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Virtual Subnet Selection Options for DHCPv4 and DHCPv6
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Status of this Memo

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Abstract

This memo defines a Virtual Subnet Selection (VSS) option for DHCPv4 and DHCPv6, and a DHCPv4 relay-agent-information sub-option. These are intended for use by DHCP clients, relay agents, and proxy clients in situations where VSS information needs to be passed to the DHCP server for proper address or prefix allocation to take place.

For the DHCPv4 option and relay-agent-information sub-option, this memo documents existing usage as per RFC 3942 [RFC3942].

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1. Introduction

There is a growing use of Virtual Private Network (VPN) configurations. The growth comes from many areas; individual client systems needing to appear to be on the home corporate network even when traveling, ISPs providing extranet connectivity for customer companies, etc. In some of these cases there is a need for the DHCP server to know the VPN (hereafter called a "Virtual Subnet Selector" or "VSS") from which an address, and other resources, should be

allocated.

This memo defines a Virtual Subnet Selection (VSS) option for DHCPv4 and DHCPv6, and a DHCPv4 relay-agent-information sub-option. These are intended for use by DHCP clients, relay agents, and proxy clients in situations where VSS information needs to be passed to the DHCP server for proper address or prefix allocation to take place. If the receiving DHCP server understands the VSS option or sub-option, this information may be used in conjunction with other information in determining the subnet on which to select an address as well as other information such as DNS server, default router, etc.

If the allocation is being done through a DHCPv4 relay, then the relay sub-option defined here should be included. In some cases, however an IP address is being sought by a DHCPv4 proxy on behalf of a client (which may be assigned the address via a different protocol). In this case, there is a need to include VSS information relating to the client as a DHCPv4 option.

If the allocation is being done through a DHCPv6 relay, then the DHCPv6 VSS option defined in this document should be included in the Relay-forward and Relay-reply message going between the DHCPv6 relay and server. In some cases, addresses or prefixes are being sought by a DHCPv6 proxy on behalf of a client. In this case, there is a need for the client itself to supply the VSS information using the DHCPv6 VSS option in the messages that it sends to the DHCPv6 server.

In the remaining text of this document, when a DHCPv6 address is indicated the same information applies to DHCPv6 Prefix Delegation [RFC3633] as well.

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 RFC 2119 [RFC2119].

This document uses the following terms:

- "DHCP client"

  A DHCP client is a host using DHCP to obtain configuration parameters such as a network address.

- "DHCP relay agent"

  A DHCP relay agent is a third-party agent that transfers BOOTP

and DHCP messages between clients and servers residing on different subnets, per [RFC951] and [RFC1542].

- "DHCP server"

  A DHCP server is a host that returns configuration parameters to DHCP clients.

- "DHCPv4 option"

  An option used to implement a capability defined by the DHCPv4 RFCs [RFC2131][RFC2132]. These options have one-octet code and size fields.

- "DHCPv4 sub-option"

  As used in this document, a DHCPv4 sub-option refers to a sub-option of the relay-agent-information option [RFC3046]. These sub-options have one-octet code and size fields.

- "DHCPv6 option"

  An option used to implement a capability defined by the DHCPv6 RFC [RFC3315]. These options have two-octet code and size fields.

- "downstream"

  Downstream is the direction from the access concentrator towards the subscriber.

- "upstream"

  Upstream is the direction from the subscriber towards the access concentrator.

- "VSS information"

  Information about a VPN necessary to allocate an address to a DHCP client on that VPN and necessary to forward a DHCP reply packet to a DHCP client on that VPN.

- "VPN"

  Virtual private network. A network which appears to the client to be a private network.

