

MPLS Data Plane Encapsulation for In-situ OAM Data

draft-gandhi-mpls-ioam-05

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Abbreviations

Abbreviations	Meaning
AD	Ancillary Data
ADL	Additional Data Length
BOS	Bottom of Stack
E2E	Edge To Edge
HBH	Hop By Hop
HPI	Hop By Hop Post-Stack Network Action Presence Indicator
IOAM	In-Situ OAM
ISD	In-Stack Data
IS-NAI-Opcode	In-Stack Network Action Indicator Opcode
INE	In-Stack Network Action Extension Presence Indicator
INI	In-Stack Network Action Presence Indicator
MNA	MPLS Network Action
NAI	Network Action Indicator
NAI-OP	Network Action Indicator Opcode
NASI	Network Action Sub-Stack Indicator
PNI	Post-Stack Network Action Presence Indicator
PSD	Post-Stack Data
bSPL	Base Special Purpose Label
MSD	Maximum Stack Depth

Agenda

- Requirements and Scope
- Summary
- 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)
- **MPLS Network Action (MNA) Encoding**

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
 - Raised concerns with multiple eSPLs for different use-cases + impact on MSD
- July 2021 - draft-gandhi-mpls-ioam-00 - Renamed to scope MPLS data plane
- September 2021 - Using Entropy Label Control Flags
- February 2022 - Using ELI or SPL Indicator [*draft-jags-mpls-ext-hdr*]
- July 2022 - Using MNA Encoding (bSPL TBA by IANA) [*draft-jags-mpls-mna-hdr*]

MPLS Extensions

IOAM Post-Stack Network Action Indicators

- MNA (NASI) Label is a new bSPL value to be allocated by IANA
- TTL field of the next LSE to carry MNA flags
 - PNI for Post-Stack Network Action Presence Indicator
 - HPI for Hop-By-Hop Network Action Processing Indicator
- Bit location for the PNI and HPI flags to be IANA allocated

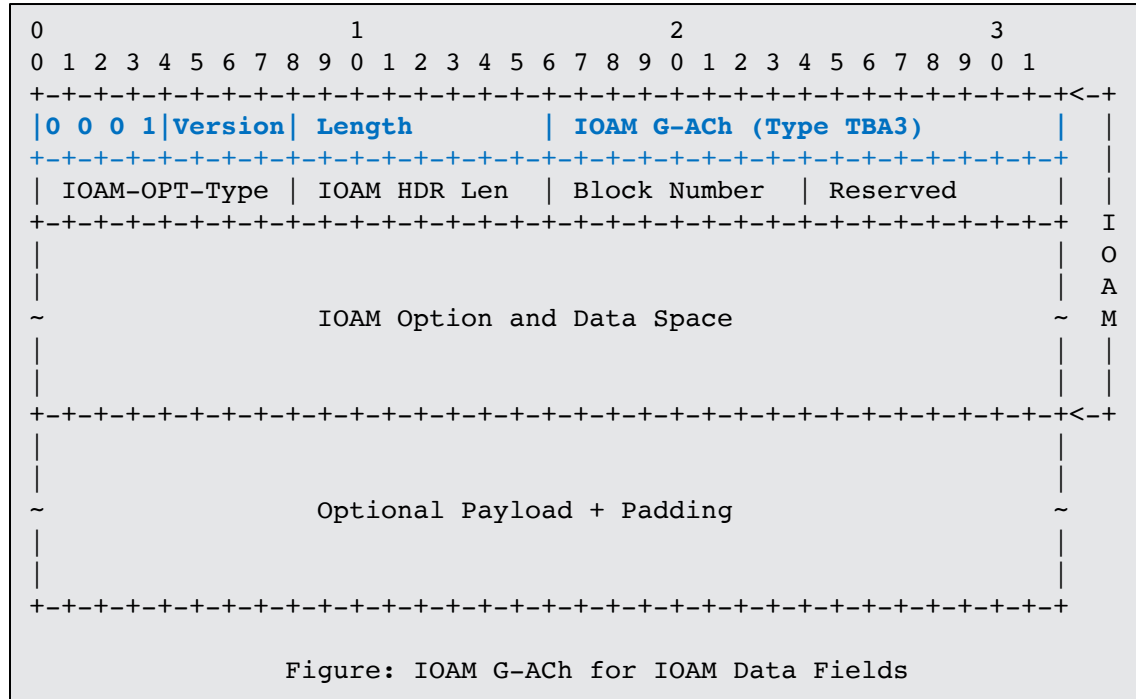
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MNA Label (bSPL Value TBA)																				TC		S	TTL								
MNA Flags																				Flags		S	PNI=1, HPI								

IOAM and HBH Indicators

- Post-Stack Network Action Presence Indicator (**PNI**) is used to indicate the presence of IOAM data fields after BOS, for both E2E and HBH cases.
- Hop-By-Hop Network Action Processing Indicator (**HPI**) is used to enable Hop-By-Hop processing on the intermediate nodes.
- 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 the intermediate and edge nodes.

