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MPL Parameter Configuration Option for DHCPv6
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Abstract

This draft defines a way to configure MPL parameter set via DHCPv6 option. MPL has a set of parameters to control its behavior, and the parameter set is often configured as a network-wide parameter because the parameter set should be identical for each MPL forwarder in an MPL domain. Using the MPL Parameter Configuration Option defined in this document, a network can be configured with a single set of MPL parameter easily.

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1. Introduction

Multicast Protocol for Low power and Lossy Networks (MPL) [[I-D.ietf-roll-trickle-mcast](#)] defines a protocol to make a multicast network among low power and lossy network i.e. wireless mesh networks. MPL has a set of parameters to control its behavior and tradeoff between end-to-end delay and network utilization. In most environments, the default parameters are acceptable. However, in some environments, the parameter set must be configured carefully in order to meet the requirements of each environment. According to the MPL draft [section 5.4](#), each parameter in the set should be same for all nodes within an MPL domain. And the MPL draft does not define a method to configure the MPL parameter set.

Some managed wireless mesh networks may have a DHCP server to configure network parameters. MPL parameter set shall be considered as a part of network parameters (nodes in an MPL domain should use an identical parameter set). This document is to define the way to distribute parameter sets for MPL forwarders as a simple DHCPv6 [[RFC3315](#)] option.

2. MPL Parameter Configuration Option

Per MPL domain, there are following 10 parameters. An MPL domain is defined by an MPL domain address.

- o PROACTIVE_FORWARDING
- o SEED_SET_ENTRY_LIFETIME
- o DATA_MESSAGE_IMIN
- o DATA_MESSAGE_IMAX
- o DATA_MESSAGE_K
- o DATA_MESSAGE_TIMER_EXPIRATIONS
- o CONTROL_MESSAGE_IMIN
- o CONTROL_MESSAGE_IMAX
- o CONTROL_MESSAGE_K
- o CONTROL_MESSAGE_TIMER_EXPIRATIONS

One network may have multiple MPL domains with different

configurations. To configure more than one MPL domain via DHCP, there may be more than one MPL Parameter Configuration Option given to DHCP clients from a DHCP server.

2.1. Unsigned Short Floating Point

MPL has many timer parameters. Expected range of the timers depends on the network topology or MAC/PHY nature. To accommodate wide range of timer values efficiently, the MPL Parameter Configuration Option uses base-10 unsigned short floating point number with 3-bit exponent and 13-bit significand defined as follows (exp. stands for exponent).

```

      0                               1
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
+---+---+---+---+---+---+---+---+
| exp. |      significand      |
+---+---+---+---+---+---+---+

```

The represented value is (significand) * 10^(exp.). The minimum exponent is 0 (binary 000) and the maximum is 6 (binary 110). exp=7 (binary 111) is reserved for future use. The minimum significand is 0 (all 0) and the maximum is 8191 (all 1).

Unlike IEEE754 half precision floating point (binary16), there is no sign bit (no negative value for a timer), exponent is not biased (no fractional value for a timer), no implicit leading 1 in significand, and base is 10. Therefore, there could be more than one representation for a value.

Followings are examples of common timer values represented by unit of millisecond.

One second (1,000 milliseconds): exp = 3, significand = 1, 0x6001.

One minute (60,000 milliseconds): exp = 4, significand = 6, 0x8006.

One hour (3,600,000 milliseconds): exp = 5, significand = 36,
0xa024.

One day (86,400,000 milliseconds): exp = 5, significand = 864,
0xa360

Maximum timer length represented by an unsigned short floating point with millisecond precision is 8191 * 10⁶ milliseconds (13 weeks 3 days 19 hours 16 minutes 40 seconds).

With exponent and significand, an unsigned short floating point (usfp) can be encoded as follows.


```
usfp = (exponent << 13)| (0x1fff & significand);
```

