

# 3GPP TR 29.818 V0.1.1 (2012-03)

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*Technical Report*

## **3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Study on the enhancement of protocols for SMS service over SGs; (Release 11)**



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**Keywords**

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# Contents

Foreword .....	5
1 Scope .....	6
2 References.....	6
3 Definitions, symbols and abbreviations .....	6
3.1 Definitions .....	6
3.2 Symbols.....	6
3.3 Abbreviations.....	7
4 SMS over SGs architecture and alternative protocols .....	7
4.1 Requirements for alternative protocols to SMS over SGs architecture.....	7
4.2 SMS over SGs architecture and impacted protocols .....	7
4.3 Solutions with alternative protocols.....	10
4.3.1 Solution with Diameter .....	10
4.4 Solutions comparison.....	10
5 Procedures over the C interface for SMS .....	11
5.1 General .....	11
5.2 Description of the procedures.....	11
5.2.1 Send Routing Info for SM procedure .....	11
5.3 Implementation with alternative protocols.....	13
5.3.1 Implementation with Diameter .....	13
5.3.2 Implementation with another IETF based protocol.....	14
5.4 Comparison of protocol alternatives .....	14
6 Procedures over the D interface for SMS .....	14
6.1 General .....	14
6.2 Description of the procedures.....	14
6.2.x Procedure XXX .....	14
6.3 Implementation with alternative protocols.....	14
6.3.1 Implementation with Diameter .....	14
6.4 Comparison of protocol alternatives .....	14
7 Procedures over the E interface for SMS.....	14
7.1 General .....	14
7.2 Description of the procedures.....	15
7.2.1 MO Forward Short Message procedure .....	15
7.2.2 MT Forward Short Message procedure.....	16
7.3 Implementation with alternative protocols.....	17
7.3.1 Implementation with Diameter .....	17
7.4 Comparison of protocol alternatives .....	18
8 Interworking with other networks.....	18
8.1 Interworking use cases.....	18
8.1.1 General.....	18
8.1.2 Diameter based sending HPLMN and MAP based receiving HPLMN .....	18
8.1.3 Diameter based sending HPLMN and receiving HPLMN .....	21
8.1.4 MAP based sending HPLMN and Diameter based receiving HPLMN .....	21
8.1.5 Interworking with SMPP protocol .....	24
8.1.6 Conclusions on interworking use cases .....	25
8.2 Interworking Function with alternative protocols.....	26
8.2.1 Interworking Function with Diameter .....	26
8.3 Comparison of protocol alternatives .....	26

8 Comparison of solutions .....26

9 Recommendations .....26

**Annex A (informative): Change history.....26**

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# Foreword

This Technical Specification has been produced by the 3<sup>rd</sup> 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.

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# 1 Scope

The present document is a study on alternative protocols for the SMS over SGs architecture. Several involved interfaces are using MAP protocols for which alternative protocols will be analysed.

After addressing the requirements to introduce these protocol alternatives, the TR will identify which MAP procedures on the different interfaces for SMS need to have their equivalent with alternative protocols and will give their description with them. Interworking with other networks will be analysed with the possible use of interworking functions.

It will compare solutions with alternative protocols and make recommendations.

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# 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 TS 23.272: "Circuit Switched (CS) fallback in Evolved Packet System (EPS); Stage 2"
- [4] 3GPP TS 29.002: "Mobile Application Part (MAP) specification"

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# 3 Definitions, symbols and abbreviations

*Delete from the above heading those words which are not applicable.*

*Clause numbering depends on applicability and should be renumbered accordingly.*

## 3.1 Definitions

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

*Definition format (Normal)*

*<defined term>: <definition>.*

## 3.2 Symbols

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

*Symbol format (EW)*

<symbol>      <Explanation>

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [x] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [x].

*Abbreviation format (EW)*

<ACRONYM>   <Explanation>

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# 4 SMS over SGs architecture and alternative protocols

## 4.1 Requirements for alternative protocols to SMS over SGs architecture

*This subclause will describe the requirements for introducing alternative protocols to SMS over SGs architecture.*

Currently, SMS service over LTE relies either on the use of the SGs interface between MME and MSC-VLR, or on the SMS over IP solution relying on IMS.

Operators may have to consider a SMS over SGs solution as not all UEs may be expected to support the necessary IMS client (e.g. M2M devices, dongles, inbound roamers). Nevertheless, the solution SMS over SGs requires the support of MAP interfaces on the HSS/HLR, MSC-VLR, SMS-GMSC, SMS-IW MSC and SMS router.

For networks supporting LTE but no 3GPP CS Services other than SMS over SGs (e.g. CDMA networks) and supporting users (and their device) that are only PS or inbound roamers only having PS access in the VPLMN, operators may want to avoid to deploy MAP based interfaces on many network entities only for a SMS use over LTE and instead use alternative protocols.

In EPS, there is also a principle to avoid relying on MAP (apart interworking cases with legacy entities) but to preferably rely on IETF based protocols such as Diameter.

As interworking with other PLMNs still requires MAP interfaces, the Technical Report will address the interworking between the LTE PLMNs using alternative protocols for SMS with PLMNs using MAP protocols for SMS.

