**3GPP TSG-WG SA4 Meeting #131-bis-e *S4-250582***

**Online, Apr 11 – 17, 2025 (revision of S4-250528)**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **26.510** | **CR** | **0020** | **rev** | **1** | **Current version:** | **18.3.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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|  |
| ***Title:***  | Stage 3 on Improved QoS Support for Media Streaming services |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | S4 |
|  |  |
| ***Work item code:*** | AMD\_PRO-MED |  | ***Date:*** | 2025-04-08 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | In FS\_AMD, several QoS features which could be beneficial to the Media Delivery System have been studied, including ECN marking for L4S, PDU Set handling and QoS monitoring. As concluded and recommended, this paper intends to integrate the ECN marking for L4S and QoS monitoring features into the procedures and protocols for both 5GMSd and 5GMSu. |
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| ***Summary of change:*** | i. Integrate *ECN marking for L4S* into the procedures for both 5GMSd and 5GMSu.ii. Integrate the *QoS monitoring* feature into the procedures for both 5GMSd and 5GMSu.ii. Support other relevant aspects resulting from stage-2. |
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| ***Consequences if not approved:*** | Support of ECN marking for L4S and QoS monitoring features are missing and WI is not complete. |
|  |  |
| ***Clauses affected:*** | 3.3, 5.2.7.1, 5.4.3, 5.5.3, 8.7.3.1, 9.3.3.1, 11.3.1.2, 11.3.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\* \* \* \* First change \* \* \* \*

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

5GC 5G Core

AF Application Function

ANBR Access Network Bit rate Recommendation

API Application Programming Interface

AS Application Server

BDT Background Data Transfer

CHEM Coverage and Handoff Enhancements using Multimedia error robustness

DN Data Network

DS Differentiated Services

DSCP DS Code Point

EAS Edge Application Server

ECN Explicit Congestion Notification

EEC Edge Enabler Client

EES Edge Enabler Server

FQDN Fully Qualified Domain Name

GPSI Generic Public Subscription Identifier

ICE Interactive Connectivity Establishment

JSON JavaScript Object Notation

L4S Low Latency, Low Loss and Scalable Throughput

MFBR Maximum Flow Bit Rate

NEF Network Exposure Function

OAM Operations, Administration and Maintenance

PCC Policy Control and Charging

PCF Policy Control Function

PDR Packet Detection Rule

PHB Per-Hop Behaviour

QoE Quality of Experience

QoS Quality of Service

QFI QoS Flow Identifier

RTC Real-Time (media) Communication

STUN Session Traversal Utilities for NAT, Simple Traversal of User Datagram Protocol (UDP) through Network Address Translators

SWAP Simple WebRTC Application Protocol

TCP Transmission Control Protocol

TOS Type of Service

TURN Traversal Using Relays around NAT

UE User Equipment

URI Uniform Resource Identifier

URL Uniform Resource Locator

\* \* \* \* Next change \* \* \* \*

#### 5.2.7.1 General

These operations are used by the Media Application Provider to configure Policy Templates for the media delivery sessions of a particular Provisioning Session.

A Policy Template, identified by its policyTemplateId, represents a set of PCF/NEF API parameters which defines the service quality and/or associated charging for the corresponding media delivery session(s). The Policy Template is configured as part of the provisioning procedures with the Media AF using the API specified in clause 8.7 and is subsequently instantiated by a Media Session Handler or Media AS (whichever is acting as Dynamic Policy invoker) using the interactions specified in clause 5.3.3.

When a Policy Template requires media to be delivered in a specific Data Network and/or network slice at reference point M4, the applicationSessionContext array shall be present with at least one of the following properties populated:

- The dnn property contains the name of the Data Network in which the Media AS is hosted.

- When Network Slicing is used, the sliceInfo property contains information about the network slice which is serving the UE.

When a Policy Template is intended to influence the network QoS of Service Data Flows used for media delivery, the qoSSpecifications array shall be populated with objects of type QosRange (see clause 7.3.3.4). Each member of the array describes the QoS limits of an application service component that a Media Client is permitted request when instantiating the Policy Template:

- The componentReference property is a string used by the Dynamic Policy invoker to reference this QosRange when instantiating the Policy Template. It shall be unique for all members of the same qoSSpecifications array.

- The qosReference value, as specified in clause 5.6.2.7 of TS 29.514 [18], is obtained with the Service Level Agreement. See TS 23.502 [3] for detailed usage.

- The maximumBitRate properties of the downlinkQosSpecification and uplinkQosSpecification objects define the maximal bit rates which are permitted to be requested by a Dynamic Policy invoker on (respectively) downlink and uplink Service Data Flows. These values are defined by configuration of the 5G System and are therefore populated by the Media AF rather than by the Media Application Provider.

- The maximumAuthorisedBitRate properties of the downlinkQosSpecification and uplinkQosSpecification objects define the maximal bit rates which a Dynamic Policy invoker is authorised to request on (respectively) downlink and uplink Service Data Flows. Higher bit rates are not authorised by the Media Application Provider when the Policy Template is instantiated.

- The minimumPacketLossRate properties of the downlinkQosSpecification and uplinkQosSpecification objects define the minimal packet loss rates which are permitted to be requested by a Dynamic Policy invoker on (respectively) downlink and uplink Service Data Flows. Lower packet loss rates are not permitted by the Media Application Provider when the Policy Template is instantiated.

