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In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1   Scope

The present document specifies the protocol aspects for the network resource management capability of SEAL to support vertical applications (e.g. V2X) over the 3GPP system.

The present document is applicable to the user equipment (UE) supporting the network resource management client functionality as described in 3GPP TS 23.434 [2], to the application server supporting the network resource management server functionality as described in 3GPP TS 23.434 [2] and to the application server supporting the vertical application server (VAL server) functionality as defined in the specific vertical application service (VAL service) specifications.

NOTE: The specification of the VAL server for a specific VAL service is out of scope of present document.

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 23.434: "Service Enabler Architecture Layer for Verticals (SEAL); Functional architecture and information flows".

[3]   3GPP TS 23.003: "Numbering, addressing and identification".

[4]   3GPP TS 23.203: "Policy and charging control architecture".

[5]   3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".

[6]   3GPP TS 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".

[7]   3GPP TS 24.486: "Vehicle-to-Everything (V2X) Application Enabler (VAE) layer; Protocol aspects; Stage 3".

[8]   3GPP TS 24.545: "Location Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[9]   3GPP TS 24.547: "Identity management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[10]   3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs".

[11]   3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".

[12]   3GPP TS 29.214: "Policy and Charging Control over Rx reference point".

[13]   3GPP TS 29.468: "Group Communication System Enablers for LTE (GCSE_LTE); MB2 reference point; Stage 3".

[14]   3GPP TS 29.514: "5G System; Policy Authorization Service; Stage 3".

[15]   Void.

[16]   IETF RFC 3095: "RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed".

[17]   IETF RFC 3428: "Session Initiation Protocol (SIP) Extension for Instant Messaging".

[18]   IETF RFC 3841: "Caller Preferences for the Session Initiation Protocol (SIP)".

[19]   IETF RFC 4825: "The Extensible Markup Language (XML) Configuration Access Protocol (XCAP)".

[20]   IETF RFC 5795: "The Robust Header Compression (ROHC) Framework".

[21]   Void

[21A]   IETF RFC 6838: "Media Type Specifications and Registration Procedures".

[22]   IETF RFC 9110: "HTTP Semantics".

[23]   IETF RFC 7252: "The Constrained Application Protocol (CoAP)".

[24]   IETF RFC 7959: "Block-Wise Transfers in the Constrained Application Protocol (CoAP)".

[25]   IETF RFC 7641: "Observing Resources in the Constrained Application Protocol (CoAP)".

[26]   IETF RFC 8323: "CoAP (Constrained Application Protocol) over TCP, TLS, and WebSockets".

[27]   IETF RFC 8949: "Concise Binary Object Representation (CBOR)".

[28]   Void

[29]   IETF RFC 9177: "Constrained Application Protocol (CoAP) Block- Wise Transfer Options Supporting Robust Transmission".

[30]   IETF RFC 8610: "Concise Data Definition Language (CDDL): A Notational Convention to Express Concise Binary Object Representation (CBOR) and JSON Data Structures".

[31]   3GPP TS 24.546: "Configuration management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[32]   OMA OMA-TS-XDM_Core-V2_1-20120403-A: "XML Document Management (XDM) Specification".

[33]   3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description".

[34]   3GPP TS 23.247: "Architectural enhancements for 5G multicast-broadcast services; Stage 2".

[35]   3GPP TS 26.517: "5G Multicast-Broadcast User Services; Protocols and Formats".

3   Definitions of terms and abbreviations

3.1   Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

SEAL network resource management client: An entity that provides the client side functionalities corresponding to the SEAL network resource management service.

SEAL network resource management server: An entity that provides the server side functionalities corresponding to the SEAL network resource management service.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.434 [2] apply:

SEAL client
SEAL server
SEAL service
VAL server
VAL service
VAL user
Vertical
Vertical application

3.2   Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

BM-SC	Broadcast-Multicast Service Centre
MBS	Multicast/Broadcast Services
CoAP	Constrained Application Protocol
SNRM-C	SEAL Network Resource Management Client
SNRM-S	SEAL Network Resource Management Server
PCF	Policy Control Function
SEAL	Service Enabler Architecture Layer for verticals
VAL	Vertical Application Layer

4   General description

Network resource management is a SEAL service that provides the network resource management related capabilities (e.g. unicast and multicast network resources) to one or more vertical applications. The present document enables a SEAL network resource management client (SNRM-C) and a VAL server that communicate with a SEAL network resource management server (SNRM-S).

The SNRM-S obtains and controls multicast resources from the underlying 3GPP network system via the BM-SC and controls unicast resources from the underlying 3GPP network system via the PCRF/PCF.

5   Functional entities

5.1   SEAL network resource management client (SNRM-C)

The SNRM-C functional entity acts as the application client for network resource management related transactions.

To be compliant with the HTTP procedures in the present document the SNRM-C:

    a)   shall support the role of XCAP client as specified in IETF RFC 4825 [19];

    b)   shall support the role of XDMC as specified in OMA OMA-TS-XDM_Core-V2_1 [32]; and

    c)   shall support the multicast resource management procedures in clause 6.2.3.

To be compliant with the CoAP procedures in the present document the SNRM-C:

    a)- shall support the role of CoAP client as specified in IETF RFC 7252 [23];

    b)- shall support the capability to observe resources as specified in IETF RFC 7641 [25];

    c)- shall support the block-wise transfer as specified in IETF RFC 7959 [24];

    d)- may support the robust block transfer as specified in IETF RFC 9177 [29];

e)- should support CoAP over TCP and Websocket as specified in IETF RFC 8323 [26];

f)- shall support CBOR encoding as specified in IETF RFC 8949 [27];

g)- shall support the procedures in clause 6.2.3; and

h)- shall support the procedure in clause 6.2.4.

NOTE 1: The security mechanism to be supported for the CoAP procedures is described in 3GPP TS 24.547 [9].

NOTE 2: Support for TCP for the CoAP procedures is required if the client connects over the network which blocks or impedes the use of UDP, e.g. when NATs are present in the communication path.

NOTE 3: The CoAP protocol supports mechanism for reliable message exchange over UDP. Use of TCP can also be beneficial if reliable transport is required for other reasons, e.g. better observability of resources. Usage of CoAP over TCP is an implementation choice.

NOTE 4: Support for the robust block transfer mechanism for the CoAP procedures is beneficial in environments where packet loss is highly asymmetrical and where performance optimization of block transfers is required.

5.2 SEAL network resource management SEAL server (SNRM-S)

The SNRM-S is a functional entity used to provide resource management of 3GPP system network resources (e.g. unicast, multicast) to one or more vertical applications.

To be compliant with the HTTP procedures in the present document the SNRM-S shall:

   a)   shall support the role of XCAP server as specified in IETF RFC 4825 [19];

   b)   shall support the role of XDMS as specified in OMA OMA-TS-XDM_Core-V2_1 [32];

   c)   shall support the unicast resource management procedures in clause 6.2.2; and

   d)   shall support the multicast resource management procedures in clause 6.2.3.

To be compliant with the CoAP procedures in the present document the SNRM-C:

   a)- shall support the role of CoAP server as specified in IETF RFC 7252 [23];

   b)- shall support the capability to observe resources as specified in IETF RFC 7641 [25];

   c)- shall support the block-wise transfer as specified in IETF RFC 7959 [24];

   d)- shall support the robust block transfer as specified in IETF RFC 9177 [29];

   e)- shall support CoAP over TCP and Websocket as specified in IETF RFC 8323 [26];

   f)- shall support CBOR encoding as specified in IETF RFC 8949 [27];

   g)- shall support the procedure in clause 6.2.3; and

   h)- shall support the procedure in clause 6.2.4.

NOTE: The security mechanism to be supported for the CoAP procedures is described in 3GPP TS 24.547 [9].

6 Network resource management procedures

6.1 General

This clause provides the procedures for network resource management between the SNRM-C and the SNRM-S and from the SNRM-S and the VAL server.

6.2 On-network procedures

6.2.1 General

6.2.1.1 Authenticated identity in HTTP request

Upon receiving an HTTP request, the SNRM-S shall authenticate the identity of the sender of the HTTP request is authorized as specified in 3GPP TS 24.547 [9], and if authentication is successful, the SNRM-S shall use the identity of the sender of the HTTP request as an authenticated identity.

6.2.1.2 Authenticated identity in CoAP request

Upon receiving a CoAP request, the SNRM-S shall authenticate the identity of the sender of the CoAP request as specified in 3GPP TS 24.547 [9], and if authentication is successful, the SNRM-S shall use the identity of the sender of the CoAP request as an authenticated identity.

6.2.2 Unicast resource management

6.2.2.1 General

This clause describes the procedures used for unicast resource management. The unicast resource management comprises procedures for:

   a) activation and deactivation of bearers;

   b) modification of the QoS characteristics of a bearer; and

   c) modification of GBR due to application requirement.

The VAL client can request the VAL server to provide unicast resources (see clause 6.2.2.2), to modify or to release unicast resources (see clause 6.2.2.3) or to perform network resource adaptation (see clause 6.2.2.4).

   NOTE: A VAL service communication can consist of both unicast and multicast bearers which can all need modification due to the same event.

VAL specific pre-requisites and resultant behaviour by functional entities in performing the unicast resource management procedures are specified in the respective VAL TS (e.g. for V2X application layer, see 3GPP TS 24.486 [7]).

Unicast resource management is supported with PCRF interactions with SIP core and PCC interactions with the SNRM-S. The PCRF procedures are specified in 3GPP TS 29.214 [12] and the PCF procedures are specified in 3GPP TS 29.514 [14].

6.2.2.2 Request for unicast resource at VAL service communication establishment procedure with SIP core

6.2.2.2.1 VAL server procedure

If the VAL client requests VAL service communication with the VAL server, the VAL server shall generate an HTTP POST request message according to procedures specified in IETF RFC 9110 [22]. In the HTTP POST request message, the VAL server:

a) shall include a Request-URI set to the URI corresponding to the identity of the SNRM-S;

b) shall include an Accept header field set to "application/vnd.3gpp.seal-unicast-info+xml";

c) shall include a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info +xml";

d) shall include an application/vnd.3gpp.seal-unicast-info+xml MIME body and in the <unicast-info> root element:

    1) shall include a <request> element which shall include:

        i) a <requester-identity> element set to the identity of the VAL server performing the request;

        ii) an <identity> element set to the identity of the VAL user or VAL UE which requests the VAL service communication; and

        iii) an optional <requirement-info> element set to the requested unicast resource information; and

e) shall send the HTTP POST request message towards the SNRM-S according to IETF RFC 9110 [22].

NOTE: Before terminating connection due to no response from the SNRM-S, the VAL server allows sufficient time for the SNRM-S to reserve resources and respond. It is up to implementation to decide how long the VAL server waits for receiving response.

6.2.2.2.2 Server procedure

Upon receiving an HTTP POST request message containing:

a) an Accept header field set to "application/vnd.3gpp.seal-unicast-info+xml";

b) a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info +xml"; and

c) an application/vnd.3gpp.seal-unicast-info+xml MIME body with a <request> element in the <unicast-info> root element;

the SNRM-S:

a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

    1) if the identity of the sender of the received HTTP POST request is not authorized to request unicast resource, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and

    2) shall support handling an HTTP POST request from a VAL server according to procedures specified in IETF RFC 4825 [19] "POST Handling"; and

b) shall evaluate the need for network resources and use of resource sharing, and then send a SIP MESSAGE request containing request for resources according to procedures specified in 3GPP TS 29.214 [12] for EPS and 3GPP TS 29.514 [14] for 5GS.

Upon receiving a SIP 200 (OK) response to the SIP MESSAGE request, the SNRM-S:

a) shall generate an HTTP 200 (OK) response message according to IETF RFC 9110 [22]. In the HTTP 200 (OK) response message, the SNRM-S:

    1) shall include a Request-URI set to the URI corresponding to the identity of the VAL server;

    2) shall include a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info+xml"; and

3) shall include an application/vnd.3gpp.seal-unicast-info+xml MIME body and in the <unicast-info> root element:

   i) shall include a <request-result> element set to "success" indicating success of the resource request operation; and

   b) shall send the HTTP 200 (OK) response message towards the VAL server according to IETF RFC 9110 [22].

6.2.2.3   Request for modification of unicast resources procedure with SIP core

6.2.2.3.1   VAL server procedure

To modify unicast bearers, the VAL server shall generate an HTTP POST request according to procedures specified in IETF RFC 9110 [22]. In the HTTP POST request message, the VAL server:

   a) shall include a Request-URI set to the URI corresponding to the identity of the SNRM-S;

   b) shall include an Accept header field set to "application/vnd.3gpp.seal-unicast-info+xml";

   c) shall include a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info +xml";

   d) shall include an application/vnd.3gpp.seal-unicast-info+xml MIME body and in the <unicast-info> root element:

   1) shall include a <modification> element which shall include:

      i) a <requester-identity> element set to the identity of the VAL server performing the request;

      ii) an <identity> element set to the identity of the VAL user or VAL UE which requests the VAL service communication; and

      iii) an <requirement-info> element set to the modified unicast resource information; and

   e) shall send the HTTP POST request message towards the VAL server according to IETF RFC 9110 [22].

   NOTE: Before terminating connection due to no response from the SNRM-S, the VAL server allows sufficient time for the SNRM-S to reserve resources and respond. It is up to implementation to decide how long the VAL server waits for receiving response.

6.2.2.3.2   Server procedure

Upon receiving an HTTP POST request message containing:

   a) an Accept header field set to "application/vnd.3gpp.seal-unicast-info+xml";

   b) a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info +xml"; and

   c) an application/vnd.3gpp.seal-unicast-info+xml MIME body with a <modification> element in the <unicast-info> root element;

the SNRM-S:

   a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

   1) if the identity of the sender of the received HTTP POST request is not authorized to modify unicast resource, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and

   2) shall support handling an HTTP POST request from a VAL server according to procedures specified in IETF RFC 4825 [19] "POST Handling";

   b) if the media bearer modification is not required, shall generate an HTTP 200 (OK) response message according to IETF RFC 9110 [22]. In the HTTP 200 (OK) response message, the SNRM-S:

   1) shall include a Request-URI set to the URI corresponding to the identity of the VAL server;

   2) shall include a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info+xml";

   3) shall include an application/vnd.3gpp.seal-unicast-info+xml MIME body and in the <unicast-info> root element:

      i) shall include a <modification-result> element set to "failure" indicating failure of the resource modification request operation; and

   4) shall send the HTTP 200 (OK) response message towards the VAL server according to IETF RFC 9110 [22]; and

  c) if the media bearer modification is required, shall send a SIP MESSAGE request containing the modified parameters of the unicast bearer according to procedures specified in 3GPP TS 29.214 [12] for EPS and 3GPP TS 29.514 [14] for 5GS.

Upon receiving a SIP 200 (OK) response to the SIP MESSAGE request, the SNRM-S:

  a) shall generate an HTTP 200 (OK) response message according to IETF RFC 9110 [22]. In the HTTP 200 (OK) response message, the SNRM-S:

   1) shall include a Request-URI set to the URI corresponding to the identity of the VAL server;

   2) shall include a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info+xml"; and

   3) shall include an application/vnd.3gpp.seal-unicast-info+xml MIME body and in the <unicast-info> root element:

      i) shall include a <modification-result> element set to "success" indicating success of the resource modification request operation; and

  b) shall send the HTTP 200 (OK) response message towards the VAL server according to IETF RFC 9110 [22].

6.2.2.4 Network resource adaptation procedure with SIP core

6.2.2.4.1 VAL server procedure

In order to request unicast resources or modify already allocated unicast resources to VAL communications, the VAL server shall generate an HTTP POST request according to procedures specified in IETF RFC 9110 [22]. In the HTTP POST request message, the VAL server:

  a) shall include a Request-URI set to the URI corresponding to the identity of the SNRM-S;

  b) shall include an Accept header field set to "application/vnd.3gpp.seal-unicast-info+xml";

  c) shall include a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info +xml";

  d) shall include an application/vnd.3gpp.seal-unicast-info+xml MIME body and in the <unicast-info> root element:

   1) shall include an <adaptation> element which shall include:

      i) a <requester-identity> element set to the identity of the VAL server performing the request;

      ii) an <identity> element which shall include one of the following elements:

         A) a <VAL-ue-id-list> element with one or more <VAL-ue-id> child elements set to the identities of the VAL UEs for whom the network resource adaptation occurs; or

         B) a <VAL-group-id> element set to the identity of the VAL group for whom the network resource adaptation occurs; and

      iii) a <requirement> element set to the VAL service QoS requirements as applied for the corresponding VAL UEs or group of UEs; and

  e) shall send the HTTP POST request message towards the VAL server according to procedures specified in IETF RFC 9110 [22].

6.2.2.4.2 Server procedure

Upon receiving an HTTP POST request message containing:

a) an Accept header field set to "application/vnd.3gpp.seal-unicast-info+xml";

b) a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info +xml"; and

c) an application/vnd.3gpp.seal-unicast-info+xml MIME body with an <adaptation> element in the <unicast-info> root element;

the SNRM-S:

a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

   1) if the identity of the sender of the received HTTP POST request is not authorized to adapt unicast resource, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and

   2) shall support handling an HTTP POST request from a VAL server according to procedures specified in IETF RFC 4825 [19] "POST Handling"; and

b) shall apply/enforce the resource adaptation per VAL UE, and then initiate the PCC procedures for each VAL UE as described in 3GPP TS 29.214 [12] for EPS and 3GPP TS 29.514 [14] for 5GS. After the PCC procedures, the SNRM-S shall generate an HTTP 200 (OK) response message according to IETF RFC 9110 [22]. In the HTTP 200 (OK) response message, the SNRM-S:

   1) shall include a Request-URI set to the URI corresponding to the identity of the VAL server;

   2) shall include a Content-Type header field set to "application/vnd.3gpp.seal-unicast-info+xml";

   3) shall include an application/vnd.3gpp.seal-unicast-info+xml MIME body and in the <unicast-info> root element:

      i) shall include an <adaptation-result> element set to "success" or "failure" indicating success or failure of the network resource adaptation with the underlying network; and

   4) shall send the HTTP 200 (OK) response message towards the VAL server according to procedures specified in IETF RFC 9110 [22].

6.2.3 Multicast resource management

6.2.3.1 General

The SNRM-C, SNRM-S and VAL server utilizes multicast bearers in EPS (see 3GPP TS 23.246 [33]) and 5G multicast and broadcast communication services (MBS) in 5GS (see 3GPP TS 23.247 [34]).

   NOTE: It is implementation specific whether the VAL server decides to use multicast or broadcast MBS sessions.

For multicast resource management in the EPS, the procedures described in clauses 6.2.3.2 to 6.2.3.9 are used.

For multicast resource management in the 5GS, the procedures described in clauses 6.2.3.10 to 6.2.3.17 are used.

6.2.3.2 Use of pre-established MBMS bearers procedure

6.2.3.2.1 VAL server procedure

When a user originates a request for a VAL service group communication session for one of these areas, in order to use the pre-established MBMS bearers, the VAL server shall generate an HTTP POST request according to procedures specified in IETF RFC 9110 [22]. In the HTTP POST request message, the VAL server:

a) shall include a Request-URI set to the URI corresponding to the identity of the SNRM-S;

b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml";

    c) shall include an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body and in the <mbms-info> root element:

        1) shall include an <request> element which shall include:

            i) a <requester-identity> element set to the identity of the VAL server performing the request;

            ii) a <VAL-group-id> element set to the identity of the VAL group that the MBMS bearer is requested for;

            iii) a <service-anouncement-mode> indicating whether the request is sent by NRM server or by the VAL server;

            iv) a <QoS> element indicating the requested QoS for the bearer;

            v) an optional <broadcast-area> element indicating the area where the MBMS bearer is requested for; and

            vi) an <endpoint-info> element set to the information of the endpoint of the VAL server to which the user plane notifications have to be sent; and

    d) shall send the HTTP POST request message towards the SNRM-S according to IETF RFC 9110 [22].

6.2.3.2.2 SNRM server HTTP procedure

Upon receiving an HTTP POST request message containing:

    a) a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

    b) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with a <request> element in the <mbms-info> root element;

the SNRM-S:

    a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

        1) if the identity of the sender of the received HTTP POST request is not authorized to request mbms resource, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and

        2) shall support handling an HTTP POST request from a VAL server according to procedures specified in IETF RFC 4825 [19] "POST Handling"; and

    b) shall determine to activate MBMS bearer, and then generate an HTTP POST request message according to IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-S:

        1) shall set the Request-URI to the URI corresponding to the identity of the SNRM-C;

        2) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml";

        3) shall include in a MIME body with Content-Type header field set to "application/vnd.3gpp.seal-info+xml", the <seal-request-uri> element set to the VAL user ID of the user;

        4) shall include an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with the <version> element set to "1" and one or more <announcement> elements associated with the pre-activated MBMS bearers in the <mbms-info> root element. Each set of an <announcement> element:

            i) shall include a <TMGI> element set to a TMGI value;

    NOTE 1: The same TMGI value can only appear in one <announcement> element. The TMGI value is also used to identify the <announcement> when updating or cancelling the <announcement> element.

    NOTE 2: The security key active for the general purpose MBMS subchannel on which the mapping (i.e. the Map Group To Bearer message) of media or media control to this MBMS bearer was indicated, is used for MBMS subchannels on this MBMS bearer, unless a different key or an indication of not using encryption is in place.

ii) may include an <alternative-TMGI> element set to a list of additional alternative TMGI used in roaming scenarios;

iii) may include the QCI value in the <QCI> element;

iv) shall include one or more MBMS service area IDs in <mbms-service-area-id> elements in the <mbms-service-areas> element;

NOTE 3: Initial mappings of groups to MBMS subchannels on an MBMS bearer for the purpose of carrying media or media control can occur only where the MBMS service area for this bearer and the MBMS service area for the bearer carrying the general purpose MBMS subchannel on which the Map Group To Bearer message is sent intersect. However, once media or media control were successfully mapped to this bearer, the reception by the SNRM-C can continue (until Unmap Group To Bearer is received or until timeout) throughout the entire MBMS service area of this bearer.

v) if multiple carriers are supported, shall include the frequency to be used in the <frequency> element;

NOTE 4: In the current release if the <frequency> element is included, the frequency in the <frequency> element is the same as the frequency used for unicast.

vi) shall include a <seal-mbms-sdp> element set to the SDP with media and application control information applicable to groups that can use this bearer;

vii) may include a <monitoring-state> element set to "monitoring" or "not-monitoring" used to control if the client is actively monitoring the MBMS bearer quality or not;

viii) may include an <announcement-acknowlegement> element set to "true" or "false" indicating if the NRM server requires an acknowledgement of the MBMS bearer announcement;

ix) may include an <unicast-status> element set to "listening" or "not-listening" indicating if the listening status of the unicast bearer is requested;

x) if the packet headers are compressed with ROHC specified in IETF RFC 5795 [20] in this MBMS bearer, shall include a <seal-mbms-rohc> element; and

5) shall send the HTTP POST request message towards the SNRM-C according to IETF RFC 9110 [22].

Upon receiving an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

b) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-listening-status-report> element;

the SNRM-S:

a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

1) if the identity of the sender of the received HTTP POST request is not authorized to report mbms listening status, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and

2) shall support handling an HTTP POST request from a SNRM-C according to procedures specified in IETF RFC 4825 [19] "POST Handling";

b) shall generate an HTTP 200 (OK) response message to the VAL server according to IETF RFC 9110 [22]. In the HTTP 200 (OK) response message, the SNRM-S:

1) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml";

2) shall include an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-bearers> element in the <mbms-info> root element which:

i) shall include a <result> element set to "success" or "failure" indicating success or failure of the MBMS bearers request operation;

ii) may include a <TMGI> element set to a TMGI value;

iii) shall include a <user-plane-address> element set to the BM-SC user plane IP address and port; and

iv) may include a <service-description> element indicating MBMS bearer related configuration information as defined in 3GPP TS 26.346 [10]; and

c) shall send the HTTP 200 (OK) response message towards the VAL server according to IETF RFC 9110 [22].

6.2.3.2.3 SNRM client HTTP procedure

Upon receiving an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

b) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with one or more <announcement> element(s);

the SNRM-C:

a) shall store the content of the <announcement> elements and generate an HTTP POST request message according to IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-C:

1) shall set the Request-URI to the URI corresponding to the identity of the SNRM-S;

2) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

3) shall include an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-listening-status-report> subelement which:

i) shall include an <identity> element set to the identity of the VAL user or VAL UE who wants to report the MBMS listening status;

ii) shall include one or more <TMGI> elements for which the listening status applies;

iii) shall include an <mbms-listening-status> element set to "listening" if the SNRM-C is listening to the MBMS bearer or "not-listening" if the SNRM-C is not listening; and

iv) may include an <mbms-reception-quality-level> element set to the reception quality level per TMGI; and

b) shall send the HTTP POST request towards the SNRM-S according to IETF RFC 9110 [22].

6.2.3.2.4 SNRM server CoAP procedure

Upon receiving an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

b) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with a <request> element in the <mbms-info> root element;

the SNRM-S:

a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

1) if the identity of the sender of the received HTTP POST request is not authorized to request mbms resource, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and

2) shall support handling an HTTP POST request from a VAL server according to procedures specified in IETF RFC 4825 [19] "POST Handling"; and

b) shall determine to activate MBMS bearer, and then generate a CoAP PUT request according to IETF RFC 7252 [23]. In the CoAP PUT request, the SNRM-S:

1) shall set the CoAP URI to the MBMS Resource Configuration resource URI according to the resource definition in clause A.3.1.2.2.3:

a) the "apiRoot" is set to the SNRM-C URI;

    b) the "valServiceId" is set to the identity of the VAL service; and

    c) the "tmgi" is set to a TMGI value;

  2) shall include Content-Format option set to "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=mbms-resource-config";

  3) shall include "MbmsResourceConfig" object in the payload:

    i) may include an "alternativeTmgis" attribute set to a list of additional alternative TMGIs used in roaming scenarios;

    ii) may include the QCI value in the "qci" attribute;

    iii) shall include one or more MBMS service area IDs in the "serviceAreas" attribute;

NOTE 1: Initial mappings of groups to MBMS subchannels on an MBMS bearer for the purpose of carrying media or media control can occur only where the MBMS service area for this bearer and the MBMS service area for the bearer carrying the general purpose MBMS subchannel on which the Map Group To Bearer message is sent intersect. However, once media or media control were successfully mapped to this bearer, the reception by the SNRM-C can continue (until Unmap Group To Bearer is received or until timeout) throughout the entire MBMS service area of this bearer.

    iv) if multiple carriers are supported, shall include the frequency to be used in the "frequency" attribute;

NOTE 2: In the current release if the "frequency" attribute is included, the frequency in the "frequency" attribute is the same as the frequency used for unicast.

    v) shall include the "sdp" attribute set to the SDP with media and application control information applicable to groups that can use this bearer;

    vi) shall include the "monitorConfig" object:

      a) may include the "receptionQuality" attribute set to "true" or "false" used to control if the client is actively monitoring the MBMS bearer quality or not; and

      b) may include the "unicastResource" set to "true" or "false" indicating if the listening status of the unicast bearer is requested or not; and

    vii) if the packet headers are compressed with ROHC specified in IETF RFC 5795 [20] in this MBMS bearer, shall include the "rohcEnabled" attribute set to "true"; and

  4) shall send the CoAP PUT request protected towards the SNRM-C with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [9].

