**3GPP TSG- Meeting #S4-242016**

**Orlando, USA, 18th Nov – 22nd Nov Revision of S4-241752**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  |  | **CR** | **0098** | **rev** | **2** | **Current 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 | **X** |

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|  |
| ***Title:***  | Stage-2 Aspects of Network Slicing  |
|  |  |
| ***Source to WG:*** | Samsung Electronics Co. Ltd. |
| ***Source to TSG:*** | S4 |
|  |  |
| ***Work item code:*** | FS\_MS\_NS\_Ph2, TEI19 |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | C |  | ***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 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:*** | Document S4-241752 was endorsed during SA4#129-e meeting, and it was decided to agree the CR in a future meeting ‘as is’ as SA4 was finalizing Rel-18, and wanted to wait on Rel-19 agreements. This is a resubmission of the endorsed CR as is.Meeting minutes for agreement of above endorsed CR are here: https://docs.google.com/document/d/1X-8V\_GaFvAb19crf\_9nbne8mflYtpeln5OrR5cCyofc/edit?tab=t.0#heading=h.sputs25034yc  |
|  |  |
| ***Summary of change:*** | [From S4-241752]:Following are stage-2 agreements of FS\_MS\_NS\_Ph2 study being implemented into stage-2 spec:1. Use cases and collaboration scenarios for network slicing documented in clauses 5.3 and 5.4 [of TR 26941] be included in an informative annex2. The stage-2 alignment changes described in clause 6.1.3 of TR 26941 to support policy provisioning for a plurality of Network Slices and/or Data Networks3. Key issue description and candidate solution on bootstrapping application invocation on a Network Slice is included as informative annex   |
|  |  |
| ***Consequences if not approved:*** | Feature for network slicing will be incomplete.  |
|  |  |
| ***Clauses affected:*** | 2, 4.0.6, 5.8.1, 6.9.6, Annex X, Annex Y |
|  |  |
|  | **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:*** | S4-241752: Endorsed CR on stage-2 aspects of network slicingS4-242016: Submission of endorsed CR for agreement |

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

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System architecture for the 5G System (5GS)".

[3] 3GPP TS 23.502: "Procedures for the 5G System (5GS)".

[4] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".

[5] Void

[6] 3GPP TS 26.307: "Presentation layer for 3GPP services".

[7] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".

[8] 3GPP TS 26.234: "Transparent end-to-end Packet-switched Streaming Service (PSS); Protocols and codecs".

[9] 3GPP TS 23.003: "Technical Specification Group Core Network and Terminals; Numbering, addressing and identification".

[10] 3GPP TS 28.530: "Management and orchestration; Concepts, use cases and requirements".

[11] 3GPP TS 28.531: "Management and orchestration; Provisioning".

[12] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[13] 3GPP TS 23.222: "Common API Framework for 3GPP Northbound APIs".

[14] IETF RFC 1034: "Domain names - concepts and facilities".

[15] 3GPP TS 23.548: "5G System Enhancements for Edge Computing; Stage 2".

[16] 3GPP TS 23.558: "Architecture for enabling Edge Applications".

[17] 3GPP TS 28.538: "Management and orchestration; Edge Computing Management".

[18] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description".

[19] 3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs".

[20] 3GPP TS 26.347: "Multimedia Broadcast/Multicast Service (MBMS); Application Programming Interface and URL".

[21] 3GPP TS 26.348: "Northbound Application Programming Interface (API) for Multimedia Broadcast/Multicast Service (MBMS) at the xMB reference point".

[22] 3GPP TS 26.531: "Data collection and reporting; General description and architecture".

[23] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[24] 3GPP TS 27.007: "AT command set for User Equipment (UE)".

[25] CTA-5005: "Web Application Video Ecosystem – DASH-HLS Interoperability Specification".

[26] 3GPP TS 26.511: "5G Media Streaming (5GMS); Profiles, Codecs and Formats".

[27] ISO/IEC 23000-19: "Information Technology Multimedia Application Format (MPEG-A) – Part 19: Common Media Application Format (CMAF) for segmented media".

[28] IETF RFC 8216: "HTTP Live Streaming".

[29] ISO/IEC 23009-1: "Information Technology – Dynamic Adaptive Streaming Over HTTP (DASH) – Part 1: Media Presentation Description and Segment Formats".