- "VPN Identifier"

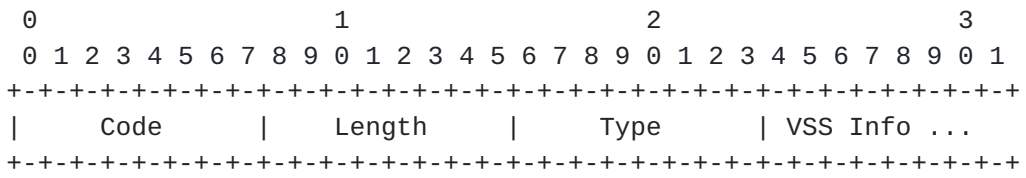
The VPN-ID is defined by [RFC2685] to be a sequence of 7 octets.

3. Virtual Subnet Selection Option and Sub-Option Definitions

The Virtual Subnet Selection options and sub-option contain a generalized way to specify the VSS information about a VPN. There are two options and one sub-option defined in this section. The actual VSS information is identical in each.

3.1. DHCPv4 Virtual Subnet Selection Option

The format of the option is:



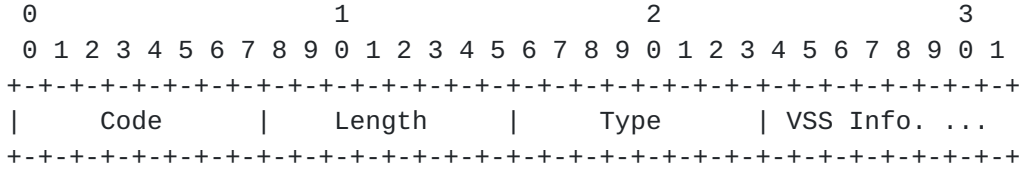
Code The option code (221).

Length The option length, minimum 1 octets.

Type and VSS Information -- see Section 3.4

3.2. DHCPv4 Virtual Subnet Selection Sub-Option

This is a sub-option of the relay-agent-information option [RFC3046]. The format of the sub-option is:



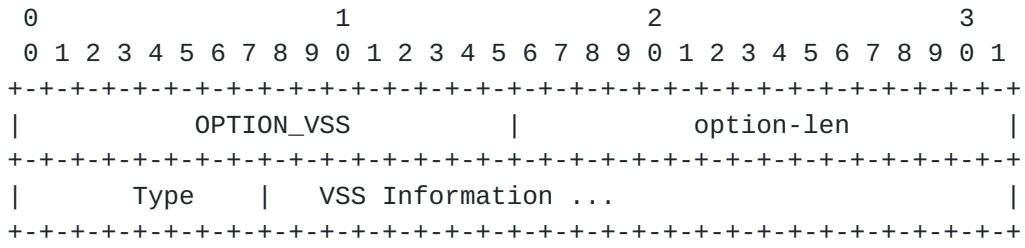
Code The sub-option code (151).

Length The option length, minimum 1 octets.

Type and VSS Information -- see Section 3.4

3.3. DHCPv6 Virtual Subnet Selection Option

The format of the DHCPv6 Virtual Subnet Selection option is shown below. This option may be included by a client or relay-agent (or both).



option-code OPTION_VSS (TBD).

option-len The number of octets in the option, minimum 1.

Type and VSS Information -- see Section 3.4

3.4. Virtual Subnet Selection Type and Information

All of the (sub)options defined above carry identical payloads, consisting of a type and additional VSS information as follows:

Type	VSS Information format:
0	NVT ASCII VPN identifier
1	RFC2685 VPN-ID
2-254	Not Allowed
255	Global, default VPN.

o Type 0 -- NVT ASCII VPN identifier

  Indicates that the VSS information consists of a NVT ASCII string. It MUST NOT be terminated with a zero byte.

o Type 1 -- RFC2685 VPN-ID

  Indicates that the VSS information consists of an RFC2685 VPN-ID [RFC2685], which is defined to be 7 octets in length.

o Type 255 -- Global, default VPN

Indicates that there is no explicit, non-default VSS information but rather that this option references the normal, global, default address space. In this case, there MUST NOT be any VSS Information and the length of the VSS option MUST be 1.

All other values of the Type field are invalid as of this memo and a VSS option with a Type field containing any value other than zero (0), one (1), or 255 SHOULD be ignored.

