

Link State Routing
Internet-Draft
Intended status: Standards Track
Expires: November 24, 2022

K. Talaulikar
Arrcus Inc
P. Psenak
Cisco Systems
May 23, 2022

Advertising Layer 2 Bundle Member Link Attributes in OSPF
draft-ietf-lsr-ospf-l2bundles-04

Abstract

There are deployments where the Layer 3 (L3) interface on which OSPF operates is a Layer 2 (L2) interface bundle. Existing OSPF advertisements only support advertising link attributes of the Layer 3 interface. If entities external to OSPF wish to control traffic flows on the individual physical links which comprise the Layer 2 interface bundle, link attribute information for the bundle members is required.

This document defines the protocol extensions for OSPF to advertise the link attributes of L2 bundle members.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on November 24, 2022.

Copyright Notice

Copyright (c) 2022 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of

publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1.	Introduction	2
1.1.	Requirements Language	3
2.	L2 Bundle Member Attributes	3
3.	IANA Considerations	6
4.	Security Considerations	7
5.	Acknowledgements	7
6.	References	7
6.1.	Normative References	7
6.2.	Informational References	8
	Authors' Addresses	9

[1.](#) Introduction

There are deployments where the Layer 3 interface on which an OSPF adjacency is established is a Layer 2 interface bundle, for instance a Link Aggregation Group (LAG) [[IEEE802.1AX](#)]. This reduces the number of adjacencies that need to be maintained by the OSPF protocol in cases where there are parallel links between the neighbors. Entities external to OSPF such as Path Computation Elements (PCE) [[RFC4655](#)] may wish to control traffic flows on individual members of the underlying Layer 2 bundle. To do so, link attribute information for individual bundle members is required. The protocol extensions defined in this document provide the means to advertise this information.

This document defines sub-TLVs to advertise link attribute information for each of the L2 bundle members which comprise the Layer 3 interface on which OSPF operates. Similar capabilities were introduced in IS-IS via [[RFC8668](#)].

[[RFC8665](#)] and [[RFC8666](#)] introduced the adjacency segment identifier (Adj-SID) link attribute for OSPFv2 and OSPFv3 respectively which can be used as an instruction to forwarding to send traffic over a specific link [[RFC8402](#)]. This document enables the advertisement of

the Adj-SIDs using the same Adjacency SID Sub-TLV at the granularity level of each L2 bundle member link so that traffic may be steered over that specific member link.

Note that the advertisements at the L2 bundle member link-level defined in this document are intended to be provided to external (to OSPF) entities and do not alter or change the OSPF route computation. The following items are intentionally not defined and are outside the scope of this document:

- o What link attributes will be advertised. This is determined by the needs of the external entities.
- o A minimum or default set of link attributes.
- o How these attributes are configured.
- o How the advertisements are used.
- o What impact the use of these advertisements may have on traffic flow in the network.
- o How the advertisements are passed to external entities.

1.1. 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.

2. L2 Bundle Member Attributes

A new L2 Bundle Member Attributes Sub-TLV is introduced to advertise L2 bundle member attributes in both OSPFv2 and OSPFv3. In the case of OSPFv2, this sub-TLV is an optional sub-TLV of the OSPFv2 Extended Link TLV that is used to describe link attributes via the OSPFv2 Extended Link Opaque LSA [[RFC7684](#)]. In the case of OSPFv3, this sub-TLV is an optional sub-TLV of the Router Link TLV of the OSPFv3 E-

Router-LSA [[RFC8362](#)].

When the OSPF adjacency is associated with an L2 bundle interface, this sub-TLV is used to advertise the underlying L2 bundle member links along with their respective link attributes. The inclusion of this information implies that the identified link is a member of the L2 bundle associated with an OSPF L3 link and that the member link is operationally up. Therefore advertisements of member links MUST NOT be done when the member link becomes operationally down or it is no longer a member of the identified L2 bundle.

The advertisement of the L2 Bundle Member Attributes Sub-TLV may be assymetric for an OSPF link depending on the underlying layer 2 connectivity i.e., advertised by the router on only one end.

