# ETSI TS 124 538 V18.7.0 (2025-07)

**TECHNICAL SPECIFICATION**

5G;
Enabling MSGin5G Service;
Protocol specification
(3GPP TS 24.538 version 18.7.0 Release 18)

Reference

RTS/TSGC-0124538vi70

Keywords

5G

*ETSI*

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# Modal verbs terminology

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).

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1   presented to TSG for information;

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

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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 supporting MSGin5G services as specified in 3GPP TS 23.554 [2] for:

1. communication between the MSGin5G UE and the MSGin5G Server over the MSGin5G-1 interface;

2. communication between the Application Client and the MSGin5G Client over the MSGin5G-5 interfaces; and

3. communication between the MSGin5G Client residing on the Constrained UE  and the MSGin5G Gateway Client over the MSGin5G-6 interfaces.

The present specification defines the usage and interactions of the MSGin5G Service with SEAL services.

The present specification also defines the message format, message contents, error handling and system parameters applied by the protocols for the MSGin5G Service.

# 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 23.554: "Application architecture for MSGin5G Service; Stage 2;".

[3]         3GPP TS 23.434: "Service Enabler Architecture Layer for Verticals".

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

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

[6]         3GPP TS 24.546: "Configuration management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[7]         3GPP TS 29.538: "Enabling MSGin5G Service; Application Programming Interfaces (API) specification; Stage 3".

[8]         JSON Schema: " JSON Schema Draft-07", http://json-schema.org/specification.html

[9]         3GPP TS 23.304: "Proximity based Services (ProSe) in the 5G System (5GS)".

[10]        3GPP TS 24.544: "Group Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[11]        3GPP TS 24.545: "Location Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[12]        3GPP TS 24.546: "Configuration Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[13]        3GPP TS 24.547: "Identity Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[14]        3GPP TS 24.548: "Network Resource Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[15]        3GPP TS 24.007: "Mobile radio interface signalling layer 3; General Aspects".

[16]        3GPP TS 33.501: "Security architecture and procedures for 5G system".

[17]        3GPP TS 23.502: " Procedures for the 5G System; Stage 2"

[18]        3GPP TS 23.003: "Numbering, addressing and identification".

[19]        IETF RFC 4122: "A Universally Unique IDentifier (UUID) URN Namespace".

[20]        3GPP TS 29.641: "3GPP registry for Service Names and Port Numbers".

[21]        3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".

[22]        3GPP TS 23.433: "Service Enabler Architecture Layer for Verticals (SEAL); Data Delivery enabler for vertical applications".

[23]        3GPP TS 24.543: "Data Delivery Management - Service Enabler Architecture Layer for Verticals (SEAL); Protocol specification".

[24]        3GPP TS 33.535: "Authentication and Key Management for Applications (AKMA) based on 3GPP credentials in the 5G System (5GS)".

# 3        Definitions of terms, symbols 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].

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.554 [2] apply:

**Application Client**
**Broadcast Area**
**Messaging Topic**
**MSGin5G Client**
**MSGin5G Gateway Client**
**MSGin5G Gateway UE**
**MSGin5G Group**
**MSGin5G Service**
**MSGin5G Server**
**MSGin5G UE**
**Non-3GPP UE**
**Non-MSGin5G UE**
**Constrained UE**

## 3.2        Symbols

For the purposes of the present document, the following symbols apply:

<symbol>        <Explanation>

## 3.3 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].

| | |
|---|---|
| AF | Application Function |
| AS | Application Server |
| CAPIF | Common API Framework for northbound APIs |
| CoAP | Constrained Application Protocol |
| NIDD | Non IP Data Delivery |
| SCEF | Service Capability Exposure Function |
| SCS | Service Capability Server |
| SEAL | Service Enabler Architecture Layer for Verticals |
| SEALDD | SEAL Data Delivery |
| SDDM | SEAL Data Delivery Management |
| SDDM-C | SEAL Data Delivery Management Client |
| SDDM-S | SEAL Data Delivery Management Server |

# 4 General description

The MSGin5G Service (message service for MIoT over 5G System) is basically designed and optimized for massive IoT device communication including thing-to-thing communication and person-to-thing communication. The MSGin5G Service provides messaging communication capability in 5GS including the following message communication models:

a) Point-to-Point message;

b) Application-to-Point message/ Point-to-Application message;

c) Group message; and

d) Broadcast message.

The MSGin5G Service support the message exchanging between the following UE types:

a) MSGin5G UE:

   1) light weight Constrained UEs (e.g. sensors, actuators) and

   2) Unconstrained UEs with advanced capabilities (e.g. washing machine, micro-ovens);

b) Legacy 3GPP UE; and

c) Non-3GPP UE.

MSGin5G Service also provides the following capabilities to enhance the message delivery for all message communication models:

- MSGin5G Store and Forward;

- Message delivery based on Messaging Topic;

- Message Aggregation;

- Message Segmentation and Reassembly; and

- Usage of Network Capabilities including UE reachability status monitoring and MSGin5G device triggering.

The MSGin5G Client contained in the MSGin5G UE communicates with the MSGin5G Server over the MSGin5G-1 reference point (see 3GPP TS 23.554 [2]). CoAP specified in IETF RFC 7252 [5] is used as the basic transport protocol of MSGin5G service in this reference point and shall be supported by the MSGin5G Client and MSGin5G Server.

An MSGin5G Client may reside in a Constrained UE which cannot connect to the 3GPP network directly for message exchange with MSGin5G Server (e.g. the Constrained UE is out of 3GPP RAN coverage, with or without authorization

to use UE-to-Network relay). If allowed by configuration, the MSGin5G Client residing in a Constrained UE can use the options listed below to communicate with the MSGin5G Server:

- the MSGin5G Client residing in a Constrained UE uses another UE as UE-to-Network relay. In this scenario, the MSGin5G Client residing on the Constrained UE communicates with the MSGin5G Server over the MSGin5G-1 reference point (see 3GPP TS 23.554 [2]); or

- the MSGin5G Client residing in a Constrained UE interacts with an MSGin5G Gateway UE which supports MSGin5G Gateway Client. The MSGin5G Gateway UE provides access to multiple Constrained UEs to connect to the 3GPP network for MSGin5G services. In this scenario, the MSGin5G Client residing in the Constrained UE communicates with the MSGin5G Gateway Client residing on the MSGin5G Gateway UE over the MSGin5G-6 reference point (see 3GPP TS 23.554 [2]) for sending and receiving MSGin5G messages. The transport protocols of MSGin5G-6 reference point is also based on CoAP specified in IETF RFC 7252 [5].

An Application Client may reside on the same UE with the MSGin5G Client or reside on a different UE. The Application Client communicates with the MSGin5G Client over the MSGin5G-5 reference point (see 3GPP TS 23.554 [2]).

Additionally, the MSGin5G Client(s) may interact with SEAL Clients over the SEAL-C reference point specified for each SEAL service as specified in 3GPP TS 23.434 [3]. The MSGin5G Server(s) may interact with SEAL Servers over the SEAL-S reference point specified for each SEAL service as specified in 3GPP TS 23.434 [3]. The interaction between a SEAL Client and the corresponding SEAL Server is supported by SEAL-UU reference point specified for each SEAL service as specified in 3GPP TS 23.434 [3].

By means of using the MSGin5G-1 reference point, the following aspects can be provided:

a) MSGin5G UE registration and de-registration towards the MSGin5G Server;

b) MSGin5G message delivery and MSGin5G message delivery status report;

c) Messaging Topic Subscription and Unsubscription; and

d) MSGin5G UE bulk registration and bulk de-registration towards the MSGin5G Server.

By means of using the MSGin5G-5 reference point, the following aspects can be provided:

a) Application Client registration and de-registration towards the MSGin5GClient; and

b) The exchanging of message and message delivery status report between the Application Client and the MSGin5G Server by using MSGin5G Client.

By means of using MSGin5G-6 reference point, the following aspects can be provided:

a) Constrained UE registration and de-registration towards the MSGin5G Server by using MSGin5G Gateway UE;

b) The exchanging of MSGin5G message and MSGin5G message delivery status report between Constrained UE and MSGin5G Server by using MSGin5G Gateway UE; and

c) The bulk registration and de-registration procedures from multiple Constrained UEs towards the MSGin5G Server by using MSGin5G Gateway UE.

The necessary 5GC Network Capabilities, e.g. device triggering, may be used in MSGin5G Service as specified in 3GPP TS 23.554 [2]. The device trigger is delivered to the MSGin5G Client via SCEF/NEF and the Core Network as specified in 3GPP TS 23.502 [17] and is out of scope of this document.

The authentication between the MSGin5G Client and the MSGin5G Server shall be based on DTLS with AKMA as specified in Annex C of 3GPP TS 33.535 [24].

# 5          Functional entities

## 5.1          MSGin5G Client

### 5.1.1          General functionalities of MSGin5G Client

An MSGin5G Client acts as client-side functionality for MSGin5G UE configuration, registration and message delivery.

The functionalities of MSGin5G Client include:

 a)  supporting registration to an MSGin5G Server;

 b)  supporting configuration required to use MSGin5G Service;

 c)  constructing MSGin5G message when:

   1)  requested by an Application Client resides on the same MSGin5G UE or;

   2)  requested by the Application Client resides on another UE without MSGin5G Client;

 d)  delivering MSGin5G message payload to the targeted Application Client;

   1)  directly when the Application Client resides on the same MSGin5G UE or;

   2)  over MSGin5G-5 reference point when the Application Client resides on another UE without MSGin5G Client by acting as a gateway;

 e)  exchanging MSGin5G messages with an MSGin5G Server; and

 f)  supporting MSGin5G message aggregation and segmentation according to service provider's policy.

### 5.1.2          MSGin5G Gateway Client

An MSGin5G Gateway Client is an MSGin5G Client which supports MSGin5G Gateway service functionality in additional to the MSGin5G Client functionalities specified in clause 5.1.1. It enables constrained devices to obtain services from the MSGin5G Server when communications via ProSe UE-to-Network Relay are not or cannot be supported.

The MSGin5G Gateway service functionality in the MSGin5G Gateway Client supports the bulk configuration and bulk (de-)registration for the MSGin5G Client residing on the Constrained UE, e.g. checking whether bulk configuration/bulk (de-)registration can be used, holding the (de-)registration request from MSGin5G Client residing on the constrained device, construction of the bulk (de-)registration request and splits of the MSGin5G UE bulk (de-)registration response, etc.

## 5.2          MSGin5G Server

An MSGin5G Server functional entity provides server-side functionality for configuration, registration and message delivery.

The following functionalities of MSGin5G Server need to be considered in current document:

 a)  exchanging MSGin5G messages with MSGin5G Client;

 b)  routing MSGin5G messages based on UE Service ID;

 c)  supporting transport level protocol selection and conversion for exchanging MSGin5G messages with MSGin5G UE;

 d)  to resolve the MSGin5G Group Service ID to determine the members of the Group specified in 3GPP TS 23.434 [3];

e) supporting MSGin5G message aggregation and segmentation according to service provider's policy;

f) supporting MSGin5G UE configuration procedures as specified in 3GPP TS 23.434 [3] and 3GPP TS 24.546 [6] or communicating with the SEAL Configuration Management Server to provide MSGin5G configuration data on a UE to be ready for the MSGin5G Service; and

g) managing MSGin5G UE information related to the MSGin5G Service, such as MSGin5G Client availability.

# 6 MSGin5G Procedures

## 6.1 General

In clause 6, the detailed behaviors of the MSGin5G UE, the MSGin5G Server and Constrained UE during the MSGin5G procedures are described.

Depending on communication over different MSGin5G interfaces, different MSGin5G procedures are supported as:

a) For the communication between the MSGin5G Client on MSGin5G UE and the MSGin5G Server over the MSGin5G-1 interface, the following procedures are involved:

1) Configuration, including bulk configuration;

2) Registration and de-registration, including bulk registration and bulk de-registration;

3) MSGin5G message delivery including sending and receiving MSGin5G message, aggregated MSGin5G message, MSGin5G message delivery status report and aggregated MSGin5G message delivery status report.

4) MSGin5G message segment and reassembly; and

5) Messaging topic subscription.

b) For the communication between the Application Client(may resides on the same UE with the MSGin5G Client or reside on a different UE) and the MSGin5G Client on MSGin5G UE over the MSGin5G-5 interfaces, the following procedures are involved:

1) Application Registration; and

2) Message delivery information including construct MSGin5G message information, route information and notifications information.

c) For the communication between the Constrained UE and the MSGin5G Gateway UE over the MSGin5G-6 interfaces, the following procedures are involved:

1) Bulk configuration;

2) Bulk registration and de-registration; and

3) Registration to gateway services.

The constrained UE which does not connect to the 3GPP network directly could exchange messages with MSGin5G Server using a Relay UE.

For procedures used for bullet a) and bullet c), CoAP specified in IETF RFC 7252 [5] is used as the basic transport protocol. The messages defined for bullet a) and bullet c) use CoAP requests/responses as specified in IETF RFC 7252 [5]. The field in the headers of the CoAP messages in clause 6 are set as following:

a) The "T" field in the header of CoAP request to indicate whether acknowledgement is required. Thus if it needs a CoAP response (e.g. CoAP 2.01 (Created) response or CoAP 2.04 (Change) response) for a CoAP request, the "T" field in the header of CoAP request is set to "0" and the "T" field in the hearder of the CoAP response is set to "2". The "Message ID" field in the header of CoAP response is set to the same value with that of the corresponding CoAP request. The "Token" fields in the header of CoAP response should be set to the same value with that of the corresponding CoAP request.

   b)  If a CoAP request is generated to match another CoAP request, the "Token" field in the header of the CoAP request is set to the same value with that of the matched CoAP request.

For procedures used for bullet b), guidance on definitions of the message format and information elements are described in Annex A.

The authorization of MSGin5G Client by the MSGin5G Server is performed by verifying the UE service ID as specified in Annex Y of TS 33.501 [16].

# 6.2 Configuration

## 6.2.1 MSGin5G UE Configuration

### 6.2.1.1 General

MSGin5G UE Configuration is based on the configuration management functionality specified in TS 23.434 [3] and TS 24.546 [6].

### 6.2.1.2 Procedure at MSGin5G Client

The MSGin5G UE should support the configuration management client functionality as specified in 3GPP TS 24.546 [6]. The configuration management client functionality may be collocated with MSGin5G Client or it can be separated with MSGin5G Client as per 3GPP TS 23.554 [2].

If the configuration management client functionality is not collocated with the MSGin5G Client, the MSGin5G Client should use SEAL-C interface to interact with configuration management client functionality for MSGin5G UE configuration.

The MSGin5G UE configuration procedures at the configuration management client functionality are based on the procedures in clause 6.2.3.3 of 3GPP TS 24.546 [6], in the procedures:

   a)  the configuration management client functionality on the MSGin5G UE acts as SCM-C;

   b)  the configuration management server functionality at the server-side acts as SCM-S;

   c)  shall set the Option header to the CoAP URI identifying the user profile document to be retrieved according to the resource API definition in Annex C.3.1 of 3GPP TS 24.546 [6],

      1)  the "apiRoot" is set to the URI of the configuration management server functionality at the server-side;

      2)  the "valServiceId" is set to the unique service identifier of MSGin5G service; and

      3)  the configuration management client functionality shall make a GET request for the UE Configurations as described in Annex C.3.1.2.2.3.1 of 3GPP TS 24.546 [6] and shall set applicable query parameters defined in table C.3.1.2.2.3.1-1 of 3GPP TS 24.546 [6] with the clarification listed below.

         i)  the ue-uri is set to the MSGin5G UE ID as specified in 3GPP TS 23.554 [2]

         ii)  the ue-vendor and/or the ue-type parameter are set to the MSGin5G UE information as specified in 3GPP TS 23.554 [2] if included.

Upon receiving the requested MSGin5G UE configuration data included in the CoAP 2.05 (Content) response, the configuration management client functionality shall submit the configuration data to MSGin5G Client by SEAL-C interface if it is not collocated with the MSGin5G Client. The MSGin5G Client shall store the configuration data, including MSGin5G UE Service ID, the address of MSGin5G Server and other available MSGin5G Service specific information.

The corresponding JSON Schema used in step c) is defined in 7.3.2.1.

### 6.2.1.3 Procedure at MSGin5G Server

The configuration management server functionality as specified in 3GPP TS 24.546 [6] may be collocated with MSGin5G Server or it can be separated with MSGin5G Server as per 3GPP TS 23.554 [2].

The MSGin5G UE configuration procedures at the configuration management server functionality are based on the procedures in clause 6.2.3.4 of 3GPP TS 24.546 [6]. In the procedures, the configuration management server function acts as SCM-S.

## 6.2.2 Constrained UE configuration to use Relay UE

### 6.2.2.1 Procedure at Relay UE

The Relay UE acts as either 5G ProSe Layer-2 and Layer-3 UE-to-Network Relay entity as specified in 3GPP TS 23.304 [9] and relays the CoAP GET request/response as traffic between the configuration management client functionality and the configuration management server functionality.

### 6.2.2.2 Procedure at Constrained UE

In order to send an MSGin5G UE Configuration request, the configuration management client functionality on the Constrained UE shall use the procedures specified in clause 6.2.1.2.

Upon receiving an CoAP 2.05 (Content) response and the recipient's address included in the CoAP Option is set to the MSGin5G Client itself, the MSGin5G Client shall handle the CoAP 2.05 (Content) response as specified in clause 6.2.1.2.

## 6.2.3 Constrained UE configuration via MSGin5G Gateway UE

### 6.2.3.1 General

If multiple configuration requests from one or more the MSGin5G Clients on the Constrained UEs are received by the MSGin5G Gateway UE, the MSGin5G Gateway UE may constuct a bulk configuration request based on the service policy to the MSGin5G Server. Upon receiving the bulk configuration response from the MSGin5G Server, the MSGin5G Gateway UE splits the bulk configuration response into multiple individual configuration responses and notifies the MSGin5G Clients on the Constrained UEs separately and may include protocol conversion between JSON and XML on the MSGin5G Gateway UE.

### 6.2.3.2 Procedure at Constrained UE

#### 6.2.3.2.1 Configuration initiated by Constrained UE

In order to get the MSGin5G Service configuration information, the MSGin5G Client on the Constrain UE which has established a connection for One-to-one ProSe Direct Communication as specified in 3GPP TS 23.304[9] shall send a CoAP GET request to the MSGin5G Gateway Client on MSGin5G Gateway UE. In the CoAP GET request, the MSGin5G Client on the Constrain UE:

    a)   shall set the Option header to the CoAP URI identifying the user profile document to be retrieved according to the resource API definition in clause C.3.1 of 3GPP TS 24.546 [6]:

        1)  the "apiRoot" is set to the URI of the MSGin5G Gateway side;

        2)  the "valServiceId" is set to the unique service identifier of MSGin5G service; and

        3)  the MSGin5G Client on the Constrain UE shall generate a GET request for the UE Configurations as described in Annex C.3.1.2.2.3.1 of 3GPP TS 24.546 [6] and shall set applicable query parameters defined in table C.3.1.2.2.3.1-1 of 3GPP TS 24.546 [6] with the clarification listed below:

            i)  the ue-uri is set to the MSGin5G UE ID as specified in 3GPP TS 23.554 [2]; and

    ii)  optionally, the ue-vendor or the ue-type parameter or both are set to the MSGin5G UE information as specified in 3GPP TS 23.554 [2].

Upon receiving the requested MSGin5G UE configuration data included in thed CoAP 2.05 (Content) response, the MSGin5G Client on the Constrain UE shall store the configuration data, including MSGin5G UE Service ID, the address of MSGin5G Server and other available MSGin5G Service specific information.

## 6.2.3.3        Procedure at MSGin5G Gateway UE

### 6.2.3.3.1        Reception of the Configuration Request from Constrained UE

Upon reception of a CoAP GET request where the CoAP URI of the request identifies the UE Configurations resource as described in clause C.3.1.2.2.3.1 of 3GPP TS 24.546 [6], the MSGin5G Gateway UE shall decide whether to use bulk configuration based on the service policy as:

    a)  if the MSGin5G Gateway UE decides not to use bulk configuration based on the service policy, the MSGin5G Gateway UE shall forward the CoAP GET request to the MSGin5G Server without any change; and

    b)  if the MSGin5G Gateway UE decides to use bulk configuration based on the service policy, the MSGin5G Gateway Client on MSGin5G Gateway UE:

        1)  shall store or cache the whole CoAP GET request;

        2)  shall generate a CoAP 2.05 (Content) response including:

            i)  the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json"; and

            ii)  the "CoAP payload" element with "Maximum configuration time" to indicate the expected time when the Configuration Response can be received; and

        3)  may start a timer associated with the "MSGin5G UE ID". The expiration of the timer is set to the value of the "Maximum configuration time" element.

The MSGin5G Gateway UE may start a timer for periodic bulk configuration based on implementation, e.g. when the first configuration request for which the MSGin5G Gateway UE decided to use bulk configuration received from the constrained UE.

    NOTE:  How to decide that bulk configuration is used is implementation specific and outside the scope of the present document.

### 6.2.3.3.2        Sending the Bulk Configuration Request to MSGin5G Server

The MSGin5G Gateway UE should support the configuration management client functionality as specified in 3GPP TS 23.546 [6]. The configuration management client functionality may be collocated with MSGin5G Gateway Client or it may be separated from MSGin5G Gateway Client as per 3GPP TS 23.554 [2].

If the configuration management client functionality is not collocated with the MSGin5G Gateway Client, the MSGin5G Gateway Client should use SEAL-C interface to interact with configuration management client functionality.

Based on implementation, upon:

    a)  expiry of one or more timers of Maximum configuration time response to Constrain UE;

    b)  expiry of the timer for periodic bulk configuration; or

    c)  excess of the maximum number of MSGin5G UE configuration requests from constrained UEs,

the configuration management client functionality may initiate a CoAP GET request to the MSGin5G Server including cached or stored configuration requests which need to be bulk handled based on the procedures in clause 6.2.3.3 of 3GPP TS 24.546 [6]. In the procedures:

    a)  the configuration management client functionality on the MSGin5G UE acts as SCM-C;

    b)  the configuration management server functionality at the server-side acts as SCM-S;

    c) the "Content-Format" element shall be set to "50" to indicate the format of the CoAP payload is "application/json"; and

    d) the Option header shall be set to the CoAP URI identifying the user profile document to be retrieved according to the resource API definition in Annex C.3.1 of 3GPP TS 24.546 [6]:

       1) the "apiRoot" is set to the URI of the configuration management server functionality at the server-side; and

       2) the "valServiceId" is set to the unique service identifier of MSGin5G service; and

    e) the following information elements in the CoAP payload encoded in JSON format shall be included:

       1) the "Bulk configuration flag" element to indicate that this CoAP GET request is used for bulk configuration; and

       2) the "List of MSGin5G UE IDs" element to include one or more MSGin5G UE ID from the cached/stored configuration requests from the constrained UEs.

### 6.2.3.3.3 Reception of the bulk Configuration Response from MSGin5G Server

Upon receiving the requested MSGin5G UE configuration data, the configuration management client functionality shall submit the configuration data to MSGin5G Gateway Client by SEAL-C interface if it is not collocated with the MSGin5G Client. The MSGin5G Gateway Client in MSGin5G Gateway UE:

    a) shall split content of the "List of MSGin5G UE configuration information" element into multiple individual configuration information; and

    b) shall generate one or more CoAP 2.05 (Content) response as configuration responses to constrained UE(s) separately based on the cached CoAP GET requests associated with the MSGin5G UE ID. Each CoAP 2.05 (Content) response includes:

       1) the CoAP "Message ID" element and the "Token" element with the same values in the CoAP GET request for configuration from the constrained UE; and

       2) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" and the CoAP payload including the elements as specified in clause 6.2.3.4.

## 6.2.3.4 Procedure at MSGin5G Server

### 6.2.3.4.1 Reception of the bulk Configuration Request from MSGin5G Gateway UE

Upon reception of a CoAP GET request where the CoAP URI of the request identifies the UE Configurations resource as described in clause C.3.1.2.2.3.1 of 3GPP TS 23.546 [6], the configuration management server functionality shall follow the procedures in clause 6.2.3.4 of 3GPP TS 24.546 [6] with the clarification listed below:

    a) the configuration management server functionality shall return a 2.05 (Content) response, in addition to the information elements listed in clause 6.2.1.3 of the present document, the response also includes the list of MSGin5G UE configuration information found based on the list of MSGin5G UE IDs received from the CoAP GET request payload, each MSGin5G UE configuration information:

       1) shall include the "UE Service ID" element assigned to the requesting constrain UE;

       2) shall include the "MSGin5G Server address" element to indicate the MSGin5G Server which serves this constrain UE; and

       3) may include the "MSGin5G Service specific information" element to indicate the specific information of the MSGin5G Service.

# 6.3 Registration

## 6.3.0 General

Registration procedure is used to register the MSGin5G Client on the MSGin5G UE to the MSGin5G Server to use MSGin5G Services. Deregistration procedure is used to deregister the MSGin5G Client on the MSGin5G UE to the MSGin5G Server to not use MSGin5G Services.

For the MSGin5G Client on the MSGin5G UE deciding to initiate a registration procedure or a deregistration procedure to the MSGin5G Server, the procedures are specified in clause 6.3.1 and clause 6.3.3.

In case of the Application Client not residing in the MSGin5G UE with the MSGin5G Client, the Application Client initiates a registration to, or deregistration from, MSGin5G Client on MSGin5G UE as specified in clause 6.3.2.

For the MSGin5G Client residing in the constrained UE deciding to initiate a registration procedure or a deregistration procedure to the MSGin5G Server via an MSGin5G Gateway Client, the procedures are specified in clause 6.3.4 and clause 6.3.5. Before the MSGin5G Gateway Client decides to bulk the registration or deregistration from the MSGin5G Client residing in the constrained UE as specified in subclause 6.3.4.3.1, the MSGin5G Client residing in the constrained UE shall register to the gateway service to the MSGin5G Gateway Client on the MSGin5G Gateway UE as specified in clause 6.3.5.

The MSGin5G Client residing in the constrained UE decides how to register to the MSGin5G Server based on the UE policy. Based on the decision, different reference points, i.e. the MSGin5G-1 reference point or the MSGin5G-6 reference point, and different constructures of the registration request or deregistration request will be invoked.

