**3GPP TSG- Meeting #**

**, , -** revision of S4aI240066

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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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| ***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 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-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)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | While 3GPP and MPEG in DASH support DASH metrics, the reporting is not common to any player, for example all DASH players as well as HLS players. As an example, CTA WAVE has developed: CTA-5004: Web Application Video Ecosystem Common-Media-Client-Data (CMCD) with an excellent overview here: https://ottverse.com/common-media-client-data-cmcd/. It is worthwhile to study the benefits of integrating commonly supported metrics and client data reporting in 5GMS workflows. The focus is the integration of already defined metrics rather than developing new metrics. Examples of study include support of specific metric keys, player APIs, sending options from client to server (user plane, M5 reference point, EVEX), M3 reference point impact, as well as usage of the data in operations. A study of creating a common harmonized reporting framework and studying the interaction of different frameworks may be included. | | | | | | | | |
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| ***Summary of change:*** | | Addresses the work item objectives for this key issue   * Documents the key issue in more detail, in particular how they relate to the 3GPP Media Delivery architecture and/or the MBS User Service architecture * Studies collaboration scenarios between the Application Service Provider and the 5G System and for each of the key topics. * Based on existing architectures, provides one or more deployment architectures that address the key topics and the collaboration models. * Maps the key topics to basic functions and develop high-level call flows. * Identifies the issues that need to be solved. * Provides candidate solutions including call flows, protocols and APIs for each of the identified issues. * Identifies gaps and recommend potential normative work for stage-2 and stage-3, including which existing specifications would be impacted and/or if any new specifications would preferably be developed. | | | | | | | | |
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| ***Consequences if not approved:*** | |  | | | | | | | | |
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| ***Clauses affected:*** | | 5.16 (new), 6.16 (new) | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TR 26.804 CR 0014 | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | Updated scope, references and abbreviations are in CR 0014  **References**  [CTA-5004] CTA-5004: Web Application Video Ecosystem Common-Media-Client-Data (CMCD)  [26531] 3GPP TS 26.531, Data Collection and Reporting; General Description and Architecture  [26532] 3GPP TS 26.532, Data Collection and Reporting; Data Collection and Reporting; Protocols and Formats  **Abbreviations**:  CDN Content Delivery Network  CMCD Common-Media-Client-Data | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | |  |  |  |  | | --- | --- | --- | --- | | [S4aI240066](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI240066.zip) | [FS\_AMD] Common Client Metadata | Qualcomm Germany | Thomas Stockhammer |   **Revisions**: none  **Presenter**: Thomas Stockhammer  **Online Discussion**:   * Fred: Reference to EVEX? * Thomas: That's correct. I need a proper reference * Rufail: : if we are going to Common Media Metadata, this was used for CDN right? I think we should use AS instead of CDN. * Thomas: They don’t know what AS is. It is our duty to do this. * Rufail: maybe we can add  a sentence saying this, the description of CDN is more generic. * Fred: this is architecture mapping we are asking for * Thomas: that's part of work * Frd: That's coming then. * Rufail: CMCD is a very generic technology. I am just making this comment that the description needs to be specific. * Fred: Could you clarify how you will address the reference. * Thomas: The idea is to basically put it as comments.   **Decision**: endorsed.  [S4aI240066](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI240066.zip) is **endorsed**.  Thomas – Thanks also for this contribution.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | [S4aI240066](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI240066.zip) | CR | [FS\_AMD] Common Client Metadata | Qualcomm Germany | Spec: 26.804 CR0015 |   What would be most useful in this one is a feature comparison matrix (probably in the gap analysis clause) that compares our QoE metrics report for DASH (TS 26.247) plus our consumption report for 5GMS (TS 26.510) with the key–value pairs for CMCD.  This revision addresses updates based on the above comments and the editor’s Note. | | | | | | | | |

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

## 5.16 Common Client Metadata

### 5.16.1 Description

#### 5.16.1.1 Introduction

While 3GPP and MPEG in DASH support DASH metrics, the reporting is not common to any player, for example all DASH players as well as HLS players. As an example, CTA WAVE has developed: CTA-5004: Web Application Video Ecosystem Common Media Client Data (CMCD) [CTA-5004]. It is worthwhile to study the benefits of integrating commonly supported metrics and client data reporting in 5GMS workflows. The focus is the integration of already defined metrics rather than developing new metrics. Examples of study include support of specific metric keys, player APIs, sending options from client to server (user plane, M5 reference point [26510], Data collection and reporting [26531], [26532]), M3 reference point impact, as well as usage of the data in operations. A study of creating a common harmonized reporting framework and studying the interaction of different frameworks may be included.

