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**RSVP-TE Signaling Extension for Bandwidth availability  
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**Abstract**

Packet switching network usually contains links with variable bandwidth, e.g., copper, radio, etc. The bandwidth of such link is sensitive to external environment. Availability is typically used for describing the link during network planning. This document describes an extension for RSVP-TE signaling for setting up a label switching path (LSP) in a Packet Switched Network (PSN) network which contains variable bandwidth link by introducing an optional availability field in RSVP-TE signaling.

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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:

RSVP-TE    Resource Reservation Protocol-Traffic Engineering

LSP        Label Switched Path

PSN        Packet Switched Network

SNR        Signal-to-noise Ratio



TLV	Type Length Value
PE	Provider Edge
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.

There are some data communication technologies that allow seamless change of maximum physical bandwidth. For 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 will lower the modulation level since demodulating lower modulation level need lower signal-to-noise ratio (SNR). This is called adaptive modulation technology [EN 302 217]. However, lower modulation level also means lower link bandwidth. When link bandwidth reduces by modulation down-shifting, high priority traffic can be maintained, while lower priority traffic is dropped. Similarly the cooper links may change their link bandwidth due to external interference.

The parameter, availability [[G.827](#), [F.1703](#), [P.530](#)], is often used to describe the link capacity during network planning. Assigning different availability classes to different types of service over such kind of links provides more efficient planning of link capacity. To set up a 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, voice service usually needs 'five nines' availability, while non-real time data packets may needs four or three nines availability. Since different service types may need different availabilities guarantee, multiple <availability, bandwidth> pairs may be required when signaling.

To fulfill LSP setup by signaling in these scenarios, this document specifies the following extension:



- o A new SENDER\_TSPEC object is defined which includes multiple bandwidth profiles with different availability. This object is an extension on the Ethernet SENDER\_TSPEC defined by [\[RFC6003\]](#) which support multiple bandwidth profile TLVs, but limited in the scope of Ethernet. The extension uses the object generically, and amends availability information in the bandwidth profile TLV.

## **2. Overview**

A PSN tunnel may span one or more links in a network. To setup a label switching path (LSP), a PE node may collect link information which is spread in routing message, e.g., OSPF TE LSA message, by network nodes to get know about the network topology, and calculate out a 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.

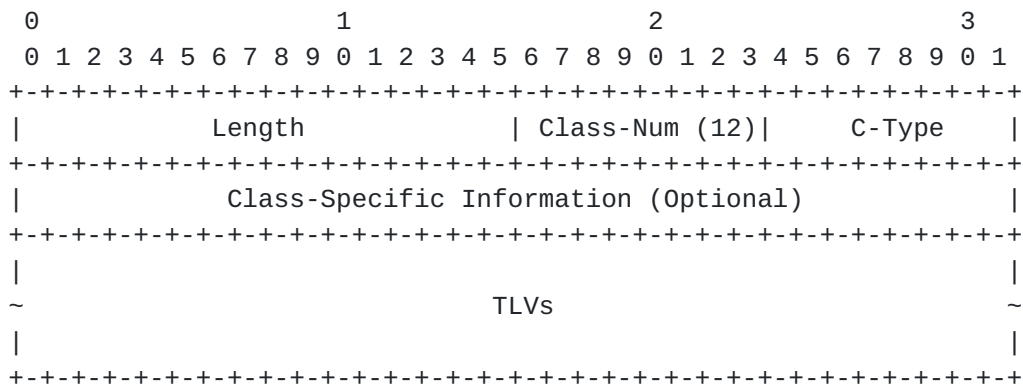
In case that there is(are) link(s) with variable bandwidth in a network, a <bandwidth, availability> requirement list should be specified for a LSP. Each <bandwidth, availability> pair in the list means a bandwidth with specified availability is required. The list could be inherited from the result of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

When a PE node initiates a PATH/RESV signaling for setting up the LSP, the PATH message should carry the <bandwidth, availability> requirement list as bandwidth request, and the 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. SENDER\_TSPEC Object**

The SENDER\_TSPEC object (Class-Num = 12) has the following format:



Class-Specific Information: 32 bits

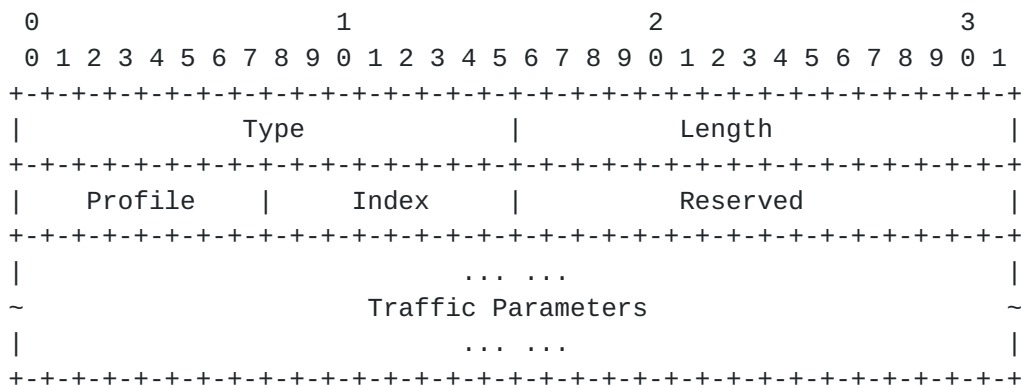
This field indicates the specific information for each C-Type.

TLV (Type-Length-Value):

The SENDER\_TSPEC object MUST include at least one TLV and MAY include more than one TLV.

### [3.1.1.1. Bandwidth Profile TLV](#)

The Bandwidth Profile TLV has the following format.



Type: TBD, 16 bits;

Length: 16 bits;

Profile: 8 bits

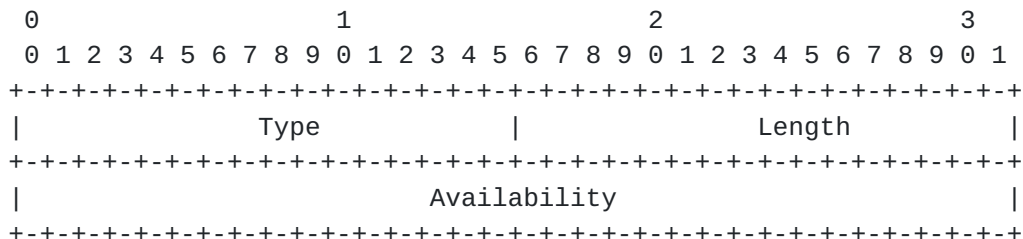
This field is defined as a bit vector of binary flags. The following flags are defined:





Flag 3 (bit 2): Availability Flag (AF)

When The Flag 3 is set to value 1, there is an availability sub-TLV included in this Bandwidth Profile TLV. The availability sub-TLV has the following format:



Type (2 octets): TBD

Length (2 octets): 4

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

Index: 8 bits

See [\[RFC6003\]](#) section 4.1.

### Traffic Parameters:

This field includes the traffic parameters information. The format is different for different C-Type.

C-Type = IntServ: See [[RFC2210](#)];

C-Type = Ethernet: See [[RFC6003](#)];

### 3.2. FLOWSPEC Object

The FLOWSPEC object (Class-Num = 9, Class-Type = TBD) has the same format as the Ethernet SENDER\_TSPEC object.

### 3.3. Signaling Process

The source node initiates PATH messages including one or more Bandwidth Profile TLVs with different availability value in the SENDER\_TSPEC object. Each Bandwidth Profile TLV specifies the portion of bandwidth request with referred availability requirement.



The destination nodes check whether it can satisfy the bandwidth requirement by comparing each bandwidth requirement inside the SENDER\_TSPEC objects with the remaining link sub-bandwidth resource with respective availability guarantee when received the PATH message.

- o If all bandwidth requirements can be satisfied, it should reserve the bandwidth resource from each remaining sub-bandwidth portion 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 requirement cannot be satisfied, it should generate PathErr message with the error code "Traffic Control Error" and the error value "Bad Tspec value" (see [[RFC2205](#)]).

#### **4. Security Considerations**

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

#### **5. IANA Considerations**

TBD

#### **6. References**

##### **6.1. Normative References**

- [RFC2210] Wroclawski, J., 'The Use of RSVP with IETF Integrated Services', [RFC 2210](#), September 1997.
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- [RFC6003] Papadimitriou, D. 'Ethernet Traffic Parameters', [RFC 6003](#), October 2010.



- [G.827] ITU-T Recommendation, ''Availability performance parameters and objectives for end-to-end international constant bit-rate digital paths'', September, 2003.
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- [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

## **6.2. Informative References**

- [MCOS] Minei, I., Gan, D., Kompella, K., and X. Li, "Extensions for Differentiated Services-aware Traffic Engineered LSPs", Work in Progress, June 2006.

## **7. Acknowledgments**

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