Upon receiving a response to the CoAP PUT request, the SNRM-S:

  a) shall generate an HTTP 200 (OK) response message to the VAL server according to IETF RFC 9110 [22]. In the HTTP 200 (OK) response message, the SNRM-S:

    1) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

    2) shall include an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-bearers> element in the <mbms-info> root element which:

      i) shall include a <result> element set to "success" or "failure" indicating success or failure of the MBMS bearers request operation depending on whether the CoAP response is a successful response or a failure response;

      ii) may include a <TMGI> element set to a TMGI value;

      iii) shall include a <user-plane-address> element set to the BM-SC user plane IP address and port; and

      iv) may include a <service-description> element indicating MBMS bearer related configuration information as defined in 3GPP TS 26.346 [10]; and

  b) shall send the HTTP 200 (OK) response message towards the VAL server according to IETF RFC 9110 [22].

6.2.3.2.5 SNRM client CoAP procedure

Upon reception of a CoAP PUT request where the CoAP URI of the request identifies MBMS Resource Configuration resource as described in clause A.3.1.2.2.3.2, the SNRM-C:

a) shall determine the identity of the sender of the received CoAP PUT request as specified in clause 6.2.1.2, and:

1) if the identity of the sender of the received CoAP PUT request is not authorized to create or update requested MBMS resource configuration resource, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP PUT request and skip rest of the steps;

b) shall support handling a CoAP PUT request from a SNRM-C according to procedures specified in IETF RFC 7252 [23];

c) shall create or update the MBMS resource configuration resource pointed at by the CoAP URI with the content of "MbmsResourceConfig" object received in the request and return a CoAP 2.01 (Created) or a CoAP 2.04 (Changed) response; and

d) if monitoring configuration is included in the "monitorConfig" attribute, shall start the monitoring accordingly.

6.2.3.3 MBMS bearer announcement over MBMS bearer procedure

6.2.3.3.1 General

The availability of a MBMS bearer is announced to SNRM-Cs by means of an MBMS bearer announcement message. One or more MBMS bearer announcement elements are included in an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body.

An MBMS bearer announcement message can contain new MBMS bearer announcements, updated MBMS bearer announcements or cancelled MBMS bearer announcements or a mix of all of them at the same time in an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body. Each initial MBMS bearer announcement message announces one MBMS bearer intended to carry a general purpose MBMS subchannel used for application level multicast signalling in a specified MBMS service area and additionally, the message could also announce zero or more extra MBMS bearers intended to carry media and media control.

NOTE 1: A new MBMS bearer announcement does not implicitly remove previously sent MBMS bearer announcements if the previously sent MBMS bearer announcement is not included in an MBMS bearer announcement message.

NOTE 2: The SNRM-C will use the same identity which has been authenticated by VAL service with SIP core using SIP based REGISTER message. If VAL service do not support SIP protocol, then HTTP based method needs to be used.

NOTE 3: The VAL service can select appropriate procedure(s) based on service specific requirements. If the VAL service supports HTTP, CoAP and SIP, HTTP is prior.

When CoAP is used the availability of an MBMS bearer is announced to SNRM-C by creating an MBMS Resource Config resource at the SNRM-C. A single announcement is included in the "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=mbms-resource-config" MIME body.

When and to whom the SNRM-S sends the MBMS bearer announcement is based on local policy in the SNRM-S.

6.2.3.3.2 SNRM server SIP and HTTP procedures

6.2.3.3.2.1 MBMS bearer announcement procedure

6.2.3.3.2.1.0 Generate MBMS bearer announcement message in XML

For each SNRM-C that the SNRM-S is sending an MBMS bearer announcement to, the SNRM-S:

a) shall generate an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with the <version> element set to "1" and one or more <announcement> elements associated with the pre-activated MBMS bearers. Each set of an <announcement> element:

1) shall include a <TMGI> element set to a TMGI value;

NOTE 1: The same TMGI value can only appear in one <announcement> element. The TMGI value is also used to identify the <announcement> when updating or cancelling the <announcement> element.

NOTE 2: The security key active for the general purpose MBMS subchannel on which the mapping (i.e. the Map Group To Bearer message) of media or media control to this MBMS bearer was indicated, is used for MBMS subchannels on this MBMS bearer, unless a different key or an indication of not using encryption is in place.

2) may include an <alternative-TMGI> element set to a list of additional alternative TMGI used in roaming scenarios;

3) may include the QCI value in the <QCI> element;

4) shall include one or more MBMS service area IDs in <mbms-service-area-id> elements in the <mbms-service-areas> element;

NOTE 3: Initial mappings of groups to MBMS subchannels on an MBMS bearer for the purpose of carrying media or media control can occur only where the MBMS service area for this bearer and the MBMS service area for the bearer carrying the general purpose MBMS subchannel on which the Map Group To Bearer message is sent intersect. However, once media or media control were successfully mapped to this bearer, the reception by the SNRM-C can continue (until Unmap Group To Bearer is received or until timeout) throughout the entire MBMS service area of this bearer.

5) if multiple carriers are supported, shall include the frequency to be used in the <frequency> element;

NOTE 4: In the current release if the <frequency> element is included, the frequency in the <frequency> element is the same as the frequency used for unicast.

6) shall include a <seal-mbms-sdp> element set to the SDP with media and application control information applicable to groups that can use this bearer;

7) may include a <monitoring-state> element set to "monitoring" or "not-monitoring" used to control if the client is actively monitoring the MBMS bearer quality or not;

8) may include an <announcement-acknowlegement> element set to "true" or "false" indicating if the NRM server requires an acknowledgement of the MBMS bearer announcement;

9) may include an <unicast-status> element used to indicate the listening status of the unicast bearer which is requested; and

10) if the packet headers are compressed with ROHC specified in IETF RFC 5795 [20] in this MBMS bearer, shall include a <seal-mbms-rohc> element.

6.2.3.3.2.1.1   SIP based procedure

If the VAL service supports SIP, the SNRM-S shall generate an SIP MESSAGE request in accordance with 3GPP TS 24.229 [6] and IETF RFC 3428 [17] with the constructed application/vnd.3gpp.seal-mbms-usage-info+xml MIME body as specified in clause 6.2.3.3.2.1. In the SIP MESSAGE request, the SNRM-S:

a) shall set the Request-URI to the URI received in the To header field in a third-party SIP REGISTER request;

b) shall include an Accept-Contact header field with the g.3gpp.icsi-ref media-feature tag with the value of "urn:urn-7:3gpp-service.ims.icsi.seal" along with parameters "require" and "explicit" according to IETF RFC 3841 [18];

c) shall include a P-Asserted-Service header field with the value "urn:urn-7:3gpp-service.ims.icsi.seal";

d) shall include the MBMS public service identity of the SNRM-S in the P-Asserted-Identity header field;

e) shall include in a MIME body with Content-Type header field set to "application/vnd.3gpp.seal-info+xml", the <seal-request-uri> element set to the VAL user ID of the user; and

f) shall send the SIP MESSAGE request towards the SNRM-C according to 3GPP TS 24.229 [6].

6.2.3.3.2.1.2   HTTP based procedure

If the VAL service does not support SIP, the SNRM-S shall generate an HTTP POST request message in accordance with IETF RFC 9110 [22] with the constructed application/vnd.3gpp.seal-mbms-usage-info+xml MIME body as specified in clause 6.2.3.3.2.1. In the HTTP POST request message, the SNRM-S:

   a) shall set the Request-URI to the URI corresponding to the identity of the SNRM-C;

   b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml";

   c) shall include in a MIME body with Content-Type header field set to "application/vnd.3gpp.seal-info+xml", the <seal-request-uri> element set to the VAL user ID of the user; and

   d) shall send the HTTP POST request towards the SNRM-C according to IETF RFC 9110 [22].

6.2.3.3.2.2   MBMS bearer de-announcement procedure

When the SNRM-S wants to cancel an MBMS bearer announcement associated with an <announcement> element, the SNRM-S sends an MBMS bearer announcement as specified in clause 6.2.3.3.2.1 where the SNRM-S in the <announcement> element to be cancelled. The SNRM-S:

   a) shall include the same TMGI value as in the <announcement> element to be cancelled in the <TMGI> element; and

   b) shall not include an <mbms-service-areas> element.

6.2.3.3.3   SNRM client SIP and HTTP procedures

Upon receiving a SIP MESSAGE request containing:

   a) a P-Asserted-Service header field containing the "urn:urn-7:3gpp-service.ims.icsi.seal"; and

   b) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body containing one or more <announcement> element(s);

or an HTTP POST request message containing:

   a) a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

   b) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body containing one or more <announcement> element(s);

the SNRM-C for each <announcement> element in the application/vnd.3gpp.seal-mbms-usage-info+xml MIME body:

   a) if the <mbms-service-areas> element is present:

      1) if an <announcement> element with the same value of the <TMGI> element is already stored:

         i) shall replace the old <announcement> element with the <announcement> element received in the application/vnd.3gpp.seal-mbms-usage-info+xml MIME body;

      2) if there is no <announcement> element with the same value of the <TMGI> element stored:

         i) shall store the received <announcement> element;

      3) shall store the MBMS public service identity of the SNRM-S received in the P-Asserted-Identity header field and associate the MBMS public service identity with the new <announcement> element;

      4) if there is an <announcement-acknowlegement> element set to "true", shall send an acknowledgement of the MBMS bearer to the SNRM-S; and

      5) shall check the condition for sending a listening status report;

   b) if no <mbms-service-areas> element is present:

      1) shall discard a previously stored <announcement> element identified by the value of the <TMGI>; and

    2) check the condition for sending a listening status report;

  c) if the <monitoring-state> element is present:

    1) if the <monitoring-state> is set to "monitor", shall start to monitor the MBMS bearer quality; and

    2) if the <monitoring-state> is set to "not-monitor", shall stop monitoring the MBMS bearer quality; and

  d) if the <unicast-status> element is present, shall include the <unicast-listening-status> element in the MBMS listening status report message.

6.2.3.3.4 SNRM Server CoAP procedures

6.2.3.3.4.1 MBMS bearer announcement procedure

For each SNRM-C that the SNRM-S is sending an MBMS bearer announcement to, the SNRM-S:

  a) shall generate a CoAP PUT request according to IETF RFC 7252 [23]. In the CoAP PUT request, the SNRM-S:

    1) shall set the CoAP URI to the MBMS Resource Configuration resource URI according to the resource definition in clause A.3.1.2.2.3:

      a) the "apiRoot" is set to the SNRM-C URI;

      b) the "valServiceId" is set to the identity of the VAL service; and

      c) the "tmgi" is set to a TMGI value;

    2) shall include Content-Format option set to "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=mbms-resource-config";

    3) shall include "MbmsResourceConfig" object in the payload:

      i) may include an "alternativeTmgis" attribute set to a list of additional alternative TMGIs used in roaming scenarios;

      ii) may include the QCI value in the "qci" attribute;

      iii) shall include one or more MBMS service area IDs in the "serviceAreas" attribute;

NOTE 1: Initial mappings of groups to MBMS subchannels on an MBMS bearer for the purpose of carrying media or media control can occur only where the MBMS service area for this bearer and the MBMS service area for the bearer carrying the general purpose MBMS subchannel on which the Map Group To Bearer message is sent intersect. However, once media or media control were successfully mapped to this bearer, the reception by the SNRM-C can continue (until Unmap Group To Bearer is received or until timeout) throughout the entire MBMS service area of this bearer.

      iv) if multiple carriers are supported, shall include the frequency to be used in the "frequency" attribute;

NOTE 2: In the current release if the "frequency" attribute is included, the frequency in the "frequency" attribute is the same as the frequency used for unicast.

      v) shall include the "sdp" attribute set to the SDP with media and application control information applicable to groups that can use this bearer;

      vi) shall include the "monitorConfig" object:

        a) may include the "receptionQuality" attribute set to "true" or "false" used to control if the client is actively monitoring the MBMS bearer quality or not; and

        b) may include the "unicastResource" set to "true" or "false" indicating if the listening status of the unicast bearer is requested or not; and

      vii) if the packet headers are compressed with ROHC specified in IETF RFC 5795 [20] in this MBMS bearer, shall include the "rohcEnabled" attribute set to "true"; and

    4) shall send the CoAP PUT request protected towards the SNRM-C with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [9].

6.2.3.3.4.2   MBMS bearer de-announcement procedure

When the SNRM-S wants to cancel an MBMS bearer announcement, the SNRM-S shall send a CoAP DELETE request to the SNRM-C to delete the MBMS Resource Config resource in the SNRM-C. The SNRM-S:

    a) shall generate a CoAP DELETE request according to IETF RFC 7252 [23]. In the CoAP DELETE request, the SNRM-S:

       1) shall set the CoAP URI to the MBMS Resource Configuration resource URI of the resource to be deleted according to the resource definition in clause A.3.1.2.2.3:

          a) the "apiRoot" is set to the SNRM-C URI;

          b) the "valServiceId" is set to the identity of the VAL service; and

          c) the "tmgi" is set to a TMGI value; and

    b) shall send the CoAP DELETE request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [9].

6.2.3.3.5   SNRM Client CoAP procedures

6.2.3.3.5.1   MBMS bearer announcement procedure

Upon reception of a CoAP PUT request where the CoAP URI of the request identifies an MBMS Resource Configuration resource as described in clause A.3.1.2.2.3.2, the SNRM-C:

    a) shall determine the identity of the sender of the received CoAP PUT request as specified in clause 6.2.1.2, and:

       1) if the identity of the sender of the received CoAP PUT request is not authorized to update the requested VAL group document, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP PUT request and skip rest of the steps;

    b) shall support handling a CoAP PUT request from a SGM-C according to procedures specified in IETF RFC 7252 [23];

    c) shall create or update the MBMS resource configuration resource pointed at by the CoAP URI with the content of "MbmsResourceConfig" object received in the request and return a CoAP 2.01 (Created) or a CoAP 2.04 (Changed) response;

    d) if monitoring configuration is included in the "monitorConfig" attribute:

       1) if the "receptionQuality" attribute is present and is set to "true", shall start monitoring the MBMS bearer quality;

       2) if the "receptionQuality" attribute is not present or is present and is set to "false", shall stop monitoring the MBMS bearer quality;

       3) if the "unicastResource" attribute is present and is set to "true", shall start monitoring the associated unicast resource; and

       4) if the "unicastResource" attribute is not present or is present and is set to "false", shall stop monitoring the associated unicast resource; and

    e) shall check the condition for sending a listening status report.

6.2.3.3.5.2   MBMS bearer de-announcement procedure

Upon reception of a CoAP DELETE request where the CoAP URI of the request identifies MBMS Resource Configuration resource as described in clause A.3.1.2.2.3.3, the SNRM-C:

a) shall determine the identity of the sender of the received CoAP DELETE request as specified in clause 6.2.1.2, and:

    1) if the identity of the sender of the received CoAP DELETE request is not authorized to delete the requested MBMS resource configuration resource, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP DELETE request and skip rest of the steps;

b) shall support handling a CoAP DELETE request from a SNRM-S according to procedures specified in IETF RFC 7252 [23];

c) shall delete the MBMS resource pointed at by the CoAP URI];

d) if monitoring configuration was included in the "monitorConfig" attribute, shall stop the monitoring accordingly; and

e) shall check the condition for sending a listening status report.

6.2.3.4 MBMS bearer quality detection procedure

NOTE 1: The SNRM-C will use the same identity which has been authenticated by VAL service with SIP core using SIP based REGISTER message. If VAL service do not support SIP protocol, then HTTP or CoAP based method needs to be used.

NOTE 2: The VAL service can select appropriate procedure(s) based on service specific requirements. If the VAL service supports both HTTP, CoAP and SIP, HTTP is prior.

6.2.3.4.1 SNRM client SIP and HTTP procedures

6.2.3.4.1.0 General

Upon determining the MBMS bearer quality, if the MBMS bearer quality reaches a certain threshold, the SNRM-C shall report the MBMS listening status. The SNRM-C:

NOTE 1: The SNRM-C may determine the MBMS bearer quality by using the BLER of the received data. When no data is received, the quality estimation can consider the reference signals and the modulation and coding scheme (MCS). The UE may also use predictive methods to estimate the expected MBMS bearer quality (e.g. speed and direction) to proactively inform the NRM server of an expected loss of the MBMS bearer quality.

NOTE 2: The threshold used to indicate MBMS bearer quality depends on VAL service type and the metrics used. The metrics used and the associated thresholds are out of scope of this specification.

NOTE 3: The application/vnd.3gpp.seal-mbms-usage-info+xml can contain both the listening status "listening" and "not listening" at the same time.

a) shall generate an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-listening-status-report> element in the <mbms-info> root element which;

    1) shall include an <identity> element set to the identity of the VAL user or VAL UE who wants to report the MBMS listening status;

    2) shall include an <mbms-listening-status> element set to "listening" if the SNRM-C is listening to the MBMS bearer or "not-listening" if the SNRM-C is not listening;

    3) shall include one or more <TMGI> elements for which the listening status applies;

    4) may include an <mbms-reception-quality-level> element set to the reception quality level per TMGI; and

    5) if the <unicast-status> element is present in the MBMS announcement message, shall include an <unicast-listening-status> element set to "listening" or "not-listening" indicating the unicast listening status.

6.2.3.4.1.1 SIP based procedure

If the VAL service supports SIP, the SNRM-S shall generate a SIP MESSAGE request according to
3GPP TS 24.229 [6] and IETF RFC 3428 [17] with the constructed application/vnd.3gpp.seal-mbms-usage-info+xml
MIME body as specified in clause 6.2.3.4.1 and the application/vnd.3gpp.seal-info+xml MIME body. In the SIP
MESSAGE request, the SNRM-C:

   a) shall include a Request-URI set to the MBMS public service identity of the SNRM-S received in the P-Asserted-
      Identity header field of the announcement message;

   b) shall include an Accept-Contact header field with the g.3gpp.icsi-ref media-feature tag with the value of
      "urn:urn-7:3gpp-service.ims.icsi.seal" along with parameters "require" and "explicit" according to
      IETF RFC 3841 [18];

   c) should include a public user identity in the P-Preferred-Identity header field as specified in 3GPP TS 24.229 [6];

   d) shall include a P-Preferred-Service header field with the value "urn:urn-7:3gpp-service.ims.icsi.seal";

   e) shall send the SIP MESSAGE request according to 3GPP TS 24.229 [6].

6.2.3.4.1.2 HTTP based procedure

If the VAL service does not support SIP, the SNRM-S shall generate an HTTP POST request message in accordance
with IETF RFC 9110 [22] with the constructed application/vnd.3gpp.seal-mbms-usage-info+xml MIME body as
specified in clause 6.2.3.4.1 and the application/vnd.3gpp.seal-info+xml MIME body. In the HTTP POST request
message, the SNRM-C:

   a) shall set the Request-URI to the URI corresponding to the identity of the SNRM-S;

   b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

   c) shall send the HTTP POST request towards the SNRM-S according to IETF RFC 9110 [22].

6.2.3.4.2 SNRM server SIP and HTTP procedure

6.2.3.4.2.1 SIP based procedure

Upon receiving a SIP MESSAGE request containing:

   a) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-listening-status> element and
      an <mbms-reception-quality-level> element;

the SNRM-S:

   a) shall verify that the public user identity in the P-Asserted-Identity header field is bound to the VAL user ID in
      the <seal-request-uri> element in the application/vnd.3gpp.seal-info+xml MIME body;

   b) may send an MBMS bearer announcement message as specified in clause 6.2.3.3 with additional proposal for
      measurements, e.g. information about neighbouring MBMS bearers; and

   c) may send user plane delivery mode to VAL server based on the MBMS listening status to preserve the service
      continuity as described in clause 6.2.3.5.

6.2.3.4.2.2 HTTP based procedure

Upon receiving an HTTP POST request message containing:

   a) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-listening-status> element and
      an <mbms-reception-quality-level> element;

the SNRM-S:

   a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.3.4.1.2,
      and:

    1) if the identity of the sender of the received HTTP POST request is not authorized to detect MBMS bearer quality, shall respond with an HTTP 403 (Forbidden) response to the HTTP POST request and skip rest of the steps;

  b) may send an MBMS bearer announcement message as specified in clause 6.2.3.3 with additional proposal for measurements, e.g. information about neighbouring MBMS bearers; and

  c) may send user plane delivery mode to VAL server based on the MBMS listening status to preserve the service continuity as described in clause 6.2.3.5.

6.2.3.4.3 SNRM client CoAP procedure

Upon determining the MBMS bearer quality, if the MBMS bearer quality reaches a certain threshold, the SNRM-C shall report the MBMS listening status. The SNRM-C:

NOTE 1: The SNRM-C may determine the MBMS bearer quality by using the BLER of the received data. When no data is received, the quality estimation can consider the reference signals and the modulation and coding scheme (MCS). The UE may also use predictive methods to estimate the expected MBMS bearer quality (e.g. speed and direction) to proactively inform the NRM server of an expected loss of the MBMS bearer quality.

NOTE 2: The threshold used to indicate MBMS bearer quality depends on VAL service type and the metrics used. The metrics used and the associated thresholds are out of scope of this specification.

NOTE 3: As a precondition, the SNRM-S must be observing the MBMS Resource State resource at the SNRM-C as described in clause 6.2.3.4.4.

  1) shall include Content-Format option set to "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=mbms-resource-state"; and

  2) shall include "MbmsResourceState" object in the payload:

    i) shall include the "tmgi" attribute set to the TMGI of the MBMS resource;

    ii) shall include the "monitorConfig" set to the current monitoring configuration at the SNRM-C;

    iii) may include the "receptionQualityLevel" set to the measured reception quality level;

    iv) if the "unicastResource" attribute of the "monitorConfig" object is set to "true", shall include the "unicastListeningState" set to "true" or "false" indicating the unicast listening status of "listening" or "not-listening" respectively; and

    v) if the "suspension" attribute of the "monitorConfig" object is set to "true", shall include the "suspensionState" set to "true" or "false" indicating the suspension status of "suspending" or "not-suspending" respectively.

6.2.3.4.4 SNRM server CoAP procedure

In order to obtain listening status reports from the SNRM-Cs, for each SNRM-C which has been configured to monitor the MBMS Resource, the SNRM-S shall send an extended CoAP GET request as specified in IETF RFC 7641 [25] with the CoAP URI set to the URI of the observable MBMS Resource State resource described in clause A.3.1.2.3.3.1 with the Observe option set to 0 (Register).

Upon receiving a CoAP 2.05 (Content) response that matches the extended CoAP GET request and which contains the Observe option, the SNRM-S:

  a) shall handle the response according to IETF RFC 7641 [25];

  b) may send an MBMS bearer announcement message as specified in clause 6.2.3.3 with additional proposal for measurements, e.g. information about neighbouring MBMS bearers; and

  c) may send user plane delivery mode to VAL server based on the MBMS listening status to preserve the service continuity as described in clause 6.2.3.5.

6.2.3.5 Service continuity in MBMS scenarios

6.2.3.5.1 SNRM client procedures

If the VAL UE is located in MBSFN 1 and can listen to TMGI 1, where no additional MBMS bearers that the SNRM-C is interested in are active in the current cell, the SNRM-C shall send an MBMS listening status report with information related to TMGI 1 as specified in clause 6.2.3.4.1 towards the SNRM-S.

If the VAL UE moves into a new cell in which both TMGI 1 and TMGI 2 are active, the SNRM-C shall send a location information report as specified in 3GPP TS 24.545 [8] clause 6.2.2.2.2 towards the SNRM-S.

If the SNRM-C receives TMGI 1 and TMGI 2, the SNRM-C shall send an MBMS listening status report with information related to TMGI 1 and TMGI 2 as specified in clause 6.2.3.4.1 towards or in clause 6.2.3.4.3 the SNRM-S.

If the VAL UE moves into a new cell in MBSFN area 2, where only TMGI 2 is active, the SNRM-C shall send an MBMS listening status report with information related to TMGI 2 as specified in clause 6.2.3.4.1 or in clause 6.2.3.4.3 towards the SNRM-S.

6.2.3.5.2 SNRM server HTTP procedure

Upon receiving an HTTP POST request message containing:

  a) a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

  b) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-listening-status-report> element;

the SNRM-S:

  a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

    1) if the identity of the sender of the received HTTP POST request is not authorized to report mbms listening status, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and

    2) shall support handling an HTTP POST request from a SNRM-C according to procedures specified in IETF RFC 4825 [19] "POST Handling";

  b) shall generate an HTTP POST request message according to IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-S:

    1) shall include a Request-URI set to the URI corresponding to the identity of the VAL server;

    2) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml";

    3) shall include an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with a <user-plane-delivery-mode> element in the <mbms-info> root element which shall include:

      i) a <delivery-mode> element indicating whether to deliver the user data to the UE(s) via unicast mode or multicast mode;

      ii) an <MBMS-media-stream-id> element indicating the MBMS media stream to be used to deliver the media currently over unicast, or the MBMS media stream currently being used.; and

      iii) one or more <unicast-media-stream-id> element(s), each element indicating the unicast media stream to be used to deliver the media currently over multicast, or the unicast to be stopped and switched to multicast; and

  c) shall send the HTTP POST request towards the VAL server according to IETF RFC 9110 [22].

Upon receiving an HTTP POST request message containing:

  a) a Content-Type header field set to "application/vnd.3gpp.seal-location-info+xml";

b) an application/vnd.3gpp.seal-location-info+xml MIME body with a <report> element in the <location-info> root element;

the SNRM-S:

a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

1) if the identity of the sender of the received HTTP POST request is not authorized to report location information, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and

2) shall support handling an HTTP POST request from a SNRM-C according to procedures specified in IETF RFC 4825 [19] "POST Handling"; and

b) shall send an MBMS bearer announcement message with information related to TMGI 2 as specified in clause 6.2.3.3 towards the SNRM-C.

6.2.3.5.3 SNRM server CoAP procedure

Upon receiving a CoAP 2.05 (Content) response with a listening status report as described in clause 6.2.3.4.4, the SNRM-S:

a) shall generate an HTTP POST request message according to IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-S:

1) shall include a Request-URI set to the URI corresponding to the identity of the VAL server;

2) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

3) shall include an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with a <user-plane-delivery-mode> element in the <mbms-info> root element which shall include:

   i) a <delivery-mode> element indicating whether to deliver the user data to the UE(s) via unicast mode or multicast mode;

   ii) an <MBMS-media-stream-id> element indicating the MBMS media stream to be used to deliver the media currently over unicast, or the MBMS media stream currently being used.; and

   iii) one or more <unicast-media-stream-id> element(s), each element indicating the unicast media stream to be used to deliver the media currently over multicast, or the unicast to be stopped and switched to multicast; and

b) shall send the HTTP POST request towards the VAL server according to IETF RFC 9110 [22].

Upon reception of a CoAP PUT request message where the CoAP URI of the CoAP PUT request identifies a location report as specified in in 3GPP TS 24.545 [8] clause 6.2.2.5.2 , and containing:

a) a Content-Format option set to "application/vnd.3gpp.seal-location-info+cbor;modeltype=location-report"; and

b) a "LocationReport" object;

the SNRM-S:

a) shall determine the identity of the sender of the received CoAP PUT request as specified in clause 6.2.1.2; and

1) if the identity of the sender of the received CoAP PUT request is not authorized to report location information, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP PUT request and shall skip rest of the steps; and

2) shall support handling a CoAP PUT request according to IETF RFC 7252 [23]; and

b) shall send an MBMS bearer announcement message with information related to TMGI 2 as specified in clause 6.2.3.3 towards the SNRM-C.

6.2.3.6 MBMS suspension notification procedure

6.2.3.6.1 SNRM client HTTP procedure

Upon receiving an HTTP POST request message containing:

    a) a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

    b) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-suspension-reporting-instruction> element in the <mbms-info> root element;

the SNRM-C shall send an HTTP 204 (No Content) response according to IETF RFC 9110 [22] towards the SNRM-S.

