A YANG Data Model for Segment Routing in IPv6 (SRv6) support in Path
Computation Element Communications Protocol (PCEP)
draft-li-pce-pcep-srv6-yang-00

Abstract

This document augments a YANG data model for the management of Path
Computation Element communications Protocol (PCEP) for communications
between a Path Computation Client (PCC) and a Path Computation
Element (PCE), or between two PCEs in support for Segment Routing in
IPv6. The data model includes configuration data and state data
(status information and counters for the collection of statistics).

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 September 9, 2019.

Copyright Notice

Copyright (c) 2019 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

Li & Sivabalan          Expires September 9, 2019               [Page 1]
1. Introduction

The Path Computation Element (PCE) defined in [RFC4655] is an entity that is capable of computing a network path or route based on a network graph, and applying computational constraints. A Path Computation Client (PCC) may make requests to a PCE for paths to be computed.

PCEP is the communication protocol between a PCC and PCE and is defined in [RFC5440]. PCEP interactions include path computation requests and path computation replies as well as notifications of specific states related to the use of a PCE in the context of Multiprotocol Label Switching (MPLS) and Generalized MPLS (GMPLS) Traffic Engineering (TE). [RFC8231] specifies extensions to PCEP to enable stateful control of MPLS TE LSPs.


The PCEP operational state is included in the same tree as the PCEP configuration consistent with Network Management Datastore Architecture [RFC8342]. The origin of the data is indicated as per the origin metadata annotation.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119][RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Terminology and Notation

This document also uses the following terms defined in [RFC7420]:

- PCEP entity: a local PCEP speaker.
- PCEP peer: to refer to a remote PCEP speaker.
- PCEP speaker: where it is not necessary to distinguish between local and remote.

Further, this document also uses the following terms defined in [RFC8231]:

- Stateful PCE, Passive Stateful PCE, Active Stateful PCE
- Delegation, Revocation, Redelegation
- LSP State Update, Path Computation Update message (PCUpd).

[RFC8281]:

- PCE-initiated LSP, Path Computation LSP Initiate Message (PCInitiate).

[RFC8408]:

- Path Setup Type (PST).

[I-D.ietf-pce-segment-routing]:

- Segment Routing (SR).
3.1. Tree Diagrams

A simplified graphical representation of the data model is used in this document. The meaning of the symbols in these diagrams is defined in [RFC8340].

3.2. Prefixes in Data Node Names

In this document, names of data nodes and other data model objects are often used without a prefix, as long as it is clear from the context in which YANG module each name is defined. Otherwise, names are prefixed using the standard prefix associated with the corresponding YANG module, as shown in Table 1.

<table>
<thead>
<tr>
<th>Prefix</th>
<th>YANG module</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>te-types</td>
<td>ietf-te-types</td>
<td>[I-D.ietf-teas-yang-te]</td>
</tr>
<tr>
<td>p</td>
<td>ietf-pcep</td>
<td>[I-D.ietf-pce-pcep-yang]</td>
</tr>
<tr>
<td>st</td>
<td>ietf-srv6-types</td>
<td>[I-D.raza-spring-srv6-yang]</td>
</tr>
</tbody>
</table>

Table 1: Prefixes and corresponding YANG modules

4. The Design of PCEP-SRv6 Data Model

4.1. The Overview of PCEP SRv6 Data Model

The PCEP-SRv6 YANG module defined in this document has all the common building blocks for the PCEP-SRv6 extension.
module: ietf-pcep-srv6
  augment /p:pcep/p:entity/p:capability:
    +--rw srv6 {srv6}?
      +--rw enabled?     boolean
      +--rw msd-limit?   boolean
      +--rw srv6-msd* [msd-type]
        +--rw msd-type     uint8
        +--rw msd-value?   uint8
  augment /p:pcep/p:entity/p:peers/p:peer/p:capability:
    +--rw srv6 {srv6}?
      +--rw enabled?     boolean
      +--rw msd-limit?   boolean
      +--rw srv6-msd* [msd-type]
        +--rw msd-type     uint8
        +--rw msd-value?   uint8
  augment /p:pcep/p:entity/p:lsp-db/p:lsp:
    +--ro srv6 {srv6}?
      +--ro segment-list
        +--ro segment* [index]
          +--ro index        uint32
          +--ro sid-value?   st:srv6-sid

5. PCEP-SRv6 YANG Modules

5.1. ietf-pcep-srv6 module

RFC Ed.: In this section, replace all occurrences of ‘XXXX’ with the actual RFC number and all occurrences of the revision date below with the date of RFC publication (and remove this note).

<CODE BEGINS> file "ietf-pcep-srv6@2019-03-08.yang"
module ietf-pcep-srv6 {

  yang-version 1.1;

  prefix ps;

  import ietf-srv6-types {
    prefix "st";
    reference "RFC XXXX";
  }

  import ietf-te-types {
    prefix "te-types";
  }

<CODE ENDS>
Internet-Draft                PCE-SRv6-YANG                   March 2019

reference "RFC XXXX";
}

import ietf-pcep {
    prefix "p";
    reference "RFC XXXX";
}

organization
"IETF PCE (Path Computation Element) Working Group";

contact
"WG Web:  <http://tools.ietf.org/wg/pce/>
WG List:  <mailto:pce@ietf.org>
Editor:  Cheng Li
         <mailto:chengli13@huawei.com>";
description
"The YANG module augments the PCEP yang operational
model with SRv6";

revision 2019-03-08 {
    description "Initial revision.";
    reference
      "RFC XXXX:  A YANG Data Model for Path Computation
      Element Communications Protocol (PCEP) - Segment Routing in IPv6
      (SRv6)";
}