[30] 3GPP TS 26.502: "5G Multicast-Broadcast User Service Architecture".

[31] Void.

[A] GSM Association: "5G Network Slicing", <https://www.gsma.com/futurenetworks/ip_services/understanding-5g/network-slicing/>.

[B] 5G Network Slicing: Android documentation, <https://source.android.com/docs/core/connect/5g-slicing>.

[C] Apple device support for private 5G and LTE networks: <https://support.apple.com/guide/deployment/support-for-private-5g-and-lte-networks-depac6747317/web>.

[D] GSM Association: "Network Slicing: North America’s Perspective (Current) Version 1.0", https://www.gsma.com/newsroom/wp-content/uploads//NG.130-White-Paper-Network-Slicing-NA-Perspective.pdf, August 2021.

\* \* \* \* Second change \* \* \* \*

### 4.0.6 Dynamic policies

The dynamic policies feature is applicable to both downlink media streaming and uplink media streaming. It enables the 5GMS Client in the UE to manipulate the network traffic handling policies for an ongoing media streaming session.



NOTE: The PCF is accessed via the NEF when the 5GMS network services are deployed outside the Trusted DN.

Figure 4.0.6‑1: High-level arrangement for dynamic policies



Figure 4.0.6‑2: Domain model for dynamic policies

With reference to figure 4.0.6‑2, dynamic policies work as follows:

1. A conceptual *Service Operation Point* is an abstract set of requirements that support a media streaming service (e.g., SD, HD, UHD). It is identified by an *External reference* that is used to tag *Policy Template* resources provisioned in the 5GMS System and *Service Descriptions* included in *Media Entry Point* documents.

2. The Service Operation Point is embodied in the 5G System by a *Policy Template* which is provisioned in the 5GMS network services by the 5GMS Application Provider within the scope of an umbrella *Provisioning Session*. A Policy Template may be defined as being applicable to one or more application session contexts, each identifying a particular Data Network and/or Network Slice. The Policy Template carries the *External reference* and Network QoS parameters corresponding to a single Service Operation Point. (Any number of Policy Templates provisioned for different Data Networks and/or Network Slices may reference the same Service Operation Point.) The 5GMS network services may reject attempts to provision a Policy Template that specifies Network QoS parameters outside acceptable bounds imposed by local system configuration.

 In addition, the Policy Template may include a reference to an existing Background Data Transfer policy. If no previously defined Background Data Transfer policy exists, the Policy Template may instead include the parameters that are used by the 5GMS network services to provision a Background Data Transfer policy for the current Provisioning Session. These parameters may include desired time windows when Background Data Transfer may be advertised to 5GMS Clients, a quota representing the maximum number of 5GMS Clients that are permitted to take advantage of Background Data Transfers in each such time window and a quota representing a ceiling for the aggregate volume of data that all 5GMS Clients are permitted to transfer in each Background Data Transfer window. Hence, an advertised time window is not a guarantee that a request for Background Data Transfer will actually be granted by the 5GMS System.

3. The 5GMS Application Provider makes one or more *Media Entry Point* documents (e.g., DASH MPDs) available for use by the 5GMS Client. To take advantage of the dynamic policies feature, a Media Entry Point document includes one or more *Service Descriptions*, each identifying the streaming requirements of a presentation that correspond to a single Service Operation Point (e.g., SD, HD, UHD) and identified by means of an *External reference*. The same Service Description may be included in more than one Media Entry Point document in case a common Service Operation Point is applicable to multiple media presentations.

4. When a Media Entry Point is selected by the 5GMS Client at the start of a media streaming session, the 5GMS Client retrieves Service Access Information from a network-side component of the 5GMS System describing the set of available Policy Templates provisioned in step 2 and exposes this to a controlling application on the UE.

4a. If Background Data Transfer was provisioned as part of any Policy Templates in step 2 above, the Service Access Information includes details of the advertised time windows when Background Data Transfers are available and the data volume quota (if any). Maximum bit rates for the 5GMS Client in either or both the uplink and downlink direction may also be nominated by the 5G System and signalled to the 5GMS Client in the Service Access Information. Finally, an endpoint in the 5GMS network services may be provided allowing the 5GMS Client to subscribe to receive real-time notifications of Background Data Transfer warning notifications.