If the SNRM-C detects the MBMS suspension and has not received a <suspension-reporting> element set to "disable", the SNRM-C shall generate an HTTP POST request message according to IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-C:

    a) shall include a Request-URI set to the URI corresponding to the identity of the SNRM-S;

    b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml";

    c) shall include an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-suspension-report> element in the <mbms-info> root element which:

        1) shall include an <identity> element set to the identity of the VAL user or VAL UE that reports MBMS suspension;

        2) if at least one MBMS bearer is about to be suspended:

            i) shall include an <mbms-suspension-status> element set to "suspending";

            ii) shall set the <number-of-reported-bearers> element to the total number of the included <suspended-TMGI> elements and <other-TMGI> elements;

            iii) shall include <suspended-TMGI> element(s) set to the TMGI value for each of the MTCHs on the same MCH corresponding to the MBMS bearers about to be suspended; and

            iv) may include <other-TMGI> elements, if available, corresponding to the TMGI values for other MTCHs on the same MCH as the MBMS bearers to be suspended; and

        3) if the MBMS bearer is no longer about to be suspended, shall include:

            i) an <mbms-suspension-status> element set to "not-suspending";

            ii) a <number-of-reported-bearers> element set to the number of included <suspended-TMGI> elements; and

            iii) a <suspended-TMGI> element set to the corresponding TMGI value for each of the MTCHs of the MBMS bearers that are no longer about to be suspended; and

    d) shall send the HTTP POST request message towards the SNRM-S according to IETF RFC 9110 [22].

6.2.3.6.2 SNRM server HTTP procedure

If the SNRM-S decide on a subset of all VAL UEs in the MBMS broadcast area that shall report on MBMS bearer suspension, the SNRM-S shall generate an HTTP POST request message according to IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-S:

    a) shall include a Request-URI set to the URI corresponding to the identity of the SNRM-C;

    b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml";

    c) shall include an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with an <mbms-suspension-reporting-instruction> element in the <mbms-info> root element which:

        1) if a unicast bearer is used for MBMS suspension reporting, shall include:

        i)   an <identity> element set to the identity of the VAL user or VAL UE that shall report MBMS suspension; and

        ii) a <suspension-reporting> element indicating to enable or disable the suspension reporting for the SNRM-C; and

    2) if a multicast bearer is used for MBMS suspension reporting, shall include:

        i)   a <suspension-reporting-client-subset> element containing a uniquely defined subset of NRM clients that shall report MBMS suspension; and

  d) shall send the HTTP POST request message towards the SNRM-C according to IETF RFC 9110 [22].

6.2.3.6.3 SNRM client CoAP procedure

When the SNRM-C detects a change in the MBMS suspension state, the SNRM-C shall notify the SNRM-S of the change. The SNRM-C:

  NOTE 1: As a precondition, the SNRM-S must be observing the MBMS Resource State resource at the SNRM-C as described in clause 6.2.3.6.4.

  a) shall send a CoAP 2.05 (Content) response to the extended CoAP GET request according to IETF RFC 7641 [25]:

    1) shall include Content-Format option set to "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=mbms-resource-state"; and

    2) shall include "MbmsResourceState" object in the payload:

        i)   shall include the "tmgi" attribute set to the TMGI of the MBMS resource;

        ii) shall include the "monitorConfig" set to the current monitoring configuration at the SNRM-C;

        iii) may include the "receptionQualityLevel" set to the measured reception quality level; and

        iv) if the "unicastResource" attribute of the "monitorConfig" object is set to "true", shall include the "unicastListeningState" set to "true" or "false" indicating the unicast listening status of "listening" or "not-listening" respectively; and

        v) if the "suspension" attribute of the "monitorConfig" object is set to "true", shall include the "suspensionState" set to "true" or "false" indicating the suspension status of "suspending" or "not-suspending" respectively.

6.2.3.6.4 SNRM server CoAP procedure

If the SNRM-S decides on a subset of all VAL UEs in the MBMS broadcast area that shall report on MBMS bearer suspension, the SNRM-S shall update the monitoring configuration of the identified SNRM-Cs to enable MBMS bearer suspension monitoring.

The SNRM-S:

  a) shall ensure that it is already observing the MBMS Resource State resource of the MBMS bearer for which a suspension report is required. To start observing, the SNRM-S shall send an extended CoAP GET request as specified in IETF RFC 7641 [25] with the CoAP URI set to the URI of the observable MBMS Resource State resource described in clause A.3.1.2.3.3.1 with the Observe option set to 0 (Register);

  b) shall generate a CoAP PUT request according to IETF RFC 7252 [23]. In the CoAP PUT request, the SNRM-S:

    1) shall set the CoAP URI to the MBMS Resource Configuration resource URI according to the resource definition in clause A.3.1.2.2.3:

        i)   the "apiRoot" is set to the SNRM-C URI;

        ii) the "valServiceId" is set to the identity of the VAL service;

        iii) the "tmgi" is set to a TMGI value;

2) shall include Content-Format option set to "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=mbms-resource-config"; and

3) shall include "MbmsResourceConfig" object in the payload set to a modified MBMS resource configuration which shall include the "monitorConfig" object:

   i)   may include the "receptionQuality" attribute set to the existing value;

   ii) may include the "unicastResource" attribute set to the existing value; and

   iii) shall include the "suspension" attribute set to set to "true"; and

c) shall send the CoAP PUT request protected towards the SNRM-C with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [9].

6.2.3.7 MBMS bearer event notification procedure

6.2.3.7.1 SNRM server procedure

NOTE   The details between the SNRM-S and EPS (BM-SC) are defined in 3GPP TS 29.468 [13].

Upon receiving an MBMS bearer event notification as described in the clause 6.4.5 of 3GPP TS 29.468 [13], the SNRM-S shall send a user plane delivery mode as described in clause 6.2.2.4.2 towards the VAL server.

6.2.3.8 Switching between MBMS bearer and unicast bearer procedure

6.2.3.8.1 SNRM client HTTP and CoAP procedure

If the VAL UE detects changing MBMS bearer condition (good or bad MBMS coverage) for the corresponding MBMS service, the SNRM-C shall send an MBMS listening status report as specified in clause 6.2.3.4.1 or in clause 6.2.3.4.3 towards the SNRM-S.

6.2.3.8.2 SNRM server HTTP and CoAP procedure

Upon receiving an MBMS listening status report from SNRM-C as specified in clause 6.2.3.4.2 or in clause 6.2.3.4.4, the SNRM-S shall send a user plane delivery mode as described in clause 6.2.2.4.2 towards the VAL server.

6.2.3.9 Use of dynamic MBMS bearers procedure

6.2.3.9.1 VAL server procedure

If the VAL server uses a unicast bearer for communication with the UE on the DL at the start of the group communication session, in order to trigger to use an MBMS bearer in EPS for the DL VAL service communication, the VAL server shall send an MBMS bearer request message as described in clause 6.2.3.2.1 towards the SNRM-S.

6.2.3.9.2 SNRM server HTTP and CoAP procedures

Upon receiving an HTTP POST request message containing:

a) a Content-Type header field set to "application/vnd.3gpp.seal-mbms-usage-info+xml"; and

b) an application/vnd.3gpp.seal-mbms-usage-info+xml MIME body with a <request> element in the <mbms-info> root element;

the SNRM-S:

a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

   1) if the identity of the sender of the received HTTP POST request is not authorized to request mbms resource, shall respond with a HTTP 403 (Forbidden) response to the HTTP POST request and shall skip rest of the steps; and

    2) shall support handling an HTTP POST request from a VAL server according to procedures specified in IETF RFC 4825 [19] "POST Handling"; and

  b) shall determine to activate MBMS bearer, and then send an MBMS bearer announcement message as described in clause 6.2.3.2.2 or in clause 6.2.3.2.3 towards the SNRM-C.

Upon receiving an MBMS bearer response from the SNRM-C as specified in clause 6.2.3.2.2 or in clause 6.2.3.2.3, the SNRM-S shall send an MBMS bearers response message as described in clause 6.2.3.2.2 or in clause 6.2.3.2.3 towards the VAL server.

6.2.3.9.3 SNRM client HTTP and CoAP procedures

Upon receiving an MBMS bearer announcement from the SNRM-S, the SNRM-C shall act on the announcement as described in clause 6.2.3.2.3 or in clause 6.2.3.2.4.

6.2.3.10 MBS session creation and MBS session announcement procedure

6.2.3.10.1 General

The availability of an MBS bearer is announced to SNRM-Cs by means of an MBS session announcement message. One or more MBS session announcement elements are included in an "application/vnd.3gpp.seal-mbs-usage-info+xml" MIME body.

An MBS session announcement message can contain new MBS bearer announcements, updated MBS bearer announcements or cancelled MBS bearer announcements or a mix of all of them at the same time in an application/vnd.3gpp.seal-mbs-usage-info+xml MIME body. Each initial MBS session announcement message announces one MBS session intended to carry a general purpose MBS subchannel used for application level multicast signalling in a specified MBS service area and additionally, the message could also announce zero or more extra MBS session intended to carry media and media control.

  NOTE 1: A new MBS session announcement does not implicitly remove previously sent MBS session announcements if the previously sent MBS session announcement is not included in an MBS session announcement message.

  NOTE 2: The SNRM-C will use the same identity which has been authenticated by a VAL service with SIP core using SIP based REGISTER message. If a VAL service do not support SIP protocol, then HTTP based method needs to be used.

  NOTE 3: The VAL service can select appropriate procedure(s) based on service specific requirements. If the VAL service supports HTTP, CoAP and SIP, then HTTP is prior.

When CoAP is used the availability of an MBS session is announced to the SNRM-C by creating an MBS Resource Config resource at the SNRM-C. A single announcement is included in the "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=mbs-resource-config" MIME body.

When and to whom the SNRM-S sends the MBS session announcement is based on local policy in the SNRM-S.

6.2.3.10.2 SNRM server SIP and HTTP procedures

6.2.3.10.2.1 HTTP based MBS session announcement procedure

To share the MBS session announcement with the SNRM-C, the SNRM-S shall generate an HTTP POST request message in accordance with IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-S:

  a) shall set the Request-URI to the URI corresponding to the identity of the SNRM-C;

  b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml";

  c) shall include a MIME body in the HTTP POST request message, with the MIME Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml"and MIME payload with the MBS session announcement XML generated as specified in clause 6.2.3.10.6;

    d)   shall include a MIME body in the HTTP POST request message, with the MIME Content-Type header field set to "application/vnd.3gpp.seal-info+xml"and "and MIME payload with SEAL info XML as specified in clause 7.4.2 where the <seal-request-uri> element:

       1) shall include <VAL-user-id> element set to the VAL user ID of the user; and

       2) may include <VAL-group-id> element set to the VAL group identity that is served by this MBS session;

    e)   shall send the HTTP POST request towards the SNRM-C according to IETF RFC 9110 [22].

    NOTE 1: The MBS session announcement procedure is used by the SNRM-S for announcement of both the pre-defined and on demand MBS session to the SNRM-C.

    NOTE 2: The MBS session announcement procedure can be used by the SNRM-S to share the associated information between a specific group communication and MBS session to the SNRM-C, rather than defining the MapGroupToSessionStream as specified in clause 14.3.4A.6.1 of 3GPP TS 24.434 [2].

6.2.3.10.2.2 HTTP based MBS session de-announcement procedure

To share the MBS session de-announcement with the SNRM-C, the SNRM-S shall generate an HTTP POST request message in accordance with IETF RFC 9110 [22], the SNRM-S:

    a)   shall set the Request-URI to the URI corresponding to the identity of the SNRM-C;

    b)   shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml";

    c)   shall include the mbs-usage-info XML payload in the HTTP POST body carrying the MBS session de-announcement XML generated as below;

       1) an "application/vnd.3gpp.seal-mbs-usage-info+xml" with root element as <seal-mbs-usage-info>; and

         i) shall include <version> sub-element set to "1"; and

         ii) shall include one or more <mbs-announcement> elements, with each <mbs-announcement> element shall include only the <mbs-session-id> element set to the MBS session ID that will be released;

    d)   shall send the HTTP POST request towards the SNRM-C according to IETF RFC 9110 [22].

6.2.3.10.2.3 SIP based MBS session announcement procedure

If the VAL service supports SIP, the SNRM-S shall generate a SIP MESSAGE request in accordance with 3GPP TS 24.229 [6] and IETF RFC 3428 [17]. In the SIP MESSAGE request, the SNRM-S shall:

    a)   set the Request-URI to the URI received in the To header field in a third-party SIP REGISTER request;

    b)   include a Accept-Contact header field with the g.3gpp.icsi-ref media-feature tag with the value of "urn:urn-7:3gpp-service.ims.icsi.seal" along with parameters "require" and "explicit" according to IETF RFC 3841 [18];

    c)   include a P-Asserted-Service header field with the value "urn:urn-7:3gpp-service.ims.icsi.seal";

    d)   include the MBS public service identity of the SNRM-S in the P-Asserted-Identity header field;

    e)   include a MIME body in the SIP MESSAGE request, with the MIME Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml"and MIME payload with the MBS session announcement XML generated as specified in clause 6.2.3.10.6;

    f)   include a MIME body in the SIP MESSAGE request, with the MIME Content-Type header field set to "application/vnd.3gpp.seal-info+xml" and MIME payload with SEAL info XML as specified in clause 7.4.2 where the <seal-request-uri> element:

       1) shall include <VAL-user-id> element set to the VAL user ID of the user; and

       2) may include <VAL-group-id> element set to the VAL group identity that is served by this MBS session; and

    g)   send the SIP MESSAGE request towards the SNRM-C according to 3GPP TS 24.229 [6].

NOTE 1: The MBS session announcement procedure is used by the SNRM-S for announcement of both the pre-defined and on demand MBS session to the SNRM-C.

NOTE 2: The MBS session announcement procedure can be used by the SNRM-S to share the associated information between a specific group communication and MBS session to the SNRM-C, rather than defining the MapGroupToSessionStream as specified in clause 14.3.4A.6.1 of 3GPP TS 24.434 [2].

6.2.3.10.2.4   SIP based MBS session de-announcement procedure

To share the MBS session de-announcement with the SNRM-C, the SNRM-S shall generate a SIP MESSAGE request in accordance with 3GPP TS 24.229 [6] and IETF RFC 3428 [17], the SNRM-S shall:

a) set the Request-URI to the URI received in the To header field in a third-party SIP REGISTER request;

b) include an Accept-Contact header field with the g.3gpp.icsi-ref media-feature tag with the value of "urn:urn-7:3gpp-service.ims.icsi.seal" along with parameters "require" and "explicit" according to IETF RFC 3841 [18];

c) include a P-Asserted-Service header field with the value "urn:urn-7:3gpp-service.ims.icsi.seal";

d) include the MBS public service identity of the SNRM-S in the P-Asserted-Identity header field;

e) include the mbs-usage-info XML payload in the SIP MESSAGE body carrying the MBS session de-announcement XML generated as below;

   1) an "application/vnd.3gpp.seal-mbs-usage-info+xml" with root element as <seal-mbs-usage-info>; and shall

      i)   include <version> sub-element set to "1"; and

      ii) include one or more <mbs-announcement> elements, with each <mbs-announcement> element shall include only the <mbs-session-id> element set to the MBS session ID that will be released; and

f) send the SIP MESSAGE request towards the SNRM-C according to 3GPP TS 24.229 [6].

6.2.3.10.3   SNRM client SIP and HTTP procedures

6.2.3.10.3.1   HTTP based MBS session announcement procedure

Upon receiving an HTTP POST request message from SNRM-S, the SNRM-C shall check for:

a) the Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml"; and

b) the MIME body with the Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml" and process the MIME payload as per MBS session announcement XML as specified in clause 6.2.3.10.6. For each <mbs-announcement> element, the SNRM-C shall check for:

   1) the < mbs-session-id> element to find the mbs-session-id;

   2) the <mbs-session-props> element to find the if the user data is delivered via broadcast or multicast mode;

   3) the <mbs-listening-status-notify> element set to "true" to indicate the SNRM-C to send listening status notification for this MBS session;

   4) the <mbs-announcement-acknowledgement> element set to "true" to indicate the SNRM-C to send the MBS announcement acknowledgement on receiving this announcement; and

   5) the <mbs-session-join-notify> element set to "true" to indicate the SNRM-C to send session join notification for when the VAL user or UE joins the group;

   6) the <seal-mbs-sdp> element for the SDP information associated with MBS session;

   7) the <mbms-announcement> element to find if the established eMBMS bearer information that shall be used by the SNRM-C when attached to the LTE.

c) the MIME body with the Content-Type header field set to "application/vnd.3gpp.seal-info+xml"and process the MIME payload as per SEAL info XML as specified in clause 7.4.2. For the <seal-request-uri> element, check for:

    1) the <VAL-user-id> element to the find the VAL user ID of the user; and

    2) the <VAL-group-id> element to the find VAL group identity that is served by this MBS session;

d) shall send the HTTP 200 (OK) response towards the SNRM-S according to IETF RFC 9110 [22].

6.2.3.10.3.2 HTTP based MBS session de-announcement procedure

Upon receiving an HTTP POST request message from SNRM-S, the SNRM-C shall:

a) check if the Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml"; and

b) check for the MIME body with the Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml";

c) process the MBS session announcement XML received in HTTP POST request body, for each <mbs-announcement> element with an < mbs-session-id> sub-element the SNRM-C checks if there exists an MBS session matching and notifies the associated VAL client(s);

d) shall send the HTTP 200 (OK) response towards the SNRM-S according to IETF RFC 9110 [22].

6.2.3.10.3.3 SIP based MBS session announcement procedure

Upon receiving a SIP MESSAGE request from SNRM-S, the SNRM-C shall check for:

a) the P-Asserted-Service header field containing the "urn:urn-7:3gpp-service.ims.icsi.seal";

b) the application/vnd.3gpp.seal-mbs-usage-info+xml MIME body and process the MIME payload as per MBS session announcement XML as specified in clause 7.4.7. For each <mbs-announcement> element, the SNRM-C shall check for:

    1) the <mbs-session-id> element to find the mbs-session-id;

    2) the <mbs-session-props> element to find the if the user data is delivered via broadcast or multicast mode;

    3) the <mbs-listening-status-notify> element set to "true" to indicate the SNRM-C to send listening status notification for this MBS session;

    4) the <mbs-announcement-acknowledgement> element set to "true" to indicate the SNRM-C to send the MBS announcement acknowledgement on receiving this announcement;

    5) the <mbs-session-join-notify> element set to "true" to indicate the SNRM-C to send session join notification for when the VAL user or UE joins the group;

    6) the <seal-mbs-sdp> element for the SDP information associated with MBS session; and

    7) the <mbms-announcement> element to find if the established eMBMS bearer information that shall be used by the SNRM-C when attached to the LTE;

c) the MIME body with the Content-Type header field set to "application/vnd.3gpp.seal-info+xml"and process the MIME payload as per SEAL info XML as specified in clause 7.4.2. For the <seal-request-uri> element, check for:

    1) the <VAL-user-id> element to the find the VAL user ID of the user; and

    2) the <VAL-group-id> element to the find VAL group identity that is served by this MBS session; and

d) shall send the SIP 200 (OK) towards the SNRM-S according to 3GPP TS 24.229 [6].

6.2.3.10.3.4 SIP based MBS session de-announcement procedure

Upon receiving a SIP MESSAGE request from SNRM-S, the SNRM-C shall check for:

a) the P-Asserted-Service header field containing the "urn:urn-7:3gpp-service.ims.icsi.seal";

b) the application/vnd.3gpp.seal-mbs-usage-info+xml MIME body and process the MIME payload as per MBS session announcement XML as specified in clause 7.4.7. For each <mbs-announcement> element, with an <mbs-session-id> sub-element the SNRM-C checks if there exists an MBS session matching and notifies the associated VAL client(s); and

c) shall send the SIP 200 (OK) towards the SNRM-S according to 3GPP TS 24.229 [6].

6.2.3.10.4 SNRM Server CoAP procedures

Editor's note: The SNRM sever CoAP procedure is FFS.

6.2.3.10.5 SNRM Client CoAP procedures

Editor's note: The SNRM client CoAP procedure is FFS.

6.2.3.10.6 Generate MBS session announcement message in XML

For each SNRM-C that the SNRM-S is sending an MBS session announcement to, the SNRM-S:

a) shall generate an application/vnd.3gpp.seal-mbs-usage-info+xml MIME body as described in the clause 7.4.7 with the root element as <seal-mbs-usage-info>and the <version> element set to "1" and one or more <announcement> elements associated with the pre-activated MBS session. Each set of an <announcement> element:

  1) shall include an <mbs-session-id> element set to the MBS session ID indicating the MBS session for the media stream currently being used;

  2) shall include an <mbs-session-props> element, contains the following sub-elements:

    i) <delivery-mode>, an element contains a string "broadcast" or "multicast" to indicate whether to deliver the user data to the UE(s) via broad mode or multicast mode;

    ii) shall include an <mbs-service-areas> element that provides one or more <mbs-service-area-id> sub-elements to provide applicable service areas of the MBS session;

  3) may include the below elements if the SNRM-S requires such a report or notification:

    i) <mbs-listening-status-notify> element set to "true" to indicate the SNRM-C to send listening status notification for this MBS session;

    ii) <mbs-announcement-acknowledgement> element set to "true" to indicate the SNRM-C to send the MBS announcement acknowledgement on receiving this announcement; and

    iii) <mbs-session-join-notify> element set to "true" to indicate the SNRM-C to send session join notification for when the VAL user or UE joins the group;

  4) shall include a <seal-mbs-sdp> element set to the SDP with media and application control information applicable to groups that can use this MBS session; and

  5) may include a <mbms-announcement> element set to the announcement information as specified in clause 6.2.3.3.2.1.0 related to the established eMBMS bearer, that shall be used by SNRM-C when attached to the LTE.

6.2.3.10.7 VAL server procedure

When a user originates a request for a VAL service group communication session for one of these areas, in order to use the pre-established MBS session, the VAL server shall generate an HTTP POST request according to procedures specified in IETF RFC 9110 [22]. In the HTTP POST request message, the VAL server:

a) shall include a Request-URI set to the URI corresponding to the identity of the SNRM-S;

b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml";

    c) shall include an application/vnd.3gpp.seal-mbs-usage-info+xml MIME body and in the <mbs-info> root element:

        1) shall include an <mbs-resource-request> element which shall include:

            i) a <requester-identity> element set to the identity of the VAL server performing the request;

            ii) a <VAL-group-id> element set to the identity of the VAL group that requires MBS session;

            iii) a <service-announcement-mode> indicating whether the request is sent by NRM server or by the VAL server;

            iv) a <QoS> element indicating the requested QoS for the MBS session;

            v) shall include an <mbs-session-props> element, contains the following sub-elements:

                A) <delivery-mode>, an element contains a string "broadcast" or "multicast" to indicate whether to deliver the user data to the UE(s) via broad mode or multicast mode;

                B) shall include an <mbs-service-areas> element that provides one or more <mbs-service-area-id> sub-elements to provide applicable service areas of the MBS session; and

            vi) an <endpoint-info> element set to the information of the endpoint of the VAL server to which the user plane notifications have to be sent; and

    d) shall send the HTTP POST request message towards the SNRM-S according to IETF RFC 9110 [22].

6.2.3.11 MBS listening status report procedure

6.2.3.11.1 Generate MBS listening status reporting message in XML

The SNRM-C shall generate the MBS listening status report XML as per the schema defined in clause 7.4.7 represented by the application/vnd.3gpp.seal-mbs-usage-info+xml with the <seal-mbs-usage-info> element as the root element of the XML document, and sub-element has one or more <mbs-listening-status-report> element. Each <mbs-listening-status-report>:

    a)   <identity>, an element contains the identity of the VAL user or VAL UE who wants to report the MBS listening status;

    b) shall include an <mbs-session-props> element that includes the following sub-elements:

        1) <delivery-mode>, an element contains a string "broadcast" or "multicast" to indicate whether to deliver the user data to the UE(s) via broad mode or multicast mode;

        2) <mbs-session-id> element set to the MBS session ID indicating the MBS session for which the listening status being shared; and

    c) <mbs-listening-status>, an element contains a string "listening" or "not-listening" used to indicate the MBS listening status per TMGI; and

    d) <mbs-reception-quality-level>, an optional element contains an integer used to indicate the reception quality level.

6.2.3.11.2 SNRM server SIP and HTTP procedures

6.2.3.11.2.1 SNRM server HTTP procedure

Upon receiving an HTTP POST request message containing:

    a) an application/vnd.3gpp.seal-mbs-usage-info+xml MIME body with an <mbs-listening-status> element and an optional <mbs-reception-quality-level> element;

the SNRM-S:

    a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

1) if the identity of the sender of the received HTTP POST request is not authorized to detect MBS session quality, shall respond with an HTTP 403 (Forbidden) response to the HTTP POST request and skip rest of the steps;

b) shall process the HTTP POST body carrying the MBS session listening report that provides the VAL user/UE identity, delivery mode, MBS session identity, listening status and reception quality associated with the MBS session information as shared by the SNRM-C. The SNRM-S may send the multicast/broadcast resource response to the VAL server based on the MBS listening status, for VAL server to switch the delivery mode towards the VAL UE if required.

c) shall send the HTTP 200 (OK) response towards the SNRM-C according to IETF RFC 9110 [22].

6.2.3.11.2.2 SNRM server SIP procedure

Upon receiving a SIP MESSAGE request containing:

a) a P-Asserted-Service header field containing the "urn:urn-7:3gpp-service.ims.icsi.seal"; and

b) an "application/vnd.3gpp.seal-mbs-usage-info+xml" body containing an <mbs-listening-status> element;

the SNRM-S shall:

a) verify the public user identity in the P-Asserted-Identity header field and:

1) if the identity of the sender of is not authorized to detect MBS session quality, shall respond with an SIP 403 response and skip rest of the steps;

b) process the SIP MESSAGE MIME body carrying the "application/vnd.3gpp.seal-mbs-usage-info+xml" body representing the MBS session listening report that provides the delivery mode, MBS session identity, listening status and reception quality associated with the MBS session information as shared by the SNRM-C. The SNRM-S may send the multicast/broadcast resource response to the VAL server based on the MBS listening status, for VAL server to switch the delivery mode towards the VAL UE if required; and

c) send the SIP 200 (OK) towards the SNRM-C according to 3GPP TS 24.229 [6].

6.2.3.11.3 SNRM client SIP and HTTP procedures

6.2.3.11.3.1 SNRM client HTTP procedure

To share the listening status report for MBS session(s) with the SNRM-S, the SNRM-C shall generate an HTTP POST request message in accordance with IETF RFC 9110 [22]. In the HTTP POST request, the SNRM-C:

a) shall set the Request-URI to the URI corresponding to the identity of the SNRM-S;

b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml";

c) shall include the mbs-usage-info XML payload in the HTTP POST body carrying the listening status report generated as per clause 6.2.3.11.1 for those MBS session(s) the SNRM-C desires to share the listening status; and

d) shall send the HTTP POST request towards the SNRM-C according to IETF RFC 9110 [22].

NOTE: The SNRM-C sends the MBS listening report to SNRM-S on receiving the MBS session announcement with listening notification indication or reception quality associated with the MBS session is not sufficient to receive media etc.

