

Path Segment/ID in PCEP

draft-li-pce-controlled-id-space-00

draft-li-pce-sr-path-segment-00

draft-li-pce-sr-bidir-path-00

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Motivation

- Use cases like end-2-end 1+1 path protection, bidirectional path correlation or performance measurement (PM) require the ability to implement “path identification” in SR networks:
 - [\[draft-cheng-spring-mpls-path-segment\]](#) introduces a new segment to uniquely identify an SR path in a specific context that is referred to as Path Segment.
 - [\[draft-li-spring-passive-pm-for-srv6-np\]](#) defines a Path ID to identify an SRv6 path.
- For configuring or allocating “path ID” to an SR path, extensions in PCEP are needed.
 - Path ID allocation and conveying it within PCEP
 - PCE controlled ID Space, where PCC informs the PCE the ID space range from which it should make allocations
- Bidirectional path correlation is required in some scenarios such as mobile backhaul transport network for segment routing.
 - Bidirectional path correlation based on path Segment/ path ID.

Drafts

- **draft-li-pce-sr-path-segment-00**
 - specifies extensions to the PCEP to support path identifier allocation between PCEP speakers.
- **draft-li-pce-sr-bidir-path-00**
 - defines PCEP extensions for grouping two reverse unidirectional SR Paths into an Associated Bidirectional SR path
- **draft-li-pce-controlled-id-space-00**
 - specifies a mechanism for a PCC to inform the PCE of the identifier space under its control via PCEP.

draft-li-pce-sr-path-segment-00
PCEP Extension for Path Identification in SR

draft-li-pce-sr-path-segment-00

- specifies a mechanism to carry the SR path identification information in PCEP
 - The path ID can be allocated by Ingress PCC itself and informed to the PCE. The PCE can then inform the egress PCC.
 - The PCC can also request PCE to allocate the path ID, in this case, the PCE would allocate and inform the assigned path ID to the ingress/egress PCC using PCEP messages.
 - Also, the PCE can allocate a path ID on its own accord and inform the ingress/egress PCC in case of PCE-initiated LSPs.
 - (Next Version) The path ID can be allocated by Egress PCC. The PCE should request the Egress PCC to allocate a Path ID and inform the PCE, which may further inform to the ingress PCC.

Capabilities Advertisement

- For advertising the capability of Path ID allocation, new flags are required:
 - SR-PCE-CAPABILITY TLV [[I-D.ietf-pce-segment-routing](#)] in OPEN message:
 - P-flag: Path Identification bit, set to indicate that it has the capability to encode SR path identification.
 - SRv6-PCE-CAPABILITY TLV [[I-D.negi-pce-segment-routing-ipv6](#)]
 - P-flag: Path Identification bit, set to indicate that it has the capability to encode SRv6 path identification.

