Path Computation Element Communication Protocol (PCEP) Extensions to Enable IFIT

draft-chen-pce-pcep-ifit-02

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Huanan Chen (China Telecom)
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 dataplane on-path telemetry techniques, including In-situ OAM (**IOAM**) (draft-ietf-ippm-ioam-data) and **Alternate Marking** (RFC8321, RFC8889)

❑ The **PCEP extension** defined in this document allows to signal the IFIT capabilities. In this way IFIT methods are automatically activated and running.

The IFIT attributes can be generalized and included as TLVs carried inside the LSPA (**LSP Attributes**) object in order to be applied for all path types, as long as they support the relevant data plane telemetry method
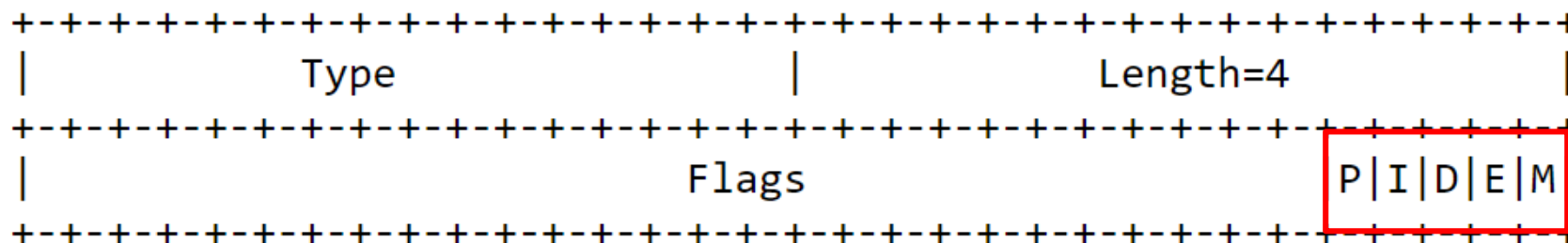
Changes from -01 to -02

Comments during IETF 109

- Mike Koldychev: consider the case of different IFIT methods for each Segment Lists (draft-koldychev-pce-multipath).
  - If it is needed to apply different IFIT methods for each Segment List, the IFIT attributes can be added into the PATH-ATTRIB object, instead of the LSPA object, according to draft-koldychev-pce-multipath that defines PCEP Extensions for Signaling Multipath Information.

- It has been added the AltMark Mode (HbH, DOH).

- The companion document (draft-ietf-idr-sr-policy-ifit) has been adopted in IDR WG

IFIT capability advertisement TLV

A new **IFIT-CAPABILITY TLV**, that is an optional TLV for use in the OPEN Object for IFIT attributes via PCEP capability advertisement

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Type              |           Length=4            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Flags                         |P|I|D|E|M|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

P: IOAM Pre-allocated Trace Option Type-enabled flag (draft-ietf-ippm-ioam-data)

I: IOAM Incremental Trace Option Type-enabled flag (draft-ietf-ippm-ioam-data)

D: IOAM DEX Option Type-enabled flag (draft-ietf-ippm-ioam-data)

E: IOAM E2E Option Type-enabled flag (draft-ietf-ippm-ioam-data)

M: Alternate Marking enabled flag (RFC8321)

- If set to 1 by a PCC, the flag indicates that the PCC allows instantiation of the feature by a PCE
- If set to 1 by a PCE, the flag indicates that the PCE supports the feature instantiation
- The flag MUST be set by both PCC and PCE in order to support the instantiation

IFIT Attributes TLV

The **IFIT-ATTRIBUTES TLV** provides the configurable knobs of the IFIT feature, and it can be included as an optional TLV in the **LSPA object**

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Type                |             Length             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                                |
//                       sub-TLVs                               //
|                                                                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
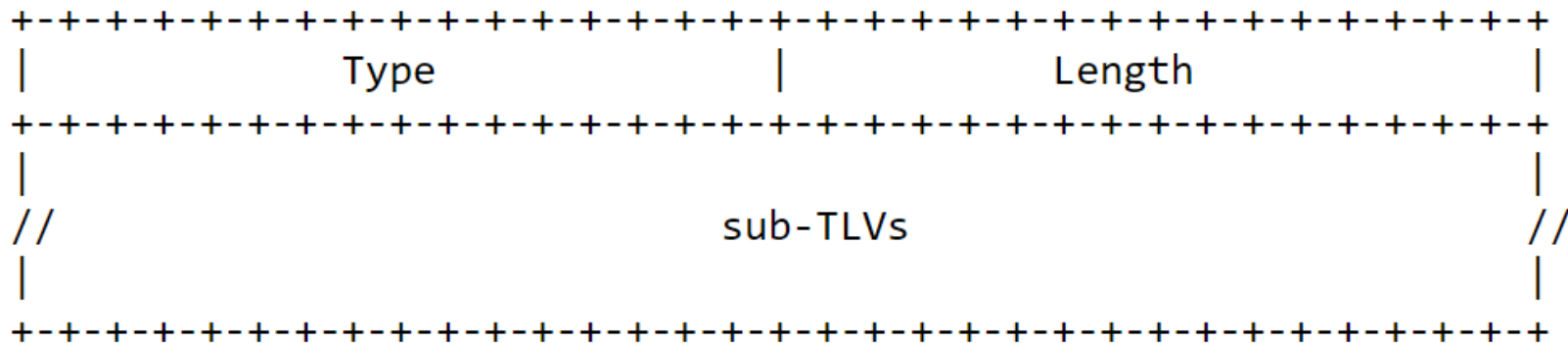
IFIT attribute TLVs, carried inside the LSPA object and applicable to all path types

