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T. Lemon
Nominum, Inc.
H. Deng
L. Huang
China Mobile

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Relay Agent Encapsulation for DHCPv4
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Abstract

This document describes a general mechanism whereby DHCP relay agents can encapsulate DHCP packets that they are forwarding in the direction of DHCP servers, and decapsulate packets that they are forwarding toward DHCP clients, so that more than one relay agent can insert relay agent suboptions into the forwarding chain.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

In some networking environments, it is useful to be able to configure relay agents in a hierarchy, so that information from a relay agent close to the client can be combined with information from one or more relay agents closer to the server, particularly in cases where the relay agents may be in separate administrative domains.

The current Relay Agent Information Option (RAIO) specification [RFC3046] specifies that when a relay agent receives a packet containing an RAIO, it must not add an RAIO. This prevents chaining of RAIOs, and hence prohibits the hierarchical use case.

DHCP version 6 [RFC3315] provides a much cleaner technique for providing RAIO suboptions to the DHCP server. Rather than appending an information option to the DHCP client's message, the relay agent encapsulates the DHCP client message in a new DHCP message which it sends to the DHCP server along with any options it chooses to add to provide information to the DHCP server.

This document specifies a mechanism for providing the same functionality in DHCPv4.

1.1. 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].

1.2. Terminology

The following terms and acronyms are used in this document:

BOOTREPLY message	Any DHCP or BOOTP message in which the 'op' field is set to BOOTREPLY.
BOOTREQUEST message	Any DHCP or BOOTP message in which the 'op' field is set to BOOTREQUEST.
DHCP	Dynamic Host Configuration Protocol Version 4 [RFC2131]
decapsulate	the act of de-encapsulating DHCP packets being relayed from DHCP servers or relay agents in the direction of DHCP clients, according to this specification.

encapsulate	the act of encapsulating DHCP packets that are being relayed from DHCP clients or relay agents toward DHCP servers, according to the method described in this specification.
encapsulating relay agent	a relay agent that implements this specification and is configured to encapsulate.
L2RA	Layer 2 Relay Agent--a relay agent that doesn't have an IP address reachable by the DHCP server.
L3RA	Layer 3 Relay Agent--a relay agent that has an IP address reachable by the DHCP server.
option buffer	the portion of the DHCP packet following the magic cookie in the 'vend' field of the DHCP Packet.
RAIO	Relay Agent Information Option [RFC3046]. Also commonly referred to as "Option 82."
RAIO suboption	a DHCP suboption that has been defined for encapsulation in the Relay Agent Information Option
relay message	a RELAYFORWARD or RELAYREPLY message.
RELAYFORWARD message	Any DHCP or BOOTP message in which the 'op' field is set to RELAYFORWARD.
RELAYREPLY message	Any DHCP or BOOTP message in which the 'op' field is set to RELAYREPLY.
silently discard	in many places in this specification, the implementation is required to silently discard erroneous messages. What is meant by 'silently discard' is that the implementation MUST NOT send any ICMP message indicating that the delivery was in error. It may be desirable for the implementation to keep a count of messages that have been discarded, either by message type or by reason for discarding, or some combination. Nothing in this specification should be construed to forbid such data collection.

2. Protocol Summary

This document specifies two new BOOTP message types: the RELAYFORWARD message, and the RELAYREPLY message. These messages are analogous to the Relay Forward and Relay Reply messages in DHCPv6 [RFC3315].

Although this specification is generally aimed at DHCP implementations, it is not specifically restricted to DHCP, and is applicable to BOOTP in cases where the BOOTP server is a DHCP server that implements this specification, or the less likely case that the BOOTP server only supports the BOOTP protocol, but still implements this specification.

In general, when the term "DHCP" appears in this specification, the reader should not read this as intending to exclude BOOTP.

2.1. RELAYFORWARD Message

Conforming relay agents encapsulate messages being sent toward DHCP servers in RELAYFORWARD messages.

