

Network Working Group
Internet Draft
Intended status: Standards Track

H. Long, M. Ye
Huawei Technologies Co., Ltd
G. Mirsky
Ericsson
A.D'Alessandro
Telecom Italia S.p.A
H. Shah
Ciena

Expires: August 2016

February 19, 2016

Ethernet Traffic Parameters with Availability Information
draft-ietf-ccamp-rsvp-te-bandwidth-availability-04.txt

Abstract

A Packet switching network may contain links with variable bandwidth, e.g., copper, radio, etc. The bandwidth of such links is sensitive to external environment. Availability is typically used for describing the link during network planning. This document introduces an optional Availability TLV in Resource ReSerVation Protocol -- Traffic Engineer (RSVP-TE) signaling. This extension can be used to set up a label switching path (LSP) in a Packet Switched Network (PSN) that contains links with discretely variable bandwidth.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at
<http://www.ietf.org/ietf/lid-abstracts.txt>

The list of Internet-Draft Shadow Directories can be accessed at
<http://www.ietf.org/shadow.html>

This Internet-Draft will expire on August 19, 2016.

Copyright Notice

Copyright (c) 2016 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. Introduction	3
2. Overview	4
3. Extension to RSVP-TE Signaling.....	4
3.1. Availability TLV.....	4
3.2. Signaling Process.....	5
4. Security Considerations.....	6
5. IANA Considerations	6
5.1 Ethernet Sender TSpec TLVs	6
6. References	7
6.1. Normative References.....	7
6.2. Informative References.....	7
7. Appendix: Bandwidth Availability Example.....	8
8. Acknowledgments	9

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:

RSVP-TE	Resource Reservation Protocol-Traffic Engineering
LSP	Label Switched Path
PSN	Packet Switched Network
SNR	Signal-to-noise Ratio

TLV Type Length Value

LSA Link State Advertisement

1. Introduction

The RSVP-TE specification [RFC3209] and GMPLS extensions [RFC3473] specify the signaling message including the bandwidth request for setting up a label switching path in a PSN network.

Some data communication technologies 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 that the requested bandwidth is ensured. A more detailed example on the bandwidth availability can be found in Appendix A. 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.

If the availability requirement is not specified in the signaling message, the bandwidth will be reserved as the highest availability. For example, the bandwidth with 99.999% availability of a link is 100 Mbps; the bandwidth with 99.99% availability is 200 Mbps. When a video application requests for 120 Mbps without availability requirement, the system will consider the request as 120 Mbps with 99.999% availability, while the available bandwidth with 99.999% availability is only 100 Mbps, therefore the LSP path cannot be set up. But in fact, video application doesn't need 99.999% availability; 99.99% availability is enough. In this case, the LSP could be set up if availability is specified in the signaling message.

To fulfill LSP setup by signaling in these scenarios, this document specifies an Availability TLV. The Availability TLV can be applicable to any kind of physical links with variable discrete bandwidth, such as microwave or DSL. Multiple Availability TLVs together with multiple Ethernet Bandwidth Profiles can be carried in the Ethernet SENDER_TSPEC object.

2. Overview

A PSN tunnel may span one or more links in a network. To setup a label switching path (LSP), a node may collect link information which is spread in routing message, e.g., OSPF TE LSA message, by network nodes to get to know about the network topology, and calculate out an LSP route based on the network topology, and send the calculated LSP route to signaling to initiate a PATH/RESV message for setting up the LSP.

In case that there is(are) link(s) with variable discrete bandwidth in a network, a <bandwidth, availability> requirement list should be specified for an LSP. Each <bandwidth, availability> pair in the list means that listed bandwidth with specified availability is required. The list could be inherited from the results of service planning for the LSP.

A node which has link(s) with variable discrete bandwidth attached should contain a <bandwidth, availability> information list in its OSPF TE LSA messages. The list provides the information that how much bandwidth a link can support for a specified availability. This information is used for path calculation by the node(s). The routing extension for availability can be found in [ARTE].

When a node initiates a PATH/RESV signaling to set up an LSP, the PATH message should carry the <bandwidth, availability> requirement list as bandwidth request. Intermediate node(s) will allocate the bandwidth resource for each availability requirement from the remaining bandwidth with corresponding availability. An error message may be returned if any <bandwidth, availability> request cannot be satisfied.