4. Overview of Virtual Subnet Selection Usage

At the highest level, the VSS option or sub-option determines the VPN on which a DHCP client is supposed to receive an IP address. How the option or sub-option is entered and processed is discussed below, but the point of all of the discussion is to determine the VPN on which the DHCP client resides. This will affect a relay agent, in that it will have to ensure that the packets sent to and received from the DHCP client flow over the correct VPN. This will affect the DHCP server in that it determines the IP address space used for the IP address allocation.

A DHCP server has as part of its configuration some IP address space from which it allocates IP addresses to DHCP clients. These allocations are typically for a limited time, and thus the DHCP client gets a lease on the IP address. In the absence of any VPN information, the IP address space is in the global or default VPN used throughout the Internet. When a DHCP server deals with VPN information, each VPN defines a new address space inside the server, one distinct from the global or default IP address space. A server which supports the VSS option or sub-option thereby supports allocation of IP addresses from multiple different VPNs. Supporting IP address allocation from multiple different VPNs means that the DHCP server must be prepared to configure multiple different address spaces (one per distinct VPN) and allocate IP addresses from these different address spaces.

These address spaces are typically independent, so that the same IP address could be allocated to one client in the global, default VPN, and to a different client residing in a different VPN. There is no conflict in this allocation, since the clients have essentially different IP addresses. The IPv4 or IPv6 address is qualified by the VPN.

Thus a VSS option or sub-option is a way of signaling the use of a VPN other than the global or default VPN. The next question is: who

decides what VPN a DHCP client should be using?

There are three entities which can either insert a VSS option or sub-option into a DHCPv4 packet or DHCPv6 message; a DHCP client, a relay agent, or a DHCPv4 or DHCPv6 server. While all of these entities could include a different VSS option or sub-option in every request or response, this situation is neither typical nor useful. There are two known paradigms for use of the VSS option or sub-option, which are discussed below.

The typical use of the VSS option or sub-option is for the relay agent to know the VPN on which the DHCP client is operating. The DHCP client itself does not, in this scenario, know the VPN on which it resides. The relay agent is responsible for mediating the access between the VPN on which the DHCP client resides and the DHCP server. In this situation, the relay agent will insert a VSS sub-option into the relay-agent-information option (for DHCPv4) or a VSS option into the Relay-forward message (for DHCPv6) of every request it forwards from the DHCP client. The server will use the VSS option or sub-option to determine the VPN on which the client resides, and use that VPN information to select the address space within its configuration from which to allocate an IP address to the DHCP client.

In this scenario, the relay agent might also send a VSS option or sub-option in either a DHCPv4 or DHCPv6 Leasequery request, but in this case, it would use the VSS option in the Leasequery request to select the correct address space for the Leasequery. In this scenario, the relay agent would be acting as a DHCP client from a Leasequery standpoint, but it would not be as if a DHCP client were sending in a VSS option in a standard DHCP address allocation request, say a DHCPDISCOVER.

In this scenario, only one relay agent would mediate the VPN access for the DHCP client to the DHCP server, and it would be the relay agent which inserts the VSS information into the request packet and would remove it prior to forwarding the response packet on.

The DHCP server would know that it should respond to VPN information specified in a VSS option or sub-option, and it would be configured with appropriate VPN address spaces to service the projected client requirements. Thus, in this common scenario, the DHCP client knows nothing of any VPN access, the relay agent has been configured in some way that allows it to determine the VPN of the DHCP client and transmit that using a VSS option or sub-option to the DHCP server, and the DHCP server responds to the VPN specified by the relay agent. There is no conflict between different entities trying to specify different VSS information -- each entity knows its role through policy or configuration external to this document.

