MP-DCCP progress

draft-ietf-tsvwg-multipath-dccp-02

Markus Amend on behalf of the authors, TSVWG Interim 01 ‘22

LIFE IS FOR SHARING.

General updates

MP-DCCP **part of the 3GPP Study Phase for Rel. 18 ATSSS** enhancements

- SA2 Feb. 22: S2-2200983 (https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_149E_Electronic_2022-02/Docs/S2-2200983.zip)

Presentation **@ MWC 28 Feb – 3 March 2022**, GSMA booth

Open Source code at GitHub updated with new handshaking procedure according to -02 and stability fixes to -03

Enhancing functionalities like **encapsulation, re-ordering and new scheduling mechanisms** are on the way to be published and will allow **full-fledged tests for 3GPP ATSSS, Hybrid Access and E2E. iPerf3** (MP-)DCCP patch ready.

Standardization roadmap further stabilized to keep track with 3GPP development

PoC with a big terminal vendor agreed using MP-DCCP public code

Draft development at GitHub with currently 9 contributors.

Draft status

(Partially) Ready

Function/Mechanism	Draft	Open Source	
Handshaking	✓	✓	
MP Capable Feature	✓	✓	
MP_CONFIRM	✓	✗	
MP_JOIN	✓	—	Address ID is missing
MP_KEY	✓	—	MP_KEY is implemented, but only “plain text “ type is supported.
MP_SEQ	✓	✓	
MP_HMAC	✓	✓	
MP_RTT	✓	—	MP_RTT implemented, but Type and Age is missing.
MP_ADDADDR	✓	✗	
MP_REMOVEADDR	✓	✗	
MP_PRIO	✓	✗	

Still to work on

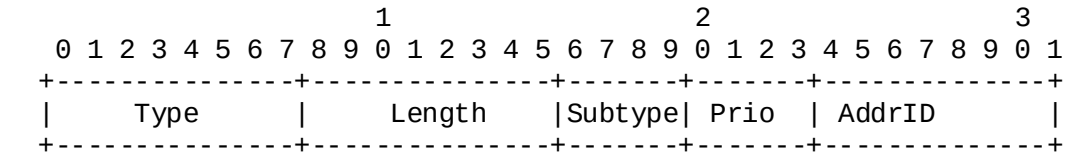
Function/Mechanism	Draft	Open Source
Fallback mechanism	—	—
MP_FAST_CLOSE	—	✗

✓ Finalized, ready for review/testing

— Work on, contribution is welcome

✗ Not implemented, contribution is welcome

NEW MP_PRIO: Fine granular path management



```
                     1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---------------+---------------+-------+-------+--------------+
|     Type      |     Length    |Subtype| Prio  | AddrID       |
+---------------+---------------+-------+-------+--------------+
```

The following values are available for Prio field:

* 0: Do not use. The path is not available.

* 1: Standby: do not use this path for traffic scheduling, if another path (secondary or primary) is available.

* 2: Secondary: do not use this path for traffic scheduling, if the other paths are good enough. The path will be used occasionally, e.g. when primary paths are congested or become not available.

* 3: Primary: can use the path in any way deemed reasonable by peer. Will always be used for packet scheduling decisions.

* 4 - 15: relative priority of one path over the other to give relative path priority for primary paths. The peer should consider sending more traffic over higher priority path. Higher numbers indicate higher priority.

Active exchange of prioritization and cost information as indicator for user plane scheduling decisions.

