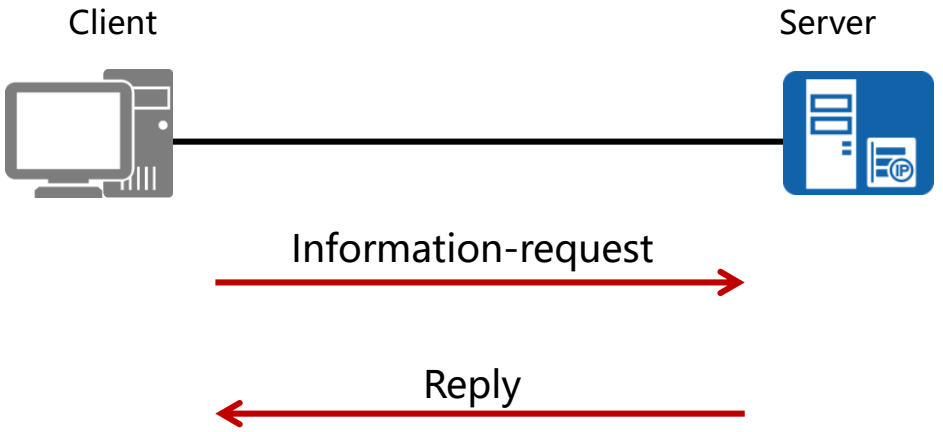
Assigning IPv6 Addressing



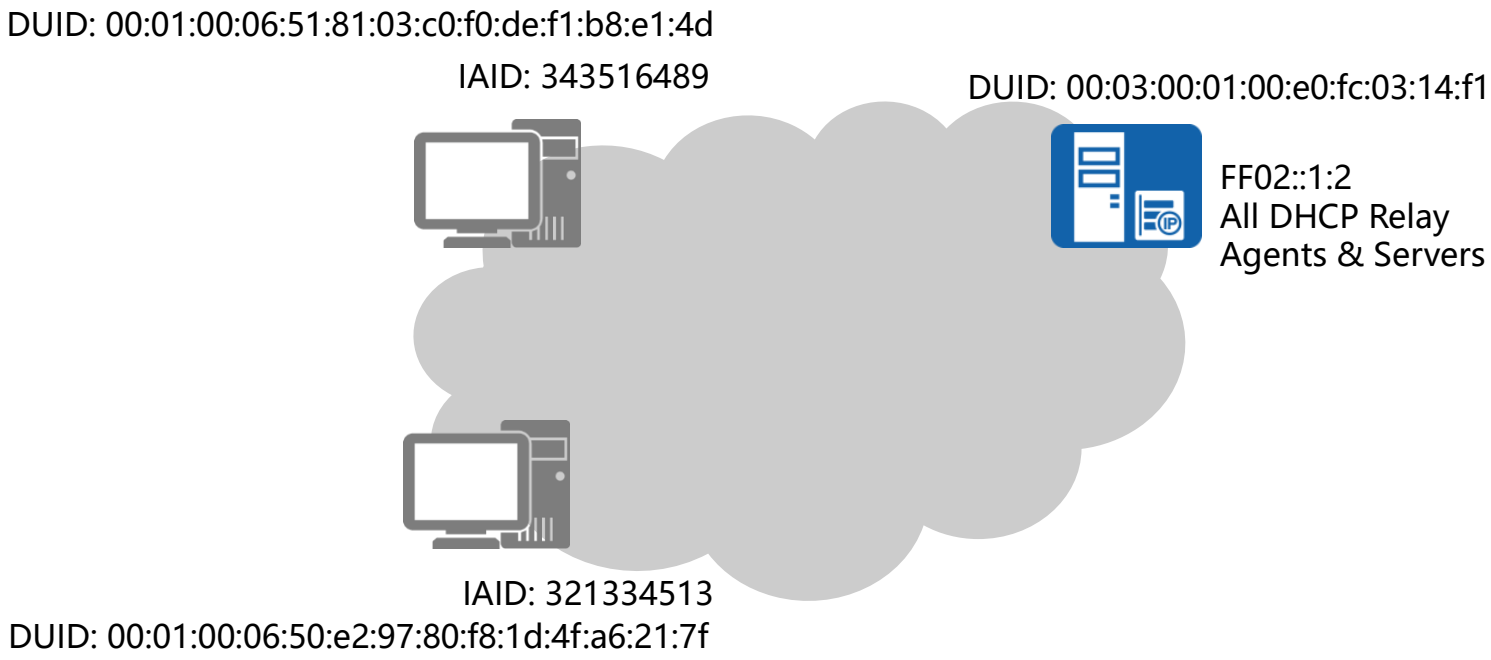
- Discovery of servers and assignment of IPv6 addresses & configuration parameter relies on a set of four messages.

