                 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 DHCPOFFER or DHCPACK 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 DHCPDISCOVER 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 DHCPOFFER or DHCPACK. In this
   case the client will discard the DHCPOFFER or DHCPACK. 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. In this case the client will discard the DHCPOFFER 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 chose when this option is not present.

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Director.

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 is 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.

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Acknowledgement