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Title: Discussion on use of SEAL and ADAES frameworks to support management of 5GMS AS instance by 5GMS AF instance

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# Abstract

The feasibility study for 5GMS Phase 2 identified the need for a 5GMS AF instance to manage a deployment of 5GMS AS instances. This discussion paper investigates the suitability of the SA6-defined SEAL framework for this purpose.

# 1. Background

Following a study on the subject of reference point **M3** in the 5G Media Streaming architecture in clause 5.14 of TR 26.804 [8], SA4 sent an LS to SA2 (copying SA6) [S4-230436] asking for advice about generic solutions that enable an Application Function to determine the health and server load of an Application Server under its control as well as life-cycle management. In the context of 5G Media Streaming, this is applicable to the case of a 5GMS AF instance managing a population of 5GMS AS instances, some of which may deployed centrally, with others deployed as Edge Application Servers.

SA6 provided a response [S6-231605|S4-230756] indicating that existing frameworks such as **SEAL** and **CAPIF** were suitable for achieving these aims across a wide range of application layers defined by industry verticals, including the media industry vertical. SA6 strongly advised SA4 not to attempt to duplicate generic functionality already defined in these frameworks.

This discussion paper examines these frameworks and assesses their suitability for use in the second phase of normative specification (Rel-18) currently underway for 5G Media Streaming currently.

# 2. SEAL framework summary

The figure below, reproduced from TS 23.434 [2], illustrates the generic on-network functional model for SEAL.



TS 23.434 [2] Figure 6.2-1: Generic on-network functional model

Note that this figure is drafted upside-down compared with the 5G Media Streaming architecture: the application traffic between the client and server components of the vertical application is depicted at the top (reference point VAL‑UU) and the "control" flows that the SEAL framework provides to support the vertical application (reference point SEAL‑UU) are at the bottom. As in the 5GMS architecture, both of these reference points traverse the User Plane.

As an observation, the SEAL framework is reminiscent of SA4's own attempt to generalise an architectural framework for media services (the Media Service Enablers framework documented in TR 26.857 [3]).

No attempt is made in TS 23.434 [2] to define application protocols at reference point VAL‑UU, but there is support in the SEAL architecture for the concept of proxies for application protocols such as HTTP as well as so-called "lightweight" application protocols such as DTLS, TLS or secure WebSocket. Support for SIP session initiation and Diameter protocol are explicitly called out in clause 6.4.3.

TS 23.434 [2] defines a number of generic application support functionalities (so-called **SEAL services**) at reference point SEAL‑UU. Each one defines a trio of service-specific reference points that are specialisations of SEAL‑UU, SEAL‑S and SEAL‑C respectively:

* Clause 9: **Location management service**.
* Clause 10: **Group management service**.
* Clause 11: **Client configuration management service**.
* Clause 12: **Client identity management service**.
* Clause 13: **Key management service**.
* Clause 14: **Network resource management and monitoring service**.
	+ The SEAL Server may be specialised as a **Network Resource Management Server** to support management of unicast network resources (interacting with the PCF), event monitoring of the 5G System (interacting with the NEF) or management of multicast‑broadcast resources (interacting with the MB-SMF or MBSF).
		- NOTE: The latter (see clause 14.3.4A of TS 23.434 [2]) appears to have some overlaps with the architecture for MBS User Services defined in TS 26.502 [4].
	+ The SEAL Network Resource Management Server may also act as a TSN‑AF to enable management of time-sensitive networking in the 5G System.
* Clause 17: **Notification management service**.
	+ Both pull- and push-based notification delivery methods are defined at stage‑2.
		- Clause 17.3.3 mentions WebSockets in passing as a possible stage‑3 realisation of a push-based notification channel.

Finally, clause 19 envisages a value-added SEAL Service for Application Data Analytics Enablement (ADAE). This is further specified by SA6 in TS 23.436 [5].

# 3. Instantiation of SEAL framework for 5G Media Streaming

In Rel‑18, TS 23.434 [2] does not include a specific instantiation of its framework architecture to cover 5G Media Streaming. 5GMS is not a vertical application in the sense understood by SEAL. However, it is instructive to attempt an informal instantiation of the SEAL architectural elements in the 5GMS architecture as a thought experiment in order to understand whether the advice received from SA6 is able in principle to satisfy SA4's requirements in the area of 5GMS AS management by a 5GMS AF instance.

