

MPLS Data Plane Encapsulation for In-situ OAM Data

draft-gandhi-mpls-ioam-sr-05

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Agenda

- Requirements and Scope
- Summary
- Next Steps

Requirements and Scope

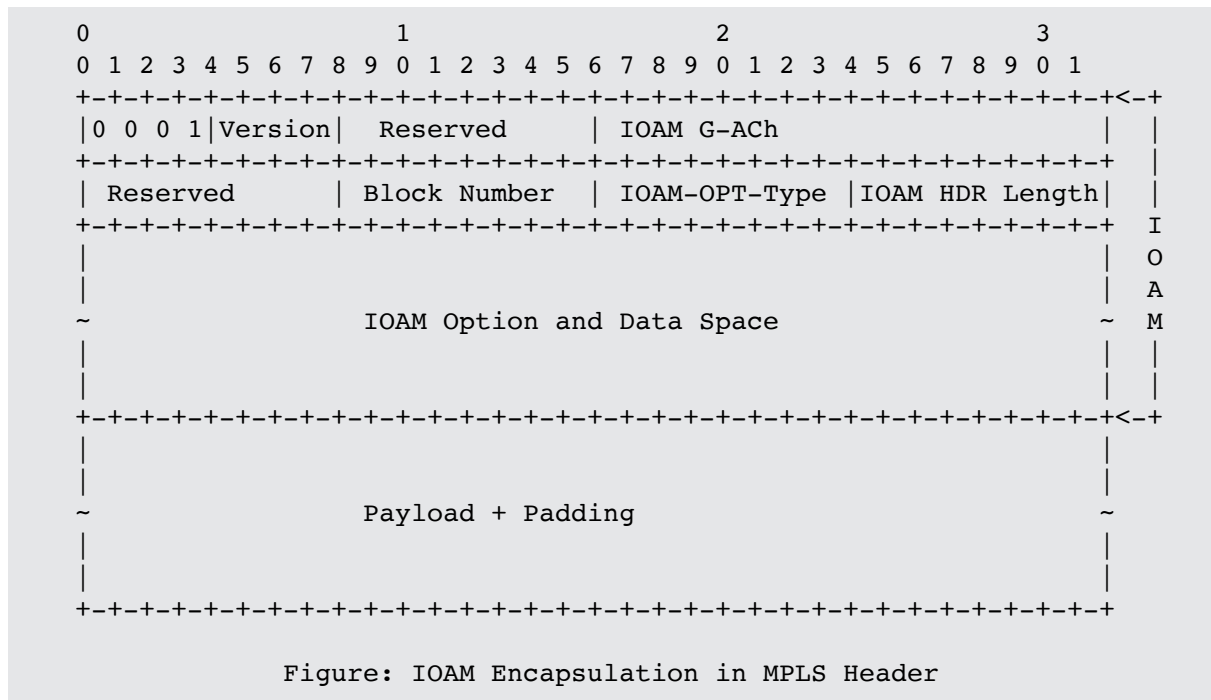
Requirements:

- Transport In-situ OAM (IOAM) data fields with MPLS Encapsulation

Scope:

- Using data fields defined in:
 - *draft-ietf-ippm-ioam-data*
 - *draft-ietf-ippm-ioam-direct-export*
 - *draft-ietf-ippm-ioam-flags*
- Edge-to-edge (E2E) IOAM
- Hop-by-hop (HbH) IOAM