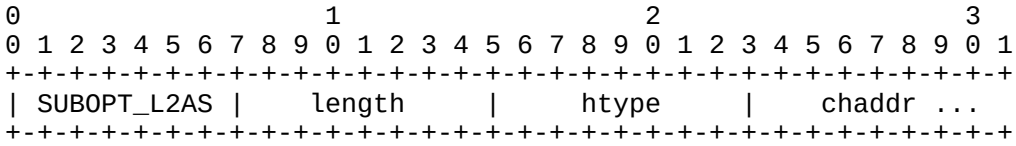
2.2. RELAYREPLY Message

A conforming DHCP server encapsulates any message being sent toward a DHCP client in a RELAYREPLY message, if the message being responded to was encapsulated.

A conforming relay agent, when it receives a RELAYREPLY message, decapsulates the message contained in the RELAYREPLY message and sends it to the next relay or to the client.

2.3. Layer Two Address suboption

In cases where the closest relay agent to the client is an L2RA, but where there is an L3RA on the path to the client, the DHCP server will encode the link layer address that would normally go in the chaddr field of the DHCP packet into a Layer Two Address suboption.



The Layer Two Address suboption has four fields:

SUBOPT_L2AS One octet: the suboption code for the Layer Two Address suboption (TBD).

length One octet: the length of the Layer Two Address suboption.

htype One octet: the type of the Layer Two Address suboption-- corresponds to the 'htype' field in a non-relay DHCP or BOOTP message.

chaddr One or more octets: the layer two address of the client, from the 'chaddr' field of the DHCP or BOOTP message.

3. Encoding

RELAYFORWARD and RELAYREPLY messages are distinguished through the use of the 'op' field of the DHCP packet.

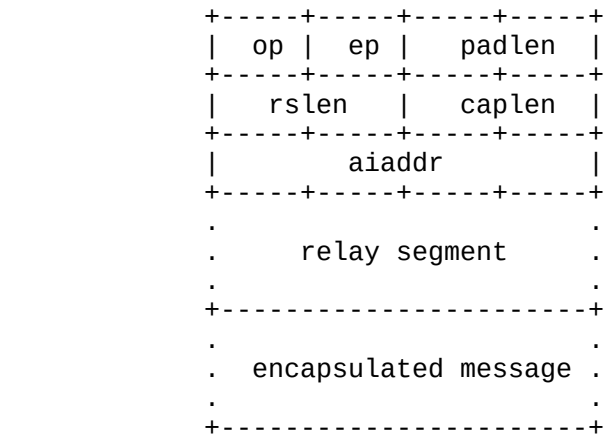
In non-relay DHCP packets, the 'op' field either contains BOOTREQUEST, for any DHCP message from the client to the server, or BOOTREPLY, for any DHCP message from the server to the client.

This document defines two additional codes, RELAYFORWARD and RELAYREPLY. Conforming DHCP servers and DHCP relay agents MUST support these two new values for the 'op' field. DHCP clients should never see either value.

code	meaning
1	BOOTREQUEST
2	BOOTREPLY
3	RELAYFORWARD
4	RELAYREPLY

Values for the 'op' field

RELAYFORWARD and RELAYREPLY messages share only the 'op' field in common with other DHCP and BOOTP messages. The remainder of the message consists of a series of fixed-length fields followed by two variable-length fields: the relay segment, and the encapsulated message.



3.1. The fixed-length header

The fixed-length header of the relay message contains a series of fields that perform two purposes: to provide enough information that the DHCP server can reconstruct the original packet sent by the DHCP client, and to establish the lengths of the two variable-length segments.

To satisfy the first of these requirements, two fields in the fixed-length header report the amount of padding stripped from the client message, if any, and whether or not an end option was stripped from the client message. Except for a relay message that immediately encapsulates a message from a DHCP client, these fields are always zero. Using these two fields, the DHCP server can reconstruct the client packet exactly, and this allows the DHCP server to validate any signature [RFC3118] that may be present.