In the following mapping:

* The VAL Client is instantiated inside the Media Stream Handler (downlink Media Player or uplink Media Streamer).
* The VAL Server is instantiated inside the 5GMS AS.
* The SEAL Client is instantiated inside the Media Session Handler.
* The SEAL Server is instantiated inside the 5GMS AF.

This instantiation is illustrated in the figure below:



Figure 1: Hypothetical instantiation of SEAL reference model in 5G Media Streaming architecture

Regarding the SEAL reference points:

* **SEAL‑S** operates in parallel with reference point **M3**.
* **SEAL-C** operates in parallel with reference points **M6** and **M7**.
* **SEAL‑UU** is realised by reference point **M5**.
* **VAL‑UU** is realised by reference point **M4**.

In the context of this discussion paper, the management of the 5GMS AS by the 5GMS AF therefore falls within the purview of reference point SEAL‑S. Clause 6.5.2.7 of TS 23.434 [2] states:

"The specific SEAL service reference point corresponding to SEAL-S is specified in the specific SEAL service functional model."

However, the SEAL framework defined in TS 23.434 [2] lacks a SEAL service that satisfies the requirement for a VAL Server to report its current health and load to the SEAL Server.

# 4. Application Data Analytics Enablement Service

TS 23.436 [5] defines an additional SEAL service called the **Application Data Analytics Enablement Service (ADAES)**. The stated purposes of this are (i) to expose data analytics services from different 3GPP domains to verticals and Application Service Providers, and (ii) to define value-added application data analytics services covering statistics and predictions that may be of interest to end-to-end applications.

The data analytics exposure procedures covered by the ADAE Service in Rel-18 are as follows. Those of greatest relevance to this discussion paper are highlighted.

* Clause 8.2: **Application performance** analytics.
* Clause 8.3: **Slice-specific application performance** analytics.
* Clause 8.4: **UE-to-UE application performance** analytics.
* Clause 8.5: **Location accuracy** analytics.
* Clause 8.6: **Service API** analytics.
* Clause 8.7: **Slice usage pattern** analytics.
* Clause 8.8: **Edge load** analytics.
* Clause 8.9: **Service experience to support application performance** analytics.

The so-called "on-network" functional architecture for ADAE is reproduced below. In this case, the SEAL Server is instantiated as an **ADAE Server** and the SEAL Client as an ADAE Client. Reference point SEAL‑S is specialised as ADAE‑S, reference point SEAL‑C as ADAE‑C and reference point SEAL‑UU as ADAE‑UU.



TS 23.436 [5] Figure 5.2.2-1: Architecture for Application Data Analytics Enablement
(reference point representation)

# 5. Instantiation of ADAE framework for 5G Media Streaming

Figure 5.2.2‑2 of TS 23.436 [5] depicts a *Naf\_[SAdae]* service exposed by the ADAE Server which appears to be the same as that later defined in clause 9.2.2 with the different name *SS\_ADAE\_\**. Regardless of its name, this service is intended to be consumed only by the VAL Server (at reference point ADAE‑S) and by the ADAE Client (at reference point ADAE‑UU). Hence, this service may be unsuitable for consumption of data analytics by an Application Function such as the 5GMS AF.



TS 23.436 [5] Figure 5.2.2-2: Architecture for application data analytics enablement –
Service based representation

In the context of this discussion paper, the 5GMS AF (ADAE Server) is interested in managing the instances of the 5GMS AS (VAL Server) and obtaining server health and load information about them. Taking into account the mapping in the above figure, the use of reference point **ADAE‑S** by the ADAE Server (5GMS AF) to subscribe to application performance analytics from a VAL Server (5GMS AS) may satisfy SA4's requirement.

Annex A of TS 23.436 [5] illustrates some example deployment scenarios for the ADAE Service. These focus on usage in connection with an Edge Data Network, although the ADAE architecture is equally applicable to non-edge deployments, as evidenced by figure 5.3‑1 of [5], reproduced below, which shows deployment of the ADAE Server in either a Data Network or in an Edge Data Network in connection with the 3GPP network data analytics model.