5. At the start of a media streaming session, the controlling application on the UE selects one of the Service Descriptions listed in the Media Entry Point document that realises its preferred Service Operation Point. Either the Media Player (when the Service Descriptions are within the Media Entry Point document) or the controlling application (when the Service Descriptions are not within the Media Entry Point document) informs the 5GMS Client of its choice by passing the corresponding External reference to it.

6. If there is a Policy Template available for the current media streaming session with the indicated External reference, the 5GMS Client instantiates this Policy Template by interacting with a network-side component of the 5GMS System in order to realise the Service Operation Point described by the Policy Template and the Service Description. The effect of this is that the corresponding network Quality of Service is applied to the media streaming session.

7. At any point during one of the advertised Background Data Transfer time windows the 5GMS Client may request a Background Data Transfer by instantiating a Policy Template with a Background Data Transfer specification in the 5GMS network services, including an estimate of the data volume it intends to transfer. The 5GMS network services may grant the request for the Background Data Transfer if the data volume estimate is acceptable and if the quota of requests for the time window in question has not already been exceeded. If the request is granted, the 5GMS network services apply the appropriate Background Data Transfer Quality of Service policy to the media streaming session from the Policy Template in question. The Background Data Transfer grant returned to the 5GMS Client includes an estimate of the time period for which Background Data Transfer is available for the 5GMS Client to use and an indication of the maximum data volume that it is permitted to transfer. After this period has expired, the 5GMS network services automatically revert the network Quality of Service back to its state before the grant.

8. The 5GMS media services also subscribe to receive Background Data Transfer warning notifications from the PCF related to the individual Background Data Transfer policy as defined in clause 4.16.7.3 of TS 23 502 [3]. The 5GMS media services shall notify the 5GMS Client when the network performance of that particular media streaming session degrades below the Background Data Transfer policy currently in force or when the aggregate data volume for all data transfers during the current Background Data Transfer time window has been reached.

In addition, the use of dynamic policies by 5GMS Clients is logged by the 5GMS System and, if suitably provisioned, is exposed by it to subscribing 5GMS Application Providers in the form of events (see also clause 4.0.12).

\* \* \* \* Third change (new change) \* \* \* \*

## 5.8 Dynamic Policy based on Network Slicing for downlink media streaming

### 5.8.1 Procedure

The 5GMSd Application Provider requests the assignment of more than one network slice for the distribution of the service. The 5GMSd Application Provider indicates the desired network slice features that correspond to the Service Access Information. Upon successful assignment of the network slices for the service, the 5GMSd AF shall respond with the list of allowed S-NSSAIs to the 5GMSd Application Provider.

Figure 5.8.1-1 is the flowchart diagram for this procedure.



Figure 5.8.1-1: Dynamic Policy based on Network Slicing for Downlink Streaming

Pre-requisites:

1. The UE knows how to access the network slice(s) associated with a particular Provisioning Session.

2. The 5GMSd AS(s) serving the content for the particular Provisioning Session shall be accessible through the DNN(s) associated to the network slice(s) provisioned for the distribution of that content.

3. The 5GMSd Application Provider may identify the Network Slice(s) and/or Data Network(s) applicable to each Policy Template it provisions in the 5GMSd AF in step 4 of the baseline provisioning procedure defined in clause 5.3.2 of the present document.

NOTE: The 5GMSd AF may map the external slice identifier and DNN to operator-internal identifiers.

4. The 5GMSd AF has been preconfigured by the 5G System operator with a mapping from IP subnet range(s) to slice identifiers/DNN duples so that it can select an appropriate network slice and/or Data Network when manipulating the network QoS of the application flows described by a Network Assistance session or Dynamic Policy invocation. The 5GMSd AF may use information about the selected network slice and/or Data Network to filter viable Policy Templates before including them in Service Access Information provided to the 5GMSd Client described in clause 4.3.2 of the present document.

The steps are as follows:

1. The 5GMSd-Aware Application triggers media playback by invoking the Media Player with the Media Player Entry for the selected content.

2. The Media Player requests the manifest from the 5GMSd AS.

3. The Media Player notifies the Media Session Handler about the upcoming media session and may request specific 5GMSd AF-based Network Assistance for that session, when not already established.

