Use-cases and Requirements for MPTCP Proxy in ISP Networks

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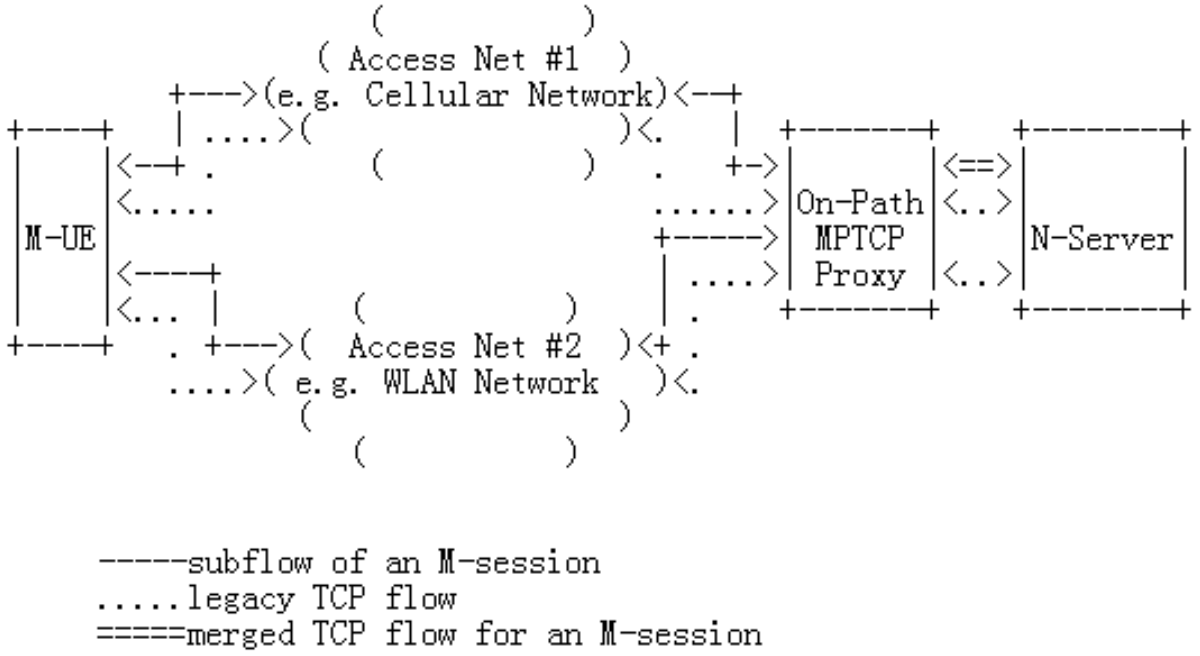
Motivations for ISP MPTCP Proxy

- Boosting MPTCP Utilization
  - For M-UEs on behalf of N-Servers
  - For N-UEs on behalf of multiple access networks
- Resource Pooling from Multiple Networks
  - Flexible Proxy invocation/Pooling strategies depending on (i.e., subscribers, applications, and ISPs)
- Service Continuity for a mobile terminal
  - Multiple Connections and Seamless Handover between Multiple Networks/Access points
- Assist MTPCP Connection Establishment
  - Terminate or pass MPTCP signal from UE to Server

