Path Computation Element (PCE) WG Status

IETF 108 - Online

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Note Well

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Definitive information is in the documents listed below and other IETF BCPs. For advice, please talk to WG chairs or ADs:

- BCP 9 (Internet Standards Process)
- BCP 25 (Working Group processes)
- BCP 25 (Anti-Harassment Procedures)
- BCP 54 (Code of Conduct)
- BCP 78 (Copyright)
- BCP 79 (Patents, Participation)
- https://www.ietf.org/privacy-policy/ (Privacy Policy)

Administrivia

- Minute taker(s), jabber scribe(s)
- Meetecho Etiquette
  - Join the queue if you would like to speak/present
    - Do not send audio directly
  - Please state your name before speaking
  - Be mindful of the agenda time
    - Longer discussion on mailing list (or jabber)
- Collaborative minutes
    - https://codimd.ietf.org/notes-ietf-108-pce?both

Using the Mailing List

- Please use the mailing list actively to discuss all working group business
- Open issues with drafts should be discussed on the list, and conclusions reported to the list
- New drafts should be introduced to the working group first on the mailing list, to gauge interest
- Working group consensus is determined from the mailing list
- Priority in meetings is given to drafts that have been discussed on the list

Please be Vocal

- During WG Adoption and WG LC calls, the response is less.
- Please be vocal on the list to help us gauge the consensus better.
- The working group mailing lists are looked at by the IESG, IAB, and others (internal and external to IETF) to determine interest/participation level in our standards process.
- Please review ideas from your peers, these are community outputs of the working group as a whole.

Using the Wiki

- A way to give you visibility as the document progress through the WG
  - adoption queue
  - WG LC queue
  - balancing work between chairs
  - shepherding responsibilities
  - pending actions
  - IPR polls
- Use this wiki
  - make sure this is up to date!
- https://trac.ietf.org/trac/pce/wiki/WikiStart

Early Codepoint Allocation

- If you have an implementation of a WG I-D
  - that requires inter-operation with other implementations
    - Please request for early IANA codepoint allocation
  - Make sure to include an Implementation Status section in your I-D
  - Make sure the IANA section is correct and complete
    - And meets the condition set out in RFC 7120

Agenda Bashing

1. Introduction

1.1 Administrivia, Agenda Bashing (chairs, 5 min)

1.2 WG Status (chairs, 10 min) [15/100]

1.3 State of WG I-Ds and next steps (chairs, 10 min) [25/100]

2. Segment Routing

2.1 SR Birdirectional (Rakesh, 10 min) [35/100]

draft-ietf-pce-sr-bidir-path-02

2.2 Multipath ERO (Mike Koldychev, 10 min) [45/100]

draft-koldychev-pce-multipath-03

2.3 Entropy (Quan, 10 min) [55/100]

draft-peng-pce-entropy-label-position-03

2.4 SRv6-Yang (Luc-Fabrice/Shuping, 10 mins) [65/100]

draft-li-pce-pcep-srv6-yang-01

2.5 IFIT (Giuseppe, 5 mins) [70/100]

draft-chen-pce-sr-policy-ifit-02

3. Stateful PCE

3.1 Local Protection Enforcement (Andrew, 10 mins) [80/100]

draft-stone-pce-local-protection-enforcement-01

3.2 Extended LSP Flag (Quan, 10 min) [90/100]

draft-xiong-pce-lsp-flag-02

3.3 Path MTU (Shuping, 10 mins) [100/100]

draft-li-pce-pcep-pmtu-01

4. If time permits

4.1 SR Path Ingress Protection (Huaimo, 10 mins) [110/100]

draft-chen-pce-sr-ingress-protection-03

WG Status

Beyond the WG

- 11 new RFC since IETF 106 (Singapore)
  - RFC 8780 - draft-ietf-pce-wson-rwa-ext
  - RFC 8779 - draft-ietf-pce-gmpls-pcep-extensions
  - RFC 8786 - draft-ietf-pce-stateful-flags
  - RFC 8751 - draft-ietf-pce-stateful-hpce
  - RFC 8745 - draft-ietf-pce-stateful-path-protection
  - RFC 8741 - draft-ietf-pce-lsp-control-request
  - RFC 8733 - draft-ietf-pce-stateful-pce-auto-bandwidth
  - RFC 8697 - draft-ietf-pce-association-group
  - RFC 8694 - draft-ietf-pce-inter-area-as-applicability
  - RFC 8685 - draft-ietf-pce-hierarchy-extensions
  - RFC 8664 - draft-ietf-pce-segment-routing
- *Thanks to everyone who contributed – authors, shepherd, reviewers, AD…*

Beyond the WG

- Documents in RFC editor queue
  - draft-ietf-pce-association-diversity (AUTH48)

- Drafts with the IESG
  - draft-ietf-pce-stateful-pce-lsp-scheduling (DISCUSS)
  - draft-ietf-pce-pcep-flowspec
    - Authors found an issue with L2 flow specification's BGP registry and have posted an update to this I-D for feedback on the mailing list

- Early codepoint allocations
  - draft-ietf-pce-association-policy (Expires 2021-05)

Beyond the WG

- Errata (all for RFC 8231)
  - 5796 Technical Errata by Hillol (Held for Document Update)
  - 5970 Technical Errata by Subham Burnwal (Verified)
  - 6012 Editorial Errata by Dhruv Dhody (Verified)
  - 6231 Technical Errata by Dhruv Dhody (Reported)
    - Chairs' opinion - should be accepted (companion to 5970)

Liaisons and Communications

- ITU-T-SG-15 – LS
  - To CCAMP, MPLS, PALS, PCE, TEAS
  - Scott Mansfield is coordinating across WGs
  - Reply to LS on OTNT Standardization Work Plan
    - Sent on 2020-01-14
    - URL of the IETF Web page: https://datatracker.ietf.org/liaison/1669/
  - LS on OTNT Standardization Work Plan Issue 27
    - Received on 2020-02-19
    - URL of the IETF Web page: https://datatracker.ietf.org/liaison/1673/
    - Reply by 2020-08-20

Status of WG I-Ds & Next Steps

WG LC Queue

- draft-ietf-pce-pcep-extension-for-pce-controller-06
  - Mainly editorial changes with one additional IANA request
  - Last update on 2020-07-13
- draft-ietf-pce-association-policy-11
  - New Implementation details added
  - Last update on 2020-06-23
- draft-ietf-pce-association-bidir-06
  - Clarification on the PLSP-ID Usage and the B flag in the SRP object
  - Last update on 2020-03-13

WG documents “nearing” WG LC

- draft-ietf-pce-pcep-yang-14
  - TE yang dependencies are progressing
  - Dependency on draft-ietf-netconf-tls-client-server (used for PCEPS/TLS) is also making progress
  - Very early YANG Doctor review was done
    - should get it done again…
  - Made open-wait-timer & keep-wait-timer as read-only.
  - Last updated on 2020-07-07

WG documents

- draft-ietf-pce-pcep-stateful-pce-gmpls
  - Was merged with draft-ietf-pce-remote-initiated-gmpls-lsp
  - Implementation Status is missing
  - Last updated on 2020-04-24 (version -13)
- draft-ietf-pce-pcep-extension-native-ip
  - Update (-05)
    - Encoding changes, new fields – ETTL, Peer Cookie etc
    - Editorial changes
- draft-ietf-pce-enhanced-errors
  - Update (-07)
    - Editorial changes

WG documents

- draft-ietf-pce-flexible-grid
  - Update (-03)
    - Mainly editorial
- draft-ietf-pce-segment-routing-ipv6
  - Update (-06)
    - Clarification statement on the use of term LSP in PCEP in the context of SRv6
    - Renaming of a field in SRv6-ERO/SRv6-RRO
    - Other editorial changes

WG documents

- draft-ietf-pce-binding-label-sid
  - Update (-03)
    - Update in the length of TE-PATH-BINDING TLV
    - Other editorial changes
- draft-ietf-pce-vn-association
  - Adopted after 105
  - Update (-02)
    - Mainly editorial changes
- draft-ietf-pce-sr-path-segment
  - Adopted after 105
  - Update (-01)
    - Mainly editorial changes

Recent WG documents

- draft-ietf-pce-sr-bidir-path
  - On the agenda

- draft-ietf-pce-segment-routing-policy-cp
  - No update since adoption

Adoption Poll Queue

- draft-zhao-pce-pcep-extension-pce-controller-sr
- draft-dugeon-pce-stateful-interdomain

- Other adoption request's are at - https://trac.ietf.org/trac/pce/wiki#IndividualdocumentsthatauthorsconsiderreadyforWGAdoption

Thanks & Stay Safe!

