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Title: Discussion on instantiation of generic data collection and reporting architecture for 5G Media Streaming

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# Abstract

Having defined a generic architecture for UE data collection and reporting in TS 26.531 [6] under the EVEX Work Item [2], the generic architecture needs to be instantiated within the 5G Media Streaming domain by modifying TS 26.501 [1]. This discussion paper proposes such an instantiation and raises some discussion points for agreement.

# 1. Background

The 5G Media Streaming architecture specified in Release 16 [1] already supports two different forms of reporting for 3GP-DASH based downlink media streaming:

1. AF-based **QoE metrics reporting** from the Media Session Handler to the 5GMSd AF.

*As specified in Release 16, this reuses the XML-based QoE reporting format for DASH specified in clause 10.6.2 of TS 26.247 [10].*

1. **Consumption reporting** from the Media Session Handler to the 5GMS AF.

*This uses a simple JSON-based reporting format defined in clause 11.3.3 of TS 26.512 [6].*

NOTE: There is no support in Release 16 for reporting of uplink media streaming by the UE, and no agreement to add this in Release 17 because it is considered more straightforward to collect uplink QoE metrics from the 5GMSu AS than from the UE.

A Release 17 Work Item [2] was agreed at SA Plenary to define a generic architecture for UE data collection and reporting, as envisaged in TS 23.288 [5]. In the context of 5G Media Streaming, the scope of the Work Item includes publication of the above forms of 5GMS reporting information, along with other relevant UE data such as CDN access logs, dynamic policy invocation and network assistance support, to the 5GMS Application Provider, and also exposure to other functions in the 5G System via the NWDAF (subject to SA2 agreement).

In order to achieve these aims, TS 26.512 [6] needs to be modified to instantiate the generic data collection and reporting architecture recently defined in TS 26.531 [7]. This discussion paper presents some options for this instantiation.

# 2. Proposed instantiation of generic reference architecture for 5G Media Streaming

Figure 1 below illustrates how the generic reference architecture defined in TS 26.531 [7] could be instantiated within the 5G Media Streaming architecture.



Figure 1: 5G Media Streaming instantiation of  
generic reference architecture for data collection and reporting

In the above architectural instantiation:

1. The Data Collection AF is instantiated inside the 5GMS AF. This provides the function for:
   1. Provisioning of UE data collection and reporting for 5GMS at reference point R1 and/or M1 (see discussion in section 3.1).
   2. Receiving direct 5GMS metrics reports and consumption reports at reference point R2 and/or M5 (see discussion in section 3.2).
   3. Receiving indirect 5GMS consumption reports at reference point R3.
   4. Receiving 5GMS access logs from the 5GMS AS at reference point R4 (see discussion in section 3.3).
   5. Collating information on the use of 5GMS dynamic policies and network assistance from the 5GMS AF via an internal interface.
   6. Repackaging and/or (dis)aggregating the information in received 5GMS metrics reports and consumption reports for exposure to the NWDAF via the Naf\_EventExposure service at reference point R5.
   7. Packaging and/or aggregating information on the use of 5GMS dynamic policies and/or network assistance for exposure to the NWDAF via the Naf\_EventExposure service at reference point R5 (or via the Nnef\_EventExposure service, as appropriate).
   8. Repackaging and/or (dis)aggregating the information in received 5GMS metrics reports, consumption reports and access logs for publication to the 5GMS Application Provider via the Naf\_EventExposure service at reference point R6 (or via the via the Nnef\_EventExposure service, as appropriate) (see discussion in section 3.4).

NOTE: This instantiation of the Data Collection AF is only aware of data reporting formats relating to 5G Media Streaming and is designed to reject any other kinds of report.

1. The Direct Data Collection Client is instantiated within the Media Session Handler of the 5GMS Client.

NOTE: The Data Collection Client realises at least the reporting aspects of the *Metrics Collection & Reporting* and the *Consumption Collection & Reporting* subfunctions of the Media Session Handler.

# 3. Topics for discussion

## 3.1 Provisioning of generic UE data collection and reporting in the context of 5GMS

In Release 16, 5G Media Streaming procedures at reference point M1 [1] are used to provision the 5GMS metrics reporting and 5GMS consumption reporting features.

Meanwhile, TS 26.531 [7] defines procedures for provisioning the generic aspects of data collection and reporting, such as data processing instructions, data exposure restrictions, etc. (Data collection client configurations are also derived by the Data Collection AF from the provisioning information.)

