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NETCONF DHCPv6 Option  
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## 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].

## Status of this Memo

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## Table of Contents

1. Introduction . . . . .	2
2. NETCONF DHCPv6 Container Option . . . . .	2
2.1. NETCONF over SSH Sub-Option . . . . .	3
2.2. NETCONF over TLS Sub-Option . . . . .	4
3. DHCPv6 Client Behavior . . . . .	4
3.1. Priorities . . . . .	5
4. DHCPv6 Server Behavior . . . . .	5
5. Security Considerations . . . . .	5
6. IANA Considerations . . . . .	6
7. Acknowledgements . . . . .	6
8. References . . . . .	6
8.1. Normative References . . . . .	6
8.2. Informative References . . . . .	6
Index . . . . .	6
Authors' Addresses . . . . .	6

## 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.

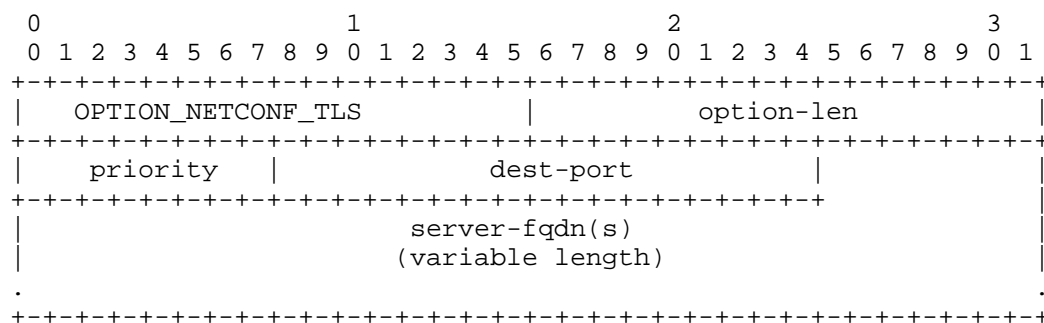
server-fqdn    List of FQDNs to use for the NETCONF server,  
                 formatted according to Section 8 of [RFC3315].

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].



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

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## Index

- 4
- 4.1 2, 4

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