Multipath in 3GPP ATSSS

“3GPP Access Traffic Steering Switching and Splitting (ATSSS)”

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Disclaimers and References

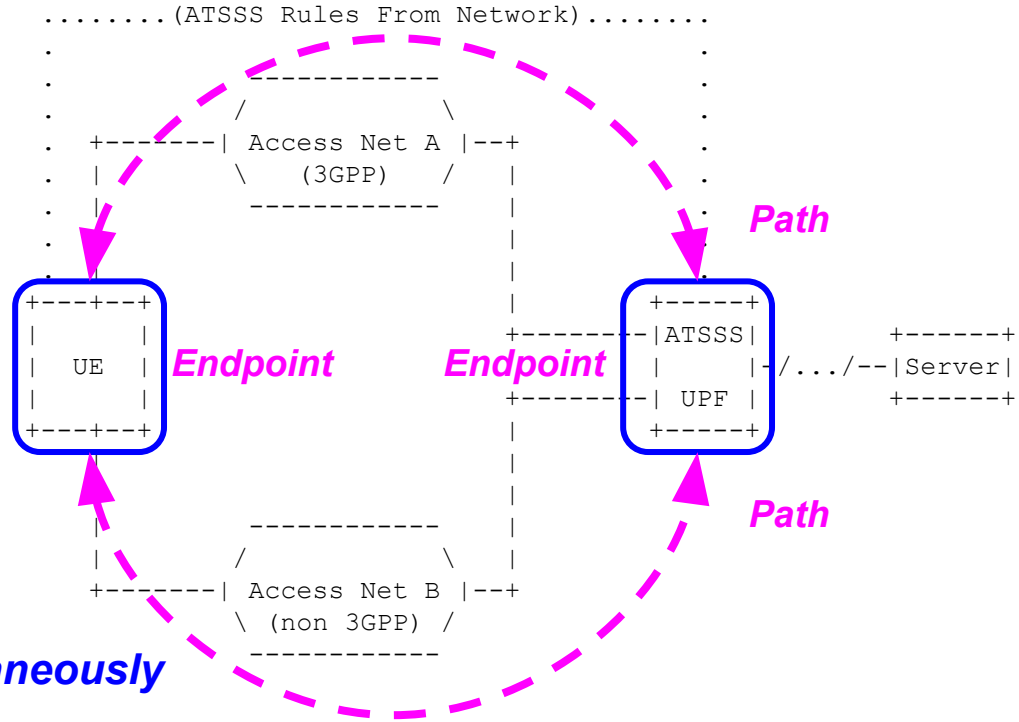
This presentation is on multiple simultaneous active paths in ATSSS.
ATSSS, 5G, and 3GPP are all a LOT bigger than what's described here.

*This presentation is **our** understanding, wearing no 3GPP or IETF hats*

ATSSS Phase One is documented here
ATSSS Phase Two Study is documented here
ATSSS Overview for IETF Participants is available here
IETF 108 presentation based on that Overview is available here

3GPP reference model in IETF terminology

- *ATSSS uses only two paths*
  - *“One 3GPP, one non-3GPP”*
  - *E.g. Cellular + WiFi/wireline*
- *Network provides ATSSS rules*
  - *Modes assigned “per flow”*
- *“Steering”*
  - *Selecting a path*
- *“Switching”*
  - *Selecting a different path*
- *“Splitting”*
  - *Using multiple paths **simultaneously***



