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Generalized UDP Source Port for DHCP Relay  
draft-ietf-dhc-relay-port-03

## Abstract

This document proposes an extension to the DHCP and DHCPv6 protocols that allows any valid number to be used as the relay agent's UDP source port for DHCP packets.

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Internet-Draft

DHCP Relay Source Port

April 2017

Table of Contents

- [1.](#) Introduction . . . . . [2](#)
- [1.1.](#) Requirements Language . . . . . [3](#)
- [2.](#) Terminology . . . . . [3](#)
- [3.](#) Changes to DHCP and DHCPv6 Specifications . . . . . [3](#)
- [3.1.](#) Changes to DHCP in [RFC 2131](#) . . . . . [4](#)
- [3.2.](#) Changes to DHCPv6 in [RFC 3315](#) . . . . . [4](#)
- [4.](#) Relay Source Port Sub-option and Option . . . . . [4](#)
- [4.1.](#) Source Port Sub-option for DHCP . . . . . [5](#)
- [4.2.](#) Relay Source Port Option for DHCPv6 . . . . . [5](#)
- [5.](#) Relay Agent and Server Behavior . . . . . [6](#)
- [5.1.](#) DHCP . . . . . [6](#)
- [5.2.](#) DHCPv6 . . . . . [6](#)
- [5.3.](#) Compatibility . . . . . [7](#)
- [6.](#) A DHCPv6 Cascaded Relay Example . . . . . [7](#)
- [7.](#) IANA Considerations . . . . . [8](#)
- [8.](#) Security Considerations . . . . . [8](#)
- [9.](#) Acknowledgments . . . . . [8](#)
- [10.](#) Document Change Log . . . . . [9](#)
- [10.1.](#) Changes to [draft-ietf-dhc-relay-port-03](#) . . . . . [9](#)
- [10.2.](#) Changes to [draft-ietf-dhc-relay-port-02](#) . . . . . [9](#)
- [10.3.](#) Changes to [draft-ietf-dhc-relay-port-01](#) . . . . . [9](#)
- [10.4.](#) Changes to [draft-ietf-dhc-relay-port-00](#) . . . . . [9](#)
- [11.](#) Normative References . . . . . [9](#)
- Authors' Addresses . . . . . [10](#)

[1.](#) Introduction

[RFC 2131](#) [[RFC2131](#)] and [RFC 3315](#) [[RFC3315](#)] specify the use of UDP as the transport protocol for DHCP and DHCPv6. They also define both the server side and client side port numbers. The DHCP server port is UDP number (67) and the client port is UDP number (68); for DHCPv6 the server port is (546) and the client port is (547).

This fixed UDP port of DHCP protocol scheme creates challenges in certain DHCP relay operations. For instance, in a large scale DHCP relay implementation on a single switch node, the DHCP relay functionality may be partitioned among multiple relay processes. All these DHCP relay processes may share the same IP address of the switch node. If the UDP source port has to be a fixed number as currently specified, the transport socket operation of DHCP packets would need to go through a central entity or process which would

defeat the purpose of distributing DHCP relay functionality.

In some large-scale deployment, the decision to split the DHCP functionality into multiple processes on a node may not be purely

based on DHCP relay computational load. But rather DHCP relay could just be one of the functions in a multi-process implementation.

Although assigning a different IP/IPv6 source address for each DHCP relay process can be a solution, it would introduce operational and network management complexities, especially given the scarceness of the IPv4 addresses.

This document proposes an extension to relax the fixed UDP source port requirement for the DHCP relay agents. This extension requires a DHCP server or relay agent, in the case of cascaded relay agents [[RFC3315](#)], to remember the inbound packet's UDP port number along with the IP/IPv6 address. The DHCP server when sending back replies MUST use the UDP port number that the incoming relay agent uses instead of the fixed DHCP port number.

### [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](#)].

## [2](#). Terminology

**Downstream Device:** In the DHCP relay context, it refers to the next relay agent for forwarding Relay-reply Messages.

**Upstream Device:** In the DHCP relay context, it refers to the next relay agent or DHCP server for forwarding Relay-forward Messages.

