MAMS* User-Plane Protocols

(IETF 103)

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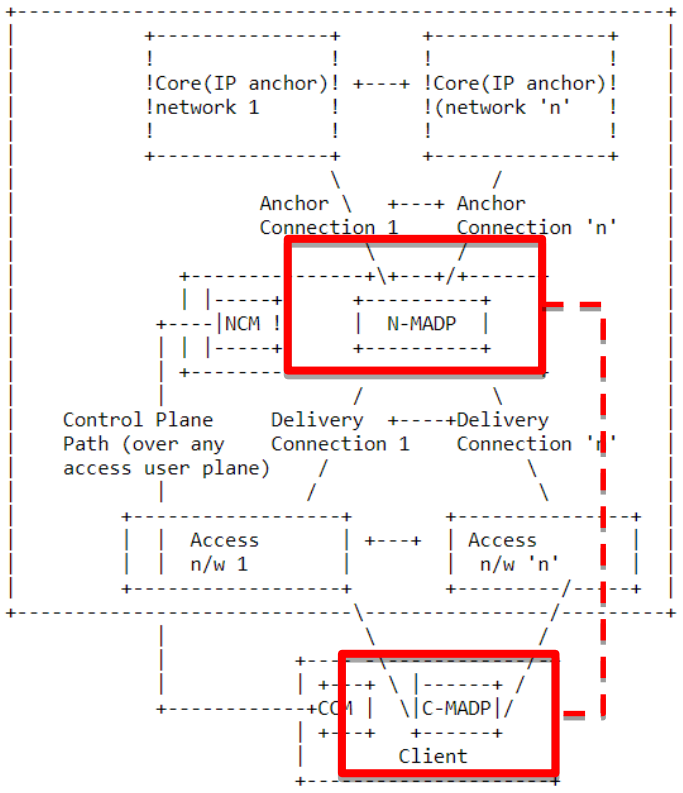
*: Multi-Access Management Service

draft: https://tools.ietf.org/html/draft-zhu-intarea-mams-user-protocol-06

MAMS Reference Architecture

- **Network Multi Access Data Proxy (N-MADP)**: user-plane functionalities in the network
- **Client Multi Access Data Proxy (C-MADP)**: user-plane functionalities in the client



Multi-Access User-Plane Protocols
(between N-MADP and C-MADP)

Ref: https://tools.ietf.org/html/draft-kanugovi-intarea-mams-framework-02

MAMS U-Plane Related Requirements

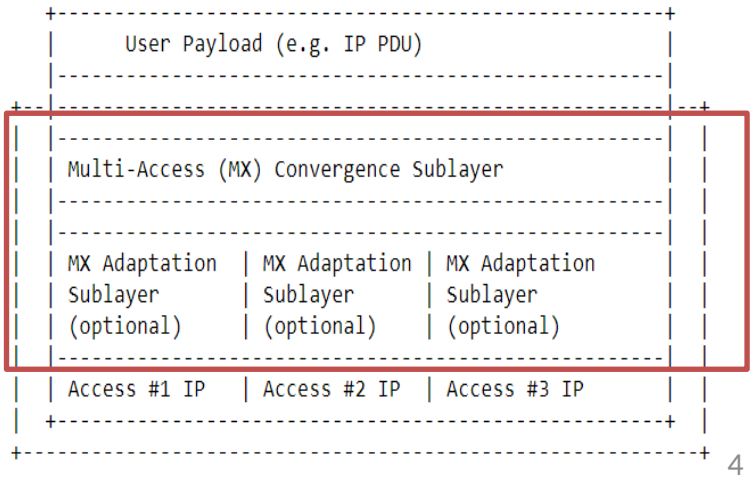
- Access technology agnostic
- Support common transport deployments
- Independent Access path selection for Uplink and Downlink
- Adaptive access network path selection
- Multipath support and Aggregation of access link capacities
- Lossless Path (Connection) switching
- Concatenation and Fragmentation to adapt to MTU differences