## 6.3.1 MSGin5G UE Registration

### 6.3.1.1 Procedure at MSGin5G Client

#### 6.3.1.1.1 MSGin5G UE registration

After the UE Service ID is configured to the MSGin5G UE, in order to register MSGin5G UE to the MSGin5G Server, the MSGin5G Client shall send a CoAP POST request to the MSGin5G Server according to procedures specified in IETF RFC 7252 [5]. In this CoAP POST request, the MSGin5G Client:

    a)   shall set the "T" field in the CoAP header to 0 to indicate acknowledge message required;

    b)   shall include the MSGin5G Server address in the Option header of the CoAP POST request and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI;

    c)   shall set the "Content-Format" element to "50" to indicate the format of the CoAP payload is "application/json"; and

    d)   shall include the following information elements in the CoAP payload encoded in JSON format as specified in clause 7.3.3.1:

        1)   the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

        2)   the "Message Type" element with a "REG" value to indicate that this CoAP POST request is used for registration;

        3)   the "UE Service ID" element to indicate the MSGin5G UE initiating registration procedure; and

        4)   optionally, the "MSGin5G Client Profile" element to include a set of parameters describing the MSGin5G Client. This element may include the "MSGin5G Client Triggering Information" element, the "MSGin5G Client Communication Availability" element and "MSGin5G Client Supported MSGin5G Segment Size":

            i)   The "MSGin5G Client Triggering Information" element shall include:

               -   the "MSGin5G UE ID" element to indicate the MSGin5G UE hosting the MSGin5G Client; and

- either:

    - a "MSGin5G Client Port" element to indicate the port number that the MSGin5G Client listens on for device triggers from the MSGin5G Server; or

    - a "MSGin5G Client Ports" element to indicate a List of port numbers that the MSGin5G Client listens on for device triggers from the MSGin5G Server and protocol (e.g., SMS, NIDD, etc.) associated with each port number; and

ii) the "MSGin5G Client Communication Availability" element informs the MSGin5G Server whether the client has a specific application-level schedule/periodicity to its MSGin5G communications, which may be used in conjunction with UE reachability monitoring to determine whether and when MSGin5G communications are attempted. This element:

- shall include the "Scheduled communication time" element to indicate the time when the UE becomes available for communication;

- shall include the "Communication duration time" element to indicate the duration time of periodic communication;

- may include the "Periodic communication indicator" element to identify whether the client communicates periodically or not;

- may include the "Periodic communication interval" element to indicate the interval Time of periodic communication if "Periodic communication indicator" element is included;

- may include the "Data size indication" element to indicate the expected data size to be exchanged during the communication duration; and

- may include the "Store and forward option" element to indicate the UE does not request store and forward services for incoming MSGin5G requests.

iii) The "MSGin5G Client Supported MSGin5G Segment Size" element is used to indicate the maximum size of the payload of MSGin5G message supported by MSGin5G Client. The maximum value of this IE shall not exceed 2048 bytes.

## 6.3.1.1.2 MSGin5G UE de-registration

The MSGin5G Client initiates a CoAP POST request to de-register from the MSGin5G Server. In this CoAP POST request, the MSGin5G Client:

a)  shall set the "T" field in the CoAP header to 0 to indicate acknowledge message required;

b)  shall include the MSGin5G Server address in the Option header of the CoAP POST request and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI;

c)  shall set the "Content-Format" element to "50" to indicate the format of the CoAP payload is "application/json"; and

d)  shall include the following information elements encoded in JSON format as specified in clause 7.3.3.2:

1)  the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

2)  the "Message Type" element with a "DEREG" value to indicate that the CoAP POST request is used for de-registration; and

3)  the "UE Service ID" element to indicate the MSGin5G UE initiating de-registration procedure.

## 6.3.1.2 Procedure at MSGin5G Server

### 6.3.1.2.1 MSGin5G UE registration

Upon reception of the CoAP POST request containing MSGin5G service identifier indicating that the received request is for MSGin5G service and Message Type indicating that the received request is for registration, the MSGin5G Server shall verify the UE service ID. After a successful verification, the MSGin5G Server:

a) shall store the UE Service ID and the MSGin5G Client Profile information included in the received CoAP POST request; and

b) shall generate a CoAP 2.01 (Created) response or CoAP 2.04 (Change) response including the following parameters:

1) the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for registration; and

2) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" and the CoAP payload encoded in JSON format as specified in clause 7.3.3.1 including:

   i) the "UE Service ID" element to indicate the MSGin5G UE initiating registration procedure;

   ii) the "Registration result" element to indicate whether the registration is success or failure;

   iii) optionally, the "Registration expiration time" element to indicate the expiration time of the registration. This element is present only when the value of the "Registration result" element is set to success; and

   iv) the "Failure Cause" element to indicate reason for failure. This element shall only present if the value of "Registration result" shows that the registration is failed.

### 6.3.1.2.2 MSGin5G UE de-registration

Upon reception of the CoAP POST request containing MSGin5G service identifier indicating that the received request is for MSGin5G service and Message Type indicating that the received request is for deregistration from an MSGin5G UE, the MSGin5G Server shall verify the UE service ID. After a successful verification, the MSGin5G Server:

a) shall delete the registration information of the MSGin5G UE and any applicable MSGin5G Client Profile information that it has stored; and

b) shall generate a CoAP 2.04 (Change) response including the following parameters:

1) the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for deregistration;

2) optionally, the MSGin5G Client address in the Option header of the CoAP response and set the Option header to a corresponding value, if it is provided in the payload of CoAP POST request; and

3) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" and the CoAP payload encoded in JSON format as specified in clause 7.3.3.2 including:

   i) the "UE Service ID" element to indicate the MSGin5G UE initiating de-registration procedure;

   ii) the "De-registration result" element to indicate whether the registration is success or failure; and

   iii) the "Failure Cause" element to indicate reason for failure. This element shall only present if the value of "De-registration result" shows that the de-registration is failed.

## 6.3.2 Application Client registration to MSGin5GClient on MSGin5G UE

### 6.3.2.1 Procedure at MSGin5G Client on MSGin5G UE

#### 6.3.2.1.1 Application Client on non-MSGin5G UE registration to MSGin5G Client on MSGin5G UE

Upon reception of registration request from the application client on the non-MSGin5G UE, the MSGin5G Client on the MSGin5G UE decides whether to accept the registration request based on local condition.

If the registration is accepted by the MSGin5G Client on the MSGin5G UE, the MSGin5G Client on the MSGin5G UE:

a) stores Application ID included in the registration request from the Application Client on the non-MSGin5G UE and the mapping between the transport identifier and the Application ID;

NOTE 1: Based on the connection mode, e.g. L2 connection or L3 connection, the MSGin5G UE can allocate a specified MAC address or UDP port for exchanging information between the MSGin5G Client on the MSGin5G UE and the Application Client on the non-MSGin5G UE. The transport mechanism is based on the legacy transport protocol.

NOTE 2: The MSGin5G Client on the MSGin5G UE retrieves the transport identifier from the transport layer. The transport identifier can be a Layer-2 ID, e.g. a MAC address, or a Layer-3 ID, e.g. an IP address with a specific UDP port.

b) allocates a Registration ID for the Application Client on the non-MSGin5G UE; and

c) constructs the registration response and sends it to the application client on the non-MSGin5G UE. The registration response shall include:

　　1) the Registration Result indicates the registration is accepted by the MSGin5G Client on the MSGin5G UE; and

　　2) the Registration ID allocated by the MSGin5G Client on the MSGin5G UE.

If the registration is not accepted by the MSGin5G Client on the MSGin5G UE, the MSGin5G Client on the MSGin5G UE constructs the registration response and sends it to the application client on the Constrained UE. The registration response shall include:

a) the Registration Result indicating the registration is not accepted by the MSGin5G Client on the MSGin5G UE; and

b) the Failure Reason indicating an appropriate reason why the registration request is rejected by the MSGin5G Client on the MSGin5G UE.

#### 6.3.2.1.2 Application Client on non-MSGin5G UE de-registration to MSGin5G Client on MSGin5G UE

Upon reception of de-registration request from the Application Client on the non-MSGin5G UE, the MSGin5G Client on the MSGin5G UE:

a) removes the mapping between Application ID and transport identifier of the Application Client on the non-MSGin5G UE based on the Registration ID included in the de-registration request; and

b) constructs the de-registration response including:

　　1) the De-registration Result indicating whether the de-registration is accepted or not;

　　2) the Registration ID included in the de-registration request, if the de-registration is accepted by the MSGin5G Client on the MSGin5G UE; and

　　3) the Failure Reason indicating an appropriate cause indicating why the de-registration request is rejected by the MSGin5G Client on the MSGin5G UE, if the de-registration is not accepted by the MSGin5G Client on the MSGin5G UE.

NOTE: Based on the connection mode, e.g. L2 connection or L3 connection, the MSGin5G Client on the MSGin5G UE may allocate a specified MAC address or UDP port for exchanging information between the MSGin5G Client on the MSGin5G UE and the Application Client on the non-MSGin5G UE. The transport mechanism is based on the legacy transport protocol.

### 6.3.2.2 Procedure at Application Client on non-MSGin5G UE

#### 6.3.2.2.1 Application Client on non-MSGin5G UE registration to MSGin5G Client on MSGin5G UE

In order to register Application Client on the non-MSGin5G UE to the MSGin5G Client on the MSGin5G UE, the Application Client on the non-MSGin5G UE sends a registration request to the MSGin5G Client on the MSGin5G UE. The registration request shall include the "Application ID" to indicate the Application Client on the non-MSGin5G UE initiating registration.

NOTE: If a specified MAC address or UDP port is configured for exchanging information between the MSGin5G Client on MSGin5G UE and the Application Client on the non-MSGin5G UE, the Application Client on the non-MSGin5G UE shall send the registration request to the specified MAC address or UDP port.

#### 6.3.2.2.2 Application Client on non-MSGin5G UE de-registration to MSGin5G Client on MSGin5G UE

In order to de-register Application Client on the non-MSGin5G UE to the MSGin5G Client on MSGin5G UE, the Application Client on the non-MSGin5G UE sends a de-registration request to the MSGin5G Client on the MSGin5 Client on the MSGin5G UE. The de-registration request shall include the "Registration ID" which has been allocated by the MSGin5G Client on the MSGin5G UE during the registration procedure.

NOTE: If a specified MAC address or UDP port is configured for exchanging information between the MSGin5G Client on the MSGin5G UE and the Application Client on the non-MSGin5G UE, the Constrained UE shall send the de-registration request to the specified MAC address or UDP port.

## 6.3.3 Constrained UE registration to Relay UE

### 6.3.3.1 General

The Relay UE acts as either 5G ProSe Layer-2 or Layer-3 UE-to-Network Relay entity as specified in 3GPP TS 23.304 [9] and relays the CoAP POST request/response as traffic between the MSGin5G Server and the Constrained UE.

### 6.3.3.2 void

#### 6.3.3.2.1 void

#### 6.3.3.2.2 void

### 6.3.3.3 Procedure at Constrained UE

#### 6.3.3.3.1 Constrained UE registration via Relay UE

In order to register Constrained UE to the MSGin5G Server, the MSGin5G Client on Constrained UE sends a CoAP POST request to the MSGin5G Server via the Relay UE. The CoAP POST request is constructed as specified in clause 6.3.1.1.1.

#### 6.3.3.3.2 Constrained UE de-registration via Relay UE

In order to de-register Constrained UE to the MSGin5G Server, the MSGin5G Client on Constrained UE sends a CoAP POST request to the MSGin5G Server via the Relay UE. The CoAP POST request is constructed as specified in clause 6.3.1.1.2.

## 6.3.4 Constrained UE registration via MSGin5G Gateway Client

### 6.3.4.1 General

If multiple registration requests from one or more the MSGin5G Clients on the Constrained UEs are received, the MSGin5G Gateway Client constructs a bulk registration/de-registration request to the MSGin5G Server and sends a response to each Constrained UE separately. Upon receiving the bulk registration response from the MSGin5G Server, the MSGin5G Gateway Client splits the bulk registration response into multiple individual registration responses and notifies the MSGin5G Clients on the Constrained UEs separately.

### 6.3.4.2 Procedure at Constrained UE

#### 6.3.4.2.1 Registration initiated by Constrained UE

After the UE Service ID is configured to the MSGin5G UE, in order to register MSGin5G UE to the MSGin5G Server, the MSGin5G Client on the Constrained UE shall send a CoAP POST request to the MSGin5G Server. If the registration request is allowed to delay for bulk registration initiated by the MSGin5G Gateway Client, in the CoAP POST request, the MSGin5G Client on the Constrained UE:

a) shall set the "T" field in the CoAP header to 0 to indicate acknowledge message required;

b) shall include the MSGin5G Server address in the Option header of the CoAP POST request and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI;

c) shall set the "Content-Format" element to "50" to indicate the format of the CoAP payload is "application/json"; and

d) shall include the following information elements in the CoAP payload encoded in JSON format:

  1) the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

  2) the "Message Type" element with a "REG" value to indicate that this CoAP POST request is used for registration;

  3) the "UE Service ID" element to indicate the MSGin5G UE initiating registration procedure;

e) optionally, the "Registration urgent degree" element with a "false" value to indicate that this registration is not urgent;

f) optionally, the "MSGin5G Client Profile" element to include a set of parameters describing the MSGin5G Client. This element may include the "MSGin5G Client Triggering Information" element and the "MSGin5G Client Communication Availability" element:

  i) The "MSGin5G Client Triggering Information" element shall include:

    - the "MSGin5G UE ID" element to indicate the MSGin5G UE hosting the MSGin5G Client; and

    - either:

      - a "MSGin5G Client Port" element to indicate the port number that the MSGin5G Client listens on for device triggers from the MSGin5G Server;or

      - a "MSGin5G Client Ports" element to indicate a List of port numbers that the MSGin5G Client listens on for device triggers from the MSGin5G Server and protocol (e.g., SMS, NIDD, etc.) associated with each port number; and

  ii) the "MSGin5G Client Communication Availability" element informs the MSGin5G Server whether the client has a specific application-level schedule/periodicity to its MSGin5G communications, which may be used in conjunction with UE reachability monitoring to determine whether and when MSGin5G communications are attempted. This element:

- shall include the "Scheduled communication time" element to indicate the time when the UE becomes available for communication;

- shall include the "Communication duration time" element to indicate the duration time of periodic communication;

- may include the "Periodic communication indicator" element to identify whether the client communicates periodically or not;

- may include the "Periodic communication interval" element to indicate the interval Time of periodic communication if "Periodic communication indicator" element is included;

- may include the "Data size indication" element to indicate the expected data size to be exchanged during the communication duration; and

- may include the "Store and forward option" element to indicate the UE does not request store and forward services for incoming MSGin5G requests; and

g) optionally, the "Registration request expiration time" element to indicate the maximum validity time of the registration request; and

h) optionally, the "waitTime" element to indicate the time the MSGin5G Gateway Client can wait with sending the (bulk-)registration request to the MSGin5G Server.

### 6.3.4.2.2 De-registration initiated by Constrained UE

The MSGin5G Client on the Constrained UE initiates a CoAP POST request to de-register from the MSGin5G Server. If the de-registration request is allowed to delay for bulk de-registration initiated by the MSGin5G Gateway UE, in the CoAP POST request, the MSGin5G Client on the Constrained UE:

a) shall set the "T" field in the CoAP header to 0 to indicate acknowledge message required;

b) shall include the MSGin5G Server address in the Option header of the CoAP POST request and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI;

c) shall set the "Content-Format" element to "50" to indicate the format of the CoAP payload is "application/json"; and

d) shall include the following information elements encoded in JSON format as specified in clause 7.3.3.2:

1) the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

2) the "Message Type" element with a "DEREG" value to indicate that the CoAP POST request is used for de-registration;

3) the "UE Service ID" element to indicate the MSGin5G UE initiating de-registration procedure;

4) optionally, the "De-registration urgent degree" element with a "false" value to indicate that this registration is not urgent; and

5) optionally, the "De-registration request expiration time" element to indicate the maximum processing time of the registration request allowed.

### 6.3.4.2.3 Reception of the Registration Response from MSGin5G Gateway Client

Upon reception of the CoAP POST request containing the MSGin5G service identifier indicating that the received request is for MSGin5G service and Message Type indicating that the received request is for registration response, the Constrained UE shall generate CoAP 2.04 (Change) response including the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for registration response.

### 6.3.4.2.4 Reception of the De-registration Response from MSGin5G Gateway Client

Upon reception of the CoAP POST request containing the MSGin5G service identifier indicating that the received request is for MSGin5G service and Message Type indicating that the received request is for de-registration response, the Constrained UE shall generate CoAP 2.04 (Change) response including the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for de-registration response.

## 6.3.4.3 Procedure at MSGin5G Gateway Client

### 6.3.4.3.1 Reception of the Registration Request from Constrained UE

Upon reception of the CoAP POST request containing MSGin5G service identifier indicating that the received request is for MSGin5G service and Message Type indicating that the received request is for registration, the MSGin5G Gateway Client shall check the value of the "Registration urgent degree" element included in the CoAP POST request as:

a) if the "Registration urgent degree" element with a "true" value is included, the MSGin5G Gateway Client shall forwards the CoAP POST request to the MSGin5G Server without any change.

b) if the "Registration urgent degree" element with a "false" value is included, the MSGin5G Gateway Client:

1) shall store or cache the whole CoAP POST request;

2) shall generate a CoAP 2.01 (Created) response or CoAP 2.04 (Change) response to nofity the MSGin5G Client on the Constrained UE that the registration request is buffered for bulk registration procedure and the CoAP response includes:

   i) the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for registration; and

   ii) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" . The CoAP payload shall include the "UE Service ID" element to indicate the Constrained UE initiating registration procedure. The CoAP payload may include the "Expected registration time" element to indicate the expected time when the Registration Response can be received; and

3) may start a timer associated with the "UE Service ID". If the "Registration request expiration time" element is included in the CoAP request from the Constrained UE, the expiration of the timer is set to the value of the "Registration request expiration time" element. Else, the MSGin5G Gateway Client determines whether to start a timer and the value of the timer based on implementation.

The MSGin5G Gateway Client may start a timer for periodic bulk registration based on implementation, e.g. when the first registration request from the constrained UE the "false" value of the "Registration urgent degree" element.

### 6.3.4.3.2 Sending the Bulk Registration Request to MSGin5G Server

Based on implementation, upon:

a) expiry of one or more timers started in 2) above;

b) expiry of the timer for periodic bulk registration; or

c) excess of the maximum number of MSGin5G UE registration requests from constrained UEs,

the MSGin5G Gateway Client may initiate a CoAP POST request to the MSGin5G Server including all cached/stored MSGin5G UE registration requests from the constrained UEs. In this CoAP POST request, the MSGin5G Client in the MSGin5G Gateway Client:

a) shall set the "T" field in the CoAP header to 0 to indicate acknowledge message required;

b) shall include the MSGin5G Server address in the Option header of the CoAP POST request and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI;

c) shall set the "Content-Format" element to "50" to indicate the format of the CoAP payload is "application/json"; and

d) shall include the following information elements in the CoAP payload encoded in JSON format as specified in clause 7.3.3.x:

1) the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

2) the "Message Type" element with a "BREG" value to indicate that this CoAP POST request is used for bulk registration;

3) the "UE Service ID" element to indicate the MSGin5G UE initiating bulk registration procedure;

4) the "Number of individual MSGin5G UE registration requests" element to indicate the total number of MSGin5G UE registration requests which are bulked in this CoAP request; and

5) the "List of individual MSGin5G UE registration request" element to include one or more elements as specified in bullet d) of 6.3.1.1.1.

NOTE: The MSGin5G Gateway Client should consider the value of the "Registration request expiration time" element in the individual MSGin5G UE registration request from multiple constrained UEs to avoid failure of registration.

### 6.3.4.3.3 Reception of the Bulk Registration Response from MSGin5G Server

Upon reception of the CoAP 2.01 (Created) response or CoAP 2.04 (Change) response for the CoAP POST message for bulk registration from the MSGin5G Server , the MSGin5G Gateway Client:

a) shall split content of the "List of individual MSGin5G UE registration response" element into multiple individual registration responses;

b) shall generate one or more CoAP POST requests as registration responses to constrained UE(s) separately based on the cached the CoAP POST requests associated with the UE Service ID included in the individual registration responses. Each CoAP POST request includes:

1) the "Token" element with the same values in the CoAP POST request for registration request from the constrained UE; and

2) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" and the CoAP payload including:

i) the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

ii) the "Message Type" element with a "REGRESP" value to indicate that this CoAP POST request is used as a registration response;

iii) the "UE Service ID" element to indicate the constrained UE initiating registration procedure;

iv) the "Registration result" element to indicate whether the registration is success or failure;

v) optionally, the "Failure Cause" element to indicate reason for failure. This element shall be only present if the value of "Registration result" shows that the registration is failed; and

vi) optionally, the "Registration expiration time" element to indicate the expiration time of the registration. This element is present only when the value of the "Registration result" element is set to success.

### 6.3.4.3.4 Reception of the De-registration Request from Constrained UE

Upon reception of the CoAP POST request containing MSGin5G service identifier indicating that the received request is for MSGin5G service and Message Type indicating that the received request is for de-registration, the MSGin5G Gateway UE shall check the value of the "Registration urgent degree" element included in the CoAP POST request as:

a) if the "de-registration urgent degree" element with a"true" value is included, the MSGin5G Gateway UE shall forwards the CoAP POST request to the MSGin5G Server without any change.

b) if the "De-registration urgent degree" element with a "false" value is included, the MSGin5G Gateway UE:

1) shall store or cache the whole CoAP POST request;

2) shall generate a CoAP 2.04 (Change) response to nofity the MSGin5G Client on the Constrained UE that the de-registration request is buffered for bulk de-registration procedure and the CoAP response includes:

i) the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for registration;

ii) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" and the CoAP payload encoded in JSON format as specified in clause 7.3.3.2 including the "UE Service ID" element to indicate the MSGin5G UE initiating de-registration procedure and optionally the "Expected registration time" element to indicate the expected time when the De-registration Response can be received; and

3) may start a timer associated with the "UE Service ID". If the "De-registration request expiration time" element is included in the CoAP request from the Constrained UE, the expiration of the timer is set to the value of the "de-registration request expiration time" element. Else, the MSGin5G Gateway UE determines whether to start a timer and the value of the timer based on implementation.

### 6.3.4.3.5 Sending the Bulk De-registration Request to MSGin5G Server

Based on implementation, upon:

a) expiry of one or more timers started in subclause 6.3.x.b.4;

b) expiry of the timer for periodic bulk de-registration; or

c) excess of the maximum number of MSGin5G UE de-registration requests from constrained UEs,

the MSGin5G Gateway UE may initiate a CoAP POST request to the MSGin5G Server including all cached/stored MSGin5G UE de-registration requests from the constrained UEs. In this CoAP POST request, the MSGin5G Client in the MSGin5G Gateway UE:

a) shall set the "T" field in the CoAP header to 0 to indicate acknowledge message required;

b) shall include the MSGin5G Server address in the Option header of the CoAP POST request and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI;

c) shall set the "Content-Format" element to "50" to indicate the format of the CoAP payload is "application/json"; and

d) shall include the following information elements encoded in JSON format as specified in clause 7.3.3.7:

1) the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

2) the "Message Type" element with a "BDEREG" value to indicate that the CoAP POST request is used for bulk de-registration;

3) the "UE Service ID" element to indicate the MSGin5G UE initiating de-registration procedure;

4) the "Number of individual MSGin5G UE de-registration requests" element to indicate the total number of MSGin5G UE de-registration requests which are bulked in this CoAP request; and

5) the "List of individual MSGin5G UE de-registration request" element to include one or more elements as specified in bullet d) of 6.3.1.1.2.

NOTE: The MSGin5G Gateway UE should consider the value of the "De-registration request expiration time" element in the individual MSGin5G UE de-registration request from multiple constrained UEs to avoid failure of de-registration.

#### 6.3.4.3.6 Reception of the Bulk De-registration Response from MSGin5G Server

Upon reception of the CoAP 2.04 (Change) response for the CoAP POST message for bulk de-registration from the MSGin5G Server , the MSGin5G Gateway UE:

a) shall split content of the "List of individual MSGin5G UE de-registration response" element into multiple individual de-registration responses;

b) shall generate one or more CoAP POST requests as de-registration responses to constrained UE(s) separately based on the cached the CoAP POST requests associated with the UE Service ID included in the individual registration responses. Each CoAP POST request includes:

   1) the "Token" element with the same values in the CoAP POST request for de-registration request from the constrained UE; and

   2) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" and the CoAP payload including:

      i) the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

      ii) the "Message Type" element with a "DEREGRESP" value to indicate that this CoAP POST request is used as a de-registration response;

      iii) the "UE Service ID" element to indicate the constrained UE initiating de-registration procedure;

      iv) the "De-registration result" element to indicate whether the de-registration is success or failure; and

      v) the "Failure Cause" element to indicate reason for failure. This element shall be only present if the value of "De-registration result" shows that the de-registration is failed.

### 6.3.4.4 Procedure at MSGin5G Server

#### 6.3.4.4.1 Reception of the Bulk Registration Request from MSGin5G Gateway Client

Upon reception of the CoAP POST request containing MSGin5G service identifier indicating that the received request is for MSGin5G service and Message Type indicating that the received request is for bulk registration, the MSGin5G Server shall verify each UE service ID in the individual MSGin5G UE registration request included in the "List of individual MSGin5G UE registration request" element of the CoAP POST request. For each successful verification, the MSGin5G Server:

a) shall store the UE Service ID and the MSGin5G Client Profile information included in the individual MSGin5G UE registration request; and

b) shall generate a CoAP 2.01 (Created) response or CoAP 2.04 (Change) response including the following parameters:

   1) the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for bulk registration; and

   2) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" and the CoAP payload including:

      i) the "Number of individual MSGin5G UE registration responses" element to indicate total number of MSGin5G UE registration responses which are bulked in this response; and

      ii) the "List of individual MSGin5G UE registration response" element to include one or more elements as specified in bullet 2) of 6.3.1.2.1.

#### 6.3.4.4.2 Reception of the Bulk De-registration Request from MSGin5G Client

Upon reception of the CoAP POST request containing MSGin5G service identifier indicating that the received request is for MSGin5G service and Message Type indicating that the received request is for bulk de-registration, the MSGin5G Server shall verify each UE service ID in the individual MSGin5G UE de-registration request included in the "List of

individual MSGin5G UE de-registration request" element of the CoAP POST request. For each successful verification, the MSGin5G Server:

a) shall delete the UE Service ID and the MSGin5G Client Profile information included in the individual MSGin5G UE registration request; and

b) shall generate a CoAP 2.04 (Change) response including the following parameters:

    1) the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for bulk de-registration; and

    2) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" and the CoAP payload including:

        i) the "Number of individual MSGin5G UE registration responses" element to indicate total number of MSGin5G UE de-registration responses which are bulked in this response; and

        ii) the "List of individual MSGin5G UE de-registration response" element to include one or more elements as specified in bullet 2) of 6.3.1.2.2.

## 6.3.5 Constrained UE Registration to MSGin5G Gateway UE

### 6.3.5.1 General

When the constrained UE with MSGin5G Client selects the MSGin5G Gateway UE, the MSGin5G Client on the MSGin5G UE will initiate the registration procedure to register the gateway service to the MSGin5G Gateway Client on the MSGin5G Gateway UE.

### 6.3.5.2 Procedure on MSGin5G Gateway UE

#### 6.3.5.2.1 Constrained UE Registration to MSGin5G Gateway UE

Upon reception of the CoAP POST request containing MSGin5G service identifier indicating that the received request is for MSGin5G service and Message Type indicating that the received request is use to register to the gateway service, the MSGin5G Gateway Client on the MSGin5G Gateway UE:

a) shall check whether the MSGin5G UE identified by the UE service ID and MSGin5G UE ID, if available, is authorized to use the gateway service or not; and

b) shall generate a CoAP 2.01 (Create) response or CoAP 2.04 (Change) response including the following parameters:

    1) the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for registration; and

    2) the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json" and the CoAP payload encoded in JSON format as specified in clause 7.3.3.3 including:

        i) the "UE Service ID" element to indicate the MSGin5G UE initiating registration procedure;

        ii) the "Registration result" element to indicate whether the registration is success or failure;

        iii) optionally, the "Accepted time till" element to indicate the time when constrained device is allowed to use the gateway service; and

        iv) optionally, the "Failure Cause" element to indicate the reason for failure.