There is the requirement to have no impact on Rel8 and later releases UEs using the SMS over SGs architecture. It will be achieved by the introduction of alternative protocols for SMS, without impact on the 3GPP architecture for SMS over SGs. Other SMS architecture approaches are outside the scope of this TR.

This study will not address the use of alternative protocols for the SMS over IP architecture relying on IMS.

The MSC-VLR supports SMS over SGs. Instead of interacting via MAP with the HSS, the MSC-VLR will use an alternative protocol for the D interface. Similarly the SMS-GMSC/SMS-IW MSC and SMS-Router will use an alternative protocol for the interface with HSS instead of MAP. The E interface between MSC-VLR, the SMS-GMSC/SMS-IW MSC and SMS-Router will also use an alternative protocol.

Among the possible alternative protocols, the study will, in particular, analyse the use of Diameter based protocols.

Functional entities with dual stacks MAP / alternative protocol or Interworking Functions will be deployed at the network border to interact with external networks only supporting MAP for SMS.

## 4.2 SMS over SGs architecture and impacted protocols

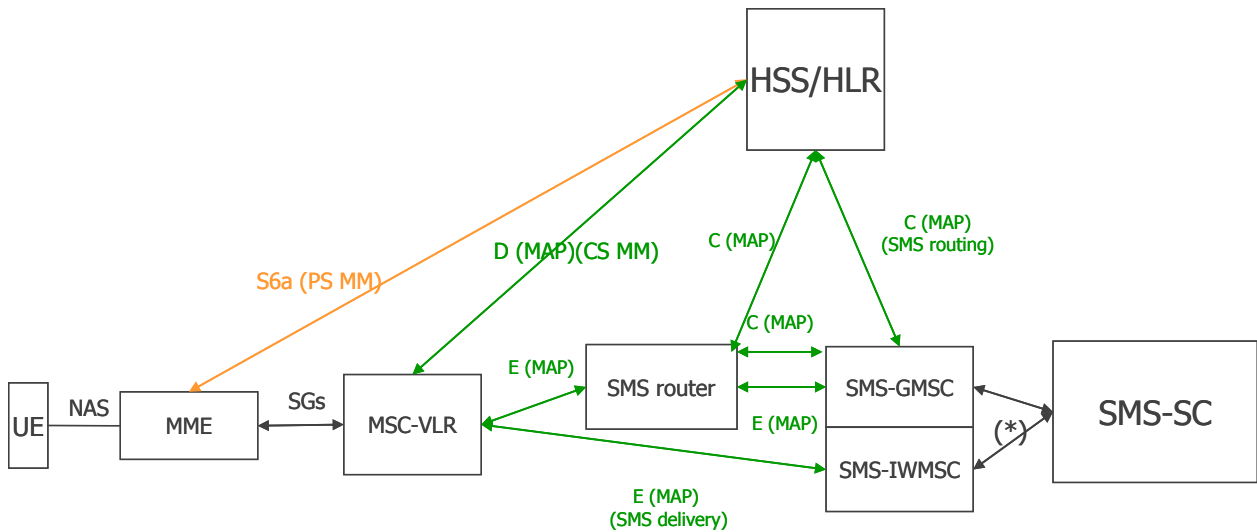
*This subclause will describe the existing SMS over SGs architecture with the impacted MAP protocols. According to the interface, it will indicate the MAP procedures needed for the SMS support and that should have their equivalent in alternative protocols.*

The following figure presents the 3GPP SMS over SGs architecture as described according to 3GPP TS 23.040 [2] and 3GPP TS 23.272 [3], with the involved functional entities and reference points. It indicates the following reference points specified in stage 3 with MAP protocols:

- C reference point for SMS supported by HSS/HLR, SMS-GMSC, SMS-IWMSC, SMS-Router
- D reference point supported by HSS/HLR, MSC-VLR
- E reference point for SMS supported by MSC, SGSN, SMS-GMSC, SMS-IWMSC, SMS-Router.

This figure does not contain SGSNs as the primary objective of the Technical Report is to study the support of PS only UEs connected to a LTE network with access via MME and with a SMS over SGS architecture. Nevertheless, the introduction of SGSNs supporting related existing SMS specifications should be applicable.

Editor’s note: further investigation to include SGSNs to be done.



**Figure 4.2-1: SMS over SGs architecture and MAP protocols**

Editor’s note: Figure to be described with the Visio tool.

NOTES: (\*) No mandatory protocol between the SMS-SC and the SMS-GMSC/IWMSC is specified by 3GPP below the transfer (TP) layer.

SMS Router is part of the architecture, but is optional and used for MT SMS delivery .

The following table lists the MAP procedures specific to SMS, described in 3GPP TS 29.002 [4] subclause 12. It indicates if they apply to the C, D or E interfaces and with which functional entities.