The fixed-length header consists of five fields:

op The BOOTP 'op' field, which, for a relay message, MUST contain the RELAYFORWARD or RELAYREPLY code.

ep If an End option was present in the option buffer prior to encapsulation, this field is set to 1; otherwise, it is set to 0. This field is a single byte.

padlen The length of any padding that was removed from the option buffer prior to encapsulation: two bytes in network byte order.

rslen The length of the relay segment: two byte in network byte order.

caplen The length of the encapsulation segment: two byte in network byte order.

aiaddr Relay agent IP address.

3.2. Relay Segment

The relay segment contains any RAIO suboptions that the encapsulating agent (the relay agent or the DHCP server) wishes to send. End and Pad options MUST NOT appear in the relay segment.

3.3. Encapsulation Segment

The encapsulation segment contains the entire DHCP message being encapsulated, with four exceptions:

- The encapsulating agent MUST omit the IP and UDP headers, as well as any layer two header, from the encapsulated message.
- The encapsulating agent MUST omit any options following the first End option in the option buffer. These options are assumed to be garbage, and are not covered by any signature [RFC3118].
- The encapsulating MUST omit any Pad options present either at the end of the option buffer, or prior to the first End option, that are followed only by other Pad options or a single End option. The encapsulating agent MUST record number of Pad options that were omitted in the 'padlen' field of the message header.
- The encapsulating agent MUST omit the End option, if present. The encapsulating agent MUST set the 'ep' field in the message header to 1 if an End option was present in the option buffer, and to zero if no End option was present.

These exceptions apply only to the option buffer. The encapsulating agent MUST NOT modify the contents of the 'file' and 'sname' fields. The encapsulating agent MUST NOT count End or Pad options that appear in these fields.

4. DHCP Relay Agent Behavior

DHCP Relay agents implementing this specification MUST have a configuration parameter controlling relay encapsulation. By default, relay encapsulation MUST be disabled.

Relay agents with encapsulation disabled MUST NOT encapsulate. Relay agents with encapsulation disabled MUST NOT decapsulate.

In any case where a relay agent implementing this specification does not encapsulate or decapsulate, it MUST behave exactly as a relay agent that does not implement this specification at all.

DHCP relay agents that are configured with encapsulation enabled, but which have no agent-specific options to send to the DHCP server, MUST encapsulate. Relay agents that are configured with encapsulation enabled MUST decapsulate.

Layer two relay agents MUST silently discard any messages that contains an IPsec authentication header [RFC4302]. This is because they cannot modify such messages, but also cannot detect that a message from the DHCP server is in response such messages, since the response message might not contain an IPsec authentication header.

If a relay message would exceed the MTU of the outgoing interface, it MUST be discarded, and an error condition SHOULD be logged.

4.1. Packet processing

Relay agents implementing this specification may receive packets directed toward DHCP servers with a source port of 67 (BOOTPS). Therefore, the source port cannot be used to determine whether the packet is traveling toward a DHCP server or toward a DHCP client.

In order to determine whether a message is traveling toward a DHCP client or toward a DHCP server, the relay agent must check the 'op' field of the DHCP message. If the 'op' field is set to BOOTREQUEST or RELAYFORWARD, the message is traveling toward a DHCP server. If the 'op' field is set to BOOTREPLY or RELAYREPLY, the message is traveling toward a DHCP client. At the time of the writing of this specification, no other value is meaningful in the 'op' field.

Relay agents implementing this specification MUST NOT encapsulate or decapsulate messages with other values in the 'op' field. It is assumed that if meanings are defined for additional values, the document that specifies the meaning of those values will update this document; in the absence of such an update, the behavior specified here will remain in effect.