### 6.3.5.3 Procedure on Constrained UE

#### 6.3.5.3.1 Constrained UE Registration to MSGin5G Gateway UE

After selecting the MSGin5G Gateway UE, in order to register the gateway service to the MSGin5G Gateway Client on the MSGin5G Gateway UE, the MSGin5G Client on the constrained UE shall send a CoAP POST request to the MSGin5G Server according to procedures specified in IETF RFC 7252 [5]. In this CoAP POST request, the MSGin5G Client in the constrained UE:

a) shall set the "T" field in the CoAP header to 0 to indicate acknowledge message required;

b) shall include the MSGin5G UE address in the Option header of the CoAP POST request and set the Option header to a corresponding value, e.g. if the MSGin5G UE address is a URI, the Uri-Path Option is set to the value of such URI;

c) shall set the "Content-Format" element to "50" to indicate the format of the CoAP payload is "application/json"; and

d) shall include the following information elements in the CoAP payload encoded in JSON format as specified in clause 7.3.3.1:

    1) the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

    2) the "Message Type" element with a "GWREG" value to indicate that this CoAP POST request is used to register to the gateway service;

    3) the "UE Service ID" element to indicate the MSGin5G UE initiating registration procedure;

    4) optionally, the "MSGin5G UE ID" element to represents the constrained UE; and

    5) optionally, the "Time till" element to indicate the time when constrained UE is intended to use the gateway service.

## 6.4 MSGin5G Message delivery

## 6.4.0 General Description

This clause specifies the MSGin5G message delivery procedures.

The procedures of MSGin5G message exchange between MSGin5G Client and MSGin5G Server, i.e. the MSGin5G message exchange procedures via MSGin5G-1 reference point, including the sending and reception of MSGin5G messages and MSGin5G message delivery status report, are specified in clause 6.4.1,

If the MSGin5G Client residing in a Constrained UE uses an UE-1 as relay, the MSGin5G message exchange procedures via MSGin5G-1 reference point specified in clause 6.4.1 are also applied. The procedures at the Relay UE are specified in clause 6.4.2.4 and the procedures at the MSGin5G Client residing in the Constrained UE are specified in clause 6.4.2.5.

If the MSGin5G Client residing in a Constrained UE interacts with an MSGin5G Gateway UE which supports MSGin5G Gateway Client, the MSGin5G message exchange procedures via MSGin5G-1 reference point specified in clause 6.4.1 are also applied. When the MSGin5G Gateway UE receives an MSGin5G message from the MSGin5G Client residing in a Constrained UE or from the MSGin5G Server, the MSGin5G Gateway UE may generate a new MSGin5G message based on the received MSGin5G message and send the new MSGin5G message to the corresponding MSGin5G Server or the MSGin5G Client residing in a Constrained UE respectively by using the procedures via MSGin5G-1 reference point specified in clause 6.4.1.

The procedures used for message or message delivery report sending or receiving between a MSGin5G Client and an Application Client residing in different UEs over MSGin5G-5 are specified in clause 6.4.2.2 and clause 6.4.2.3.

# 6.4.1      Procedures between MSGin5G UE and MSGin5G Server

## 6.4.1.1      Procedure at MSGin5G Client

### 6.4.1.1.1      General

This clause specifies the procedures for sending and receiving MSGin5G message, aggregated MSGin5G message, MSGin5G message delivery status report and aggregated MSGin5G message delivery status report at MSGin5G Client.

### 6.4.1.1.2      Sending of an MSGin5G message

In order to send an MSGin5G message, the MSGin5G Client shall compare the size of the payload of the received message from the Application Client to the MSGin5G Client Supported MSGin5G segment size. If the size of the payload exceeds, the MSGin5G Client shall segment the MSGin5G message into a set of segmented MSGin5G messages such that the payload of each segmented MSGin5G message can fit within the MSGin5G Client Supported MSGin5G segment size. For each segmented MSGin5G message, the steps listed below shall be processed individually.

The MSGin5G Client shall send the MSGin5G message in a CoAP POST request message according to procedures specified in IETF RFC 7252 [5]. In the CoAP POST request message, The MSGin5G Client:

   a)  shall set the "T" field in the CoAP header to 0 if delivery status report from the recipient is requested, i.e. indicates that this message is the type of Confirmable, to ensure the application layer delivery status report;

   b)  shall include the MSGin5G Server address in a CoAP Option, e.g. if the MSGin5G Server address is a URI, includes a Uri-Path Option with the value of the URI;

   c)  shall set the CoAP Content-Format to "50", i.e. application/json;

   d)  shall include the information elements specified in 3GPP TS 23.554 [2] in the CoAP payload encoded in JSON format as specified in clause 7.3.4:

      1)  shall include an "MSGin5G service identifier" element to indicate that this CoAP POST request message is used for MSGin5G service;

      2)  shall include a "Message Type" element and set it to "MSG" to indicate that this CoAP POST request message is used for MSGin5G message;

      3)  shall include an "Originating UE Service ID" element set to the UE which requests the sending of the MSGin5G message;

      4)  shall include a "Recipient UE Service ID/AS Service ID" element if the recipient is an MSGin5G UE/Non-MSGin5G UE or Application Server;

      5)  shall include a "Group Service ID" element if the recipient is an MSGin5G Group;

      6)  shall include a "Broadcast Area ID" element if the message needs to be broadcast;

      7)  shall include a "Messaging Topic" element if this message will be distributed based on Messaging Topic. This element shall not present in other message scenarios;

   NOTE:      In an MSGin5G Message request, only one of these IEs listed from step 4) to step 6) shall be included.

      8)  may include one or more "Application ID" elements to indicate the application(s) for which the payload is(are) intended;

      9)  shall include a "Message ID" which is globally unique within the MSGin5G service to identify this specific MSGin5G message;

      10) may include a "Delivery status required" element if delivery acknowledgement from the recipient is requested;

      11) may include a "Priority type" element to indicate the application priority level requested for this message. If this IE is not included, this message has a default priority level, i.e. NORMAL;

12) may include a "Message is segmented" element with a "true" value to indicate that this message is part of a segmented message;

13) if "Message is segmented" element with a "true" value is included, shall include a "Segmentation set identifier" element to indicate that this segmented message is associated within a set of segmented messages. All segmented messages associated with the same MSGin5G message shall be assigned the same unique identifier;

14) if "Message is segmented" element with a "true" value is included and this message is the first segment of the set of segmented messages, shall include a "Total number of message segments" element to indicate the total number of segments for the MSGin5G message;

15) if "Message is segmented" element with a "true" value is included, shall include a "Message segment number" element to indicate the number of each segmented message within a set of segmented messages;

16) if "Message is segmented" element with a "true" value is included and this message is the last segment of the set of segmented messages, shall include a "Last segment flag" element to indicate that this segmented message is the last segment in the set of segmented messages;

17) shall include a "Store and forward flag" element to indicate whether store and forward services are requested for this message;

18) if store and forward services are requested, may include a "Store and forward parameters" element to carry the parameters used by MSGin5G Server for providing store and forward services. The "Store and forward parameters":

    i)   may include a "Message expiration time" element to indicate the message expiration time used for providing store and forward services if the destination is not available for communications; and

    ii)  may include an "Application specific store and forward information" element to carry the information used by MSGin5G Server for handling store and forward, e.g. a delivery time/date; and

19) may include a "Payload" element which carries the application payload that is transferred by the MSGin5G Service in the CoAP payload and located it after the elements listed from step 1) to 19); The content of "Payload" element is transparent to the MSGin5G Service, i.e. MSGin5G Server and MSGin5G Client is unaware of the content; and

   e)   if needed, i.e. a message segment recovery request is received, acts as Message Sender to perform the procedures in clause 6.5.1.1.

### 6.4.1.1.3 Sending of an aggregated MSGin5G message

Before the sending of an MSGin5G message, the MSGin5G Client shall check if aggregation is allowed for this message, check the message data size, and the priority level to determine if the message can be aggregated. For example, if the MSGin5G Client finds that the messages have small payload size when compared to the maximum segment size that can be transmitted over CoAP and the messages are not high priority messages, i.e. the value of Priority type included in the message is not "High", which could be sent as per scheduling policy towards a selected target, the MSGin5G Client can decide to aggregate messages until optimal use of segment size before sending message towards MSGin5G Server.

If the message can be aggregated, the MSGin5G Client aggregates multiple MSGin5G message requests intended for a selected target and sends the aggregated message in a single CoAP POST request message. The sending of the CoAP POST request message shall follow the procedures specified in clause 6.4.1.1.2 with the clarifications listed below:

   a)   The MSGin5G Client should not segment the aggregated message, so in step d) of clause 6.4.1.1.2, the "Message is segmented", "Segmentation set identifier", "Total number of message segments", "Message segment number" and "Last segment flag" elements should not be included.

   b)   In addition to the step d) of clause 6.4.1.1.2, the MSGin5G Client should include a "Number of individual messages" element in this message to indicate the total number of messages which are aggregated into this single message.

c) In addition to the step d) of clause 6.4.1.1.2, the MSGin5G Client should include a "List of individual messages" element in this message. Each child element of this "List of individual messages" element contains information elements listed below:

1) "Message ID" of the individual message;

2) "Payload" which carries the application payload that is transferred by the individual MSGin5G message;

3) one or more optional "Application ID" elements;

4) an optional "Delivery status required" element; and

5) an optional "Priority type" element.

d) The MSGin5G Client shall not include the "Payload" element outside the "List of individual messages" element, i.e. the 19) in step e) of clause 6.4.1.1.2 shall not be processed.

### 6.4.1.1.4 Sending of an MSGin5G message delivery status report

In order to send a MSGin5G message delivery status report, the MSGin5G Client shall send a CoAP POST request according to procedures specified in IETF RFC 7252 [5]. In the CoAP POST request, the MSGin5G Client:

a) shall sets the "T" field in the CoAP header to 0, i.e. indicates that this message is the type of Confirmable, to ensure that the MSGin5G message delivery status report can be received by the originator of the receiving MSGin5G message;

b) shall include the MSGin5G Server address in a CoAP Option, e.g. if the MSGin5G Server address is a URI, includes a Uri-Path Option with the value of the URI;

c) shall set the CoAP Content-Format to "50", i.e. application/json; and

d) shall include the information elements specified in 3GPP TS 23.554 [2] in the CoAP payload encoded in JSON format as specified in clause 7.3.4.2:

1) shall include a "MSGin5G service identifier" element to indicate that this CoAP POST request message is used for MSGin5G service;

2) shall include an "Message Type" element and set it to "IMDN" to indicate that this CoAP POST request message is used for MSGin5G message delivery status report;

3) shall include an "Originating UE Service ID" element set to the UE which requests the sending of the MSGin5G message delivery status report;

4) shall include a "Recipient UE Service ID/AS Service ID" element if the recipient is an MSGin5G UE/Non-MSGin5G UE or an Application Server. This element indicates is the sender of the message that this message delivery status report is for;

5) shall include the "Message ID" element copied from the MSGin5G message that is being acknowledged;

6) shall include a "Delivery Status" element to carry the delivery status description. The delivery status can be success or failure in delivery; and

7) may include a "Failure Cause" element to indicate the failure reason if the delivery status is failure.

### 6.4.1.1.5 Sending of a aggregated MSGin5G message delivery status report

The MSGin5G Client can aggregate multiple MSGin5G message delivery status reports into one single message. The MSGin5G Client shall check whether the MSGin5G message delivery status reports can be aggregated as specified in clause 6.4.1.1.3.

If the MSGin5G message delivery status reports can be aggregated, the MSGin5G Client aggregates MSGin5G message delivery status reports intended for a selected target and sends the aggregated MSGin5G message delivery status reports in a single CoAP POST request message. The sending of the CoAP POST request message shall follow the procedures specified in clause 6.4.1.1.4 with the clarifications listed below:

a) In step d) of clause 6.4.1.1.4, the "Delivery Status" element and the "Failure Cause" element should not be included.

b) In addition to the step d) of clause 6.4.1.1.4, the MSGin5G Client should include a "Number of individual messages" element in this message to indicate the total number of MSGin5G message delivery status reports which are aggregated into this single message.

c) In addition to the step d) of clause 6.4.1.1.4, the MSGin5G Client should include a ""List of individual messages" element in this message. Each child element in this "List of individual messages" element contains information elements listed below:

   1) "Message ID" of the individual MSGin5G message delivery status reports which is copied from the MSGin5G message that is being acknowledged;

   2) "Delivery Status" element to carry the delivery status description; and

   3) an optional "Failure Cause" element to indicate the failure reason if the delivery status is failure.

### 6.4.1.1.6 Reception of an MSGin5G message

Upon receiving an CoAP POST request containing the MSGin5G Service identifier and the "Message Type" with the value "MSG", if the "Number of individual messages" element and "List of individual messages" element are not included, the MSGin5G Client shall handle the CoAP POST request according to procedures specified in IETF RFC 7252 [5] with the clarifications listed below:

a) The MSGin5G Client shall check whether a "Message is segmented" element is included in the CoAP POST request. If this element is included, the MSGin5G Client shall wait until all the segmented messages have been received by checking the "Segmentation set identifier", "Total number of message segments", "Message segment number" and "Last segment flag" elements, i.e. the "Message segment number" equals the "Total number of message segments" and the "Last segment flag" is present. The MSGin5G Client shall reassemble all the segmented messages into a single MSGin5G message.

b) The MSGin5G Client shall provide the received information in the "payload" element to the Application Client(s) if one or more "Application ID" elements are included. The Application Client(s) is(are) indicated by the "Application ID" element(s):

   1) If the Application Client is on the other UE, the MSGin5G Client shall send the received information to the corresponding UE via MSGin5G-5 reference point as specified in clause 6.4.2.2.

   2) If the Application Client is on the same MSGin5G UE with the MSGin5G Client, the MSGin5G Client shall deliver the received information to the Application Client via MSGin5G-5 reference point.

NOTE: when the Application Client and MSGin5G Client are resided on the same MSGin5G UE, the interaction in MSGin5G-5 reference point may implementation specific and is out of scope of the present document.

c) If a "Delivery status required" element is included in the CoAP POST request, the MSGin5G Client shall send an MSGin5G message delivery status report as specified in clause 6.4.1.1.4 or clause 6.4.1.1.5 with the clarifications listed below:

   1) if the message delivery status is supported by the Application Client(s), the MSGin5G message delivery status report shall be sent after the delivery status information is received from the Application Client(s), and shall be generated based on this(these) delivery status information; or

   2) if the message delivery status is not supported by the Application Client, the MSGin5G message delivery status report shall be sent immediately by the MSGin5G Client on behalf of the Application Client(s).

### 6.4.1.1.7 Reception of a aggregated MSGin5G message

Upon receiving an CoAP POST request containing the MSGin5G Service identifier and the "Message Type" with the value "MSG", if a "Number of individual messages" and a "List of individual messages" are included, the MSGin5G Client concludes that this message is an aggregated MSGin5G message. The MSGin5G Client shall handle the CoAP POST request according to procedures specified in IETF RFC 7252 [5] with the clarifications listed below:

a) The MSGin5G Client shall split the received aggregated message request into multiple new created individual MSGin5G messages:

   1) all elements listed in step d) of clause 6.4.1.1.2 included in the received MSGin5G message, except the "Message ID", "Message is segmented", "Segmentation set identifier", "Total number of message segments", "Message segment number" and "Last segment flag" elements, are copied to each new created individual MSGin5G message; and

   2) each child element of the "List of individual messages" element in the received aggregated MSGin5G message is included in a new created individual MSGin5G message. The "Message ID", "Payload", "Application ID" (if present), "Delivery status required" (if present) and "Priority type" (if present) in the child element of the "List of individual messages" are used as the same elements in the new created individual MSGin5G message; and

b) The MSGin5G Client shall handle each individual MSGin5G messages according to step b) and c) specified in clause 6.4.1.1.6.

### 6.4.1.1.8 Reception of an MSGin5G message delivery status report

Upon receiving an CoAP POST request containing the MSGin5G Service identifier and the "Message Type" with the value "IMDN", if the "Number of individual messages" element and "List of individual messages" element are not be included and a "Delivery Status" element is included, the MSGin5G Client shall handle the CoAP POST request according to procedures specified in IETF RFC 7252 [5] with the clarifications listed below:

a) The MSGin5G Client shall provide the received information in the "Delivery Status" element and the "Failure Cause" element (if applicable) to the Application Client(s) if one or more "Application ID" elements are included. The Application Client(s) is(are) indicated by the "Application ID" element(s):

   1) If the Application Client is on the other MSGin5G UE, the MSGin5G Client shall send the received information to the corresponding MSGin5G UE via MSGin5G-6 (if MSGin5G Client is supported by MSGin5G UE-2) as specified in clause 6.4.2.4 or MSGin5G-5 reference point (if MSGin5G Client is not supported by MSGin5G UE-2) as specified in clause 6.4.2.2.

   2) If the Application Client is on the same MSGin5G UE with the MSGin5G Client, the MSGin5G Client shall deliver the received information to the Application Client via MSGin5G-5 reference point.

   NOTE: when the Application Client and MSGin5G Client are resided on the same MSGin5G UE, the interaction in MSGin5G-5 reference point may implementation specific and is out of scope of the present document.

### 6.4.1.1.9 Reception of a aggregated MSGin5G message delivery status report

Upon receiving an CoAP POST request containing the MSGin5G Service identifier and the "Message Type" with the value "IMDN", if a "Number of individual messages" and a "List of individual messages" are included, the MSGin5G Client concludes that this message is an aggregated MSGin5G message. The MSGin5G Client shall handle the CoAP POST request according to procedures specified in IETF RFC 7252 [5] with the clarifications listed below:

a) The MSGin5G Client shall split the received aggregated MSGin5G message delivery status report into multiple new created individual MSGin5G message delivery status reports:

   1) all elements listed in clause 6.4.1.1.5 included in the received MSGin5G message delivery status report, except the "Message ID", are copied to each new created individual MSGin5G message delivery status report; and

   2) each child element of the "List of individual messages" element in the received aggregated MSGin5G message is included in a new created individual MSGin5G message delivery status report. The "Message ID", "Delivery Status" and the "Failure Cause" (if present) in the child element of the "List of individual messages" are used as the same elements in the new created individual MSGin5G message; and

b) The MSGin5G Client shall handle each individual newly created MSGin5G delivery status report according to step a) specified in clause 6.4.1.1.8.

## 6.4.1.2 Procedure at MSGin5G Server

### 6.4.1.2.1 General

An MSGin5G Server provides server-side functionality of messages delivery among MSGin5G UE, Application Server and Message Gateway. A messages delivery procedure in the MSGin5G Server can be divided to origination and termination procedures.

The origination procedure may consist:

a) the reception of messages at the MSGin5G Server;

b) the related authentication and authorization of the message on the MSGin5G Server; and

c) the possible message response to the sender.

NOTE: If the message is received from the other MSGin5G Server in the same service domain, the step b) above may be skipped.

When the MSGin5G Server receives message from MSGin5G UE, the reception procedures is specified in clause 6.4.1.2.2, 6.4.1.2.3, 6.4.1.2.4 and 6.4.1.2.5. When the MSGin5G Server receives message from Application Server, Message Gateway or another MSGin5G Server, the reception procedure is specified in 3GPP TS 29.538 [7].

The termination procedure consists the MSGin5G Server delivery of a message.

Before the MSGin5G Server delivers a message, the MSGin5G Server shall learn the communication model of the message by analyzing the Service ID of the recipient in the message, then generates a new message based on the received message and send it to the recipient:

a) if a "Recipient UE Service ID" element is included, this message is a Point-to-Point message or an Application-to-Point message. The MSGin5G Server analyzes the URI:

   1) if the URI points to an MSGin5G Client served by this MSGin5G Server, the MSGin5G Server send the MSGin5G message to the MSGin5G Client via MSGin5G-1 reference point as specified in clause 6.4.1.2.6, 6.4.1.2.7, 6.4.1.2.8 or 6.4.1.2.9; or

   2) if the URI points to a Message Gateway served by this MSGin5G Server, the MSGin5G Server sends the message to the Message Gateway via MSGin5G-2 or MSGin5G-4 reference point as specified in 3GPP TS 29.538 [7];

   3) if the URI points to a MSGin5G Client or Message Gateway served by another MSGin5G Server, the MSGin5G Server sends the message to the other MSGin5G Server which serves the MSGin5G Client or Message Gateway via MSGin5G-8 reference point as specified in 3GPP TS 29.538 [7];

NOTE 1: The analysis procedure is implementation specific, e.g. by querying the DNS or local database, and is out of scope of the present document.

b) if a "Recipient AS Service ID" element is included, this message is a Point-to-Application message. The MSGin5G Server analyses the URI:

   1) if the URI points to an Application Server served by this MSGin5G Server, the MSGin5G Server sends the message to the Application Server via MSGin5G-3 reference point as specified in 3GPP TS 29.538 [7];

   2) if the URI points to an Application Server served by another MSGin5G Server, the MSGin5G Server sends the message to the MSGin5G Server which serves the Application Server via MSGin5G-8 reference point as specified in 3GPP TS 29.538 [7];

NOTE 2: The analysis procedure is implementation specific, e.g. by querying the DNS or local database, and is out of scope of the present document.

c) if a "Group Service ID" element is included, this message is a Group message. The MSGin5G Server obtains the group members by checking the group profile with the "Group Service ID". For each group member, the MSGin5G Server analyzes its UE Service ID and sends the message to it as specified in step a);

 d) if a "Broadcast Area ID" element is included, this message is a Broadcast message. The MSGin5G Server forwards the Broadcast message request to the CBCF (as specified in 3GPP TS 23.041 [21]) via the Broadcast Message Gateway and MSGin5G-7 reference point based on the Broadcast Area ID as specified in 3GPP TS 29.538 [7]; and

 e) if a "Messaging Topic" element is included, this message is needed to be distributed based on Messaging Topic. The MSGin5G Server obtains the subscribers of the Messaging Topic by checking the related subscription. The subscriber of the Messaging Topic can be MSGin5G UE, Application Server or Message Gateway (on behalf of non-MSGin5G UE). For each subscriber, the MSGin5G Server analyzes its Service ID and sends the message to it as specified in step a) or b).

### 6.4.1.2.2 Reception of an MSGin5G message

Upon receiving an CoAP POST request from an MSGin5G Client on an MSGin5G UE, containing the MSGin5G Service identifier and the "Message Type" with the value "MSG", i.e. the request is for sending an MSGin5G message, the MSGin5G Server executes the message origination procedure. If the "Number of individual messages" element and "List of individual messages" element are not be included, the MSGin5G Server shall handle the CoAP POST request according to procedures specified in IETF RFC 7252 [5] with the clarifications listed below:

 a) The MSGin5G Server shall authenticate the message and shall verify that the sending UE is authorized to send the message by checking the registration status of the MSGin5G Client and the "Originating UE Service ID" element in the CoAP payload. If message is needed to be rejected, the MSGin5G Server shall send a message response in a new CoAP POST request to the originating entity as specified in step e) and skips the rest steps in this clause;

 b) The MSGin5G Server executes the message segment related procedures as specified in clause 6.5.3 if needed;

 c) Void;

 d) If the message is stored for deferred delivery as specified in clause 6.4.1.2.6 or 6.4.1.2.7, the MSGin5G Server shall send a message response in a new CoAP POST request to the originating entity as specified in step e); and

 e) The MSGin5G Server shall send a message response in a new CoAP POST request to the originating entity as specified in IETF RFC 7252 [5] with the clarifications listed below:

 1) may set the "T" field in the CoAP header to 0 or 1;

 2) shall include the originating MSGin5G Client's address in an CoAP Option, e.g. if the originating MSGin5G Client address is a URI, includes a Uri-Path Option with the value of the URI;

 3) shall set the CoAP Content-Format to "50", i.e. application/json; and

 4) shall include the information elements specified in 3GPP TS 23.554 [2] in the CoAP payload encoded in JSON format as specified in clause 7.3.4.3:

 i) shall include an "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

 ii) shall include an "Originating UE Service ID" element set to the UE which sends the MSGin5G message this message response is responded to;

 iii) shall include the "Message ID" copied from the received MSGin5G message which this message response is responded to;

 iv) may include a "Delivery Status" element to indicate that the delivery status of this MSGin5G message is a failure, or is stored for deferred delivery;

 v) may include a "Failure Cause" element to indicate the reason for failure; and

 vi) in addition to the information elements specified in 3GPP TS 23.554 [2], shall also include a "Message Type" element set to "MSGRESP" to indicate that this message is a message response.

### 6.4.1.2.3 Reception of an aggregated MSGin5G message

Upon receiving a CoAP POST request from an MSGin5G Client on an MSGin5G UE, containing the MSGin5G Service identifier and the "Message Type" with the value "MSG", if a "Number of individual messages" and a "List of individual messages" are included, the MSGin5G Server learns that this message is an aggregated MSGin5G message. The MSGin5G Server shall handle the whole aggregated MSGin5G message according to procedures specified in clause 6.4.1.2.2.

### 6.4.1.2.4 Reception of an MSGin5G delivery status report

Upon receiving a CoAP POST request from an MSGin5G Client on an MSGin5G UE, containing the MSGin5G Service identifier and the "Message Type" with the value "IMDN", if the "Number of individual messages" element and "List of individual messages" element are not be included and a "Delivery Status" element is included, the MSGin5G Server shall handle the CoAP POST request according to procedures specified in IETF RFC 7252 [5] with no additional requirement.

### 6.4.1.2.5 Reception of an aggregated MSGin5G delivery status report

Upon receiving an CoAP POST request from an MSGin5G Client on an MSGin5G UE, containing the MSGin5G Service identifier and the "Message Type" with the value "IMDN", if a "Number of individual messages" and a "List of individual messages" are included, the MSGin5G Server concludes that this message is an aggregated MSGin5G message. The MSGin5G Server shall handle the whole aggregated MSGin5G delivery status report according to procedures specified in clause 6.4.1.2.4.

### 6.4.1.2.6 Sending of an MSGin5G message

In order to deliver the MSGin5G message, the MSGin5G Server executes the messages termination procedure. The MSGin5G Server shall conclude the communication model of the message as specified in clause 6.4.1.2.1.

If the MSGin5G Server determines to deliver the MSGin5G message to an MSGin5G UE served by itself as specified in clause 6.4.1.2.1, the MSGin5G Server shall check the registration information of the recipient MSGin5G Client in MSGin5G UE, if the MSGin5G UE state is "registered" for the MSGin5G service the MSGin5G Server will start the delivery procedure.

If the MSGin5G UE provides the "communication availability" information during the registration, the MSGin5G Server will schedule the message delivery based on this information, e.g. delivers the MSGin5G message in the delivery window based on the specific application-level schedule/periodicity. The MSGin5G Server can also use UE reachability status monitoring specified in 3GPP TS 29.538 [7] to check whether the recipient is available. If the recipient is available, the MSGin5G Server tries to deliver the MSGin5G message to the MSGin5G UE.

