IETF 105

July 22, 2019

Monreal

MPTCP Inactivity Time Option and Subflow Rate Limit Option

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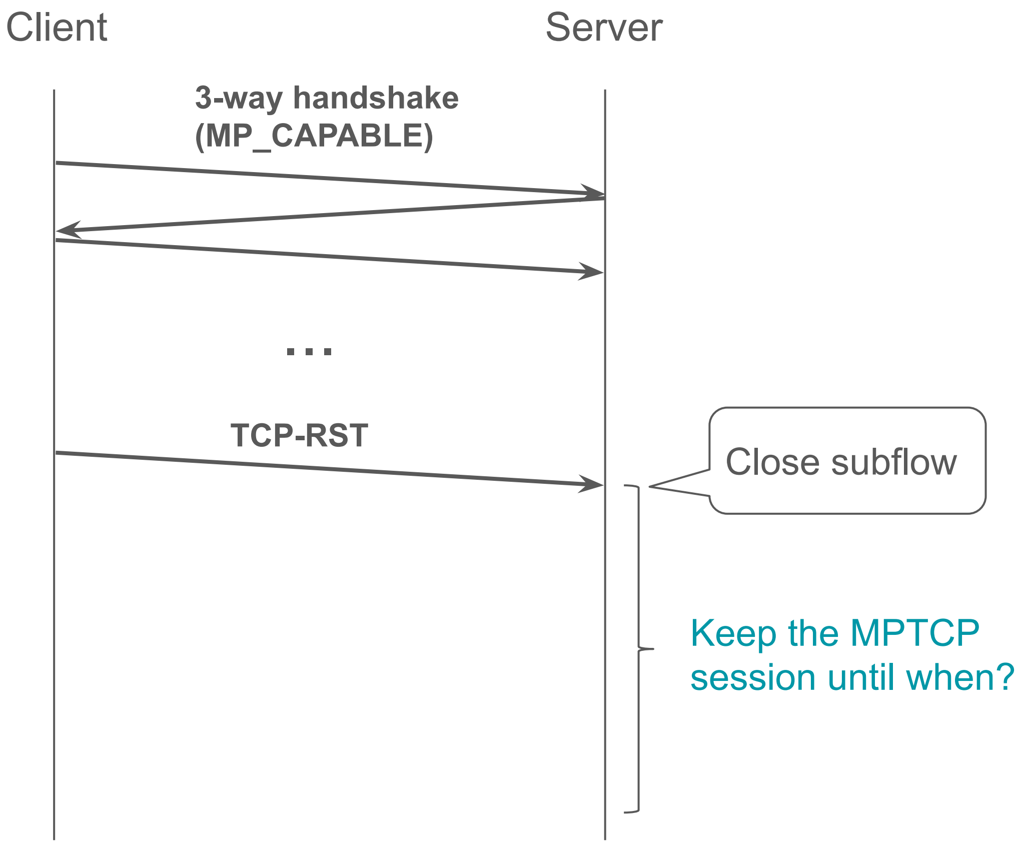
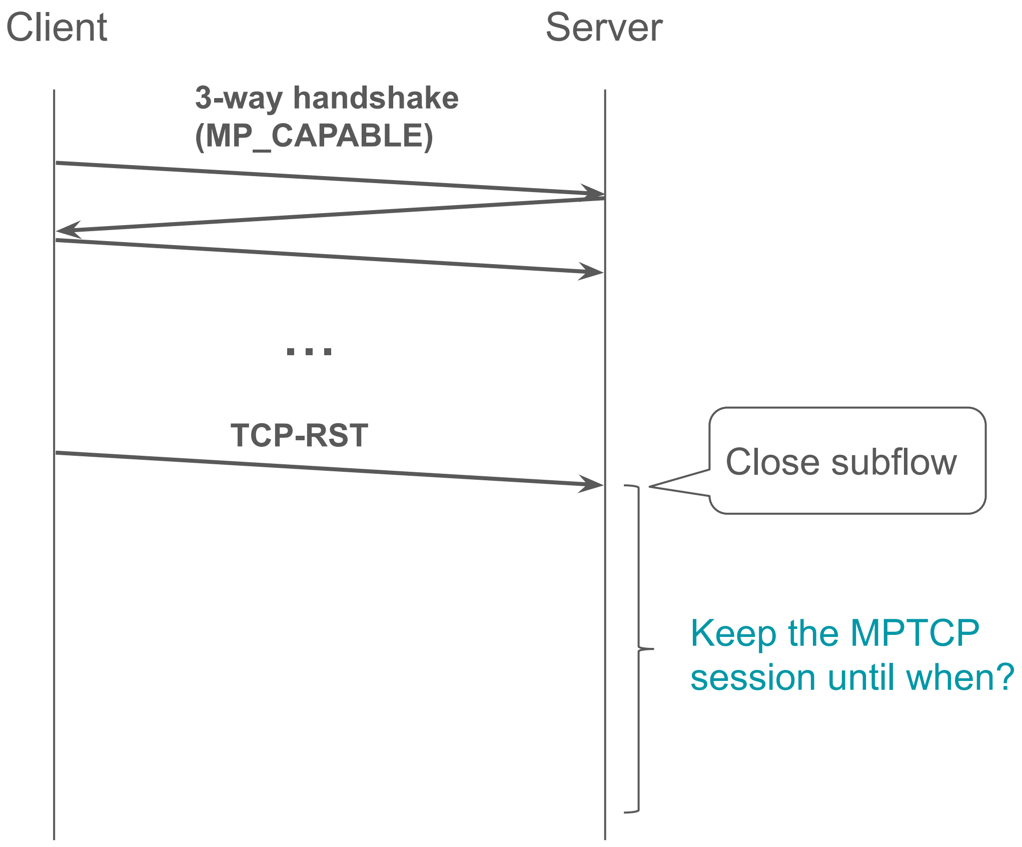
MPTCP Inactivity Time Option