Ref: https://tools.ietf.org/html/draft-kanugovi-intarea-mams-framework-02

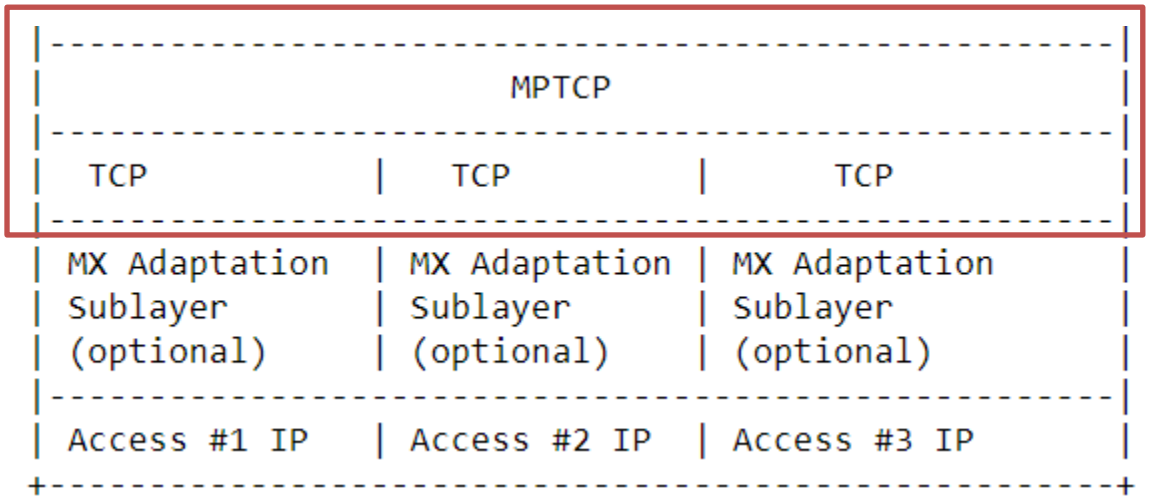
MAMS U-Plane Protocol Stacks

- **Multi-Access (MX) Convergence Sublayer**: performs tasks across multiple accesses, e.g., access (path) selection, multi-link (path) aggregation, splitting/reordering, lossless switching, etc.
  - MP-TCP Proxy
  - GRE-based Convergence Protocol (modified)
  - Trailer-based Convergence protocol (new)

- **Multi-Access (MX) Adaptation Sublayer:** handle access-specific tasks, e.g. tunneling, network security, and NAT.
  - UDP Tunneling
  - IPsec Tunneling
  - Client Net Address Translation (NAT)
  - Pass Through



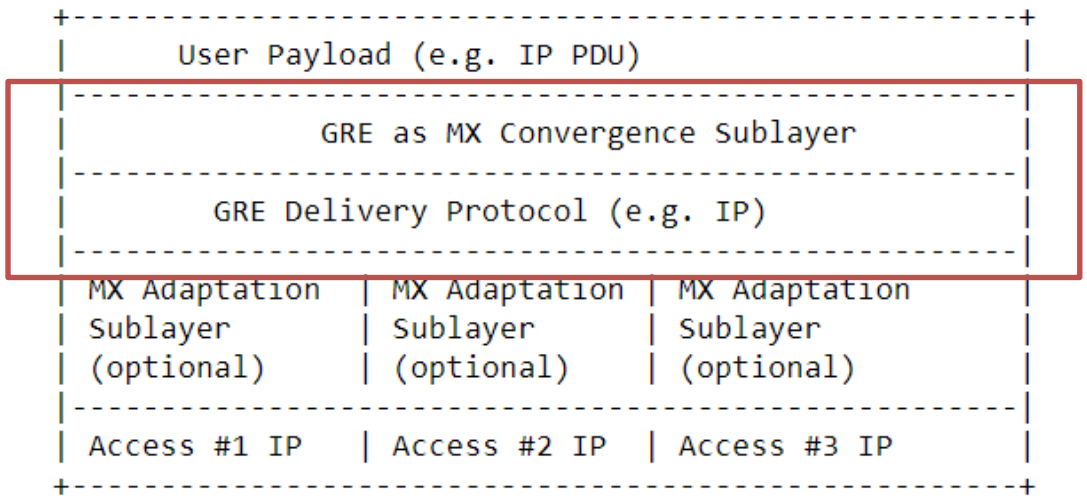
MAMS Convergence Option #1: MP-TCP Proxy



