

PCE Working Group
Internet-Draft
Intended status: Standards Track
Expires: January 13, 2022

B. Rajagopalan
V. Beeram
Juniper Networks
G. Mishra
Verizon Communications Inc.
July 12, 2021

**Path Computation Element Protocol(PCEP) Extension for RSVP Color
draft-rajagopalan-pcep-rsvp-color-01**

Abstract

This document specifies extensions to Path Computation Element Protocol (PCEP) to carry a newly defined attribute of RSVP LSP called 'color' that can be used as a guiding criterion for selecting the LSP as a next hop for a service route.

Requirements Language

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 [\[RFC2119\]](#).

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). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

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."

This Internet-Draft will expire on January 13, 2022.

Copyright Notice

Copyright (c) 2021 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

(<https://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	2
2.	Protocol Operation	3
3.	TLV Format	4
4.	Usage with BGP-CT	4
5.	Security Considerations	4
6.	IANA Considerations	5
7.	Acknowledgments	5
8.	References	5
8.1.	Normative References	5
8.2.	Informative References	6
	Authors' Addresses	6

[1.](#) Introduction

This document defines a new RSVP LSP property, called "color", that can be exchanged over PCEP. The 'color' field can be used as one of the guiding criteria in selecting the LSP as a next hop for service prefixes.

While the specific details of how the service prefixes are associated with the appropriate RSVP LSP's are outside the scope of this specification, the envisioned high level usage of the 'color' field is as follows.

The service prefixes are marked with some indication of the type of underlay they need. The underlay LSP's carry corresponding markings, which we refer to as "color" in this specification, enabling an ingress node to associate the service prefixes with the appropriate underlay LSP's.

As an example, for a BGP-based service, the originating PE could attach some community, e.g. the Extended Color Community [[RFC5512](#)] with the service route. A receiving PE could use locally configured policies to associate service routes carrying Extended Color Community 'X' with underlay RSVP LSP's of color 'Y'.

While the Extended Color Community provides a convenient method to perform the mapping, the policy on the ingress node is free to

classify on any property of the route to select underlay RSVP LSP's of a certain color.

The 'color' specified in this draft is mainly used for facilitating underlay selection, and does not have any effect on the constraints used for path computation.

2. Protocol Operation

The STATEFUL-PCE-CAPABILITY negotiation message is enhanced to carry the color capability, which allows PCC & PCE to determine how incompatibility should be handled, should only one of them support color. An older implementation that does not recognize the new color TLV would ignore it upon receipt. This can sometimes result in undesirable behavior. For example, if PCE passes color to a PCC that does not understand colors, the LSP may not be used as intended. A PCE that clearly knows the PCC's color capability can handle such cases better, and vice versa. Following are the rules for handling mismatch in color capability.

A PCE that has color capability **MUST NOT** send color TLV to a PCC that does not have color capability. A PCE that does not have color capability can ignore color marking reported by PCC.

When a PCC is interacting with a PCE that does not have color capability, the PCC

- o **SHOULD NOT** report color to the PCE.
- o **MUST NOT** override the local color, if it is configured, based on any messages coming from the PCE.

The actual color value itself is carried in a newly defined TLV in the LSP Object defined in [[RFC8231](#)].

If a PCC is unable to honor a color value passed in an LSP Update request, the PCC must keep the LSP in DOWN state, and include an LSP Error Code value of "Unsupported Color" [Value to be assigned by IANA] in LSP State Report message.

If an RSVP tunnel has multiple LSP's associated with it, the PCE should designate one of the LSP's as primary, and attach the color with that LSP. If PCC receives color TLV for an LSP that it treats as secondary, it **SHOULD** respond with an error code of 4 (Unacceptable Parameters).

3. TLV Format

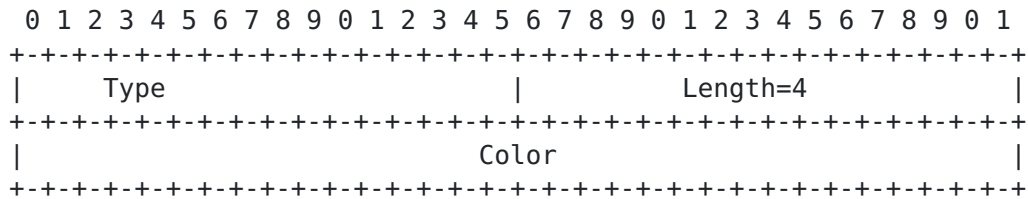


Figure 1: Color TLV in LSP Object

Type has the value [TO-BE-ASSIGNED-BY-IANA]. Length carries a value of 4. The 'color' field is 4-bytes long, and carries the actual color value.

