

# PCE as a Central Controller (PCECC)

[draft-zhao-pce-pcep-extension-for-pce-controller-05](#)

[draft-zhao-pce-pcep-extension-pce-controller-sr-00](#)

[draft-palle-pce-controller-labeldb-sync-01](#)

# Overview

## Architecture

### draft-ietf-teas-pce-central-control-03

- An Architecture for Use of PCE and PCEP in a Network with Central Control
- WG Last Called

## Use-cases

### draft-ietf-teas-pcecc-use-cases-01

- The Use Cases for Using PCE as the Central Controller(PCECC) of LSPs
- WG Adopted

## Solutions

- Extension to PCEP as per the above architecture and use-cases
- Request to WG to consider these solution drafts for adoption

# Document Map

## draft-zhao-pce-pcep-extension-for-pce-controller-05

- Base for PCECC
- Label Synchronization
- New PCEP Messages/Objects

## draft-zhao-pce-pcep-extension-pce-controller-sr-00

- Extension for Segment Routing
- New PCEP Object

## draft-palle-pce-controller-labeldb-sync-01

- Synchronization Optimization procedures
  - Sync Avoidance
  - Incremental Sync

# PCECC

## Description

- Section 3.1.2 of draft-ietf-teas-pce-central-control
- Section 5 of draft-ietf-teas-pcecc-use-cases-01

LSPs are provisioned as explicit label instructions at each hop on the end-to-end path.

Each router along the path must be told what label forwarding instructions to program and what resources to reserve.

The controller uses PCEP to communicate with each router along the path of the end-to-end LSP.

Note that the PCE-based controller will take responsibility for managing some part of the MPLS label space for each of the routers that it controls

- It may take wider responsibility for partitioning the label space for each router and allocating different parts for different uses.

# PCECC - SR

## Description

- Section 3.1.5 of draft-ietf-teas-pce-central-control
- Section 4 of draft-ietf-teas-pcecc-use-cases

Use PCEP protocol for SR label distribution when PCE is managing the label space.

PCE as a central controller can allocate and provision the node/adjacency label (SID) via PCEP.

In some deployments PCE (and PCEP) are better suited than IGP because of centralized nature of PCE and direct TCP based PCEP session to the node.

The Label Map are updated on all PCEP sessions.

In case of redundant PCEs, label should be synchronized.

# PCEP extension

Capability	<ul style="list-style-type: none"><li>• Advertise PCECC capability in Open</li></ul>
Label Download	<ul style="list-style-type: none"><li>• Label allocated by PCE</li><li>• A new PCEP message PCLabelUpd to download label instructions on each node.</li></ul>
Label Map	<ul style="list-style-type: none"><li>• Label allocated by PCE for SR (node, prefix, adj)</li><li>• PCLabelUpd to advertise the label mapping on all sessions.</li></ul>
Session Termination	<ul style="list-style-type: none"><li>• PCC marks all labels on the session as stale.</li><li>• For SR labels, PCC should find alternative PCE to delegate the orphan labels.</li><li>• Stale labels are cleared on state timeout interval.</li></ul>
Label-DB Synchronization	<ul style="list-style-type: none"><li>• First, PCE synchronize its LABEL-DB to PCC.</li><li>• Second, PCC reports all the stale marked labels to PCE.</li></ul>

# Label DB Synchronization

- At PCC all labels are marked stale that were previously reported by this PCE on session down.
- LABEL-DB synchronization is a two phase procedure.
  - In first phase, immediately after the LSP state synchronization PCE MUST synchronize its LABEL-DB to PCC.
  - In second phase, PCC MUST report all the stale marked labels to PCE using PCLabelRpt message.
- PCE decide to delete or keep this label entries and inform PCC using PCLabelUpd Message and PCC will remove the stale marking for the all labels on receipt of corresponding PCLabelUpd message.
- In case of PCECC SR, if PCC has any alternate PCEP session with another PCE, then PCC MUST delegate the SR labels of this session to this alternate PCE in a sequence of PCLabelRpt message. PCE can accept it and can send PCLabelUpd message to update or clean the label.

```

+ ++++++          + ++++++
| PCE             | PCC
|                 | Transit
|                 | Node
+ ++++++          + ++++++

.
.
----- PCLabelUpd, PLSP-ID=2-----| (Label
      (LSP ID=2)                   | Download
      for LSP's)
----- PCLabelUpd, PLSP-ID=3-----|
      (LSP ID=3)
----- PCLabelUpd, PLSP-ID=4-----|
      (LSP ID=4)
.
.
.
----- Session Down-----X      | (Session
.                                  | down, mark
.                                  | all label's
.                                  | Stale of this
.                                  | Session)
|<----- Session Re-established-----| (Session up)
.
.
|<-----PCRpt, SYNC=0-----| (No LSP to SYNC)
.
|----PCLabelUpd, PLSP-ID=2, SYNC=1----| (LABEL-DB
|----PCLabelUpd, PLSP-ID=3, SYNC=1----| SYNC, unmark
.                                  | stale label)
|-----PCLabelUpd, SYNC=0-----|
.                                  | (End of LABEL-DB
.                                  | SYNC)
|<-----PCLabelRpt, PLSP-ID=4, SYNC=1--| (Report all stale
.                                  | Labels of this
|<-----PCLabelRpt, SYNC=0-----| Session)
.
|----- PCLabelUpd, PLSP-ID=4 -----| Label Cleanup
      (LSP ID=4, R=1)
.
.

```

# PCEP Messages

## Label Update

```
<PCLabelUpd Message> ::= <Common Header>
                           <pce-label-update-list>
Where:
<pce-label-update-list> ::= <pce-label-update>
                           [<pce-label-update-list>]
<pce-label-update> ::= (<pce-label-download>|<pce-label-map>)
Where:
<pce-label-download> ::= <SRP>
                           <LSP>
                           <label-list>
<label-list > ::= <LABEL>
                  [<label-list>]
<pce-label-map> ::= <SRP>
                   <LABEL>
                   <FEC>
```

## Label Report

```
<PCLabelRpt Message> ::= <Common Header>
                           <pce-label-report-list>
Where:
<pce-label-report-list> ::= <pce-label-report>
                           [<pce-label-report-list>]
<pce-label-report> ::= (<pce-label-delegate>|<pce-label-map>)
Where:
<pce-label-delegate> ::= <SRP>
                           <LSP>
                           <label-list>
<label-list > ::= <LABEL>
                  [<label-list>]
<pce-label-map> ::= <SRP>
                   <LABEL>
                   <FEC>
```



# Next Step

- Implementation Exists
  - As part of Hackathon and Bits n Bytes
- Reviews welcome!
- Request for WG adoption