6.2.3.11.3.2 SNRM client SIP procedure

If the VAL service supports SIP, the SNRM-C shall generate a SIP MESSAGE request according to 3GPP TS 24.229 [6] and IETF RFC 3428 [17]. In the SIP MESSAGE request, the SNRM-C shall:

a) include a Request-URI set to the MBS public service identity of the SNRM-S received in the P-Asserted-Identity header field of the announcement message;

b) include an Accept-Contact header field with the g.3gpp.icsi-ref media-feature tag with the value of "urn:urn-7:3gpp-service.ims.icsi.seal" along with parameters "require" and "explicit" according to IETF RFC 3841 [18];

c) include a public user identity in the P-Preferred-Identity header field as specified in 3GPP TS 24.229 [6];

d) include a P-Preferred-Service header field with the value "urn:urn-7:3gpp-service.ims.icsi.seal";

e) set the Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml"and XML payload with the MBS listening status report generated as per clause 6.2.3.11.1 for those MBS session(s) the SNRM-C desires to share the listening status; and

f) send the SIP MESSAGE request according to 3GPP TS 24.229 [6].

6.2.3.12 MBS UE session join notification procedure

6.2.3.12.1 SNRM server SIP and HTTP procedures

6.2.3.12.1.1 SNRM server HTTP procedure

Upon receiving an HTTP POST request message containing

a) an Content-Type header field with "application/vnd.3gpp.seal-mbs-usage-info+xml" value;

the SNRM-S:

a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

1) if the identity of the sender of the received HTTP POST request is not authorized, shall respond with an HTTP 403 (Forbidden) response to the HTTP POST request and skip rest of the steps;

b) shall process the HTTP POST body carrying the UE session join notification status where the VAL identities, MBS session identity, MBS multicast joining status and mbs-reception-quality-level shared by the SNRM-C shall be processed by the SNRM-S and may store for future usage to serve requests from SNRM-C or VAL server associated with this information;

c) shall send the HTTP 200 (OK) response towards the SNRM-C according to IETF RFC 9110 [22].

6.2.3.12.1.2 SNRM server SIP procedure

Upon receiving an SIP MESSAGE request containing:

a) a P-Asserted-Service header field containing the "urn:urn-7:3gpp-service.ims.icsi.seal"; and

b) an Content-Type header field with "application/vnd.3gpp.seal-mbs-usage-info+xml";

the SNRM-S shall:

a) verify the public user identity in the P-Asserted-Identity header field and:

1) if the identity of the sender is not authorized, shall respond with an SIP 403 response and skip rest of the steps;

b) process the SIP MESSAGE body carrying the "application/vnd.3gpp.seal-mbs-usage-info+xml" body representing the UE session join notification status comprising of the VAL identities, MBS session identity, MBS multicast joining status and mbs-reception-quality-level shared by the SNRM-C, which may be stored for future usage to serve requests from SNRM-C or VAL server associated with this information; and

c) send the SIP 200 (OK) towards the SNRM-C according to 3GPP TS 24.229 [6].

6.2.3.12.2 SNRM client SIP and HTTP procedures

6.2.3.12.2.1 SNRM client HTTP procedure

Upon request from VAL client to share the UE group join notification status with the SNRM-S, the SNRM-C shall generate an HTTP POST request message in accordance with IETF RFC 9110 [22]. In the HTTP POST request, the SNRM-C:

a)　shall set the Request-URI to the URI corresponding to the identity of the SNRM-S;

b)　shall include a Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml";

c)　shall include the mbs-usage-info XML payload in the HTTP POST body carrying the UE session join notification status generated as described below. The SNRM-C shall include <mbs-session-join-notification> under the <seal-mbs-usage-info> root element for the MBS session(s) it desires to share the group joining notification and each <mbs-session-join-notification> element;

　　1)　shall include the <VAL-identities> sub-element, shall include the following elements:

　　　　A)　a <VAL-user-id> element that contains the identity of the VAL user sharing the group join notification; and

　　　　B)　a <VAL-group-id> element set to the identity of the VAL group for whom the VAL user as joined; and

　　2)　shall include the <mbs-session-id> sub-element, set to the MBS session identifier indicating the MBS session associated with the group for which the group join notification is shared;

　　3)　shall include the <mbs-multicast-joining-status> sub-element, set to the string "successfully joined";

　　4)　<mbs-reception-quality-level>, an optional element contains an integer used to indicate the reception quality level, to make an efficient switching decision to MBMS or unicast reception if needed; and

d)　shall send the HTTP POST request towards the SNRM-S according to IETF RFC 9110 [22].

6.2.3.12.2.2 SNRM client SIP procedure

Upon request from VAL client to share the UE group join notification status with the SNRM-S, if the VAL service supports SIP the SNRM-C shall generate a SIP MESSAGE request according to 3GPP TS 24.229 [6] and IETF RFC 3428 [17]. In the SIP MESSAGE request, the SNRM-C shall:

a)　include a Request-URI set to the MBS public service identity of the SNRM-S received in the P-Asserted-Identity header field of the announcement message;

b)　include an Accept-Contact header field with the g.3gpp.icsi-ref media-feature tag with the value of "urn:urn-7:3gpp-service.ims.icsi.seal" along with parameters "require" and "explicit" according to IETF RFC 3841 [18];

c)　include a public user identity in the P-Preferred-Identity header field as specified in 3GPP TS 24.229 [6];

d)　include a P-Preferred-Service header field with the value "urn:urn-7:3gpp-service.ims.icsi.seal";

e)　set the Content-Type header field set to "application/vnd.3gpp.seal-mbs-usage-info+xml"and include the mbs-usage-info XML payload in the SIP MESSAGE body carrying the UE session join notification status generated as described below. The SNRM-C shall include <mbs-session-join-notification> element(s) for each MBS session(s) it desires to share the group joining notification under the <seal-mbs-usage-info> root element and each <mbs-session-join-notification> element:

　　1)　shall contain the <VAL-identities> sub-element, which shall include the following elements:

　　　　A)　a <VAL-user-id> element that contains the identity of the VAL user sharing the group join notification; and

　　　　B)　a <VAL-group-id> element set to the identity of the VAL group for whom the VAL user as joined; and

　　2)　shall contain the <mbs-session-id> sub-element, set to the MBS session identifier indicating the MBS session associated with the group for which the group join notification is shared;

3) shall contain the <mbs-multicast-joining-status> sub-element, set to the string "successfully joined"; and

4) may contain <mbs-reception-quality-level>, an optional element contains an integer used to indicate the reception quality level, to make an efficient switching decision to MBMS or unicast reception if needed; and

f) send the SIP MESSAGE request according to 3GPP TS 24.229 [6].

6.2.3.13 Application coordinated UE-to-UE communication requirements management procedure

6.2.3.13.1 General

This clause describes the procedure for managing the application requirements necessary for UE-to-UE coordinated communication via Uu interface.

6.2.3.13.2 Application coordinated connectivity initiation procedure

6.2.3.13.2.1 SNRM server HTTP procedures

Upon receiving an HTTP POST request message containing

a) an Content-Type header field with "application/vnd.3gpp.seal-app-comm-requirements-info+xml" value;

the SNRM-S:

a) shall determine the identity of the sender of the received HTTP POST request as specified in clause 6.2.1.1, and:

1) if the identity of the sender of the received HTTP POST request is not authorized to detect MBS session quality, shall respond with an HTTP 403 (Forbidden) response to the HTTP POST request and skip rest of the steps;

b) shall process the HTTP POST body carrying the XML specifying the application requirements for the coordinated communication as specified in clause 7.4.6;

c) shall determine if the source VAL UE identity shared by the SNRM-C is authorized for the coordinated UE to UE direct service communication with the UE(s) shared in the <target-val-ue-id-list> element and in case of "unauthorized" the SNRM-S shall respond with an HTTP 403 (Forbidden) response to the HTTP POST request and skip rest of the steps;

d) shall check for the presence of service requirements in the request:

1) if not provided, the SNRM-S shall fetch the application context of the VAL UE shared in the <target-val-ue-id-list> as specified in clause 6.2.3.13.4.1; or

2) if provided, the SNRM-S shall wait for service requirements from the VAL UE shared in the <target-val-ue-id-list>. If already available, the SNRM-S shall process the application requirements received from the current requested SNRM-C and the one shared by the SNRM-C residing on the VAL UE shared in the <target-val-ue-id-list> to determine common requirements; and

e) shall send the HTTP 200 (OK) response towards the SNRM-C according to IETF RFC 9110 [22]; and

f) shall trigger the 3GPP system to establish the Uu connectivity based on the common requirements determined in d).2) above and the SNRM-S shall send the notification to the SNRM-C(s) as specified in clause 6.2.3.13.3.1 to all the SNRM-C.

6.2.3.13.2.2 SNRM client HTTP procedures

Upon receiving request from VAL application client for the application connectivity request to start a UE to UE co-ordinated communication with other VAL UE, the SNRM-C shall generate an HTTP POST request message in accordance with IETF RFC 9110 [22]. In the HTTP POST request, the SNRM-C:

a) shall set the Request-URI to the URI corresponding to the identity of the SNRM-S;

b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-app-comm-requirements-info+xml";

c) shall include the XML specifying the application requirements for the coordinated communication in the HTTP POST body. The XML shall be generated as specified in clause 7.4.6, by including root element <seal-app-comm-info> with the <app-connectivity-request> child element. The <app-connectivity-request> element:

   1) shall include a <source-val-ue-id> sub-element set to the identity of the SNRM-C acting as the VAL UE and performing the request;

   2) shall include a <source-ip-address> sub-element set to the ip-address of the SNRM-C acting as the VAL UE and performing the request;

   3) shall include a <VAL-service-id> sub-element set to the VAL service identity of the VAL application performing the request;

   4) shall include a <target-val-ue-id-list> sub-element with one or more <VAL-ue-id> child elements set to the identities of the VAL UEs for whom the UE-to-UE coordinated communication is required.

   5) may include a <app-service-requirements> sub-element that provides the application requirements for the UE to UE co-ordinated communication and shall include at least one of the below sub-elements:

      i) <packet-size> element set with the size of the packets to be transmitted;

      ii) <packet-trans-interval> element set with the transmission interval between the consecutive packets;

      iii) <packet-e2e-latency> element set with the end-to-end latency value for the packet transmission;

      iv) <packet-error-kpi> element set with the KPIs related to the packet error;

      v) <bitrate> element set with the bit rate required for the communication; and

   6) may include a <app-connectivity-context> sub-element that may include the sub-elements:

      i) <location> element set with the location coordinates information of the VAL UE as specified in clause 7.4.2 of 3GPP TS 24.545 [8];

      ii) <speed> element set with the speed information of the VAL UE;

      iii) <direction> element set with the direction information of the VAL UE; and

d) shall send the HTTP POST request towards the SNRM-S according to IETF RFC 9110 [22].

6.2.3.13.3 Application coordinated connectivity notification procedure

6.2.3.13.3.1 SNRM server HTTP procedures

To share the application connectivity requirement notification with the SNRM-C, the SNRM-S shall generate an HTTP POST request message in accordance with IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-S:

a) shall set the Request-URI to the URI corresponding to the identity of the SNRM-C;

b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-app-comm-requirements-info+xml";

c) shall include a XML representing the application connectivity notification in HTTP POST body, this notification XML shall be generated as specified in clause 7.4.6 by including the root element as <seal-app-comm-info> with the <app-connectivity-notify> sub-element and the <app-connectivity-notify> element:

   1) shall include a <session-info> sub-element set to the session information for the application coordinated communication session;

   2) shall include a <VAL-service-id> sub-element set to the VAL service identity of the VAL application performing the request;

   3) shall include a <requestor-val-ue-id> sub-element set to the identity of the SNRM-C that requested for coordinated application communication;

4) may include a <target-val-ue-id-list> sub-element with one or more <VAL-ue-id> child elements set to the identities of the VAL UEs accepted by the SNRM-S for the direct UE-to-UE application coordinated communication; and

d) shall send the HTTP POST request towards the SNRM-C according to IETF RFC 9110 [22].

6.2.3.13.3.2 SNRM client HTTP procedures

Upon receiving the HTTP POST request message from SNRM-S, the SNRM-C shall:

a) check if the Content-Type header field set to "application/vnd.3gpp.seal-app-comm-requirements-info+xml";

b) shall process the XML received in the HTTP POST request, which represents the application connectivity notification as specified in clause 7.4.6 that includes:

1) the session information for the established application coordinated communication;

2) the VAL service identity, VAL UE ID associated with VAL application that requested the application coordinated communication;

3) the optional list of those VAL UE identities accepted by the SNRM-S for the direct UE to UE application coordinated communication; and

c) shall send the HTTP 200 (OK) response towards the SNRM-S according to IETF RFC 9110 [22].

The SNRM-C notifies the corresponding VAL client of the established application-level direct UE-to-UE connection.

6.2.3.13.4 Application connectivity context fetch procedure

6.2.3.13.4.1 SNRM server HTTP procedures

To fetch the application connectivity context of the SNRM-C, the SNRM-S shall generate an HTTP POST request message in accordance with IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-S:

a) shall set the Request-URI to the URI corresponding to the identity of the SNRM-C;

b) shall include a Content-Type header field set to "application/vnd.3gpp.seal-app-comm-requirements-info+xml";

c) shall include a XML representing the application connectivity context fetch information in HTTP POST body, the XML shall be generated as specified in clause 7.4.6 by including the root element as <seal-app-comm-info> with the <app-connectivity-context-request> sub-element and the <app-connectivity-context-request> element:

1) shall include a <requestor-val-ue-id> sub-element set to the identity of the SNRM-C that requested for coordinated application communication;

2) shall include a <VAL-service-id> sub-element set to the VAL service identity associated with the request;

3) may include a <VAL-specific-context> sub-element set to additional information required to identify the context (e.g. device type, device vendor etc.); and

d) shall send the HTTP POST request towards the SNRM-C according to IETF RFC 9110 [22].

6.2.3.13.4.2 SNRM client HTTP procedures

Upon receiving the HTTP POST request message from SNRM-S, the SNRM-C shall:

a) shall check if the Content-Type header field set to "application/vnd.3gpp.seal-app-comm-requirements-info+xml";

b) shall process the XML sent in the HTTP POST request which represents the application connectivity context fetch operation part of the <app-connectivity-context-request> element as specified in clause 7.4.6 and notify the VAL client on the UE;

c) may generate HTTP POST response body; and

1) shall set the Content-Type header field set to "application/vnd.3gpp.seal-app-comm-requirements-info+xml" value;

2) shall include the XML representing the application connectivity context information as specified in clause 7.4.6. The XML shall be generated by including the root element as <seal-app-comm-info> with the <app-connectivity-context-response> sub-element that shall include the <app-connectivity-context> child element with the below sub-elements:

    i) <location> element set with the location coordinates information of the VAL UE as specified in clause 7.4.2 of 3GPP TS 24.545 [8];

    ii) <speed> element set with the speed information of the VAL UE;

    iii) <direction> element set with the direction information of the VAL UE; and

  d) send the HTTP 200 (OK) response towards the SNRM-C according to IETF RFC 9110 [22].

6.2.3.14 VAL service group media transmissions over 5G MBS sessions procedure

The SNRM-S shall provide the information associated with a group to the SNRM-C in advance by sending an MBS session announcement or an additional signalling message for the MBS session, e.g., MapGroupToSessionStream (similar to the MapGroupToBearer in eMBMS) as per clause 14.3.4A.6.1 of 3GPP TS 23.434 [2].

In the current release, the SNRM-S shall re-use the MBS announcement procedure as specified in clause 6.2.3.10.2.1 to send indication regarding the VAL service group media transmissions over MBS sessions to the SNRM-C. Upon receiving the MBS announcement the SNRM-C shall process the same as specified in clause 6.2.3.10.3.1.

6.2.3.15 Aplication level control signalling over 5G MBS sessions procedure

The SNRM-S shall provide the information associated with the newly created MBS session for application-level controlling signalling to the SNRM-C by sending an MBS session announcement procedure as specified in clause 6.2.3.10.2.1.

The VAL-Client on joining the group shall trigger SNRM-C to send UE session join notification for MBS session towards the SNRM-S as per the clause 6.2.3.12.2.1.

6.2.3.16 Service continuity between 5G MBS delivery and unicast delivery procedure

During an ongoing MBS session there shall be a need for service continuity between 5G broadcast to unicast and vice-a-versa based on the media reception quality to ensure the better media quality. The SNRM-C on detecting:

  a) the bad broadcast reception, shall send the MBS listening status report to the SNRM-S as specified in clause 6.2.3.11.3.1 with the current quality indication set to the <mbs-reception-quality-level> element;

  b) the broadcast reception with good quality, shall send the MBS listening status report to the SNRM-S as specified in clause 6.2.3.11.3.1 with the current quality indication set to the <mbs-reception-quality-level> element.

6.2.3.17 VAL service inter-system switching between 5G and LTE procedure

As per clause 14.3.4A.10 of 3GPP TS 23.434 [2] there are four scenarios introduced as specified below with the procedures performed between SNRM-C to SNRM-S and vice versa:

1) inter-system switching from 5G MBS session to LTE eMBMS bearer, the:

  a) SNRM-S may send an MBMS bearer announcement to SNRM-C as specified in clause 6.2.3.3.2.1;

  b) SNRM-C shall send an eMBMS listening status report as specified in clause 6.2.3.3.3; and

  c) SNRM-S shall send the Map Group to Bearer information to SNRM-C.

2) inter-system switching from 5G MBS session to LTE unicast bearer do not have procedures triggered SNRM-S to SNRM-C and vice-a-versa.

3) inter-system switching from LTE eMBMS to 5G MBS session. the

    a) SNRM-S may send an MBS session announcement procedure as specified in clause 6.2.3.10.2.1;

    b) SNRM-C shall send an MBS listening status report as specified in clause 6.2.3.11.2; and

    c) SNRM-S shall send the Map Group to Bearer information to SNRM-C as part of MBS session announcement in a) above.

4) inter-system switching from LTE eMBMS bearer to 5G unicast PDU session do not have procedures triggered SNRM-S to SNRM-C and vice-a-versa.

6.2.4 Network assisted UE-to-UE communications resource management

6.2.4.1 General

This clause describes the QoS management procedures by a server and clients, while the clients are in communications with each other. The QoS management consists of fulfilling the requirements for the QoS parameters i.e. latency, throughput, reliability and jitter, while the clients communicating with each other via the server. The network assisted QoS management procedures may be performed by a VAL server and VAL clients for a VAL application. The network assisted QoS management may be performed by the SNRM-S acting as application server and to manage QoS in a communication between two or more SNRM-Cs acting as application clients.

The network assisted UE-2-UE communications resource management contains of the following steps:

    a) network assisted QoS management initiation, where an SNRM-C initiates the procedure by providing an SNRM-S a set of end-to-end QoS requirements for a service area and a validity period and requesting a QoS management for communications with one or more SNRM-Cs; and

    b) network assisted QoS management provisioning, where the S-NRM-S receives a QoS downgrade information from one or more SNRM-Cs engaged in a communication and therefore notifies the SNRM-Cs with a QoS change. The SNRM-S may also get the downgrade information from 5GCN and may act upon it by communicating to 5GCN to modify the QoS profile or update the PCC rules to apply new traffic policy for the ongoing communications based on subscription information.

6.2.4.2 Network assisted QoS management initiation

6.2.4.2.1 SNRM client HTTP procedure

In order to initiate the network assisted QoS management for UE communications, the SNRM-C shall send an HTTP POST request message according to procedures specified in IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-C:

    a) shall set the Request-URI to the URI identifying the SNRM-S;

    b) shall include an Accept header field set to "application/vnd.3gpp.seal-network-QoS-management-info+xml";

    c) shall include a Content-Type header field set to "application/vnd.3gpp.seal-network-QoS-management-info +xml"; and

    d) shall include an application/vnd.3gpp.seal-network-QoS-management-info+xml MIME body with the <network-QoS-management-info> root element including the <QoS-management-initiation-request> element which:

        1) shall include a <VAL-ue-id> element set to the identity or IP address of the SNRM-C acting as the VAL UE and performing the request;

        2) shall include a <VAL-ue-list> element with one or more <VAL-ue-id> child elements set to the identities of the VAL UEs which are nodes for the end-to-end application within the VAL service, for which the end-to-end QoS management applies;

        3) may include a <VAL-service-id> element set to the VAL service identity of the VAL application;

        4) may include <end-to-end-QoS-requirements> element set to the QoS requirements for latency, throughput, reliability and jitter for the VAL application for the end-to-end session;

5) may include a <service-area> element set to the geographical area or topological area where an end-to-end QoS management request applies; and

6) may include a <validity-period> element set to the period of time during which an end-to-end requirement is valid.

6.2.4.2.2 SNRM server HTTP procedure

Upon receipt an HTTP POST request from the SNRM-C for the network assisted QoS management for UE communications, the SNRM-S shall determine the identity of the sender as specified in clause 6.2.1.1 to confirm whether the sender is authorized or not. If:

a) the sender is not an authorized user, the SNRM-S shall respond with an HTTP 403 (Forbidden) response message and avoid the rest of steps; or

b) the sender is an authorized user, the SNRM-S:

1) shall initiate the network assisted QoS management for the communications between the SNRM-C acting as the VAL UE and is identified by the value of the <VAL-ue-id> element with SNRM-Cs of the VAL UEs with the identities listed as values in the <VAL-ue-list> element for the VAL service, identified by the value of the <VAL-service-id > element by using the values for the <end-to-end-QoS-requirements> element, <service-area> element and <validity-period> element from the HTTP POST request message; and

2) shall send an HTTP 200 (OK) response message according to procedures specified in IETF RFC 9110 [22], where the HTTP 200 (OK) response message:

i) shall set the Request-URI to the URI identifying the SNRM-S;

ii) shall include a Content-Type header field set to "application/vnd.3gpp.seal-network-QoS-management-info +xml"; and

iii) shall include an application/vnd.3gpp.seal-network-QoS-management-info+xml MIME body with the <network-QoS-management-info> root element including the <QoS-management-initiation-response> element which:

A) shall include a <result> element set to the outcome of the end-to-end QoS management response which indicates either a success or a failure; and

B) may include a <QoS-configuration> element set to QoS downgrade reported by the SNRM-C or for QoS change requested by SNRM-S.

6.2.4.2.3 SNRM client CoAP procedure

In order to initiate the network assisted QoS management for UE communications, the SNRM-C shall create a QoS Session resource by sending a CoAP POST request to the SNRM-S. In the CoAP POST request, the SNRM-C:

a) shall set the CoAP URI to the QoS Sessions resource URI to according to the resource definition in clause A.2.1.2.2.2:

1) the "apiRoot" is set to the SNRM-S URI;

b) shall include Content-Format option set to "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=qos-session";

c) shall include "QosSession" object:

1) shall set "requiredQoS" attribute to the required end-to-end QoS requirement;

2) shall include a list of VAL UEs which are requested to participate in the QoS session in the "participants" attribute, and for each participant, shall add a "SessionParticipant" object in which:

i) shall set "id" attribute to the VAL UE ID; and

ii) if the participant object represents the requesting VAL UE, shall include the "state" object and set its "active" attribute to "true"; and

3) may include "valServiceId" attribute set to the identity of the VAL service enabled by the QoS session;

4) may include one or more geographical area identifiers in "serviceArea" attribute; and

5) may include "validPeriod" attribute set to the time period when the QoS session is valid; and

d) shall send the request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [9].

Upon receiving a CoAP 2.01 (Created) response, the SNRM-C shall store the newly created QoS Session and shall check if it contains a reporting configuration to be applied.

6.2.4.2.4 SNRM server CoAP procedure

Upon reception of a CoAP POST request where the CoAP URI of the request identifies the QoS Sessions resource URI according to the resource definition in clause A.2.1.2.2.2, the SNRM-S:

a) shall determine the identity of the sender of the received CoAP POST request as specified in clause 6.2.1.2, and:

1) if the identity of the sender of the received CoAP POST request is not authorized to create the QoS session, shall respond with a 4.03 (Forbidden) response to the CoAP POST request and skip rest of the steps;

b) shall support handling a CoAP POST request from a SNRM-C according to procedures specified in IETF RFC 7252 [23]; and

c) shall create a new Individual QoS Session resource and for each VAL UE in the list of participants shall create a new Individual Session Participant resource and shall return a CoAP 2.01 (Created) response with the "QosSession" object including its resource URI in "resUri" attribute, and optionally a reporting configuration in "reportConf" attribute.

6.2.4.3 Network assisted QoS management provisioning

6.2.4.3.1 SNRM client HTTP procedure

In order to provision the network assisted QoS management for UE communications, the SNRM-C shall send an HTTP POST request message according to procedures specified in IETF RFC 9110 [22]. In the HTTP POST request message, the SNRM-C:

a) shall set the Request-URI to the URI identifying the SNRM-S;

b) shall include an Accept header field set to "application/vnd.3gpp.seal-network-QoS-management-info+xml";

c) shall include a Content-Type header field set to "application/vnd.3gpp.seal-network-QoS-management-info +xml";

d) shall include an application/vnd.3gpp.seal-network-QoS-management-info+xml MIME body and with the <network-QoS-management-info> root element including the <QoS-management-provision-request> element which:

1) shall include a <VAL-ue-id> element set to the identity of the SNRM-C acting as the VAL UE and performing the request; and

2) may include <QoS-downgrade-report> element set to the report indicating a QoS downgrade of the end-to-end QoS parameters (latency, throughput, reliability and jitter) which may be reported based on QoS configuration parameter from the end-to-end QoS management response.

6.2.4.3.2 SNRM server HTTP procedure

Upon receipt an HTTP POST request from the SNRM-C for provisioning the network assisted QoS management for UE communications, the SNRM-S shall determine the identity of the sender as specified in clause 6.2.1.1 to confirm whether the sender is authorized or not. If:

a) the sender is not an authorized user, the SNRM-S shall respond with an HTTP 403 (Forbidden) response message and avoid the rest of steps; or

b) the sender is an authorized user, the SNRM-S:

   1) shall provision the network assisted QoS management for SNRM-C acting as the VAL UE and is identified by the value of the <VAL-ue-id> element by using the value for <QoS-downgrade-report> element from the HTTP POST request message; and

   2) shall send an HTTP 200 (OK) response message according to procedures specified in IETF RFC 9110 [22], where the HTTP 200 (OK) response message:

      i) shall set the Request-URI to the URI identifying the SNRM-S;

      ii) shall include a Content-Type header field set to "application/vnd.3gpp.seal-network-QoS-management-info +xml"; and

      iii) shall include an application/vnd.3gpp.seal-network-QoS-management-info+xml MIME body with the <network-QoS-management-info> root element including the <QoS-management-provision-response> element which:

         A) shall include a <server-id> element set to the identity of the VAL server; and

         B) shall include a <requested-QoS-parameters> element set to change request for the end-to-end QoS management, imposed by the VAL server on one or more VAL UEs, engaged in a network-assisted communication.

6.2.4.3.3 SNRM client CoAP procedure

In order to provision the network assisted QoS management for UE communications, the SNRM-C shall send a CoAP PUT request to the SNRM-S to update the reported QoS of the QoS session participant. In the CoAP PUT request, the SNRM-C:

a) shall set the CoAP URI to the "resUri" of the QoS session participant corresponding to the VAL UE, so that the CoAP URI of the request identifies the Individual Session Participant resource to be updated according to the resource definition in clause A.2.1.2.4.3.2:

   1) the "apiRoot" is set to the SNRM-S URI;

   2) the "qosSessionId" is set to point to the QoS session; and

   3) the "participantId" is set to the VAL UE ID;

b) shall include Content-Format option set to "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=session-participant";

c) shall include "SessionParticipant" object which:

   1) shall include "state" object with the "active" attribute set to "true"; and

   2) shall include "reportedQoS" attribute with the experienced or expected QoS; and

d) shall send the request protected with the relevant ACE profile (OSCORE profile or DTLS profile) as described in 3GPP TS 24.547 [9].