In order to deliver the MSGin5G message, the MSGin5G Server shall send the MSGin5G message in an new CoAP message according to procedures specified in IETF RFC 7252 [5] via MSGin5G-1 reference point. The sending of the CoAP message shall follow the procedures below:

   a) the MSGin5G Server shall set the "T" field in the CoAP header to 0 if delivery status report from the recipient is requested, i.e. indicate that this message is the type of Confirmable, to ensure the application layer delivery status report;

   b) the MSGin5G Server shall set the CoAP Content-Format to "50", i.e. application/json;

   c) the MSGin5G Server shall remove any "Priority type" element, "Store and forward flag" and related "Store and forward parameters" elements from the CoAP payload of the received message. If "Message is segmented" and related elements is included in the received message, the MSGin5G Server shall handle the message as specified in clause 6.5.3;

   d) based on the communication model, the MSGin5G Server shall generate the new CoAP message as specified below:

      1) if the Service ID of the recipient points to an MSGin5G Client, the MSGin5G Server:

         i) shall include the recipient MSGin5G Client address in an CoAP Option, e.g. if the MSGin5G Client address is a URI, include a Uri-Path Option with the value of the URI; and

ii) shall copy other elements in the CoAP payload of the received message to the new CoAP POST request;

2) if the Service ID of the recipient points to an Application Server or a Message Gateway, the MSGin5G Server shall follow the procedure specified in 3GPP TS 29.538 [7];

3) if the MSGin5G message is a Group message, the MSGin5G Server:

   i) shall obtain the group members by checking the group profile with the "Group Service ID" element included in the received MSGin5G message; and

   ii) for each group member which is an MSGin5G UE, include its CoAP address got from the recipient MSGin5G UE registration specified in clause 6.3.1.2 in an CoAP Option, e.g. if the recipient client's address is a URI, includes a Uri-Path Option with the value of the URI. The MSGin5G Server shall add the "Recipient UE Service ID" element and set the value of it to the UE Service ID. The MSGin5G Server shall also copy other elements in the CoAP payload of the received message to the new CoAP POST request;

4) if the MSGin5G message is needed to be distributed based on Messaging Topic, the MSGin5G Server: shall obtain the UE Service ID/AS Service ID of the subscribers by checking the subscription with this Messaging Topic and

   i) for each subscriber which is an MSGin5G UE, include its CoAP address got from the recipient MSGin5G UE registration specified in clause 6.3.1.2 in an CoAP Option, e.g. if the recipient client's address is a URI, includes a Uri-Path Option with the value of the URI. The MSGin5G Server shall add the "Recipient UE Service ID" element and set the value of it to the UE Service ID. The MSGin5G Server shall also copy other elements in the payload of the received message to the new CoAP 2.05 response; or

   ii) for each subscriber which is Application Server or a Message Gateway, the MSGin5G Server shall follow the procedure specified in 3GPP TS 29.538 [7]; and

5) if the MSGin5G message is a broadcast message, the MSGin5G Server shall forward the Broadcast message request to the CBCF (as specified in 3GPP TS 23.041 [21]) via the Broadcast Message Gateway as specified in 3GPP TS 29.538 [7]; and

e) before sending the new CoAP message generated in step d), the MSGin5G Server shall compare the size of the"Payload" element in the payload of the new CoAP message to theMSGin5G Client Supported MSGin5G segment size of the recipient MSGin5G Client by checking the MSGin5G Client Supported MSGin5G segment size in the MSGin5G UE registration request of the recipient. If the size exceeds, the MSGin5G Server shall segment the MSGin5G message into a set of segmented MSGin5G messages such that the payload of each segmented MSGin5G message can fit within the MSGin5G Client Supported MSGin5G segment size. For each segmented MSGin5G message, in addition to the information elements generated in step d), the MSGin5G Server shall also:

1) include a "Message is segmented" element with a "true" value to indicate that this message is part of a segmented message;

2) include a "Segmentation set identifier" element to indicate that this segmented message is associated within a set of segmented messages. The same unique identifier is assigned to all segmented messages associated with the same MSGin5G message;

3) include a "Total number of message segments" element in the first segment of the MSGin5G message to indicate the total number of segments for the MSGin5G message;

4) include a "Message segment number" element to indicate segmented message number of each segmented message within the set of segmented messages; and

5) include a "Last segment flag" element in the last segment in the set of segmented messages;

If the MSGin5G UE state is "not registered", based on local implementation, the MSGin5G Server may try to inform the MSGin5G UE via the device triggering procedure as specified in 3GPP TS 29.538 [7] about an incoming message and the MSGin5G UE needs to register and receive the message.

The MSGin5G Server checks the availability of recipient by checking the UE registration status. The MSGin5G Server may also use UE reachability status monitoring specified in 3GPP TS 29.538 [7] to check whether the recipient is available. If the recipient is available, the MSGin5G Server send the new CoAP message generated as above to the

recipient. If the recipient is unavailable, the MSGin5G Server checks whether a "Store and forward flag" element indicates that "Store and forward" service is requested for this MSGin5G message:

a1) if the "Store and forward flag" element indicates that "Store and forward" service is not requested, the MSGin5G Server discards the message or local implementation may apply. The MSGin5G Server may send a message response as specified in clause 6.4.1.2.2 which includes delivery status information in the "Delivery Status" element, e.g., that the message was discarded and the procedure is finished; or

b1) if the "Store and forward flag" element indicates that "Store and forward" service is requested,

1) the MSGin5G Server stores the message temporarily and waits for the next delivery opportunity until the expiration time of this message which is included in the "Message expiration time" element in the "Store and forward parameters" element passed. The delivery opportunity may be known by the MSGin5G Server by the registration of recipient MSGin5G Client or by obtaining the information from the "Store and forward parameters" element, e.g. from the "Application specific store and forward information" element. The MSGin5G Server may send a message response as specified in clause 6.4.1.2.2 which includes store and forward status information in the "Delivery Status" element, e.g., the delivery had been deferred; and

2) when the delivery opportunity comes, the MSGin5G Server attempts delivery of the new CoAP message to the recipient. If the UE delivery opportunity does not come until the expiration time of this message which is included in the "Message expiration time" element in the "Store and forward parameters" element passed, the MSGin5G Server attempts delivery of the new CoAP message at the message expiration time, e.g. try to inform the MSGin5G UE via the device triggering procedure as specified in 3GPP TS 29.538 [7], and if the delivery is still failed, the stored message is discarded. The MSGin5G Server may send a message response as specified in clause 6.4.1.2.2 which includes store and forward status information the "Delivery Status" element, e.g., that the message was discarded.

## 6.4.1.2.7 Sending of an aggregated MSGin5G message

If the MSGin5G Server receives an aggregated MSGin5G message as specified in clause 6.4.1.2.3, and the payload of the received aggregated MSGin5G message is smaller than the MSGin5G Client Supported MSGin5G segment size of the recipient, it shall send it as specified in clause 6.4.1.2.6 without splitting the received aggregated message request into multiple individual MSGin5G message.

If the payload of the received aggregated MSGin5G message is larger than the MSGin5G Client Supported MSGin5G segment size of the recipient, the MSGin5G Server should remove the last individual message in the List of individual messages element from the aggregated message until the payload of the aggregated message is smaller than the MSGin5G Client Supported MSGin5G segment size that can be transmitted over available transport, and then send the remaining aggregated MSGin5G message as specified in clause 6.4.1.2.6. The MSGin5G messages removed from the aggregated message may be sent individually or aggregated again by the MSGin5G Server according to service configuration.

NOTE: Aggregated MSGin5G message is supported by all MSGin5G Clients and Application Servers. MSGin5G message and MSGin5G delivery status report cannot be aggregated in the same aggregated MSGin5G message.

If the MSGin5G Server receives an MSGin5G message as specified in clause 6.4.1.2.2, it may send multiple MSGin5G messages toward the same recipient in an aggregated MSGin5G message. Before the sending of an MSGin5G message, the MSGin5G Server shall check if aggregation is allowed for this message, MSGin5G Server shall also check the message data size, and the priority level to determine if the message can be aggregated. For example, if the MSGin5G Server finds that the received messages have small payload size when compared to the MSGin5G Client Supported MSGin5G segment size that can be transmitted over CoAP and the messages are not high priority messages, which could be sent as per scheduling policy towards a selected target. The MSGin5G Server can decide to aggregate messages until optimal use of segment size before sending message towards MSGin5G Client.

If the message can be aggregated, the MSGin5G Server aggregates multiple MSGin5G messages, and sends the aggregated message in a single CoAP POST request message. The sending of the CoAP POST request message shall follow the procedures specified in clause 6.4.1.2.6 with the clarifications listed below:

a) The MSGin5G Server should not segment the aggregated message, so the MSGin5G Server should ensure that the payload of the new aggregated MSGin5G message is smaller than the MSGin5G Client Supported MSGin5G segment size and skips the step e) in clause 6.4.1.2.6. The "Message is segmented", "Segmentation set

identifier", "Total number of message segments", "Message segment number" and "Last segment flag" elements should not be included in the aggregated MSGin5G message.

b) In addition to the elements specified in clause 6.4.1.2.6, the MSGin5G Server should include a "Number of individual messages" element in this message to indicate the total number of messages which are aggregated into this single message.

c) In addition to the elements specified in clause 6.4.1.2.6, the MSGin5G Server should include a "List of individual messages" element in this message. Each child element of this "List of individual messages" element contains information elements listed below:

    1) a "Message ID" to identify the individual message;

    2) a "Payload" which carries the application payload that is transferred by the individual MSGin5G message;

    3) one or more optional "Application ID" element(s);

    4) an optional "Delivery status required" element; and

    5) an optional "Priority type" element.

### 6.4.1.2.8    Sending of an MSGin5G delivery status report

Upon receiving an MSGin5G delivery status report as specified in clause 6.4.1.2.4, the MSGin5G Server may generate a new CoAP POST request containing the MSGin5G delivery status report if the MSGin5G Server decides not to aggregate the delivery status report. The new CoAP POST request is sent to the recipient obtained from the "Recipient UE Service ID" element in the payload of the received CoAP POST request. The MSGin5G Server:

a) shall set the "T" field in the CoAP header to 0;

b) shall include the recipient address in the Option header of the CoAP message and set the Option header to a corresponding value, e.g. if the MSGin5G Client address is a URI, includes a Uri-Path Option with the value of the URI; and

c) shall copy other elements in the payload of the received message to the new CoAP POST request.

### 6.4.1.2.9    Sending of a aggregated MSGin5G delivery status report

If the MSGin5G Server receives an aggregated MSGin5G delivery status report as specified in clause 6.4.1.2.5, it shall generate a new CoAP POST request containing the aggregated MSGin5G delivery status report and sends it to the recipient obtained from the "Recipient UE Service ID" element in the payload of the received CoAP POST request. The MSGin5G Server:

a) shall set the "T" field in the CoAP header to 0;

b) shall include the recipient address in the Option header of the CoAP message and set the Option header to a corresponding value, e.g. if the MSGin5G Client address is a URI, includes a Uri-Path Option with the value of the URI; and

c) shall copy other elements in the payload of the received message to the new CoAP POST request.

If the MSGin5G Server receives MSGin5G delivery status report as specified in clause 6.4.1.2.4, it may aggregate multiple MSGin5G message delivery status reports into one single message. The MSGin5G Server shall check whether the MSGin5G message delivery status reports can be aggregated as specified in clause 6.4.1.2.7.

If the MSGin5G message delivery status reports can be aggregated, the MSGin5G Server aggregates MSGin5G message delivery status reports intended for a selected target and sends the aggregated MSGin5G message delivery status reports in a single CoAP POST request message. The sending of the CoAP POST request message shall follow the procedures specified in clause 6.4.1.2.8 with the clarifications listed below:

a) the "Delivery Status" element and the "Failure Cause" element in payload of every individual MSGin5G message should not be copied to the payload of the new CoAP POST request message.

b) In addition to clause 6.4.1.2.8, the MSGin5G Server should include a "Number of individual messages" element in this message to indicate the total number of MSGin5G message delivery status reports which are aggregated into this single message.

c) In addition to clause 6.4.1.2.8, the MSGin5G Server should include a "List of individual messages" element in this message. Each child element of this "List of individual messages" element contains information elements listed below:

   1) "Message ID" of the individual MSGin5G message delivery status reports which is copied from the MSGin5G message that is being acknowledged;

   2) "Delivery Status" element copied from the individual MSGin5G message delivery status report; and

   3) an optional "Failure Cause" element copied from the individual MSGin5G message delivery status report.

## 6.4.2 Message delivery and message delivery status report delivery between MSGin5G UE and another UE

### 6.4.2.1 General

Clauses 6.4.2.2 and 6.4.2.3 define the procedures used for message or message delivery report sending or receiving between a MSGin5G Client and an Application Client residing in different UEs over MSGin5G-5.

In these procedures, for delivering messages or message delivery reports to a MSGin5G Client in a MSGin5G UE, the Application Client residing in different a UE may use any message format or protocol supported by the MSGin5G Client.

   NOTE 1: How the Application Client knows the message protocol/format supported by the MSGin5G Client is out of scope of this specification.

In the procedures, for delivering messages or message delivery reports to Application Client residing in a different UE, the MSGin5G Client in MSGin5G UE may use any message format or protocol supported by the Application Client.

   NOTE 2: How the MSGin5G Client knows the message protocol/format supported by the Application Client is out of scope of this specification.

Annex A lists some message formats/protocols examples (only for implementation reference) which may be used for the interaction between Application Client residing in a different UE and MSGin5G Client in MSGin5G UE over MSGin5G-5.

Clauses 6.4.2.4 and 6.4.2.5 define the procedures used for message exchange between MSGin5G Client residing in a Constrained UE which cannot connect to the 3GPP network directly and MSGin5G Server by using another UE as a UE-to-Network relay. In this case, the MSGin5G Client communicates with the MSGin5G Server via MSGin5G-1 reference point. All messages specified in clause 6.4.1 apply.

### 6.4.2.2 Procedure at MSGin5G Client in MSGin5G UE

#### 6.4.2.2.1 Sending of an message to an Application Client residing in a different UE

Upon successfully receiving a MSGin5G message including an Application ID from MSGin5G Server, if the Application ID is registered by an Application Client residing in a different UE, based on Application Client registration information, the MSGin5G Client in the MSGin5G UE shall send a request to the Application Client residing in the different UE, including the following information elements:

   a) the Message Type IE, e.g. if the message formats/protocols in Annex A are used, this IE is set to value "MESSAGE RECEIVED REQUEST", indicating the request/message is for delivering a message;

   b) the Message ID IE with the unique identity of this message;

   c) if the received message is a point-to-point or application-to-point message, the Originator Address IE indicating the originating UE or AS;

   d) if the received message is a group message, the Group ID IE indicating the originating group;

NOTE: the information included in the Originator Address IE is generated based on the received originating UE/AS Service ID, the information included in the Group ID IE is generated based on received Group Service ID. How to generate the value of Originator Address IE and Group ID IE is implementation specific.

e) the Payload IE indicating the application message content included in the received message;

f) if the delivery status report is required by the originator, the Delivery Status Required IE with "true"; and

g) optionally, the Priority IE indicating the application priority level.

### 6.4.2.2.2 Reception of an message from Constrained UE

Upon receiving a request from Application Client residing in a different UE, and the request is for initiating a MSGin5G message, e.g. , if the message formats/protocols in Annex A are used, the Message Type IE is set to "MESSAGE SENDING REQUEST", the MSGin5G Client in the MSGin5G UE shall construct and send a CoAP POST request to MSGin5G Server as specified in clause 6.4.1.1.2. The MSGin5G Client generates the Recipient UE Service ID/AS Service ID based on Target address IE the included in the request from the Constrained UE.

If the Application Client residing in a different UE indicates "UE" in the Target Type IE, the Target Address shall include information of another MSGin5G Client.

If an IPv4 or IPv6 address is included in the Target Address, the MSGin5G Client generates the Recipient UE Service ID/AS Service ID based on the mapping between the addresses and UE Service IDs/AS Service IDs stored in the MSGin5G UE.

If the Application Client residing in a different UE indicates "UE" in the Target Type IE, in order to route the MSGin5G message to the correct target MSGin5G Client, the Target Address may indicate an FQDN.

When the MSGin5G Client cannot generate the Recipient UE Service ID/AS Service ID based on Target address IE, the MSGin5G Client generates the request message to the Application Client residing in a different UE as specified in clause 6.4.2.2.3 if the Delivery status is required , e.g. , if the message formats/protocols in Annex A are used, the Delivery status required IE is set to "DELIVERY REPORT REQUIRED ". Otherwise, the MSGin5G Client discards the request from the Application Client residing in the different UE.

### 6.4.2.2.3 Sending of a message delivery status report to Constrained UE

Upon receiving a MSGin5G message delivery status report request including an Application ID from MSGin5G Server, and the Application ID is registered by the Application Client residing in a different UE, based on the Application Client registration information, the MSGin5G Client in the MSGin5G UE shall send a request/response message to the Application Client residing in the different UE, in the request, including the following information elements:

a) the Message Type IE indicating the request/message is for delivering a message delivery status, e.g. if the message formats/protocols in Annex A are used, the Message Type IE is set to "DELIVERY REPORT RECEIVED REQUEST";

b) the Message ID IE with the unique identity of this message delivery report;

c) the Reply-to Message ID IE indicating the delivery status is for which message; and

d) the Delivery Status IE indicating the delivery status.

### 6.4.2.2.4 Reception of an message delivery status report from Constrained UE

Upon receiving a request/response from Application Client residing in a different UE, and the request is for delivering a message delivery report, e.g. , if the message formats/protocols in Annex A are used, the Message Type IE is set to "DELIVERY REPORT SENDING REQUEST", the MSGin5G Client in the MSGin5G UE shall construct and send a CoAP POST request to MSGin5G Server as specified in clause 6.4.1.1.4.

#### 6.4.2.2.5 Sending of an message sending response to Constrained UE

Upon received the message request from Application Client residing in a different UE, the MSGin5G Client in the MSGin5G UE sends a response to the Application Client residing in the different UE including the following information elements:

    a) the Message Type IE indicating this is a response to the message sending request, e.g. if the message formats/protocols in Annex A are used, the Message Type IE is set to "MESSAGE SENDING RESPONSE" .

    b) the Result IE indicating success or failure of the message sending request; and

    c) optionally, the Failure Reason IE indicating the reason of failure when the Result IE is set to failure.

### 6.4.2.3 Procedure at Application Client residing in the different UE

#### 6.4.2.3.1 Sending of an message via MSGin5G UE

In order to initiate an MSGin5G message by using the MSGin5G Client in MSGin5G UE, the Application Client residing in a different UE with the MSGin5G Client shall send a request/message to the MSGin5G Client including the following information elements:

    a) the Message Type IE indicating the request/message is for initiating a MSGin5G message, e.g.if the message formats/protocols in Annex A are used, the Message Type IE is set to "MESSAGE SENDING REQUEST" ;

    b) the Message ID IE with the unique identity of this message;

    c) the Target Address IE with the information for MSGin5G Client to generate the Recipient UE/AS/Group Service ID in the MSGin5G message request;

    d) optionally, the Target Type IE indicating the type of the message recipient, e.g. if the message formats/protocols in Annex A are used, the Target Type IE has the value of "UE" if the message is sent to a UE, has the value of "AS" if the message is sent to an Application Server, or has the value of "GROUP" if message is sent to a MSGin5G Group;

    e) optionally, the Application ID IE indicating the application(s) for which the payload is intended;

    f) the Payload IE including the application content of the message to send to the recipient; and

    g) optionally, the Delivery Status Required IE with the value "true" if delivery status report is required.

#### 6.4.2.3.2 Sending of an MSGin5G message delivery status report via MSGin5G UE

In order to sending an message delivery report by using the MSGin5G Client in MSGin5G UE, the Application Client residing in a different UE with the MSGin5G Client shall send a request/response to the MSGin5G Client including the following information elements:

    a) the Message Type IE indicating the request/response is for sending a delivery status report, e.g.if the message formats/protocols in Annex A are used, the Message Type IE is set to "DELIVERY REPORT SENDING REQUEST";

    b) the Message ID IE with the unique identity of this message delivery report;

    c) the Reply-to Message ID IE copied from the received message, to indicate the delivery status is for which message; and

    d) the Delivery Status IE with delivery status.

#### 6.4.2.3.3 Sending of a message received response to MSGin5G UE

Upon received the message request from MSGin5G Client in MSGin5G UE, the Application Client residing in a different UE with the MSGin5G Client sends a response to the MSGin5G Client, including the following information elements:

a) the Message Type IE indicating the request/message is for initiating a MSGin5G message, e.g.if the message formats/protocols in Annex A are used, the Message Type IE is set to "MESSAGE RECEIVED RESPONSE" .

b) the Result IE indicating success or failure of the message received request; and

c) optionally, the Failure Reason IE indicating the reason of failure when the Result IE is set to failure.

### 6.4.2.4 Procedure at Relay UE

#### 6.4.2.4.1 Sending of an MSGin5G message to Constrained UE

When the Relay UE receives a CoAP POST request from UDP port 65401 and the recipient's address included in the CoAP Option is set to another MSGin5G Client-2 which has established a connection for ProSe UE-to-Network Relay Communication with it as specified in 3GPP TS 23.304[9], the Relay UE acts as either 5G ProSe Layer-2 and Layer-3 UE-to-Network Relay entity as specified in 3GPP TS 23.304 [9] and relays the CoAP POST request as a downlink traffic to the MSGin5G Client-2, Otherwise the MSGin5G Client-1 shall discard the CoAP POST request and may send a CoAP 4.04 (Not Found) response to the MSGin5G Server.

#### 6.4.2.4.2 Reception of an MSGin5G message from Constrained UE with MSGin5G Client

When the Relay UE receives a CoAP POST request from UDP port 65401 and the recipient's address included in the CoAP Option is set to the MSGin5G Server, the Relay UE acts as either 5G ProSe Layer-2 and Layer-3 UE-to-Network Relay entity as specified in 3GPP TS 23.304 [9] and relays the CoAP POST request as a uplink traffic to the MSGin5G Server.

### 6.4.2.5 Procedure at MSGin5G Client in Constrained UE

#### 6.4.2.5.1 Sending of an MSGin5G message

In order to send an MSGin5G message or MSGin5G message delivery status report, the MSGin5G Client shall use the procedures specified in clause 6.4.1.1.2, 6.4.1.1.3, 6.4.1.1.4 and 6.4.1.1.5.

#### 6.4.2.5.2 Reception of an MSGin5G message

Upon receiving an CoAP POST request and the recipient's address included in the CoAP Option is set to the MSGin5G Client itself, the MSGin5G Client shall handle the CoAP Post request as specified in clause 6.4.1.1.6, 6.4.1.1.7, 6.4.1.1.8 and 6.4.1.1.9.

# 6.5 MSGin5G Message Segmentation and Reassembly

## 6.5.1 Segment recovery and received confirmation procedures

The Message Sender in this clause can only be the MSGin5G Client (when the message is from MSGin5G Client) or MSGin5G Server (when the message is from Application Server).

The Message Receiver in this clause can only be the MSGin5G Client (when the message is targeted to an MSGin5G Client) or MSGin5G Server (when the message is targeted to an Application Server).

### 6.5.1.1 Procedure at Message Sender

Upon receiving a CoAP POST request containing the MSGin5G service identifier and containing the Message Type with a value "SEGREC" which indicates the request is for message segment recovery, the MSGin5G Client shall send a CoAP ACK response to the request. Then the MSGin5G Client shall send all requested segmented messages as requested in the received "List of Segment range" element to the message receiver (e.g. Application Server, UE) as specified in 6.4.1.1.2.

### 6.5.1.2 Procedure at Message Receiver

#### 6.5.1.2.1 Segments recovery procedure when failed to receive all segments

If not all segments are received within expected time, the Message Receiver shall send a CoAP POST request to the Message Sender for recovering the segments which are not received. In the CoAP POST request, the Message Receiver:

a) shall set the "T" field in the CoAP header to 0 to indicate this request is the type of Confirmable;

b) shall include the Message Sender address in a CoAP Option, e.g. if the Message Sender address is a URI, includes a Uri-Path Option with the value of the URI;

c) shall set the CoAP Content-Format to "50", i.e. application/json; and

d) shall include the following information elements in the CoAP payload encoded in JSON format:

   1) an "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

   2) a "Message Type" element with a value "SEGREC" to indicate that this request is for segments recovery;

   3) a "Segmentation Set Identifier" element copied from one of the previous received segments; and

   4) a "List of Segment range" element to indicate the segments range which the client wants to recover, each segment range consist of start and end sequence number of missing segments e.g. (5-7, 10-10, 15-19).

If not all segments are received within the expected time (based on configuration), the Message Receiver may consider that the recovery is failed. The Message Receiver may initiate the procedure again with updated list of segment range.

NOTE: The MSGin5G message segment recovery procedure may repeat based on the configuration.

The corresponding JSON Schema used in step d) is defined in clause 7.3.6.2.

#### 6.5.1.2.2 Segments received confirmation procedure

If the Message Receiver determines that it receives all segments successfully, or the Message Receiver determines that it is failed (including recovery failed) to receive all segments, the Message Receiver sends the message segments received confirmation to the Message Sender by a CoAP POST request. In the CoAP POST request, the Message Receiver:

a) shall set the "T" field in the CoAP header to 0 to indicate this request is the type of Confirmable;

b) shall include the Message Sender address in a CoAP Option, e.g. if the Message Sender address is a URI, includes a Uri-Path Option with the value of the URI;

c) shall set the CoAP Content-Format to "50", i.e. application/json; and

d) shall include the following information elements in the CoAP payload encoded in JSON format:

   1) the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

   2) the "Message Type" element with a value "SEGCONFIR" to indicate that this request is for sending message segments received confirmation;

   3) the "Segmentation Set Identifier" element copied from one of the previous received segments; and

   4) the "Result" element to indicate whether the segments are received successful or failed.

The corresponding JSON Schema used in step d) is defined in 7.3.6.1.

## 6.5.2 Procedure at MSGin5G Client

### 6.5.2.1 Procedure at MSGin5G Client in Sending UE

To support MSGin5G Message segmentation and reassembly, the Message Client performs the procedures specified in 6.4.1.1.2, and acts as Message Sender to perform the procedures in clause 6.5.1.1 if needed. When the MSGin5G Client performs the procedures in clause 6.5.1.1, the MSGin5G Server acts as Message Receiver.

### 6.5.2.2 Procedure at MSGin5G Client in Recipient UE

Upon receiving an MSGin5G message, to support MSGin5G Message segmentation and reassembly, the MSGin5G Client performs the procedures in 6.4.1.1.6, and acts as Message Receiver to perform the procedures in clause 6.5.1.2 if needed. When the MSGin5G Client performs the procedures in clause 6.5.1.2, the MSGin5G Server acts as Message Sender.

## 6.5.3 Procedure at MSGin5G Server

### 6.5.3.1 General

When the MSGin5G Server receives a message which is not segment message, the MSGin5G Server should follow the procedures in clause 6.4.1.2.6 to perform potential segment if needed (i.e. if the payload size of the received message exceeds the MSGin5G Client Supported MSGin5G segment size of the target UE).

This following clauses specify the procedures when the MSGin5G Server receives segmented message delivery request, message segments recovery request or message segments received confirmation request.

### 6.5.3.2 Procedures on receiving message segments targeting to a MSGin5G UE

Upon receiving a message segment targeting to MSGin5G UE, the MSGin5G Server checks if the payload of this MSGin5G message segment exceeds the MSGin5G Client Supported MSGin5G segment size of the targeted UE,

    a)  if exceed, upon receiving all segments,

        1)  reassembles them into a single MSGin5G message;

        2)  splits the re-assembled message to segments such that the payload of each segment is smaller than the MSGin5G Client Supported MSGin5G segment size of the targeted UE; and

        3)  sends each new segment to the target MSGin5G UE as specified in clause 6.4.1.2.6; and

    b)  if not exceed, upon receiving all segments, sends each segment to the target MSGin5G UE as specified in clause 6.4.1.2.6.

