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DHCP4o6 Bulk and Active Leasequery
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Abstract

As networks migrate towards IPv6, some entities still have the requirement for IPv4 configuration. DHCPv4 over DHCPv6 [RFC7341] provides a mechanism for obtaining IPv4 configuration information dynamically in IPv6 networks. DHCPv4/DHCPv6 Bulk Leasequery and Active Leasequery allow a client to get DHCP address binding information data in bulk transfer or in real-time via TCP. This document describes an extension of DHCPv6 Bulk and Active Leasequery that provides a mechanism to get DHCPv4 over DHCPv6 lease information.

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1. Introduction

The DHCPv4 Leasequery [RFC4388] extends the basic DHCPv4 capability [RFC2131] [RFC2132]to allow a requestor to query a DHCPv4 server for an individual binding information. DHCPv4 Bulk Leasequery[RFC6926] extends [RFC4388] to allow a requestor to query a DHCPv4 server for bulk transfer of binding information. DHCPv4 Active Leasequery further extends [RFC6926] to create a long-lived TCP connection between the requester and DHCPv4 server for near real-time binding information. Paralle Leasequery protocols are also defined for DHCPv6.

In IPv6 migration, some hosts in IPv6 network may also need DHCPv4 configuration using DHCPv4 over DHCPv6[RFC7341]. In some use cases, it also need to extend DHCPv4 over DHCPv6 to carry related IPv6 information along with the DHCPv4 configuration, such as [I-D.fsc-softwire-dhcp4o6-saddr-opt]. In these extending DHCPv4 over DHCPv6 messages, IPv4 and IPv6 bindings may interact and correlate with each other. The DHCPv4 lease information (including IPv4 address and other DHCPv4 options) is encapsulated in DHCPv4 Message option as defined in[RFC7341]. And the related IPv6 bindings is encapsulated in DHCPv6 message (DHCPV4-QUERY/DHCPV4-RESPONSE messages).

The interaction of the DHCPv4 and IPv6 information used by DHCP4o6

makes it different from original DHCPv4 [RFC2131]. One example is Lightweight 4over6 dynamic provisioning: A client (lwB4) may use DHCPv6 option(OPTION_DHCP4O6_SADDR) [I-D.fsc-softwire-dhcp4o6-saddr-opt] to set the IPv6 tunnel source address in the DHCP4o6 server. For each lwB4, the lwAFTR needs to create a mapping entry. The mapping contains the tuple (lease IPv4 address, port set, IPv6 tunnel source address). The lwAFTR must obtain the tuple before providing service to a particular lwB4. However, there is no single DHCP server contains all three pieces of information.

The lwB4's IPv6 tunnel source address may be an active IPv6 address lease or a manual static address. The OPTION_DHCP4O6_SADDR is a DHCPv6 option but may not bind to the active IPv6 address lease. Furthermore, DHCP4o6 message doesn't contain DUID or any kind of identifiers for the requestor to query the DHCPv4 lease and co-relate it to the IPv6 configuration. In this scenario, the requestor (lwAFTR) cannot get the lwB4s' IPv6 tunnel source address using DHCPv4 Bulk/Active Leasequery or DHCPv6 Bulk/Active Leasequery.

DHCPv4 Bulk/Active Leasequery is DHCPv4 protocol, they can't be used to query DHCPv6 bindings. Similarly, DHCPv6 Bulk/Active Leasequery is DHCPv6 protocol, it can't be used to query DHCPv4 bindings. This document describes an extension of DHCPv6 Bulk and Active Leasequery to allow a requestor to request DHCPv4 lease and related IPv6 configuration.

2. Terminology

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 [RFC2119].

3. Protocol Overview

In IPv6 network, entities use DHCPv4 over DHCPv6 to get DHCPv4 configuration and even get the related IPv6 configuration just like the OPTION_DHCP4O6_SADDR defined in [I-D.fsc-softwire-dhcp4o6-saddr-opt]. Entities may need other related IPv6 configuration along with DHCPv4 lease using DHCPv4 over DHCPv6. DHCP4o6 Bulk/Active Leasequery mechanism based on both DHCPv4/DHCPv6 Bulk Leasequery and DHCPv4/DHCPv6 Active Leasequery make requestor get DHCP4o6 lease information (DHCPv4 lease and related IPv6 configuration) in bulk transfer or in real-time from DHCP4o6 server via TCP.