/* Identity */
identity path-setup-srv6 {
    base te-types:path-signaling-type;
    description
      "SRv6 path setup type";
}

/* Features */
feature srv6 {
    description
      "Support Segment Routing in IPv6 (SRv6) for PCE.";
}

/* Groupings */
grouping srv6-msd {
    description
      "SRv6 MSD";
leaf msd-type {
  type uint8;
  description
    "SRv6 Maximum Segment Depth (MSD) Type";
}
leaf msd-value {
  type uint8;
  description
    "SRv6 MSD value for the type";
}

}  

grouping srv6 {
  description
    "SRv6";
  container srv6 {
    if-feature srv6;
    description
      "If SRv6 is supported";
    leaf enabled{
      type boolean;
      description
        "Enabled or Disabled";
    }
    leaf msd-limit {
      type boolean;
      default false;
      description
        "True indicates no limit on MSD, the
         list srv6-msd is ignored";
    }
    list srv6-msd {
      key "msd-type";
      description "list of SRv6 MSD";
      uses srv6-msd;
    }
  }
}

grouping segment-list {
  description
    "Segment list grouping";
  container segment-list {
    description
      "Segments for given segment list";
    list segment {
      key "index";
    }
  }
}
description "Configure Segment/hop at the index";
uses segment-properties;
}
}

grouping segment-properties {
  description "Segment properties grouping";
  leaf index {
    type uint32;
    description "Segment index";
  }
  leaf sid-value {
    type st:srv6-sid;
    description "SRv6 SID value";
  }
}

/*
 * Augment modules to add SRv6
*/
augment "/p:pcep/p:entity/p:capability"{
  description "Augmenting SRv6";
  uses srv6;
}
  description "Augmenting SRv6";
  uses srv6;
}
augment "/p:pcep/p:entity/p:lsp-db/p:lsp"{
  description "Augmenting SRv6";
  contains srv6 {
      description "For SRv6 path";
    }
    if-feature srv6;
    uses segment-list;
    description "SRv6";
  }
}
6. Security Considerations

The YANG module defined in this document is designed to be accessed via network management protocol such as NETCONF [RFC6241] or RESTCONF [RFC8040]. The lowest NETCONF layer is the secure transport layer and the mandatory-to-implement secure transport is SSH [RFC6242]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [RFC8446].

The NETCONF access control model [RFC8341] provides the means to restrict access for particular NETCONF or RESTCONF users to a pre-configured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in the YANG module which are writable/creatable/deletable (i.e., config true, which is the default). These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g., <edit-config>) to these data nodes without proper protection can have a negative effect on network operations. These are the subtrees and data nodes and their sensitivity/vulnerability:


Unauthorized access to above list can adversely affect the PCEP session between the local entity and the peers. This may lead to inability to compute new paths, stateful operations on the delegated as well as PCE-initiated LSPs.

Some of the readable data nodes in this YANG module may be considered sensitive or vulnerable in some network environments. It is thus important to control read access (e.g., via get, get-config, or notification) to these data nodes. These are the subtrees and data nodes and their sensitivity/vulnerability:

/p:pcep/p:entity/p:lsp-db/p:lsp/ps:srv6 - The SRv6 SID in the network. Unauthorized access to this could provide the all path and network usage information.
7. IANA Considerations

This document registers a URI in the "IETF XML Registry" [RFC3688]. Following the format in RFC 3688, the following registration has been made.


Registrant Contact: The PCE WG of the IETF.

XML: N/A; the requested URI is an XML namespace.

This document registers a YANG module in the "YANG Module Names" registry [RFC6020].

Name: ietf-pcep
Prefix: ps
Reference: This I-D

8. Acknowledgements

The authors would like to thank Dhruv Dhody for the initial YANG model.

9. References

9.1. Normative References


Internet-Draft                PCE-SRv6-YANG                   March 2019

and A. Bierman, Ed., "Network Configuration Protocol
(NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011,

[ RFC 6242 ] Wasserman, M., "Using the NETCONF Protocol over Secure
Shell (SSH)", RFC 6242, DOI 10.17487/RFC6242, June 2011,

RFC 7950, DOI 10.17487/RFC7950, August 2016,

Protocol", RFC 8040, DOI 10.17487/RFC8040, January 2017,

[ RFC 8174 ] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC
2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174,

[ RFC 8231 ] 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,

[ RFC 8281 ] 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,

BCP 215, RFC 8340, DOI 10.17487/RFC8340, March 2018,

Access Control Model", STD 91, RFC 8341,
DOI 10.17487/RFC8341, March 2018,

[ RFC 8408 ] Sivabalan, S., Tantsura, J., Minei, I., Varga, R., and J.
Hardwick, "Conveying Path Setup Type in PCE Communication
Protocol (PCEP) Messages", RFC 8408, DOI 10.17487/RFC8408,


9.2. Informative References


Authors' Addresses

Cheng Li
Huawei Technologies
Huawei Campus, No. 156 Beiqing Rd.
Beijing  100095
China

EMail: chengli13@huawei.com

Siva Sivabalan
Cisco Systems, Inc.
2000 Innovation Drive
Kanata, Ontario  K2K 3E8
Canada

EMail: msiva@cisco.com