3GPP TR 23.863 V2.0.0 (2012-11)

Technical Report

3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Support of Short Message Service (SMS) in IMS without MSISDN; Stage 2 (Release 12)

Keywords
3GPP, Architecture, IMS, SMS

3GPP

Postal address

3GPP support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet
http://www.3gpp.org

Contents

Foreword

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

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

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

Since Release 7, SMS delivery over IMS has been possible with TS 23.204 [4]. The fundamental principle used when developing that work is to reuse the legacy CS SMS infrastructure in order to preserve the possibility to deliver SMS to both CS/PS domain and IMS as the user may roam between both domains. In addition, the existing SMS infrastructure that an operator has in place e.g. SC, GMSC-SMS, IWMSC is able to be reused. This is achieved by mandating MSISDN as part of the SMS delivery addressing, even for SMS delivery toward IMS.

In Release 11, MTC allows the UE to have PS only subscription without MSISDN. Such UE may also be IMS UE. Allowing Messages delivery to these UEs in IMS without MSISDN is an important requirement for these devices.

Therefore, there is a need to improve the SMS submit/delivery mechanism within IMS to allow MSISDN-less delivery toward the IMS registered UEs.

1 Scope

This Technical Report is to specify architecture enhancement toward SMS submit/delivery mechanism in IMS to allow IMS registered UE to:

- Receive and send SMS without requiring an MSISDN associated as part of their IMS subscription record in HSS and
- any possible enhancements towards the related storing and forwarding mechanism if the UE is out of reach.

There are three potential aspects for these IMS UEs without MSISDN that need to be investigated:

1) Server - IMS UE communication via SMS (e.g. for M2M).
2) IMS UE to IMS UE communication via SMS for person to person communications. Both UEs do not have MSISDN.
3) SMS Interworking between IMS UE without MSISDN and traditional UE (e.g. CS) with MSISDN.

Normative specification work (if needed or feasible) for each of these areas can be started independently.

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 23.040: "Technical realization of the Short Message Service (SMS)".

[3] 3GPP TR 21 912 (V3.1.0): "Example 2, using fixed text".

[4] 3GPP TS 23.204: "Short Message Service (SMS) over generic 3GPP Internet Protocol (IP) access".

[6] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[7] 3GPP TS 29.311: "Service Level Interworking (SLI) for messaging services".

[8] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 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 TR 21.905 [1].

Server: A Short Message Entity (SME) in the network which sends or receives SMS to/from MSISDN-less IMS UE.

Traditional UE: UE with MSISDN for as part of its subscription profile and using MSISDN for SMS service.

3.2 Abbreviations

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

4 Architecture Requirements and assumptions

4.1 General

The solution shall not impact the SMS service defined in TS 23.040 [2] and shall coexist with SMS services that make use of MSISDN.

Existing charging procedures for SMS associated with MSISDN shall not be affected. Charging for SMS not associated with an MSISDN will need to be based on an identity other than MSISDN.

4.2 MSISDN-less IMS UE - Server communication

The solution can assume that:

- Server can receive UE specific information, e.g. E.164 address of UE's IP-SM-GW or a new functionality to support this scenario;
- Server can receive SMS via traditional SMS addressing method (i.e. has E.164 address associated with it).
- When UE receives an SM from Server, the UE is expected to know which address to use for SM reply to Server if needed (e.g. address from SM payload or from TP-OA field, etc.).

4.3 Communication between MSISDN-less IMS UEs

4.4 MSISDN-less IMS UE – Traditional UE communication

5 Solution Alternatives

5.1 Server - MSISDN-less IMS UE communication via SMS

5.1.1 Server to MSISDN-less IMS UE

5.1.1.1 Alternative 1: Direct delivery without IP-SM-GW

5.1.1.1.1 Procedure

Figure 5.1.1.1-1 shows a solution when SMS sender delivers the short message directly to the MSISDN-less IMS UE by creating a terminating SMSIP request. This solution does not use the legacy SMS architecture.

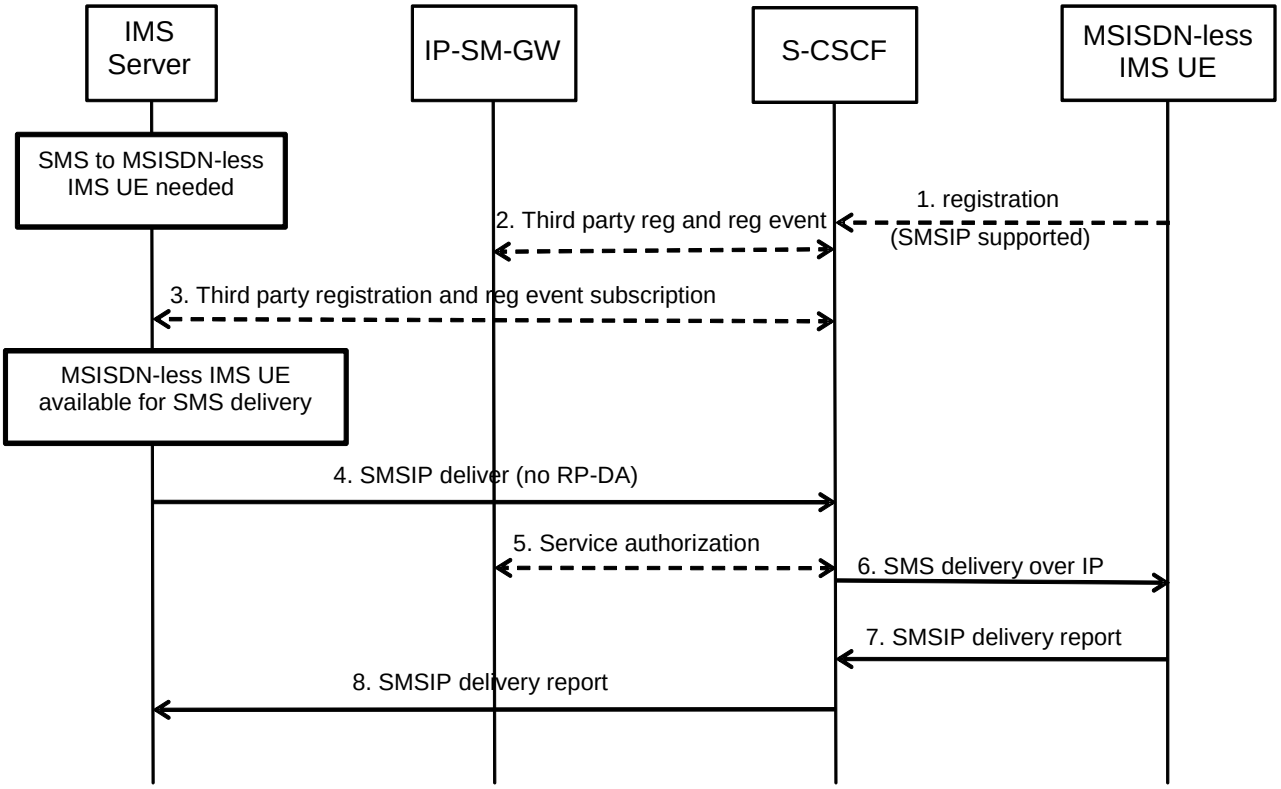

Figure 5.1.1.1-1: Direct SMSIP delivery to MSISDN-less IMS UE

0) SMS sender decides to send an SMS to the MSISDN-less IMS UE.

1-3) (optional) Either the SMS sender is a server that is aware of the registration status of the SMSIP capable MSISDN-less IMS UE, or it is assumed that the MSISDN-less IMS UE is always registered.

NOTE 1: There is no trigger to make the MSISDN-less IMS UE to register.

4) As the SMSIP capable MSISDN-less IMS UE is available, the SMS sender creates an SMSIP request as done by the IP-SM-GW in short message termination procedure in case of transport-level interworking with the following changes:

- The creation of the SMSIP request is not triggered by an SMS received from SMS-GMSC, but triggered by an application / service logic.
- The target of the SMSIP request is not a tel URI received in the SMS, but the SIP URI determined by an application / service logic.
- The body of the message is the RP-DATA message created by application / service logic. The RP-DATA includes SMS headers and the SMS user information encoded as specified in TS 23.040 [2].

NOTE 2: For terminating short message: as the SMSIP message is the last hop of the "SMS path", the RP-Destination-Address element is not needed.

5) (optional) According to operator policy terminating SMSIP requests (not created by an IP-SM-GW) can be routed to IP-SM-GW for service authorization.

NOTE 3 Charging function is not affected by the fact that the served UE is an MSISDN-less IMS UE.

6) SMSIP request is sent to the MSISDN-less IMS UE. Note that the 200 OK SIP response is not shown in the figure.

7-8) MSISDN-less IMS UE sends back delivery report in SMSIP request. Note that the 200 OK SIP response is not shown.

5.1.1.1.2 Affect / necessary changes in existing functionality

Optional service authorization in IP-SM-GW for a terminating SMSIP request. If operator policy does not require service authorization, then the IP-SM-GW will not be triggered as a terminating service.

5.1.1.1.3 Applicability

Requirements for SMS addressing / routing: None, the SMS path not used at all.

Restriction/requirement on SM sender: Store and forward functionality is not available, SMS sender either must be aware of the availability of the MSISDN-less IMS UE, or it can be assumed that the MSISDN-less IMS UE is an always-on type equipment.

5.1.1.1.4 Advantages, drawbacks

Pro

- Simple, no additional requirement for existing functions (except if service authorization in IP-SM-GW needed).

Con

- SMS sender must be able to create an SMSIP request with terminating SMS and process delivery report (i.e. not the 'usual' SMS sending function).
- No intermediate storage, just a one-shot-message sending.
- SMS sender must know recipient availability status or assume always-on status. There is no trigger to make the MSISDN-less IMS UE to register when the server wants to send a short message.

5.1.1.2 Alternative 2: Direct delivery with IP-SM-GW

5.1.1.2.1 Procedure

Figure 5.1.1.2-1 shows a solution when SMS sender triggers IP-SM-GW to deliver a short message directly to the MSISDN-less IMS UE over IP. This solution uses the last hop of the "SMS path" mandating SMS over IP.

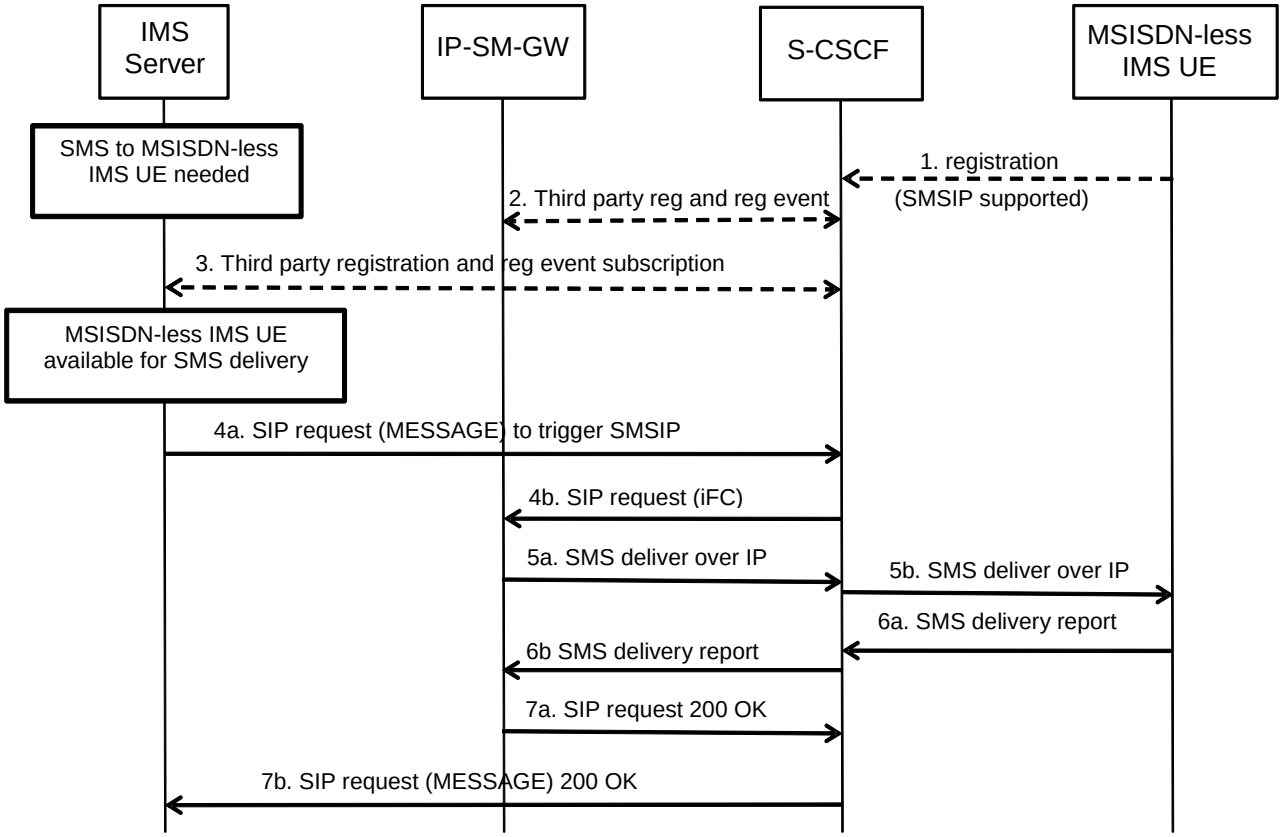

Figure 5.1.1.2-1: Triggering SMSIP delivery in IP-SM-GW to MSISDN-less IMS UE

0) SMS sender decides to send an SMS to the MSISDN-less IMS UE.

1-3) (optional) Either the SMS sender is a server that is aware of the registration status of the SMSIP capable MSISDN-less IMS UE, or it is assumed that the MSISDN-less IMS UE is always registered.

NOTE 1: There is no trigger to make the MSISDN-less IMS UE to register.

4) As the SMSIP capable MSISDN-less IMS UE is available, the SMS sender triggers IP-SM-GW to deliver short message to the MSISDN-less IMS UE. The trigger can be:

- a SIP request (addressing either the IP-SM-GW, or the MSISDN-less IMS UE if it can be assumed that the IP-SM-GW will be triggered as terminating service of the MSISDN-less IMS UE); or

NOTE 2: Using a plain SIP MESSAGE request has the drawback that IP-SM-GW must answer immediately with a 202 Accepted response, which means only that an intermediate node handles the request.

- any direct (proprietary) request addressing the IP-SM-GW.

NOTE 3: The IM trigger case is described in separate solution as well.

The trigger must include:

- the text message the short message must contain;
- the target MSISDN-less IMS UE's SIP URI.

5) The IP-SM-GW creates an SMSIP request as described in procedure for short message termination in case of service-level interworking with the following changes:

- The trigger is generalized, not necessary triggered by an Instant Message, the trigger can be any request that includes the target of the SMS and the actual message to be delivered.

NOTE 4: To avoid too many variants of triggers and mechanisms, the same procedure as defined for Alternative 5 for IP-SM-GW to retrieve the target's SIP_URI can be reused here.

SMSIP request is sent to the MSISDN-less IMS UE. Note that the 200 OK SIP response not shown.

6) MSISDN-less IMS UE sends back delivery report in SMSIP request. Note that the 200 OK SIP response not shown.

7) IP-SM-GW sends back a response to the SMS sender.

5.1.1.2.2 Affect / necessary changes in existing functionality

Generalized functionality in IP-SM-GW: create terminating SMSIP based on any request, leaving the RP-Destination-Address empty.

Also domain selection functionality of IP-SM-GW has to be skipped. According to TS 23.204 [4] 6.11 point 4 delivery over CS/PS is also needed if not possible via IMS even if IP-SM-GW is triggered by IM and not MT-SM. But in this case it is not possible since HLR query via SRIforSM cannot be done without MSISDN-B. Also RSMDS cannot be done without MSISDN.

5.1.1.2.3 Applicability

Requirements for SMS addressing / routing: None, only the last hop of the SMS path is used.

Restriction/requirement on SM sender: Store and forward functionality is not available, SMS sender either must be aware of the availability of the MSISDN-less IMS UE, or it can be assumed that the MSISDN-less IMS UE is an always-on type equipment.

5.1.1.2.4 Advantages / Drawbacks

Pro

- Simple, generalization of an existing functions.

Con

- SMS sender must be able to create an SMSIP request with terminating SMS and process delivery report (i.e. not the 'usual' SMS sending function).
- No intermediate storage, just a one-shot-message sending.
- SMS sender must know recipient availability status or assume always-on status. There is no trigger to make the MSISDN-less IMS UE to register when the server wants to send a short message.
- It is necessary to standardize how the target of the SMS is sent to the IP-SM-GW.

5.1.1.3 Alternative 3: SMS delivery with modified IM-SMS interworking

5.1.1.3.1 Procedure

Figure 5.1.1.3-1 shows a solution when server sends Instant Message and IP-SM-GW interworks that to SMS over IP.

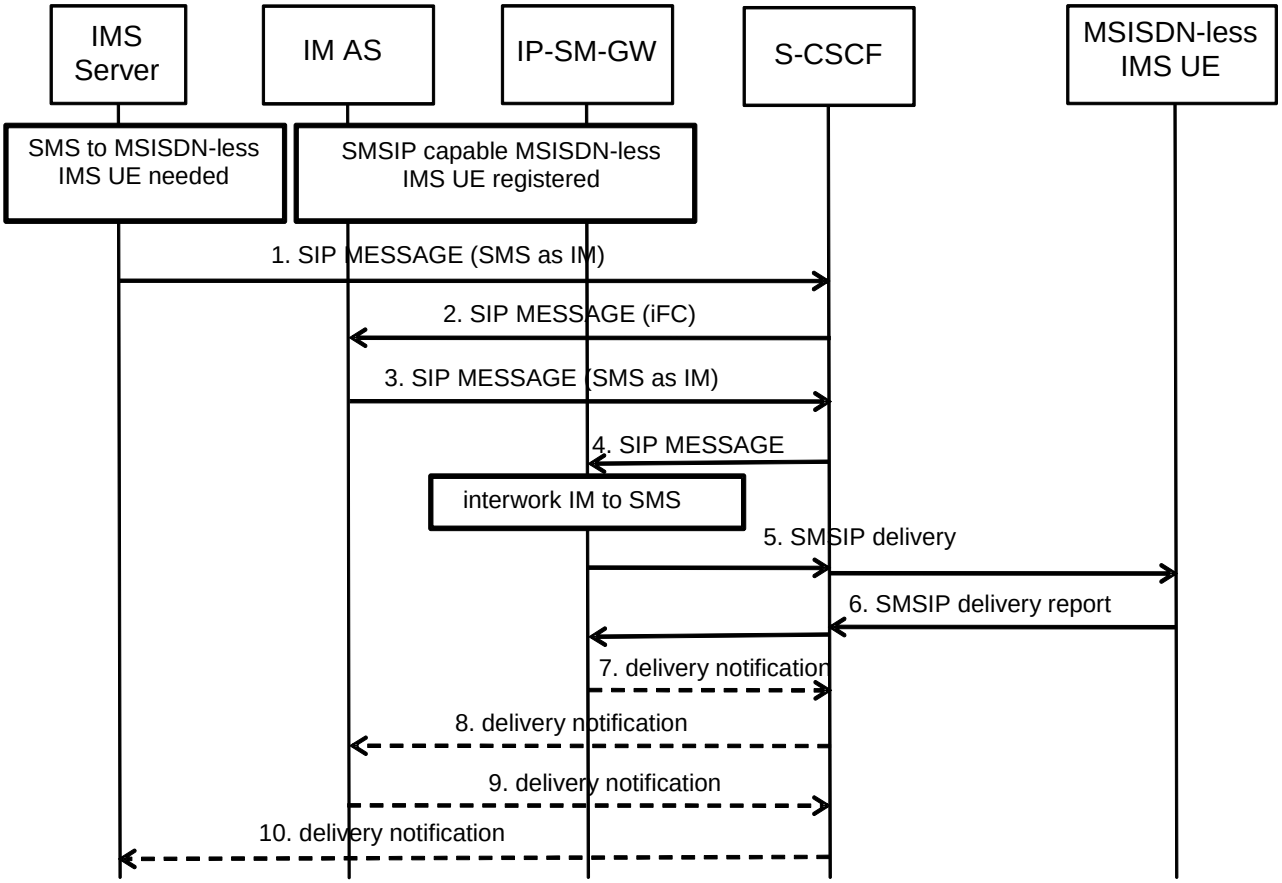

Figure 5.1.1.3-1: IM to SM interworking – registered case

0) SMS sender decides to send a message to the SMS capable MSISDN-less IMS UE as an Instant Message.

1-4) SMS sender triggers IP-SM-GW to deliver short message to the MSISDN-less IMS UE by sending an Instant Message.

5) The IP-SM-GW creates an SMSIP request as described in procedure for short message termination in case of service-level interworking. SMSIP request is sent to the MSISDN-less IMS UE. Note that the 200 OK SIP response not shown.

6) MSISDN-less IMS UE sends back delivery report in the SMSIP request. Note that the 200 OK SIP response not shown.

7-10) If requested in the Instant Message, IP-SM-GW sends back a delivery notification towards the SMS sender.

Figure 5.1.1.3-2 shows the same scenario when SMSIP capable MSISDN-less IMS UE is not registered.

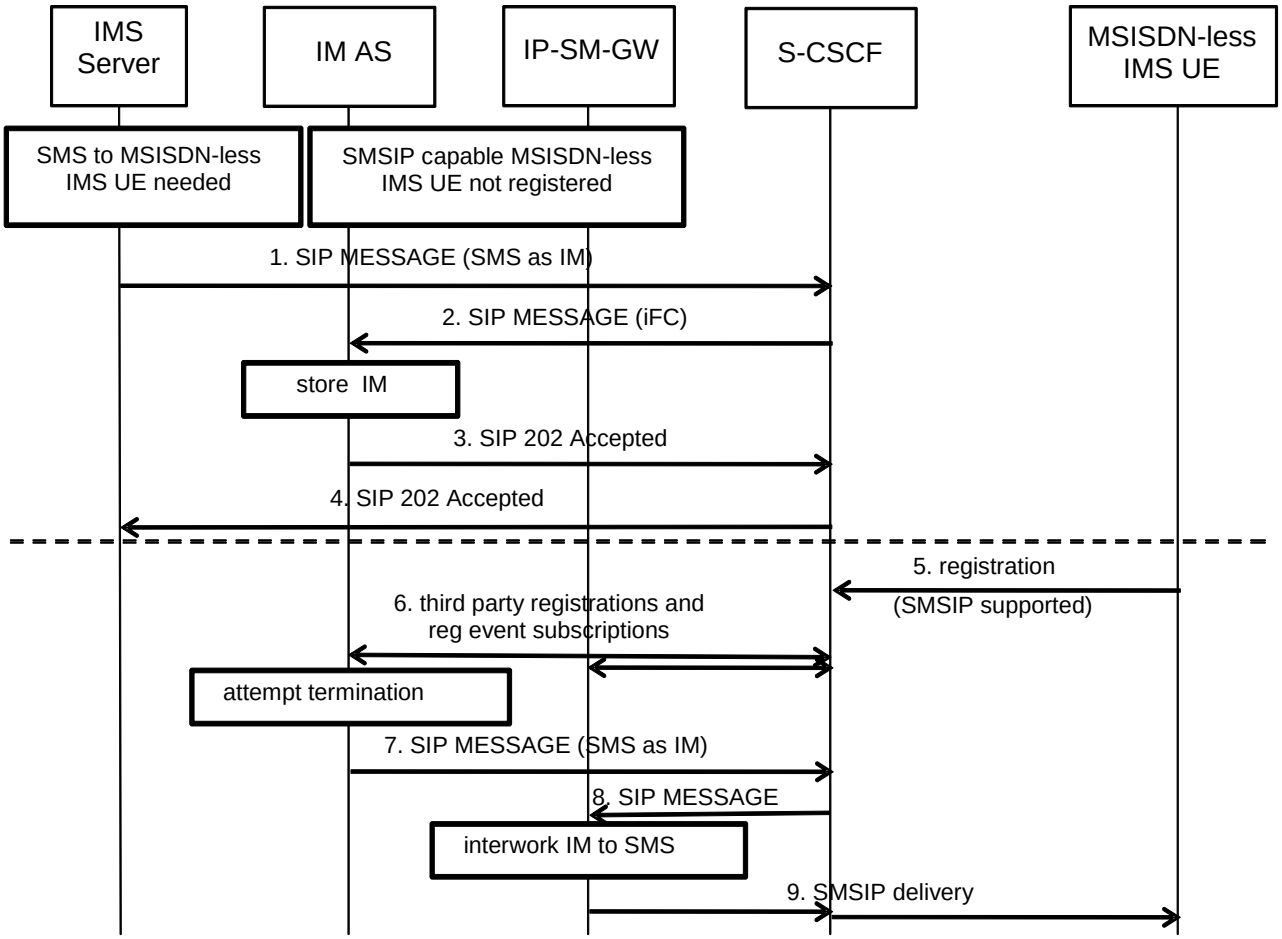

Figure 5.1.1.3-2: IM to SM interworking – unregistered case

0) SMS sender decides to send a message to the SMS capable MSISDN-less IMS UE as an Instant Message.