Stateless Configuration Information



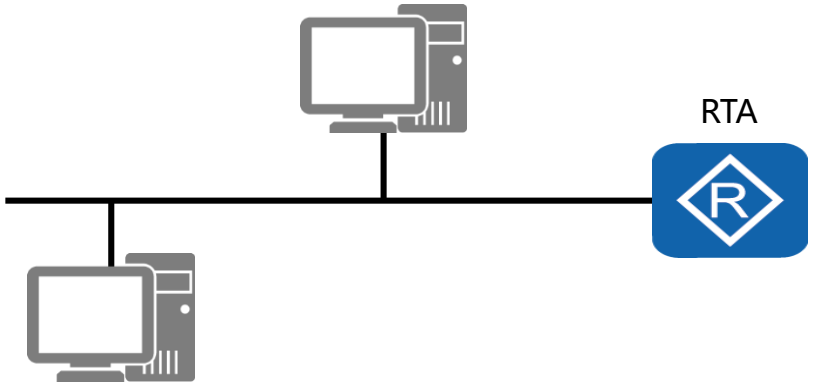
- Information-request used when IPv6 addressing not required.
- Reply used to deliver configuration parameters.

DHCP Unique Identifier (DUID



- Unique identifier of clients & servers in the DHCP community.
- Parameters bound to each DUID using Identity Associations (IA).

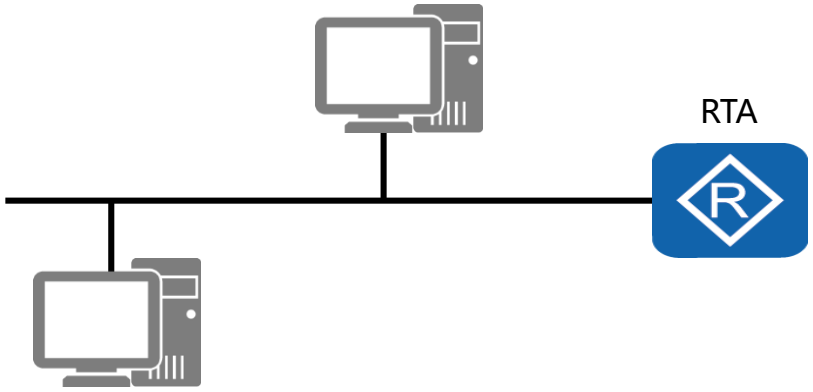
Setting the DHCP DUID




```
[RTA]dhcpv6 duid ll
Warning: The DHCP unique identifier should be globally-unique and
stable. Are you sure to change it? [Y/N]y
```

- Enables assignment of either the DUID-LL or DUID-LLT format.
- The DUID-LL format is assigned by default.

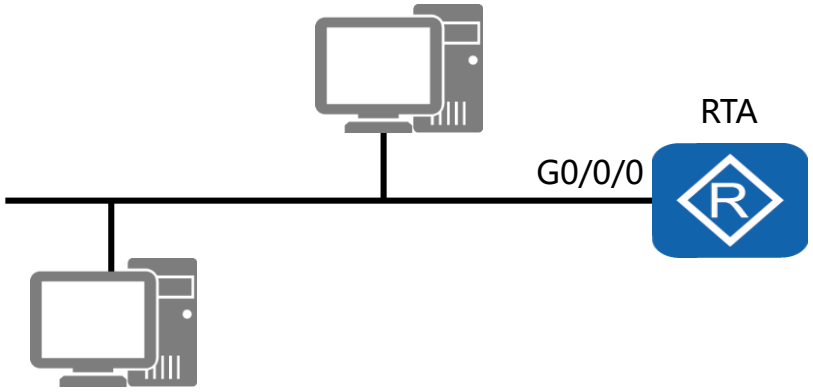
IPv6 Address Pool




```
[RTA]dhcpv6 pool pool1
[RTA-dhcpv6-pool-pool1]address prefix 3000::/64
[RTA-dhcpv6-pool-pool1]excluded-address 3000::1
[RTA-dhcpv6-pool-pool1]dns-server 3001::1
[RTA-dhcpv6-pool-pool1]dns-domain-name huawei.com
```