- Pros: mature protocols, real-world deployments, etc.
- Cons: non-TCP traffic (e.g. QUIC), same path/access for downlink (TCP data) and uplink (TCP ACK)
- Change: none

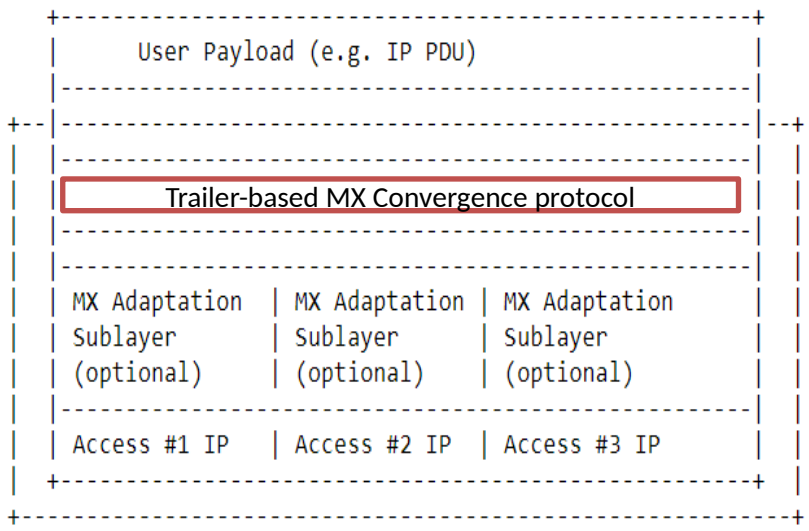
Ref: https://tools.ietf.org/html/draft-ietf-tcpm-converters-04

MAMS Convergence Option #2: GRE

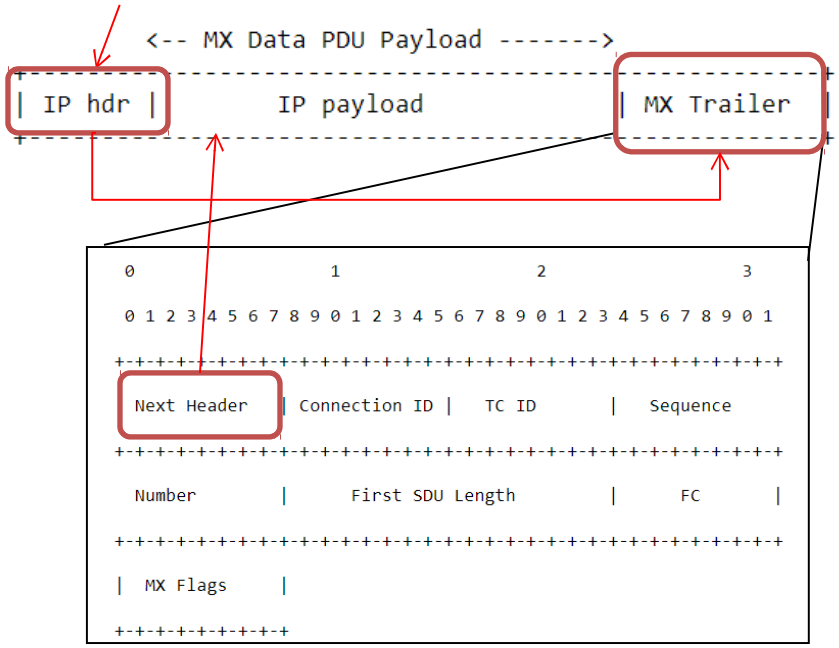


- Pros: support all IP traffic
- Cons: IP-over-IP encapsulation overhead, low flexibility (reusing GRE header).
- Change: reuse the “Key” field in the GRE header to carry MAMS-specific info.

