

The IPv4 Subnet Selection Option for DHCP

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Abstract

This memo defines a new Dynamic Host Configuration Protocol (DHCP) option for selecting the subnet on which to allocate an address. This option would override a DHCP server's normal methods of selecting the subnet on which to allocate an address for a client.

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1. Introduction

The Dynamic Host Configuration Protocol (DHCP) [RFC2131] provides a framework for passing configuration information to hosts on a TCP/IP network. RFC 2132 [RFC2132] specifies DHCP option configuration information that may be carried in DHCP packets to/from the DHCP server and the DHCP client. This document specifies a new DHCP option.

To select the subnet on which to allocate an address, the DHCP server determines the subnet from which the request originated, and then selects an address on the originating subnet or on a subnet that is on the same network segment as the originating subnet. The subnet from which the request originates can be determined by:

- o Using the subnet address of the giaddr field in the DHCP packet header, or if the giaddr field is zero;
- o Using the subnet address of the local interface on which the DHCP server received the packet.

This memo defines a new DHCP option, the subnet selection option, which allows the DHCP client to specify the subnet on which to allocate an address. This option takes precedence over the methods that the DHCP server uses to determine the subnet on which to select an address.

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 [RFC2119].

1.1. Motivational Example

An example of where this option could be useful is in a device (e.g.: a RAS device) that is allocating addresses on behalf of its clients. In this case the device would be allocating addresses through DHCP and then managing those addresses among its clients.

In this scenario, the device is connected to a private "internal" network on which the DHCP server would be located. The device is also connected to one or more service providing "external" networks (i.e.: the networks that the device's clients are connected to). Furthermore, the internal network is not IP connected to the external networks, although inside the device there is connectivity between the internal and external networks (e.g.: though the backplane).

Recall that the device is allocating addresses for its clients on the external networks and that there is no IP connectivity between the internal network and the external networks. The DHCP requests cannot originate from the external networks since packets cannot be routed between the external network and the internal network. Thus, the DHCP requests must originate from the internal network. The problem with originating the DHCP requests from the internal network is that the DHCP server will allocate addresses on the internal network's subnet, when what is required are addresses on the external subnets. The subnet selection option provides a solution to this problem.

The device would send its DHCP request on the internal subnet, but would include the subnet selection option containing the address of the external subnet on which it requires the address. The subnet selection option instructs the DHCP server to allocate the address on the requested subnet as opposed to the normal operation of allocating the address on the subnet from which the DHCP request originated.

2. Subnet Selection Option Definition

The subnet selection option is a DHCP option. The option contains a single IPv4 address that is the address of a subnet. The value for the subnet address is determined by taking any IPv4 address on the subnet and ANDing that address with the subnet mask (i.e.: the network and subnet bits are left alone and the remaining (address) bits are set to zero). When the DHCP server is configured to respond to this option, is allocating an address, and this option is present then the DHCP server **MUST** allocate the address on either:

- o the subnet specified in the subnet selection option, or;
- o a subnet on the same network segment as the subnet specified in the subnet selection option.

The format of the option is:

Code	Len	IPv4 Address			
118	4	A1	A2	A3	A4

Servers configured to support this option **MUST** return an identical copy of the option to any client that sends it, regardless of whether or not the client requests the option in a parameter request list. Clients using this option **MUST** discard DHCP OFFER or DHCP ACK packets that do not contain this option.

This option does not require changes to operations or features of the DHCP server other than to select the subnet on which to allocate an address. For example, the handling of DHCP DISCOVER for an unknown subnet should continue to operate unchanged.

When this option is present and the server is configured to support this option, the server **MUST NOT** offer an address that is not on the requested subnet or network segment. Servers that do not understand this option will allocate an address using their normal algorithms and will not return this option in the DHCP OFFER or DHCP ACK. In this case the client will discard the DHCP OFFER or DHCP ACK. 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 DHCP OFFER or DHCPACK. In this case the client will discard the DHCP OFFER or DHCPACK.

During an address renew, the DHCP server may send a DHCPACK directly to the allocated address, however packets from the DHCP server may not be routable to the address. Thus, in all packets that the DHCP client sends that contain the subnet selection option, the giaddr field in the BOOTP header MUST be set to an IPv4 address on which the DHCP client will accept DHCP packets (e.g.: the address on the subnet connected to the internal network).

The IPv4 address to which a DHCP server sends a reply to MUST be the same as it would choose when this option is not present.

3. Intellectual Property

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4. IANA Considerations

IANA has assigned a value of 118 for the DHCP option code described in this document.

5. Acknowledgements

This document is the result of work undertaken the by DHCP working group. Thanks to Ted Lemon, Tim Aston and Ralph Droms for their helpful comments in this work.

W. Mark Townsley and Pratik Gupta originally published a subnet selection option Internet Draft in July 1997. The work in this document was not based on the original work but it does achieve the same goals.

6. Security Considerations

DHCP currently provides no authentication or security mechanisms. Potential exposures to attack are discussed in section 7 of the protocol specification [RFC2131].

The subnet selection option allows for the DHCP client to specify the subnet on which to allocate an address. This 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.

Servers that implement the subnet selection 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 subnets (as indicated in the subnet selection option) from which addresses may be requested.

7. References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, 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.

8. Editor's Address

Glenn Waters
Nortel Networks
310-875 Carling Avenue,
Ottawa, Ontario K1S 5P1
Canada

Phone: +1 613-765-0249
EMail: gww@nortelnetworks.com

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