It is important to ensure that each entity in this scenario both supports the VSS option and sub-option (for DHCPv4) or the VSS option (for DHCPv6), and that it is configured correctly. Deploying relay agents which support and emit VSS sub-options in concert with DHCPv4 servers which do not support the VSS option or sub-option as defined in this document SHOULD NOT be done, as such an ensemble will not operate correctly together because all of the IP addresses will be allocated from the global or default VPN regardless of the VPN on which the client's reside.

In the second scenario, the DHCP server would be configured in some way to know the VPN on which a particular DHCP client should be given access. The DHCP server would in this case include the VSS sub-option in the relay-agent-information option for DHCPv4 or the VSS option in the Relay-reply message for DHCPv6. The relay agent responsible for mediating VPN access would use this information to select the correct VPN for the DHCP client. In the event that there were more than one relay agent involved in this transaction, some external configuration or policy would be needed to inform the DHCPv6 server into which Relay-reply message the VSS option should go.

Once the relay agent has placed the DHCP client into the proper VPN, it SHOULD begin including VSS information in requests that it forwards to the DHCP server. Since this information does not conflict with the DHCP server's idea of the proper VPN for the client, everything works correctly.

In this second scenario, the DHCP client is again unaware of any VPN activity. In this case, however, the DHCP server knows the VPN for the client, and the relay agent responds to the VSS information specified by the DHCP server. Similar to the first scenario, each entity knows its role through a means external to this document and no two entities try to specify VSS information in conflict.

Again, in this scenario, it is important that both the relay agent as well as the DHCP server both support the VSS option and sub-option (for DHCPv4) and the VSS option (for DHCPv6). Deploying and configuring VPN support in one element and not in the other is not a practical approach.

There are many other scenarios which can be created with multiple relay agents each inserting VSS information into different Relay-forward messages, relay agent VSS information conflicting with client VSS information, or DHCP server VSS information conflicting with relay agent and client VSS information. Since these scenarios do not describe situations that are useful today, specifying precisely how to resolve all of these conflicts is unlikely to be valuable in the event that these scenarios actually become practical in the future.

The current use of the VSS option and sub-option require that each entity knows the part that it plays in dealing with VPN data. Each entity -- client, relay agent or agents, and server -- SHOULD know through some policy or configuration beyond the scope of this document whether it is responsible for specifying VPN information using the VSS option or sub-option or responsible for responding to VSS information specified by another entity, or simply ignoring any VSS information which it might see.

Some simple conflict resolution approaches are discussed below, in the hopes that they will cover simple cases that may arise from scenarios beyond those envisioned today. However, for more complex scenarios, or simple scenarios where appropriate conflict resolution strategies differ from those discussed in this document, a document detailing the usage scenarios and appropriate conflict resolution strategies SHOULD be created and submitted for discussion and approval.

5. Relay Agent Behavior

A relay agent which receives a DHCP request from a DHCP client on a VPN SHOULD include Virtual Subnet Selection information in the DHCP packet prior to forwarding the packet on to the DHCP server unless inhibited from doing so by configuration information or policy to the contrary.

A DHCPv4 relay agent SHOULD include a DHCPv4 VSS sub-option in a relay-agent-information option [RFC3046], while a DHCPv6 relay agent SHOULD include a DHCPv6 VSS option in the Relay-forward message.

The value placed in the Virtual Subnet Selection sub-option or option SHOULD be sufficient for the relay agent to properly route any DHCP reply packet returned from the DHCP server to the DHCP client for which it is destined.

Anytime a relay agent places a VSS option or sub-option in a DHCP request, it MUST send it only to a DHCP server which supports the VSS option or sub-option.

Since this option or sub-option is placed in the packet in order to specify the VPN on which an IP address is allocated for a particular DHCP client, one presumes that an allocation on that VPN is necessary for correct operation. If this presumption is correct, then a relay agent which places this option in a packet and doesn't receive it (or receives a different value than that sent to the server) in the returning packet should drop the packet since the IP address that was allocated will not be in the correct VPN. If an IP address that is on the requested VPN is not required, then the relay agent is free to

accept the IP address that is not on the VPN that was requested.

