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## **Subtype Capability Exchange During MPTCP Handshake**

### **Abstract**

Multipath TCP provides the ability to simultaneously use multiple paths between peers. MPTCP protocol defines seven subtypes in MPTCP v0 [RFC6824] and ten subtypes in MPTCP v1 [RFC8684] to differentiate message types and implement some additional functions during a session.

This draft proposes an enhancement to support Subtype Capability Exchange during MPTCP connection establishment in order to improve elastic scalability of MPTCP protocol. It includes: 1) requirements for which this kind of capability exchange during handshake is important for a MPTCP session; 2) a typical flow for Subtype Capability Exchange between peers; 3) a feasible solution on protocol design is suggested.

### **Status of This Memo**

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## Table of Contents

- [1. Introduction](#)
  - [1.1. Requirements Language](#)
  - [1.2. Background](#)
- [2. One Typical Flow](#)
- [3. Protocol Implementation](#)
  - [3.1. Carrying Subtype Capabilities in MP\\_CAPABLE Option](#)
- [4. Security Considerations](#)
- [5. IANA Considerations](#)
- [6. References](#)
  - [6.1. Normative References](#)
  - [6.2. Informative References](#)
- [Authors' Addresses](#)

## 1. Introduction

### 1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

### 1.2. Background

Table 1 lists all subtypes that have been specified in current MPTCP versions. Besides version negotiation, MPTCP peers can not interact with each other on the granularity of subtype capability. This feature may cause inflexible protocol extension. For example, if a new message type A is added in future extension, a higher version should be released to import it and a new subtype may need to be allocated. Another case is that if a sender does not know the subtypes supported by a receiver in a MPTCP session, as a result, invalid data packets may be sent from the sender during data transmission and the receiver will discard it which causes system overhead on receiver side.

Value	Symbol	Name	MPTCPv0	MPTCPv1
0x0	MP_CAPABLE	Multipath Capable	Supported	Supported
0x1	MP_JOIN	Join Connection	Supported	Supported
0x2	DSS	Data Sequence Signal (Data ACK and Data Sequence Mapping)	Supported	Supported
0x3	ADD_ADDR	Add Address	Supported	Supported

Value	Symbol	Name	MPTCPv0	MPTCPv1
0x4	REMOVE_ADDR	Remove Address	Supported	Supported
0x5	MP_PRI0	Change Subflow Priority	Supported	Supported
0x6	MP_FAIL	Fallback	Supported	Supported
0x7	MP_FASTCLOSE	Fast Close	Supported	Supported
0x8	MP_TCP_RST	Subflow Reset	/	Supported
0xf	MP_EXPERIMENTAL	Reserved for Private Use	/	Supported

Table 1: Overview MPTCP Subtypes

This document suggests a new function of Subtype Capability Exchange during MPTCP handshake in the scenario that MPTCP peers in a session support same MPTCP protocol version but with different subtype sets.

## 2. One Typical Flow

Figure 1 illustrates a typical flow for this Subtype Capability Exchange during MPTCP connection setup. The field of Subtype Capability is used to indicate whether these subtypes are supported by the sender, for example, Host A Subtype Capabilities indicates the status of the subtypes on Host A and Host B Subtype Capabilities indicates that on Host B. Through the transmission of this information between both parties, a sender can determine whether a message can be properly processed by its receiver and only send the message that can be supported by the receiver during data transmission.

