**3GPP TSG-SA WG4 Meeting 131 S4-250278**

**Geneva, Switzerland, 17th Feb – 21st Feb 2025 Revision of S4-250258**

|  |
| --- |
| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **26.501** | **CR** | **0107** | **rev** | **3** | **Current version:** | **18.8.0** |  |
|  |
| *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)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

|  |
| --- |
|  |
| ***Title:***  | [AMD-ARCH-MED] Stage 2 for Multi-access media delivery |
|  |  |
| ***Source to WG:*** | Samsung Electronics Co. Ltd., Dolby France SAS, BBC |
| ***Source to TSG:*** | S4 |
|  |  |
| ***Work item code:*** | AMD-ARCH-MED |  | ***Date:*** | 2025-02-19 |
|  |  |  |  |  |
| ***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 canbe found in 3GPP [TR 21. 900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | SP-241963 describes the work item objectives for the AMD-ARCH-MED work item. One of the objectives of this work item is the implementation of conclusions of study on topic of multi-access media delivery documented in TR 26804. Specifically, below are the details of the objectives related to this topic, extracted from the work item description:b. for *Multi-access media delivery* as introduced in clause 5.18 of TR 26.804:i adding an informative annex is added to TS 26.501 documenting:1. A brief description of multi-access media delivery, based on clause [5.18.1 of TR 26804].2. The mapping of the ATSSS architecture into the 5GMS architecture, as described in clause 5.18.3.2 of TR 26804  |
|  |  |
| ***Summary of change:*** | Based on conclusions in clause 6.18 of TR 26804, an Annex into the stage-2 specification is added with description of multi-access media delivery, and mapping of ATSSS architecture into the 5GMS architecture |
|  |  |
| ***Consequences if not approved:*** | Multi-access delivery feature for media streaming is incomplete. |
|  |  |
| ***Clauses affected:*** | 2, F (new) |
|  |  |
|  | **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:*** | S4aI250028: Implementing agreements based on conclusions of FS\_AMD study on topic of Multi-access media delivery.S4aI250036: Implementation of editorial comments received during Post #130 MBS adhoc meeting.S4-250258: Resubmission of S4AI250036 to SA4#131 meetingS4-250278: Cover page corrections from the previous revision |

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

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System architecture for the 5G System (5GS)".

[3] 3GPP TS 23.502: "Procedures for the 5G System (5GS)".

[4] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".

[5] Void

[6] 3GPP TS 26.307: "Presentation layer for 3GPP services".

[7] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".

[8] 3GPP TS 26.234: "Transparent end-to-end Packet-switched Streaming Service (PSS); Protocols and codecs".

[9] 3GPP TS 23.003: "Technical Specification Group Core Network and Terminals; Numbering, addressing and identification".

[10] 3GPP TS 28.530: "Management and orchestration; Concepts, use cases and requirements".

[11] 3GPP TS 28.531: "Management and orchestration; Provisioning".

[12] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[13] 3GPP TS 23.222: "Common API Framework for 3GPP Northbound APIs".

[14] IETF RFC 1034: "Domain names - concepts and facilities".

[15] 3GPP TS 23.548: "5G System Enhancements for Edge Computing; Stage 2".

[16] 3GPP TS 23.558: "Architecture for enabling Edge Applications".

[17] 3GPP TS 28.538: "Management and orchestration; Edge Computing Management".

[18] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description".

[19] 3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs".

[20] 3GPP TS 26.347: "Multimedia Broadcast/Multicast Service (MBMS); Application Programming Interface and URL".

[21] 3GPP TS 26.348: "Northbound Application Programming Interface (API) for Multimedia Broadcast/Multicast Service (MBMS) at the xMB reference point".

[22] 3GPP TS 26.531: "Data collection and reporting; General description and architecture".

[23] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[24] 3GPP TS 27.007: "AT command set for User Equipment (UE)".

[25] CTA-5005: "Web Application Video Ecosystem – DASH-HLS Interoperability Specification".

[26] 3GPP TS 26.511: "5G Media Streaming (5GMS); Profiles, Codecs and Formats".

[27] ISO/IEC 23000-19: "Information Technology Multimedia Application Format (MPEG-A) – Part 19: Common Media Application Format (CMAF) for segmented media".

[28] IETF RFC 8216: "HTTP Live Streaming".

