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Optimized Link State Routing Protocol Version 2 (OLSRv2) and MANET Neighborhood Discovery Protocol (NHDP) Extension TLVs

Abstract

This specification describes extensions to definitions of TLVs used by the Optimized Link State Routing Protocol version 2 (OLSRv2) and the MANET Neighborhood Discovery Protocol (NHDP) to increase their abilities to accommodate protocol extensions. This document updates RFC 7181 (OLSRv2) and RFC 6130 (NHDP).

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc7188.

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1. Introduction

The MANET Neighborhood Discovery Protocol (NHDP) [RFC6130] and the Optimized Link State Routing Protocol version 2 (OLSRv2) [RFC7181] are protocols for use in Mobile Ad Hoc Networks (MANETs) [RFC2501], based on the Generalized MANET Packet/Message Format [RFC5444].

This document updates [RFC6130] and [RFC7181], specifically their use of TLV (Type-Length-Value) elements, to increase the extensibility of these protocols and to enable some improvements in their implementation.

This specification reduces the latitude of implementations of [RFC6130] and [RFC7181] to consider some messages, which will not be created by implementations simply following those specifications, as a reason to consider the message as "badly formed", and thus as a reason to reject the message. This gives greater latitude to the creation of extensions of these protocols, in particular extensions that will interoperate with unextended implementations of those protocols. As part of that, it indicates how TLVs with unexpected value fields must be handled, and adds some additional options to those TLVs.

Note that TLVs with unknown type or type extension are already specified as to be ignored by [RFC6130] and [RFC7181] and also are not a reason to reject a message.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

Additionally, this document uses the terminology of [RFC5444], [RFC6130], and [RFC7181].

3. Applicability Statement

This document updates the specification of the protocols described in [RFC6130] and [RFC7181].

Specifically, this specification updates [RFC6130] and [RFC7181] in the following ways:

- Removes the latitude of rejecting a message with a TLV with a known type, but with an unexpected TLV Value field, for the TLV Types defined in [RFC6130] and [RFC7181].

- Specifies the handling of a TLV Value field with unexpected length.

- Sets up IANA registries for TLV Values for the Address Block TLVs:

  - LOCAL_IF, defined in [RFC6130].

  - LINK_STATUS, defined in [RFC6130].

  - OTHER_NEIGHB, defined in [RFC6130].

  - MPR, defined in [RFC7181], now considered as a bit field.

  - NBR_ADDR_TYPE, defined in [RFC7181], now considered as a bit field.

- Defines a well-known TLV Value for "UNSPECIFIED" for the Address Block TLV Types LOCAL_IF, LINK_STATUS, and OTHER_NEIGHB, all defined in [RFC6130].

4. TLV Values

NHDP [RFC6130] and OLSRv2 [RFC7181] define a number of TLVs within the framework of [RFC5444]. These TLVs define the meaning of only some of the contents that can be found in a TLV Value field. This limitation may be either defining only certain TLV Values or considering only some lengths of the TLV Value fields (or a single-value field in a multivalue Address-Block TLV). This specification describes how NHDP [RFC6130] and OLSRv2 [RFC7181] are to handle TLVs with other TLV Value fields.

4.1. Unrecognized TLV Values

NHDP and OLSRv2 specify that, in addition to well-defined reasons (in the respective protocol specifications), an implementation of these protocols MAY recognize a message as "badly formed" and therefore "invalid for processing" for other reasons (Section 12.1 of [RFC6130] and Section 16.3.1 of [RFC7181]). These sections could be interpreted as allowing rejection of a message because a TLV Value field is unrecognized. This specification removes that latitude:

- An implementation MUST NOT reject a message because it contains an unrecognized TLV value. Instead, any unrecognized TLV Value field MUST be processed or ignored by an unextended implementation of NHDP or OLSRv2, as described in the following sections.

- Hence, this specification removes the 7th, 10th, and 11th bullets in Section 12.1 of [RFC6130].

It should be stressed that this is not a change to [RFC6130] or [RFC7181], except with regard to not allowing this to be a reason for rejection of a message. [RFC6130] or [RFC7181] are specified in terms such as "if an address is associated with a value of LOST by a LINK_STATUS TLV". Association with an unrecognized value has no effect on any implementation strictly following such a specification.