CMCD defines set of *media client data*, structured as key/value pairs, that allow a media player to communicate mutually beneficial media-related information to a CDN via either (i) a set of custom headers, (ii) a URL request query string, or (iii) a JSON object. *Common* is used because the same data structure can be used across all players and all CDNs. CTA WAVE is currently extending the specification and version is expected to be available by the end of 2024. A player may be instructed through a configuration API, for example defined in dash.js, on how to exactly report. In addition, in the 6th edition of MPEG-DASH in ISO/IEC 23009-1 [11], an API based configuration and an MPD-based signaling is provided in order for the DASH client to be instructed to enable CMCD information collection and reporting.

The use-cases which CMCD enables are broad – including robust pre-fetching of content, analytics solutions, forensic debugging, CDN delivery optimization, alerting and monitoring systems, low latency optimizations, server-side switching, research analytics and content steering decisioning.

A basic overview of CMCD is provided in figure 5.16.1-1 illustrating option (i) in green and (ii) in red. With every HTTP request, typically and primarily for the request of a media segment, some custom data is sent either as HTTP header or as query string appended to the segment request URL. In a third mode that is not widely implemented, corresponding to option (iii) above, the media client may also provide the information in a JSON object to the application out of band of media segment requests.

A close-up of a text

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Figure 5.16.1-1: Basic CMCD concept – Media client sends key–value pairs to CDN in-band with requests

#### 5.16.1.2 Use Cases

In the context of 5G Media Streaming, the CMCD information may be used for several purposes that are elaborated further in the remainder of this clause:

1) *Operational optimization of the 5GMSd AS:* The Application Server uses CMCD information to optimise its operation.

2) *Operational optimisation of the 5GMSd AF and 5G Media Streaming:* The Application Function uses CMCD information in order to configure the 5G System for optimised media delivery across the User Plane.

3) *UE data collection, reporting and event exposure by 5GMS System:* The Application Function uses the data collection and reporting framework to provide CMCD information to the 5G System or to external 5GMS Application Providers.

### 5.16.2 Collaboration scenarios

#### 5.16.2.1 In-band reporting of CMCD information

In the context of the collaboration scenarios in annex A of TS 26.501 [26501] and the URL query or HTTP request header reporting mechanisms, the following scenarios are considered:

Scenario 1 5GMSd AS is deployed in an external Data Network (OTT) as documented in clause A.1 of [26501]. In this case, a third-party service provider logs data from clients about operational performance. The 5GMSd Application Provider may use the data in order to optimize its overall service including clients served through a 5G system.

Scenario 2 Both 5GMSd AF and 5GMSd AS are deployed in the trusted Data Network as documented in clause A.2 of [26501]. In this case, the 5GMSd AS can provide the collected data to the 5GMSd AF via M3, which can further process the information for delivery optimisations. Many use cases may be considered, for example network assistance, policy updates, etc. The extent to which each metric key can be used in an operational context needs to be analysed further.

In a similar fashion, when the 5GMSd AS and 5GMSd AF are external per clause A.2 of [26501], such considerations may be taken into account, and also in the case where the 5GMSd AS is internal and the 5GMSd AF is external, as documented in clause A.6 of [26501].

Scenario 3 5GMSd AF is deployed in the trusted Data Network and the 5GMSd AS deployed in an external Data Network as documented in clause A.4 of [26501]. In this case, provisioning updates may be done by the 5GMSd Application Provider in response to received CMCD information.

Similar aspects apply for the collaboration document in clause A.4 of [26501].

The core scenarios for collaboration are summarized in bullet 2), namely the case that the 5GMSd AS collects information which is shared with the 5GMSd AF for further actions. The remaining discussion in this clause considers the case in which both the 5GMSd AS and the 5GMSd AF are both deployed in the Trusted DN. However, it is generally also possible for a third-party provided in a non-trusted environment to use CMCD information according to the following scenarios.