Relay agents implementing this specification MAY differentiate between DHCP and BOOTP messages. Under normal circumstances, BOOTP and DHCP messages are forwarded to the same server, which should be able to successfully decapsulate both DHCP and BOOTP messages. However, some relay agents may send BOOTP and DHCP packets to

different servers; this document should not be construed to require that such a relay agent should encapsulate all messages regardless of protocol.

4.1.1. Packets traveling toward DHCP servers

Any DHCP or BOOTP packet with an 'op' value of BOOTREQUEST or RELAYFORWARD is traveling toward a DHCP server. When a DHCP relay agent that is configured to encapsulate receives such a packet, the relay agent MUST encapsulate that packet into a RELAYFORWARD message and send it to the address or addresses with which it is configured to forward messages intended for DHCP servers.

4.1.2. Packets traveling toward DHCP clients

Any DHCP or BOOTP packet with an 'op' value of BOOTREPLY or RELAYREPLY is traveling toward a DHCP client. When a DHCP relay agent that is configured to encapsulate recieves a RELAYREPLY message that is traveling toward a DHCP or BOOTP client, the relay agent MUST decapsulate that message and forward the decapsulated message toward the client.

4.1.3. Anti-spoofing

Because this specification allows for chaining of relay agent-supplied information, it is now possible for a relay agent outside of the trusted portion of a network to communicate relay agent information to the DHCP server without preventing the legitimate relay from communicating return path information to the DHCP server, as is the case with RFC3046.

In order to prevent this sort of spoofing, relay agents implementing this specification MUST be configurable to discard all RELAYFORWARD messages that they receive. Administrators relying on a trusted network architecture to control the flow of information to the DHCP server SHOULD configure relay agents on the edge of their networks to discard RELAYFORWARD messages.

4.2. Constructing RELAYFORWARD messages

4.2.1. Initializing the fixed-length header

The relay agent constructs the RELAYFORWARD message by constructing the fixed-length header as specified in the earlier section titled 'Encoding'. The relay agent MUST set the 'op' field to a value of RELAYFORWARD.

If the relay agent is not a layer two relay agent

[I-D.ietf-dhc-l2ra], it MUST store one of its own IP addresses in the 'aiaddr' field. This address MUST be a valid IP address that is reachable by the next hop relay(s) or DHCP server(s) to which the relay agent is configured to forward.

DHCP servers normally use the relay agent IP address to determine on what link the DHCP client's IP address should be allocated. In some cases, the value stored in the 'aiaddr' field will not be a valid IP address on the link on which the source message was received. In this case, the relay agent MUST include a link selection suboption [RFC3527] that identifies that link in the relay segment.

If the relay agent is a layer two relay agent, it MAY include a link selection suboption in the relay segment.

If the message being encapsulated is a BOOTREQUEST, L2RAs MUST store a value of zero in the 'aiaddr' field. Otherwise, the L2RA MUST copy the value of the 'aiaddr' field in the RELAYFORWARD message being encapsulated into the 'aiaddr' field of the RELAYFORWARD message that it generates.

The 'rslen' field depends on the length of the relay segment. The 'caplen', 'padlen' and 'ep' values in the fixed header are initialized differently depending on whether the message being encapsulated is a BOOTREQUEST or a RELAYFORWARD message.

4.2.2. Initializing the relay segment

Following the fixed header, the relay agent MUST append any RAIO suboptions it wishes to send to the DHCP server; this is the 'relay segment'. It MUST store the length of the relay segment in the 'rslen' field of the fixed header.

The relay agent SHOULD include a Relay Agent ID suboption [I-D.ietf-dhc-relay-id-suboption] in the relay segment to identify itself to the DHCP server.

4.2.3. Fixed header settings for RELAYFORWARD messages

If the message being encapsulated is a RELAYFORWARD message, the relay agent MUST initialize the 'caplen' field of the fixed header to the length of the source message, excluding any layer 2, IP and UDP headers. It MUST append the contents of the message, again excluding any layer 2, IP or UDP headers, to the new message. It MUST initialize the 'ep' and 'padlen' fields in the fixed header of the new message to zero.