- The pduSetQosLimits properties of the downlinkQosSpecification and uplinkQosSpecification objects define the minimal delay budget and minimal error rates for PDU Sets which are permitted to be requested by a Dynamic Policy invoker on (respectively) downlink and uplink Service Data Flows. Lower delay and error rates are not permitted by the Media Application Provider when the Policy Template is instantiated.

- The pduSetMarking flag is used to specify whether Media Clients instantiating this Policy Template for uplink media delivery, or Media AS instances for downlink media delivery, are required to apply PDU Set marking to media transport protocol PDUs falling within the scope of a Dynamic Policy Instance based on this Policy Template.

NOTE 1: PDU Set marking is used by the 5G System to satisfy the QoS requirements of application flows.

When a Policy Template is intended to be used for differential charging, the chargingSpecification property shall be present.

When a Policy Template is intended to be used for Background Data Transfer, the properties of a new Background Data Transfer policy are specified by the Media Application Provider in the bdtSpecification property (of type Bdt‌Policy‌Schedule).

- The startDate and endDate indicate the time period for which the Background Data Transfer specification is valid. A Background Data Transfer specification may be removed from its parent Policy Template by the Media AF when it expires.

- The windows property indicates the time windows over which the Background Data Transfer may occur.

- Each such time window is characterised by a start time (startTime), a duration (duration) and the days of the week on which the time window is scheduled (daysOfWeek).

- The numberOfUes property indicates the maximum number of UEs permitted to instantiate the Policy Template and make use of Background Data Transfers during a single time window instance.

- The estimatedDataVolumePerUe that reflects the average data volume that each UE is expected to transfer during a single time window instance.

NOTE 2: The product of the numberOfUes and estimatedDataVolumePerUe properties represents an estimate of the maximum data volume that may be transferred during any given time window instance.

- The aggregate‌Uplink‌BitRate‌Limit and aggregate‌DownlinkBitRate‌Limit properties specify limits on the total aggregate bit rate of all currently instantiated Policy Templates to be enforced by the Media AF's admission control function. If omitted, the Media AF may instantiate a Policy Template with a Background Data Transfer specification regardless of additional costs that may be incurred by the Media Application Provider as a result.

When a Policy Template requires ECN marking for L4S functionality to be enabled, the l4SEnablement property shall be present and set to true.

NOTE 3: Both the Media AS and the Media Access Function of the Media Client are assumed to support the L4S protocol stack.

When a Policy Template requires QoS monitoring, the qoSMonitoringConfigurations property shall be present and this array shall contain at least one QoS monitoring configuration.

HTTP responses for successful and operation-specific failure cases are specified in the following clauses. For all other failure cases, an HTTP response indicating a response code in accordance with clause 7.1.6 shall be returned to the API client. In all failure cases a message body in accordance with clause 7.1.7 shall be included in the response message.

\* \* \* \* Next change \* \* \* \*

#### 5.3.3.2 Create Dynamic Policy Instance resource operation

In order to instantiate a new dynamic policy, the Media Session Handler or Media AS (whichever is acting as Dynamic Policy invoker) shall first create a resource for the Dynamic Policy Instance in the Media AF. The Dynamic Policy invoker shall use the HTTP POST message for this purpose. The body of the HTTP POST message shall be a Dynamic Policy Instance resource representation that includes a Provisioning Session identifier, the resource identifier of the target Policy Template and a set of Service Data Flow descriptions identifying the application flow(s) to be policed.

1. The provisioningSessionId property associates the Dynamic Policy Instance resource with a Provisioning Session.

2. The policyTemplateId property uniquely identifies the Policy Template on which the Dynamic Policy Instance is based.

3. For each application flow to be managed by the Dynamic Policy Instance resource, an instance of the Application‌Flow‌Binding object shall be present in the appplication‌Flow‌Bindings array. The applicationFlow‌Description property of this object shall be populated by the Dynamic Policy invoker and shall declare a Service Data Flow template according to TS 23.503 [17] that describes application flow in question. Exactly one of the following filtering specifications shall be populated in the Application‌FlowDescription object to identify traffic belonging to a media delivery application flow:

- a packetFilter object (including 5-tuples, Type of Service, Security Parameter Index, etc.). A Media Client shall not attempt to instantiate more than one Dynamic Policy Instance at the same time that cites the same set of packet filters*.*

- a domainName populated with the fully-qualified Internet domain name of a Media AS at reference point M4*.* A Media Client shall not attempt to instantiate more than one Dynamic Policy Instance at the same time that cites the same domainName*.*

 In addition, the top-level media type of the application flow may be declared in the mediaType property.

 When the policy binding for the chosen Policy Template indicates that PDU Set marking is enabled (i.e., the pduSetMarking flag is set to true in Service Access Information), the Dynamic Policy invoker shall also populate the mediaTransportParameters property with the media transport protocol parameters to be used by the Media Access Function on the application flow in question to label uplink PDUs belonging to the same PDU Set and/or to indicate the last PDU in each PDU Set and/or to indicate the end of a data burst comprising one or more PDU Sets.

 When the policy binding for the chosen Policy Template indicates that PDU Set marking is enabled (i.e., the pduSetMarking flag is set to true in Service Access Information), the Dynamic Policy invoker shall also populate the mediaTransportParameters property with the media transport protocol parameters to be used by the Media AS on the application flow in question to label downlink PDUs belonging to the same PDU Set and/or to indicate the last PDU in each PDU Set and/or to indicate the end of a data burst comprising one or more PDU Sets.

