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**Source: ETRI, Uangel**

**Title: Solution #8 update: Service KPIs in CAPIF for EAS Service APIs**

**Spec: 3GPP TR 23.700-98**

**Agenda item: 10.7**

**Document for: Approval**

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# 1 Introduction

This paper proposes to modify solution #8 by adding Service KPI-related information elements in CAPIF to support EAS Service APIs as described in KI#2.

# 2 Discussion

In TS 23.558, "Service KPI" IEs are specified to provide information about service characteristics provided by EASs; or required by ACs. This is used for discovery or provisioning of EASs which meet the Service KPIs required by ACs.

In the similar manner, Service KPIs of EASs (as API Providers) need to be specified in CAPIF to be used for discovery or provisioning of EAS Service APIs which meet the Service KPIs required by EASs (as API Invokers).

The proposed IEs related to Service KPIs can be summarized as follows:

* Service KPIs provided by EAS as API Provider
	+ Service API publish request [TS 23.222]
		- Service API information
			* Service KPI (new IE): information about service characteristics provided by the Service API; can be mapped to EAS Service KPIs in EAS Profile [TS 23.558] of the EAS providing the Service API
* Service KPIs required by EAS as API Invoker
	+ Onboard API invoker request [TS 23.222]
		- APIs for enrollment
			* Service KPI per API (new IE): information about service characteristics required by the API invoker;
	+ Onboard API invoker response [TS 23.222]
		- Service API information
			* Service KPI per API (new IE): information about service characteristics provided by the Service API which is allowed to access

The following tables are listed for references with highlighting the information elements relevant to Service KPIs to be added.

**Table 8.2.4-1: EAS Profile [TS 23.558]**

|  |  |  |
| --- | --- | --- |
| **Information element** | **Status** | **Description** |
| EASID  | M | The identifier of the EAS |
| EAS Endpoint | M | Endpoint information (e.g. URI, FQDN, IP address) used to communicate with the EAS. This information maybe discovered by EEC and exposed to ACs so that ACs can establish contact with the EAS. |
| ACID(s) | O | Identifies the AC(s) that can be served by the EAS  |
| EAS Provider Identifier | O | The identifier of the ASP that provides the EAS. |
| EAS Type | O | The category or type of EAS (e.g. V2X) |
| EAS description | O | Human-readable description of the EAS  |
| EAS Schedule | O | The availability schedule of the EAS (e.g. time windows) |
| EAS Geographical Service Area | O | The geographical service area that the EAS serves. ACs in UEs that are located outside that area shall not be served. |
| EAS Topological Service Area | O | The EAS serves UEs that are connected to the Core Network from one of the cells included in this service area. ACs in UEs that are located outside this area shall not be served. See possible formats in Table 8.2.7-1. |
| EAS Service KPIs | O | Service characteristics provided by EAS, detailed in Table 8.2.5-1 |
| EAS service permission level | O | Level of service permissions e.g. trial, gold-class supported by the EAS |
| EAS Feature(s) | O | Service features e.g. single vs. multi-player gaming service supported by the EAS |
| EAS Service continuity support | O | Indicates if the EAS supports service continuity or not. This IE also indicates which ACR scenarios are supported by the EAS. |
| List of EAS DNAI(s) | O | DNAI(s) associated with the EAS. This IE is used as Potential Locations of Applications in clause 5.6.7 of 3GPP TS 23.501 [2].It is a subset of the DNAI(s) associated with the EDN where the EAS resides. |
| List of N6 Traffic Routing requirements | O | The N6 traffic routing information and/or routing profile ID corresponding to each EAS DNAI. |
| EAS Availability Reporting Period | O | The availability reporting period (i.e. heartbeat period) that indicates to the EES how often it needs to check the EAS's availability after a successful registration. |
| EAS Required Service APIs | O | A list of the Service APIs that are required by the EAS |
| EAS Status | O | The status of the EAS (e.g. enabled, disabled, etc.)  |