In the context of collaboration scenarios, the three different use cases introduced in clause 5.16.1.2 may also be considered:

1) *Operational optimisation of the 5GMSd AS:* If the Application Server is deployed externally, the CMCD information may be considered as information describing the media delivery session.

2) *Operational optimisation of the 5GMSd AF and 5G Media Streaming:* If the Application Function is deployed externally, NEF-based access to 5G System functionalities may be employed to optimise the delivery based on CMCD information, for example by applying network assistance or dynamic policy updates.

3) *UE data collection, reporting and event exposure by 5GMS System:* The Data reporting server may be external and the Data Collection AF instantiated in the 5GMSd AF exposes CMCD information collected in the operational service as events.

### 5.16.3 Architecture mapping

#### 5.16.3.1 In-band reporting of CMCD information

In the case where CMCD information is reported in band with media requests at reference point M4, no architectural updates are needed to that defined in clause 4.1.1 of TS 26.501 [26501] or to the generalized media delivery architecture defined in clause 4.1.2.1 of [26501]. However, the functionality of the 5GMSd AS is extended to collect CMCD information and share it with the 5GMSd AF via reference point M3.

Furthermore, in case of UE data collection, reporting and event exposure, the functional architecture in clause 4.2 of TS 26.531 [26531] applies. No explicit data collection client is run in the UE, but the data collection client is operated in the AS, and the AS then provides the information to the Data Collection AF as shown in Figure 5.16.3-1.



Figure 5.16.3‑1: Reference architecture for data collection and reporting when AS is delegated for collecting the data

### 5.16.4 High-level call flow

The focus of the call flow is on Scenario 2 as defined in clause 5.16.2.1 above, for which the CMCD information is initially sent to the 5GMSd AS via reference point M4d, and then provided to the 5GMSd AF at reference point M3. The call flow is aligned with QoE metrics collection and reporting as defined in clause 5.5 of TS 26.501 [26501], but addresses the user plane aspects.

Figure 5.16.4-1 illustrates a scenario where CMCD collection and reporting by the 5GMSd AS is configured by the 5GMSd AF via reference point M3d. In this example, it is assumed that the CMCD collection information provided by the 5GMSd AF comprises instructions/rules regarding CMCD reporting. It is further assumed that the 5GMSd AF is required to deliver CMCD reports to separate destination entities, upon optionally having performed post-processing the collected report information. The 5GMSd AF and 5GMSd AS can be either trusted or untrusted.



Figure 5.16.4-1: CMCD-based data collection in 5GMSd

The message sequence steps are described below:

1: The **5GMSd AF is provisioned at reference point M1d with CMCD reporting configuration information**, each pertaining to CMCD information collection by the Media Player and reporting of to the 5GMSd AF via the 5GMSd AS. The 5GMSd AF is provisioned with different CMCD collection, reporting and **processing information** regarding required post-processing functionality and subsequent and separate delivery of processed CMCD information to the 5GMSd Application Provider **and/or to the OAM Server**. **The 5GMSd AF also configures the 5GMSd AS to collect and report CMCD information and provides relevant information to the 5GMSd AF**.

2: The 5GMSd-Aware Application triggers the Service Announcement and Content Discovery procedure at reference point M8d. The Service Announcement includes the whole **Service Access Information that includes a CMCD collection and reporting configuration**to be used by the Media Player. **The information typically includes a session identifier**.

3: Time passes until the 5GMSd Client initiates session establishment and media playback.

4: Streaming Session and media playback is established.

4a: The 5GMSd-Aware Application informs the Media Player of impending media playback by invoking a suitable method at reference point M7d.

4b: The Media Player requests the establishment of a streaming session by invoking a suitable method at reference point M11d on the Media Session Handler, which acknowledges the request.

4c: The Media Session Handler requests may acquire full Service Access Information from the 5GMSd AF via reference point M5d if did not already receive this in step 2 above.

4d: The Media Session Handler informs the Media Player about the successful set-up of the streaming session by means of a suitable notification at reference point M11.

