**3GPP TSG- S4 Meeting #115e** ***S4-211161***

**Electronic Meeting, 18th August – 27th August 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **Pseudo CHANGE REQUEST** | | | | | | | | |
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|  | **26.804** | **CR** | **<CR#>** | **rev** | **<Rev#>** | **Current version:** | **<Version#>** |  |
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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 |  |

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| ***Title:*** | [FS\_5GMS\_EXT] Proposal of Candidate Solutions for ToS based traffic detection | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson LM | | | | | | | | | |
| ***Source to TSG:*** | S4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | FS\_5GMS\_EXT | | | | |  | ***Date:*** | | | <Res\_date> |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **<Cat>** |  | | | | | ***Release:*** | | | <Release> |
|  | *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 can be 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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | The technical report does not contain detailed call flows for using different traffic detection parameters, like a ToS field. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | A set of candidate solutions is proposed, containing detailed call flows when using a ToS field for traffic detection. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  |  | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  |  | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\*\*\*\* First Change \*\*\*\*

## 5.3 Traffic Identification

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### < Snip>

### 5.3.4 Mapping to 5G Media Streaming and High-Level Call Flows

#### 5.3.4.1 General

The Service Data Flow Templates support multiple different combinations to define parameters for traffic detection. This clause describes the common parameter combinations to detect specifically media streaming application traffic.

The Service Data Flow Template can take the form of either Service Data Flow filters (i.e. IP Packet Filter Sets) or an Application Id referencing Packet Flow Descriptions (PFDs).

An IP Packet Filter Set can contain different combinations of parameter values. Unspecified parameter values in the IP Packet Filter Sets are used to match any value of the corresponding information in the header of an IP packet. Common IP Packet Filter Set combinations are:

- 5-Tuple: The source and destination IP addresses, source and destination port numbers (potentially expressed as a small range of values) and the Protocol ID. This method of traffic detection is further described in clause 5.3.4.2 below.

- ToS: The source IP address and the Type of Service (ToS). This method of traffic detection is further described in clause 5.3.4.3 below.

Editor’s Note: Additional parameter value combinations such as 3-Tuple or usage of Flow Label (IPV6 only) can be beneficial.

A Packet Flow Description (PFD) can contain different parameters. Common parameters are:

- Domain Name: The Internet domain name of an application server. This method of traffic detection is not described further in the present document.

\*\*\*\* Next Change \*\*\*\*

### 5.3.6 Candidate Solutions

#### 5.3.6.1 Solution Overview

This section gives an overview of the different candidate solutions for traffic identification beyond providing 5-Tuples (non-wildcarded). Two types of solutions are separated:

- Charging separation-only: Only the application detection filters in the UPF are provisioned with either IP Packet Filter Set (PFS) or PFD parameters,

- QoS separation: The application detection filters in the UE and in the UPF are provisioned with either IP Packet Filter Set or PFD parameters in order to mark the packets with the associated QFI inside the 5G System.

Note, both types of solutions may also be used for traffic policing.

- Candidate IP-PFS Solution 1: Using ToS for Downlink-only QoS flow mapping

- Candidate IP-PFS Solution 2: Using ToS for Uplink-only QoS flow mapping

- Candidate IP-PFS Solution 3: Using ToS for bi-directional QoS flow mapping, initiated by downlink traffic

- Candidate IP-PFS Solution 4 (a & b): Using ToS for bi-directional QoS flow mapping, initiated by uplink traffic

#### 5.3.6.2 Candidate IP-PFS Solution 1: Using ToS for Downlink-only QoS flow mapping

This candidate solution focuses on a scenario, where only downlink traffic should be mapped to a specific QoS Flow and handled separated by the 5G System. Related uplink traffic is handled using default QoS.

Editor’s Note: Such a solution is counter productive for TCP and QUIC based transports, i.e. protocols depending on acknowledgements. Such solutions can make sense for RTP/UDP based flows, like in Media Production.

#### 5.3.6.3 Candidate IP-PFS Solution 2: Using ToS for Uplink-only QoS flow mapping

This candidate solution focuses on a scenario, where only uplink traffic should be mapped to a specific QoS Flow and handled separated by the 5G System. Related downlink traffic is handled using default QoS.

