MINT
MPLS Inband Network Telemetry

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Motivation

Provide simple, protocol agnostic, flexible, inband mechanism to track and collect per flow per packet network telemetry data with low cost and high performance of HW
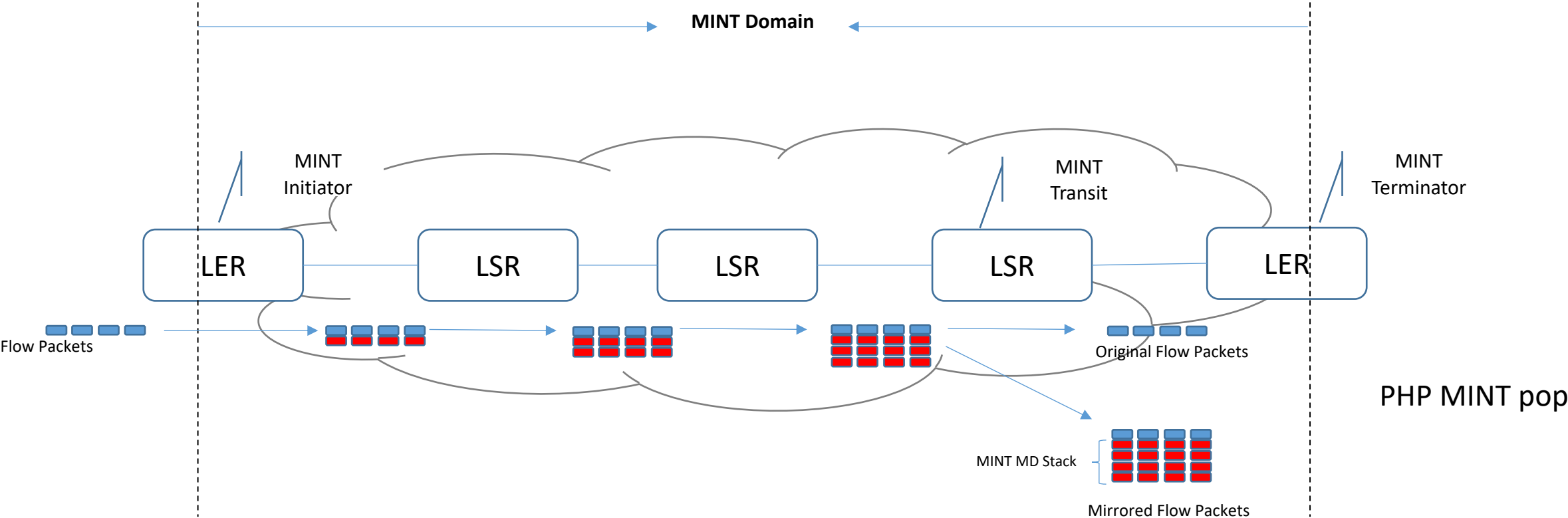
Requirements

- Collect per hop per packet metadata for a given flow
- Metadata is for live packet and instantaneous representation of network state for a given flow
- Use live metadata to solve interesting problems for a given flow
  - Flow E2E latency
  - Congestion on any hop
  - Mapping of Flow to LSP to underlay
  - Per hop resident time
  - Arrive rate
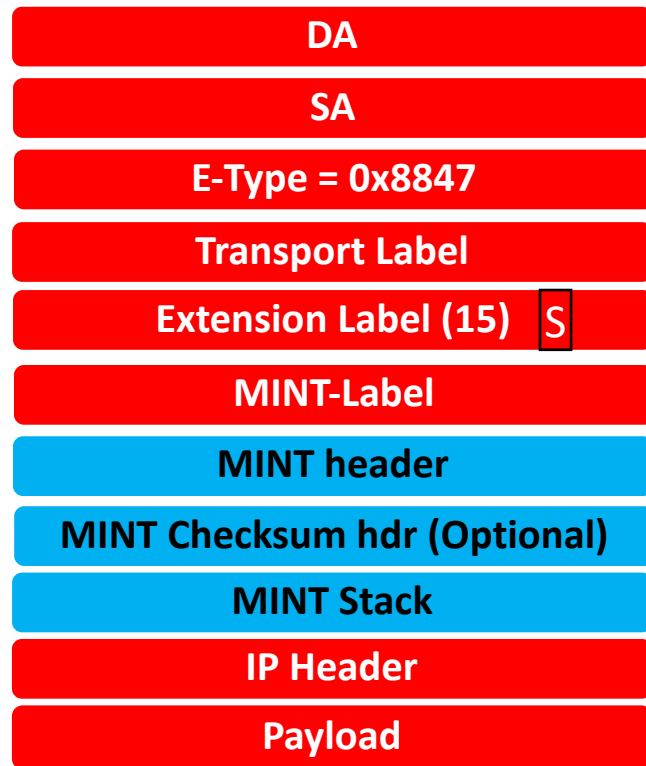 - Queue congestion
  - Drops

