

# MPLS Data Plane Encapsulation for In-situ OAM Data

*draft-gandhi-mpls-ioam-04*

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# Agenda

- Requirements and Scope
- Summary
- Discussions
- Next Steps

# Requirements and Scope

## Requirements:

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

## Scope:

- Using IOAM data fields defined in:
  - *draft-ietf-ippm-ioam-data*
  - *draft-ietf-ippm-ioam-direct-export*
- Edge-to-Edge (E2E) IOAM
- Hop-By-Hop (HBH) IOAM (that includes E2E)

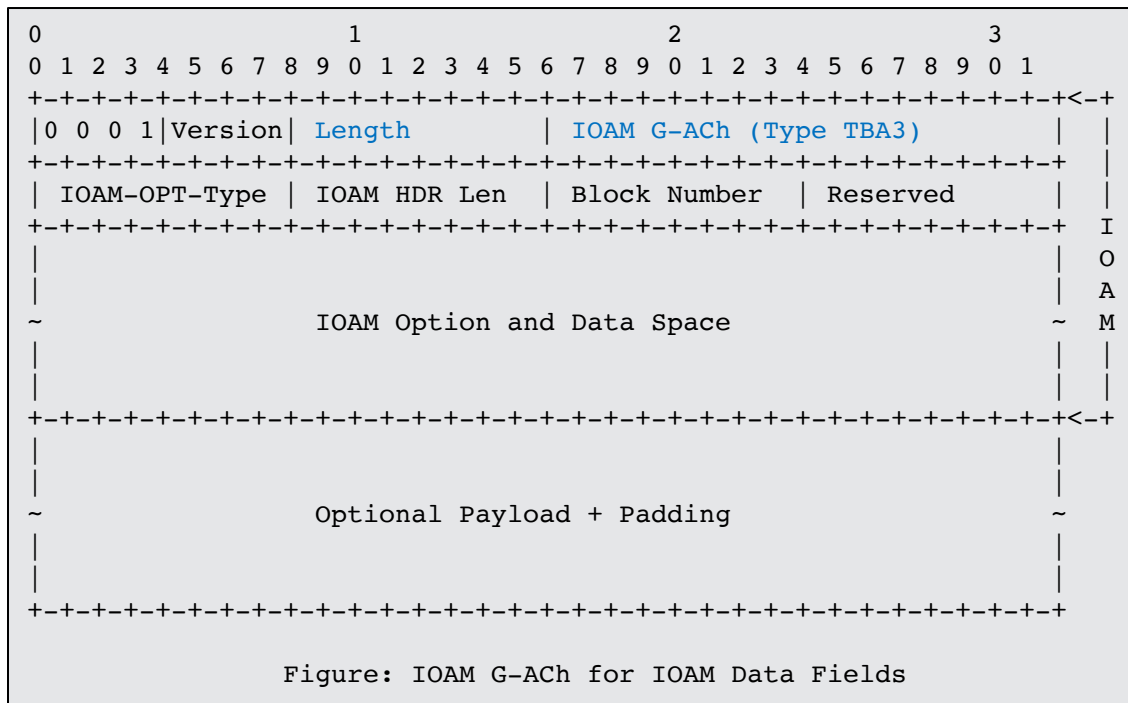
# History of the draft

- October 2018 - Published draft-gandhi-**spring**-ioam-sr-mpls-00
- October 2019 - Published draft-gandhi-**mpls**-ioam-sr-00
- January 2021 - Completed **MPLS-RT** Expert review
  - Added to use G-ACh Type for IOAM
  - Renamed/updated to focus on MPLS
  - July 2021 - draft-gandhi-mpls-ioam-00
  - Raised concerns with multiple eSPLs for different use-cases + impact on MSD
- September 2021 - draft-gandhi-mpls-ioam-01 - Using Entropy Label Control Flags
- February 2022 - Using X-Label (TBD) TTL field Flags

# MPLS Extensions

# New IOAM G-ACh Type for IOAM Data Fields

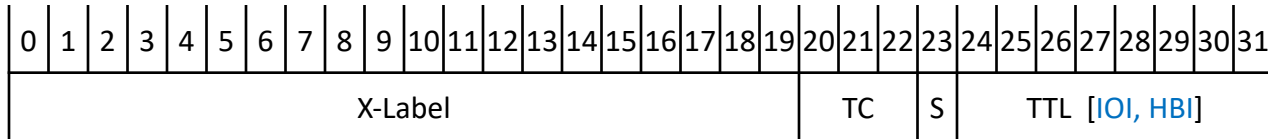
- New Generic Associated Channel (G-ACh) Type (value TBA3) defined for IOAM.
- Block Number is used to:
  - Aggregate IOAM data collected in data plane, e.g., compute measurement metrics for each block of a flow
  - Correlate IOAM data from different nodes
- Length field added to find next G-ACh.
- Updates RFC 5586 as G-ACh carried with user traffic, length field added in the header and multiple G-ACh can be added.
- Note that the G-ACh is not really used to “transport” the user traffic but to transport the IOAM data fields with the user traffic.