3. Extension to RSVP-TE Signaling

3.1. Availability TLV

An Availability TLV is defined as a TLV of the Ethernet SENDEDR_TSPEC object [RFC6003] in this document. The Ethernet SENDER_TSPEC object MAY include more than one Availability TLV. The Availability TLV has the following format:

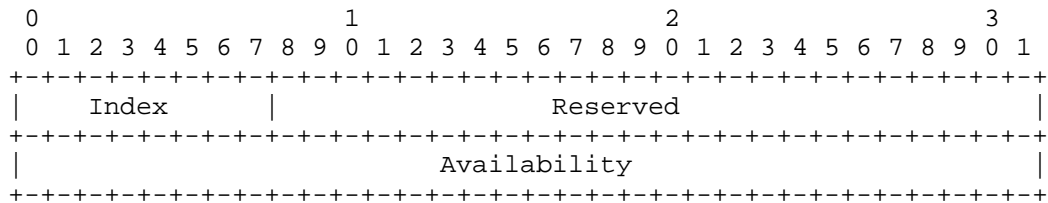


Figure 1: Availability TLV

Index (1 octet):

The Availability TLV MUST come along with Ethernet Bandwidth Profile TLV. If the bandwidth requirements in the multiple Ethernet Bandwidth Profile TLVs have different Availability requirements, multiple Availability TLVs SHOULD be carried. In such a case, the Availability TLV has one to one correspondence with Ethernet Bandwidth Profile TLV by having the same value of Index field. If all the bandwidth requirements in the Ethernet Bandwidth Profile have the same Availability requirement, one Availability TLV SHOULD be carried. In this case, the Index field is set to 0.

Reserved (3 octets): These bits SHOULD be set to zero when sent and MUST be ignored when received.

Availability (4 octets): a 32-bit floating number describes the decimal value of availability requirement for this bandwidth request. The value MUST be less than 1.

3.2. Signaling Process

The source node initiates PATH messages which carry a number of bandwidth request information, including one or more Ethernet Bandwidth Profile TLVs and one or more Availability TLVs. Each Ethernet Bandwidth Profile TLV corresponds to an availability parameter in the Availability TLV.

The intermediate and destination nodes check whether they can satisfy the bandwidth requirements by comparing each bandwidth requirement inside the SENDER_TSPEC objects with the remaining link sub-bandwidth resource with respective availability guarantee on the local link when received the PATH message.

- o If all <bandwidth, availability> requirements can be satisfied (the requested bandwidth under each availability parameter is smaller than or equal to the remaining bandwidth under the corresponding availability parameter on its local link), it SHOULD reserve the bandwidth resource from each remaining sub-bandwidth portion on its local link to set up this LSP. Optionally, the higher availability bandwidth can be allocated to lower availability request when the lower availability bandwidth cannot satisfy the request.
- o If at least one <bandwidth, availability> requirement cannot be satisfied, it SHOULD generate PathErr message with the error code "Admission Control Error" and the error value "Requested Bandwidth Unavailable" (see [RFC2205]).

If two LSPs request for the bandwidth with the same availability requirement, a way to resolve the contention is comparing the node ID, the node with the higher node ID will win the contention. More details can be found in [RFC3473].

If a node does not support Availability TLV, it SHOULD generate PathErr message with the error code "Extended Class-Type Error" and the error value "Class-Type mismatch" (see [RFC2205]).

4. Security Considerations

This document does not introduce new security considerations to the existing RSVP-TE signaling protocol.

5. IANA Considerations

IANA maintains registries and sub-registries for RSVP-TE used by GMPLS. IANA is requested to make allocations from these registries as set out in the following sections.

5.1 Ethernet Sender TSpec TLVs

IANA maintains a registry of GMPLS parameters called "Generalized Multi-Protocol Label Switching (GMPLS) Signaling Parameters".