TS 23.436 [5] Figure 5.3-1: ADAE internal functional architecture

The above figure implies that the VAL Server (5GMS AS) is the consumer of data analytics from the ADAE Server (5GMS AF), which is the exact opposite of SA4's requirements! However, the text accompanying the above figure in clause 5.3 of TS 23.436 [5] explains that the ADAE Server may act as a consumer of data analytics, either directly from the individual Data Sources illustrated above (via reference point ADAE‑Y) or else indirectly (via reference point ADAE‑X) from an **Application layer – Data Collection and Coordination Function (A-DCCF)** acting as a single point of contact for data analytics. This feels like a red herring, however.

Instead, the following hypothetical mapping between the ADAE architecture and the 5GMS architecture is suggested:

* The VAL Server is instantiated inside the 5GMS AS (the same as in the generic SEAL mapping).
* The ADAE Server (specialisation of SEAL Server) is instantiated inside the 5GMS AF.

This instantiation is illustrated in the figure below:



Figure 2: Hypothetical instantiation of ADAE reference model in 5G Media Streaming architecture

## 5.1 Application performance analytics: VAL Server performance analytics

Clause 6.1 of TS 23.436 [5] defines an ADAE feature that "…supports the **derivation and exposure of application layer analytics to provide insight on the operation and performance of an application (VAL server or EAS, application session)**, and in particular statistics or prediction on parameters related to e.g. VAL server number of connections for a given time and area, VAL server rate of connection requests, connection probability failure rates, RTT and deviations for a VAL server or VAL UE session, packet loss rates etc. This feature also supports the collection of service experience information from the ADAE clients (as described in clause 8.9) to support application performance analytics."

Clause 8.2 of TS 23.436 [5] defines two high-level call flow to support application performance analytics:

* Clause 8.2.2 defines the procedure for **VAL Server performance analytics**. See below.
* Clause 8.2.3 defines the procedure for **VAL session performance analytics**. This is not relevant to the SA4 Use Case because data is collected from the ADAE Client rather than from the VAL Server.



TS 23.436 [5] Figure 8.2.2-1: ADAES support for VAL server performance analytics

Ignoring the involvement of the ADAE Client and A-ADRF (which are not pertinent to the SA4 Use Case), the relevant steps are adjusted as shown in **boldface** to satisfy the SA4 requirements:

1. The consumer of the ADAES analytics service sends a VAL performance analytics subscription request to ADAES **(mapped onto internal interface inside 5GMS AF)**.

2. The ADAES sends a subscription response as a positive or negative acknowledgement to the consumer of the analytics service **(mapped onto internal interface inside 5GMS AF)**.

3. The ADAES maps the analytics event ID to a list of data collection event identifiers, and a list of data producer IDs. Such mapping may be preconfigured by OAM or may be determined by ADAES based on the analytics event type / vertical type and/or data producer profile.

4. The ADAES sends a data collection subscription request to the Data Producers (at the DN side ~~or UE side~~) with the respective Data Collection Event ID and the requirement for data collection. Such data producers include ~~the A-ADRF, the A-DCCF,~~ the VAL server **embedded in the 5GMS AS**~~, SEALDD server, or the VAL UEs~~.

5. The Data Producer~~(s)~~ **(VAL server embedded in the 5GMS AS)** sends a subscription response as a positive or negative acknowledgement to the ADAES.

~~NOTE: The ADAES acting as AF may also subscribe to NEF/SMF/PCF/NWDAF to monitor network/UE situation or network data analytics required for the application data analytics event.~~

~~6. The ADAES based on subscription, may receive offline stats/data from A-ADRF on the VAL server performance based on the analytics/data collection event ID. Such offline data can be average/peak throughput, average/maximum e2e delay, jitter, av. PER, availability, VAL server load, number of failed transactions, and can be for a given area and time of the day (based on the time/area of the request).~~

A session starts between the VAL server #1 **embedded in the 5GMS AS** and a UE (this could happen for more than one UEs)

7. The Data Producer at DN side **(VAL server embedded in the 5GMS AS)**, starts collecting data from the data generating entities, e.g. real-time networking or application data (from networking start at DN or VAL server itself), such as RTT, PER, throughput.

8a. The Data Producer **(VAL server embedded in the 5GMS AS)** sends the real-time data to the ADAES, where the data correspond to the data collection ID or the analytics event ID for which the ADAES subscribed.