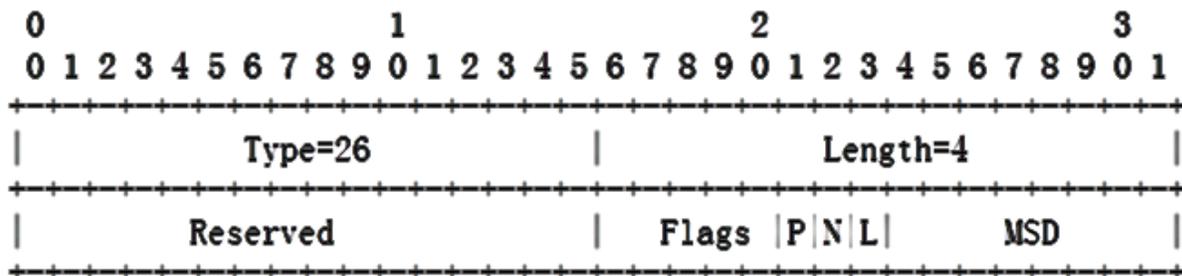


Figure 1: P-flag in SR-PCE-CAPABILITY TLV

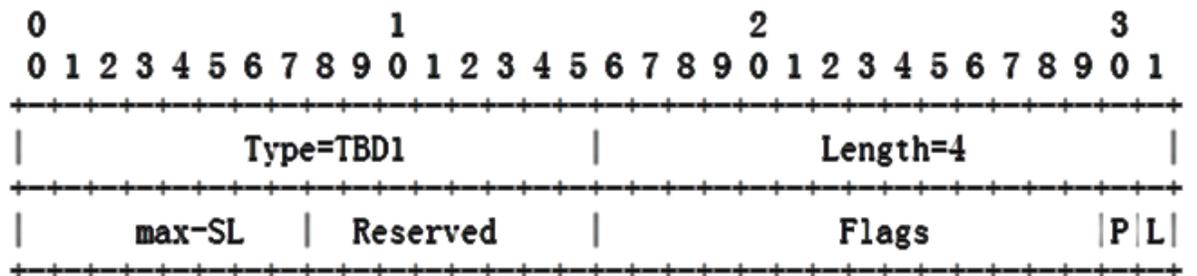


Figure 2: P-flag in SRv6-PCE-CAPABILITY TLV

P-flag in LSP Object

- P-flag: Indicating path ID needs to be allocated by PCE for this LSP
 - LSP.P-flag: MUST be set in PCReq/PCRpt msg, when PCC requires the path ID allocation.
 - LSP.P-flag: MUST be set in PCRep/PCUpd/PCInitiate, when PCE reply the path ID allocation requirement.

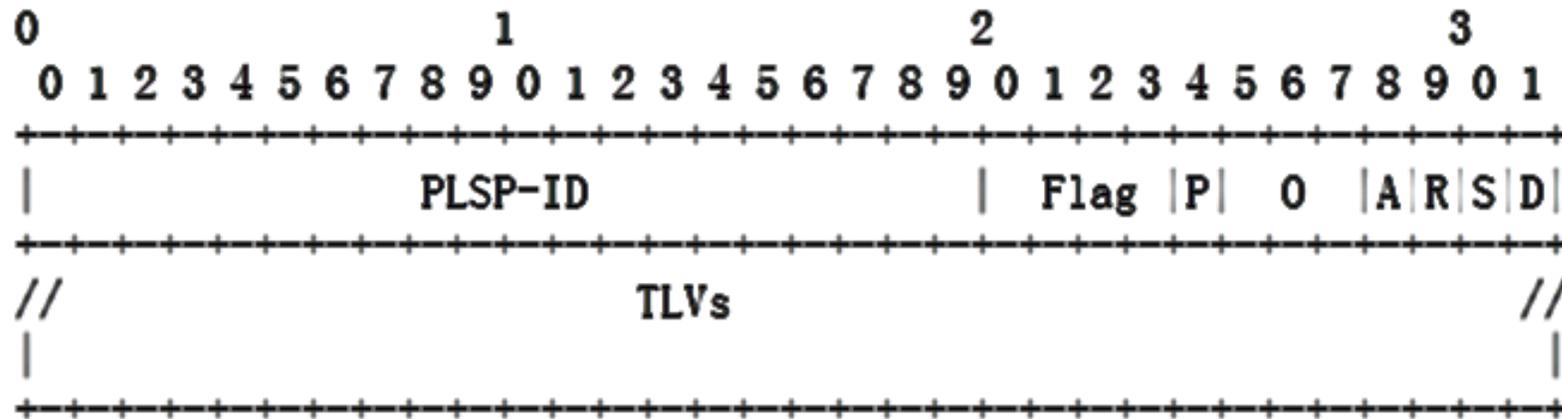


Figure 3: P-flag in LSP Object

Inform the Egress PCC: Path FEC Object & CCI

- This document extends the procedures of [[I-D.zhao-pce-pcep-extension-pce-controller-sr](#)] by defining a new Path FEC object to inform the Path Identification information to the Egress PCC.
- One or more following TLV(s) are allowed in the Path FEC object:
 - **SYMBOLIC-PATH-NAME TLV**: a human readable string that identifies an LSP in the network [[RFC8231](#)].
 - **LSP-IDENTIFIERS TLV**: optional for SR, but could be used to encode the source, destination and other identification information for the path [[RFC8231](#)].
 - **SPEAKER-ENTITY-ID TLV**: a unique identifier for the PCEP speaker, used to identify the Ingress PCC [[RFC8232](#)].
- The Path ID information is encoded directly in the Central Control Instructions(CCI) SR object. The Path ID TLV MAY also be included in the CCI SR object.