6.2.4.3.4 SNRM server CoAP procedure

Upon reception of a CoAP PUT request where the CoAP URI of the request identifies Individual QoS Session Participant resource as described in clause A.2.1.2.4.3.2, the SNRM-S:

a) shall determine the identity of the sender of the received CoAP PUT request as specified in clause 6.2.1.2, and:

   1) if the identity of the sender of the received CoAP PUT request is not authorized to update requested QoS session participant resource, shall respond with a CoAP 4.03 (Forbidden) response to the CoAP PUT request and skip rest of the steps;

b) shall support handling a CoAP PUT request from a SNRM-C according to procedures specified in IETF RFC 7252 [23]; and

    c) shall update the individual QoS session participant resource pointed at by the CoAP URI with the content of "SessionParticipant" object received in the request and return a CoAP 2.04 (Changed) response; and

    d) if reported QoS is included in "reportedQoS" attribute, shall determine any needed actions to fulfil the end-to-end QoS for the QoS session.

6.3 Off-network procedures

The off-network procedures are out of scope of the present document in this release of the specification.

7 Coding

7.1 General

This clause specifies the coding to enable an SNRM-C and an SNRM-S to communicate.

7.2 Application unique ID

The AUID shall be set to the VAL service ID as specified in specific VAL service specification.

7.3 Structure

The network resource management document shall conform to the XML schema described in clause 7.4.

7.3.1 VALInfo document

The <seal-request-uri> element shall be the root element of the VALInfo document.

The <seal-request-uri> element shall include one of the followings:

    a) a <VAL-user-id> element may include a <VAL-client-id> element; or

    b) a <VAL-group-id> element.

7.3.2 UnicastInfo document

The <seal-unicast-info> element shall be the root element of the UnicastInfo document.

The <seal-unicast-info> element shall include one of the followings:

    a) a <request> element;

    b) a <request-result> element;

    c) a <modification> element;

    d) a <modification-result> element;

    e) an <adaptation> element; or

    f) an <adaptation-result> element.

The <request> element shall include the followings:

    a) a <requester-identity> element;

    b) an <identity> element; and

    c) an optional < requirement-info> element.

The <modification> element shall include the followings:

    a) a <requester-identity> element;

    b) an <identity> element; and

    c) a <requirement-info> element.

The <adaptation> element shall include the followings:

    a) a <requester-identity> element;

    b) an <identity> element which shall include one of the following elements:

        1) a <VAL-ue-id-list> element which shall include:

            i) one or more <VAL-ue-id> elements; and

        2) a <VAL-group-id> element; and

    c) a <requirement> element.

7.3.3 MBMSInfo document

The <seal-mbms-info> element shall be the root element of the MBMSInfo document.

The <seal-mbms-info> element shall include one of the followings:

    a) one or more <announcement> elements;

    b) an <mbms-listening-status-report> element;

    c) a <request> element;

    d) an <mbms-bearers> element;

    e) a <user-plane-delivery-mode> element;

    f) an <mbms-suspension-reporting-instruction> element; or

    g) an <mbms-suspension-report> element.

The <announcement> element shall include:

    a) a <TMGI> element;

    b) an optional <alternative-TMGI> element;

    c) an optional <QCI> element;

    d) an <mbms-service-areas> element which shall include:

        1) one or more <mbms-sa-id> elements;

    e) a <frequency> element;

    f) an <seal-mbms-sdp> element;

    g) an optional <monitoring-state> element;

    h) an optional <announcement-acknowlegement> element;

    i) an optional <unicast-status> element; and

    j) an optional <seal-mbms-rohc> element.

The <mbms-listening-status-report> element shall include:

 a) an <identity> element;

 b) a <TMGI> element;

 c) an <mbms-listening-status> element;

 d) an optional <mbms-reception-quality-level> element; and

 e) an optional <unicast-listening-status> element.

The <request> element shall include:

 a) a <requester-identity> element;

 b) a <VAL-group-id> element;

 c) a <service-anouncement-mode> element;

 d) a <QoS> element;

 e) an optional <broadcast area> element; and

 f) an <endpoint-info> element.

The <mbms-bearers> element shall include:

 a) a <result> element;

 b) an optional <TMGI> element;

 c) a <user-plane-address> element; and

 d) an optional <service-description> element.

The <user-plane-delivery-mode> element shall include:

 a) a <delivery-mode> element;

 b) an <MBMS-media-stream-id> element; and

 c) a <unicast-media-stream-id> element;

The <mbms-suspension-reporting-instruction> element shall include either the first two followings or the third following:

 a) an <identity> element;

 b) a <suspension-reporting> element; or

 c) a <suspension-reporting-client-subset> element which shall include:

  1) one or more <NRM-client-id> elements.

 The <mbms-suspension-report> element shall include:

 a) an <mbms-suspension-status> element;

 b) an <number-of-reported-bearers> element;

 c) one or more <suspended-TMGI> element; and

 d) an optional <other-TMGI> element.

7.3.4   NetworkQoSManagementInfo document

The <seal-network-QoS-management-info> element shall be the root element of the NetworkQoSManagementInfo document.

The <seal-network-QoS-management-info> element shall include one of the followings:

   a) a <QoS-management-initiation-request> element;

   b) a <QoS-management-initiation-response> element;

   c) a <QoS-management-provision-request> element; and

   d) a <QoS-management-provision-response> element;

The <QoS-management-initiation-request> element:

   a) shall include a <VAL-ue-id> element;

   b) shall include a <VAL-ue-list> element;

      1) shall include one or more <VAL-ue-id> elements;

   c) may include <VAL-service-id> element which:

   d) may include <end-to-end-QoS-requirements> element;

   e) may include <service-area> element; and

   f) may include <validity-period> element.

The <QoS-management-initiation-response> element:

   a) shall include a <result> element; and

   b) may include a <QoS-configuration> element.

The <QoS-management-provision-request> element:

   a) shall include a <VAL-ue-id> element; and

   b) may include a <QoS-downgrade-report> element;

The <QoS-management-provision-response> element:

   a) shall include a <server-id> element; and

   b) shall include a <requested-QoS-parameters> element;

7.3.5   Application communication requirements info document

The <seal-app-comm-info> element shall be the root element of the Application communication requirements info document.

The <seal-app-comm-info> element shall include one of the followings:

   a) a <app-connectivity-request> element;

   b) a <app-connectivity-notify> element;

   c) a <app-connectivity-context-request> element; and

   d) a <app-connectivity-context-response> element;

The <app-connectivity-request> element:

   a) shall include an <source-val-ue-id> element;

    b) shall include an <source-ip-address> element;

    c) shall include an <VAL-service-id> element;

    d) shall include an <target-val-ue-id-list> element;

    e) may include an <app-service-requirements> element; or

    f) may include an <app-connectivity-context> element;

The <app-service-requirements> element may include any:

    a) a <packet-size> element;

    b) a <packet-trans-interval> element;

    c) a <packet-e2e-latency> element;

    d) a <packet-error-kpi> element; or

    e) a <bitrate> element;

The <app-connectivity-context> element may include any of the following:

    a) a <location> element;

    b) a <speed> element; or

    c) a <direction> element;

The <app-connectivity-notify> element:

    a) a <session-info> element;

    b) a <VAL-service-id> element;

    c) a <requestor-val-ue-id> element; and

    d) a <target-val-ue-id-list> element;

The <app-connectivity-context-request> element:

    a) a <requestor-val-ue-id> element;

    b) a <VAL-service-id> element; and

    c) a <VAL-specific-context> element.

The <app-connectivity-context-response> element may include and an <app-connectivity-context> element.

7.3.6   SEAL MBS Usage Info document

The <seal-mbs-usage-info> element shall be the root element of the MBSInfo document.

The <seal-mbs-usage-info> element shall include one of the followings:

    a) one or more <mbs-announcement> elements;

    b) an <mbs-listening-status-report> element;

    c) an <mbs-session-join-notification> element; or

    d) a <mbs-resource-request> element;

The <mbs-announcement> element shall include:

    a) a <mbs-session-id> element;

 b) a <mbs-session-props> element shall include:

  1) a <delivery-mode> element;

  2) an optional <mbs-service-areas> element shall include:

   A) a <mbs-service-area-id> element;

 c) an optional <mbs-listening-status-notify> element;

 d) an optional <mbs-session-join-notify> element;

 e) an optional <mbs-announcement-acknowledgement> element;

 f) a <seal-mbs-sdp> element; and

 g) an optional <mbms-announcement> element;

The <mbs-listening-status-report> element shall include:

 a) an <identity> element;

 b) a <mbs-session-props> element shall include:

  1) a <delivery-mode> element;

  2) an optional <mbs-service-areas> element shall include:

   A) a <mbs-service-area-id> element;

 c) a <mbm-listening-status> element; and

 d) an optional <mbs-reception-quality-level> element;

The <mbs-session-join-notification> element shall include:

 a) a <VAL-identities> element shall include:

  1) a <VAL-user-id> element may include a <VAL-client-id> element; or

  2) a <VAL-group-id> element.

 b) a <mbs-session-id> element;

 c) a <mbs-multicast-joining-status> element; and

 d) an optional <mbs-reception-quality-level> element;

The <mbs-resource-request> element shall include:

 a) a <requester-identity> element;

 b) a <VAL-group-id> element;

 c) a <service-announcement-mode> element;

 d) a <QoS> element; and

 e) an optional <mbs-service-areas> element shall include:

  1) a <mbs-service-area-id> element;

7.4 XML schema

7.4.1 General

This clause defines the XML schemas for application/vnd.3gpp.seal-info+xml, application/vnd.3gpp.seal-unicast-info+xml and application/vnd.3gpp.seal-mbms-usage-info+xml.

7.4.2 XML schema for application/vnd.3gpp.seal-info+xml

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="urn:3gpp:ns:sealInfo:1.0"
xmlns:sealinfo="urn:3gpp:ns:sealInfo:1.0"
elementFormDefault="qualified"
attributeFormDefault="unqualified"
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#">
  <!-- root XML element -->
  <xs:element name="seal-request-uri" type="sealinfo:sealinfo-Type" id="info"/>
  <xs:complexType name="sealinfo-Type">
    <xs:sequence>
      <xs:element name="VAL-user-id" type="sealinfo:contentType" minOccurs="0"/>
      <xs:element name="VAL-group-id" type="xs:string" minOccurs="0"/>
      <xs:element name="anyExt" type="sealinfo:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="contentType">
    <xs:choice>
      <xs:element name="sealURI" type="xs:anyURI"/>
      <xs:element name="sealString" type="xs:string"/>
      <xs:element name="sealBoolean" type="xs:boolean"/>
      <xs:element name="anyExt" type="sealinfo:anyExtType" minOccurs="0"/>


      <xs:any namespace="##other" processContents="lax"/>
    </xs:choice>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="anyExtType">
    <xs:sequence>
      <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

</xs:schema>
```

7.4.3 XML schema for application/vnd.3gpp.seal-unicast-info+xml

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="urn:3gpp:ns:sealUnicastInfo:1.0"
xmlns:sealunicast="urn:3gpp:ns:sealUnicastInfo:1.0"
elementFormDefault="qualified"
attributeFormDefault="unqualified"
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#">
  <!-- the root element -->
  <xs:element name="seal-unicast-info" id="unicast">
    <xs:complexType>
      <xs:choice maxOccurs="unbounded">
        <xs:element name="request" type="sealunicast:requestType"/>
        <xs:element name="request-result" type="xs:string"/>
        <xs:element name="modification" type="sealunicast:modificationType"/>
        <xs:element name="modification-result" type="xs:string"/>
        <xs:element name="adaptation" type="sealunicast:adaptationType"/>
        <xs:element name="adaptation-result" type="xs:string"/>
        <xs:element name="anyExt" type="sealunicast:anyExtType" minOccurs="0"/>
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:choice>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>
  </xs:element>
```

```
  <xs:complexType name="requestType">
    <xs:sequence>
      <xs:element name="requester-identity" type="xs:string"/>
      <xs:element name="identity" type="xs:string"/>
      <xs:element name="requirement-info" type="xs:string" minOccurs="0"/>
        <xs:element name="anyExt" type="sealunicast:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="modificationType">
    <xs:sequence>
      <xs:element name="requester-identity" type="xs:string"/>
      <xs:element name="identity" type="xs:string"/>
      <xs:element name="requirement-info" type="xs:string"/>
        <xs:element name="anyExt" type="sealunicast:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="adaptationType">
    <xs:sequence>
      <xs:element name="requester-identity" type="xs:string"/>
      <xs:element name="identity" type="xs:string"/>
      <xs:element name="requirement-info" type="xs:string"/>
        <xs:element name="anyExt" type="sealunicast:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="anyExtType">
    <xs:sequence>
      <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

</xs:schema>
```

7.4.4 XML schema for application/vnd.3gpp.seal-mbms-usage-info+xml

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="urn:3gpp:ns:sealMbmsInfo:1.0"
xmlns:sealmbms="urn:3gpp:ns:sealMbmsInfo:1.0"
elementFormDefault="qualified"
attributeFormDefault="unqualified"
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#">
  <!-- the root element -->
  <xs:element name="seal-mbms-usage-info" type="sealmbms:seal-mbms-usage-info-Type" id="mbms"/>
  <xs:complexType name="seal-mbms-usage-info-Type">
    <xs:sequence>
      <xs:element name="mbms-listening-status-report" type="sealmbms:mbms-listening-status-
reportType"
      minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="mbms-suspension-report" type="sealmbms:mbms-suspension-reportType"
      minOccurs="0"/>
      <xs:element name="announcement" type="sealmbms:announcementTypeParams" minOccurs="0"/>
      <xs:element name="user-plane-delivery-mode" type="sealmbms:user-plane-delivery-modeType"
minOccurs="0"/>
      <xs:element name="mbms-suspension-reporting-instruction" type="sealmbms:mbms-suspension-
reporting-instructionType" minOccurs="0"/>
      <xs:element name="request" type="sealmbms:requestType" minOccurs="0"/>
      <xs:element name="version" type="xs:integer"/>
      <xs:element name="anyExt" type="sealmbms:anyExtType" minOccurs="0"/>
     <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="mbms-listening-status-reportType">
    <xs:sequence>
      <xs:element name="identity" type="xs:string"/>
      <xs:element name="TMGI" type="xs:hexBinary" maxOccurs="unbounded"/>
      <xs:element name="mbms-listening-status" type="xs:string"/>
```

```
      <xs:element name="mbms-reception-quality-level" type="xs:integer"/>
      <xs:element name="unicast-listening-status" type="xs:string"/>
      <xs:element name="anyExt" type="sealmbms:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="mbms-suspension-reportType">
    <xs:sequence>
      <xs:element name="mbms-suspension-status" type="xs:string" minOccurs="0" maxOccurs="1"/>
      <xs:element name="number-of-reported-bearers" type="xs:integer" minOccurs="0" maxOccurs="1"/>
      <xs:element name="suspended-TMGI" type="xs:hexBinary" minOccurs="0"/>
      <xs:element name="other-TMGI" type="xs:hexBinary" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="anyExt" type="sealmbms:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="announcementTypeParams">
    <xs:sequence>
      <xs:element name="TMGI" type="xs:hexBinary" minOccurs="1"/>
      <xs:element name="alternative-TMGI" type="xs:hexBinary" minOccurs="0"/>
      <xs:element name="QCI" type="xs:integer" minOccurs="0"/>
      <xs:element name="frequency" type="xs:unsignedLong" minOccurs="0"/>
      <xs:element name="mbms-service-areas" type="sealmbms:mbms-service-areasType" minOccurs="0"/>
      <xs:element name="seal-mbms-sdp" type="xs:string"/>
      <xs:element name="monitoring-state" type="xs:string" minOccurs="0"/>
      <xs:element name="announcement-acknowlegement" minOccurs="0"/>
      <xs:element name="unicast-status" type="xs:string" minOccurs="0"/>
      <xs:element name="seal-mbms-rohc" minOccurs="0"/>
      <xs:element name="anyExt" type="sealmbms:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="mbms-service-areasType">
    <xs:sequence>
      <xs:element name="mbms-service-area-id" type="xs:hexBinary"
      minOccurs="1" maxOccurs="unbounded"/>
      <xs:element name="anyExt" type="sealmbms:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute/>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="user-plane-delivery-modeType">
    <xs:sequence>
      <xs:element name="delivery-mode" type="xs:string" minOccurs="1"/>
      <xs:element name="MBMS-media-stream-id" type="xs:string" minOccurs="1"/>
      <xs:element name="unicast-media-stream-id" type="xs:string" minOccurs="0"/>
      <xs:element name="anyExt" type="sealmbms:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="mbms-suspension-reporting-instructionType">
    <xs:sequence>
      <xs:element name="suspension-reporting" type="xs:string" minOccurs="1"/>
      <xs:element name="suspension-reporting-client-subset" type="sealmbms:suspension-reporting-
client-subsetType" minOccurs="1"/>
      <xs:element name="anyExt" type="sealmbms:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="suspension-reporting-client-subsetType">
    <xs:sequence>
      <xs:element name="NRM-client-id" type="xs:string" minOccurs="1" maxOccurs="unbounded"/>
      <xs:element name="anyExt" type="sealmbms:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
```

```
    </xs:complexType>

  <xs:complexType name="requestType">
     <xs:sequence>
       <xs:element name="requester-identity" type="xs:string"/>
       <xs:element name="identity" type="xs:string"/>
       <xs:element name="requirement-info" type="xs:string" minOccurs="0"/>
      <xs:element name="anyExt" type="sealmbms:anyExtType" minOccurs="0"/>
       <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
     </xs:sequence>
     <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="anyExtType">
     <xs:sequence>
       <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
     </xs:sequence>
  </xs:complexType>

</xs:schema>
```

7.4.5   XML schema for application/vnd.3gpp.seal-network-QoS-management-info+xml

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="urn:3gpp:ns:seal NetworkQoSManagementInfo:1.0"
xmlns:sealNetworkQoSManagement="urn:3gpp:ns:seal NetworkQoSManagementInfo:1.0"
elementFormDefault="qualified"
attributeFormDefault="unqualified"
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#">
  <!-- the root element -->
  <xs:element name="seal-network-QoS-management-info" id="NetworkQoSManagement">
  <xs:complexType>
    <xs:choice maxOccurs="unbounded">
      <xs:element name="QoS-management-initiation-request" type="sealNetworkQoSManagement:QoS-
management-initiation-requestType"/>
      <xs:element name="QoS-management-initiation-response" type="sealNetworkQoSManagement:QoS-
management-initiation-responseType"/>
      <xs:element name="QoS-management-provision-request" type="sealNetworkQoSManagement:QoS-
management-provision-requestType"/>
      <xs:element name="QoS-management-provision-response" type="sealNetworkQoSManagement:QoS-
management-provision-responseType"/>
      <xs:element name="anyExt" type="sealNetworkQoSManagement:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:choice>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>
  </xs:element>

  <xs:complexType name="QoS-management-initiation-requestType">
     <xs:sequence>
       <xs:element name="VAL-ue-id" type="xs:string"/>
       <xs:element name="VAL-ue-list" type="xs:string"/>
       <xs:element name="VAL-service-id" type="xs:string" minOccurs="0"/>
       <xs:element name="end-to-end-QoS-requirements" type="xs:string" minOccurs="0"/>
       <xs:element name="service-area" type="xs:string" minOccurs="0"/>
       <xs:element name="validity-period" type="xs:string" minOccurs="0"/>
       <xs:element name="anyExt" type="sealNetworkQoSManagement:anyExtType" minOccurs="0"/>
       <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
     </xs:sequence>
     <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="QoS-management-initiation-responseType">
     <xs:sequence>
       <xs:element name="result" type="xs:string"/>
       <xs:element name="QoS-configuration" type="xs:string" minOccurs="0"/>
       <xs:element name="anyExt" type="sealNetworkQoSManagement:anyExtType" minOccurs="0"/>
       <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
     </xs:sequence>
     <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="QoS-management-provision-requestType">
    <xs:sequence>
       <xs:element name="VAL-ue-id" type="xs:string"/>
```

```
      <xs:element name="QoS-downgrade-report" type="xs:string" minOccurs="0"/>
      <xs:element name="anyExt" type="sealNetworkQoSManagement:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="QoS-management-provision-responseType">
    <xs:sequence>
      <xs:element name="server-id" type="xs:string"/>
      <xs:element name="requested-QoS-parameters" type="xs:string"/>
      <xs:element name="anyExt" type="sealNetworkQoSManagement:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="anyExtType">
    <xs:sequence>
      <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

</xs:schema>
```

7.4.6 XML schema for application/vnd.3gpp.seal-app-comm-requirements-info+xml

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="urn:3gpp:ns:sealAppCommunicationInfo:1.0"
xmlns:sealappcomminfo="urn:3gpp:ns:sealAppCommunicationInfo:1.0"
xmlns:sealloc="urn:3gpp:ns:sealLocationInfo:1.0" elementFormDefault="qualified"
attributeFormDefault="unqualified" xmlns:xenc="http://www.w3.org/2001/04/xmlenc#">
  <!-- the sealloc.xsd shall be referenced from 3GPP TS 24.545 -->
  <xs:import namespace="urn:3gpp:ns:sealLocationInfo:1.0" schemaLocation="sealloc.xsd"/>
  <!-- the root element -->
  <xs:element name="seal-app-comm-info" type="sealappcomminfo:seal-app-comm-info-Type" id="mbs"/>
  <xs:complexType name="seal-app-comm-info-Type">
    <xs:sequence>
      <xs:element name="app-connectivity-request" type="sealappcomminfo:app-connectivity-
requestType" minOccurs="0"/>
      <xs:element name="app-connectivity-notify" type="sealappcomminfo:app-connectivity-notifyType"
minOccurs="0"/>
      <xs:element name="app-connectivity-context-request" type="sealappcomminfo:app-connectivity-
context-requestType" minOccurs="0"/>
      <xs:element name="app-connectivity-context-response" type="sealappcomminfo:app-connectivity-
context-responseType" minOccurs="0"/>
      <xs:element name="version" type="xs:integer"/>
      <xs:element name="anyExt" type="sealappcomminfo:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <!--app-connectivity-reqType-->
  <xs:complexType name="app-connectivity-requestType">
    <xs:sequence>
      <xs:element name="source-val-ue-id" type="xs:string"/>
      <xs:element name="source-ip-address" type="xs:string"/>
      <xs:element name="VAL-service-id" type="xs:string"/>
      <xs:element name="target-val-ue-id-list" type="sealappcomminfo:VAL-ue-id-listType"/>
      <xs:element name="app-service-requirements" type="sealappcomminfo:app-service-
requirementsType" minOccurs="0"/>
      <xs:element name="app-connectivity-context" type="sealappcomminfo:app-connectivity-
contextType" minOccurs="0"/>
      <xs:element name="anyExt" type="sealappcomminfo:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <!--VAL-ue-id-listType-->
  <xs:complexType name="VAL-ue-id-listType">
    <xs:sequence>
      <xs:element name="VAL-ue-id" type="xs:string"/>
      <xs:element name="anyExt" type="sealappcomminfo:anyExtType" minOccurs="0"/>
```

```
            <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <!--app-service-requirementsType-->
    <xs:complexType name="app-service-requirementsType">
        <xs:sequence>
            <xs:element name="packet-size" type="xs:integer" minOccurs="0"/>
            <xs:element name="packet-trans-interval" type="xs:integer" minOccurs="0"/>
            <xs:element name="packet-e2e-latency" type="xs:integer" minOccurs="0"/>
            <xs:element name="packet-error-kpi" type="xs:string" minOccurs="0"/>
            <xs:element name="bitrate" type="xs:integer" minOccurs="0"/>
            <xs:element name="anyExt" type="sealappcomminfo:anyExtType" minOccurs="0"/>
            <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <!--app-connectivity-contextType-->
    <xs:complexType name="app-connectivity-contextType">
        <xs:sequence>
            <xs:element name="location" type="sealloc:tPointCoordinate" minOccurs="0"/>
            <xs:element name="speed" type="xs:integer" minOccurs="0"/>
            <xs:element name="direction" type="xs:string" minOccurs="0"/>
            <xs:element name="anyExt" type="sealappcomminfo:anyExtType" minOccurs="0"/>
            <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <!--app-connectivity-notifyType-->
    <xs:complexType name="app-connectivity-notifyType">
        <xs:sequence>
            <xs:element name="session-info" type="xs:string"/>
            <xs:element name="VAL-service-id" type="xs:string"/>
            <xs:element name="requestor-val-ue-id" type="xs:string"/>
            <xs:element name="target-val-ue-id-list" type="sealappcomminfo:VAL-ue-id-listType"/>
            <xs:element name="anyExt" type="sealappcomminfo:anyExtType" minOccurs="0"/>
            <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <!--app-connectivity-context-reqType-->
    <xs:complexType name="app-connectivity-context-requestType">
        <xs:sequence>
            <xs:element name="requestor-val-ue-id" type="xs:string"/>
            <xs:element name="VAL-service-id" type="xs:string"/>
            <xs:element name="VAL-specific-context" type="xs:string"/>
            <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <!--app-connectivity-context-responseType-->
    <xs:complexType name="app-connectivity-context-responseType">
        <xs:sequence>
            <xs:element name="app-connectivity-context" type="sealappcomminfo:app-connectivity-
contextType" minOccurs="0"/>
            <xs:element name="anyExt" type="sealappcomminfo:anyExtType" minOccurs="0"/>
            <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>

    <xs:complexType name="anyExtType">
        <xs:sequence>
            <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
    </xs:complexType>

</xs:schema>
```

7.4.7 XML schema for application/vnd.3gpp.seal-mbs-usage-info+xml

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
```

```
targetNamespace="urn:3gpp:ns:sealMbsInfo:1.0"
xmlns:sealmbs="urn:3gpp:ns:sealMbsInfo:1.0"
xmlns:sealmbms="urn:3gpp:ns:sealMbmsInfo:1.0"
xmlns:sealinfo="urn:3gpp:ns:sealInfo:1.0"
elementFormDefault="qualified" attributeFormDefault="unqualified"
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#">
  <xs:import namespace="urn:3gpp:ns:sealMbmsInfo:1.0" schemaLocation="sealMbmsInfo.xsd"/>
  <xs:import namespace="urn:3gpp:ns:sealInfo:1.0" schemaLocation="sealInfo.xsd"/>

  <!-- the root element -->
  <xs:element name="seal-mbs-usage-info" type="sealmbs:seal-mbs-usage-info-Type" id="mbs"/>
  <!--SEAL-MBS-USAGE-INFO-->
  <xs:complexType name="seal-mbs-usage-info-Type">
    <xs:sequence>
      <xs:element name="mbs-announcement" type="sealmbs:mbs-announcementTypeParams" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="mbs-listening-status-report" type="sealmbs:mbs-listening-status-reportType"
minOccurs="0"/>
      <xs:element name="mbs-session-join-notification" type="sealmbs:mbs-session-join-
notificationType" minOccurs="0"/>
      <xs:element name="mbs-resource-request" type="sealmbs:mbs-resource-requestType"
minOccurs="0"/>
      <xs:element name="version" type="xs:integer"/>
      <xs:element name="anyExt" type="sealmbs:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <!--MBS Announcement Information-->
  <xs:complexType name="mbs-announcementTypeParams">
    <xs:sequence>
      <xs:element name="mbs-session-id" type="xs:string"/>
      <xs:element name="mbs-session-props" type="sealmbs:mbs-session-propsType"/>
      <xs:element name="mbs-listening-status-notify" minOccurs="0"/>
      <xs:element name="mbs-session-join-notify" minOccurs="0"/>
      <xs:element name="mbs-announcement-acknowledgement" minOccurs="0"/>
      <xs:element name="seal-mbs-sdp" type="xs:string"/>
      <xs:element name="mbms-announcement" type="sealmbms:announcementTypeParams" minOccurs="0"/>
      <xs:element name="anyExt" type="sealmbs:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <!--MBS Session Properties-->
  <xs:complexType name="mbs-session-propsType">
    <xs:sequence>
      <xs:element name="delivery-mode" type="xs:string"/>
      <xs:element name="mbs-service-areas" type="sealmbs:mbs-service-areasType" minOccurs="0"/>
      <xs:element name="anyExt" type="sealmbs:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <!--MBS Service Area-->
  <xs:complexType name="mbs-service-areasType">
    <xs:sequence>
      <xs:element name="mbs-service-area-id" type="xs:hexBinary" minOccurs="1"
maxOccurs="unbounded"/>
      <xs:element name="anyExt" type="sealmbs:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <!--MBS Listening Status-->
  <xs:complexType name="mbs-listening-status-reportType">
    <xs:sequence>
      <xs:element name="identity" type="xs:string"/>
      <xs:element name="mbs-session-props" type="sealmbs:mbs-session-propsType"/>
      <xs:element name="mbs-listening-status" type="xs:string"/>
      <xs:element name="mbs-reception-quality-level" type="xs:integer"/>
      <xs:element name="anyExt" type="sealmbs:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
```

```
    </xs:complexType>

  <!--MBS Session Join Notification-->
  <xs:complexType name="mbs-session-join-notificationType">
    <xs:sequence>
      <xs:element name="VAL-identities" type="sealinfo:sealinfo-Type"/>
      <xs:element name="mbs-session-id" type="xs:string"/>
      <xs:element name="mbs-multicast-joining-status" type="xs:string"/>
      <xs:element name="mbs-reception-quality-level" type="xs:integer" minOccurs="0"/>
       <xs:element name="anyExt" type="sealmbs:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <!--MBS Resource Request-->
  <xs:complexType name="mbs-resource-requestType">
    <xs:sequence>
      <xs:element name="requester-identity" type="xs:string"/>
      <xs:element name="VAL-group-id" type="xs:string"/>
      <xs:element name="service-anouncement-mode" type="xs:string"/>
      <xs:element name="QoS" type="xs:string"/>
      <xs:element name="mbs-service-areas" type="sealmbs:mbs-service-areasType" minOccurs="0"/>
      <xs:element name="anyExt" type="sealmbs:anyExtType" minOccurs="0"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:complexType name="anyExtType">
    <xs:sequence>
      <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

</xs:schema>
```

7.5 Data semantics

7.5.1 VALInfo document

The <seal-request-uri> element is the root element of the XML document. The < seal-request-uri> element contains one of following sub-elements:

   a) <VAL-user-id>, an element contains the identity of the VAL user. This element contains an optional <VAL-client-id> attribute that contains the identity of the VAL client; or

   b) <VAL-group-id>, an element contains the group identity of a set of VAL users or VAL clients according to the VAL service.