The L2 Bundle Member Attributes Sub-TLV has the following format:

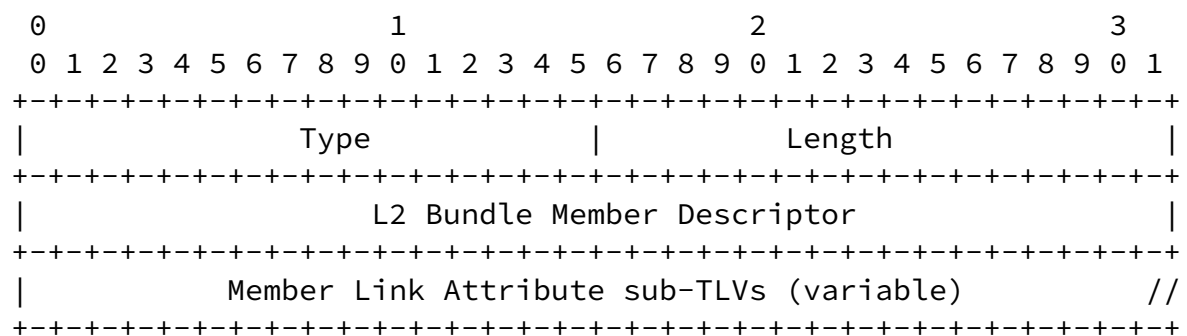


Figure 1: L2 Bundle Member Attributes sub-TLV Format

Where:

Type: 24 for OSPFv2 and 29 for OSPFv3

Length: Variable.

L2 Bundle Member Descriptor: A 4 octet Link Local Identifier as described in [[RFC4202](#)] and used in [[RFC8510](#)] for the member link.

Link attributes for L2 bundle member links are advertised as sub-TLVs

of the L2 Bundle Member Attribute Sub-TLV.

In the case of OSPFv2, the L2 Bundle Member Attributes Sub-TLV shares the sub-TLV space of the Extended Link TLV and the sub-TLVs of the Extended Link TLV MAY be used to describe the attributes of the member link. Figure 2 below lists sub-TLVs and their applicability for L2 bundle member links. The sub-TLVs that are not applicable MUST NOT be used as sub-TLVs for the L2 Bundle Member Attributes Sub-TLV. Specifications that introduce new sub-TLVs of the Extended Link TLV MUST indicate their applicability for the L2 Bundle Member Attributes Sub-TLV. An implementation MUST ignore any sub-TLVs received that are not applicable in the context of the L2 Bundle Member Attribute Sub-TLV.

Y - applicable

N - not-applicable

- 1 SID/Label (N)
- 2 Adj-SID (Y)
- 3 LAN Adj-SID/Label (Y)
- 4 Network-to-Router Metric (N)
- 5 RTM Capability (N)
- 6 OSPFv2 Link MSD (N)
- 7 Graceful-Link-Shutdown (N)
- 8 Remote IPv4 Address (N)
- 9 Local/Remote Interface ID (N)
- 10 Application Specific Link Attributes (Y)
- 11 Shared Risk Link Group (Y)
- 12 Unidirectional Link Delay (Y)
- 13 Min/Max Unidirectional Link Delay (Y)
- 14 Unidirectional Delay Variation (Y)
- 15 Unidirectional Link Loss (Y)
- 16 Unidirectional Residual Bandwidth (Y)
- 17 Unidirectional Available Bandwidth (Y)
- 18 Unidirectional Utilized Bandwidth (Y)
- 19 Administrative Group (Y)

- 20 Extended Administrative Group (Y)
- 21 Maximum Link Bandwidth (Y)
- 22 Traffic Engineering Metric (Y)
- 24 L2 Bundle Member Attributes (N)

Figure 2: Applicability of OSPFv2 Link Attribute Sub-TLVs for L2 Bundle Members

In the case of OSPFv3, the L2 Bundle Member Attributes Sub-TLV shares the sub-TLV space of the Router Link TLV and the sub-TLVs of the Router Link TLV MAY be used to describe the attributes of the member link. Figure 3 below lists sub-TLVs that are applicable to the Router Link TLV and their applicability for L2 bundle member links. The sub-TLVs that are not applicable MUST NOT be used as sub-TLVs for the L2 Bundle Member Attributes Sub-TLV. Specifications that introduce new sub-TLVs of the Router Link TLV MUST indicate their applicability for the L2 Bundle Member Attributes Sub-TLV. An implementation MUST ignore any sub-TLVs received that are not applicable in the context of the L2 Bundle Member Attribute Sub-TLV.

