

Multipath TCP Extension for Robust Session Establishment

draft-amend-mptcp-robe-01.txt

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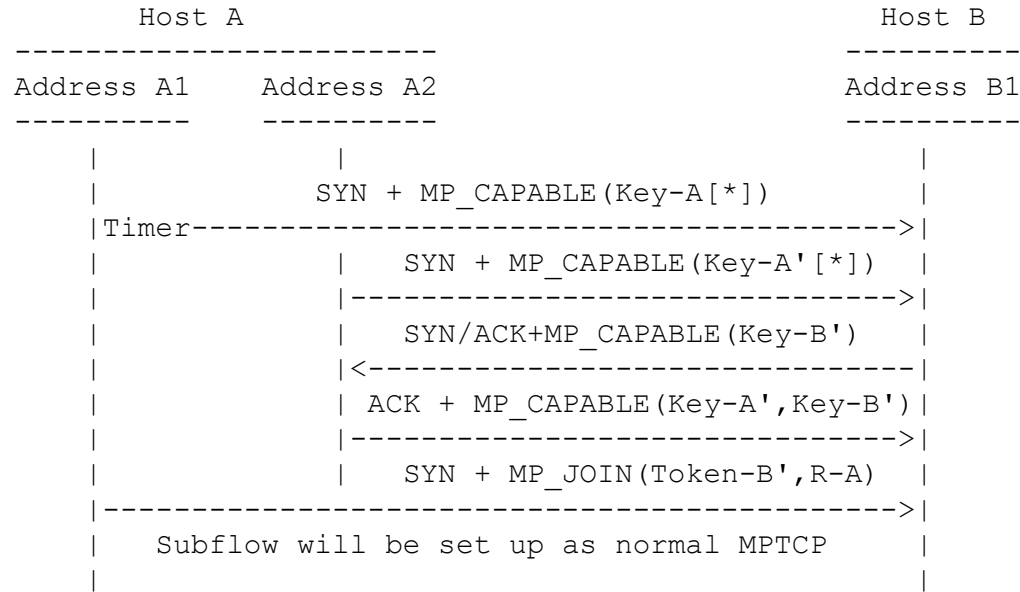
Updates since IETF105

- Merger with draft-kang-mptcp-initial-path-selection
- Renamed the original RobE_EXT from -00 draft to RobE_eSIM
- Adding new solutions RobE_IPS and RobE_TIMER
- Improved document structure with distinguishing between solutions requiring MPTCP protocol adaption or not.
- Started to define Fallback concepts

Definition for Robust Session Establishment

1. MPTCP RobE is a set of extensions to regular MPTCP [RFC6824] and its next upcoming version [I-D.ietf-mptcp-rfc6824bis]. It is designed to provide a more Robust Establishment (RobE) of MPTCP sessions.
2. RobE includes RobE_TIMER, RobE_SIM, RobE_eSIM and RobE_IPS. It also presents the design and protocol procedure for the combination scenario in addition to these stand-alone solutions, i.e. the combination of RobE_SIM and RobE_IPS, the combination of RobE_TIMER and RobE_IPS.

The RobE_Timer Solution



[*] Key-A in the first MP-capable is related to RFC6824 only and does not exist in RFC6824bis.