Table 8.2.5-1: EAS Service KPIs [TS 23.558]

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| Maximum Request rate | O | Maximum request rate from the AC supported by the server.  |
| Maximum Response time | O | The maximum response time advertised for the AC's service requests. |
| Availability | O | Advertised percentage of time the server is available for the AC's use. |
| Available Compute | O | The maximum compute resource available for the AC. |
| Available Graphical Compute | O | The maximum graphical compute resource available for the AC. |
| Available Memory | O | The maximum memory resource available for the AC. |
| Available Storage | O | The maximum storage resource available for the AC. |
| Connection Bandwidth | O | The connection bandwidth in Kbit/s advertised for the AC's use. |
| NOTE: The maximum response time includes the round-trip time of the request and response packet, the processing time at the server and the time required by the server to consume 3GPP Core Network capabilities, if any. |

Table 8.2.2-1: AC Profile [TS 23.558]

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| ACID | M | Identity of the AC. |
| AC Type | O | The category or type of AC (e.g. V2X). This is an implementation specific value. |
| Preferred ECSP list | O | When used in a service provisioning request, this IE indicates to the ECS which ECSPs are preferred for the AC. The ECS may use this information in the selection of EESs.  |
| AC Schedule | O | The expected operation schedule of the AC (e.g. time windows) |
| Expected AC Geographical Service Area | O | The expected location(s) (e.g. route) of the hosting UE during the AC's operation schedule. This geographic information can express a geographic point, polygon, route, signalling map, or waypoint set. |
| AC Service Continuity Support | O | Indicates if service continuity support is required or not for the application. The IE also indicates which ACR scenarios are supported by the AC and which of these are preferred by the AC. |
| List of EASs | O | List of EAS that serve the AC along with the service KPIs required by the AC |
| > EASID | M | Identifier of the EAS |
| > Expected AC Service KPIs | O | KPIs expected in order for ACs to receive currently required services from the EAS, as described in Table 8.2.3-1 |
| > Minimum required AC Service KPIs | O | Minimum KPIs required in order for ACs to receive meaningful services from the EAS, as described in Table 8.2.3-1 |

Table 8.2.3-1: AC Service KPI [TS 23.558]

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| Connection bandwidth | O | The required connection bandwidth in Kbit/s for the application. |
| Request rate | O | The request rate to be generated by the AC.  |
| Response time | O | Response time (NOTE) required for the server servicing the requests. |
| Availability | O | Percentage of time the server is required to be available for the AC's use. |
| Compute | O | The compute resources required by the AC. |
| Graphical Compute | O | The graphical compute resources required by the AC. |
| Memory | O | The memory resources required by the AC. |
| Storage | O | The storage resources required by the AC. |
| NOTE: The response time includes the round-trip time of the request and response packet, the processing time at the server and the time required by the server to consume 3GPP Core Network capabilities, if any. |

Table 8.4.4.2.2-1: Definition of type APIInvokerEnrolmentDetails [TS 29.222]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| apiInvokerId | string | O | 0..1 | API invoker ID assigned by the CAPIF core function to the API invoker while on-boarding the API invoker. Shall not be present in the HTTP POST request from the API invoker to the CAPIF core function, to on-board itself. Shall be present in all other HTTP requests and responses. |  |
| onboardingInformation | OnboardingInformation | M | 1 | On-boarding information about the API invoker necessary for the CAPIF core function to on-board the API invoker. |  |
| notificationDestination | Uri | M | 1 | URI where the notification should be delivered to. |  |
| requestTestNotification | boolean | O | 0..1 | Set to true by Subscriber to request the CAPIF core function to send a test notification as defined in in subclause 7.6. Set to false or omitted otherwise. | Notification\_test\_event |
| websockNotifConfig | WebsockNotifConfig | O | 0..1 | Configuration parameters to set up notification delivery over Websocket protocol as defined in subclause 7.6. | Notification\_websocket |
| apiList | APIList | O | 0..1 | A list of APIs. When included by the API invoker in the HTTP request message, it lists the APIs that the API invoker intends to invoke while onboard or API invoker update. When included by the CAPIF core function in the HTTP response message, it lists the APIs that the API invoker is allowed to invoke while onboard or API invoker update. |  |
| apiInvokerInformation | string | O | 0..1 | Generic information related to the API invoker such as details of the device or the application.  |  |
| supportedFeatures | SupportedFeatures | O | 0..1 | Used to negotiate the supported optional features of the API as described in subclause 7.8.This attribute shall be provided in the HTTP POST request and in the response of successful resource creation. |  |