4. When the Dynamic Policy invoker attempts to activate a QoS-related Policy Template, the qosSpecification property shall also be present in the Application‌Flow‌Binding object containing the following properties specified in clause 7.3.3.6 to describe the QoS requirements of the media application flows described by the bound applicationFlowDescription property:

- downlinkBitRates shall indicate the maximum requested bit rate, minimum desired bit rate and minimum requested bit rate in the downlink direction.

- uplinkBitRates shall indicate the maximum requested bit rate, minimum desired bit rate and minimum requested bit rate in the uplink direction.

- desiredPacketLatency may indicate the desired packet latency in both the downlink and uplink directions.

- desiredPacketLossRate may indicate the desired packet loss rate in both the downlink and uplink directions.

- desiredDownlinkPduSetQosParameters may be populated to indicate the desired delay budget and error rate for PDU Sets in the downlink direction, as well as indicating whether the loss of a single PDU in a PDU Set is significant for the receiving application.

- desiredUplinkPduSetQosParameters may be populated to indicate the desired delay budget and error rate for PDU Sets in the uplink direction, as well as indicating whether the loss of a single PDU in a PDU Set is significant for the receiving application.

5. When the Dynamic Policy invoker instantiates a Policy Template that is provisioned with a Background Data Transfer (BDT) specification per clause 5.2.7.1, the bdtSpecification property shall be present and it shall contain the following properties:

- estimatedDataTransferVolume, indicating the data volume that the Media Client estimates it will use during the current Background Data Transfer time window.

- Each object (see clause 7.3.3.14) conveyed in the windows array indicates a time window over which Background Data Transfers are requested by the Dynamic Policy invoker from those offered in the dynamic policy configuration of the Service Access Information resource (see clause 5.3.2.1).

- Each such window may additionally indicate the maximum bit rate for Background Data Transfers in the downlink and uplink directions that the Dynamic Policy invoker is bidding for in (respectively) the maximimumDownlinkBitRate and maximimumUplinkBitRate properties. In response, the Media AF populates these properties with the maximum permitted bit rate for Background Data Transfers in the downlink and uplink directions respectively when the dynamic policy is in force.

6. When the 5G System employs a traffic enforcement function to ensure that traffic complies with the policy described by the qosSpecification property, the Media AF shall explicitly indicate this in the Dynamic Policy resource representation by setting the qosEnforcement property to true.

If the operation is successful, the Media AF shall create a new Dynamic Policy Instance resource. In this case, the Media AF shall return a 201 (Created) HTTP response message to the Dynamic Policy invoker, and the URL of the newly created Dynamic Policy Instance resource, including its resource identifier, shall be provided as the value of the Location HTTP header field. The response message body shall be a representation of the current state of the Dynamic Policy Instance resource (see clause 9.3.3.1), including any properties assigned by the Media AF.

- The l4sEnabled property in the response message body shall be populated with the enablement status of ECN marking for L4S functionality in the 5G System.

- The qosMonitoringEnabled property in the response message body shall be populated with the enablement status of QoS monitoring in the 5G System and, if QoS monitoring is enabled and QoS monitoring results are immediately available, the qoSMonitoringResults property shall be populated with the most recent results set.

Upon successful creation of the Dynamic Policy Instance resource, notifications of updates to the resource may be notified asynchronously to the Dynamic Policy invoker:

- If the notificationURL property is present in the Service Access Information, the Dynamic Policy invoker shall subscribe to the MQTT sub-topic corresponding to the resourceId of the Dynamic Policy Instance and shall expect to receive asynchronous notifications published by the Media AF on the MQTT notification channel of type NOTIFICATION\_‌DYNAMIC\_‌POLICY\_‌INSTANCE concerning changes to the Dynamic Policy Instance, including details about new Background Data Transfer opportunities.

- The Media AF shall use the MQTT notification channel signalled in the Service Access Information (if any, see clause 5.3.2.3) to notify the Dynamic Policy invoker subscriber about updates to the Dynamic Policy Instance resource. A notification message of type NOTIFICATION\_‌DYNAMIC\_‌POLICY\_‌INSTANCE shall be published to the MQTT sub-topic corresponding to the resourceId of the Dynamic Policy Instance.

The usage and message formats for the MQTT notification channel are specified in clause 10.2.

When the Dynamic Policy Instance is successfully instantiated, the Media AF triggers the creation of a corresponding PCC rule in the 5G System according to clause 5.5.3 to enforce the required QoS and/or charging policy on the specified application flow(s). Depending on the ApplicationFlowDescription objects in the received Dynamic Policy Instance resource representation and the filterMethod indicated by each one, the Media AF shall populate for each one a flowDescription object and/or provide an Application Identifier referring to a PFD (Packet Flow Description) object containing the domain name of a Media AS instance.

NOTE: When the Media AF is deployed in an external Data Network, it is the responsibility of the NEF to map any external Application Identifier supplied by the Media AF into an internal Application Identifier that is known to the PCF.

If the supplied Dynamic Policy Instance is not acceptable to the Media AF, the create operation shall fail with an HTTP response status code of 400 (Bad Request) and an error message body per clause 7.1.7. In this case, the Dynamic Policy Instance resource shall remain in an uncreated state in the Media AF.