4. The Media Session Handler retrieves information from the 5GMSd AF to assist with the route selection for the session. This may include information about the network slices, the DNNs, any pre-authorized QoS guarantees for that Provisioning Session. The Media Session Handler gets information about the operation point selection from the Media Player as described in step 4.

5. The Media Session Handler and the UE Policy Management in the UE perform the route selection procedure using information such as the playback operation point, the traffic descriptors. The UE Policy Management will use the matching filter to retrieve the Route Selection descriptor, which provides the DNN, and the S-NSSAI(s), identifying the network slice(s) to be used for this Provisioning Session.

6. The UE reuses an existing PDU session with the selected S-NSSAI and DNN from step 5, or requests the establishment of a new PDU session with the identified parameters, if one doesn't exist already.

7. The streaming of the media content at the target operation point starts.

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

### 6.9.6 Dynamic Policy based on Network Slicing for uplink media streaming

The 5GMSu Application Provider requests the assignment of more than one network slice for the uplink media streaming service. The 5GMSu Application Provider indicates the desired network slice features that correspond to the Service Access Information. Upon successful assignment of the network slices for the service, the 5GMSu AF shall respond with the list of allowed S-NSSAIs to the 5GMSu Application Provider.

Figure 6.9.6-1 is the sequence diagram for this procedure.



Figure 6.9.6-1.: Dynamic Policy based on Network Slicing for uplink streaming

Pre-requisites:

1. The UE knows how to access the network slice(s) associated with a particular Provisioning Session.

2. The 5GMSu AS instance(s) serving the content for the particular Provisioning Session are accessible through the DNN(s) associated with the network slice(s) provisioned for the contribution of that content.

3. The 5GMSu Application Provider may identify Network Slice(s) and/or Data Network(s) applicable to each Policy Template it provisions in the 5GMSu AF in step 3 of the baseline provisioning procedure defined in clause 6.2.2.2 of the present document.

NOTE: The 5GMSu AF may map the external slice identifier and DNN to operator-internal identifiers

4. The 5GMSu AF has been preconfigured by the 5G System operator with a mapping from IP subnet range(s) to slice identifiers/DNN duples so that it can select an appropriate network slice and/or Data Network when manipulating the network QoS of the application flows described by a Network Assistance session or Dynamic Policy invocation. The 5GMSu AF may use information about the selected network slice and/or Data Network to filter viable Policy Templates before including them in Service Access Information provided to the 5GMSu Client described in clause 4.3.2 of the present document.

The steps are as follows:

1. The 5GMSu-Aware Application triggers the 5GMSu Client for uplink media streaming of content.

2. If it has not already been provided with the necessary Service Announcement parameters by the 5GMSu-Aware Application in the previous step, the Media Session Handler in the 5GMSu Client retrieves Service Access Information from the 5GMSu AF for the Provisioning Session of interest.

**3. The Media Session Handler in the 5GMSu Client invokes Network Assistance on the 5GMSu AF and receives information in response to assist it with the route selection for the uplink media streaming session. This may include information about the network slices, the DNNs and any pre-authorized QoS guarantees for that Provisioning Session.**

**4. The 5GMSu Client and the UE Policy Management in the UE perform the route selection procedure using information such as the uplink streaming Service Operation Point and the traffic descriptors. The UE Policy Management uses the matching filter to retrieve the Route Selection descriptor, which provides the DNN and the S-NSSAI(s) identifying the network slice(s) to be used for uplink media streaming sessions associated with this Provisioning Session.**

**5. The UE either reuses an existing PDU Session with the selected S-NSSAI and DNN from step 3 or, if one doesn't exist already, it requests the establishment of a new PDU Session with the identified parameters.**

6. The 5GMSu Client contributes media content to the 5GMSu AS at reference point M4u using the PDU Session selected in the previous step and this content is made available to the 5GMSu Application Provider at reference point M2u.

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

Annex F (informative):
Network Slice selection for 5GMS

#### F.1 Introduction

Clauses 5 and 6 of the present document describe the high-level procedures for downlink and uplink media streaming respectively. As part of these procedures, the 5GMS Application Provider performs service provisioning at the 5GMS AF. The 5GMS-Aware Application subsequently receives Service Access Information from the 5GMS Application Provider over reference point M8 or else the Media Session Handler acquires it directly from the 5GMS AF over reference point M5. This annex describes an example method for network slice selection based on traffic description information inside URSP rules for bootstrapping 5GMS application invocation on a Network Slice.

