MPLS Extension Header for In-network Services

`draft-song-mpls-extension-header-00`

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MPLS Architecture Principles @ IETF90

“No idea is so bad that it won’t be proposed over and over again”

George Swallow

From IPv4 to IPv6

- Extend the address space
  - Not so successful due to NAT
- Extension headers!
  - Offer huge innovation possibilities
    - Security
    - Segment routing
    - In network services (SFC, In-situ OAM)
    - Network programming!
- However, there are still issues unsolved
  - IPv6 header overhead (40-byte base header)
  - Can’t quickly skip the extension headers to access the upper layer protocols

Can we do the same thing on MPLS?

- MPLS is imperfect
  - No indicator for the upper layer protocols
  - Difficult to encapsulate new headers and metadata
- Many not so successful attempts to fix MPLS
  - The room is tiny
  - Backward compatibility!
- “Case by case” patching is not good
  - Difficult to combine multiple special cases
  - Difficult to extend
  - Difficult to standardize
  - Difficult to support future needs
- Designing a general mechanism to solve a lot of problem and create a lot of innovation opportunities is plausible
  - Learn experience from the other protocols!

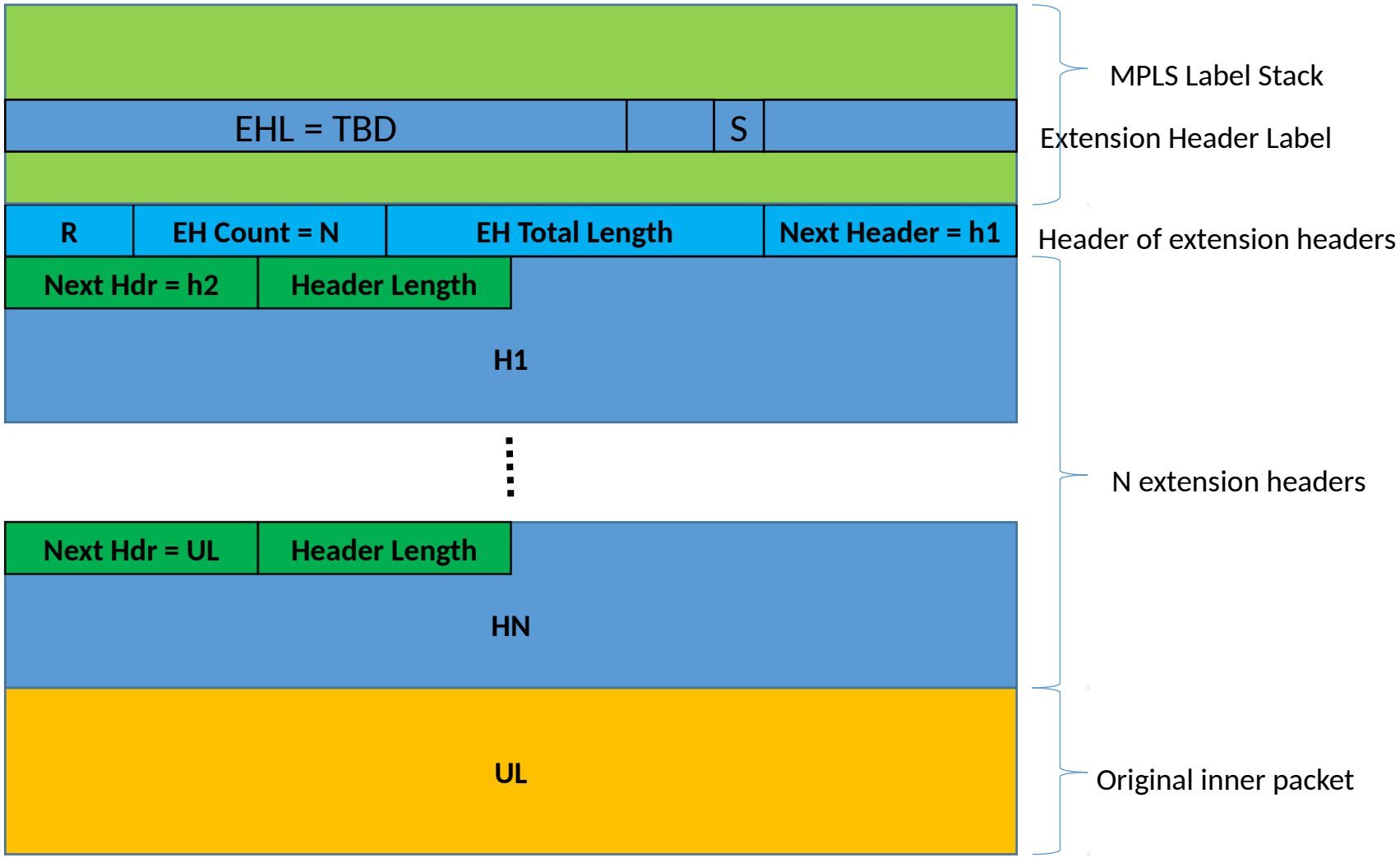
Time is coming!

- In-network services need to be supported by MPLS
  - INT/IOAM
  - Network Programming
  - DDOS prevention
- Multiple services may need to stacked together
- Need to be backward compatible if needed
- Performance considerations
  - Avoid unnecessary label stack scanning
  - Allow quick access to the inner packet

Ways to achieve that

- A Special “Extension Header Label”
  - Use case is significant enough to deserve one
  - 8 unallocated so far (4-6 and 8-12)
- Two-label scheme: XL(15) + EHL
  - Still okay, but need one more label
  - No need to go this way, otherwise it’s tempting to play with the EHL encoding
- Dual FEC labels to indicate the existence of EH
  - Avoid the trouble to introduce a new special label
  - Complicate the control plane
- We prefer the option #1

Packet Format



Some Details

- Extension Header Label (EHL) can be in any location in the label stack
  - For backward compatibility, it needs to be at BOS
  - For upgraded networks, it can be at any location in the stack
    - Preferred to be close at the top for performance reasons
- Next Header values
  - The Next Header field in the last extension header can have two special values:
    - “NONE” – no any header and payload after this header
    - “UNKNOWN” – the header or payload type after this header is unknown
      - To be compatible with the original MPLS design
- How about load balancing?
  - Use ELI+EL and put the label pair anywhere in the label stack
  - Can quickly skip the extension headers and use the upper layer protocol for LB

Conclusions

- MPLS is widely deployed
- MPLS has low overhead
- But it is difficult for MPLS to support in-network services
- A flexible and extensible solution - MPLS extension header
  - We believe the use cases are strong enough to deserve a special label for MPLS extension headers
  - We are developing new applications and use cases which can take advantage of the MPLS extension headers
- Feedback is welcome!