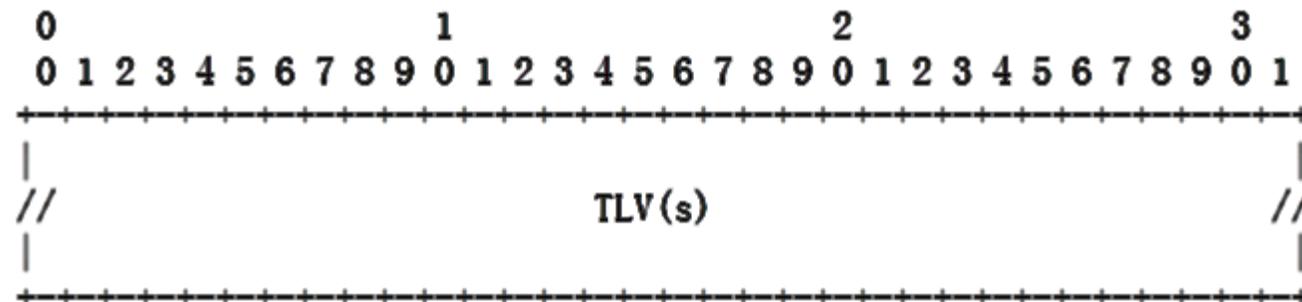


Figure 2: The path FEC object Format

Example: PCE allocated Path ID on its own

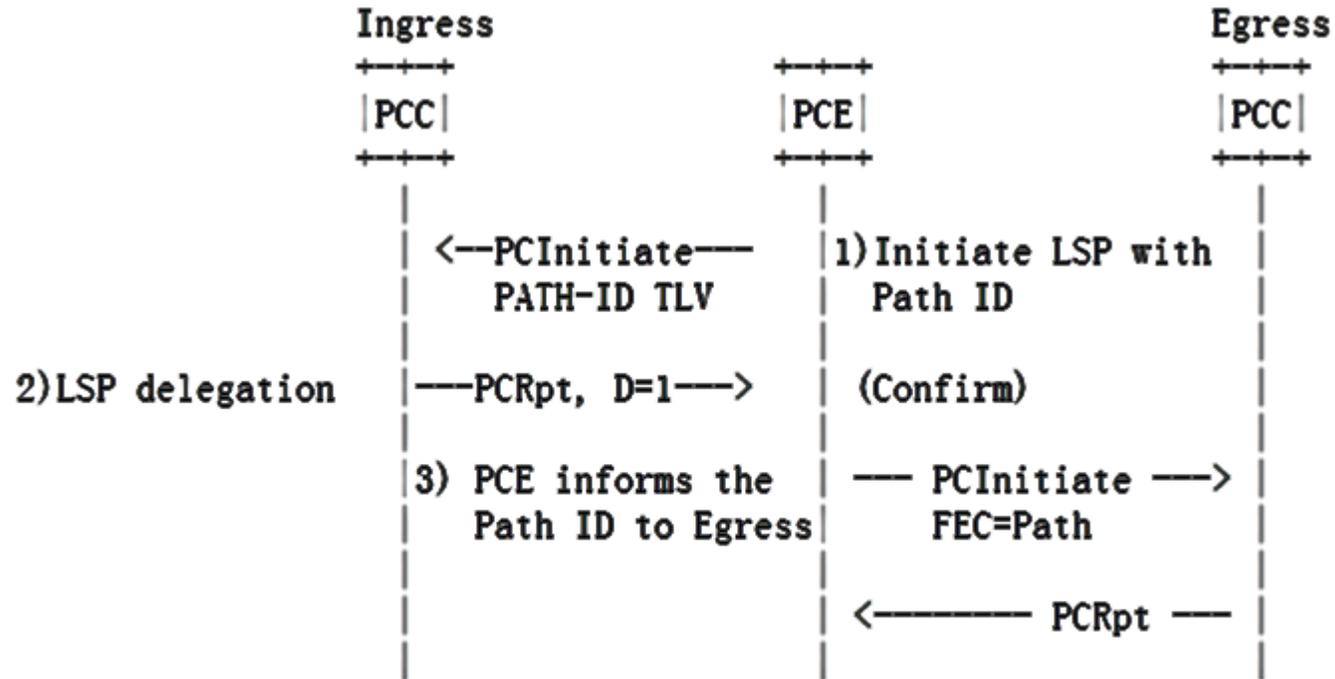


Figure 5: PCE allocated Path ID on its own

draft-li-pce-sr-bidir-path-00
PCEP Extension for Segment Routing (SR)
Bi-directional Associated Paths

draft-li-pce-sr-bidir-path-00

- For associating two SR paths, this document defines a new association group called 'Double-sided Bidirectional SR Path Association Group'
 - The SR paths belonging to this association is conveyed via PCEP messages to the PCEP peer.
 - A member of the Double-sided Bi-directional SR Path Association Group can take the role of a forward or reverse SR path.
 - The TLVs, handling rules, error conditions are same as [[I-D.ietf-pce-association-bidir](#)].
- B-flag in RP and SRP object MUST be set.
- The PATH-ID TLV [[I-D.li-pce-sr-path-segment](#)] MUST also be included in the LSP object for these SR paths.

Example: PCE-Initiated Bidir Path

- A stateful PCE:
 - Create/update the forward/reverse SR path independently
 - Establish/remove the association relationship on a per SR path basis.
 - Create/update the SR path and the association on a PCC via PCInitiate/PCUpd messages, respectively.
- The Path-ID TLV MUST be included for each SR path in the LSP object.
- The opposite direction SR SHOULD be informed via PCInitiate message with the matching association group.
- Similarly PCC initiated SR Paths are delegated to the PCE which would update with the other direction SR path and the association group information!

