**3GPP TSG- Meeting #**

**, , - revision of S4-251121**

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

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| ***Title:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
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| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | The objective of this work item is to address the recommendations for stage-3 extensions of the studies FS\_AMD and FS\_MS\_NS\_Ph2 in the relevant specifications, primarily TS 26.510, TS 26.512 and TS 26.517, and based on the stage-2 extensions in TS 26.501 and TS 26.502. Specifically, the following objectives are identified:2. Provide relevant extensions to the Stage 3 5G Media Streaming protocols:d. For *distributing encrypted and high-value content* as introduced in clause 5.10 of TR 26.804:i. Support the Content Protection Information Exchange Format (CPIX) as specified in ETSI TS 103 799 at reference point M2d.ii. Support the DASH-IF Interoperability Points specified in DASH-IF IOP Part 6 at reference point M4d for both DASH and HLS.iii. Specification of a Content Preparation Template format in TS 26.512  that can configure encryption content preparation tasks in the 5GMS AS.iv. Support other relevant aspects resulting from stage-2.3. For key topic address the following aspects:a. Specify the required protocols or protocol extensionsb. Define relevant APIsc. Specify the OpenAPIs YAML as well as other stage-3 API.e. Address remaining stage-3 aspects.4. Coordinate work with other 3GPP groups as needed. For details see clause 8.5. Coordinate work with external organizations such as SVTA (primarily the DASH-IF WG), CTA WAVE, ISO/IEC JTC29 WG3 (MPEG Systems), 5G-MAG, DVB and/or IETF, as needed. |
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| ***Summary of change:*** | * Define a content preparation template for encryption, possibly aligning with CPIX document structures

Address the relevant signaling on M4 in the manifest to provide the content protection signaling for DASH, and possibly HLS. |
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| ***Consequences if not approved:*** | Feature not supported |
|  |  |
| ***Clauses affected:*** | 2, 8.8 (new), 10.2, Annex X (new) |
|  |  |
|  | **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 =====

# 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 26.501: "5G Media Streaming (5GMS); General description and architecture".

[3] DASH Industry Forum, "Specification of Live Media Ingest",
<https://dashif-documents.azurewebsites.net/Ingest/master/DASH-IF-Ingest.pdf>

[4] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".

[5] Standard ECMA-262, 5.1 Edition: "ECMAScript Language Specification", June 2011.

[6] IETF RFC 6234: "US Secure Hash Algorithms (SHA and SHA-based HMAC and HKDF)".

[7] 3GPP TS 23.003: "Numbering, addressing and identification".

[8] ITU-T Recommendation X.509 (2005) | ISO/IEC 9594-8:2005: "Information Technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks".

[9] Void

[10] IETF RFC 4648: "The Base16, Base32, and Base64 Data Encodings".

[11] IEEE Standard 1003.1™, Issue 7: "The Open Group Base Specifications", 2018.
<https://pubs.opengroup.org/onlinepubs/9699919799/>

[12] 3GPP TS 29.571: "Common Data Types for Service Based Interfaces; Stage 3".

[13] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[14] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".

[15] 3GPP TS 27.007: "AT Command set for User Equipment (UE)".

[16] Void[17] IETF RFC 7468: "Textual Encodings of PKIX, PKCS, and CMS Structures", April 2015.

[18] ISO 3166‑1: "Codes for the representation of names of countries and their subdivisions — Part 1: Country codes".

[19] ISO 3166‑2: "Codes for the representation of names of countries and their subdivisions — Part 2: Country subdivision code".

[20] IETF RFC 5280: "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile", May 2008.

[21] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[22] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[23] OpenAPI: "OpenAPI 3.0.0 Specification", <https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md>.

[24] IETF RFC 9112: "HTTP/1.1", June 2022.

[25] IETF RFC 9110: "HTTP Semantics", June 2022.

[26] Void

[27] Void

[28] IETF RFC 9111: "HTTP Caching", June 2022.

[29] Void

[30] IETF RFC 8446: "The Transport Layer Security (TLS) Protocol Version 1.3", August 2018.

[31] IETF RFC 9113: "HTTP/2", June 2022.

[32] ISO/IEC 23009-1: "Information technology; Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats".

[33] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".

[34] 3GPP TS 29.514: "5G System; Policy Authorization Service; Stage 3".

[35] 3GPP TS 26.511: "5G Media Streaming (5GMS); Profiles, codecs and formats".

[36] Void.

[37] 3GPP TS 26.244: "Transparent end-to-end packet switched streaming service (PSS); 3GPP file format (3GP)".