- DHCPv6 parameters are assigned for each address pool.

Enable DHCPv6 Server




```
[RTA]ipv6
[RTA]dhcp enable
[RTA]interface GigabitEthernet 0/0/0
[RTA-GigabitEthernet0/0/0]ipv6 enable
[RTA-GigabitEthernet0/0/0]ipv6 address 3000::1/64
[RTA-GigabitEthernet0/0/0]dhcpv6 server pool1
```

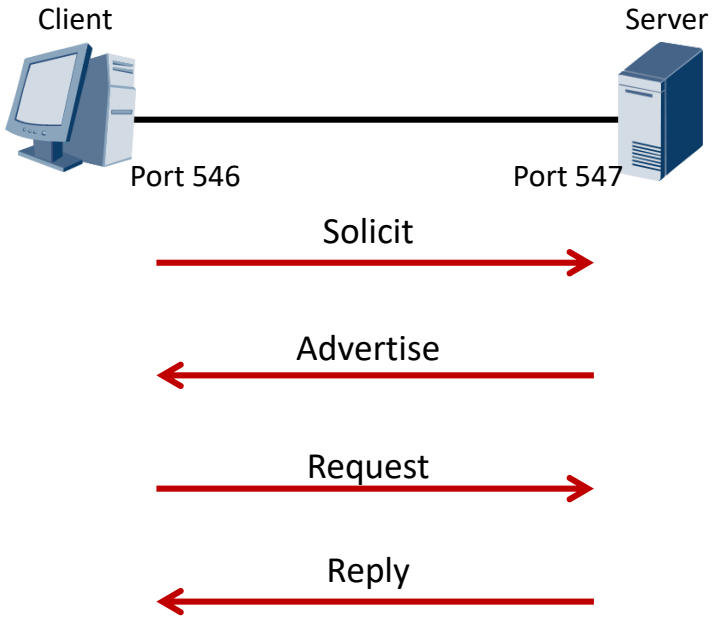
- Address pool is associated with the DHCPv6 server interface.

Displaying DHCPv6 Information

```
<RTA>display dhcpv6 pool
DHCPv6 pool: pool1
  Address prefix: 3000::/64
    Lifetime valid 172800 seconds, preferred 86400 seconds
    2 in use, 0 conflicts
   Excluded-address 3000::1
   Information refresh time: 86400
   DNS server address: 3001::1
   Domain name: huawei.com
   Conflict-address expire-time: 172800
   Active normal clients: 2
```

- Configured pools, pool based parameters, and client activity are referenced under the display dhcp pool command.

DHCPv6 Protocol Grab



Source	Destination	Protocol	Length	Info
fe80 Source address efd:1a19	ff02::1:2	DHCPv6	112	Solicit XID: 0
fe80::2e0:fcff:fe2d:1cc8	ff02::1:fffd:1a19	ICMPv6	86	Neighbor Solic
fe80::5689:98ff:fefd:1a19	fe80::2e0:fcff:fe2d:1cc8	ICMPv6	86	Neighbor Adver
fe80::2e0:fcff:fe2d:1cc8	fe80::5689:98ff:fefd:1a19	DHCPv6	172	Advertise XID:
fe80::5689:98ff:fefd:1a19	ff02::1:2	DHCPv6	154	Request XID: 0
fe80::2e0:fcff:fe2d:1cc8	fe80::5689:98ff:fefd:1a19	DHCPv6	172	Reply XID: 0xa
::	ff02::1:ff00:2	ICMPv6	86	Neighbor Solic
::	ff02::1:ff00:2	ICMPv6	86	Neighbor Solic
::	ff02::1:ff00:2	ICMPv6	86	Neighbor Solic

- Configured pools, pool based parameters, and client activity are referenced under the *display dhcp pool* command.

