**3GPP SA WG2 Meeting #162 S2-2405164**

**Changsha, China, April 15th – April 19th, 2024 (revision of S2-2404939)**

**Source:**  **Nokia, China Mobile**

**Title:** **New Solution for KI#2 Direct subscription to UPF Event Exposure service via the user plane**

**Document for:**  **Approval**

**Agenda Item:**  **19.11**

**Work Item / Release: FS\_UPEAS Ph2 / Rel-19**

*Abstract of the contribution: New solution for KI#2:* Direct subscription to UPF Event Exposure service via the user plane.

# Discussion

This pCR provides a solution for direct subscription via the user plane to the UPF Event Exposure service by an AF. The following related issues are addressed:

- How does the AF request the 5GC to directly subscribe to the UPF Event Exposure service via the user plane, and how is it authorized to directly subscribe to the UPF Event Exposure service via the user plane?

- How does the AF discover the properties of the UPF Event Exposure service to subscribe to, like the relevant endpoints, the version(s) of the exposed service, etc.?

- When a subscription request arrives at the UPF from the AF, how does the UPF know that the request is properly authorized by 5GC?

- How does the AF become aware of PSA UPF changes, to change its subscription to the new PSA UPF?

# Proposal

A new solution is proposed for KI#2 for incorporation in the UPEAS Ph2 TR23.700-63.

\*\*\* First change (all new text) \*\*\*

## 6.X Solution #x: Direct subscription to UPF Event Exposure service via the user plane

### 6.X.1 Key Issue mapping

This solution is for KI #2.

### 6.X.2 Description

#### 6.X.2.1 General

In this solution direct subscription via N6 to the UPF Event Exposure service by an AF is described. The following related issues are addressed:

- How does the AF request the 5GC to directly subscribe to the UPF Event Exposure service via N6, and how is it authorized to directly subscribe to the UPF Event Exposure service via N6?

- How does the AF discover the properties of the UPF Event Exposure service to subscribe to, like the relevant endpoints, the version(s) of the exposed service, etc.?

- When a subscription request arrives at the UPF from the AF, how does the UPF know that the request is properly authorized by 5GC?

- How does the AF become aware of PSA UPF changes, to change its subscription to the new PSA UPF?

#### 6.X.2.2 Solution Description

If a UPF supports direct subscription via N6 to its Event Exposure service, it advertises this in its NF profile that it registers at the NRF. Dedicated Event Exposure service instances for direct subscription via N6 may be used as these service instances are accessed via N6 and hence exposed. Common Event Exposure service instances for subscription over both control plane and N6 are not excluded. Dedicated Event Exposure service instances for subscription via N6 are flagged accordingly in the UPF NF profile registered at the NRF, i.e. include in the relevant NFService IE an attribute (e.g. boolean) like “N6basedSubscription” with default value meaning "N6 based subscription” is not supported (e.g. boolean value false). Discovery query parameters are enhanced accordingly to support a new query parameter “n6-based-subscription” to discover UPF Event Exposure service instances that support (or do not support) N6 based subscription. This way the dedicated Event Exposure service instances for subscription via N6 may not even be discovered for subscription over the control plane, and vice-versa. If common Event Exposure service instances for subscription over both control plane and N6 are used, then these service instances in the UPF NF profile support registering different endpoints/parameters for N6 based subscription (vs. subscription via the control plane/5GC NFs). The endpoints exposed for subscription over the N6 are flagged accordingly.

The AF either leverages the Nnef\_AFsessionWithQoS procedure properly extended if subscription to the UPF Event Exposure service is for QoS Monitoring of a UE’s PDU Session or a new NEF service if subscription to the UPF Event Exposure service is for any new event for a specific UE’s PDU Session. The following description focuses on direct subscription to the UPF Event Exposure service for QoS Monitoring of a UE’s PDU Session. The AF requests the possibility and authorization to describe directly to the PSA UPF Event Exposure service. NEF/PCF proceeds with authorization of the AF request. NEF/PCF identifies the SMF serving the relevant PDU Session. SMF exposes a new Event: “PSA UPF change”. Among other things subscription to the new event notifies the UPF ID of the PSA UPF serving a PDU Session. NEF/PCF subscribes to the SMF “PSA UPF change” event and gets the UPF ID of the PSA UPF serving a PDU Session. NEF/PCF retrieves the UPF NF profile of the PSA UPF serving the PDU Session from the NRF and checks if it supports direct subscription via N6. If this is the case NEF/PCF returns to the AF the properties of the UPF Event Exposure service that can be used for subscription via N6 (N6 endpoints, version, http scheme, etc.). It also returns an access token to be used by the AF when subscribing directly to the UPF Event Exposure service via N6. The AF leverages the information provided by NEF/PCF and subscribes directly to the UPF Event Exposure service via the N6 interface providing a description of the data flows to be monitored in the direct subscription to the UPF. The UPF checks the authorization token and if it is OK accepts the AF request.

NOTE: It is up to SA3 to decide if an authorization token is mandatory for the UPF to verify that the AF request via N6 is already authorized by 5GC or any other mechanism applies.

UPF still needs to identify the relevant QFIs for which monitoring is requested. For this purpose, SMF/PCF exposes a new operation which maps QoS parameters/References to the relevant QFI or NEF propagates QoS parameters/References to PCF, SMF and the SMF provides the QoS parameters/References together with the QFI of the QoS flows to the UPF. The AF also provides the notification endpoint(s) for receiving notifications from the PSA UPF.