1-2) The Instant Message reaches the IM AS with the iFC mechanism. As the IM AS is aware of the MSISDN-less IMS UE's registration status, it stores the Instant Message.

3-4) IM AS sends back a response indicating that the message is handled by an intermediate entity.

5-6) MSISDN-less IMS UE registers, IM AS (and IP-SM-GW) is notified on the availability of an SMSIP capable MSISDN-less IMS UE.

7-8) IM AS sends the stored Instant Message towards the MSISDN-less IMS UE. The request reaches the IP-SM-GW with the iFC mechanism.

9) The same procedure applies as in registered case, starting from step 5, see figure 5.1-3. The rest of the procedure is not shown.

5.1.1.3.2 Affect / necessary changes in existing functionality

In case of service level interworking from IM to SM on the terminating side (see clause 6.1.5.3.4 in TS 29.311 [7]), the IP-SM-GW will not perform the SMS router functionality (i.e. no domain selection for SMS termination).

5.1.1.3.3 Applicability

Requirements for SMS addressing / routing: None, only the last hop of the SMS path is used.

IM AS is available in the MSISDN-less IMS UE's network, and the MSISDN-less IMS UE is authorized to use both instant messaging and SMS over IP services.

Domain selection functionality of IP-SM-GW has to be skipped. According to TS 23.204 [4] (see clause 6.11, bullet 4) delivery over CS/PS is also needed if not possible via IMS even if IP-SM-GW is triggered by IM and not MT-SM. But

in this case it is not possible since HLR query via SRIforSM cannot be done without MSISDN-B. Also RSMDS cannot be done without MSISDN.

5.1.1.3.4 Advantages / Drawbacks

Pro

- Simple, minimal change in existing functionality (IP-SM-GW must not perform SMS router functionality).
- intermediate storage available.

Con

- IM needed in the MSISDN-less IMS UE's network.

5.1.1.4 Alternative 4: SMS delivery through SMS proxy

5.1.1.4.1 Procedure

In the following two solutions an "SMS proxy" is assigned to the MSISDN-less IMS UE. The E.164 address of the SMS proxy can be stored as an addition to the subscriber data of the MSISDN-less IMS UE. The "SMS proxy" can be co-located with the IP-SM-GW.

The scenario in figure 5.1.1.4-1 assumes that the "SMS proxy" is co-located with IP-SM-GW.

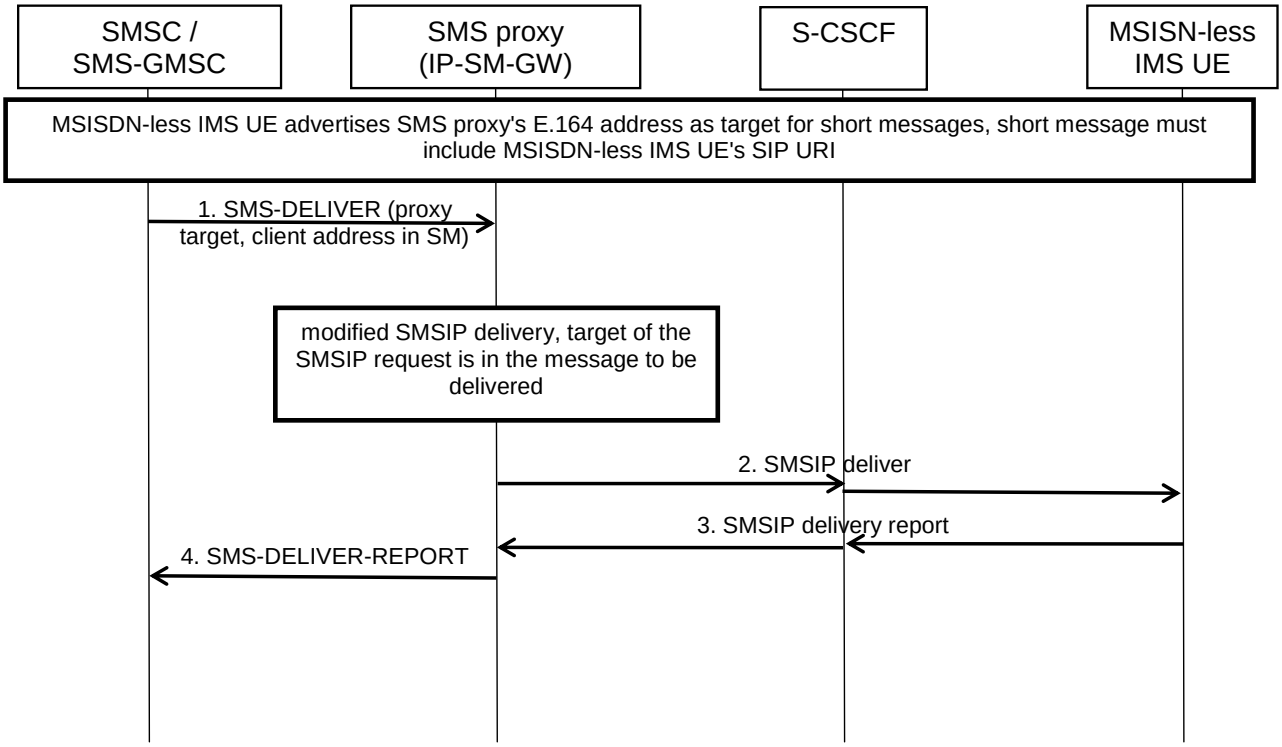

Figure 5.1.1.4-1: SMS proxy (co-located with IP-SM-GW)

0) SMS sender decides to send an SMS to the MSISDN-less IMS UE.

1) SMS sender sends the short message to the E.164 address of the "SMS proxy". The short message includes the MSISDN-less IMS UE's SIP URI besides the actual message. The short message is delivered to the SMS proxy.

NOTE 1: As for this solution the SC alert mechanism is not available, it is advised to send short messages via SMS proxy with short validity period.

2) Based on the received short message the SMS proxy creates a terminating short message as an SMSIP request with the following changes:

- the user information is copied from the received message after cutting out the MSISDN-less IMS UE's SIP URI; and

- the target of the SMSIP request is the MSISDN-less IMS UE's SIP URI received in the SMS.

NOTE 2: The 200 OK SIP response is not shown in the figure.

3) MSISDN-less IMS UE's SIP URI sends back delivery report in SMSIP request. Note that the 200 OK SIP response not shown.

4) SMS proxy (IP-SM-GW) sends back delivery report towards the SC.

As from SC point of view the SMS proxy is the target of the short message, the SC alert mechanism must not be triggered (a successful delivery to an another MSISDN-less IMS UE would trigger another delivery attempt to the unavailable MSISDN-less IMS UE), so the IP-SM-GW will not report the short message delivery status in this case.

In case of failure the delivery report must indicate a temporary error to ensure that SC will re-attempt delivery.

5.1.1.4.2 Affect / necessary changes in existing functionality

Generalized functionality in IP-SM-GW: create terminating SMSIP based on any request.

IP-SM-GW will not report short message delivery status to the HLR and will not attempt domain selection.

5.1.1.4.3 Applicability

Requirements for SMS addressing / routing: None.

Restriction/requirement on SM sender:

1. The SMS sender either must be aware of the MSISDN-less IMS UE's availability, or it can be assumed that the MSISDN-less IMS UE is an always-on type equipment.

2. SMS sender must know the SMS proxy of the MSISDN-less IMS UE: can be a subscription info, or could be configured number (even in inter-operator agreement if the incoming short messages for all MSISDN-less IMS UEs for a certain operator are handled by the same SMS proxy).

3. In addition to the actual message, the address (SIP URI) of the MSISDN-less IMS UE must also be included in the short message, this reduces the maximum message length that can be sent in a single short message.

Assuming that the SMS proxy is always on, the SC alert mechanism is not applicable.

5.1.1.4.4 Evaluation

Pro

- The SMS sender can use any access technology to send short message.

Con

- If the SMS proxy cannot forward the short message to the addressed MSISDN-less IMS UE, then the message delivery fails, but the SC alert mechanism cannot be used, only the re-attempt delivery mechanism of the SC will trigger another delivery attempt. At the same time to ensure that offline MSISDN-less IMS UEs do not cause big load (both on the number of short message delivery attempts and on the number of stored shored messages), the validity period must be set to a low value.

- SMS sender must send a short message to an SMS proxy, and the message must include the real addressee of the message.

- It is necessary to standardize how the target of the SMS is sent to the SMS proxy.

5.1.1.5 Alternative 5: Direct delivery with IP-SM-GW interworking

5.1.1.5.1 Procedure

Each IMS server/application has an assigned MSISDN.

The MSISDN-less terminating short code or other special address is a "code" that the IP-SM-GW recognizes as a MSISDN-less IMS UE terminated IM or SM during the process.

The MSISDN-less terminating code will indicate MSISDN-less UE address is embedded in the use data. This is a common code used by all MSISDN-less IMS UEs for MT procedures.

Figure 5.1.1.5-1 shows a solution when server sends a SIP MESSAGE to MSISDN-less IMS UE via IP-SM-GW.

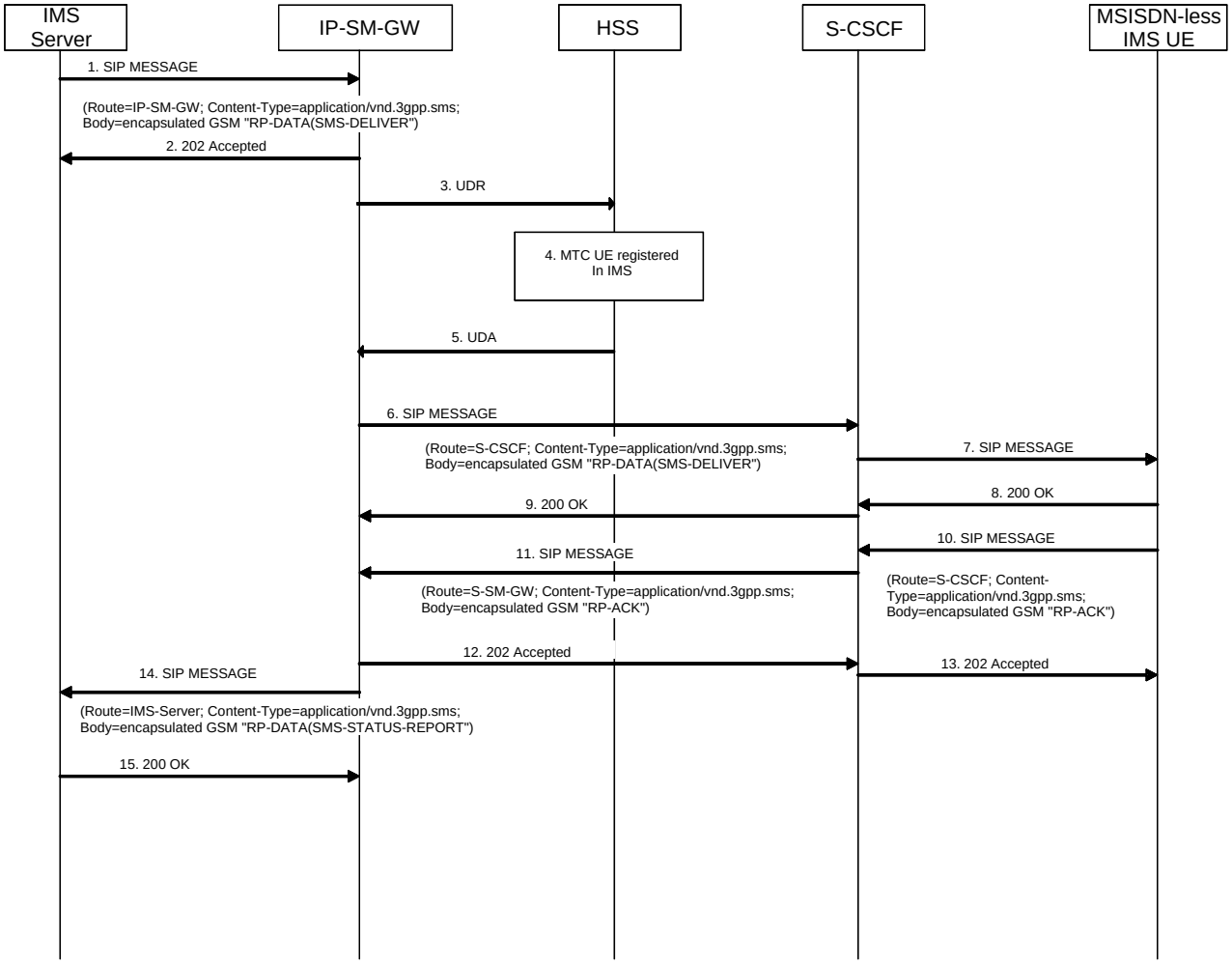

Figure 5.1.1.5-1: IMS Server Delivery SM to MSISDN-less UE

0) IMS server decides to send an IM or SM to the MSISDN-less IMS UE.

1) IMS server sends an IM or SM to the MSISDN-less IMS UE via IP-SM-GW.

   This request includes a vnd.3gpp.sms payload that includes the short message and routing information for the IP-SM-GW to forward the short message. SIP Request URI and To headers should be IM-SM-GW SIP URI, From header should be IMS server SIP URI.

   IMS Server MSISDN should be included in RP-OA and TP-OA of RP-DATA (SMS-DELIVER) (see TS 24.011 [6] and TS 23.040 [2]).

   MSISDN-less UE terminating code should be included. IMS server must embed MSISDN-less IMS UE address in use data body. IMS Server includes MSISDN-less UE terminating code so IP-SM-GW can retrieve UE

address (e.g. SIP URI) from the use data body – embedding UE address is required since SIP headers do not include UE address. The MSISDN-less UE terminating code is included in RP-DA.

2) IP-SM-GW returns 202 Accepted.

3-5) (optional) IP-SM-GW receives SIP MESSAGE with SMS-DELIVER, and queries HSS for MSISDN-less IMS UE. HSS returns UE status and S-CSCF address.

IP-SM-GW will retrieve MSISDN-less UE address from the user data body per indication of MSISDN-less terminating code, and query HSS using MSISDN-less UE address.

6) IP-SM-GW sends SIP MESSAGE to S-CSCF.

In this step, IP-SM-GW will fill the UE address in SIP Request URI and To headers as it is a pure MT scenario. From header should be IP-SM-GW. RP-OA and TP-OA will be IMS server MSISDN, IP-SM-GW may not parse or change RP-DATA.

7) S-CSCF sends SIP MESSAGE to MSISDN-less IMS UE.

S-CSCF will not change SIP headers except Route header. S-CSCF will not parse or change RP-DATA encapsulated in SIP MESSAGE

8-9) UE returns 200 OK.

10) UE parses SMS payload successfully and returns RP-ACK encapsulated in a SIP MESSAGE to S-CSCF with the IP-SM-GW address in SIP Request URI and To headers, and MSISDN-less UE SIP URI in SIP From header. UE may optionally embed UE address in the user data of RP-ACK.

In the RP-ACK, RP-DA (optional) is IMS server MSISDN that the UE obtained from the TP-OA of RP-DATA; the MSISDN-less terminating code that the UE obtained from the received SM is included in RP-OA.

11) S-CSCF forwards a SIP MESSAGE containing the RP-ACK to IP-SM-GW.

S-CSCF will not change SIP headers except Route header. S-CSCF will not parse or change RP-DATA encapsulated in SIP MESSAGE.

12-13) IP-SM-GW returns 202 Accepted.

14) (optional) IP-SM-GW sends a SIP MESSAGE encapsulating SMS-STATUS-REPORT in RP-DATA to IMS server.

IP-SM-GW will fill IMS server SIP URI in SIP Request URI and To headers, and IP-SM-GW URI in From header. It must fill TP-Recipient-Address (TP-RA) (mandatory field) so this is set to the MSISDN-less terminating code, and must include MSISDN-less UE address in the user data body. IP-SM-GW either obtains UE address from the user data body of RP-ACK or from previously saved data.

15) (optional) IMS server returns 200 OK.

5.1.1.5.2 Affect / necessary changes in existing functionality

IMS server will use MSISDN-less terminating code. This MSISDN-less terminating short code or other special address is a "code" that the IP-SM-GW recognizes as a MSISDN-less IMS UE terminated IM or SM during the process.

IMS server will embed MSISDN-less UE address in SM use data body of RP-DATA.

UE will embed MSISDN-less UE address in SM use data body of RP-ACK.

IP-SM-GW must recognize MSISDN-less terminating code as an indicator to obtain embedded UE IP identifier from the SM use data body.

5.1.1.5.3 Applicability

Requirements for SMS addressing / routing: same as existing function.

Restriction/requirement on SM sender: Store and forward functionality is not available if SIP MESSAGE is sent to IP-SM-GW (since IP-SM-GWs do not support this functionality).

5.1.1.5.4 Evaluation

Pro

- Minimal impact on IP-SM-GW, IMS Server and MSISDN-less UE to use MSISDN-less terminating code for embedded MSISDN-less IMS address.
- IP-SM-GW can use MSISDN-less IMS UE address embedded in use data for billing identifier.

NOTE: In practice, some SM entities only use parameters in RP-DATA for billing but ignore SIP headers.

- Encapsulating sender or receiver's alternative address in use data body has been commonly used in practice, like encapsulating email address in use data body for email and SM exchanges at Email GW.
- The MSISDN-less terminating code can be optionally used as MTC user group identifier.

Con

- IM or SM needed in the IMS network with MSISDN-less IMS UE.

5.1.2 MSISDN-less IMS UE to Server

5.1.2.1 Alternative 1: Direct delivery with IP-SM-GW interworking

5.1.2.1.1 Procedure

Each IMS server/application has an assigned MSISDN.

The MSISDN-less originating short code or other special address is a "code" that the IP-SM-GW recognizes as a MSISDN-less IMS UE originated IM or SM during the process.

The MSISDN-less originating short code or other special address will indicate MSISDN-less UE address is embedded in the use data. This is a common code used by all MSISDN-less IMS UEs for MO procedures.

Figure 5.1.2.1-1 shows a solution when an MSISDN-less IMS UE sends a SIP MESSAGE to IMS sever via IP-SM-GW.

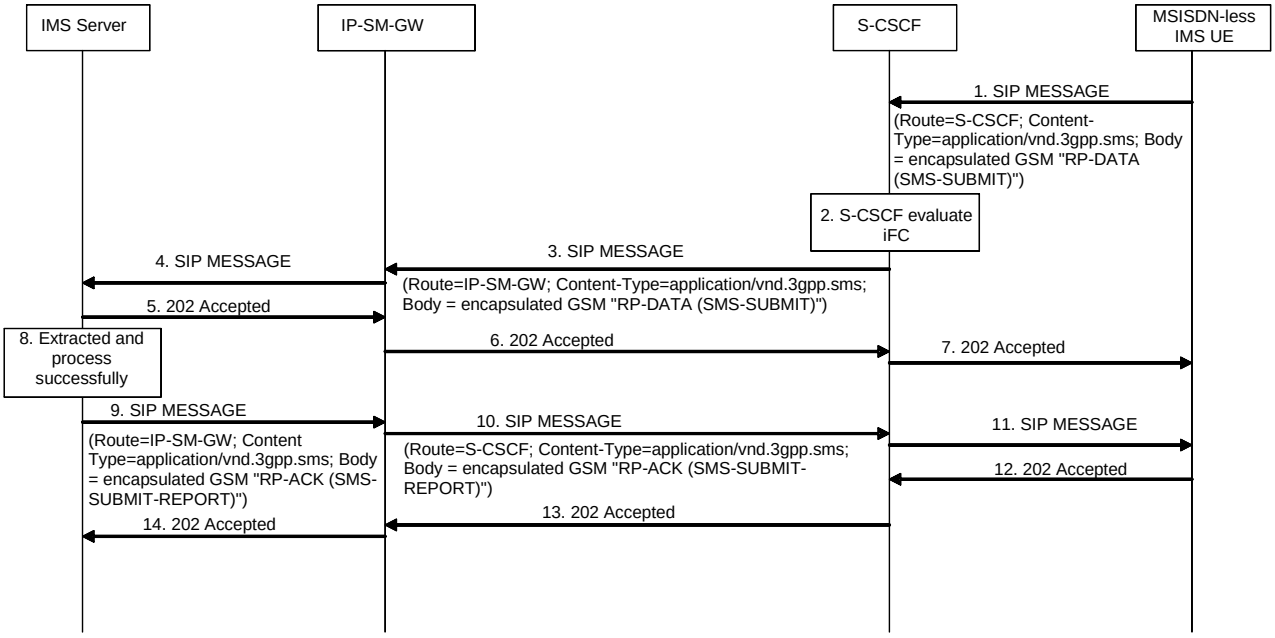

Figure 5.1.2.1-1: MSISDN-less UE Submit SM to IMS Server

1) MSISDN-less IMS UE originates an IM or SM to IMS server via IP-SM-GW.

This request includes a vnd.3gpp.sms payload that includes the short message and routing information for the IP-SM-GW to forward the short message.

SIP Request URI and To headers should be IM-SM-GW SIP URI, From header should be UE SIP URI.

MSISDN-less Originating code should be included, and IMS server MSISDN in RP-DA and TP-DA of RP-DATA (SMS-SUBMIT). The MSISDN-less UE originating code is included in RP-OA.

MSISDN-less IMS UE address is embedded in use data body. Even UE address is already in SIP From header, it is strongly suggest to embed UE address in the user data body so that next hop IP-SM-GW won't need to embed it when sending SIP MESSAGE to the IMS server.

2) S-CSCF runs iFC.

3) S-CSCF routes SIP MESSAGE to IP-SM-GW.

S-CSCF will not change SIP headers except Route header. S-CSCF will not parse or change RP-DATA encapsulated in SIP MESSAGE

4) IP-SM-GW forwards SIP MESSAGE to IMS server.

IP-SM-GW will fill IMS server URI in SIP Request URI and To headers, and IP-SM-GW URI in To header. IP-SM-GW will not change addresses in RP-DATA.

5-7) IMS server returns 202 Accepted.

8) IMS server parses SM data.

9) IMS server returns RP-ACK encapsulated in a SIP MESSAGE to MSISDN-less UE to IP-SM-GW. SIP From header will be IMS server SIP URI, and SIP Request URI and To headers will be IP-SM-GW SIP URI. In RP-ACK, RP-OA is the IMS server MSISDN, and the MSISDN-less originating code that the IMS server obtained from the received SM is included in RP-DA. MSISDN-less UE address is embedded in the use data body.

10) IP-SM-GW retrieves MSISDN-less UE address from the user data body or from previously saved data, send SIP MESSAGE with RP-ACK encapsulated to S-CSCF. SIP Request URI and To headers are UE URI, From header is IP-SM-GW URI.

11) S-CSCF forwards SIP MESSAGE with RP-ACK to MSISDN-less UE.

12-14) MSISDN-less UE returns 202 Accepted.

5.1.2.1.2 Affect / necessary changes in existing functionality

MSISDN-less UE will use MSISDN-less originating code. This MSISDN-less originating code will help IP-SM-GW realize it is a MSISDN-less IMS UE originated IM or SM during the process.

MSISDN-less UE will embed MSISDN-less UE address in SM use data body of RP-DATA.

IMS-Server will embed MSISDN-less UE address in SM use data body of RP-ACK.

IP-SM-GW must recognize MSISDN-less originating code as an indicator to obtain embedded UE IP identifier from the SM use data body.

5.1.2.1.3 Applicability

Requirements for SMS addressing / routing: same as existing function.

Restriction/requirement on SM sender: Store and forward functionality is not available if SIP MESSAGE is sent to IP-SM-GW (since IP-SM-GWs do not support this functionality).

5.1.2.1.4 Evaluation

Pro

- Minimal impact on IP-SM-GW, IMS Server and MSISDN-less UE to use MSISDN-less originating code for embedded MSISDN-less IMS address.
- IP-SM-GW can use MSISDN-less IMS UE address in SIP From header or embedded in use data for as billing identifier.