PCEP Extensions for Associated Bidirectional SR Paths

draft-ietf-pce-sr-bidir-path-02

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Agenda

- Requirements and Scope
- Double-sided Associated Bidirectional **with Reverse** LSP
- PCEP Object Definitions
- Next Steps

Requirements and Scope

Requirements:

- Packet transport networks deploying bidirectional SR Paths
- Co-routed and non-co-routed forward and reverse SR Paths

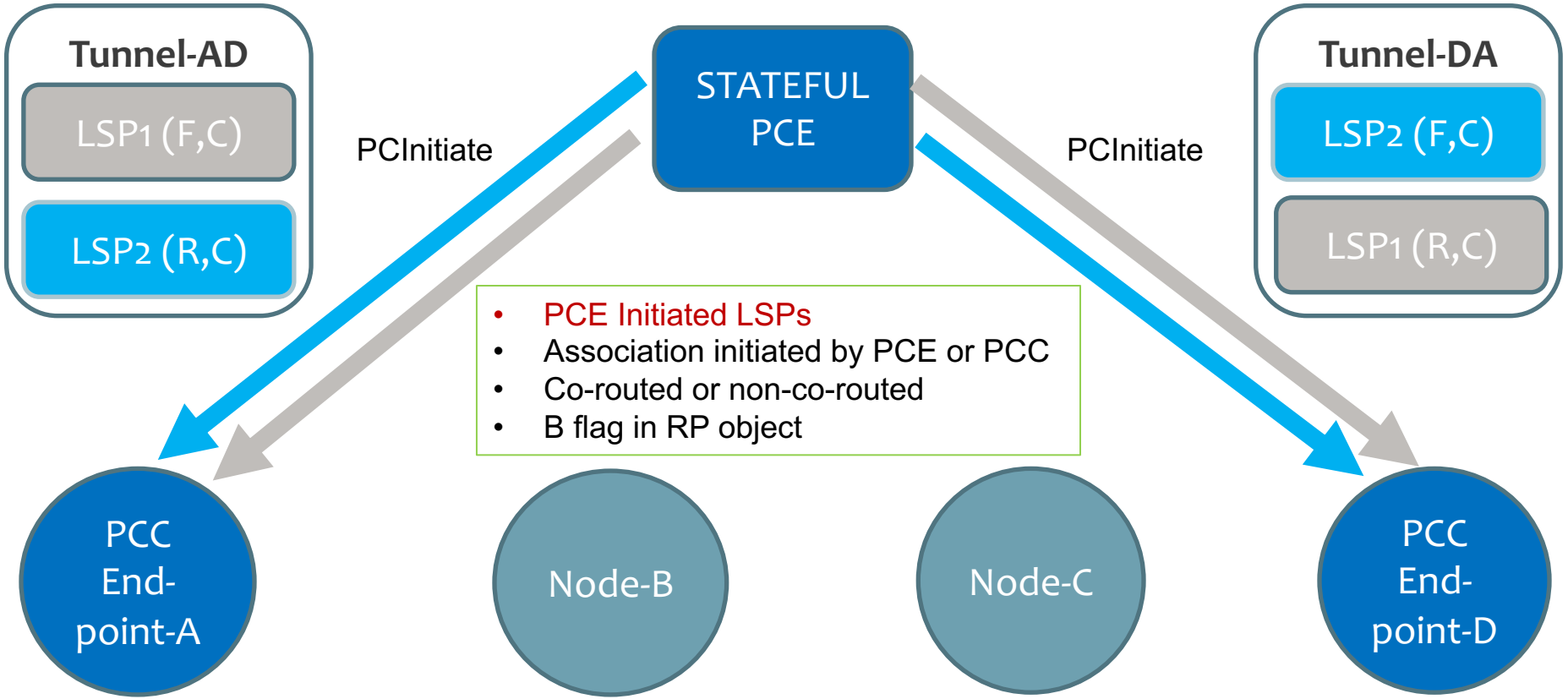
Scope:

- Associated bidirectional SR Paths
- PCE-Initiated LSPs
- PCC-Initiated LSPs
- Stateless PCE (e.g. for co-routed path computation requests)

Not in Scope:

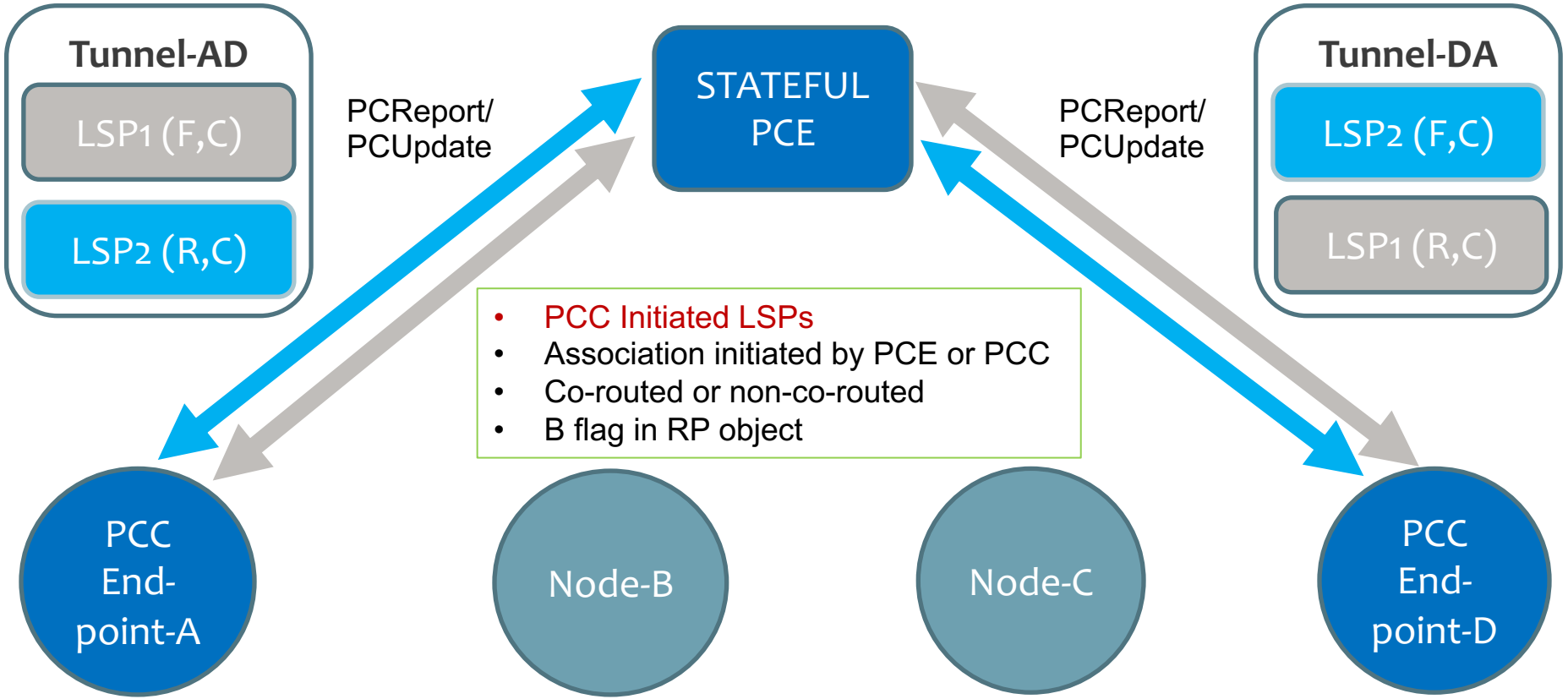
- Associating a bidirectional SR Path with an RSVP-TE LSP

Double-sided Associated Bidirectional **with Reverse** LSP



- PCE Initiated LSPs
- Association initiated by PCE or PCC
- Co-routed or non-co-routed
- B flag in RP object

Double-sided Associated Bidirectional **with Reverse** LSP



PCEP Association Object

- Association Type (TBD1) = Double-sided Bidirectional **with Reverse** LSP Association Group
- The Association Object Populated using the procedure defined in [*draft-ietf-pce-association-bidir]*

Error Handling (PCErr Error-Type 26 - Association Error)

- PCErr defined in [*draft-ietf-pce-association-bidir]* are applicable to SR Paths

Specifically –

1. Both forward and reverse LSPs MUST belong to the same bidirectional TE tunnel [RFC3209].
   - Error-Value = Bidirectional LSP Association - Tunnel mismatch
2. LSP (forward or reverse) cannot be part of more than one Bidirectional LSP Association Group.
   - Error-Value = Bidirectional LSP Association - Group Mismatch
3. If a PCEP speaker receives a different PST value for Bidirectional LSP association group and it does not support.
   - Error-Value = Bidirectional LSP Association - Path Setup Type Not Supported

Next Steps

- Welcome your review comments and suggestions

Thank you

IETF 108 – Online
PCE Working Group

PCEP Extensions for Signaling Multipath Information

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Introduction

In the SR Policy architecture, the unit of signaling in both PCEP and BGP is the Candidate-Path. In BGP each update may contain multiple segment-list sub-TLVs, but in PCEP each update contains only a single ERO object. This is very limiting for SR Policy use-case, since it means PCEP cannot represent SR Candidate-Paths having more than one Segment-List.