~~8b. The ADAES may receive also data (periodically or if a threshold is reached based on configuration) from the application of the UE within the ongoing session (via ADAEC). Such data can be about the RTT, average/peak throughput, jitter, QoE measurements (MOS, stalling events, stalling ratios, etc), QoS profile load, VAL server load, etc.~~

~~9. When the VAL UE session with VAL server finishes, the ADAEC notifies the ADAEC of the completion of the reporting.~~

10. The ADAES abstracts or correlates the data based on the analytics event and the data collection configuration. Such correlation can be filtering of data for the same metrics but with different granularities or be combining/aggregating the data of segments of the end-to-end path (end to end is between VAL client and server). The outcome is an abstracted/correlated/filtered set of data.

11. The ADAES derives application layer analytics on **5GMS AS (**VAL server #1**)** performance, based on the analytics ID and type of request. Such analytics can be stats or prediction for a given area/time and based on the event type for a given network configuration.

12**.** The ADAES sends the analytics to the **5GMS AF** consumer, where these analytics include the **5GMS AS (**VAL server 1**)** predicted or statistic performance for a given area and time horizon, including also the confidence level, whether offline/online analytics were used.

The stage-2 definitions of operations that support interactions between the analytics consumer and the ADAE Server are defined as part of the *SS\_ADAE\_VAL\_performance\_analytics* service in clause 9.2.2 of TS 23.436 [5]:

* *SS\_ADAE\_VAL\_performance\_analytics\_****subscribe*** supporting steps 1 and 2 of the high-level call flow. The baseline request parameters are defined in clause 8.2.4.2 and the response parameters in clause 8.2.4.3.
* *SS\_ADAE\_VAL\_performance\_analytics\_****notify*** supporting step 12 of the high-level call flow. The baseline information included in notifications is defined in clause 8.2.4.7. However, this provides very little detail.

NOTE: Although the high-level call flow identifies alternative consumers of the *SS\_ADAE\_‌VAL\_‌performance\_‌analytics* service – specifically an NF or AF – table 9.2.2‑1 of TS 23.436 [5] currently specifies that the only known service consumer is the VAL Server. SA4's Use Case, where the service consumer is an AF (specifically the 5GMS AF), is therefore not currently supported, although this gap could be mitigated by instantiating the ADAE Server in the 5GMS AF, as proposed in figure 2 of this discussion paper.

## 5.2 Edge load analytics

Clause 6.7 of TS 23.436 [5] defines an ADAE feature that "…provides insight on the operation and performance of an EDN and in particular statistics or prediction on parameters relating to the EAS/EES load for one or more EAS/EES" and "edge platform load parameters, which include the aggregated load per EDN or per DNAI due to the edge support services and e.g., load level of edge computational resources. Such analytics can improve edge support services by allowing the pro-active edge service operation changes to deal with possible edge overload scenarios. For example, this can trigger EAS migration to a different EDN / central DN, or pro-active EAS reselection for a target UE or group of UEs."

Clause 8.8 of TS 23.436 [5] defines two high-level call flow that may be used to obtain edge load analytics from a 5GMS EAS instance, with adjustments to satisfy SA4 requirements shown again in **boldface**.

### 5.2.1 Subscribe–notify paradigm for obtaining edge load analytics

Clause 8.8.2.1 of TS 23.436 [5] defines a procedure for obtaining edge load analytics using a subscribe-notify paradigm with the following pre-conditions:

1. ADAES has discovered the APIs to access the edge services at EDN.

~~2. ADAES has subscribed to OAM and NWDAF for receiving management and DN performance analytics respectively.~~

3. Data producers (e.g. ~~A-ADRF,~~ EAS~~, EES~~) may be pre-configured with data producer profiles (as in Table 8.2.4.8-1) for the data they can provide. ADAES ~~and ADAEC~~ have discovered available data producers and their data producer profiles.



TS 23.436 [5] Figure 8.8.2.1-1: ADAES support for edge analytics

1. The consumer of the ADAES analytics service sends an edge analytics subscription request to ADAES **(mapped onto internal interface inside 5GMS AF?)**.

2. The ADAES sends an edge analytics subscription response as an ACK to the analytics consumer **(mapped onto internal interface inside 5GMS AF?)**.

3. The ADAES **instantiated inside the 5GMS AF** maps the analytics event ID to a list of data collection event identifiers, and a list of data producer IDs. Such mapping may be preconfigured by OAM or may be determined by ADAES based on the analytics event ID and/or data producer profile (Table 8.2.4.8-1). Such Data Producers can be EASs onboarded to EDN~~, EESs, A-ADRF, as well as MEC Platform services~~.