In Release 17, there are two top-level options:

1. **Expose separate R1 and M1 interfaces to the 5GMS Application Provider.** 5G Media Streaming is provisioned over reference point M1 mostly as before, but the provisioning of 5GMS AF-based QoE metrics reporting and consumption reporting is removed from interface M1 in TS 26.512 [6]. Instead, these features are re-specified in TS 26.512 Rel‑17 to be provisioned by the 5GMS Application Provider via R1.
2. **Extend M1 to support generic aspects of UE data collection and reporting pertintent to 5G Media Streaming.** In this model, reference point R1 is not instantiated in the 5G Media Streaming architecture, being hidden inside the 5GMS AF and inside the 5GMS Application Provider. Within this model, two further choices are available:
   1. **Extend M1 provisioning of 5GMS AF-based QoE metrics reporting and consumption reporting to include generic data collection and reporting aspects** such as data processing instructions and data exposure restrictions**.** Here, the baseline provisioning parameters at R1 are simply replicated at M1 under the MetricsReportingConfiguration resource and ConsumptionReportingProvisioning resource.
   2. **Abstract away the generic data collection and reporting aspects at M1.** With this more nuanced approach, only a subset of the generic data collection and reporting provisioning procedures are exposed via M1 on a case-by-case basis.

For example, the Event ID corresponding to 5GMS downlink streaming access logs does not necessarily need to be provisioned explicitly at M1. Instead, simply provisioning the Content Hosting feature at M1 may be enough to implicitly provision reporting of access log data by the 5GMSd AS to the Data Collection and Reporting AF instantiated in the 5GMSd AF.

The question then arises about how much control over the data collected and reported is possible behind this abstraction. In this example, is it possible to customise the data processing instructions, or does the 5GMS AF determine the data processing rules? Is it possible to define data exposure restrictions, or does the 5GMS AF determine those?

### Analysis

1. Option A represents a large delta that would be quite disruptive to the TS 26.512 [6].
2. Other sibling Work Items (such as 5GMS\_EDGE) are proposing approaches similar to Option B(i).
3. Option B(ii) feels like a neater solution architecturally because it exposes a cleaner abstraction outside the 5G System. However, any abstraction that hides the detail of UE data collection and reporting also limits the ability of a 5GMS Application Provider to control and manage it. This could be mitigated by exposing more generic data collection and reporting concepts at M1, but at the cost of additional specification work.

## 3.2 Direct data reporting

In Release 16, QoE metrics and media consumption are reported directly to the 5GMS AF at reference point M5 according to TS 26.501 [1].

Meanwhile, TS 26.531 [7] defines the concept of a generic data reporting envelope at reference point R2, and procedures for sending these data reporting envelopes to the Data Collection AF instantiated in the 5GMS AF.

In Release 17, there are two top-level options:

1. **Expose separate R2 and M5 interfaces to the Media Session Handler.** The existing Service Access Information is provided to the Media Session Handler at reference point M5, mostly as before, but the ClientMetricsReportingConfiguration and ClientConsumptionReportingConfiguration elements are removed from the ServiceAccessInformation resource. Instead, the configuration of AF-based QoE metrics reporting and consumption reporting uses the generic envelope for client reporting configuration defined in TS 26.531 [1]. This envelope is profiled in TS 26.512 [6] to carry the baseline parameters for QoE metrics and consumption reporting hitherto carried in the abovementioned structures.

When it comes to reporting data, M5\_MetricsReporting and M5\_ConsumptionReporting APIs defined in TS 26.512 [6] are deprecated in favour of the generic Ndcaf\_DataReporting service (e.g. HTTPS POST to the Data Collection AF in the 5GMSd AF). The QoE metrics report for 5GMS and the consumption report for 5GMS are conveyed to the Data Collection AF in a generic data reporting envelope. The existing reporting formats defined in TS 26.512 [6] need to be mapped into this generic data reporting envelope.

1. **Subsume reference point R2 into M5.** In this model, reference point R2 is not instantiated in the 5G Media Streaming architecture, being hidden inside the Media Session Handler. Instead of retrieving its data reporting client configuration from the Data Collection AF at R2, the Direct Data Collection Client continues to use the ClientMetricsReportingConfiguration and ClientConsumptionReporting‌Configuration elements from the Service Access Information the Media Session Handler has retrieved at M5. This may need to be enhanced slightly following a gap analysis with the baseline data reporting client configuration. For example, the external application identifier may need to be added to the Service Access Information.

Similarly, depending on the stage 3 design, the external application identifier may also need to be added to the existing reporting formats for QoE metrics reports and consumption reports.