The converse, however, is more complicated. In the DHCPv6 case, the appearance of the option in the Relay-reply packet does indeed indicate that the DHCPv6 server understood and acted upon the contents of the VSS option in the Relay-forward packet. In the DHCPv4 case, however, the appearance of the sub-option in the relay-agent-information option received by the relay agent does not necessarily indicate that the DHCPv4 server even understood, let alone acted correctly upon, the VSS sub-option that it received.

The reason is that [RFC3046] specifies that a DHCPv4 server which supports the relay-agent-information option SHALL copy all sub-options received in a relay-agent-information option into any outgoing relay-agent-information option. Because of these requirements, even a DHCPv4 server which doesn't implement support for the Virtual Subnet Selection sub-option will almost certainly copy it into the outgoing relay-agent-information option. This means that the appearance of the Virtual Subnet Selection sub-option in a relay-agent-information option doesn't indicate support for the Virtual Subnet Selection sub-option.

There are only two pieces of information which can be determined from the appearance or lack of appearance of the DHCPv4 Virtual Subnet Selection sub-option in a relay-agent-information option received by a relay agent from a DHCPv4 server. First, if the Virtual Subnet Selection sub-option does not appear, then the server was able to support this sub-option but chose not to do so. Second, if the Virtual Subnet Selection sub-option appears and has a different value than the one originally included in the relay-agent-information option, then the DHCP server was able to support this sub-option and allocated an address using different VSS information than was originally provided by the relay agent.

Thus, if a DHCPv4 relay agent has a requirement to determine if the address allocated by a DHCPv4 server is on a particular VPN, it must use some other approach than the appearance of the VSS sub-option in the reply packet to make this determination.

This document does not create a requirement that a relay agent remember the contents of a VSS DHCPv4 sub-option or VSS DHCPv6 option sent to a DHCP server. In many cases, the relay agent may simply use the value of the VSS returned by the DHCP server to forward the response to the DHCP client. If the VSS information, the IP address allocated, and the VPN capabilities of the relay agent all interoperate correctly, then the DHCP client will receive a working IP address. Alternatively, if any of these items don't interoperate with the others, the DHCP client will not receive a working address.

Note that in some environments a relay agent may choose to always place a VSS option or sub-option into packets and messages that it forwards in order to forestall any attempt by a downstream relay agent or client to specify VSS information. In this case, a type field of 255 is used to denote the global, default VPN. When the type field of 255 is used, there MUST NOT be any additional VSS Information in the VSS option.

5.1. VPN assignment by the DHCP server

In some cases, a DHCP server may use the Virtual Subnet Selection sub-option or option to inform a relay agent that a particular DHCP client is associated with a particular VPN. It does this by sending the Virtual Subnet Selection sub-option or option with the appropriate information to the relay agent in the relay-agent-information option for DHCPv4 or the Relay-reply message in DHCPv6. If the relay agent is unable to honor the DHCP server's requirement to place the DHCP client into that VPN it MUST drop the packet and not send it to the DHCP client.

The DHCP server MUST NOT place VSS information in an outgoing packet if the relay agent or DHCP client is unprepared to properly interpret the VSS information.

In this situation, once the relay agent has placed the DHCP client into the VPN specified by the DHCP server, it will send in a VSS option or sub-option when forwarding packets from the client. The DHCP server in normal operation will echo this VSS information into the outgoing replies.

5.2. DHCP Leasequery

Sometimes a relay-agent needs to submit a DHCP Leasequery [RFC4388] [RFC5007] packet to the DHCP server in order to recover information about existing DHCP allocated IP addresses on other than the normal, global VPN. In the context of a DHCP Leasequery the relay agent is a direct client of the DHCP server and is not relaying a packet for another DHCP client. Thus, the instructions in Section 6 on Client Behavior should be followed to include the necessary VSS information.