ATSSS and eATSSS steering functions

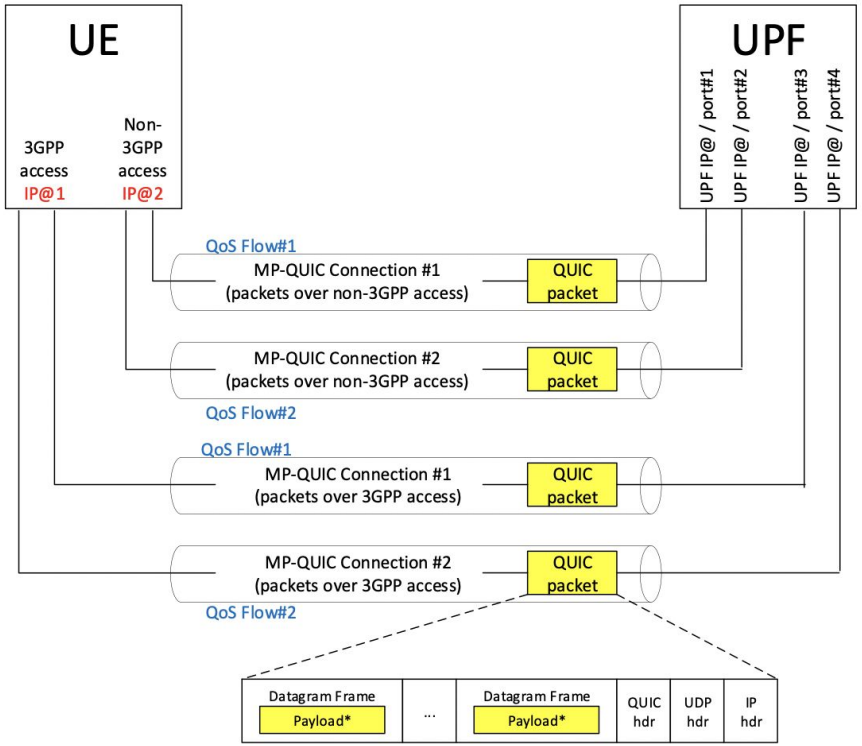
Application Traffic Steering, Switching, and Splitting (ATSSS)

- RFC8803 (0-RTT TCP Convert Protocol) based solution using MPTCP
- ATSSS Lower Layer (ATSSS-LL)supports traffic aggregation of 3GPP and non-3GPP user plane paths, without any specific protocol between UE and UPF (steering/switching only)

Enhanced ATSSS (eATSSS)

- Goal: add splitting support for non-TCP traffic/any IP & Ethernet traffic
- Additional goal: support for additional eATSSS modes

ATSSS Tunneling/Proxying based on MP-QUIC



- UE is assigned with three IP addresses:
  - IP@3: IP address of the MA PDU Session
  - Two link-specific IP addresses: one for 3GPP (IP@1) and one for non-3GPP access (IP@2)
- Potentially multiple MP-QUIC connections between UE and UPF e.g. per QoS flow
- E2E payload traffic sent in QUIC datagram frames:
  - **Tunneling**: The whole PDU is send as QUIC payload
  - **Proxying**: Payload contains UDP payload (UDP proxying), IP payload (IP proxying), or Ethernet Frame (for Ethernet PDU Sessions)
  - Trade-off between packet overhead and signaling/computational overhead

Campus/Enterprise Use Case

- **Campus/enterprise type of deployment:** A subscriber is simultaneously using both cellular and WLAN connectivity to access the same service
- This use case provides:
  - **For the user:** 1) Increased capacity, 2) Increased coverage and 3) Increased reliability
  - **For the access provider:** 1) Increased capacity, 2) Increased coverage, 3) Increased reliability and 4) Minimized cost

ATSSS modes already deployed

- "Active-Standby" *(could work using migration in QUICv1)*
  - Forward traffic via “active access” when available, switching to “standby”
- "Smallest Delay" *(could work using migration in QUICv1)*
  - Forward traffic on access with the smallest RTT measured by UE/UPF
- "Load-Balancing" *(require multipath QUIC to enable traffic splitting)*
  - Forward traffic distributed among available access networks (“30%/70%”)
- "Priority-based" *(could work partially using migration in QUICv1)*
  - Assign priorities to accesses
  - Forward traffic on “high priority” path until congestion is encountered
  - *(require multipath QUIC to enable traffic splitting across accesses)*

All new eATSSS steering modes require multipath

- New capabilities under discussion in 3GPP SA2 include
  - Changing access splitting weights dynamically
  - Forwarding on both accesses when necessary to provide redundancy
  - Forwarding on both accesses if RTT difference is below a threshold
  - UE making decisions about uplink access on its own
    - Reasons besides link status, include battery, energy consumption, etc.
- *None of these can be supported using only migration in QUICv1*

Why is Multipath QUIC needed for ATSSS?

- ATSSS in 3GPP needs to support traffic splitting across multiple accesses for any IP and Ethernet traffic with in-order delivery
- Multipath QUIC is a strong candidate for ATSSS as it builds on the synergies of the QUIC stack
  - i.e. no need to have yet another protocol stack as QUIC will be on cellular phones/smart phones
- Multipath QUIC needs to support
  - Simultaneous use of multiple paths and
  - In-order delivery within streams split over multiple paths

Questions and Comments?