IOAM Data Field Encapsulation in MPLS Header



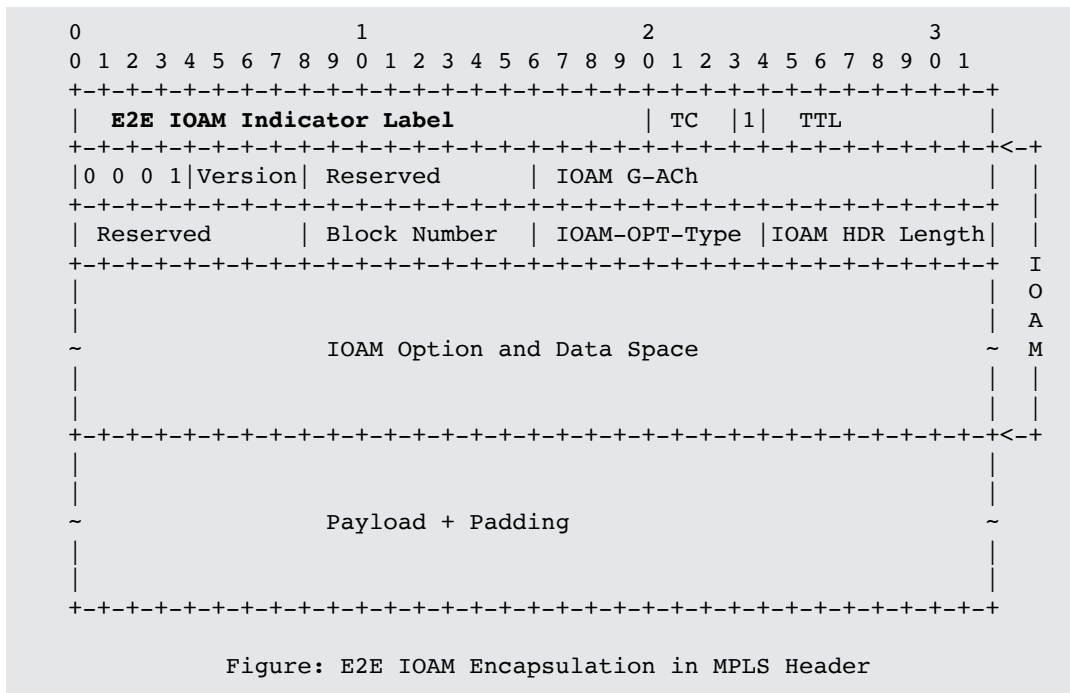
IOAM G-ACh Header

- New Generic Associated Channel (G-ACh) Type (value [TBA3](#)) defined for IOAM
- Protocol value *0001b* allows to avoid incorrect IP header based hashing over ECMP paths
- Block Number can be used to:
 - Aggregate IOAM data collected in data plane, e.g. compute measurement metrics for each block of a flow
 - Correlate IOAM data from different nodes

IOAM Indicator Label

- “IOAM Indicator Label” is used to indicate the presence of the IOAM data fields in the MPLS header after EOS.
- Separate Indicator Labels are used for E2E and HbH IOAM to optimize IOAM processing on transit nodes.

E2E IOAM Encapsulation in MPLS Header



E2E Indicator Label Allocation Methods

1. Extension Label (15) and Label assigned by IANA with value **TBA1**
 - From Extended Special Purpose Labels (eSPL) range
2. Global Label allocated by a controller
 - The controller provisions the label on encapsulating and decapsulating nodes
3. The **IOAM Enabled Label** allocated by the decapsulating node
 - **Signaling/advertisement extensions needed to convey the label to all encapsulating nodes (out of scope)**

E2E Indicator Label Allocation Methods

Method	Extra Label stack Size	Location on Stack	Other cases
eSPL Label	+2	Bottom	
Global Label	+1	Bottom	
Signal/Advertise Label	+1	Bottom	

E2E IOAM Procedure

1. The encapsulating node inserts an E2E Indicator Label and one or more IOAM data field(s) in the MPLS header.
2. The decapsulating node "punts the timestamped copy" of the data packet including IOAM data field(s).
 - a. The decapsulating node for E2E IOAM also pops the IOAM Indicator Label and the IOAM data field(s) from the MPLS header.
 - b. The decapsulating node processes IOAM data field(s).
 - c. The decapsulating node forwards the data packet downstream.