In this draft, we propose a way for the PCE to return multiple paths that together (through ECMP/UCMP) satisfy a single objective. We keep the mechanism generic, so that it is applicable to tunneling architectures other than SR Policy (e.g. RSVP-TE). It is also applicable to stateless PCEP (PCReq/PCRep).

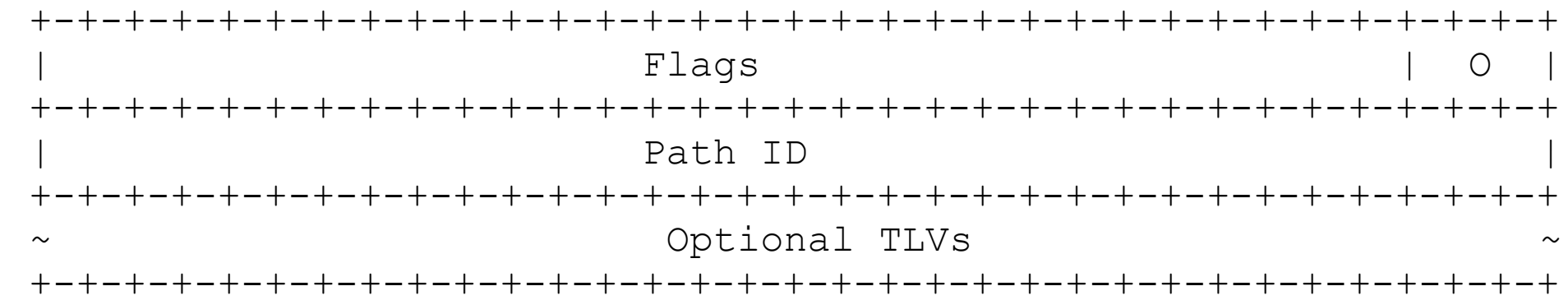
Motivating Example

Splitting of Requested Bandwidth

- PCC requests 100 Gbps of bandwidth, but all the links in the network have only 60 Gbps of bandwidth available. The PCE would need to return at least 2 paths to meet the objective.
- The PCE has a choice of how many paths to return and their weights. For example, the PCE can return 2 paths with 50/50 split, or the PCE can return 3 paths with 40/30/30 split, etc.
- PCC does not know in advance how many paths the PCE will return, it simply has the constraint that 100 Gbps of bandwidth is to be sent in total.

PATH-ATTRIBUTES

We introduce a new “separator” object, PATH-ATTRIBUTES:

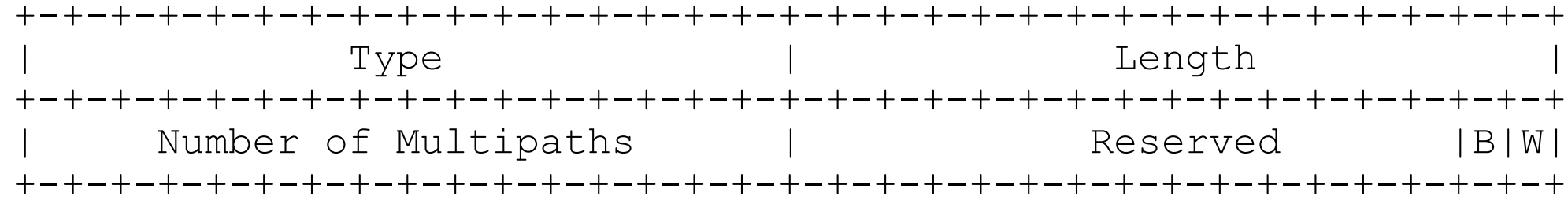



```
<intended-path> ::= ((<PATH-ATTRIB><ERO>)[<intended-path>])
<actual-path> ::= ((<PATH-ATTRIB><RRO>)[<actual-path>])
```

Optional TLVs can encode additional attributes/state about the path, such as weight for UCMP, protection, etc.

Capability

PCC needs specify how many multipaths it can install in forwarding. For this, we introduce the MULTIPATH-CAP TLV:



This TLV is mandatory in the OPEN object (if the PCC/PCE supports this draft) and can also be optionally carried in the LSP object to override the global values.

For example, if multipath is not desired for one particular Candidate Path, then this TLV can be included in the LSP object with Number of Multipaths set to 1.

Conclusion

Next steps:

- Request WG adoption
- Q & A

PCEP Extension for SR-MPLS Entropy Label Position

draft-peng-pce-entropy-label-position-03

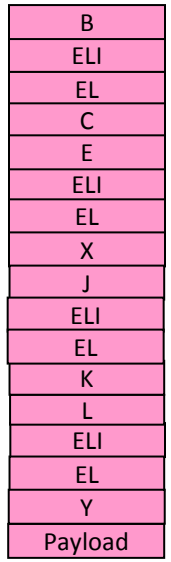
Quan Xiong(ZTE)
Shaofu Peng(ZTE)
Fengwei Qin(China Mobile)

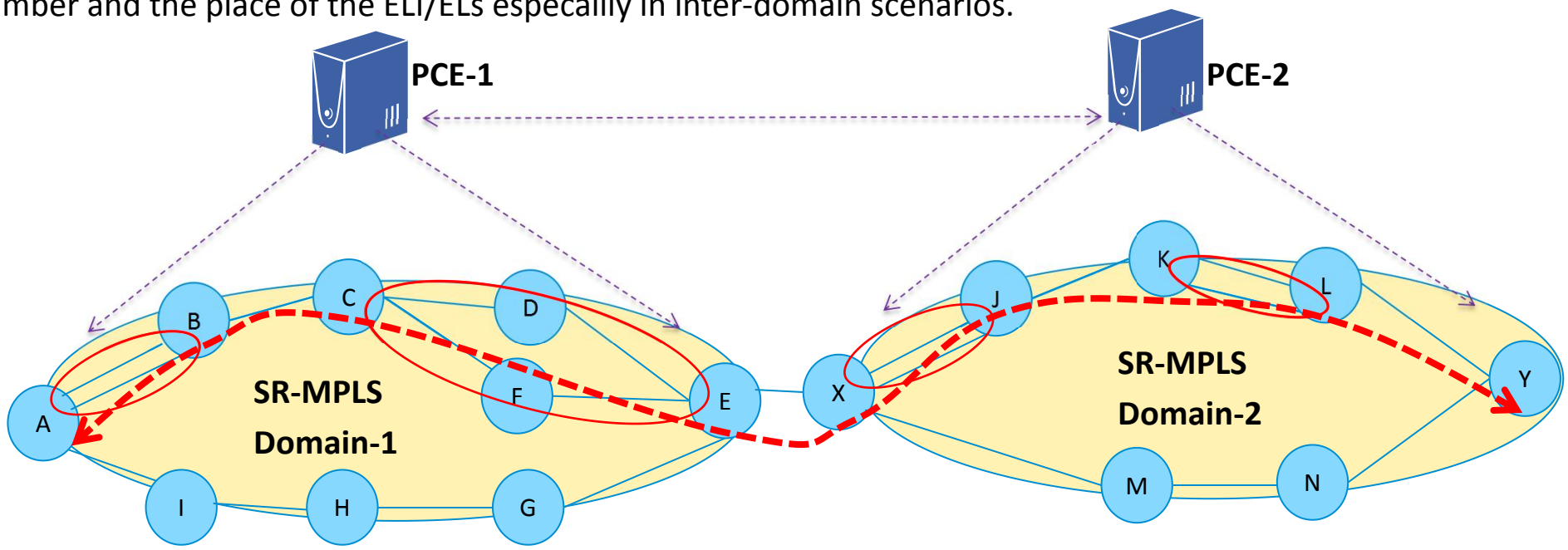
IETF PCE, July 2020, Online

Overview

- RFC8662 proposes to apply the entropy labels to SR-MPLS networks and provides following criteria to determine the best ELI/ELs placement:
  - a limited number of <ELI, EL> pairs SHOULD be inserted in the SR-MPLS label stack;
  - the inserted positions SHOULD be whithin the Entropy Readable Label Depth (ERLD) of a maximize number of transit LSRs;
  - a minimum number of <ELI, EL> pairs SHOULD be inserted while satisfying the above criteria.
- The controller (e.g. PCE) MAY perform the end-to-end path computation as well as the the Entropy Label Position (ELP) including the number and the place of the ELI/ELs especailly in inter-domain scenarios.

