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OSPF-TE 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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Conventions used in this document

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].

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

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 [ETPAI].

2. Overview

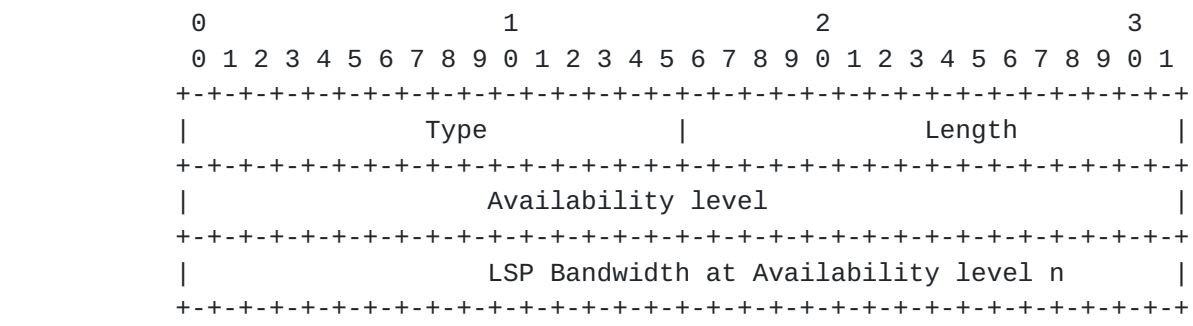
A node which has link(s) with variable bandwidth attached should include < availability, bandwidth> information list in its OSPF Traffic Engineering (TE) LSA messages. The list provides the mapping between the link nominal bandwidth and its availability level. This information is used for path calculation 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 [ETPAI].

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.

3. TE Metric Extension to OSPF-TE

3.1. Availability SCSI-TLV

The Generalized SCSI is defined in [GSCSI]. 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: 0x01, 16 bits.

Length: A 16 bits field that expresses the length of the TLV in bytes.

Availability level: 32 bits

This field is a 32-bit IEEE floating point number which 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 which describes the LSP Bandwidth for the Availability level represented in the Availability field. The units are bytes per second.

3.2. Processing Procedures

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, only the first Availability SCSI-TLV for an availability level carried in the same ISCD SHALL be processed.

4. Security Considerations

This document does not introduce security issues beyond those discussed in [RFC4203]. As with [RFC4203], it specifies the content of an Opaque LSAs in OSPFv2. As Opaque LSAs are not used for Shortest Path First (SPF) computation or normal routing, the extensions specified here have no direct effect on IP routing. Tampering with GMPLS TE LSAs may have an impact on the ability to set up connections in the underlying data plane network. As the additional availability information may represent information that an operator may wish to keep private, consideration should be given to securing this information. [RFC3630] notes that the security mechanisms described in [RFC2328] apply to Opaque LSAs carried in OSPFv2. 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.

5. 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.

Type	Description	Reference

| --- | --- | --- |
| 0x01 | Availability | [This ID] |

The registration procedure for this registry is Standards Action as defined in [RFC8126].

6. References

6.1. Normative References

[GSCSI] Ceccarelli, D. and Berger, L., "Generalized Routing Interface Switching Capability Descriptor Switching Capability Specific Information", Work in Progress, January, 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.

6.2. Informative References

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

[RFC2328] Moy, J., "OSPF Version 2", STD 54, RFC 2328, April 1998.

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

[RFC8126] Cotton,M. and Leiba,B., and Narten T., "Guidelines for Writing an IANA Considerations Section in RFCs", RFC 8126, June 2017.

[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

[ETPAI] H., Long, M., Ye, Mirsky, G., Alessandro, A., Shah, H., "Ethernet Traffic Parameters with Availability Information", Work in Progress, August, 2016

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