	C interface	D interface	E interface
MAP-SEND-ROUTING-INFO-FOR-SM	SMS-GMSC / HLR / SMS Router SMS-IWMSC /HLR		
MAP-MO-FORWARD-SHORT-MESSAGE			Serving MSC / SMS-IWMSC
MAP-REPORT-SM-DELIVERY-STATUS	SMS-GMSC / HLR		
MAP-READY-FOR-SM		Serving MSC-VLR / HLR	
MAP-ALERT-SERVICE-CENTRE	HLR / SMS-IWMSC		
MAP-INFORM-SERVICE-CENTRE	HLR / SMS Router/ SMS-GMSC		
MAP-SEND-INFO-FOR-MT-SMS (internal to MSC-VLR, so outside the scope )			
MAP-SEND-INFO-FOR-MO-SMS (internal to MSC-VLR, outside the scope )			
MAP-MT-FORWARD-SHORT-MESSAGE			SMS-GMSC / SMS Router/ Serving MSC
MAP-MT-FORWARD-SM-FOR-VGCS For on going voice group call: so outside the scope of the TR			

**Table 4.1-2: MAP procedures specific to SMS**

For SMS over C and E interfaces, no other MAP procedures are required.

For the D interface, other MAP procedures not specific to SMS are required to ensure SMS:

- MAP\_UPDATE\_LOCATION
- MAP\_CANCEL\_LOCATION
- MAP\_INSERT\_SUBSCRIBER\_DATA

As no CS service apart SMS is configured, the CS subscription data in HLR would be limited to the SMS related subscription data (eg SMS teleservice)

- MAP\_DELETE\_SUBSCRIBER\_DATA

This procedure is used to remove the SMS related subscription data when unsubscribed.

The hereunder MAP procedures over D interface are not required as such for the SMS support but may nevertheless require an equivalent Diameter based procedure.

- MAP\_PURGE
- MAP\_RESET

VLR will have then to restore its number in HLR at first radio contact

- MAP\_RESTORE\_DATA

This procedure may be part of the restoration procedure after VLR restart or HLR reset

- MAP\_PROVIDE\_SUBSCRIBER-INFO  
May be used by HLR, but not related as such to SMS.
- MAP-ACTIVATE/DEACTIVATE-TRACE-MODE  
May be used by HLR, but not related as such to SMS.

Other MAP procedures over D interface do not require Diameter equivalent over D interface when used for SMS.

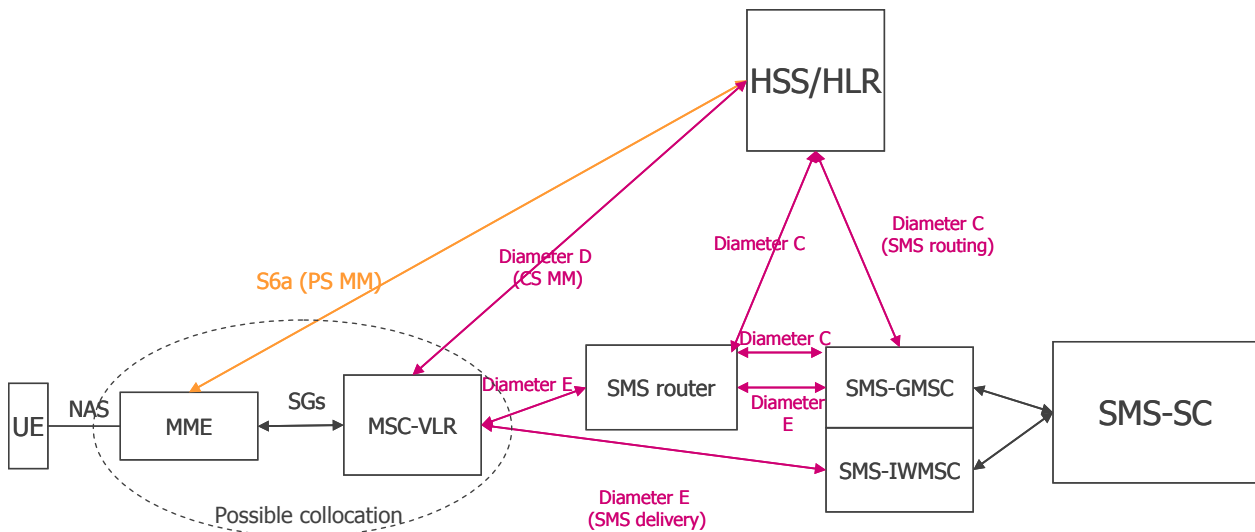
*Editor's note: Further investigation and confirmation is to be done on the MAP procedures for which should be defined equivalent Diameter based procedures over D interface*

### 4.3 Solutions with alternative protocols

#### 4.3.1 Solution with Diameter

*This subclause will describe which interfaces supporting MAP protocols for SMS over SGs should be replaced by Diameter based protocols.*

The architecture presented in the following figure is the same as in figure 4.1-1. The reference points (C, D, E) previously with MAP protocols here support Diameter based protocols.



**Figure 4.3-1: Title missing**

The functionalities of the MSC-VLR are limited to those required to support SMS.

The MME and MSC VLR can be collocated.

This figure does not contain SGSNs as the primary objective of the Technical Report is to study the support of PS only UEs connected to a LTE network with access via MME. Nevertheless, this figure should be compatible with introduction of SGSNs supporting MAP E interface and Gr or S6d interfaces. It should also allow supporting S4-SGSNs with Diameter E interface. The further description of Diameter C for SMS interface takes into account SGSN related handling.