Table 8.4.4.2.4-1: Definition of type APIList [TS 29.222]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| serviceAPIDescriptions | array(ServiceAPIDescription) | M | 1..N | Definition of the service API |  |

**Table 8.2.4.2.2-1: Definition of type ServiceAPIDescription [TS 29.222]**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Attribute name** | **Data type** | **P** | **Cardinality** | **Description** | **Applicability** |
| apiName | string | M | 1 | API name, it is set as {apiName} part of the URI structure as defined in subclause 4.4 of 3GPP TS 29.501 [18].  |  |
| apiId | string | O | 0..1 | API identifier assigned by the CAPIF core function to the published service API. Shall not be present in the HTTP POST request from the API publishing function to the CAPIF core function. Shall be present in the HTTP POST response from the CAPIF core function to the API publishing function and in the HTTP GET response from the CAPIF core function to the API invoker (discovery API). |  |
| aefProfiles | array(AefProfile) | C | 1..N | AEF profile information, which includes the exposed API details (e.g. protocol). For CAPIF-4/4e interface, API publishing function shall provide this attribute to the CAPIF core function in service API publishing. For CAPIF-1/1e interface, the CAPIF core function shall provide this attribute to the API Invoker during service API discovery. (NOTE 2) |  |
| description | string | O | 0..1 | Text description of the API |  |
| supportedFeatures | SupportedFeatures | O | 0..1 | The supported optional features of the CAPIF API. (NOTE 1) |  |
| shareableInfo | ShareableInformation | O | 0..1 | Represents whether the service API and/or the service API category can be published to other CCFs. |  |
| serviceAPICategory | string | C | 0..1 | The service API category to which the service API belongs to. This attribute is only applicable for CAPIF-6/6e interface. (NOTE 2) |  |
| ccfId | string | C | 0..1 | CAPIF core function identifier which can be contacted further for discovering the details of service API information. This attribute is only applicable for CAPIF-6/6e interface and shall be provided with serviceAPICategory. (NOTE 2) |  |
| apiSuppFeats | SupportedFeatures | O | 0..1 | Provided by the consumer to indicate the features supported by the service API. | ApiSupportedFeaturePublishing |
| pubApiPath | PublishedApiPath | C | 0..1 | It contains the published API path within the same CAPIF provider domain. it shall be provided by the CCF when publishing the service API to other CCF via the CAPIF-6 reference point. |  |
| NOTE 1: For CAPIF\_Publish\_Service\_API, the supported features attribute shall be provided in the HTTP POST request and in the response of successful resource creation. In addition, the supportedFeatures attribute may include one or more the supported features as defined in subclause 8.2.6.NOTE 2: For CAPIF-6/6e interface, at least one of aefProfiles or serviceAPICategory and the corresponding ccfId shall be provided. |

# 3 Proposal

It is proposed to modify the text of TR 23.700-98 as follows.

# 4 Revisions history

* S6-212549\_rev1
	+ As per Ericsson's comment
		- The proposed Service KPI IE is removed from *Onboard API invoker request*
		- The proposed Service KPI IE is newly included in *Service API discover request* and *Service API discover response*

*1st CHANGE*

## 7.8 Solution #8: EAS Service API enablement using CAPIF

### 7.8.1 Architecture enhancements

None.