[Section 7.1.1 of RFC8231](#) [[RFC8231](#)] defines STATEFUL-PCE-CAPABILITY flags. The following flag is used to indicate if the speaker supports color capability:

C-bit (TO-BE-ASSIGNED-BY-IANA): A PCE/PCC that supports color capability must turn on this bit.

4. Usage with BGP-CT

RSVP LSP's marked with color can also be used for inter-domain service mapping as defined in BGP-CT [[I-D.kaliraj-idr-bgp-classful-transport-planes](#)]. In BGP-CT, the mapping community of the service route is used to select a "resolution scheme", which in turn selects LSP's of various "transport classes" in the defined order of preference. The 'color' field defined in this specification could be used to associate the RSVP LSP with a particular transport class.

A colored RSVP LSP can also be exported into BGP-CT for inter-domain classful transport.

5. Security Considerations

This document defines a new TLV for color, and a new flag in capability negotiation, which do not add any new security concerns beyond those discussed in [[RFC5440](#)], [[RFC8231](#)] and [[RFC8281](#)].

An unauthorized PCE may maliciously associate the LSP with an incorrect color. The procedures described in [[RFC8253](#)] and [[RFC7525](#)] can be used to protect against this attack.

6. IANA Considerations

IANA is requested to assign code points for the following:

- o Code point for "Color" TLV from the sub-registry "PCEP TLV Type Indicators".
- o C-bit value from the sub-registry "STATEFUL-PCE-CAPABILITY TLV Flag Field".
- o An error code for "Unsupported color" from the sub-registry "LSP-ERROR-CODE TLV Error Code Field".

7. Acknowledgments

The authors would like to thank Kaliraj Vairavakkalai, Colby Barth & Natrajan Venkataraman for their review & suggestions, which helped improve this specification.

8. References

8.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- [RFC5440] Vasseur, JP., Ed. and JL. Le Roux, Ed., "Path Computation Element (PCE) Communication Protocol (PCEP)", [RFC 5440](#), DOI 10.17487/RFC5440, March 2009, <<https://www.rfc-editor.org/info/rfc5440>>.
- [RFC5512] Mohapatra, P. and E. Rosen, "The BGP Encapsulation Subsequent Address Family Identifier (SAFI) and the BGP Tunnel Encapsulation Attribute", [RFC 5512](#), DOI 10.17487/RFC5512, April 2009, <<https://www.rfc-editor.org/info/rfc5512>>.
- [RFC7525] Sheffer, Y., Holz, R., and P. Saint-Andre, "Recommendations for Secure Use of Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)", [BCP 195](#), [RFC 7525](#), DOI 10.17487/RFC7525, May 2015, <<https://www.rfc-editor.org/info/rfc7525>>.

- [RFC8231] Crabbe, E., Minei, I., Medved, J., and R. Varga, "Path Computation Element Communication Protocol (PCEP) Extensions for Stateful PCE", [RFC 8231](#), DOI 10.17487/RFC8231, September 2017, <<https://www.rfc-editor.org/info/rfc8231>>.
- [RFC8253] Lopez, D., Gonzalez de Dios, O., Wu, Q., and D. Dhody, "PCEPS: Usage of TLS to Provide a Secure Transport for the Path Computation Element Communication Protocol (PCEP)", [RFC 8253](#), DOI 10.17487/RFC8253, October 2017, <<https://www.rfc-editor.org/info/rfc8253>>.
- [RFC8281] Crabbe, E., Minei, I., Sivabalan, S., and R. Varga, "Path Computation Element Communication Protocol (PCEP) Extensions for PCE-Initiated LSP Setup in a Stateful PCE Model", [RFC 8281](#), DOI 10.17487/RFC8281, December 2017, <<https://www.rfc-editor.org/info/rfc8281>>.

8.2. Informative References

- [I-D.kaliraj-idr-bgp-classful-transport-planes]
Vairavakkalai, K., Venkataraman, N., Rajagopalan, B., Mishra, G., Khaddam, M., Xu, X., and R. J. Szarecki, "BGP Classful Transport Planes", [draft-kaliraj-idr-bgp-classful-transport-planes-07](#) (work in progress), February 2021.

Authors' Addresses

Balaji Rajagopalan
Juniper Networks

Email: balajir@juniper.net

Vishnu Pavan Beeram
Juniper Networks

Email: vbeeram@juniper.net

Gyan Mishra
Verizon Communications Inc.

Email: gyan.s.mishra@verizon.com