Generic Multi-Access (GMA) Convergence Encapsulation Protocols (IETF 104)

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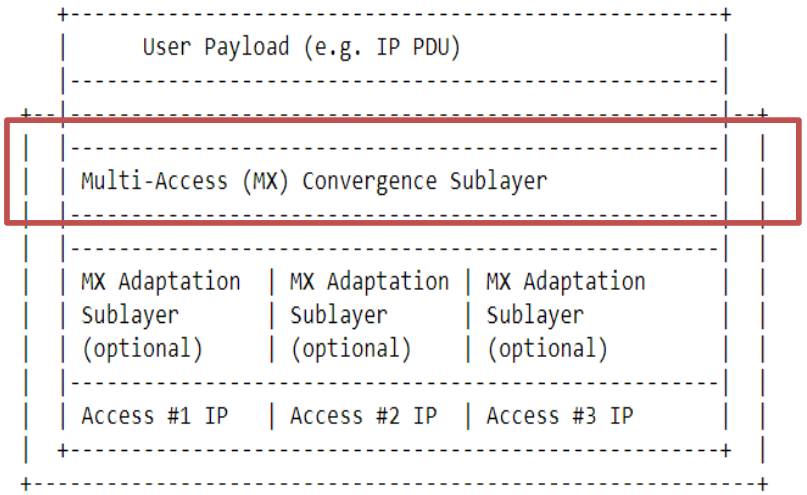
draft: https://www.ietf.org/id/draft-zhu-intarea-gma-01.txt

Motivation (1): Multi-Access Management Service (MAMS)

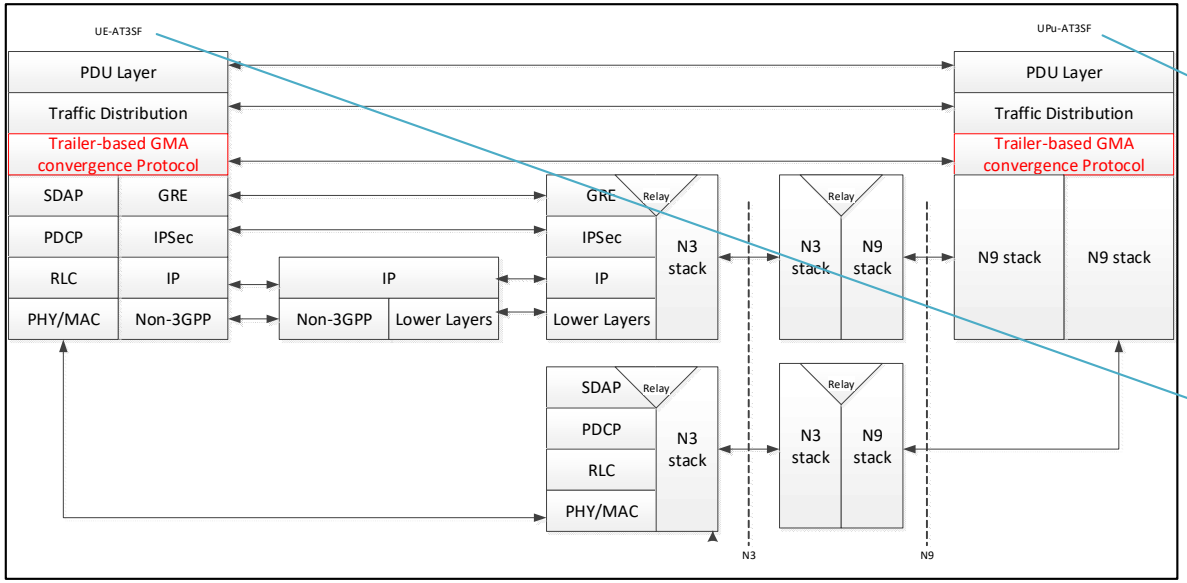
- **Multi-Access (MX) Convergence Sublayer**: performs tasks across multiple accesses, e.g., access (path) selection, multi-link (path) aggregation, splitting/reordering, lossless switching, etc.
  - Multi-Path TCP
  - IP-over-IP tunneling with GRE
  - Trailer-based GMA encapsulation