- Enable/disable paths (Prio=0)
- Keep paths as backup in case primary path is broken (Prio=1)
- Primary/Secondary (Prio=2-15) give 14 levels of granularity for path aggregation

Can be used to select

Steering (permanent path selection)

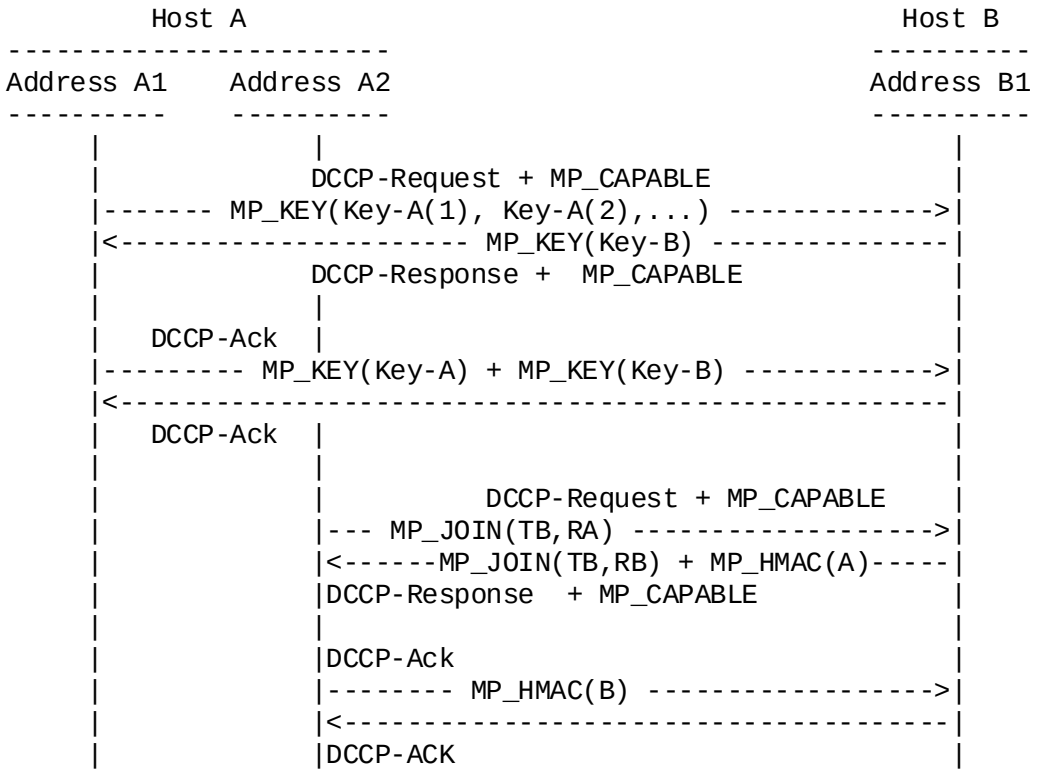
Switching (seamless handover)

Splitting (aggregation)

→ Advanced over MPTCP binary Prio parameter

→ Excluded at the moment from MP-QUIC development

NEW: handshaking procedure



Resembles MPTCP well proved handshaking mechanism including security aspects

4-way initial handshake

- **to negotiate MP support and**
- **exchange key material for setup of subsequent flows**

`MP_CAPABLE` **feature and** `MP_KEY` **option are used**

Unlimited subsequent subflow setup using `MP_JOIN` **after successful initial handshake**

Part of 3GPP Rel. 18 Study Phase for ATSSS 1/2

MP-DCCP is a selected solution to study the Key Issue (KI) on **non-TCP multi-path support for ATSSS, see S2-2200757**

