**3GPP TSG-WG SA2 Meeting #151E e-meeting *S2-2204390r04***

**Elbonia, May 16th – 20th, 2022 (revision of S2-2202371)**

**Source: Huawei, HiSilicon**

**Title: KI #1/#2, New Sol: QoS enhancement to support synchronized delivery of multiple QoS flows**

**Document for: Approval**

**Agenda Item: 9.19**

**Work Item / Release: FS\_XRM / Rel-18**

*Abstract: Propose a solution for QoS enhancement to support synchronized delivery of multiple QoS flows of the same application related to KI#1 and KI#2.*

# 1. Introduction/Discussion

SA#149e agrees to study *Key Issue #1:* *Policy control enhancements to support multi-modality flows coordinated transmission for single UE.* and *Key Issue #2: Support the Application Synchronization and QoS Policy Coordination for Multi-modal Traffic among Multiple UEs*. Both key issues require to study *Potential enhancements to policy control to support coordination handling at the application* and *Whether and how interaction between an AF and the 5GS is needed for* *QoS policy coordination.* Both key issues require *delivering related tactile and multi-modal data (e.g., audio, video and haptic data related to a specific time) for an application to the user at a similar time.*

Observation 1: The QoS policy coordination is among multiple QoS flows of the same application in both single UE case and multiple UEs case,

Observation 2: Related tactile and multi-modal data (e.g., audio, video and haptic data related to a specific time) for an application needs to deliver to the user at a similar time in both single UE case and multiple UEs case.

Observation 3: Related tactile and multi-modal data (e.g., audio, video and haptic data) for an application have dependency with each other. For example, a VR service has the basic video flow, enhancement video flow, audio flow and haptic data flow. Once the basic video flow cannot be delivered to the receiver, the basic experience of users already cannot be satisfied, so it’s useless to deliver the related enhancement video flow, audio flow and haptic data flow to the receiver.

This contribution proposes a solution for the enhanced interaction between AF and the 5GS and also QoS policy enhancement to support the delivery of data from multiple QoS flows of an application in a similar time. The solution applies to both KI#1 and KI#2.

# 2. Text Proposal

It is proposed to capture the following changes vs. TR 23.700-60.

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

6.X Solution #X: QoS enhancement to support the synchronized delivery of multiple QoS flows

### 6.X.1 Key Issue mapping

Table 6.0-1: Mapping of Solutions to Key Issues

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Solutions |  |  |  |  |  |  |  |  |  |
|  | <Key Issue #1> | <Key Issue #2> | <Key Issue #3> | <Key Issue #4> | <Key Issue #5> | <Key Issue #6> | <Key Issue #7> | <Key Issue #8> | <Key Issue #9> |
| #1 |  |  |  |  |  |  |  |  |  |
| #2 |  |  |  |  |  |  |  |  |  |
| #x | X | X |  |  |  |  |  |  |  |

Editor's Note: This clause lists the key issue(s) addressed by this solution.

### 6.X.2 Description

This contribution proposes enhanced interaction between AF and the 5GS and also QoS policy enhancement to support the delivery of data from multiple QoS flows of an application in a similar time.

For an application, service flows requiring coordinated delivery are grouped into a service flow group. Each service flow group has group level treatment requirements used for associated control of the service flows in the group, e.g., delivery of data to the receiver at a similar time. Each flow in the service flow group still has its own QoS requirements which is mapped to QoS profile such as 5QI, ARP, PDB, PER, etc.

For each group of service flows of an application, AF provides service flow association requirements to 5GS via interactions between AF and PCF. The service flow association requirements indicate association among a group of service flows of the application, and associated control between these service flows. The service flow association requirements consist of a service flow coordination group ID and group level treatment requirements for a group of service flows. The service flow coordination group ID is for identifying a group of service flows, and the group level treatment requirements include information for associated control of service flows in the group, e.g., information for joint fulfillment of admission control/resource allocation by taking service flows in the group as a whole, information for indicating synchronized delivery of service flows to the receiver side and information of synchronization accuracy. The group level treatment requirements may not apply uniformly to all of the flows in the group, but for instance synchronized delivery may be required only among specific flows.

PCF maps the service flow coordination group to QoS flow coordination group in the 5GS and derives associated group level treatment policy in the network based on service flow association requirements.

PCF can provide PCC rule with group level treatment policy for service flows in the group, the group level treatment policy/requirement could include the following information:

1. Synchronized delivery, indicating synchronized delivery of data from multiple service flows of an application. Generally, the synchronization can be satisfied when the synchronization accuracy on delivery of data from multiple service flows are higher than or equal to the lower bound of synchronization accuracy for the flows within the group for which synchronized delivery has been requested.

2. Joint QoS fulfilment, indicating that fulfilment of QoS of a service flow of a group e.g., to be delivered on time, is relevant to the QoS fulfilment decisions of the remaining service flows in the same group and thus they should be treated jointly (e.g., if QoS of a service flow or a certain percentage of QoS flows in a service flow group cannot be fulfilled, no need to fulfil the QoS of other service flows in the same service flow group). Such QoS fulfilment could be limited to a certain period of the lifetime of the flow. This attribute can be used for one or more service flows within the service flow group .

3. Joint admission control/resource allocation, indicating associated resource allocation in 5GS (e.g., RAN, UPF) among service flows. For example, once some of the service flows cannot be allocated with the network resource due to poor network condition, some of the others do not need to be allocated to save the network resource and thus they should be treated jointly. The dependency relationship can be bidirectional or unidirectional. This attribute can be used for one or more service flows within the service flow group.

Each service flow in a service flow group is treated as individual QoS flow without aggregation, and based on the PCC rule, SMF could derive QoS parameters for each QoS flow.