4.2. TLV Value Lengths

The TLVs specified in [RFC6130] and [RFC7181] may be either single-value or multivalue TLVs. In either case, the length of each item of information encoded in the TLV Value field is the "single-length", defined and calculated as in Section 5.4.1 of [RFC5444]. All TLVs specified in [RFC6130] and [RFC7181] have a one- or two-octet single-length. These are considered the expected single-lengths of such a received TLV.

Other single-length TLV Value fields may be introduced by extensions to [RFC6130] and [RFC7181]. This document specifies how implementations of [RFC6130] and [RFC7181], or extensions thereof, MUST behave on receiving TLVs of the TLV types defined in [RFC6130] and [RFC7181], but with TLV Value fields with other single-length values.

The following principles apply:

- If the received single-length is greater than the expected single-length, then the excess octets MUST be ignored.

- If the received single-length is less than the expected single-length, then the absent octets MUST be considered to have all bits cleared (0).

Exception:

- A received CONT_SEQ_NUM with a single-length < 2 SHOULD be considered an error.

4.3. Undefined TLV Values

[RFC6130] and [RFC7181] define a number of TLVs, but for some of these TLVs they specify meanings for only some TLV Values. This document establishes IANA registries for these TLV Values, with initial registrations reflecting those used by [RFC6130] and [RFC7181], and as specified in Section 4.3.3.

There are different cases of TLV Values with different characteristics. These cases are considered in this section.

4.3.1. NHDP TLVs: LOCAL_IF, LINK_STATUS, and OTHER_NEIGHB

For the Address-Block TLVs LOCAL_IF, LINK_STATUS, and OTHER_NEIGHB TLVs, defined in [RFC6130], only a limited number of values are specified for each. These are converted, by this specification, into extensible registries with initial registrations for values defined and used by [RFC6130] -- see Section 5.

An implementation of [RFC6130] that receives a LOCAL_IF, LINK_STATUS, or OTHER_NEIGHB TLV with any TLV Value other than the values that are defined in [RFC6130] MUST ignore that TLV Value, as well as any corresponding attribute association to the address.

4.3.2. OLSRv2 TLVs: MPR and NBR_ADDR_TYPE

The Address-Block TLVs MPR and NBR_ADDR_TYPE, defined in [RFC7181], are similar to those defined in [RFC6130] in having only limited values specified (1, 2, and 3): 1 and 2 represent the presence of two different attributes associated to an address, and 3 represents "both 1 and 2".

These TLV Value fields are, by this specification, converted to bit fields and MUST be interpreted as such. As the existing definitions of values 1, 2, and 3 behave in that manner, it is likely that this will involve no change to an implementation, but any test of (for example) Value = 1 or Value = 3 MUST be converted to a test of (for example) Value bitand 1 = 1, where "bitand" denotes a bitwise AND operation.

This specification creates registries for recording reservations of the individual bits in these bit fields, with initial registrations for values defined and used by [RFC7181] -- see Section 5.

Other TLVs defined by [RFC7181] are not affected by this specification.

4.3.3. Unspecified TLV Values

The registries defined in Section 5 for the LOCAL_IF, LINK_STATUS, and OTHER_NEIGHB TLVs each include an additional TLV Value UNSPECIFIED. This TLV Value represents a defined value that, like currently undefined TLV Values, indicates that no information is associated with this address; the defined value will always have this meaning. Such a TLV Value may be used to enable the creation of more efficient multivalue Address Block TLVs or to simplify an implementation.

The similar requirement for the MPR and NBR_ADDR_TYPES TLVs is already satisfied by the TLV Value zero, provided that each bit in the TLV Value is defined as set (’1’) when indicating the presence of an attribute, or clear (’0’) when indicating the absence of an attribute. Therefore, this is required for registrations from the relevant registries; see Section 5.

For the LINK_METRIC TLV, this is already possible by clearing the most significant bits (0 to 3) of the first octet of the TLV Value. It is RECOMMENDED that in this case the remaining bits of the TLV Value are either all clear (’0’) or all set (’1’).

5. IANA Considerations

IANA has completed the ten actions set out in the following sections.

5.1. LOCAL_IF Address Block TLVs

5.1.1. New Registry

IANA has created a new sub-registry called "LOCAL_IF TLV Values" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry.

