**3GPP TSG- #130 *r02***

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| *CR-Form-v12.3* |
| **PSEUDO CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  |
| *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 | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:***  |  |
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| ***Source to WG:*** | Xiaomi |
| ***Source to TSG:*** | S4 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | No candidate technologies yet in the QUIC-based segment delivery in 5GMS clause. |
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| ***Summary of change:*** | Based on the discussion on S4aI240165 and revised to S4aI240198 (not disposed and revised to S4-241930), it was mentionned that concrete possible technologies using QUIC help to understand better the analysis of the Work Topic. Based on the discussion on S4aI240165 (whose note are copied below), we propose to list those possible technologies with the important caveats that:1. **Those are not candidade solutions, as for other Work Topics, but candidate technologies.**
2. **The listed candidate technologies are not endorsed by the study but merely recognised to be existing.**

On point 1), the reason is that the Work Topic was built on the idea of exploring the possible benefits of QUIC (technology based) and the slving a concrete problem. Therefore, there is no solutions rather technologies leveraging QUIC directly or indirectly.On point 2), the Work Topic is clearly not mean to study any those technologies in details nor comparing them. However, we believe it worthwile to capture those technologies seems they were anyway mentioned during the discussions on the Work Topic as assumed application-layer protocols.* Emmanuel presents [r01\_BBC](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Inbox/Drafts/S4aI240165r01_BBC.docx)
	+ Richard: Call flows are good. In the middle call flow there is still an error, wrong sequence 15a, 15
	+ Imed: You need a protocol on top of QUIC, is it HTTP/3 or is it a different protocol?
		- Emmanuel: It was MPEG-DASH part 6, but our intention is more the latter. We want to focus on QUIC streams, for parallel delivery. We need to improve and clarify.
		- Rufael: Follow-up, this is just a DASH diagram, there are no specific issue for QUIC. What is the delta?
		- Richard: All stuff in blue is the delta. Like init segment
		- Thomas: The in-concreteness makes it very difficult, because you always need to assume that there is a new delivery protocol.
		- Emmanuel: We have started the study like this, so we should make sure that we either continue like this or start from functionality.
		- Richard: M2 and M4 permits H3 already
		- Saba: Similar comments, we should understand what is on the application layer to make an analysis.
		- Emmanuel: We try to address your comments.
	+ Emmanuel: We agree on comments. We would not study MOQ, but we need some more offline discussion.
		- Richard: We should go into details of MOQ potentially, but this is early. Will be interesting what gaps we observe?
		- Emmanuel: No gaps likely.
	+ Fred: to be noted
		- Thomas: no need to be noted, nothing wrong.
		- Rufael: What specific parts are for QUIC?
		- Richard: merge?
		- Rufael: would prefer keep it individual
		- Richard: merging would be easier.
		- Rufael: do not think it is mergeable
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| ***Consequences if not approved:*** | No progress of the QUIC topic in FS\_AMD. |
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| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

Change #1

## 2 References

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[5] “”IETF IETF RFC 9114: "HTTP/3", June 2022.

…

[32] IETF RFC 9000: "QUIC: A UDP-Based Multiplexed and Secure Transport", May 2021.

…

[HTTP-PRIO] IETF RFC 9218: "Extensible Prioritization Scheme for HTTP", June 2022.

[DASH6] ISO/IEC 23009-6: "Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 6: DASH with server push and WebSockets".

[WT-H3] A. Frindell, E. Kinnear, V. Vasiliev: "WebTransport over HTTP/3", Work In Progress, Internet Draft, draft-ietf-webtrans-http3, <https://datatracker.ietf.org/doc/html/draft-ietf-webtrans-http3/>

[x7] Nguyen, M., Nys, P., Pham, S., Silhavy, D., Arbanowski, S., & Steglich, S., "Toward WebTransport Support in HTTP Adaptive Streaming", in *Tenth International Conference on Communications and Electronics 2024* (ICCE) (pp. 96-101), IEEE, July 2024.