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DHCPv6 Protocol Grab - Advertise

```
> Frame 4: 172 bytes on wire (1376 bits), 172 bytes captured (1376 bits) on interface 0
> Ethernet II, Src: HuaweiTe_2d:1c:c8 (00:e0:fc:2d:1c:c8), Dst: HuaweiTe_fd:1a:19 (54:89:98:fd:1a:19)
> Internet Protocol Version 6, Src: fe80::2e0:fcff:fe2d:1cc8, Dst: fe80::5689:98ff:fefd:1a19
> User Datagram Protocol, Src Port: 547, Dst Port: 546
v DHCPv6
    Message type: Advertise (2)
    Transaction ID: 0xaa9029
  v Client Identifier
      Option: Client Identifier (1)
      Length: 10
      Value: 00030001548998fd1a19
      DUID: 00030001548998fd1a19
      DUID Type: link-layer address (3)
      Hardware type: Ethernet (1)
      Link-layer address: 54:89:98:fd:1a:19
  v Server Identifier
      Option: Server Identifier (2)
      Length: 10
      Value: 0003000100e0fc2d1cc8
      DUID: 0003000100e0fc2d1cc8
      DUID Type: link-layer address (3)
      Hardware type: Ethernet (1)
      Link-layer address: 00:e0:fc:2d:1c:c8
  > Identity Association for Non-temporary Address
  > DNS recursive name server
  > Domain Search List
```


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DHCPv6 Protocol Grab - Request

```
> Frame 5: 154 bytes on wire (1232 bits), 154 bytes captured (1232 bits) on interface 0
> Ethernet II, Src: HuaweiTe_fd:1a:19 (54:89:98:fd:1a:19), Dst: IPv6mcast_01:00:02 (33:33:00:01:00:02)
> Internet Protocol Version 6, Src: fe80::5689:98ff:fefd:1a19, Dst: ff02::1:2
> User Datagram Protocol, Src Port: 546, Dst Port: 547
v DHCPv6
    Message type: Request (3)
    Transaction ID: 0xaa9029
  > Client Identifier
  > Server Identifier
  > Identity Association for Non-temporary Address
  v Option Request
      Option: Option Request (6)
      Length: 6
      Value: 001700180003
      Requested Option code: DNS recursive name server (23)
      Requested Option code: Domain Search List (24)
      Requested Option code: Identity Association for Non-temporary Address (3)
  > Elapsed time
```