- **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

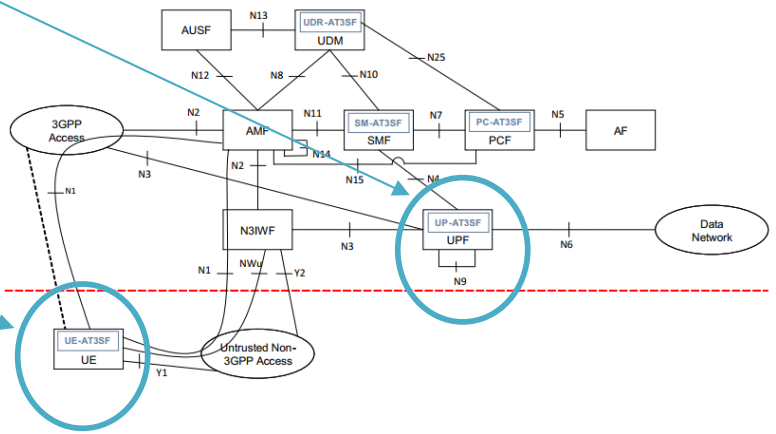


Motivation (2): 3GPP Release 16 ATSSS

ATSSS E2E User Plane Protocol Stack



ATSSS Network Reference Model



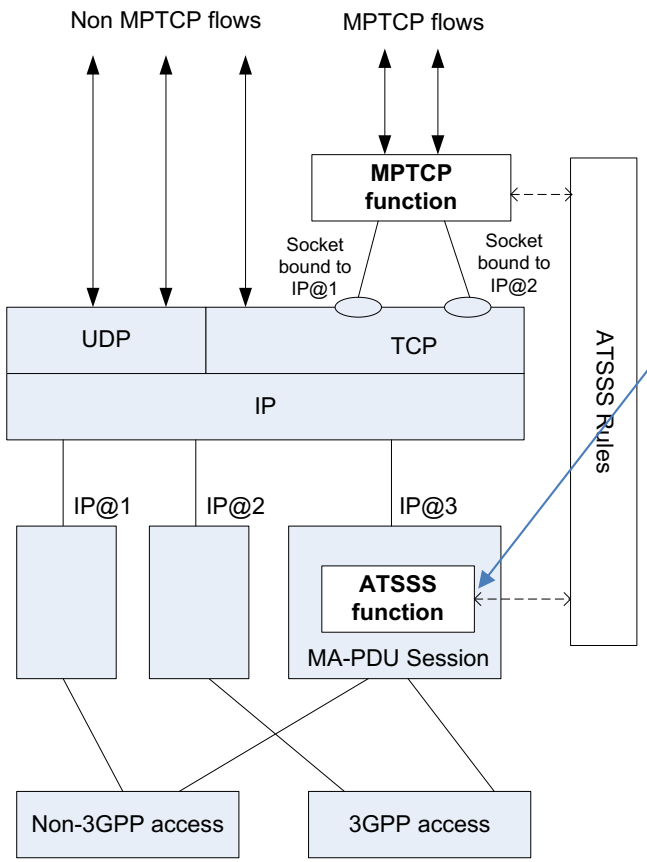
Source: TR 23.793

Client | Access Network | Core Network

ATSSS: Access Traffic Splitting Switching and Steering

- This GMA convergence method **avoids the use of IP-over-IP tunnelling solution (GRE), and the GMA protocol appends a trailer with control information which is used to carry necessary info,** e.g. Sequence Number, for IP packets splitting and reordering, etc.
- To apply GMA protocol, the original Protocol Type value of the IP packet is stored in the GMA trailer and Protocol Type field of the IP header can be set to a special value as an indication of the presence of the GMA trailer, Length field and Checksum field in the IP header are recalculated with the GMA trailer.

