MPTCP Proxy for Mobile Networks
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Abstract

This document discusses the motivation and usecases for ISP deployed MPTCP proxies in mobile networks.

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1 Introduction

Due to the scarcity of wireless frequency resources and the instability of wireless signals, combined with the operators’ strong motive to preserve service upgrade with smooth network evolution, make full use of mobile terminal’s multi-homing capability has long been a quest for mobile networks.

In particular, the motivations include resource pooling for better performance (where the network could provide a better performance for resource-intensive services by allowing them to transparently using combined capacities from different RATs) as well as intelligent selection for better accommodation and seamless handover for better mobility.

Since R6, 3GPP network defined GAN, interfaces for non-3GPP RATs through GERAN simulation. In R7, I-WLAN was introduced to 3GPP network, for inter-working of PLMN with WLAN RAT. In R8, it is specified that a shared anchor could be used for both I-WLAN and PS RATs, yielding seamless handover. Since R8, there have been work on EPS’s mobility support for simultaneous multiple RATs through different PDN connections (MAPCON). Most recently, in R10, it is possible to use EPS’s mobility support for simultaneous multiple RATs through a single PDN connection (IFOM).

However, there is still not possible for a single IP flow to make full use of multiple interfaces simultaneously.

2 Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

3 Considerations for MPTCP Proxy

MPTCP[RFC6824] offers transparent wireless resource pooling for a single "IP flow" for multi-homing UEs with least network complications, as it effectively implements automatic RAT selection/handover/pooling through TCP’s adaptive end-to-end rating mechanism[RFC6356].

However, end-to-end MPTCP solution deprives network’s control over service/RAT preference, which is considered to be essential for better operation and service provision in 3GPP networks. As the same time, it has to suffer from compatibility issues with legacy application SPs who are reluctant to support MPTCP natively.
Therefore, network deployed MPTCP proxy comes as a compromise, which would certainly benefit MPTCP-enabled UEs without SP’s MPTCP deployment by providing protocol adaptation, and at the same time maintain as the wireless network operator’s policy enforcement point for their preferred network selection/usage strategies.

4 Use-cases for Network deployed MPTCP Proxy

For 3rd party service provider who does not supporting MPTCP in their servers, the network deployed proxy could be used to enable MPTCP capability in resource pooling from various radio access networks for enhanced QoE/mobility.

As for 3rd party service providers supporting MPTCP, the network deployed proxy could also bring benefits to both the operator and the users by enabling the following benefits.

4.1 Dynamic traffic offloading based on network information

For real-time interactive services with higher QoS requirements it is expected that 3GPP network can provide better guarantees on the average case. For bulk data transfer who is satisfied with best-effort delivery, Wi-Fi would be a great choice. But the vertical partition does not fit everywhere for the wireless condition itself is quite dynamic and hard to predict. It is important to implement adaptive offloading mechanisms in order to achieve higher resource utility with ever changing radio environment for a possibly moving terminal based on network status, e.g. cell load, AP’s signal intensity, user’s subscription type, etc.

4.2 Resource pooling for reduced expense

Due to its low construction and operation expenses, Wi-Fi has been adopted by mobile operators as a complementary RAT for their traditional 3GPP networks. However, different construction and operation expenses of various radio networks result in differences in charging rates/policies for different RATs.

For instance, Wi-Fi access may be charged by the access duration, while the 3GPP access may be charged by the consumed data volume. Even if using the same policy, Wi-Fi service is expected to be much cheaper than 3GPP data service.

Moreover, different subscription packages may offer various data plans for various RATs. For instance, a basic 4G package may contain free data volume as well free Wi-Fi access too.
By enabling MPTCP session between UE and network proxy, via mediating sub-flow data traffic based on their Radio access types and the user's subscription package, it is possible to further reduce the usage expenses from both sides of the network and user.

5 Requirements for MPTCP Proxy

In order to realize the above use-cases, it is expected that a network deployed MPTCP proxy provide the following functionality:

5.1 Protocol transition

To allow a MPCTP-enabled UE to make full use of the multiple radio interfaces even if it is communicating with a non-MPTCP server, the proxy should support

(a) Detection of UE’s MPTCP capability;

(b) Negotiation with MPTCP UE on behalf of non-MPTCP SP;

(c) Translation/Mapping between TCP and MPTCP sessions.

5.2 Traffic mediation

(a) Anchoring of sub-flow traffic: On one hand, it is not always possible for a single GW be sitting on the path of every sub-flow from a MPTCP session, hence explicit traffic anchoring to enable a single point of general control over MPTCP sub-flows should be considered.

(b) Mediation of sub-flow traffic: On the other hand, for fine-grained mediation of sub-flow traffic, both static and dynamic selection/offloading/pooling policies should be allowed. For instance, "always prefer Wi-Fi over 3GPP" could be a static policy for bulk data transfer services, while "use 3GPP only for backup unless Wi-Fi is congested" could be a dynamic offloading policy for a un-prioritized VoIP service.

5 Security Considerations

TBA.

6 IANA Considerations

There is no IANA action in this document.
7 References

7.1 Normative References


[IFOM] IP Flow Mobility and seamless WLAN offload. 3GPP work item 450041.


Authors’ Addresses

Lingli Deng
China Mobile
Email: denglingli@chinamobile.com

Dapeng Liu
China Mobile
Email: liudapeng@chinamobile.com

Tao Sun
China Mobile
Email: suntao@chinamobile.com