The recipient of the XML ignores any unknown element and any unknown attribute.

7.5.2 UnicastInfo document

The recipient of the XML ignores any unknown element and any unknown attribute.

The <seal-unicast-info> element is the root element of the XML document. The <seal-unicast-info> element contains a <request> or <request-result> element.

<request> is an optional element used to include the unicast resource management requested information. The <request> element contains the following sub-elements:

   a) <requester-identity>, an element contains the identity of the VAL server performing the request;

   b) <identity>, an element contains the identity of the VAL user or VAL UE; and

   c) <requirement-info>, an optional element contains the requested unicast resource information.

<request-result> contains a string set to either "success" or "failure" used to indicate success or failure of the resource request operation ".

<modification> contains the following sub-elements:

    a) <requester-identity>, an element contains the identity of the VAL server performing the request;

    b) <identity>, an element contains the identity of the VAL user or VAL UE; and

    c) <requirement-info>, an element contains the modified unicast resource information.

<modification-result> contains a string set to either "success" or "failure" used to indicate success or failure of the resource modification request operation.

<adaptation> contains the following sub-elements:

    a) <requester-identity>, an element contains the identity of the VAL server performing the request;

    b) <identity>, an element contains one of the following elements:

        1) <VAL-ue-id-list>, an element contains one or more <VAL-ue-id> elements. Each <VAL-ue-id> element contains the identity of the VAL UE for whom the network resource adaptation occurs; and

        2) <VAL-group-id>, an element contains the identity of the VAL group for whom the network resource adaptation occurs; and

    c) <requirement>, an element contains VAL service QoS requirements as applied for the corresponding VAL UEs or group of UEs.

<adaptation-result> contains a string set to either "success" or "failure" used to indicate success or failure of the network resource adaptation with the underlying network.

7.5.3 MBMSInfo document

The recipient of the XML ignores any unknown element and any unknown attribute.

The <seal-mbms-info> element is the root element of the XML document. The <seal-mbms-info> element contains one or more <announcement> subelements, the <mbms-listening-status-report> subelement, the <request> subelement, the <mbms-bearers> subelement, the <user-plane-delivery-mode> subelement, the <mbms-suspension-reporting-instruction> subelement and the <mbms-suspension-report> subelement.

<announcement> element contains the following sub-elements:

    a) <TMGI>, an element contains the TMGI. The <TMGI> element is coded as described in 3GPP TS 24.008 [5] clause 10.5.6.13 excluding the Temporary mobile group identity IEI and the Length of temporary mobile group identity contents (octet 1 and octet 2 in 3GPP TS 24.008 [5] clause 10.5.6.13);

    b) <alternative-TMGI>, an optional element contains a list of additional alternative TMGI used in roaming scenarios;

    c) <QCI>, an optional element contains the QCI information used by the ProSe UE-Network Relay to determine the ProSe Per-Packet Priority value to be applied for the multicast packets relayed to Remote UE over PC5. QCI values are defined in 3GPP TS 23.203 [4];

    d) <mbms-service-areas>, an element contains a list of MBMS service area IDs for the applicable MBMS broadcast area as specified in 3GPP TS 23.003 [3] for service area identifier (SAI), and with the encoding as specified in 3GPP TS 29.061 [11] for the MBMS-Service-Area AVP;

    e) <frequency>, an optional element contains identification of frequency in case of multi carrier support. The <frequency> element is coded as specified in 3GPP TS 29.468 [13];

    f) <seal-mbms-sdp>, an element contains SDP with media and application control information applicable to groups that can use this bearer;

    g) <monitoring-state>, an optional element contains a string used to control if the client is actively monitoring the MBMS bearer quality or not:

       - The value "monitor" indicates that the SNRM-C shall monitor the MBMS bearer quality; and

    - The value "not-monitor" indicates that the SNRM-C shall not monitor the MBMS bearer quality;

  h) <announcement-acknowlegement>, presence of the <announcement-acknowlegement> element indicates the NRM server requires an acknowledgement of the MBMS bearer announcement;

  i) <unicast-status>, presence of the <unicast-status> element indicates the listening status of the unicast bearer is requested; and

  j) <seal-mbms-rohc>, presence of the <seal-mbms-rohc> element indicates that the flows delivered by the announced MBMS bearer are header compressed with ROHC as specified in IETF RFC 5795 [20] and IETF RFC 3095 [16].

<mbms-listening-status-report> element contains the following sub-elements:

  a) <identity>, an element contains the identity of the VAL user or VAL UE who wants to report the MBMS listening status;

  b) <TMGI>, an element contains the TMGI. The <TMGI> element is coded as described in 3GPP TS 24.008 [5] clause 10.5.6.13 excluding the Temporary mobile group identity IEI and the Length of temporary mobile group identity contents (octet 1 and octet 2 in 3GPP TS 24.008 [5] clause 10.5.6.13);

  c) <mbms-listening-status>, an element contains a string "listening" or "not-listening" used to indicate the MBMS listening status per TMGI;

  d) <mbms-reception-quality-level>, an optional element contains an integer used to indicate the reception quality level per TMGI; and

  e) <unicast-listening-status>, an optional element contains a string "listening" or "not-listening" used to indicate the unicast listening status.

<request> is an element used to include the multicast resource management requested information. The <request> element contains the following sub-elements:

  a) <requester-identity>, an element contains the identity of the VAL server performing the request;

  b) <VAL-group-id>, an element contains the identity of the VAL group that the MBMS bearer is requested for;

  c) <service-anouncement-mode>, an element contains a string used to indicate whether the request is sent by NRM server or by the VAL server:

    - The value "NRM-S" indicates the request is sent by NRM server;

    - The value "VAL-server" indicates the request is sent by the VAL server;

  d) <QoS>, an element contains the requested QoS information for the bearer;

  e) <broadcast-area>, an optional element specifying the serving MBMS service area id where the MBMS bearer is requested for; and

  f) <endpoint-info>, an element contains the information of the endpoint of the VAL server to which the user plane notifications have to be sent.

<mbms-bearers> element contains the following sub-elements:

  a) <result>, an element contains a string either "success" or "failure" indicating success or failure of the MBMS bearers request operation;

  b) <TMGI>, an optional element contains the TMGI. The <TMGI> element is coded as described in 3GPP TS 24.008 [5] clause 10.5.6.13 excluding the Temporary Mobile Group Identity IEI and Length of Temporary Mobile Group Identity contents (octet 1 and octet 2 in 3GPP TS 24.008 [5] clause 10.5.6.13);

  c) <user-plane-address>, an element contains the BM-SC user plane IP address and port; and

  d) <service-description>, an optional element contains the MBMS bearer related configuration information as defined in 3GPP TS 26.346 [10];

<user-plane-delivery-mode> element contains the following sub-elements:

a) <delivery-mode>, an element contains a string used to indicate whether to deliver the user data to the UE(s) via unicast mode or multicast mode:

- The value "unicast" indicates to deliver the user data to the UE(s) via unicast mode;

- The value "multicast" indicates to deliver the user data to the UE(s) via multicast mode;

b) <MBMS-media-stream-id>, an element set to the MBMS media stream ID indicating the MBMS media stream to be used to deliver the media currently over unicast, or the MBMS media stream currently being used; and

c) one or more <unicast-media-stream-id> element(s), each element set to the unicast media stream ID indicating the unicast media stream to be used to deliver the media currently over multicast, or the unicast to be stopped and switched to multicast.

<mbms-suspension-reporting-instruction> contains the following sub-elements:

a) <identity>, an element contains the identity of the VAL user or VAL UE that reports MBMS suspension in case of a unicast bearer is used for MBMS suspension reporting;

b) <suspension-reporting>, an element contains a string used to enable or disable the suspension reporting for the SNRM-C in case of a unicast bearer is used for MBMS suspension reporting:

- The value "enable" indicates to enable the suspension reporting;

- The value "disable" indicates to disable the suspension reporting; and

c) <suspension-reporting-client-subset>, an element contains one or more <NRM-client-id> child elements set to the identities of the NRM clients that shall report MBMS suspension in case of a multicast bearer is used for MBMS suspension reporting;

<mbms-suspension-report> element contains the following sub-elements:

a) <mbms-suspension-status>, an element contains a string used to indicate the MBMS bearers intended suspension status:

- The value "suspending" indicates that the RAN has decided to suspend the referenced MBMS bearer(s) at the beginning of the next MCCH modification period;

- The value "not-suspending" indicates that the RAN has decided to revoke its decision to suspend the referenced MBMS bearer(s) before the beginning of the next MCCH modification period;

b) <number-of-reported-bearers>, an element contains a hex binary number denoting the total number of occurrences of the <suspended-TMGI> and <other-TMGI> elements reported as part of the MBMS bearer suspension status;

c) <suspended-TMGI>, an element contains a TMGI that is being reported as about to be suspended or as no longer about to be suspended; and

d) <other-TMGI>, an element contains a TMGI that is not being reported as about to be suspended or as no longer about to be suspended, but which shares the same MCH with MBMS bearers reported in the <suspended-TMGI> elements;

a) shall include a <VAL-ue-id> element; and

b) may include a <QoS-downgrade-report> element;

The <QoS-management-provision-response> element:

a) shall include a <server-id> element; and

b) shall include a <requested-QoS-parameters> element;

7.5.4 NetworkQoSManagementInfo document

The recipient of the XML ignores any unknown element and any unknown attribute.

The <seal-network-QoS-management-info> element is the root element of the XML document. The <seal-network-QoS-management-info> element contains a <QoS-management-initiation-request> element, a <QoS-management-initiation-response> element, a <QoS-management-provision-request> element or a <QoS-management-provision-response> element.

A <QoS-management-initiation-request> element is used to request for initiation of the network assisted QoS management. The <QoS-management-initiation-request> element:

    a) shall include a <VAL-ue-id> element which contains the identity of IP address of the VAL UE performing the request;

    b) shall include a <VAL-ue-list> element which contains one or more <VAL-ue-id> child elements, each contains the identity of the VAL UE;

    c) may include a <VAL-service-id> element which contains the VAL service identity of the VAL application;

    d) may include a <end-to-end-QoS-requirements> element which contains the QoS requirements for latency, throughput, reliability and jitter for the VAL application for the end-to-end session;

    e) may include a <service-area> element which contains the geographical area or topological area where an end-to-end QoS management request applies; and

    f) may include a <validity-period> element which contains the period of time during which an end-to-end requirement is valid.

A <QoS-management-initiation-response> element is used to get the response for initiation of the network assisted QoS management. The <QoS-management-initiation-response> element:

    a) shall include a <result> element which contains the outcome of the end-to-end QoS management response which indicates either a success or a failure; and

    b) may include a <QoS-configuration> element which contains QoS downgrade reported by the SNRM-C or for QoS change requested by SNRM-S.

A <QoS-management-provision-request> element is used to request for provisioning of the network assisted QoS management. The <QoS-management-initiation-request> element:

    a) shall include a <VAL-ue-id> element which contains the identity of the SNRM-C acting as the VAL UE and performing the request; and

    b) may include <QoS-downgrade-report> element which contains the report indicating a QoS downgrade of the end-to-end QoS parameters (latency, throughput, reliability and jitter) which may be reported based on QoS configuration parameter from the end-to-end QoS management response.

A <QoS-management-provision-response> element is used to get the response for provisioning of the network assisted QoS management. The <QoS-management-initiation-request> element:

    a) shall include a <server-id> element which contains the identity of the VAL server; and

    b) shall include a <requested-QoS-parameters> element which contains change request for the end-to-end QoS management, imposed by the VAL server on one or more VAL UEs, engaged in a network-assisted communication.

7.5.5 Application Communication Requirements Info document

The recipient of the ApplicationCommunicationRequirementsInfo XML ignores any unknown element and any unknown attribute.

The <seal-app-comm-info> element is the root element of the XML document. The <seal-app-comm-info> element contains anyone of these <app-connectivity-request>, <app-connectivity-notify> element, <app-connectivity-context-request> element or <app-connectivity-context-response> as sub-element.

The <app-connectivity-request> element is used to initiate the application coordinated communication. The <app-connectivity-request> element:

a) shall include a <source-val-ue-id> element contains the identity of the VAL Client or VAL UE initiating the application coordinated communication;

b) shall include a <source-ip-address> element contains the identity of IP address of the VAL UE performing the request;

c) shall include a <VAL-service-id> element which contains the VAL service identity of the VAL application;

d) shall include a <target-val-ue-id-list> element which contain one or more <VAL-ue-id> child elements that store the VAL identity(s) of the target VAL-UE; and

e) may include an <app-service-requirements> element that shall include any of the following sub-elements:

    a) a <packet-size> element contains an integer to specify the size of the packet;

    b) a <packet-trans-interval> element contains an integer to specify the interval;

    c) a <packet-e2e-latency> element contains an integer to specify the end-to-end latency;

    d) a <packet-error-kpi> element contains an integer to specify the KPI for packet error; or

    e) a <bitrate> element contains an integer to specify the bit rate.

f) The <app-connectivity-context> element that shall include any of the following sub-elements:

    a) a <location> element contains an location co-ordinate as defined as "tPointCoordinate";

    b) a <speed> element contains an integer to specify the speed; or

    c) a <direction> element contains a string used to indicate the direction.

The <app-connectivity-notify> element shared contains the notification information for the application coordinated communication initiated and shall include:

a) a <session-info> element contains a string used to identify the application communication session;

b) a <VAL-service-id> element contains the VAL service identity of the VAL application;

c) a <requestor-val-ue-id> element contains one <VAL-ue-id> child element that store the VAL identity of the requestor VAL-UE; and

d) a <target-val-ue-id-list> element which contain one or more <VAL-ue-id> child elements that store the VAL identity(s) of the target VAL-UE for whom the application coordinated communication is accepted by the SNRM-S.

The <app-connectivity-context-request> element:

a) a <requestor-val-ue-id> element contains one <VAL-ue-id> child element that store the VAL identity of the requestor VAL-UE;

b) a <VAL-service-id> element contains the VAL service identity of the VAL application; and

c) a <VAL-specific-context> element contains a string used to identify the context.

The <app-connectivity-context-response> element may include and an <app-connectivity-context> element that shall include any of the following sub-elements:

    a) a <location> element contains a location co-ordinate as defined as "tPointCoordinate";

    b) a <speed> element contains an integer to specify the speed; or

    c) a <direction> element contains a string used to indicate the direction.

7.5.6   SEAL MBS Usage Info document

The recipient of the SEALMBSUsageInfo XML ignores any unknown element and any unknown attribute.

The <seal-mbs-usage-info> element is the root element of the XML document. The <seal-mbs-usage-info> element contains one or more <mbs-announcement> subelements, the <mbs-listening-status-report> subelement, the <mbs-session-join-notification> subelement and the <mbs-resource-request> subelement.

<mbs-announcement> element contains the following sub-elements:

a) <mbs-session-id>, an element contains a string that identifies the MBS session;

b) <mbs-session-props> element shall include below sub-elements:

1) a <delivery-mode> element contains a string that indicates the delivery mode as "broadcast" or "multicast";

2) an optional <mbs-service-areas> element shall include:

A) one or more <mbs-service-area-id> sub-elements to provide applicable service areas for the MBS broadcast area as specified in 3GPP TS 23.003 [3] for service area identifier (SAI), and with the encoding as specified in 3GPP TS 29.061 [11];

c) an optional <mbs-listening-status-notify>, presence of this element indicates the SNRM-S requires an listening status report for this MBS session;

d) an optional <mbs-session-join-notify>, presence of this element indicates the SNRM-S requires an UE group join notification for this MBS session;

e) an optional <mbs-announcement-acknowledgement> element, presence of this element indicates the SNRM-S requires an acknowledgement for the MBS bearer announcement;

f) a <seal-mbs-sdp> element; an element contains SDP with media and application control information applicable to groups that can use this MBS session and

g) an optional <mbms-announcement> element; provides the established eMBMS Bearer information with the encoding as per the <announcement> element specified in clause 7.5.3.

<mbs-listening-status-report> element contains the following sub-elements:

a) <identity>, an element contains the identity of the VAL user or VAL UE who wants to report the MBS listening status;

b) <mbs-session-props> element shall include below sub-elements:

1) a <delivery-mode> element contains a string that indicates the delivery mode as "broadcast" or "multicast";

2) an optional <mbs-service-areas> element shall include:

A) one or more <mbs-service-area-id> sub-elements to provide applicable service areas for the MBS broadcast area as specified in 3GPP TS 23.003 [3] for service area identifier (SAI), and with the encoding as specified in 3GPP TS 29.061 [11];

c) <mbs-listening-status>, an element contains a string "listening" or "not-listening" used to indicate the MBS listening status; and

d) <mbs-reception-quality-level>, an optional element contains an integer used to indicate the reception quality level.

<mbs-session-join-notification> element contains the following sub-elements:

a) <VAL-identities>, an element contains the identity of the VAL user or VAL UE who wants to report the UE session join notification;

b) <mbs-session-id>, an element contains a string that identifies the MBS session;

c) <mbs-multicast-joining-status>, an element contains a string "broadcast" or "multicast"; and

d) <mbs-reception-quality-level>, an optional element contains an integer used to indicate the reception quality.

<mbs-resource-request> is an element used to include the multicast resource management requested information. The <mbs-resource-request> element contains the following sub-elements:

a) <requester-identity>, an element contains the identity of the VAL server performing the request;

b) <VAL-group-id>, an element contains the identity of the VAL group that the MBS session is requested for;

c) <service-announcement-mode>, an element contains a string used to indicate whether the request is sent by the SNRM-S or by the VAL server:

    The value "NRM-S" indicates the request is sent by the SNRM-S;

    The value "VAL-server" indicates the request is sent by the VAL server;

d) <QoS>, an element contains the requested QoS information for the MBS session; and

e) <mbs-service-areas>, an optional element specifying the serving MBS service area id where the MBS session is requested for.

7.6 MIME types

The MIME type for the VALInfo document shall be "application/vnd.3gpp.seal-info+xml MIME body".

The MIME type for the UnicastInfo document shall be "application/vnd.3gpp.seal-unicast-info+xml MIME body".

The MIME type for the MBMSInfo document shall be "application/vnd.3gpp.seal-mbms-usage-info+xml MIME body".

The MIME type for the NetworkQoSManagementInfo document shall be "application/vnd.3gpp.seal-network-QoS-management-info+xml MIME body".

The MIME type for the ApplicationCommunicationRequirementsInfo document shall be "application/vnd.3gpp.seal-app-comm-requirements-info+xml MIME body".

The MIME type for the SEALMBSUsageInfo document shall be "application/vnd.3gpp.seal-mbs-usage-info+xml MIME body".

Editor's note: The MIME types "application/vnd.3gpp.seal-app-comm-requirements-info+xml MIME body" and "application/vnd.3gpp.seal-mbs-usage-info+xml MIME body" need to be registered after the freezing of the Rel-18 version of this specifications.

7.7 IANA registration template

7.7.1 IANA registration template for VALInfo

Your Name:

<MCC name>

Your Email Address:

<MCC email address>

Media Type Name:

Application

Subtype name:

application/vnd.3gpp.seal-info+xml

Required parameters:

None

Optional parameters:

"charset" the parameter has identical semantics to the charset parameter of the "application/xml" media type as specified in section 9.1 of IETF RFC 7303.

Encoding considerations:

binary.

Security considerations:

Same as general security considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. In addition, this media type provides a format for exchanging information in SIP or in HTTP, so the security considerations from IETF RFC 3261 apply while exchanging information in SIP and the security considerations from IETF RFC 9110 apply while exchanging information in HTTP.

The information transported in this media type does not include active or executable content.

Mechanisms for privacy and integrity protection of protocol parameters exist. Those mechanisms as well as authentication and further security mechanisms are described in 3GPP TS 24.229.

This media type does not include provisions for directives that institute actions on a recipient's files or other resources.

This media type does not include provisions for directives that institute actions that, while not directly harmful to the recipient, may result in disclosure of information that either facilitates a subsequent attack or else violates a recipient's privacy in any way.

This media type does not employ compression.

Interoperability considerations:

Same as general interoperability considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. Any unknown XML elements and any unknown XML attributes are to be ignored by recipient of the MIME body.

Published specification:

3GPP TS 24.548 "Network Resource Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification" version 16.0.0, available via http://www.3gpp.org/specs/numbering.htm.

Applications which use this media type:

Applications supporting the SEAL network resource management as described in the published specification.

Fragment identifier considerations:

The handling in section 5 of IETF RFC 7303 applies.

Restrictions on usage:

None

Provisional registration? (standards tree only):

N/A

Additional information:

1. Deprecated alias names for this type: none

2. Magic number(s): none

3. File extension(s): none

4. Macintosh File Type Code(s): none

5. Object Identifier(s) or OID(s): none

Intended usage:

Common

Person to contact for further information:

- Name: <MCC name>

- Email: <MCC email address>

- Author/Change controller:

    i) Author: 3GPP CT1 Working Group/3GPP_TSG_CT_WG1@LIST.ETSI.ORG

    ii) Change controller: <MCC name>/<MCC email address>

7.7.2　IANA registration template for UnicastInfo

Your Name:

<MCC name>

Your Email Address:

<MCC email address>

Media Type Name:

Application

Subtype name:

application/vnd.3gpp.seal-unicast-info+xml

Required parameters:

None

Optional parameters:

"charset" the parameter has identical semantics to the charset parameter of the "application/xml" media type as specified in section 9.1 of IETF RFC 7303.

Encoding considerations:

binary.

Security considerations:

Same as general security considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. In addition, this media type provides a format for exchanging information in SIP or in HTTP, so the security considerations from IETF RFC 3261 apply while exchanging information in SIP and the security considerations from IETF RFC 9110 apply while exchanging information in HTTP.

The information transported in this media type does not include active or executable content.

Mechanisms for privacy and integrity protection of protocol parameters exist. Those mechanisms as well as authentication and further security mechanisms are described in 3GPP TS 24.229.

This media type does not include provisions for directives that institute actions on a recipient's files or other resources.

This media type does not include provisions for directives that institute actions that, while not directly harmful to the recipient, may result in disclosure of information that either facilitates a subsequent attack or else violates a recipient's privacy in any way.

This media type does not employ compression.

Interoperability considerations:

Same as general interoperability considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. Any unknown XML elements and any unknown XML attributes are to be ignored by recipient of the MIME body.

Published specification:

3GPP TS 24.548 "Network Resource Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification" version 16.0.0, available via http://www.3gpp.org/specs/numbering.htm.

Applications which use this media type:

Applications supporting the SEAL network resource management as described in the published specification.

Fragment identifier considerations:

The handling in section 5 of IETF RFC 7303 applies.

Restrictions on usage:

None

Provisional registration? (standards tree only):

N/A

Additional information:

1. Deprecated alias names for this type: none

2. Magic number(s): none

3. File extension(s): none

4. Macintosh File Type Code(s): none

5. Object Identifier(s) or OID(s): none

Intended usage:

Common

Person to contact for further information:

- Name: <MCC name>

- Email: <MCC email address>

-   Author/Change controller:

    i)   Author: 3GPP CT1 Working Group/3GPP_TSG_CT_WG1@LIST.ETSI.ORG

    ii) Change controller: <MCC name>/<MCC email address>

7.7.3   IANA registration template for MBMSInfo

Your Name:

<MCC name>

Your Email Address:

<MCC email address>

Media Type Name:

Application

Subtype name:

application/vnd.3gpp.seal-mbms-usage-info+xml

Required parameters:

None

Optional parameters:

"charset" the parameter has identical semantics to the charset parameter of the "application/xml" media type as specified in section 9.1 of IETF RFC 7303.

Encoding considerations:

binary.

Security considerations:

Same as general security considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. In addition, this media type provides a format for exchanging information in SIP or in HTTP, so the security considerations from IETF RFC 3261 apply while exchanging information in SIP and the security considerations from IETF RFC 9110 apply while exchanging information in HTTP.

The information transported in this media type does not include active or executable content.

Mechanisms for privacy and integrity protection of protocol parameters exist. Those mechanisms as well as authentication and further security mechanisms are described in 3GPP TS 24.229.

This media type does not include provisions for directives that institute actions on a recipient's files or other resources.

This media type does not include provisions for directives that institute actions that, while not directly harmful to the recipient, may result in disclosure of information that either facilitates a subsequent attack or else violates a recipient's privacy in any way.

This media type does not employ compression.

Interoperability considerations:

Same as general interoperability considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. Any unknown XML elements and any unknown XML attributes are to be ignored by recipient of the MIME body.

Published specification:

3GPP TS 24.548 "Network Resource Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification" version 16.0.0, available via http://www.3gpp.org/specs/numbering.htm.

Applications which use this media type:

Applications supporting the SEAL network resource management as described in the published specification.

Fragment identifier considerations:

The handling in section 5 of IETF RFC 7303 applies.