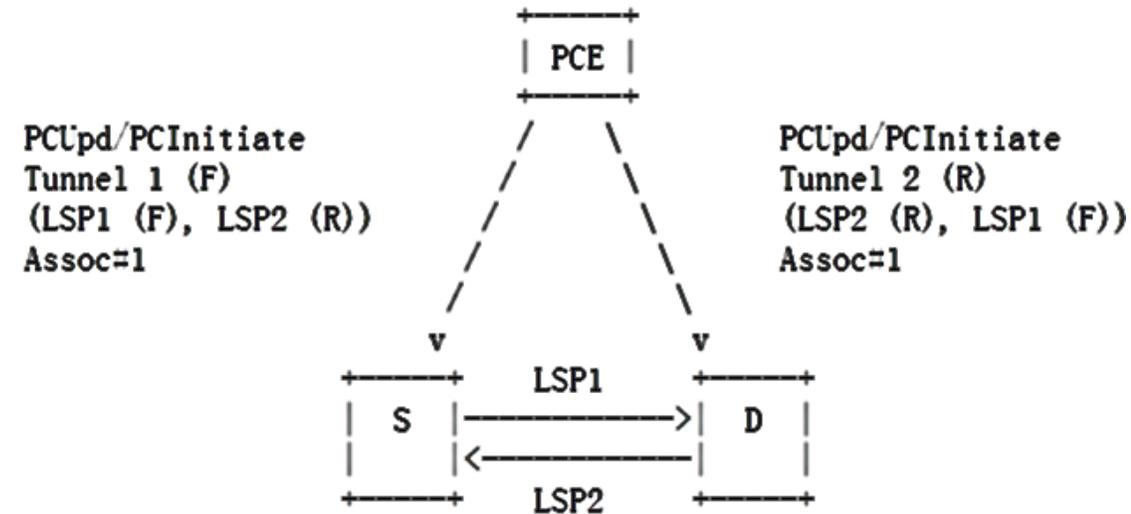


Figure 1: PCE-Initiated Double-sided Bidirectional SR Path

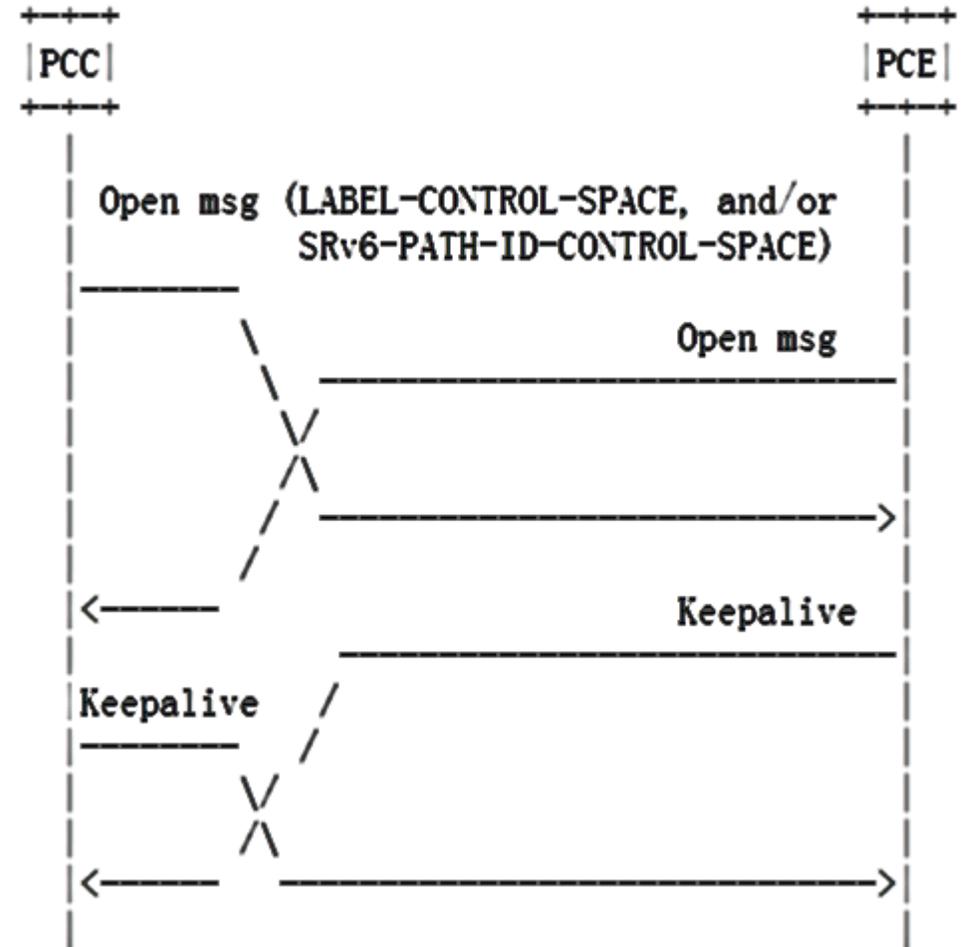
draft-li-pce-controlled-id-space-00
PCE Controlled ID Space

draft-li-pce-controlled-id-space-00

- [\[I-D.zhao-pce-pcep-extension-for-pce-controller\]](#) specifies the procedures and PCEP protocol extensions for using the PCE as a central controller, where label forwarding entries (Central Controller's Instructions (CCI)) are downloaded through extending PCEP.
- [\[I-D.zhao-pce-pcep-extension-for-pce-controller-sr\]](#) specifies the procedures and PCEP protocol extensions for using the PCE as the central controller in SR networks.
- However, these documents assume that label range to be used by a PCE is known and set on both PCEP peers.
- This document specifies the extension to support advertisement of the various ID space (Label/ Path ID etc) to the PCE to control.