If the request is acceptable but the Media AF forbids the instantiation of the referenced Policy Template, for example because the quota for Background Data Transfers has been exceeded or because the UE is not permitted in the charging specification, the create operation shall fail with an HTTP response status code of 403 (Forbidden) and an error message body per clause 7.1.7. In this case, the Dynamic Policy Instance resource shall remain in an uncreated state in the Media AF.

If the request is acceptable but the Media AF is unable to provision the resources required by the supplied Dynamic Policy Instance, the create operation shall fail with an HTTP response status code of 500 (Internal Server Error) and an error message body per clause 7.1.7. In this case, the Dynamic Policy Instance resource shall remain in an uncreated state in the Media AF.

If the Dynamic Policy invoker needs to instantiate several dynamic policies, it may invoke this operation as often as needed.

\* \* \* \* Next change \* \* \* \*

### 5.4.3 Dynamic Policy invocation

At the start of a media delivery session, the Media Session Handler shall determine the external reference and target QoS parameters of the initial Service Operation Point by invoking an appropriate API method on the Media Session Handler at reference point M11. Based on the parameter values supplied, the Media Session Handler shall attempt to instantiate a Dynamic Policy satisfying the Media Access Function’s requirements using the operation specified in clause 5.3.3.2 if the target QoS lies within the bounds of a Policy Template with the corresponding external reference advertised in the Service Access Information for the media delivery session.

The Media Session Handler shall subscribe to receive notifications from the Media Access Function at reference point M11 of changes to the Service Operation Point during the course of the media delivery session. When such a change occurs (e.g., when the Media Access Function selects a different MPEG‑DASH Representation), the Media Access Function shall send a notification to the Media Session Handler at reference point M11 citing the external reference and target QoS parameters of the new Service Operation Point. If the QoS of the new Service Operation Point is not satisfied by the currently instantiated Dynamic Policy, the Media Session Handler shall attempt to instantiate a Dynamic Policy satisfying the Media Access Function’s requirements using the operation specified in clause 5.3.3.2 if the target QoS lies within the bounds of a Policy Template with the corresponding external reference advertised in the Service Access Information for the media delivery session.

The Media-aware Application shall subscribe to receive notifications from the Media Session Handler at reference point M6 concerning Background Data Transfer opportunities. When such an opportunity is announced to the Media Session Handler by the Media AF at reference point M5, the Media Session Handler shall send a corresponding notification to the Media-aware Application at reference point M6 that includes an estimate of the opportunity window. If it wishes to avail itself of the Background Data Transfer opportunity, the Media-aware Application shall invoke a suitable API method on the Media Session Handler at reference point M6, providing an estimate of the data volume it intends to transfer over reference point M4. The Media Session Handler shall then attempt to instantiate a Dynamic Policy with Background Data Transfer network characteristics (including the data volume estimate supplied by the Media-aware Application) using the operation specified in clause 5.3.3.2 if a suitable Policy Template is advertised in the Service Access Information for the media delivery session.

If it supports an L4S protocol stack, the Media Access Function may subscribe to receive notifications from the Media Session Handler at reference point M11 concerning successful instantiation of a Policy Template that requires ECN marking for L4S functionality to be enabled. Whensuccessful instantiation of such a Policy Template is confirmed to the Media Session Handler by the Media AF at reference point M5, the Media Session Handler shall send a corresponding notification to the Media Access Function at reference point M11 to inform it that ECN marking for L4S functionality shall be enabled for the corresponding media delivery session. The Media Access Function shall then enable ECN marking for L4S functionality by setting the ECT(1) bit on outgoing packets and should use congestion notifications to perform early bit rate adaptation.

If it supports QoS monitoring, the Media Access Function may subscribe to receive notifications from the Media Session Handler at reference point M11 concerning successful instantiation of a Policy Template that requires QoS monitoring enabled. When successful instantiation of such a Policy Template is confirmed to the Media Session Handler by the Media AF at reference point M5, the Media Session Handler shall send a corresponding notification to the Media Access Function at reference point M11 to inform it that QoS monitoring is enabled for the corresponding media delivery session. On receipt of such a confirmation, the Media Access Function shall further subscribe to receive notifications from the Media Session Handler at reference point M11 concerning the QoS monitoring results. When QoS monitoring results are notified to the Media Session Hander by the Media AF at reference point M5 (via the asynchronous MQTT notification channel for the Dynamic Policy instance – see clause 5.3.3.2), the Media Session Hander shall send a notification to the Media Access Function at reference point M11. The Media Access Function may use the QoS monitoring results accordingly, e.g. to request/upload the next media segment based on the reported packet latency, change the bit rate of next requested/uploaded media segment based on the reported congestion status.

\* \* \* \* Fourth change \* \* \* \*

### 5.5.3 Policy control interactions for Dynamic Policies

The Dynamic Policies feature operates at reference point M5 between the Media Session Handler in the Media Client and a Media AF that has been appropriately provisioned with Policy Templates (see clause 5.2.7). The Dynamic Policy API at reference point M5 (see clauses 5.3.3 and 9.3) is specified in a generic way such that the associated functionality in the 5GC may be realised by various means.

NOTE 1: This clause does not limit the possible set of 5G System exposure functionalities for realising dynamic policies.