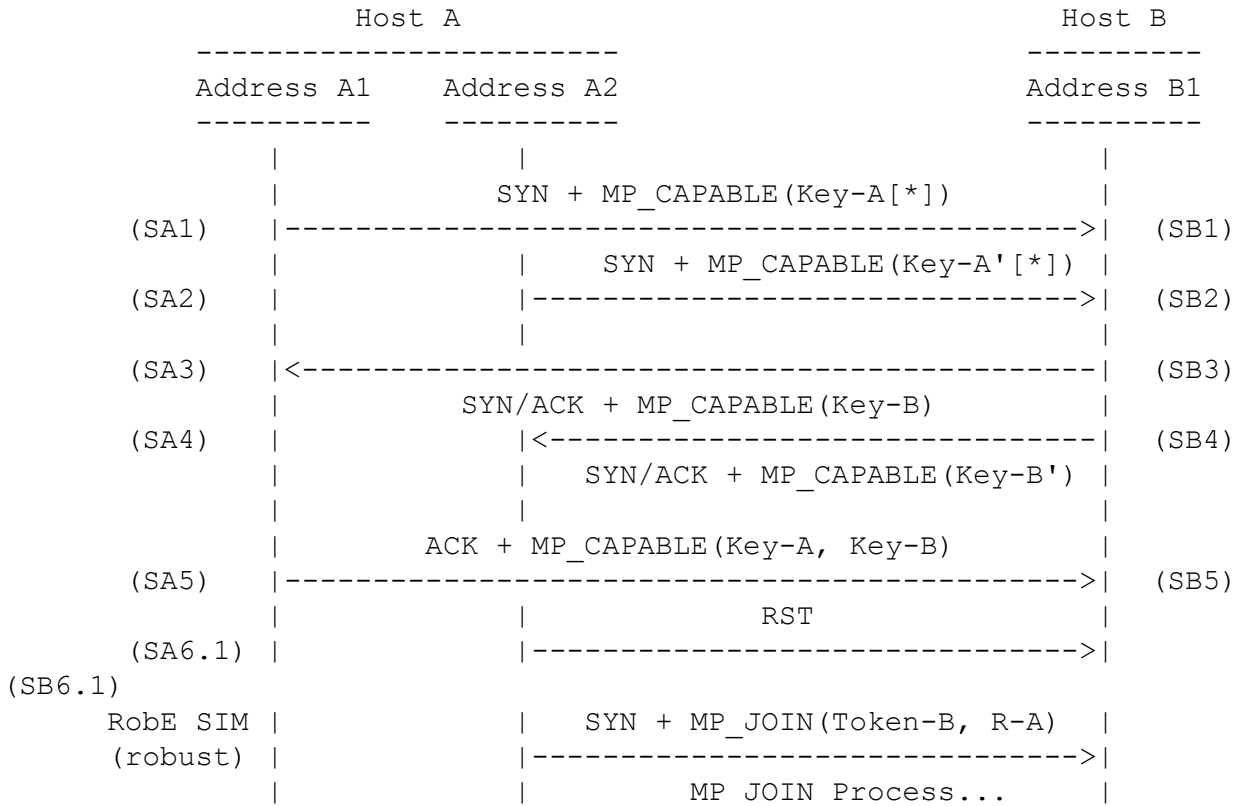
Figure 2: The RobE_TIMER Solution

In **RobE_TIMER**, resiliency against network outages is achieved by modifying the SYN retransmission timer: If one path is defective, another path is used.

[Notes]:

1. How to set the Timer is TBD.
2. If there is the case that the first SYN on default path arrives earlier than that from the second path, the MPTCP connection will be initialized on the path of the first SYN. The server could treat the second SYN as obsolete and drop it.

The RobE_SIM Solution



[*] Key-A in the first MP-capable is related to RFC6824 only and does not exist in RFC6824bis.

Figure 3: MPTCP RobE_SIM Connection Setup

RobE_SIM provides the ability to simultaneously use multiple paths for connection setup.

RST is used to terminate connections setup on other paths when connection has been established on the fastest path.