4e: The media playback pipeline is set up between the Media Player, the 5GMSd AS at reference point M4d and with the 5GMSd Application Provider at reference point M2d.

5: **Using a suitable interaction at reference point M11d, the Media Session Handler interrogates the Media Player on its capability to perform in-band CMCD collection and reporting at reference point M4d and instructs the player to enable CMCD collection and reporting, including a session identifier**.

6: The **Media Player acknowledges** its support for the collection of the required CMCD information at reference point M11d.

During the course of media playback, steps 7a to 7f below may be repeated, depending on the duration of the playback.

7a: The Media Player requests **media content from the 5GMSd AS via reference point M4d and includes configured CMCD information in the request, either as an additional query parameter in the request URL or else as additional HTTP request headers, according to the configuration obtained in step 5 above**.

7b: The 5GMSd AS extracts and processes CMCD information from this request.

7c: In the case of a live streaming service, media content may have already been published by the 5GMSd Application Provider to the 5GMSd AS at reference point M2d. However, in this case it is considered that the 5GMSd AS ingests media from the 5GMSd Application Provider in pull mode. The 5GMSd AS checks if the requested data is already cached and if not, requests the data from the upstream 5GMSd Application Provider. **The 5GMSd AS may also use information in the CMCD information to request future segments in advance of a request at reference point M4d.**

NOTE: CMCD information does not currently include a timestamp when the future media data would be available.

7d: The 5GMSd AS delivers the requested media data to the Media Player at reference point M4d.

7e: The Media Player starts playback and informs the Media Session Handler by means of a suitable notification at reference point M11d.

7f: **The 5GMSd AS provides the requested CMCD information to the 5GMSd AF**.

7g: **The 5GMSd AF extracts the relevant CMCD information and processes the data.**

7h: **Based on certain information, for example buffer levels, etc., the 5GMSd AF may decide to communicate with the 5G System to initiate media handling functions such as network assistance.**

8: **In accordance with its CMCD reporting configuration as provisioned in step 1, the 5GMSd AF performs separate post-processing in accordance with the received types of CMCD reports.**

9: The 5GMSd AF exposes an event containing **processed CMCD information** to the 5GMSd Application Provider in accordance with the Event Data Processing Configuration provisioned in step 1.

10: **The 5GMSd AF sends a processed CMCD report in accordance with some configuration provisioned in step 1 to the OAM Server**.

NOTE: Although not explicitly shown or described in figure 5.16.3-1, should the 5GMSd AF represent an untrusted network entity and the OAM Server represent a trusted network entity, the delivery of processed CMCD reports from the 5GMSd AF to the OAM Server depicted in step 10 is mediated by the NEF (Network Exposure Function).

### 5.16.5 Gap analysis and requirements

In order to understand the gaps and requirements from the above call flow, relevant gaps are highlighted in **bold**. In summary, the following gaps are identified:

1) Lack of provisioning information to configure CMCD reporting, including delivery to the 5GMSd Application Provider and to the OAM Server on reference point M1d in step 1 of clause 5.16.4.

2) Lack of configuration signalling for the 5GMSd AS to collect CMCD information for specific sessions or all clients on reference point M3d in step 1a and 1b of clause 5.16.4.

3) Lack of Service Access Information that contains CMCD configuration information and a session identifier on M5d in step 2 of clause 5.16.4.

4) Lack of Media Player configuration API on M7d to configure CMCD collection and reporting, including the acknowledgement of the capabilities in step 5 and step 6 of clause 5.16.4.

5) Missing functionalities in Media Player that reports CMCD information on M4d as part of the media requests. If the next segment request is included, then CMCD information needs to be extended to add the timestamp when the next media object is available in step 7c of clause 5.16.4.

6) Missing functionalities in the 5GMSd AS to extract and process CMCD information received in step 7f of clause 5.16.4 and:

a. Provide the CMCD information to the 5GMSd AF at reference point M3d.

b. To proactively request media segments according to the received CMCD information. This is expected to be an optional feature of AS to improve operation.

8) Missing functionalities in 5GMSd AF to process CMCD information received from the 5GMSd AS via reference point M3d, and to use this information to initiate and re-configure media session handling as needed in the 5G Core, and to aggregate the information for delivery to the 5GMSd Application Provider and/or to the OAM Server per steps 8, 9 and 10 of clause 5.16.4.