In this release, the Media AF converts Dynamic Policies API invocations received at reference point M5 into direct or indirect invocations of the Policy Authorization Service exposed by the PCF, and converts responses from the PCF into their equivalents at reference point M5 for return to the Media Session Handler.

To realise dynamic policies, the Media AF shall interact with the PCF using one of the following methods:

A. If the Media AF is deployed in the Trusted DN, it may directly invoke the Npcf\_Policy‌Authorization service at reference point N5, as specified in TS 29.514 [18].

NOTE 2: It is the responsibility of the Media AF in this case to discover and track changes to the PCF instance responsible for the PDU Session supporting the media streaming session at reference point M4 using the discovery services provided by the NRF and/or BSF.

B. If the Media AF is deployed outside the Trusted DN, or if it is more convenient for a Media AF deployed in the Trusted DN to do so, it invokes the Nnef\_AFSession‌With‌QoS and/or Nnef\_Chargeable‌Party services exposed by the NEF, as specified in clauses 4.4.9 and 4.4.8 respectively of TS 29.522 [19], to indirectly invoke the PCF at reference point N33.

NOTE 3: Per clause 4.4.9 of TS 29.522 [19], the Nnef\_AFSession‌With‌QoS service is realised at reference point N33 by the AsSession‌With‌QoS exposure API. Similarly, the Nnef\_Chargeable‌Party service is realised by the Chargeable‌Party exposure API per clause 4.4.8 of [19].

NOTE 4: Configuration of the NEF endpoint address and access credentials in the Media AF in this case is beyond the scope of the present document.

When the first Dynamic Policy is created by the Media Session Handler for a particular media delivery session (per clause 5.3.3.2), the Media AF shall create an *AF application session context* in the PCF responsible for the PDU Session corresponding to the M4 application flows indicated in the DynamicPolicy.‌application‌Flow‌Bindings array.

If no corresponding AF application session context already exists, the Media AF shall use the Npcf\_‌Policy‌Authorization\_‌Create operation at reference point N5 (or, if deployed outside the Trusted DN, the equivalent Nnef\_AFsession‌WithQoS service operation) with the appropriate service information to create and provision a new AF application session context. The information in the AppSessionContext‌ReqData shall be derived from the application flow descriptions in the Dynamic Policy Instance resource and/or the requested QoS.

The mapping of application flows listed in the DynamicPolicy.‌application‌Flow‌Bindings array to media components and sub-components of the AF application session context is implementation-dependent.

[If the pduSetQoSLimits property is populated in QosRange.‌downlink‌QoS‌Specification, then the Media‌Component.‌pduSetQosDl object shall be populated as follows by the Media AF:

- The pduSetDelayBudget property shall be set to the larger value of pduSetQoSLimits.‌pduSetDelayBudget and desiredDownlink‌PduSet‌QosParameters.‌pduSetDelayBudget.

- The pduSetErrorRate property shall be set to the larger value of pduSetQoSLimits.pduSetErrorRate and desiredDownlink‌PduSet‌QosParameters.‌pduSetErrorRate.

- The pduSetHandlingInfo property shall be set to the value of pduSetQoSLimits.pduSetHandlingInfo, ignoring the value of desiredDownlink‌PduSet‌QosParameters.‌pduSetHandlingInfo, if any.

Otherwise, the Media‌Component.‌pduSetQosDl object shall be populated directly from the desiredDownlink‌PduSet‌QosParameters object.

If the pduSetQoSLimits property is populated in QosRange.‌uplink‌QoS‌Specification, then the Media‌Component.‌pduSetQosUl object shall be populated as follows by the Media AF:

- The pduSetDelayBudget property shall be set to the larger value of pduSetQoSLimits.‌pduSetDelayBudget and desiredUplink‌PduSet‌QosParameters.‌pduSetDelayBudget.

- The pduSetErrorRate property shall be set to the larger value of pduSetQoSLimits.‌pduSetErrorRate and desiredUplink‌PduSet‌QosParameters.‌pduSetErrorRate.

- The pduSetHandlingInfo property shall be set to the value of pduSetQoSLimits.‌pduSetHandlingInfo, ignoring the value of desiredUplink‌PduSet‌QosParameters.‌pduSetHandlingInfo, if any.

Otherwise, the Media‌Component.‌pduSetQosUl object shall be populated directly from the desiredUplink‌PduSet‌QosParameters object.]

When instantiating a Policy Template that includes the l4SEnablement property set to true, the Media AF shall enable ECN marking for L4S functionality in the 5G System by invoking the Npcf\_‌PolicyAuthorization\_‌Create service operation at reference point N5 (see clause 4.2.2 of TS 29.514 [18]) or the Nnef\_‌AFsessionWithQoS\_‌Create service operation at reference point N33 (see clause 5.14 of TS 29.122 [20]) for the media application flow(s) described by the Dynamic Policy Instance.

When instantiating a Policy Template that includes aqoSMonitoringConfigurations property, the Media AF shall enable QoS monitoring in the 5G System for each member of this array by invoking the Npcf\_‌PolicyAuthorization\_‌Create service operation on the PCF at reference point N5 (see clause 4.2.2 of TS 29.514 [18]) or the Nnef\_‌AFsessionWithQoS\_‌Create service operation on the NEF at reference point N33 (see clause 5.14 of TS 29.122 [20]), including the QoSMonitorConfig array member from the Policy Template as a parameter.