Restrictions on usage:

None

Provisional registration? (standards tree only):

N/A

Additional information:

1. Deprecated alias names for this type: none

2. Magic number(s): none

3. File extension(s): none

4. Macintosh File Type Code(s): none

5. Object Identifier(s) or OID(s): none

Intended usage:

Common

Person to contact for further information:

- Name: <MCC name>

- Email: <MCC email address>

- Author/Change controller:

    i) Author: 3GPP CT1 Working Group/3GPP_TSG_CT_WG1@LIST.ETSI.ORG

    ii) Change controller: <MCC name>/<MCC email address>

7.7.4 IANA registration template for NetworkQoSManagementInfo

Your Name:

<MCC name>

Your Email Address:

<MCC email address>

Media Type Name:

Application

Subtype name:

application/vnd.3gpp.seal-network-QoS-management-info +xml

Required parameters:

None

Optional parameters:

"charset" the parameter has identical semantics to the charset parameter of the "application/xml" media type as specified in section 9.1 of IETF RFC 7303.

Encoding considerations:

binary.

Security considerations:

Same as general security considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. In addition, this media type provides a format for exchanging information in SIP or in HTTP, so the security considerations from IETF RFC 3261 apply while exchanging information in SIP and the security considerations from IETF RFC 9110 apply while exchanging information in HTTP.

The information transported in this media type does not include active or executable content.

Mechanisms for privacy and integrity protection of protocol parameters exist. Those mechanisms as well as authentication and further security mechanisms are described in 3GPP TS 24.229.

This media type does not include provisions for directives that institute actions on a recipient's files or other resources.

This media type does not include provisions for directives that institute actions that, while not directly harmful to the recipient, may result in disclosure of information that either facilitates a subsequent attack or else violates a recipient's privacy in any way.

This media type does not employ compression.

Interoperability considerations:

Same as general interoperability considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. Any unknown XML elements and any unknown XML attributes are to be ignored by recipient of the MIME body.

Published specification:

3GPP TS 24.548 "Network Resource Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification" version 16.3.0, available via http://www.3gpp.org/specs/numbering.htm.

Applications which use this media type:

Applications supporting the SEAL network resource management as described in the published specification.

Fragment identifier considerations:

The handling in section 5 of IETF RFC 7303 applies.

Restrictions on usage:

None

Provisional registration? (standards tree only):

N/A

Additional information:

1. Deprecated alias names for this type: none

2. Magic number(s): none

3. File extension(s): none

4. Macintosh File Type Code(s): none

5. Object Identifier(s) or OID(s): none

Intended usage:

Common

Person to contact for further information:

- Name: <MCC name>

- Email: <MCC email address>

- Author/Change controller:

    i) Author: 3GPP CT1 Working Group/3GPP_TSG_CT_WG1@LIST.ETSI.ORG

    ii) Change controller: <MCC name>/<MCC email address>

7.7.5　IANA registration template for ApplicationCommunicationRequirementsInfo

Your Name:

<TS rapporteur name>

Your Email Address:

<TS rapporteur email address>

Media Type Name:

Application

Subtype name:

application/vnd.3gpp.seal-app-comm-requirements-info+xml

Required parameters:

None

Optional parameters:

"charset" the parameter has identical semantics to the charset parameter of the "application/xml" media type as specified in section 9.1 of IETF RFC 7303.

Encoding considerations:

binary.

Security considerations:

Same as general security considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. In addition, this media type provides a format for exchanging information in SIP or in HTTP, so the security considerations from IETF RFC 3261 apply while exchanging information in SIP and the security considerations from IETF RFC 9110 apply while exchanging information in HTTP.

The information transported in this media type does not include active or executable content.

Mechanisms for privacy and integrity protection of protocol parameters exist. Those mechanisms as well as authentication and further security mechanisms are described in 3GPP TS 24.229.

This media type does not include provisions for directives that institute actions on a recipient's files or other resources.

This media type does not include provisions for directives that institute actions that, while not directly harmful to the recipient, may result in disclosure of information that either facilitates a subsequent attack or else violates a recipient's privacy in any way.

This media type does not employ compression.

Interoperability considerations:

Same as general interoperability considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. Any unknown XML elements and any unknown XML attributes are to be ignored by recipient of the MIME body.

Published specification:

3GPP TS 24.548 "Network Resource Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification" version 18.5.0, available via http://www.3gpp.org/specs/numbering.htm.

Applications which use this media type:

Applications supporting the SEAL network resource management for the use of application coordinated UE-to-UE communication requirements management procedure as described in the published specification.

Fragment identifier considerations:

The handling in section 5 of IETF RFC 7303 applies.

Restrictions on usage:

None

Provisional registration? (standards tree only):

N/A

Additional information:

1. Deprecated alias names for this type: none

2. Magic number(s): none

3. File extension(s): none

4. Macintosh File Type Code(s): none

5. Object Identifier(s) or OID(s): none

Intended usage:

Common

Person to contact for further information:

- Name: <MCC name>

- Email: <MCC email address>

- Author/Change controller:

   i) Author: 3GPP CT1 Working Group/3GPP_TSG_CT_WG1@LIST.ETSI.ORG

   ii) Change controller: <MCC name>/<MCC email address>

7.7.6 IANA registration template for SEALMBSUsageInfo

Your Name:

<TS rapporteur name>

Your Email Address:

<TS rapporteur email address>

Media Type Name:

Application

Subtype name:

application/vnd.3gpp.seal-mbs-usage-info+xml

Required parameters:

None

Optional parameters:

"charset" the parameter has identical semantics to the charset parameter of the "application/xml" media type as specified in section 9.1 of IETF RFC 7303.

Encoding considerations:

binary.

Security considerations:

Same as general security considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. In addition, this media type provides a format for exchanging information in SIP or in HTTP, so the security considerations from IETF RFC 3261 apply while exchanging information in SIP and the security considerations from IETF RFC 9110 apply while exchanging information in HTTP.

The information transported in this media type does not include active or executable content.

Mechanisms for privacy and integrity protection of protocol parameters exist. Those mechanisms as well as authentication and further security mechanisms are described in 3GPP TS 24.229.

This media type does not include provisions for directives that institute actions on a recipient's files or other resources.

This media type does not include provisions for directives that institute actions that, while not directly harmful to the recipient, may result in disclosure of information that either facilitates a subsequent attack or else violates a recipient's privacy in any way.

This media type does not employ compression.

Interoperability considerations:

Same as general interoperability considerations for application/xml media type as specified in section 9.1 of IETF RFC 7303. Any unknown XML elements and any unknown XML attributes are to be ignored by recipient of the MIME body.

Published specification:

3GPP TS 24.548 "Network Resource Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification" version 18.5.0, available via http://www.3gpp.org/specs/numbering.htm.

Applications which use this media type:

Applications supporting the SEAL network resource management for the use of procedures for MBS (Multicast/Broadcast Services) bearers as described in the published specification.

Fragment identifier considerations:

The handling in section 5 of IETF RFC 7303 applies.

Restrictions on usage:

None

Provisional registration? (standards tree only):

N/A

Additional information:

   1. Deprecated alias names for this type: none

2. Magic number(s): none

3. File extension(s): none

4. Macintosh File Type Code(s): none

5. Object Identifier(s) or OID(s): none

Intended usage:

Common

Person to contact for further information:

- Name: <MCC name>

- Email: <MCC email address>

- Author/Change controller:

    i) Author: 3GPP CT1 Working Group/3GPP_TSG_CT_WG1@LIST.ETSI.ORG

    ii) Change controller: <MCC name>/<MCC email address>

Annex A (normative): CoAP resource representation and encoding

A.1 General

The information in this annex provides a normative description of CoAP resource representation and encoding.

The general rules for resource URI structure, cache usage, error handling, and common data types are described in clause C.1 of 3GPP TS 24.546 [31].

A.2 Resource representation and APIs for QoS session

A.2.1 SU_QosSessionManagement API

A.2.1.1 API URI

The CoAP URIs used in CoAP requests from SNRM-C towards the SNRM-S shall have the Resource URI structure as defined in clause C.1.1 of 3GPP TS 24.546 [31] with the following clarifications:

- The <apiName> shall be "su-nqs".

- The <apiVersion> shall be "v1".

- The <apiSpecificSuffixes> shall be set as described in clause A.2.1.2

A.2.1.2 Resources

A.2.1.2.1 Overview

{apiRoot}/su-nqs/<apiVersion>

/qos-sessions

/{qosSessionId}

/participants

/{participantId}
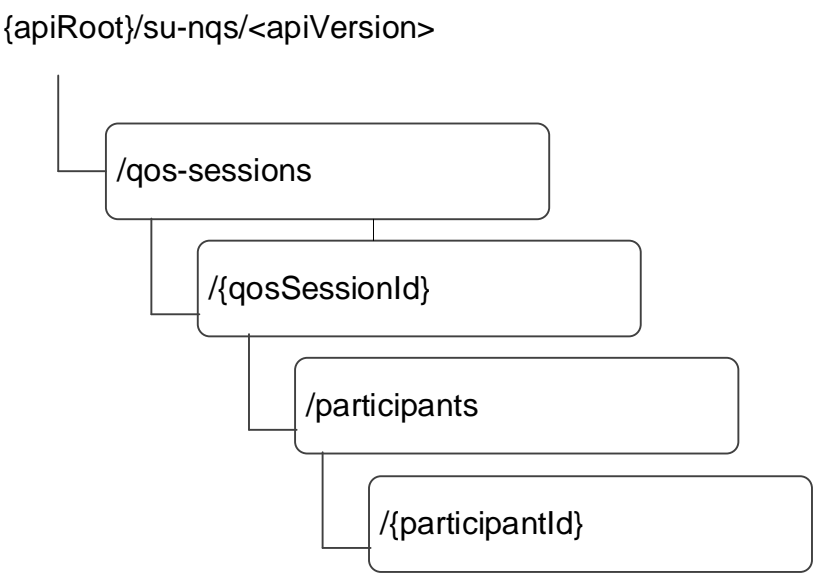
Figure A.2.1.2.1-1: Resource URI structure of the SU_QosSessionManagement API

Table A.2.1.2.1-1 provides an overview of the resources and applicable CoAP methods.

Table A.2.1.2.1-1: Resources and methods overview

Resource name	Resource URI	CoAP method	Description
QoS Sessions	/qos-sessions	POST	Create a new QoS session.
		GET	Retrieve QoS sessions according to the query parameters. If there are no query parameters, do not fetch any QoS session.
Individual QoS Session	/qos-sessions/{qosSessionId}	GET (NOTE)	Retrieve an individual QoS session information according to query parameter on the resource identified by {qosSessionId}. If there are no query parameter, fetch the whole QoS session resource identified by {qosSessionId}.
		PUT	Update an individual QoS session identified by {qosSessionId}.
		DELETE	Delete a QoS session identified by {qosSessionId}.
Individual QoS Session Participant	/qos-sessions/{qosSessionId}/participants/{participantId}	GET (NOTE)	Retrieve QoS session participant information according to the query parameters.
		PUT	Create or update QoS session participant information.
		DELETE	Delete QoS session participant information.
NOTE: The GET method can also be used to observe this resource.			

A.2.1.2.2   Resource: QoS Sessions

A.2.1.2.2.1   Description

The QoS Sessions resource represents all the QoS sessions that are created at a given SNRM-S, or allows to create a new QoS session.

A.2.1.2.2.2   Resource Definition

Resource URI: **{apiRoot}/su-nqs/<apiVersion>/qos-sessions**

This resource shall support the resource URI variables defined in the table A.2.1.2.2.2-1.

Table A.2.1.2.2.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See clause C.1.1 of 3GPP TS 24.546 [31].
apiVersion	string	See clause A.2.1.1

A.2.1.2.2.3   Resource Standard Methods

A.2.1.2.2.3.1   POST

This operation creates a QoS session at the SNRM-S.

This method shall support the request data structures specified in table A.2.1.2.2.3.1-1 and the response data structures and response codes specified in table A.2.1.2.2.3.1-2, and the response options specified in table A.2.1.2.2.3.1-3.

Table A.2.1.2.2.3.1-1: Data structures supported by the POST Request payload on this resource

Data type	P	Cardinality	Description
QosSession	M	1	Details of the QoS session that needs to be created,

Table A.2.1.2.2.3.1-2: Data structures supported by the POST Response payload on this resource

Data type	P	Cardinality	Response codes	Description
QosSession	M	1	2.01 Created	QoS session created successfully.
NOTE: The mandatory CoAP error status codes for the GET Request listed in table C.1.3-1 of 3GPP TS 24.546 [31] shall also apply..				

Table A.2.1.2.2.3.1-3: Options supported by the 2.01 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location-Path	string	M	1	Contains the location path of the newly created resource relative to the request URI. It contains the qosSessionId segment of the complete resource URI according to the structure: {apiRoot}/su-nqs/<apiVersion>/qos-sessions/{qosSessionId}

A.2.1.2.2.3.2   GET

This operation retrieves QoS sessions satisfying filter criteria.

This method shall support the URI query parameters specified in table A.2.1.2.2.3.2-1.

Table A.2.1.2.2.3.2-1: URI query parameters supported by the GET Request on this resource

Name	Data type	P	Cardinality	Description
qos-session-id	string	O	0..1	Identifies a QoS session.
val-service-id	string	O	0..1	Identifies a VAL service.
participant-id	ValTargetUe	O	0..1	Identifies a VAL user or VAL UE to match a QoS session participant.

This method shall support the request options specified in table A.2.1.2.2.3.2-2, the response data structures and response codes specified in table A.2.1.2.2.3.2-3, and the response options specified in table A.2.1.2.2.3.2-4.

Table A.2.1.2.2.3.2-2: Options supported by the GET Request on this resource

Name	Data type	P	Cardinality	Description
Observe	Uinteger	O	0..1	When set to 0 (Register) it extends the GET request to subscribe to the changes of this resource. When set to 1 (Deregister) it cancels the subscription.
NOTE: Other request options also apply in accordance with normal CoAP procedures.				

This method shall support the response data structures and response codes specified in table A.2.1.2.2.3.2 -3.

Table A.2.1.2.2.3.2-3: Data structures supported by the GET Response payload on this resource

Data type	P	Cardinality	Response codes	Description
array(QosSession)	M	0..N	2.05 Content	List of QoS sessions. This response shall include QoS sessions matching all the query parameters provided in the request.
NOTE: The mandatory CoAP error status codes for the GET method listed in table C.1.3-1 of 3GPP TS 24.546 [31] also apply.				

Table A.2.1.2.2.3.2-4: Options supported by the 2.05 Response Code on this resource

Name	Data type	P	Cardinality	Description
Observe	Uinteger	O	0..1	Sequence number of the notification.
NOTE: Other response options also apply in accordance with normal CoAP procedures.				

A.2.1.2.3 Resource: Individual QoS Session

A.2.1.2.3.1 Description

The Individual QoS Session resource represents an individual QoS session that is created at the SNRM-S.

A.2.1.2.3.2 Resource Definition

Resource URI: **{apiRoot}/su-nqs/<apiVersion>/qos-sessions/{qosSessionId}**

This resource shall support the resource URI variables defined in the table A.2.1.2.3.2-1.

Table A.2.1.2.3.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See clause C.1.1 of 3GPP TS 24.546 [31].
apiVersion	string	See clause A.2.1.1
qosSessionId	string	Represents an individual QoS session resource.

A.2.1.2.3.3 Resource Standard Methods

A.2.1.2.3.3.1 GET

This operation retrieves QoS session information satisfying filter criteria.

This method shall support the URI query parameters specified in table A.2.1.2.3.3.1-1.

Table A.2.1.2.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
session-participants	boolean	O	0..1	This is a content filtering flag. When set to "true", it indicates to the SNRM-S to include the participants of the QoS session. Set to "false" or omitted otherwise.
session-configuration	boolean	O	0..1	This is a content filtering flag. When set to "true", it indicates to the SNRM-S to include the configuration information of the QoS session. Set to "false" or omitted otherwise.

This method shall support the request options specified in table A.2.1.2.3.3.1-2, the response data structures and response codes specified in table A.2.1.2.3.3.1-3, and the response options specified in table A.2.1.2.3.3.1-4.

Table A.2.1.2.3.3.1-2: Options supported by the GET Request on this resource

Name	Data type	P	Cardinality	Description
Observe	Uinteger	O	0..1	When set to 0 (Register) it extends the GET request to subscribe to the changes of this resource. When set to 1 (Deregister) it cancels the subscription.
NOTE: Other request options also apply in accordance with normal CoAP procedures.				

Table A.2.1.2.3.3.1-3: Data structures supported by the GET Response payload on this resource

Data type	P	Cardinality	Response codes	Description
QosSession	M	1	2.05 Content	The QoS session information based on the request from the VAL server. This response shall include QoS session participants list if session-participants flag is set to "true" in the request, QoS session configuration information if the session-configuration flag is set to "true" in the request, or the whole QoS session resource if all the flags are omitted in the request.
NOTE: The mandatory CoAP error status codes for the GET method listed in table C.1.3-1 of 3GPP TS 24.546 [31] also apply.				

Table A.2.1.2.3.3.1-4: Options supported by the 2.05 Response Code on this resource

Name	Data type	P	Cardinality	Description
Observe	Uinteger	O	0..1	Sequence number of the notification.
NOTE: Other response options also apply in accordance with normal CoAP procedures.				

A.2.1.2.3.3.2 PUT

This operation updates the QoS session.

This method shall support the request data structures specified in table A.2.1.2.3.3.2-1 and the response data structures and response codes specified in table A.2.1.2.3.3.2-2.

Table A.2.1.2.3.3.2-1: Data structures supported by the PUT Request payload on this resource

Data type	P	Cardinality	Description
QosSession	M	1	Updated details of the QoS session.

Table A.2.1.2.3.3.2-2: Data structures supported by the PUT Response payload on this resource

Data type	P	Cardinality	Response codes	Description
QosSession	O	0..1	2.04 Changed	The QoS session updated successfully, and the updated QoS session may be returned in the response.
NOTE: The mandatory CoAP error status codes for the PUT method listed in table C.1.3-1 of 3GPP TS 24.546 [31] shall also apply.				

A.2.1.2.3.3.3 DELETE

This operation deletes the QoS session.

This method shall support the response data structures and response codes specified in table A.2.1.2.3.3.3-1.

Table A.2.1.2.3.3.3-1: Data structures supported by the DELETE Response payload on this resource

Data type	P	Cardinality	Response codes	Description
n/a			2.02 Deleted	The individual QoS session is deleted.
NOTE: The mandatory CoAP error status codes for the DELETE method listed in table C.1.3-1 1 of 3GPP TS 24.546 [31] shall also apply.				

A.2.1.2.4 Resource: Individual QoS Session Participant

A.2.1.2.4.1 Description

The Individual QoS Session Participant resource represents an individual QoS session participant information that is maintained at the SNRM-S.

A.2.1.2.4.2 Resource Definition

Resource URI: **{apiRoot}/su-nqs/<apiVersion>/qos-sessions/{qosSessionId}/participants/{participantId}**

This resource shall support the resource URI variables defined in the table A.2.1.2.4.2-1.

Table A.2.1.2.3.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See clause C.1.1 of 3GPP TS 24.546 [31]
apiVersion	string	See clause A.2.1.1.
qosSessionId	string	Represents an individual QoS session resource.
participantId	ValTargetUe	Identifies an individual QoS session participant.

A.2.1.2.4.3 Resource Standard Methods

A.2.1.2.4.3.1 GET

This operation retrieves the individual QoS session participant's information.

This method shall support the response data structures and response codes specified in table A.2.1.2.4.3.1-1.

Table A.2.1.2.4.3.1-1: Data structures supported by the GET Response payload on this resource

Data type	P	Cardinality	Response codes	Description
SessionParticipant	M	1	2.05 Content	The QoS session participant information.
NOTE: The mandatory CoAP error status codes for the GET method listed in table C.1.3-1 of 3GPP TS 24.546 [31] also apply.				

A.2.1.2.4.3.2 PUT

This operation creates or updates the QoS session participant information.

This method shall support the request data structures specified in table A.2.1.2.4.3.2-1 and the response data structures and response codes specified in table A.2.1.2.4.3.2-2.

Table A.2.1.2.4.3.2-1: Data structures supported by the PUT Request payload on this resource

Data type	P	Cardinality	Description
SessionParticipant	M	1	New or updated information of the QoS session participant.

Table A.2.1.2.4.3.2-2: Data structures supported by the PUT Response payload on this resource

Data type	P	Cardinality	Response codes	Description
SessionParticipant	O	0..1	2.01 Created	The QoS session participant resource was created successfully, and the created resource may be returned in the response.
SessionParticipant	O	0..1	2.04 Changed	The QoS session participant resource was updated successfully, and the updated resource may be returned in the response.
NOTE: The mandatory CoAP error status codes for the PUT method listed in table C.1.3-1 of 3GPP TS 24.546 [31] shall also apply.				

A.2.1.2.4.3.3   DELETE

This operation deletes the QoS session participant information.

This method shall support the response data structures and response codes specified in table A.2.1.2.4.3.3-1.

Table A.2.1.2.4.3.3-1: Data structures supported by the DELETE Response payload on this resource

Data type	P	Cardinality	Response codes	Description
n/a			2.02 Deleted	The QoS session participant resource is deleted.
NOTE: The mandatory CoAP error status codes for the DELETE method listed in table C.1.3-1 1 of 3GPP TS 24.546 [31] shall also apply.				

A.2.1.3   Data Model

A.2.1.3.1   General

This clause specifies the application data model supported by the API. Data types listed in clause C.1.4 of 3GPP TS 24.546 [31] apply to this API.

Table A.2.1.3.1-1 specifies the data types defined specifically for the SU_QosSessionManagement API service.

Table A.2.1.3.1-1: SU_QosSessionManagement API specific Data Types

Data type	Section defined	Description	Applicability
QosSession	A.2.1.3.2.2	QoS session details.	
SessionParticipant	A.2.1.3.2.3	Represents membership and configuration details of the QoS session participant.	
ParticipantState	A.2.1.3.2.4	Represents the state of the member in the group. E.g., an explicit member will register in the group by setting its "registered" attribute to "true", or will set that attribute to "false" when leaving the group.	

Table A.2.1.3.1-2 specifies data types re-used by the SU_QosSessionManagement API service.

Table A.2.1.3.1-2: Re-used Data Types

Data type	Reference	Comments	Applicability
GeographicalAreaId	3GPP TS 24.546 [31]	Identity of a geographical area.	
ScheduledCommunicationTime	3GPP TS 24.546 [31]	Represents a scheduled communication time.	
Uinteger	3GPP TS 24.546 [31]	Unsigned integer.	
Uri	3GPP TS 24.546 [31]	Unified resource identifier.	
ValTargetUe	3GPP TS 24.546 [31]	Used to identify either a VAL User or a VAL UE.	

A.2.1.3.2 Structured data types

A.2.1.3.2.1 Introduction

A.2.1.3.2.2 Type: QosSession

Table A.2.1.3.2.2-1: Definition of type QosSession

Attribute name	Data type	P	Cardinality	Description	Applicability
resUri	Uri	O	0..1	The URI for the individual QoS session resource. (NOTE)	
requiredQoS	string	M	1	End-to-end QoS requirements for the QoS session.	
participants	array(SessionParticipant)	M	1..N	List of participants of the QoS session.	
valServiceId	string	O	1..N	Identity of the VAL services enabled by the QoS session.	
serviceArea	array(GeographicalAreaId)	O	1..N	List of geographical area ids addressed by the QoS session.	
validPeriod	ScheduledCommunicationTime	O	0..1	Indicates time period when the QoS session is valid.	
reportConf	string	O	0..1	Reporting configuration for the active participants to report their QoS.	
NOTE: The "resUri" attribute is set by the SNRM-S and is not modifiable by the SNRM-C.					

A.2.1.3.2.3 Type: SessionParticipant

Table A.2.1.3.2.3-1: Definition of type SessionParticipant

Attribute name	Data type	P	Cardinality	Description	Applicability
resUri	Uri	O	0..1	The URI of the individual QoS session participant resource. (NOTE)	
id	ValTargetUe	M	1	This is a QoS session participant identity (VAL user ID or VAL UE ID) as per 3GPP TS 23.434 [2].	
state	ParticipantState	O	0..1	Indicates the current state of the participant of the QoS session, e.g. it may indicate that the participant is active. When absent the state is unknown.	
reportedQoS	string	O	0..1	QoS information reported by the participant.	
NOTE: The "resUri" attribute is set by the SNRM-S and is not modifiable by the SNRM-C.					

A.2.1.3.2.4 Type: ParticipantState

Table A.2.1.3.2.3-1: Definition of type ParticipantState

Attribute name	Data type	P	Cardinality	Description	Applicability
active	boolean	O	0..1	Indicates if the participant is active in the QoS session, i.e. is actively reporting its QoS. When absent or "false" the participant is not active.	

A.2.1.4 Error Handling

General error responses are defined in clause C.1.3 of 3GPP TS 24.546 [31].

A.2.1.5 CDDL Specification

A.2.1.5.1 Introduction

The data model described in clause A.2.1.3 shall be binary encoded in the CBOR format as described in IETF RFC 8949 [27].

Clause A.2.1.5.2 uses the Concise Data Definition Language described in IETF RFC 8610 [30] and provides corresponding representation of the SU_QosSessionManagement API data model.

A.2.1.5.2 CDDL document

```
;;; QosSession
;;+ Represents a QoS Session.
QosSession = {
 ? resUri: Uri
 requiredQoS: text              ; QoS requirements for the QoS Session.
 participants: [+ SessionParticipant]; The list of participants.
 ? valServiceId: text           ; VAL service enabled by the QoS Session.
 ? serviceArea: [+ GeographicalAreaId]; The list of geographical area ids addressed by the QoS
Session.
 ? validPeriod: ScheduledCommunicationTime
 ? reportConf: text             ; Reporting configuration for the active participants of the QoS
Session.
}

;;; SessionParticipant
;;+ Represents information of the QoS Session participant.
SessionParticipant = {
 ? resUri: Uri
 id: ValTargetUe               ; Identifies the participant of the QoS Session. Once set, this
information cannot be updated.
 ? state: ParticipantState
 ? reportedQoS: text           ; QoS information reported by the QoS Session participant.
}

;;; ParticipantState
;;+ Represents the state of the QoS Session participant.
ParticipantState = {
 ? active: bool
}

;;; GeographicalAreaId
;;+ Identifies a geographical area.
GeographicalAreaId = text

;;; ValTargetUe
;;+ Represents information identifying a VAL user ID or a VAL UE ID.
valUserId = {
 valUserId: text               ; Unique identifier of a VAL user.
}

valUeId = {
 valUeId: text                 ; Unique identifier of a VAL UE.
}

ValTargetUe = valUserId / valUeId

;;; DayOfWeek
;;+ integer between and including 1 and 7 denoting a weekday. 1 shall indicate Monday, and the
subsequent weekdays shall be indicated with the next higher numbers. 7 shall indicate Sunday.
DayOfWeek = 1..7

;;; TimeOfDay
;;+ String with format partial-time or full-time as defined in subclause 5.6 of IETF RFC 3339.
Examples, 20:15:00, 20:15:00-08:00 (for 8 hours behind UTC).
TimeOfDay = text

;;; ScheduledCommunicationTime
;;+ Represents an offered scheduled communication time.

ScheduledCommunicationTime = {
```

```
 ? daysOfWeek: [1*6 DayOfWeek]   ; Identifies the day(s) of the week. If absent, it indicates every
day of the week.
 ? timeOfDayStart: TimeOfDay
 ? timeOfDayEnd: TimeOfDay
}

;;; Uri
;;+ string providing an URI formatted according to IETF RFC 3986.
Uri = text
```

A.2.1.6 Media Types

See clause A.4.