Y - applicable

N - not-applicable

- 5 Adj-SID (Y)
- 6 LAN Adj-SID (Y)
- 7 SID/Label (N)
- 8 Graceful-Link-Shutdown (N)
- 9 OSPFv3 Link MSD (N)
- 10 Application Specific Link Attributes (Y)
- 11 Shared Risk Link Group (Y)
- 12 Unidirectional Link Delay (Y)
- 13 Min/Max Unidirectional Link Delay (Y)
- 14 Unidirectional Delay Variation (Y)
- 15 Unidirectional Link Loss (Y)
- 16 Unidirectional Residual Bandwidth (Y)

- 17 Unidirectional Available Bandwidth (Y)
- 18 Unidirectional Utilized Bandwidth (Y)
- 19 Administrative Group (Y)
- 20 Extended Administrative Group (Y)
- 21 Traffic Engineering Metric (Y)
- 22 Maximum Link Bandwidth (Y)
- 23 Local Interface IPv6 Address (N)
- 24 Remote Interface IPv6 Address (N)
- 29 L2 Bundle Member Attributes (N)

Figure 3: Applicability of OSPFv3 Link Attribute Sub-TLVs for L2 Bundle Members

3. IANA Considerations

This document adds new sub-TLVs to the OSPFv2 and OSPFv3 registry.

The following code-point has been assigned via early allocation in the OSPFv2 Extended Link TLV Sub-TLVs registry under the OSPFv2 Parameters IANA registry:

Value: 24

Name: L2 Bundle Member Attributes

The following code-point has been assigned via early allocation in the OSPFv3 Extended LSA Sub-TLVs registry under the OSPFv3 Parameters IANA registry:

Value: 29

Name: L2 Bundle Member Attributes

4. Security Considerations

The OSPF protocol has supported the advertisement of link attribute information, including link identifiers, for many years. The advertisements defined in this document are identical to existing advertisements defined in [[RFC3630](#)], [[RFC4203](#)], [[RFC5329](#)], [[RFC7471](#)],

[RFC8665], and [RFC8666] - but are associated with L2 links which are part of a bundle interface on which the OSPF protocol operates. Therefore the security considerations of these documents are applicable and there are no new security issues introduced by the extensions in this document.

As always, if the protocol is used in an environment where unauthorized access to the physical links on which OSPF packets are sent occurs then attacks are possible. The use of authentication as defined in [RFC5709], [RFC7474], [RFC4552], and [RFC7166] is recommended for preventing such attacks.

5. Acknowledgements

This document leverages the similar work done for IS-IS and the authors of this document would like to acknowledge the contributions of the authors of [RFC8668].

The authors would like to thank Anoop Ghanwani for his review and feedback on this document. The authors would also like to thank Acee Lindem for his detailed shepherd review of this document.

6. References

6.1. Normative References

[IEEE802.1AX]

Institute of Electrical and Electronics Engineers, "IEEE Standard for Local and Metropolitan Area Networks - Link Aggregation.", Nov 2008.

[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>>.

[RFC4202] Kompella, K., Ed. and Y. Rekhter, Ed., "Routing Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)", [RFC 4202](#), DOI 10.17487/RFC4202, October 2005, <<https://www.rfc-editor.org/info/rfc4202>>.

Tantsura, J., and A. Lindem, "OSPFv2 Prefix/Link Attribute Advertisement", [RFC 7684](#), DOI 10.17487/RFC7684, November 2015, <<https://www.rfc-editor.org/info/rfc7684>>.

- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in [RFC 2119](#) Key Words", [BCP 14](#), [RFC 8174](#), DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.
- [RFC8362] Lindem, A., Roy, A., Goethals, D., Reddy Vallem, V., and F. Baker, "OSPFv3 Link State Advertisement (LSA) Extensibility", [RFC 8362](#), DOI 10.17487/RFC8362, April 2018, <<https://www.rfc-editor.org/info/rfc8362>>.
- [RFC8665] Psenak, P., Ed., Previdi, S., Ed., Filssils, C., Gredler, H., Shakir, R., Henderickx, W., and J. Tantsura, "OSPF Extensions for Segment Routing", [RFC 8665](#), DOI 10.17487/RFC8665, December 2019, <<https://www.rfc-editor.org/info/rfc8665>>.
- [RFC8666] Psenak, P., Ed. and S. Previdi, Ed., "OSPFv3 Extensions for Segment Routing", [RFC 8666](#), DOI 10.17487/RFC8666, December 2019, <<https://www.rfc-editor.org/info/rfc8666>>.