For each of the Dynamic Policy Instances it is managing, the Media AF shall subscribe to the following PCF/NEF notifications on the corresponding AF application session context:

- Service Data Flow QoS notification control;

- Service Data Flow deactivation;

- Resources allocation outcome;

- Service Data Flow L4S enablement;

- Service Data Flow QoS monitoring enablement;

- Service Data Flow QoS monitoring results.

For each of the Dynamic Policy Instances it is managing with QoS monitoring successfully enabled in the 5G System, the Media AF may subscribe to the following notifications from a local UPF managing the corresponding application data flow(s):

- Service Data Flow QoS monitoring results.

NOTE: In this context, "local UPF" refers to a UPF instance inserted for local access to the EAS in case the Media AS is deployed as an EAS instance in the Edge DN. In order to reduce the latency of exposing QoS monitoring results, the local UPF provides notifications of network status directly to the 5GMd AF (or via a locally deployed NEF) as defined in clause 5.8.2.17 of TS 23.501 [2].

When requesting QoS provisioning for a media delivery session, the Media AF shall use the configured Policy Template of the Dynamic Policy Instance to determine the list of the QoS references within altSerReqs. The lowest priority index shall be assigned to the Policy Template with the lowest QoS requirement, and the highest priority shall be assigned to the Service Operation Point requested by the UE (if the UE is allowed to use that operation point).

When instantiating a Policy Template that has a Background Data Transfer policy, the Media AF needs to populate some of the properties in the ClientBdtSpecification object specified in clause 9.3.3.3 for inclusion in the Dynamic Policy Instance resource returned to the Media Session Handler at reference point M5.

When the Policy Template references an existing Background Data Transfer policy by including the bdtPolicyId property, in order to populate the properties of the ClientBdtSpecification object the Media AF shall first retrieve the individual Background Data Transfer policy resource referenced by bdtPolicyId from the PCF. The Npcf\_‌BDT‌Policy‌Control service operation specified in clause 5.3.3.3.1 of TS 29.554 [46] shall be used for this purpose.

When instantiating a Policy Template that includes the l4SEnablement property set to true, the enablement status of ECN marking for L4S functionality in the 5G System shall be populated in the Dynamic Policy instance resource returned to the Media Session Handler by the Media AF, as specified in clause 5.3.3.2.

When instantiating a Policy Template that includes aQoSMonitoringConfiguration property, the enablement status of QoS monitoring shall be populated in the Dynamic Policy instance resource returned to the Media Session Handler by the Media AF, along with the most recent set of QoS monitoring results, if available, as specified in clause 5.3.3.2. QoS monitoring results subsequently provided by the PCF/NEF/UPF shall be further notified to Media Session Handler by the Media AF via the asynchronous MQTT notification channel for the Dynamic Policy instance as also specified in clause 5.3.3.2.

When a dynamic policy is subsequently destroyed by the Media Session Handler (per clause 4.7.3), the Media AF shall destroy the corresponding AF application session context in the relevant PCF instance.

\* \* \* \* Fifth change \* \* \* \*

#### 8.7.3.1 PolicyTemplate resource

Table 8.7.3.1-1: Definition of PolicyTemplate resource

| Property | Type | Cardinality | Usage | Description |
| --- | --- | --- | --- | --- |
| policyTemplateId | ResourceId | 1..1 | C: ROR: ROU: RO | Resource identifier of this Policy Template assigned by the Media AF that is unique within the scope of the Provisioning Session. |
| state | string enum | 1..1 | C: ROR: ROU: RO | Current state of this Policy Template (see clause 5.2.7.2) exposed to the 5GMS Application Provider by the Media AF.Only a Policy Template in the READY state may be instantiated as a Dynamic Policy Instance and applied to media streaming sessions. |
| stateReason | Problem‌Details | 1..1 | C: ROR: ROU: RO | Additional details about the current state of this Policy Template exposed to the Media Application Provider by the Media AF.The instance sub-property shall be present and shall indicate the URL of this Policy Template resource at reference point M1.The title sub-property shall be present and shall indicate a human-readable representation of the *state* property specified above, e.g., "Policy Template ready for use" or "Policy Template invalid".The detail sub-property shall be present and shall indicate a human-readable status/error message.All other properties shall be omitted. |
| externalReference | string | 1..1 | C: RWR: RWU: RW | Additional identifier for this Policy Template, unique within the scope of its Provisioning Session, that may be cross-referenced with external metadata about a media delivery session.Example: "HD\_Premium". |
| application‌Session‌Contexts | array(object) | 0..1 | C: RWR: RWU: RW | Exactly one application session context at reference point M4 to which this Policy Template may be applied.Each object in the array shall specify at least one property. If more than one property is specified, instantiation of the Policy Template is restricted to the conjunction of all the object's properties. |
|  | sliceInfo | Snssai | 0..1 | C: RWR: RWU: RW | A Network Slice on which this Policy Template may be instantiated. (See clause 5.4.4.2 of TS 29.571 [33].) |
|  | dnn | Dnn | 0..1 | C: RWR: RWU: RW | A Data Network on which this Policy Template may be instantiated. (See clause 7.3.2.) |
| qoSSpecifications | array(Qos‌Range) | 0..1 | C: RWR: RWU: RW | The network Quality of Service policy limits to be applied to the application service component(s) of media delivery sessions that instantiate this Policy Template (see NOTE and clause 7.3.3.4).Each member of the array is identified by a component reference that is unique in this array.If present, the array shall contain at least one object. |
| charging‌Specification | Charging‌Specification | 0..1 | C: RWR: RWU: RW | The charging policy to be applied to media delivery sessions that instantiate this Policy Template is instantiated (see NOTE and clause 7.3.3.7). |
| bdtPolicyId | BdtReferenceId | 0..1 | C: RWR: ROU: RW | A reference to an existing Background Data Transfer policy in the PCF (see NOTE 1).Mutually exclusive with bdtSpecification. |
| bdtSpecification | Bdt‌Policy‌Schedule | 0..1 | C: RWR: ROU: RW | The Background Data Transfer policy specification to be associated with media delivery sessions that instantiate this Policy Template (see clause 8.7.3.2).Mutually exclusive with bdtPolicyId property. |
| l4SEnablement | boolean | 0..1 | C: RWR: ROU: RW | Indicates that ECN marking for L4S functionality is to be enabled by the Media Access Function and by the 5G System for media delivery sessions that instantiate this Policy Template. |
| qoSMonitoring‌Configurations | array(Qos‌Monitoring‌Information) | 0..1 | C: ROR: ROU: RO | The QoS monitoring configuration(s) to be provided to the PCF/NEF for media delivery sessions that instantiate this Policy Template (NOTE 2). |
| NOTE 1: Data type BdtReferenceId is specified in TS 29.122 [20].NOTE 2: Data type QosMonitoringInformation is specified in TS 29.122 [20]. |