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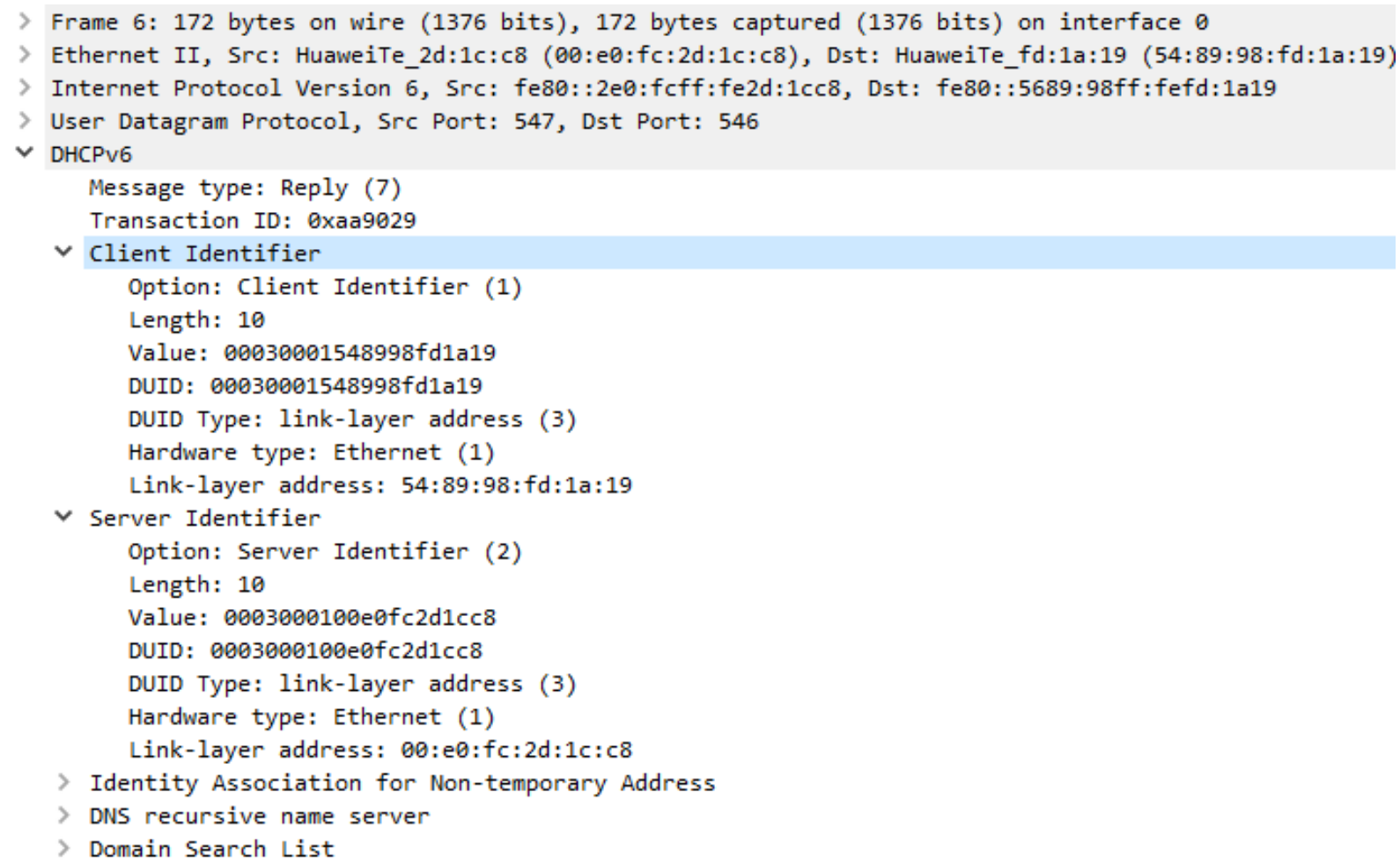
DHCPv6 Protocol Grab - Reply



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DHCPv6 Protocol Grab - DAD

```
     7 0.063000    ::                          ff02::1:ff00:2              ICMPv6     86 Neighbor Solicitation for 2001:db8:1111:2222::2 from 54:89:98:fd:1a:19
     8 1.063000    ::                          ff02::1:ff00:2              ICMPv6     86 Neighbor Solicitation for 2001:db8:1111:2222::2 from 54:89:98:fd:1a:19
     9 2.063000    ::                          ff02::1:ff00:2              ICMPv6     86 Neighbor Solicitation for 2001:db8:1111:2222::2 from 54:89:98:fd:1a:19
```

```
> Frame 7: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
> Ethernet II, Src: HuaweiTe_fd:1a:19 (54:89:98:fd:1a:19), Dst: IPv6mcast_ff:00:00:02 (33:33:ff:00:00:02)
> Internet Protocol Version 6, Src: ::, Dst: ff02::1:ff00:2
v Internet Control Message Protocol v6
    Type: Neighbor Solicitation (135)
    Code: 0
    Checksum: 0x110f [correct]
    [Checksum Status: Good]
    Reserved: 00000000
    Target Address: 2001:db8:1111:2222::2
  v ICMPv6 Option (Source link-layer address : 54:89:98:fd:1a:19)
      Type: Source link-layer address (1)
      Length: 1 (8 bytes)
      Link-layer address: HuaweiTe_fd:1a:19 (54:89:98:fd:1a:19)
```


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DHCPv6 Protocol Grab

Protocol Grab

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Summary

- Which DUID formats are currently supported within VRP?
- If the M and O bits of a Router Advertisement (RA) are set to 1, what action is taken by the client?


Thank You
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