NOTE: In practice, some SM entities only use parameters in RP-DATA for billing but ignore SIP headers.

Encapsulating sender or receiver's alternative address in use data body has been commonly used in practice, like encapsulating email address in use data body for email and SM exchanges at Email GW.

- The MSISDN-less originating code can be optionally used as MTC user group identifier.

Con

- IM or SM needed in the IMS network with MSISDN-less IMS UE.

5.1.2.2 Alternative 2: SMS delivery through SMS proxy

5.1.2.2.1 Procedure

In the following two solutions an "SMS proxy" is assigned to the MSISDN-less IMS UE. The E.164 address of the SMS proxy can be stored as an addition to the subscriber data of the MSISDN-less IMS UE. The "SMS proxy" can be co-located with the IP-SM-GW.

The scenario in figure 5.1.2.2-1 assumes that the "SMS proxy" is co-located with IP-SM-GW.

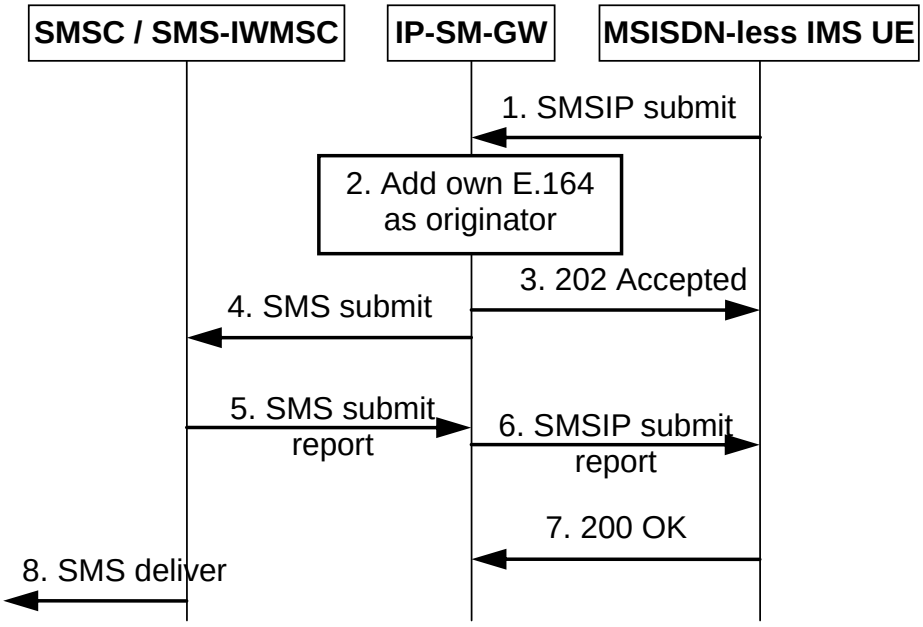

Figure 5.1.2.2-1: SMS proxy (co-located with IP-SM-GW)

1) MSISDN-less IMS UE submits a short message as an SMSIP message.
2) As no E.164 number (MSISDN) available for the originator of the request, the IP-SM-GW acts as an SMS proxy and adds its own E.164 address as the originator of the short message (RP-Originating-Address) and includes the MSISDN-less IMS UE's SIP URI into the actual message.

NOTE 1: If based on configuration the IP-SM-GW can assume that an identifier of the MSISDN-less IMS UE (e.g. device id) is already included in the short message itself (the server will know the originator's identity), then it is not necessary to insert the MSISDN-less IMS UE's SIP URI into the actual message.

3) The IP-SM-GW acknowledges the SMSIP message with a 202 (Accepted) response.

4) The IP-SM-GW forwards the short message to the SC.

5) The SC returns a submit report.

6) The IP-SM-GW forwards the submit report to the MSISDN-less IMS UE as an SMSIP message.

7) The MSISDN-less IMS UE returns a 200 (OK) response.

8) Using standard SM delivery procedures the SC attempts to deliver the short message to the "Server/SMS receiver".

The scenario in figure 5.1.2.2-2 assumes that the "SMS proxy" is not co-located with IP-SM-GW.

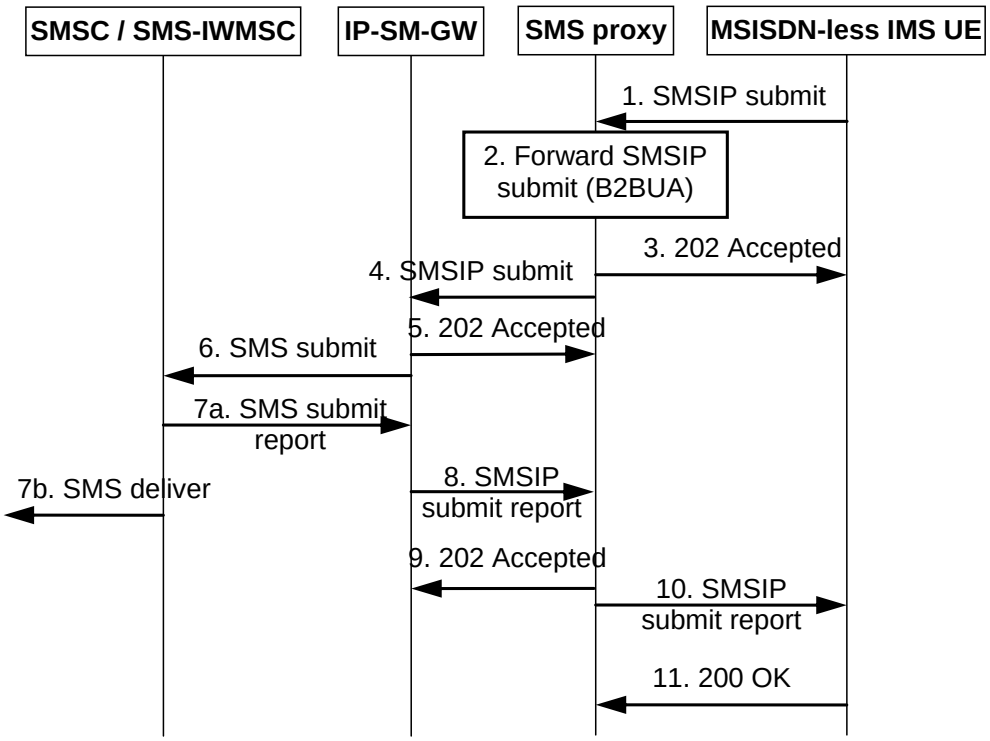

Figure 5.1.2.2-2: Standalone SMS proxy

1) MSISDN-less IMS UE submits a short message as an SMSIP message.

2) SMS proxy creates a new request to the IP-SM-GW as a B2BUA. It includes the MSISDN-less IMS UE's SIP URI into the actual message. The originator of the new SMSIP submit message is the SMS proxy.

NOTE 1: If based on configuration the SMS proxy can assume that an identifier of the MSISDN-less IMS UE (e.g. device id) is already included in the short message itself (the server will know the originator's identity), then it is not necessary to insert the MSISDN-less IMS UE's SIP URI into the actual message.

3) The SMS proxy acknowledges the SMSIP message with a 202 (Accepted) response.

4) The SMS proxy sends the new SMSIP submit request to the IP-SM-GW.

5) The IP-SM-GW acknowledges the SMSIP message with a 202 (Accepted) response.

6) The IP-SM-GW forwards the short message to the SC.

7a) The SC returns a submit report.

7b) Using standard SM delivery procedures the SC attempts to deliver the short message to the "Server/SMS receiver".

8) The IP-SM-GW forwards the submit report to the SMS proxy as an SMSIP message.

9) The SMS proxy returns a 202 (Accepted) response.

10) The SMS proxy forwards the submit report to the MSISDN-less IMS UE as an SMSIP message.

NOTE 2: No B2BUA needed for the submit report.

11) The MSISDN-less IMS UE returns a 200 (OK) response.

In both of these variants, the SMSC needs to have an indication that the sender's address is embedded in the SMS payload. This indication can be based on a special E.164 number that the IP-SM-GW inserts into the TP-OA field which will allow the SMSC to perform this triggering.

5.1.2.2.2 Affect / necessary changes in existing functionality

SMS proxy functionality in the originating network introduced that can be co-located with IP-SM-GW.

SMSC/SMS-IWMSC needs a new functionality to detect the sender identity based on indication /matching in TP-OA field.

5.1.2.2.3 Applicability

Requirements for SMS addressing / routing: None.

Restriction/requirement on SM sender: None.

Restriction/requirement on the "Server/SMS receiver": Must determine the originator's identity from the received short message itself (and can create answer SMS as described in clause 5.1.1).

5.1.2.2.4 Advantages, drawbacks

Pro

- The "Server/SMS receiver" can use any access technology to receive short message.
- Can be used for any receiver assuming that the receiver is able to determine the originator's identity from the received short message itself (and not TP-Originating-Address).

Con

- SMS proxy needed.
- It is necessary to standardize how the originator of the SMS is sent from the SMS proxy.
- SMSC is impacted and coordination of indication between IP-SM-GW and SMSC are required.

5.1.2.3 Alternative 3: SMS submit with direct delivery from originating IP-SM-GW

5.1.2.3.1 Procedure

Figure 5.1.2.3-1 shows a solution in which the MSISDN-less IMS UE submits a SM, which triggers IP-SM-GW to deliver the short message directly to the "Server/SMS receiver". This solution uses the first and last hop of the "SMS path" by basically skipping the legacy SMS architecture including the intermediate storage functionality. For the SMS submit, SMS over IP is mandatory.

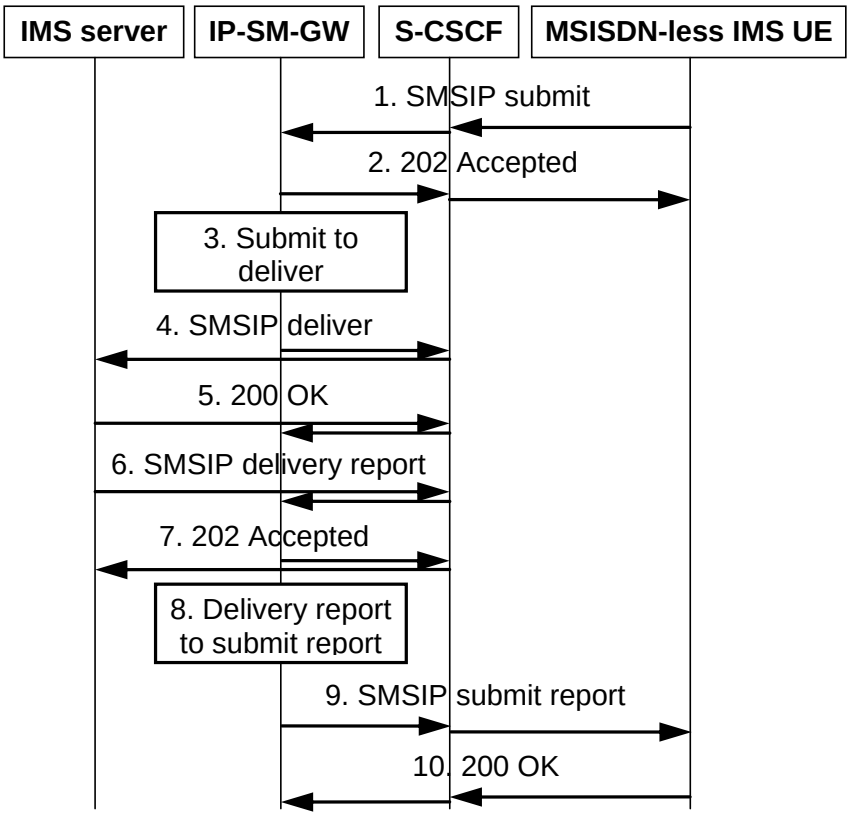

Figure 5.1.2.3-1: Direct delivery from originating IP-SM-GW

1-2) MSISDN-less IMS UE submits a short message as an SMSIP message. The IP-SM-GW acknowledges the request with a 202 (Accepted) response.

3) As no E.164 number (MSISDN) available for the originator of the request, the IP-SM-GW creates a terminating short message as follows:

- the short message includes the MSISDN-less IMS UE's SIP URI into the actual message;

Editor's note: It is necessary to standardize how the MSISDN-less IMS UE's SIP URI is sent in the SMS to the server.

NOTE 1: If based on configuration, the IP-SM-GW can assume that an identifier of the MSISDN-less IMS UE (e.g. device id) is already included in the short message itself (the server will know the originator's identity), then it is not necessary to insert the MSISDN-less IMS UE's SIP URI into the actual message.

- both the sender of the request (RP-Originating-Address) and the originator of the request (TP-Originating-Address) is set to the E.164 address of the IP-SM-GW.

4) The SMSIP message is sent to the "Server/SMS receiver".

NOTE 2: The termination of the SIP MESSAGE request to the "Server/SMS receiver" can include the routing of a request to an I-CSCF / S-CSCF in a terminating network that hosts the "SMS receiver", those hops are not shown in Figure 5.1-x.

5) The "Server/SMS receiver" answers with a 200 (OK) response.

6) The "Server/SMS receiver" sends back a delivery report in an SMSIP message.

7) The IP-SM-GW returns a 202 (Accepted) response.

8-9) The IP-SM-GW creates a submit report based on the delivery report and sends it back to the MSISDN-less IMS UE in an SMSIP request.

10) The MSISDN-less IMS UE returns a 200 (OK) response.

NOTE 3: If the MSISDN-less IMS UE has requested status report, the IP-SM-GW can send that to the MSISDN-less IMS UE after the 200 (OK) response for the submit report is received.

5.1.2.3.2 Affect / necessary changes in existing functionality

Direct delivery (creating a short message delivery request based on the short message submit request without sending it to a SC is an possible optimization implementation today, although not standardized. As part of the direct delivery procedure the IP-SM-GW may need to manipulate the short message text, inserting the originator's SIP URI.

The "Server/SMS receiver" must be ready to determine the originator's identity from the received short message itself (ignoring the TP-Originating-Address) either as the SIP URI inserted by the IP-SM-GW, or the identity (e.g. device id) inserted by the MSISDN-less IMS UE.

5.1.2.3.3 Applicability

Requirements for SMS addressing / routing: None. The "Server/SMS receiver" must know that the TP-Originating-Address of the received short message is the E.164 address of the IP-SM-GW.

Restriction on SM sender: None.

IP-SM-GW must support direct delivery, and optionally the insertion of the real originator's address into the short message.

"Server/SMS receiver" can determine the originator's identity from the received short message itself (and can create answer SMS as described in clause 5.1.1).

No storage capability in the network used, "Server/SMS receiver" is assumed to be always-on. If the "Server/SMS receiver" is not always-on, then:

- the MSISDN-less IMS UE must try resending the SMS periodically (additional load for the network);
- an additional mechanism needed to inform MSISDN-less IMS UE on the availability of the "Server/SMS receiver";
- the IP-SM-GW attempts another method, considering direct delivery as an optimization only.

5.1.2.3.4 Advantages / Drawbacks

Pro

- No service level interworking needed.
- Only the (extended) IP-SM-GW used in the network.

Con

- It may be required to add the identifier of the MSISDN-less IMS UE sender if it has not been included by the client already.
- No intermediate message storage capability used in the network.

5.2 Communication via SMS between MSISDN-less IMS UEs

5.2.1 Alternative 1: Direct delivery with IP-SM-GW interworking

5.2.1.1 Procedure

The MSISDN-less originating and terminating short codes or other special addresses are a "code" that the IP-SM-GW recognizes as a MSISDN-less IMS UE originated or terminated IM or SM during the process.

The MSISDN-less originating or terminating codes will indicate MSISDN-less UE address is embedded in the use data. Each is a common code used by all MSISDN-less IMS UEs for MT or MO procedures.

Figure 5.2.1-1 shows a solution when an MSISDN-less IMS UE sends a SIP MESSAGE to another MSISDN-less IMS UE via IP-SM-GW.

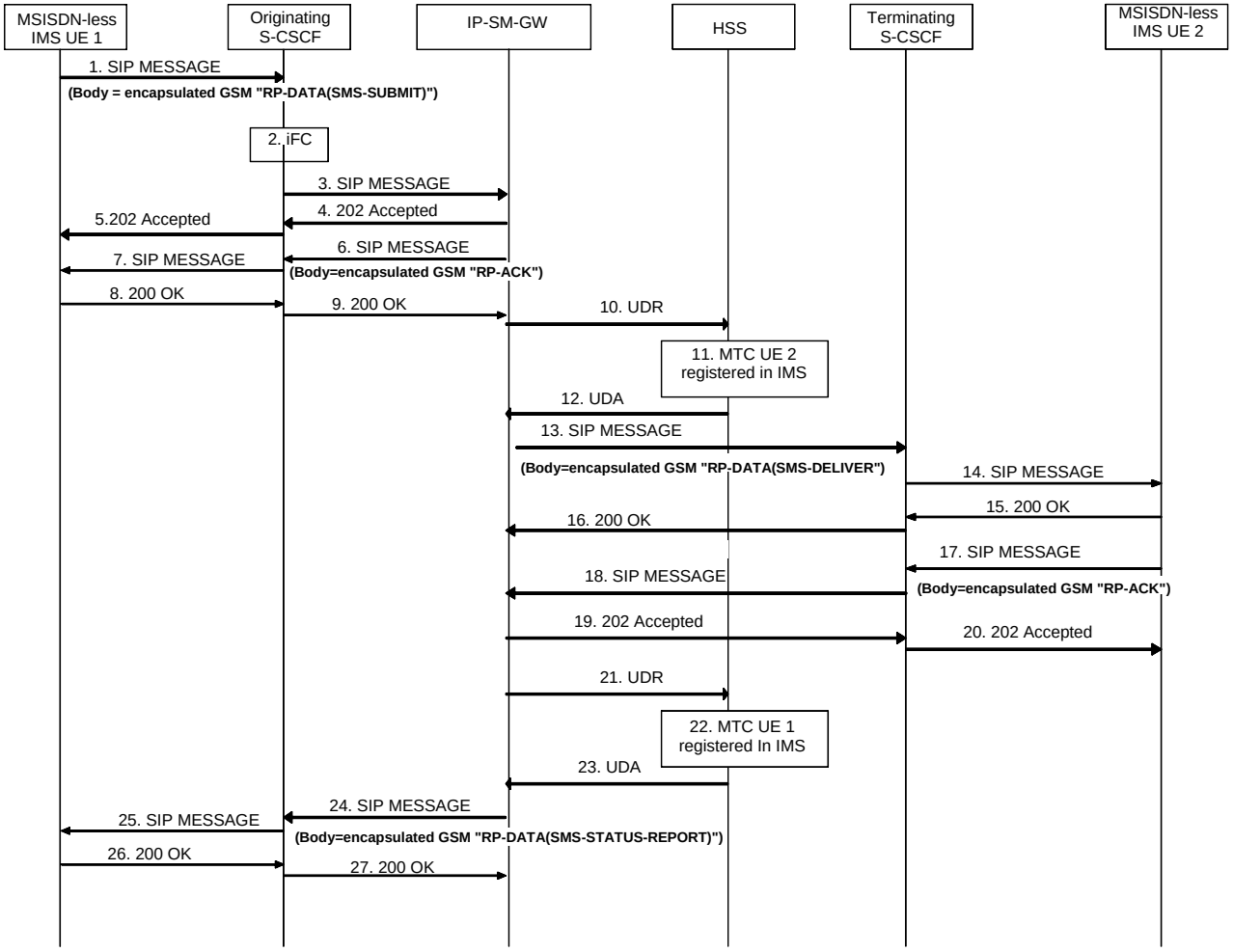

Figure 5.2.1-1: MSISDN-less UE to MSISDN-less UE

1) MSISDN-less UE 1 sends an IM or SM to the MSISDN-less IMS UE 2 via IP-SM-GW.

   This request includes a vnd.3gpp.sms payload that includes the short message and routing information for the IP-SM-GW to forward the short message. Addresses are included in RP-DATA (SMS-SUBMIT) (see TS 24.011 [6] and TS 23.040 [2]). MSISDN-less originating code, and MSISDN-less terminating code are included. MSISDN-less IMS UE 1 (originator) and MSISDN-less IMS UE 2 (recipient) addresses must be embedded in use data body. Note: SIP header does not contain MSISDN-less IMS UE 2 (recipient) addresses. So, it is critical to include MSISDN-less IMS UE 2 (recipient) addresses in use data body. The MSISDN-less originating code is included in RP-OA, and MSISDN-less terminating code in RP-DA and TP-DA.

2) S-CSCF runs iFC.

3) S-CSCF routes SIP MESSAGE to IP-SM-GW.

4-5) IP-SM-GW returns 202 Accepted.

6-7) IP-SM-GW sends a SIP MESSAGE to MSISDN-less UE 1. In RP-ACK, RP-OA is IP-SM-GW MSISDN, MSISDN-less originating code is included in RP-DA. MSISDN-less UE 1 address can be optionally embedded in use data body.

   IP-SM-GW use UE 1 SIP URI in SIP Request URI and To header and SC URI in From header. UE 1 address is in SIP header, so it is optional to embed UE 1 address in the user data body.

8-9) MSISDN-less UE 1 returns 200 OK.

10-12) (optional) IP-SM-GW queries HSS for MSISDN-less IMS UE 2. HSS returns UE 2 status and terminating S-CSCF address.

IP-SM-GW retrieves UE 2 address from the user data body per MSISDN-less originating code, and uses UE 2 address to query the HSS.

13) IP-SM-GW sends SIP MESSAGE to S-CSCF.

This request includes a vnd.3gpp.sms payload that includes the short message and routing information to forward the short message. Addresses is included in RP-DATA (SMS-DELIVER) (see TS 24.011 [6] and TS 23.040 [2]) with IP-SM-GW address in RP-OA and TP-OA, MSISDN-less UE terminating code is included in RP-DA. MSISDN-less IMS UE 1 (originator) and MSISDN-less IMS UE 2 (recipient) addresses must be embedded in use data body. Note: SIP header does not contain MSISDN-less IMS UE 1 (originator) addresses. So, it is critical to include MSISDN-less IMS UE 1 (originator) addresses in use data body.

It is a MT scenario, IP-SM-GW uses UE 2 SIP URI in SIP Request URI and To headers, and SC SIP URI in From header.

14) Terminating S-CSCF sends SIP MESSAGE to MSISDN-less IMS UE 2.

15-16) MSISDN-less IMS UE 2 returns 200 OK.

17) MSISDN-less IMS UE 2 parses SMS payload successfully and returns RP-ACK encapsulated in a SIP MESSAGE to S-CSCF. In RP-ACK, RP-DA is IP-SM-GW address, MSISDN-less terminating code is included in the RP- OA. MSISDN-less IMS UE 1 (originator) and MSISDN-less IMS UE 2 (recipient) addresses must be embedded in use data body. Note: SIP header does not contain MSISDN-less IMS UE 1 (originator) addresses.

Similar to the SIP MO scenario, UE 2 uses SC SIP URI in SIP Request URI and To headers and UE 2 SIP URI in From header.

18) Terminating S-CSCF forwards a SIP MESSAGE with RP-ACK to IP-SM-GW.

19-20) IP-SM-GW returns 202 Accepted.

21-23) (optional) IP-SM-GW queries HSS for MSISDN-less IMS UE 1. HSS returns UE 1 status and originating S-CSCF address.

IP-SM-GW retrieves UE 1 address from the user data body per MSISDN-less terminating code, and uses UE 1 address to query the HSS.

24-25) (optional) IP-SM-GW sends SIP MESSAGE encapsulating SMS-STATUS-REPORT in RP-DATA to MSISDN-less IMS UE 1.

IP-SM-GW will fill UE 1 SIP URI in SIP Request URI and To headers, and SC URI in From header. It must fill TP-Recipient-Address (TP-RA) (mandatory field) and with the MSISDN-less originating code, and must include MSISDN-less UE address in the user data body.

26-27) (optional) MSISDN-less IMS UE 1 returns 200 OK.

5.2.1.2 Affect / necessary changes in existing functionality

IP-SM-GW will use the MSISDN-less originating and terminating codes realize it is MSISDN-less IMS UE to MSISDN-less IMS UE during the process.

UE and IP-SM-GW have to embed MSISDN-less UE addresses (originator and recipient) in SM use data body (RP-DATA and RP-ACK).

MSISDN-less IMS UE can be optionally used as MTC user group identifier.

5.2.1.3 Applicability

Requirements for SMS addressing / routing: IP-SM-GW uses MSISDN-less originating and terminating codes and MSISDN-less UE addresses (originator and recipient) in SM payload together to figure out addresses and routing.