At least one of the following properties shall be present: qosSpecification, chargingSpecification, bdtPolicyId, bdtSpecification.

\* \* \* \* Sixth change \* \* \* \*

#### 9.3.3.1 DynamicPolicy resource

Table 9.3.3.1-1: Definition of Dynamic Policy Instance resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Property name | Data type | Cardinality | Usage | Description |
| dynamicPolicyId | ResourceId | 1..1 | RO | Unique identifier for this Dynamic Policy Instance assigned by the Media AF when the resource is created. |
| drovisioningSessionId | ResourceId | 1..1 | C: ROR: ROU: RO | Uniquely identifies the parent Provisioning Session, which is linked to the Application Service Provider. |
| session‌Id | MediaDelivery‌SessionId | 1..1 | C: RWR:ROU: RO | Unique identifier of the current media delivery session. |
| policyTemplateId | ResourceId | 1..1 | C: RWR: ROU: RW | Identifies the Policy Template to be applied to the application flow(s) that fall within the scope of this Dynamic Policy Instance. |
| sliceInfo | Snssai | 0..1 | C: RWR: ROU: RW | Identifying the target slice in which the Policy Template is instantiated. |
| dataNetworkName | Dnn | 0..1 | C: RWR: ROU: RW | The name of the target Data Network in which the Policy Template is instantiated. |
| location | TypedLocation | 0..1 | C: RWR: ROU: RW | The location of the UE when the Dynamic Policy was created or last updated. |
| applicationFlowBindings | array(Application‌FlowBinding) | 1..1 | C: RWR: ROU: RW | The bindings between application flows at reference point M4 managed within the scope of this Dynamic Policy Instance and their network Quality of Service requirements (see clause 9.3.3.2).The array shall contain at least one member. |
|  | componentIdentifier | string | 1..1 | C: RWR: ROU: RW | References a particular service component in the Policy Template. |
|  | application‌Flow‌Description | Application‌Flow‌Description | 1..1 | C: RWR: ROU: RW | The Dynamic Policy invoker’s specification of an application flow managed by this Dynamic Policy to be used for application traffic identification purposes in the 5G Core (see clause 7.3.3.2).When PDU Set handling is enabled for the Policy Template identified by policyTemplateId, this property shall also specify the media transport protocol parameters to be used by the Media Access Function for PDU Set signalling purposes. |
|  | qos‌Specification | Client‌Qos‌Specification | 0..1 | C: RWR: ROU: RW | The Dynamic Policy invoker’s network Quality of Service requirements of the application flow described by application‌Flow‌Description.If omitted, the default provisioned network Quality of Service requirements of the Policy Template indicated in policyTemplateId shall apply to application‌Flow‌Description. |
| bdtSpecification | Client‌Bdt‌Specification | 0..1 | C: RWR: ROU: RW | The Background Data Transfer time windows and traffic limits that apply to this Dynamic Policy (see clause 9.3.3.3). |
| qosEnforcement | boolean | 1..1 | C: ROR: ROU: RO | Indication that the Quality of Service described in qosSpecification is being enforced by the 5G System.Populated by the Media AF. |
| l4SEnabled | boolean | 0..1 | C: ROR: ROU: RO | Indication that ECN marking for L4S functionality is enabled in the 5G System.Populated by the Media AF. |
| qoSMonitoringEnabled | boolean | 0..1 | C: ROR: ROU: RO | Indication that QoS monitoring is enabled in the 5G System.Populated by the Media AF. |
| qoSMonitoringResults | QosMonitoringReport | 0..1 | C: ROR: ROU: RO | The most recent QoS monitoring report provided by the 5G System if this feature is enabled.Populated by the Media AF. |
| NOTE: Data type QosMonitoringReport is defined in TS 29.122 [20]. |

\* \* \* \* Seventh change \* \* \* \*

#### 11.3.1.2 Activate Dynamic Policy

The activatePolicy()method is invoked to request the application of a dynamic policy to a media delivery session that is configured at the Media Session Handler. The scope of the dynamic policy is all application flows that match the Media AS domain name declared when the media delivery session was created (see table 11.2.2.1‑1). The application may also provide the estimated transfer volume if the media delivery session is expected to be within the bounds of a Background Data Transfer time window.