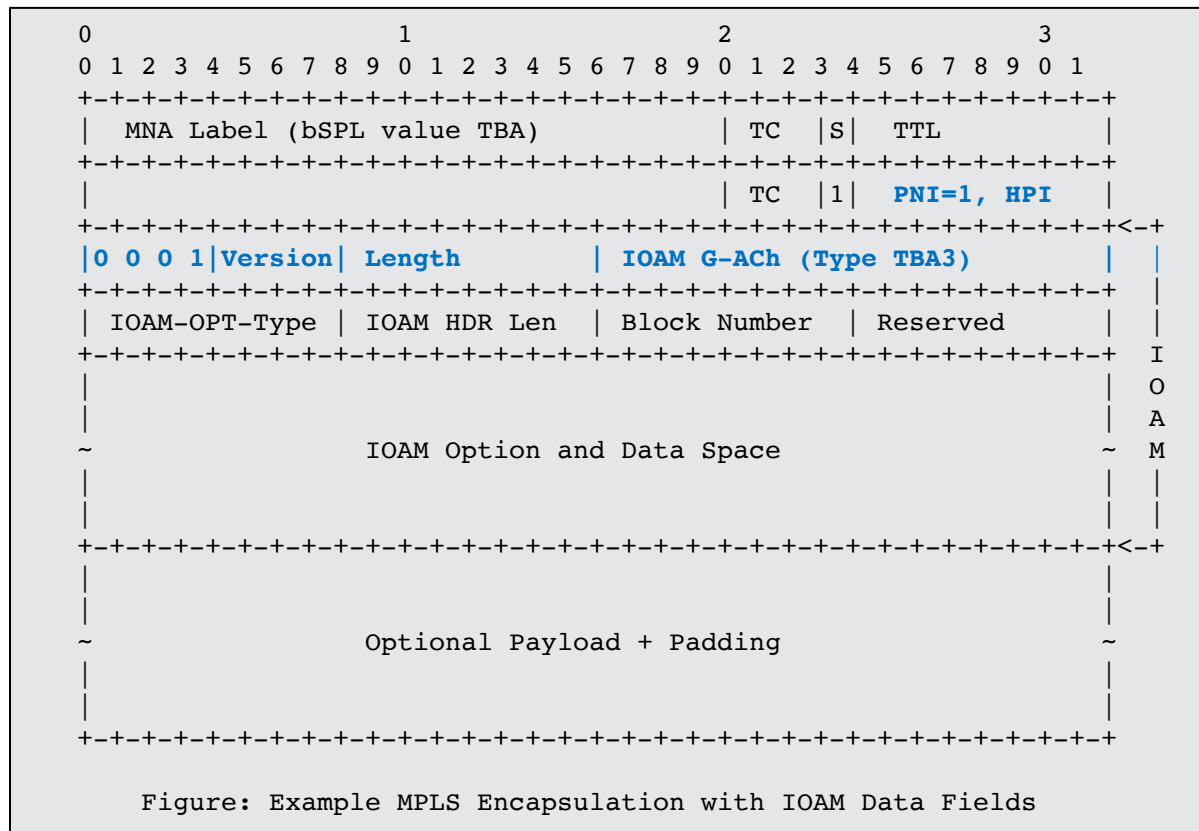
G-ACh for IOAM Post-Stack Network Action Common Header

- New Generic Associated Channel (G-ACh) Type (value **TBA3**) defined for IOAM Post-Stack Network Action Header.
- 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>

MPLS Encapsulation with IOAM Data Fields



E2E IOAM Procedure

1. E2E IOAM includes IOAM processing on encapsulating and decapsulating nodes.
 - E2E Option-Type and E2E DEX Option-Type can be carried in the IOAM data field.
2. The encapsulating node inserts (1) the MNA bSPL Label (value TBA) with the **PNI** Indicator below the label whose FEC is the end (decapsulating) node, and (2) one or more IOAM data fields as Post-Stack Network Action.
3. The intermediate nodes skip the IOAM data fields processing as HPI flag is not set.
4. The penultimate node **MUST** not remove the MPLS header. This is ensured by the encapsulating node by adding the necessary MPLS header.
5. The decapsulating node processes IOAM data field(s) in the packet.
 - The decapsulating node **MAY** “punt the timestamped copy” of the data packet including the IOAM data field(s) to slow-path.
6. The decapsulating node **MUST** remove the IOAM data field(s) from the packet.
 - The decapsulating node forwards the data packet downstream.

HBH IOAM Procedure

1. HBH IOAM includes IOAM processing on encapsulating, intermediate and decapsulating nodes.
 - Pre-allocated, Incremental, Proof of Transit, E2E Option-Type, and HBH DEX Option-Type can be carried in the IOAM data field(s).
2. The encapsulating node inserts (1) the MNA bSPL Label (value TBA) with the **PNI** and **HPI** Indicators below the label whose FEC is the end (decapsulating) node, and (2) one or more IOAM data fields as Post-Stack Network Action.
3. The intermediate nodes process the HBH IOAM data field(s) and forward the data packet downstream including updated IOAM data field(s) upon detecting HPI Flag.
 - The intermediate nodes MAY “punt the timestamped copy” of the data packet including the IOAM data field(s) to slow-path.
4. The penultimate node **MUST** not remove the MPLS header. This is ensured by the encapsulating node by adding the necessary MPLS header.
5. On decapsulating node, follow the same procedure as E2E IOAM case.

Next Steps

- Welcome your comments and suggestions
- Align Post-Stack Network Action Common Header with MNA Encoding
 - Currently G-ACh-based
 - E.g., draft-song-mpls-extension-header
 - As part of the WG process
- Requesting MPLS WG adoption

Thank you