**3GPP SA4#129-e S4-241587r02**

**Online, 19th – 23rd August 2024 *Revision of S4-241252***

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| *CR-Form-v12.0* | | | | | | | | |
| **PSEUDO CHANGE REQUEST** | | | | | | | | |
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|  | **26**.**804** | **CR** | **0013** | **rev** | **3** | **Current version:** | **18.1.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** | [FS\_AMD] Multi-Access with ATSSS: Addition of CMMF | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Dolby Sweden AB | | | | | | | | | |
| ***Source to TSG:*** | S4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | FS\_AMD | | | | |  | ***Date:*** | | | 2024-08-13 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)*  *Rel-17 (Release 17)*  *Rel-18 (Release 18)* | |
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| ***Reason for change:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Addition of CMMF as a candidate solution | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.15.6.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* \* First change\* \* \* \*

## 2 References

[MPTCP] IETF RFC 8684: "TCP Extensions for Multipath Operation with Multiple Addresses", March 2022.

[MPQUIC] Q. De Coninck, O. Bonaventure, C. Huitema, M. Kuehlewind, draft-ietf-quic-multipath-10, "Multipath Extension for QUIC", July 2024.

\* \* \* \* Second change \* \* \* \*

### 5.15.1 Description

#### 5.15.1.3 Non-ATSSS multi-access using upper layer approaches under application control

UEs connected to multiple access networks (whether they be a 3GPP or non-3GPP network, multiple disjoint 3GPP networks, etc.) inherently have the capability to deploy and utilise multi-access techniques without lower-layer support such as ATSSS.

- The use of a multipath transport protocols such as MPTCP [MPTCP] or MPQUIC [MPQUIC] is one approach to enable multi-access media delivery. However, this approach requires implementation of the protocol(s) on both the UE and on the Application Server.

- Another method to enable multi-access media delivery is to use an application layer approach similar to that described in clause 5.19.1.3 whereby CMMF [CMMF – reference included within CR adding clause 5.19] is employed to enable efficient simultaneous use of the available access networks. The benefit of this approach is that the Application Server can remain agnostic of the UEs’ use of multiple access networks.

In either case, traffic steering and routing across the appropriate network is performed using existing functionality in both the UE and network. Multiple TCP and/or QUIC connections are set up where each is bound to a different UE network interface (each with an assigned IP address appropriate to its interface’s network). An Application Server may transmit media over one access network or another via the appropriate TCP and/or QUIC connection.

\* \* \* \* Third change \* \* \* \*

### 5.15.2 Collaboration scenarios

#### 5.15.2.Z Multi-access media delivery without using ATSSS

In this scenario, based on the description in clause 5.15.1.3, the Media Stream Handler in a 5GMS Client is connected (either directly or via functions within the UE) to multiple access networks (e.g., an unmanaged Wi‑Fi network and the 5G network). The 5GMS Client performs media delivery at reference point M4 with one or more 5GMS AS instances. The 5GMS Client may choose to switch between access networks or use multiple simultaneously. To do this, a 5GMS Client binds each HTTP connection to a specific UE network interface, allowing it to deterministically request and receive content over the appropriate access network(s)). This allows the client to distribute network load across access networks, optimise costs, as well as improve QoS.

The 5GMS Client’s Media Session Handler discovers the URL of each Application Server from Media Entry Points provided in Service Access Information, acquired either from the 5GMS Application Function (AF) at reference point M5, or else obtained from the 5GMS Application Provider via reference point M8.

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Figure 5.15.2.Z-1: Multi-access media delivery without using ATSSS

Figure 5.15.2.Z-1 shows the Media Stream Handler communicating with a single 5GMS AS instance through different access networks. Neither access network has direct communication with its peers. The 5GMS AS communicates (minimally) with the Application Provider at reference point M2 and with the 5GMS AF (not depicted) via reference point M3. In some scenarios, the 5GMS Client and 5GMS AS may use lower-layer functionality and/or functions to manage multi-access media delivery. In these cases, a single reference point M4 may be split among multiple access networks. In the particular case of multipath TCP [MPTCP], where multipath handling is typically a built-in kernel function, the 5GMS Client and 5GMS AS can be largely unaware of the use of multi-access delivery after creating an MPTCP socket.

\* \* \* \* Fourth change \* \* \* \*

### 5.15.3 Architecture mapping

Editor’s Note: Based on existing architectures, develop one or more deployment architectures that address the key topics and the collaboration models.

#### 5.15.3.Z Multi-access downlink media streaming using CMMF

Integration of CMMF within the 5GMS architecture is discussed in detail within clause 5.15.3.x. This clause discusses the differences for the collaboration scenario presented in clause 5.15.2.1.

\* \* \* \* Fifth change \* \* \* \*

### 5.15.4 High-level call flow

Editor’s Note: Map the key topics to basic functions and develop high-level call flows.

#### 5.15.4.Z Multi-access downlink media streaming using CMMF

\* \* \* \* Sixth change \* \* \* \*

### 5.15.5 Gap analysis and requirements

#### 5.15.4.Z Multi-access downlink media streaming using CMMF

\* \* \* \* Seventh change \* \* \* \*

### 5.15.6 Candidate solutions

Editor’s Note: Candidate solutions for identified key issue.

#### 5.15.6.Z Multi-access downlink media streaming using CMMF

This candidate solution includes approaches where a 5GMSd Client accesses and downloads, via reference point M4d, CMMF-encoded media objects [CMMF – reference included within CR adding clause 5.19], and possibly original source media (e.g., MPEG-DASH or HLS media segments), over multiple access networks simultaneously from a single 5GMSd AS. CMMF (discussed in detail within clause 5.19.6.3) enables multi-access capabilities through application-layer implementations of the 5GMSd Client without requiring lower-layer (e.g., network, transport, etc.) multi-access integrations.

In this solution, multiple different CMMF-encoded bitstreams/objects (or representations) of the source media are stored/cached within a single logical 5GMSd AS. A CMMF-enabled 5GMSd Client requests and downloads a different CMMF-encoded representation (stripe) of the required original source media over each of the access networks available to it. These (potentially partially) received CMMF bitstreams/objects are decoded by a CMMF decoder in the 5GMSd Client yielding the required original source content once enough information has been received over all of the available access networks.

Unlike other multi-access technologies such as MPTCP, MPQUIC, ATSSS, etc., the responsibility to set up, request, and steer the delivery of content across each available access network rests with the application layer (e.g., Media Player) in this solution. For example, a Media Player sets up multiple HTTP connections in parallel, each one bound to a different network interface (each assigned with an IP address appropriate to that network). Requests to a single 5GMSd AS for different CMMF-encoded representations (stripes) of the original source media are sent from each of the HTTP connections over the different access networks. The HTTP response from the 5GMSd AS to each of these requests is routed appropriately over the appropriate access network, following standard network-layer/IP routing rules and proceedures.

As mentioned above, traffic steering over each access network may be performed by the application layer (e.g., Media Player); and multiple policies can be defined/implemented based on the desired outcome. For example, a best-effort policy may envolve downloading as much CMMF-encoded content from each available access network until the CMMF decoder can successfully decode the required media. Networks that have lower latency, higher bandwidth, etc. will naturally contribute more to the download than those with higher latency, lower bandwidth, etc. Another policy may preference delivery of content from one access network over another. In this case, a schedular may be implemented so that requests of CMMF-encoded content made to the Application Server can be throttled over one access network so that the majority of the download is completed on the other(s).

Integration of CMMF within the 5GMS System is discussed in detail within clause 5.19.6.3.

\* \* \* \* End of changes \* \* \* \*