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OSPF-Traffic Engineering Link Availability Extension for Links with Variable Discrete Bandwidth

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Abstract

A network may contain links with variable discrete bandwidth, e.g., copper, radio, etc. The bandwidth of such links may change discretely in reaction to changing external environment. Availability is typically used for describing such links during network planning. This document defines a new type of the Generalized Switching Capability-specific information (SCSI) TLV to extend the Generalized Multi-Protocol Label Switching (GMPLS) Open Shortest Path First (OSPF) routing protocol. The extension can be used for route computation in a network that contains links with variable discrete bandwidth. Note, this document only covers the mechanisms by which the availability information is distributed. The mechanisms by which availability information of a link is determined and the use of the distributed information for route computation are outside the scope of this document. It is intended that technology-specific documents will reference this document to describe specific uses.

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 June 5, 2018.

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Conventions used in this document

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.

1. Introduction

Some data plane technologies, e.g., microwave, and copper, allow seamless change of maximum physical bandwidth through a set of known discrete values. The parameter, availability, as described in [G.827], [F.1703] and [P.530] is often used to describe the link capacity. The availability is a time scale, representing a proportion of the operating time that the requested bandwidth is ensured. To set up an LSP across these links, availability information is required by the nodes to verify the bandwidth before making a bandwidth reservation. Assigning different availability classes over such links provides for a more efficient planning of link capacity to support different types of services. The link availability information will be determined by the operator and statically configured. It will usually be determined from the availability requirements of the services expected to be carried on the LSP. For example, voice service usually needs "five nines" availability, while non-real time services may adequately perform at four or three nines availability. For the route computation, both the availability information and the bandwidth resource information are needed. Since different service types may need different availability guarantees, multiple <availability, bandwidth> pairs may be required to be associated with a link.

In this document, a new type of the Generalized SCSI TLV, Availability TLV is defined. It is intended that technology-specific documents will reference this document to describe specific uses. The signaling extension to support links with discrete bandwidth is defined in [I-D. ietf-ccamp-rsvp-te-bandwidth-availability].

2. Acronyms

The following acronyms are used in this draft:

GMPLS Generalized Multi-Protocol Label Switching

LSA Link State Advertisement

ISCD Interface Switching Capability Descriptor

LSP	Label Switched Path
OSPF	Open Shortest Path First
PSN	Packet Switched Network
SCSI	Switching Capability-specific information
SNR	Signal-to-noise Ratio
SONET-SDH	Synchronous Optical Network - Synchronous Digital Hierarchy
SPF	Shortest Path First
TE	Traffic Engineering
TLV	Type Length Value

3. Overview

A node which has link(s) with variable bandwidth attached should include < availability, bandwidth> information list in its OSPF Traffic Engineering (TE) LSA messages. The list provides the mapping between the link nominal bandwidth and its availability level. This information is used for path calculation by the node(s). The setup of a Label Switched Path requires this information to be flooded in the network and used by the nodes or the PCE for the path computation. In this document, a new type of the Generalized SCSI TLV, Availability TLV is defined. The computed path can then be provisioned via the signaling protocol [I-D. ietf-ccamp-rsvp-te-bandwidth-availability].

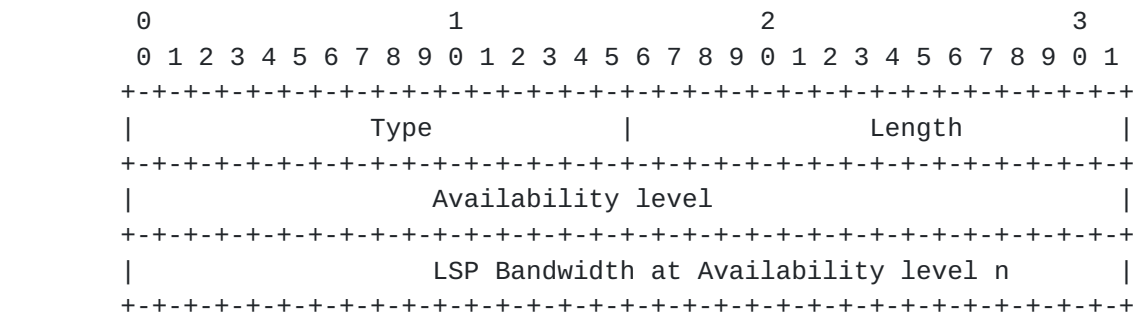
Note, the mechanisms described in this document only distribute availability information. The methods for measuring the information or using the information for route computation are outside the scope of this document.

4. TE Metric Extension to OSPF-TE

4.1. Availability SCSI-TLV

The Generalized SCSI is defined in [RFC8258]. The Availability TLV defined in this document is a new type of Generalized SCSI-TLV. The

Availability SCSI-TLV can be included for one or more times. The Availability SCSI-TLV has the following format:



Type: 0x0001, 16 bits.

Length: 2 octets, 16 bits.

