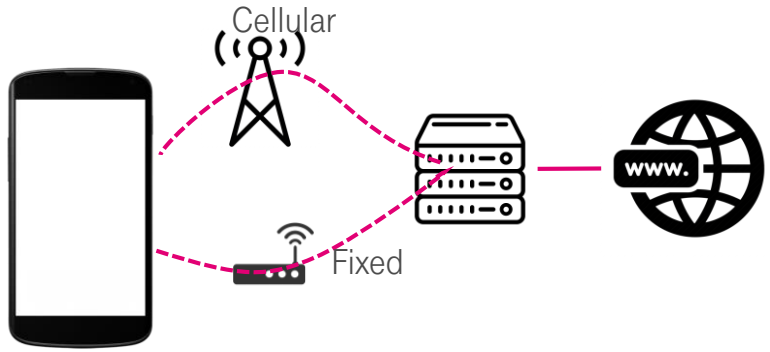
MP-DCCP

for enabling transfer of UDP or IP traffic over multiple data paths in multi-connectivity networks

draft-amend-tsvwg-multipath-dccp-01
draft-amend-tsvwg-multipath-framework-mpdccp-00
draft-amend-tsvwg-dccp-udp-header-conversion-00

Markus Amend, March 25, 2019

MOTIVATION 1/2



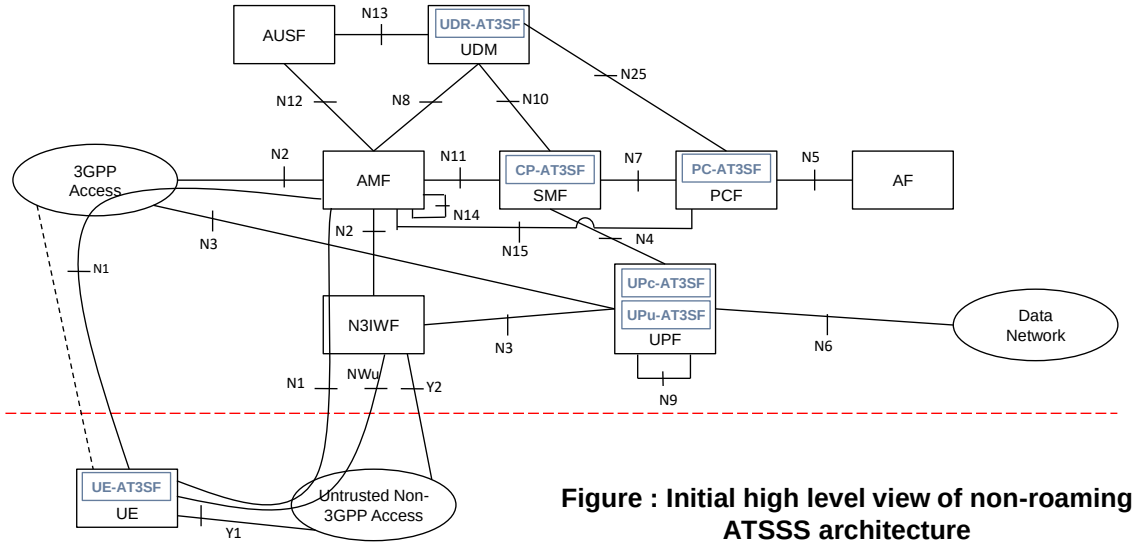
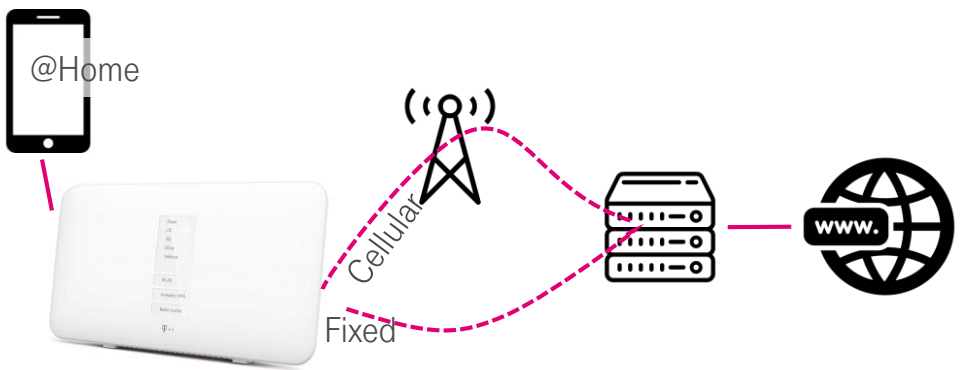


Figure : Initial high level view of non-roaming ATSSS architecture

Mobile device multi-connectivity based on expected 3GPP Rel. 16 ATSSS specification



Residential multi-connectivity based on Hybrid Access

MOTIVATION 2/2

140.000 residential customer of a European ISP over one week in August 2018

Layer 3	Layer 4	>Layer 5	Share [%]	
IPv4 and IPv6	TCP		82.77	
	UDP	QUIC	11.76	16.33
		RTP	2.64	
		Other	1.93	
	Other		0.53	
Other			0.37	

Demand

Multi-connectivity should cover the whole IP traffic mix in which TCP loses its dominating role because of QUIC

Findings

MP-TCP is a good candidate to enable the TCP share for multi-connectivity. A finding from MP-TCP is, that its congestion control empower beneficial traffic splitting.