4.2.4. Fixed header settings for BOOTREQUEST messages

If the message being encapsulated is a BOOTREQUEST message, the relay agent determines the length of the encapsulation segment by scanning forward across the option buffer of the source message, beginning with the first option in the option buffer, until an End option is reached, or the end of the buffer is reached. The difference between the offset of this location in the message and the offset of the first location following the UDP header of the message is the length of the message to be relayed.

If an End option terminated the scan, the relay agent MUST set the value of the 'ep' field in the fixed header to one. Otherwise, the relay agent MUST set the value of the 'ep' field to zero.

The relay agent MUST count all of the Pad options that follow the last option in the option buffer that is neither a Pad nor an End option. The relay agent MUST store this count in the 'padlen' field of the fixed header.

The relay agent MUST store the difference between the value stored in 'padlen' and the length of the message to be relayed in the 'caplen' field of the fixed header.

4.2.5. Initializing the encapsulation segment

The relay agent MUST copy the portion of the message being encapsulated that immediately follows the UDP header into the RELAYFORWARD message being generated. The length of the data being copied is the value that was stored in 'caplen'.

4.3. Decapsulating RELAYREPLY messages

To decapsulate a RELAYREPLY message, the relay agent creates a decapsulated message, processes any RAIO suboptions it recognizes in the relay segment, and forwards the decapsulated message to its destination.

4.3.1. Processing relay agent suboptions

The suboptions parsed from the relay segment are processed by the relay agent as specified in the Relay Agent Information Option specification [RFC3046], as well as in any documents that define suboptions to the Relay Agent Information Option. A current list of DHCP Relay Agent suboptions and the documents that define them can be located in the IANA protocol registry for Bootp and DHCP parameters, in the section titled "DHCP Relay Agent Sub-Option Codes."

4.3.2. Constructing the decapsulated message

To construct a decapsulated message, the relay agent copies the portion of the RELAYREPLY message following the relay segment, with a length specified in the 'caplen' field of the fixed-length header, into the new message.

4.4. Retransmitting modified messages

If the relay agent did not modify the message either by encapsulating or decapsulating it, it retransmits the message according to existing practice.

Otherwise, how the modified message is transmitted to its next destination depends on two factors. First, is the relay agent that modified the message a layer two [I-D.ietf-dhc-l2ra] relay agent or a layer three [RFC1542] relay agent? Second, is the modified message a BOOTREPLY message, a RELAYREPLY message, or some other message?

4.4.1. Layer two relay agents

There are two special aspects to the handling of relayed packets in Layer Two Relay Agents (L2RAs). The first is the construction of the layer two, IP and UDP headers on the packet. The second is how the L2RA makes the forwarding decision.

4.4.1.1. Constructing the headers

The L2RA constructs the headers on the relayed packet by copying and, as necessary, modifying the headers from the original packet.

If there is a layer two header, the L2RA MUST copy this header in accordance with the needs of the particular layer two implementation it is using. If the header contains a packet length field, the L2RA MUST adjust the value in the packet length field. If the header contains a non-secure integrity check such as a CRC or checksum that covers the entire packet, the L2RA MUST recompute this value.

L2RA encapsulation in cases where the layer two contains a secure integrity check must either construct a new integrity signature, or else remove the integrity signature. If neither of these is possible, the L2RA MUST silently discard the packet.

The L2RA MUST copy the IP header without modification except length and checksum field which should be recomputed. If the IP header contains any sort of secure integrity check on the packet, the L2RA MUST silently discard the packet.

The L2RA MUST copy the UDP header and adjust the 'Length' field [RFC0768]. If the contents of the 'Checksum' field are not zero, the L2RA MUST compute a new checksum according to the algorithm specified in User Datagram Protocol. [RFC0768]

4.4.1.2. Forwarding the modified packet

Ordinarily when a layer two device forwards a packet, it simply copies that packet from the interface on which it was received and transmits it, unchanged, on one or more interfaces other than that interface. The mechanism used to choose which interfaces it forwards the packet to is beyond the scope of this document.