4. The ADAES **instantiated inside the 5GMS AF** sends a subscription request to the Data Producers (EASs onboarded to EDN~~, EESs, A-ADRF, ADAEC~~) ~~or the A-DCCF~~ with the respective Data Collection Event ID and the requirement for data collection.

5. The Data Producers (e.g., EASs onboarded to EDN~~, EESs, A-ADRF, ADAEC~~) ~~or the A-DCCF~~ send a subscription response as a positive or negative acknowledgement to the ADAES **instantiated inside the 5GMS AF**.

~~6. The ADAES based on subscription receive offline stats/data on the edge DN load based on the analytics/data collection event ID from A-ADRF. Such stats can be about the load in terms of number of EAS or EES connections for a given area or time window, or the average edge computational resource usage or usage ratio based on the EDN total resource availability, EDN overload/high load indication events, probability of EAS/EES unavailability due to high load, etc.~~

7. The Data Producers at the edge start collecting data from the data generating entities. Such data can be measurements or analytics based on the data source/producer, as follows:

- from ~~OAM or~~ EAS/ASP (for EAS load info): Per EAS~~/EES~~ computational resource load, number of connections per ~~EES/~~EAS

~~- from N6 endpoint: N6 load~~

~~- from 5GC / NWDAF: DN performance analytics~~

~~- from OAM / MDAS: UPF load analytics (per DNAI)~~

~~- from MEC platform services (e.g., RNIS): per cell radio conditions / load for all cells within EDN coverage~~

NOTE 1: How the ADAES obtains the EAS load information from EAS/ASP is up to implementation.

~~NOTE 2: Steps 6 and 7 are not necessarily sequential and can be performed in parallel or in different order.~~

~~8. If in step 4 ADAES sent a subscription request to ADAEC as Data Producer, data collection is initiated by ADAEC from UE data generating entities.~~

~~NOTE 3: Data collection at the UE reuses the SA4 mechanism based on EVEX study (TS 26.531 [3]).~~

9. The edge Data Producers (targets of the subscription requests in step 4) send the data to the ADAES **instantiated inside the 5GMS AF** (based on step 7 measurements or analytics) as a data notification message. Such data can be about the load in terms of number of EAS ~~or EES~~ connections for a given area or time window, or the average edge computational resource usage or usage ratio based on the EDN total resource availability, ~~EDN overload/high load indication events,~~ probability of EAS~~/EES~~ unavailability due to high load, etc.

~~10. ADAEC sends data (periodically or if a threshold is reached based on configuration) about the edge load as collected at the UE, e.g. in terms of number of AC or EEC connections for a given UE in a given time window, number of edge service sessions, etc.~~

11. The ADAES derives edge analytics on ~~EDN / DNAI load or~~ per EES/EAS load, based on the analytics ID and type of request. The analytics are derived based on the performance analytics received ~~per DN or load analytics per DNAI/UPF; as well as considering measurements on the computational or RAN resource load~~ or number of connections for the ~~EES/~~EASs which are active at the EDN.

12**.** The ADAES **instantiated inside the 5GMS AF** sends the edge analytics to the consumer **instantiated inside the 5GMS AF**, based on the request and the derived analytics in step 9. Such analytics indicate a prediction of the EDN load considering inputs from both 5GS as well as from edge platform services. Such prediction can also be in form of a recommendation for triggering an EAS relocation to a different platform.

The stage-2 definitions of operations that support interactions between the analytics consumer and the ADAE Server are defined as part of the *SS\_ADAE\_VAL\_edge\_analytics* service in clause 9.2.2 of TS 23.436 [5]:

* *SS\_ADAE\_VAL\_edge\_analytics\_****subscribe*** supporting steps 1 and 2 of the above high-level call flow. The baseline request parameters are defined in clause 8.8.3.2 and the response parameters in clause 8.8.3.3.
* *SS\_ADAE\_VAL\_edge\_analytics\_****notify*** supporting step 9 of the above high-level call flow. The baseline information included in notifications is defined in clause 8.8.3.7. However, this provides very little detail, and NOTE 1 beside step 7 of the high-level call flow suggests that this will not be further elaborated at stage‑3 in this release.