MAMS Convergence Option #3: Trailer-based



- Protocol Type = xyz (e.g. a new IP protocol type or 114*)



Trailer-based Encapsulation Format
(114: “Any 0-Hop Protocol”)

- Pros: low overhead & high flexibility, support all IP traffic
- Change: a new trailer-based protocol

Summary

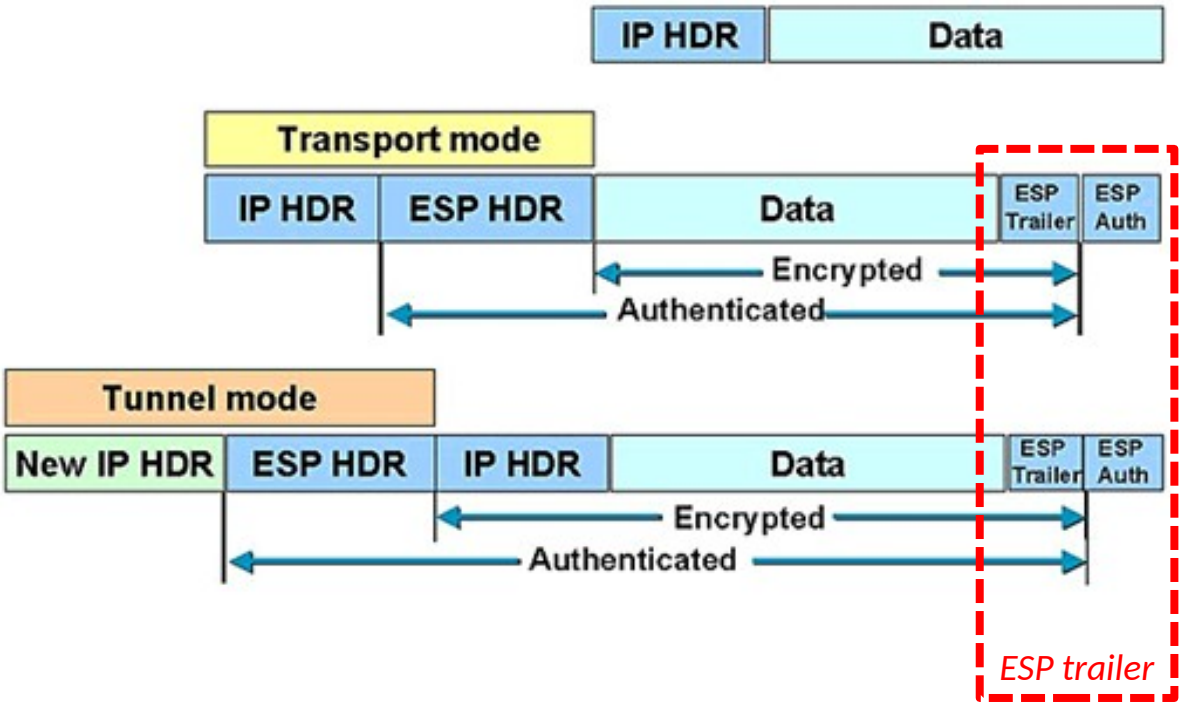
- MAMS (Multi-Access Management Service) is a programmable framework to manage and configure various multi-access convergence solutions, e.g. MP-TCP, GRE, etc.

- A new “Trailer-based Convergence Protocol” is proposed
  - low overhead & high flexibility
  - similar encapsulation approach as IPSec ESP

- Call for interests/collaborations to improve the draft
  - INTAREA WG document ?