The RobE_IPS Solution

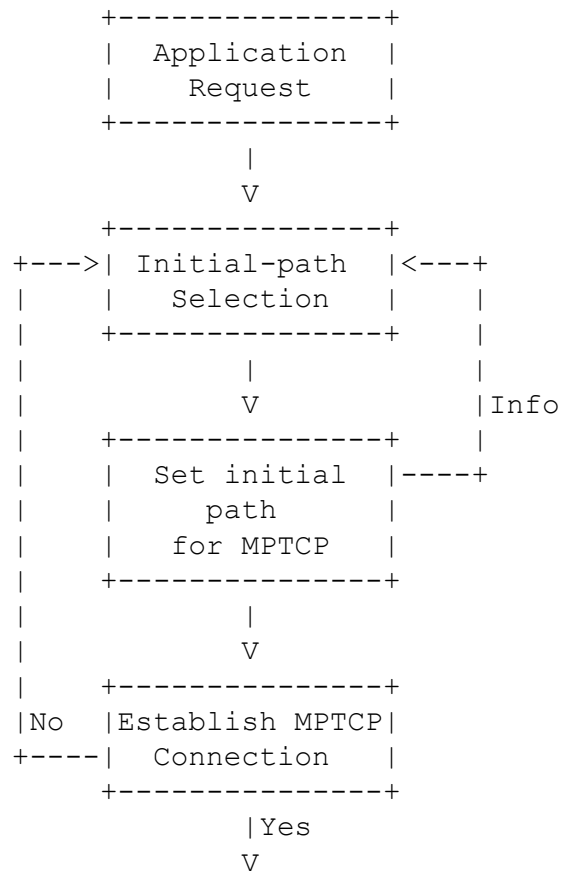


Figure 5: RobE_IPS for each connection