

# Discussions on Integrating AN and UPF

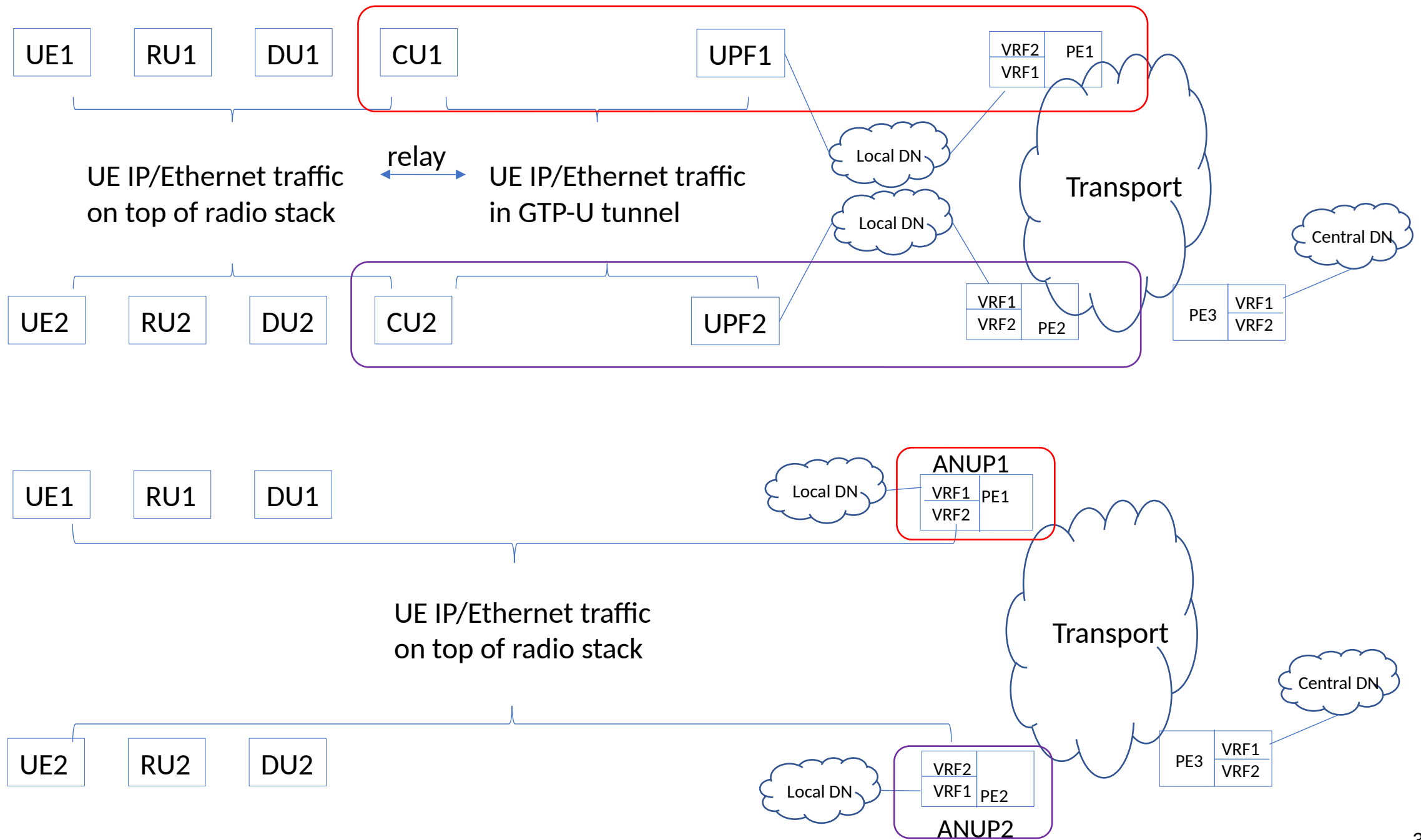
draft-zzhang-dmm-mup-evolution-06

Jeffrey Zhang, Keyur Patel, Luis Contreras, Kashif Islam, Jari Mutikainen , **Tianji Jiang** ,  
Luay Jalil , Ori Prio Sejati , Shay Zadok