MP-DCCP solution description contributed as S2-2200983 introduced as

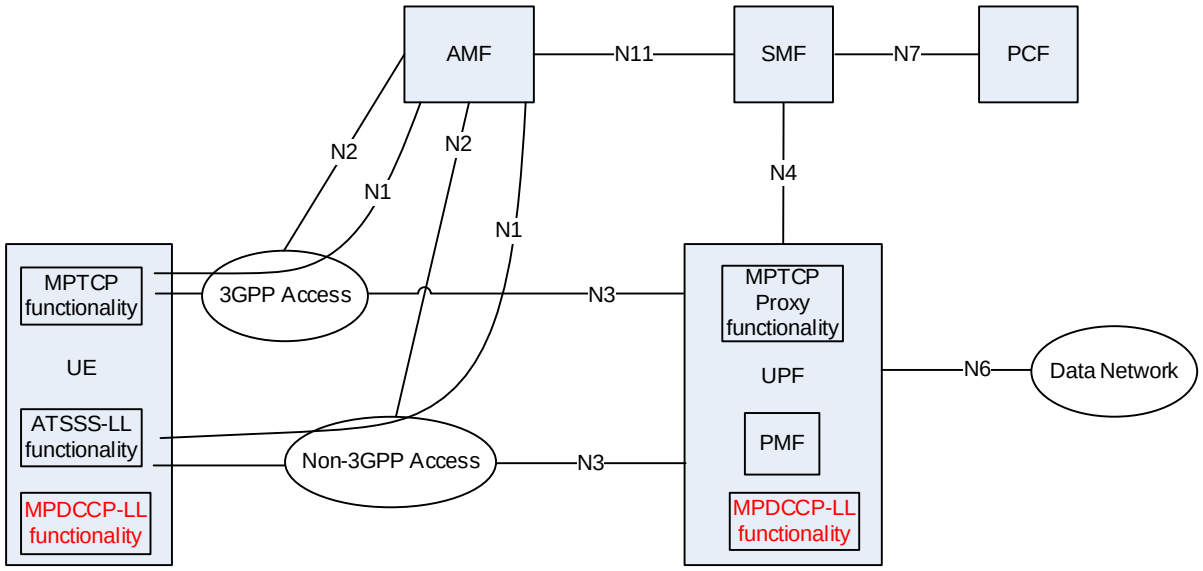
23.700-53: New Solution: MP-DCCP-LL based ATSSS steering functionality for Non-TCP traffic.

Early Supporters: Xiaomi Vodafone BT DT

Placed as Lower-Layer (-LL) solution for enabling multi-path for any traffic, at least UDP and QUIC.

Only solution which has a comprehensive set of required functionalities available as public code:

Multi-path Protocol, ATSSS defined and discussed steering modes, **re-ordering mechanisms**, Encapsulation



Part of 3GPP Rel. 18 Study Phase for ATSSS 2/2

MP-DCCP fulfils already today the requirements of **non-TCP multi-path** support for **Hybrid Access**, **end-to-end**