The DHCP4o6 Bulk/Active Leasequery mechanism is modeled on the existing DHCPv4 over DHCPv6 protocol in[RFC7341], which combines

DHCPv4 Bulk/Active Leasequery and DHCPv6 Bulk/Active Leasequery to provide DHCPv4 lease and related IPv6 information in IPv6 network. The DHCP4o6 Bulk/Active Leasequery requestors and DHCP4o6 servers communicate with each other using DHCPv6 Bulk/Active Leasequery which contains DHCPv4 Message Option defined in [RFC7341]. In DHCPv6 Bulk/Active Leasequery messages, DHCPv4 Message Option contains the DHCPv4 Bulk/Active leasequery message. The type and status of DHCPv4 Bulk/Active leasequery message in the option should be synchronous with the DHCPv6 part in the same message during the process of leasequery.

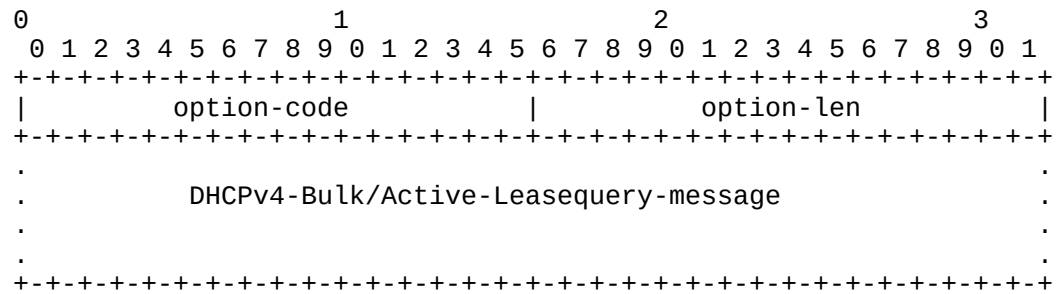
Requestor sends a DHCPv6 Bulk/Active Leasequery message contains DHCPv4 Message Option to query for DHCP4o6 lease information. In the message, the DHCPv4 lease query is put in the DHCPv4 Bulk/Active Leasequery message in DHCPv4 Message Option, and related IPv6 configuration is put in the DHCPv6 option.

The DHCPv4 lease in the DHCPv4 Message Option of the messages sent by DHCP4o6 server in response should be identical to the messages sent by the DHCPv4 Bulk/Active Leasequery server. The related IPv6 configuration part in response is put in the DHCPv6 Bulk/Active Leasequery options.

Applications which employ Active Leasequery to keep a database up to date with respect to the server’s lease state database usually use an initial Bulk Leasequery to bring their database into equivalence with that of the server. In DHCP4o6 Bulk and Active Leasequery, it works in the same way.

4. Message and Option Description

All of the message types and options defined in DHCPv4/DHCPv6 Bulk/Active Leasequery [RFC5460][I-D.ietf-dhc-dhcpv6-active-leasequery] [RFC6926][I-D.ietf-dhc-dhcpv4-active-leasequery] are also used by DHCP4o6 Bulk/Active Leasequery. In addition, a new usage of the existing option is defined in this document. DHCPv4 Message Option defined in [RFC7341] contains the DHCPv4 message sent by the DHCP client or server. In DHCP4o6 Bulk/Active Leasequery scenario, DHCPv4 Message Option contains the DHCPv4 Bulk/Active Leasequery message sent by requestor and DHCP4o6 server.



option-code: OPTION_DHCPV4_MSG (87)

option-len: Length of the DHCPv4 Bulk/Active Leasequery message.

DHCPv4-Bulk/Active-Leasequery-message:
The DHCPv4 Bulk or Active Leasequery message sent by the client or the server.

Figure 1: DHCPv4 Message Option

When using in DHCP4o6 Bulk Leasequery, DHCPv4 Message Option contains DHCPv4 Bulk Leasequery message. When DHCP4o6 Bulk Leasequery requestors query for DHCP4o6 lease information, DHCPv4 Message Option contains the DHCPv4 DHCPBULKLEASEQUERY message. In response, DHCP4o6 servers will put the DHCPv4 reply message (DHCPLEASEACTIVE , DHCPLEASEUNASSIGNED or DHCPLEASEQUERYDONE message) in the DHCPv4 Message Option.

When using in DHCP4o6 Active Leasequery, DHCPv4 Message Option contains DHCPv4 Active Leasequery message. When DHCP4o6 Active Leasequery requestors query for DHCP4o6 lease information, DHCPv4 Message Option contains the DHCPv4 ACTIVELEASEQUERY message. In response, DHCP4o6 servers will put the DHCPv4 reply message (DHCPLEASEQUERYSTATUS, DHCPLEASEACTIVE , DHCPLEASEUNASSIGNED or DHCPLEASEQUERYDONE message) in the DHCPv4 Message Option.