[MoQ] L. Curly, K. Pugin, S. Nandakumar, V. Vasiliev, I. Swett: "Media over QUIC Transport", Work In Progress, Internet Draft, draft-ietf-moq-transport, https://datatracker.ietf.org/doc/draft-ietf-moq-transport/

Change #2

#### 5.24.1.1A Relevant existing technologies

##### 5.24.1.1A.1 Extensible Prioritization Scheme for HTTP

RFC 9218 [HTTP-PRIO] defines the signalling for an HTTP client to express its preferences in terms of relative priorities when multiple requests are concurrently sent. Upon reception, the HTTP server can make use of this information for serving the response deemed to be of highest priority by the client. Similarly, an HTTP server may use this prioritisation scheme to inform downstream entities about the relative priorities of multiple responses.

##### 5.24.1.1A.2 MPEG-DASH Part 6: DASH with Server Push and WebSockets

Published in 2017, MPEG-DASH Part 6 [DASH-6] is the part of the MPEG-DASH standard that enables a DASH server to send multiple segments to a DASH client without the need to receive individual segment requests. To this end, [DASH-6] defines the concept of push directives sent by the DASH client to the DASH server, indicating which segments should be pushed. Two alternative instantiations are defined in [DASH-6]:

1. Based on HTTP/2 [4] server push functionality with specific HTTP header extensions for the DASH client to send the so-called push directives.

2. Based on the WebSocket protocol, and comprising a set of messages for the exchange of MPD, segment and push directives. This constitutes the WebSocket sub-protocol for DASH registered with IANA as 2016.serverpush.dash.mpeg.org. The WebSocket sub-protocol for DASH uses a binary format for all messages exchanged over the WebSocket connection.

##### 5.24.1.1A.3 WebTransport

The WebTransport protocol developed by the IETF can be layered over either HTTP/2 or HTTP/3 [5].

When it is layered over HTTP/3 [WT-H3], WebTransport allows a client and a server to communicate over a secure, multiplexed QUIC-based transport. WebTransport leverages the QUIC streams to offer unidirectional and bidirectional streams and guarantee reliable, ordered reception of byte streams. WebTransport over HTTP/3 relies on HTTP/3 to establish the WebTransport session with the session peer using the CONNECT HTTP method. After that point, the application directly integrates with the QUIC layer.

##### 5.24.1.1A.3 Push-based adaptive media streaming over WebTransport with server-side throughput estimation

The conference paper [x7] proposes a mechanism to support HTTP adaptive media streaming in the WebTransport protocol. In essence, this works as follows:

1. The delivery of the MPD to the DASH client is assumed to have taken place prior to the establishment of the WebTransport transport connection for media.

2. The WebTransport-capable DASH client connects to a WebTransport-capable DASH server and establishes a WebTransport connection.

3. The DASH server sends media segments of default start-up quality for the audio and video Adaptation Setsto the DASH client.

NOTE: In the prototype implementation, there is only one audio Adaptation Set listed in the DASH MPD and only one video Adaptation Set, so there is no need for the DASH client to indicate which ones it is interested in receiving.

4. The DASH client starts receiving media segments and starts sending back qlog metrics reports [84] (as summarised in clause 5.4.1.6) to the DASH server on the same bidirectional stream.

5. Based on the received qlog metrics reports, the DASH server continuously estimates the throughput available to the DASH client.

6. When the new throughput is estimated, the DASH server may decide to change the pushed Representation or inform the DASH client about the new estimated throughput for the DASH client to switch. (The paper does not explicitly mention which option is used.)

##### 5.24.1.1A.4 Media-over-QUIC Transport

The Media-over-QUIC transport protocol [MoQ] is based on QUIC or can alternatievely be layered on top of WebTransport. Although generic, the transport protocol has been initially designed for media delivery. Based on a publish–subscribe interaction pattern, it allows a publisher to distribute media content to many subscribers with a focus on latency and scalability. Since QUIC and WebTransport are merely opening communication channels between client and server, MoQT defines a set of messages to establish and operate a MoQT session. In particular, a MoQT client can indicate the desired media content to receive by sending a SUBSCRIBE message to a publisher.

