NETCONF DHCPv6 Option
draft-fa-netconf-dhcpv6-option-00

Abstract

   This document defines DHCPv6 options for bootstrapping the NETCONF
   protocol on devices.

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].

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1. Introduction

NETCONF [RFC6241] combined with the YANG [RFC6020] data modeling
language provides an extensible mechanism for configuring and
monitoring networked devices. One of the advantages that NETCONF/
YANG offers over other network management protocols is that it is
flexible enough to be adapted for use with almost any service on any
device.

The Dynamic Host Configuration Protocol for IPv6 [RFC3315] is widely
in use for the configuration of network devices. This document
describes a DHCPv6 option which can be used for provisioning the
necessary parameters to bootstrap NETCONF connectivity so that a
device can then obtain further configuration. An example device
suitable for this type of configuration process would be a managed
home gateway router.

This document uses the terms "client" and "server" to describe the
hosts at either end of a NETCONF connection. "Client" should be
understood to be the host that is actively initiating the NETCONF
connection to the "Server". These definitions are used to align with
the terminology in the DHCPv6 message flow.

2. NETCONF DHCPv6 Container Option

The following section describes the format of the NETCONF
configuration container option. A container approach has been taken

so that different NETCONF transport protocols can be supported.
Currently only two transport protocols have been defined, NETCONF

over SSH [RFC6242] and NETCONF over TLS [RFC5539]. If necessary in
the future, the option could be extended to support additional
transport protocols through the definition of new sub-options.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     OPTION_NETCONF_CONT        |           option-len          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         sub-options                           |
|                         (variable)                            |
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
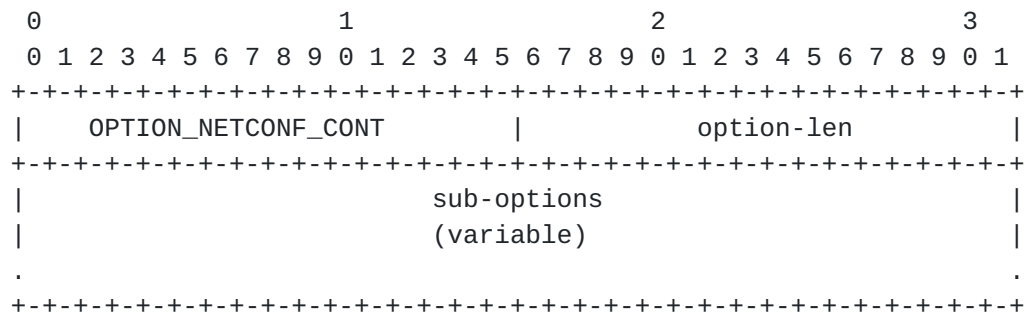
option-code OPTION_NETCONF_CONT (TBA1)
option-len Variable
sub-options Contains one or more NETCONF configuration sub-options
            (described below).

2.1. NETCONF over SSH Sub-Option

Clients which implement NETCONF transport over Secure Shell (SSH) use
the following sub-option to obtain configuration necessary to
establish a connection.

The procedure for establishing NETCONF connectivity over SSH, is
described in [RFC6242].

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     OPTION_NETCONF_SSH         |           option-len          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   priority    |             dest-port         |               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+               |
|                         server fqdn(s)                        |
|                         (variable length)                     |
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
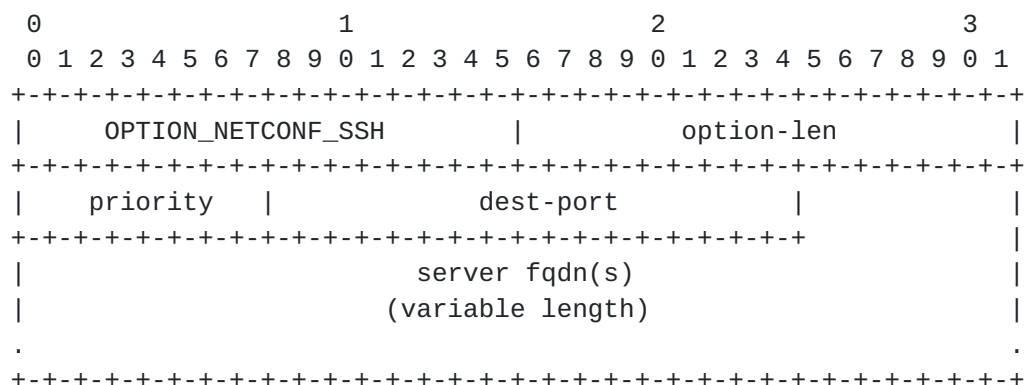
option-code   OPTION_NETCONF_SSH (TBA2)
option-len   Variable
priority   8-bit integer. Described in Section 3.1
dest-port   16-bit integer to be used by the client as the
                  destination layer 4 port to initiate the SSH
                  connection to.
server-fqdn   List of FQDNs to use for the NETCONF server,
                  formatted according to Section 8 of [RFC3315].

In case the client receives more than one server address in the
server-fqdn field, the client SHOULD initiate connections to the
addresses in the order they are listed in the server-fqdn field,
attempting to establish a connection to each server until one is
successfully established.

2.2. NETCONF over TLS Sub-Option

Clients which implement NETCONF transport over Transport Layer
Security (TLS) use the following sub-option to obtain configuration
necessary to establish a connection.

The procedure for establishing NETCONF connectivity over TLS, is
described in [RFC5539].