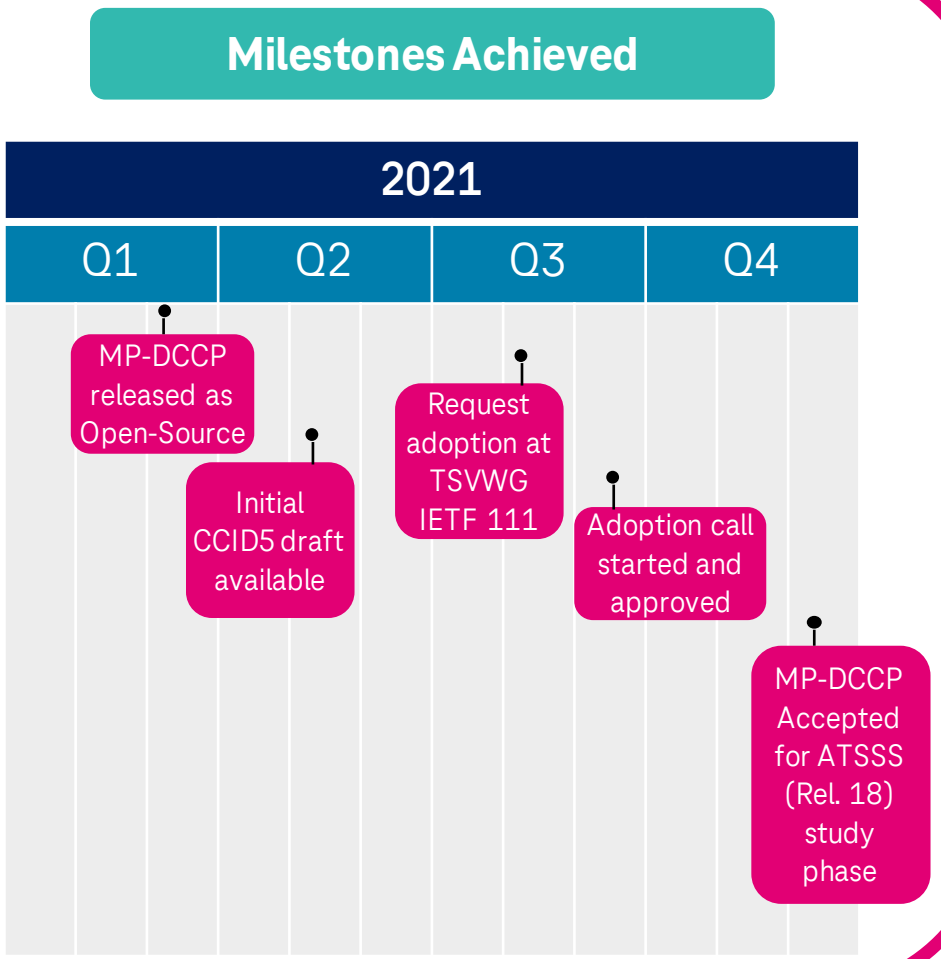
and in particular for

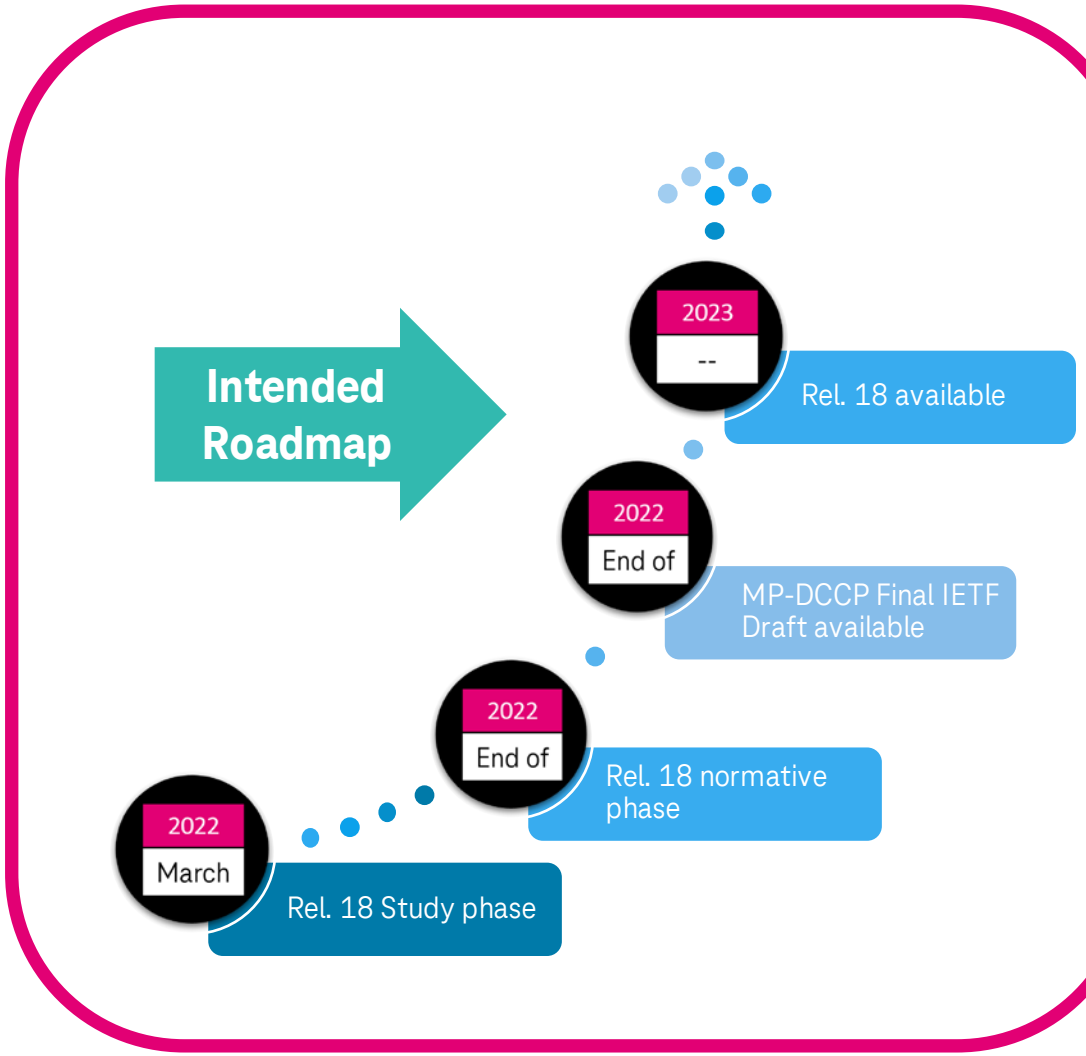
ATSSS →

3GPP ATSSS KI requirements	MP-DCCP standard/prototype capabilities	
Non-TCP support	MP-DCCP encapsulation[1]	✓
Steering modes	Scheduling[1] - Traffic distribution logics.	✓
Re-ordering	Compensate paths latency difference[1]	✓
Path measurement	As input for scheduling decisions Congestion Control CCID 2, 3, 4, 5	✓
Path management	(Re-)Establish/destruct flows	✓

[1] Prototype publication expected soon