The input parameters of the method are specified in table 11.3.1.2‑1.

Table 11.3.1.2-1: Input parameters for activatePolicy() method

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | O | Description |
| sessionId | string | M | The media delivery session identifier (as specified in clause 7.3.2) of an initialised media delivery session in the Media Session Handler. |
| serviceOperationPointReference | string | M | The external reference identifier of a Service Operation Point that uniquely identifies a Policy Template within the context of sessionId. |
| estimatedTransferVolume | integer | C | The estimated volume of data to be transferred, expressed in bytes.Minimum value 1 byte.Required to be populated when the Policy Template corresponding to the referenced Service Operation Point declares a Background Data Transfer policy. |

The Media Session Handler conveys the request to the Media AF and provides the corresponding response to the invoker of the method.

The anonymous return value of the method is specified in table 11.3.1.2‑2.

Table 11.3.1.2-2: Return value for activatePolicy() method

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | O | Description |
| — | object | C | Information about the activated Dynamic Policy.Null if the method invocation is unsuccessful. |
|  | recommendedDownlinkBitRate | BitRate | M | The recommended downlink bit rate for the requested Service Operation Point. |
|  | recommendedUplinkBitRate | BitRate | M | The recommended uplink bit rate for the requested Service Operation Point. |
|  | grantedBackgroundDataTransferWindows | array(TimeWindow) | M | Indicates the time window(s) for which Background Data Transfer has been successfully activated. |
|  | l4SEnabled | boolean | M | Indicates whether ECN Marking for L4S functionality has been successfully activated by both the Media AF and by the Media Access Function for the media delivery session. |
|  | qoSMonitoringEnabled | boolean | M | Indicates whether QoS monitoring has been successfully activated by the Media AF for the media delivery session. |

\* \* \* \* Eighth change \* \* \* \*

### 11.3.2 Dynamic Policy information

Table 11.3.2-1 specifies the status information that can be obtained from the Media Session Handler.

Table 11.3.2-1: Status Information relating to Dynamic Policies

|  |  |  |  |
| --- | --- | --- | --- |
| Status | Type | Parameter | Definition |
| currentDynamicPolicies[mediaDeliverySession] | object |  | Descriptions of the Dynamic Policies currently instantiated for each current media delivery session, including the external reference identifier of its Service Operation Point and details of applicable Background Data Transfer quotas, if any. |

Table 11.3.2-2 provides a list of general notification events exposed by the Media Session Handler.

Table 11.3.2-2: Notification Events relating to Dynamic Policies

|  |  |  |
| --- | --- | --- |
| Event | Definition | Payload |
| POLICY\_ACTIVATED | Triggered when a new Dynamic Policy is successfully activated for the media delivery session. | Media delivery session identifier,Service Operation Point reference,(Background Data Transfer window start,)(Background Data Transfer window end,)Recommended downlink bit rate,Recommended uplink bit rate*.* |
| POLICY\_DEACTIVATED | Triggered when the Dynamic Policy for this media delivery session is deactivated. | Media delivery session identifier,Service Operation Point reference. |
| BACKGROUND\_DATA\_TRANSFER\_OPPORTUNITY | Triggered when a new Background Data Transfer opportunity is notified to the Media Session Handler by the Media AF (see clause 10.2). | Media delivery session identifier,Service Operation Point reference,Background Data Transfer window start,Background Data Transfer window end. |
| L4S\_ENABLED | Triggered when ECN Marking for L4S is successfully activated by the Media AF and by the Media Access Function for the media delivery session. | Media delivery session identifier. |
| QOS\_MONITORING\_ENABLED | Triggered when QoS monitoring is successfully activated by the Media AF for the media delivery session. | Media delivery session identifier |
| QOS\_MONITORING\_RESULTS | Triggered when QoS monitoring results are notified to the Media Session Handler by the Media AF. | Media delivery session identifier,QoS monitoring results. |

Table 11.3.3-3 provides a list of error events exposed by the Media Session Handler through reference points M6 and M11 in relation to Dynamic Policies.

Table 11.3.2-3: Error Events relating to Dynamic Policies

|  |  |  |
| --- | --- | --- |
| Status | Definition | Payload |
| ERROR\_INVALID\_‌SERVICE\_‌OPERATION\_‌POINT | Triggered when the provided Service Operation Point reference is not valid for the media delivery session. | Media delivery session identifier,Service Operation Point reference. |
| ERROR\_UNAUTHORISED | Triggered when the application is not authorised to instantiate a dynamic policy for the provided Service Operation Point reference. | Media delivery session identifier,Service Operation Point reference. |
| ERROR\_BACKGROUND\_DATA\_TRANSFER | Triggered when there is an error during a Background Data Transfer, for example if it is cancelled before the end of the advertised opportunity window. | Media delivery session identifier,Error reason. |

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