*Editor's note: further investigation to include or not SGSNs with MAP E interface and Gr or S6d interfaces or S4-SGSNs with Diameter E to be done.*

*Editor's note: further investigation to do about the Diameter variants that can be used for the C interface: e.g. variants based on new Diameter commands or reusing commands defined for the Sh interface.*

## 4.4 Solutions comparison

*This subclause will do a comparison of the solutions described in subclause 4.3*

---

# 5 Procedures over the C interface for SMS

*In order to prepare the TS work, this subclause will give a description of some of the procedures that are equivalent to the MAP procedures and that are required for the C interface for SMS over SGs.*

## 5.1 General

In order to prepare the TS work and to have a more detailed view of procedures content, this clause lists the equivalent procedures equivalent to the MAP ones for the C interface used for SMS and describe some of them. They include a description of the information elements of the procedure, their category (Mandatory, Conditional, Optional) and the behaviour of the involved entities for the interface.

The equivalent procedures to MAP procedures over the C interface for SMS comprise:

- Send Routing Info for SM procedure equivalent to the MAP-SEND-ROUTING-INFO-FOR-SM procedure
- Report SM Delivery Status procedure equivalent to the MAP-REPORT-SM-DELIVERY-STATUS procedure
- Alert Service Centre procedure equivalent to the MAP-ALERT-SERVICE-CENTRE procedure
- Inform Service Centre procedure equivalent to MAP-INFORM-SERVICE-CENTRE.

## 5.2 Description of the procedures

### 5.2.1 Send Routing Info for SM procedure

*Each of the procedure examples covered in the TR for the C interface for SMS will be covered through such a subclause. The description is independent of the protocol.*

**Editor's note: The subclause content and its detailed wording may require further investigation and complements.**

This procedure shall be used between the SMS-GMSC and the HSS to retrieve the routing information needed for routing the short message to the serving MSC or SGSN. This procedure is also used between the SMS-GMSC and the SMS Router, and between the SMS Router and the HSS in order to enforce routing of the SM delivery via the HPLMN of the receiving MS.

This procedure is used according to the call flows described in 3GPP TS 23.040 [2] clause 10.

**Editor's note: to also investigate the use of this procedure by the IP-SM-GW to allow SM delivery via IMS and by the SMS-IW MSC towards the home HSS of the SM destination user.**

Table 5.2.1-1 specifies the involved information elements for the request.

Table 5.2.1-2 specifies the involved information elements for the answer.

**Table 5.2.1-1: Send-Routing Info for SM Request**

<b>Information element name</b>	<b>Cat.</b>	<b>Description</b>
MSISDN	M	This information element shall contain the MSISDN of the user.
Supported Features (See 3GPP TS 29.229 [9])	O	If present, this Information Element shall contain the list of features supported by the origin host.
SM-RP-PRI	M	This information element shall indicate whether or not delivery of the short message shall be attempted when a service centre address is already contained in the Message Waiting Data file.
Service Centre Address	M	This information element shall contain the Service Centre address.
SM-RP-MTI	C	This information element shall contain the RP-Message Type Indicator of the Short Message. It is used to distinguish a SM sent to the mobile station in order to acknowledge an MO-SM initiated by the mobile from a normal MT-SM. This information element is formatted according to the formatting rules of address fields as described in 3GPP TS 23.040 [2].
SM-RP-SMEA	C	This information element shall contain the RP-Originating SME-address of the Short Message Entity that has originated the SM. This information element shall be present if the SMS-GMSC supports receiving of the two numbers from the HSS. Used by the short message service relay sub-layer protocol it shall be formatted according to the formatting rules of address fields as described in 3GPP TS 23 040 [2].
GPRS Support Indicator	C	This information element shall indicate that the SMS-GMSC supports GPRS specific procedure of combined delivery of Short Message via MSC and/or via the SGSN.
SM-Delivery Not Intended	O	This information element, when present, shall indicate that delivery of a short message is not intended. It further indicates whether only IMSI or only MCC+MNC are requested. This information element may be set by entities that request the service without intending to deliver a short message, and shall be evaluated by the SMS Router and may be evaluated by the HLR

Table 5.2.1-2: Send-Routing Info for-SM Answer

Information element name	Cat.	Description
Supported Features	O	If present, this information element shall contain the list of features supported by the origin host.
Result	M	This information element shall contain the result of the operation with an indication of the success / errors. The following errors are applicable in this case: <ul style="list-style-type: none"> <li>- Unknown subscriber;</li> <li>- Call Barred;</li> <li>- Teleservice Not Provisioned;</li> <li>- Absent Subscriber;</li> <li>- Facility Not Supported;</li> <li>- System failure;</li> <li>- Unexpected Data Value;</li> <li>- Data missing.</li> </ul>
IMSI	C	This information element: <ul style="list-style-type: none"> <li>- either shall contain the IMSI of the user.</li> <li>- or, if enforcement of routing an SM via the HPLMN of the receiving MS is deployed, shall contain an MT Correlation ID instead of an IMSI when the service is used between SMS-GMSC and SMS Router (see 3GPP TS 23.040 [26] for more information).</li> <li>- or, if the "SM-Delivery Not Intended" Information Element was present in the request with a value of "only MCC+MNC requested", may contain MCC+MNC+dummy MSIN.</li> </ul> This information element shall be present in a successful answer
Network Node Number	C	This information element either: <ul style="list-style-type: none"> <li>- shall contain the ISDN number of MSC or the ISDN number of SGSN,</li> <li>- or if the "SM-Delivery Not Intended" Information Element was present in the request, may contain a dummy address.</li> </ul> This information element shall be present in a successful answer
GPRS Node Indicator	C	This information element shall be present and indicate if the Network Node Number contains a SGSN Number
Additional Number	C	This information element, when present, shall contain either the SGSN number or the MSC number

Editor's note: Descriptions of information elements and of the errors specified in the Result information element are currently based on those specified in MAP-SEND-ROUTING-INFO-FOR-SM and should be further investigated.

