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Multiple TLV Instances in IS-IS

Abstract

Emerging technologies are adding information into IS-IS TLVs at a steady pace while deployment scales are simultaneously increasing. This causes the contents of many critical TLVs to exceed the currently supported limit of 255 octets. Extensions such as [RFC7356] require significant IS-IS changes that could help address the problem, but a less drastic solution would be beneficial. This document codifies the common mechanism of extending the TLV space through multiple TLV instances.

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Table of Contents

- [1. Introduction](#)
- [2. Requirements Language](#)
- [3. Procedure for Advertising Multiple TLV Instances](#)
- [4. Procedure for Receiving Multiple TLV Instances](#)
- [5. Operational Considerations](#)
- [6. IANA Considerations](#)
- [7. Security Considerations](#)
- [8. References](#)
 - [8.1. Normative References](#)
 - [8.2. Informative References](#)
- [Authors' Addresses](#)

1. Introduction

The continued growth of the Internet has resulted in a commensurate growth in the scale of service provider networks and the amount of information carried in IS-IS [[IS010589](#)] Type-Length-Value (TLV) tuples. Simultaneously, new traffic engineering technologies are defining new attributes, further adding to the scaling pressures. The original TLV definition allows for 255 octets of payload, which is becoming increasingly inadequate.

Some TLV definitions have addressed this by explicitly stating that a TLV may appear multiple times inside of an LSP. However, this has not been done for many legacy TLVs, leaving the situation ambiguous. The intent of this document is to clarify the situation by explicitly defining the use of multiple instances of TLVs as the mechanism for scaling TLV contents, except where explicitly prohibited.

Today, as an example, the Extended IS Reachability TLV (22) [[RFC5305](#)] and MT Intermediate Systems TLV (222) [[RFC5120](#)] are TLVs where existing standards do not specify the behavior expected when multiple copies of the TLV are present and no other mechanism for expanding the information carrying capacity of the TLV has been specified.

[[RFC7356](#)] has proposed a 16 bit length field for TLVs in flooding scoped Protocol Data Units (PDUs), but does nothing to address

legacy implementations that do not yet implement the full breadth and scope of that RFC.

2. Requirements Language

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 [BCP 14](#) [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

3. Procedure for Advertising Multiple TLV Instances

If the TLV contains information that specifies the applicability of its contents (i.e., a key), the key information MUST be replicated in additional TLV instances so that all contents specific to that key can be identified. This allows more sub-TLVs to be advertised for the same key information. The specification of the key for a given TLV is out of scope for this document.

This should be applied recursively. If a TLV is structured with sub-TLVs and sub-sub-TLVs, then replication of key information allows for the advertisement of additional sub-TLVs and sub-sub-TLVs for that key.

Note: If the fixed portion of a TLV includes information that is NOT part of the key and the non-key elements of the fixed portion of the TLV (metric and other bits in the control octet in the example below) differ, the values in the first TLV present in the lowest numbered LSP MUST be used.

As an example, consider the Extended IP Reachability TLV (type 135). A prefix in this TLV is specified by:

- *4 octets of metric information

- *1 octet of control information which includes 6 bits specifying the prefix length

- *0-4 octets of IPv4 prefix

followed by up to 250 octets of sub-TLV information.

The key consists of the 6 bits of prefix length and the 0-4 octets of IPv4 prefix.

If this is insufficient sub-TLV space, then the node MAY advertise additional instances of the Extended IS Reachability TLV. The key information MUST be replicated identically and the additional sub-TLV space may be populated with additional information. The complete

information for a given key in such cases is the joined set of all the carried information under the key in all the TLV instances.

4. Procedure for Receiving Multiple TLV Instances

A node that receives multiple TLV instances MUST accept all of the information in all of the instances. The order of arrival and placement of the TLV instances in LSP fragments MUST NOT change the behavior of the node once all the fragments have been received.

The contents of multiple TLV instances of the same type should be processed as if they were concatenated. If the internals of the TLV contain key information, then replication of the key information should be taken to indicate that subsequent data should be processed as if the subsequent data were concatenated.

Specifically, if a TLV is structured with sub-TLVs and key information is replicated, then the sub-TLVs should be processed as if they were concatenated.

This process should be applied recursively. If a TLV is structured with sub-TLVs and sub-sub-TLVs with replicated key information at all levels, then sub-sub-TLVs should be processed as if they were concatenated.

For example, suppose that a node received an LSP with multiple instances of the Extended IS Reachability TLV. The first instance contained key information K with sub-TLVs A, B, and C. The second instance contained key information K with sub-TLVs D, E, and F. The receiving node should then process this as having key information K and sub-TLVs A, B, C, D, E, F, or, because ordering is irrelevant, sub-TLVs D, E, F, A, B, C.

5. Operational Considerations

The generation of multiple TLVs for a given object is triggered by more information than will fit into a single TLV. If multiple TLVs are advertised in the presence of nodes which do not support multiple TLVs, operation of routing in the network is likely to be compromised.

6. IANA Considerations

This document makes no requests of IANA.

7. Security Considerations

This document creates no new security issues for IS-IS. Additional instances of existing TLVs expose no new information.

Security concerns for IS-IS are addressed in [[ISO10589](#)], [[RFC5304](#)], and [[RFC5310](#)].

8. References

8.1. Normative References

- [**ISO10589**] ISO, "Intermediate system to Intermediate system routing information exchange protocol for use in conjunction with the Protocol for providing the Connectionless-mode Network Service (ISO 8473)", August 1987, <[ISO/IEC 10589:2002](#)>.
- [**RFC2119**] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
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- [**RFC5120**] Przygienda, T., Shen, N., and N. Sheth, "M-ISIS: Multi Topology (MT) Routing in Intermediate System to Intermediate Systems (IS-ISs)", RFC 5120, DOI 10.17487/RFC5120, February 2008, <<https://www.rfc-editor.org/info/rfc5120>>.
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