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DHCPv4 over DHCPv6 Source Address Option
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Abstract

DHCPv4 over DHCPv6 [I-D.ietf-dhc-dhcpv4-over-dhcpv6] describes one possible mechanism for dynamically configuring IPv4 over an IPv6 only network. For DHCPv4 over DHCPv6 to function with some softwire mechanisms, the operator must obtain information about the DHCP 4o6 client's allocated IPv4 address and PSID, as well as the /128 IPv6 prefix that the client will use as the source of IPv4-in-IPv6 tunnel. This memo defines a DHCPv6 option to convey this IPv6 prefix between the DHCP 4o6 client and server. It is designed to work in conjunction with the DHCPv4 IPv4 address allocation process message flow.

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].

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

DHCPv4 over DHCPv6 [I-D.ietf-dhc-dhcpv4-over-dhcpv6] describes a mechanism for dynamically configuring IPv4 over an IPv6 only network by transporting the complete set of DHCPv4 messages within a specific pair of DHCPv6 messages. The IPv4 configuration provisioned to the DHCP 4o6 clients is then generally used for configuring IPv4 over IPv6 services. IPv4 addresses can be dynamically leased to DHCP 4o6 clients in the same manner as IPv4 addresses are leased to DHCPv4 clients in IPv4 networks. The main advantages to this approach is a greater efficiency in the use of limited IPv4 address resources over IPv6 networks.

Currently defined IPv4 over IPv6 transition technologies are, by design, quite prescriptive in the location of the tunnel endpoint within the home network. The tunnel endpoint must usually be configured on either the home gateway device, or sourced from a very specific IPv6 tunnel prefix allocated to the home network (and in some cases, both). This is necessary to enable the end-to-end

provisioning chain between the IPv4-over-IPv6 client in the home network, the border router (the egress point from the IPv4 over IPv6 domain to the IPv4-only domain) and the provisioning systems responsible for configuring the functional elements.

The dynamic leasing of IPv4 addresses to clients alters this end-to-end provisioning chain. It can no longer be assumed that a Softwire Initiator sourcing from a specific IPv6 prefix have to use a certain IPv6 address as the source for encapsulating its IPv4 packets. Therefore, a mechanism is necessary to inform the service provider of the binding between the allocated IPv4 address (learnt through DHCPv4) and the IPv6 address that the IPv4 over IPv6 client will use for accessing IPv4-over-IPv6 services. The service provider can then use this binding information to provision other functional elements it their network such as the border router accordingly.

A second benefit of such a mechanism is that it allows much more flexibility in the location of the IPv4 over IPv6 tunnel endpoint as this will be dynamically signalled back to the service provider. The DHCP 4o6 client and tunnel client could be run on end devices attached to any valid IPv6 prefix allocated to an end-user, located anywhere within an arbitrary home network topology.

As The DHCP 4o6 server manages the leasing of IPv4 addresses to the DHCP 4o6 clients, which runs on the Softwire Initiators, it holds the most accurate IPv4 lease information available across the IPv6 network between the server and the client. It follows that the DHCP 4o6 server should also hold information about the /128 IPv6 prefixes that active clients are using, so that the server contains a single, comprehensive and up to date dynamic IPv4/IPv6 binding table.

This memo describes a DHCPv6 option so that the server can indicate to the client a preferred IPv6 prefix to use (if necessary) and for the client to signal back the /128 IPv6 prefix that they will bind the allocated IPv4 configuration to. The DHCP 4o6 server then stores this information alongside the IPv4 lease information.

Current mechanisms suitable for extending to incorporate DHCPv4 over DHCPv6 with dynamic IPv4 address leasing include [I-D.ietf-softwire-map] and [I-D.ietf-softwire-lw4over6]. For these mechanisms to function, the operator needs the information about the DHCP 4o6 client’s allocated IPv4 address, PSID and also the /128 IPv6 prefix that the client will use to source the IPv4-in-IPv6 tunnel endpoint.

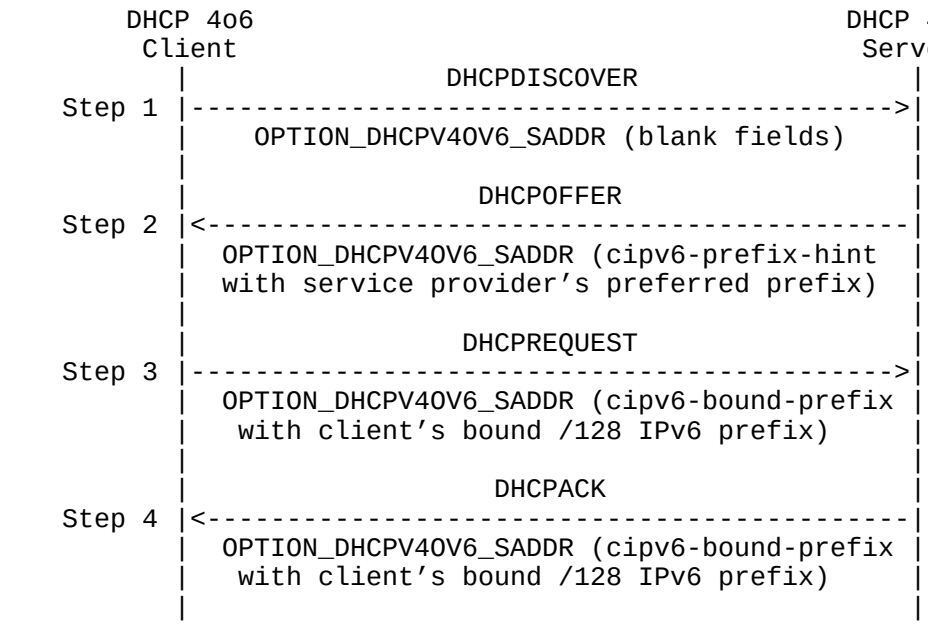
2. Applicabiliity

Although DHCPv4 over DHCPv6 is used as the configuration protocol throughout this document, the DHCPv6 option and provisioning process which is described here may also be used with other DHCP based IPv4 over IPv6 configuration mechanisms, such as DHCPv4 over IPv6 [I-D.ietf-dhc-dhcpv4-over-ipv6].