MPTCP Inactivity Timeout (ITO)


Client
Server
3-way handshake (MP_CAPABLE)
...
TCP-RST
Close subflow
Keep the MPTCP session until when?

MPTCP Inactivity Timeout (ITO)


Client
Server
3-way handshake (MP_CAPABLE)
...
TCP-RST
Close subflow
Keep the MPTCP session until when?

RFC6824(-bis) does not specify how long MPTCP hosts should maintain idle sessions.

Inactivity time:
duration that an MPTCP session has no established subflow.

Recommend a Default ITO?

TCP does not recommend a default value for idle connection, but:

RFC1122: TCP KeepAlive >= 2 hours

RFC5382: NAT timeout >= 2 hours + 4 minutes

Use cases

1. Hosts want to keep the session alive through transient failures
   → Request its peer for an enough ITO.

   For TCP, this does not work due to NAT timeout

   For MPTCP, NAT is not a problem

2. Highly-loaded servers quickly terminate unused MPTCP sessions
   by setting a small local ITO.
   → May signal its clients that idle sessions will be closed shortly.

ITO Option Format

```
                     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 2 3 4 5 6 7 8 9
+---------------+---------------+-------+-------+-------------------------------+
|     Kind      |  Length = 5   |Subtype| (rsv) |  Inactivity Timeout (16 bit)  |
+---------------+---------------+-------+-------+-------------------------------+
```

Timeout Range:

`Min = 0`: remove session immediately when there is no active subflow

`Max = 2^16-1 seconds ~ 18 hours`

ITO option is indicative: Local policy could override this request

ITO option is exchanged unreliably

To improve the delivery: - May send X times per second/RTT/lifetime?

- Or attach it to a Sequence Number

Subflow Rate Limit Option

Motivation

Mobile users usually have limited cellular data quota

They want to use cellular networks, but still need to

limit the monetary cost, or

reserve the data quota.

But: traffic are mostly downstreamed, which clients cannot control.

→ Client could request the server a max sending rate on a subflow.