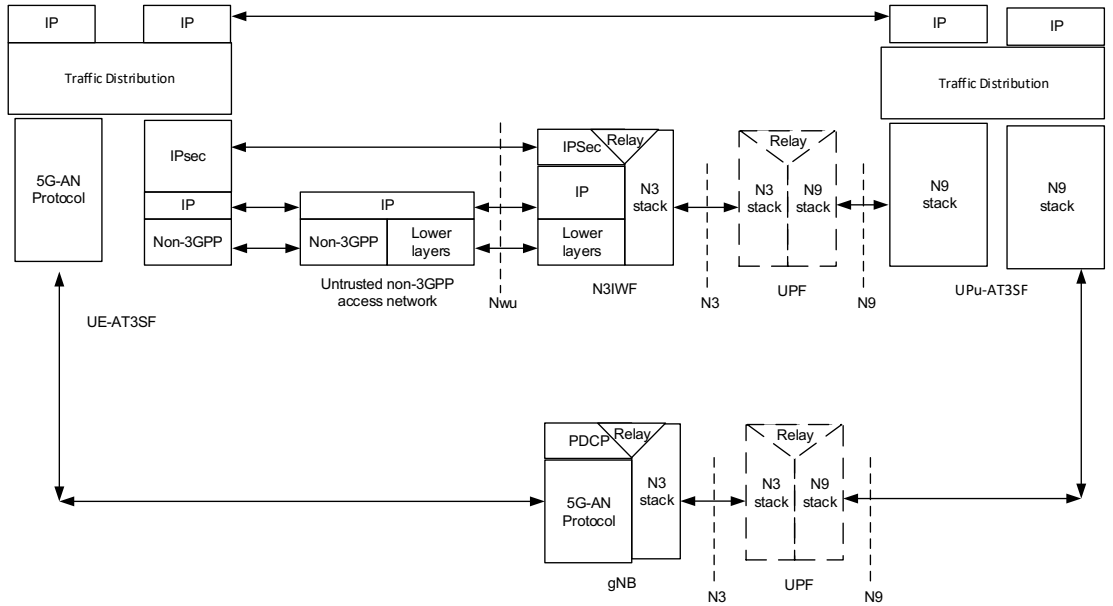
3GPP R16 ATSSS Conclusions



Lower Layer Steering functions:

- ATSSS Function supports NULL tunnelling as described in clause 6.1.7.1 for IP and Ethernet traffic.
- Other steering methods for IP and Ethernet traffic flow switching.
  - Additional steering methods supporting traffic switching shall be based on IETF protocols. Currently, the candidates of the IETF protocols are still work in progress to be standardized. The evaluation of such methods, the selection of the protocol and the introduction may be considered for Rel-16 as a low priority. By the completion of the normative phase, if there is no IETF protocol available to support IP and Ethernet traffic switching within Rel-16 timeframe, this functionality will be deferred to future release.