Once a DHCP packet has been modified by the L2RA either as an encapsulation or a decapsulation, the L2RA must forward it either toward the DHCP server or the DHCP client. The implementation has two options: transmit the packet as it would transmit any other packet, or use its configuration and/or information in the relay header to direct the packet out a particular interface.

The details of ordinary packet forwarding in devices that implement L2RA is beyond the scope of this document.

When processing a RELAYREPLY message, the L2RA MAY use information in the relay segment of the RELAYREPLY to determine on which network interface the RELAYREPLY should be forwarded.

When processing any other message, the L2RA MAY use configuration information to direct the packet out a specific port or ports that have been marked as reaching DHCP servers. The L2RA MUST NOT forward any packet on the interface on which it was received, even if that interface is so marked.

4.4.2. Layer three relay agents

4.4.2.1. Transmitting a decapsulated RELAYREPLY message

When the decapsulated message is itself a RELAYREPLY message, the relay agent MUST forward the decapsulated message to the IP address specified in the 'aiaddr' field of the fixed-length header.

If the relay segment of the packet that was decapsulated contains a Link Layer Address suboption, the relay agent MUST transmit the packet to that link layer address without attempting to use Address Resolution Protocol (ARP) to translate the address contained in 'aiaddr' to a layer two address.

4.4.2.2. Transmitting a decapsulated BOOTREPLY message

When transmitting a decapsulated BOOTREPLY message, the relay agent transmits the message as specified in Bootstrap Protocol, Section 4 [RFC0951].

4.4.2.3. Transmitting other messages

When transmitting RELAYFORWARD and BOOTREQUEST messages, the relay agent simply sends the message to the IP address or addresses configured as DHCP servers for that relay agent.

5. DHCP Server Behavior

A DHCP server which receives a RELAYREPLY message MUST silently discard that message.

5.1. Receiving RELAYFORWARD messages

DHCP servers that implement this specification MUST decapsulate RELAYFORWARD messages.

5.1.1. Decapsulation

By design, this specification supports multiple layers of encapsulation. The DHCP server implementation therefore MUST decapsulate each layer and retain the information in that layer, organized so that the ordering of the encapsulation is available both during packet processing, and when constructing the reply.

Aside from the necessity of handling an RAIO differently than an encapsulation when constructing a RELAYREPLY message, DHCP servers MUST NOT, by default, treat relay suboptions received in an RAIO any differently than relay suboptions received in an encapsulation.

It is not the goal of this specification to define a particular implementation strategy or data structure for representing the encapsulation, so long as the ability to process the options and suboptions as required below is preserved. Implementations MAY provide means for addressing the contents of relay segments and of the inner encapsulation segment in any convenient form, as long as it conforms generally to the requirements of this document.

5.1.2. Processing of decapsulated suboptions

This section specifies requirements for the processing of decapsulated relay suboptions in the default case, where no custom

processing has been specified. This should not be construed to forbid implementations for providing mechanisms for customizing the processing of these suboptions.

This document does not specify special handling for DHCP options. Only the inner encapsulation--the encapsulation of the original message sent from the client, which is done by the first encapsulating relay--can ever contain DHCP Options; hence, whatever normal mechanisms a DHCP server provides for processing these options should suffice.

Some relay agent suboptions, such as the Relay Agent Subnet Selection suboption [RFC3527], are intended to be processed by DHCP servers. Others, like the Circuit ID and Remote ID [RFC3046] suboptions, were not intended to be processed by the DHCP server, but are often used by the DHCP server for identification purposes.

In cases where more than one relay agent sends the same suboption, the DHCP server must either factor all such suboptions into its processing, or choose one such suboption and use that exclusively for processing.