**Relay Source Port:** This is the UDP port that a relay agent uses to receive Relay-forward Messages from an upstream device.

**Downstream Source Port:** This is the UDP port that the downstream device uses when forwarding Relay-forward Messages to this

relay agent device. This UDP port is to be used by this relay agent device when forwarding the Relay-reply Messages to that downstream device.

Non-DHCP UDP Port: Any valid UDP port other than port 67 for DHCP and port 547 for DHCPv6.

### 3. Changes to DHCP and DHCPv6 Specifications

Shen & Chen

Expires October 13, 2017

[Page 3]

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Internet-Draft

DHCP Relay Source Port

April 2017

#### 3.1. Changes to DHCP in [RFC 2131](#)

[Section 4.1 of RFC 2131](#) [[RFC2131](#)] specifies that:

DHCP uses UDP as its transport protocol. DHCP messages from a client to a server are sent to the 'DHCP server' port (67), and DHCP messages from a server to a client are sent to the 'DHCP client' port (68).

This specification adds the following extension to the above paragraph.

DHCP messages from a relay agent to a server are sent to the 'DHCP server' port (67), and the UDP source port it uses can be any valid UDP port available in the relay system, including the DHCP port 67. The default port number is 67 if there is no explicit configuration for the generalized source UDP port extension for DHCP relay.

#### 3.2. Changes to DHCPv6 in [RFC 3315](#)

[Section 5.2 of RFC 3315](#) [[RFC3315](#)] specifies that:

Clients listen for DHCP messages on UDP port 546. Servers and relay agents listen for DHCP messages on UDP port 547.

This specification adds the following extension to the above paragraph.

A DHCP relay agent can listen for DHCP messages from a server or another upstream relay agent device on any valid UDP port available in the relay system including the DHCP UDP port 547. The default UDP port is 547 if there is no explicit configuration for the generalized UDP source port extension for DHCP relay.

#### [4.](#) Relay Source Port Sub-option and Option

Although a DHCP or DHCPv6 server can implicitly determine the UDP source port when it receives a message from a relay agent, this sub-option makes the request explicit for the server to use a non-DHCP UDP port in the reply message. When DHCPv6 cascaded relay agents are involved, the downstream non-DHCP UDP port needs to be recorded using the option.

##### [4.1.](#) Source Port Sub-option for DHCP

The Relay Agent "Source Port Sub-option" is a new option, and it is part of the relay-agent-information option for DHCP [[RFC3046](#)].

The format of the "Source Port Sub-option" is shown below:

```
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| SubOpt Code  |      Len      |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
```

Where:

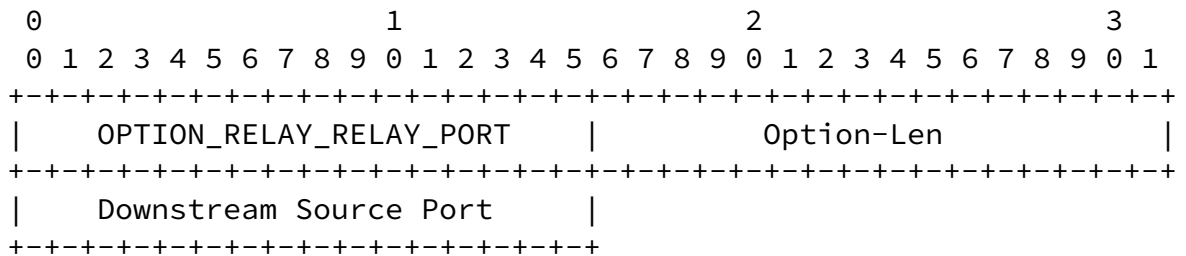
SubOpt Code: SUBOPT\_RELAY\_PORT. 8 bits value, to be assigned by IANA.

Len: 8 bits value to be set to 0.

##### [4.2.](#) Relay Source Port Option for DHCPv6

The "Relay Source Port Option" is a new DHCPv6 option. It MUST be used either by a DHCPv6 relay agent that uses a non-DHCP UDP port communicating with the DHCP server and the upstream relay agent, or by a DHCPv6 relay agent that detects the use of a non-DHCP UDP port by a downstream relay agent.

