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Virtual Subnet Selection Sub-Option for the Relay Agent Information Option for DHCPv4 <draft-ietf-dhc-agent-vpn-id-05.txt>

Status of this Memo

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Abstract

In some environments, a relay agent resides in a network element which also has access to one or more virtual private networks (VPNs). If a DHCP server wishes to offer service to DHCP clients on those different VPNs the DHCP server needs to know information about the VPN on which each client resides. The Virtual Subnet Selection sub-

option of the relay-agent-information option is used by the relay agent to tell the DHCP server important information about the VPN (called the Virtual Subnet Selection information, or VSS) for every DHCP request it passes on to the DHCP server, and is also used to properly forward any DHCP reply that the DHCP server sends back to the relay agent.

1. Introduction

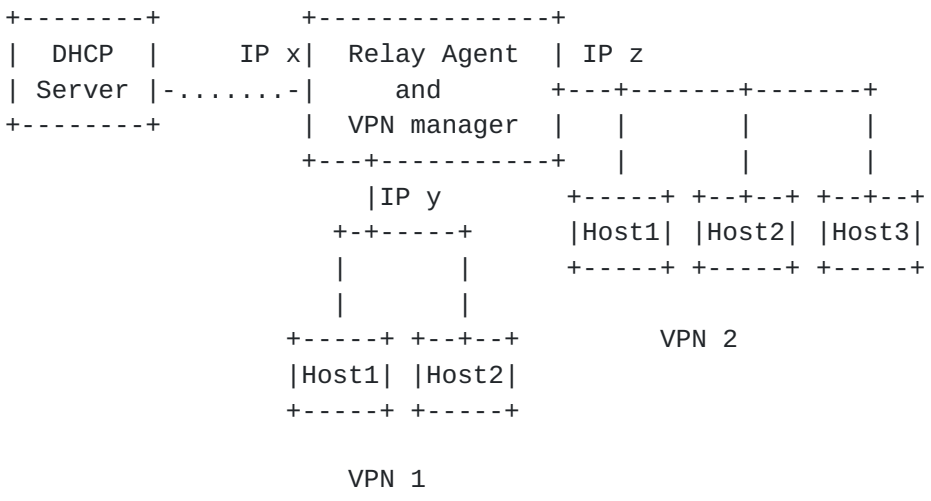
There exist situations where there are multiple VPNs serviced by one or more network elements which also contain relay agents. These VPNs contain DHCP clients, and there is a desire to allow a DHCP server to supply the full range of DHCP services to these DHCP clients.

The network element which contains the relay agent typically is also the network element which knows about the VPN association of the DHCP client and could include information about the VPN in the relay-agent-information option in the client's DHCP requests. This information about the VPN is called the Virtual Subnet Selection information, or VSS information. This document defines a sub-option for the relay-agent-information option which contains this VSS information, and which allows the relay agent to communicate the VSS information to the DHCP server.

When the DHCP server sends its response to the relay agent for forwarding back to the DHCP client, the relay agent will also need to use the Virtual Subnet Selection sub-option to determine to which VPN to send the DHCP response.

This sub-option can also be used by the DHCP server to inform a relay agent that a particular DHCP client is associated with a particular VPN by sending the Virtual Subnet Selection sub-option in the relay-agent-information option back to the relay agent.

Consider the following architecture:



In this architecture, the relay agent knows the VPN for each of the DHCP clients, and inserts the VSS information about the VPN in the Virtual Subnet Selection sub-option in every DHCP request it forwards on to the DHCP server.

When the DHCP server copies the relay-agent-information option from the incoming packet into the server's reply packet, it will copy over the Virtual Subnet Selection sub-option as well.

When the relay agent receives a DHCP reply packet from the server with a Virtual Subnet Selection sub-option, it will forward the packet onto the proper VPN based on the VSS information in the Virtual Subnet Selection sub-option.

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 [RFC 2119].

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 [RFC 951] and [RFC 1542].

- "DHCP server"

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

- "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"

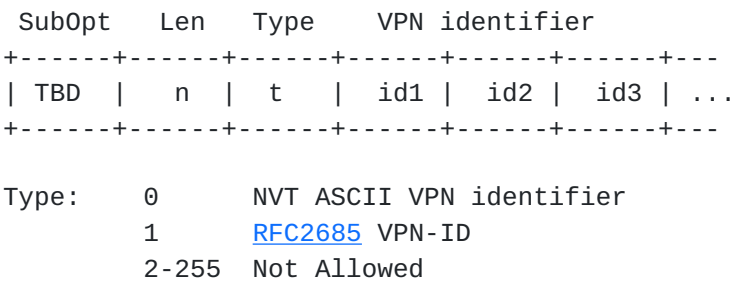
  The VPN-ID is defined by [RFC 2685] to be a sequence of 7 octets.

3. Virtual Subnet Selection Sub-Option Definition

The Virtual Subnet Selection sub-option MAY be used by any DHCP relay agent which desires to specify the VSS information about a VPN from which a DHCP client request was sent.

The Virtual Subnet Selection sub-option contains a generalized way to specify the VSS information about a VPN.

The format of the option is:



There are two types of identifiers which can be placed in the Virtual Subnet Selection sub-option. The first type of identifier which can be placed in the Virtual Subnet Selection sub-option is an NVT ASCII string. It MUST NOT be terminated with a zero byte.

The second type of identifier which can be placed in the Virtual Subnet Selection sub-option is an RFC2685 VPN-ID [RFC 2685], which is defined to be 7 octets in length.