Label Stack with ELI/EL





PCEP Extensions

- Open Object
  - indicate that it supports the SR path with ELP configuration.

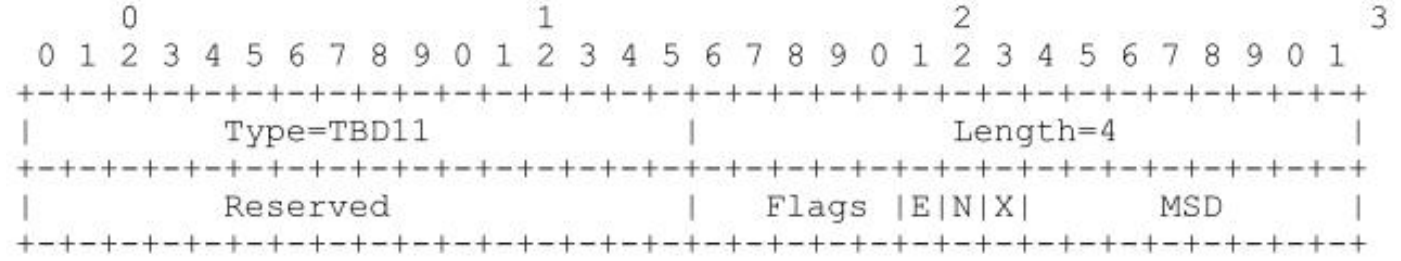


Figure 1: E-flag in SR-PCE-CAPABILITY sub-TLV

- LSP Object
  - indicate to compute the SR path with ELP information.

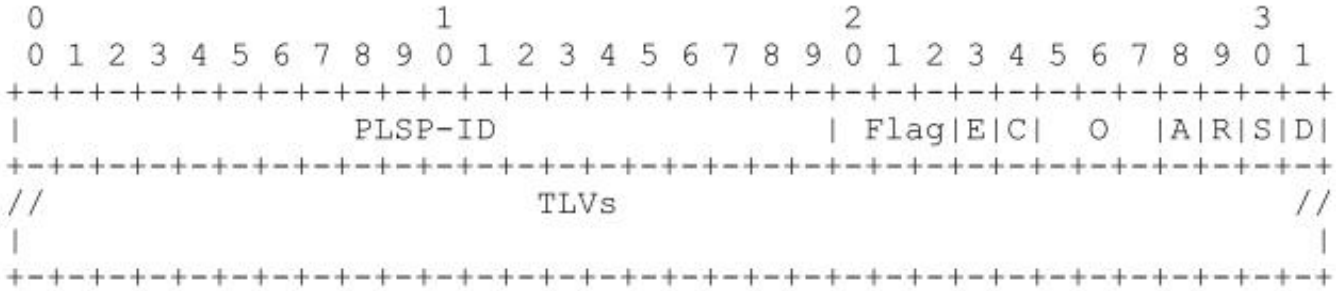


Figure 2: E-flag in LSP Object

- ERO Object
  - indicate that the position after this SR-ERO subobject is the position to insert <ELI, EL>, otherwise it cannot insert <ELI, EL> after this segment.

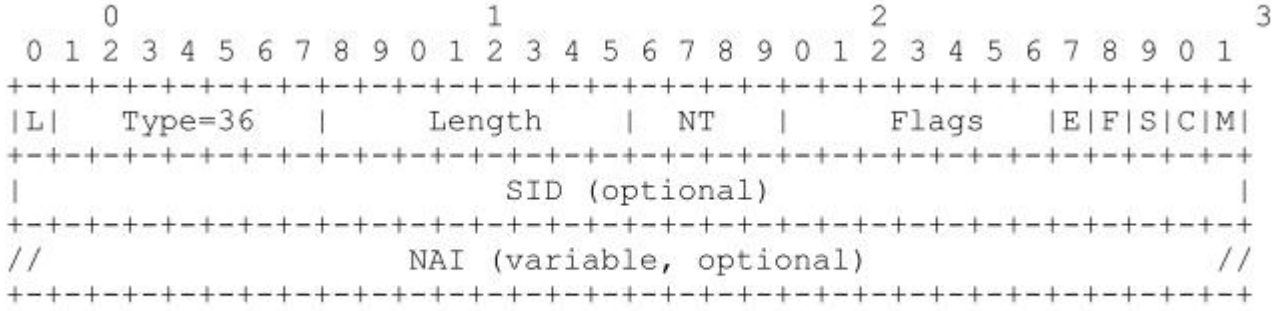


Figure 4: E-flag in SR-ERO subobject

Next Step

- Comments and discussions are very welcome!

Thank you!

A YANG data model for Segment Routing in IPv6 (SRv6) support in Path Computation Element communications Protocol (PCEP)

draft-li-pce-pcep-srv6-yang-01

Cheng Li, Shuping Peng, Huawei
Mike Koldychev, Cisco
Siva Sivabalan, Ciena
Luc-Fabrice Ndifor, MTN-Cameroon

PCEP - SRv6

PCEP for SR-MPLS	• RFC 8664
PCEP for SRv6	• I-D.ietf-pce-segment-routing-ipv6

PCEP-YANG	• I-D.ietf-pce-pcep-yang • Support SR-MPLS • Near WG-LC
PCEP-YANG for SRv6	• This I-D

PCEP – SRv6

- Use of PCE (and PCEP) to compute (and convey) SRv6 paths
- Capability Advertisement
  - *SRv6 PCE Capability sub-TLV*
- A new Path Setup Type (PST)
- A new ERO/RRO sub-object for SRv6
  - *Called SRv6-ERO and SRv6-RRO sub-object*
- Refer [I-D.ietf-pce-segment-routing-ipv6]

PCEP YANG Structure

- Entity
  - *The local PCEP speaker*
- Peer
  - *The remote PCEP speaker*
- Session
  - *The current PCEP session between local and remote PCEP speakers*
- SR-MPLS
  - *Capability at entity and peer level*
  - *PST for LSP and a reference to the TE model*

```
module: ietf-pcep
     +--rw pcep!
        +--rw entity
           +--rw addr                              inet:ip-address
           ...
           +--rw capability
           ...
           |  +--rw sr {sr}?
           |     +--rw enabled?     boolean
           |     +--rw msd-limit?   boolean
           |     +--rw nai?         boolean
           +--rw msd?                              uint8 {sr}?
           +--rw pce-info
           ...
           +--ro lsp-db {stateful}?
           |  +--ro db-ver?             uint64 {sync-opt}?
           |  ...
           |  +--ro lsp* [plsp-id pcc-id lsp-id]
           |     +--ro plsp-id                uint32
           |     +--ro pcc-id                 inet:ip-address
           |     +--ro source?
           |     |       -> /te:te/lsps-state/lsp/source
           |     +--ro destination?
           |     |       -> /te:te/lsps-state/lsp/destination
           |     +--ro tunnel-id?
           |     |       -> /te:te/lsps-state/lsp/tunnel-id
           |     +--ro lsp-id
           |     |       -> /te:te/lsps-state/lsp/lsp-id
           |     +--ro extended-tunnel-id?
           |     |       -> /te:te/lsps-state/lsp/extended-tunnel-id
           |     +--ro pst?                   identityref
           ...
           +--rw peers
              +--rw peer* [addr]
                 +--rw addr                      inet:ip-address
                 ...
                 |  +--rw sr {sr}?
                 |     +--rw enabled?     boolean
                 |     +--rw msd-limit?   boolean
                 |     +--rw nai?         boolean
                 +--rw msd?                           uint8 {sr}?
                 ...
                 +--ro sessions
                    +--ro session* [initiator]
                       +--ro initiator                pcep-initiator
                       ...
```

PCEP - SRv6 YANG

- A new PST identity type
- Augment Capability at entity and peer level
  - *Capability enabled*
  - *Multiple MSD types*
- Augment the LSP container in LSP-DB
  - *For SRv6 paths, the segment list is added*

```
module: ietf-pcep-srv6
    augment /pcep:pcep/pcep:entity/pcep: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 /pcep:pcep/pcep:entity/pcep:peers/pcep:peer
              /pcep: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 /pcep:pcep/pcep:entity/pcep:lsp-db/pcep:lsp:
      +--ro srv6 {srv6}?
         +--ro segment-list
            +--ro segment* [index]
               +--ro index        uint32
               +--ro sid-value?   srv6-types:srv6-sid
```

Next Step

- Request more reviews especially the implementers and operators of SRv6.
- The work is in scope of PCE WG and is in stable condition
  - *Candidate for WG adoption?*

THANK YOU!