By default, DHCP servers MUST use the outermost suboption (the one added by the relay agent closest to the DHCP server) for every suboption that was sent by more than one relay agent.

5.1.3. Address allocation

During normal processing, DHCP servers use a variety of data to determine where the DHCP client is in the network topology. These data are provided by relay agents. In the absence of any relay-agent-provided topology data, the DHCP server assumes that the client is connected to the link on which the message was received.

One datum used by DHCP servers in locating the client is the value of the 'giaddr' field of the BOOTP header. This specification eliminates the use of giaddr; hence, it cannot be used in the address allocation decision.

The functionality provided by giaddr is replaced in this specification by the 'aiaddr' field in the fixed-length relay header.

5.1.3.1. Default link selection algorithm

DHCP servers MUST implement a default algorithm for determining the link to which the client is attached. This algorithm is to first search the client message for a subnet selection option [RFC3011].

The server next searches for link-identifying data in each RELAYFORWARD encapsulation, starting from the inner most and ending at the outermost, until a RELAYFORWARD is found that identifies the client's location.

A RELAYFORWARD encapsulation contains link-identifying data if the value of the 'aiaddr' field of the fixed-length header is not zero, or if the relay segment contains a Link Selection suboption [RFC3527].

If a Link Selection suboption is present in the innermost RELAYFORWARD message containing link-identifying data, the DHCP server MUST use the contents of that option to identify the link to which the client is connected.

Otherwise, if a Subnet Selection option was found in the client message, the DHCP server MUST use the contents of that option to identify the link to which the client is connected.

Otherwise, the DHCP server MUST use the contents of the 'aiaddr' field in the RELAYFORWARD encapsulation that was identified as being the innermost RELAYFORWARD containing link-identifying data.

5.1.3.2. Other link selection algorithms

DHCP servers implementing this specification MAY implement link selection algorithms other than the one described in the preceding section. DHCP servers MUST NOT use any link selection algorithm other than the one described in the preceding section unless specially configured to do so.

5.2. Responding to RELAYFORWARD messages

Once the DHCP server has processed the encapsulated message from the DHCP client and constructed a response to the DHCP client, it constructs a RELAYREPLY message and sends it toward the client.

5.2.1. Constructing a RELAYREPLY encapsulation

The server MUST encapsulate any response to a client message contained in one or more RELAYFORWARD encapsulations in a set of corresponding RELAYREPLY encapsulations. Each RELAYREPLY is nested in the same way that the corresponding RELAYFORWARD was nested, so that the innermost RELAYREPLY corresponds to the innermost RELAYFORWARD, and the outermost RELAYREPLY corresponds to the outermost RELAYFORWARD.

5.2.1.1. Constructing the relay segments

The server MUST copy every suboption that appeared in the relay segment of the RELAYFORWARD encapsulation into corresponding outgoing RELAYREPLY encapsulation's relay segment. The server SHOULD NOT preserve the order of options from the incoming relay segment to the outgoing relay segment.

If the message encapsulated by a particular RELAYREPLY encapsulation is not a RELAYREPLY, or if the message encapsulated by that RELAYREPLY is a RELAYREPLY, but the 'aiaddr' field of the fixed-length header of the inner RELAYREPLY has a value of zero, the DHCP server MUST include a Layer Two Address suboption in the relay segment. The DHCP server MUST set the 'htype' field of the Layer Two Address suboption to the value of 'htype' in the client message. The DHCP server MUST set the 'chaddr' field in the Layer Two Address suboption to the value of the 'chaddr' field in the client message.

5.2.1.2. Constructing the fixed-length header

The server MUST set the values of 'ep' and 'padlen' in the fixed-length header to zero. The server MUST set the value of 'caplen' to the length of the message encapsulated in the RELAYREPLY encapsulation being constructed. The server MUST set the value of 'rslen' to the length of the relay segment of the RELAYREPLY encapsulation being constructed.

