Mobile User Plane Evolution

draft-zzhang-dmm-5g-distributed-upf
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draft-zzhang-dmm-mup-evolution
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DMM, IETF113
Purposes

• draft-zzhang-dmm-5g-distributed-upf
  • 5G User Plane overview, distribution trend, alternative implementation
  • Sets the stage for discussion in next draft

• draft-zzhang-dmm-mup-evolution
  • Instead of co-located but logically separate gNB/UPF functions, what if they’re integrated?
  • Would need to bring to 3GPP
    • Socializing the idea first among parties friendly with IETF/wireline technologies
    • No intention to do 3GPP work in IETF
      • With enough support, 3GPP delegates from supporting parties would bring to 3GPP
        • No official IETF involvement (e.g., no Liaison is expected)
5G User Plane

- AN Part + CN Part
  - AN part – radio/access link between UE and AN/gNB; PDU over radio/access layers
  - CN part – GTP between AN/gNB and UPF; PDU over GTP
- AN/gNB extends the PDU to UPF over GTP
  - AN/gNB/I-UPF relays the PDU
  - UPF terminates GTP and routes/switches PDU to/from DN
    - “routing/switching” refers to traffic forwarding based on inner IP/Ether header

![Diagram of 5G User Plane](image-url)
Distributed UPF and DN

- With MEC, UPFs are being distributed closer to AN/gNB
- DNs are also distributed to host edge resources
  - Implemented as VPNs for inter-site connection
- While central PSA UPFs can remain, they could be removed
  - Persistent IP addresses can be provided even when UEs re-anchor
    - Via host routes in DN VPN – this is like mac address routes
  - Complete local breakout to inter-connected local DN simplifies and optimize MEC, MBS and LAN-type services
Alternatives to UPF/GTP implementation

• Some operators/vendors are pushing for alternative implementation/deployment
  • Under the hood – no 3GPP architecture/signaling changes
  • Discussions/specifications in DMM

• **SRv6-replacing-GTP**: draft-ietf-dmm-srv6-mobile-uplane
  • Based on N2/N4-signaled GTP parameters, SRv6 tunnels are used instead
    • Information like TEID is embedded in SRv6 SIDs
    • SRv6 tunnels can start/end at gNB/UPF or GW attached to gNB/UPF
  • All claimed benefits can be achieved by MPLS as well

• **SRv6 MUP Architecture**: draft-mhkk-dmm-srv6mup-architecture
  • An SRv6 specific, router based, and partial implementation of Distributed UP
An Alternative View of SRv6 MUP Architecture

- The collection of distributed <MUP Controller, MUP GWs, MUP PE> appears to the SMF as a single/central PSA-UPF
  - No change of 3GPP architecture/signaling
  - An alternative to distributed “traditional” UPFs

- This is actually SR-agnostic
  - Works equally well with (SR-)MPLS
  - [https://datatracker.ietf.org/doc/draft-zpm-dmm-mup-bgp-signaling](https://datatracker.ietf.org/doc/draft-zpm-dmm-mup-bgp-signaling) is the SR-agnostic version of BGP signaling from the MUP Controller
    - Based on draft-mpmz-bess-mup-safi w/ minimum changes

- This is so far just for partial UPF functions
  - For complete set of UPF functions, either extend this router-based architecture or just deploy traditional but distributed UPFs
In xG, AN and UPF may be integrated into ANUP
- PDU terminates at ANUP
- Routing/switching at ANUP
- If this gains traction with parties familiar/friendly with IETF/wireline technologies, it will then be brought to 3GPP
Why Bother?

• Simplified/flattened network architecture
  • 3GPP/wireless for the radio access; IETF/wireline for the rest
  • Seamless integration of wireline/wireless services
    • Not in the context of WWC, but for MEC, MBS, LAN-type services, etc..

• Optimized signaling and data plane
  • No need for separate N2 & N4 signaling
  • No need for AN-UPF connection

• This is feasible as NFs are more and more virtualized
  • Even VPN PE could be integrated into the ANUP device
    • As an implementation choice (not xG architecture assumption)
Separate UPFs May Still Be Used

- For home-routed roaming, MVNO, or one UPF for multiple ANs in proximity
- AN-UPF connection can be GTP tunnels or IETF PWs
Summary

• 5G already support distributed UPFs for MEC purposes
• Alternative User Plane implementation may be desired by some operators
  • “under the hood” w/o changes to 5G architecture/signaling
• In 6G, it may be desired to integrate AN/gNB and UPF functions into a single entity for a flattened architecture
  • 3GPP/wireless technology for radio connection
  • IETF/wireline technology for the rest
  • This is only to socialize the thoughts – actual work would be done in 3GPP
• Seeking comments and collaboration