establishment

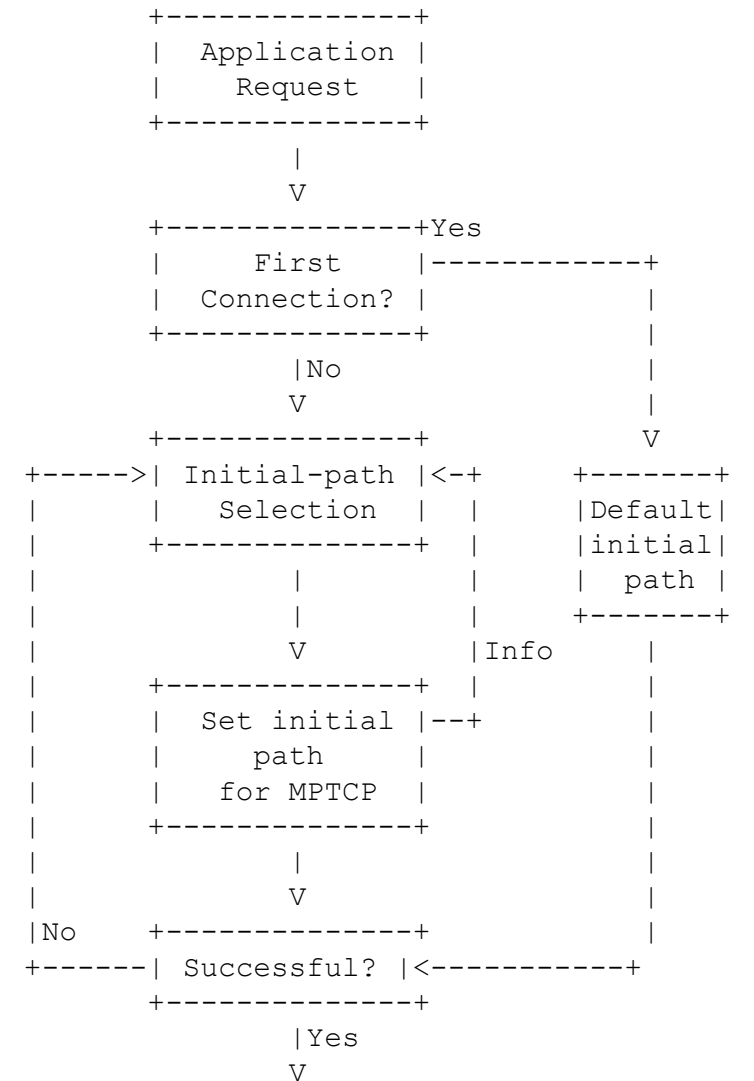
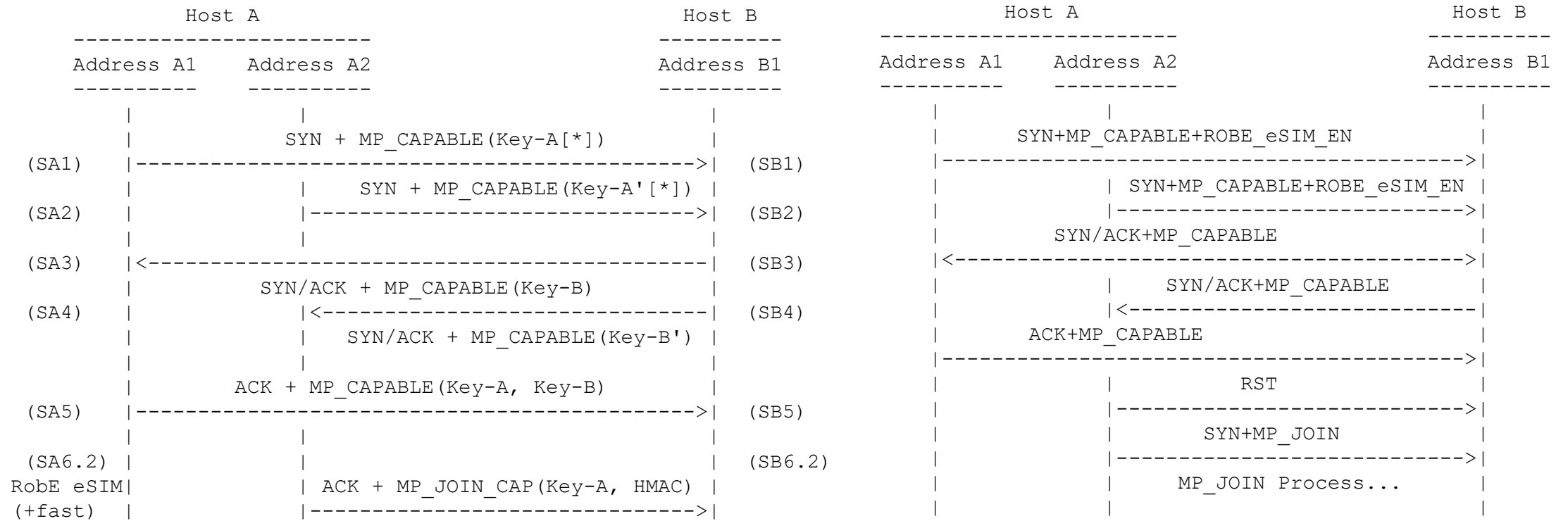