Editor's note: Diameter addresses identifying a node to be investigated,

## 5.3 Implementation with alternative protocols

### 5.3.1 Implementation with Diameter

A Diameter application will be defined for the C interface for SMS.

A Diameter command pair (Request, Answer) will be associated to each of the procedures:

- Send Routing Info for SM
- Report SM Delivery Status
- Alert Service Centre
- Inform Service Centre.

Information elements will be coded into new or reused Diameter AVPs.

Regarding to the result of the operations, the Result-Code AVP will be used to indicate success / errors defined in the Diameter Base Protocol. The Experimental-Result AVP will be used for errors in the Diameter C for SMS application.

*Editor's note: Another implementation with Diameter but using commands defined for the Sh interface to be investigated.*

### 5.3.2 Implementation with another IETF based protocol

For the C interface for SMS, there is no solution described with another IETF based protocol than Diameter.

## 5.4 Comparison of protocol alternatives

*This subclause will do a comparison of the protocol alternatives for the C interface.*

---

# 6 Procedures over the D interface for SMS

*In order to prepare the TS work, this subclause will give a description of some of the procedures that are equivalent to the MAP procedures and that are required for the D. interface for SMS over SGs.*

## 6.1 General

## 6.2 Description of the procedures

### 6.2.x Procedure XXX

*Each of the procedure examples covered in the TR for the D interface for SMS will be covered through such a subclause. The description is independent of the protocol.*

## 6.3 Implementation with alternative protocols

### 6.3.1 Implementation with Diameter

*This subclause will address implementation aspects related to the use of a Diameter based protocol for the D interface for SMS.*

## 6.4 Comparison of protocol alternatives

*This subclause will do a comparison of the protocol alternatives for the D interface.*

---

# 7 Procedures over the E interface for SMS

## 7.1 General

In order to prepare the TS work and to have a more detailed view of procedures content, this clause list the equivalent procedures equivalent procedures to the MAP ones for the E interface used for SMS and describe some of them. They include a description of the information elements of the procedure, their category (Mandatory, Conditional, Optional) and the behaviour of the involved entities for the interface.

The equivalent procedures to MAP procedures over the E interface for SMS comprise:

- MO Forward Short Message equivalent to the MAP-MO-FORWARD-SHORT-MESSAGE procedure

- MT Forward Short Message equivalent to the MAP-MT-FORWARD-SHORT-MESSAGE procedure

## 7.2 Description of the procedures

### 7.2.1 MO Forward Short Message procedure

*Each of the procedure examples covered in the TR for the E interface for SMS will be covered though such a subclause. The description is independent of the protocol.*

**Editor's note: The subclause content and its detailed wording may require further investigation and complements.**

This procedure shall be used between the serving MSC and the SMS-IW MSC to forward mobile originated short messages.

This procedure is used according to the call flows described in 3GPP TS 23.040 [2] clause 10.

Table 7.2.1-1 specifies the involved information elements for the request.

Table 7.2.1-2 specifies the involved information elements for the answer.

**Table 7.2.1-1: MO Forward Short Message Request**

Information element name	Cat.	Description
SMRP DA	M	This information element shall contain the Service Centre address received from the mobile station.
Supported Features	O	If present, this information element shall contain the list of features supported by the origin host.
SMRP OA	M	This information element shall contain the MSISDN of the user
SMRP UI	M	This information element shall contain the short message transfer protocol data unit

**Table 7.2.1-2: MO-Forward Short Message Answer**

Information element name	Cat.	Description
Supported Features	O	If present, this information element shall contain the list of features supported by the origin host.
Result	M	This information element shall contain the result of the operation with an indication of the success / errors. The following errors are applicable in this case: <ul style="list-style-type: none"> <li>- Facility Not Supported;</li> <li>- System Failure;</li> <li>- SM Delivery Failure;</li> <li>- Unexpected Data Value.</li> </ul>
Error Diagnostic	C	If the Result information element indicates " SM Delivery Failure ", this information element shall be present and indicate one of the following <ul style="list-style-type: none"> <li>- unknown Service Centre address;</li> <li>- Service Centre congestion;</li> <li>- invalid Short Message Entity address;</li> <li>- subscriber not Service Centre subscriber;</li> <li>- protocol error.</li> </ul>

**Editors' note: Descriptions of information elements and of the errors specified in the Result and Error Diagnostic information element are currently based on those specified in MAP-MO-FORWARD-SHORT-MESSAGE and should be further investigated.**

### 7.2.2 MT Forward Short Message procedure

**Editors' note: The subclause and its detailed wording may require further investigation and complements.**

This procedure shall be used between the G-MSC and the serving MSC (transiting an SMS Router, if present) to forward mobile terminated short messages..

This procedure is used according to the call flows described in 3GPP TS 23.040 [2] clause 10.