Restriction/requirement on UE: none.

5.2.1.4 Evaluation

Pro

- Minor change in existing functionality in IP-SM-GW and MSISDN-less UEs to use MSISDN-less terminating code and MSISDN-less originating code for embedded MSISDN-less IMS addresses.
- MSISDN-less IMS UE addresses are used in SIP From or To headers, and embedded in use data. MSISDN-less IMS UE addresses need to be used for billing purpose. Note: in practice, some SM entities only use parameters in RP-DATA for billing but ignore SIP headers.
- Encapsulating sender or receiver's alternative address in use data body has been commonly used in practice, like encapsulating email address in use data body for email and SM exchanges at Email GW. Encapsulating sender or receiver's MSISDN-less IMS UE address in use data body aligns with current usages.
- The MSISDN-less originating and terminating codes can be optionally used as MTC user group identifier.

Con

- IM or SM needed in the IMS network with MSISDN-less IMS UE.

5.2.2 Alternative 2: Direct delivery with SIP level interworking I

5.2.2.1 Procedure

The SIP MESSAGE carries identities of sender and receiver for the MSISDN-less originating and terminating SMS. The UE, which can handle MSISDN-less originating and terminating SMS, can retrieve the sender's identity from SIP level instead of the TP-OA/DA.

NOTE: The actual SIP protocol details are left for CT1 to decide.

Figure 5.2.2-1 shows the SMS submit aspect when an MSISDN-less IMS UE sends a SMS to another MSISDN-less IMS UE via IMS.

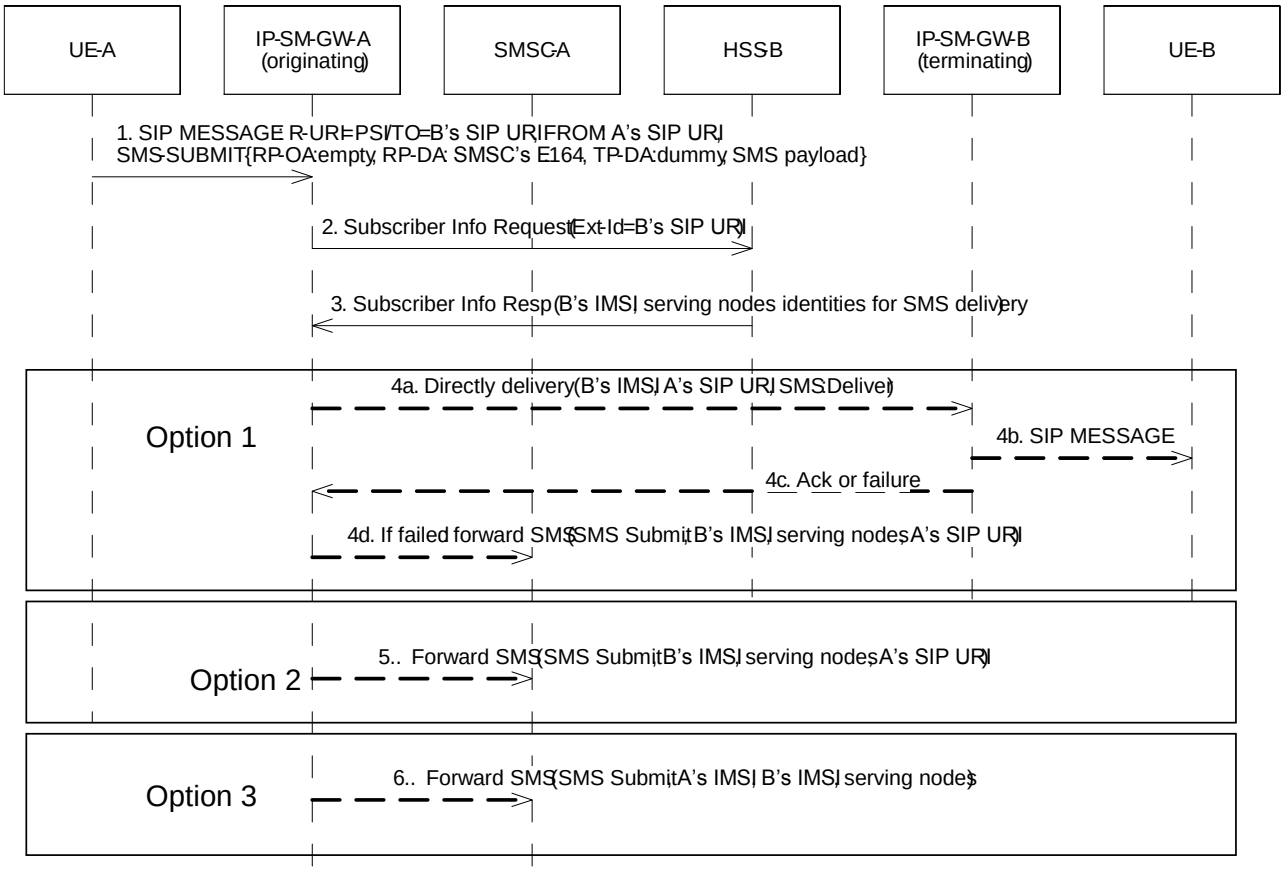

Figure 5.2.2-1: MSISDN-less UE to MSISDN-less UE, SMS submit aspect

1) UE-A is IMS registered and IP-SM-GW-A has been included as part of 3rd party registration. UE-A constructs a MO-SMS and delivers to IP-SM-GW-A based on existing procedure. Since party B does not have MSISDN, the UE-A fills the TP-DA field with dummy value (e.g., 000000s). UE-A sets the R-URI to PSI (SMSC address) and the To header with B's SIP URI in the MESSAGE. Based on the existing procedure, P-CSCF fills the A's default URI to p-asserted-identity before sending the MESSAGE to S-CSCF and S-CSCF executes the iFC and forwards the MESSAGE to IP-SM-GW-A.

2. IP-SM-GW-A retrieves the B's SIP URI from the To Header. It queries the HSS-B for B's IMSI and SMS routing info (similarly with "Subscriber Info Request" message defined in TS 23.682 [8] for machine type triggering message between HSS and MTC-IWF).

3. HSS return's B's IMSI and current serving nodes for SMS delivery to Party B.

4a. In step 3, HSS returns IP-SM-GW-B as one of the possibly delivery node. Based on local policy, IP-SM-GW-A may try to deliver this SMS directly to B without going to SMSC-A first.

It constructs a SIP MESSAGE with {p-asserted-identity: A's SIP-URI, To: B's SIP-URI, R-URI=IP-SM-GW-B, SMS Deliver {TP-OA=dummy, RP-OA=IP-SM-GW-A, RP-DA=B's IMSI, sms payload). Note the use of B's IMSI for SMS delivery is the same as MSISDN-less T4 as currently being documented in TS 23.682 [8].

4b. IP-SM-GW-B adds its own URI to topmost p-asserted-identity, to ensure the UE-B sends the delivery report to IP-SM-GW-B. IP-SM-GW-B delivers the SIP MESSAGE to UE-B by using the B's SIP URI it received in the To header field. UE-B stores and removes the topmost URI in p-asserted-identity, and uses it as an R-URI for delivery report. The remaining URIs in the p-asserted-identity contain the A's SIP URI.

4c-d. Successful or failure notice back to IP-SM-GW-A. UE-B may be temporary out of coverage or memory full so the delivery in this scenario may fail. If failed, the IP-SW-GW-A will submit this SMS to SMSC-A for store and forwarding with step 4d.

5-6. IP-SM-GW-A submits the SMS to SMSC-A with the procedure similar to TS 23.204 [4], clause 6.3, step 6. It may reuse the similar message as defined for Submit Trigger in TS 23.682 [8] between SMSC and MTC-IWF

(T4 reference point) with the new addition that the A's SIP URI is included. Alternatively, A's IMSI is included instead of A's SIP URI to avoid additional parameter to that interface.

Figure 5.2.2-2 shows the segment on how the SMSC-A forwards the SMS to receiver's MSISDN-less IMS UE.

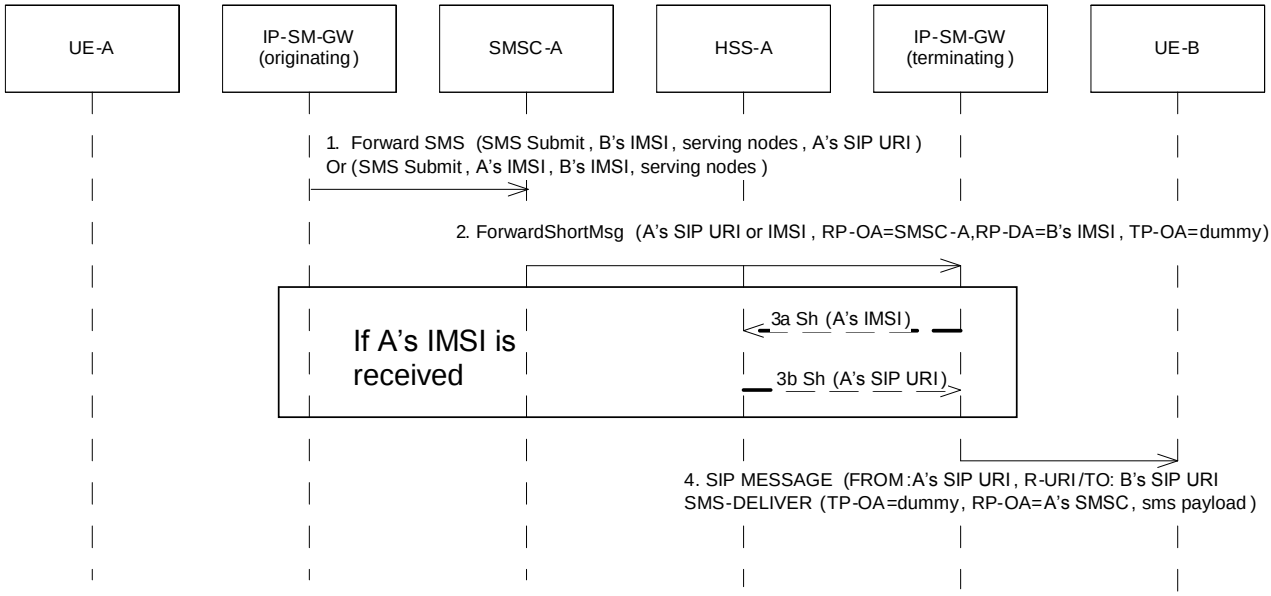

Figure 5.2.2-2. SMS deliver without MSISDN

1. This is the submit part shown in figure 5.2.2-1, step 4d, 5, or 6.
2. SMSC-A selects the IP-SM-GW-B for delivery and sends the SMS with forwardshortMsg to IP-SM-GW-B. This message includes A's SIP URI or IMSI. The TP-OA field sets to some dummy value (e.g., 000s).
3. IP-SM-GW-B is aware that A's party does not have MSISDN because of the dummy value in TP-OA or the inclusion of A's SIP URI. If only IMSI is received, IP-SM-GW-B queries the HSS-A for A's SIP URI via Sh.
4. IP-SM-GW-B delivers the SIP MESSAGE to UE-B as in step 4b in the previous flow, except the IP-SM-GW-B uses the SIP URI instead of IMSI received from step 2.

Editor's note: Interworking with traditional IMS UE is FFS.

5.2.2.2 Affect / necessary changes in existing functionality

Originating IP-SM-GW will use the Sh to query receiver's HSS to determine the IMSI and delivery nodes address (i.e. T4 approach as in TS 23.682 [8]).

If only A's IMSI is sent then Terminating IP-SM-GW will use the Sh to query sender's HSS to determine the A's SIP-URI.

IP-SM-GW is made aware the recipient's IMS UE can handle this new SIP/SMS protocol as defined in this proposal.

5.2.2.3 Applicability

Restriction/requirement on UE: New type of UE required.

5.2.2.4 Evaluation

Pro

- Build on top of the T4 MTC-HSS-SMSC approach for delivery.
- No SMS payload is used for embedding sender's and receiver's addresses.
- Storing and forwarding with SMSC is supported.

Con

- Required new type of IMS UE.
- Only valid for intra-PLMN scenario (i.e., both UE-A and -B belong to the same operator) because Step 2 and 3 in Figure 5.2.2-1 is based on MTC-IWF - HSS query that is defined in TS 23.682 [8], and it is defined as intra operator interface.

5.2.3 Alternative 3: Direct delivery with SIP level interworking II

5.2.3.1 Procedure

The SIP MESSAGE carries identities of sender and receiver for the MSISDN-less originating and terminating SMS. The UE, which can handle MSISDN-less originating and terminating SMS, can retrieve the sender's identity from SIP level instead of the TP-OA/DA.

NOTE: The actual SIP protocol details are left for CT1 to decide.

Figure 5.2.3-1 shows the SMS submit aspect when an MSISDN-less IMS UE sends a SMS to another MSISDN-less IMS UE via IMS.

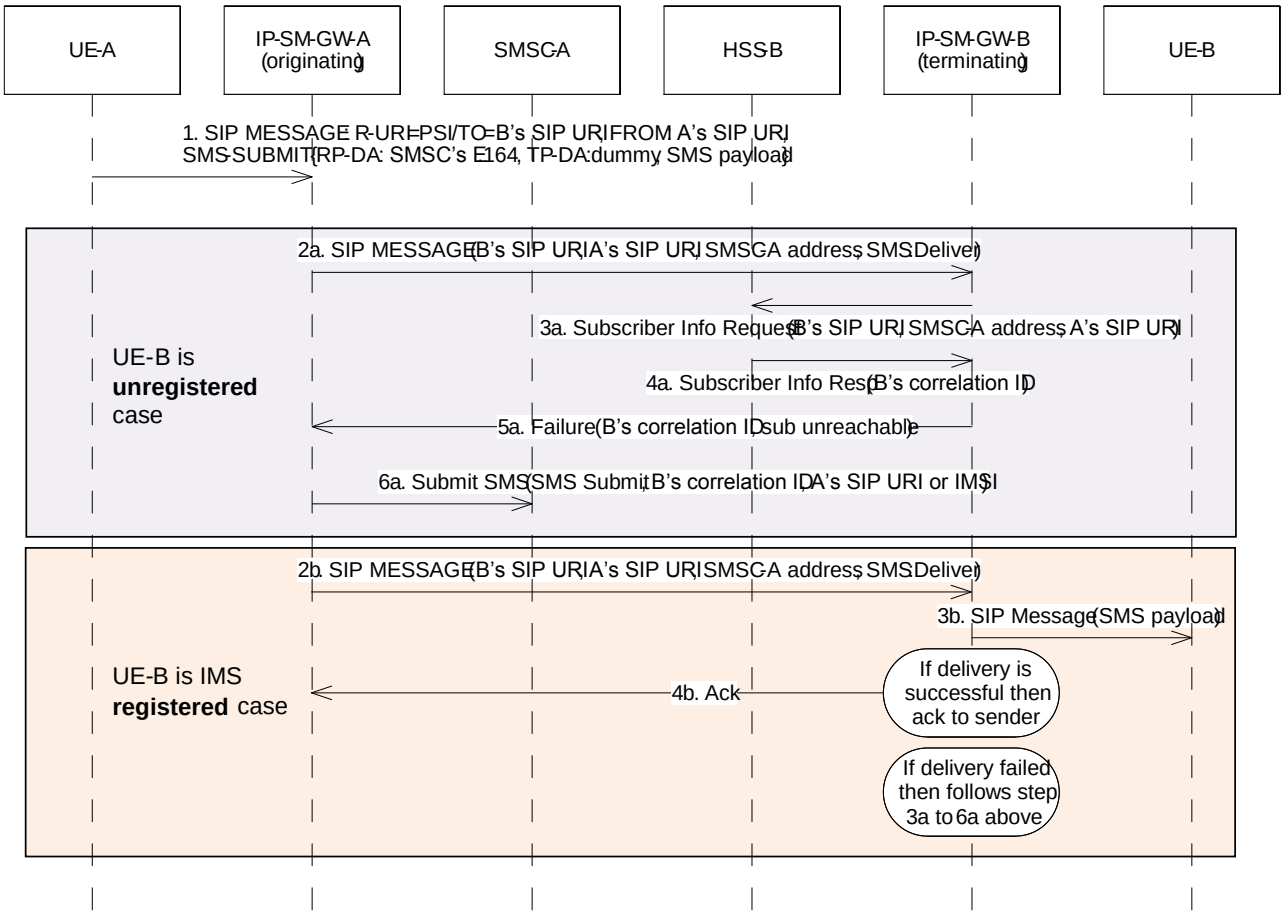

Figure 5.2.3.1-1: MSISDN-less UE to MSISDN-less UE, SMS submit aspect

1) UE-A is IMS registered and IP-SM-GW-A has been included as part of 3rd party registration. UE-A constructs a MO-SMS and delivers to IP-SM-GW-A based on existing procedure. Since party B does not have MSISDN, the UE-A fills the TP-DA field with dummy value (e.g., 000000s) and also indicates B's SIP URI in SIP MESSAGE (e.g., UE-A sets the R-URI to PSI (SMSC address) and the To header with B's SIP URI in the MESSAGE). Based on the existing procedure, P-CSCF fills the A's default URI to p-asserted-identity before sending the MESSAGE to S-CSCF and S-CSCF executes the iFC and forwards the MESSAGE to IP-SM-GW-A. It is up to stage 3 to define how B's SIP URI is to be indicated in the protocol level.

2a. SIP MESSAGE arrives to IMS network of UE-B. The UE is not IMS registered and the message is routed to S-CSCF then to an IP-SM-GW-B using the procedure defined in TS 23.228 [xx] for "Mobile Terminating call procedures to unregistered Public User Identity that has services related to unregistered state". IP-SM-GW-B aware that the UE-B is unreachable and may try to deliver the SMS via SGSN or MSC. This can be done by querying the HSS for the current serving MSC and SGSN address.

3a/4a. IP-SM-GW-B aware that UE is not reachable in IMS and is not trying to deliver via MSC or SGSN so it sets the message waiting flag and stores the SMSC-A address and A's party identity (SIP-URI) in HSS, and retrieves B's correlation ID (see sub clause 5.2.3.2).

5a. IP-SM-GW-B returns a negative ack to IP-SM-GW-A, and indicates that UE-B is unreachable along with B's correlation ID.

6a. IP-SM-GW-A submits the SMS toward SMSC-A with indication that UE-B is unreachable along with B's correlation ID.

2b/3b. SIP MESSAGE arrives to IMS network of UE-B. The UE is IMS registered so this message is routed to IP-SM-GW-B that is serving the UE-B. IP-SM-GW-B then tries to deliver the SMS to UE-B

4b. If message is successful delivered to UE-B then a ack is sent back to IP-SM-GW-A.

If message is failed to deliver (e.g., UE is out of coverage) then IP-SM-GW-B follows step 3a to 6a to submit the SMS to SMSC-A for store and forwarding.

Figure 5.2.3-2 shows the segment on how the SMSC-A forwards the SMS to receiver's MSISDN-less IMS UE.

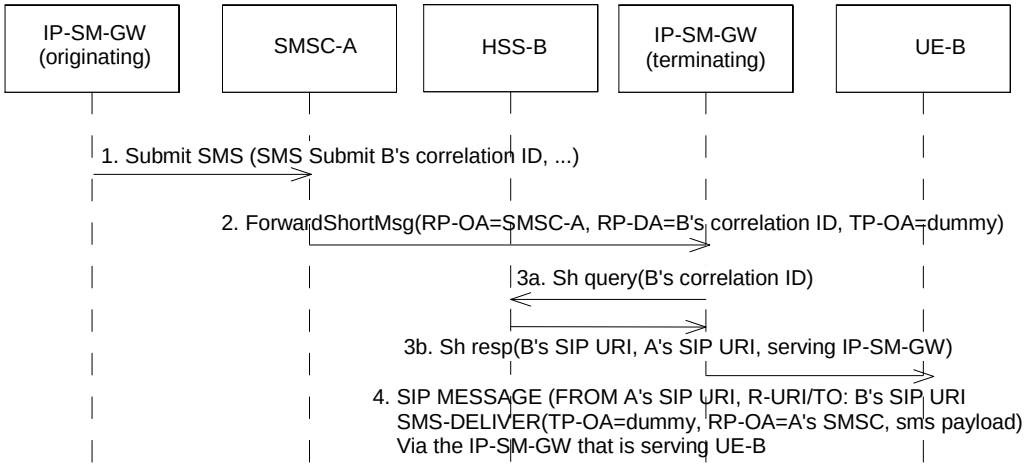

Figure 5.2.3-2: SMS deliver without MSISDN

1. This is the step 6a of figure 5.2.3-1.
2. SMSC-A receives a trigger to redeliver and selects the IP-SM-GW for delivery. The correlation ID points toward the IP-SM-GW at the terminating network.
3. IP-SM-GW (terminating) queries the HSS to retrieve the sender and receiver identities (SIP-URI) corresponding to this correlation ID. The HSS also returns the current serving IP-SM-GW.
4. IP-SM-GW (terminating) delivers the SIP MESSAGE to UE-B via serving IP-SM-GW that is associated with UE-B.

5.2.3.2 The use of "Correlation ID"

Operator may be sensitive to send the A or B's party IMSI to other PLMN. Instead of providing the IMSI, terminating party's HSS can return a "correlation ID". This "correlation ID' is similar to MT Correlation ID that is being defined in TS 23.040 [2] as MCC+MNC+Sender ID to correlate an SMS. This correlation ID can map an incoming SMS to both the sender and receiver's identity. This "correlation ID" is only associated with the terminating SMS when there is a message waiting flag active in the subscription data for the user. This "correlation ID" points to an IP-SM-GW that can handle the forwardSMS operation by SMSC.

NOTE: Correlation ID is the form of SIP-URI is possible, based on the supporting protocol between the IP-SM-GW and SMSC.

5.2.3.3 Affect / necessary changes in existing functionality

Terminating IP-SM-GW will use the Sh to query receiver's HSS to determine the sender and receiver's SIP URI.

Terminating network HSS needs to generate a correlation ID for mapping to sender/receiver's identity for the terminating SMS.

5.2.3.4 Applicability

Restriction/requirement on UE: New type of UE required.

5.2.3.5 Evaluation

Pro

- IMSI is not sent across PLMN.
- No SMS payload is used for embedding sender's and receiver's addresses.
- Storing and forwarding with SMSC is supported.

Con

- Required new type of IMS UE.

5.3 Communication via SMS between MSISDN-less IMS UE and Traditional UE

5.3.1 MSISDN-less IMS UE to Traditional UE

5.3.1.1 Alternative 1: Direct delivery with IP-SM-GW interworking

5.3.1.1.1 Procedure

Figure 5.3.1.1-1 shows a solution which the MSISDN-less IMS UE sends a SIP MESSAGE to Traditional UE via IP-SM-GW. In this solution, The IP-SM-GW shall recognize the message is from MSISDN-less IMS UE. The IP-SM-GW includes a special code in "RP-OA" to indicate the SM is originated by the MSISDN-less UE and MSISDN-less UE's SIP URI in the "TP-UD", and then forward the SM to the SMS-SC. Then the SMS-SC sends the SM to the traditional UE.