HbH IOAM Encapsulation in MPLS Header

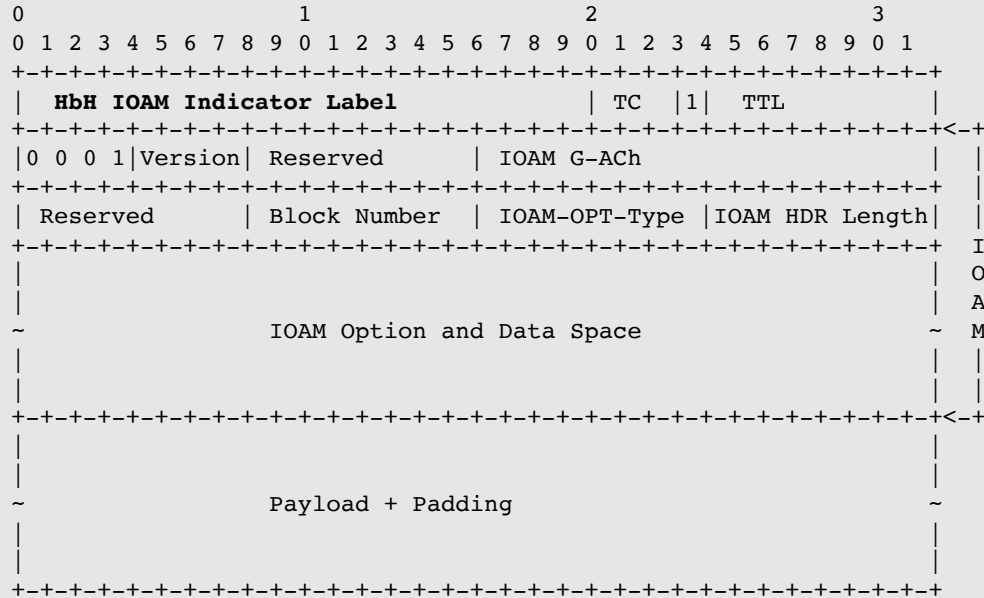


Figure: HbH IOAM Encapsulation in MPLS Header

HbH Indicator Label Allocation Methods

1. Extension Label (15) and Label assigned by IANA with value **TBA2**
 - From Extended Special Purpose Labels (eSPL) range
2. Global Label allocated by a controller
 - The controller provisions the label on encapsulating, **transit** and decapsulating nodes
3. **The IOAM Enabled Label allocated by the transit nodes**
 - **Signaling/advertisement extensions needed to convey the label to all encapsulating nodes (out of scope)**

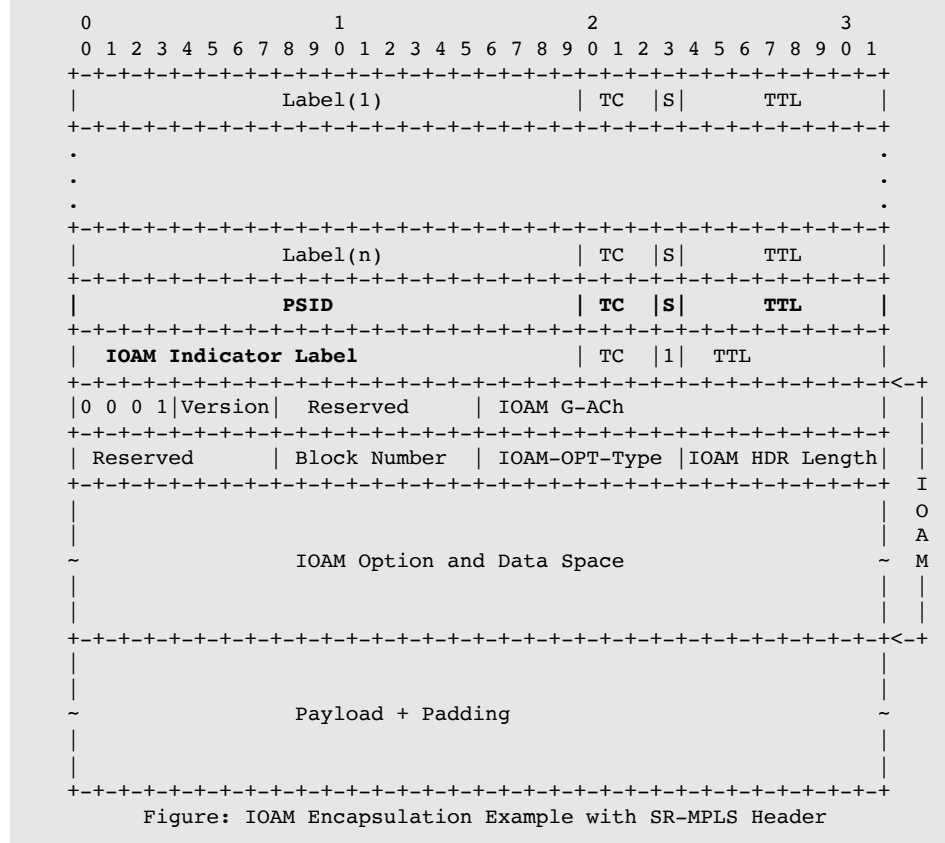
HbH Indicator Label Allocation Methods

Method	Extra Label stack Size	Location on Stack	Scan Label Stack	Different FIB Entry for Local Label	Other cases
eSPL Label	+2	Bottom	Yes	No	
Global Label	+1	Bottom	Yes	No	
Signal/Advertise Label (like SFL)	+0	Top	No	Yes	

HbH IOAM Procedure

1. The encapsulating node inserts a HbH Indicator Label and one or more IOAM data field(s) in the MPLS header.
2. The transit node processes HbH IOAM data field(s) and forwards the data packet including updated IOAM data field(s).
 - a. Transit node may punt the timestamped copy of the data packet for further IOAM processing
3. The decapsulating node "punts the timestamped copy" of the data packet including IOAM data field(s).
 - a. The decapsulating node for E2E IOAM also pops the IOAM Indicator Label and the IOAM data field(s) from the MPLS header.
 - b. The decapsulating node processes IOAM data field(s).
 - c. The decapsulating node forwards the data packet downstream.