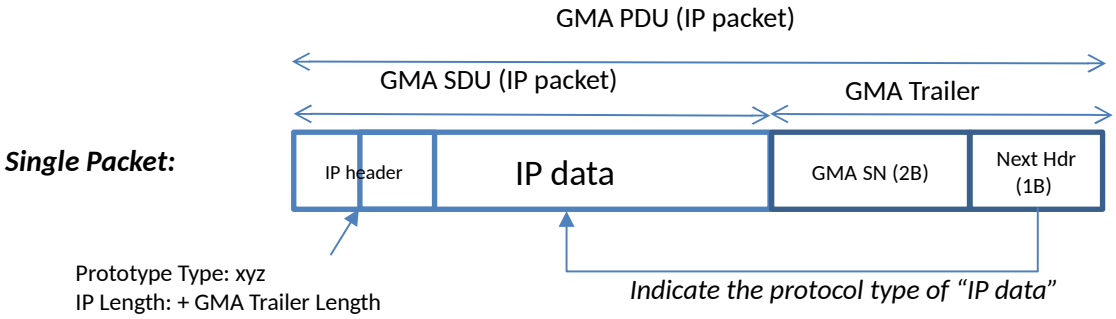
Backup

IPSec ESP Encapsulation



- Trailer-based encapsulation is also used in IPSec

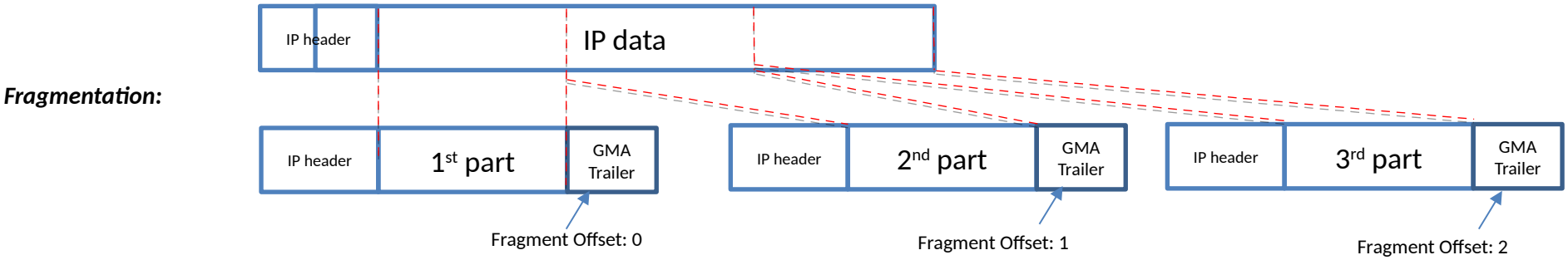
GMA Concatenation & Fragmentation



PDU: Protocol Data Unit
SDU: Service Data Unit

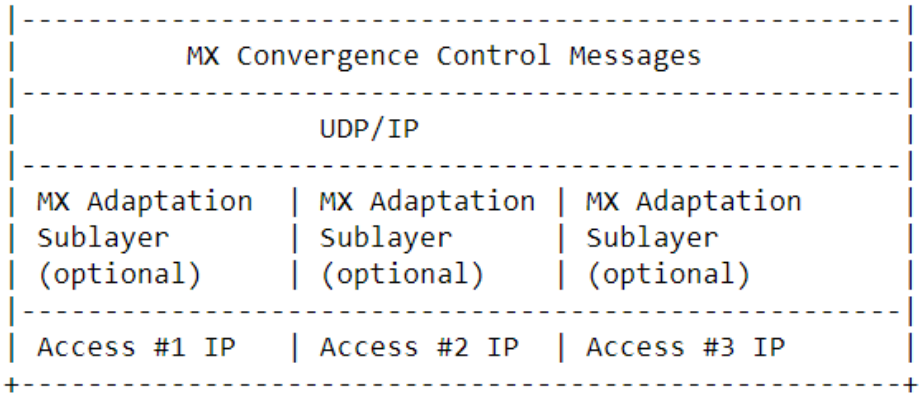
Indicate the protocol type and length of the 1st IP packet