PCEP SR Policy Extensions to Enable IFIT

draft-chen-pce-sr-policy-ifit-02

Online, Jul 2020, IETF 108

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Hang Yuan (UnionPay)
Tianran Zhou (Huawei)
Weidong Li (Huawei)
Giuseppe Fioccola (Huawei)
Yali Wang (Huawei)

Background and Motivation

- In-situ Flow Information Telemetry (**IFIT**) refers to network OAM applications that apply dataplane on-path telemetry techniques, including In-situ OAM (**IOAM**) (draft-ietf-ippm-ioam-data) and **Alternate Marking** (RFC8321)

- An SR Policy is identified through the tuple <headend, color, endpoint>
- A headend may be informed about a candidate path for an SR Policy by various means including:
  - via configuration,
  - PCE (**draft-ietf-pce-segment-routing-policy-cp**),
  - BGP (**draft-ietf-idr-segment-routing-te-policy**).

This document defines **extensions to PCEP to distribute SR policies carrying IFIT information** carrying **In-situ Flow Information Telemetry** (IFIT) information.

So data plane on-path telemetry methods, like IOAM and Alternate Marking, can be enabled automatically when the SR policy is applied

Changes from -00 to -02

We got some feedback on the mailing list and about the companion **draft-qin-idr-sr-policy-ifit**.

The main questions were about the **applicability** and we clarified it:

- This PCEP extension allows to signal the IFIT capabilities together with the SR-policy. In this way IFIT methods are automatically activated and running.
- The flexibility and dynamicity of the IFIT applications are given by the use of additional functions on the controller and on the network nodes, but this is out of scope here.

Another comment was about its possible **generalization** to any data plane:

- Note that the IFIT attributes here described can also be generalized and included as TLVs for other Association Groups.
    - In this regard RFC 8697 defines the generic mechanism to associate sets of LSPs and a set of attributes, for example IFIT.

Reference only to the relevant documents for the **data plane**:

- draft-ietf-ippm-ioam-ipv6-options: IOAM application to IPv6 (and SRv6).
- draft-ietf-6man-ipv6-alt-mark: Alternate Marking application to IPv6 (and SRv6).

Relevant document for the **control plane** are already adopted:

- draft-ietf-pce-segment-routing-policy-cp

IFIT Attributes in SR Policy

SR Policy Association Group (**SRPAG**) is defined to extend PCEP to support association among candidate paths of a given SR policy.

The following TLVs are introduced to construct the SR policy structure:

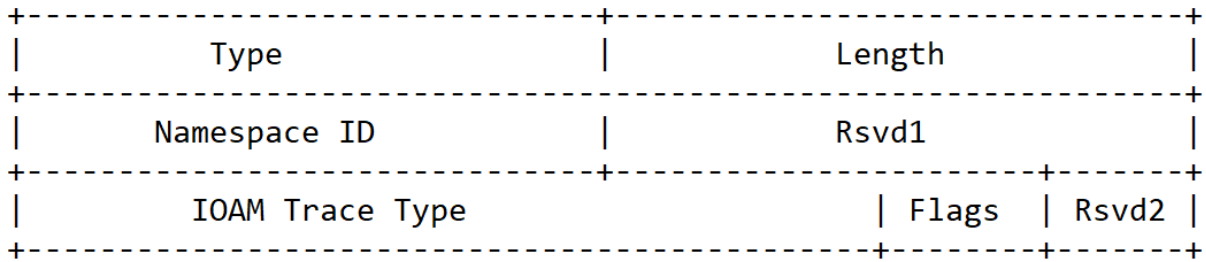
- SR Policy Identifiers TLV
- SR Policy Name TLV
- SR Policy Candidate Path Identifiers TLV
- SR Policy Candidate Path Preference TLV

This document is to add **IFIT attribute TLVs** to the SRPAG.

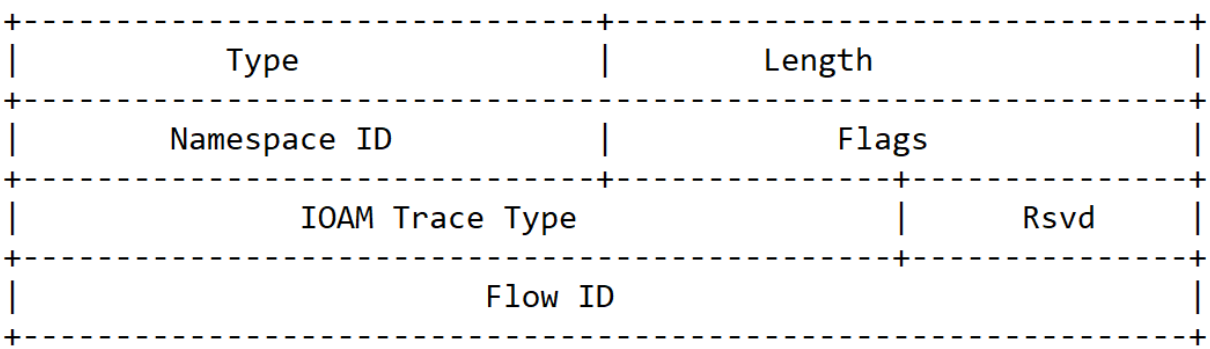
SR Policy for IOAM

When SR policy enables the IOAM, the IOAM header will be inserted into every packet of the traffic that is steered into the SR paths:

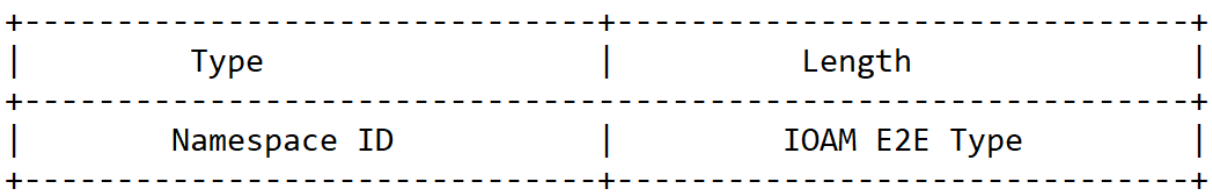
- IOAM Pre-allocated Trace Option TLV and IOAM Incremental Trace Option TLV



- IOAM Directly Export Option TLV



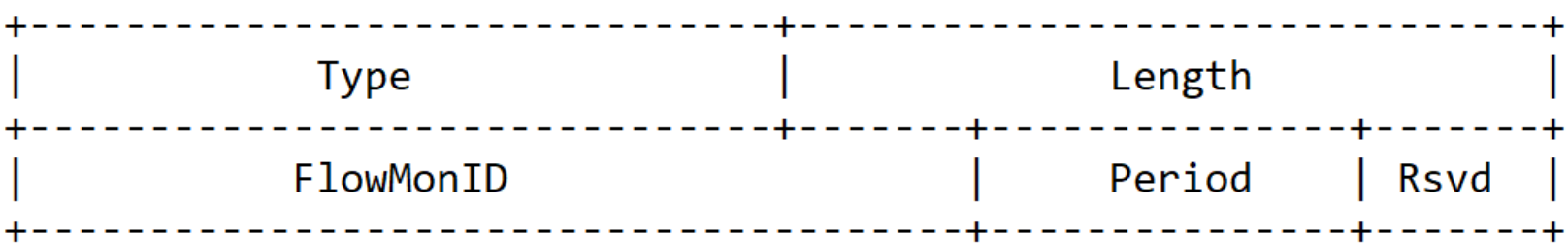
- IOAM Edge-to-Edge Option TLV



SR Policy for Alternate Marking

SR Policy for Enhanced Alternate Marking to apply both RFC 8321 and draft-ietf-ippm-multipoint-alt-mark