6. Client Behavior

A DHCPv4 or DHCPv6 client will employ the VSS option to communicate VSS information to their respective servers. This information MUST be included in every message concerning any IP address on a different VPN than the global or default VPN. A DHCPv4 client will place the DHCPv4 VSS option in its packets, and a DHCPv6 client will place the DHCPv6 VSS option in its messages.

A DHCPv6 client that needs to place a VSS option into a DHCPv6 message SHOULD place a single VSS option into the DHCPv6 message at the same level as the Client Identifier option. A DHCPv6 client MUST NOT include different VSS options in the same DHCPv6 message.

Note that, as mentioned in Section 1, throughout this document when a DHCPv6 address is indicated the same information applies to DHCPv6 Prefix Delegation [RFC3633] as well.

Since this option is placed in the packet in order to change the VPN on which an IP address is allocated for a particular DHCP client, one presumes that an allocation on that VPN is necessary for correct operation. If this presumption is correct, then a client which places this option in a packet and doesn't receive it or receives a different value in the returning packet should drop the packet since the IP address that was allocated will not be in the correct VPN. If an IP address that is on the requested VPN is not required, then the client is free to accept the IP address that is not on the VPN that the was requested.

Clients should be aware that some DHCP servers will return a VSS option with different values than that which was sent in. In addition, a client may receive a response from a DHCP server with a VSS option when none was sent in by the Client.

Note that when sending a DHCP Leasequery request, a relay agent is acting as a DHCP client and so it should include the respective DHCPv4 or DHCPv6 VSS option in its DHCPv4 or DHCPv6 Leasequery packet if the DHCP Leasequery request is generated for other than the default, global VPN. It should not include a DHCPv4 sub-option in this case.

7. Server Behavior

A DHCP server receiving the VSS option or sub-option SHOULD allocate an IP address (or use the VSS information to access an already allocated IP address) from the VPN specified by the included VSS information.

In the case where the type field of the VSS option or sub-option is 255, the VSS option denotes the global, default VPN. In this case, there is no explicit VSS information beyond the type field.

This document does not prescribe any particular address allocation policy. A DHCP server may choose to attempt to allocate an address using the VSS information and, if this is impossible, to not allocate an address. Alternatively, a DHCP server may choose to attempt address allocation based on the VSS information and, if that is not

possible, it may fall back to allocating an address on the global or default VPN. This, of course, is also the apparent behavior of any DHCP server which doesn't implement support for the VSS option and sub-option. Thus, DHCP clients and relay agents SHOULD be prepared for either of these alternatives.

In some cases, a DHCP server may use the Virtual Subnet Selection sub-option or option to inform a relay agent that a particular DHCP client is associated with a particular VPN. It does this by sending the Virtual Subnet Selection sub-option or option with the appropriate information to the relay agent in the relay-agent-information option for DHCPv4 or the Relay-reply message in DHCPv6.

In this situation, the relay agent will place the client in the proper VPN, and then it will send in a VSS option or sub-option in subsequent forwarded requests. The DHCP server will see this VSS information and since it doesn't conflict in any way with the server's notion of the VPN on which the client is supposed to reside, it will process the requests based on the VPN specified in the VSS option or sub-option, and echo the same VSS information in the outgoing replies.

In a similar manner, a DHCP server may use the Virtual Subnet Selection option to inform a DHCP client that the address (or addresses) it allocated for the client is on a particular VPN.

In either case above, care should be taken to ensure that a client or relay agent receiving a reply containing a VSS option will correctly understand the VSS option. Otherwise, the client or relay agent will end up using the address as though it were a global address.

7.1. Returning the DHCPv4 or DHCPv6 Option

DHCPv4 or DHCPv6 servers receiving a VSS option (for sub-option processing, see below) MUST return an instance of this option in the reply packet or message if the server successfully uses this option to allocate an IP address, and it MUST NOT include an instance of this option if the server is unable to support, is not configured to support, or does not implement support for VSS information in general or the requested VPN in particular.

If they echo the option (based on the criteria above), servers SHOULD return an exact copy of the option unless they desire to change the VPN on which a client was configured.