IP Length: all IP packets+ GMA Trailer Length



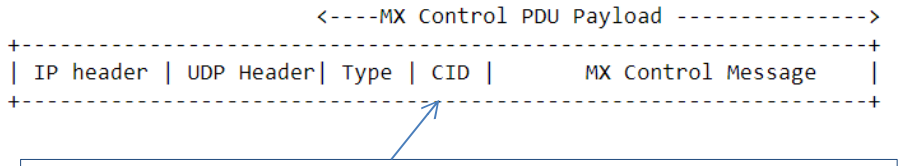
MAMS Convergence Control Messages

MX Convergence Control Protocol stack



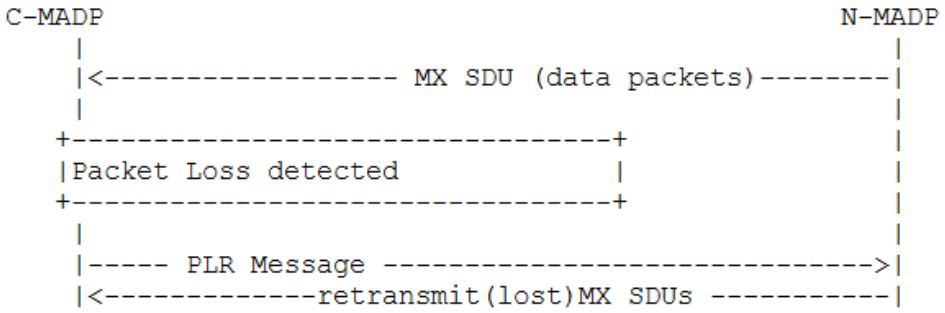
- Keep-alive Message
- Probe-REQ/ACK Message
- Acknowledgement Message
- First Sequence Number (FSN) Message
- Coded MX SDU (CMS) Message
- …

MX Convergence Control PDU



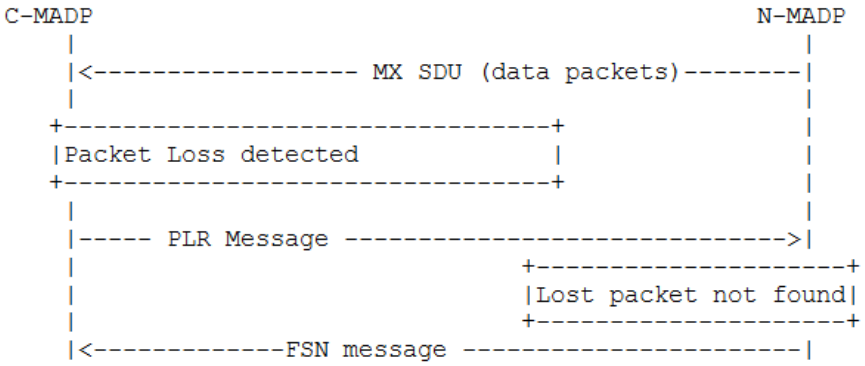
CID: the identification of the delivery connection for sending the control message

MAMS Convergence Control Flow (1): Retransmission

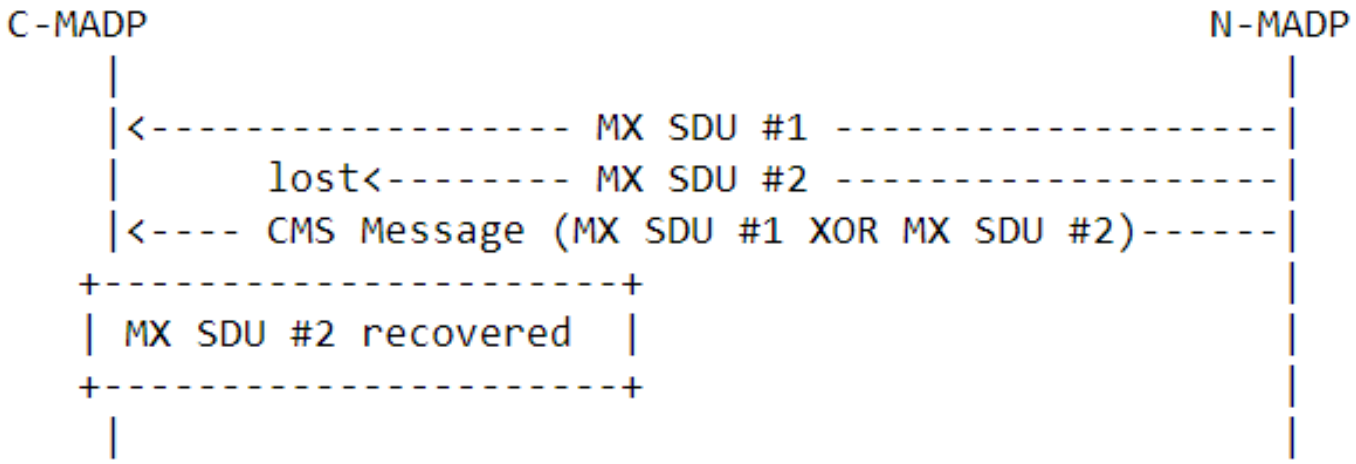


C-MADP may send out the Packet Loss Report (PLR) messages to report lost MX SDU for example during handover. In response, C-MADP may retransmit the lost MX SDU accordingly.