### 6.5.3.3 Procedures on receiving message segments targeting to an Application Server

Upon receiving all message segments from MSGin5G UE to an Application Server, the MSGin5G Server shall reassemble them into a single MSGin5G message and sends it to the Application Server as specified in TS 29.538 [7].

Upon receiving message segments from MSGin5G UE to an Application Server, the MSGin5G Server acts as a Message Receiver to perform the procedures specified in clause 6.5.1.2.1 and in clause 6.5.1.2.2 if needed. In these procedures, the MSGin5G Client in the MSGin5G UE acts as Message Sender.

### 6.5.3.4 Procedures on receiving message segments recovery request to a MSGin5G UE

Upon receiving a CoAP POST request containing the MSGin5G service identifier and containing the Message Type with a value "SEGREC" indicating the request is for message segment recovery, if the request is targeted to an MSGin5G UE, the MSGin5G Server shall construct a new CoAP POST request to the targeted UE. In the request, the MSGin5G Server:

a) shall construct the new CoAP POST request with the corresponding value in the received CoAP POST request message except the Option header; and

b) shall include the MSGin5G Client address in the Option header of the CoAP message and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI.

### 6.5.3.5 Procedures on receiving message segments received confirmation to a MSGin5G UE

Upon receiving a CoAP POST request containing the MSGin5G service identifier and containing the Message Type with a value "SEGCOFIR" indicating the request is for message segments received confirmation, if the request is targeted to an MSGin5G UE, the MSGin5G Server shall construct a new CoAP POST request to the targeted UE. In the request, the MSGin5G Server:

a) shall construct the new CoAP POST request with the corresponding value in the received CoAP POST request message except the Option header; and

b) shall include the MSGin5G Client address in the Option header of the CoAP message and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI.

# 6.6 Messaging Topic Subscription and Unsubscription

## 6.6.1 General

As specified in 3GPP TS 23.554 [2], an MSGin5G Client may subscribe one or more Messaging Topics on the MSGin5G Server.

The Messaging Topic subscription and unsubscription are based on the CoAP Observe method as specified in IETF RFC 7641 [4], the MSGin5G Client acts as an observer, the MSGin5G Server acts as a CoAP Server, the Messaging Topic is a resource to observe.

If multiple MSGin5G Servers are deployed, to enable the message delivery based on Messaging Topic between different MSGin5G Servers, an MSGin5G Server shall subscribe the Messaging Topic list from other MSGin5G Servers as specified in clause 5.4.2.2 of 3GPP TS 29.538 [7]. The MSGin5G Server may work in either Mod.A or Mod.B specified in 3GPP TS 23.554 [2] based on the service policy.

## 6.6.2 Procedure at MSGin5G Client

### 6.6.2.1 Messaging Topic Subscription

Upon receiving a request to subscribe a Messaging Topic from an Application Client, MSGin5G Client shall send a CoAP GET request, as specified in IETF RFC 7641 [4], to the MSGin5G Server. In the CoAP GET request, the MSGin5G Client:

a) shall set the "T" field in the CoAP header to the value "0" to indicate this request is the type of Confirmable;

b) shall include the MSGin5G Server address in the Option header and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI;

c) shall include the Messaging Topic name in the Uri-Path Option (e.g. "\top");

d) shall include the Observe Option with the value "0" which indicates the request is for observing a resource, i.e. for subscribing a Messaging Topic;

e) shall include the Content-Format Option with the value "50" which indicate the format of the CoAP payload is "application/json" as specified in RFC 7252 [5]; and

    f)   shall include the CoAP Payload in JSON format, including the following information elements as specified in clause 8.8.1 of 3GPP TS 23.554 [2]:

       1)  an "Originating UE Service ID" element set to the MSGin5G UE which requests the Messaging Topic subscription; and

       2)  optionally, an "Expiration time" element which indicates the expiration time of the Messaging Topic subscription.

The corresponding JSON Schema used in step g) is defined in clause 7.3.5.1.

## 6.6.2.2 Messaging Topic Unsubscription

If the MSGin5G Client needs to unsubscribe a Messaging Topic, as specified in RFC 7641 [4], the MSGin5G Client shall send a CoAP GET request to MSGin5G Server. In the request, the MSGin5G Client:

    a)  shall set the "T" field in the CoAP header to the value "0" to indicate this request is the type of Confirmable;

    b)  shall include the MSGin5G Server address in the Option header and set the Option header to a corresponding value, e.g. if the MSGin5G Server address is a URI, the Uri-Path Option is set to the value of such URI;

    c)  shall include the Messaging Topic name in the Uri-Path Option (e.g. "\top");

    d)  shall include the Observe Option with the value "1" which indicates the observer request to cancel the previous resource observation, i.e. the MSGin5G Client requests to unsubscribe the Messaging Topic;

    e)  shall include the Content-Format Option with the value "50" which indicate the format of the CoAP payload is "application/json" as specified in RFC 7252 [5]; and

    e)  shall include the CoAP Payload in JSON format and an "Originating UE Service ID" element indicating the MSGin5G UE which requests the Messaging Topic unsubscription shall be included in the CoAP Payload.

The corresponding JSON Schema used in step g) is defined in 7.3.5.2.

## 6.6.3 Procedures at MSGin5G Server

## 6.6.3.0 General procedures at MSGin5G Server

The MSGin5G Server should support parsing CoAP request as specified in RFC 7252 [5] and RFC 7641 [4].

Upon receiving a CoAP GET request from MSGin5G Client, the MSGin5G Server shall parse the CoAP headers, Options and Payload in the request to get:

    a)  the value of Observe Option;

    b)  the Messaging Topic from the Uri-Path Option;

    c)  the Originating UE Service ID from the Payload; and

    d)  the Expiration time from the Payload if exists in the Payload.

## 6.6.3.1 Messaging Topic Subscription

If the Observe Option is included in the CoAP GET request with a value "0" as specified in RFC 7641 [4], the MSGin5G Server shall:

    a)  if the Messaging Topic does not exist locally:

       1)  if the Messaging Topic exists on the other MSGin5G Server ,

          i)   if the MSGin5G Server works in Mod.A as specified in clause 8.8.4.1 of 3GPP TS 23.554 [2], the MSGin5G Server forwards the Messaging Topic Subscription to the other MSGin5G Server B; or

    ii) if the MSGin5G Server works in Mod.B as specified in clause 8.8.4.1 of 3GPP TS 23.554 [2], the MSGin5G Server subscribes the message topic on the MSgin5G Server B as specified in clause 5.4.2.5 of 3GPP TS 29.538 [7], or

  2) if the message topic does not exist on any MSGin5G Server B:

    i) the MSGin5G Server creates the message topic locally; and

    ii) if there are Messaging Topic list subscriptions from other MSGin5G Server(s), the MSGin5G Server shall send a Messaging Topic list notification to the corresponding MSGin5G Server(s) as specified in clause 5.4.2.4 of 3GPP TS 29.538 [7];

  b) if the Originating UE Service ID is not in the list of the subscribers of the Messaging Topic, add the Originating UE Service ID to the list of the subscribers of the topic, and record its expiration time if exists;

  c) if an entry with a matching Originating UE Service ID is already present in the list of the subscribers of the Messaging Topic, updates the expiration time of the subscription of this UE; and

  d) send a CoAP Notifications with a 2.05 (Content) response code to the MSGin5G Client and with CoAP Payload in JSON format, including the following information elements as specified in clause 8.8.1 of 3GPP TS 23.554 [2]:

    1) a "subscription status" element set to indicate whether the subscription was successfully added or deleted on the MSGin5G Server; and

    2) optionally, an "Expiration time" element set to indicate the expiration time of the Messaging Topic subscription.

The MSGin5G Server shall remove the Originating UE Service ID from list of the subscribers of the Messaging Topic when the expiration time reached.

### 6.6.3.2 Messaging Topic Unsubscription

If the Observe Option is included in the received CoAP GET request with a value "1" as specified in RFC 7461 [4], the MSGin5G Server shall handle the CoAP GET request according to procedures specified in IETF RFC 7252 [5] with the clarifications listed below:

  a) if the Messaging Topic exists, the MSGin5G Server shall remove the Originating UE Service ID from list of the subscribers of the Messaging Topic; and

  b) the MSGin5G Server sends a CoAP Notifications with a 2.05 (Content) response code to the MSGin5G Client, and with CoAP Payload in JSON format. A "subscription status" element set to indicate whether the subscription was successfully added or deleted on the MSGin5G Server shall be included in this CoAP Payload as specified in clause 8.8.3 of 3GPP TS 23.554 [2].

# 6.7 Void

# 6.8 Usage of SEAL

## 6.8.1 General

The MSGin5G Service functional entities, i.e. MSGin5G Client and MSGin5G Server, utilize the SEAL services. All SEAL services specified in 3GPP TS 24.544 [10], 3GPP TS 24.545 [11], 3GPP TS 24.546 [12], 3GPP TS 24.547 [13], 3GPP TS 24.548 [14], and 3GPP TS 24.543 [23] are available to MSGin5G Service. In this clause, the procedures whose utilization by MSGin5G Service are well-known are described.

NOTE: If SEAL client is co-located with MSGin5G client, then MSGin5G client act as a SEAL client to perform procedures. If SEAL client is not co-located with MSGin5G client, then the interaction between MSGin5G client and SEAL client is implementation specific.

## 6.8.2 Configuration management service

### 6.8.2.1 General

The MSGin5G Client and MSGin5G Server utilize configuration management service procedures of SEAL to support MSGin5G Service. The procedure to fetch VAL UE configuration data specified in clause 6.2.3 of 3GPP TS 24.546 [12] is applicable for the configuration management services of the MSGin5G Service. The MSGin5G UE configuration data is specified in clause 7.2.

## 6.8.3 Group management service

### 6.8.3.1 General

The MSGin5G Client and MSGin5G Server utilize group management service procedures of SEAL to support MSGin5G Service. The following procedures of group management service of SEAL as specified in 3GPP TS 24.544 [10] are applicable for the MSGin5G Service:

a) Group creation specified in clause 6.2.2; with following clarification:

1) Upon receiving Group Creation notification as specified in clause of 3GPP TS 24.544 [10], for list of VAL user IDs or VAL UE IDs which does not have group management client on the UE (e.g. Legacy 3GPP UEs or Non-3GPP UEs), the MSGin5G server initiate the group creation notification towards those UEs;

b) Group configuration management specified in clause 6.2.5; and

c) Group membership specified in clause 6.2.4.

e) Location-based group creation specified in clause 6.2.6;

f) Group announcement and join specified in clause 6.2.7;

g) Group member leave specified in clause 6.2.9;

h) Temporary groups specified in clause 6.2.11; and

i) Group deletion specified in clause 6.2.12.

NOTE: If the UE that is involved the Group management procedures does not have group management client (e.g. Legacy 3GPP UEs, Non-3GPP UEs or Application Server), it is responsibility of the VAL server (MSGin5G Server) to initiate the necessary group management request/response towards SEAL Group Management server on behalf of those UE. And if applicable, send and receive the necessary group management request/response to/from those UEs.

## 6.8.4 Data delivery management service

### 6.8.4.1 General

The MSGin5G Client and MSGin5G Server functionalities can be integrated in the SEALDD enabler layer as defined by 3GPP TS 23.433 [22] Annex B, and then the MSGin5G Client functionality is integrated in the SEAL Data Delivery Management Client (SDDM-C) and the MSGin5G Server functionality is integrated in the SEAL Data Delivery Management Server (SDDM-S) as specified by 3GPP TS 24.543 [23]. The SDDM-C and the SDDM-S can use MSGin5G functionalities to send SEALDD traffic in MSGin5G message format defined by the present specification.

# 7 Coding

## 7.1 General

This clause contains the information elements coding for the messages used in the procedures described in the present document.

In order to identify the usage of messages, in addition to the information elements specified in 3GPP TS 23.554 [2], a "Message Type" element shall be added to each message. The possible values of "Message Type" element are listed below:

a) "REG" refers to registration;

b) "DEREG" refers to de-registration;

c) "MSG" refers to MSGin5G message;

d) "MSGRESP" refers to message response; and

e) "IMDN" refers to MSGin5G delivery status report";

f) "SEGREC" refers to segments recovery;

g) "SEGCONFIR" refers to message segments received confirmation.

h) "BREG" refers to bulk registration;

i) "BDEREG" refers to bulk de-registration;

j) "REGRESP" refers to registration response;

k) "DEREGRESP" refers to de-registration response; and

l) "GWREG" refers to gateway registration.

## 7.2 MSGin5G UE Configuration data

### 7.2.1 General

This clause specified the extension of the SEAL UE configuration document as defined in 3GPP TS 24.546 [6].

### 7.2.2 Application unique ID

The AUID shall be set to the unique service identifier of MSGin5G service as specified in 3GPP TS 23.554 [2]

### 7.2.3 Structure

The MSGin5G UE configuration document structure is described in clause 7.2 of 3GPP TS 24.546 [6] with the MSGin5G specific clarifications specified in this clause.

The <on-network> element of the <seal-UE-configuration> element specified in clause 7.2 of 3GPP TS 24.546 [6]:

a) shall include a <MSGin5G-Server-address> element;

b) shall include a <MSGin5G-UE-Service-id> element; and

c) may include a <Segment-size> element.

## 7.2.4 XML schema

### 7.2.4.1 General

The MSGin5G UE configuration document is composed according the XML schema described in the clause 7.2 of 3GPP TS 24.546 [6], and extended with extensions from the XML schema defined in clause 7.2.4.2.

### 7.2.4.2 XML schema for MSGin5G specific extensions

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema
  xmlns="urn:3gpp:ns:seal:MSGin5GUEConfig:1.0"
  targetNamespace="urn:3gpp:ns:seal: MSGin5GUEConfig:1.0"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns: msgin5guec="urn:3gpp:ns:seal: MSGin5GUEConfig:1.0"
  elementFormDefault="qualified"
  attributeFormDefault="unqualified">

  <!—MSGin5G specific "on-network" child elements -->
  <xs:element name="MSGin5G-Server-address" type="xs:string"/>
  <xs:element name="MSGin5G-UE-Service-id" type="xs:string"/>
  <xs:element name="Segment-size" type="xs:unsignedInt"/>

</xs:schema>
```

## 7.2.5 Data semantics

The <VAL-UE-id> element in <seal-UE-configuration> element is MSGin5G UE ID as specified in TS 23.554 [2].

The <VAL-Service-id> element in <seal-UE-configuration> element is MSGin5G service ID.

The <MSGin5G-Server-address> element in <on-network> element of <seal-UE-configuration> element is the address information of the initial MSGin5G Server serving the MSGin5G Client.

The <MSGin5G-UE-Service-id> element in <on-network> element of <seal-UE-configuration> element is the MSGin5G UE Service ID as specified in TS 23.554 [2].

The <Segment-size> element in <on-network> element of <seal-UE-configuration> element is the segment size used for the MSGin5G UE to do message segmentation, the payload size of every segmented message will not exceed the segment size.

## 7.2.6 MIME types

The MIME type for the MSGin5G UE configuration document shall use the MIME type as specified in the clause 7.2.6 of 3GPP TS 24.546 [6].

## 7.3 MSGin5G message structure

### 7.3.1 General

This clause defines the JSON schema of the body of CoAP requests realizing the MSGin5G message. The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of MSGin5G message, the properties are defined as shorten form and the relationship between the properties and IEs used in clause 6 are described in the description of the properties.

## 7.3.2 Configuration

### 7.3.2.1 MSGin5G UE Configuration structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationship between the properties and IEs used in clause 6.2 are described in the description of the properties, The JSON schema is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_UE_Configuration_schema",
  "title": "MSGin5G_UE_Configuration",
  "type": "object",
  "properties": {
    "ueId": {
      "type": "string",
      "description": "Refer to MSGin5G UE ID"
    },
    "addInfos": {
      "type": "array",
      "description": "Refer to other related informations",
      "items": {
        "$ref": "#/$defs/AddInfo"
      }
    }
  },
  "required": ["ueId"],
  "$defs": {
    "AddInfo": {
      "type": "object",
      "properties": {
        "name": {
          "type": "string"
        },
        "value": {
          "type": "string"
        }
      },
      "required": ["name", "value"]
    }
  }
}
```

### 7.3.2.2 MSGin5G Gateway UE Configuration structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationship between the properties and IEs used in clause 6.2.3.3.1 are described in the description of the properties, The JSON schema of CoAP 2.05 notification for the configuration request from Constrained UE is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G Gateway_UE_Bulk_Configuration_notification_schema",
  "title": "MSGin5G Gateway UE Bulk Configuration notification",
  "type": "object",
  "properties": {
    "maxConfTime": {
      "type": "integer",
      "description": "Refer to the maximum wait time in seconds for the bulk configuration request
to be sent to the MSGin5G Server"
    }
  },
  "required": [
    "maxConfTime"
  ]
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationship between the properties and IEs used in

clause 6.2.3.3.2 are described in the description of the properties, The JSON schema of the bulk configuration request to MSGin5G Server is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G Gateway_UE_Bulk_Configuration_request_schema",
  "title": "MSGin5G Gateway UE Bulk Configuration request",
  "type": "object",
  "properties": {
    "listUeId": {
      "type": "array",
      "description": "Refer to list of MSGin5G UE ID of Constrain UE",
      "items": {
        "$ref": "#/$defs/UeId"
      }
    },
    "bulkConFlag": {
      "type": "boolean",
      "default": "false",
      "description": "Refer to indicates this request is used for MSGin5G UE bulk configuration"
    },
    "addInfos": {
      "type": "array",
      "description": "Refer to other related informations",
      "items": {
        "$ref": "#/$defs/AddInfo"
      }
    }
  },
  "required": ["listUeId", "bulkConFlag"],
  "$defs": {
    "AddInfo": {
      "type": "object",
      "properties": {
        "name": {
          "type": "string"
        },
        "value": {
          "type": "string"
        }
      },
      "required": ["name", "value"]
    },
    "UeId": {
      "type": "object",
      "properties": {
        "MSGin5GUeid": {
          "type": "string",
          "format": "uri"
        }
      },
      "required": ["MSGin5GUeid"]
    }
  }
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationship between the properties and IEs used in clause 6.2.3.3.3 are described in the description of the properties, The JSON schema of CoAP 2.05 response for the configuration request from MSGin5G Server is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G Gateway_UE_Bulk_Configuration_response_schema",
  "title": "MSGin5G Gateway UE Bulk Configuration response",
  "type": "object",
  "properties": {
    "listConInfo": {
      "type": "array",
      "description": "Refer to each element of the list is used to complete the configuration of the
constrained UEs",
      "items": {
        "$ref": "#/$defs/ConfInfo"
      }
    }
  },
  "required": ["listConInfo"],
  "$defs": {
```

```
    "ConfInfo": {
      "type": "object",
      "properties": {
        "ServiceId": {
          "type": "string"
        },
        "serverAddr": {
          "type": "string",
          "format": "uri"
        },
        "specInfo": {
          "type": "array",
          "items": {
          "$ref": "#/$defs/AddInfo"
          }
        }
      },
      "required": ["ServiceId", "serverAddr"]
    },
    "AddInfo": {
      "type": "object",
      "properties": {
        "name": {
          "type": "string"
        },
        "value": {
          "type": "string"
        }
      },
      "required": ["name", "value"]
    }
  }
}
}
```

## 7.3.3    Registration

### 7.3.3.1    MSGin5G UE Registration structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.1.1.1 and clause 6.3.4.2.1 are described in the description of the properties. The JSON schema of the CoAP POST request for the MSGin5G registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Registration_request_schema",
  "title": "MSGin5G Registration Request",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "REG"
      ],
      "description": "Refer to the usage of this message. The value REG refers to MSGin5G
Registration"
    },
    "urgentTag": {
      "type": "boolean",
      "default": false,
      "description": "Refer to registration not urgent in case of registration via a Gateway UE"
    },
    "waitTime":{
      "type": "integer",
      "description": Refer to the wait time in seconds in case of non-urgent registration via a
Gateway UE"
    },"
    },
```

```
      "oriAddr": {
        "type": "object",
        "properties": {
          "oriAddrType": {
            "enum": [
              "UE"
            ]
          },
          "addr": {
            "type": "string",
            "format": "uri"
          }
        },
        "description": "Refer to Originating UE Service ID"
      },
      "cliProfile": {
        "type": "object",
        "properties": {
          "triInfo": {
            "type": "object",
            "properties": {
              "ueId": {
                "type": "string",
                "format": "uri",
                "description": "Refer to MSGin5G UE ID"
              },
              "cliPort": {
                "type": "string",
                "description": "Refer to MSGin5G Client Port"
              },
              "cliPorts": {
                "type": "array",
                "description": "Refer to MSGin5G Client Ports",
                "items": {
                "$ref": "#/$defs/portInfo"
                }
              }
            },
            "required": [
              "ueId",
              {
                  "OneOf":["cliPort", "cliPorts"]
              }
            ],
            "description": "Refer to MSGin5G Client Triggering Information"
          },
          "comAvail": {
            "type": "object",
            "properties": {
              "schTime": {
                "type": "string",
                "format": "date-time",
                "description": "Refer to Scheduled Communication Time"
              },
              "durTime": {
                "type": "integer",
                "description": "Refer to Communication Duration Time in seconds"
              },
              "periIndi": {
                "type": "boolean",
                "default": false,
                "description": "Refer to Periodic Communication Indicator"
              },
              "periInterval": {
                "type": "integer",
                "description": "Refer to Periodic Communication Interval in seconds"
              },
              "dataSize": {
                "type": "integer",
                "description": "Refer to Data Size Indication in octets"
              },
              "storeForward": {
                "type": "boolean",
                "default": false,
                "description": "Refer to Store and Forward Option"
              }
            },
              "required": [
```

```
                  "schTime",
                  "durTime"
                ],
              "description": "Refer to MSGin5G Client Communication Availability"
            },
            "MaxSeg": {
              "type": "integer",
              "description": "Refer to UE Supported MSGin5G Segment Size element in bytes",
              "maximum": "2048"
            }
          },
          "description": "Refer to MSGin5G Client Profile"
        },
        "reqExpTime": {
          "type": "string",
          "format": "date-time",
          "description": "Refer to requested expiration time in seconds"
        }
      },
      "required": [
      "msgIden",
      "msgType",
      "oriAddr "
      ],
      "$defs": {
        "portInfo": {
          "type": "object",
          "properties": {
            "portNum": {
              "type": "int",
              "description": "the port number MSGin5G Client listens on for device triggers from the
MSGin5G Server"
            },
            "Protocol": {
              "type": {
              "enum": [
                "SMS",
                "NIDD",
                "OTHER"
              ]
            }
          },
          "required": [
          "portNum",
          "Protocol"
        ]
        }
      }
    }
  }
}
```
The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.1.2.1 are described in the description of the properties. The JSON schema of CoAP 2.01 (Created) response or CoAP 2.04 (Change) response for the MSGin5G registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Registration_response_schema",
  "title": "MSGin5G Registration Response",
  "type": "object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "result": {
```

```
      "type": "boolean",
      "default": true,
      "description": "Refer to Registration result. The value true refers to success"
    },
      "regExpTime": {
      "type": "integer",
      "description": "Refer to expiration time of the registration in seconds"
    },
      "cause": {
      "type": "string",
      "description": "Failure Cause."
    }
  },
    "required": [
    "oriAddr",
    "result"

  ],
    "dependentRequired": {
    "regExpTime ": [
      "result": {
        "const": "true"
      }
    }],
    "Cause": [{
      "result": {
        "const": "false"
      }
    }]
  }
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G
service, the properties are defined as shorten form and the relationships between the properties and elements used in
clause 6.3.4.3.1 are described in the description of the properties. The JSON schema of CoAP 2.01 (Created) response
or CoAP 2.04 (Change) response for the MSGin5G registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Registration_notification_schema",
  "title": "MSGin5G Registration Notification",
  "type": "object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "expectedTime": {
      "type": "integer",
      "description": "Refer to the expected time for receiving Registration Response in seconds"
    }
  },
    "required": [
    "oriAddr"
    ]
}
```

### 7.3.3.2 MSGin5G UE De-registration structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G
service, the properties are defined as shorten form and the relationships between the properties and elements used in
clause 6.3.1.1.2 are described in the description of the properties. The JSON schema of the CoAP POST request for the
MSGin5G de-registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Deregistration_request_schema",
  "title": "MSGin5G Deregistration Request",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "DEREG"
      ],
      "description": "Refer to the usage of this message. The value DEREG refers to MSGin5G De-
registration"
    },
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    }
  },
  "required": [
    "msgIden",
    "oriAddr ",
  ]
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.1.2.2 are described in the description of the properties. The JSON schema of CoAP 2.04 (Change) response for the MSGin5G de-registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_ Deregistration_response_schema",
  "title": "MSGin5G Deregistration Response",
  "type": "object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "result": {
      "type": "boolean",
      "default": true,
      "description": "Refer to De-registration result. The value true refers to success"
    },
    "cause": {
      "type": "string",
      "description": "Failure Cause."
    }
  },
  "required": [
```

```
      "oriAddr",
      "result"
    ],
    "dependentRequired": {
      "Cause": [{
        "result": {
          "const": "false"
        }
      }]
    }
  }
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.4.3.4 are described in the description of the properties. The JSON schema of CoAP 2.04 (Change) response for the MSGin5G deregistration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G Deregistration_notification_schema",
  "title": "MSGin5G Deregistration Notification",
  "type": "object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "expectedTime": {
      "type": "integer",
      "description": "Refer to the expected time for receiving Deregistration Response in seconds"
    }
  },
    "required": [
    "oriAddr"
  ]
}
```

### 7.3.3.3 Structure of registration to MSGin5G Gateway UE

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.5.3.1 are described in the description of the properties. The JSON schema of the CoAP POST request for the registration to MSGin5G Gateway UE is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Gateway Registration_request_schema",
  "title": "MSGin5G Gateway Registration Request",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "GWREG"
```

```
      ],
      "description": "Refer to the usage of this message. The value GWREG refers to MSGin5G Gateway
Registration"
    },
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "oriUEAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "expiredTime": {
      "type": "integer",
      "description": "Refer to Gateway Service expiration time in seconds"
    }
  },
  "required": [
  "msgIden",
  "msgType",
  "oriAddr "
  ]
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.5.2.1 are described in the description of the properties. The JSON schema of CoAP 2.01 (Created) response or CoAP 2.04 (Change) response for the registration to MSGin5G Gateway UE is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Gateway Registration_response_schema",
  "title": "MSGin5G Gateway Registration Response",
  "type": "object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "result": {
      "type": "boolean",
```