NOTE: Table 9.2.2‑1 of TS 23.436 [5] currently specifies that the only known service consumers are the VAL Server, the EAS or the EES. SA4's Use Case, where the service consumer is an AF (specifically the 5GMS AF), is therefore not currently supported, although this gap could be mitigated by instantiating the ADAE Server in the 5GMS AF, as proposed in figure 2 of this discussion paper.

### 5.2.2 Request–response paradigm for obtaining edge load analytics

Clause 8.8.2.2 of TS 23.436 [] describes a simple request-response paradigm to explicitly request analytics data about particular application server(s) from the ADAE server.



TS 23.436 [5] Figure 8.8.2.2-1: ADAES support for edge analytics

1. The analytics consumer sends a request message to the ADAE server to receive analytics data for one or more application servers. The request message includes the identity of the analytics consumer, security credential(s) for authorization and verification, identity of all the application server for which analytics data is requested, type of analytics data, time duration since when analytics data is required.

2. Upon receiving the request, the ADAE server authenticates and authorizes the analytics consumer. If the analytics consumer is authorized, the ADAE server may get the analytics data by performing step 3 to 9 of clause 8.8.2.1. The ADAE server sends a response message including the statistical and predictive analytics data of the application servers for the requested duration period (if the time duration is available).

The stage-2 definitions of operations that support interactions between the analytics consumer and the ADAE Server are defined as part of the *SS\_ADAE\_VAL\_edge\_analytics* service in clause 9.2.2 of TS 23.436 [5]:

* *SS\_ADAE\_VAL\_edge\_analytics\_****Get\_analytics\_data*** supporting steps 1 and 2 of the above high-level call flow. The baseline request parameters are defined in clause 8.8.3.8 and the response parameters in clause 8.8.3.9. However, this provides very little detail, and NOTE 1 beside step 7 of the subscribe–notify high-level call flow (imported by the above call flow) suggests that this will not be further elaborated at stage‑3 in this release.

NOTE: Table 9.2.2‑1 of TS 23.436 [5] currently specifies that the only known service consumers are the VAL Server, the EAS or the EES. SA4's Use Case, where the service consumer is an AF (specifically the 5GMS AF), is therefore not currently supported, although this gap could be mitigated by instantiating the ADAE Server in the 5GMS AF, as proposed in figure 2 of this discussion paper.

# 6. Summary

The following table summarises the feature sets of the frameworks considered in this discussion paper:

|  |  |  |
| --- | --- | --- |
| **Framework** | **Instantiation of AS** | **Health monitoring of AS instance** |
| 5GMS [1] | Out of scope for reference point M3. | Out of scope for reference point M3. |
| SEAL [2] | No suitable SEAL service defined. | No suitable SEAL service defined. |
| ADAES [5] | Out of scope. | (See section 5.1 of this discussion paper for details.)Collection of VAL Server performance analytics (TS 23.436 [5] clause 8.2.2) potentially satisfies the SA4 requirement. The periodic reporting of data meets the requirement for a 5GMS AS heartbeat, but the normative text is not specific enough to determine whether CPU load is included in the information reported by the VAL Server to the ADAE Server. |
| EDEGAPP [7, 8] | Use Case for instantiation of EAS is documented in clause 5.12 of SA5's TS 28.538 [6], but the stage‑2 definition and stage‑3 specification of the MnS-C service are explicitly left to implementation in Rel‑17 by NOTE 3 in clause 8.12 of SA6's TS 23.558 [7]. This NOTE has disappeared in Rel‑18, so this feature seems to have come into scope, but the corresponding MnS‑C API specification has not yet been found to verify whether it meets SA4's requirements.Dynamic EAS instantiation triggering by EES defined in clause 8.12 of SA6's TS 23.558 [7]. | (See section 5.2 of this discussion paper for details.)Use Case for performance assurance of EAS in clause 5.2.2 of SA5's TS 28.538 [6] involves the ECSP management system collecting Key Performance Indicators (KPIs) from EAS instances. These KPIs include information about request rate, response time and availability.Clause 8.8 of TS 23.436 [5] defines the means for an ADAE Server to subscribe to and collect edge load analytics from an EAS instance deployed in the Edge DN. However, TS 23.436 [5] does not define a reference point or service between the EAS and the ADAE Server.Collated analytics information is exposed by the ADAE Server to a VAL Server using either a subscribe–notify paradigm or a request–response paradigm. |

# 7. Conclusions

## 7.1 Instantiation of 5GMS AS

The procedure whereby an EES can dynamically instantiate an EAS defined in clause 8.12 of TS 23.558 [7] is couched in terms of a reaction to an explicit EAS discovery request from an Application Client and a failure of the EES to find a suitable EAS instance. In this case, the EES may trigger instantiation of an EAS instance by invoking an appropriate MnS‑C service operation on the ECSP management system defined in TS 28.538 [6]. A reference to the newly instantiated EAS instance can then be included in the response to the Application Client's EAS discovery request.