Option Format

Requested Rate (32 bits) is specified in IEEE-754 floating-point format

Range: from $1.2*10^{-38}$ to $3.4*10^{38}$

Unit: Kbps

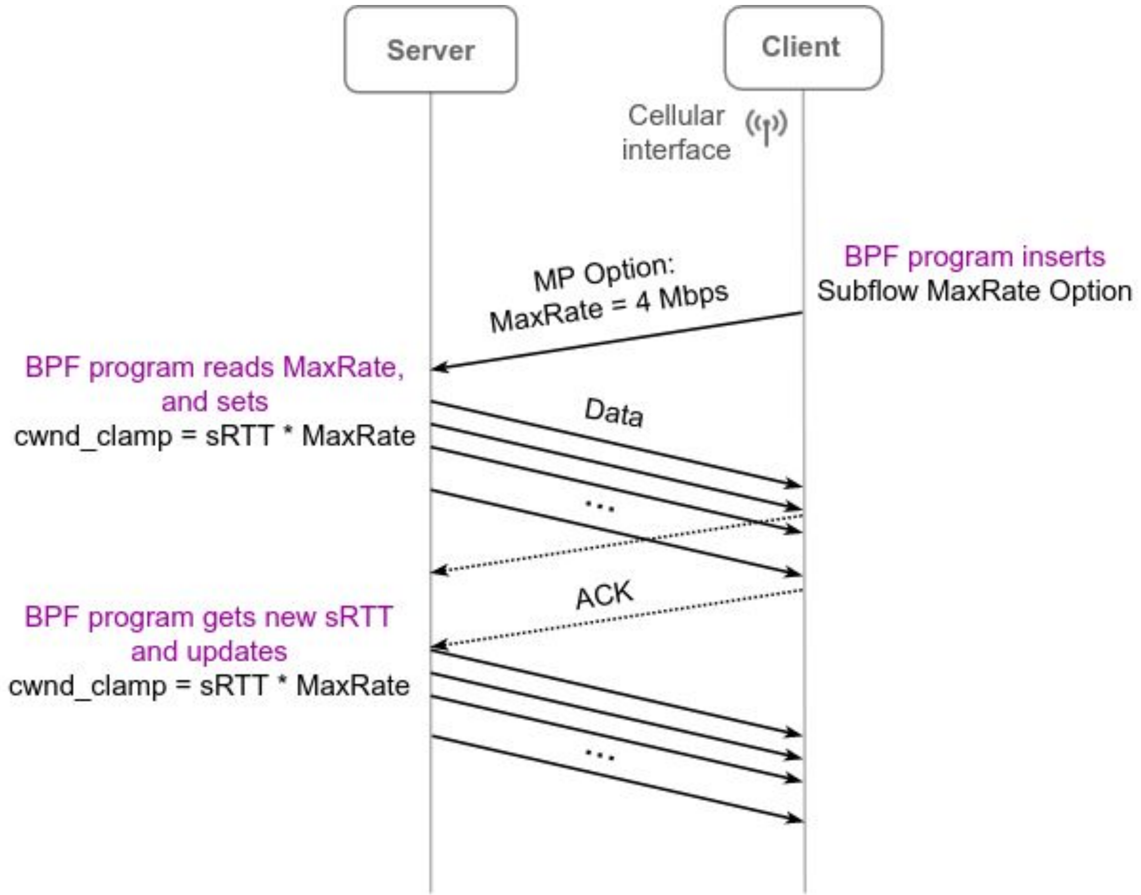
```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|S|    Exponent   |                  Fraction                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

SRL option is indicative and unreliable

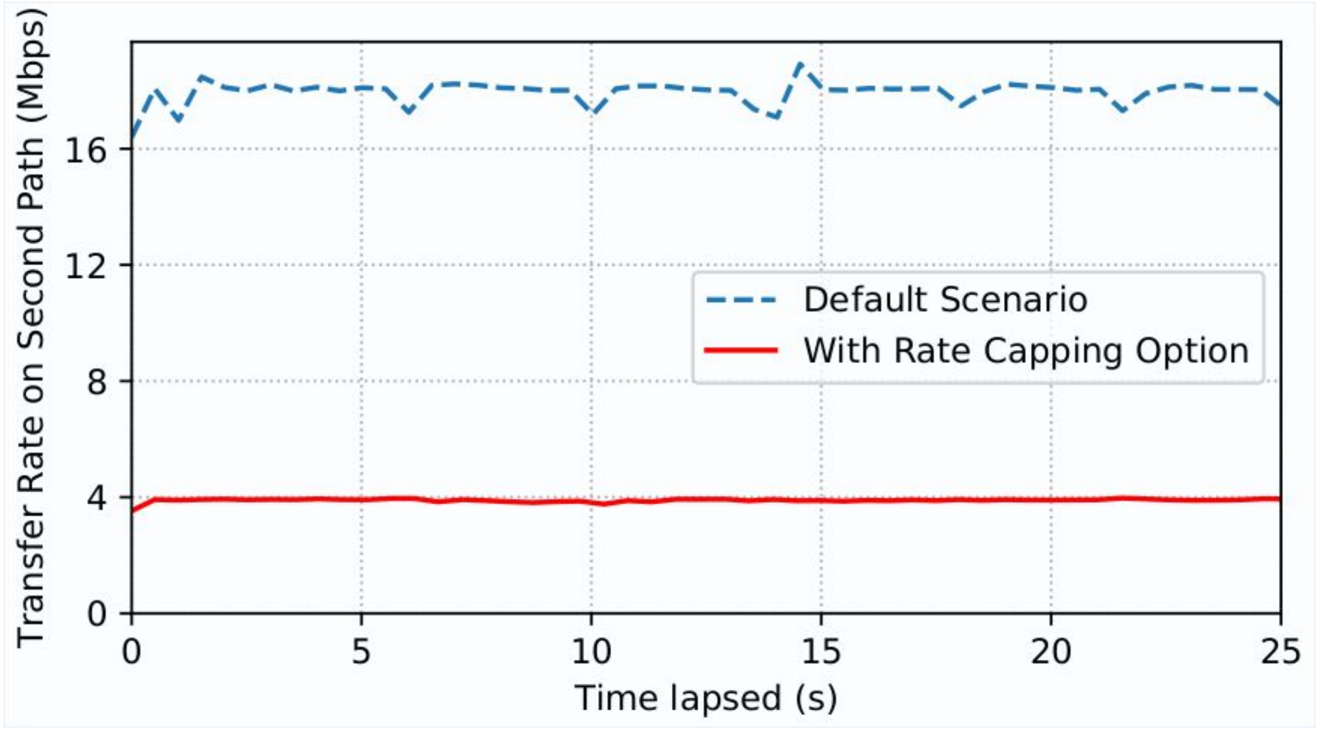
Linux Implementation Prototype

Used eBPF to quickly testing new MPTCP options

Based on TCP-BPF (in mainline Linux)


Server
Client
Cellular interface
BPF program inserts Subflow MaxRate Option
MP Option: MaxRate = 4 Mbps
BPF program reads MaxRate, and sets cwnd_clamp = sRTT * MaxRate
Data
...
ACK
BPF program gets new sRTT and updates cwnd_clamp = sRTT * MaxRate
...

Experiment: Capping on second subflow



Request rate-limit of Zero?

Allow peers to disable a subflow temporarily

Open Questions

Improve reliability

- May send X times per second/RTT/lifetime?
- Should the server respond to the request?

Duration of rate-limit policy

- until the end of connection?
- or allow clients to specify?

Combine with other use cases?

- backup when latency/bw satisfied
- traffic ratio among subflows
- cap max amount of data

SRL Option: Security Considerations

Attacker could throttle the rate on a subflow.

But, it could instead drop packets or inject TCP-RST or MP-FASTCLOSE.

Inserting option is one-off, while dropping packets needs continuity.

For specialized hardware, which one is easier?

Countermeasures

- Use HMAC? cannot protect initial path, but make it harder
- Receivers cap the values in a safe range

ITO Option: Security Consideration

Implementations should define a safe range of values, restricting:

- Local setting by applications
- Received ITO options

May restrict accepting ITO options only from trusted peers.