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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 introduces an optional ISCD Availability sub-TLV to extend the Open Shortest Path First (OSPF) Generalized Multi-Protocol Label Switching (GMPLS). This extension can be used for route computation in a network that contains links with variable discrete bandwidth.

Status of this Memo

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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 Capacity Descriptor
LSP	Label Switched Path
OSPF	Open Shortest Path First
PSN	Packet Switched Network
SNR	Signal-to-noise Ratio
SONET-SDH	Synchronous Optical Network - Synchronous Digital Hierarchy
SPF	Shortest Path First

1. Introduction

Some data communication technologies, e.g., microwave, and copper, allow seamless change of maximum physical bandwidth through a set of known discrete values. The parameter availability [G.827], [F.1703], [P.530] is often used to describe the link capacity during network planning. The availability is a time scale, which is a proportion of the operating time that the requested bandwidth is ensured. Assigning different availability classes to different types of service over such kind of links provides more efficient planning of link capacity. To set up an LSP across these links, availability information is required for the nodes to verify bandwidth satisfaction and make bandwidth reservation. The availability information should be inherited 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. Since different service types may need different availabilities guarantees, multiple <availability, bandwidth> pairs may be required when signaling. The signaling extension for links with discrete bandwidth is defined in [ETPAI].

For the route computation, the availability information should be provided along with bandwidth resource information. In this document, an extension on Interface Switching Capacity Descriptor (ISCD) [RFC4202] for availability information is defined.

2. Overview

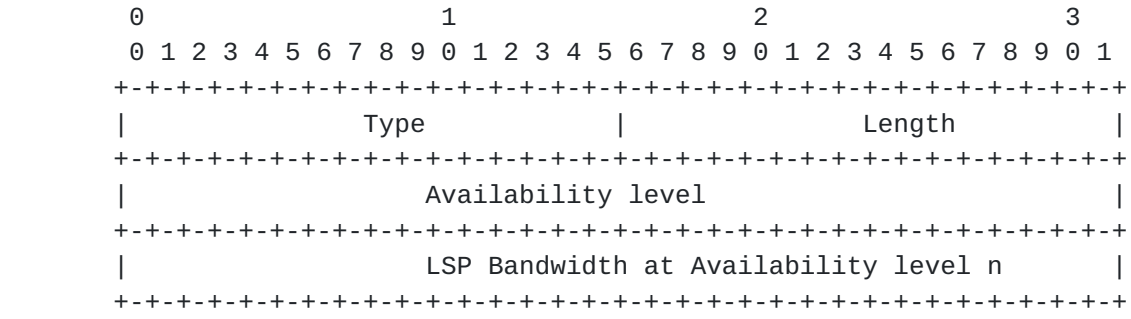
A node which has link(s) with variable bandwidth attached should include a <bandwidth, availability> information list in its OSPF TE LSA messages. The list provides the mapping between the link nominal bandwidth and its availability level. This information is used for path calculation by the node(s).The setup of a Label Switched Path requires this piece of information to be flooded in the network and used by the nodes or the PCE for the path computation. The computed path can then be provisioned via the signaling protocol.

For links with variable discrete bandwidth, Availability information is needed to be carried by the signaling for a better link bandwidth utilization. Extensions to RSVP-TE can be found in [ETPAI].

3. Extension to OSPF-TE

3.1. ISCD Availability sub-TLV

The ISCD sub-TLV is defined in Section 1.4 of [RFC4203]. The ISCD Availability sub-TLV is defined in this document as a sub-TLV of ISCD. The Switching Capability specific information field of ISCD MAY include one or more ISCD Availability sub-TLV(s). The ISCD Availability sub-TLV has the following format:



Type: TBA by IANA, suggested value is 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 ISCD 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 at a certain Availability level which was described in the Availability field. The units are bytes per second.

3.2. Processing Procedures

A node which has link(s) with variable bandwidth attached SHOULD contain one or more ISCD Availability sub-TLVs in its OSPF TE LSA messages. Each ISCD Availability sub-TLV provides the information about how much bandwidth a link can support for a specified availability. This information SHOULD be used for path calculation by the node(s).

A node that doesn't support ISCD Availability sub-TLV SHOULD ignore ISCD Availability sub-TLV. If a node who supports ISCD Availability sub-TLVs doesn't receive the TLV, it indicates that the link is with fixed bandwidth, and the availability can be interpreted as the highest availability value, e.g., five nines. It's legal to send multiple ISCD Availability sub-TLVs for the same availability level.

4. Security Considerations

This document extends [RFC4203]. As with [RFC4203], it specifies the contents of 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 effect on the underlying transport (optical and/or Synchronous Optical Network - Synchronous Digital Hierarchy (SONET-SDH)) network. [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 an Availability sub-TLV of the ISCD sub-TLV of the TE Link TLV in the TE Opaque LSA for OSPF v2. IANA will created and maintain a new sub-registry, the "Types for sub-TLV of Interface Switching Capability Descriptor" registry under the "Open Shortest Path First (OSPF) Traffic Engineering TLVs" registry, see http://www.iana.org/assignments/ospf-traffic-eng-tlvs.

This document proposes a suggested value for the Availability sub-TLV; it is recommended that the suggested value be granted by IANA.

Type	Description	Reference
0	Reserved	[This ID]
0x01	Availability	[This ID]

The registration procedure for this registry is Standards Action as defined in [RFC5226].

6. References

6.1. Normative References

[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.

[RFC5226] Narten,T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", RFC 5226, May 2008.

[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, June, 2015

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