3. Solution Overview

The DHCPv6 option (OPTION_DHCPV4OV6_SADDR) described by this memo is intended to be used alongside the normal DHCPv4 IPv4 address allocation message flow as described in [RFC2131], in the context of DHCPv4 over DHCPv6 [I-D.ietf-dhc-dhcpv4-over-dhcpv6] . It is a two-way communication process, allowing the service provider to (optionally) indicate to the client a preferred prefix alongside the DHCPOFFER message, which can be used for binding the received IPv4 configuration and sourcing tunnel traffic. When the client has selected the IPv6 prefix to bind the IPv4 configuration to, it passes this back to the DHCP 4o6 server along with the DHCPREQUEST message. This may be necessary if there are multiple IPv6 prefixes in use in the customer network, or if the specific IPv4 over IPv6 transition mechanism requires the use of a particular prefix for any reason.

The following diagram shows the client/server message flow and how the different fields of OPTION_DHCPV4OV6_SADDR are used. In each step, the relevant DHCPv4 message is given above the arrow and the relevant paramaters used in OPTION_DHCPV4OV6_SADDR’s fields below the arrow.



IPv6/IPv4 Binding Message Flow

The OPTION_DHCPV4OV6_SADDR (defined below) option is included by the DHCP 4o6 client within DHCPv4-query messages. The DHCP 4o6 server MAY reply with this option within DHCPv4-response messages.

The DHCP 4o6 Server and Client MAY implement the OPTION_DHCPV4OV6_SADDR option. If used, this option MUST be present within all future DHCPv4 over DHCPv6 transactions.

The option comprises of two prefixes (with associated prefix length fields):

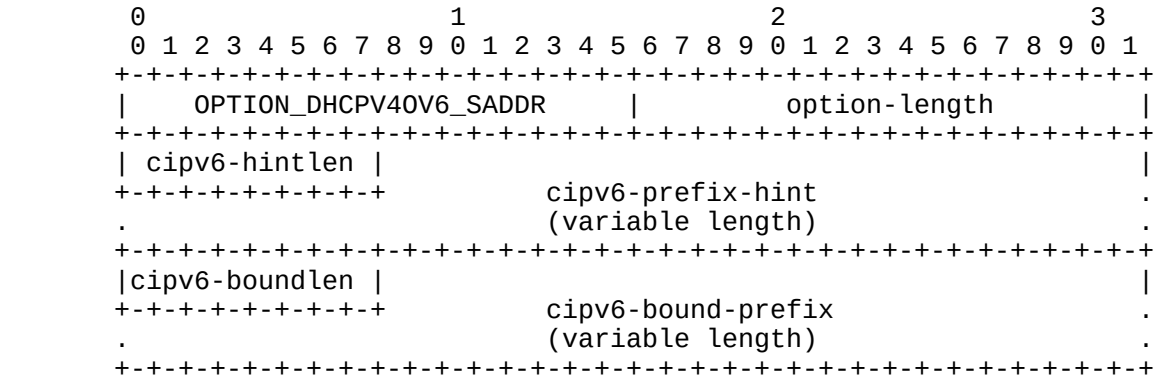
cipv6-prefix-hint Used by the server to indicate a preferred prefix that the client should use to bind IPv4 configuration to. If this field contains a prefix, the client MUST perform a longest prefix match between cipv6-prefix-hint and all prefixes configured on the device. The selected prefix MUST then be used to bind the received IPv4 configuration to. If this field is left blank, then the client can select any valid IPv6 prefix.

cipv6-bound-prefix Used by the client to inform the DHCP 4o6 Server of the IPv6 prefix that it has bound the IPv4

configuration to. This MUST be a /128 prefix configured on the client.

4. DHCPv4 over DHCPv6 Source Address Option

The format of DHCPv4 over DHCPv6 Source address option is defined as follows:



- option-code: OPTION_DHCPV4OV6_SADDR (TBA)
- option-length: 2 + length of cipv6-prefix-hint + length of cipv6 -bound-prefix, specified in bytes.
- cipv6-hintlen: 8-bit field expressing the bit mask length of the IPv6 prefix specified in cipv6-prefix-hint.
- cipv6-prefix-hint: The IPv6 prefix that the server uses to indicate the preferred prefix that the client should use to bind IPv4 configuration to.
- cipv6-boundlen: 8-bit field expressing the bit mask length of the IPv6 prefix specified in cipv6-bound-prefix. Default: 128.
- cipv6-bound-prefix: The IPv6 prefix that the client is using to bind the allocated IPv4 configuration to.

5. Security Considerations

TBD

6. IANA Considerations

IANA is requested to allocate the DHCPv6 option code: OPTION_DHCPV4OV6_SADDR.

7. Acknowledgements

8. References

8.1. Normative References

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