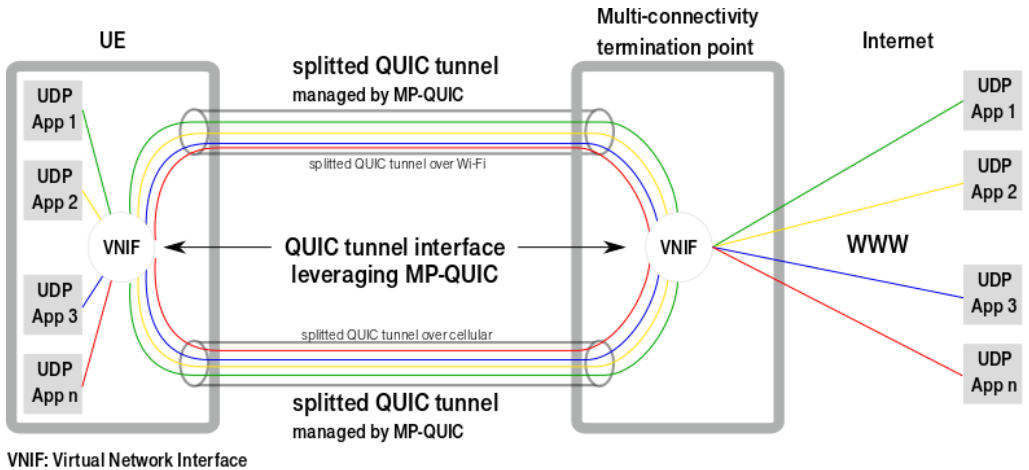
Multipath support for UDP or even IP does not exist.

UDP or IP encapsulation into MP-TCP is not an option as it would impose reliable in-order delivery.

A potential MP-IP or MP-UDP must not impose reliability in a sense that high latency, packet scrambling or head-of-line blocking occurs extraordinary.Otherwise it breaks the UDP and IP principles on transportation and service expecations!

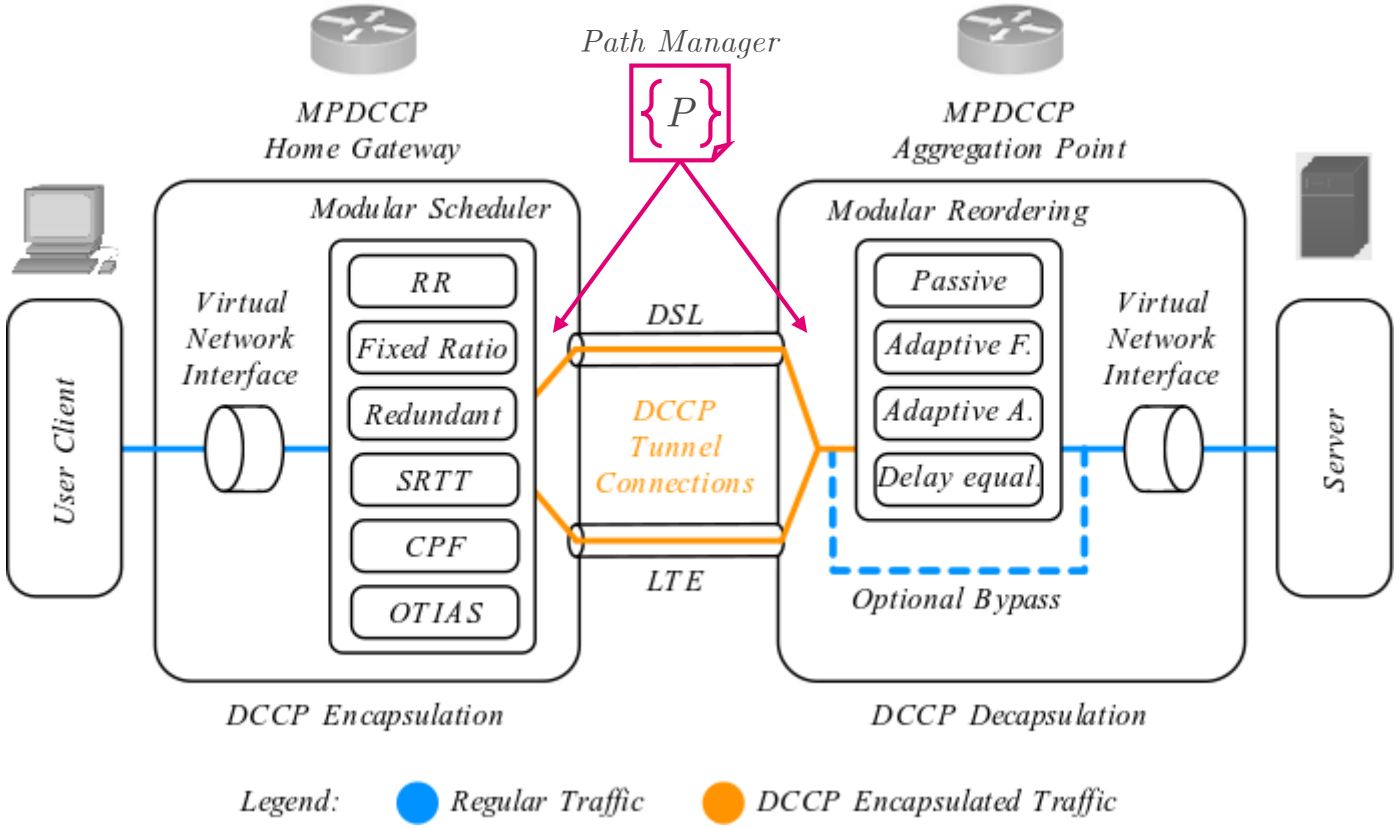
WHY NOT USING MP-QUIC?