Table 7.2.2-1 specifies the involved information elements for the request.

Table 7.2.2-2 specifies the involved information elements for the answer.

**Table 7.2.2-1: MT Forward Short Message Request**

Information element name	Cat.	Description
SMRP DA	M	This information element shall contain either an IMSI or a LMSI. The use of the LMSI is an operator option. The LMSI can be provided if it is received from the HLR. The IMSI is used if the use of the LMSI is not available.
Supported Features	O	If present, this information element shall contain the list of features supported by the origin host.
SMRP OA	M	This information element shall contain the Service Centre address.
SMRP UI	M	This information element shall contain the short message transfer protocol data unit.
More Messages To Send	C	This information element indicates whether or not the Service Centre has more messages to send

Editor's note: SM Delivery Timer and SM Delivery Start Time defined in the MAP-MT-FORWARD-SHORT-MESSAGE were introduced for IP-SM-GW, it should be confirmed they have to be introduced in this procedure.

**Table 7.2.2-2: MT Forward Short Message Answer**

Information element name	Cat.	Description
Supported Features	O	If present, this information element shall contain the list of features supported by the origin host.
Result	M	This information element shall contain the result of the operation with an indication of the success / errors. The following errors are applicable in this case: <ul style="list-style-type: none"> <li>- Unidentified subscriber;</li> <li>- Absent Subscriber;</li> <li>- Subscriber busy for MT SMS;</li> <li>- Facility Not Supported;</li> <li>- Illegal Subscriber indicates that delivery of the mobile terminated short message failed because the mobile station failed authentication;</li> <li>- Illegal equipment indicates that delivery of the mobile terminated short message failed because an IMEI check failed, i.e. the IMEI was blacklisted or not white-listed;</li> <li>- System Failure;</li> <li>- SM Delivery Failure;</li> <li>- Unexpected Data Value;</li> <li>- Data Missing.</li> </ul>
Error Diagnostic	C	If the Result information element indicates "SM Delivery Failure", this information element shall be present and indicate one of the following: <ul style="list-style-type: none"> <li>- memory capacity exceeded in the mobile equipment;</li> <li>- protocol error;</li> <li>- mobile equipment does not support the mobile terminated short message service;</li> <li>- protocol error</li> </ul>
SMRP UI	O	This information element may contain a short message transfer protocol data unit in the message delivery acknowledgement from the MSC to the Service Center



Editor's note: Descriptions of information elements and of the errors specified in the Result and Error Diagnostic information element are currently based on of those specified in MAP-MT-FORWARD-SHORT-MESSAGE and should be further investigated.

## 7.3 Implementation with alternative protocols

### 7.3.1 Implementation with Diameter

A Diameter application will be defined for the E interface for SMS.

A Diameter command pair (Request, Answer) will be associated to each of the procedures:

- MO Forward Short Message equivalent to the MAP-MO-FORWARD-SHORT-MESSAGE procedure
- MT Forward Short Message equivalent to the MAP-MT-FORWARD-SHORT-MESSAGE procedure

Editor's note: to investigate if one or two commands pairs will be defined

Information elements will be coded into new or reused Diameter AVPs.

Regarding to the result of the operations, the Result-Code AVP will be used to indicate success / errors defined in the Diameter Base Protocol. The Experimental-Result AVP will be used for errors in the Diameter C for SMS application.

Editor's note: for interworking cases, the functionalities of the IWF to be investigated.

## 7.4 Comparison of protocol alternatives

*This subclause will do a comparison of the protocol alternatives for the E interface.*

---

# 8 Interworking with other networks

## 8.1 Interworking use cases

*This subclause will identify the different interworking use case ,and identify those relying on a dual stack Diameter MAP in some functional elements (e.g. HSS, SMS Router...) and those requiring an interworking Function (IWF)*

### 8.1.1 General

Many use cases for interworking can be identified, with the protocols to be used for the interworking and about the IWFs to be eventually introduced.

Figures in the following subclauses describe the interworking use cases that can occur with a PLMN supporting the SMS over SGs architecture with Diameter or other IETF based protocol and hereafter named "Diameter based PLMN".

NOTE: The "Diameter" expression used in the subclauses of 8.1 can be replaced by "alternative protocol" expression for cases where an alternative protocol is used instead of Diameter.

They take into account:

- if PLMN of the sender or PLMN of the receiver is Diameter based or MAP based
- the roaming cases (inbound or outbound).

It is assumed in these figures that:

- A MSC VLR belonging to a Diameter based PLMN is only with Diameter, so requiring IWFs (Diameter/ MAP) at the network border in some use cases