The format of the "Relay Source Port Option" is shown below:



Where:

Option-Code: OPTION\_RELAY\_RELAY\_PORT. 16 bits value, to be assigned by IANA.

Option-Len: 16 bits value to be set to 2.

Downstream Source Port: 16 bits value. To be set by the DHCPv6 relay either to the downstream relay agent's UDP source port used for the UDP packet, or to zero if only the local relay agent uses the non-DHCP UDP port.

## [5. Relay Agent and Server Behavior](#)

### [5.1. DHCP](#)

When a relay agent uses a non-DHCP UDP port communicating with the DHCP server, it MUST include the "Source Port Sub-option" in Relay-forward messages to indicate that.

When a DHCP server receives a message from a relay agent with the "Source Port Sub-option", it MUST remember the UDP source port of the

message and use that port number as the UDP destination port when sending the reply message to the same relay agent.

## 5.2. DHCPv6

The DHCPv6 relay agent MUST include the "Relay Source Port Option" when it uses a non-DHCP UDP port to communicate to a DHCPv6 server or an upstream DHCPv6 relay agent. Also when a DHCPv6 relay agent detects that a downstream relay agent uses a non-DHCP UDP port in the packet, it MUST record the port number in the "Downstream Source Port" field of this option. If this option is included to indicate only the local non-DHCP UDP port usage and there is no downstream relay agent's non-DHCP UDP port usage, the field Downstream Source Port field MUST be set to zero.

The DHCPv6 relay agent MUST include this option in the following three cases:

- 1) The local relay agent uses a non-DHCP UDP port.
- 2) the downstream relay agent uses a non-DHCP UDP port.
- 3) the local relay agent and the downstream relay agent both use non-DHCP UDP ports.

In the first case, the value of the "Downstream Source Port" field is set to zero. In the other two cases, the value of the field is set to the UDP port number that the downstream relay agent uses.

When a DHCPv6 server receives a Relay-forward message with the "Relay Source Port Option", it MUST copy the option when constructing the Relay-reply chain in response to the Relay-forward message. This option MUST NOT appear in any message other than a Relay-forward or

Relay-reply message. Additionally, the DHCPv6 server MUST check and use the UDP source port from the UDP packet of the Relay-forward message in replying to the relay agent.

When a relay agent receives a Relay-reply message with the "Relay Source Port Option" from a server or from an upstream relay agent, if the "Downstream Source Port" field in the option is non-zero, it MUST use this UDP port number to forward the Relay-reply message to the

downstream relay agent.

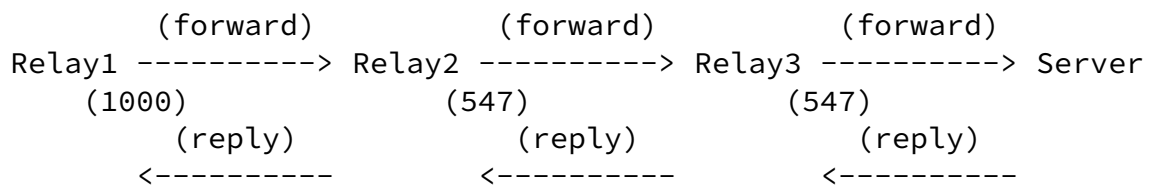
### 5.3. Compatibility

With this source port generalization, the DHCP and DHCPv6 server MUST be upgraded to support the extension specified in this document before the extension is used by a relay agent.

The implementation is advised to allow configuration for relay agent specifying a DHCP relay port number. It can be used to allow the relay agent either using a normal DHCP UDP port or non-DHCP UDP port.

### 6. A DHCPv6 Cascaded Relay Example

An example of DHCPv6 cascaded relay agents with the "Relay Source Port Option" is shown below.



In the above diagram, all the DHCPv6 devices support this generalized UDP source port extension except for Relay3. Relay1 is the only relay agent device uses a non-DHCP UDP port. Relay2 is the upstream device of Relay1.