IANA has populated this registry as specified in Table 1.

Value	Name	Description	Reference
0	THIS_IF	The network address is associated with this local interface of the sending router	RFC 7188
1	OTHER_IF	The network address is associated with another local interface of the sending router	RFC 7188
2-223		Unassigned	
224-254		Reserved for Experimental Use	RFC 7188
255	UNSPECIFIED	No information about this network address is provided	RFC 7188

Table 1: LOCAL_IF TLV Values

New assignments are to be made by Expert Review [RFC5226].

The Designated Experts are required to use the guidelines specified in [RFC6130] and [RFC7181].

5.1.2. Modification to Existing Registry

IANA maintains a sub-registry called "LOCAL_IF Address Block TLV Type Extensions" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry. This sub-registry already had an entry for value 0. IANA has replaced the entry in the Description column for this value with the text "This value is to be interpreted according to the registry LOCAL_IF TLV Values". The resulting table is as specified in Table 2.

Type Extension	Description	Reference
0	This value is to be interpreted according to the registry LOCAL_IF TLV Values	RFC 6130, RFC 7188
1-255	Unassigned	

Table 2: LOCAL_IF Address Block TLV Type Extensions Modifications

5.2. LINK_STATUS Address Block TLVs

5.2.1. New Registry

IANA has created a new sub-registry called "LINK_STATUS TLV Values" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry.

IANA has populated this registry as specified in Table 3.

Value	Name	Description	Reference
0	LOST	The link on this interface from the router with that network address has been lost	RFC 7188
1	SYMMETRIC	The link on this interface from the router with that network address has the status of symmetric	RFC 7188
2	HEARD	The link on this interface from the router with that network address has the status of heard	RFC 7188
3-223		Unassigned	
224-254		Reserved for Experimental Use	RFC 7188
255	UNSPECIFIED	No information about this network address is provided	RFC 7188

Table 3: LINK_STATUS TLV Values

New assignments are to be made by Expert Review [RFC5226].

The Designated Experts are required to use the guidelines specified in [RFC6130] and [RFC7181].

5.2.2. Modification to Existing Registry

IANA maintains a sub-registry called "LINK_STATUS Address Block TLV Type Extensions" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry. This sub-registry already had an entry for value 0. IANA has replaced the entry in the Description column for this value with the text "This value is to be interpreted according to the registry LINK_STATUS TLV Values". The resulting table is as specified in Table 4.

Type Extension	Description	Reference
0	This value is to be interpreted according to the registry LINK_STATUS TLV Values	RFC 6130, RFC 7188
1-255	Unassigned	

Table 4: LINK_STATUS Address Block TLV Type Extensions Modifications

5.3. OTHER_NEIGHB Address Block TLVs

5.3.1. Create New Registry

IANA has created a new sub-registry called "OTHER_NEIGHB TLV Values" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry.

IANA has populated this registry as specified in Table 5.

Value	Name	Description	Reference
0	LOST	The neighbor relationship with the router with that network address has been lost	RFC 7188
1	SYMMETRIC	The neighbor relationship with the router with that network address is symmetric	RFC 7188
2-223		Unassigned	
224-254		Reserved for Experimental Use	RFC 7188
255	UNSPECIFIED	No information about this network address is provided	RFC 7188

Table 5: OTHER_NEIGHB Address Block TLV Values

New assignments are to be made by Expert Review [RFC5226].

The Designated Experts are required to use the guidelines specified in [RFC6130] and [RFC7181].

5.3.2. Modification to Existing Registry

IANA maintains a sub-registry called "OTHER_NEIGHB Address Block TLV Type Extensions" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry. This sub-registry already had an entry for value 0. IANA has replaced the entry in the Description column for this value with the text "This value is to be interpreted according to the registry OTHER_NEIGHB TLV Values". The resulting table is as specified in Table 6.

Type Extension	Description	Reference
0	This value is to be interpreted according to the registry OTHER_NEIGHB TLV Values	RFC 6130, RFC 7188
1-255	Unassigned	

Table 6: OTHER_NEIGHB Address Block TLV Type Extensions Modifications

5.4. MPR Address Block TLVs

5.4.1. New Registry

IANA has created a new sub-registry called "MPR TLV Bit Values" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry.

IANA has populated this registry as specified in Table 7.