Terminology

- MINT Domain
  - *MPLS domain with all nodes participating in MINT*

- MINT Node
  - *Single node in MINT domain*

- MINT Label
  - *IANA allocated extension labels*

- MINT metadata
  - *Information inserted by each MINT node*

- MINT Initiator
  - *MINT nodes at the edge of MINT domain*
  - *Responsible for inserting the Extension-Label, MINT-Label and MINT metadata*

- MINT Transit
  - *MINT nodes within the MINT domain*
  - *Responsible for detecting the MINT-Label and inserting MINT metadata*

- MINT Terminator
  - *MINT nodes at the edge of MINT domain*
  - *Responsible for detecting the MINT-Label*
  - *Stripping the MINT metadata and forwarding the packet*

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MINT Deployment

MINT Domain

MINT
Initiator

MINT
Transit

MINT
Terminator

| LER | LSR | LSR | LSR | LER |

Flow Packets

Original Flow Packets

PHP MINT pop

MINT MD Stack

Mirrored Flow Packets

MINT Packet Format

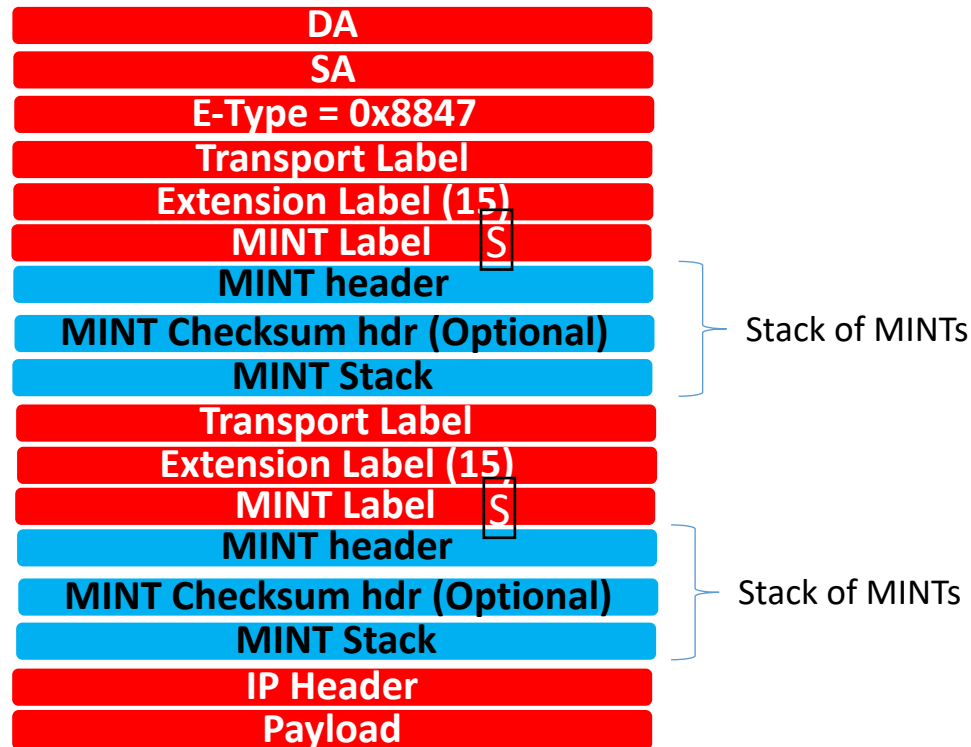| |
|---|
| DA |
| SA |
| E-Type = 0x8847 |
| Transport Label |
| Extension Label (15)   S |
| MINT-Label |
| **MINT header** |
| **MINT Checksum hdr (Optional)** |
| **MINT Stack** |
| IP Header |
| Payload |

Stack of MINTs

- MINT presence is indicated by MINT label present after the Extension Label (15)
- MINT label is always the last label in a label stack with S (end of stack) bit set
- MINT header contains MINT length and other checks
- MINT checksum is for MINT stack and header only
- MINT header will provide next protocol field and can be used to create a next header chain
- Entropy label can be used for load balancing
- Each Tunnel will have its own MINT stack
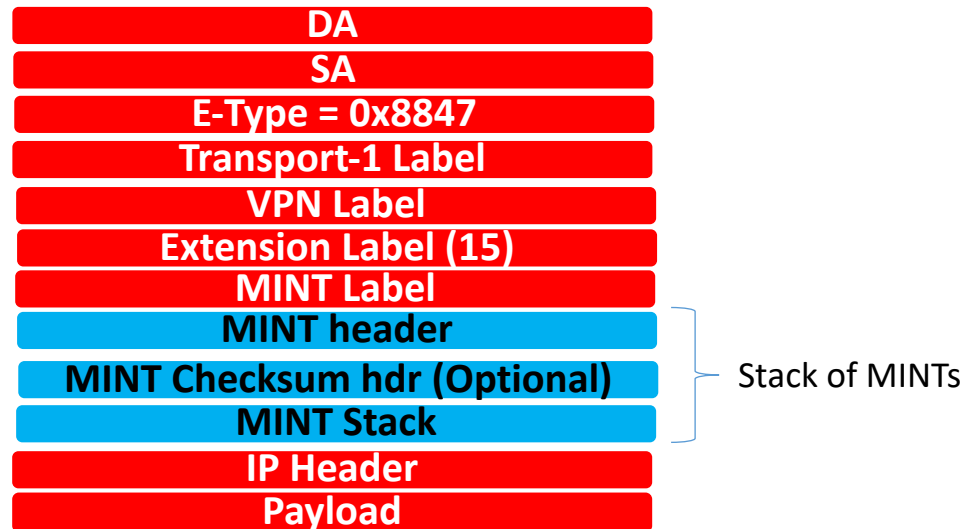 - RSVP over LDP can have RSVP MINT stack over LDP MINT stack