#### F.2 Network Slice selection based on Application Descriptor in URSP rules

From clause 5.15.5.2.2 of TS 23.501 [2], the UE uses either the URSP rules (which includes the NSSP) or the UE local configuration to determine which PDU Sessions to use to route ongoing application traffic. Clause 6.6.2.1 of TS 23.503 [4] describes the structure of URSP rules. One of the components of a URSP rule is the *Traffic description information* that helps a UE to identify matching application traffic. Table 6.6.2.1-2 of TS 23.503 [4] specifies a number of Traffic descriptor options, one of which is the *Application descriptor* that identifies traffic of applications running on the UE. An Application descriptor consists of OS Id and OS App Id properties that are known to both the UE application and the 5GMS Application Service Provider.

Assumptions:

- The 5GMS-Aware Application developer is aware of different OS App Ids supported by the UE operating system.

Figure F.2‑1 below illustrates the procedure for bootstrapping application invocation on a Network Slice.



Figure F.2‑1: Call flow for bootstrapping application invocation on a Network Slice

The steps are as follows:

1. The 5GMS-Aware Application is installed on the UE, and and is programmed to invoke an OS-specific network connection API using a pre-defined OS App Id supported by the UE operating system.

2. The 5GMS Application Provider provisions the media streaming session in the 5GMS AF with one or more network slices at reference point M1. The provisioning information may include external application Id information. The 5GMS AF uses this information to synthesise application traffic descriptor information used for application guidance, as specified in clause 4.15.6.10 of TS 23.502 [3].

3. The 5GMS AF uses the Nnef\_ServiceParameter service defined in clause 5.2.6.1 of TS 23.502 [3] to provide application guidance for URSP determination via the NEF as described in clause 4.15.6.10 of TS 23.502 [3], which is eventually delivered to the UE as described in clause 4.15.6.7 of TS 23.502 [15]. The application guidance for URSP includes service parameters such as the application traffic descriptor information (synthesised in the previous step) and Route selection parameters (DNN and S-NSSAI) as specified in clause 4.15.6.10 of TS 23.502 [3].

NOTE 1: URSP rules may also be configured in the UE as described in TS 23.503 [4].

4. The 5GMS Application Provider may provide Service Access Information to the 5GMS-Aware Application at reference point M8. In the Service Access Information, the 5GMS Application Provider may include information related to Service Operation Points associated with different Network Slices.

5. The 5GMS-Aware Application initiaites a media streaming session with the 5GMS Client at reference point M6. The 5GMS Client uses an OS-specific UE-internal API to request a network connection for use at reference points M5 (step 10) and M4 (step 11).

NOTE 2: If the 5GMS-Aware Application is aware about Network Slices, the 5GMS-Aware Application may explicitly indicate the Network Slice to use as part of its request for a network connection. In this case, the following step is skipped.

6. Based on the OS App Id configured for the 5GMS-Aware Application in step 1, the UE Operating System enables selection of the appropriate Network Slice using the application descriptor present in the traffic description information inside the currently configured URSP rules.

NOTE 3: If multiple network slices are provided for the same traffic descriptor, the precedence information in the route selection descriptor is used to select the appropriate Network Slice.

NOTE 4: Whether the UE OS should evaluate the URSP rule is up to implementation.

7. The UE Operating System checks whether a PDU Session already exists in the selected Network Slice and, if so, selects this PDU Session for further interaction with the media streaming endpoints (steps 10 and 11).

8. Alternatively, if no PDU Session exists in the Network Slice, the UE Operating System creates a PDU Session using the UE-requested PDU Session establishment procedure specified in clause 4.3.2.2 of TS 23.502 [3].

NOTE 5: See table A-1 in TS 23.503 [4] for an example of this procedure.

NOTE 6: According to clause 6.6.2.3 of TS 23.503 [4], the mechanisms used by the UE Operating System to check for the existance of a PDU Session in the selected Network Slice and to establish a new PDU Session if needed are up to UE implementation.

9. Once the PDU Session is available, the 5GMS Client interacts with DNS system to resolve the IP address of the 5GMS AF and 5GMS AS instances.