In the edge extensions to the 5G Media Streaming architecture, the capabilities of an EES may be instantiated in the 5GMS AF (see clause 4.5.2 of TS 26.501 [1]). Using the above dynamic EAS instantiation procedure, a virtualised network function with the capabilities of a 5GMS AS ("5GMS EAS") may be instantiated by a 5GMS AF. This applies equally to step 17 in the client-driven procedure defined in clause 8.1 of [1] and to step 8 in the AF-driven procedure defined in clause 8.2.

Triangulating between these two specifications, it seems possible for a 5GMS EAS to be instantiated by an EES instantiated inside a 5GMS AF, thereby satisfying the SA4 requirements in the case of edge-deployed Application Server instances.

However, the above procedure only applies to edge-deployed Application Server instances. 3GPP does not currently specify an interoperable means for an AF to instantiate a non-edge instance of an AS, so this SA4 requirement is not met.

## 7.2 Health monitoring of non-edge-deployed AS instance

The procedure defined in clause 8.2.2 of TS 23.436 [5] whereby an ADAE Server collects performance analytics from a VAL Server potentially meets SA4's requirements for a 5GMS AF instance to obtain health and service load information about a 5GMS AS instance that it is managing.

The subscribe–notify paradigm may satisfy SA4's requirements, although it is unclear why a request–response paradigm is not also defined for the VAL performance analytics service (c.f. the edge load analytics procedure *SS\_ADAE\_VAL\_edge\_analytics\_****Get\_analytics\_data***).

In addition, lack of detail in TS 23.436 [5] about the specific baseline parameters exposed by a VAL Server means that it remains unclear whether service load is one of them.

Moreover, it is also unclear from TS 23.436 [5] whether an AF (such as the 5GMS AF) is permitted to consume VAL performance analytics from the ADAE Server using the *SS\_ADAE\_VAL\_performance\_analytics* service since there is no reference point defined between the AF and the ADAE Server. A potential workaround suggested is to instantiate an ADAE Server instance in every 5GMS AF instance.

## 7.3 Health monitoring of Edge AS instance

The procedure defined in clause 8.8 of TS 23.436 [5] whereby an ADAE Server collects edge load analytics from an EAS instance potentially meets SA4's requirements for a 5GMS AF instance to obtain health information about a 5GMS AS instance that it is managing.

The *SS\_ADAE\_VAL\_edge\_analytics* service supports both a subscribe–notify paradigm and a request–response paradigm between the analytics consumer (the 5GMS AF) and the ADAE Server. However, it is unclear from TS 23.436 [5] whether an AF (such as the 5GMS AF) is permitted to consume edge analytics from the ADAE Server using the *SS\_ADAE\_edge\_analytics* service since there is no reference point defined between the AF and the ADAE Server. Again, instantiating an ADAE Server instance in every 5GMS AF instance is a potential workaround.

Finally, it is noted that TS 23.436 [5] does not define a reference point or service between the EAS and the ADAE Server for subscribing to and obtaining edge analytics. This precludes interoperability unless another specification fills this gap.

# 8. Proposal

It is proposed that SA4 agrees to include the information documented in sections 2–7 in clause 5.14 of TR 26.804 (Rel‑18) [8].

# References

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

[2] 3GPP TS 29.434: "Service Enabler Architecture Layer for Verticals (SEAL); Functional architecture and information flows".

[3] 3GPP TR 26.857: "5G Media Service Enablers".

[4] 3GPP TS 26.502: "5G multicast-broadcast services; User service architecture".

[5] 3GPP TS 23.436: "Functional architecture and information flows for Application Data Analytics Enablement Service".

[6] 3GPP TS 23.538: "Management and orchestration; Edge Computing Management (ECM)".

[7] 3GPP TS 23.558: "Architecture for enabling Edge Applications".

[8] 3GPP TR 26.804: "Study on 5G media streaming extensions"