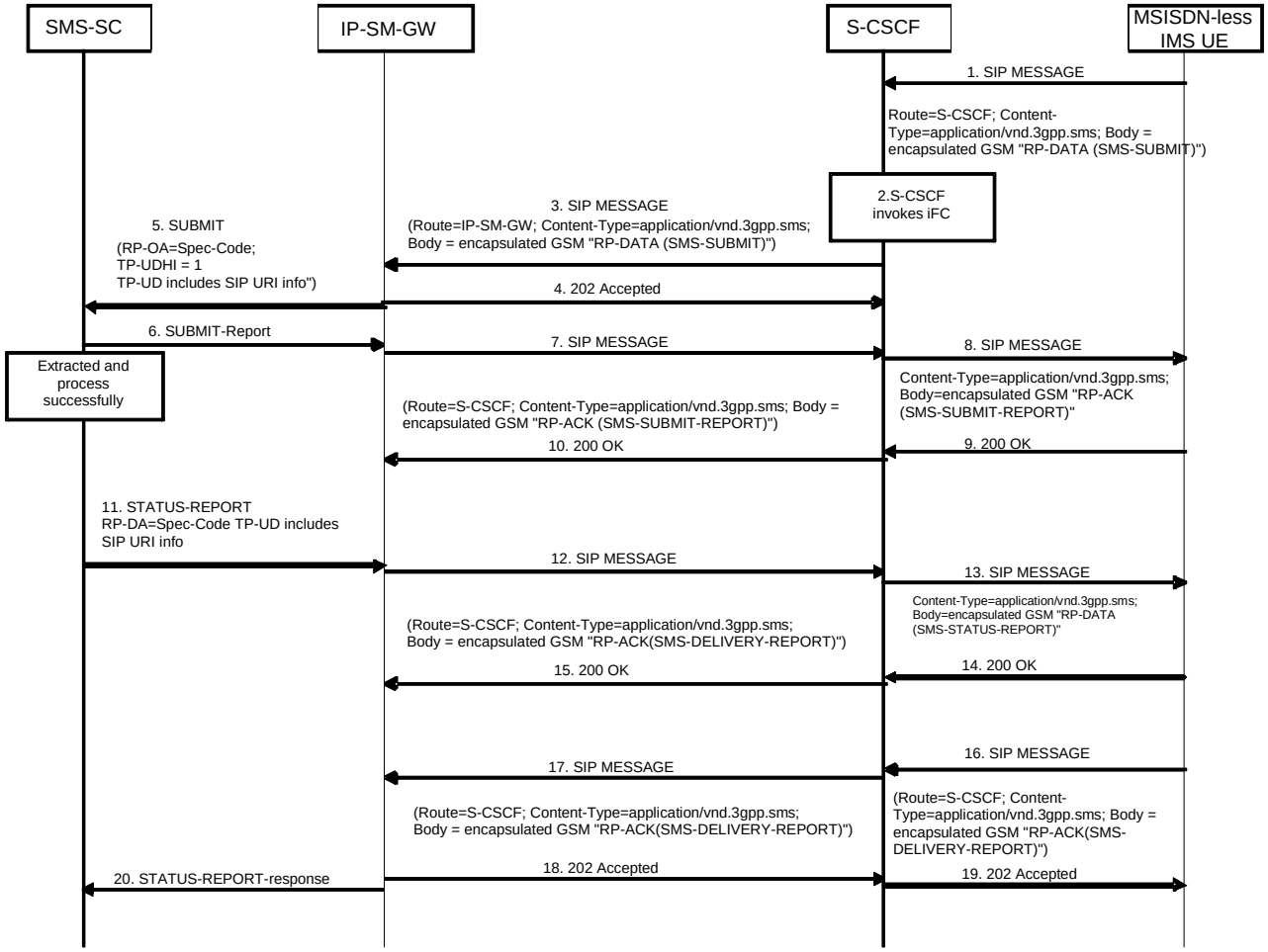

Figure 5.3.1.1-1: MSISDN-less UE Submit SMS to Traditional UE

1) MSISDN-less IMS UE originates an SIP MESSAGE to Traditional UE via IP-SM-GW according to TS 23.341.

   a) The SIP MESSAGE request includes a vnd.3gpp.sms payload that includes the short message and routing information for the IP-SM-GW to forward the short message.

   b) SIP Request URI and To headers should be the PSI of the SC of the SM-over-IP sender.

   c) From header should be UE SIP URI.

   d) MSISDN-less IMS UE address is embedded in use data body.

NOTE 1: The MSISDN-less IMS UE SIP URI is embedded in the user data body. This can be done by UE or IP-SM-GW.

2) S-CSCF invokes iFC.

3) S-CSCF forwards SIP MESSAGE to IP-SM-GW.

4) IP-SM-GW returns 202 accepted.

5) IP-SM-GW recognizes this message from MSISDN-less IMS UE, and executes the special handling, which includes:

   a) the RP-OA contains the special code of IP-SM-GW, which indicates the SM originated by a MSISDN-less UE.

   b) the TP-UD contains the SIP URI of the MSISDN-less UE

   c) the TP-UDHI is set to 1, which indicates there are headers in the message body.

Then, IP-SM-GW forwards the SM to SC.

6) SMS-SC sends SUBMIT-REPORT to IP-SM-GW

7) IP-SM-GW generates a special SIP MESSAGE according to the special code in the RP-DA, which includes:

   a) Request-URI and To header uses the SIP URI in the TP-UD.

   b) From and P-Asserted-Identity uses the identity of the IP-SM-GW.

   c) the body of the request shall contain the RP-ACK or RP-ERROR message for the SM submit report.

8) S-CSCF forwards the SIP MESSAGE to the MSISDN less UE.

9) The MSISDN less UE returns 200 OK to S-CSCF.

10) S-CSCF returns 200 OK to IP-SM-GW.

11) SMS-SC sends STATUS-REPORT to IP-SM-GW.

12) IP-SM-GW generates a special SIP MESSAGE according to the special code in the RP-DA, which includes:

   a) Request-URI and To header uses the SIP URI in the TP-UD.

   b) From and P-Asserted-Identity uses the identity of the IP-SM-GW.

   c) the body of the request which shall contain an RP-DATA message as defined in TS 24.011 [6], including the SMS headers and the SMS user information encoded as specified in TS 23.040 [2].

NOTE 2: If needed, IP-SM-GW can use the SIP URI of the MSISDN-less UE in the TP-UD and the TP-Message-Reference (TP-MR) to correlate the STATUS-REPORT message in step 11 with the SUBMIT message in step 3.

13) S-CSCF forwards the SIP MESSAGE to the MSISDN less UE.

14) The MSISDN less UE returns 200 OK to S-CSCF.

15) S-CSCF returns 200 OK to IP-SM-GW.

16) MSISDN-less IMS UE generates an SIP MESSAGE to Traditional UE via IP-SM-GW according to TS 23.341, which includes:

   a) create a delivery report for the status report. The content of the delivery report is defined in TS 24.011 [6].

17) S-CSCF executes iFCs and forwards the SIP MESSAGE to the IP-SM-GW.

18) IP-SM-GW returns 202 Accepted response to S-CSCF.

19) S-CSCF returns 202 Accepted response to MSISDN-less IMS UE.

20) IP-SM-GW executes the similar handling with step 5) and sends a proper delivery report to SC response.

The procedure between SMS-SC and traditional UE applies the procedure specified in TS 23.040 [2].

5.3.1.1.2 Affect / necessary changes in existing functionality

MSISDN-less UE will embed MSISDN-less UE address in SM use data body of RP-DATA.

IP-SM-GW will embed MSISDN-less UE address in SM use data body of RP-ACK.

IP-SM-GW is required to know that the SM is originated by the MSISDN-less UE and obtain embedded UE SIP URI from the SM use data body.

IP-SM-GW shall uses the special code in the "RP-DA" header of the MAP message as an indicator that the SM is sent to an MSISDN-less UE and obtain embedded UE SIP URI from the SM user data body.

5.3.1.1.3 Applicability

Requirements for SMS addressing / routing: same as existing function.

5.3.1.1.4 Evaluation

Pro

- Minimal impact on MSISDN-less UE.
- No special requirements for the MSISDN-less UE except one optional feature to embed the SIP URI in the TP-UD.

Con

- One special code shall be allocated to indicate the type of MSISDN-less IMS UE.

5.3.1.2 Alternative 2: Delivery with IP-SM-GW interworking to traditional UE

5.3.1.2.1 Procedure

Figure 5.3.1.2-1 shows a solution, which the MSISDN-less IMS UE sends a SIP MESSAGE to Traditional UE via IP-SM-GW. In this solution, the IP-SM-GW recognizes IMS UE is MSISDN-less from the 3rd party registration, as the Tel-URI for this UE is not received.

When IP-SM-GW receives the MO Short Message from this UE, it examines the TP-DA field to determine if the terminating party is addressed by MSISDN or unknown/dummy value. If it is unknown/dummy value, the IP-SM-GW delivers the Short Message using SIP level procedure as shown in clause 5.2.2 or 5.2.3. Otherwise, IP-SM-GW fills the RP-OA with a pre-configured number. This number points the Short Message reply back to an IP-SM-GW' that can provide traditional UE to MSISDNless UE interworking as defined in Alternative 1 under clause 5.3.2.1. IP-SM-GW then forwards the Short Message to SMSC and includes the A's SIP URI from P-Served-User header or P-Asserted-Identity header. SMSC then inserts this SIP-URI to the payload before delivering the Short Message to traditional UE.

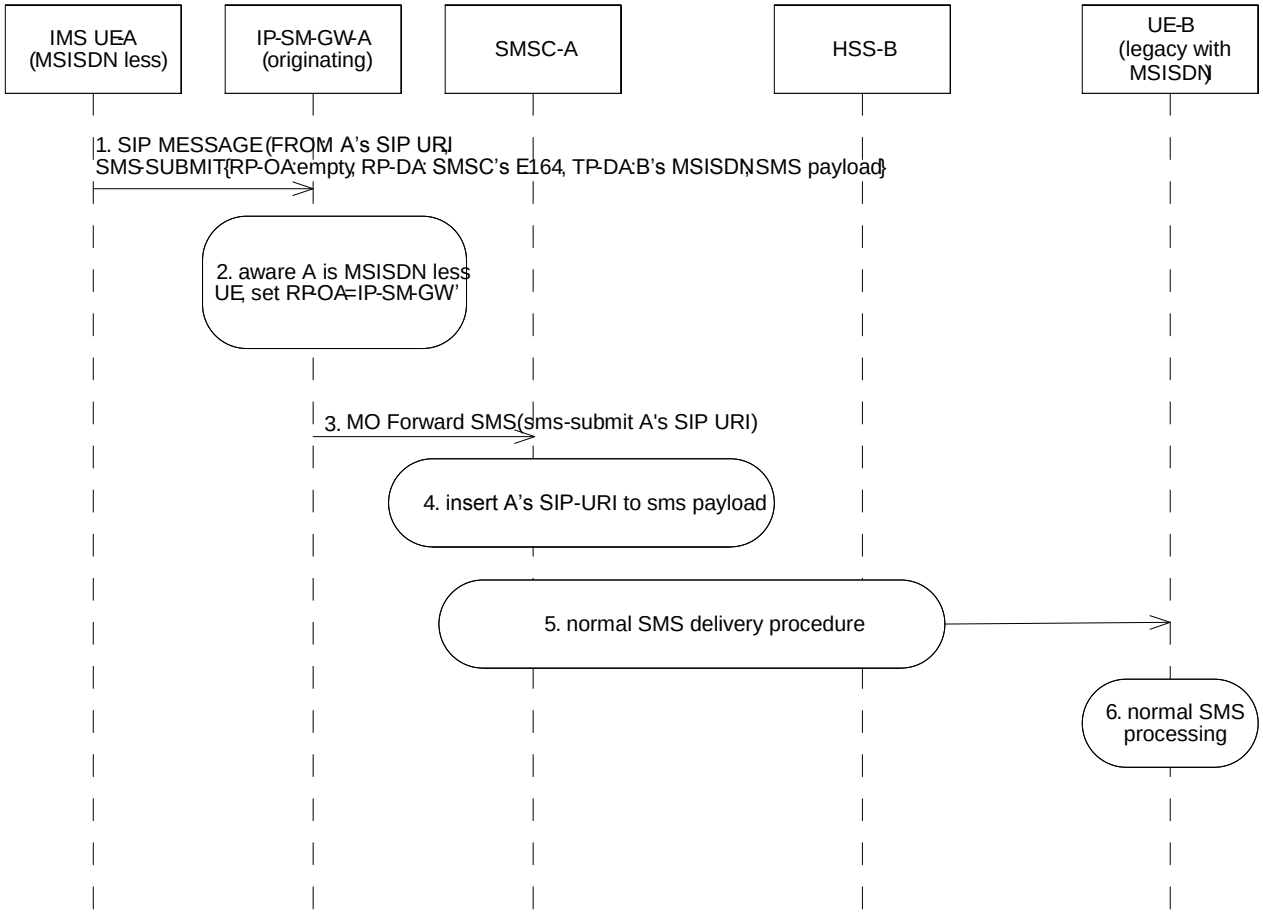

Figure 5.3.1.2-1: MSISDN-less IMS UE to traditional UE

1. UE-A sends a SIP MESSAGE to UE-B using B's E.164,
2. IP-SM-GW is aware that UE-A does not have MSISDN from 3rd party registration. Hence, IP-SM-GW knows to execute special SMS submit procedure to UE-B. It checks the TP-DA field to determine that party-B is addressed with B's MSISDN. IP-SM-GW then fills in the RP-OA with a IP-SM-GW' address that it can interwork the reply Short Message back to UE-A with the alternative defined in clause 5.3.2.1,
3. IP-SM-GW submits the Short Message to SMSC-A and includes the A's SIP URI from P-Served-User header or P-Asserted-Identity header.
4. SMSC inserts A's SIP URI to sms payload before deliver the Short Message to UE-B.

NOTE: After SMSC performed the A's SIP URI insertion into the SM payload, the SMSC may have to segment the payload into multiple Short Messages if the message size exceeded the payload size. If the incoming Short Message is part of a larger message (e.g., segmented into multiple parts by the sending entity), SMSC may need to reassemble all the segmented parts before performing the A's SIP-URI insertion and re-segmenting into multiple Short Messages to be delivered to the receiver.

5-6. Normal Short Message delivery procedure to UE-B.

5.3.1.2.2 Affect / necessary changes in existing functionality

IP-SM-GW checks the TP-DA to determine the procedure for interworking (deliver to MSISDNless IMS UE or to legacy UE). IP-SM-GW fills the RP-OA with a IP-SM-GW' address that can provide the interworking for SMS reply as in alternative defined in clause 5.3.2.1,

SMSC embeds the A's SIP URI to sms payload before delivery the SMS to UE-B. It may require the SMSC to consolidate the segmented short messages first, then performs the insertion, and the re-segment the message back to multiple short messages.

5.3.1.2.3 Applicability

Requirements for SMS addressing / routing: same as existing function.

5.3.1.2.4 Evaluation

Pro

- solution provides compatibility with solution for sending Short Message between two MSISDNless UEs.

Con

- Require more complex handling function in the SMSC.
- Charging may be impacted if it is done "per Short Message" usage.

5.3.1.3 Alternative 3: MSISDN-less UE delivery SMS to traditional UE Only

For SMS delivery between MSISDN-less UE and traditional UE, it may be not needed for the traditional UE to reply the SMS. In this solution, the SMS sending from the MSISDN-less UE may not insert the SIP URI of the MSISDN-less UE in the TP-UD field. Alternatively, the originating address field can be anonymous to avoid traditional UE to reply the SMS. Specific indication may be carried with the SMS for authorization of anonymous SMS, either in originating or terminating PLMN.

5.3.1.3.1 Procedure

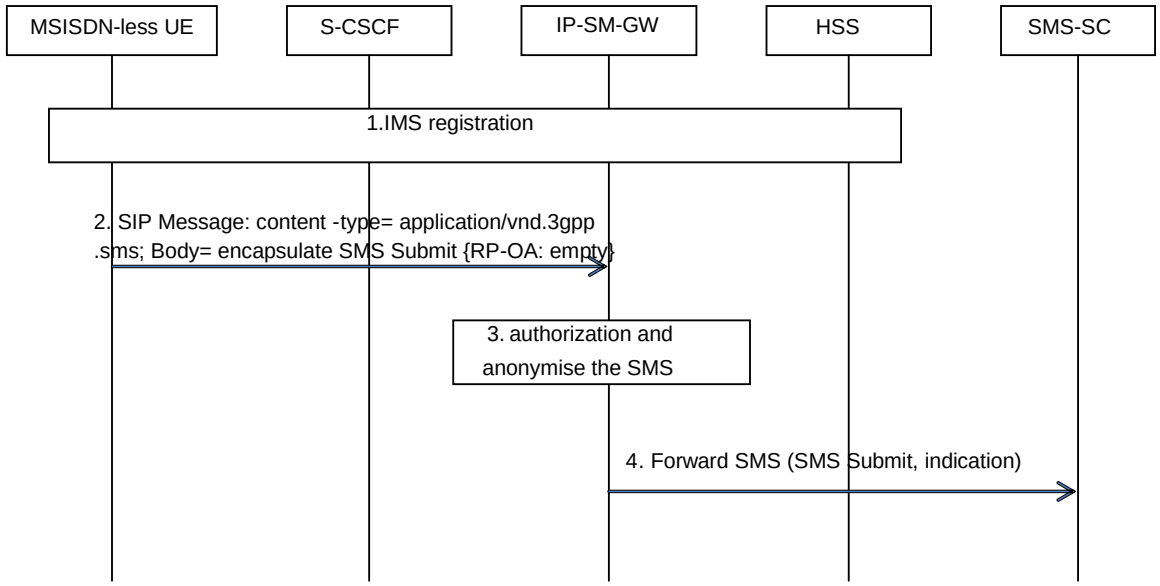

Figure 5.3.1.3-1: Procedure flows

1. The UE performs IMS registration as per TS 23.204 [4]. The HSS may indicate the IP-SM-GW that the UE is MSISDN-less in response to the quarry message.
2. The MSISDN-less UE originates SIP message and sends the SIP message to SMSC via IP-SM-GW. The RP-OA fields left as empty.
3. The IP-SM-GW checks whether the SIP message is from MSISDN-less UE if such information is not provided by the HSS. If the SIP message is from the MSISDN-less UE, the IP-SM-GW performs authorization based on stored subscriber information and checks whether the MSISDN-less UE is authorized to send SMS to traditional UE by anonymous. If the result is negative, the IP-SM-GW shall not forward the SMS and instead return appropriate error cause to MSISND-less UE in the failure report. Otherwise the IP-SM-GW extracts the Short Message, sets the RP-OA fields as anonymous value as per TS 29.311 [7], and forwards the SMS to SMSC.
4. The IP-SM-GW forwards the anonymous SMS to the SMSC. The IP-SM-GW may send the SMS with indication that the SMS is from MSISDN-less UE authorized to send anonymous SMS.

5.3.1.3.2 Affect / necessary changes in existing functionality

The IP-SM-GW is required to recognize the SIP message is from MSISDN-less UE.

The indication may be necessary for anonymity allowance.

5.3.1.3.3 Applicability

Requirements of SMS addressing / routing: same as existing function.

5.3.1.3.4 Evaluation

Pro

- MSISDN-less UE is not necessary to carry the sender information for the MSISDN-less UE.

Con

- An indication for anonymity allowance may be necessary.

5.3.2 Traditional UE to MSISDN-less IMS UE

5.3.2.1 Alternative 1: SMS Delivery through IP-SM-GW

5.3.2.1.1 Procedure

Short message mobile originated procedure:

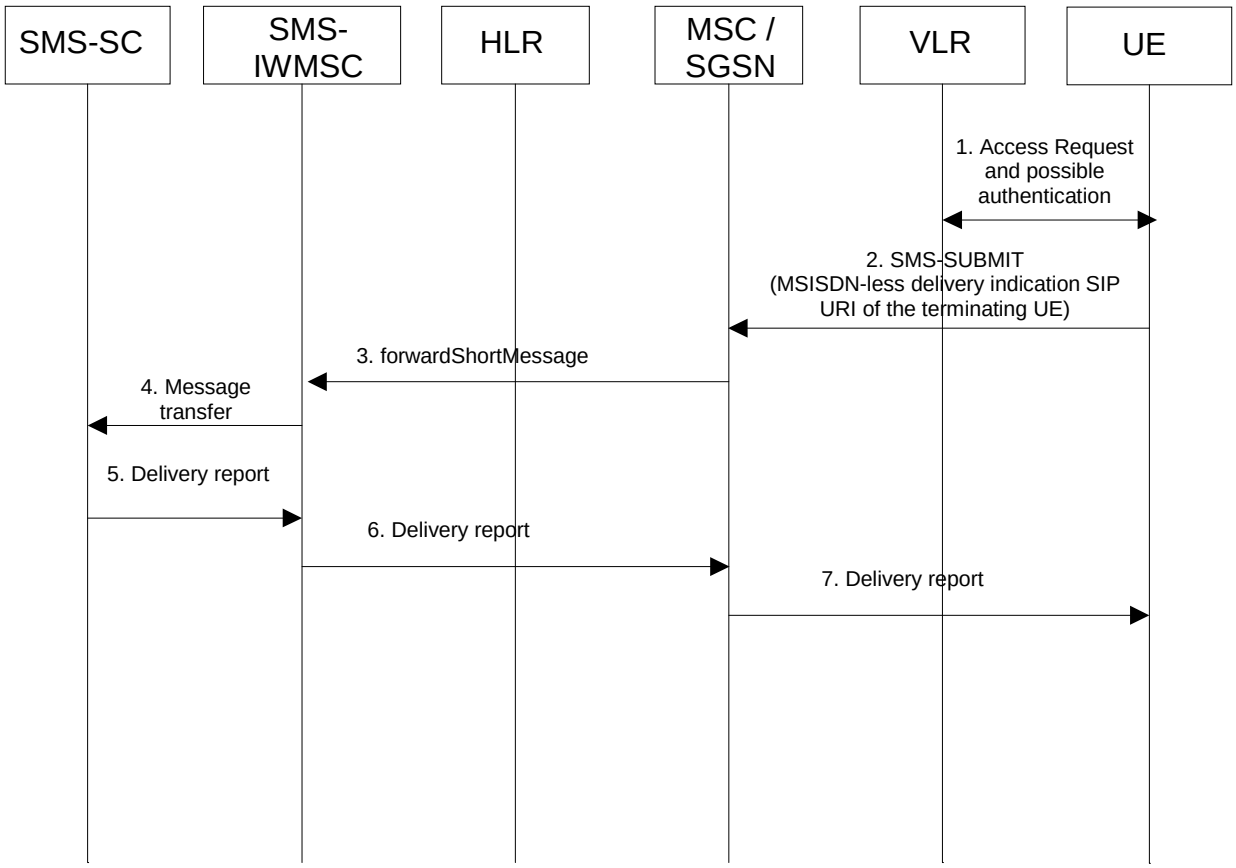

Figure 5.3.2.1-1: SMS MO procedure - Traditional UE to SC

1) Traditional UE performs Access Request to the VLR and possible authentication procedure as specified in TS 23.040 [2].

2) Traditional UE decides to send a message to the SMS capable MSISDN-less IMS UE. Traditional UE sends a short message via SMS-SUMBIT to the MSC/SGSN as specified in TS 23.040 [2], with the following changes:

   - An indication which indicates that the terminating UE is an MSISDN-less IMS UE is carried in the SMS-SUBMIT, e.g. by setting a specific value to the TP-Destination-Address or TP-Protocol-Identifier field, or to define a new indication field. This is up to stage 3 to decide;

   - The IMPU of the terminating UE in the form of SIP URI is carried in the TP-User-Data field (either in the header or in the short message), of the SMS-SUBMIT;

3)-7) The MSC/SGSN transfer the SMS Message to the SMS-SC via the SMS-IWMSC, and the SMS-SC sends back delivery report to the UE as specified in TS 23.040 [2].