Editor’s Note: Such a solution is counter productive for TCP and QUIC based transports, i.e. protocols depending on acknowledgements. Such solutions can make sense for RTP/UDP based flows, like in Media Production.

#### 5.3.6.3 Candidate IP-PFS Solution 3: Using ToS for bi-directional QoS flow mapping, initiated by downlink traffic

This candidate solution focuses on a scenario, where both, downlink and uplink application traffic should be mapped to a specific QoS Flow and handled separated by the 5G System. In this candidate solution, the 5GMS AS initiates the QoS flow establishment by using specific ToS values in the downlink traffic.



Figure 5.3.6.3-1:

Assumption:

- A PCC rule for the UE is activated in the 5G System. The PCC rule contains a Service Data Flow Filter with a ToS value and the UE IP address.

Steps

1. The 5GMS Client triggers a TCP connection creation by sending a TCP SYN packet. The TCP packet is forwarded by the UE and the UPF to the 5GMS AS.

2. The 5GMS AS looks up the ToS policy, including the ToS value for this UE / network.

NOTE: The 5GMS AS may also wait until the first HTTP REQUEST header is received to determine the purpose of the request. A 5GMS Client may use the TCP connection for subsequent HTTP transactions (persistent TCP connection).

3. The 5GMS AS sends a TCP SYN/ACK to the UE. The packet reaches the UPF on its path to the UE.

4. The UPF detects a PDR match for the UE. Here, the PDR for the UE IP address contains the ToS value. The PDR was provided to the UPF in an earlier step as described in Clause 5.3.4.3.

5. The UPF encapsulates the DL IP packet into N3 packet. The UPF sets the QFI value in the N3 Packet header.

6. The UPF sends the N3 packet via RAN to the UE.

7. The UE detects a new QFI.

8. Reflective QoS is activated for the PDU Session and the UE creates a “UE derived QoS Rule” as defined in TS 23.501, Clause 5.7.5.2.

9. The UE forwards the TCP SYN/ACK to the 5GMS Client.

10. The 5GMS Client send the TCP ACK to complete the TCP connection creation. The TCP ACK does not need to contain a specific ToS value.

11. The UE detects a PDR match for the UE. Here, the PDR is the 5-Tuple as stored in the UE derived QoS rule.

12. The UE encapsulates the IP packet into the according radio protocols, including the QFI marking.

The 5GMS Client continue using the established TCP connection.

Discussion:

- The 5GMS AS need to determine, whether QoS should be used for this session and which ToS Value to use.

- The Npcf\_PolicyAuthorization API allows provision a ToS value (without a direction indication). The Nnef\_AFsessionWithQOS API does not support provisioning of a ToS value.

#### 5.3.6.4 Candidate IP-PFS Solution 4a: Using ToS for bi-directional QoS flow mapping, initiated by uplink traffic

This candidate solution focuses on a scenario, where both, downlink and uplink application traffic should be mapped to a specific QoS Flow and handled separated by the 5G System. In this candidate solution, the 5GMS Client initiates the QoS flow establishment by using specific ToS values in the uplink traffic. Here, the reception of the ToS marked IP Packet in the UPF triggers the creation of a new QoS rule in the UPF, similar to reflective QoS principles.

NOTE: Creation of a new QoS rule derived from an IP packet is only defined as “UE derived QoS rule” creation in TS 23.501, Clause 5.3.4 (reflective QoS).



Figure 5.3.6.4-1:

Assumption:

- A PCC rule for the UE is activated in the 5G System. The PCC rule contains a Service Data Flow Filter with a ToS value and the UE IP address.

Steps

1. The 5GMS Client triggers a TCP connection creation by sending a TCP SYN packet. The TCP packet is forwarded by the UE and the UPF. The 5GMS Client has set a ToS value in the TCP SYN packet, as provided by the 5GMS AF in an earlier step (See Clause 5.3.4.3).

2. The UPF detects a PDR match for the UE. Here, the PDR for the PDU Session (e.g. identified by the TEID) contains the ToS value. The PDR was provided to the UPF in an earlier step as described in Clause 5.3.4.3.

3. The UPF creates a “UPF derived QoS Rule”, similar to the “UE derived QoS Rule” (see TS 23.501, Clause 5.7.5.2). The UPF derives the IP Packet Filter set (similar to the derivation in the “UE derived QoS rule”) by taking the IP addresses, Protocol Id and port numbers into the IP Packet Filter Set.