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# Basic Idea

- In 5G, UPFs are more and more distributed close to gNB-CU (AN)
  - For MEC, private networks, or local Internet peering
  - Could be co-located – with direct link in between or even running on the same server
  - Distributed UPF means distributed DNs – implemented as VPNs
- In B5G/6G, what if AN and UPF are integrated into a single NF (ANUP)?
  - A flattened, routing/switching-based architecture
    - ANUP is a router/switch with wireless/wired connections
      - Foundation of Internet
    - 3GPP/wireless technologies responsible for wireless access
      - Mobility Management, UE authentication/authorization, ...
    - IETF/wireline technologies for the rest



# Disclaimer

- The work needs to be done in 3GPP
- We're discussing here to socialize the idea among IETF/wireline-friendly people
- Yes, we are getting more interests and/or supports among mobile operators. The 3GPP Rel-19 planning is on-going. We are considering to bring it to 3GPP for further study (Rel-19 & 6G planning)

# Discussion Points: IETF-116 => 117 (San Francisco)

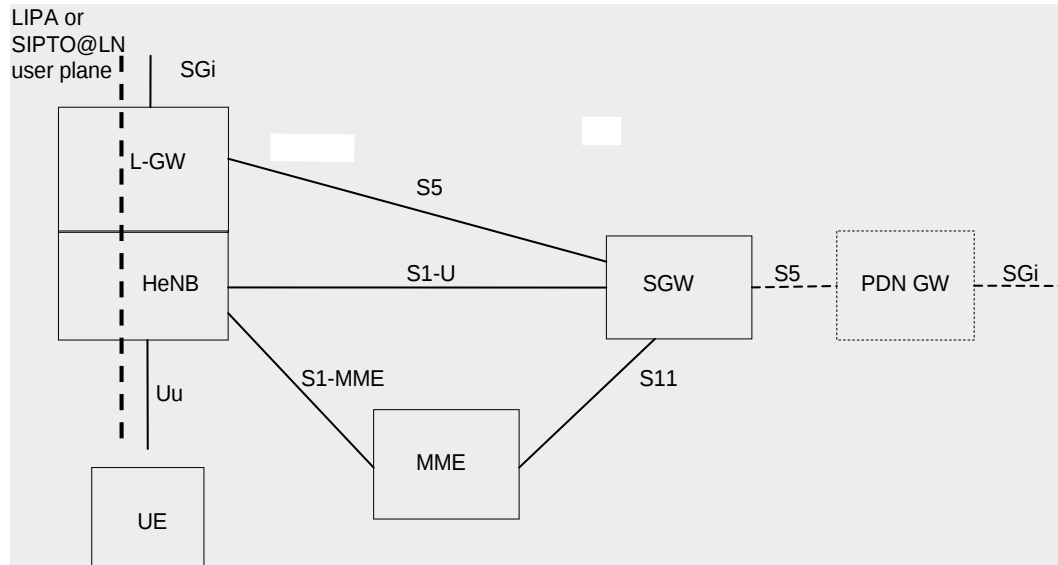
- I.D. changes: *draft-zhang-dmm-mup-evolution-04* => 06

I.D. contents updated to add in:

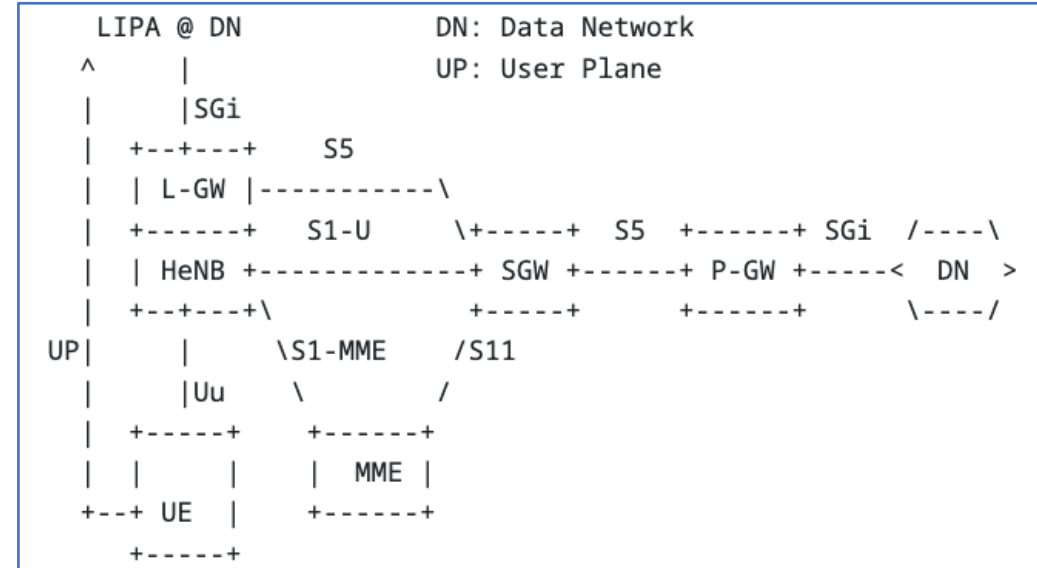
- 3GPP 'ANUP-like' work in 4G : Local IP Access (LIPA)
  - bodes well for 5G (B5G, 6G)
- ANUP-like work will benefit some high-profile use cases, e.g. 3GPP Satellite-Access

# I.D. updated: 3GPP 'ANUP-like' work in 4G: LIPA (Local IP Access)\*

## Architecture for 4G/LIPA (TS 23.401)



## Architecture in MUP#v06

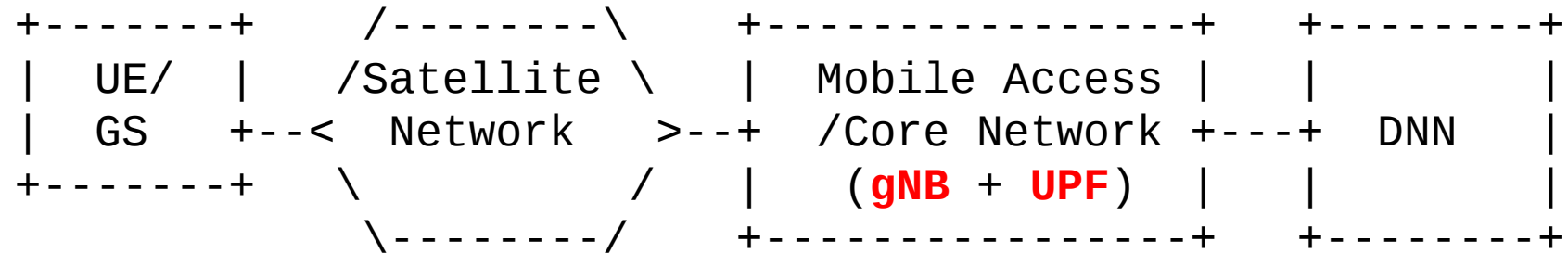


- LIPA enables a UE connected via a HeNB to access DN network without the user plane traversing the mobile operator's network
- The local IP access (LIPA) feature is achieved using a local-GW (L-GW) collocated with the HeNB
- The functionalities of HeNB and L-GW are integrated to provide the direct UP path between the HeNB and the L-GW; there is NO interface between HeNB and L-GW. ← ANUP-like integration