The network (e.g., RAN/SMF) aligns the data delivery time of each individual QoS flow in the QoS flow coordination group to the receiver side based on the group level treatment policy as much as possible besides the fulfillment of the QoS requirements of each individual QoS flow such as PDB. RAN can use such group level treatment policy for handover decisions, e.g., handover all the flows in the group to target RAN together to facilitate the synchronized delivery. Admit all QoS flows in the QoS flow coordination group as a whole.

NOTE 1: For multiple UEs case, it assumes the UEs connect to the same NG-RAN.

### 6.X.3 Procedures

#### 6.X.3.1 Enhanced interaction between AF and 5GS for QoS policy coordination among multiple QoS flows

AF provides service flow coordination group ID together with group level treatment requirements to PCF via NEF using the procedure of setting up an AF session with required QoS. The AF can provide the requirements and information of all of the service flows in a group with a single request or using multiple requests. In the latter case the flow coordination group ID is used to correlate the different requests together in the PCF. If the AF provides or adds service flows in separate requests, joint admission control/resource allocation can be performed not at one specific point of time but still in a joint manner in that failed admission of one service flow can affect the corresponding actions on already established and to-be-established service flows in the same service flow group.



Figure 6.X.3-1: Setting up an AF session with required QoS procedure

1. The AF sends one or multiple requests to reserve resources for an AF session using Nnef\_AFsessionWithQoS\_Create request message (AF Identifier, UE address, Flow description(s), QoS reference, (optional) Alternative Service Requirements (containing one or more QoS reference parameters in a prioritized order), service flow coordination group ID, group level treatment requirements to the NEF.

The group level treatment requirements may include joint admission and joint QoS fulfilment policy for the flows in the group. The policy can indicate that the admission and/or QoS fulfilment is to be failed if it fails for any of the flows in the group or any of the flows in the group indicated as critical.

The group level treatment requirements may include also synchronized delivery requirement for any specifically indicated flows in the group.

2. NEF performs authorization of the AF request. It continues with step 3 if the request is authorized and continues with step 5 is the request is not authorized.

3. The NEF interacts with the PCF by triggering a Npcf\_PolicyAuthorization\_Create request and provides AF Identifier, UE address, Flow description(s), the QoS reference, and the optional Alternative Service Requirements (containing one or more QoS reference parameters in a prioritized order), service flow coordination group ID, and group level treatment requirements. PCF uses this information to issue policy rules for the service flows in the request together. PCF also uses this information to check if there is already established service flows using the same service flow coordination group ID, in which case PCF treats the received request together with the existing policy rules for the service flow coordination group. If multiple PCFs are selected for the service flows of the group, the NEF interacts with the PCFs for the QoS requirements provision.

Editor's note: Whether and how to have the coordination between PCFs when multi-PCFs selected for the service flows of the group are FFS.

4. PCF responses to NEF whether the policy is authorized or not.

5.NEF response to AF whether the request is granted or not.

#### 6.X.3.2 Procedure to distribute coordination group ID and group level treatment policy in 5GS

PCF derives the group level treatment policy for each service flow coordination group based on the group level treatment requirements from the application, and SMF maps the service flow coordination group to QoS flow coordination group in the 5GS. Each service flow in a service flow group should be treated as individual QoS flow without aggregation.

PCF distributes the service flow coordination group ID and group level treatment policy in 5GS using the following procedure.

Editor’s note: Which aspects of the group level treatment policy (joint admission, joint QoS fulfilment, synchronized delivery) can be enforced in PCF without RAN impact and interaction and which aspects require or can benefit from providing new information to RAN is FFS.

1. PCF provides service flow coordination group ID and group level treatment policy to SMF using the existing session management policy association procedure (e.g., SMF policy association modification procedure).

 

Figure 6.X.3-3: PDU session modification procedure

2. If the PCC rule contains a service flow coordination group ID, SMF binds the PCC rule to a new QoS Flow and no other PCC rule is bound to this QoS Flow. SMF may apply the group level treatment policy on the service flows in the service flow coordination group accordingly from this step (e.g., considering successfully PDU session establishment/modification or handover only if resource for all involved QoS flows are allocated/admitted).

3-4. SMF may provide QoS flow coordination group ID and group level treatment policy further to RAN via AMF as part of session management information using the existing PDU session modification procedure.

NOTE 2 The QoS flow coordination group ID and group level treatment policy is included in case RAN awareness and impact is required (to be coordinated with RAN WG).

Follow up procedures are the same as the current PDU session modification procedure.

According to the above procedures, the RAN and SMF can identify the QoS flows in the same QoS flow coordination group and apply the group level treatment policy e.g., coordinated transmission to ensure synchronized delivery, joint QoS fulfilment, joint admission control/resource allocation among the QoS flows.

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

AF

* Uses extended Nnef\_AFSessionWithQoS API to provide group level treatment policy to a group of flows. The flow grouping is indicated by a unique flow group coordination ID.

NEF

* Supports extended Nnef\_AFSessionWithQoS API to provide group level treatment policy to a group of flows. The flow grouping is indicated by a unique flow group coordination ID. Provides the policy and the group coordination ID to PCF.

PCF

* Supports and enforces group level treatment policy for the group of flows sharing the same flow group coordination ID. Provides information about the group level treatment policy to (SMF and via SMF to) RAN.

RAN

* Potential impacts to RAN in case RAN awareness (beyond PCF awareness) is required for enhanced enforcement of joint admission, joint QoS fulfilment or synchronous delivery policy for the flow group. Some information provided to RAN can also be considered as “assistance information” that can optionally help the RAN to optimize its implementation for, e.g., synchronous delivery but where its exact use by the RAN does not need to be normatively specified.

No impacts to UE, UPF.

\* \* \* \* End of changes \* \* \* \*