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IS-IS extensions for Computed Multicast applied to MPLS based Segment Routing

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Abstract

This document describes the IS-IS extensions required to support multicast for MPLS based Segment Routing. In this approach IS-IS speakers compute their role in multicast tree construction based on the information in the IS-IS routing information base.

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1. Introduction

[ALLAN-1] describes a solution for multicast for Segment Routing with MPLS data plane in which source specific multicast distribution trees (MDTs) are computed from information distributed via an IGP. Using this approach, both any-source multicast (ASM) and engineered p2mp trees can be supported.

This memo describes TLVs for IS-IS to support the segment routing multicast approach as described in [ALLAN-1].

1.1. Authors

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1.2. 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 RFC2119 [RFC2119].

2. Conventions used in this document

2.1. Terminology

Candidate replication point - is a node will potentially need to install state as determined at some intermediate step in MDT computation. It will either resolve to having no role or a role as a replication point once multicast has converged.

Candidate role - refers to any potential combination of roles on a given MDT as determined at some intermediate step in MDT computation. For example, a node with a candidate role may be a leaf and may be a candidate replication point.

Downstream - refers to the direction along the shortest path to one or more leaves for a given multicast distribution tree

Multicast convergence - is when all computation and state installation to ensure the FIB reflects the multicast information in the IGP is complete.

Pinned path - Is a unique shortest path extending from a leaf upstream towards the root for a given MDT. Therefore is a component of an MDT that must be there. It will not necessarily extend from the leaf all the way to the root during intermediate computation steps. A pinned path can result from pruning operations.

Role - refers specifically to a node that is either a root, a leaf or a replication node for a given multicast distribution tree

Unicast convergence- is when all computation and state installation to ensure the FIB reflects the unicast information in the IGP is complete.

Upstream - refers to the direction along the shortest path to the root of a given multicast distribution tree

3. Overview

[ALLAN-1] adds the concept of the multicast segment to the Segment Routing architecture [IDSR].

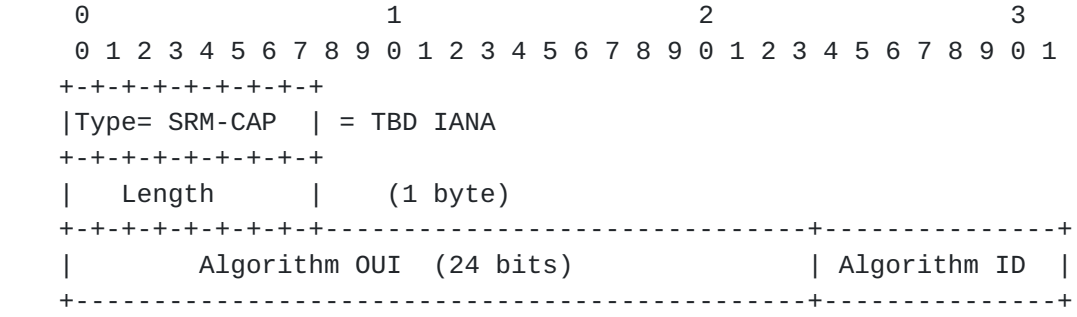
Extending the IS-IS to support multicast segments adds synchronization of knowledge of: multicast SIDs, multicast group membership and agreement on the algorithm to use for computation of multicast distribution trees(MDTs) across the set of IS-IS speakers in an area/domain. This document specifies the TLVs necessary for IS-IS to support multicast segments in the Segment Routing architecture.

4. New TLVs

4.1. Compute Capability TLV

The presence of this sub-TLV in an LSP (TLV 144 defined in [RFC6329]) indicates both that the originating node supports computed spring multicast, and the algorithm that is configured to be used for a particular topology. All nodes supporting computed multicast are required to agree on the algorithm for correct operation of the network for that topology.