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    OPTION_NETCONF_TLS         |          option-len          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    priority   |          dest-port           |              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+              |
|                        server-fqdn(s)                        |
|                       (variable length)                     |
.                                                             .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

```
option-code  OPTION_NETCONF_TLS (TBA3)
option-len   Variable
priority     8-bit integer.  Described in Section 3.1
dest-port    16-bit integer to be used by the client as the
             destination layer 4 port for initiating the TLS
             connection
server-fqdn  List of FQDNs to use for the NETCONF server, formatted
             according to Section 8 of [RFC3315].
```
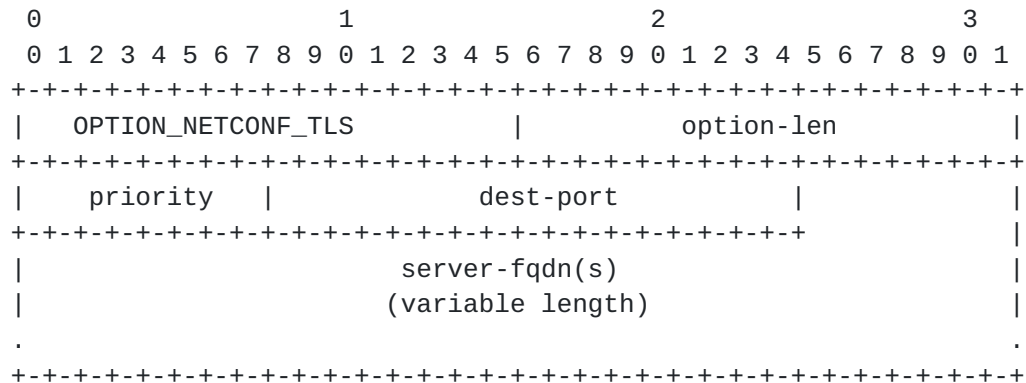
In case the client receives more than one server FQDN in the server-
fqdn field, the client SHOULD initiate connections to the addresses
in the order they are listed in the server-fqdn field, attempting to
establish a connection to each server until one is successfully
established.

3. DHCPv6 Client Behavior

When a device which implements both NETCONF functionality and the
DHCP option described in this document creates a DHCPv6 SOLICIT
message, it SHOULD include OPTION_NETCONF_CONT (TBD) within the ORO
field.

On receipt of an DHCP ADVERTISE response message including the
OPTION_NETCONF_CONT option, the client evaluates the sub-options
which it contains as follows:

o If OPTION_NETCONF_CONT does not contain a transport sub-option
   implemented by the client, then it MUST be discarded by the

client.

   o If OPTION_NETCONF_CONT contains a single NETCONF transport
      protocol sub-option implemented by the client, then the client
      SHOULD attempt establish a NETCONF session using the configured
      transport protocol.

   o If OPTION_NETCONF_CONT contains multiple NETCONF transport
      protocol sub-options supported by the client, then the client
      SHOULD follow the procedure described below to establish a
      connection to the NETCONF server.

3.1. Priorities

   As NETCONF is not limited to on specific transport protocol, the
   NETCONF client and/or server may have been deployed with support for
   more than one NETCONF transport protocol.

   The 'priority' field contained within the transport protocol specific
   sub-options give the service provider a method of indicating to the
   client the order in which to attempt using the different supported
   protocols to establish NETCONF connectivity.

   A client which supports two (or more) NETCONF transport protocols,
   and receives configuration parameters for at least two protocols
   SHOULD inspect the values of the priority field. The sub-option with
   the highest priority value SHOULD be used as the first NETCONF
   protocol to attempt for establishing connectivity.

   In the event that this connection attempt is not successful, then the
   client SHOULD attempt to establish connectivity using the NETCONF
   transport protocol sub-option with the second highest priority, then
   the third highest priority, and so on until either a successful
   connection has been established, or there are no more

   In the event that the client receives two options with the same
   priority, the client SHOULD implement a mechanism for prioritising
   one mechanism over the other. This mechanism is implementation
   specific.

4. DHCPv6 Server Behavior

   When a DHCPv6 server receives a client SOLICIT message containing the
   OPTION_NETCONF_CONT option code within the ORO field, it SHOULD
   respond with an ADVERTISE message containing the sub-options

   If the operator has deployed their NETCONF infrastructure with
   support for more than one NETCONF transport protocol and has a
   preference for clients to use one transport protocol over another,
   then the 'priorities' field SHOULD be used within the NETCONF
   transport protocol sub-options to indicate to the client the order to
   attempt using the protocols for connectivity as described in Section
   3.1.

[5](#). Security Considerations

The NETCONF protocol relies on the underlying transport protocol to
provide security. Security considerations described in [RFC5539] and
[RFC6242] are also applicable to this document.

6. IANA Considerations

IANA is kindly asked to allocate DHCPv6 option codes for
OPTION_NETCONF_CONT, OPTION_NETCONF_SSH and OPTION_NETCONF_TLS.

7. Acknowledgements

Many thanks to everyone.

8. References

8.1. Normative References

[RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate
            Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC3315]   Droms, R., Bound, J., Volz, B., Lemon, T., Perkins, C. and
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[RFC6241]   Enns, R., Bjorklund, M., Schoenwaelder, J. and A. Bierman,
            "Network Configuration Protocol (NETCONF)", RFC 6241, June
            2011.

8.2. Informative References

[RFC5539]   Badra, M., "NETCONF over Transport Layer Security (TLS)",
            RFC 5539, May 2009.

[RFC6020]   Bjorklund, M., "YANG - A Data Modeling Language for the
            Network Configuration Protocol (NETCONF)", RFC 6020,
            October 2010.

[RFC6242]   Wasserman, M., "Using the NETCONF Protocol over Secure
            Shell (SSH)", RFC 6242, June 2011.

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