MP-QUIC is a reliable and end-to-end encrypted protocol. Its application for enabling multipath transfer for UDP/QUIC traffic only works as QUIC tunnel, managed by MP-QUIC.



- **Useless encryption is applied and requires resources**
  - UDP as guest: Turns UDP into reliable transmission ☹
    - QUIC as guest: Encryption over Encryption, otherwise like TCP below ☹☹
  - TCP as guest: TCP's CC + FC over outer QUIC's CC + FC ☹☹☹

SOLUTION: MP-DCCP AND AN IP COMPATIBLE FRAMEWORK

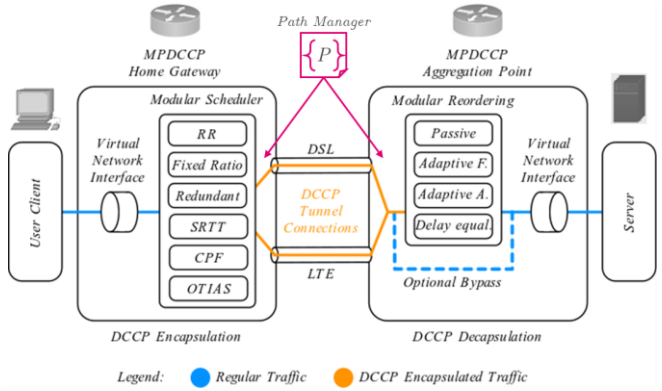


https://tools.ietf.org/html/draft-amend-tsvwg-multipath-dccp-01

https://tools.ietf.org/html/draft-amend-tsvwg-multipath-framework-mpdccp-00

https://tools.ietf.org/html/draft-amend-tsvwg-dccp-udp-header-conversion-00

MP-DCCP FACTS



Architecture is IP and UDP capable and leverage the standardized DCCP

Architecture can be applied for load-balancing, seamless handover and traffic splitting

It does not impose any other transport characteristic than congestion control

It uses DCCP tunnel per path leveraging the congestion control for efficient multipath traffic distribution (similar to MP-TCP)

A Prototype is available Linux based (not published yet) covering MP-DCCP, the IP framework and U-DCCP.

The implementation further comprise a modular scheduler scheme which is comparable to MP-TCP

And an modular re-ordering engine, which is very critical for multipath transmission of unreliable protocols

A NS3 implementation and further prototoype optimization is done in cooperation with

SUMMARY AND OUTLOOK

It is challenging to develop a multipath protocol / architecture for transmission of unreliable traffic like UDP and IP.

Compared to MP-TCP, the re-ordering becomes the critical part.

Linux based prototype was developed and evaluated successfully and results will be published soon.

Independent of MP-DCCP‘s success at IETF:

- the challenge for a „unreliable“ MP-QUIC is exactly the same
- and could profit from MP-DCCP findings and results.

My expectation today:

- Feedback from the audience
- intensive discussion on the tsvwg mailinglist
- and extended presentation at IETF 105 about the challenges and findings on „unreliable“ multipath transmission

BACKUP

REQUIRED (MP-)QUIC ADAPTATIONS

In case MP-QUIC shall become an alternative for ATSSS and Hybrid Access like network architectures, it would require a paradigm change:

→ Configurable encryption for

- reducing the useless overhead in case of QUIC over MP-QUIC over trusted network paths
- designing a MP-QUIC ↔ QUIC converter

→ Deal with unreliable traffic to some extent and remove at least the Flow Control

- Unreliable traffic support requires a complete re-work of current MP-QUIC framework, which bases on QUICs reliable and in-order delivery.