The format of the sub-TLV is:



Where:

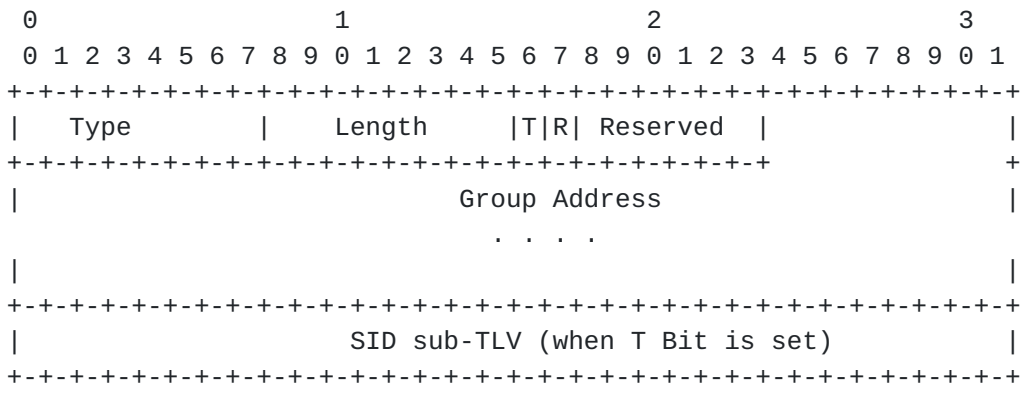
The upper 24 bits contains an organizationally unique identifier (as per [RFC7042]) and the lower 8 bits contains an algorithm identifier.

The default algorithm supported as per [ALLAN-1] is identified by Algorithm OUI = 0x008037 (Ericsson), Algorithm ID = 0x01 (default).

4.2. SRM SID Multicast Group Binding sub-TLV

The SID Multicast Group Binding sub-TLV communicates the binding between the SID specific to the MDT for the multicast group originating at the advertising node and the multicast group address as well as transmit and receive interest for the advertising node. Note that if the TLV does not have the T bit set, the SID TLV is not included in the message. The encoding is as a sub-TLV from the 135,

235, 236 and 237 registry. This sub-TLV SHOULD be advertised when N bit set in the IPv4/IPv6 Extended Reachability Attribute Flags for the corresponding prefix as defined in [RFC7794]. The encoding of the SID sub-TLV is as per section 2.3 of [SPRING-ISIS].



Where:

Type = TBD (IANA assignment from TLV 135, 235, 236 and 237 registry)

Length = 8 octet Variable which includes size of the T/R, reserved fields, multicast group address and the SID TLV

T-bit indicates that this node is a source for the multicast group specified in the sub-tlv.

R-bit indicates that this node is a receiver for the multicast group specified in the sub-tlv.

Group address = 4 octet IPv4 multicast group address (when used with TLV 135 or 235), 16 octet IPv6 multicast group address (when used with TLV 236 or 237).

SID sub-TLV contains the segment ID to use for this multicast segment.