Availability level: 32 bits

This field is a binary32-format floating point number as defined by [IEEE754-2008]. The bytes are transmitted in network order; that is, the byte containing the sign bit is transmitted first. This field describes the decimal value of availability guarantee of the switching capability in the Interface Switching Capability Descriptor (ISCD) [RFC4202] object. The value MUST be less than 1. The Availability level is usually expressed in the value of 0.99/0.999/0.9999/0.99999.

LSP Bandwidth at Availability level n: 32 bits

This field is a 32-bit IEEE floating point number as defined by [IEEE754-2008]. The bytes are transmitted in network order; that is, the byte containing the sign bit is transmitted first. This field describes the LSP Bandwidth for the Availability level represented in the Availability field. The units are bytes per second.

4.2. Processing Procedures

The ISCD allows routing protocols such as OSPF to carry technology specific information in the Switching Capability-specific information (SCSI) field, see [RFC4203]. A node advertising an interface with a Switching Capability which supports variable bandwidth attached SHOULD contain one or more Availability SCSI-TLVs in its OSPF TE LSA messages. Each Availability SCSI-TLV provides the information about how much bandwidth a link can support for a

specified availability. This information may be used for path calculation by the node(s).

The Availability SCSI-TLV MUST NOT be sent in ISCDs with Switching Capability field values that have not been defined to support the Availability SCSI-TLV. Non-supporting nodes would see such as a malformed ISCD/LSA.

Absence of the Availability SCSI-TLV in an ISCD containing Switching Capability field values that have been defined to support the Availability SCSI-TLV, SHALL be interpreted as representing fixed-bandwidth link with the highest availability value.

Only one Availability SCSI-TLV for the specific availability level SHOULD be sent. If multiple are present, the Availability SCSI-TLV with the lowest bandwidth value SHALL be processed. If an Availability SCSI-TLV with an invalid value (e.g., large than 1) is received, the Availability SCSI-TLV will be ignored.

5. Security Considerations

This document specifies the contents of Opaque LSAs in OSPFv2. Tampering with GMPLS TE LSAs may have an effect on traffic engineering computations. [RFC3630] suggests mechanisms such as [RFC2154] to protect the transmission of this information, and those or other mechanisms should be used to secure and/or authenticate the information carried in the Opaque LSAs. An analysis of the security of OSPF is provided in [RFC6863] and applies to the extensions to OSPF as described in this document. Any new mechanisms developed to protect the transmission of information carried in Opaque LSAs will also automatically protect the extensions defined in this document.

Please refer to [RFC5920] for details on security threats; defensive techniques; monitoring, detection, and reporting of security attacks; and requirements.

6. IANA Considerations

This document introduces a new type for availability of the Generalized SCSI-TLV of the TE Link TLV in the TE Opaque LSA for OSPF v2. Technology-specific documents will reference this document to describe specific use of this Availability SCSI-TLV.

IANA has created a registry called the "Generalized SCSI (Switching Capability Specific Information) TLVs Types" registry. The registry

is needed to be updated to include the Availability SCSI-TLV. This document proposes a suggested value for the Availability SCSI-TLV; it is requested that the suggested value be granted by IANA.

Note (Please REMOVE this note before publication): the registry will be created by [RFC8258]. The requested value should be added to it when it is created.

Type	Description	Reference
0x01	Availability	[This ID]

7. References

7.1. Normative References

[RFC8258] Ceccarelli, D. and Berger, L., "Generalized Routing Interface Switching Capability Descriptor Switching Capability Specific Information", RFC 8258, October, 2017.

[RFC4202] Kompella, K. and Rekhter, Y. (Editors), "Routing Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)", RFC 4202, October 2005.

[RFC4203] Kompella, K., Ed., and Y. Rekhter, Ed., "OSPF Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)", RFC 4203, October 2005.

[IEEE754-2008] IEEE standards, "IEEE Standard for Floating-Point Arithmetic", IEEE Standard 754, August 2008

7.2. Informative References

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

[RFC2154] Murphy, S., Badger, M., Wellington, B., "OSPF with Digital Signatures", RFC2154, June 1997.

[RFC3630] Katz, D., Kompella, K., and D. Yeung, "Traffic Engineering (TE) Extensions to OSPF Version 2", RFC 3630, September 2003.

[RFC5920] Fang, L., "Security Framework for MPLS and GMPLS Networks", RFC 5920, July 2010.

[RFC6863] Hartman, S. and D. Zhang, "Analysis of OSPF Security According to the Keying and Authentication for Routing Protocols (KARP) Design Guide", RFC 6863, March 2013.

[G.827] ITU-T Recommendation, "Availability performance parameters and objectives for end-to-end international constant bit-rate digital paths", September, 2003.

[F.1703] ITU-R Recommendation, "Availability objectives for real digital fixed wireless links used in 27 500 km hypothetical reference paths and connections", January, 2005.

[P.530] ITU-R Recommendation," Propagation data and prediction methods required for the design of terrestrial line-of-sight systems", February, 2012

[I-D. ietf-ccamp-rsvp-te-bandwidth-availability] H., Long, M., Ye, Mirsky, G., Alessandro, A., Shah, H., "Ethernet Traffic Parameters with Availability Information", Work in Progress, August, 2017

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", RFC 8174, May 2017.

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