IANA has created a new sub-registry called "Ethernet Sender TSpec TLVs / Ethernet Flowspec TLVs" to contain the TLV type values for TLVs carried in the Ethernet SENDER_TSPEC object. A new type for Availability TLV is defined as follow:

Type	Description	Reference
-----	-----	-----
TBD	Availability	[This ID]

6. References

6.1. Normative References

- [RFC3209] Awduche, D., Berger, L., Gan, D., Li, T., Srinivasan, V., and G. Swallow, "RSVP-TE: Extensions to RSVP for LSP Tunnels", RFC 3209, December 2001.
- [RFC3473] Berger, L., "Generalized Multi-Protocol Label Switching (GMPLS) Signaling Resource ReserVation Protocol-Traffic Engineering (RSVP-TE) Extensions", RFC 3473, January 2003.
- [RFC6003] Papadimitriou, D. "'Ethernet Traffic Parameters'", RFC 6003, October 2010.

6.2. Informative References

- [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

[EN 302 217] ETSI standard, ''Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas'', April, 2009

[ARTE] H., Long, M., Ye, Mirsky, G., Alessandro, A., Shah, H., ''OSPF Routing Extension for Links with Variable Discrete Bandwidth'', Work in Progress, June, 2015

7. Appendix: Bandwidth Availability Example

In mobile backhaul network, microwave links are very popular for providing connection of last hops. In case of heavy rain, to maintain the link connectivity, the microwave link MAY lower the modulation level since demodulating the lower modulation level needs a lower Signal-to-Noise Ratio (SNR). This is called adaptive modulation technology [EN 302 217]. However, a lower modulation level also means lower link bandwidth. When link bandwidth is reduced because of modulation down-shifting, high-priority traffic can be maintained, while lower-priority traffic is dropped. Similarly, the copper links MAY change their link bandwidth due to external interference.

Presuming that a link has three discrete bandwidth levels:

The link bandwidth under modulation level 1, e.g., QPSK, is 100 Mbps;

The link bandwidth under modulation level 2, e.g., 16QAM, is 200 Mbps;

The link bandwidth under modulation level 3, e.g., 256QAM, is 400 Mbps.

In sunny day, the modulation level 3 can be used to achieve 400 Mbps link bandwidth.

A light rain with X mm/h rate triggers the system to change the modulation level from level 3 to level 2, with bandwidth changing from 400 Mbps to 200 Mbps. The probability of X mm/h rain in the local area is 52 minutes in a year. Then the dropped 200 Mbps bandwidth has 99.99% availability.

A heavy rain with Y(Y>X) mm/h rate triggers the system to change the modulation level from level 2 to level 1, with bandwidth changing from 200 Mbps to 100 Mbps. The probability of Y mm/h rain in the local area is 26 minutes in a year. Then the dropped 100 Mbps bandwidth has 99.995% availability.

For the 100M bandwidth of the modulation level 1, only the extreme weather condition can cause the whole system unavailable, which only happens for 5 minutes in a year. So the 100 Mbps bandwidth of the modulation level 1 owns the availability of 99.999%.

In a word, the maximum bandwidth is 400 Mbps. According to the weather condition, the sub-bandwidth and its availability are shown as follows:

Sub-bandwidth(Mbps)	Availability
-----	-----
200	99.99%
100	99.995%
100	99.999%

8. Acknowledgments

The authors would like to thank Khuzema Pithewan, Lou Berger, Yuji Tochio, Dieter Beller, and Autumn Liu for their comments on the document.

Authors' Addresses

Hao Long
Huawei Technologies Co., Ltd.
No.1899, Xiyuan Avenue, Hi-tech Western District
Chengdu 611731, P.R.China

Phone: +86-18615778750
Email: longhao@huawei.com

Min Ye (editor)
Huawei Technologies Co., Ltd.
No.1899, Xiyuan Avenue, Hi-tech Western District
Chengdu 611731, P.R.China

Email: amy.yemin@huawei.com

Greg Mirsky (editor)
Ericsson

Email: gregory.mirsky@ericsson.com

Alessandro D'Alessandro
Telecom Italia S.p.A

Email: alessandro.dalessandro@telecomitalia.it

Himanshu Shah
Ciena Corp.
3939 North First Street
San Jose, CA 95134
US

Email: hshah@ciena.com