```
      "default": true,
      "description": "Refer to Registration result. The value true refers to success"
    },
    "acceptedTime": {
      "type": "integer",
      "description": "Refer to allowed expiration time for Gateway Service in seconds"
    },
    "failure reason": {
      "type": "string",
      "description": "Refer to Failure Reason"
    }
  },
    "required": [
    "oriAddr",
    "result"
  ],
  "dependentRequired": {
    "acceptedTime": [{
      "result": {
        "const": "true"
      }
    }],
    "failure reason": [{
      "result": {
        "const": "false"
      }
    }]
  }
}
```

## 7.3.3.4      MSGin5G UE Registration Response structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.4.3.3 are described in the description of the properties. The JSON schema of the CoAP POST request for the MSGin5G registration response to Constrained UE is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Registration_Response_to_Constrained_UE_schema",
  "title": "MSGin5G Registration Response to Constrained UE",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "REGRESP"
      ],
      "description": "Refer to the usage of this message. The value REGRESP refers to MSGin5G
Registration Response to Constrained UE"
    },
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "result": {
      "type": "boolean",
      "default": true,
      "description": "Refer to Registration result. The value true refers to success"
    },
```

```
      "cause": {
        "type": "string",
        "description": "Failure Cause."
      },
      "regExpTime": {
        "type": "integer",
        "description": "Refer to expiration time of the registration in seconds"
      }
    },
    "required": [
    "oriAddr",
    "result"
    ],
    "dependentRequired": {
      "regExpTime ": [{
        "result": {
          "const": "true"
        }
      }],
      "Cause": [{
        "result": {
          "const": "false"
        }
      }]
    }
  }
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.4.2.3 are described in the description of the properties. The JSON schema of CoAP 2.04 (Change) response for the MSGin5G registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Registration_Response_Ack",
  "title": "MSGin5G Registration Response Ack",
  "type": "object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    }
  },
    "required": [
    "oriAddr"
  ]
}
```

### 7.3.3.5 MSGin5G UE Deregistration Response structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.4.3.6 are described in the description of the properties. The JSON schema of the CoAP POST request for the MSGin5G deregistration response to Constrained UE is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Deregistration_response_to_Constrained_UE_schema",
  "title": "MSGin5G Deregistration Response to Constrained UE",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
```

```
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "DEREGRESP"
      ],
      "description": "Refer to the usage of this message. The value DEREGRESP refers to MSGin5G
Deregistration Response to Constrained UE"
    },
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "result": {
      "type": "boolean",
      "default": true,
      "description": "Refer to Deregistration result. The value true refers to success"
    },
    "cause": {
      "type": "string",
      "description": "Failure Cause."
    }
  },
  "required": [
    "oriAddr",
    "result"
  ],
  "dependentRequired": {
    "Cause": [{
      "result": {
        "const": "false"
      }
    }]
  }
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.4.2.4 are described in the description of the properties. The JSON schema of CoAP 2.04 (Change) response for the MSGin5G de-registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Deregistration_Response_Ack",
  "title": "MSGin5G Deregistration Response Ack",
  "type": "object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    }
  },
  "required": [
```

```
      "oriAddr"
    ]
}
```

## 7.3.3.6 MSGin5G UE Bulk Registration structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.4.3.2 are described in the description of the properties. The JSON schema of the CoAP POST request for the MSGin5G bulk registration to MSGin5G Server is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Bulk Registration Request_to MSGin5G Server",
  "title": "MSGin5G Bulk Registration Request to MSGin5G Server",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "BREG"
      ],
      "description": "Refer to the usage of this message. The value BULKREG refers to MSGin5G Bulk
Registration to MSGin5G Server"
    },
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "NumOfIndividualRequests": {
      "type": "integer",
      "description": "Number of individual MSGin5G UE registration requests"
    },
    "ListOfIndividualRequests": {
      "type": "array",
      "description": "List of individual MSGin5G UE registration requests",
      "item": {
        "$ref": "#/MSGin5G Registration Request"
      }
    },
    "required": [
    "msgIden",
    "msgType",
    "oriAddr",
    "NumOfIndividualRequests",
    "ListOfIndividualRequests"
    ]
  }
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.4.4.1 are described in the description of the properties. The JSON schema of CoAP 2.01 (Created) response or CoAP 2.04 (Change) response for the MSGin5G bulk registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Bulk_Registration_response_schema",
  "title": "MSGin5G Bulk Registration Response",
  "type": "object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "NumOfIndividualResponses": {
      "type": "integer",
      "description": "Number of individual MSGin5G UE registration responses"
    },
    "ListOfIndividualResponses": {
      "type": "array",
      "description": "List of individual MSGin5G UE registration responses",
      "item": {
        "$ref": "#/MSGin5G Registration Request"
      }
    },
    "required": [
    "oriAddr",
    "NumOfIndividualResponses",
    "ListOfIndividualResponses"
    ]
  }
}
```

### 7.3.3.7 MSGin5G UE Bulk Deregistration structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.4.3.5 are described in the description of the properties. The JSON schema of the CoAP POST request for the MSGin5G bulk deregistration to MSGin5G Server is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Bulk Deregistration Request_to MSGin5G Server",
  "title": "MSGin5G Bulk Deregistration Request to MSGin5G Server",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "BDEREG"
      ],
      "description": "Refer to the usage of this message. The value BULKDEREG refers to MSGin5G Bulk
Registration to MSGin5G Server"
    },
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
```

```
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "NumOfIndividualRequests": {
      "type": "integer",
      "description": "Number of individual MSGin5G UE deregistration requests"
    },
    "ListOfIndividualRequests": {
      "type": "array",
      "description": "List of individual MSGin5G UE deregistration requests",
      "item": {
        "$ref": "#/MSGin5G Deregistration Request"
      }
    },
    "required": [
    "msgIden",
    "msgType",
    "oriAddr",
    "NumOfIndividualRequests",
    "ListOfIndividualRequests"
    ]
  }
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause 6.3.4.4.2 are described in the description of the properties. The JSON schema of CoAP 2.04 (Change) response for the MSGin5G bulk deregistration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Bulk_Deregistration_response_schema",
  "title": "MSGin5G Bulk Deregistration Response",
  "type": "object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string",
          "format": "uri"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "NumOfIndividualResponses": {
      "type": "integer",
      "description": "Number of individual MSGin5G UE deregistration responses"
    },
    "ListOfIndividualResponses": {
      "type": "array",
      "description": "List of individual MSGin5G UE deregistration responses",
      "item": {
        "$ref": "#/MSGin5G Deregistration Request"
      }
    },
    "required": [
    "oriAddr",
    "NumOfIndividualResponses",
    "ListOfIndividualResponses"
    ]
  }
}
```

## 7.3.4 MSGin5G Message

### 7.3.4.1 JSON schema of MSGin5G message

The JSON schema of the MSGin5G message is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Message_schema",
  "title": "MSGin5G Message",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "MSG"
      ],
      "description": "the usage of this message. The value MSG refers to MSGin5G message"
    },
    "appId": {
      "type": "string",
      "description": "Refer to Application ID"
    },
    "msgId": {
      "type": "string",
      "format": "uuid",
      "description": "Refer to Message ID"
    },
    "isDelivStatReq": {
      "type": "boolean",
      "default": false,
      "description": "Refer to Delivery status required"
    },
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE",
            "AS"
          ]
        },
        "addr": {
          "type": "string"
        }
      },
      "description": "Refer to Originating UE Service ID or Originating AS Service ID"
    },
    "destAddr": {
      "type": "object",
      "properties": {
        "destAddrType": {
          "enum": [
            "UE",
            "AS",
            "GROUP",
            "BC",
            "TOPIC
          ]
        },
        "addr": {
          "type": "string"
        }
      },
      "description": "Refer to Recipient UE Service ID or Recipient AS Service ID or Group Service
ID or Broadcast Area ID or Messaging Topic"
    },
    "sfFlag": {
      "type": "boolean",
      "default": false,
      "description": "Refer to Store And Forward Flag"
```

```
    },
    "sfParam": {
      "$ref": "#/$defs/SfParams",
      "description": "Refer to Store And Forward Parameters"
    },
    "payload": {
      "type": "string",
      "description": "Refer to Payload"
    },
    "priority": {
      "type": "string",
      "enum": [
        "HIGH",
        "NORMAL",
        "LOW"
      ],
      "default": "NORMAL",
      "description": "Refer to Priority Type"
    },
    "isSegmented": {
      "type": "boolean",
      "default": false,
      "description": "Refer to Message Is Segmented"
    },
    "segParams": {
      "$ref": "#/$defs/SegParams"
    }
  },
  "required": [
    "msgIden ",
    "msgId",
    "msgType",
    "oriAddr",
    "destAddr"
  ],
  "dependentRequired": {
    " sfParams": [
      " sfFlag"
    ],
    " segParams": [
      " isSegmented "
    ],
    "if": {
      "properties": {
        "oriAddrType": {
          "const": "AS"
        }
      }
    },
    "then": {
      "properties": {
        "destAddrType": {
          "not":{
            "const": "AS"
          }
        }
      }
    }
  }
},
"$defs": {
  "SfParams": {
    "type": "object",
    "properties": {
      "expireTime": {
        "type": "string",
        "format": " date-time",
        "description": "Refer to Message expiration time"
      },
      "appSpecSf": {
        "type": "object",
        "description": "Refer to Application Specific Store And Forward Information"
      }
    }
  },
  "SegParams": {
    "type": "object",
    "properties": {
      "segId": {
```

```
      "type": "string",
      "description": "Refer to Segmentation Set Identifier"
    },
    "totalSegCount": {
      "type": "integer",
      "description": "Refer to Total Number Of Message Segments"
    },
    "segNumb": {
      "type": "integer",
      "description": "Refer to Message Segment Number"
    },
    "lastSegFlag": {
      "type": "string",
      "description": "Refer to Last Segment Flag"
    },
    "required": [
      "segId",
      "totalSegCount",
      "segNumb"
    ]
      }
    }
  }
}
```

### 7.3.4.2 JSON schema of MSGin5G message delivery status report

The JSON schema of the MSGin5G message delivery status report is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Message_schema",
  "title": "MSGin5G message delivery status report",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "IMDN"
      ],
      "description": "the usage of this message. The value IMDN refers to MSGin5G message delivery
status report"
    },
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE",
            "AS"
          ]
        },
        "addr": {
          "type": "string"
        }
      },
      "description": "Refer to Originating UE Service ID or Originating AS Service ID"
    },
    "destAddr": {
      "type": "object",
      "properties": {
        "destAddrType": {
          "enum": [
            "UE",
            "AS"
          ]
        },
        "addr": {
          "type": "string"
        }
      },
      "description": "Refer to Recipient UE Service ID or Recipient AS Service ID"
```

```
    },
    "msgId": {
      "type": "string",
      "format": "uuid",
      "description": "Refer to Message ID"
    },
    "DelSta": {
      "type": "string",
      "enum": [
        "success",
        "failure"
      ],
      "description": "Refer to Delivery Status"
    },
    "Cause": {
      "type": "string",
      "description": "Refer to Failure Cause"
    }
  },
  "required": [
    "msgIden ",
    "msgType",
    "msgId",
    "oriAddr",
    "destAddr",
    "DelSta"
  ],
  "dependentRequired": {
    "Cause": [{
      "DelSta": {
        "const": "failure"
      }
    }],
    "if": {
      "properties": {
        "oriAddrType": {
          "const": "AS"
        }
      }
    },
    "then": {
      "properties": {
        "destAddrType": {
          "not": {
            "const": "AS"
          }
        }
      }
    }
  }
}
```

### 7.3.4.3      JSON schema of MSGin5G message response

The JSON schema of the MSGin5G message response is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Message_schema",
  "title": "MSGin5G message response",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "MSGRESP"
      ],
      "description": "the usage of this message. The value MSGRESP refers to MSGin5G message
response"
    },
    "oriAddr": {
      "type": "object",
      "properties": {
```

```
        "oriAddrType": {
          "enum": [
            "UE",
            "AS"
          ]
        },
        "addr": {
          "type": "string"
        }
      },
      "description": "Refer to Originating UE Service ID or Originating AS Service ID"
    },
    "msgId": {
      "type": "string",
      "format": "uuid",
      "description": "Refer to Message ID"
    },
    "DelSta": {
      "type": "string",
      "enum": [
        "failure",
        "stored for deferred delivery"
      ],
      "description": "Refer to Delivery Status"
    },
    "Cause": {
      "type": "string",
      "description": "Refer to Failure Cause"
    }
  },
  "required": [
    "msgIden ",
    "msgType",
    "msgId",
    "oriAddr",
    "DelSta"
  ]
}
```

## 7.3.5 Messaging Topic Subscription and Unsubscription

### 7.3.5.1 Messaging Topic subscription structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationship between the properties and IEs used in clause 6.6 are described in the description of the properties, The JSON schema is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/Message_Topic_Subscription_schema",
  "title": "Message_Topic_Subscription",
  "type":"object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "expireTime": {
      "type": "string",
      "format": "date-time",
      "description": "Refer to Messaging Topic subscripition expiration time"
    },
    "required": ["oriAddr"]
```

```
    }
}
```

## 7.3.5.2 Messaging Topic unsubscription structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationship between the properties and IEs used in clause 6.6 are described in the description of the properties, The JSON schema is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/Message_Topic_Unsubscription_schema",
  "title": "Message_Topic_Unsubscription",
  "type":"object",
  "properties": {
    "oriAddr": {
      "type": "object",
      "properties": {
        "oriAddrType": {
          "enum": [
            "UE"
          ]
        },
        "addr": {
          "type": "string"
        }
      },
      "description": "Refer to Originating UE Service ID"
    },
    "required": ["oriAddr"]
  }
}
```

## 7.3.6 Structure about message segment

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationship between the properties and IEs used in clause 6.5 are described in the description of the properties, The JSON schema is defined below.

## 7.3.6.1 Segments received confirmation structure

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/Segments_Received_Confirmation_schema",
  "title": "Message_Received_Confirmation",
  "type":"object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "SEGCONFIR"
      ],
      "description": "the usage of this message. The value SEGCONFIR refers to message segments
received confirmation"
    },
    "segId": {
      "type": "string",
      "description": "Refer to Segmentation Set Identifier"
    },
    "result": {
      "type": "boolean",
      "description": "Refer to segments received result. The value true refers to success"
    },
    "required": ["msgIden","msgType","segId","result"]
  }
}
```

## 7.3.6.2 Segments recovery structure

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/Segments_Recovery_schema",
  "title": "Segments_Recovery",
  "type":"object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "SEGREC"
      ],
      "description": "the usage of this message. The value SEGREC refers to message segment
recovery"
    },
    "segId": {
      "type": "string",
      "description": "Refer to Segmentation Set Identifier"
    },
    "segNoList": {
      "type": "string",
      "description": "Refer to List of Segment range, e.g. (5-7, 10-10, 15-19)"
    },
    "required": ["msgIden","msgType","segId","segNoList"]
  }
}
```

# Annex A (Informative): Message formats/protocols used for Constrained UE and Application Client

## A.1 General

The following clauses provide guidance of message formats/protocols which may be used between MSGin5G Client residing in an MSGin5G UE and other UEs. The Annex A.2 provides guidance of message formats/protocols between MSGin5G Client residing in an MSGin5G UE and the Application Client residing in another UE. The AnnexA.3 provides guidance of message formats/protocols between MSGin5G Client residing in a Constrained UE which cannot connect to the 3GPP network directly for message exchange with MSGin5G Server and a MSGin5G Gateway Client on the MSGin5G Gateway UE.

## A.2 Based on standard L3 message

## A.2.0 General

The following clauses describe an example based on standard L3 message as specified in clause 11.2 of 3GPP TS 24.007 [15].

Each message definition in the clause includes a brief description of the message direction, the use, and the significance indicates whether the message is relevant only on the sender or receiver (local) or the message is relevant on both sender and receiver (dual).

NOTE: Message format defined in this clause can be used if the communication between the MSGin5G Client and the Application Client is based on PC5 / NR-PC5.

## A.2.1 Message contents and functions

### A.2.1.1 for sending a message to MSGin5G Client

For sending a message to MSGin5G Client, the Application Client may use the message content specified in Table A.2.1.1-1.

Message type: MESSAGE SENDING REQUEST

Significance: dual

Direction: the Application Client residing on another UE to the MSGin5G Client of the MSGin5G UE

**Table A.2.1.1-1: message content for sending a message to MSGin5G Client**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|--------------------|--------------------|----------|--------|--------|
| | Message Type | Message Type A.2.2.1 | M | V | 1 |
| | Target address | Target address A.2.2.2 | M | LV | 6-n |
| | Message ID | Message ID A.2.2.4 | M | V | 16 |
| | Payload | Payload A.2.2.5 | M | LV-E | 3-2050 |
| 21 | Application ID | Application ID A.2.2.3 | O | TV | 3 |
| B- | Delivery status required | Delivery status required A.2.2.6 | O | TV | 1 |
| D- | Target Type | Target Type A.2.2.7 | O | TV | 1 |

If using the message content specified in table A.2.1.1-1, the Application Client may generate a message according to 6.4.2.3.1 and send the generated message to the MSGin5G Client.

## A.2.1.2 for sending a message delivery report to MSGin5G Client

For sending a message delivery status report to MSGin5G Client, the Application Client may use the message content specified in Table A.2.1.2-1.

Message type: DELIVERY REPORT SENDING REQUEST

Significance: dual

Direction: the Application Client residing on another UE to the MSGin5G Client of the MSGin5G UE

**Table A.2.1.2-1: message content for sending a message delivery status report to MSGin5G Client**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|--------------------|--------------------|----------|--------|--------|
| | Message Type | Message Type A.2.2.1 | M | V | 1 |
| | Delivery Status | Delivery Status A.2.2.8 | M | V | 1 |
| | Message ID | Message ID A.2.2.4 | M | V | 16 |
| | Reply-to Message ID | Reply-to Message ID A.2.2.13 | M | V | 16 |

If using the message content specified in table A.2.1.2-1, the Application Client may generate a message according to 6.4.2.3.2 and send the generated message to the MSGin5G Client.

## A.2.1.3 for sending a message to Application Client

For sending a message to Application Client, the MSGin5G Client may use the message content specified in Table A.2.1.3-1.

Message type: MESSAGE RECEIVED REQUEST

Significance: dual

Direction: the MSGin5G Client of the MSGin5G UE to the Application Client residing another UE

**Table A.2.1.3-1: message content for sending a message to Application Client**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|---------------------|----------------|----------|--------|--------|
| | Message Type | Message Type A.2.2.1 | M | V | 1 |
| | Message ID | Message ID A.2.2.4 | M | V | 16 |
| | Payload | Payload A.2.2.5 | M | LV-E | 3-2050 |
| 32 | Originator Address | Originator Address A.2.2.10 | O | TLV | 3-257 |
| 43 | Group ID | Group ID A.2.2.11 | O | TLV | 3-257 |
| B- | Delivery status required | Delivery status required A.2.2.6 | O | TV | 1 |
| C- | Priority | Priority A.2.2.9 | O | TV | 1 |

If using the message content specified in table A.2.1.3-1, the MSGin5G Client may generate a message according to 6.4.2.2.1 and send the generated message to the Application Client.

## A.2.1.4 for sending a message delivery status report to Application Client

For sending a message delivery status report to Application Client, the MSGin5G Client may use the message content specified in Table A.2.1.4-1.

Message type: DELIVERY REPORT RECEIVED REQUEST

Significance: dual

Direction: the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE

**Table A.2.1.4-1: message content for sending a message delivery status report to MSGin5G Client**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|---------------------|----------------|----------|--------|--------|
| | Message Type | Message Type A.2.2.1 | M | V | 1 |
| | Delivery Status | Delivery Status A.2.2.8 | M | V | 1 |
| | Message ID | Message ID A.2.2.4 | M | V | 16 |
| | Reply-to Message ID | Reply-to Message ID A.2.2.13 | M | V | 16 |

If using the message content specified in table A.2.1.4-1, the MSGin5G Client may generate a message according to 6.4.2.2.3 and send the generated message to the Application Client.

## A.2.1.5 for sending a message sending response to Application Client

For sending a message sending response to Application Client, the MSGin5G Client may use the message content specified in Table A.2.1.5-1.

Message type: MESSAGE SENDING RESPONSE

Significance: dual

Direction: the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE

**Table A.2.1.5-1: message content for message sending response**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|--------------------|----------------|----------|--------|--------|
| | Message Type | Message Type A.2.2.1 | M | V | 1 |
| | Result | Result A.2.2.11 | M | V | 1 |
| | Spare half octet | Spare half octet A.2.2.18 | M | V | 1/2 |
| 51 | Failure Reason | MSGin5G cause A.2.2.17 | O | TV | 2 |

If using the message content specified in table A.2.1.5-1, the MSGin5G Client may generate a message according to 6.4.2.2.3 and send the generated message to the Application Client.

## A.2.1.6 for sending a message received response to MSGin5G Client

For sending a message sending response to MSGin5G Client, the Application Client residing on another UE may use the message content specified in Table A.2.1.6-1.

Message type: MESSAGE RECEIVED RESPONSE

Significance: dual

Direction: the Application Client residing on another UE to the MSGin5G Client of the MSGin5G UE

**Table A.2.1.6-1: message content for message sending response**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|--------------------|----------------|----------|--------|--------|
| | Message Type | Message Type A.2.2.1 | M | V | 1 |
| | Result | Result A.2.2.11 | M | V | 1 |
| | Spare half octet | Spare half octet A.2.2.18 | M | V | 1/2 |
| 51 | Failure Reason | MSGin5G cause A.2.2.17 | O | TV | 2 |

If using the message content specified in table A.2.1.6-1, the Application Client may generate a message according to 6.4.2.3.3 and send the generated message to the MSGin5G Client.

## A.2.1.7 Registration Request

The Registration Request is sent by the Application Client residing on another UE to the MSGin5G Client of the MSGin5G UE to initiate registration. See table A.2.1.7.

Message type: REGISTRATION REQUEST

Significance: dual

Direction: the Application Client residing on another UE to the MSGin5G Client of the MSGin5G UE

**Table A.2.1.7: REGISTRATION REQUEST content**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|--------------------|----------------|----------|--------|--------|
| | Message Type | Message Type A.2.2.1 | M | V | 1 |
| | Application ID | Application ID A.2.2.3 | M | V | 2 |
| | Credential information | Credential information A.2.2.15 | M | LV | 3-65537 |

## A.2.1.8 Registration Accept

The Registration Accept is sent by the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE to indicate the registration is accepted. See table A.2.1.8.

Message type:    REGISTRATION ACCEPT

Significance: dual

Direction: the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE

**Table A.2.1.8: REGISTRATION ACCEPT content**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|---------------------|----------------|----------|--------|--------|
| | Message Type | Message Type<br>A.2.2.1 | M | V | 1 |
| | Registration ID | MSCin5G Registration ID<br>A.2.2.16 | M | V | 6 |

## A.2.1.9 Registration Reject

The Registration Reject is sent by the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE to indicate the registration is rejected. See table A.2.1.9.

Message type:    REGISTRATION REJECT

Significance: dual

Direction: the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE

**Table A.2.1.9: REGISTRATION REJECT content**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|---------------------|----------------|----------|--------|--------|
| | Message Type | Message Type<br>A.2.2.1 | M | V | 1 |
| | Failure Reason | MSGin5G cause<br>A.2.2.17 | M | V | 1 |

## A.2.1.10 De-registration Request

The De-registration Request is sent by the Application Client residing on another UE to the MSGin5G Client of the MSGin5G UE to initiate de-registration. See table A.2.1.10.

Message type:    DEREGISTRATION REQUEST

Significance: dual

Direction: the Application Client residing on another UE to the MSGin5G Client of the MSGin5G UE

**Table A.2.1.10: DEREGISTRATION REQUEST content**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|---------------------|----------------|----------|--------|--------|
| | Message Type | Message Type<br>A.2.2.1 | M | V | 1 |
| | Registration ID | MSCin5G Registration ID<br>A.2.2.16 | M | V | 6 |

## A.2.1.11 De-registration Accept

The De-registration Accept is sent by the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE to indicate the de-registration is accepted. See table A.2.1.11.

Message type:    DEREGISTRATION ACCEPT

Significance:  dual

Direction: the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE

**Table A.2.1.11: DEREGISTRATION ACCEPT content**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|---------------------|----------------|----------|--------|--------|
|  | Message Type | Message Type<br>A.2.2.1 | M | V | 1 |
|  | Registration ID | MSCin5G Registration ID<br>A.2.2.16 | M | V | 6 |

## A.2.1.12 De-registration Reject

The De-registration Reject is sent by the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE to indicate the de-registration is rejected. See table A.2.1.12.

Message type:    DEREGISTRATION REJECT

Significance:  dual

Direction: the MSGin5G Client of the MSGin5G UE to the Application Client residing on another UE

**Table A.2.1.12: DEREGISTRATION REJECT content**

| IEI | Information Element | Type/Reference | Presence | Format | Length |
|-----|---------------------|----------------|----------|--------|--------|
|  | Message Type | Message Type<br>A.2.2.1 | M | V | 1 |
|  | Failure Reason | MSGin5G cause<br>A.2.2.17 | M | V | 1 |

# A.2.2    information elements coding

## A.2.2.1  Message Type

The purpose of the Message type information element is to identify the type of the request or response.

The value part of the Message type information element is coded as shown in Table A.2.2.1-1.

The Message type information element is a type 3 information element with a length of 1 octet.

**Table A.2.2.1-1: Message types**

```
          Bits
8  7  6  5  4  3  2  1

0  0  0  0  0  0  0  1    MESSAGE SENDING REQUEST
0  0  0  0  0  0  1  0    MESSAGE SENDING RESPONSE
0  0  0  0  0  0  1  1    MESSAGE RECEIVED REQUEST
0  0  0  0  0  1  0  0    MESSAGE RECEIVED RESPONSE
0  0  0  0  0  1  0  1    DELIVERY REPORT SENDING REQUEST
0  0  0  0  0  1  1  0    DELIVERY REPORT RECEIVED REQUEST
0  0  0  0  0  1  1  1    REGISTRATION REQUEST
0  0  0  0  1  0  0  0    REGISTRATION ACCEPT
0  0  0  0  1  0  0  1    REGISTRATION REJECT
0  0  0  0  1  0  1  0    DEREGISTRATION REQUEST
0  0  0  0  1  0  1  1    DEREGISTRATION REJECT
0  0  0  0  1  1  0  0    DEREGISTRATION ACCEPT

All other values are reserved.
```

## A.2.2.2   Target address

The Target address information element is used to indicate the address of target recipient or the target group while sending message from Application Client residing on another UE.

The Target address information element is coded as shown in figure A.2.2.2-1 and table A.2.2.2-1.

The Target address information element is a type 4 information element.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Length of Target address contents | | | | | | | | octet 1 |
| Target address type value | | | | | | | | octet 2 |
| Target address contents | | | | | | | | octet 3 |
| | | | | | | | | octet n |

**Figure A.2.2.2-1: Target address information element**

**Table A.2.2.2-1: Target address information element**

| Target Address type value (octet 2) Bits | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | IPv4 address |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | IPv6 address |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | FQDN |

All other values are reserved.

Target address content is contained in octet 6 to octet n; The maximum value depends on the length of FQDN.

If Target address type value indicates IPv4 address, the Target address contents in octet 3 to octet 6 contains an IPv4 address.

If Target address type value indicates IPv6 address, the Target address contents in octet 3 to octet 18 contains an IPv6 address.

If Target address type indicates FQDN, the Target address contents in octet 3 to octet n contains an FQDN encoded as defined in clause 28.3.2 of 3GPP TS 23.003 [18].

## A.2.2.3   Application ID

The purpose of the Application ID information element is to uniquely identify the application for which the payload is intended.

The Application ID information element is coded as shown in figure A.2.2.3-1 and table A.2.2.3-1

The Application ID information element is a type 3 information element with a length of 3 octets.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Application ID IEI | | | | | | | | octet1 |
| Application ID value | | | | | | | | octet 2 |
| | | | | | | | | octet 3 |
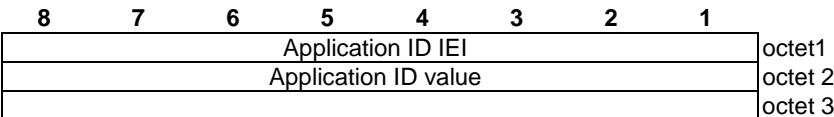
**Figure A.2.2.3-1: Application ID value**

**Table A.2.2.3-1: Application ID value**

| Application ID value (octet 2-3) |
|---|
| The Application ID contains a number that uniquely identifies the destination application. |

## A.2.2.4   Message ID

The Message ID information element uniquely identifies a message or message delivery report.