- Enhanced Alternate Marking (EAM) TLV



Discussion & Next Steps

- Collect feedbacks
- Evaluate WG adoption considering the anchor adopted work
- Welcome questions, comments

Thank you

Local Protection Enforcement in PCEP

draft-stone-pce-local-protection-enforcement

IETF 108 - Online

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Changes since IETF 106

draft-stone-pce-local-protection-enforcement-02

- 2 new co-authors
- Draft renamed from ‘path’ to ‘local’
- Added more text for various use cases and comparison between them
- Added text discussing use cases where there is no preference / “do not care”
- Implementations

Changes not yet posted

- *Formatting nits*
- *Change recommended bit to <TBD> until IANA allocation*

Use case

Influence path computation for expanded use cases

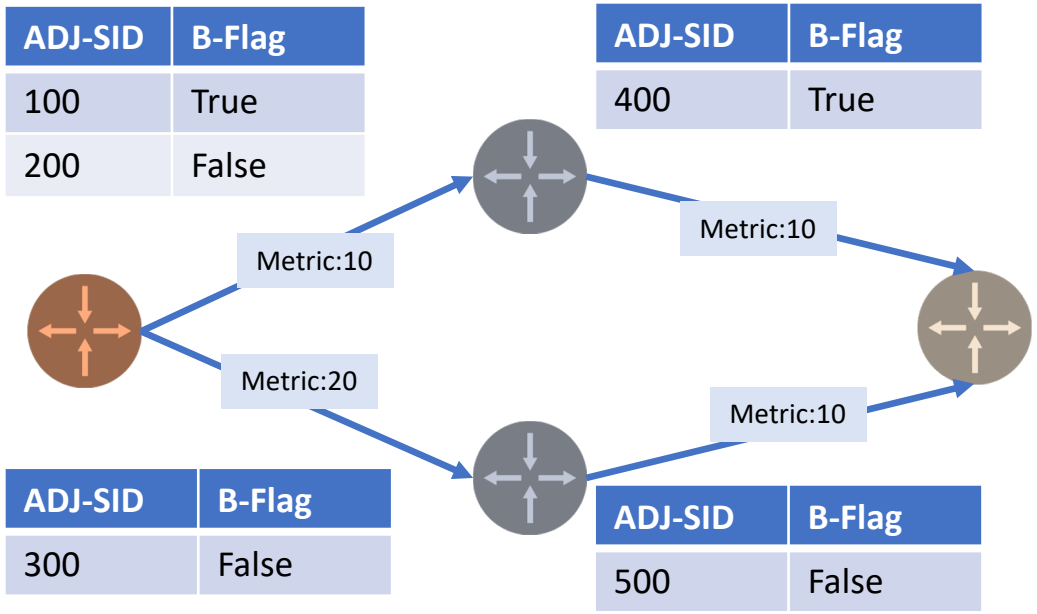
- Segment IDs (ADJ-SIDs specifically) may be protected.
- The protection status is advertised in IGP extensions with the B-Flag.
- The selection of a SID has implications during failure scenarios.
- A PCE can consider this backup flag:
  1. A constraint per path calculation to influence shortest path
  2. Deterministic selection of a SID along a shortest path when multiple options are available

Improve interoperability

- Existing implementations have interpreted ‘Local Protection Desired’ (L-Bit) differently (*hard vs soft constraint*)
- Experienced at EANTC interop testing and Service Provider trials

Use case

- LSP 1 : must have a protected path
  - Feasible Result:
    - Path (100, 400); Cost 20
- LSP 2 : must not have a protected path
  - Feasible result:
    - Path (300, 500); Cost 30
- LSP 3 : no enforcement, but deterministic SID selection
  - Feasible result:
    - Path (100, 400); Cost 20
    - Path (200, 400); Cost 20
    - Path (300, 500); Cost 30
  - Shortest path:
    - Protection Preferred: Path (100, 400); Cost 20
    - Unprotected Preferred: Path (200, 400); Cost 20

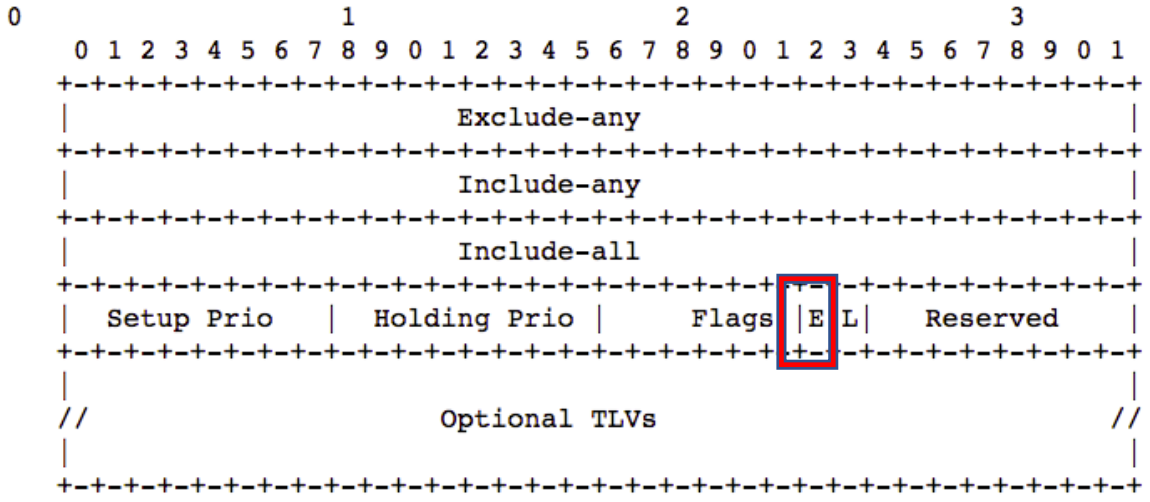


LFA Links/Paths not shown

Proposal

1. Wording and statements around the usage of existing Local Protection Desired Bit, while attempting to be *generally* backwards compatible with existing PCC and PCE implementations

2. New Flag: Enforcement (E-Flag) to accompany the L-Flag in the LSP Attributes object



Flags (8 bits)

- L flag: As defined in [RFC5440] and further updated by this document. When set, protection is desired. When not set, protection is not desired. The enforcement of the protection is identified via the E-Flag.

- E flag (Protection Enforcement): When set, the value of the L-Flag MUST be treated as a MUST constraint where applicable, when protection state of a SID is known. When E flag is not set, the value of the L-Flag MUST be treated as a MAY constraint.

Implementation Status

Nokia (demo)

- PCC: SROS
- PCE: Network Services Platform (NSP)

Cisco (demo)

- PCC: IOS-XR 7.4.1
- PCE: IOS-XR 7.4.1

Next step

1. Requesting working group adoption

2. Requesting early IANA code points so that implementations may proceed further

Thank you

LSP Object Flag Extension of Stateful PCE

draft-xiong-pce-lsp-flag-02

Quan Xiong(ZTE)

IETF PCE, July 2020, Online

PCEP Extensions

- LSP Object
  - As defined in [RFC8231], the length of LSP Object Flag field is 12bits and bit 1 to bit 11 has been assigned shown on the right figure.
  - This document proposes to define a new LSP-EXTENDED-FLAG TLV for LSP object to extend the length of the flag field.