Short message mobile terminated procedure:

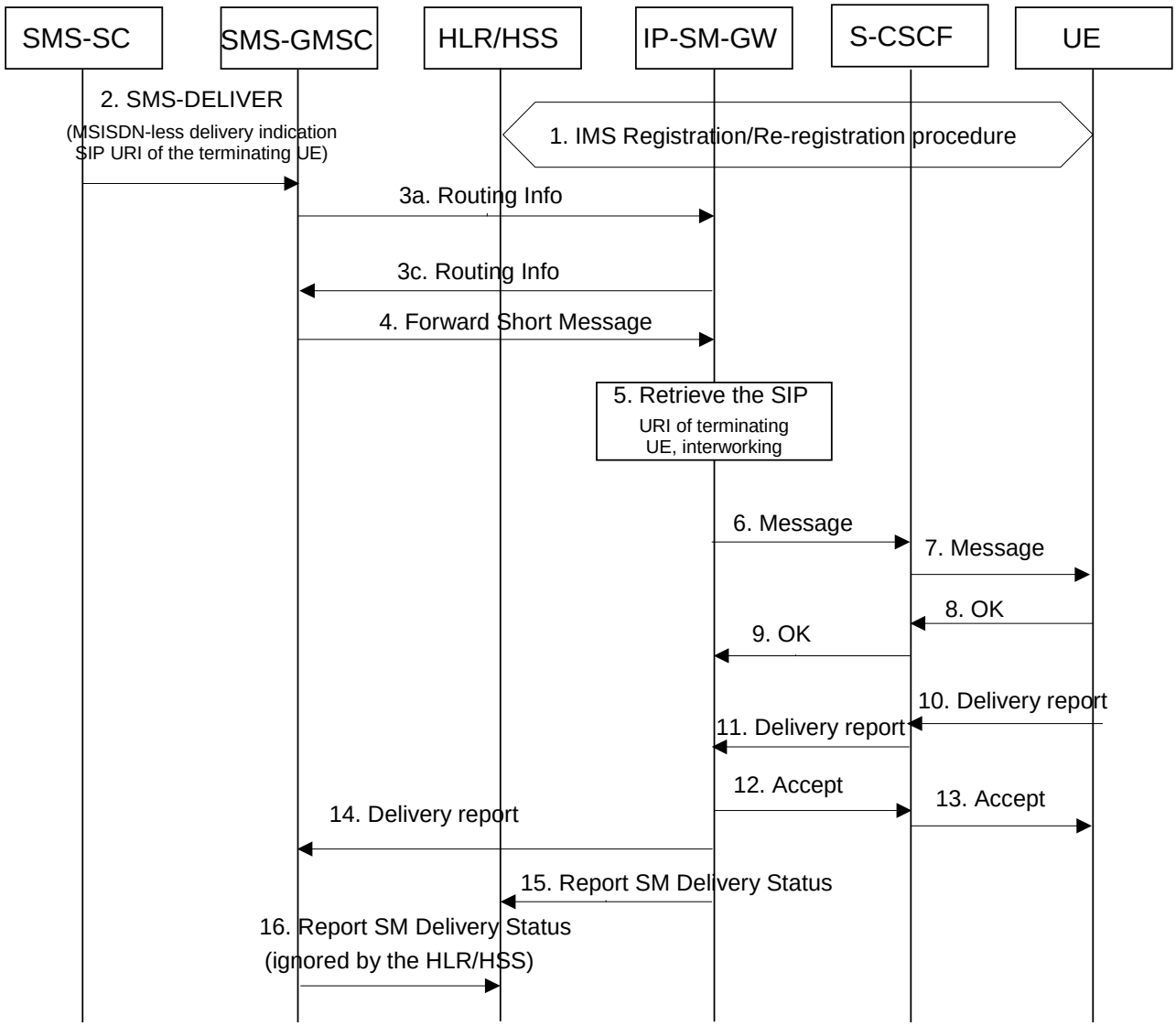

Figure 5.3.2.1-2: SMS MT procedure - SC to MSISDN-less IMS UE via IP-SM-GW

1) An MSISDN-less IMS UE performs IMS registration/Re-registration procedure as specified in TS 23.204 [4].

2) The SMS-SC sends the short message via SMS-DELIVER to the SMS-GMSC as specified in TS 23.204 [4], with the following changes:

   - An indication which indicates that the terminating UE is an MSISDN-less IMS UE is carried in the RP-Destination-Address field (or a newly defined field) of the RP-MT-DATA which encapsulates the SMS-DELIVER;

- The IMPU of the terminating UE in the form of SIP URI is carried in the TP-User-Data field (either header or short message) of the SMS-DELIVER message, which is copied by the SMS-SC from the TP-User-Data field of the received SMS-SUMBIT message.

3a)-3c) The routing info interrogation procedure is performed as specified in TS 23.204 [4], with the following differences:

- The indication which indicates that the terminating UE is an MSISDN-less IMS UE is included in the routing info request, e.g. in the MSISDN field;

- **Step 3b is not performed.**

4) The SMS-GMSC forwards the short message to the IP-SM-GW as specified in TS 23.204 [4].

5) The IP-SM-GW, based on the indication which indicates that the terminating UE is an MSISDN-less IMS UE, retrieves the SIP URI of the terminating UE in the TP-User-Data, and encapsulates the short message in a SIP Message as specified in TS 23.204 [4] with the Request URI set to the SIP URI of the terminating UE.

6)-9) The IP-SM-GW sends the SIP Message which encapsulates the short message to the UE via the S-SCSF as specified in TS 23.204 [4]. The UE acknowledges the SIP request.

10)-16) The UE sends the delivery report to the S-CSCF and delivery report procedures are performed as specified in TS 23.204 [4].

If the SMS delivery to the IMS UE fails in IMS domain, the IP-SM-GW may send the SIP-URI of the UE to the HLR/HSS to interrogate the routing info for the SM. The HSS/HLR gets the IMSI of the UE based on the SIP-URI and returns the MSC/SGSN address to the IP-SM-GW if available. The IP-SM-GW can then try to deliver the SM to the terminating UE via CS/PS domain.

5.3.2.1.2 Affect / necessary changes in existing functionality

The IP-SM-GW needs to recognize the indication which indicates that the terminating UE is an MSISDN-less IMS UE, and to retrieve the SIP URI of the terminating UE. The SMS-SC may need enhancement to support the indication; however, if the indication is carried in TP-Destination-Address field of SMS-SUMBIT, then there is no change in SMS-SC's function.

The traditional UE may need enhancement to include the indication and the SIP URI of the terminating UE in the SMS-SUBMIT. If the indication is carried in TP-Destination-Address field of SMS-SUMBIT (i.e. a specific number is input by the user as the destination address of the SM) and the SIP URI of the terminating UE is carried in TP-User-Data short message part, then there is no change in UE's function of SMS delivery; but there may be some impact on traditional UE's other application functions related to SMS addressing for terminating UE (e.g. address book).

The HSS/HLR will not send the MSC/SGSN address to the IP-SM-GW after receiving the routing info request from the SMS-GMSC (because there is no MSISDN of the terminating UE in the request), but may provide the MSC/SGSN address to the IP-SM-GW when receiving the SIP URI of the UE from the IP-SM-GW for routing info if the SMS delivery fails in IMS domain.

5.3.2.1.3 Applicability

Requirements for SMS addressing / routing: The SMS path is not changed. The SIP URI is carried in the SMS message to address the terminating UE, and only used for SMS routing in IMS domain after the IP-SM-GW retrieves the SIP URI of the terminating UE.

Roaming: If different values for the indication are used in the HPLMN and VPLMN, the SMS may fail to be delivered; however, this can be resolved based on roaming agreement or by choosing a global unique indication.

5.3.2.1.4 Advantages, drawbacks

Pro

- No additional requirement for the MSC/SGSN, SMS-IWMSC and SMS-GMSC.

Con

- Require enhancements in the IP-SM-GW and HSS/HLR. There may be some changes to the SMS-SC.
- It reduces the maximum message length that can be sent in a single short message to include the SIP URI of the MSISDN-less IMS UE in the short message.
- It may have some impact on user experience.

5.3.2.2 Alternative 2: SMS Delivery through specific Server

5.3.2.2.1 Procedure

The main difference between Alternative 2 and Alternative 1 is that a Server for the specific service(s) of SMS to MSISDN-less IMS UE is used in place of the IP-SM-GW and the Server has a MSISDN which is known by the user or the traditional UE for the specific services. Therefore, the MSISDN of the Server is carried in the SMS message for the SMS delivery.

Short message mobile originated procedure:

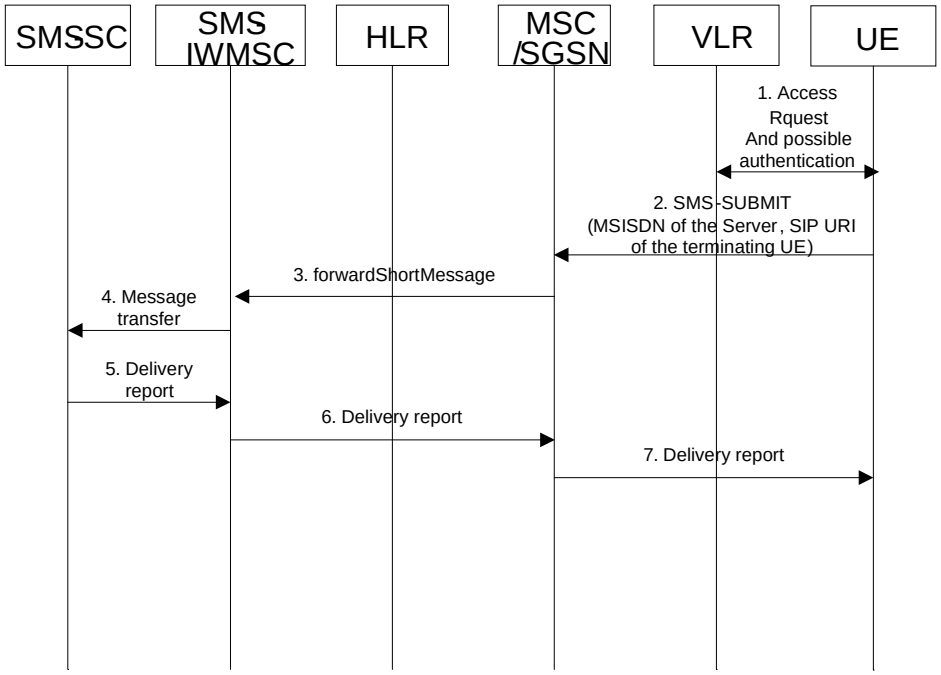

Figure 5.3.2.2-1: SMS MO procedure - Traditional UE to SC with Server MSISDN

1) Traditional UE performs Access Request to the VLR and possible authentication procedure as specified in TS 23.040 [2].

2) Traditional UE decides to send a message to the SMS capable MSISDN-less IMS UE. Traditional UE sends a short message via SMS-SUMBIT to the MSC/SGSN as specified in TS 23.040 [2], with the following changes:

   - The MSISDN of the Server is carried in the TP-Destination-Address field of the SMS-SUBMIT;
   - The IMPU of the terminating UE in the form of SIP URI is carried in the TP-User-Data field (either in the header or in the short message) of the SMS-SUBMIT;

3)-7) The MSC/SGSN transfer the SMS Message to the SMS-SC via the SMS-IWMSC, and the SMS-SC sends back delivery report to the UE as specified in TS 23.040 [2].

Short message mobile terminated procedure:

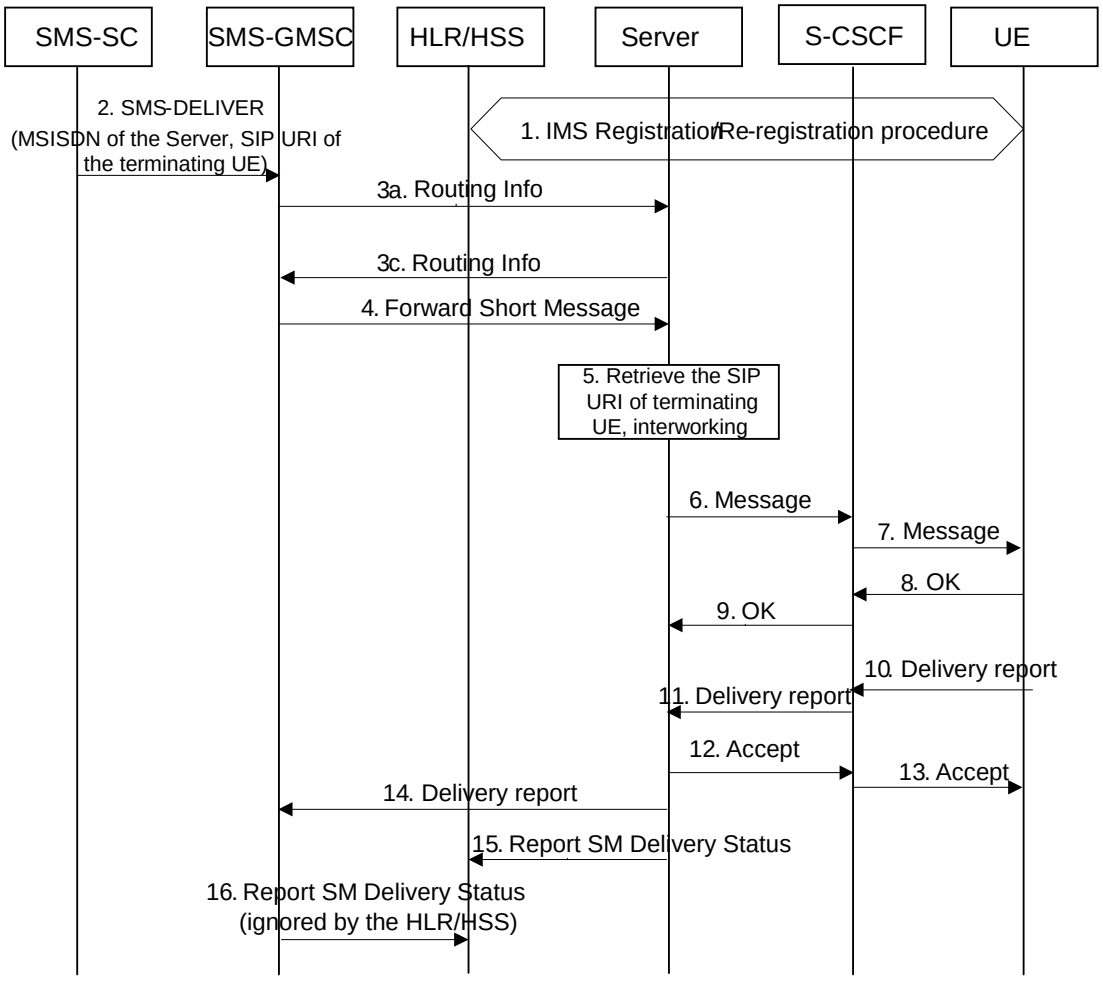

Figure 5.3.2.2-2: SMS MT procedure - SC to MSISDN-less IMS UE with Server MSISDN

1) An MSISDN-less IMS UE performs IMS registration/Re-registration procedure as specified in TS 23.204 [4], with the difference that the Server is in place of the IP-SM-GW.

2) The SMS-SC sends the short message via SMS-DELIVER to the SMS-GMSC as specified in TS 23.204 [4], with the following changes:

   - The MSISDN of the Server is carried in the RP-Destination-Address field of the RP-MT-DATA which encapsulates the SMS-DELIVER;

   - The IMPU of the terminating UE in the form of SIP URI is carried in the TP-User-Data field (either header or short message) of the SMS-DELIVER message, which is copied by the SMS-SC from the TP-User-Data field of the received SMS-SUMBIT message.

3a)-3c) The routing info interrogation procedure is performed as specified in TS 23.204 [4], with the following differences:

   - HLR/HSS forward the routing info request to the Server based on the MSISDN of the Server;

   - The Server performs the function of the IP-SM-GW in the routing info interrogation procedure, e.g. creating a MT Correlation ID which associates the routing info request with the subsequent Forward Short Message message(s);

   - **Step 3b is not performed;**

4) The SMS-GMSC forwards the short message to the Server based on the MSISDN of the Server.

5) The Server retrieves the SIP URI of the terminating UE in the TP-User-Data, and encapsulates the short message in a SIP Message as specified in TS 23.204 [4] with the Request URI set to the SIP URI of the terminating UE.

6)-9) The Server sends the SIP Message which encapsulates the short message to the UE via the S-SCSF as specified in TS 23.204 [4]. The UE acknowledges the SIP request.

10)-16) The UE sends the delivery report to the S-CSCF and delivery report procedures are performed as specified in TS 23.204 [4] with the difference that the Server is in place of the IP-SM-GW.

If the SMS delivery to the IMS UE fails in IMS domain, the Server may send the SIP-URI of the UE to the HLR/HSS to interrogate the routing info for the SM. The HSS/HLR gets the IMSI of the UE based on the SIP-URI and returns the MSC/SGSN address to the Server if available. The Server can then try to deliver the SM to the terminating UE via CS/PS domain.

5.3.2.2.2 Affect / necessary changes in existing functionality

The traditional UE may need be configured with the MSISDN of the Server for the specific service(s) of SMS to MSISDN-less IMS UE, and include the MSISDN of the Server and the SIP URI of the terminating UE in the SMS-SUBMIT; however, if the MSISDN of the Server is input by the user as the destination address of the SM and the SIP URI of the terminating UE is carried in TP-User-Data short message part, then there is no change in UE's function.

The HSS/HLR may provide the MSC/SGSN address to the Server when receiving the SIP URI of the UE from the Server for routing info if the SMS delivery fails in IMS domain.

5.3.2.2.3 Applicability

Requirements for SMS addressing / routing: The SMS path is not changed except the SMS being sent to the Server instead of the IP-SM-GW. The SIP URI is carried in the SMS message to address the terminating UE, and only used for SMS routing in IMS domain after the Server retrieves the SIP URI of the terminating UE.

5.3.2.2.4 Advantages, drawbacks

Pro

- No additional requirement for the MSC/SGSN, SMS-IWMSC, SMS-GMSC, IP-SM-GW and SMS-SC.

Con

- Need the Server for the specific service(s) of SMS to MSISDN-less IMS UE. However the function can be incorporated into the existing Server(s) for specific service(s) where the SMS is delivered to MSISDN-less UE.
- The HSS/HLR needs to communicate with the Server during registration and routing info request procedures; however, it can be done in almost the same way as the HSS/HLR does with the IP-SM-GW/AS.
- It reduces the maximum message length that can be sent in a single short message to include the SIP URI of the MSISDN-less IMS UE in the short message.
- It may have some impact on user experience.

5.3.2.3 Alternative 3: SMS Delivery through enhanced MSC/SGSN

5.3.2.3.1 Procedure

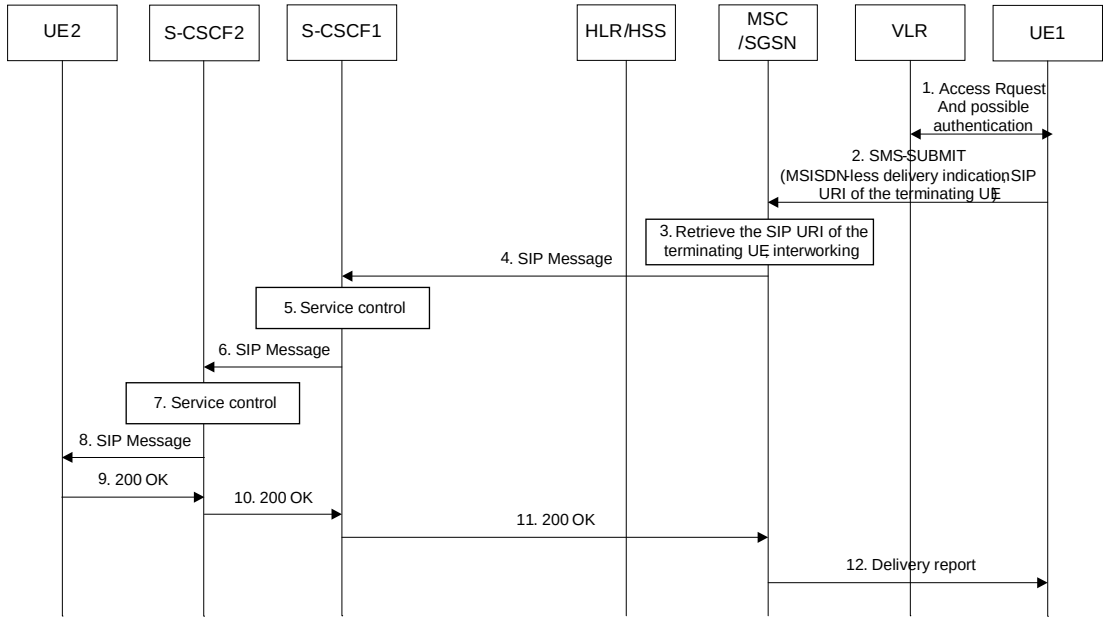

Figure 5.3.2.3-1: SMS from Traditional UE to MSISDN-less IMS UE via enhanced MSC/SGSN

Steps 1-2 are identical to Figure 5.3.2.1.1-1 Steps 1-2.

3) The MSC/SGSN, based on the indication which indicates that the terminating UE is an MSISDN-less IMS UE, retrieves the SIP URI of the terminating UE in the TP-User-Data, and encapsulates the short message in a SIP Message with the Request URI setting to the SIP URI of the terminating UE.

NOTE: Here the MSC/SGSN is enhanced MSC/SGSN which can perform CS/PS to SIP interworking (for SMS).

4)-8) The MSC/SGSN sends the SIP Message which encapsulates the short message to the UE2 via the S-SCSF1 and the S-CSCF2.

9)-11) The UE acknowledges the SIP request.

12) The MSC/SGSN sends the delivery report to the UE1.

5.3.2.3.2 Affect / necessary changes in existing functionality

The MSC/SGSN needs to be enhanced to perform CS/PS to SIP interworking for SMS.

The traditional UE may need enhancement to include the indication and the SIP URI of the terminating UE in the SMS-SUBMIT. If the indication is carried in TP-Destination-Address field of SMS-SUMBIT (i.e. a specific number is input by the user as the destination address of the SM) and the SIP URI of the terminating UE is carried in TP-User-Data short message part, then there is no change in UE's function of SMS delivery; but there may be some impact on traditional UE's other application functions related to SMS addressing for terminating UE (e.g. address book).

5.3.2.3.3 Applicability

Requirements for SMS addressing / routing: The SIP URI is used to address the terminating UE and for SMS routing in IMS domain.

Domain selection and Alter SC procedures are not supported.

5.3.2.3.4 Advantages, drawbacks

Pro

- No additional requirement for the SMS-IWMSC, SMS-GMSC, IP-SM-GW, SMS-SC and HSS/HLR.

Con

- Domain selection and Alter SC procedures are not supported.
- Needs enhancement to the MSC/SGSN for supporting CS/PS to SIP interworking for SMS.
- It reduces the maximum message length that can be sent in a single short message to include the SIP URI of the MSISDN-less IMS UE in the short message.
- It may have some impact on user experience.

6 Key Issues

6.1 Key Issue1: Storage and redelivery of the SMS for transferring SMS from Server to MSISDN-less IMS UE

6.1.1 Description

Alternatives for transferring SMS from server to MSISDN-less IMS UE are provided in clause 5.1.1, but as shown in the drawbacks (for alternatives 1 and 2), there is no intermediate storage or redelivery of the SM when the UE is unreachable or memory unavailable. This needs to be resolved.

6.1.2 Solution

6.1.2.1 Alternative 1: Forward the SMS to the SMS-SC

Figure 6.1.2.1-1 shows an alternative for storage and redelivery of the SMS when transferring SMS from Server to MSISDN-less UE.

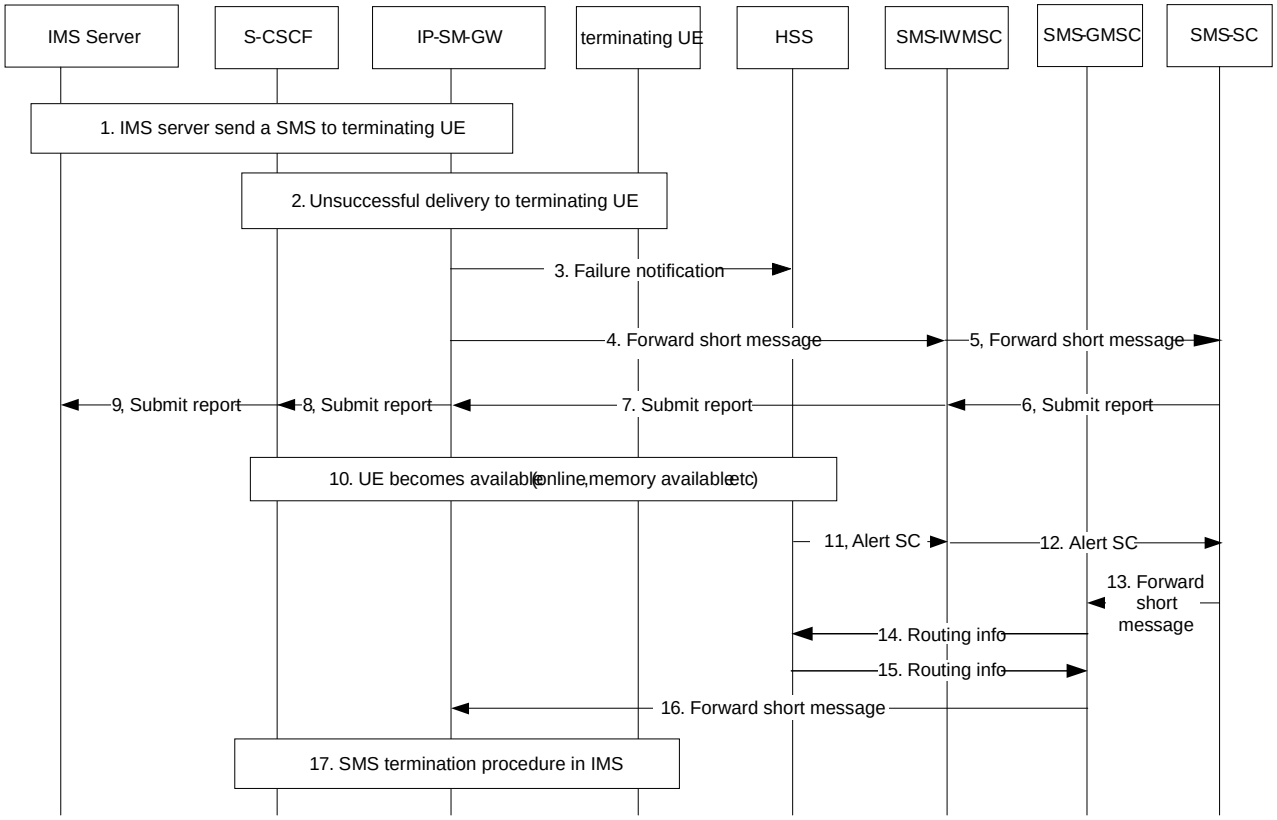

Figure 6.1.2.1-1: Storage and redelivery of the SMS: Forward the SMS to SMS-SC

1. SMS sender decides to send a short message to the MSISDN-less UE in IMS. The SMS sender which is a server may create an SMSIP request or other SIP request including the Short message information in the body of the request.