The PSA UPF of a PDU Session may change for many reasons. To cope with PSA UPF changes SMF/NEF support a new Event: “PSA UPF change”. AF subscribes to the NEF event. The subscription may be explicit, or implicit e.g. when the AF requests the possibility to subscribe directly to the UPF Event Exposure service. NEF subscribes to the SMF event above. The subscription may be explicit, or implicit e.g. when the NEF requests to subscribe to the SMF via any new/existing event in which the UPF ID is provided. Upon PSA UPF change, notifications are sent including the properties of the UPF Event Exposure service via N6 of the new PSA UPF. Upon receiving a notification of a PSA UPF change the AF subscribes to the new PSA UPF via N6 and unsubscribes from the previous PSA UPF.

Editor’s note: It is up to SA3 to evaluate the risk of exposing control plane information of the UPF to untrusted AF.

### 6.X.3 Procedures



Figure 6.X.3-1: Setting up an AF session with required QoS procedure with request for direct subscription via N6 to the UPF Event Exposure service

The AF session with required QoS procedure described in TS 23.502 clause 4.15.6.6 is leveraged with the following extensions:

1. The AF includes in the Nnef\_AFsessionWithQoS\_Create/Update request message its request for direct subscription via N6 to the UPF Event Exposure service for QoS Monitoring.

2. Authorization includes authorization for direct subscription via N6 to the UPF Event Exposure service.

5. The response to the AF includes the properties of the UPF Event Exposure service via N6 (e.g. addressing information, http scheme, etc.) and also includes an authorization token to be used by the AF when directly subscribing to the UPF Event Exposure service via N6.

Between steps 1 and 5 of Fig. 6.X.3-1 the following functionalities are executed (in parallel to steps 3, 3a, 3b, 4, 4a, 4b):



Figure 6.X.3-2: Authorizing direct subscription via N6 to the UPF Event Exposure service and providing the properties of the relevant UPF Event Exposure service to the AF

1. NEF after receiving the AF request authorizes the AF request including authorizing (or not) the extra requirement to directly subscribe via N6 to the UPF Event Exposure service.

2. NEF determines the SMF serving the UE/PDU Session.

3. (3a.) NEF subscribes to Nsmf\_EventExposure Service which supports a new event: “PSA UPF change” with input the PDU Session ID of the PDU Session for which QoS monitoring is needed. (3b.) Upon successful subscription SMF returns to the NEF the UPF ID of the current PSA UPF and further notifies the NEF when a PSA UPF change occurs.

4. (4a. and 4b.) NEF retrieves the UPF NF profile of the PSA UPF with the UPF ID and determines if it supports direct subscription via N6 to its Event Exposure service.

5. If this is the case, (5a. and 5b.) NEF requests an authorization token from the NRF, on behalf of the AF, to be used for direct subscription to the UPF Event Exposure service via N6.

6. NEF returns response “5” to AF with the new required information.

As shown in Figure 6.X.3-2, the AF with the information provided by the NEF, directly subscribes to the UPF via N6 by sending a UPF Event Exposure subscribe request (HTTP request like defined in TS 29.564) to the N6 routable IP address of the UPF Event Exposure service. The AF provides a description of the data flows to be monitored in the direct subscription to the UPF and the authorization token provided by the NEF. The UPF checks the authorization token and accepts the request accordingly. The UPF responds to the AF with the status of the service after it has enabled the service or if service initiation failed.



Figure 6.X.3-2: Subscription creation (direct)

Once the subscribed service has been enabled in the UPF and acknowledged to the AF, the UPF starts sending notification reports about subscribed events, according to the service parameters and policies, directly to the AF via N6, as is shown in Figure 6.X.3-3.



Figure 6.X.3-3: UPF sends notification on subscribed events

A PSA UPF change triggers the following procedure:



Figure 6.X.3-4: PSA UPF change and subscription update.

1. SMF notifies the NEF of a PSA UPF change for a PDU Session and provides to the NEF the new PSA UPF (UPF-2) ID.

2. Steps 2, 2a, 2b, 3a, 3b are similar to steps 4, 4a, 4b, 5a, 5b in Fig. 6.X.3-2.

4. NEF sends PSA UPF change notification to the AF and the properties of the UPF Event Exposure service of the new PSA UPF (UPF-2), together with an authorization token.

5. AF unsubscribes from UPF-1.

6. AF subscribes to UPF-2.

### 6.X.4 Impacts on services, entities and interfaces

**AF:**

- Supports direct subscription via N6 to the UPF Event Exposure service for QoS Monitoring of a UE’s PDU Session,

- Supports proper security mechanism, e.g. providing an authorization token in the subscription request.

- Supports “PSA UPF change” via receiving relevant notification(s) and unsubscribing from the old PSA UPF and subscribing to the new PSA UPF.

**NEF (PCF):**

- Supports authorization of direct subscription via N6 to the UPF Event Exposure service for QoS Monitoring of a UE’s PDU Session and provisioning of proper information for the direct subscription to the AF. NEF supports a new exposure event “PSA UPF change” to notify the AF of PSA UPF changes.

**SMF:**

- Supports a new exposure event “PSA UPF change” to notify NEF of PSA UPF changes. SMF also supports linkage of QoS parameters/References to QFIs.

**UPF:**

- Supports direct subscription via N6 to its Event Exposure service.

**NRF:**

- Supports extensions for registering and discovering dedicated UPF Event Exposure service instances for direct subscription via N6.

**RAN/UE:**

- None.

\*\*\* END of first change \*\*\*