Change #3

### 5.24.6 Candidate solutions

#### 5.24.6.1 General

The candidate solutions in the following clauses are considered in relation to instantiation of the following types of 5GMS Client:

- Media-independent QUIC-aware 5GMS Client, as introduced in clause 5.24.2.3 and as mapped in clause 5.24.3.4.

- Media-optimised QUIC-aware 5GMS Client, as introduced in clause 5.2.4.2.3 and as mapped in clause 5.24.3.4.

NOTE: The QUIC-agnostic 5GMS Client type is covered by clause 5.4.

Additional candidate solutions may be identified subsequently, subject to further study.

#### 5.24.6.2 MPEG-DASH over HTTP/3 with server push and priority information

This candidate solution is an instantiation of the media-independent QUIC-aware 5GMS Client based on the following technologies:

- MPEG-DASH Part 1 [11].

- The HTTP/3 protocol as specified in RFC 9114 [5], including the server push functionality.

- The Extensible Prioritization Scheme for HTTP as specified in RFC 9218 [HTTP-PRIO].

This candidate solution enables the delivery of DASH content to a 5GMSd Client using the HTTP/3 protocol at reference point M4d. In addition, both the 5GMSd AS and the Media Player support the server push functionality and the extensible prioritisation scheme for HTTP.

The call flow in clause 5.24.3.3 applies.

#### 5.24.6.3 MPEG-DASH Part 6 over WebTransport

##### 5.24.6.3.1 Prerequisites

This candidate solution is an instantiation of the media-optimised QUIC-aware 5GMS Client based on the following technologies:

- MPEG-DASH Part 1 [11].

- MPEG-DASH Part 6 [DASH-6].

- WebTransport protocol over HTTP/3 [WT-H3].

This candidate solution enables the delivery of DASH content to a UE using the WebTransport protocol layered over HTTP/3 at reference point M4. In addition, both the 5GMSd AS and the Media Player support the WebSocket sub-protocol for DASH defined in MPEG-DASH Part 6 specified in clause 8.2 of [DASH-6]. However, the communication runs over a WebTransport connection instead of a WebSocket connection.

The call flow in clause 5.24.3.X applies.

#### 5.24.6.4 Media-over-QUIC

This candidate solution is an instantiation of the media-optimised QUIC-aware 5GMS Client based on the following technologies:

- MPEG-DASH Part 1 [11].

- Media-over-QUIC Transport protocol [MoQ]

This candidate solution enables the delivery of DASH content to a UE using the WebTransport protocol over HTTP/3 or the QUIC protocol at reference point M4. In addition, both the 5GMSd AS and the Media Player support the Media-over-QUIC Transport protocol. The media content delivered using the Media-over-QUIC Transport protocol is assumed to be DASH segments, and it is also assumed that the MPD has been delivered in the initialisation phase such that the Media Player is able to generate SUBSCRIBE messages with the information related to desired Representation or simply called tracks in the context of MoQ.

The call flow in clause 5.24.3.X applies.

#### 5.24.6.5 Push-based adaptive media streaming over WebTransport with server-side throughput estimation

This candidate solution is an instantiation of the media-optimised QUIC-aware 5GMS Client based on the following technologies:

- MPEG-DASH Part 1 [11].

- WebTransport protocol over HTTP/3 [WT-H3].

- A specific WebTransport sub-protocol for MPEG-DASH as specified in [x7].

This candidate solution enables the delivery of DASH content to a UE using the WebTransport over HTTP/3 protocol at reference point M4. In addition, both the 5GMSd AS and the Media Player support the protocol described in [x7] (as summarised in clause 5.24.1.1A.3.

The call flow in clause 5.24.3.X applies.

END OF CHANGES