2. The short message is received by IP-SM-GW/S-CSCF on the terminating side. The short message fails to reach the UE, e.g. due to the UE not being reachable in IMS or exceeded memory capacity of the UE, and a failure delivery report is returned to the IP-SM-GW. Or, if the short message is not delivered via the IP-SM-GW, the S-CSCF encapsulates the short message failing to reach the UE in the appropriate SIP method and sends to the IP-SM-GW.

3. The IP-SM-GW sends a Report SM Delivery Status to the HSS. Before sending report to HSS, the IP-SM-GW creates a MT Correlation ID according to TS 23.040 [2] which is stored along with the corresponding SIP URI which identifies the terminating UE of the short message. The MT Correlation ID, the address of the IP-SM-GW and SMS-SC, the IMSI of the terminating UE and the failure reason are sent along with the Report SM Delivery Status to the HSS. The HSS records the received information in the corresponding MWD.

NOTE 1: The IP-SM-GW acquires the address of the SMS-SC serving the terminating UE from the HSS during registration procedure or be provisioned by configuration, as specified in TS 23.204 [4].

4. The IP-SM-GW extracts the short message from the SIP request and forwards the short message to the SMS-SC based on the SMS-SC address via the SMS-IWMSC using standard MAP signalling. The MT Correlation ID is included in the short message.

5. The SMS-IWMSC forwards the short message to the SMS-SC. The SMS-SC stores the received short message.

NOTE 2: The MT Correlation ID can be recognized by the SMS-SC to save the received short message without forwarding it.

6-9. The SMS-SC sends a submit report to the IP-SM-GW via the SMS-IWMSC. The IP-SM-GW forwards the submit report to the IMS Server via the S-CSCF.

10. At any time after the unsuccessful SM termination procedure, the status of the UE may indicate that UE is available, due to e.g. registration in IMS or memory being available.

11. The HSS checks the user's MWD. If the MWD is not NULL, the HSS initiates an Alert service centre message to the SMS-IWMSC. The Alert service centre message includes the MT Correlation ID.

12. The SMS-IWMSC forwards the Alert service centre message to the SMS-SC.

13. Upon receipt of the Alert service centre message, the SMS-SC re-sends the stored short message associated with the MT Correlation ID to the IP-SM-GW via the SMS-GMSC. The Short message includes the MT Correlation ID.

14. The SMS-GMSC interrogates the HSS to retrieve routing information (i.e. the address of the IP-SM-GW) based on the MT Correlation ID.

15. The HSS returns the address of the IP-SM-GW related to the MT Correlation ID.

16. The SMS-GMSC delivers the short message to the IP-SM-GW including the MT Correlation ID.

17. Upon receipt of the short message from the SMS-SC, the IP-SM-GW performs appropriate interworking to generate a new SIP message (e.g. SMSIP request) including the received short message in the body of the request to re-attempt to send the Short message. The IP-SM-GW uses the SIP URIs related to the MT Correlation ID to generate the SIP message. The termination procedure in IMS is performed.

6.1.2.2 Alternative 2: Save the SMS in IP-SM-GW

Figure 6.1.2.2-1 shows another alternative for storage and redelivery of the SMS when transferring the SMS from Server to MSISDN-less UE.

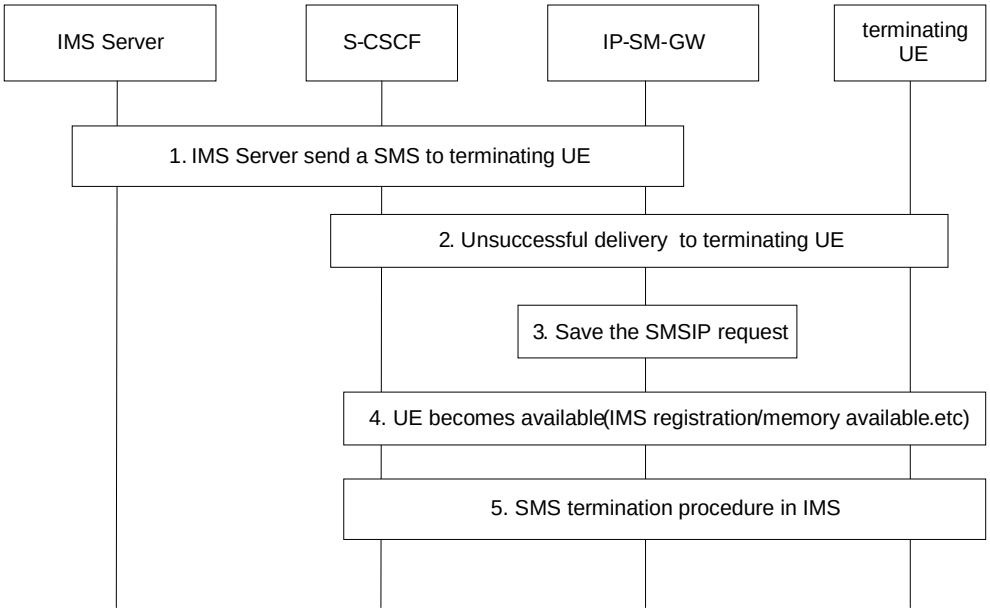

Figure 6.1.2.2-1: Storage and redelivery of the SMS: Save the SMS in IP-SM-GW

1. SMS sender decides to send a Short message to the MSISDN-less IMS UE. The SMS sender which is a server may create an SMSIP request or other SIP request including the Short message information in the body of the request.

2. The short message is received by IP-SM-GW/S-CSCF on the terminating side. The short message fails to reach the UE, e.g. due to the UE not being reachable in IMS or exceeded memory capacity of the UE, and a failure delivery report is returned to the IP-SM-GW. Or, if the short message is not delivered via the IP-SM-GW, the S-CSCF encapsulates the short message failing to reach the UE in the appropriate SIP method and sends to the IP-SM-GW.

3. The IP-SM-GW stores the delivery request for the short message.

NOTE 1: The IP-SM-GW will save the SIP request for short message in IMS domain when short message fails to forward to terminating UE, but need not to save the request from the SMS-GMSC as specified in TS 23.204 [4].

4. At any time after the unsuccessful SM termination procedure, the status of the UE may indicate that UE is available, due to e.g. registration in IMS or memory being available. The IP-SM-GW is notified of the change of UE status (i.e. from being unavailable to available) as specified in TS 23.204 [4].

5. The IP-SM-GW re-attempts to send the stored request for Short message upon notification of the availability of the UE. The termination procedure in IMS is performed.

6.1.2.3 Alternative 3: Reuse SMS SC in SIMTC approach

The following figure 6.1.2.3-1 reuses the T4 approach in TS 23.682 [8] with the adaptation needed for SMSMI work from Server to UE direction.

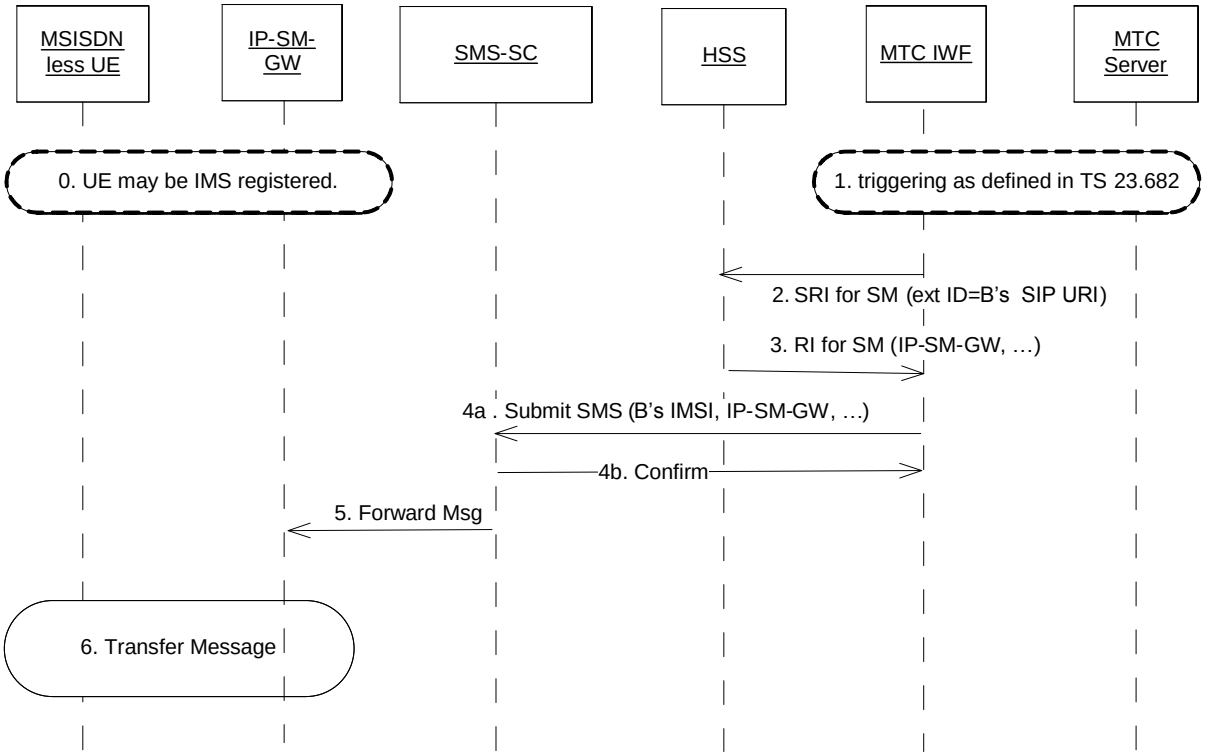

Figure 6.1.2.3-1 SIMTC with IP-SM-GW adaption

0. If UE is IMS registered, the IP-SM-GW (AS) is in the loop as part of the 3rd party registration and has context of IMSI and B's SIP URI association.

1. Same procedure as defined in clause A.3.1, steps 1 to 3, related to SMS generation from Server.

2. The external ID used for SRI for SM is MSIDN-less UE's URI. This message is sent to HSS.

3. In addition to the information and criteria defined in the present document, the IP-SM-GW address is returned in the Routing Information because UE is also IMS registered. IMSI is returned as defined by the present document.

4. The MTC-IWF selects a suitable SMS-SC for SMS submission. IP-SM-GW address received from HSS along with other possible addresses is sent to this SMS-SC. The SMS-SC confirms to the MTC Server that the SMS has been stored in the SMS-SC.

5. The SMS is delivered to the UE using B's IMSI and in this case, it is forwarded to IP-SM-GW.

NOTE: The SMS-SC does not perform an SRI for SM with the HSS; instead it uses the visited node address information received in step 4a.

6. IP-SM-GW uses the SIP URI associated with the B's IMSI of the message received for the target UE to send the Short Message (SMS DELIVER, SC Address) encapsulated in the appropriate SIP method towards the S-CSCF.

It can be seemed that the following additional requirements are needed for this study in the Server to UE direction:

1. External ID is the IMPU (SIP-URI) of the UE in step 4
2. RI for SM in step 6 from HSS will include IP-SM-GW for performing SMS router function and to route to UE in IMS when it is IMS registered based on current procedure. (Routing is based on IMSI returned by HSS).
3. The SMS SC will perform the storing and forwarding functionality also for SMSMI.
4. Optimization to perform direct delivery without going via SMS-SC when both Server and IMS UE are available is TBD.

6.1.3 Evaluation

6.1.3.1 Evaluation for alternative 1

Impacts to existing function of the network entities: The IP-SM-GW transfers to the SMS-SC the short message which fails to be delivered to the terminating UE. The SMS-SC needs to be enhanced to store the short message received from the IP-SM-GW which fails to be delivered to the terminating UE, instead of immediately delivering it. The HSS/HLR stores additional information (e.g. the MT Correlation ID and the addresses of the IP-SM-GW) in the MWD. The SMS-GMSC interrogates the HSS to retrieve routing information (i.e. the address of the IP-SM-GW) related to the MT Correlation ID.

6.1.3.2 Evaluation for alternative 2

No other impacts on the network entities except that the saving and redelivery SMS functions are required in IP-SM-GW.

6.1.3.3 Evaluation for alternative 3

Minor enhancement is needed on top of SIMTC work for providing "storing and forwarding" functionality also for this study.

6.2 Key Issue 2: Traditional UE replies SMS to MSISDN-less IMS UE

6.2.1 Description

Upon receiving a short message from an MSISDN-less IMS UE, it should be possible for tradition UE to reply a short message based on the information of the received short message automatically or manually. How the traditional UE generates the replied short message correctly needs study.

6.2.2 Solution

6.2.2.1 Alternative 1: Generated the replied message by User

If tradition UE is operated by a person, who recognizes that the short message came from an MSISDN-less UE, he can remember SIP URI or extract SIP URI with the help of UE's enhanced function. Then he uses the SIP URI to reply the short message as depicted in clause 5.3.2.

Pro

- No change or little enhancement to traditional UE.

Con

- Bad user experience.

6.2.2.2 Alternative 2: Generated the replied message by UE

The traditional UE is enhanced to recognize whether the short message comes from MSISDN-less IMS UE, which is done by special indication or special code. When replying automatically or manually, the enhanced traditional UE is able to extract the SIP URI from the received short message user body, and then use the SIP URI as the destination address to generate the replied short message as depicted in clause 5.3.2. The extracting behaviour is similar with one that some traditional UE can extract the E.164 number in the message body.

Pro

- Good user experience.

Con

- Need enhancement to traditional UE. For some traditional UE, it can not be applied.

6.2.2.3 Alternative 3: Use special reply number

When SMS proxy is in the submit path of a short message from MSISDN-less IMS UE, SMS proxy can assign a routable E.164 number (reply number) owned by SMS proxy as the originator address (RP-Originating-Address). When need to reply, the traditional UE uses this reply number as the destination address and reply short message to SMS SC. SMS SC delivers the short message to SMS proxy according to the replied number. SMS proxy is able to restore the SIP URI from the reply number, and creates a terminating message using the SIP URI. Then SMS proxy delivers the message to MSISDN-less IMS UE.

NOTE: To restore the SIP URI from the reply number, SMS proxy must establish the relationship between the reply number and SIP URI. The relationship may be static or dynamic. The static relationship means to assign a unique E.164 number to the MSISDN-less IMS UE which has the requirement to communicate with traditional UE. The dynamic relationship is used to save the E.164 number resource. For example, SMS proxy assigns an unused reply number to an MSISDN-less IMS UE only when it sends a short message to traditional UE. The relationship is valid during a special period, and after that the reply number can be reused.

Pro

- No change to traditional UE.

Con

- SMS proxy assigns the E.164 number for replying short message and establishes the relationship between SIP URI and reply number.
- The static relationship requires more E.164 number resource. It can not work if there is a large number of MSISDN-less UEs.
- The dynamic relationship takes less E.164 number. But reply message may be delivered to wrong destination when the number expires and is assigned to another MSISDN-less UE.

6.3 Key Issue 3: MSISDN-less UE's SIP URI in SMS payload

6.3.1 Description

Many Alternatives in this TR requires the MSISDN-less UE's SIP URI to be carried in the SMS payload. The drawback of such approach is that the payload size of 160 characters (7 bit/ea) is reduced by length of the SIP-URI plus possibly some overhead bytes.

For concatenated SMS, the pointers used within the SMS payload will have to be reconstructed if IP-SM-GW inserts the SIP URI to the SMS payload.

Charging is also impacted if the insertion of SIP URI is requirement additional SMS to be sent due to exceeding the payload size of 160, when charges to the user is based per SMS.

6.3.2 Solution

6.3.2.1 General

Because there is a requirement not to impact the SMS service defined in TS 23.040 [2], it is not expected a solution with protocol changes would meet this requirement.

If those alternatives that require MSISDN-less UE's SIP URI in SMS payload are selected, Stage 3 will have to determine how to encode the SIP-URI within the SMS payload.

6.3.2.2 Alternative 1: Included by IMS UE

When an SMS over IP is initiated to an IMS server or a remote UE, the MSISDN-less IMS UE includes its own MSISDN-less IMS UE SIP URI in SMS user data body, as depicted in clauses 5.1.2.1 and 5.2.1. As the IMS UE is not trusted, IP-SM-GW in path must extract SMS user data (TP-User-Data), then checks the IMS UE address included by UE by comparing it with the SIP URI carried in P-Served-User header or P-Asserted- Identity header. If not correct, IP-SM-GW replaces the IMS UE address in SMS user data body with SIP URI carried in P-Served-User header or P-Asserted- Identity header. If IP-SM-GW finds that the SIP URI inserted by user is invalid, it will reject the SMS.

Pro

- UE can select the preferred identity if there are more SIP URIs assigned.

Con

- IP-SM-GW should extract TP-User-Data to check the validity of the SIP URI included by UE. There is no more advantage over Alternative 2.

6.3.2.3 Alternative 2: Inserted by IP-SM-GW

When an SMS over IP is initiated to an IMS server or a remote UE, the MSISDN-less IMS UE does not include any IMS UE address in SMS user data body. Upon receiving such a message, IP-SM-GW in path must insert MSISDN-less IMS UE SIP URI in SMS user data. The inserted SIP URI is obtained from P-Served-User header or P-Asserted-Identity header. For single SMS, the insert of SIP-URI may result in payload size exceeding, so the IP-SM-GW should be able to reconstruct SMS using concatenated SMS or additional SMS. For concatenated SMS, the IP-SM-GW has to reconstruct the pointers within the SMS payload.

Pro

- Simple to UE. UE need not include IMS UE SIP URI into SMS user data.

Con

- UE cannot select the preferred identity if there are more SIP URIs assigned, or uses P- Prefered- Identity to indicate its preference.
- IP-SM-GW should be able to reconstruct SMS when the payload size exceeds after inserting SIP URI to single SMS or a concatenated SMS is received.

6.3.2.4 Alternative 3: Retrieved by IMS Server

If an SMSIP originated by an MSISDN-less IMS UE is delivered to an IMS Server directly from S-CSCF, IMS Server can retrieve the originator's SIP URI from P-Served-User header or P-Asserted- Identity header. In this case, it does not require the IMS UE or IP-SM-GW include IMS UE address in the message.

Pro

- No requirement to UE and IP-SM-GW to include the MSISDN-less IMS UE SIP URI.

Con

- Only applies the scenario that the message is delivered to IMS server directly from S-CSCF.

6.3.3 Assessment

Table 6.2.3-1 summarizes the requirements to MSISDN-less UE and IP-SM-GW of Alternative1 vs. Alternative 2

Table 6.2.3-1: Requirements of Alternative1 vs. Alternative 2

Essential nodes and requirements▾	Alternative 1: Included by IMS UE	Alternative 2: Inserted by IP-SM-GW
MSISDN-less UE	It selects the preferred identity and inserts into payload.	Need not any handling of its own SIP URI.
IP-SM-GW	It checks the validity of SIP URI inserted by UE, and rejects this SMS if the SIP URI is invalid.	It selects the default SIP URI and inserts into payload. It should be able to reconstruct the SMS in some cases.

7 Alternatives Assessment and Conclusions

7.1 Assessment of Server - MSISDN-less IMS UE communication via SMS alternatives

Table 7.1-1 summarizes the criteria / requirements vs. Alternatives for Server to UE direction.

Table 7.1-1: Criteria / Requirements vs. Alternatives for Server to UE direction

Alternative ► Criteria▼	Alt 1: Server creates the SMSIP delivery directly	Alt 2: Direct delivery with IP-SM-GW	Alt 3: Use of IM AS	Alt 4: SMS delivery through SMS proxy	Alt 5: Direct delivery with IP-SM-GW interworking
Store and forwarding capability	NO	NO	YES	NO	NO
SMS payload size	No impact	Reduced by the length of the target SIP URI	No impact	Reduced by the length of the target SIP URI	Reduced by the length of the target SIP URI
Roaming impacts	NO	NO	NO	NO	NO
Compatibility with SIMTC	+	-	+	-	-
Essential nodes and requirements▼					
Server	- Assume UE is always on or aware the UE registration status by 3rd party registration and event package - Create the SMS IP request directly and process delivery report - Retry if delivery failed	- Assume UE is always on or aware the UE registration status by 3rd party registration and event package - reuse the same mechanism as in Alternative 5 for embedding SIP URI in the SMS payload - Retry if delivery failed	- Create the SMS as Instant Message	- Assume UE is always on - Create SMS toward SMS proxy by setting TP-DA with E.164 of the SMS proxy - target SIP URI is embedded in the SMS payload	SIP Request to IP-SM-GW contains a "terminating code" that allows the IP-SM-GW to aware that this SMS is toward MSISDN-less UE. - "terminating code" is put into RP-DA. - target SIP URI is embedded in the SMS payload - process the status report by looking into the body to determine which target this is from.
IP-SM-GW	- Perform service authorization if required by configuration	- Create the SMS IP request based on the incoming message from server with retrieving the target SIP URI from SMS payload, based on the indication as proposed in alt 5. - Domain selection (i.e.	- Perform service level interworking from IM to SMS (existing procedure) - Domain selection (i.e., retry to CS domain) must not be used.	- Retrieve the target SIP URI from SMS payload and create SMS IP request directly - Delivery report to SC is either success or temporary failure. - Will not report status to HSS because SC alert	- Triggered by the "terminating code", IP-SM-GW creates the SMS IP request by retrieving the target SIP URI from SMS payload. - "terminating code" is placed into RP-OA. - for sending the SMS-STATUS-REPOR to IMS Server, the TP-

Alternative ► Criteria▼	Alt 1: Server creates the SMSIP delivery directly	Alt 2: Direct delivery with IP-SM-GW	Alt 3: Use of IM AS	Alt 4: SMS delivery through SMS proxy	Alt 5: Direct delivery with IP-SM-GW interworking
		retry to CS domain) must not be used.		mechanism can not be used	RA is set to "terminating code" and includes the target SIP URI (i.e. MSISDN-less UE) in the user data body.
SMSC-GMSC	N/A	N/A	N/A	The validity period for retry must be set to low value. SMSC does not know the actual recipient of the SMS so charging can be affected.	N/A
IM AS	N/A	N/A	Store IM if UE is unavailable (existing procedure)	N/A	N/A
MSISDN-less UE	None	None	None	None	The RP-ACK contains - the "terminating code" in RP-OA. - IMS server E.164 in RP-DA. - its own SIP URI in the SM data body.

Interim conclusions for Release 11 are:

- Enhance the work to be completed by SIMTC to allow "storing and forwarding functionality" to be reused by SMSMI. This requires an extension with dependency on SIMTC.

- For solution without "storing and forwarding functionality", adopt Alt-1 and Alt-3 for Rel-11 as they are implementation only without any needs for further standardization. This allows maximum compatibility with SIMTC.

- Other solutions, which reduce the payload side is seem unnecessary complicated, as SIMTC does not has similar requirements. So they are not considered for this Server to UE direction.

7.2 Assessment of MSISDN-less IMS UE - Server communication via SMS alternatives

Table 7.2-1 summarizes the criteria / requirements vs. Alternatives for UE to Server direction.