If the message encapsulated in the RELAYREPLY being constructed is a RELAYREPLY, and the 'aiaddr' field of the RELAYFORWARD encapsulation corresponding to the inner RELAYREPLY is not zero, the DHCP server MUST copy the value from that 'aiaddr' field to the 'aiaddr' field of the RELAYREPLY being constructed.

Otherwise, if the BROADCAST bit in the 'flags' field of the inner message is set to 1, or 'ciaddr' is zero and 'yiaddr' is also zero, the DHCP server MUST set the value of 'aiaddr' to 255.255.255.255. If 'ciaddr' is not zero, the DHCP server must copy that value to 'aiaddr'. If 'ciaddr' is zero and 'yiaddr' is not, the DHCP server MUST copy the value of 'yiaddr' to 'aiaddr'.

5.2.2. Transmission of RELAYREPLY messages

If the value of 'aiaddr' in the outermost RELAYFORWARD encapsulation to which the RELAYREPLY is a response is nonzero, the DHCP server MUST transmit the RELAYREPLY to that IP address.

Otherwise, if 'ciaddr' and 'yiaddr' are both zero, or the BROADCAST bit in the 'flags' field is set to 1, or the DHCP server

implementation is not able to perform the ARP-cache preloading trick described in Bootstrap Protocol, Section 4 [RFC0951], the DHCP server MUST broadcast the RELAYREPLY message to the 255.255.255.255 broadcast address.

Otherwise, the DHCP server MUST use the value of 'ciaddr', if nonzero, or 'yiaddr', otherwise, as the destination address for the message, and MUST preload its ARP cache (or otherwise arrange to transmit the message without using ARP) to the layer two address provided by the client in 'htype' and 'chaddr' and 'hlen'.

5.3. Responding to messages other than RELAYFORWARD

When a DHCP server constructs a response to a DHCP client message that did not arrive encapsulated in a RELAYFORWARD message, the DHCP server MUST NOT encapsulate the response in a RELAYREPLY message. DHCP server implementors should be careful that their servers do not respond to an incoming packet with RAIO from a non-conforming relay agent with a RELAYREPLY message.

6. DHCP Client Behavior

A DHCP client that receives either a RELAYFORWARD message or a RELAYREPLY message MUST silently discard that message.

7. Security Considerations

DHCP Relay Information Option [RFC3046] limits relay agent information to a single relay agent, and provides some minimal anti-spoofing. By supporting relay agent chaining, it is now possible for a relay agent downstream of the trusted portion of a provider network to communicate relay agent information options to a DHCP server.

This specification defines a much more robust spoofing rejection mechanism, by allowing the administrator to configure the relay to discard RELAYFORWARD messages originating from outside of the trusted portion of the network. Administrators of networks that rely on this trusted/untrusted configuration are encouraged to configure edge relays to discard RELAYFORWARD messages.

In networks where trusted relay agents may be separated from the DHCP server by transit networks that are not trusted, it is possible to modify the message in transit. This possibility exists with normal DHCP relays as well. Administrators of such networks should consider using relay agent authentication [RFC4030] to prevent modification of relay agent communications in transit.

8. IANA Considerations

We request that IANA assign one new suboption code from the registry of DHCP Agent Sub-Option Codes maintained in http://www.iana.org/assignments/bootp-dhcp-parameters. This suboption code will be assigned to the Layer Two Address Suboption.

9. References

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Authors' Addresses

Ted Lemon
Nominum, Inc.
2000 Seaport Blvd
Redwood City, CA 94063
USA

Phone: +1 650 381 6000
Email: mellon@nominum.com

Hui Deng
China Mobile
53A, Xibianmennei Ave.
Beijing, Xuanwu District 100053
China

Email: denghui@chinamobile.com

Lu Huang
China Mobile
53A, Xibianmennei Ave.
Xunwu District, Beijing 100053
China

Email: huanglu@chinamobile.com