The appearance of the DHCPv6 VSS option in the OPTION_ORO [RFC3315] or the OPTION_ERO [RFC4994] should not change the processing or decision to return (or not to return) the VSS option as specified in

this document.

7.2. Returning the DHCPv4 Sub-Option

The case of the DHCPv4 sub-option is a bit more complicated. Note that [RFC3046] specifies that a DHCPv4 server which supports the relay-agent-information option SHALL copy all sub-options received in a relay-agent-information option into any outgoing relay-agent-information option. Thus, the default behavior for any DHCPv4 server is to return any VSS sub-option received to the relay agent whether or not the DHCPv4 server understand the VSS sub-option. A server which implements the VSS sub-option MUST include the VSS sub-option in the relay-agent-information option in the reply packet if it successfully acted upon the VSS information in the incoming VSS sub-option.

Moreover, if a server uses different VSS information to allocate an IP address than it receives in a particular DHCPv4 sub-option, it MUST include that alternative VSS information in a sub-option that it returns to the DHCPv4 relay agent.

If a DHCPv4 server supports this sub-option and for some reason (perhaps administrative control) does not honor this sub-option from the request then it MUST NOT echo this sub-option in the outgoing relay-agent-information option.

Note that the appearance of the VSS sub-option in a reply packet from a DHCPv4 server to a relay-agent does not communicate any useful information about whether or not the server used the VSS sub-option in its processing. However, the absence of a VSS sub-option in a reply from a DHCPv4 server when a VSS sub-option was included in a request to the DHCPv4 server is significant, and means that the server did not use the VSS information present in the sub-option in its processing.

7.3. Making sense of conflicting VSS information

It is possible for a DHCPv4 server to receive both a VSS option and a VSS sub-option in the same packet. Likewise, a DHCPv6 server can receive multiple VSS options in nested Relay-forward messages as well as in the client message itself. In either of these cases, the VSS information from the relay agent closest to the DHCP server SHOULD be used in preference to all other VSS information received. In the DHCPv4 case, this means that the VSS sub-option takes precedence over the VSS option, and in the DHCPv6 case, this means that the VSS option from the outer-most Relay-forward message in which a VSS option appears takes precedence.

The reasoning behind this approach is that the relay-agent closer to the DHCP server is almost certainly more trusted than the DHCP client or more distant relay agents, and therefore information in the relay-agent-information option or the Relay-forward message is more likely to be correct.

In general, relay agents SHOULD be aware through configuration or policy external to this document whether or not they should be including VSS information in packets that they forward and so there should not be conflicts among relay agent specified VSS information.

In these situations where multiple VSS option or sub-options appear in the incoming packet or message, when constructing the response to be sent to the DHCP client or relay agent, all existing VSS options or sub-options MUST be replicated in the appropriate places in the response and MUST contain the VSS information that was used by the DHCP server to allocate the IP address.

8. Security

Message authentication in DHCPv4 for intradomain use where the out-of-band exchange of a shared secret is feasible is defined in [RFC3118]. Potential exposures to attack are discussed in section 7 of the DHCP protocol specification in [RFC2131].

Implementations should consider using the DHCPv4 Authentication option [RFC3118] to protect DHCPv4 client access in order to provide a higher level of security if it is deemed necessary in their environment.

Message authentication in DHCPv4 relay agents as defined in [RFC4030] should be considered for DHCPv4 relay agents employing this sub-option. Potential exposures to attack are discussed in section 7 of the DHCP protocol specification in [RFC2131].

For DHCPv6 use of the VSS option, the "Security Considerations" section of [RFC3315] details the general threats to DHCPv6, and thus to messages using the VSS option. The "Authentication of DHCP Messages" section of [RFC3315] describes securing communication between relay agents and servers, as well as clients and servers.

The VSS option could be used by a client in order to obtain an IP address from a VPN other than the one where it should. This option would allow a client to perform a more complete address-pool exhaustion attack since the client would no longer be restricted to attacking address-pools on just its local subnet.