10. The 5GMS Client interacts with the 5GMS AF for media session handling procedures.

11. The 5GMS Client interacts with the 5GMS AS for media streaming.

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

Annex G (informative):
Collaboration scenarios for network slicing

#### G.1 Collaboration scenarios for network slicing based on 5G Media Streaming scenarios

### G.1.0 Introduction

This clause presents the MNO CDN, OTT, and multi-MNO distribution collaboration scenarios corresponding to those described in clauses A.2, A.3, A.8, A.11, and A.14 of the present document enhanced with network slicing. Other MNO CDN and OTT collaboration scenarios (clauses A.1, A.4, A.5, A.6, A.7, A.10, A.12, and A.13 of the present document) can be similarly enhanced, and are therefore not presented here.

## G.1.1 Media streaming with both AF and AS deployed in the trusted Data Network

The collaboration scenario shown in figure G.1.1-1 corresponds to the MNO CDN collaboration scenario described in clause A.2 and A.11 of the present document delivered using a network slice.



Figure G.1.1-1: Media streaming with AF and AS in the trusted Data Network
with Network Slicing

The 5GMS Application Provider may negotiate with the MNO for creation of a network slice.

All the interactions between the participating entities (5GMS Application Provider, 5GMS-Aware Application, 5GMS Client, 5GMS AF, and 5GMS AS) for the 5G Media Streaming session described in clause A.2 and A.11 of the present document apply in this scenario. All M4 interactions happen through a PDU Session established within the provisioned network slice.

## G.1.2 Media streaming with both AF and AS deployed in an external Data Network (OTT)

This collaboration scenario shown in figure G.1.2-1 corresponds to the OTT collaboration scenario described in clause A.3 and A.14 of the present document delivered using a network slice.



Figure G.1.2-1: Media streaming with AF and AS in an external Data Network (OTT)
with Network Slicing

The 5GMS Application Provider may negotiate with the MNO for the creation of a network slice.

All the interactions between all the participating entities (5GMS Application Provider, 5GMS-Aware Application, 5GMS Client, 5GMS AF, and 5GMS AS) described in clause A.3 of the present document apply in this scenario. All M4 and M5 interactions happen through a PDU Session established within the provisioned network slice.

## G.1.3 Media streaming with AFs deployed in two separate trusted Data Networks sharing AS in an external Data Network

This collaboration scenario shown in figure G.1.3-1 represents a multi-MNO distribution scenario where an external CDN (5GMS AS) is used to deliver content to multiple UEs connected to different 5GMS-capable PLMNs, as described in clause A.8 of the present document, but delivered using network slices on those PLMNs.



Figure G.1.3-1: Media streaming with AFs in two trusted Data Networks sharing AS in external Data Network with Network Slicing

The 5GMS Application Provider may negotiate with each of the PLMNs for creation of network sliced. The network slice for each PLMN is provisioned by the PLMN operator.

All the interactions between all the participating entities (5GMS Application Provider, 5GMS-Aware Application, 5GMS Client, 5GMS AF, and 5GMS AS, PCF) described in clause A.8 of the present document apply in this scenario. All M4 and M5 interactions happen through PDU Sessions established within the provisioned network slices. Each UE in a different PLMN may use the provisioned network slice in that PLMN for all the 5G Media Streaming operations. The same external CDN (5GMS AS) serves the users of both the PLMNs, and all the signaling and media traffic is sent through PSU Sessions in respective network slices.

#### G.2 Collaboration scenarios for network slicing with multiple slices or Data Networks

## G.2.0 Introduction

From the network slicing architecture specification in TS 23.501 [2], the following is inferred:

1. A UPF instance may be shared between multiple network slices.

2. Multiple PDU Sessions terminating in different Data Networks may share the same slice.

3. PDU Sessions in different network slice instances may terminate in the same Data Network.

Based on this, the following two collaborations are possible:

- Media streaming wherein content is delivered by/to a 5GMS AS through two different network slices.

- Media streaming wherein 5GMS AS instances deployed in different Trusted DNs are accessed by the 5GMS client in the same network slice.

This clause describes collaboration options based on the above two possibilities.

## G.2.1 Media streaming with AS deployed in external Data Network and AS delivering content through two different network slices

This collaboration scenario shown in figure G.2.1-1 represents the case of accessing the same external Data Network through two different network slices. An external CDN (5GMS AS) is accessed by the UE via this Data Network.