Bit	Value	Name	Description	Reference
7	0x01	Flooding	The neighbor with that network address has been selected as flooding MPR	RFC 7188
6	0x02	Routing	The neighbor with that network address has been selected as routing MPR	RFC 7188
0-5			Unassigned	

Table 7: MPR Address Block TLV Bit Values

New assignments are to be made by Expert Review [RFC5226].

The Designated Experts are required to use the guidelines specified in [RFC6130] and [RFC7181]. Additionally, the Designated Experts are required to ensure that the following sense is preserved:

- For each bit in the field, a set bit (1) means that the address has the designated property, while an unset bit (0) means that no information about the designated property is provided. In particular, an unset bit must not be used to convey any specific information about the designated property.

5.4.2. Modification to Existing Registry

IANA maintains a sub-registry called "MPR Address Block TLV Type Extensions" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry. This sub-registry already had an entry for value 0. IANA has replaced the entry in the Description column for this value with the text "This value is to be interpreted according to the registry MPR TLV Bit Values". The resulting table is as specified in Table 8.

Type Extension	Description	Reference
0	This value is to be interpreted according to the registry MPR TLV Bit Values	RFC 7181, RFC 7188
1-255	Unassigned	

Table 8: MPR Address Block TLV Type Extensions Modifications

5.5. NBR_ADDR_TYPE Address Block TLVs

5.5.1. New Registry

IANA has created a new sub-registry called "NBR_ADDR_TYPE Address Block TLV Bit Values" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry.

IANA has populated this registry as specified in Table 9.

Bit	Value	Name	Description	Reference
7	0x01	ORIGINATOR	The network address is an originator address reachable via the originating router	RFC 7188
6	0x02	ROUTABLE	The network address is a routable address reachable via the originating router	RFC 7188
0-5			Unassigned	

Table 9: NBR_ADDR_TYPE Address Block TLV Bit Values

New assignments are to be made by Expert Review [RFC5226].

The Designated Experts are required to use the guidelines specified in [RFC6130] and [RFC7181]. Additionally, the Designated Experts are required to ensure that the following sense is preserved:

- For each bit in the field, a set bit (1) means that the address has the designated property, while an unset bit (0) means that no information about the designated property is provided. In particular, an unset bit must not be used to convey any specific information about the designated property.

5.5.2. Modification to Existing Registry

IANA maintains a sub-registry called "NBR_ADDR_TYPE Address Block TLV Type Extensions" within the "Mobile Ad hoc NETwork (MANET) Parameters" registry. This sub-registry already had an entry for value 0. IANA has replaced the entry in the Description column for this value with the text "This value is to be interpreted according to the registry NBR_ADDR_TYPE TLV Bit Values". The resulting table is as specified in Table 10.

Type Extension	Description	Reference
0	This value is to be interpreted according to the registry NBR_ADDR_TYPE Address Block TLV Bit Values	RFC 7181, RFC 7188
1-255	Unassigned	

Table 10: NBR_ADDR_TYPE Address Block TLV Type Extensions Modifications

6. Security Considerations

The updates made to [RFC6130] and [RFC7181] have the following implications on the security considerations:

- Created IANA registries for retaining TLV values for TLVs, already defined in the already published specifications of the two protocols, and with initial registrations for the TLV values defined by these specifications. This does not give rise to any additional security considerations.

- Enabled protocol extensions for registering TLV values in the created IANA registries. Such extensions MUST specify appropriate security considerations.

- Created, in some registries, a registration for "UNSPECIFIED" values for more efficient use of multivalue Address Block TLVs. The interpretation of an address being associated with a TLV of a given type and with the value "UNSPECIFIED" is identical to that address not being associated with a TLV of that type. Thus, this update does not give rise to any additional security considerations.

- Reduced the latitude of implementations of the two protocols to reject a message as "badly formed" due to the value field of a TLV being unexpected. These protocols are specified in terms such as "if an address is associated with a value of LOST by a LINK_STATUS TLV". Association with an unknown value (or a value newly defined to mean no link status information) has no effect on such a specification. Thus, this update does not give rise to any additional security considerations.

- o Did not introduce any opportunities for attacks on the protocols through signal modification that are not already present in the two protocols.

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8. References

8.1. Normative References

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8.2. Informative References

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