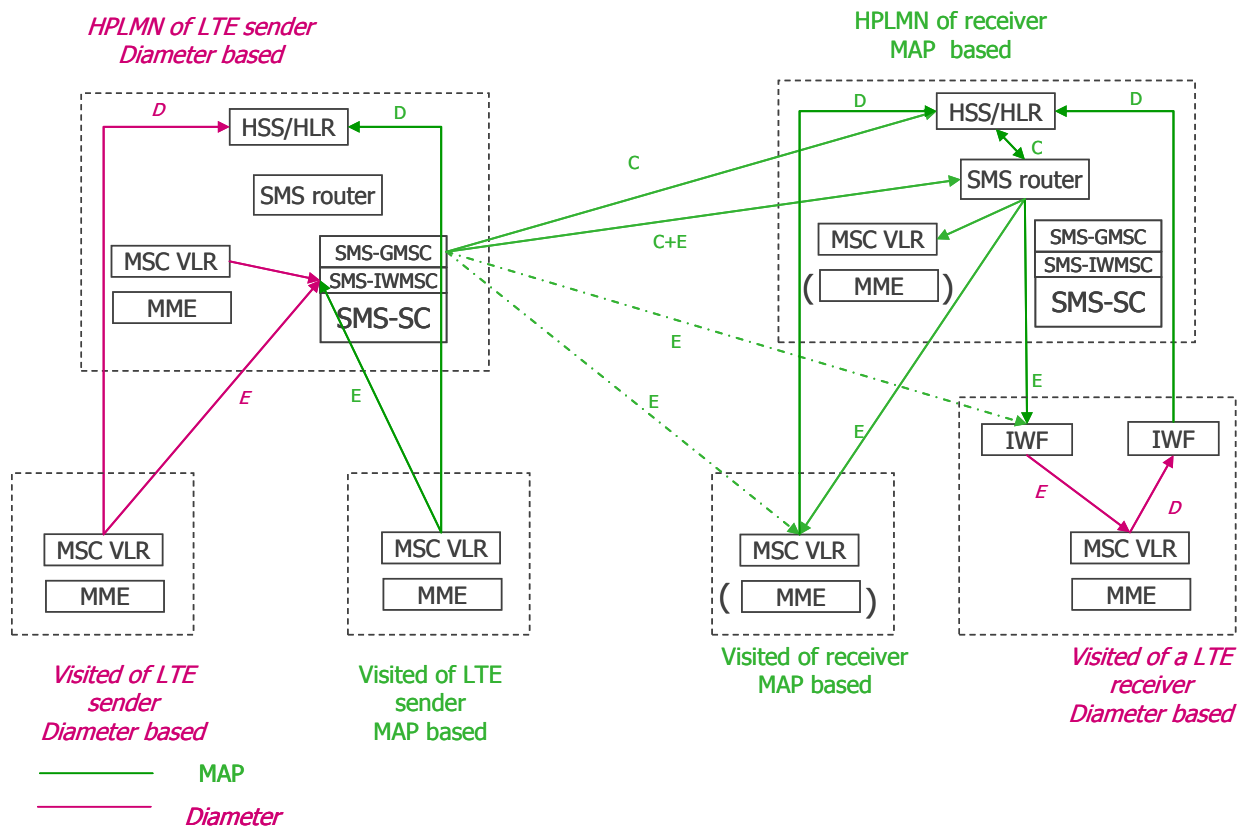
- HSS and central SMS functions (SMS/IWMSC, SMS-GMSC/ SMS Router) in a Diameter based PLMN have dual protocol stacks, MAP and Diameter. Otherwise, if they are only Diameter, it would require additional IWFs to present a MAP protocol to external networks requiring it.

Other assumptions may be taken for these figures. For example, the C interface in all figures is only MAP based.

*Editor's note: additional description in the 8.1 subclauses related to different assumptions such the protocol used (MAP or Diameter) over the C interface may be added.*

The SMPP interworking use case is also presented as largely used between deployed PLMNs for SMS.

### 8.1.2 Diameter based sending HPLMN and MAP based receiving HPLMN



**Figure 8.1.2-1: Diameter based sending HPLMN and MAP based receiving HPLMN interworking.**

*Editor's note: to assess if these figures can be kept with this format without use of Visio.*

Central SMS entities and HSS/HLR in the Diameter based HPLMN of the LTE sender have dual stacks (Diameter and MAP) to interface with other PLMNs.

For the case of an inbound LTE roamer visiting a Diameter based PLMN and belonging to a MAP based HPMLN, there are two IWFs in the Visited network to translate Diameter D and E interfaces into the corresponding MAP D and E interfaces.

The introduction of the IWFs does not modify the Stage 2 call flows described in 3GPP TS 23.040 [2], The IWF is only translating messages from a protocol to another.

Hereafter some examples build upon the call flows figures from 3GPP TS 23.040[2] clause 10.