[38] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format", December 2017.

[39] ISO/IEC 14496-12: "Information technology – Coding of audio-visual objects – Part 12: ISO base media file format".

[40] ISO/IEC 23000-19: "Information technology – Multimedia application format (MPEG‑A) – Part 19: Common media application format (CMAF) for segmented media".

[41] IETF RFC 3986: "URI Generic Syntax".

[42] 3GPP TS 26.118: "Virtual Reality (VR) profiles for streaming applications".

[43] 3GPP TS 24.558: "Enabling Edge Applications; Protocol specification".

[44] 3GPP TS 29.558: "Enabling Edge Applications; Application Programming Interface (API) specification; Stage 3".

[45] 3GPP TS 23.502: "Procedures for the 5G System (5GS); Stage 2".

[46] 3GPP TS 29.517: "5G System; Application Function Event Exposure Service; Stage 3".

[47] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[48] 3GPP TS 26.531: "Data Collection and Reporting; General Description and Architecture".

[49] 3GPP TS 26.532: "Data Collection and Reporting; Protocols and Formats".

[50] 3GPP TS 29.522: "5G System. Network Exposure Function Northbound APIs; Stage 3".

[51] 3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs".

[52] 3GPP TS 26.347: "Multimedia Broadcast/Multicast Service (MBMS); Application Programming Interface and URL".

[53] IETF draft-bhutton-json-schema-validation: "JSON Schema Validation: A Vocabulary for Structural Validation of JSON", June 2022.

[54] IETF RFC 3339: "Date and Time on the Internet: Timestamps", July 2002.

[55] 3GPP 29.591: "Network Exposure Function Southbound Services; Stage 3".

[56] 3GPP TS 26.510: "Media delivery; interactions and APIs for provisioning and media session handling".

[57] IETF RFC 2045: "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies".

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

[59] IETF RFC 9001: "Using TLS to Secure QUIC", May 2021.

[60] IETF RFC 9114: "HTTP/3", June 2022.

[61] IETF RFC 8673: "HTTP Random Access and Live Content", November 2019.

[62] Consumer Technology Association CTA-5005-A: "Web Application Video Ecosystem – DASH-HLS Interoperability Specification".

[63] DASH-IF Guidelines: "Low-latency Modes for DASH", available here:
<https://dash-industry-forum.github.io/docs/CR-Low-Latency-Live-r8.pdf>

[64] 3GPP TS 26.517: "5G Multicast-Broadcast User Services; Protocols and Formats".

[65] Consumer Technology Association CTA‑5004: "Web Application Video Ecosystem – Common Media Client Data", September 2020,
https://cdn.cta.tech/cta/media/media/resources/standards/pdfs/cta-5004-final.pdf.

[66] IETF RFC 4122: "A Universally Unique IDentifier (UUID) URN Namespace", July 2005.

[DASH-IF-IOP-6] DASH Interoperability Forum: "DASH-IF Interoperability Points; Part 6: Content protection and security".

[103799] ETSI TS 103 799: "Content Protection Information Exchange Format (CPIX)".

## ===== CHANGE =====

## 3.3 Abbreviations

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CBCS Cipher Block Chaining

CENC Common Encryption

CPIX Content Protection Information Exchange

…

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## 8.8 Key exchange for encrypted content

If the 5GMSd AS supports content encoding and packaging, but the DRM server (including License and Key Servers) is deployed externally in the 5GMSd Application Provider domain, then the 5GMSd AS needs to communicate with the License Server for content encoding and packaging.

In order to support exchange of public keys between the Encryptor/Packager on the 5GMSd ASand the external License Server and Authorization Server via reference point M2d, the 5GMSd AS shall support the Content Protection Information Exchange Format (CPIX) as specified in ETSI TS 103 799 [103799] at reference point M2d.

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## 10.2 DASH distribution

In the case of DASH distribution, M4d is relevant for the distribution as shown in figure 10.2-1.



Figure 10.2-1: M4d usage for DASH distribution

For DASH-based distribution according to TS 26.247 [4] and ISO/IEC 23009-1 [32], two main formats are of relevance:

1) The Media Presentation Description (MPD) that is processed in the DASH Access Client.

2) The Segment formats that are passed through the DASH Access Client and processed in the Media Playback and Content Decryption Platform. Note that the DASH Access Client may parse Segments to extract, for example, In-band Events or producer reference times.

Other resources may be referenced in the MPD, for example DRM related information.