All other values of the type field are invalid as of this memo and VSS sub-options containing any other value than zero (0) or one (1) SHOULD be ignored.

A relay agent which recieves a DHCP request from a DHCP client on a VPN SHOULD include a Virtual Subnet Selection sub-option in the relay-agent-information option that it inserts in the DHCP packet prior to forwarding it on to the DHCP server.

The value placed in the Virtual Subnet Selection sub-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. Servers supporting this sub-option MUST return an instance of this sub-option in the relay-agent-info option to any relay-agent that sends it. Servers SHOULD return the an exact copy of the sub-option unless they desire to change the VPN on which a client was configured, which would typically be a very unusual thing to do.

In the event that a Virtual Subnet Selection option and a Virtual Subnet Selection sub-option are both received in a particular DHCP client packet, the information from the Virtual Subnet Selection sub-option MUST be used in preference to the information in the Virtual Subnet Selection option. This reasoning behind this approach is that the relay-agent is almost certainly more trusted than the DHCP client, and therefore information in the relay-agent-information

option that conflicts with information in the packet generated by the DHCP client is more likely to be correct.

Relay agents which include this sub-option when forwarding DHCP client requests should probably discard DHCPOFFER or DHCPACK packets that do not contain this sub-option in their associated relay-agent-info options. This does not imply any memory of the particular packets forwarded with this sub-option included. Rather, the expectation is that the relay agent will use whatever algorithm that it used on the DHCPDISCOVER and DHCPREQUEST packets to decide to include this sub-option on the DHCPOFFER and DHCPACK packets to decide if they should have this sub-option included in their relay-agent-info options.

Since this sub-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 relay agent which places this sub-option in a packet and doesn't receive it 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 pass the packet along to the DHCP client with the IP address that is not on the VPN that the relay agent requested.

Servers that do not understand this option will allocate an address using their normal algorithms and will not return this option in the DHCPOFFER or DHCPACK. In this case the client should consider discarding the DHCPOFFER or DHCPACK, as mentioned above. Servers that understand this option but are administratively configured to ignore the option MUST ignore the option, use their normal algorithms to allocate an address, and MUST NOT return this option in the DHCPOFFER or DHCPACK such that the client will know that the allocated address is not in the VPN requested and will consider this information in deciding whether or not to accept the DHCPOFFER. In other words, this option MUST NOT appear in a DHCPOFFER or DHCPACK from a server unless it was used by the server in making or updating the address allocation requested.

In some cases, a DHCP server may use the Virtual Subnet Selection sub-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 with the appropriate information to the relay agent in the relay-agent-information option. 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.

This sub-option SHOULD NOT be used without also making use of some form of authentication for relay-agent-information option.

While this sub-option is the way that a relay-agent can insert VPN information into a DHCP client packet that it is forwarding, when a relay-agent needs to submit a DHCP Leasequery packet to the DHCP server in order to recover information about existing DHCP allocated IP addresses on other than the normal, global VPN, it SHOULD NOT use this sub-option. Instead, it SHOULD use the Virtual Subnet Selection option, since in the context of a DHCP Leasequery the relay agent is the client and is not relaying a packet for another DHCP client.

4. Security

Message authentication in DHCP relay agents as defined in [RFC 3040] should be considered for relay agents employing this sub-option. Potential exposures to attack are discussed in section 7 of the DHCP protocol specification in [RFC 2131].

The Virtual Subnet Selection sub-option could be used by a DHCP client masquerading as a relay agent in order to obtain an IP address from a VPN other than the one on which it resides. The DHCP server processing for this sub-option should be aware of this possibility and use whatever techniques it can devise to prevent such an attack. Information such as the giaddr might be used to detect and prevent this sort of attack, as well as the use of The Authentication Suboption for the Dynamic Host Configuration Protocol (DHCP) Relay Agent Option [RFC 3040].

Any program which unicasts a DHCP packet to the DHCP server with a relay-agent-information option in it with a vpn-id for a different VPN would cause the DHCP server to allocate an address from that different VPN, but since the DHCP server cannot (in general) communicate directly back to the program that sent in the malicious DHCP packet, the entire cycle of creating a lease will not be completed. Certainly many leases could be offered, which would result in a temporary form of address-pool exhaustion.

Servers that implement the Virtual Subnet Selection 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 VPNs from which addresses may be requested.

5. IANA Considerations

IANA is requested to assign sub-option number 151 for this sub-option in the DHCP Relay Agent Sub-options space [RFC 3046], in accordance with the spirit of [RFC 3942]. While [RFC 3942] doesn't explicitly mention the sub-option space for the DHCP Relay Agent Information option, 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 VPN Identifier sub-option from the DHCP Relay Agent Sub-options space [RFC 3046] for the VPN Identifier sub-option defined in Section 3.

While the type byte of the Virtual Subnet Selection sub-option 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 [RFC 2434]. Basically, this means that they are defined by RFCs approved by the IESG.

Moreover, any changes or additions to the type byte codes MUST be made concurrently in the type byte codes of the Virtual Subnet Selection option. The type bytes and data formats of the Virtual Subnet Selection option and Virtual Subnet Selection sub-option MUST always be identical.

6. Acknowledgments

None.

7. Normative References

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2131, March 1997.

[RFC 2434] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 2434, October 1998.

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

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

[RFC 3040] Stapp, M. and T. Lemon, "The Authentication Suboption for the Dynamic Host Configuration Protocol (DHCP) Relay Agent Option" RFC 3040, March 2005.

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

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