5. Requestor and Server Behavior

5.1. Extension to Bulk Leasequery

DHCP4o6 Bulk Leasequery extends the Bulk Leasequery to allow a requestor getting bulk of DHCP4o6 lease information. A requestor attempts to establish a TCP connection to a DHCP4o6 server in order to initiate a leasequery exchange. If the attempt fails, the requestor MAY retry.

After a connection is established, the requestor constructs a DHCP4o6 Bulk Leasequery message. In DHCPv6 LEASEQUERY message, the Query options MUST include an OPTION_ORO option to indicate the options for each client's related IPv6 configuration that the requestor would like the server to return. The query-type in Query option MUST be identical with the query-type of the DHCPv4 Bulk Leasequery message in DHCPv4 Message Option. Related IPv6 configuration is binding to the DHCPv4 lease, and DHCPv4 DHCPBULKLEASEQUERY message in the DHCPv4 Message Option formats as defined in [RFC6926].

When DHCP4o6 server receives the extending DHCPv6 Bulk Leasequery message, it first addresses the DHCPv4 Bulk Leasequery message as defined in [RFC6926]. Then DHCP4o6 server addresses related IPv6 configuration query recording to the DHCPv4 replying. In LEASEQUERY-REPLY, LEASEQUERY-DATA or LEASEQUERY-DONE message, DHCPv4 Message Option contains the DHCPLEASEACTIVE , DHCPLEASEUNASSIGNED or DHCPLEASEQUERYDONE message as a reply to DHCPv4 lease query and Client Data Option contains the related IPv6 option as a reply to related IPv6 configuration query. The status description in DHCPv6 reply message MUST be identical with the status in DHCPv4 reply message in semantics.

5.2. Extension to Active Leasequery

DHCP4o6 Active Leasequery extends the Active Leasequery to allow a requestor getting the current DHCP4o6 lease information and in this scenario, DHCP4o6 server MUST support the DHCP4o6 Bulk Leasequery. As defined in[I-D.ietf-dhc-dhcpv6-active-leasequery], an Active Leasequery requestor would typically use Bulk Leasequery to initialize its database with all current data when that database contains no binding information. In addition, requestors would use Bulk Leasequery to recover missed information in the event that it recover from the failure. It also works in DHCP4o6 Active Leasequery.

A requestor attempts to establish a TCP connection to a DHCP4o6 server in order to initiate an Active Leasequery exchange. If the attempt fails, the requestor MAY retry. After a connection is established, the requestor constructs a DHCP4o6 Active Leasequery message. In ACTIVELEASEQUERY message, the Query options MUST include an OPTION_ORO option to indicate the options for each client's related IPv6 configration that the requestor would like the server to return. The query-type in Query option MUST be identical with the query-type of the DHCPv4 Active Leasequery message in DHCPv4 Message Option. Similar to Bulk Leasequery, the DHCPv4 Active Leasequery message DHCPACTIVELEASEQUERY message in the DHCPv4 Message Option composes as defined in [I-D.ietf-dhc-dhcpv4-active-leasequery].

When DHCP4o6 server receives the extending Active Leasequery message, it first addresses the DHCPv4 Active Leasequery message as defined in[I-D.ietf-dhc-dhcpv4-active-leasequery]. Then DHCP4o6 server addresses related IPv6 configuration query according to the DHCPv4 replying. The status description in DHCPv6 reply message MUST be identical with the status in DHCPv4 reply message in semantics. When the server updates DHCPv4 lease or related IPv6 information, it will generate a response to requestors. In response, the server sends updates of DHCPv4o6 lease information in the DHCPv6 LEASEQUERY-DATA message. In LEASEQUERY-REPLY, LEASEQUERY-DATA or LEASEQUERY-DONE message, DHCPv4 Message Option contains the DHCPLEASEACTIVE, DHCPLEASEUNASSIGNED or DHCPLEASEQUERYDONE message as a reply to DHCPv4 lease query and Client Data Option contains the related IPv6 option as a reply to related IPv6 configuration query.

6. Security Considerations

The "Security Considerations" section of [RFC5460] and [I-D.ietf-dhc-dhcpv6-active-leasequery]details the threats to DHCPv6 Bulk Leasequery and Active Leasequery especially additional concerns for the use of TCP. In this document, DHCPv4 leasequery messages are encapsulated in the defined option. In order to bypass firewalls or network authentication gateways, a malicious attacker may leverage this feature to convey other messages using DHCPv6 leasequery message.

It is possible for a rogue host to reply as a DHCP4o6 leasequery requestor, which may get configuration of the network. Or there is a rogue server to provide false lease, which may misdirect requestor. Requestors and DHCP4o6 servers may use TLS or other authentication methods to protect the leasequery process.

7. References

7.1. Normative References

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