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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 Generalized Multi-Protocol Label Switching (GMPLS) Open Shortest Path First (OSPF) routing protocol. This 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.

Status of this Memo

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This Internet-Draft will expire on April 8, 2016.

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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 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, an extension on Interface Switching Capacity Descriptor (ISCD) [RFC4202] for availability information is defined. The signaling extension to support links with discrete bandwidth is defined in [ETPAI].

2. Overview

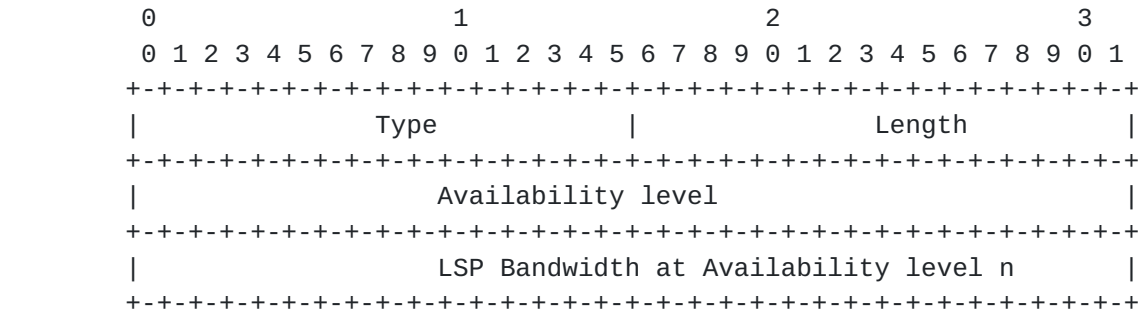
A node which has link(s) with variable bandwidth attached should include a < availability, bandwidth> information list in its OSPF TE LSA messages. The list provides the mapping between the link nominal bandwidth and its availability level. This information is used for path calculation by the node(s).The setup of a Label Switched Path requires this information to be flooded in the network and used by the nodes or the PCE for the path computation. In this document, an extension to Interface Switching Capacity Descriptor (ISCD) [RFC4202] for availability information 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. ISCD Availability sub-TLV

The ISCD sub-TLV is defined in Section 1.4 of [RFC4203]. The ISCD Availability sub-TLV defined in this document is 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 for the Availability level represented 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 does not support the ISCD Availability sub-TLV SHOULD ignore ISCD Availability sub-TLV but it SHOULD be included in LSAs sent to OSPF neighbors [RFC3630]. If a node who supports ISCD Availability sub-TLVs does not receive the TLV, it SHOULD assume that the link is with fixed bandwidth, and the availability can be interpreted as the highest availability value, e.g., five nines. It's not allowed to send multiple ISCD Availability sub-TLVs for the same availability level.

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 an Availability sub-TLV of the ISCD sub-TLV of the TE Link TLV in the TE Opaque LSA for OSPF v2. IANA is requested to create 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 requested 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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