# I.D. Updated: 3GPP Satellite Access

## Satellite Network for 3GPP Wireless Access

UE: User Entity  
GS: Ground Station



UE/GS via Satellite-based Mobile Access Network

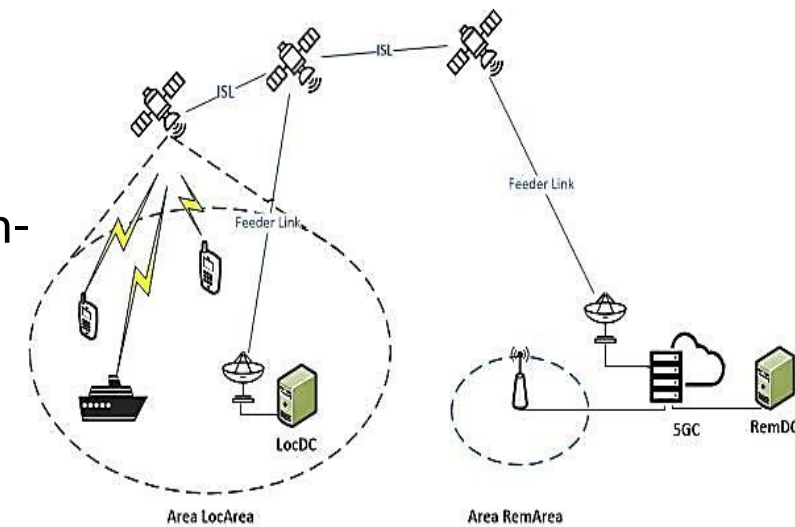
# I.D. Updated: 3GPP Satellite Access (2)

## 1. 3GPP SA2 Satellite Access (Ph2, Rel-18, Completed)

- To support the satellite-based wireless access under the discontinuous coverage :
  - gNB on board-SAT while UPF may or may not on the ground (i.e., on-board SAT) ←
  - UEs have to remain with no service or attempt to re-register during discontinuous coverage; reduce the signaling impact to target RAT or system
  - Enhance power saving mechanisms, e.g. PSM, MICO and eDRX, etc., to optimize the discontinuous coverage (NO attempt PLMN access w/o network coverage; attempt as needed otherwise)

## 2. 3GPP SA2 Satellite Access (Ph3, Rel-19, Planning)

- Use-case study on service requirements via satellite access taking into account 5G new capabilities :
  - gNB on board-SAT while UPF may or may not on the ground (i.e., on-board SAT) ←
  - UE-to-UE communication via satellite(s) without going through the ground network
  - UE LAN using satellite access
  - Store and forward satellite operation for delay-tolerant communication services



← Reduced complexity & simplified control if both gNB & UPF are collocated on Satellite(s).

# Discussion Points across IETFs: IETF-114,115,116 & 117

- Simplified & Reduced signaling w/ optimized data plane
- ULCL I-UPF for MEC case : local breakout (LBO)
- NAT with overlapping private address spaces in different regions
- Increased burden on more complicated AN; QoS handling
- Routing, VPN PE in ANUP
- Mobility Handover: The scenario of distributed UPFs (i.e., dUPFs, being co-located with ANs) and the handover procedures for dUPFs (not integrated with ANs) apply to ANUP transparently as well.
- Paging: For UEs in power-saving mode (PSM), or eDRX, MICO, etc., downlink messages could be processed more efficiently via msg buffering, paging, transmitting, under the ANUP framework.
- Microservice architecture: discussed the pros and cons along with the justification to champion ANUP (UP vs. CP)
- Existing similar work in LTE: Local IP Access (LIPA)
- Use case discussion: Satellite scenarios will benefit from the ANUP-like scheme.
- And more .....

# Summary & Next Steps:

- Really appreciate the comments
- Will continue to discuss with more mobile architects and update the draft accordingly

## Boosted by 3GPP already:

- 3GPP [4G](#) LIPA work bodes well for 5G (B5G, 6G) 'ANUP-like' proposal
- The 3GPP Rel-19 planning ([5G](#)) is on-going. We are considering to bring it to 3GPP for further study (Rel-19)
- The 3GPP Rel-20 ([6G](#) roadmap) targets toward the beginning of Y-2025, a perfect timing for exploration and even adoption of the ANUP-like work

**WG Adoption?**