IOAM Encapsulation Example with SR-MPLS Header



Next Steps

- Welcome your comments and suggestions
- Requesting MPLS WG adoption

Thank you

Open Review Comments

1. Label Stack Size Imposed by Ingress

- Applicable to E2E and HbH cases
- Available label stack size reduced for the LSP
 - HbH IOAM Indicator (Extension Label 15 when using eSPL)
- May need to add entropy label due to ECMP impact, further reducing available label stack size for the LSP
 - ELI
 - Entropy Label

Reply:

- This is true for all mechanisms using eSPL
 - SFC: <https://tools.ietf.org/html/rfc8595>
 - E2E: draft-cheng-mpls-inband-pm-encapsulation
- E2E and HbH - Use IOAM Enabled Label (like SFL) – Label stack size not changed

2. Transit Nodes Scanning Label Stack

- Applicable to HbH case
- Transit nodes need to scan deeper into the MPLS header to find IOAM Indicator Label only when HbH IOAM is enabled

Reply:

- ✓ This is also true for ELI and EL today
- ✓ With any indicator scheme, the node will have to look past EOS into the packet to find the IOAM data that needs to be processed
- ✓ Use IOAM enabled label (like SFL) that avoids scanning label stack

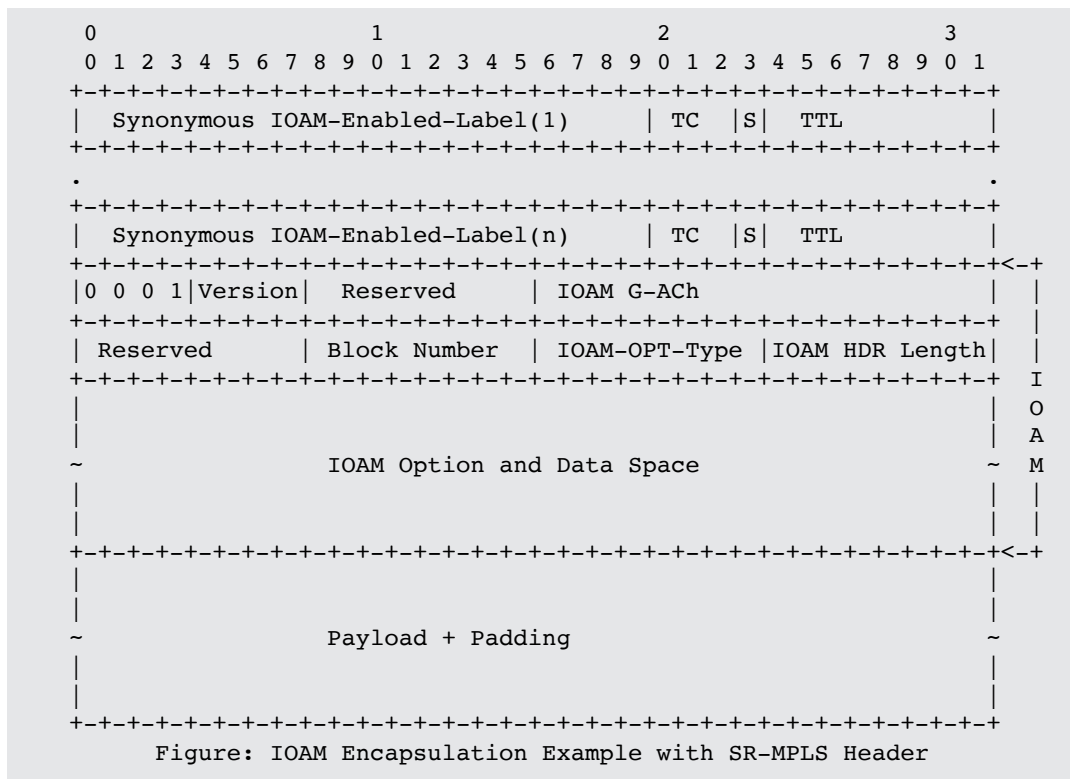
3. Different FEC (like SFL) for IOAM Data Packets

- Applicable to HbH case
- With a special FEC for IOAM packets and a "normal" FEC for data packets that don't carry IOAM info, a node might drop the normal traffic while the IOAM traffic flows
- Use IOAM Enabled label (like SFL) for IOAM packets

Reply:

- ✓ This is indeed an issue with using SFL kind of approach. OAM reports the metrics of the LSP on which the normal traffic is not flowing. The forwarding normal packets are not using the LSP used by the OAM, as there are two synonymous LSPs

3. Example HbH IOAM Encapsulation Using IOAM Enabled Label



4. IOAM Data After EOS

- Applicable to E2E and HbH cases
- What if the LSP is carrying a PW or is DetNet?
- What if it is a MS-PW?
- In all these cases there is a CW immediately after EOS.
- Then there is the universal fragmentation idea that is floating about that also wants to follow EOS.

Reply:

- ✓ This is a generic issue applicable to all G-ACH mechanisms used for data traffic.

Thank you