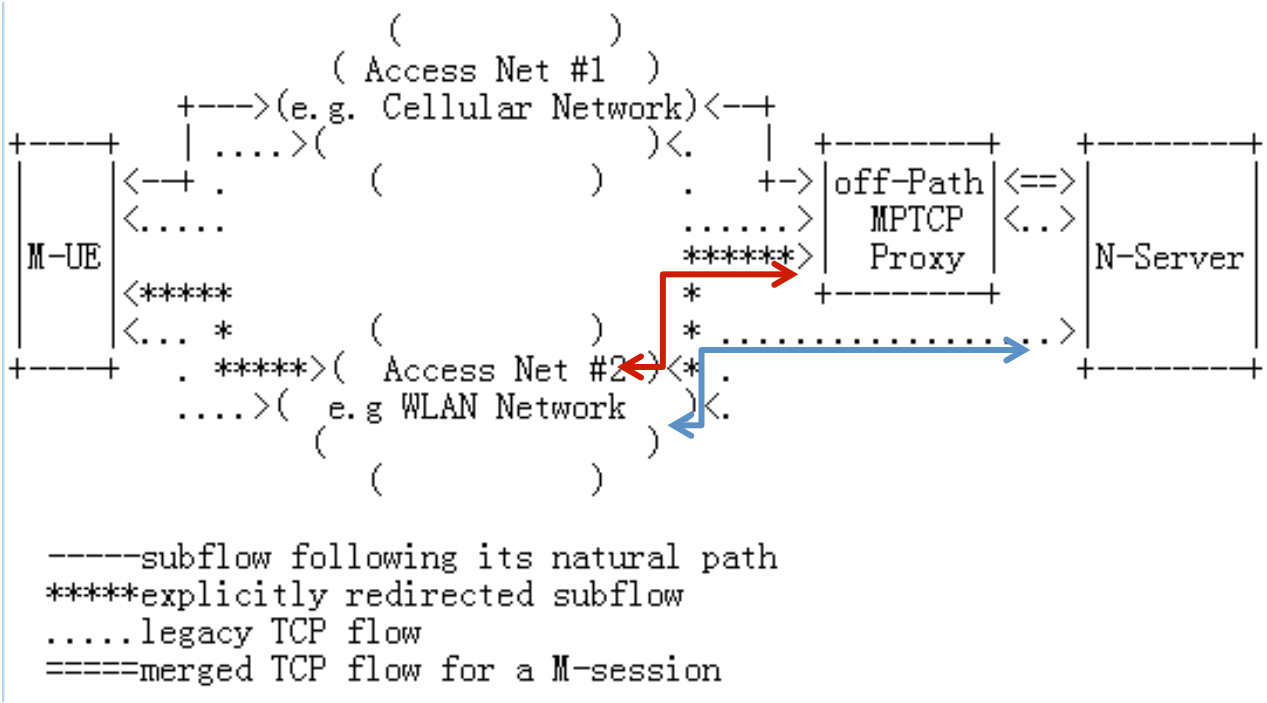
Deployment Considerations

- (1) On-path MPTCP Proxy



Deployment Considerations

- (2) Off-path MPTCP Proxy



Deployment Scenarios

- For M-client to N-server
  - IP Gateway from ISP cellular core network
    - Reusing interfaces for subscriber/network info
  - LB from ISP/ICP Data Center
    - Boost MPTCP deployment at the serving side
  - Cellular/WLAN Dual-mode small cell
    - Local resource pooling without CN involvement
- For N-client to M-server/M-Proxy
  - CPE/CGN from ISP fixed access network

Requirements for MPTCP proxy

- Protocol transition
- Traffic Steering for Off-Path Proxying
- Resource Policy within a Single ISP
- Protection against third-party traffic
- MPTCP Proxy Selection from Multiple Candidates
- Load Balancing Algorithm for Multiple Networks
- Misc

Protocol transition

- Proxy between an M-UE and an N-Server
  - Compatibility: An on-path MPTCP Proxy supports detection of M-UE/N-server combinations for further proxying while leaving M-UE/M-server and N-UE/N-server sessions intact.
  - Transparency: An on-path MPTCP Proxy supports negotiation with and acting towards the M-UE like a M-server on behalf of N-Server, while acting towards the N-Server like a N-UE on behalf of the M-UE.

Traffic Steering for Off-Path Proxy

- in the off-path MPTCP Proxy use-case
  - Explicit Traffic Steering: the Proxy MUST support explicit traffic steering, to allow all the subsequent subflow traffic go through the exactly the same MPTCP Proxy used in the corresponding M-session establishment for both directions (including uplink and downlink traffic from/to the M-UE).
  - Globally Routable Address: the Proxy SHOULD expose a globally routable address to allow explicit steering of subsequent subflow traffic.

Resource Policy within a Single ISP

- to enable such fine-grained resource pooling policy from the network, who owns multiple access networks
  - Network Access Type Information: an MPTCP proxy SHOULD be able to acquire a subflow's Network Access Type information/update.
  - Resource Policy: an MPTCP Proxy MUST support flexible control to set limits to the number of subflows and the number of M-sessions from an M-UE/to an N-Server.

Protection against 3rd-party traffic

- Provision Negotiation: an MPTCP Proxy SHOULD support both subscriber/M-session/ subflow level resource reservation negotiation with a M-UE.
- Origin Authentication: an off-path MPTCP Proxy MUST support subflow authentication for traffic from an unauthorized third-party WiFi.

MPTCP Proxy Selection

- Multiple proxies from a single ISP
  - Flexible Selection: it SHOULD be possible for the ISP to enforce flexible selection policy regarding which MPTCP Proxy to serve which M- session, based on
    - the MPTCP Proxy's location,
    - the MPTCP Proxy's type (on-path/off-path)
    - the application type

Load Balancing Algorithm for Multiple Networks

- The MPTCP Proxy SHOULD be configurable with the load balancing ratio per each available path.
  - the ISP may enforce policies that would optimize various parameters such as:
    - Network resources usage as a whole.
    - Optimized invocation of available MPTCP Proxies.
    - Optimized MPTCP Proxy local performances.
    - Enhanced QoE (including increase both upstream and downstream throughputs)

Misc

- Reliability: MUST avoid single point of failure
- Scalability: SHOULD be easy to scale
- Comlexities with other TCP option signals
  - SHOULD NOT alter non-MPTCP signals
  - MUST NOT inject MPTCP signals if the TCP option size is consumed
  - SHOULD NOT inject MPTCP signals if this leads to local fragmentation
  - TCP-AO, when present, MUST be the first to be processed

Next Step

- call for more review and comment
- WG item?