Figure G.2.1-1: Media streaming with AS in external Data Network accessible through two different network slices

The 5GMS Application Provider may negotiate with the MNO to setup two different network slices with different service level agreements (SLA). After the SLA negotiation, the operator may provision two network slices, and provide connectivity services to the external Data Network through both the slices.

The 5GMS Application Provider may deliver Service Access Information through reference point M8. The Service Access Information delivered to the 5GMS-Aware Application may have information about different Service Operation Points accessible through each of the network slices. Upon receiving the Service Access Information, the 5GMS-Aware Application passes this information to the 5GMS Client. The 5GMS Client selects the Service Operation Point of interest, and requests media streaming session establishment over the PDU Session in the network slice that provides the required Service Operation Point. Media streaming (M4) thus happens through the selected network slice.

The other network slice may be used to fetch/contribute other media streaming assets (depending on criticality and SLA availability considerations), or serves as an alternate network slice in case the first slice becomes unavailable, as discussed in clause 6.3.

NOTE: The usage of multiple network slices simultaneously by the same application is currently not supported by either Android or iOS. This collaboration scenario is unlikely to be deployed.

## G.2.2 Media streaming with AS deployed in multiple trusted Data Networks

This collaboration scenario shown in figure G.2.2-1 represents the case of accessing two different Data Networks using the same network slice. A CDN server (5GMS AS) is either deployed in each of the trusted Data Networks, or presents a multi-homed interface at reference point M4 through each of the trusted DNs.



Figure G.2.2-1: Media streaming with AS deployed in multiple trusted Data Networks

The 5GMS Application Provider may negotiate with the MNO to provision a network slice. The operator provisions the network slice, and provides connectivity services to both the DNs through the slice.

The 5GMS Application Provider may deliver Service Access Information through reference point M8. The Service Access Information delivered to the 5GMS-Aware Application may have information about different Service Operation Points accessible through each of the DNs. For example, an enterprise may utiliYe an enterprise-specific CDN (e.g., hosting enterprise-related video tutorials). 5G Media Streaming sessions for enterprise-related video tutorials use the PDU Session terminating in the enterprise-specific CDN, while some other video tutorial requests are sent through PDU Sessions terminating in a different CDN. Alternatively, a DN may act as a back-up CDN, utilised by the 5GMS Client if the primary CDN is inaccessible or unavailable for any reason.

In a variant of this scenario, the second CDN may be a CDN edge with optional media processing.

In another variation of the above scenario shown in figure G.2.2-1, a common 5GMS AS may serve traffic via two trusted Data Networks down the separate PDU Sessions, as shown in figure G.2.2-2.



Figure G.2.2-2: Media streaming with single AS serving traffic
through multiple Data Networks

#### G.3 Collaboration options based on network slicing scenarios

## G.3.0 Introduction

Clause 5.15.2 of TS 23.501 [2] describes the identification of a network slice using S-NSSAI, and specifies the following:

|  |
| --- |
| *An S-NSSAI identifies a Network Slice.**An S-NSSAI is comprised of:**- A Slice/Service type (SST), which refers to the expected Network Slice behaviour in terms of features and services;**- A Slice Differentiator (SD), which is optional information that complements the Slice/Service type(s) to differentiate amongst multiple Network Slices of the same Slice/Service type.* |

Based on the above NSSAI identification, different network slicing scenarios are possible:

1. *A slice allocated for a specific customer/tenant.* For example, a network slice allocated by the MNO for a specific enterprise. In this scenario, all applications of every UE in the enterprise use the allocated network slice. The SD field of the S-NSSAI is used to indicate the customer/tenant.

- Both the Android [B] and iOS [C] mobile Operating Systems have recently started supporting 5G network slicing in mobile devices for enterprise users. Android 12 onwards supports network slicing with a separate enterprise slice and slicing based on user profiles, while Android 13 onwards supports network slicing with multiple enterprise slices [B].

2. *A slice allocated for a specific customer/tenant for a specific service/application.* For example, a network slice allocated by the MNO for a specific enterprise and application. In this scenario, the application in every UE in the enterprise uses the allocated enterprise network slice; all other applications in enterprise UEs use a different (possibly default) network slice. The SD field of the S-NSSAI is used to indicate the customer/tenant and the service information.