Roadmap


Milestones Achieved
2021
Q1
Q2
Q3
Q4
MP-DCCP released as Open-Source
Initial CCID5 draft available
Request adoption at TSVWG IETF 111
Adoption call started and approved
MP-DCCP Accepted for ATSSS (Rel. 18) study phase


Intended Roadmap
2023
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Rel. 18 available
2022
End of
MP-DCCP Final IETF Draft available
2022
End of
Rel. 18 normative phase
2022
March
Rel. 18 Study phase

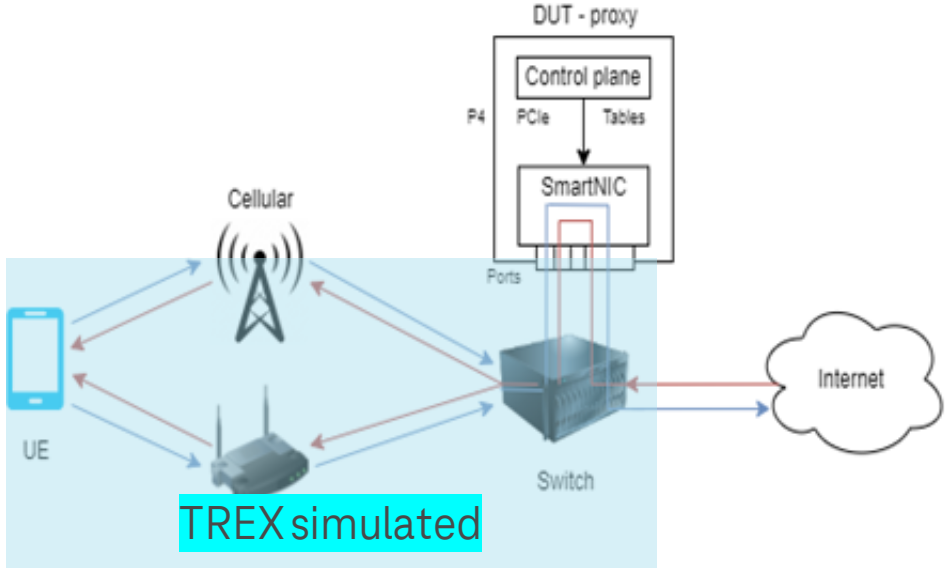
P4 based Hardware Acceleration of MP-DCCP Proxy