### Analysis

1. Option A involves removing specification at reference point M5 in TS 26.512 [6] and adding it back in at a different clause. It also involves deprecating the DASH QoE metrics reporting format in favour of a reporting format based on the generic envelope.
2. Option B feels neater and a smaller delta to the existing TS 26.512 specification.

## 3.3 Downlink access reporting by the 5GMSd AS

The access logs recorded by the 5GMSd AS for downlink media streaming represent an additional source of UE data that can be reported to the Data Collection AF in the 5GMSd AF and exposed to interested event subscribers.

In Release 16, TS 26.501 [1] declares reference point M3 out of scope. It is therefore not possible to piggyback reference point R4 on any existing interface. Instead, an interface is needed at reference point R4 between the 5GMSd AS and the Data Collection AF in the 5GMSd AF.

The generic reporting envelope needs to be instantiated in TS 26.532 [8] to include all relevant HTTP server log fields in each reporting record. The QLOG data model for HTTP/3 logging described in clause 5.4.1.6 of TR 26.804 [9] may be of use in this context.

The data report message could look something like this:

|  |
| --- |
| Date: Wed, 29 Nov 2017 22:51:00 GMT  Content-Type: application/json+3gpp-data-report  Content-Length: 1436  User-Agent: 5GMSdAS (5G-MAG Reference Tools; Nginx; Linux x86\_64; rv:1.0)  {  "target\_event\_id": "MS\_ACCESS\_LOG",  "external\_application\_identifier", "1234567890"  "records": [  ["2017-11-29T22:50:20Z", "79.210.252.187", 443, "GET", "/", "HTTP/1.1", "200", 19502, "-", "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:57.0) Gecko/20100101 Firefox/57.0", 443, "-"],  ["2017-11-29T22:50:20Z", "79.210.252.187", 443, "GET", "/scripts/jquery-1.4.1.min.js", "HTTP/1.1", "404", 225, "https://www.hk56.de/", "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:57.0) Gecko/20100101 Firefox/57.0", "-"],  ["2017-11-29T22:50:20Z", "79.210.252.187", 443, "GET", "/global/bilder/bahnhof.jpg", "HTTP/1.1", "200", 48577, "https://www.hk56.de/", "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:57.0) Gecko/20100101 Firefox/57.0", 443, "-"],  ["2017-11-29T16:23:58Z", "2a01:238:4378:b500:ff4:e499:7e9b:7ae8", 443, "GET", "/", "HTTP/1.1", "200", 19502, "-", "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:57.0) Gecko/20100101 Firefox/57.0", "-"],  ["2017-11-29T22:50:20Z", "2a01:238:4378:b500:ff4:e499:7e9b:7ae8", 443, "GET", "/scripts/jquery-1.4.1.min.js", "HTTP/1.1", "404", 225, "https://www.hk56.de/", "Mozilla/5.0 (Windows NT 6.3; WOW64; Trident/7.0; rv:11.0) like Gecko", "-"],  ["2017-11-29T22:50:20Z", "2a01:238:4378:b500:ff4:e499:7e9b:7ae8", 443, "GET", "/global/bilder/bahnhof.jpg", "HTTP/1.1", "200", 48577, "https://www.hk56.de/", "Mozilla/5.0 (Windows NT 6.3; WOW64; Trident/7.0; rv:11.0) like Gecko", "-"]  ]  } |

## 3.4 Exposure of events to 5GMS Application Provider

Once the contents of data reports have been processed by the Data Collection AF in the 5GMS AF, and certain configurable thresholds have been met (e.g. rate limiting timer expired, data averaging period timer expired, maximum output size reached, minimum records threshold met) an event may need to be exposed by the Data Collection AF to the 5GMS Application Provider by invoking the Naf\_EventExposure\_Notify callback on the Event Consumer AF at reference point R6. (In case the latter is outside the Trusted DN, the Nnef\_EventExposure\_Notify callback is invoked instead.)

The format of the events exposed by the Naf\_EventExposure\_Notify operation is tightly specified in TS 29.517 [10]: an AfEventExposureNotify data structure containing a subscription correlation identifier (notifId) and an array of AfEventNotification objects (eventNotifs).