4. The UPF forwards the TCP SYN packet to the 5GMS AS.

5. The 5GMS AS replies with a TCP SYN / ACK packet to continue the TCP connection creation.

6. The UPF detects a PDR match for the UE. Here, the PDR for the UE contains the 5-Tuple of the TCP connection.

7. The UPF encapsulates the DL IP packet into N3 packet. The UPF sets the QFI value in the N3 Packet header.

8. The UPF sends the N3 packet via RAN to the UE.

9. The UE detects a new QFI.

10. Since Reflective QoS is activated for the PDU Session, the UE creates a “UE derived QoS Rule” as defined in TS 23.501, Clause 5.7.5.2.

11. The UE forwards the TCP SYN/ACK to the 5GMS Client.

12. The 5GMS Client send the TCP ACK to complete the TCP connection creation. The TCP ACK does not need to contain a specific ToS value.

13. The UE detects a PDR match for the UE. Here, the PDR is the 5-Tuple as stored in the UE derived QoS rule.

14. The UE encapsulates the IP packet into the according radio protocols, including the QFI marking.

The 5GMS Client continue using the established TCP connection.

Discussion:

- TS 23.501 define only a “UE derive QoS Rule”. The concept does not exist for the UPF.

- The Npcf\_PolicyAuthorization API allows provision a ToS value (without a direction indication). The Nnef\_AFsessionWithQOS API does not support provisioning of a ToS value.

#### 5.3.6.5 Candidate IP-PFS Solution 4b: Using ToS for bi-directional QoS flow mapping, initiated by uplink traffic

This candidate solution focuses on a scenario, where both, downlink and uplink application traffic should be mapped to a specific QoS Flow and handled separated by the 5G System. In this candidate solution, the 5GMS Client initiates the QoS flow establishment by using specific ToS values in the uplink traffic. Here, the IP packet with the ToS value reaches the 5GMS AS and is re-used for downlink traffic.



Figure 5.3.6.5-1:

Assumption:

- A PCC rule for the UE is activated in the 5G System. The PCC rule contains a Service Data Flow Filter with a ToS value and the UE IP address.

Steps

1. The 5GMS Client triggers a TCP connection creation by sending a TCP SYN packet. The TCP packet is forwarded by the UE and the UPF to the 5GMS AS. The 5GMS Client has set a ToS value in the TCP SYN packet, as provided by the 5GMS AF in an earlier step.

2. The 5GMS AS reads the ToS Value from the uplink packet. The 5GMS AS uses the UL ToS value for the downlink packets.

NOTE: When the 5G System employs an N6 NAT, the N6 NAT may set the downlong ToS value to the same value as the uplink ToS value.

3. The 5GMS AS sends a TYP SYN/ACK to the UE. The packet reaches the UPF on its path to the UE.

4. The UPF detects a PDR match for the UE. Here, the PDR for the UE IP address contains the ToS value. The PDR was provided to the UPF in an earlier step as described in Clause 5.3.4.3.

5. The UPF encapsulates the DL IP packet into N3 packet. The UPF sets the QFI value in the N3 Packet header.

6. The UPF sends the N3 packet via RAN to the UE.

7. The UE detects a new QFI.

8. Since Reflective QoS is activated for the PDU Session, the UE creates a “UE derived QoS Rule” as defined in TS 23.501, Clause 5.7.5.2.

9. The UE forwards the TCP SYN/ACK to the 5GMS Client.

10. The 5GMS Client send the TCP ACK to complete the TCP connection creation. The TCP ACK does not need to contain a specific ToS value.

11. The UE detects a PDR match for the UE. Here, the PDR is the 5-Tuple as stored in the UE derived QoS rule.

12. The UE encapsulates the IP packet into the according radio protocols, including the QFI marking.

The 5GMS Client continue using the established TCP connection.

Discussion:

- The 5GMS AS need to determine, whether QoS should be used for this session and which ToS Value to use.

- The Npcf\_PolicyAuthorization API allows provision a ToS value (without a direction indication). The Nnef\_AFsessionWithQOS API does not support provisioning of a ToS value.

\*\*\*\* Last Change \*\*\*\*