### 7.8.2 Solution description

#### 7.8.2.1 General

This solution addresses the Key issue #2: Enablement of Service APIs exposed by EAS as specified in the clause 4.2 by supporting for an EAS to expose its Service APIs towards the other EASs.

As specified in TS 23.558 (Rel-17), the Edge Enabler Layer exposes Service APIs towards the EASs. The exposed Service APIs include the capabilities provided by EES (clause 8.6 of TS 23.558); the capabilities provided by the 3GPP core network (clause 8.7 of TS 23.558); and SEAL service APIs (clause A.4 of TS 23.558).

In this solution, the Edge Enabler Layer also supports for an EAS to expose its Service APIs (i.e., EAS Service APIs) towards the other EASs in order to fulfil the architectural requirements specified in the clause 5.xThis solution exploits CAPIF [TS 23.222] to support publication/discovery, and change subscription of EAS Service APIs as studied in Sol#15 of TR 23.758 (Rel-17) with the following architectural assumptions within the CAPIF architecture:

- An EAS may act as an API provider by implementing API provider domain functions (i.e., API exposing function, API publishing function, and API management function)

- An EAS may act as an API invoker

- An EES may act as a CAPIF provider by implementing CAPIF core function (CCF)

Based on the architectural assumption above, the essential operations regarding EAS Service APIs complying with CAPIF are as follows:

- An EAS (acting as API provider) may publish its EAS Service APIs to EES (acting as CAPIF provider)

- An EAS (acting as API invoker) may discover EAS Service APIs from EES (acting as CAPIF provider)

- An EAS (acting as API invoker) may subscribe to be notified of dynamic information or availability of EAS Service APIs from EES (acting as CAPIF provider)

Editor's note: TBD for further considerations in other deployment scenarios such as EAS implementing CCF.

#### 7.8.2.2 CAPIF operations in Edge Enabler Layer

The Figure 7.8.2.2-1 depicts the essential operational steps for EAS Service API enablement using the CAPIF operations as shown in Annex A of TS 23.222.

Pre-conditions:

1. The EAS #A-1 and EAS #A-2 have completed the EAS registration with the EES #A.



Figure 7.8.2.2-1: CAPIF operations in Edge Enabler Layer for EAS Service API enablement

1. The EAS #A-2 (AMF) registers its API provider domain functions to the EES #A (CCF) via CAPIF-3.

2. The EAS #A-2 (APF) publishes its exposing Service API(s) to the EES #A (CCF) via CAPIF-4.

3. The EAS #A-1 (API invoker) performs onboarding process with the EES #A (CCF) via CAPIF-1.

4. The EAS #A-1 (API invoker) discovers from the EES #A (CCF) a Service API required to run via CAPIF-1.

5. The EAS #A-1 (API invoker) invokes the Service API provided by EAS #A-2 (AEF) via CAPIF-2 as discovered from the EES #A (CCF).

6. The EAS #A-1 (API invoker) subscribes to notifications of any updates of target Service APIs on the EES #A (CCF) via CAPIF-1.

7. The EES #A (CCF) and EES #B (CCF) inter-operate with each other via CAPIF-6 for interconnection operations for publication and discovery of Service APIs managed by each EES.

Editor's note: TBD for enhancements to information elements of CAPIF APIs, e.g., Service KPIs, Required Service APIs, Event information across EESs, etc.

#### 7.8.2.3 Service KPIs in CAPIF for EAS Service APIs

In TS 23.558, "Service KPI" IEs are specified to provide information about service characteristics provided by EASs; or required by ACs. This is used for discovery or provisioning of EASs which meet the Service KPIs required by ACs.

In the similar manner, Service KPIs of EASs (as API Providers) need to be specified in CAPIF to be used for discovery or provisioning of EAS Service APIs which meet the Service KPIs required by EASs (as API Invokers).