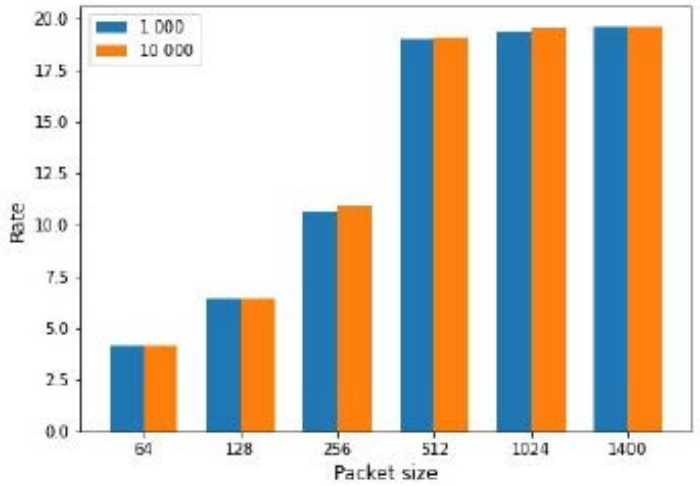
P4: Domain-specific language, specifying how data plane devices process packets - P4.org

P4 code compiles to different targets (smartNIC, Switching ASIC Tofino, ...) → hardware acceleration

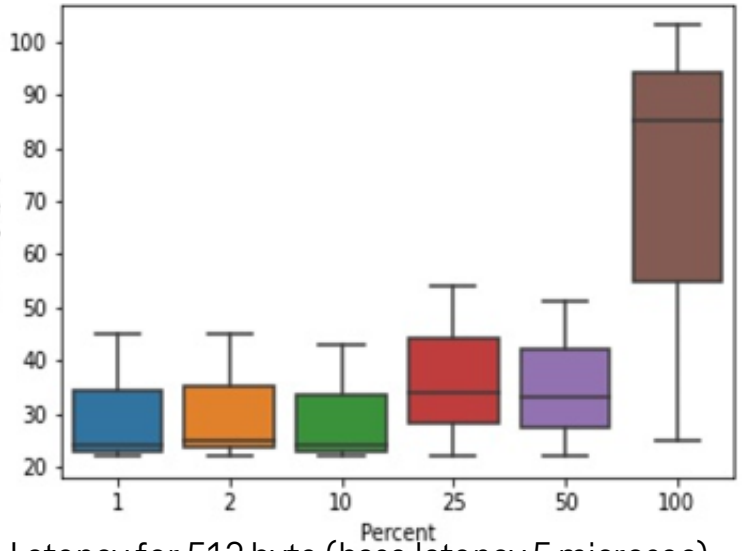
Implemented (parts of) MP-DCCP Proxy functionality in P4: DCCP header parsing and processing, MP_SEQ parsing and processing, ACK generation, keeping track of per tunnel sequence and CWND numbers per paths, Encap/Decap, RR path scheduler

Compiled to Netronome Agilo CX, TREX (v2.93 using DPDK version 21.02.0-rc1) on Intel X710 (2x10G)





Throughput over packet size for simulated 1k or 10k UEs



Latency for 512 byte (base latency 5 microsec)

Review is needed as the draft moves forward

Authors believe most MP-DCCP features and requirements are described in -03

All encompassing MP-DCCP Linux Kernel prototype is steadily evolving covering already most functionalities

Clear demand from 3GPP ATSSS Rel. 18 “non-TCP” Key Issue study on ATSSS

Continues result publication is ensured from academia and industry

Who can join for draft review?