Ref: TS 23.793



3GPP R16 ATSSS User Plane Protocol Stack with NULL tunnel

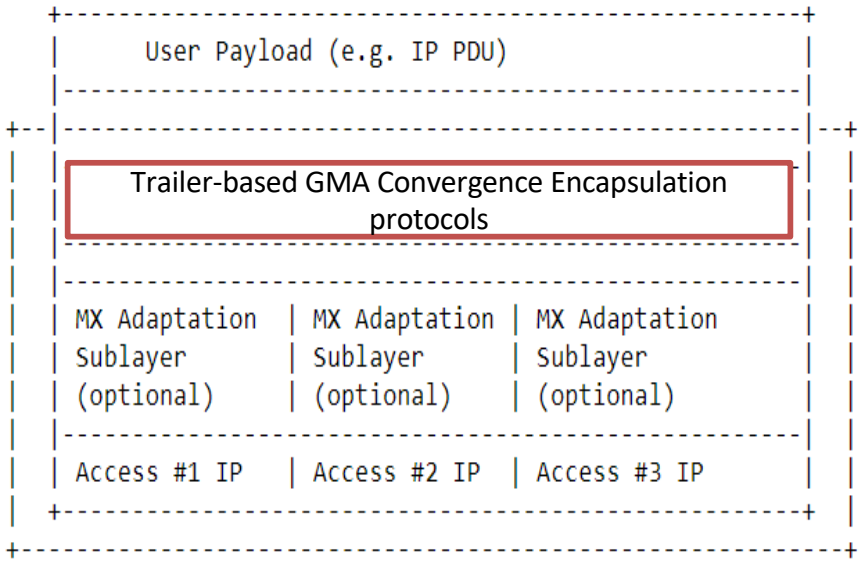
Problem Statement

- Multi-access convergence operations, e.g. aggregation/splitting, retransmission, etc. requires inserting additional control information, e.g. Sequence Number, etc. into each IP packet

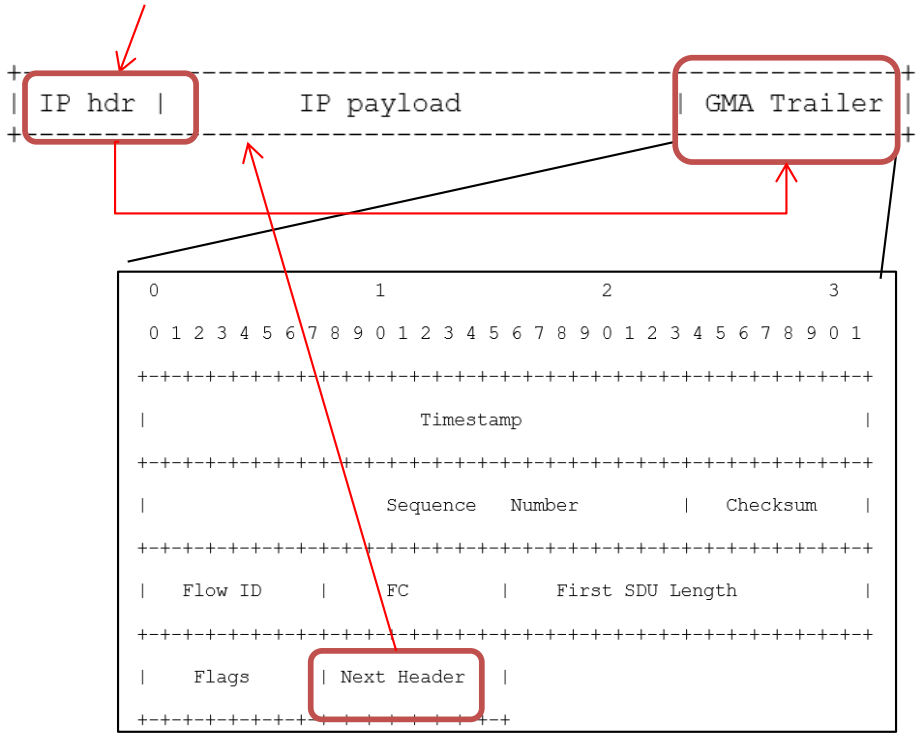
- IP-over-IP tunneling has been used in today's solution (ATSSS, MAMS) to insert the GRE header, and then encode additional control info in the GRE header fields, e.g. Key, Sequence Number

- The IP-over-IP tunneling/GRE approach has the following drawbacks:
  - High IP-over-IP tunneling overhead, e.g. 80% for a 40 Bytes TCP ACK packet
  - Difficult to add field for new operations, e.g. fragmentation, concatenation, etc..

Our Proposal: Trailer-based Encapsulation



- Protocol Type = xyz (a new IP protocol type)