[6.2](#). Informational References

- [RFC3630] Katz, D., Kompella, K., and D. Yeung, "Traffic Engineering (TE) Extensions to OSPF Version 2", [RFC 3630](#), DOI 10.17487/RFC3630, September 2003, <<https://www.rfc-editor.org/info/rfc3630>>.
- [RFC4203] Kompella, K., Ed. and Y. Rekhter, Ed., "OSPF Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)", [RFC 4203](#), DOI 10.17487/RFC4203, October 2005, <<https://www.rfc-editor.org/info/rfc4203>>.
- [RFC4552] Gupta, M. and N. Melam, "Authentication/Confidentiality for OSPFv3", [RFC 4552](#), DOI 10.17487/RFC4552, June 2006, <<https://www.rfc-editor.org/info/rfc4552>>.
- [RFC4655] Farrel, A., Vasseur, J., and J. Ash, "A Path Computation Element (PCE)-Based Architecture", [RFC 4655](#), DOI 10.17487/RFC4655, August 2006, <<https://www.rfc-editor.org/info/rfc4655>>.

- [RFC5329] Ishiguro, K., Manral, V., Davey, A., and A. Lindem, Ed., "Traffic Engineering Extensions to OSPF Version 3", [RFC 5329](#), DOI 10.17487/RFC5329, September 2008, <<https://www.rfc-editor.org/info/rfc5329>>.
- [RFC5709] Bhatia, M., Manral, V., Fanto, M., White, R., Barnes, M., Li, T., and R. Atkinson, "OSPFv2 HMAC-SHA Cryptographic Authentication", [RFC 5709](#), DOI 10.17487/RFC5709, October 2009, <<https://www.rfc-editor.org/info/rfc5709>>.
- [RFC7166] Bhatia, M., Manral, V., and A. Lindem, "Supporting Authentication Trailer for OSPFv3", [RFC 7166](#), DOI 10.17487/RFC7166, March 2014, <<https://www.rfc-editor.org/info/rfc7166>>.
- [RFC7471] Giacalone, S., Ward, D., Drake, J., Atlas, A., and S. Previdi, "OSPF Traffic Engineering (TE) Metric Extensions", [RFC 7471](#), DOI 10.17487/RFC7471, March 2015, <<https://www.rfc-editor.org/info/rfc7471>>.
- [RFC7474] Bhatia, M., Hartman, S., Zhang, D., and A. Lindem, Ed., "Security Extension for OSPFv2 When Using Manual Key Management", [RFC 7474](#), DOI 10.17487/RFC7474, April 2015, <<https://www.rfc-editor.org/info/rfc7474>>.
- [RFC8402] Filsfils, C., Ed., Previdi, S., Ed., Ginsberg, L., Decraene, B., Litkowski, S., and R. Shakir, "Segment Routing Architecture", [RFC 8402](#), DOI 10.17487/RFC8402, July 2018, <<https://www.rfc-editor.org/info/rfc8402>>.
- [RFC8510] Psenak, P., Ed., Talaulikar, K., Henderickx, W., and P. Pillay-Esnault, "OSPF Link-Local Signaling (LLS) Extensions for Local Interface ID Advertisement", [RFC 8510](#), DOI 10.17487/RFC8510, January 2019, <<https://www.rfc-editor.org/info/rfc8510>>.
- [RFC8668] Ginsberg, L., Ed., Bashandy, A., Filsfils, C., Nanduri, M., and E. Aries, "Advertising Layer 2 Bundle Member Link Attributes in IS-IS", [RFC 8668](#), DOI 10.17487/RFC8668, December 2019, <<https://www.rfc-editor.org/info/rfc8668>>.

Authors' Addresses

Ketan Talaulikar
Arrcus Inc
India

Email: ketant.ietf@gmail.com

Talaulikar & Psenak

Expires November 24, 2022

[Page 9]

Internet-Draft

OSPF L2 Bundle Member Link Attributes

May 2022

Peter Psenak
Cisco Systems
Apollo Business Center
Mlynske nivy 43
Bratislava 821 09
Slovakia

Email: ppsenak@cisco.com