Figure 6: RobE_IPS using default route when no meaningful heuristic available

RobE_IPS provides a heuristic to select properly an initial path for connection establishment with a remote host based on empirical data derived from previous connection information.

The RobE_eSIM Solution



[*] Key-A in the first MP-capable is related to RFC6824 only and does not exist in RFC6824bis.

Figure 15: Fallback to MPTCP when missing RobE_eSIM support

Figure 11: MPTCP RobE_eSIM implicit Connection Setup

RobE_eSIM provides the ability to simultaneously use multiple paths for connection setup.

MP_JOIN_CAP is used for decreasing overhead, merging all simultaneous established paths without MP_JOIN process

ROBE_eSIM_EN can be used for negotiation between both sides.

RobE_IPS with Server-RTT

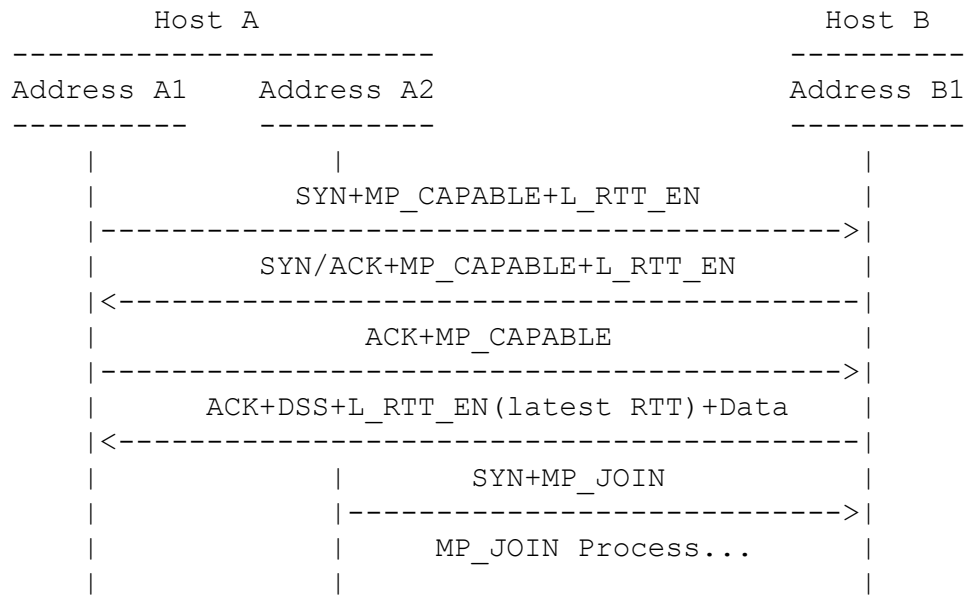


Figure 18: Negotiation procedure for RTT exchange

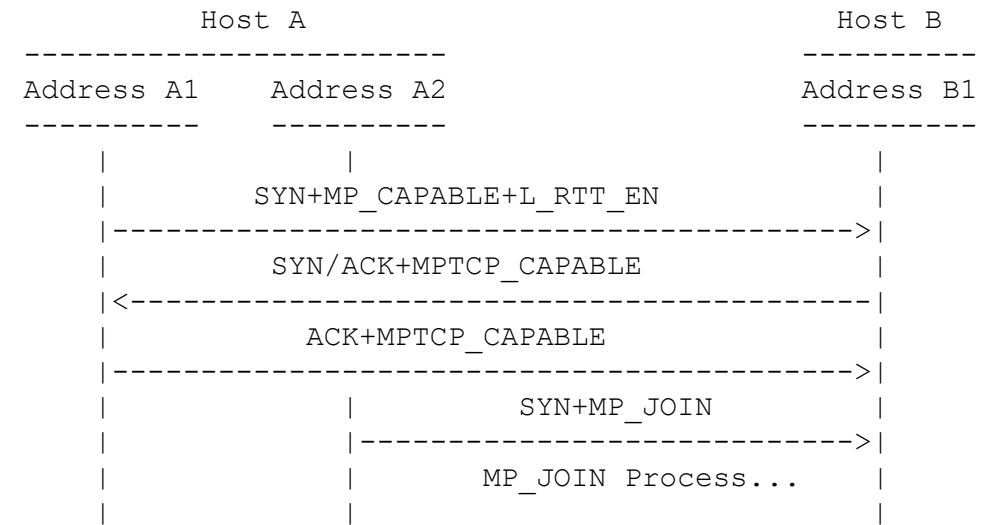
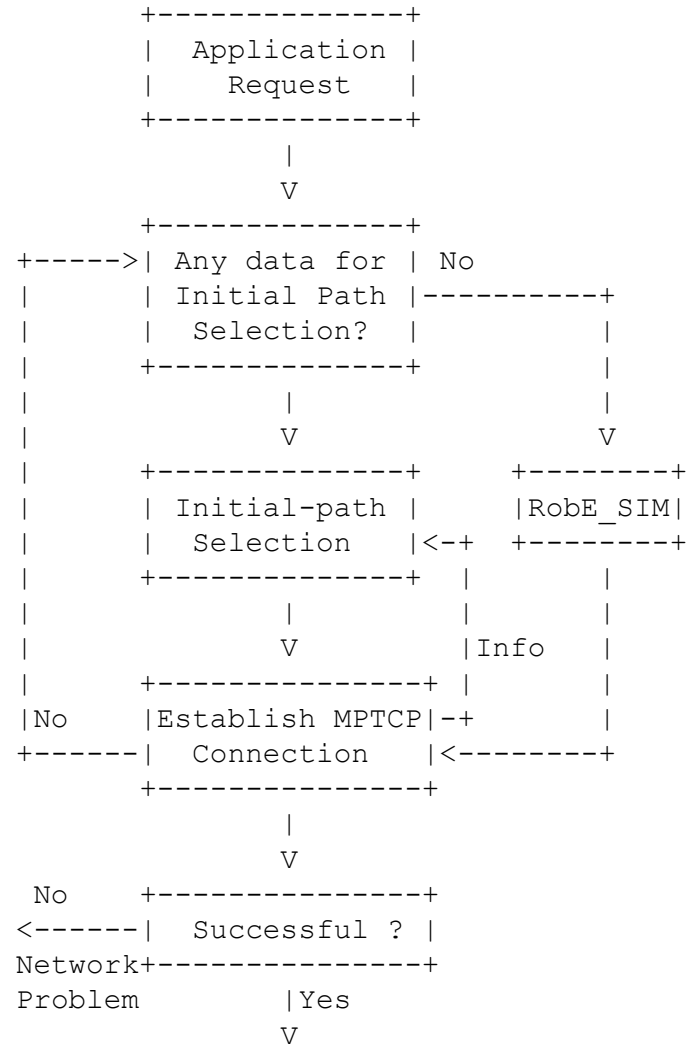