[29] ISO/IEC 23009-1: "Information Technology – Dynamic Adaptive Streaming Over HTTP (DASH) – Part 1: Media Presentation Description and Segment Formats".

[30] 3GPP TS 26.502: "5G Multicast-Broadcast User Service Architecture".

[31] Void.

[32] 3GPP TS 26.506: "5G Real-time Media Communication Architecture".

[33] 3GPP TS 23.222: "Common API Framework for 3GPP Northbound APIs".

[34] 3GPP TS 33.122: "Security aspects of Common API Framework (CAPIF) for 3GPP northbound APIs".

[35] IETF RFC 6749: "The OAuth 2.0 Authorization Framework", October 2012.

[RFC6897] IETF RFC 6897: "Multipath TCP (MPTCP) Application Interface Considerations", March 2013

[MPQUIC] IETF Internet Draft: "Multipath Extension for QUIC", draft-ietf-quic-multipath-10, July 2024

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

Annex F (informative):
Multi-access media delivery

#### F.1 Introduction

Media streaming applications traditionally obtain content from a single source over a single path within a network. This imposes several limitations:

1. Performance is constrained to that of the source and path chosen. Any limits on network bandwidth and latency between the client and that source are directly translated to the client’s achievable Quality of Service (QoS) and Quality of Experience (QoE).

2 Disruptions or degraded performance caused by any of the network links between the client and source can lead to poor user experience, often in the form of lower playback quality, rebuffering, or complete playback failure.

Multi-access technologies may be integrated into the 5G Media Streaming System to allow media streaming applications to efficiently access content from the source over multiple access networks either serially or concurrently, potentially guided by the service or network provider.

To access content over multiple access networks, a UE may use a 3GPP access network and/or a non-3GPP access network. However, a UE contains at most one USIM and smartphone UEs with multiple SIM card slots are not typically able to use more than one at the same time. Multiple UEs may be combined in a single device to form a composite terminal that is able to access more than one access network concurrently. In a common scenario for media production, 5G modem units provide multiple SIM card slots intended for concurrent use.

UEs connected to multiple access networks (whether they be a 3GPP access network or non-3GPP access network, multiple disjoint 3GPP networks, etc.) may deploy and utilise multi-access techniques using any of the following:

- The use of a multipath transport protocols such as MPTCP [RFC6897] or MPQUIC [MPQUIC] is one approach to enable multi-access media delivery. 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 whereby a suitable object coding protocol 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.

- The use of lower-layer network support using ATSSS (Access Traffic Steering, Switching, and Splitting) an optional feature for multi-access supported by the UE and 5G Core network and described in TS 23.501 [2]. The ATSSS feature enables a *Multi-Access PDU Connectivity Service* allowing for the exchange of PDUs between the UE and a Data Network by simultaneously using one or more 3GPP access networks and/or non-3GPP access networks. The Multi-Access PDU Connectivity Service is facilitated by a *Multi-Access PDU (MA PDU) Session* that may have User Plane resources on two access networks. In the context of the generalised media delivery architecture specified in the present document, the application flow between the Media Session Handler and the 5GMS AF at reference point M5 or the application flow between the Media Stream Handler (i.e., Media Player or Media Streamer) and the 5GMS AS at reference point M4, if conveyed over an MA PDU Session, may use two different access networks.

In multi-access delivery using ATSSS, the UE and the UPF are provided with ATSSS and N4 rules respectively by the network that specify how the upstream and downstream traffic is to be split, switched, or steered over multiple access networks. Clause 5.32 of TS 23.501[2] specifies higher-layer steering mechanisms such as MPTCP (Multipath TCP) and MPQUIC (Multipath-enabled QUIC), and lower layer ATSSS-LL (ATSSS Low-Layer) functionalities. TS 23.501 [2] also specifies different steering modes that define how traffic is to be distributed across multiple access networks. RFC 6897 [RFC6897] and Internet Draft [MPQUIC] describe capabilities and APIs available for higher level applications (e.g., 5G Media Streaming) to interact with the lower layers for application control of multipath delivery if the underlying transport connections are using MPTCP or MPQUIC respectively.

#### F.2 ATSSS mapping into 5GMS architecture

Figure F.2-1 shows the collaboration scenario for multi-access media delivery using different ATSSS steering functionalities described in clause 5.32 of TS 23.501 [2].