Bit	Description	Reference
0	Unassigned	
1	ERO-compression	[RFC8623]
2	Fragmentation	[RFC8623]
3	P2MP	[RFC8623]
4	Create	[RFC8281]
5-7	Operational (3 bits)	[RFC8231]
8	Administrative	[RFC8231]
9	Remove	[RFC8231]
10	SYNC	[RFC8231]
11	Delegate	[RFC8231]

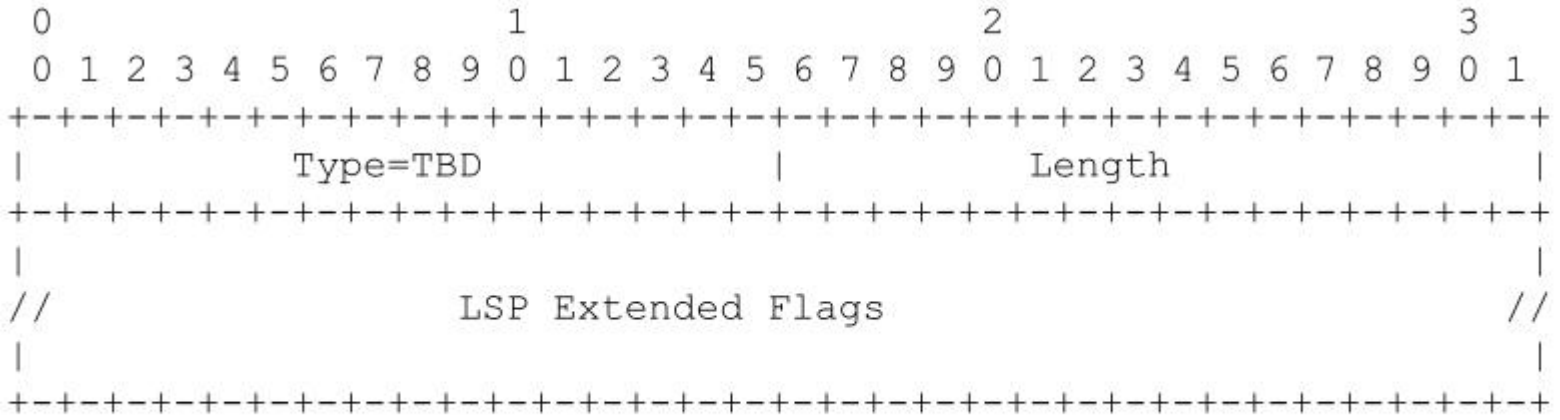


Figure 1: LSP-EXTENDED-FLAG TLV Format

PCEP Extensions (cont)

- PCEP-Error Object
  - The LSP-EXTENDED-FLAG TLV MUST be included in the LSP Object when the bits of the extended flag field need to be used.
  - If the TLV is missing, the PCE will generate an error with Error-type=6 (Mandatory Object missing) and error-value TBD2 (LSP-EXTENDED-FLAG TLV missing and close the session.

Error-Type	Meaning
6	Mandatory Object missing
	Error-value
	TBD2: LSP-EXTENDED-FLAG TLV missing

Table 2

Next Step

- The draft has been discussed and updated in the mailing list.
- Comments and discussions are very welcome!

Thank you!

Support for Path MTU (PMTU) in the Path Computation Element (PCE) communication Protocol (PCEP)

draft-li-pce-pcep-pmtu-01

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Motivation

- In traditional MPLS, the Path MTU can be signaled via signaling protocols like RSVP-TE[3209] and LDP[RFC3988].

- However, there is no additional signaling to establish Segment Routing (SR) paths, so the SR tunnel cannot currently support the negotiation mechanism of the Path MTU.
  - SR information is reported by BGP-LS, and the PCE can calculate the SR Paths based on this info.

- When SIDs (Label or IPv6 address) are pushed in a packet, the packet will be dropped (in IPv6) or fragmented in forwarding since the packet size may exceed the Path MTU.

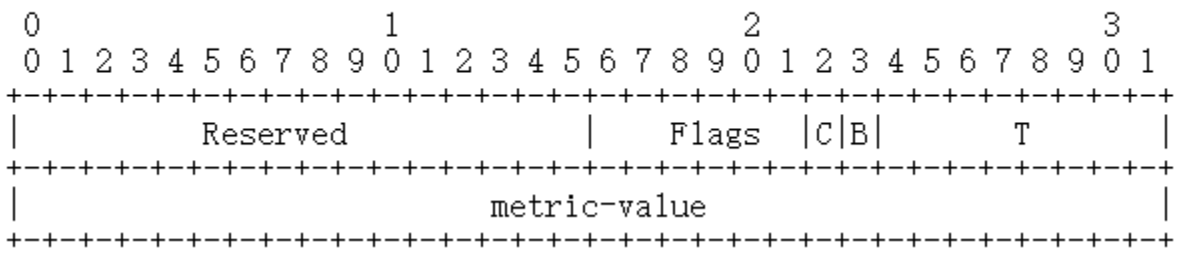
- From Operator:
  - When using leased line over multi-domains, MTU should be learned to avoid dropping packets.

- This draft is to specify the **extensions to PCEP** to carry **Path MTU** in PCEP messages.

METRIC Object for Path MTU

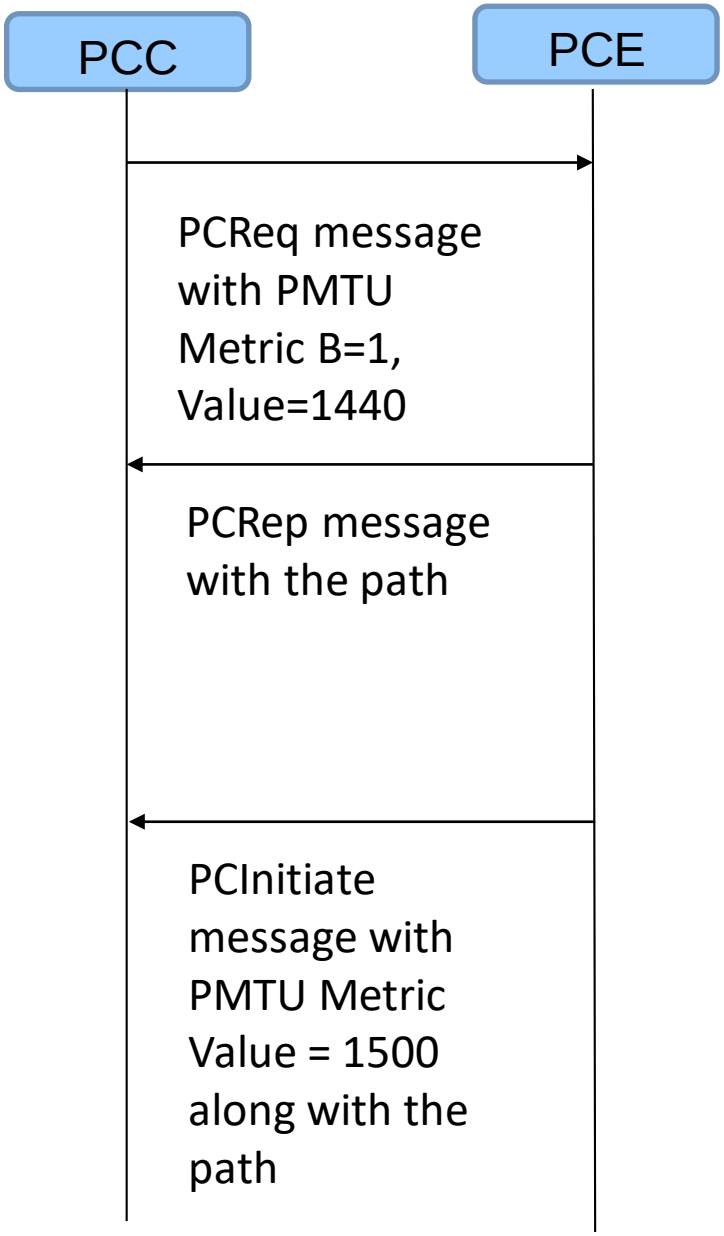
- This document defines a new type for the existing METRIC object for Path MTU.
  - T = TBD by IANA
  - B (Bound - 1 bit): Bound
  - metric-value = PMTU
- The Path MTU metric type of the METRIC object in PCEP represents the minimum of the Link MTU of all the links along the path.

The format of the METRIC object body is as follows:



PMTU for Segment Routing

- PCE can be used for computing one or more SR-TE paths taking into account various constraints and objective functions.
  - Path MTU could be another metric for PCE to consider
- Once a path is chosen, the PCE can inform an SR-TE path on a PCC using PCEP extensions specified in [RFC8664].
  - PCE could also inform the Path MTU to the PCC
- [I-D.ietf-pce-segment-routing-ipv6] adds the support for IPv6 data plane in SR.
- **The new metric type for path MTU is applicable for the SR-TE path and does not require any additional extensions.**



Next Step

- There is a need to convey the PMTU information over the PCEP.
- draft-ietf-idr-sr-policy-path-mtu-01 has been progressed and become a WG draft in IDR.
  - It defines extensions to BGP to distribute **path MTU** information within SR policies.
- This draft is the corresponding draft for PCEP.
- We would like to call for WG adoption for this draft.

Thank you for your attention!

