Mobile User Plane Evolution

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Jeffrey Zhang, Keyur Patel, Luis Contreras, Kashif Islam
IETF 115, HotRFC
5G User Plane

• Mobile Communication Network (MCN): RAN + CN
  • Radio Access Network (RAN)
    • A network of radio access components (gNB) that terminate the air interface from UEs
    • Decomposed RAN with RU/DU/CU split
  • Core Network (CN)
    • The brain of an MCN; to enable and implement mobile services

• User Plane: data plane that carries mobile user traffic
  • Spans from UE to RU/DU/CU (RAN) to UPF (CN)
  • User Plane Function (UPF) is a NF in CN – like a BNG
    • Routing/switching between UE and the Data Network (DN) – SDN style

• Distributed UPFs co-located with CUs
  • For MEC, private 5G, and local Internet peering
  • Requires distributed DN – implemented as VPN (DNVPN)
UE IP/Ethernet traffic on top of radio stack
UE1  
RU1  
DU1  
CU1  

UE IP/Ethernet traffic on top of radio stack  

UE2  
RU2  
DU2  
CU2  

UE IP/Ethernet traffic in GTP-U tunnel  

Local DN  
Local DN  

Transport  

Central DN  

VRF1  
VRF2  
PE1  

VRF1  
VRF2  
PE2  

VRF1  
VRF2  
PE3  

Local DN  

UE IP/Ethernet traffic on top of radio stack

UE IP/Ethernet traffic in GTP-U tunnel

Local DN

Central DN
UE IP/Ethernet traffic on top of radio stack

UE IP/Ethernet traffic in GTP-U tunnel

UE1 -> CU1 -> UPF1

UE2 -> CU2 -> UPF2
UE IP/Ethernet traffic on top of radio stack

UE IP/Ethernet traffic in GTP-U tunnel

UE1  RU1  DU1  CU1  UPF1

UE2  RU2  DU2  CU2  UPF2

relay

Local DN

Transport

Central DN

VRF1  PE1

VRF2  PE2

VRF1  PE3

VRF2

ANUP1

VRF1  PE1

VRF2  PE2

ANUP2
UE IP/Ethernet traffic on top of radio stack

UE IP/Ethernet traffic in GTP-U tunnel

Local DN

Transport

Central DN
Integrating gNB-CU and UPF

- ANUP: AN (gNB-CU) and UPF functions integrated into a single NF
  - Optionally with DNVPN PE function integrated
  - Integration when desired/feasible, separation when required

- A router/switch with wireless/wired connections
  - 3GPP/wireless technologies for wireless access, just like:
    - IEEE technologies for Ethernet connection to a router
    - WIFI technologies for WIFI connection to a router
  - IETF/IEEE/wireline technologies for the rest:
    - Routing/switching
    - VPN/EVPN/whatever features/services as currently in wireline world
Advantages

• Simplified signaling and optimized data plane
  • No more N3 (GTP-U) tunneling
    • The need for N3 tunneling was due to central UPFs
  • 7-step signaling involving 4 NFs and 3 interfaces reduced to 2-step signaling

• Unified architecture for wireline/wireless
  • A router-switch with wireless/wired connections
  • Many 5G special features/procedures are not needed anymore or can be greatly simplified
    • MEC, 5MBS, LAN-type services, etc.
Will 3GPP Accept Integrated ANUP?

- It seems a natural evolution
  - To people familiar/friendly with IETF/wireline technologies
  - But a big paradigm shift on 3GPP/wireless side
- But the work is to be done in 3GPP
- Trying to get support from mobile operators
  - Socializing the idea first among their IETF/wireline people on mobile side
- Will bring to 3GPP if we get enough support
  - The work is on 3GPP not IETF side