Both Relay1 and Relay2 include the "Relay Source Port Option" in Relay-forward message. Relay1 sets the "Downstream Source Port" field in the option to zero. Relay2 notices the "Relay Source Port Option" is included in the message from Relay1, and it determines that the UDP source port used by Relay1 is 1000. Relay2 will include the "Relay Source Port Option" and it sets the "Downstream Source Port" field in the option to 1000. The DHCPv6 server copies the



message.

When Relay2 receives the Relay-reply message with the "Relay Source Port Option", it finds the "Downstream Source Port" field has the value of 1000. Relay2 then uses this port number in the UDP packet when sending the Relay-reply message to Relay1.

When Relay1 receives the Relay-reply message with the "Relay Source Port Option", it finds that the "Downstream Source Port" field has the value of zero. Relay1 then uses the normal DHCP port 547 in the packet sending the Relay-reply message to its downstream relay agent or uses UDP port 546 to a DHCPv6 client.

## 7. IANA Considerations

A new sub-option, DHCP Relay Source Port, is defined in this document within the DHCP Relay Agent Information Option. It needs to be assigned by IANA from the DHCP Relay Agent sub-options space [[RFC3046](#)].

A new option, DHCPv6 Relay Source Port, is defined in this document for DHCPv6 and it needs to be assigned by IANA for the DHCPv6 option code.

## 8. Security Considerations

If the network uses firewall to block or allow DHCP packets with both static UDP source and destination port numbers, this may no longer match the packets from new DHCP relay agent and server software. The firewall rules need to be modified only to match the DHCP server side of the UDP port number, and if necessary, IP addresses and other attributes.

## 9. Acknowledgments

The authors would like to thank Peter Arberg, Bhanu Gopalasetty, Andre Kostur, Ted Lemon, and Kishore Seshadri for their review and comments of this document.

The authors would like to thank Bernie Volz for discussions that led to the definition of The Relay Source Port sub-option and DHCPv6 Relay Source Port Option.

The RFC text was produced using Marshall Rose's xml2rfc tool.

## 10. Document Change Log

### 10.1. Changes to [draft-ietf-dhc-relay-port-03](#)

- o Posted the draft in April 2017.
- o Added the "Relay Agent and Server Behavior" section.

### 10.2. Changes to [draft-ietf-dhc-relay-port-02](#)

- o Posted the draft in February 2017.
- o Added the Terminology section.
- o Defined the Sub-option and Option names for DHCP and DHCPv6.
- o Added the DHCPv6 cascaded relay agents example.

### 10.3. Changes to [draft-ietf-dhc-relay-port-01](#)

- o Posted the draft in January 2017.
- o Change the DHCPv6 Relay Source Port Option, UDP Source Port field to Downstream Source Port. Add the option handling mechanism for DHCPv6 server and relay agents.

### 10.4. Changes to [draft-ietf-dhc-relay-port-00](#)

- o Posted first version of working group draft in October 2016.
- o This draft was renamed from [draft-shen-dhc-client-port-03.txt](#).

## 11. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), DOI 10.17487/RFC2119, March 1997, <<http://www.rfc-editor.org/info/rfc2119>>.
- [RFC2131] Droms, R., "Dynamic Host Configuration Protocol", [RFC 2131](#), DOI 10.17487/RFC2131, March 1997, <<http://www.rfc-editor.org/info/rfc2131>>.
- [RFC3046] Patrick, M., "DHCP Relay Agent Information Option", [RFC 3046](#), DOI 10.17487/RFC3046, January 2001, <<http://www.rfc-editor.org/info/rfc3046>>.

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Internet-Draft

DHCP Relay Source Port

April 2017

[RFC3315] Droms, R., Ed., Bound, J., Volz, B., Lemon, T., Perkins, C., and M. Carney, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", [RFC 3315](https://www.rfc-editor.org/rfc/rfc3315), DOI 10.17487/RFC3315, July 2003, <<http://www.rfc-editor.org/info/rfc3315>>.

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