2.2. MPL Parameter Configuration Option Format

To distribute a configuration of an MPL domain or a default value for all MPL domains (wildcard) under the network managed by the DHCP server, this document defines a DHCPv6 option format as follows. Short floating point format is used to describe wide range of timer values.

```

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_MPL_PARAMETERS   |   option_len   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|P| Z |   C_K   | Z2 |   DM_K   |   SE_LIFETIME   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   DM_IMIN   |   DM_IMAX   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   DM_T_EXP   |   C_IMIN   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   C_IMAX   |   C_T_EXP   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

(if option_len = 32 )
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   MPL Domain Address (128bits)   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   (cont'ed)   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   (cont'ed)   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   (cont'ed)   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

OPTION_MPL_PARAMETERS: DHCPv6 option identifier (not yet assigned).

option_len: Length of the option. It SHOULD be 16 (without MPL domain address) or 32 (with MPL domain address)

P (1 bit): A flag to indicate PROACTIVE_FORWARDING

Z (1 bit) Reserved. Should be 0.

C_K (5 bits): CONTROL_MESSAGE_K.

Z2 (3 bits) Reserved. Should be all 0.

DM_K (5 bits): DATA_MESSAGE_K.

SE_LIFETIME: SEED_SET_ENTRY_LIFETIME. The unit is millisecond and the type is unsigned short floating point.

DM_IMIN: DATA_MESSAGE_IMIN. The unit is millisecond and the type is unsigned short floating point.

DM_IMAX: DATA_MESSAGE_IMAX. The unit is millisecond and the type is unsigned short floating point.

DM_T_EXP: DATA_MESSAGE_TIMER_EXPIRATIONS. The unit is millisecond and the type is unsigned short floating point.

C_IMIN: CONTROL_MESSAGE_IMIN. The unit is millisecond and the type is unsigned short floating point.

C_IMAX: CONTROL_MESSAGE_IMAX. The unit is millisecond and the type is unsigned short floating point.

C_T_EXP: CONTROL_MESSAGE_TIMER_EXPIRATIONS. The unit is millisecond and the type is unsigned short floating point.

2.3. DHCPv6 Client Behavior

Clients MAY request MPL Parameter Configuration Option, as described in [RFC3315](#) [[RFC3315](#)], sections [17.1.1](#), [18.1.1](#), [18.1.3](#), [18.1.4](#), [18.1.5](#) and 22.7. As a convenience to the reader, we mention here that the client includes requested option codes in Option Request Option.

Clients MUST discard MPL Parameter Configuration Option if it is invalid (i.e. it sets reserved bits or it has timers with reserved exp=7 in Unsigned Short Floating Point).

2.4. MPL Forwarder Behavior

If a DHCPv6 client requests and receives MPL Parameter Configuration Option, the node SHOULD join the MPL domain given by the option and act as an MPL forwarder. Each node SHOULD configure its MPL forwarder with the given parameter set for the MPL domain.

The priority of MPL Parameter Configuration applied for an MPL Domain is as follows (high to low).

- o Specific MPL Parameter Configuration to the MPL Domain (optlen=32)
- o Wildcard MPL Parameter Configuration (optlen=16)
- o Default configuration given in the MPL specification.

There SHALL be no more than one MPL Parameter Configuration Option for a MPL domain or the wildcard. Thus, the order of DHCPv6 options in the packet has no effect on precedence.

A node MAY leave from an MPL domain if the following two conditions are satisfied. 1) The MPL domain is configured by a DHCPv6 option from a DHCPv6 server previously. 2) The node has received an updated MPL Parameter Configuration Option without a configuration for the MPL domain.

MPL parameter may be updated occasionally. With stateful DHCPv6, updates can be done when the renewal timer expires. Information Refresh Time Option [[RFC4242](#)] shall be used to keep each forwarders updated.

To reduce periodical update traffic a node may try to use very long interval between updates. In the case, reconfigure shall be used to keep forwarder parameter sets synchronized. For stateless DHCPv6, [[I-D.jiang-dhc-stateless-reconfiguration](#)] may be used (if approved).

2.5. DHCPv6 Server Behavior

Sections [17.2.2](#) and [18.2](#) of [RFC3315](#) [[RFC3315](#)] govern server operation in regards to option assignment. As a convenience to the reader, we mention here that the server will send MPL Parameter Configuration Option only if configured with specific value for MPL Parameter Configuration Option and the client requested it.

Servers MUST ignore incoming MPL Parameter Configuration Option.

2.6. DHCPv6 Relay Behavior

It's never appropriate for a relay agent to add options to a message heading toward the client, and relay agents don't actually construct Relay-Reply messages anyway. There are no additional requirements for relays.

3. IANA Considerations

A DHCPv6 option code for MPL Parameter Configuration Option needs to be assigned from IANA.

4. Security Considerations

A forged option may cause excessive layer-2 broadcasting. Implementations should set reasonable bounds for each parameter. For example, not too high K, not too low IMIN, etc. These may be implementation dependent or may be derived from MAC/PHY specifications. DHCP server or the network itself shall be trusted by some means including network access control or DHCP authentications.

5. References

5.1. Normative References

- [I-D.ietf-roll-trickle-mcast]
Hui, J. and R. Kelsey, "Multicast Forwarding Using Trickle", [draft-ietf-roll-trickle-mcast-07](#) (work in progress), February 2014.
- [RFC3315] Droms, R., Bound, J., Volz, B., Lemon, T., Perkins, C., and M. Carney, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", [RFC 3315](#), July 2003.
- [RFC4242] Venaas, S., Chown, T., and B. Volz, "Information Refresh Time Option for Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", [RFC 4242](#), November 2005.

5.2. Non-Normative References

- [I-D.ietf-dhc-option-guidelines]
Hankins, D., Mrugalski, T., Siodelski, M., Jiang, S., and S. Krishnan, "Guidelines for Creating New DHCPv6 Options", [draft-ietf-dhc-option-guidelines-17](#) (work in progress), January 2014.
- [I-D.jiang-dhc-stateless-reconfiguration]
Jiang, S. and B. Liu, "Stateless Reconfiguration in Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", [draft-jiang-dhc-stateless-reconfiguration-01](#) (work in progress), February 2014.

Appendix A. Update History

Updates on [draft-doi-roll-mpl-configuration-05](#) to [draft-ietf-roll-mpl-configuration-00](#):

- o I-D renamed.

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