Figure 20: Fallback to MPTCP without RobE_IPS

For the asymmetric downloading service, the latest RTT for these subflows is calculated by data sender, i.e. application server and transformed to date receiver.

L_RTT_EN is used for negotiation of this capabilities between both sides during session establishment when RobE_IPS is enabled on client and returning latest RTT from server to client.

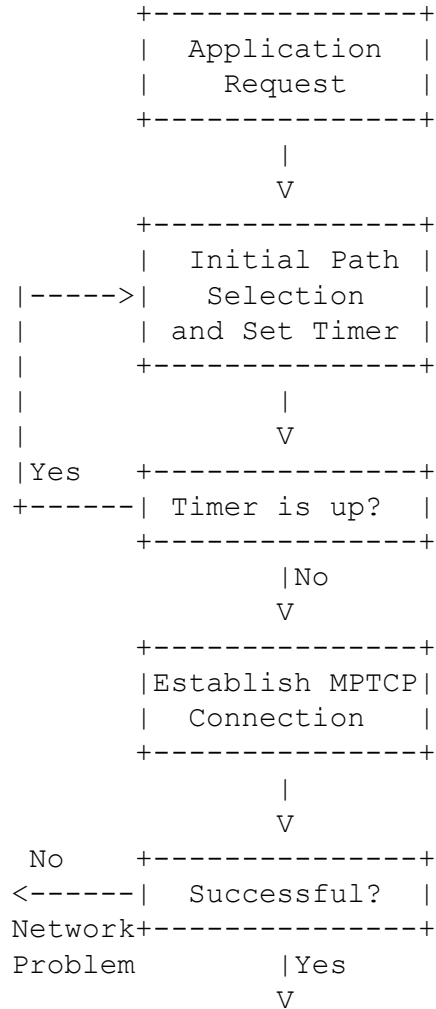
Combination of RobE_SIM and RobE_IPS



RobE_SIM can be used at the very beginning when the sender is ignorant about path info. And optimal initial path selection can be used for consecutive connections.

Figure 9: Combination of RobE_SIM and RobE_IPS

Combination of RobE_TIMER and RobE_IPS



When the system enables RobE_IPS and uses the selected initial path for session establishment, it sets the timer for path switching.

When timer is up, the system will change to another path for re-establish connection considering the requirement for time delay from application.

Figure 10: Combination of RobE_Timer and RobE_IPS

IANA Considerations

Value	Symbol	Name	Reference
TBD	ROBE_eSIM_EN	RobE_eSIM enabled	Section 3.1
TBD	MP_JOIN_CAP	Join connection directly in RobE_eSIM	Section 3.1
TBD	L_RTT_EN	Server RTT enabled	Section 3.2

Overview RobE Features

Scenario	MPTCP	RobE_TIMER	RobE_SIM	RobE_eSIM	RobE_IPS
IP packet loss	Delayed connection	In the scope of timer	No impact	No impact	Delayed connection
IP broken	No connection	In the scope of timer	No impact	No impact	No Connection
IP setup duration dependency	Default route	Default route (+ path 1..n)	Fastest path	Fastest path	Selected Path
MP availability duration	MP_CAPABLE HS + MP_JOIN HS	Sum_1..n(MP_CAPABLE_n HS) + MP_JOIN HS	MP_CAPABLE HS + MP_JOIN HS	max (MP_CAPABLE_1 .. MP_CAPABLE_2 HS)	MP_CAPABLE HS + MP_JOIN HS
Guaranteeing session setup	Depend on the default route	Yes	Yes	Yes	Depends on selection

IP: Initial Path; MP: Multi-Path; HS: Handshake

Next Steps

1. Ready for adoption?
2. Any comments welcome