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Signaling Entropy Label Capability and Entropy Readable Label-stack Depth Using OSPF
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Abstract

Multiprotocol Label Switching (MPLS) has defined a mechanism to load-balance traffic flows using Entropy Labels (EL). An ingress Label Switching Router (LSR) cannot insert ELs for packets going into a given tunnel unless an egress LSR has indicated via signaling that it has the capability to process ELs, referred to as Entropy Label Capability (ELC), on that tunnel. In addition, it would be useful for ingress LSRs to know each LSR's capability of reading the maximum label stack depth and performing EL-based load-balancing, referred to as Entropy Readable Label Depth (ERLD). This document defines a mechanism to signal these two capabilities using OSPF and OSPFv3. These mechanism is particularly useful in the environment where Segment Routing (SR) is used, where label advertisements are done via protocols like OSPF and OSPFv3.

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 [BCP14] [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on April 23, 2020.

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1. Introduction

[RFC6790] describes a method to load-balance Multiprotocol Label Switching (MPLS) traffic flows using Entropy Labels (EL). It also introduces the concept of Entropy Label Capability (ELC) and defines

the signaling of this capability via MPLS signaling protocols. Recently, mechanisms have been defined to signal labels via link-state Interior Gateway Protocols (IGP) such as OSPF [I-D.ietf-ospf-segment-routing-extensions]. In such scenarios, the signaling mechanisms defined in [RFC6790] are inadequate. This draft defines a mechanism to signal the ELC using OSPF. This mechanism is useful when the label advertisement is also done via OSPF.

In addition, in the cases where stacked LSPs are used for whatever reasons (e.g., SR-MPLS [I-D.ietf-spring-segment-routing-mpls]), it would be useful for ingress LSRs to know each intermediate LSR's capability of reading the maximum label stack depth and performing EL-based load-balancing. This capability, referred to as Entropy Readable Label Depth (ERLD) as defined in [I-D.ietf-mpls-spring-entropy-label] may be used by ingress LSRs to determine the position of the EL label in the stack, and whether it's necessary to insert multiple ELs at different positions in the label stack.

2. Terminology

This document makes use of the terms defined in [RFC6790], [RFC7770] and [I-D.ietf-mpls-spring-entropy-label].

3. Advertising ELC Using OSPF

Even though ELC is a property of the node, in some cases it is advantageous to associate and advertise the ELC with the prefix. In multi-area networks, routers may not know the identity of the prefix originator in a remote area, or may not know the capabilities of such originator. Similarly, in a multi domain network, the identity of the prefix originator and its capabilities may not be known to the ingress LSR.

If a router has multiple line cards, the router MUST NOT announce ELC unless all of its line-cards are capable of processing ELs.

If the router supports ELs on all of its line cards, it SHOULD advertise the ELC with every local host prefix it advertises in OSPF.

When an OSPF Area Border Router (ABR) advertises the prefix to the connected area based on the intra-area or inter-area prefix that is reachable in some other area, it MUST preserve the ELC signalling for such prefix.

When an OSPF Autonomous System Boundary Router (ASBR) redistributes the prefix from another instance of the OSPF or from some other protocol, it SHOULD preserve the ELC signaling for the prefix. The

exact mechanism used to exchange ELC between protocol instances on the ASBR is outside of the scope of this document and is implementation specific.

3.1. Advertising ELC Using OSPFv2

[RFC7684] defines the OSPFv2 Extended Prefix TLV to advertise additional attributes associated with a prefix. The OSPFv2 Extended Prefix TLV includes a one octet Flags field. A new flag in the Flags field is used to signal the ELC for the prefix:

0x20 - E-Flag (ELC Flag): Set by the advertising router to indicate that the prefix originator is capable of processing ELs.

3.2. Advertising ELC Using OSPFv3

[RFC5340] defines the OSPFv3 PrefixOptions that are advertised along with the prefix. A new bit in the OSPFV3 PrefixOptions is used to signal the ELC for the prefix:

0x04 - E-Flag (ELC Flag): Set by the advertising router to indicate that the prefix originator is capable of processing ELs.

4. Advertising ERLD Using OSPF

A new MSD (Maximum SID Depth) type of the Node MSD sub-TLV [RFC8476], called ERLD is defined to advertise the ERLD of a given router. The scope of the advertisement depends on the application.

Assignment of a MSD-Type for ERLD is defined in [I-D.ietf-isis-mpls-elc].

If a router has multiple line-cards with different capabilities for reading the maximum label stack depth, the router MUST advertise the smallest one.

When the ERLD MSD-Type is received in the OSPFv2 or OSPFv3 Link MSD Sub-TLV, it MUST be ignored.

5. Signaling ELC and ERLD in BGP-LS

The OSPF extensions defined in this document can be advertised via BGP-LS [RFC7752] using existing BGP-LS TLVs.

The ELC Flag included in the OSPFv2 Extended Prefix TLV and the OSPFv3 PrefixOptions, as defined in Section 3, is advertised using the Prefix Attribute Flags TLV (TLV 1170) of the BGP-LS IPv4/IPv6

Prefix NLRI Attribute as defined in section 2.3.2 of [I-D.ietf-idr-bgp-ls-segment-routing-ext].

The ERLD MSD-type introduced for OSPF in Section 4 is advertised using the Node MSD TLV (TLV 266) of the BGP-LS Node NLRI Attribute as defined in section 3 of [I-D.ietf-idr-bgp-ls-segment-routing-msd].

6. Acknowledgements

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7. IANA Considerations

This document requests IANA to allocate one flag from the OSPFv2 Extended Prefix TLV Flags registry:

0x20 - E-Flag (ELC Flag)

This document requests IANA to allocate one flag from the OSPFv3 Prefix Options registry:

0x04 - E-Flag (ELC Flag)

8. Security Considerations

The security considerations as described in [RFC7770] and [I-D.ietf-mpls-spring-entropy-label] are applicable to this document.

Incorrectly setting the E flag (ELC capable) (during origination, inter-area advertisement or redistribution) may lead to black-holing of the traffic on the egress node.

Incorrectly setting of the ERLD value may lead to poor load-balancing of the traffic.

9. Contributors

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