



# Considerations for MPTCP Operation in 5G

<https://tools.ietf.org/html/draft-defoy-mptcp-considerations-for-5g-01>

Xavier de Foy, Michelle Perras (InterDigital), Uma Chunduri (Huawei),  
Kien Nguyen, Mirza Golam Kibria, Kentaro Ishizu, Fumihide Kojima (NICT)

MPTCP @ IETF 102 – Montreal

# What Changed Since IETF 101

- Revision 0 was presented in IETF 101. Feedback included:
  - There is an interest for MPTCP in 5G, but the proposal should be more concrete.
  - DMM is defining session continuity types for IP addresses.
- Between IETF 101 and 102:
  - We adapted the section on session continuity:
    - It is now using session continuity types as input to the MPTCP scheduler.
    - It is possible to send session continuity types over MPTCP signaling, so that the remote scheduler can also use this information.
  - There was some progress on Dual Connectivity, but no major update of the draft.

# Background

**Session continuity types** are defined in *draft-ietf-dmm-ondemand-mobility* for IP addresses provided by mobile networks. They will be used in 5G [1]. Four types are defined:

A **FIXED\_IPV6\_ADDRESS** is valid for a long time (it enables session continuity and address reachability)

A **SESSION\_LASTING\_IPV6\_ADDRESS** is valid over the IP session(s) lifetime, even after moving from one PoA to another (it enables session continuity, not address reachability)

A **NON\_PERSISTENT\_IPV6\_ADDRESS** does not enable session continuity nor address reachability and typically enables BBM handovers

A **GRACEFUL\_REPLACEMENT\_IPV6\_ADDRESS** is similar to a non persistent address but enables MBB handovers.

An application can request an IP address of a certain type using a new `setsc()` socket API.

Router advertisements may carry session continuity types (*draft-feng-dmm-ra-prefixtype*).

Some information on 5G **PDU Sessions** and **Session & Service Continuity (SSC)** is in appendix

[1] IETF-3GPP liaison statements: <https://datatracker.ietf.org/liaison/1554/>, [S2-181481.zip](https://datatracker.ietf.org/liaison/1554/S2-181481.zip), <https://datatracker.ietf.org/liaison/1567/>

# Usage of Session Continuity Type in MPTCP

**SSC mode 1** - the initial SESSION\_LASTING (or FIXED) IP address can be temporarily complemented by a NON\_PERSISTENT IP address

The session continuity type may not be useful to MPTCP in this case.

**SSC mode 2** - the initial NON\_PERSISTENT IP address is replaced with another NON\_PERSISTENT IP address after a short break

The session continuity type indicates to the MPTCP stack that a BBM transition is expected.

The type is also useful to track and update the backup address.

**SSC mode 3** - the initial GRACEFUL\_REPLACEMENT IP address is replaced with another GRACEFUL\_REPLACEMENT address. There is an overlap period.

Knowing the session continuity type enables making the distinction with SSC mode 1, and performing a graceful migration of traffic from the first to the second IP address.

The remote peer can implement this behavior as well, if the type is transmitted over MPTCP signaling.

The type is also useful to track and update the backup address.

u The session continuity type is a useful input to operate in 5G scenarios, it enables distinguishing between cases (e.g. SSC mode 1 and 3), and offers flexibility for future evolution.

# Dual Connectivity and MPTCP

- Some co-authors have analyzed the 3GPP specifications (Release 15) with a focus on the issue of MPTCP over dual connectivity.
- A result was a numerical analysis framework for multipath communication (in general) using DC
  - Paper [1] models DC and optimizes a traffic split for latency
- There was no major update of this section of the draft, yet.

[1] Kien Nguyen, Mirza Golam Kibria, Jing Hui, Kentaro Ishizu, and Fumihide Kojima, "Minimum Latency and Optimal Traffic Partition in 5G Small Cell Networks," IEEE VTC Spring, Porto, Portugal, June 2018.

# Next Steps: Experimentation, WG Adoption...

## Session Continuity Section

- Collect and address feedback on the recent change to use the DMM-defined session continuity type
- Experimentation (using simulation/emulation)

## Dual Connectivity Section

- Prototype MPTCP over DC (using simulation/emulation)
- Identify impacts on MPTCP and 3GPP

## Towards WG Adoption

- Is the working group considering adopting this work?  
Topic could be: MPTCP adaptation and optimization for 5G

Extra Slide

# SSC and Related Concepts in 5G

**Session and Service Continuity (SSC)** addresses various continuity requirements of applications.

- SSC is based on a distributed mobility system (where network anchors have a service area).
- It has multiple SSC modes (1:fixed anchor, 2:distributed anchors + BBM, 3:distributed anchors + MBB).
- A 5G device selects an appropriate SSC mode for each application, based on local policy – otherwise the network selects it.

**PDU Session** is a unit of network service that can hold multiple QoS flows.

- Connected to a single data network, through one or more network anchors (“multi-homed PDU sessions”).
- Associated with a single, non-modifiable session continuity mode, network slice, and type (IPv4/IPv6/Ethernet/Unstructured).
- Goes over a single radio access type at a given time.
- Corresponds to a network interface on the device (probably – it’s a likely implementation choice).
- Different applications running on a device may use different PDU sessions (e.g. for different data network, SSC mode or slice).