MINT TBA1 label 1
GBP TBA1 label 2
RFC 8321 TBA1 label 3
MACSec TBA1 label 4

IANA Allocated Extension Labels

Tunnel Mode - MINT Packet Format for Tunnel

DA
SA
E-Type = 0x8847
Transport Label
Extension Label (15)
MINT Label S
MINT header
MINT Checksum hdr (Optional)
MINT Stack
Transport Label
Extension Label (15)
MINT Label S
MINT header
MINT Checksum hdr (Optional)
MINT Stack
IP Header
Payload

Stack of MINTs

Stack of MINTs

- Each tunnel can add Extension label and MINT label for tunnel scoped metadata collection
- Tunnel initiator must add Extension label and MINT label with S bit SET
- Tunnel terminator must dispose Extension label, MINT label and MINT stack
- Transit nodes parse the label stack for only top MINT label for MD insertion
- PHP can be supported for MINT pop so that UHP is not burdened with popping two MINT stacks

Transport Mode - MINT Packet Format for MPLS VPN

DA
SA
E-Type = 0x8847
Transport-1 Label
VPN Label
Extension Label (15)
MINT Label
MINT header
MINT Checksum hdr (Optional)
MINT Stack
IP Header
Payload

Stack of MINTs

- No new Extension Label is inserted for new tunnels.
- Only when all labels are popped Extension label and MINT stack is popped
- Extension label and MINT MAY be popped based on end of MINT zone instead of transport domain termination
- There is a risk of leaking MINT data from one tunnel domain to other if MINT zones are not carefully defined and MINT stack is not popped when packet exits a MINT domain

TBAI Label 1 – MINT

MINT Header:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Ver=2.0|  GNS  | NextHdr = IP  |      Flags    |  Max Length   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

MINT MD Header:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Request Vector| Action Vector |  Hop Limit.   | Curr Length. |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

MINT MD Fragment Header:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Packet ID               | MF ID |L|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
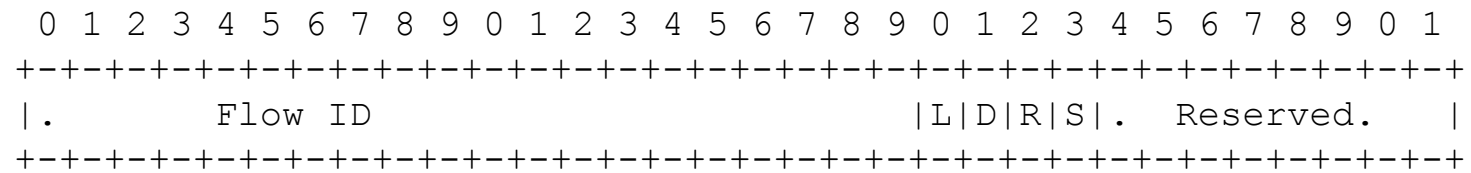
MINT Metadata Stack:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     MINT Metadata Stack                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

NextHdr field reflects the payload type

TBAI Label 2 – GBP (Group Based Policy) Protocol

GPB Header:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|.       Group Policy ID        | RES |E|A|D|Ver| NextHdr = IP  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

- Group Policy ID is a 16bit opaque value which provides a security profile for the associated payload's source

TBAI Label 3 – RFC8321

Flow-ID Label Header:

```
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|.       Flow ID                           |L|D|R|S|. Reserved.  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

- Flow ID: MPLS flow identifier
- L: Loss bit (for coloring)
- D: Delay bit (for coloring)

TBAI Label 1 – MINT chained with GPB

MINT Header:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Ver=2.0|  GNS  | NextHdr = GPB  |      Flags     |  Max Length  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
~                                                              ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     MINT Metadata Stack                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

GPB Header:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|.       Group Policy ID       | RES |E|A|D|Ver| NextHdr = IP  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

- MINT header nexthdr field will point to GPB header

Status of I-D

draft-kumar-ippm-ifa-00

https://tools.ietf.org/html/draft-kumar-mpls-mint-00

Request

      Would appreciate review and comments

      WG Adoption

Thank You