3. *A slice allocated for a specific service/application:* For example, a slice optimized for 5G Media Streaming. In this scenario, the optimized slice is shared between all UEs, specifically for 5G Media Streaming application; the UEs use a different (possibly default) slice for other applications/services. The SD field of the S-NSSAI is used to indicate the service/application.

- The GSM Association specifies application-based network slicing [A], in which different network slices are provisioned for different applications.

4. *A slice leased by MNO to a virtual operator.* In this scenario, the virtual operator leases a network slice from the MNO, and in turn, can offer any of the above three network slicing scenarios to its customers over the leased network slice.

This clause describes collaboration options based on the above network slicing scenarios by presenting MNO CDN collaboration scenario described in clause A.7 of the present document wherein both the 5GMS AF and 5GMS AS are deployed in the Trusted DN, and the 5GMS Application Provider uses reference points M1 and M2 respectively to interact with them.

NOTE: All the collaboration scenarios described in clause A of the present document can be similarly shown with each of the network slicing scenarios described in this clause.

## G.3.1 Scenario #1: Slice serving a set of enterprise services/applications

This is a network slicing scenario wherein the MNO, upon a request from an enterprise, allocates one or more network slices exclusively for enterprise users.

Figure G.3.1-1 shows the case of an enterprise network slice for all applications in the enterprise UE. Every application on the enterprise UE, including the 5GMS-Aware Application, uses the allocated network slice for communication with the DN entities.

NOTE: Android 12 onwards supports network slicing with a separate enterprise network slice allocated by the MNO.



Figure G.3.1-1: Network slice for all applications in the enterprise UE

Figure G.3.1-2 shows the case of an enterprise network slice for applications in the enterprise profile of the UE.



Figure G.3.1-2: Network slice for enterprise profile applications

In this scenario:

- Every application in the enterprise/work profile of the UE, including the 5GMS-Aware Application, uses the allocated enterprise network slice for communication with DN entities accessible from that slice.

- Every application in the non-enterprise profile of the UE (e.g., personal profile), including the 5GMS-Aware application, uses the default (e.g., eMBB) network slice for communication with DN entities accessible from that slice.

NOTE: Android 13 onwards supports network slicing with multiple enterprise slices, and slicing based on user profiles.

## G.3.2 Scenario #2: Slice serving a specific application of an enterprise

This is a network slicing scenario wherein the MNO, upon a request from an enterprise, allocates a specific network slice for a specific service/application for enterprise users.

Figure G.3.2-1 shows the case of an enterprise network slice for a specific application (e.g., 5GMS-Aware Application) for enterprise UEs. The media streaming traffic belonging to the 5GMS-Aware application is sent through the enterprise network slice, while traffic for all other applications is sent through a default network slice (e.g. eMBB).



Figure G.3.2-1: Network slice for specific application for enterprise users

URSP rules, provisioned by the PCF, as described in clause 6.6.2.2 of TS 23.503 [4], assist in traffic detection and route selection of appropriate network slice for application traffic in the UE.

## G.3.3 Scenario #3: Slice optimised for a specific service/application

This is a network slicing scenario wherein the MNO allocates a specific network slice for a specific service/application for use by multiple users. (The MNO may also provision additional network slices for carrying traffic of other specific applications.)

NOTE 1: The GSM Association specifies application-based network slicing [D], in which different network slices are provisioned for different applications.

NOTE 2: Unlike Scenario#1 and Scenario#2, the users in this scenario need not belong to the same enterprise.

Figure G.3.3-1 shows the case of a slice optimized for 5G Media Streaming. The traffic belonging to the 5GMS-Aware Applications of all users is sent through this network slice, while the traffic of other applications is sent through a default network slice (e.g., eMBB).



Figure G.3.3-1: Network slice for specific application for all users

URSP rules, provisioned by the PCF, as described in clause 6.6.2.2 of TS 23.503 [4], assist in traffic detection and route selection of the appropriate network slice for application traffic in the UE.

## Y.3.4 Scenario #4: Slice serving a virtual operator

This is a network slicing scenario where in virtual operator leases network slice from the MNO, and uses it to provide service to its customers. The virtual operator may, in turn, offer any of the above three slicing scenarios on the leased network slice.

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