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Client Link-Layer Address Option in DHCPv6

Abstract

This document specifies the format and mechanism that is to be used for encoding the client link-layer address in DHCPv6 Relay-Forward messages by defining a new DHCPv6 Client Link-Layer Address option.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc6939.

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1. Introduction

This specification defines an optional mechanism and the related DHCPv6 option to allow first-hop DHCPv6 relay agents (relay agents that are connected to the same link as the client) to provide the client's link-layer address in the DHCPv6 messages being sent towards the server.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

3. Problem Background and Scenario

The DHCPv4 specification [RFC2131] provides a way to specify the client link-layer address in the DHCPv4 message header. A DHCPv4 message header has 'htype' and 'chaddr' fields to specify the client link-layer address type and the link-layer address, respectively. The client link-layer address thus learned can be used by the DHCPv4 server and the relay agent in different ways. In some of the deployments, DHCPv4 servers use 'chaddr' as a customer identifier and a key for lookup in the client lease database.

With the incremental deployment of IPv6 to existing IPv4 networks, which results in a dual-stack network environment, there will be devices that act as both DHCPv4 and DHCPv6 clients. In service provider deployments, a typical DHCPv4 implementation will use the client link-layer address as one of the keys to build the DHCP client lease database. In dual-stack scenarios, operators need to be able

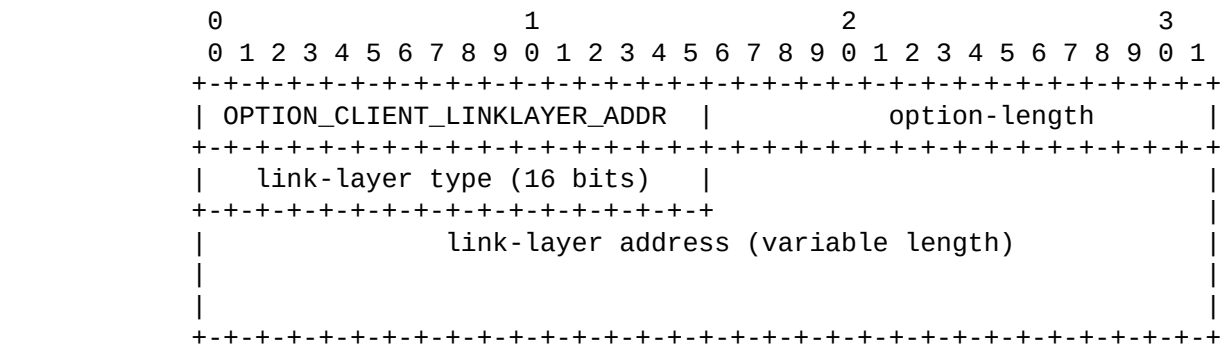
to associate DHCPv4 and DHCPv6 messages with the same client interface, based on an identifier that is common to the interface. The client link-layer address is such an identifier.

Currently, the DHCPv6 specification [RFC3315] does not define a way to communicate the client link-layer address to the DHCP server in cases where the DHCP server is not connected to the same network link as the DHCP client. The DHCPv6 specification mandates that all clients prepare and send a DHCP Unique Identifier (DUID) as the client identifier option in all the DHCPv6 message exchanges. However, none of these methods provide a simple way to extract a client's link-layer address. This presents a problem to an operator who is using an existing DHCPv4 system with the client link-layer address as the customer identifier and who desires to correlate DHCPv6 assignments using the same identifier. [RFC4361] describes a mechanism for using the same DUID in both DHCPv4 and DHCPv6. Unfortunately, this specification requires modification of existing DHCPv4 clients, and has not seen broad adoption in the industry (indeed, we are not aware of any commercial implementations).

Providing an option in DHCPv6 Relay-Forward messages to carry the client link-layer address explicitly will help the above mentioned scenarios. For example, it can be used along with other identifiers to associate DHCPv4 and DHCPv6 messages from a dual-stack client. Further, having the client link-layer address in DHCPv6 will help by providing additional information for event debugging and logging related to the client at the relay agent and the server. The proposed option may be used in a wide range of networks; two notable deployment models are service provider and enterprise network environments.