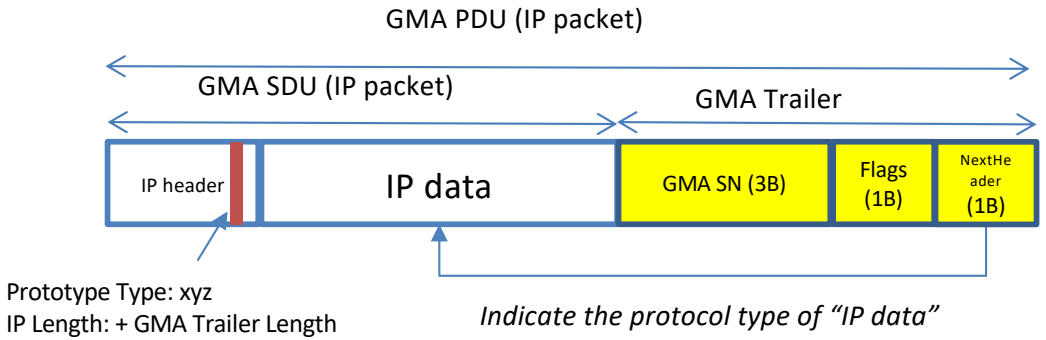


GMA Trailer Format

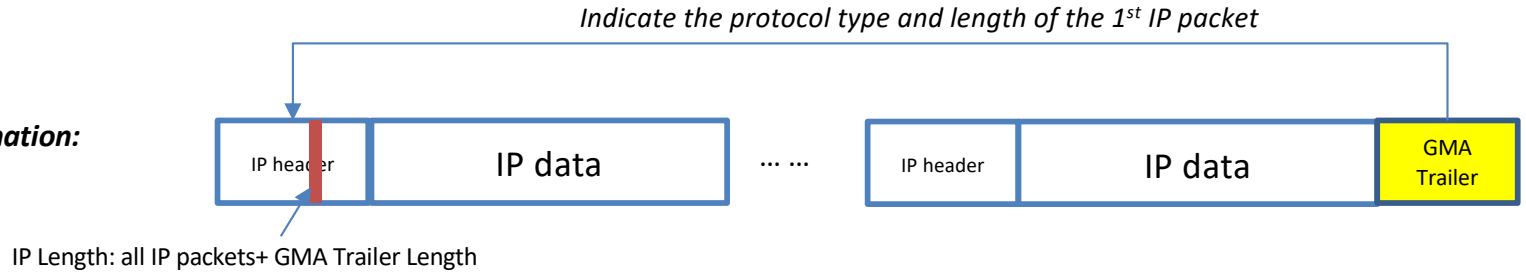
- Pros: low overhead & high flexibility, support all IP traffic
- Change: a new trailer-based encapsulation protocol

GMA Encapsulation Examples

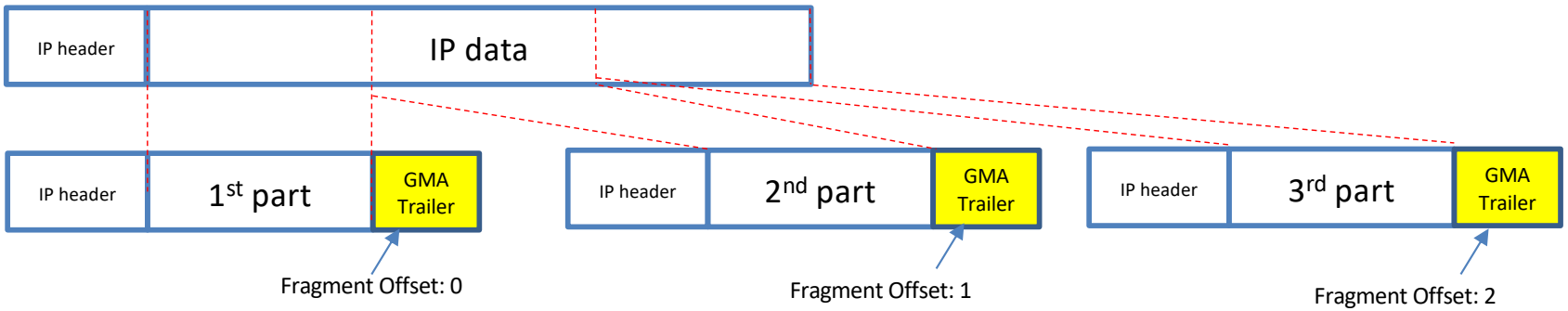
Single Packet:



Concatenation:



Fragmentation:



PDU: Protocol Data Unit
SDU: Service Data Unit

Summary

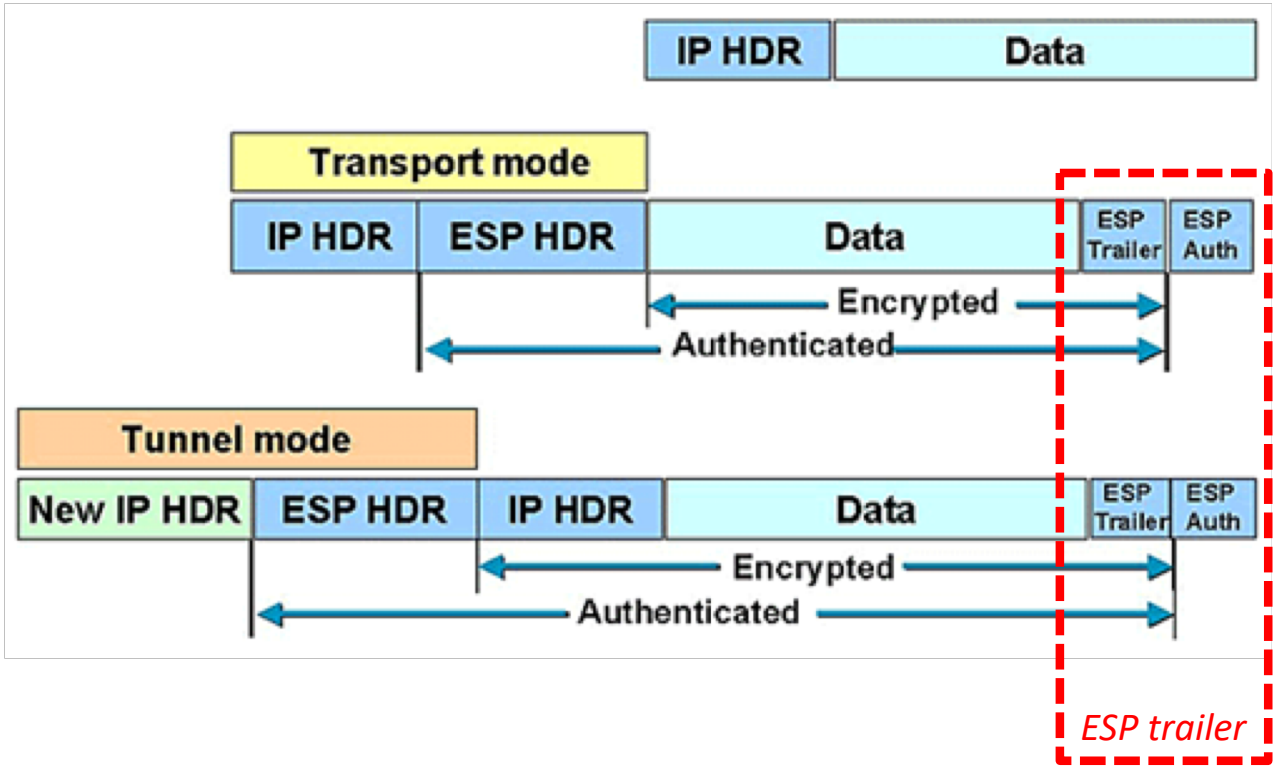
- Multi-access convergence is being developed in various standard bodies, e.g. IETF MAMS, 3GPP ATSSS, etc., with various options:
  - Layer 4: Multi-path TCP, Multi-path QUIC
  - Layer 3: GRE (RFC 8157)

- A new “Trailer-based Encapsulation Protocol” is proposed to avoid IP-over-IP tunneling and support (Layer-3) multi-access convergence
  - similar encapsulation approach as IPSec ESP
  - low overhead & high flexibility (more efficient than the GRE approach)
  - traffic splitting for all IP traffic (more generic than the Layer 4 approach)

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

Backup

IPSec ESP Encapsulation



- Trailer-based encapsulation is also used in IPSec