Table 7.2-1: Criteria / Requirements vs. Alternatives for UE to Server direction

Alternative ► Criteria▼	Alt 1: Direct delivery with IP-SM-GW interworking	Alt 2: SMS delivery through SMS proxy	Alt 3: SMS submit with direct delivery from originating IP-SM-GW
Store and forwarding capability	NO	YES	NO
SMS payload size	Reduced by the length of the target SIP URI	Reduced by the length of the target SIP URI	Reduced by the length of the target SIP URI
Roaming impacts	NO	NO (both SMSC and IP-SM-GW are from the home PLMN)	NO
Essential nodes and requirements▼			
Server	When receives the SMS, it needs to extract the sender identity from SMS payload. Construct the RP-ACK with RP-DA=short code and include sender identity – SIP URI into payload	When receives the SMS, it needs to extract the sender identity from SMS payload.	When receives the SMS, it needs to extract the sender identity from SMS payload.
IP-SM-GW	SMS status report delivery to UE is based on server to MSISDN-less UE mechanism.	When sending to the Server, it acts as SMS proxy for the MSISDN less UE by adding its own E.164 as the originator of the SMS in TP-OA. It may insert UE's SIP URI in payload if it knows that UE has not done so already.	It may insert UE's SIP URI in payload if it knows that UE has not done so already. It sets the sender of the request (RP-Originating-Address) and the originator of the request (TP-Originating-Address) is set to the E.164 address of the IP-SM-GW
SMSC-GMSC	N/A	It needs to look into the payload to be aware who is the actual sender. The trigger can be based on sending party (i.e. TP-OA is E.164 of IP SM GW)	N/A
MSISDN-less UE	Embed its own SIP URI in the payload RP-OA: Short code	None or embed its own SIP URI in the payload	None or embed its own SIP URI in the payload

Conclusions for Release 12 is:

- Conclusion for sending SMS from MSISDN-less UE to traditional UE in clause 7.4 applies also for sending SMS from MSISDN-less UE to Server. The network does not differentiate the end point is a server or a traditional UE.

7.3 Assessment of SMS between MSISDN-less IMS UEs

The following table 7.3-1 summarize the key points and also suggested evaluation criteria for the alternatives in clause 5.2.

Table 7.3-1: Criteria vs. Alternatives for SMS between MSISDN-less IMS UEs

Alternative ▸ Criteria▾	Alternative 1: Direct delivery with IP-SM-GW interworking	Alternative 2: Direct delivery with SIP level interworking I	Alternative 3: Direct delivery with SIP level interworking II
Store and forwarding capability	Not shown	YES	YES
SMS payload size	Reduced by the length of both the sender and target SIP URIs	No impact	No impact
Roaming support	?	NO	YES
Essential nodes and requirements▾			
IP-SM-GW of the sending party	Detects the special short codes RP-DA/TP-DA in order to parse the terminating SIP URI to perform directly delivery.	Detects TP-DA field is "null or dummy field" and queries the HSS for routing info using B's SIP URI retrieved from SIP MESSAGE When delivery failed, it submits the SMS to SMSC for storing and forwarding.	Detects TP-DA field is "null or dummy field" and forward the SIP MESSAGE toward the terminating IMS for handling. When delivery failed, it submits the SMS to SMSC for storing and forwarding.
IP-SM-GW of the terminating party	Not used?	Forward the SMS using the B's IMSI received from SMSC. Retrieve B's IMSI to originating network if SMS can't be terminated so the SMSC can redeliver using B"s IMSI.	When delivery failed, it queries the HSS with the correlation ID and returns that back to the originating network. When receiving a SMS from SMSC with correlation ID, it quires the HSS for routing to terminating UE.
UE	Put special designated short code in RP-OA and RP-DA/TP-DA to indicate both sender and receiver is MSISDNless. Put both sender and receiver SIP URIs in SMS payload.	SIP MESSAGE includes the B's party SIP URI, the TP-DA is filled with dummy or null) When receiving SMS, the sender's identity is retrieved from SIP header instead of TP-OA.	Same as Alt 2.
SMSC	Not used	Store and forward, and support the additional parameters from IP-SM-GW for SMS deliver function.	Same as Alt 2.
HSS	NO special requirement	No special requirement	Generate correlation ID to allow SMS routing to terminating UE.

Conclusion:

Alternative 2 does not support roaming because the IMSI is returned back to the originating network. It can be considered when both UEs belong to the same PLMN.

Alternative 3 further enhances alternative 2 with correlation ID from the terminating network to hide the IMSI from originating network.

Alternative 1 does not support store and forwarding and how roaming and terminating network is supporting this requirement is not clear. Furthermore, it requires both sender/receiver identities to be placed in sms payload, which can take up the effective use of payload space for the actual message by the sender. Therefore, it is recommended not to consider this alternative further.

It is recommended that Alt 3 is used as basis for potential normative work as it can support both roaming and non-roaming scenarios.

7.4 Assessment SMS between MSISDN-less UE and Traditional UE

There is existing service today that Traditional UE can already receive SMS from non-MSISDN source (e.g, email to SMS service). The sender identity in the form of e.g, xxx@domain.com is shown either in the sender field of the SM with alphanumeric coding (allowed in stage 3) or shown in the SMS payload. There is no de facto way on how the traditional UE can reply to this kind of email via SMS. This behaviour seems reasonable as the legacy UE can't be modified and the recipient is aware of the sending identity. This type of email to SMS interworking is implementation specific and not standardized.

Sending SMS from MSISDN-less UE to traditional UE is somewhat analogous as sending email via SMS to an traditional UE.

Conclusions for Release 12 is:

It is proposed that the same approach can be adopted for MO SMS from MSISDN-less IMS UE to Traditional UE, i.e., it is not subjected to standardization in Rel-12 and operator can implement that service in its own way.

At some point, when SA1 indicates the user requirements for a traditional UE to send/reply to an MSISDN-less UE then SA WG2 can study the solution further to meet those requirements in Rel-12 if time permits.

7.5 Conclusion

The following conclusions have been reached for this study:

- For Server - MSISDN-less IMS UE communication via SMS, the corresponding normative specification based on clause 7.1 has been specified to TS 23.682 [8] and TS 23.204 [4] in Release 11.
- The conclusion for MSISDN-less IMS UE - Server communication via SMS is detailed in clause 7.2.
- The conclusion for SMS between MSISDN-less IMS UEs is detailed in clause 7.3.
- The conclusion for SMS between MSISDN-less UE and Traditional UE is detailed in clause 7.4.

Annex A:
Addressing in SMS

A.1 General

Figure A.1-1 shows high level SMS architecture and the schematic numbering of hops in end-to-end SMS routing.

Figure A.1-1: SMS architecture with schematic hops of the "SM path"

NOTE: SMS Router as domain selection functionality is in the IP-SM-GW. The IP-SM-GW in figure A.1-1 represents the transport layer interworking functionality, which plays the same role for SMS origination/termination in case of SMS over IP, as the MSC in case of SMS over CS and the SGSN in case of SMS over PS.

The following table summarizes how the addressing is handled in different hops of the SMS path.

Table A.1-1: Addressing in the SMS architecture

SM type	MO-SMS	MO-SMS	MT-SMS	MT SMS
hop	**1. UE → MSC / SGSN / IP-SM-GW**	**2. MSC / SGSN / IP-SM-GW → SC**	**3. SC → MSC / SGSN / IP-SM-GW**	**4. MSC / SGSN / IP-SM-GW → UE**
A party	**Not included** (see CP-DATA in TS 24.011 [6], 7.2.1 and the embedded RP-MO-DATA in TS 24.011 [6], 7.3.1.2 and TS 23.040 [2], 9.3.2.1).	A party's **MSISDN** is included by the MSC / SGSN / IP-SM-GW into the RP-Originating-Address, **mandatory** element within RP-MO-DATA.	A party's **MSISDN** is included in TP-Originating-Address (based on originating SMS), **mandatory** element within SMS-DELIVER type.	A party's **MSISDN** is included in TP-Originating-Address (kept there), **mandatory** element within SMS-DELIVER type.
B party	B party's **MSISDN** is included (input from A party) in TP-Destination-Address within SMS-SUBMIT type, **mandatory** element	B party's **MSISDN** is included (kept there) in TP-Destination-Address within SMS-SUBMIT type, **mandatory** element	B party's **IMSI** (included by GMSC or SMS Router based on HSS/HLR query with MSISDN) is included in RP-Destination-Address within RP-MT-DATA, **mandatory** element	**Not included**. MSC/SGSN sends the request to the UE after paging with TIMSI (or IMSI). IP-SM-GW addresses the SIP request using standard mechanism.
sent from	A party, see above	A party, see above	SC of A party Included in RP-Originating-Address, **mandatory** element within RP-MT-DATA.	SC of A party Included in RP-Originating-Address, **mandatory** element within RP-MT-DATA.
sent to	SC of A party (configured in UE can be a logical address), included in RP-Destination-Address within RP-MO-DATA, mandatory element	SC of A party (either kept or replaced to a physical address), included in RP-Destination-Address within RP-MO-DATA, mandatory element	B party, see above	B party, see above

For information, the relevant parts of TS 23.040 [2] are copied here.

9.3.2.1 RP-MO-DATA

Basic elements of the RP-MO-DATA type.

Abbr.	Reference	P[1)]	Description
RP-OA	RP-Originating-Address	++-	Address of the originating MS.
RP-DA	RP-Destination-Address	-++	Address of the destination SC.
RP-UD	RP-User-Data	+++	Parameter containing the TPDU

1) Provision on the links SC<->MSC, MSC<->MSC or MSC<->SGSN, and MSC<->MS or SGSN<->MS indicated by "xxx", where x may be either "+" or "-", dependent on whether the parameter is mandatory or not on the respective link.

9.3.2.2 RP-MT-DATA

Basic elements of the RP-MT-DATA type.

Abbr.	Reference	P[1)]	Description
RP-PRI	RP-Priority-Request	+--	Parameter indicating whether or not the short message transfer should be stopped if the originator SC address is already contained in the MWD.
RP-MMS	RP-More-Messages-To-Send	OO-	Parameter indicating that there are more messages waiting in the SC
RP-OA	RP-Originating-Address	+++	Address of the originating SC.
RP-DA	RP-Destination-Address	++-	Address of the destination MS.
RP-UD	RP-User-Data	+++	Parameter containing the TPDU
RP-MTI	RP-Message Type Indicator	O--	Parameter indicating if the TPDU is a SMS Deliver or a SMS Status Report [2)]
RP-SMEA	RP-originating SME-Address	O--	Address of the originating SME [2)]

1) Provision on the links SC<->MSC, MSC<->MSC or MSC<->SGSN, and MSC<->MS or SGSN<->MS indicated by "xxx", where x may be "+", "-" or "O", dependent on whether the parameter is mandatory, not present or optional on the respective link.

9.2.2.1 SMS-DELIVER type

Basic elements of the SMS-DELIVER type:

Abbr.	Reference	P[1)]	R[2)]	Description
TP-MTI	TP-Message-Type-Indicator	M	2b	Parameter describing the message type.
TP-MMS	TP-More-Messages-to-Send	M	b	Parameter indicating whether or not there are more messages to send
TP-LP	TP-Loop-Prevention	O	b	Parameter indicating that SMS applications should inhibit forwarding or automatic message generation that could cause infinite looping.
TP-RP	TP-Reply-Path	M	b	Parameter indicating that Reply Path exists.
TP-UDHI	TP-User-Data-Header-Indicator	O	b	Parameter indicating that the TP-UD field contains a Header
TP-SRI	TP-Status-Report-Indication	O	b	Parameter indicating if the SME has requested a status report.
TP-OA	TP-Originating-Address	M	2-12o	Address of the originating SME.
TP-PID	TP-Protocol-Identifier	M	o	Parameter identifying the above layer protocol, if any.
TP-DCS	TP-Data-Coding-Scheme	M	o	Parameter identifying the coding scheme within the TP-User-Data.
TP-SCTS	TP-Service-Centre-Time-Stamp	M	7o	Parameter identifying time when the SC received the message.
TP-UDL	TP-User-Data-Length	M	I	Parameter indicating the length of the TP-User-Data field to follow.
TP-UD	TP-User-Data	O	3)	

9.2.2.2 SMS-SUBMIT type

Basic elements of the SMS-SUBMIT type:

Abbr.	Reference	P[1)]	P[2)]	Description
TP-MTI	TP-Message-Type-Indicator	M	2b	Parameter describing the message type.
TP-RD	TP-Reject-Duplicates	M	b	Parameter indicating whether or not the SC shall accept an SMS-SUBMIT for an SM still held in the SC which has the same TP-MR and the same TP-DA as a previously submitted SM from the same OA
TP-VPF	TP-Validity-Period-Format	M	2b	Parameter indicating whether or not the TP-VP field is present.
TP-RP	TP-Reply-Path	M	b	Parameter indicating the request for Reply Path.
TP-UDHI	TP-User-Data-Header-Indicator	O	b	Parameter indicating that the TP-UD field contains a Header.
TP-SRR	TP-Status-Report-Request	O	b	Parameter indicating if the MS is requesting a status report.
TP-MR	TP-Message-Reference	M	I	Parameter identifying the SMS-SUBMIT.
TP-DA	TP-Destination-Address	M	2-12o	Address of the destination SME.
TP-PID	TP-Protocol-Identifier	M	o	Parameter identifying the above layer protocol, if any.
TP-DCS	TP-Data-Coding-Scheme	M	o	Parameter identifying the coding scheme within the TP-User-Data.
TP-VP	TP-Validity-Period	O	o/7o	Parameter identifying the time from where the message is no longer valid.
TP-UDL	TP-User-Data-Length	M	I	Parameter indicating the length of the TP-User-Data field to follow.
TP-UD	TP-User-Data	O	3)	

A.2 Special cases in service level interworking

When service level interworking is in use, the SM will not travel end-to-end through the whole SMS path, but only either:

A) only the first hop;

This scenario assumes SMSIP, i.e. the SM travels from A party to the IP-SM-GW of the A party, where it is interworked to Instant Message. Note that in this case the SUBMIT-REPORT and the optional STATUS-REPORT are generated by the IP-SM-GW based on IM responses, i.e. travel the last hop only as SMSIP message.

Figure A.2-1: Interworking SM to IM in the originating network

There is no difference in short message addressing for this scenario;

B) only the last hop

This scenario assumes that IP-SM-GW (performing service level interworking) in the terminating network receives an IM that can be interworked to a short message. The IP-SM-GW (acting as SMS Router) may forward the created short message over CS/PS/IP.

Figure A.2-2: Interworking IM to SM in the terminating network

Differences in short message addressing:

1) the originating address will be the IP-SM-GW instead of the SC (cf. table A.1-1), and

2) the A-party address (TP-OA element) can be an implementation dependent value, if E.164 number (MSISDN) is not available in the Instant Message;

For information, the relevant part of 29.311 [7] is copied here.

6.1.5.3.2 Common Procedures

Both the SM-RP-UI parameter of the MT_FORWARD_SHORT_MESSAGE and the RP-User Data element of the RP-DATA message in the SMSIP MESSAGE body shall be set to SMS-DELIVER. And the elements of SMS-DELIVER message shall be set in accordance with 3GPP TS 23.040 [2], with the following information:

a) TP-MTI element set to 00 (SMS-DELIVER);

b) TP-MMS element set in accordance with 3GPP TS 23.040 [2];

NOTE 1: For example, for concatenated Short Messages, TP-MMS would be set to 0 while there are more messages to send.

c) TP-RP element set to 0 (TP-Reply-Path parameter is not set in this SMS-DELIVER);

d) TP-UDHI element set in accordance with 3GPP TS 23.040 [2];

e) TP-SRI element shall be set to 1, if the SIP MESSAGE request contains in a CPIM body a Disposition-Notification header field with the value of "positive-delivery" or "negative-delivery" (i.e. the SIP MESSAGE request sender requests the Instant Message Delivery Notification). Otherwise, the TP-SRI element shall be set to 0;

f) TP-OA element set based on the value of the P-Asserted-Identity header field in the Instant Message if the P-Asserted-Identity header field contains a E.164 address;

NOTE 2: If no E.164 address is present in the P-Asserted-Identity header field, the value of the TP-OA element will be implementation dependant.

g) TP-PID element set to 00000000 (SME-to-SME protocol);

h) TP-DCS element set in accordance with 3GPP TS 23.040 [2];

i) TP-SCTS element set to time when the IP-SM-GW received the Instant Message;

j) TP-UDL element set in accordance with 3GPP TS 23.040 [2]; and

k) TP-UD element set based on the content of Instant Message body.

If the content of the body in Short Message format is greater than the allowed message length of a Short Message, then the IP-SM-GW shall send concatenated Short Messages.

NOTE 3: In case of receiving MT_FORWARD_SHORT_MESSAGE_ACK message with the SM-RP-UI parameter set to value SMS-DELIVER-REPORT, containing the User error parameter for one segment of the concatenated Short Message, the default action of the IP-SM-GW is not to send any remaing segment.

3GPP TS 23.040 [2] specifies that a Short Message supports GSM 7-bit and UCS2 encoded text while an Instant Message may support different text types as defined in 3GPP TS 26.141 [16]. The IP-SM-GW shall reformat the received Instant Message text into an appropriate text type supported for Short Messages.

6.1.5.3.3 Sending of SMS-DELIVER over CS/PS

The parameters of the MT_FORWARD_SHORT_MESSAGE shall be set as described in 3GPP TS 29.002 [7], with the following information:

- Invoke-ID parameter set in accordance with 3GPP TS 29.002 [7];
- SM-RP-DA element set to the address associated with the SIP MESSAGE request receiver;
- SM-RP-OA element set to the address of the IP-SM-GW;
- More Messages To Send parameter set in accordance with 3GPP TS 29.002 [7]; and

NOTE: For example, for concatenated Short Messages, More Messages To Send would be set to 0 while there are more messages to send.

- SM-RP-UI parameter set to SMS-DELIVER.

6.1.5.3.4 Sending of SMS-DELIVER over IP

The IP-SM-GW shall send the SMSIP MESSAGE as described in 3GPP TS 24.341 [5] with the following exceptions:

- the Request-URI mapped from the Request-URI of the associated SIP MESSAGE request; and
- the body of the request shall contain an RP-DATA message. The elements of the RP-DATA message shall be set as described in 3GPP TS 24.011 [9], with the following information:

a) RP-Message Type element set to 001 (network to MS);

b) RP-Message Reference element set in accordance with 3GPP TS 24.011 [9];

c) RP-Originator Address element set to the address of the IP-SM-GW;

d) RP-Destination Address element shall be set to the MSISDN of the associated SIP MESSAGE request receiver, retrieved by the IP-SM-GW as part of the subscriber data from the HSS at registration; and

e) RP-User Data set to SMS-DELIVER.

C) all but the first hop

This scenario assumes that the IP-SM-GW in the originating network receives an IM that can be interworked to a short message.

Figure A.2-3: Interworking IM to SM in the originating network

Differences in short message addressing:

1) the A-party address (RP-OA element) can be an anonymous value, if the privacy settings in the Instant Message requires that and operator policy allows that (no affect on delivering the short message, only B party cannot reply);

For information, the relevant part of 29.311 [7] is copied here.

6.1.6.3 Sending of SMS-SUBMIT over CS/PS

To submit a Short Message to the SC, the IP-SM-GW shall send MO_FORWARD_SHORT_MESSAGE as described in 3GPP TS 29.002 [7] and 3GPP TS 23.040 [2]. In addition, for the information elements listed below, the following interworking procedures shall apply:

- Invoke-ID parameter set in accordance with 3GPP TS 29.002 [7];
- SM-RP-DA parameter set to the address of user's home network Service Centre configured in the IP-SM-GW, or retrieved as part of the subscriber data from the HSS at registration by the IP-SM-GW;
- if the SIP MESSAGE request contains the Privacy header field with "header" or "user" or "id" and the operator policy allows sending of anonymous Short Message, the value of SM-RP-OA shall be set to an anonymous value. If the SIP MESSAGE request does not contain the Privacy header field, the value of the SM-RP-OA shall be set based on the value of the P-Asserted-Identity header field or the address retrieved as part of the subscriber data from the HSS at registration by the IP-SM-GW;
- SM-RP-UI parameter set to SMS-SUBMIT; and
- the elements of the SMS-SUBMIT message shall be set as described in 3GPP TS 23.040 [2] subclause 9.2.2, with the following information:

a) TP-MTI element set to 01 (SMS-SUBMIT);

b) TP-RD element set to 1 (Instruct the SC to reject an SMS SUBMIT for an SM still held in the SC which has the same TP MR and the same TP DA as the previously submitted SM from the same OA.);

c) if the SIP MESSAGE request contains an Expires header field with a non-zero value, the value of TP VPF element shall be set according to the TP VP element. Otherwise, the value of TP VPF element shall be set to 00 (TP VP field not present);

d) TP VP element set based on the Expires header field value and the optional Date header field value;

e) TP-UDHI element set in accordance with 3GPP TS 23.040 [2];

f) if the SIP MESSAGE request contains in a CPIM body a Disposition-Notification header field with the value of "positive-delivery" or "negative-delivery" (i.e. the SIP MESSAGE request sender requests the Instant Message Delivery Notification), the value of TP SRR element shall be set to 1 (A status report is requested), Otherwise, the value of TP-SRR element shall be set to 0 (A status report is not requested);

g) TP-MR element set in accordance with 3GPP TS 23.040 [2];

h) TP-RP element set to 0 (TP Reply Path parameter is not set in this SMS SUBMIT);

i) TP-DA element set based on the value of the Request-URI in the Instant Message as long as the Request-URI contains a E.164 address;

j) TP-PI element set to 00000000 (SME-to-SME protocol);

k) TP-DCS element set in accordance with 3GPP TS 23.040 [2];

l) TP-UDL element set in accordance with 3GPP TS 23.040 [2]; and

m) TP-UD element set based on the content of Instant Message body.

If the content of the body in Short Message format is greater than the allowed message length of a Short Message, then the IP-SM-GW shall send concatenated Short Messages.

NOTE: In case of receiving MO_FORWARD_SHORT_MESSAGE_ACK message with the SM-RP-UI parameter set to value SMS-SUBMIT-REPORT, containing the User error parameter for one segment of the concatenated Short Message, the default action of the IP-SM-GW is not to send any remaing segment.

3GPP TS 23.040 [2] specifies that a Short Message supports GSM 7-bit and UCS2 encoded text while an Instant Message may support different text types as defined in 3GPP TS 26.141 [16]. The IP-SM-GW shall reformat the received Instant Message text into an appropriate text type supported for Short Messages.

D) all but the last hop

This scenario assumes that the IP-SM-GW in the terminating network receives a short message that can be interworked to an Instant Message. Note that in this case the DELIVERY-REPORT is generated by the IP-SM-GW based on IM response and sent to the SC.

Figure A.2-4: Interworking SM to IM in the terminating network

There is no difference in short message addressing for this scenario.

E) only the hops not involving the UE

This scenario assumes that the IP-SM-GW in the originating network receives an IM that can be interworked to a short message, and the IP-SM-GW in the terminating network interworks the respective short message back to Instant Message. This can be considered as the combination of scenario C and D, just listed here for completeness, the combination does not introduce any new requirement for the addressing in the SMS part of the message path.

Figure A.2-5: Double interworking: IM to SM followed by SM to IM

F) only the hops involving the UE

This scenario assumes that the IP-SM-GW in the originating network receives an SM over IP that can be interworked to an Instant Message, and the IP-SM-GW in the terminating network interworks the respective IM back to short message. This can be considered as the combination of scenario A and B, just listed here for completeness, the combination does not introduce any new requirement for the addressing in the SMS parts of the message path.

Figure A.2-6: Double interworking: SM to IM followed by IM to SM

Annex B:
Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
07-2011	-	-	-	-	Initial draft	-	0.0.1
07-2011	-	-	-	-	Including agreed P-CRs (S2-113541, S2-113542, S2-113728, S2-113402)	0.0.1	0.1.0
10-2011					Including agreed P-CRs (S2-114428, S2-114427, S2-114429, S2-114289, S2-114406) and aligning the figure naming convention, and general reformatting	0.1.0	0.2.0
11-2011					Including agreed P-CRs (S2-115219, S2-115195, S2-115025, S2-115218, S2-115197, S2-115198, S2-115199) and minor reformatting	0.2.0	0.3.0
12-2011	SP-54	SP-110759	-	-	MCC update to version 1.0.0 for presentation to TSG SA for information	0.3.0	1.0.0
02-2012	SA2 #89				Including agreed P-CRs: S2-120842, S2-120660, S2-120847	1.0.0	1.1.0
04-2012	SA2 #90				Including agreed P-CRs: S2-121613, minor editorial to incorrect header numbering.	1.1.0	1.2.0
05-2012	SA2 #91				Including agreed P-CRs: S2-122373, S2-122374.		
07-2012	SA2 #92				Including agreed P-CRs: S2-123179, S2-123171, S2-123182, S2-123174	1.3.0	1.4.0
11-2012	SA2 #94				Including agreed P-CRs: S2-124237, S2-124607, S2-124541, and minor editorials	1.4.0	1.5.0
2012-11	SP-56	SP-120731	-	-	MCC editorial update to version 2.0.0 for presentation to TSG SA for Approval	1.5.0	2.0.0