N-MADP may send out the FSN messages to indicate the oldest MX SDU in its buffer if a lost MX SDU is not found in the buffer after receiving the ACK message from C-MADP. In response, C-MADP SHALL only report packet loss with SN not smaller than FSN.



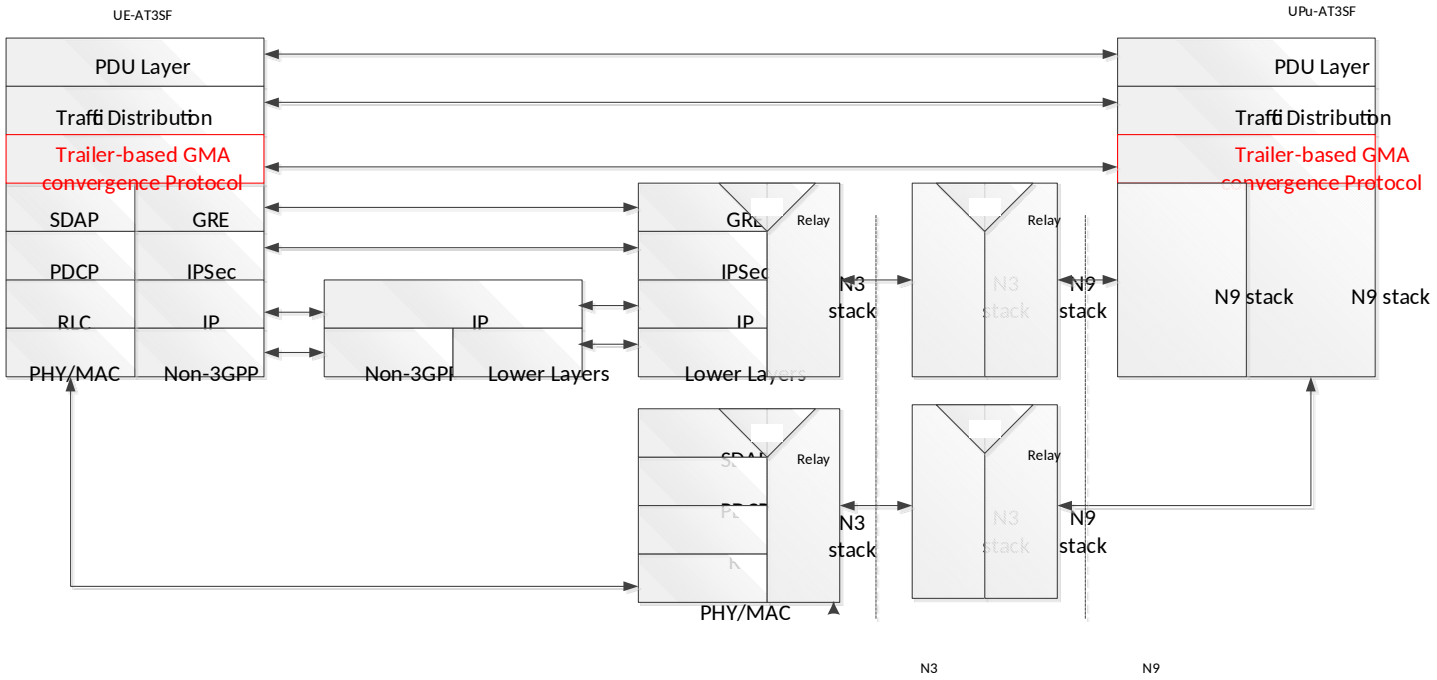
MAMS Convergence Control Flow (2): Network Coding



N-MADP (or C-MADP) may send out the CMS message to support downlink (or uplink) packet loss recovery through coding. A coded MX SDU is generated by applying a coding algorithm to multiple consecutive (uncoded) MX SDUs, and it is used for fast recovery without retransmission if any of the MX SDUs is lost.

Other Usage: 3GPP Release 16 ATSSS

E2E User Plane Protocol Stack with Trailer-based GMA (Generic Multi-Access) protocol



Source: TR 23.793

ATSSS: Access Traffic Splitting Switching and Steering