Each AfEventNotification object indicates the type of event (event) and includes a timestamp (timeStamp) and the event data itself formatted according to an event-specific data type:

|  |  |  |  |
| --- | --- | --- | --- |
| **Feature number** | **AfEventNotification.event value (from AfEvent enumeration)** | **AfEventNotification additional property** | **Data type of additional property** |
| 1 | SVC\_EXPERIENCE | svcExprcInfos | array(ServiceExperienceInfoPerApp) |
| 2 | UE\_MOBILITY | ueMobilityInfos | array(UeMobilityCollection) |
| 3 | UE\_COMM | ueCommInfos | array(UeCommunicationCollection) |
| 4 | EXCEPTIONS | excepInfos | array(ExceptionInfo) |
| 7 | USER\_DATA\_CONGESTION | congestionInfos | array(UserDataCongestionCollection) |
| 8 | PERF\_DATA | perfDataInfos | array(PerformanceDataCollection) |
| — | COLLECTIVE\_BEHAVIOUR | collBhvrInfs | array(CollectiveBehaviourInfo) |
| 9 | DISPERSION | dispersionInfos | array(DispersionCollection) |
| ? | MS\_ACCESS\_LOG | mediaStreamingAccessInfos | array(MediaStreamingAccessLogEntry) |
| ? | MS\_UE\_QOE | mediaStreamingUeQoeInfos | array(MediaStreamingUeQoeReport) |
| ? | MS\_UE\_CONSUMPTION | mediaStreamingUeConsumption | array(MediaStreamingUeConsumptionReport) |
| ? | MS\_NETWORK\_ASSISTANCE | mediaStreamingNetworkAssistance | Array(MediaStreamingNetworkAssistanceReport) |
| ? | MS\_DYNAMIC\_POLICY | mediaStreamingDynamicPolicy | Array(MediaStreamingDynamicPolicyReport) |
| ? | MBS\_REPAIR | multicastBroadcastRepair | array(MulticastBroadcastRepair) |

The rows highlighted in yellow in the above table are proposals for some additional basic media events to be defined in TS 26.532 [8] and specified by CT3 in TS 29.517 [10] to satisfy stage 3 of the EVEX Work Item.

The numbered list of supported features in table 5.8‑1 of TS 29.517 [10] may additionally need to be extended by CT3 to define a feature number for each new event type. (These values are used when negotiating the set of event types supported by the Naf\_EventExposure service consumer and the Data Collection AF at the time of subscription.)

## 3.5 Data analytics for 5G Media Streaming

More complex analysis of the UE data for 5G Media Streaming is best left to the NWDAF and is therefore out of scope for TS 26.531 [7] and TS 26.532 [8]. For example:

* Top ten downlink content items over the last hour/day/week/month.
* Proportion of downlink media streaming requests at each Operating Point (DASH Representation) over the last hour/day/week/month.

# 4. Conclusion

The present document proposes an instantiation of the generic UE data collection and reporting architecture within the 5G Media Streaming architecture. Aspects of how best to achieve this instantiation with respect to three existing reference points (M1, M5 and M3) are discussed in detail.

# 5. Proposal

It is proposed that SA4:

1. Agrees the instantiation architecture in **section 2** as the basis for further work. This will be amended according to the following agreements.
2. Agrees to pursue **Option B(ii)** as outlined in **section 3.1** for provisioning data collection and reporting for 5GMS, and to further study the extent to which data collection and reporting features need to be exposed at an extended reference point M1.
3. Agrees to pursue **Option B** as outlined in **section 3.2** for configuring data collection and reporting in the Media Session Handler via extensions to the Service Access Information exposed by the 5GMS AF at reference point M5, including adding any necessary fields to the existing QoE reporting format specified in clause 10.6.2 of TS 26.247 [11] and/or the existing consumption reporting format defined in TS 26.512 [6].
4. Agrees to define a data reporting format for 5GMS downlink access logs using the solution outlined in **section 3.3** as the basis for further work.
5. Agrees the proposed additional event types outlined in **section 3.4** as the basis for further work and liaison with CT3.

# References

[1] 3GPP TS 26.501: "5G Media Streaming architecture", Release 16.

[2] S4-210682|SP-210374: "New WID on 5GMS AF Event Exposure".

[3] 3GPP TR 23.700-91: "Study on enablers for network automation in the 5G System (5GS)", Release 17.

[4] S4-210414: "Reply LS on method for collection of data from the UE".

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

[6] 3GPP TS 26.512: "5G Media Streaming (5GMS); Protocols".

[7] 3GPP TS 26.531: "Data Collection and Reporting; General Description and Architecture".

[8] 3GPP TS 26.532: "Data Collection and Reporting; Protocols and Formats".

[9] 3GPP TR 26.804: "Study on 5G Media Streaming Extensions".

[10] 3GPP TS 29.517: "Application Function Event Exposure Service; Stage 3".

[11] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".