The Segment formats for DASH Streaming in the context of 5G Media Streaming are defined in TS 26.511 [35] based on the CMAF encapsulation. The DASH Access Client downloads the Segments from the 5GMSd AS based on the instructions in the MPD and the instructions from the 5GMSd-Aware Application through M7d (see clause 13 for details).

The interface between the DASH Access Client and the Media Playback and Content Decryption Platform as well as the 5GMSd Client requirements for media codecs are documented in TS 26.511 [35].

The following requirements apply at reference point M4d:

1) The Media Presentation Description (MPD) and Segments shall conform to an MPD according to ISO/IEC 23009-1 [32] or TS 26.247 [4].

2) The Segment formats should conform to CMAF addressable resources as well as to the requirements in TS 26.511 [35].

3) The Media Presentation should conform to the 5G Media Streaming DASH Interoperability Point as defined in clause 7.3.11 of TS 26.247 [4].

A 5GMSd Client shall support the 5G Media Streaming DASH Interoperability Point as defined in TS 26.247 [4], clause 7.3.11. A 5GMSd Client may support additional DASH profiles and interoperability points.

The MPD may contain a one or several ServiceDescription elements that include operational parameters. The MPD may also include multiple configurations for the media (different codecs, different content protection, different resolutions, etc.), for example for playback under different operating policies. For more details refer to annex G.

The handling of this information within the 5GMSd Client is documented in clause 13.2.

If the media segment formats conform to CMAF addressable resources as defined ISO/IEC 23000-19 [27], the same CMAF content may then be provided for DASH and HLS. In order to support common deployment, the media segment content should conform to CTA‑5005‑A [62].

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Annex G (normative):
DASH in 5G Media Streaming

# G.1 Introduction

This annex provides a binding between DASH as defined in ISO/IEC 23009-1 [32] and 3GPP TS 26.247 [4] as a media streaming protocol in the 5G Media Streaming System. In this context, it provides a mapping of DASH functionalities to generic 5G Media Streaming features. It also pecifies requirements and makes recommendations on how certain features defined in 5G Media Streaming are to be used and supported when DASH is used as the media streaming protocol at reference point M4.

The annex also specifies how CMAF content as profiled in TS 26.511 [35] is required to be delivered through 5G Media Streaming using DASH.

The clause expands based on the requirements specified in clause 10.2.

# G.2 General mapping of DASH to 5G Media Streaming

Based on the basic mapping of DASH in clause 10.2, the following generic aspects are documented:

- For any requirement that applies to the Media Player Entry in downlink streaming as part of the present document, for DASH this requirement applies to the Media Presentation Description (MPD) with content type "application/dash+xml".

- Media resources are primarily DASH Segments, or other data referenced in the MPD. According to clause 10.2, DASH Segments may be CMAF-addressable resources per ISO 23000‑19 [38], in particular CMAF media resources as profiled in TS 26.511 [35].

- The mapping of media resources into DASH MPDs, including codec parameters, is specified in TS 26.511 [35].

# G.3 Content Protection and DRM

## G.3.1 Overview

This clause defines the requirements and recommendations to support Content Protection and Digital Rights Management in DASH-based 5G Media Streaming according to clause 5.14 in TS 26.501 [2].

## G.3.2 DASH content encoding requirements and recommendations

A DASH Media Presentation with encrypted content shall follow the requirements and recommendations in DASH-IF Interoperability Points Part 6 [DASH-IF-IOP-6], in particular:

- DASH Segments and the corresponding CMAF-addressable resources shall follow the requirements and recommendations concerning Segments in clause 6 of [DASH-IF-IOP-6].

- DASH MPDs shall follow the requirements and recommendations concerning the MPD in clause 7 of [DASH-IF-IOP-6].

## G.3.3 Media Player requirements and recommendations

A Media Player supporting DRM-based content protection shall implement the requirements and recommendations for DASH clients defined in clauses 6 and 7 of DASH-IF Interoperability Points part 6 [DASH-IF-IOP-6].

## G.3.4 Content Preparation Template requirements to support DRM encryption

In order to configure content preparation for DRM encryption, the following parameters need to be supported:

- An indication of one of the *encryption methods* profiled in TS 26.511 [35], namely CENC or CBCS.

- The *DRM systems* that are to be supported, identified by their respective unique system identifiers.

- The URL of the *license server* from which the Media Player fetches decryption keys. The Packager shall embed the license acquisition URL in the Media Presentation Description (MPD).

- The *CPIX configuration* used to communicate encryption keys and DRM policies between the Packager and the Key Server.

## G.3.5 Examples

For examples, see clause 7.3 of DASH-IF Interoperability Points part 6 [DASH-IF-IOP-6].