- IFIT TLVs are optional and can be taken into account by the PCE during path computation and by the PCC during path setup.
- In general, the LSPA object can be carried within a PCInitiate message, a PCUpd message, or a PCRpt message in the stateful PCE model.
- IFIT for SR Policies: IFIT attibutes also complement draft-ietf-pce-segment-routing-policy-cp

IOAM Sub-TLVs

- IOAM Pre-allocated Trace Option Sub-TLV

```
+--------------------------------+--------------------------------+
|            Type=1              |            Length=8            |
+--------------------------------+--------------------------------+
|         Namespace ID          |            Rsvd1              |
+--------------------------------+-----------------------+--------+
|          IOAM Trace Type                      | Flags  | Rsvd2 |
+-----------------------------------------------+--------+-------+
```

- IOAM Incremental Trace Option Sub-TLV

```
+--------------------------------+--------------------------------+
|            Type=2              |            Length=8            |
+--------------------------------+--------------------------------+
|         Namespace ID          |            Rsvd1              |
+--------------------------------+-----------------------+--------+
|          IOAM Trace Type                      | Flags  | Rsvd2 |
+-----------------------------------------------+--------+-------+
```

- IOAM Directly Export Option Sub-TLV

```
+--------------------------------+--------------------------------+
|            Type=3              |            Length=12          |
+--------------------------------+--------------------------------+
|         Namespace ID          |            Flags             |
+--------------------------------+--------------+----------------+
|          IOAM Trace Type                     |      Rsvd      |
+----------------------------------------------+----------------+
|                            Flow ID                            |
+--------------------------------------------------------------+
```

- IOAM Edge-to-Edge Option Sub-TLV

```
+--------------------------------+--------------------------------+
|            Type=4              |            Length=4           |
+--------------------------------+--------------------------------+
|         Namespace ID          |          IOAM E2E Type        |
+--------------------------------+--------------------------------+
```

Enhanced Alternate Marking Sub-TLV

- Enhanced Alternate Marking Sub-TLV

```
+-----------------------------------+-----------------------------------+
|              Type=5               |             Length=4              |
+-----------------------------+-----+-----------------------+-----------+
|           FlowMonID         |            Period         |H|E|  R  |
+-----------------------------+-----+-----------------------+-----------+
```
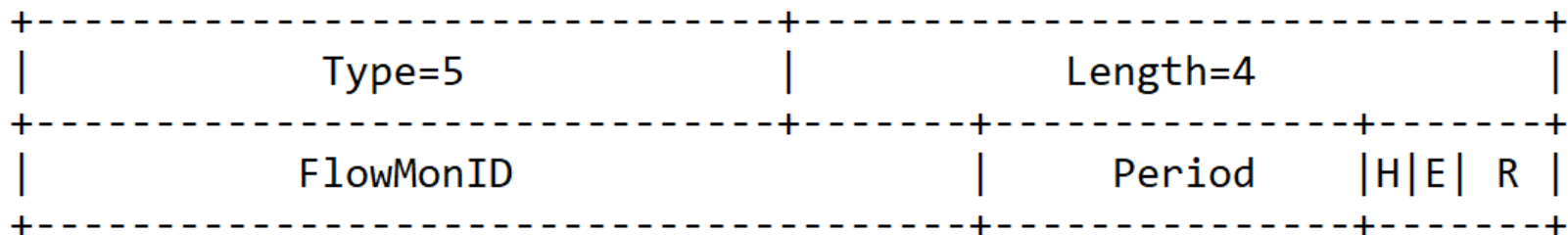
New fields added:

H: A flag indicating that the measurement is Hop-By-Hop.

E: A flag indicating that the measurement is end to end.

PCEP Messages and Example of application to SR Policy

The Examples of PCC Initiated SR Policy and PCE Initiated SR Policy are reported in draft-ietf-pce-segment-routing-policy-cp and this draft describes the addition of IFIT TLVs through LSPA object:

- For the <u>PCE-initiated LSP</u> with the IFIT feature enabled, IFIT-ATTRIBUTES TLV MUST be included in the LSPA object with the **PCInitiate message**

- The PCC creates the LSP using the attributes communicated by the PCE and the local values for the unspecified parameters

- After the successful instantiation of the LSP, the PCC automatically delegates the LSP to the PCE and generates a **PCRpt message** to provide the status report for the LSP

- When the LSP is instantiated the IFIT methods are applied as specified for the corresponding data plane, e.g. <u>draft-ietf-ippm-ioam-ipv6-options</u> and <u>draft-ietf-6man-ipv6-alt-mark</u>

- To enabling/disabling some features, the IFIT-ATTRIBUTES TLV MUST be included in the LSPA object with the **PCUpd message**

Discussion & Next Steps

- Evaluate WG adoption

- Welcome questions, comments

Thank you