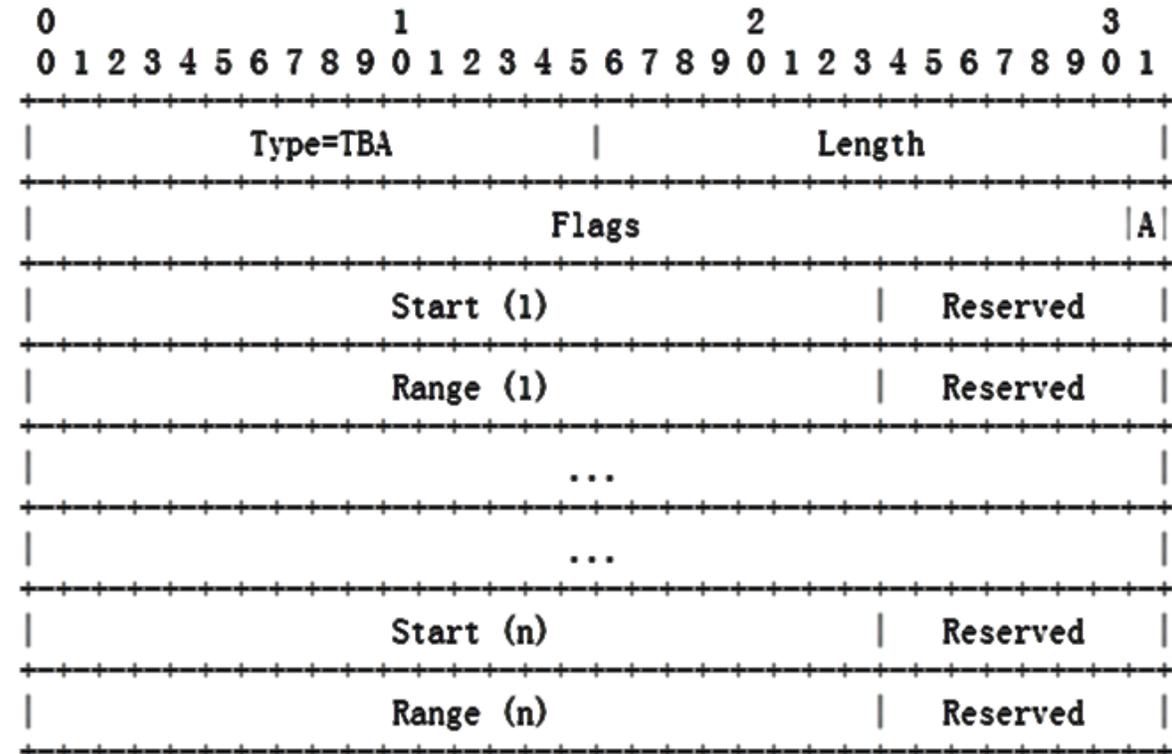
draft-li-pce-controlled-id-space-00

- For informing the PCE controlled ID space, related ID Space TLV MUST be included in the Open message.
- Each TLV (corresponding to each ID type) SHOULD be included only once in a Open Message.
- The following ID-CONTROL-SPACE TLVs are defined in this document –
 - LABEL-CONTROL-SPACE - for MPLS Labels
 - SRv6-PATH-ID-CONTROL-SPACE - for SRv6 Path ID
- The PCE can then allocate ID from within the controlled ID space.



LABEL-CONTROL-SPACE TLV

- Flags:
 - A: All space flag, set when all the label space is delegated to a PCE.
- Blocks
 - Start(i) (24 bits): indicates the beginning of the label block i.
 - Range(i) (24 bits): indicates the range of the label block i.
- Labels:
 - such as binding SID and path SID can be allocated directly from the PCE controlled space .



Thank you