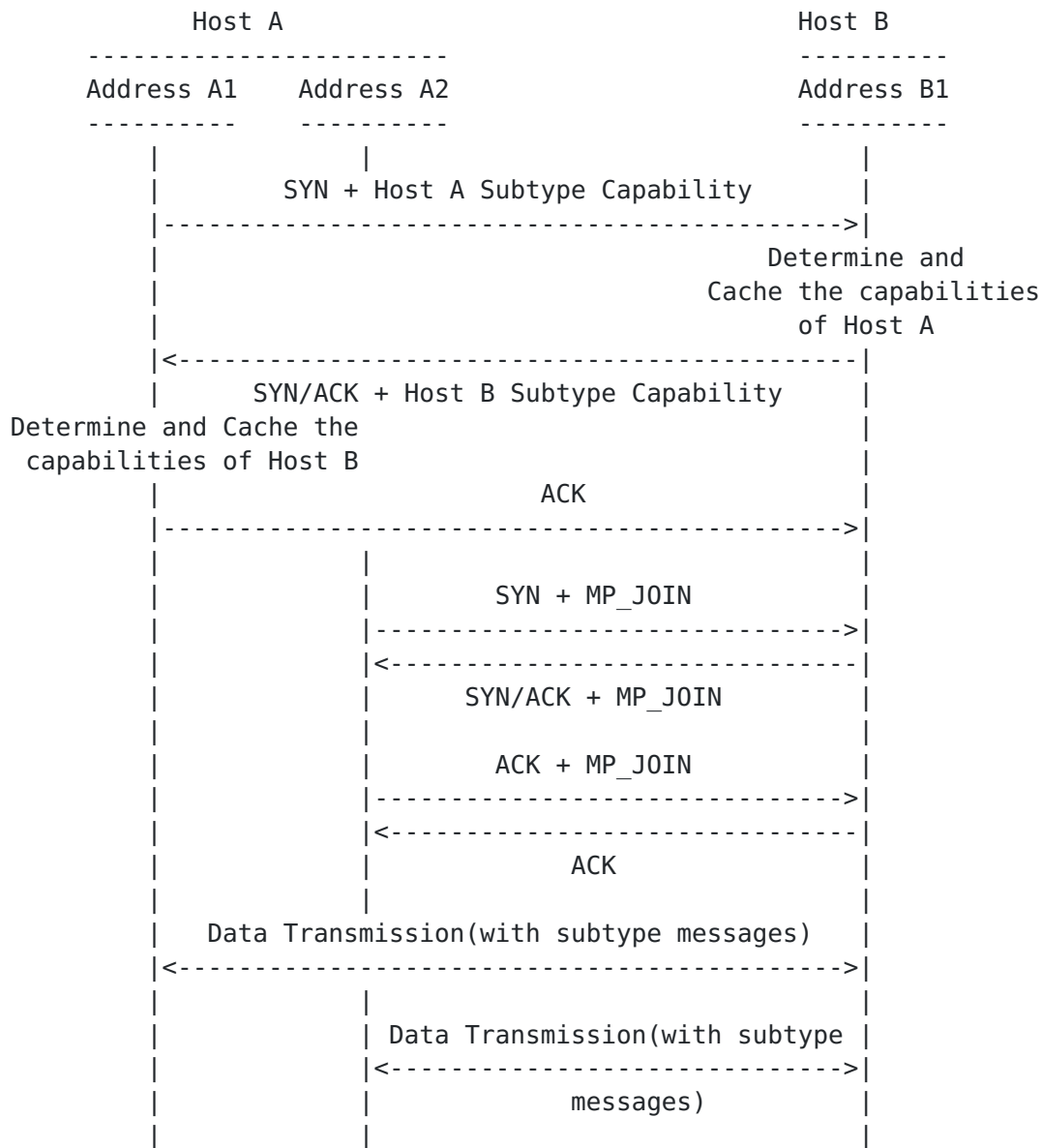


Figure 1: MPTCP Subtype Capability Exchange

In practice, another possible implementation is as follows: after receiving the subtype capability information sent by Host A, Host B determines the common subtype sets supported by both parties, and returns this common subtype sets in the reponse. Host A caches this common subtype sets locally. In data transmission phase, Host A sends the specified subtype messages to Host B that are included in the common subtype sets. As an alternative solution, its protocol design on MPTCP will be considered and updated in later versions.

### 3. Protocol Implementation

This document describes one solution on the modifications to MPTCP protocol to support this mechanism. In this solution, MP\_CAPABLE option is used and extended to add bits to carry subtype capabilities

information. There should be other possible solutions that can be defined in subsequent discussions.

### 3.1. Carrying Subtype Capabilities in MP\_CAPABLE Option

In Figure 2, a 32-bit "OptionSupported" is added to MP\_CAPABLE option to indicate whether the subtypes are supported by the sender.

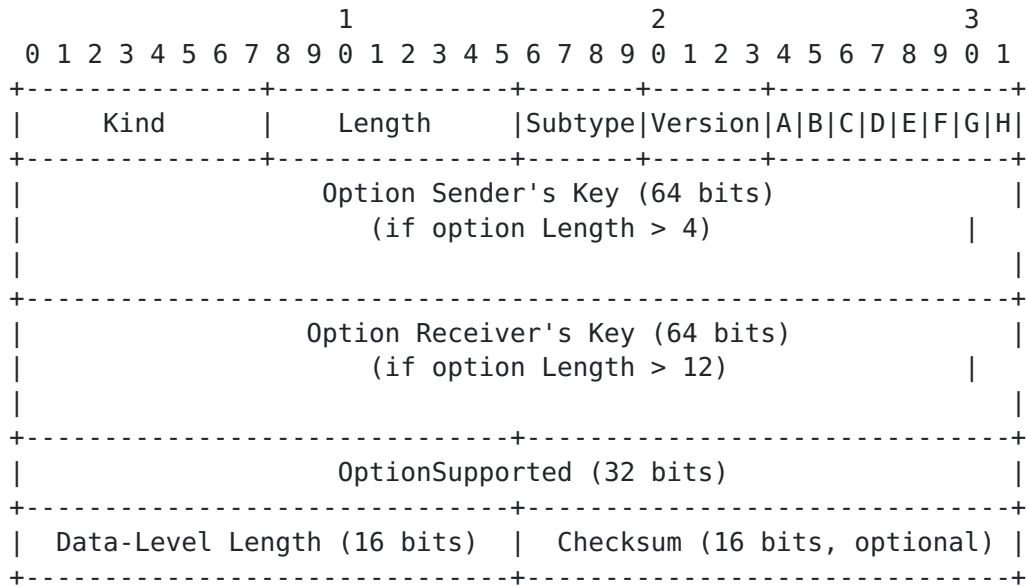


Figure 2: OptionSupported Format

For MPTCP v1, ten subtypes has been defined and applied in practice. So the first 10-bits in OptionSupported field is used for indicating whether these subtypes is supported by sender. The order is listed below:

0: MP\_CAPABLE

1: MP\_JOIN

2: DSS

3: ADD\_ADDR

4: REMOVE\_ADDR

5: MP\_PRIO

6: MP\_FAIL

7: MP\_FASTCLOSE

9: MP\_TCPRST

10: MP\_EXPERIMENTAL

11~31: Reserved for Future Use

Two values, that is 0 and 1, can be set to these bits in OptionSupported field. The value of 0 indicates that the sender does not support this subtype. The value of 1 indicates that the sender supports this subtype.

#### **4. Security Considerations**

To be added.

#### **5. IANA Considerations**

To be added.

#### **6. References**

##### **6.1. Normative References**

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##### **6.2. Informative References**

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