4. DHCPv6 Client Link-Layer Address Option

The format of the DHCPv6 Client Link-Layer Address option is shown below.



option-code: OPTION_CLIENT_LINKLAYER_ADDR (79)
option-length: 2 + length of link-layer address
link-layer type: Client link-layer address type. The link-layer type MUST be a valid hardware type assigned by the IANA, as described in [RFC0826]
link-layer address: Client link-layer address

5. DHCPv6 Relay Agent Behavior

DHCPv6 relay agents that receive messages originating from clients (for example, Solicit and Request, but not, for example, Relay-Forward or Advertise) MAY include the link-layer source address of the received DHCPv6 message in the Client Link-Layer Address option, in relayed DHCPv6 Relay-Forward messages. The DHCPv6 relay agent behavior can depend on configuration that decides whether the Client Link-Layer Address option needs to be included.

6. DHCPv6 Server Behavior

If the DHCPv6 server is configured to store or use a client link-layer address, it SHOULD look for the Client Link-Layer Address option in the Relay-Forward DHCP message of the DHCPv6 relay agent closest to the client. The mechanism described in this document is not necessary in the case where the DHCPv6 server is connected to the same network link as the client, because the server can obtain the link-layer address from the link-layer header of the DHCPv6 message. If the DHCP server receives a Client Link-Layer Address option anywhere in any encapsulated message that is not a Relay-Forward DHCP message, the server MUST silently ignore that option.

There is no requirement that a server return this option and its data in a downstream DHCP message.

7. DHCPv6 Client Behavior

The Client Link-Layer Address option is only exchanged between the relay agents and the servers. DHCPv6 clients are not aware of the usage of the Client Link-Layer Address option. The DHCPv6 client MUST NOT send the Client Link-Layer Address option, and MUST ignore the Client Link-Layer Address option if received.

8. IANA Considerations

IANA has assigned an option code (79) to OPTION_CLIENT_LINKLAYER_ADDR from the "DHCP Option Codes" registry (http://www.iana.org/assignments/dhcpv6-parameters/).

9. Security Considerations

It is possible for a rogue DHCPv6 relay agent to insert an incorrect Client Link-Layer Address option for malicious purposes. A DHCPv6 client can also pose as a rogue DHCP relay agent by sending a Relay-Forward message containing an incorrect Client Link-Layer Address option. In either case, it would be possible for a DHCPv6 client to masquerade as the same device as a DHCPv4 client, when in fact the two are distinct.

One possible attack that could be accomplished using this masquerade would be in the case where a DHCPv4 client is using DHCPv4 to do a Dynamic DNS update to install an A record so that it can be reached by other nodes [RFC4702]. A masquerading DHCPv6 client could use DHCPv6 to install a AAAA record with the same name [RFC4704]. Dual-stack nodes attempting to connect to the DHCPv4 client might then be tricked into connecting to the masquerading DHCPv6 client instead.

It is possible that there are other attacks that could be accomplished using this masquerading technique, although the authors are not aware of any. To prevent masquerades of this sort, DHCP server administrators are strongly advised to configure DHCP servers that use this option to communicate with their relay agents using IPsec, as described in Section 21.1 of [RFC3315].

In some networks, it may be the case that the operator of the physical network and the provider of connectivity over that network are administratively separate, such that the Client Link-Layer Address option would reveal information to one or the other party that they do not need and could not otherwise obtain. It is also possible, in some cases, that a relay agent might communicate with a

DHCP server over an open network where eavesdropping would be possible. In these cases, it is strongly recommended, in order to protect end-user privacy, that network operators use IPsec to provide confidentiality for messages between the relay agent and the DHCP server.

10. Acknowledgements

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11. References

11.1. Normative References

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[RFC3315] Droms, R., Bound, J., Volz, B., Lemon, T., Perkins, C., and M. Carney, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", RFC 3315, July 2003.

[RFC4361] Lemon, T. and B. Sommerfeld, "Node-specific Client Identifiers for Dynamic Host Configuration Protocol Version Four (DHCPv4)", RFC 4361, February 2006.

11.2. Informative References

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[RFC4702] Stapp, M., Volz, B., and Y. Rekhter, "The Dynamic Host Configuration Protocol (DHCP) Client Fully Qualified Domain Name (FQDN) Option", RFC 4702, October 2006.

[RFC4704] Volz, B., "The Dynamic Host Configuration Protocol for IPv6 (DHCPv6) Client Fully Qualified Domain Name (FQDN) Option", RFC 4704, October 2006.

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