Figure F.2-1: Multi-access media delivery using different ATSSS steering mechanisms

The UE and the network may negotiate the use of one or more ATSSS steering mechanisms as specified in clause 5.32 of TS 23.501 [2]:

1. If the UE and the network agree on using the low-layer steering mechanism (ATSSS-LL):

a. The 5GMS Client and the 5GMS AS are unaware of multi-access media delivery.

b. Traffic steering, switching, and splitting decisions at the UE and UPF are based on information at IP the layer and below.

c. A *data switching function* in the UE decides how to steer, switch, and split M4 flows across the 3GPP and non-3GPP accesses based on provisioned ATSSS rules and local conditions (e.g., signal loss conditions).

d. Any type of traffic, including the TCP traffic, UDP traffic, Ethernet traffic, etc. from the 5GMS Client may be steered, switched, or split.

2. If the UE and the network agree on using the high-layer MPTCP Steering mechanism:

a. The 5GMS Client and the 5GMS AS may be unaware of multi-access media delivery.

b. Traffic steering, switching, and splitting decisions at the UE and UPF are based on information at the IP layer and above.

c. The network enables an MPTCP proxy in the UPF for the multi-access PDU Session.

d. The network allocates three IP addresses/prefixes to the UE – one for the multi-access PDU Session and two additional IP addresses/prefixes called "MPTCP link-specific multipath" addresses associated with each of the 3GPP and non-3GPP Accesses. The "MPTCP link-specific multipath" addresses may not be routable via reference point N6.

e. TCP application flows at reference point M4 terminating at the Media Stream Handler of the 5GMS Client in a UE allowed to use MPTCP functionality are sent to the MPTCP proxy over the two access networks using the two link-specific multipath addresses, and the MPTCP proxy functionality in the UPF uses the multi-access PDU Session IP address/prefix to communicate with the 5GMS AS in the Data Network (DN).

f. Any non-MPTCP traffic from the 5GMS Client is routed over either the 3GPP Access or the non-3GPP Access based on a received ATSSS rule for non-MPTCP traffic as specified in clause 5.32.2 of TS 23.501 [2].

3. If the UE and the network agree on using the high-layer MPQUIC Steering mechanism:

a. The 5GMS Client and the 5GMS AS may be unaware of multi-access media delivery.

b. Traffic steering, switching, and splitting decisions at the UE and UPF are based on information at the IP layer and above.

c. The network enables an MPQUIC proxy in the UPF for the multi-access PDU Session.

d. The network allocates three IP addresses/prefixes to the UE – one IP for the multi-access PDU Session and two additional IP addresses/prefixes called "MPQUIC link-specific multipath" addresses associated with each of the 3GPP and non-3GPP Accesses. The "MPQUIC link-specific multipath" addresses may not be routable via reference point N6.

e. A *QoS Flow selection and steering mode selection* component in the Media Stream Handler of the 5GMS Client determines the number of multipath QUIC connections to be set up for the application flows at reference point M4. Each QUIC connection carries one QoS flow (based on QoS rules) i.e. each multipath QUIC connection carries the UDP traffic mapped to a single QoS flow

f. QUIC-based UDP application flows at reference point M4 terminating at the Media Stream Handler of a 5GMS Client are sent over the two access networks to the MPQUIC proxy using the two link-specific multipath addresses with multiple QUIC paths, and the MPQUIC proxy functionality in the UPF uses the multi-access PDU Session IP address/prefix to communicate with the 5GMS AS in the Data Network (DN).

Table F.2-1 provides a description of whether the 5GMS Client and/or 5GMS-Aware Application is aware of multi-access media delivery for each of the steering functionalities supported in this release.

Table F.2-1: Application awareness of UE steering functionalities

|  |  |  |
| --- | --- | --- |
| Steering functionality | Application awareness | Application transparency |
| ATSSS-LL | No | Yes |
| MPTCP | Yes. 5GMS Client or 5GMS-Aware Application may use API as described in [RFC6897] to control MPTCP behaviour. | Yes. 5GMS Client or 5GMS-Aware Application may use just the standard TCP sockets API as described in [RFC6897] to be transparent with MPTCP functionality. |
| MPQUIC | Yes. 5GMS Client or 5GMS-Aware Application may use API as described in [MPQUIC] to control MPQUIC behaviour. | Yes. 5GMS Client or 5GMS-Aware Application may be transparent with MPQUIC functionality. |

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