• <https://www.iana.org/assignments/g-ach-parameters/g-ach-parameters.xhtml#mpls-g-ach-types>

# IOAM Flags

- TTL field of the X-Label to carry IOAM Flags.
  - IOI for IOAM Indicator
  - HBI for Hop-By-Hop Indicator
- Bit location for the IOI and HBI flags can be user-defined or IANA allocated.
- X-Label can be Entropy Label, SPL allocated by IANA or Network Programming Label (TBD).



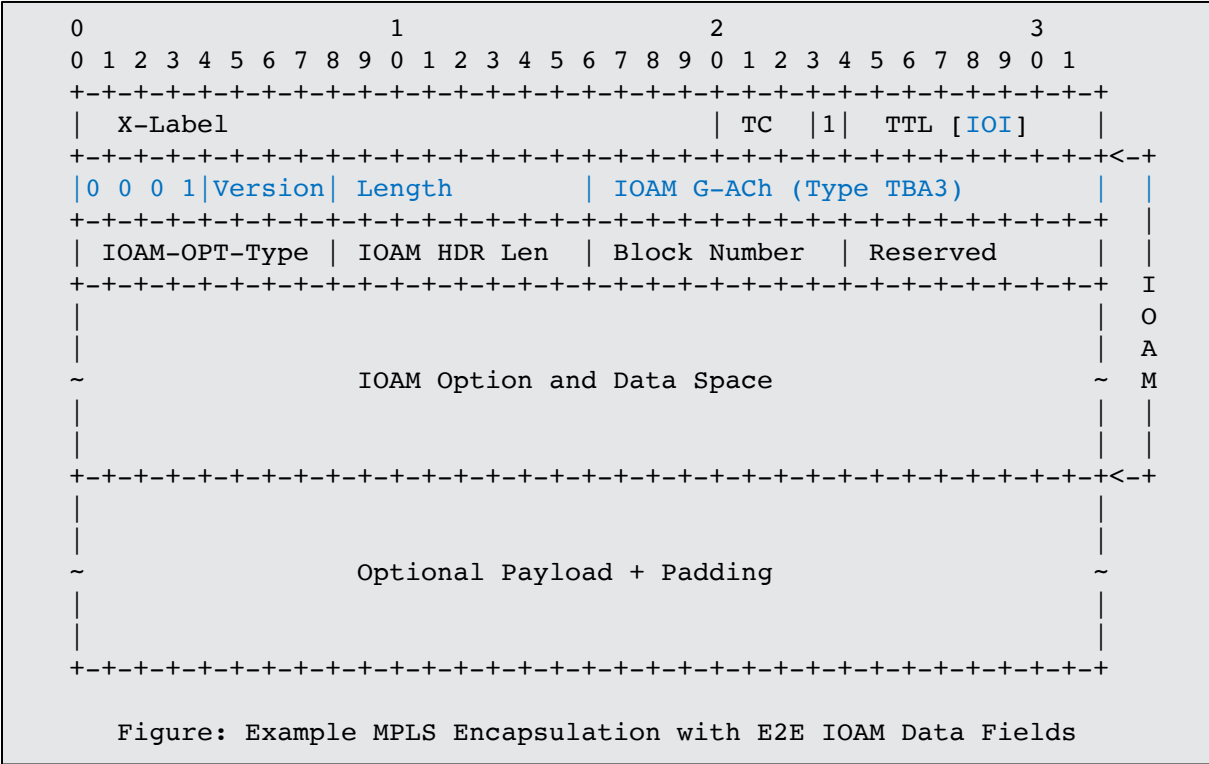
# IOAM and HBH Indicators

- IOAM Indicator (IOI) is used to indicate the presence of IOAM data fields after BOS in the MPLS Encapsulation.
- Hop-By-Hop Indicator (HBI) is used for Hop-By-Hop IOAM processing.
- In case of E2E IOAM, the IOAM Option-Type(s) in data packets are processed on edge nodes only. The intermediate nodes ignore the IOAM Option-Type(s) carried by the data packets.
- In case of HBH IOAM, the IOAM Option-Type(s) in the data packets are processed on intermediate and edge nodes.