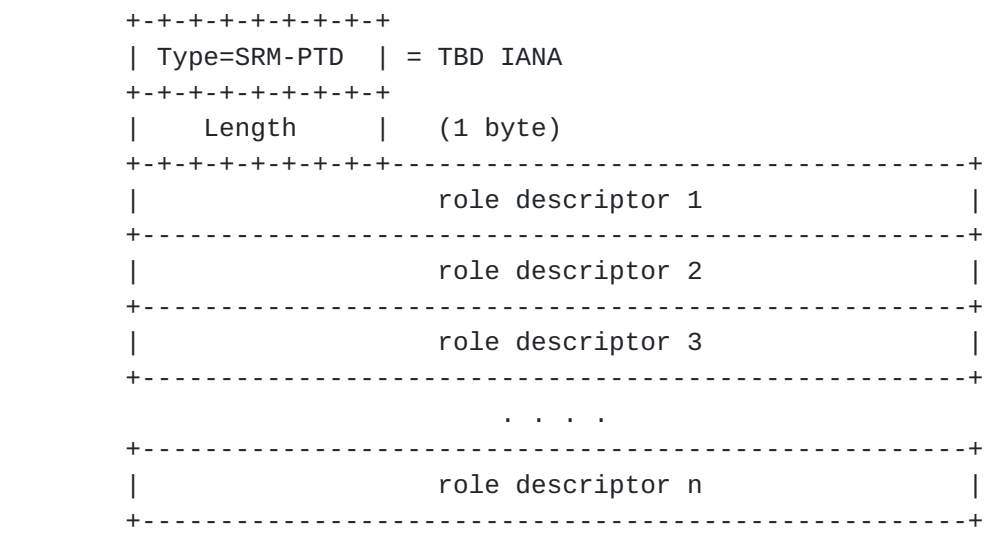
4.3. SRM Pinned Tree Descriptor sub-TLV

The pinned tree descriptor defines all nodes that have a role in a multicast distribution tree, and their relationship to the individual multicast segments that define the tree. The encoding is an unstructured list, where if the tree description exceeds 252 bytes, it may simply use more than one sub-TLV. This sub-TLV SHOULD be

advertised when N bit set in the IPv4/IPv6 Extended Reachability Attribute Flags for the corresponding prefix as defined in [RFC7794].

The encoding of a role descriptor is in the form of upstream_SID/unicast_SID/downstream _SID, where each of the SIDs is encoded as a sub-TLV as per [SPRING-ISIS].

The root of the MDT (and originator of the TLV) will have a NULL upstream SID, transit waypoints will have both a defined upstream and downstream multicast segment SID, and a leaf will have a NULL downstream SID. The unicast SID corresponds to the node for which the entry defines its role.

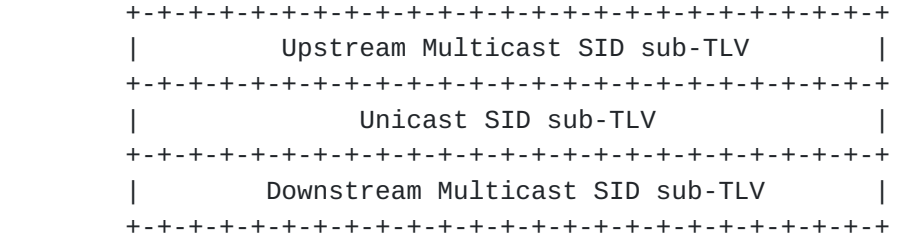


Where:

Type = TBD (IANA assignment from TLV 135, 235, 236 and 237 registry)

Length = Variable and represents size of the role descriptors

The encoding of a role descriptor is in the form:



5. Acknowledgements

6. Security Considerations

For a future version of this document.

7. IANA Considerations

This memo requires the allocation of:

1) a value for each of the SRM SID Multicast Group Binding sub-TLV, and the SRM Pinned Tree Descriptor sub-TLV from the "Sub-TLVs for TLVs 135, 235, 236, and 237" registry.

2) A value for the SRM Capability sub-TLV from the "Sub-TLVs for TLV 144" registry.

8. References

8.1. Normative References

[IS-IS] ISO/IEC 10589:2002, Second Edition, "Intermediate System to Intermediate System Intra-Domain Routing Exchange Protocol for use in Conjunction with the Protocol for Providing the Connectionless-mode Network Service (ISO 8473)", 2002.

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

[RFC6329] Fedyk et.al. "IS-IS Extensions Supporting IEEE 802.1aq Shortest Path Bridging", IETF RFC 6329, April 2012

[RFC7042] Eastlake, D. et. al.,"IANA Considerations and IETF Protocol and Documentation Usage for IEEE 802 Parameters", IETF RFC 7042, October 2013

[RFC7794] Ginsberg et. al., "IS-IS Prefix Attributes for Extended IPv4 and IPv6 Reachability", IETF RFC 7794, March 2016

[SPRING-ISIS] Previdi el.al. "IS-IS Extensions for Segment Routing", IETF work in progress, draft-ietf-isis-segment-routing-extensions-06, December 2015

8.2. Informative References

[IDSR] Filsfils et.al., "Segment Routing Architecture", IETF work in progress, draft-ietf-spring-segment-routing-08, May 2016

[ALLAN-1] Allan et.al., "A Framework for Computed Multicast applied to MPLS based Segment Routing", draft-allan-spring-mpls-mcast-framework-01, July 2016

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