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IS-IS Prefix Attributes for Extended IPv4 and IPv6 Reachability

Abstract

This document introduces new sub-TLVs to support advertisement of IPv4 and IPv6 prefix attribute flags and the source router ID of the router that originated a prefix advertisement.

Status of This Memo

This is an Internet Standards Track document.

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1. Introduction

IS-IS is a link-state routing protocol defined in [ISO10589] and [RFC1195]. Extensions in support of advertising new forms of IPv4/IPv6 prefix reachability are defined in [RFC5305], [RFC5308], and [RFC5120].

There are existing use cases in which knowing additional attributes of a prefix is useful.

It is useful to know whether or not an advertised prefix is directly connected to the advertising router. In the case of Segment Routing as described in [SR], knowing whether or not a prefix is directly connected determines what action should be taken as regards processing of labels associated with an incoming packet.

It is useful to know what addresses can be used as addresses of the node in support of services (e.g., Remote Loop Free Alternate (RLFA) endpoint).

Current formats of the Extended Reachability TLVs for both IPv4 and IPv6 are fixed and do not allow the introduction of additional flags without backwards compatibility issues. Therefore, this document defines a new sub-TLV that supports the advertisement of attribute flags associated with prefix advertisements.

In cases where multiple node addresses are advertised by a given router, it is also useful to be able to associate all of these addresses with a single Router ID even when prefixes are advertised outside of the area in which they originated. Therefore, a new sub-TLV is introduced to advertise the Router ID of the originator of a prefix advertisement.

1.1. 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 RFC 2119 [RFC2119].

2. New Sub-TLVs for Extended Reachability TLVs

The following new sub-TLVs are introduced:

- Prefix Attribute Flags
- IPv4 Source Router ID
- IPv6 Source Router ID

All sub-TLVs are applicable to TLVs 135, 235, 236, and 237.

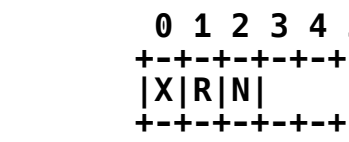
2.1. IPv4/IPv6 Extended Reachability Attribute Flags

This sub-TLV supports the advertisement of additional flags associated with a given prefix advertisement. The behavior of each flag when a prefix advertisement is leaked from one level to another (upwards or downwards) is explicitly defined below.

All flags are applicable to TLVs 135, 235, 236, and 237, unless otherwise stated.

Prefix Attribute Flags
Type: 4
Length: Number of octets of the Value field.
Value:

(Length * 8) bits.



Bits are defined/sent starting with Bit 0 defined below. Additional bit definitions that may be defined in the future SHOULD be assigned in ascending bit order so as to minimize the number of bits that will need to be transmitted.

Undefined bits MUST be transmitted as 0 and MUST be ignored on receipt.

Bits that are NOT transmitted MUST be treated as if they are set to 0 on receipt.

X-Flag: External Prefix Flag (Bit 0)
Set if the prefix has been redistributed from another protocol. This includes the case where multiple virtual routers are supported and the source of the redistributed prefix is another IS-IS instance.

The flag MUST be preserved when leaked between levels.

In TLVs 236 and 237, this flag SHOULD always be sent as 0 and MUST be ignored on receipt. This is because there is an existing X flag defined in the fixed format of these TLVs as specified in [RFC5308] and [RFC5120].

R-Flag: Re-advertisement Flag (Bit 1)
Set when the prefix has been leaked from one level to another (upwards or downwards).

N-flag: Node Flag (Bit 2)
Set when the prefix identifies the advertising router, i.e., the prefix is a host prefix advertising a globally reachable address typically associated with a loopback address.

The advertising router MAY choose to NOT set this flag even when the above conditions are met.

If the flag is set and the prefix length is NOT a host prefix (/32 for IPV4, /128 for IPv6), then the flag MUST be ignored. The flag MUST be preserved when leaked between levels.

2.2. IPv4/IPv6 Source Router ID

When a reachability advertisement is leaked from one level to another, the source of the original advertisement is unknown. In cases where the advertisement is an identifier for the advertising router (e.g., with the N-flag set in the Prefix Attribute Flags sub-TLV as described in Section 2.1), it may be useful for other routers to know the source of the advertisement. The sub-TLVs defined below provide that information.

Note that the Router ID advertised is always the Router ID of the IS-IS instance that originated the advertisement. This would be true even if the prefix had been learned from another protocol (i.e., with the X-flag set as defined in Section 2.1).

IPv4 Source Router ID
Type: 11
Length: 4
Value: IPv4 Router ID of the source of the advertisement

Inclusion of this TLV is optional and MAY occur in TLVs 135, 235, 236, or 237. When included, the value MUST be identical to the value advertised in the Traffic Engineering router ID (TLV 134) defined in [RFC5305].

If present the sub-TLV MUST be included when the prefix advertisement is leaked to another level.

IPv6 Source Router ID
Type: 12
Length: 16
Value: IPv6 Router ID of the source of the advertisement

Inclusion of this TLV is optional and MAY occur in TLVs 135, 235, 236, or 237. When included, the value MUST be identical to the value advertised in the IPv6 TE Router ID (TLV 140) defined in [RFC6119].

If present, the sub-TLV MUST be included when the prefix advertisement is leaked to another level.

2.3. Advertising Router IDs

[RFC5305] and [RFC6119] define the advertisement of router IDs for IPv4 and IPv6, respectively. Although both documents discuss the use of router ID in the context of Traffic Engineering (TE), the advertisement of router IDs is explicitly allowed for purposes other than TE. The use of router IDs to identify the source of a prefix advertisement as defined in Section 2.2 is one such use case. Therefore, whenever an IPv4 or IPv6 Source Router ID sub-TLV (as defined in Section 2.2) is used, the originating router SHOULD also advertise the corresponding address-family-specific router ID TLV.

3. IANA Considerations

This document adds the following new sub-TLVs to the registry of sub-TLVs for TLVs 135, 235, 236, and 237.

Value: 4
Name: Prefix Attribute Flags

Value: 11
Name: IPv4 Source Router ID

Value: 12
Name: IPv6 Source Router ID

This document also introduces a new registry for bit values in the Prefix Attribute Flags sub-TLV. The registration policy is Expert Review as defined in [RFC5226]. This registry is part of the "IS-IS TLV Codepoints" registry. The name of the registry is "Bit Values for Prefix Attribute Flags Sub-TLV". The defined values are:

Bit #	Name
0	External Prefix Flag (X-flag)
1	Re-advertisement Flag (R-flag)
2	Node Flag (N-flag)

4. Security Considerations

Security concerns for IS-IS are addressed in [RFC5304] and [RFC5310].

Advertisement of the additional information defined in this document introduces no new security concerns.

5. References

5.1. Normative References

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