Extensions to PCE for SR Path Ingress Protection

draft-chen-idr-sr-ingress-protection-03

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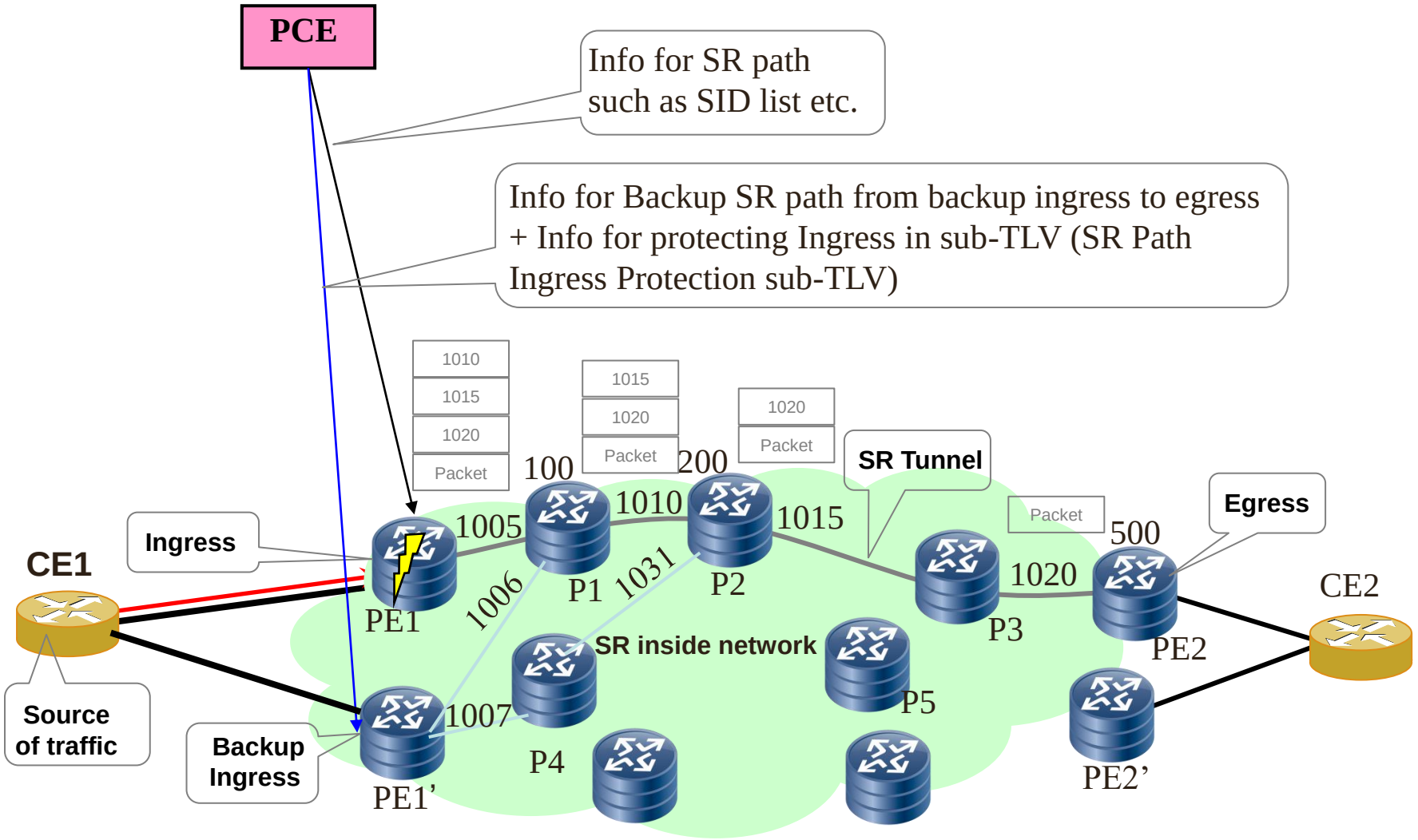
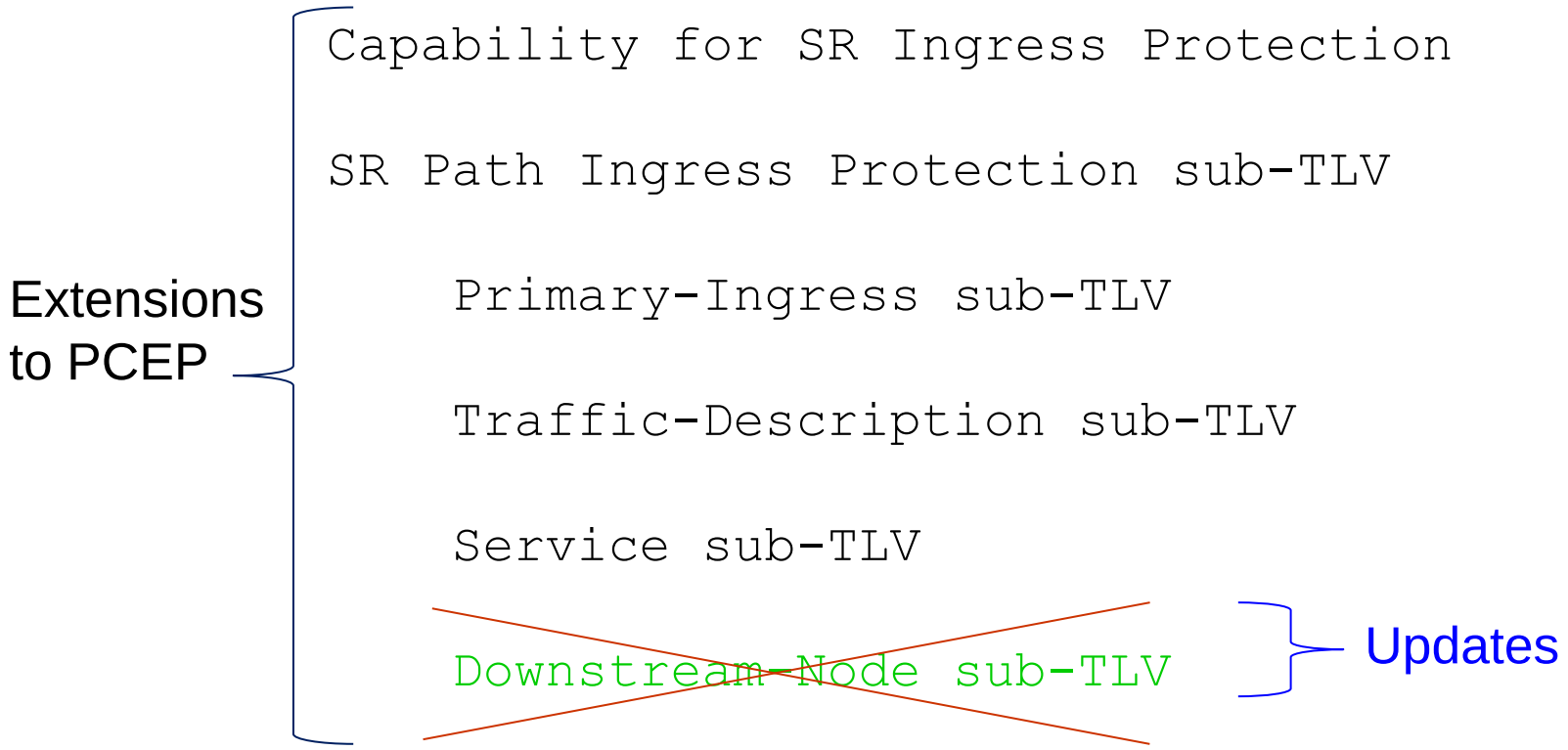
Mehmet Toy (Verizon)
Aijun Wang (China Telecom)
Zhenqiang Li (China Mobile)
Lei Liu (Fujitsu)
Xufeng Liu (Volta Networks)

Overview


PCE
Info for SR path such as SID list etc.
Info for Backup SR path from backup ingress to egress + Info for protecting Ingress in sub-TLV (SR Path Ingress Protection sub-TLV)
1010
1015
1020
Packet
1015
1020
Packet
1020
Packet
SR Tunnel
Packet
Egress
Ingress
CE1
100
200
1005
1010
1015
500
1020
CE2
PE1
1006
P1
1031
P2
P3
PE2
SR inside network
P5
1007
P4
Source of traffic
Backup Ingress
PE1'
PE2'

Updates to Previous versions



Next Step

Comments