### 5.16.6 Candidate solutions

Editor’s Note: Provide detailed semantics and syntax for the identified gaps in clause 5.16.5.

#### 5.16.6.1 Provisioning information at reference point M1d

Provisioning information is needed to configure CMCD reporting, including delivery to the 5GMSd Application Provider and to the OAM Server on reference point M1d in step 1 of clause 5.16.4. For this purpose, the following is a suitable solution:

- To support provisioning information to configure CMCD reporting, the metrics reporting provisioning procedures specified in clause 5.2.11 of TS 26.510 [26510] may be reused at reference point M1d with new metrics reporting schemes specified for the different forms of CMCD.

- To support delivery of this information to the 5GMSd Application Provider, the Event Data Processing Configuration may be reused at reference point M1d per clause 5.2.13 of TS 26.510 [26510].

- To support delivery of this information to the OAM server, this is for further study,

#### 5.16.6.2 Configuration signalling and Data Collection at reference point M3d

Configuration signalling for the 5GMSd AS to collect CMCD information for specific sessions or all clients on reference point M3d in steps 1a and 1b of clause 5.16.4. To support this functionality, the following solution may be considered:

- Reuse client metrics reporting configuration in Service Access Information exposed to the 5GMSd AS at reference point M3d. The metrics reporting scheme representing the CMCD JSON format is always indicated regardless of which metrics reporting scheme has been provisioned at reference point M1d.

Provide CMCD information to the 5GMSd AF on M3d. To support this functionality, the following solution may be considered:

- 5GMSd AS submits QoE metrics report to the 5GMSd AF using CMCD JSON format, based on CMCD query parameter or CMCD request headers received in M4d requests.

#### 5.16.6.3 Configuration signalling at reference point M5d

Provide CMCD configuration information to the Media Session Handler. To support this functionality, the following solution may be considered:

- Service Access Information contains CMCD configuration information and a session identifier at reference point M5d in step 2 of clause 5.16.4 in order to configure collection and reporting of CMCD information by the 5GMSd Client.

#### 5.16.6.4 Media Player configuration API at reference point M7d

Media Player configuration API on M7d to configure CMCD data collection and reporting, including the acknowledgement of the capabilities in step 5 and step 6 of clause 5.16.4.

#### 5.16.6.5 CMCD reporting at reference point M4d

Media Player that reports CMCD data on M4d as part of the media requests. If the next segment request is included, then CMCD needs to be extended to add the timestamp when the Segment/media object is available in step 7c of clause 5.16.4.

#### 5.16.6.6 Functional changes to 5GMSd AF

Functionalities in the 5GMSd AF to process CMCD information received from the 5GMSd AS via M3d, to use this information to initiate and re-configure media session handling functions in the 5G Core as needed, and to aggregate the information for delivery to the 5GMSd Application Provider and/or to the OAM Server per steps 8, 9 and 10 of clause 5.16.4. To support this functionality, the following solution may be considered:

- Data processing and event exposure for CMCD-based QoE metrics per clauses 4.7.3 and 4.7.4 of TS 26.501 [26501] and clause 18 of TS 26.512 [26512].

#### 5.16.6.7 Functional changes to 5GMSd AS

Functionalities in the 5GMSd AS to extract and process CMCD information received per step 7f of clause 5.16.4 and:

1. Report it to the 5GMSd AF via reference point M3d.

2. Proactively request media segments accordingly. In order to address this, the following solution may be considered:

#### 5.16.6.8 Functional changes to Media Player

Functionalities in the Media Player to report CMCD information to the 5GMSd AS at reference point M4d as part of media requests.

The CMCD specification [CTA-5004] may need to be extended to add the timestamp when the next media object is available in order to fully support the pre-fetch optimisation described in step 7c of clause 5.16.4.

#### 5.16.6.9 Functional changes to Media Session Handler

Functionalities in the Media Session Handler to process CMCD configuration information and to instruct media player to initiate CMCD collection reporting.

### 5.16.7 Summary and conclusions

Editor’s Note: Needs to be completed.

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

## 6.16 Common Client Metadata

Editor’s Note: Consolidated conclusion needs to be completed.