A.2.1.7 Void

A.2.1.8 Void

A.3   Resource representation and APIs for MBMS resource configuration and monitoring

A.3.1   SU_MbmsResourceManagement API provided by SNRM-C

A.3.1.1   API URI

The CoAP URIs used in CoAP requests from SNRM-S towards the SNRM-C shall have the Resource URI structure as defined in Annex C.1.1 of 3GPP TS 24.546 [31] with the following clarifications:

- the <apiName> shall be "su-nmb-c";

- the <apiVersion> shall be "v1"; and

- the <apiSpecificSuffixes> shall be set as described in clause A.3.1.2.

A.3.1.2 Resources

A.3.1.2.1 Overview

{apiRoot}/su-nmb-c/<apiVersion>

/val-services

/{valServiceId}

/mbms-resources

/{tmgi}

/configuration

/state
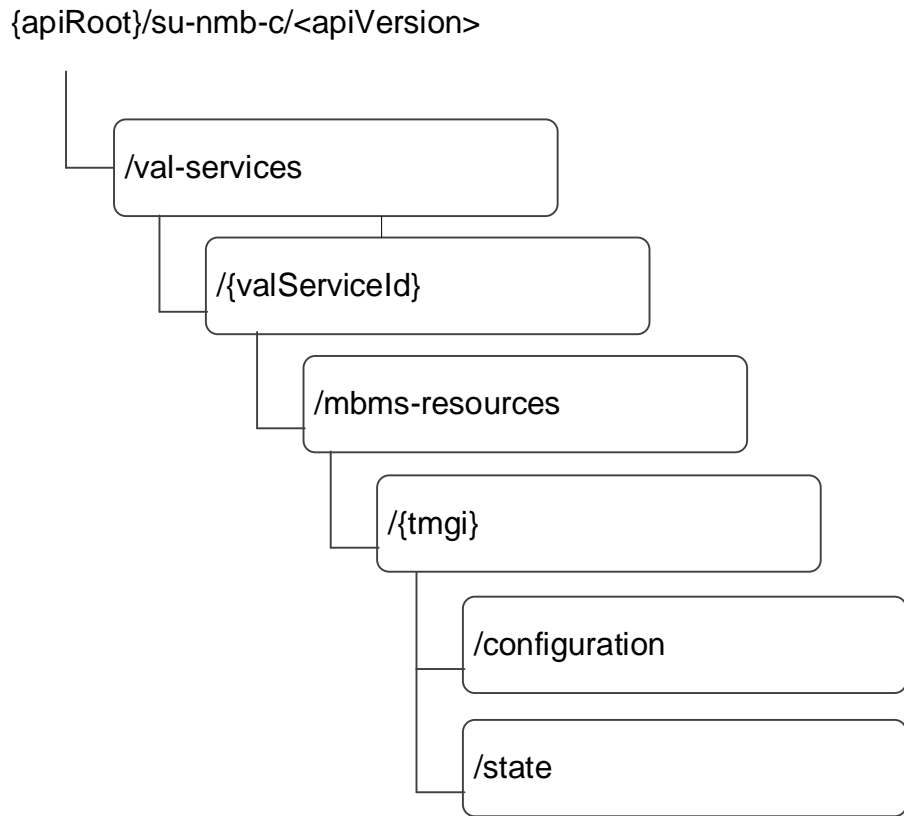
Figure A.3.1.2.1-1: Resource URI structure of the SU_MbmsResourceManagement API provided by SNRM-C

Table A.3.1.2.1-1 provides an overview of the resources and applicable CoAP methods.

Table A.3.1.2.1-1: Resources and methods overview

Resource name	Resource URI	CoAP method	Description
MBMS Resource Configuration	/val-services/{valServiceId}/mbms-resources/{tmgi}/configuration	GET	Retrieve MBMS Resource Configuration of the SNRM-C for a given VAL service and TMGI.
		PUT	Create or update MBMS Resource Configuration of the SNRM-C for a given VAL service and TMGI.
		DELETE	Delete MBMS Resource Configuration of the SNRM-C for a given VAL service and TMGI.
MBMS Resource State	/val-services/{valServiceId}/mbms-resources/{tmgi}/state	GET (NOTE)	Retrieve MBMS Resource State information for a given VAL service and TMGI.
NOTE: The GET method can also be used to observe this resource.			

A.3.1.2.2 Resource: MBMS Resource Configuration

A.3.1.2.2.1 Description

The MBMS resource configuration resource allows a SNRM-S to manage the MBMS resource configuration of a SNRM-C.

A.3.1.2.2.2 Resource Definition

Resource URI: **{apiRoot}/su-nmb-c/<apiVersion>/val-services/{valServiceId}/mbms-resources/{tmgi}/configuration**

This resource shall support the resource URI variables defined in the table A.3.1.2.2.2-1.

Table A.3.1.2.2.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See Annex C.1.1 of 3GPP TS 24.546 [31].
apiVersion	string	See clause A.3.1.1.
valServiceId	string	Identifier of a VAL service.
tmgi	bytes	Identifier of the MBMS resource (Temporary Mobile Group Identity).

A.3.1.2.2.3 Resource Standard Methods

A.3.1.2.2.3.1 GET

This operation retrieves the MBMS Resource Configuration.

This method shall support the response data structures and response codes specified in table A.3.1.2.2.3.1-1.

Table A.3.1.2.2.3.1-1: Data structures supported by the GET Response payload on this resource

Data type	P	Cardinality	Response codes	Description
MbmsResourceConfig	M	1	2.05 Content	The MBMS Resource Configuration information.
NOTE: The mandatory CoAP error status codes for the PUT method listed in table C.1.3-1 of 3GPP TS 24.546 [31] shall also apply.				

A.3.1.2.2.3.2 PUT

This operation creates and updates the MBMS Resource Configuration.

This method shall support the request data structures specified in table A.3.1.2.2.3.2-1 and the response data structures and response codes specified in table A.3.1.2.2.3.2-2.

Table A.3.1.2.2.3.2-1: Data structures supported by the PUT Request payload on this resource

Data type	P	Cardinality	Description
MbmsResourceConfig	M	1	Updated details of the MBMS Resource Configuration.

Table A.3.1.2.2.3.2-2: Data structures supported by the PUT Response payload on this resource

Data type	P	Cardinality	Response codes	Description
MbmsResourceConfig	M	1	2.01 Created	MBMS Resource Configuration created successfully.
MbmsResourceConfig	O	1	2.04 Changed	MBMS Resource Configuration updated successfully and the updated MBMS Resource Configuration may be returned in the response.
NOTE: The mandatory CoAP error status codes for the PUT method listed in table C.1.3-1 of 3GPP TS 24.546 [31] shall also apply.				

A.3.1.2.2.3.3 DELETE

This operation deletes the MBMS Resource Configuration.

This method shall support the response data structures and response codes specified in table A.3.1.2.2.3.3-1.

Table A.3.1.2.2.3.3-1: Data structures supported by the DELETE Response payload on this resource

Data type	P	Cardinality	Response codes	Description
n/a			2.02 Deleted	MBMS Resource Configuration is deleted.
NOTE: The mandatory CoAP error status codes for the DELETE method listed in table C.1.3-1 of 3GPP TS 24.546 [31] shall also apply.				

A.3.1.2.3 Resource: MBMS Resource State

A.3.1.2.3.1 Description

The MBMS Resource State resource allows the SNRM-S to retrieve and monitor the state of the MBMS Resource as seen by the SNRM-C.

A.3.1.2.3.2 Resource Definition

Resource URI: **{apiRoot}/su-nmb-c/<apiVersion>/val-services/{valServiceId}/mbms-resources/{tmgi}/state**

This resource shall support the resource URI variables defined in the table A.3.1.2.3.2-1.

Table A.3.1.2.3.2-1: Resource URI variables for this resource

Name	Data Type	Definition
apiRoot	string	See Annex C.1.1 of 3GPP TS 24.546 [31].
apiVersion	string	See clause A.3.1.1.
valServiceId	string	Identifier of a VAL service.
tmgi	bytes	Identifier of the MBMS resource (Temporary Mobile Group Identity).

A.3.1.2.3.3 Resource Standard Methods

A.3.1.2.3.3.1 GET

This operation retrieves the MBMS resource state information as seen by the SNRM-C.

This method shall support the request options specified in table A.3.1.2.3.3-1, the response data structures and response codes specified in table A.3.1.2.3.3-2, and the response options specified in table A.3.1.2.3.3-3.

Table A.3.1.2.3.3-1: Options supported by the GET Request on this resource

Name	Data type	P	Cardinality	Description
Observe	Uinteger	O	0..1	When set to 0 (Register) it extends the GET request to subscribe to the changes of this resource. When set to 1 (Deregister) it cancels the subscription.
NOTE: Other request options also apply in accordance with normal CoAP procedures.				

Table A.3.1.2.3.3-2: Data structures supported by the GET Response payload on this resource

Data type	P	Cardinality	Response codes	Description
MbmsResourceState	M	1	2.05 Content	MBMS resource state information at the SNRM-C.
NOTE: The mandatory CoAP error status codes for the GET method listed in table C.1.3-1 of 3GPP TS 24.546 [31] also apply.				

Table A.3.1.2.3.3-3: Options supported by the 2.05 Response Code on this resource

Name	Data type	P	Cardinality	Description
Observe	Uinteger	O	0..1	Sequence number of the notification.
NOTE: Other response options also apply in accordance with normal CoAP procedures.				

A.3.1.3 Data Model

A.3.1.3.1 General

This clause specifies the application data model supported by the API. Data types listed in clause C.1.4 of TS 24.546 [31] apply to this API.

Table A.3.1.3.1-1 specifies the data types defined specifically for the SU_MbmsResourceManagement API service.

Table A.2.1.3.1-1: SU_MbmsResourceManagement API specific Data Types

Data type	Section defined	Description	Applicability
MbmsResourceConfig	A.3.1.3.2.1	Represents the MBMS Resource configuration of the SNRM-C.	
MbmsResourceMonitoringConfig	A.3.1.3.2.2	Represents the MBMS Resource monitoring configuration of the SNRM-C, i.e. instructions for the SNRM-C what to monitor in relation to the MBMS resource.	
MbmsResourceState	A.3.1.3.2.3	Represents the current state of the MBMS Resource as monitored by the SNRM-C.	

Table A.3.1.3.1-2 specifies data types re-used by the SU_MbmsResourceManagement API service.

Table A.3.1.3.1-2: Re-used Data Types

Data type	Reference	Comments	Applicability
MbmsSaId	3GPP TS 24.546 [31]	String containing a unique identifier of a MBMS serving area.	
Tmgi	3GPP TS 24.546 [31]	Byte string containing an identifier of Temporary Mobile Group Identity used by the MBMS resource.	
Uinteger	3GPP TS 24.546 [31]	Unsigned integer.	

A.3.1.3.2   Structured data types

A.3.1.3.2.1   Type: MbmsResourceConfig

Table A.3.1.3.2.1-1: Definition of type MbmsResourceConfig

Attribute name	Data type	P	Cardinality	Description	Applicability
tmgi	Tmgi	M	1	TMGI for identifying the MBMS Resource.	
alternativeTmgis	Array(Tmgi)	O	0..1	A list of additional alternative TMGI used in roaming scenarios.	
qci	Uinteger	O	0..1	QCI information used by the ProSe UE-Network Relay to determine the ProSe Per-Packet Priority value to be applied for the multicast packets relayed to Remote UE over PC5. QCI values are defined in 3GPP TS 23.203 [4].	
frequency	Uinteger	O	0..1	Identification of frequency in case of multi carrier support. It is coded as specified in 3GPP TS 29.468 [13].	
serviceAreas	array(MbmsSaId)	O	0..N	List of MBMS service area identifiers.	
sdp	string	O	0..1	SDP with media and application control information applicable to groups that can use this MBMS bearer.	
rohcEnabled	boolean	O	0..1	Indicates if the flows delivered by the MBMS bearer are header compressed with ROHC as specified in IETF RFC 5795 [20] and IETF RFC 3095 [16].	
monitorConfig	MbmsResourceMonitoringConfig	O	0..1	Monitoring configuration for the SNRM-C.	

A.3.1.3.2.2   Type: MbmsResourceMonitoringConfig

Table A.3.1.3.2.2-1: Definition of type MbmsResourceMonitoringConfig

Attribute name	Data type	P	Cardinality	Description	Applicability
receptionQuality	boolean	O	0..1	Indicates if reception quality of the MBMS bearer is to be monitored.	
unicastResource	boolean	O	0..1	Indicates if the unicast resource related to the MBMS berare is to be monitored.	
suspension	boolean	O	0..1	Indicates if suspension state of the MBMS bearer is to be monitored.	

A.3.1.3.2.3 Type: MbmsResourceState

Table A.3.1.3.2.3-1: Definition of type MbmsResourceState

Attribute name	Data type	P	Cardinality	Description	Applicability
tmgi	Tmgi	M	1	Temprorary Mobile Group Identity for identifying the MBMS Resource.	
monitorConfig	MbmsResourceMonitoringConfig	M	1	MBMS Resource monitoring configuration of the SNRM-C.	
receptionQualityLevel	integer	O	0..1	Reception quality level measured for the MBMS bearer.	
suspendingState	boolean	O	0..1	Indicates if the MBMS bearer's intended suspension state: - "true" indicates that the RAN has decided to suspend the referenced MBMS bearer(s) at the beginning of the next MCCH modification period; - "false" indicates that the RAN has decided to revoke its decision to suspend the referenced MBMS bearer(s) before the beginning of the next MCCH modification period;	
unicastListeningState	boolean	O	0..1	Indicate the unicast listening status: - "true" indicates that the VAL UE is listening; - "false" indicates that the VAL UE is not listening;	

A.3.1.4 Error Handling

General error responses are defined in clause C.1.3 of 3GPP TS 24.546 [31].

A.3.1.5 CDDL Specification

A.3.1.5.1 Introduction

The data model described in clause A.3.1.3 shall be binary encoded in the CBOR format as described in IETF RFC 8949 [27].

Clause A.3.1.5.2 uses the Concise Data Definition Language described in IETF RFC 8610 [30] and provides corresponding representation of the SU_MbmsResourceManagement API provided by SNRM-C data model.

A.3.1.5.2 CDDL document

```
;;; MbmsResourceConfig
;;+ Represents MBMS resource configuration.
MbmsResourceConfig = {
 tmgi: Tmgi
 ? alternativeTmgis: [+ Tmgi]
 ? qci: Uinteger
 ? frequency: Uinteger
 ? serviceAreas: [+ MbmsSaId]
 ? sdp: text
 ? rohcEnabled: bool
 ? monitorConfig: MbmsResourceMonitoringConfig
}

;;; MbmsResourceMonitoringConfig
;;+ Represents MBMS resource monitoring configuration, i.e. instructions for the VAL UE what to
monitor in relation to the MBMS resource.
MbmsResourceMonitoringConfig = {
 ? receptionQuality: bool
 ? unicastResource: bool
 ? suspension: bool
}
```

```
;;; MbmsResourceState
;;+ Represents MBMS Resource state information as observed by the VAL UE.
MbmsResourceState = {
 tmgi: Tmgi
 monitoringConfig: MbmsResourceMonitoringConfig
 ? receptionQualityLevel: int
 ? suspendingState: bool
 ? unicastListeningState: bool
}

;;; MbmsSaId
;;+ Unique identifier of a MBMS serving area.
MbmsSaId = text

;;; Tmgi
;;+ Temporary Mobile Group Identity for use by MBMS.
Tmgi = bytes

;;; Uinteger
;;+ Unsigned Integer, i.e. only value 0 and integers above 0 are permissible.
Uinteger = int .ge 0
```

A.3.1.6   Media Types

See clause A.4.

A.3.1.7   Void

A.3.1.8   Void

A.4   Media types

A.4.1   General

This clause defines media types and its model that are applicable to APIs defined for CoAP resource representations in the present specification.

NOTE: Media types (formerly known as a multipurpose internet mail extensions (MIME) types) indicate the nature and format of a document, file, or assortment of bytes and are defined in IETF RFC 6838 [21A].

A.4.2   Media type structure and definition

The media type for the APIs defined for CoAP resource representations is "application/vnd.3gpp.seal-network-resource-info+cbor". This media type may be appended with a media type parameter to identify a particular data type, e.g., "application/vnd.3gpp.seal-network-resource-info+cbor;modeltype=qos-session", "application/vnd.3gpp.seal-location-info+cbor;modeltype=mbms-resource-config".

Editor's note(WI:eSEAL CR:0067):   The MIME type needs to be registered towards IANA.

Table A.4.2.1 lists the single media type for the APIs defined for CoAP resource representations with a required parameter to identify the defined data types.

Table A.4.2.1: Media type and parameter

Media type and paramter	Section used	Description
vnd.3gpp.seal-network-resource-info+cbor;modeltype=qos-session	6.2.4.2.3	The media type and parameter for a QoS session.
vnd.3gpp.seal-network-resource-info+cbor;modeltype=session-participant	6.2.4.3.3	The media type and parameter for a QoS session participant information.
vnd.3gpp.seal-network-resource-info+cbor;modeltype=mbms-resource-config	6.2.3.2.4, 6.2.3.3.1, 6.2.3.3.4.1, 6.2.3.6.4, 6.2.3.10.1	The media type and parameter for an MBMS resource configuration.
vnd.3gpp.seal-network-resource-info+cbor;modeltype=mbms-resource-state	6.2.3.4.3, 6.2.3.6.3	The media type and parameter for an MBMS resource state.

A.4.3 Media type registration template for application/vnd.3gpp.seal-location-info+cbor

Type name: application

Subtype name: vnd.3gpp.seal-network-resource-info+cbor

Required parameters: none

Optional parameters: modeltype.

The "modetype" parameter identifies a specific data type, e.g, "vnd.3gpp.seal-network-resource-info+cbor;modeltype=qos-session" where "quo-session" indicates the "QoSSession" data type in 3GPP TS 24.548 clause A.2.1.3.2.2.

Encoding considerations: Must be encoded as using IETF RFC 8949 [20]. See data types defined in 3GPP TS 24.548 clause A.2 and A.3 for details. Clause A.4 provides the media type structure and definition.

Security considerations: See Section 10 of IETF RFC 8949 [20] and Section 11 of IETF RFC 7252 [14].

Interoperability considerations: Applications must ignore any key-value pairs that they do not understand. This allows backwards-compatible extensions to this specification.

Published specification: 3GPP TS 24.548 "Network Resource Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specificatio", available via http://www.3gpp.org/specs/numbering.htm.

Applications that use this media type: Applications supporting the SEAL network resource management procedures as described in the published specification.

Fragment identifier considerations: Fragment identification is the same as specified for "application/cbor" media type in IETF RFC 8949 [20]. Note that currently that RFC does not define fragmentation identification syntax for "application/cbor".

Additional information:

    Deprecated alias names for this type: N/A

    Magic number(s): N/A

    File extension(s): none

    Macintosh file type code(s): none

Person & email address to contact for further information: <MCC name>, <MCC email address>

Intended usage: COMMON

Restrictions on usage: None

Author: 3GPP CT1 Working Group/3GPP_TSG_CT_WG1@LIST.ETSI.ORG

Change controller: <MCC name>/<MCC email address>

Annex B (informative):
Change history

Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
Change history								
2019-10	CT1#120	C1-196358				Draft skeleton provided by the rapporteur.	0.0.0
2019-10	CT1#120					Implementing the following p-CRs agreed by CT1: C1-196361, C1-196615, C1-196616, C1-196858	0.1.0
2019-11	CT1#121					Implementing the following p-CRs agreed by CT1: C1-198610, C1-198611, C1-198612, C1-198819 Corrections done by the rapporteur.	0.2.0
2020-03	CT1#122-e					Implementing the following p-CRs agreed by CT1: C1-200527, C1-200615, C1-200616, C1-200881, C1-200882, C1-200904 Corrections done by the rapporteur.	0.3.0
2020-03	CT-87e	CP-200172				Presentation to TSG CT for information	
2020-04	CT1#123-e					Implementing the following p-CRs agreed by CT1: C1-202297, C1-202299, C1-202301, C1-202305, C1-202312, C1-202313, C1-202314, C1-202715, C1-202716, C1-202718, C1-202719, C1-202720, C1-202721, C1-202722, C1-202723, C1-202724, C1-202725, C1-202726, C1-202727, C1-202770, C1-202772 Corrections done by the rapporteur.	1.1.0
2020-06	CT1#124-e					Implementing the following p-CRs agreed by CT1: C1-203565, C1-203566, C1-203567, C1-204065, C1-204066, C1-204067, C1-204068, C1-204069, C1-204070, C1-204071 Corrections done by the rapporteur.	1.2.0
2020-06	CT-88e					Presentation to TSG CT for approval	2.0.0
2020-06	CT-88e					Version 16.0.0 created after approval	16.0.0
2020-09	CT-89e	CP-202163	0001		F	Miscellaneous editorial corrections	16.1.0
2020-09	CT-89e	CP-202163	0002		F	Correction to identity element of MBMS bearers request	16.1.0
2020-09	CT-89e	CP-202163	0003	1	F	Updates to MBMS bear quality detection procedure	16.1.0
2020-09	CT-89e	CP-202163	0004	1	F	Updates to user plane delivery mode	16.1.0
2020-12	CT-90e	CP-203210	0005		F	Remove the protection type in the XML schema	16.2.0
2020-12	CT-90e	CP-203210	0006	1	F	Correction of SNRM-C requirements	16.2.0
2021-03	CT-91e	CP-210111	0008		F	Resolution of editor's note under clause 7	16.3.0
2021-12	CT-94e	CP-213052	0009	1	B	Procedure for network assisted QoS management	17.0.0
2021-12	CT-94e	CP-213052	0010	-	B	Info document for network assisted QoS management	17.0.0
2021-12	CT-94e	CP-213052	0011	-	B	IANA registration for NetworkQoSManagementInfo	17.0.0
2021-12	CT-94e	CP-213052	0012	1	B	XML schema and MIME type for network assisted QoS management	17.0.0
2021-12	CT-94e	CP-213031	0013	-	B	Reference update for HTTP/1.1 protocol	17.0.0
2022-06	CT-96	CP-221217	0014	-	B	Addition of Functional entities for CoAP	17.1.0
2022-06	CT-96	CP-221217	0015	-	B	Addition of Authenticated identity for CoAP	17.1.0
2022-06	CT-96	CP-221217	0016	-	B	Addition of CoAP for Network assisted QoS management provisioning	17.1.0
2022-06	CT-96	CP-221217	0017	-	B	Addition of CoAP for Network assisted QoS management initiation	17.1.0
2022-06	CT-96	CP-221217	0018	-	B	Addition of CoAP resource representation and encoding annex	17.1.0
2022-09	CT-97e	CP-222150	0021	-	B	Addition of CoAP for MBMS bearer announcement over MBMS bearer procedure	17.2.0
2022-09	CT-97e	CP-222150	0019	1	F	Minor corrections	17.2.0
2022-09	CT-97e	CP-222150	0020	1	B	Addition of CoAP for use of pre-established MBMS bearers procedure	17.2.0
2022-09	CT-97e	CP-222150	0022	-	B	Addition of CoAP for MBMS bearer quality detection procedure	17.2.0
2022-09	CT-97e	CP-222150	0023	-	B	Addition of CoAP for Service continuity in MBMS scenarios	17.2.0
2022-09	CT-97e	CP-222150	0024	-	B	Addition of CoAP for MBMS suspension notification procedure	17.2.0
2022-09	CT-97e	CP-222150	0025	-	B	Addition of CoAP for Switching between MBMS bearer bearer and unicast bearer procedure	17.2.0
2022-09	CT-97e	CP-222150	0026	-	B	Addition of CoAP for Use of dynamic MBMS bearers procedure	17.2.0
2022-09	CT-97e	CP-222150	0027	1	B	Addition of resource representation and API annex	17.2.0
2022-12	CT-98e	CP-223123	0028	1	F	Update usages of MBMS XML schema.	17.3.0
2022-12	CT-98e	CP-223123	0029	1	F	Update usages of TMGI XML element	17.3.0
2022-12	CT-98e	CP-223123	0030	1	F	Resolution of editor's note in A.2.1.2.1	17.3.0
2022-12	CT-98e	CP-223123	0031	1	F	Resolution of editor's note in A.2.1.6 and A.3.1.6	17.3.0
2022-12	CT-98e	CP-223123	0033	2	F	Update incorrect reference numbers	17.3.0
2023-03	CT-99	CP-230233	0037	1	F	Reference update: RFC 9177 and OMA-TS-XDM_Core-V2_1	17.4.0
2023-03	CT-99	CP-230248	0036	1	A	XML schema corrections	17.4.0
2023-03	CT-99	CP-230220	0038	1	F	Cleanup corrections of TS 24.548	18.0.0
2023-03	CT-99	CP-230220	0040	2	D	Editorials	18.0.0
2023-03	CT-99					Editorial Corrections	18.0.1
2023-03	CT-100	CP-231242	0042	-	A	Correction to the application/vnd.3gpp.seal-network-QoS-managment-info+xml media type	18.1.0
2023-12	CT-102	CP-233190	0044	1	F	Update to the obsoleted IETF HTTP RFCs	18.2.0
2023-12	CT-102	CP-233183	0045	1	B	Introduction of general support for 5MBS	18.2.0
2024-03	CT-103	CP-240125	0047	1	F	Correction to wrong element for network assisted QoS management provisioning procedure	18.3.0

2024-03	CT-103	CP-240125	0051	1	F	Missing text under clause 6.1	18.3.0
2024-03	CT-103	CP-240122	0048	2	B	General on the MBS session creation and MBS session announcement procedure	18.3.0
2024-06	CT-104	CP-241195	0052	1	F	Correction on use of and/or term	18.4.0
2024-06	CT-104	CP-241195	0057	-	F	Correction to XML schemas	18.4.0
2024-06	CT-104	CP-241196	0054	1	B	Procedure to share MBS Listening status report.	18.4.0
2024-06	CT-104	CP-241196	0056	1	B	Application coordinated UE-to-UE communication requirements management.	18.4.0
2024-06	CT-104	CP-241196	0053	2	B	Procedure to share MBS session announcement and de-announcement.	18.4.0
2024-06	CT-104	CP-241196	0055	2	B	Procedure to share UE session join notification for MBS session.	18.4.0
2024-09	CT-105	CP-242195	0058	1	F	Missing IANA registration template for new MIME types	18.5.0
2024-09	CT-105	CP-242195	0059	1	F	Correction to the data semantics clause	18.5.0
2024-09	CT-105	CP-242195	0061	1	F	SNRM-C handling SIP based MBS session announcement procedure	18.5.0
2024-09	CT-105	CP-242195	0062	1	F	SNRM-S sending SIP based MBS session announcement procedure	18.5.0
2024-09	CT-105	CP-242195	0063	1	F	SIP procedure for MBS listening status report	18.5.0
2024-09	CT-105	CP-242195	0064	1	F	SIP procedure for MBS UE session join notification	18.5.0
2024-09	CT-105	CP-242195	0060	2	F	Corrections to MBS procedures	18.5.0
2024-09	CT-105	CP-242199	0065	2	F	Correction to XML schema for application/vnd.3gpp.seal-unicast-info+xml	18.5.0
2025-03	CT#107	CP-250151	0067	2	A	Update of MIME types for CBOR payload	18.6.0
2025-03	CT#107	CP-250186	0068	1	F	Corrections to XML elements and reference.	18.6.0
2025-06	CT#108	CP-251193	0075	3	A	Correction to the XML schema on <anyExt> elements	18.7.0
2025-06	CT#108	CP-251193	0071	1	A	Correction to the XML schema on element names	18.7.0
2025-06	CT#108					Editorial corrections	18.7.1

History

Document history		
V18.3.0	May 2024	Publication
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