The Message ID information element is coded as shown in Figure A.2.2.4-1 and Table A.2.2.4-1.

The Message ID information element is a type 3 information element with a length of 16 octets.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Message ID value | | | | | | | | octet 1 |
| | | | | | | | | octet 16 |
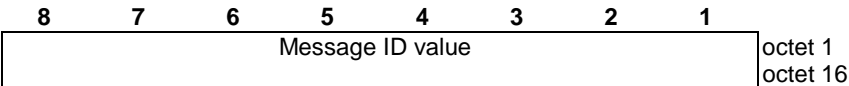
**Figure A.2.2.4-1: Message ID value**

**Table A.2.2.4-1: Message ID value**

| Message ID value (octet 1 to 16) |
|---|
| The Message ID contains a number uniquely identifying a message or message delivery report. The value is a universally unique identifier as specified in IETF RFC 4122 [19]. |

## A.2.2.5   Payload

The Payload information element is used to send application specific message;

The Payload information element is coded as shown in Figure A.2.2.5-1 and Table A.2.2.5-1.

The Payload data information element is a type 6 information element.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Length of Payload contents | | | | | | | | octet 1 |
| | | | | | | | | octet 2 |
| Payload contents | | | | | | | | octet 3 |
| | | | | | | | | octet n |

**Figure A.2.2.5-1: Payload information element**

**Table A.2.2.5-1: Payload information element**

| |
|---|
| Payload data is contained in octet 3 to octet n; Max value of 65535 octets. |

## A.2.2.6 Delivery Status Required

The purpose of the Delivery Status Required information element is to identify whether delivery status is required from the receiver or not.

The value part of the Delivery Status Required information element is coded as shown in Figure A.2.2.6-1 and Table A.2.2.6-1.

The Delivery Status Required information element is a type 1 information element.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Delivery Status Required IEI | | | | Delivery Status Required value | | | | octet 1 |
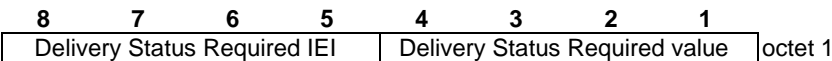
**Figure A.2.2.6-1: Delivery Status Required type**

**Table A.2.2.6-1: Delivery Status Required type**

| Delivery status value (octet 1) Bits |
|---|
| 4 3 2 1 |
| 0 0 0 0 DELIVERY REPORT NOT REQUIRED |
| 0 0 0 1 DELIVERY REPORT REQUIRED |
| |
| All other values are reserved. |

## A.2.2.7 Target Type

The purpose of the Target Type information element is to indicate the type of the message target.

The value part of the Target Type information element is coded as shown in Figure A.2.2.7-1 and Table A.2.2.7-1.

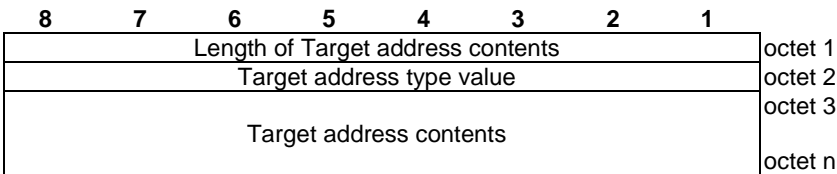The Target Type information element is a type 1 information element.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Target Type IEI | | | | Target Type value | | | | octet 1 |
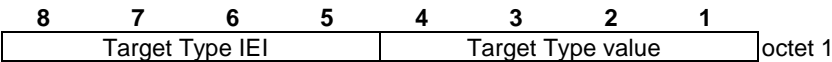
**Figure A.2.2.7-1: Target Type type**

**Table A.2.2.7-1: Target Type type**

| E2E Message type value (octet 1) Bits |
|---|
| 4 3 2 1 |
| 0 0 0 0 UE |
| 0 0 0 1 GROUP |
| 0 0 1 0 AS |
| |
| |
| |
| All other values are reserved. |

## A.2.2.8 Delivery Status

The Delivery Status information element is used to indicate the delivery status from message recipient.

The Delivery Status information element is coded as shown in Figure A.2.2.8-1 and Table A.2.2.8-1.

The Delivery Status information element is a type 3 information element.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Delivery Status value | | | | | | | | octet 1 |
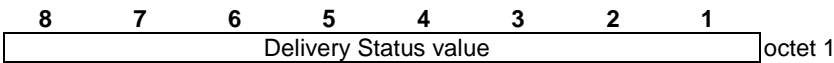
**Figure A.2.2.8-1: Delivery Status type**

**Table A.2.2.8-1: Delivery Status type**

| Delivery status value (octet 1) Bits |
|---|
| 8 7 6 5 4 3 2 1 |
| 0 0 0 0 0 0 0 0 FAILED |
| 0 0 0 0 0 0 0 1 SUCCESS |
| |
| All other values are reserved. |

## A.2.2.9 Priority

The purpose of the priority information element is to identify application level priority of the received message.

The value part of the priority information element is coded as shown in Figure 2.2.9-1 and Table 2.2.9-1.

The priority type information element is a type 1 information element.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Priority IEI | | | | Priority value | | | | octet 1 |
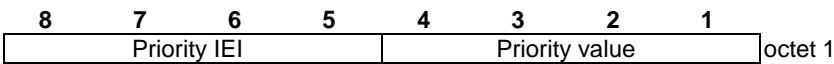
**Figure 2.2.9-1: Priority type**

**Table 2.2.9-1: Priority type**

| Priority type value (octet 1) Bits |
|---|
| 4 3 2 1 |
| 0 0 0 0 LOW |
| 0 0 0 1 MEDIUM |
| 0 0 1 0 HIGH |
| |
| All other values are reserved. |

## A.2.2.10 Originator Address

The Originator Address information element is used to indicate address of originating UE/AS while sending message to Application Client residing on another UE.

The Originator Address information element is coded as shown in Figure A.2.2.10-1 and Table A.2.2.10-1.

The Originator Address information element is a type 4 information element.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Originator Address TEI | | | | | | | | octet 1 |
| Length of Originator Address contents | | | | | | | | octet 2 |
| Originator Address contents | | | | | | | | octet 3 |
| | | | | | | | | octet n |
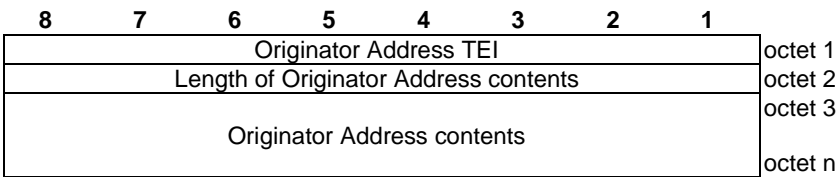
**Figure A.2.2.10-1: Originator Address information element**

**Table A.2.2.10-1: Originator Address information element**

Originator Address is contained in octet 3 to octet n; Max value of 255 octets.

## A.2.2.11 Group ID

The Group ID information element is used to indicate the group which the message is from while sending message to Application Client residing on another UE.

The Group ID information element is coded as shown in Figure A.2.2.11-1 and Table A.2.2.11-1.

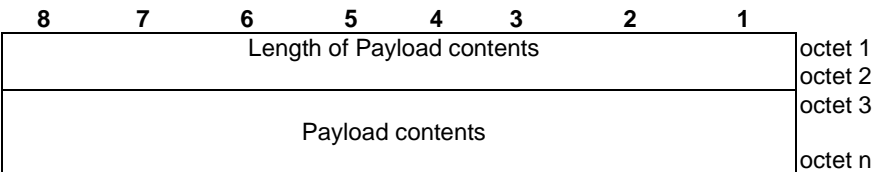The Group ID information element is a type 4 information element.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Group ID IEI | | | | | | | | octet 1 |
| Length of Group ID contents | | | | | | | | octet 2 |
| Group ID contents | | | | | | | | octet 3 |
| | | | | | | | | octet n |
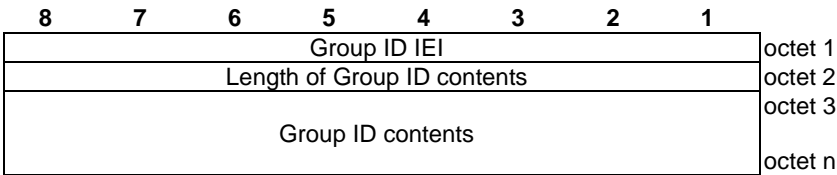
**Figure A.2.2.11-1: Group ID information element**

**Table A.2.2.11-1: Group ID information element**

Group ID is contained in octet 3 to octet n; Max value of 255 octets.

## A.2.2.11 Result

The Result information element is used to indicate the result of handling message sending request as described in A.2.1.1.

The Result information element is coded as shown in Figure A.2.2.11-1 and Table A.2.2.11-1.

The Result information element is a type 1 information element.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| | | | | Result value | | | | octet 1 |
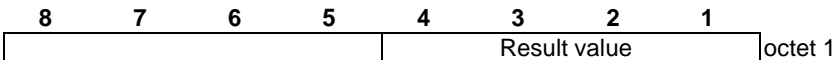
**Figure A.2.2.11-1: Result type**

**Table A.2.2.11-1: Result type**

| Result value (octet 1) Bits |
| --- |
| **4  3  2  1** |
| 0  0  0  0   FAILED |
| 0  0  0  1   SUCCESS |
| |
| All other values are reserved. |

## A.2.2.12 Void

## A.2.2.13 Reply-to Message ID

The Reply-to Message ID information element uniquely identifies the message delivery report and is same with the Message ID included in the message acknowledged.

The Reply-to Message ID information element is coded as shown in Figure A.2.2.13-1 and Table A.2.2.13-1.

The Reply-to Message ID information element is a type 3 information element with a length of 16 octets.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Reply-to Message ID value | | | | | | | | octet 1 |
| | | | | | | | | octet 16 |
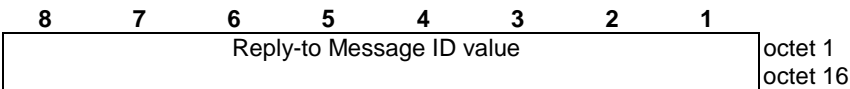
**Figure A.2.2.13-1: Reply-to Message ID value**

**Table A.2.2.13-1: Reply-to Message ID value**

| Reply-to Message ID value (octet 1 to 16) |
| --- |
| The Reply-to Message ID contains a number uniquely identifying a message. The value is a universally unique identifier as specified in IETF RFC 4122 [19]. |

## A.2.2.14 Void

## A.2.2.15 Credential information

The purpose of the Credential information element is to carry credentials from a credentials holder (e.g. application server, the MSGin5G Gateway UE).

The Credential information element is coded as shown in Figure A.2.2.15-1 and Table A.2.2.15-1.

The Credential information element is a type 6 information element with a minimum length of 3 octets and a maximum length of 65537 octets.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| Length of Credential information contents | | | | | | | | octet 1 |
| | | | | | | | | octet 2 |
| Credential information contents | | | | | | | | octet 3 |
| | | | | | | | | octet n |
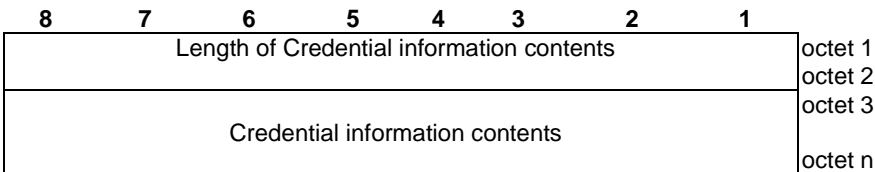
**Figure A.2.2.15-1: Credential information element**

**Table A.2.2.15-1: Credential information element**

Payload data is contained in octet 3 to octet n; Max value of 65535 octets.
The format of the Credential information contents is out of scope of this specification.

## A.2.2.16 MSCin5G Registration ID

The purpose of the MSCin5G Registration ID information element is to indicate the Registration ID that is allocated by the MSGin5G Client of the MSGin5G Gateway UE.

The MSCin5G Registration ID is a type 3 information element with a length of 6 octets.

The MSCin5G Registration ID information element is coded as shown in figure A.2.2.16 and table A.2.2.16.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| MSCin5G Registration ID value | | | | | | | | octet 1 |
| | | | | | | | | octet 6 |
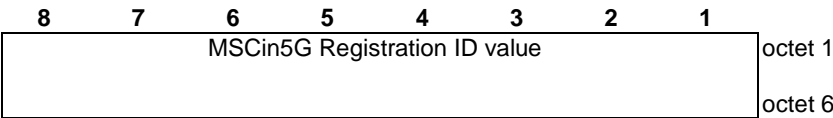
**Figure A.2.2.16: MSCin5G Registration ID information element**

**Table A.2.2.16: MSCin5G Registration ID information element**

MSCin5G Registration ID (octet 1 to 6)

This field contains the 48-bit MSCin5G Registration ID.

## A.2.2.17 MSGin5G cause

The purpose of the MSGin5G cause information element is to indicate the cause used for MSGin5G procedures.

The MSGin5G cause is a type 3 information element with a length of 2 octets.

The MSGin5G cause information element is coded as shown in figure A.2.2.17 and table A.2.2.17.

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| MSGin5G cause IEI | | | | | | | | octet 1 |
| MSGin5G cause value | | | | | | | | octet 2 |
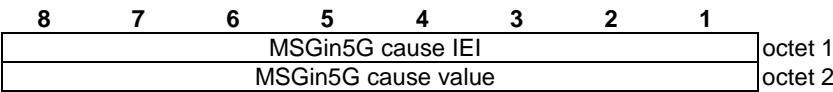
**Figure A.2.2.17: MSGin5G cause information element**

**Table A.2.2.17: MSGin5G cause information element**

| MSGin5G cause (octet 2) |
|---|
| **Bits** |

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Access via a Gateway UE is not allowed |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | Invalid credentials |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Conflict of transport identifier for unicast communication is detected |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | Connection is not available anymore |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | Lack of resources for lower layer |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | Congestion situation |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | Unknown device |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | Protocol error, unspecified |

Any other value received by the UE shall be treated as 0110 1111, "protocol error, unspecified".

## A.2.2.18 Spare half octet

This element is used in the L3 messages as specified in clause A.2.1 when an odd number of half octet type 1 information elements are used. This element is filled with spare bits set to zero and is placed in bits 5 to 8 of the octet unless otherwise specified.

# A.3 Based on CoAP

The following clauses describe example of the MSGin5G Constrained UE message format based on CoAP.

NOTE: Message format and protocol defined in this clause can be used if the communication between the Constrained UE and the MSGin5G GW UE is not based on PC5 / NR-PC5.

NOTE 2: Routing CoAP messages between the Constrained UE and the MSGin5G GW UE is not specified in this version of the specification and is implementation specific.

## A.3.1 message contents and functions

### A.3.1.1 for sending a message to MSGin5G Client

In order to send a message, the Application Client on the constrained UE may generate an CoAP POST request according to procedures specified in IETF RFC 7252 [5] to the MSGin5G Client on a MSGin5G UE. In the CoAP POST request message, the Application Client:

a) set the "T" field in the CoAP header to 0 if delivery status report from the recipient is requested, i.e. indicates this message is the type of Confirmable, to ensure the application layer delivery status report;

b) include the MSGin5G Client address in an CoAP Option, e.g. if the MSGin5G Client address is a URI, include a Uri-Path Option with the value of the URI;

c) set the CoAP Content-Format to "50", i.e. application/json; and

d) include the information elements specified in clause 6.4.2.3.1 in the CoAP payload encoded in JSON format as specified in clause A.3.2.1.

## A.3.1.2 for sending a message delivery status report to MSGin5G Client

In order to send a message delivery status report, the Application Client on the constrained UE may generate an CoAP POST request according to procedures specified in IETF RFC 7252 [5] to the MSGin5G Client on a MSGin5G UE. In the CoAP POST request message, the Application Client:

a) set the "T" field in the CoAP header to 0 indicating this message is the type of Confirmable;

b) include the MSGin5G Client address in an CoAP Option, e.g. if the MSGin5G Client address is a URI, include a Uri-Path Option with the value of the URI;

c) set the CoAP Content-Format to "50", i.e. application/json;

d) include the information elements specified in clause 6.4.2.3.2 in the CoAP payload encoded in JSON format as specified in clause A.3.2.2.

## A.3.1.3 for sending a message to Application Client

In order to send a message, the MSGin5G Client may generate an CoAP POST request according to procedures specified in IETF RFC 7252 [5] to the Application Client. In the CoAP POST request message, the MSGin5G Client:

a) set the "T" field in the CoAP header to 0 if delivery status report from the recipient is requested, i.e. indicates this message is the type of Confirmable, to ensure the application layer delivery status report;

b) include the Application Client address in an CoAP Option, e.g. if the Application Client address is a URI, include a Uri-Path Option with the value of the URI;

c) set the CoAP Content-Format to "50", i.e. application/json;

d) include the information elements specified in clause 6.4.2.2.1 in the CoAP payload encoded in JSON format as specified in clause A.3.2.3.

## A.3.1.4 for sending a message delivery status report to Application Client

In order to send a message delivery status report, the MSGin5G Client may generate an CoAP POST request according to procedures specified in IETF RFC 7252 [5] to the Application Client. In the CoAP POST request message, the MSGin5G Client:

a) set the "T" field in the CoAP header to 0 indicating this message is the type of Confirmable;

b) include the Application Client address in an CoAP Option, e.g. if the Application Client address is a URI, include a Uri-Path Option with the value of the URI;

c) set the CoAP Content-Format to "50", i.e. application/json;

d) include the information elements specified in clause 6.4.2.2.3 in the CoAP payload encoded in JSON format as specified in clause A.3.2.4.

## A.3.1.5 for sending a message sending response to Application Client

After receiving a CoAP POST request for sending a message from Application Client, the MSGin5G Client may generate an CoAP 2.05 response according to procedures specified in IETF RFC 7252 [5] to the Application Client. In the response, the MSGin5G Client:

a) include the Application Client address in an CoAP Option, e.g. if the Application Client address is a URI, include a Uri-Path Option with the value of the URI;

b) set the CoAP Content-Format to "50", i.e. application/json; and

c) include the information elements specified in clause 6.4.2.2.5 in the CoAP payload encoded in JSON format as specified in clause A.3.2.5.

## A.3.1.6    for sending a message received response to MSGin5G Client

After receiving a CoAP POST request for sending a message from MSGin5G Client, the Application Client may generate an CoAP 2.05 response according to procedures specified in IETF RFC 7252 [5] to the Application Client. In the response, the MSGin5G Client:

   a)  include the MSGin5G Client address in an CoAP Option, e.g. if the MSGin5G Client address is a URI, include a Uri-Path Option with the value of the URI;

   b)  set the CoAP Content-Format to "50", i.e. application/json; and

   c)  include the information elements specified in clause 6.4.2.3.3 in the CoAP payload encoded in JSON format as specified in clause A.3.2.6.

## A.3.1.7    Registration Request

The registration request sent by the Application Client of the Constrained UE to the MSGin5G Client of the MSGin5G Gateway UE is based on the CoAP POST request as specified in IETF RFC 7252 [5]. The Application Client of the Constrained UE:

   a)  shall set the "T" field in the CoAP header to 0 to indicate acknowledge message required;

   b)  shall include the address of the MSGin5G Gateway UE in the Option header of the CoAP POST request and set the Option header to a corresponding value, e.g. if address of the MSGin5G Gateway UE is a URI, the Uri-Path Option is set to the value of such URI;

   c)  shall set the "Content-Format" element to "50" to indicate the format of the CoAP payload is "application/json"; and

   d)  shall include the following information elements in the CoAP payload encoded in JSON format:

   1)  the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

   2)  the "Message Type" element to indicate that the CoAP POST request is used for registration;

   3)  the "Application ID " element to indicate the application client initiating registration; and

   4)  the "Credential information" element to indicate the credential information of the Constrained UE.

## A.3.1.8    Registration Response

The registration response sent by the MSGin5G Client of the MSGin5G Gateway UE to the Application Client of the Constrained UE is based on the CoAP 2.01 (Created) response or CoAP 2.04 (Change) response as specified in IETF RFC 7252 [5]. The Application Client of the Constrained UE:

   a)  shall include the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for registration; and

   b)  shall include the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json". The CoAP payload:

   1)  shall include the "Registration Result" element to indicate whether the registration is success or failure;

   2)  shall include the "Registration ID" element allocated by the MSGin5G Client of the MSGin5G Gateway UE if the value of "Registration Result" element is set to true; and

   3)  shall include the "Failure Reason" element to indicate why the registration request is rejected by the MSGin5G Client of the MSGin5G Gateway UE if the value of "Registration Result" element is set to false.

## A.3.1.9   De-registration Request

The de-registration request sent by the Application Client of the Constrained UE to the MSGin5G Client of the MSGin5G Gateway UE is based on the CoAP POST request as specified in IETF RFC 7252 [5]. The Application Client of the Constrained UE:

a)   shall set the "T" field in the CoAP header to 0 to indicate acknowledge message required;

b)   shall include the address of the MSGin5G Gateway UE in the Option header of the CoAP POST request and set the Option header to a corresponding value, e.g. if address of the MSGin5G Gateway UE is a URI, the Uri-Path Option is set to the value of such URI;

c)   shall set the "Content-Format" element to "50" to indicate the format of the CoAP payload is "application/json"; and

d)   shall include the following information elements in the CoAP payload encoded in JSON format:

1)   the "MSGin5G service identifier" element to indicate that this CoAP POST request is used for MSGin5G service;

2)   the "Message Type" element to indicate that the CoAP POST request is used for de-registration; and

3)   the "Registration ID" element to indicate which has been allocated by the MSGin5G Gateway UE during the registration procedure.

## A.3.1.10 De-registration Response

The de-registration response sent by the MSGin5G Client of the MSGin5G Gateway UE to the Application Client of the Constrained UE is based on the CoAP 2.01 (Created) response or CoAP 2.04 (Change) response as specified in IETF RFC 7252 [5]. The Application Client of the Constrained UE:

a)   shall include the CoAP "Message ID" element and the "Token" element with the same values with those in the CoAP POST request for de-registration; and

b)   shall include the "Content-Format" element with "50" to indicate the format of the CoAP payload is "application/json". The CoAP payload:

1)   shall include the "De-registration Result" element to indicate whether the de-registration is success or failure;

2)   shall include the "Registration ID" element allocated by the MSGin5G Client of the MSGin5G Gateway UE if the value of "De-registration Result" element is set to true; and

3)   shall include the "Failure Reason" element to indicate why the de-registration request is rejected by the MSGin5G Client of the MSGin5G Gateway UE if the value of "de-registration Result" element is set to false.

# A.3.2   JSON Schema

## A.3.2.1   for sending a message to MSGin5G Client

The JSON schema for application client sending message is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_APP_Message_schema",
  "title": "APP Message",
  "type": "object",
  "properties": {
    "msgType": {
      "type": "string",
      "enum": [
        "MESSAGE SENDING REQUEST"
      ],
```

```
        "description": " Refer to Message Type, it indicates the usage of this message. The value
MESSAGE SENDING REQUEST refers to message sending"
      },
      "appId": {
        "type": "string",
        "description": "Refer to Application ID"
      },
      "msgId": {
        "type": "string",
        "format": "uuid",
        "description": "Refer to Message ID"
      },
      "isDelivStatReq": {
        "type": "boolean",
        "default": false,
        "description": "Refer to Delivery Status Required"
      },
      "destAddr": {
        "type": "object",
        "properties": {
          "destAddrType": {
            "enum": [
              "UE",
              "AS",
              "GROUP",
              "TOPIC"
            ],
            "description": "the target type"
          },
          "addr": {
            "type": "string",
            "description": "the target address"
          }
        }
      },
      "payload": {
        "type": "string",
        "description": "Refer to Payload"
      },
    },
    "required": [
      "msgType",
      "msgId",
      "destAddr",
      "payload"
    ]
}
```

## A.3.2.2 for sending a message delivery report to MSGin5G Client

The JSON schema for application client sending message delivery status report is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_APP_Delivery REPORT_schema",
  "title": "APP_Delivery REPORT",
  "type": "object",
  "properties": {
    "msgType": {
      "type": "string",
      "enum": [
        "DELIVERY REPORT SENDING REQUEST"
      ],
      "description": " Refer to Message Type, it indicates the usage of this message. The value
DELIVERY REPORT SENDING REQUEST refers to message delivery status report sending"
    },
    "msgId": {
      "type": "string",
      "format": "uuid",
      "description": "Refer to Message ID indicating unique identity of this message delivery
report"
    },
    "reply2msgId": {
      "type": "string",
      "format": "uuid",
      "description": "Refer to Reply-to Message ID indicating which message the delivery status
report is for"
    },
```

```
      "deliveryStatus": {
        "enum": [
            "SUCCESS",
            "FAILED"
            ],
        "description": "Refer to delivery status"
      }
    },
    "required": [
      "msgId",
      "deliveryStatus",
      "msgType"
    ]
}
```

## A.3.2.3 for sending a message to Application Client

The JSON schema for MSGin5G client sending message to Application Client is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Messsage-to-APP_schema",
  "title": "Message to APP",
  "type": "object",
  "properties": {
    "msgType": {
      "type": "string",
      "enum": [
        "MESSAGE RECEIVED REQUEST"
      ],
      "description": " Refer to Message Type indicating the usage of this message. The value MESSAGE
RECEIVED REQUEST refers to sending message to an application client"
    },
    "msgId": {
      "type": "string",
      "format": "uuid",
      "description": "Refer to Message ID indicating which message is for"
    },
    "oriAddr": {
      "type": "string",
      "description": "Refer to the Originator Address indicating the originating UE Service ID if
the message is a group message"
    },
    "groupId": {
      "type": "string",
      "description": "Refer to the Group ID indicating the message is a group message"
    },
    "payload": {
      "type": "string",
      "description": "Refer to Payload"
    },
    "isDelivStatReq": {
      "type": "boolean",
      "default": false,
      "description": "Refer to Delivery Status Required"
    },
    "priority": {
      "type": "string",
      "enum": [
        "HIGH",
        "MEDIUM",
        "LOW"
      ],
      "default": "NORMAL",
      "description": "Refer to Priority Type"
    },
  },
  "required": [
    "msgId",
    "msgType",
    "payload"
  ]
}
```

## A.3.2.4 for sending a message delivery report to Application Client

The JSON schema for MSGin5G client sending message delivery status report to Application Client is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Delivery-Report-to-APP schema",
  "title": "Delivery report to APP",
  "type": "object",
  "properties": {
    "msgType": {
      "type": "string",
      "enum": [
        "DELIVERY REPORT RECEIVED REQUEST"
      ],
      "description": " Refer to Message Type indicating the usage of this message. The value
DELIVERY REPORT RECEIVED REQUEST refers to sending a message delivery status report to Application
Client"
    },
    "msgId": {
      "type": "string",
      "format": "uuid",
      "description": "Refer to Message ID indicating unique identity of this message delivery
report"
    },
    "reply2msgId": {
      "type": "string",
      "format": "uuid",
      "description": "Refer to Reply-to Message ID indicating which message the delivery status
report is for"
    },
    "deliveryStatus": {
      "type": "string",
      "enum": [
        "SUCCESS",
        "FAILED"
      ],
      "description": "Refer to delivery status"
    }
  },
  "required": [
    "msgId",
    "reply2msgId",
    "deliveryStatus",
    "msgType"
  ]
}
```