The proposed IEs in CAPIF related to Service KPIs can be summarized as follows:

* Service KPIs provided by EAS as API Provider
	+ Service API publish request [TS 23.222]
		- Service API information
			* Service KPI (new IE): information about service characteristics provided by the Service API; can be mapped to EAS Service KPIs in EAS Profile [TS 23.558] of the EAS providing the Service API
* Service KPIs required by EAS as API Invoker
	+ Onboard API invoker response [TS 23.222]
		- Service API information
			* Service KPI per API (new IE): information about service characteristics provided by the Service API which is allowed to access
	+ Service API discover request [TS 23.222]
		- Query information
			* Service KPI (new IE): information about service characteristics as a criterion for discovering matching Service APIs required by the API invoker
	+ Service API discover response [TS 23.222]
		- Service API information
			* Service KPI per API (new IE): information about service characteristics provided by the Service API corresponding to the discovery request

The relevant information elements of CAPIF are listed as follows. The highlighted text is proposed to add for supporting the Service KPIs.

Table 8.3.2.1-1: Service API publish request [TS 23.222]

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| API publisher information | M | The information of the API publisher may include identity, authentication and authorization information |
| Service API information | M | The service API information includes the service API name, service API type, communication type, description, Serving Area Information (optional), AEF location (optional), interface details (e.g. IP address, port number, URI), protocols, version numbers, and data format, (new) Service KPI. |
| Shareable information | O (see NOTE) | Indicates whether the service API or the service API category can be published to other CCFs. And if sharing, a list of CAPIF provider domain information where the service API or the service API category can be published is contained. |
| NOTE: If the shareable information is not present, the service API is not allowed to be shared. |

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |

Table 8.1.2.2-1: Onboard API invoker response [TS 23.222]

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| Onboarding status | M | The result of onboarding request i.e., success indication is included if the API invoker is granted permission otherwise failure. |
| Enrolled information | O(see NOTE 1) | Information from the provisioned API invoker profile which may include information to allow the API invoker to be authenticated and to obtain authorization for service APIs |
| Service API information | O(see NOTE 2) | The service API information includes the service API name, service API type, communication type, description, Serving Area Information (optional), AEF location (optional), interface details (e.g. IP address, port number, URI), protocols, version numbers, and data format, (new) Service KPI. |
| Reason | O(see NOTE 3) | This element indicates the reason when onboarding status is failure. |
| NOTE 1: Information element shall be present when onboarding status is successful.NOTE 2: Information element may be present when onboarding status is successful.NOTE 3: Information element shall be present when onboarding status is failure. |

Table 8.7.2.1-1: Service API discover request

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| API invoker identity information | M | Identity information of the API invoker discovering service APIs  |
| Query information | M | Criteria for discovering matching service APIs (e.g. service API type, Serving Area Information (optional), preferred AEF location (optional), interfaces, protocols, (new) Service KPI) (see NOTE) |
| NOTE: It should be possible to discover all the service APIs. |

Table 8.7.2.2-1: Service API discover response

|  |  |  |
| --- | --- | --- |
| Information element | Status | Description |
| Result | M | Indicates the success or failure of the discovery of the service API information |
| Service API information(see NOTE 2) | O (see NOTE 1) | List of service APIs corresponding to the request, including API description such as service API name, service API type, Serving Area Information (optional), interface details (e.g. IP address, port number, URI), protocols, version, data format, (new) Service KPI |
| CAPIF core function identity information | O(see NOTE 1) | Indicates the CAPIF core function serving the service API category provided in the query criteria |
| NOTE 1: The service API information or the CAPIF core function identity information or both shall be present if the Result information element indicates that the service API discover operation is successful. Otherwise both shall not be present. NOTE 2: If topology hiding is enabled for the service API, the interface details shall be the interface details of AEF acting as service communication entry point for the service API. |

In TS 23.222, the Service KPIs can be specified as a part of *Query information* and *Service API information* in abstract, so that the Service KPI IE can be implemented as one or more new attributes of *ServiceAPIDescription* data type in TS 29.222 (but it's up to the CT3's work).

### 7.8.3 Solution evaluation

This clause provides an evaluation of the solution.

*END OF CHANGES*