MP-DCCP progress

draft-ietf-tsvwg-multipath-dccp-02

Markus Amend on behalf of the authors, TSVWG Interim 01 '22
MP-DCCP part of the 3GPP Study Phase for Rel. 18 ATSSS enhancements


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

<table>
<thead>
<tr>
<th>Function/Mechanism</th>
<th>Draft</th>
<th>Open Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handshaking</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>MP Capable Feature</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>MP_CONFIRM</td>
<td>✅</td>
<td>❌</td>
</tr>
<tr>
<td>MP_JOIN</td>
<td>✅</td>
<td>✗</td>
</tr>
<tr>
<td>MP_KEY</td>
<td>✅</td>
<td></td>
</tr>
<tr>
<td>MP_SEQ</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>MP_HMAC</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>MP_RTT</td>
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<td></td>
</tr>
<tr>
<td>MP_ADDADDR</td>
<td>✅</td>
<td>❌</td>
</tr>
<tr>
<td>MP_REMOVEADDR</td>
<td>✅</td>
<td>❌</td>
</tr>
<tr>
<td>MP_PRIO</td>
<td>✅</td>
<td>❌</td>
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### Still to work on

<table>
<thead>
<tr>
<th>Function/Mechanism</th>
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<tbody>
<tr>
<td>Fallback mechanism</td>
<td></td>
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<tr>
<td>MP_FAST_CLOSE</td>
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<td>❌</td>
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- ✅ Finalized, ready for review/testing
- ❌ Work on, contribution is welcome
- ✗ Not implemented, contribution is welcome
NEW MP_PRIO: Fine granular path management

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
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

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
MP-DCCP fulfills 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 vs MP-DCCP standard/prototype capabilities

<table>
<thead>
<tr>
<th>3GPP ATSSS KI requirements</th>
<th>MP-DCCP standard/prototype capabilities</th>
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<tbody>
<tr>
<td>Non-TCP support</td>
<td>MP-DCCP encapsulation¹</td>
<td>✓</td>
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<tr>
<td>Steering modes</td>
<td>Scheduling¹ - Traffic distribution logics.</td>
<td>✓</td>
</tr>
<tr>
<td>Re-ordering</td>
<td>Compensate paths latency difference¹</td>
<td>✓</td>
</tr>
<tr>
<td>Path measurement</td>
<td>As input for scheduling decisions Congestion Control CCID ², ³, ⁴, ⁵</td>
<td>✓</td>
</tr>
<tr>
<td>Path management</td>
<td>(Re-)Establish/destruct flows</td>
<td>✓</td>
</tr>
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</table>

¹ Prototype publication expected soon
# Roadmap

## Milestones Achieved

<table>
<thead>
<tr>
<th>2021</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
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- **Initial CCID5 draft available**
- **MP-DCCP released as Open-Source**
- **Request adoption at TSVWG IETF 111**
- **Adoption call started and approved**
- **MP-DCCP Accepted for ATSSS (Rel. 18) study phase**

## Intended Roadmap

- **Rel. 18 available**
- **MP-DCCP Final IETF Draft available**
- **Rel. 18 normative phase**
- **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)
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?