# Edge-2-Edge IOAM

# MPLS Encapsulation with IOAM Data Fields

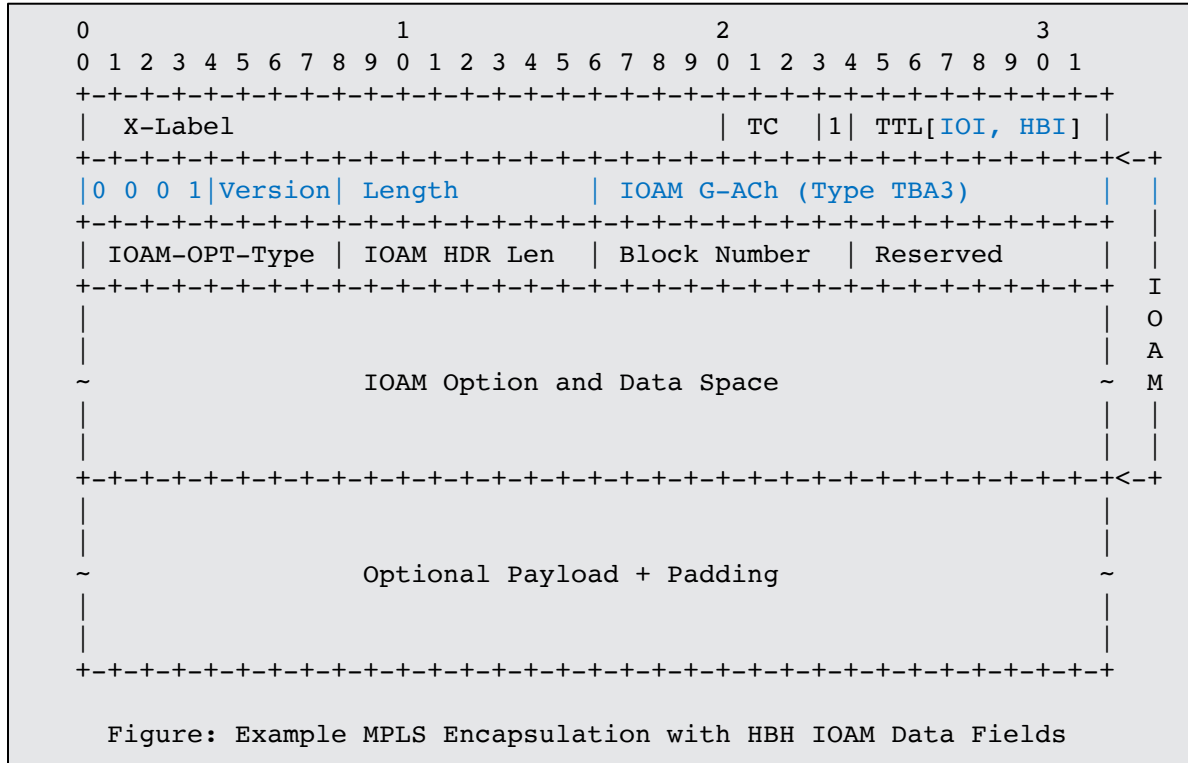


# E2E IOAM Procedure

1. E2E IOAM includes IOAM processing on encapsulating and decapsulating nodes.
  - Only E2E Option-Type is carried in the IOAM data field.
2. The encapsulating node inserts the X-Label with the IOAM Indicator in TTL below the label whose FEC is the end (decapsulating) node and one or more IOAM data fields.
3. **The intermediate nodes do not process IOAM data fields.**
4. The penultimate node MUST not remove the MPLS header. This is ensured by the encapsulating node by adding required MPLS header.
5. The decapsulating node MAY “punt the timestamped copy” of the data packet including IOAM data field(s) to slow-path.
6. The decapsulating node processes IOAM data field(s) in the packet.
7. The decapsulating node MUST remove the IOAM data field(s) from the packet.
  - The decapsulating node forwards the data packet downstream.

# Hop-By-Hop IOAM

# MPLS Encapsulation with HBH IOAM Data Fields



# HBH IOAM Procedure

1. HBH IOAM includes IOAM processing on encapsulating, intermediate and decapsulating nodes.
  - Pre-allocated, Incremental, Proof of Transit and E2E Option-Types are carried in the IOAM data field(s).
2. The encapsulating node inserts the X-Label with the IOAM Indicator and HBH Indicator in TTL below the label whose FEC is the end (decapsulating) node and one or more IOAM data fields.
3. The intermediate nodes MAY “punt the timestamped copy” of the data packet including IOAM data field(s) to slow-path when HBH Indicator is detected.
4. The intermediate nodes process HBH IOAM data field(s) and forward the data packet including updated IOAM data field(s) when HBH Indicator is detected.
5. The penultimate node MUST not remove the MPLS header. This is ensured by the encapsulating node by adding required MPLS header.
6. On decapsulating node, follow the same procedure as E2E IOAM case.

# Next Steps

- Welcome your comments and suggestions
- Requesting WG adoption

Thank you