A DHCP server that implements these options and sub-option should be

aware of this possibility and use whatever techniques that can be devised to prevent such an attack. Information such as the giaddr in DHCPv4 or link address in the Relay-forward DHCPv6 message might be used to detect and prevent this sort of attack.

One possible defense would be for the DHCP relay to insert a VSS option or sub-option to override the DHCP client's VSS option.

Servers that implement the VSS option and sub-option MUST by default disable use of the feature; it must specifically be enabled through configuration. Moreover, a server SHOULD provide the ability to selectively enable use of the feature under restricted conditions, e.g., by enabling use of the option only from explicitly configured client-ids, enabling its use only by clients on a particular subnet, or restricting the VSSs from which addresses may be requested.

9. IANA Considerations

IANA is requested to assign DHCPv4 option number 221 for the DHCPv4 VSS option defined in Section 3.1, in accordance with [RFC3942].

IANA is requested to assign sub-option number 151 for the DHCPv4 sub-option defined in Section 3.2 from the DHCP Relay Agent Sub-options space [RFC3046], in accordance with the spirit of [RFC3942]. While [RFC3942] doesn't explicitly mention the sub-option space for the DHCP Relay Agent Information option [RFC3046], sub-option 151 is already in use by existing implementations of this sub-option and the current draft is essentially compatible with these current implementations.

IANA has assigned the value of TBD for the DHCPv6 VSS option defined in Section 3.3.

While the type byte defined in Section 3.4 defines a number space that could be managed by IANA, expansion of this number space is not anticipated and so creation of a registry of these numbers is not required by this document. In the event that additional values for the type byte are defined in subsequent documents, IANA should at that time create a registry for these type bytes. New values for the type byte may only be defined by IETF Consensus, as described in [RFC5226]. Basically, this means that they are defined by RFCs approved by the IESG.

10. Acknowledgments

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11. References

11.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119, March 1997.

[RFC2131] Droms, R., "Dynamic Host Configuration Protocol", RFC 2131, March 1997.

[RFC2132] Alexander, S. and R. Droms, "DHCP Options and BOOTP Vendor Extensions", RFC 2132, March 1997.

[RFC2685] Fox, B., Gleeson, B., "Virtual Private Networks Identifier", RFC 2685, September 1999.

[RFC3046] Patrick, M., "DHCP Relay Agent Information Option", RFC 3046, January 2001.

[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.

[RFC3633] Troan, O. and R. Droms, "IPv6 Prefix Options for Dynamic Host Configuration Protocol (DHCP) version 6", RFC 3633, December 2003.

[RFC4994] Zeng, S., Volz, B., Kinnear, K. and J. Brzozowski, "DHCPv6 Relay Agent Echo Request Option", RFC 4994, September 2007.

11.2. Informative References

[RFC951] Croft, B. and J. Gilmore, "Bootstrap Protocol", RFC 951, September 1985.

[RFC1542] Wimer, W., "Clarifications and Extensions for the Bootstrap Protocol", RFC 1542, October 1993.

[RFC3118] Droms, R. and W. Arbaugh, "Authentication for DHCP Messages", RFC 3118, June 2001.

[RFC3942] Volz, B., "Reclassifying Dynamic Host Configuration Protocol version 4 (DHCPv4) Options", RFC 3942, November 2004.

[RFC4030] Stapp, M. and T. Lemon, "The Authentication Suboption for the Dynamic Host Configuration Protocol (DHCP) Relay Agent Option", RFC 4030, March 2005.

[RFC4388] Woundy, R. and K. Kinnear, "Dynamic Host Configuration Protocol (DHCP) Leasequery", RFC 4388, February 2006.

[RFC5007] Brzozowski, J., Kinnear, K., Volz, B., and S. Zeng, "DHCPv6 Leasequery", RFC 5007, September 2007.

[RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 5226, May 2008.

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