



IETF 125 – Online
PCE Working Group

PCEP Extensions for Signaling Multipath Information

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Motivation

- Stateful PCEP allows only one Segment List per SR Policy Candidate Path, which is not sufficient for modern TE requirements.
- **SR Policy with Multiple Segment Lists**
 - An SR Policy Candidate Path often uses multiple Segment Lists for ECMP/W-ECMP. This draft enables signaling them together.
- **Bandwidth Splitting (W-ECMP)**
 - Allows a PCE to satisfy a large bandwidth request by splitting traffic across multiple weighted paths.
- **Reverse Path Association**
 - Maps individual forward paths to their reverse paths, which is critical for applications like Circuit Style SR Policy (CS-SR) that require co-routed BFD/PM sessions.

Solution Description

- **PATH-ATTRIB object (Object-Class 45)** - separates each ERO/RRO; carries Path ID, O-flag (operational state), R-flag (reverse path).
- **MULTIPATH-WEIGHT TLV (type 61)**: per-path weight for W-ECMP; absent = weight 1
- **MULTIPATH-BACKUP TLV (type 62)**: protection mapping at path level (P2MP only); B-flag marks pure backup; Backup Path IDs reference protected primary path
- **MULTIPATH-OPPDIR-PATH TLV (type 63)**: links forward \leftrightarrow reverse paths by Path ID;
- **MULTIPATH-FORWARD-CLASS TLV (type TBD1)**: 3-bit FC value for QoS-based steering in Per-Flow Candidate Paths
- **MULTIPATH-CAP TLV (type 60)** in OPEN/LSP objects: negotiates max multipaths + capability flags (W/B/O/F/C); PCE MUST NOT exceed min of PCE and PCC values
- **Composite Candidate Path**: PATH-ATTRIB + COLOR TLV replaces ERO sub-objects; enables recursive SR Policy steering

Changes since IETF 124 (v16 → v20)

- **Terminology section expanded**
 - Added: PLSP, Path, LSP, Segment List, ERO definitions
- **Multipath Capability TLV**
 - PCE MUST NOT return more forward multipaths than the minimum of the values advertised by the PCE and PCC during capability negotiation
 - O-flag clarified: in the OPEN object it indicates capability advertisement; in the LSP object it indicates a per-LSP request (PCC) or provision (PCE) of opposite-direction path information
- **RBNF updated**
 - `<intended-path>` and `<actual-path>` modified to require a PATH-ATTRIB object for each ERO/RRO when multiple paths are present; single ERO remains allowed for single-path case
 - PCInitiate RBNF extended
- Examples moved to Appendix

Changes since IETF 124 (v16 → v20)

- **MULTIPATH-BACKUP TLV**

- Normative text added to explicitly exclude P2P support
- Clarified that each Backup Path ID MUST match the Path ID of a PATH-ATTRIB object in the same LSP that has the B-flag set
- New error added: if a MULTIPATH-BACKUP TLV is received on a P2P path, the receiver MUST send PCErrror

- **Signaling Opposite-Direction Path Information**

- Section 3.5 split into protocol extension section 4.5 and operation subsection, consistent with the structure of other TLV definitions
- Link/node co-routing flag descriptions clarified
- Symmetry requirement made normative (MUST): if $A \rightarrow B$ then $B \rightarrow A$, with opposite R-flags
- Length was incorrectly specified as 16 bytes; corrected to 8 bytes

Next steps

- The draft is stable and has been implemented by multiple vendors.
- Finalize discussion about authors of the draft