## A.3.2.5 for sending a message sending response to Application Client

The JSON schema for MSGin5G client sending message sending response to Application Client is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Message-Sending-Response schema",
  "title": "Delivery message sending response to APP",
  "type": "object",
  "properties": {
    "msgType": {
      "type": "string",
      "enum": [
        "MESSAGE SENDING RESPONSE"
      ],
      "description": "Refer to Message Type indicating the usage of this message. The value MESSAGE
SENDING RESPONSE refers to the response for the message sending of an Application Client"
    },
    "failReason": {
      "type": "string",
      "description": "Refer to the failure reason"
    },
    "result": {
      "type": "string",
      "enum": [
        "SUCCESS",
        "FAILED"
      ],
      "description": "Refer to the result"
```

```
    }
  },
  "required": [
    "result",
    "msgType"
  ]
}
```

## A.3.2.6   for sending a message received response to MSGin5G Client

The JSON schema for Application client sending message received response to MSGin5G Client is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_ Message-Received-Response schema",
  "title": "Delivery message received response to MSGin5G Client",
  "type": "object",
  "properties": {
    "msgType": {
      "type": "string",
      "enum": [
        "MESSAGE RECEIVED RESPONSE"
      ],
      "description": " Refer to Message Type indicating the usage of this message. The value MESSAGE
RECEIVED RESPONSE refers to sending a response for receiving a message from MSGin5G Client"
    },
    "failReason": {
      "type": "string",
      "description": "Refer to the failure reason"
    },
    "result": {
      "type": "string",
      "enum": [
          "SUCCESS",
          "FAILED"
          ],
      "description": "Refer to the result"
    }
  },
  "required": [
    "result",
    "msgType"
  ]
}
```

## A.3.2.7   Registration structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause A.3.1.7 are described in the description of the properties. The JSON schema of the CoAP POST request for the MSGin5G registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Registration_request_schema",
  "title": "MSGin5G Registration Request",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "REG"
      ],
      "description": "Refer to the usage of this message. The value REG refers to MSGin5G
Registration"
    },

    "appId": {
      "type": "string",
      "description": "Refer to Application ID"
```

```
    },
    "credential": {
      "type": "string",
      "description": "Refer to Credential Information"
    }
  },
  "required": [
    "msgId",
    "msgType",
    "appID",
    "credential"
  ]
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause A.3.1.8 are described in the description of the properties. The JSON schema of CoAP 2.01 (Created) response or CoAP 2.04 (Change) response for the MSGin5G registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Registration_response_schema",
  "title": "MSGin5G Registration Response",
  "type": "object",
  "properties": {
    "result": {
      "type": "boolean",
      "default": true,
      "description": "Refer to Registration result. The value true refers to success"
    },
    "registration ID": {
      "type": "string",
      "description": "Refer to Registration ID"
    },
    "failure reason": {
      "type": "string",
      "description": "Refer to Failure Reason"
    }
  },
    "required": [
    "result"
  ]
}
```

## A.3.2.8   De-registration structure

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause A.3.1.9 are described in the description of the properties. The JSON schema of the CoAP POST request for the MSGin5G de-registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Deregistration_request_schema",
  "title": "MSGin5G Deregistration Request",
  "type": "object",
  "properties": {
    "msgIden": {
      "type": "string",
      "format": "uri",
      "description": "Refer to Service identifier of MSGin5G service"
    },
    "msgType": {
      "type": "string",
      "enum": [
        "DEREG"
      ],
      "description": "Refer to the usage of this message. The value DEREG refers to MSGin5G De-
registration"
    },
    "registrationID": {
      "type": "string",
      "description": "Refer to Registration ID"
    }
  },
  "required": [
```

```
      "msgId",
      "msgType",
      "RegistrationID"
  ]
}
```

The schema is based on JSON Schema Draft-07 [8]. For reducing the overhead of the message used in MSGin5G service, the properties are defined as shorten form and the relationships between the properties and elements used in clause A.3.1.10 are described in the description of the properties. The JSON schema of CoAP 2.01 (Created) response or CoAP 2.04 (Change) response for the MSGin5G de-registration is defined below:

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "http://www.3gpp.org/MSGin5G/MSGin5G_Deregistration_response_schema",
  "title": "MSGin5G Deregistration Response",
  "type": "object",
  "properties": {
    "result": {
      "type": "boolean",
      "default": true,
      "description": "Refer to Registration result. The value true refers to success"
    },
    "registration ID": {
      "type": "string",
      "description": "Refer to Registration ID"
    },
    "failure reason": {
      "type": "string",
      "description": "Refer to Failure Reason"
    }
  },
    "required": [
    "result"
  ]
}
```

# Annex B (Informative):
# IANA UDP port registration form

This annex contains information to be provided to IANA for exchange of CoAP protocol messages used between MSGin5G clients acting as a realy on UEs UDP port registration or MSGin5G RelayProtocol (MSGin5GRP). The following information is to be used to register CoAPRP user port number and service name in the "IANA Service Name and Transport Protocol Port Number Registry" and specifically "Service Name and Transport Protocol Port Number Registry". This registration form can be found at: https://www.iana.org/form/ports-services.

| | |
|---|---|
| Assignee Name | <MCC name> |
| Assignee E-mail | <MCC email address> |
| Contact Person | <MCC name> |
| Contact E-mail | <MCC email address> |
| Resources required | Port number and service name |
| Transport Protocols | UDP |
| Service Code | |
| Service Name | MSGin5GRP |
| Desired Port Number | |
| Description | Message Service within the 5G System (MSGin5G) RelayProtocol (MSGin5GRP) is a 3GPP control protocol used by MSGin5G client acting as a relay hosted on a User Equipment (UE) for when the MSGin5G client resides in a UE, which does not have enough capability to communicate with a MSGin5G Server (i.e. a constrained device). MSGin5GRP provides MSGin5G functionality between MSGin5G clients hosted on UEs communicating using IP using a single physical network segment, separated from Internet and any other IP network. The network segment is wireless network segment and UEs are mobile devices. |
| Reference | 3GPP TS 24.538 |
| Defined TXT keys | N/A |
| If broadcast/multicast is used, how and what for? | The MSGin5G supports group and broadcast message delivery for thing-to-thing communication and person-to-thing communication. When performing group calls, the MSGin5G client initiates the group call to an MSGin5G group by sending a group call announcement message based on Service Enabler Architecture Layer for Verticals (SEAL) group management. The group call announcement message is an MSGin5GRP message which is sent as a UDP message to a multicast IP address of the MSGin5G group so that it is ensured that the MSGin5GRP messages sent for the corresponding MSGin5G group are only received by the MSGin5G group's members. |
| If UDP is requested, please explain how traffic is limited, and whether the protocol reacts to congestion. | The number of MSGin5GRP messages that need to be sent between MSGin5GRP clients depends upon the number of members of the MSGin5G group. MSGin5GRP employs a message control mechanism which includes a back-off mechanism to defer transmission of another MSGin5GRP message once an MSGin5GRP message is received. MSGin5GRP controls the number of messages transmitted within a certain, configurable amount of time, thus averting congestion. At maximum a few SLMP messages per second are expected in communication between MSGin5GRP clients. MSGin5GRP does not support any reaction to congestion. |

| | |
|---|---|
| If UDP is requested, please indicate whether the service is solely for the discovery of hosts supporting this protocol. | MSGin5GRP is not used solely for discovery of hosts supporting this protocol. |
| Please explain how your protocol supports versioning. | MSGin5GRP does not support versioning. |
| If your request is for more than one transport, please explain in detail how the protocol differs over each transport. | N/A |
| Please describe how your protocol supports security. Note that presently there is no IETF consensus on when it is appropriate to use a second port for an insecure version of a protocol. | MSGin5GRP does not support security. MSGin5GRP relies on the security mechanisms of the lower layers. |
| Please explain why a unique port assignment is necessary as opposed to a port in range (49152-65535) or existing port. | As a general principle, 3GPP protocols use assigned User Ports, e.g. GTP-C uses UDP port number 2123, GTP-U uses UDP port number 2152, S1AP uses SCTP port number 36412, X2AP uses SCTP port number 36422, WLCP uses 36411. A dynamic port number (i.e. 49152 to 65535) cannot be used for the MSGin5GRP because of the nature of communication on a single physical network segment, separated from Internet and any other IP network. The requirement of MSGin5GRP to continuously listen for incoming messages needs an always active listener port. There is no local server that is administering the use of emphemeral ports in the MSGin5GRP architecture, so there would be no way for one MSGin5GR client acting as a relay to know that a port is already being used by another MSGin5GRP client. |
| Please explain the state of development of your protocol. | Protocol standard definition. No implementation exists yet. |
| If SCTP is requested, is there an existing TCP and/or UDP service name or port number assignment? If yes, provide the existing service name and port number. | N/A |
| What specific SCTP capability is used by the application such that a user who has the choice of both TCP (and/or UDP) and SCTP ports for this application would choose SCTP? See RFC 4960 section 7.1. | N/A |
| Please provide any other information that would be helpful in understanding how this protocol differs from existing assigned services | This protocol is between the UEs communicating using IP over a single physical network segment, separated from Internet and any other IP network. MSGin5GRP functionality offered by the MSGin5GRP clients acting as a relay hosted by the UEs is to messaging communication capability in 5GS especially for Massive Internet of Things (MIoT). The need of listening for incoming messages requires an active listener port.<br><br>This differs from existing protocols in 3GPP where UDP ports have been requested, as those protocols have been either between the UE and network or between network elements. |

NOTE: The UDP port number of MSGin5G service has been assigned by 3GPP rather than IANA using a 3GPP allocated port number as specfied by 3GPP TS 29.641 [20].

# Annex C (Informative):  Reference flow of MSGin5G service

# C.1     Message delivery flow at MSGin5G Server

Figure C.1-1 illustrates the message delivery flow at the terminating MSGin5G Server (i.e. the hosting MSGin5G Server of the recipient MSGin5G UE).
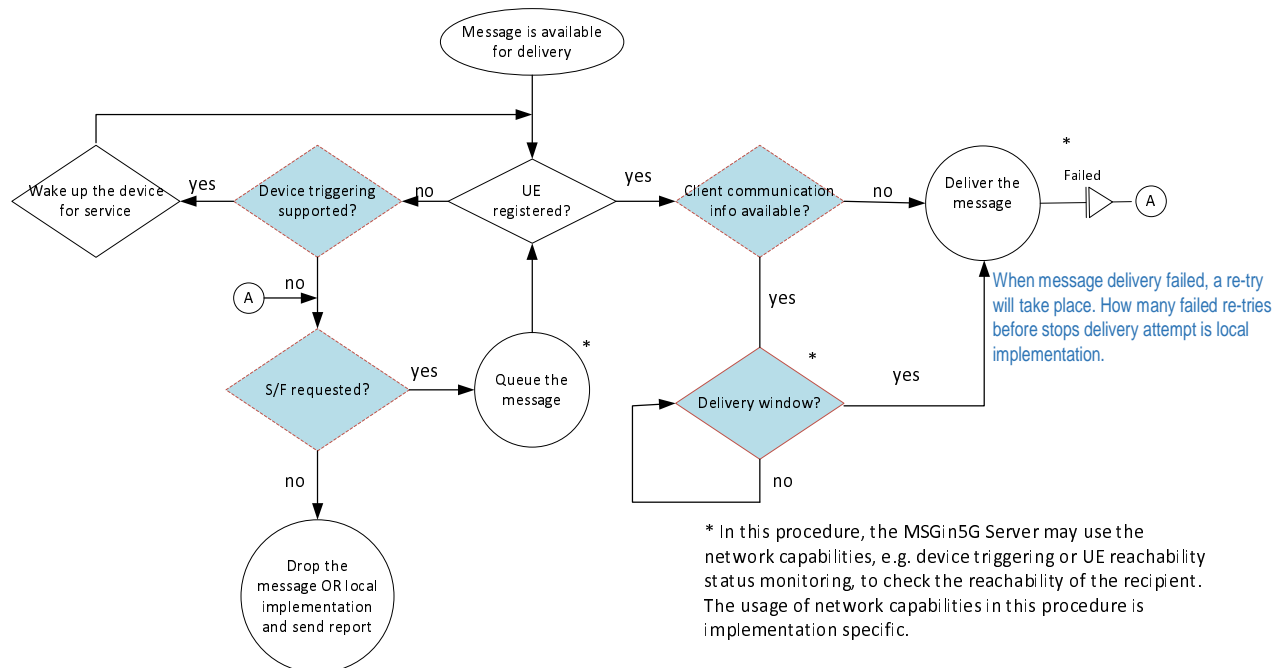


**Figure C.1-1: The Message delivery flow at MSGin5G Server**

# Annex C (informative):
# Change history

| Change history | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date | Meeting | TDoc | CR | Rev | Cat | Subject/Comment | New version |
| 2021-10 | CT1#132e | C1-216109 | | | | Draft skeleton provided by the rapporteur. | 0.0.0 |
| 2021-10 | CT1#132e | | | | | Implementing the following p-CR agreed by CT1: C1-215739, C1-215873, C1-215874, C1-216174, C1-216177, C1-216180 Editorial change from the rapporteur. Correction from the rapporteur. | 0.1.0 |
| 2021-11 | CT1#133e | | | | | Implementing the following p-CR agreed by CT1: C1-217092, C1-217293, C1-217294, C1-217295, C1-217296, C1-217330, C1-217331, C1-217332, C1-217334, C1-217335, C1-217338, C1-217339 Editorial change from the rapporteur. Correction from the rapporteur. | 0.2.0 |
| 2021-12 | | | | | | Editorial change from the rapporteur. Correction from the rapporteur. | 0.2.1 |
| 2022-01 | CT1#133 BIS-e | | | | | Implementing the following p-CR agreed by CT1: C1-220373, C1-220418, C1-220505, C1-220649, C1-220650, C1-220657, C1-220658, C1-220660, C1-220661, C1-220691, C1-220692, C1-220693, C1-220695, C1-220751, C1-220760, C1-220763, C1-220766, C1-220840 Editorial change from the rapporteur. Correction from the rapporteur. | 0.3.0 |
| 2022-03 | CT1#134-e | | | | | Implementing the following p-CR agreed by CT1: C1-221091, C1-221117, C1-221441, C1-221444, C1-221655, C1-221660, C1-221661, C1-221832, C1-221834, C1-221836, C1-221951, C1-221955, C1-221960, C1-221961, C1-221980, C1-221981, C1-222008 Editorial change from the rapporteur. Correction from the rapporteur. | 0.4.0 |
| 2022-03 | CT#95e | CP-220316 | | | | TS presented for information | 1.0.0 |
| 2022-04 | CT1#135-e | | | | | Implementing the following p-CR agreed by CT1: C1-222958, C1-222960, C1-222961, C1-223102, C1-223103, C1-223111, C1-223112, C1-223113, C1-223114, C1-223115, C1-223116, C1-223117 Editorial change from the rapporteur. Correction from the rapporteur. | 1.1.0 |
| 2022-05 | CT1#136-e | | | | | Implementing the following p-CR agreed by CT1: C1-223644, C1-223646, C1-223647, C1-223650, C1-223651, C1-224040, C1-224041, C1-224042, C1-223854, C1-223855, C1-224051, C1-223857, C1-223860, C1-224161, C1-224165, C1-223864, C1-223867, C1-223868, C1-224167, C1-224172, C1-223873, C1-224173, C1-224175 Editorial change from the rapporteur. Correction from the rapporteur. | 1.2.0 |
| 2022-06 | CT#96 | CP-221191 | | | | TS presented for approval | 2.0.0 |
| 2022-06 | CT#96 | | | | | TS approved in TSG CT plenary | 17.0.0 |
| 2022-09 | CT#97e | CP-222154 | 0001 | - | F | Correct the length of Application ID | 17.1.0 |
| 2022-09 | CT#97e | CP-222154 | 0002 | - | F | Remove the redundant IE codec | 17.1.0 |
| 2022-09 | CT#97e | CP-222154 | 0003 | 1 | F | Add the coding of Credential information IE | 17.1.0 |
| 2022-09 | CT#97e | CP-222154 | 0004 | - | F | Adding the reference to TS 23.003 for FQDN | 17.1.0 |
| 2022-09 | CT#97e | CP-222154 | 0005 | 1 | F | Differentiate the functionalities and procedures between MSGin5G Gateway UE and MSGin5G Relay UE | 17.1.0 |
| 2022-09 | CT#97e | CP-222154 | 0006 | 1 | F | Correction of Layer-2 ID | 17.1.0 |
| 2022-09 | CT#97e | CP-222154 | 0007 | - | F | Adding the reference to RFC 4122 | 17.1.0 |
| 2022-09 | CT#97e | CP-222154 | 0008 | 1 | F | Clarify how to generate the Recipient UE Service ID/AS Service ID for constrained UE | 17.1.0 |
| 2022-09 | CT#97e | CP-222154 | 0009 | 1 | F | MSGin5G Client splits the aggregated message | 17.1.0 |
| 2022-09 | CT#97e | CP-222154 | 0010 | 1 | F | Editorial corrections | 17.1.0 |
| 2022-12 | CT#98e | CP-223150 | 0011 | | F | Correct the term of "Constrained device" to "Constrained UE" | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0012 | 1 | F | Corrections of the L3 message format | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0013 | | F | Add a missing value of the Message Type IE | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0014 | | F | Add the IE of Spare half octet | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0015 | 1 | F | Correct the coding of Target Address IE | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0016 | | F | Remove the restriction of the L3 message transport | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0017 | | F | Editoral corrections of procedures | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0018 | 1 | F | IANA Registration form for UDP Port number | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0021 | 1 | D | SEAL terms in 24.538 aligned with 24.546 | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0022 | 1 | F | Add a missing functionality of the MSGin5G Client | 17.2.0 |
| 2022-12 | CT#98e | CP-223150 | 0023 | 1 | F | Editoral corrections of procedures | 17.2.0 |
| 2023-03 | CT#99 | CP-230221 | 0030 | 1 | F | Correnction of constrained devices | 17.3.0 |
| 2023-03 | CT#99 | CP-230221 | 0031 | 1 | F | Correnction of regsitration/de-registration response for constrained UE | 17.3.0 |

| 2023-03 | CT#99 | CP-230256 | 0024 | 1 | B | Introduce the concept of MSGin5G Proxy UE | 18.0.0 |
|---|---|---|---|---|---|---|---|
| 2023-06 | CT#100 | CP-231214 | 0032 | - | B | Add message delivery between different MSGin5G Servers | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0033 | - | B | add new SEAL GMS capabilities | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0034 | - | F | update the General description | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0037 | 1 | B | The procedure at Constrained UE for registration via MSGin5G Proxy UE | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0038 | 1 | B | The behaviors of MSGin5G Proxy UE receiving Registration Request | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0039 | 1 | B | The behaviors of MSGin5G Proxy UE sending bulk Registration Request | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0040 | 1 | B | The behaviors of MSGin5G Proxy UE receiving Bulk Registration Response | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0041 | 1 | B | The behaviors of MSGin5G Server receiving bulk Registration Request | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 = | 0047 | - | B | The procedure at Constrained UE for De-registration via MSGin5G Gateway UE | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0049 | - | B | The behaviors of MSGin5G Gateway UE sending bulk De-registration Request | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0050 | - | B | The behaviors of MSGin5G Gateway UE receiving Bulk De-registration Response | 18.1.0 |
| 2023-06 | CT#100 | CP-231213 | 0043 | 1 | A | Solve UDP port number ENs | 18.1.0 |
| 2023-06 | CT#100 | CP-231213 | 0035 | 2 | A | Remove EN in A.3 | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0046 | 1 | B | Alignment with definition in stage2 | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0048 | 1 | B | The behaviors of MSGin5G Gateway UE receiving De-registration Request | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0051 | 1 | B | The behaviors of MSGin5G Server receiving bulk De-registration Request | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0052 | 2 | F | Update of General description | 18.1.0 |
| 2023-06 | CT#100 | CP-231214 | 0053 | 3 | F | Update of Functional entities | 18.1.0 |
| 2023-09 | CT#101 | CP-232195 | 0056 | - | F | Note about IANA registration | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0054 | 1 | F | Update the General description of MSGin5G Procedures | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0055 | 1 | F | Update the procedures of Constrained device Configuration | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0057 | 1 | F | Add new Annex of Message delivery flow at MSGin5G Server | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0058 | 1 | F | Removal of EN in clause 4 | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0059 | 1 | B | update of clause 6.4.1.2.1 general procedure at MSGin5G Server | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0061 | 1 | F | Update the message delivery and message delivery status report delivery for Constrained UE | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0062 | 1 | F | update the procedure at Relay UE | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0064 | 1 | F | Update the registration procedure via relay UE | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0065 | 1 | F | Update the application registration to MSGin5G Client on MSGin5G UE | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0066 | 1 | B | Add the gateway registration procedure | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0067 | 1 | F | Update the Usage of SEAL | 18.2.0 |
| 2023-09 | CT#101 | CP-232199 | 0060 | 2 | B | update of MSGin5G messages procedure at MSGin5G Server | 18.2.0 |
| 2023-09 | CT#101 | CP-233296 | 0063 | - | F | Replace MSGin5G Proxy UE with MSGin5G Gateway Client | 18.2.0 |
| 2023-12 | CT#102 | CP-233139 | 0075 | - | F | update the SEAL group deletion reference | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0086 | - | F | Editorial correction in the configuration related clause | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0076 | 1 | F | Add a gerenal subclause of registration procedure | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0077 | 1 | F | Add a new schema of registration to MSGin5G Gateway UE | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0078 | 1 | F | Add a new schema of registraion response | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0079 | 1 | F | Add an optional IE to registration response | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0080 | 1 | F | Update schema of regisration request/response | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0081 | 1 | B | The procedure at Constrained UE for configuration via MSGin5G Gateway UE | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0082 | 1 | B | The behaviors of MSGin5G Gateway UE receiving Configuration Request | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0083 | 1 | B | The behaviors of MSGin5G Gateway UE sending bulk Configuration Request | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0084 | 1 | B | The behaviors of MSGin5G Server receiving bulk Configuration Request | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0085 | 1 | B | The behaviors of MSGin5G Gateway UE receiving bulk Configuration Response | 18.3.0 |
| 2023-12 | CT#102 | CP-233133 | 0071 | 2 | A | Port numbers and associated protocol in triggering information | 18.3.0 |
| 2023-12 | CT#102 | CP-233133 | 0069 | 2 | A | Correction on message Priority IE | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0073 | 2 | F | Failure Cause is not included in the registration response | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0074 | 2 | F | editorial corrections | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0087 | - | F | Missing response upon reception of registration responses from the MSGin5G Gateway Client | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0088 | - | F | Missing response upon reception of de-registration responses from the MSGin5G Gateway Client | 18.3.0 |
| 2023-12 | CT#102 | CP-233133 | 0092 | 1 | A | Correction on message response | 18.3.0 |

| 2023-12 | CT#102 | CP-233133 | 0095 | 1 | A | Correction on Store and Forward procedure | 18.3.0 |
|---------|--------|-----------|------|---|---|--------------------------------------------|--------|
| 2023-12 | CT#102 | CP-233139 | 0089 | 1 | F | Add a new schema of registration response | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0090 | 1 | F | Add a new schema of de-registration response | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0096 | 1 | F | Correction on message response | 18.3.0 |
| 2023-12 | CT#102 | CP-233139 | 0097 | 1 | F | Port numbers and associated protocol in triggering information | 18.3.0 |
| 2024-03 | CT#103 | CP-240092 | 0102 | - | F | Messaging Topic term alignment | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0106 | - | F | Remove redundant behaviors of the constrained UE | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0108 | - | F | Add a new schema of CoAP response for de-registration response ack | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0109 | - | F | Add a new schema of CoAP response for deregistration notification | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0110 | - | F | Correct the title of CoAP response for registration notification | 18.4.0 |
| 2024-03 | CT#103 | CP-240123 | 0113 | - | B | Introducing SEALDD support | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0105 | 1 | F | Correct references to MSGin5G message structures | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0107 | 1 | F | Add a new schema of CoAP response for registration response ack | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0098 | 1 | F | Add General Description clause to MSGin5G Message delivery | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0099 | 1 | F | Addition of detailed information and requirements of some messaging IEs | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0100 | 1 | F | Correct on clause 4 General description | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0103 | 1 | F | Update of Annex A based on updated architecture | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0104 | 1 | B | Update of the Messaging Topic Subscription and Unsubscription procedures | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0112 | 1 | F | Corrections on clause 6.4.2 | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0118 | - | F | Add missing elements of registration response | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0127 | - | F | Corrections to clauses A.3.2.1 - A.3.2.8 | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0111 | 3 | B | MSGin5G Gateway UE Configuration structure | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0116 | 1 | F | Clarification of headers of CoAP message | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0117 | 1 | F | Clarification of GW registration | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0119 | 1 | F | Add missing elements of registration request | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0120 | 1 | F | Add a new schema of the bulk registration request/response | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0121 | 1 | F | Add a new schema of the bulk de-registration request/response | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0125 | 1 | F | Corrections to clause 7.3.3.5 | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0126 | 1 | F | Correction of maximum payload length | 18.4.0 |
| 2024-03 | CT#103 | CP-240091 | 0115 | 2 | A | Correct the schemas of (de)registration request | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0122 | 1 | F | Corrections to clause 7.3.3.1 | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0124 | 2 | F | Corrections to clause 7.3.3.3 | 18.4.0 |
| 2024-03 | CT#103 | CP-240092 | 0123 | 1 | F | Corrections to clause 7.3.3.2 | 18.4.0 |
| 2024-03 | CT#103 | CP-240091 | 0114 | 2 | F | Correct the schemas of (de)registration request | 18.4.0 |
| 2024-06 | CT#104 | CP-241157 | 0129 | - | A | Correction of erroneous IEIs | 18.5.0 |
| 2024-06 | CT#104 | CP-241158 | 0131 | - | F | Correction on reference in clause 6.8.4.1 | 18.5.0 |
| 2024-06 | CT#104 | CP-241158 | 0132 | - | F | Add a reference of authentication mechanism for MSGin5G service | 18.5.0 |
| 2024-06 | CT#104 | CP-241158 | 0133 | - | F | Adding missing message types | 18.5.0 |
| 2024-06 | CT#104 | CP-241158 | 0134 | - | F | Clarify the CoAP response in configuration procedure | 18.5.0 |
| 2024-06 | CT#104 | CP-241158 | 0135 | - | F | Editorial corrections | 18.5.0 |
| 2024-06 | CT#104 | CP-241158 | 0130 | 1 | F | Correction on supported MSGin5G segment size and the procedure of segmentation | 18.5.0 |
| 2025-03 | CT#107 | CP-250174 | 0138 | 1 | F | Correction on message segment size | 18.6.0 |
| 2025-06 | CT#108 | **CP-251152** | 0147 | 1 | F | Correction on usage of terms in communication with Application Client | 18.7.0 |

# History

| Document history | | |
|---|---|---|
| V18.4.0 | May 2024 | Publication |
| V18.5.0 | July 2024 | Publication |
| V18.6.0 | March 2025 | Publication |
| V18.7.0 | July 2025 | Publication |
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