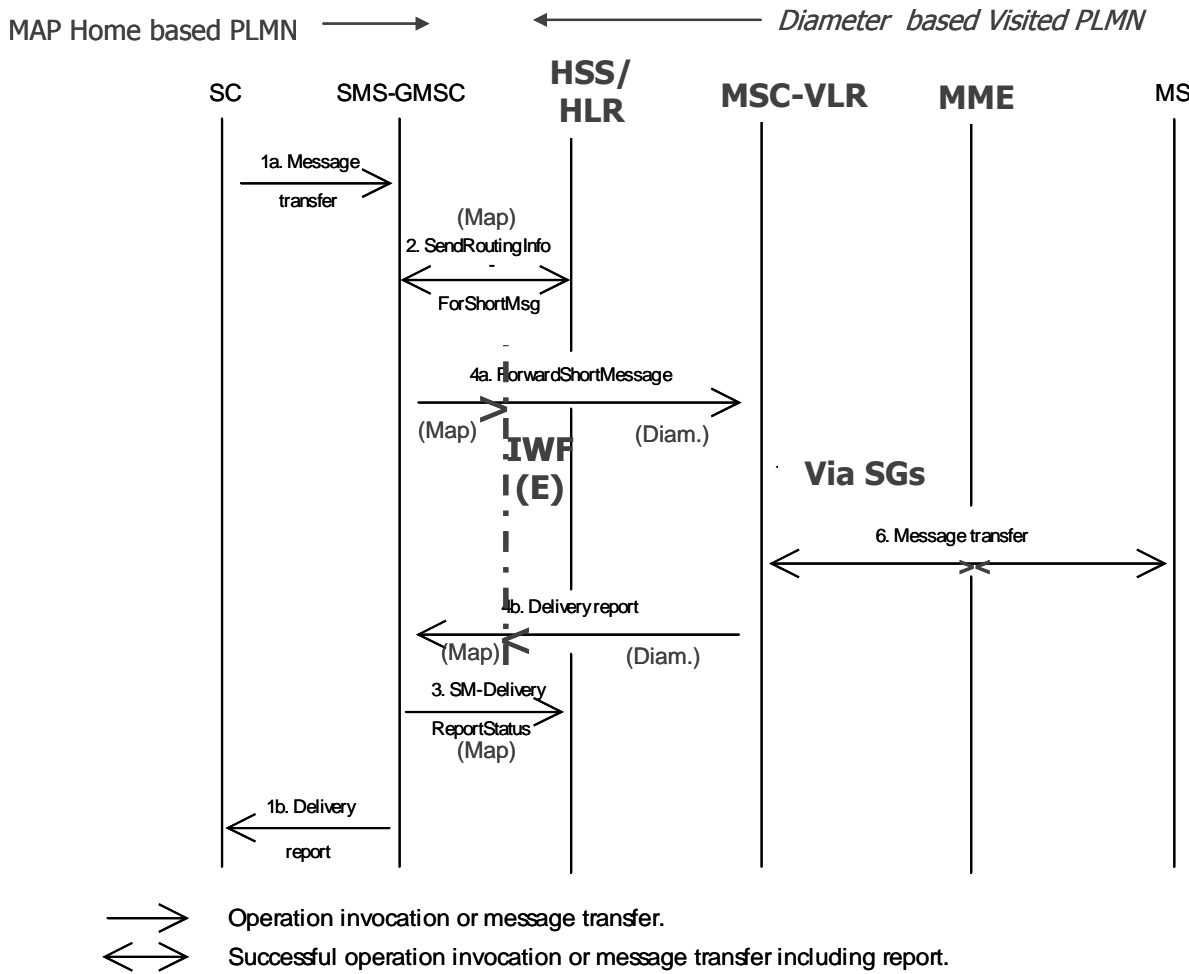


Figure 8.1.2-2; Successful MT short message transfer without SMS Router.

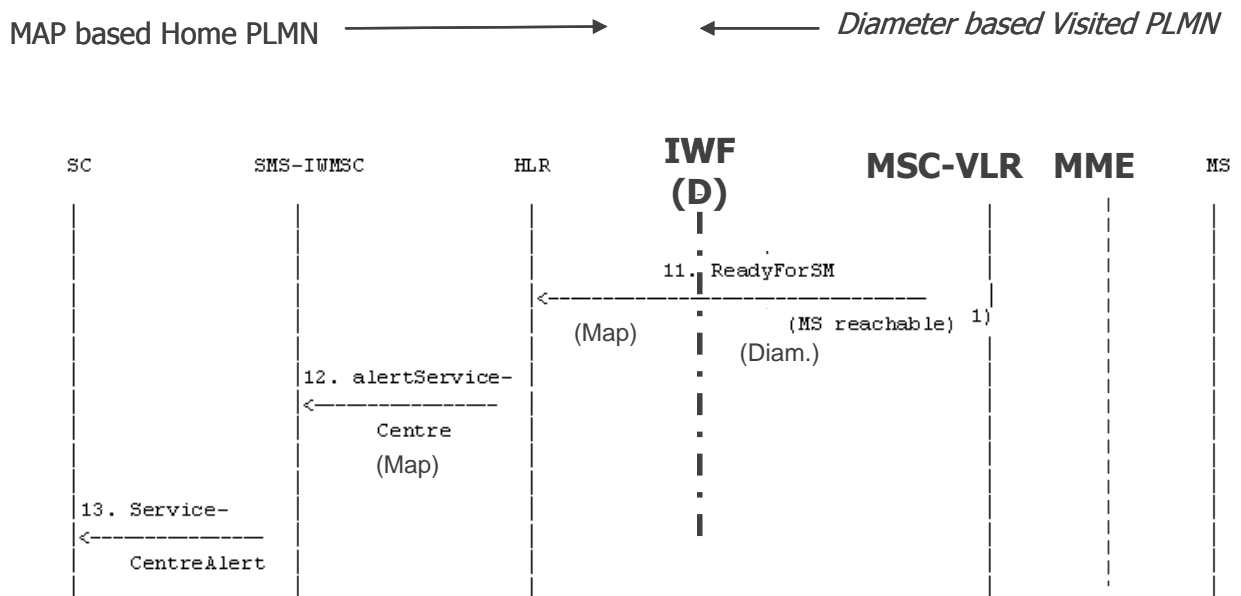
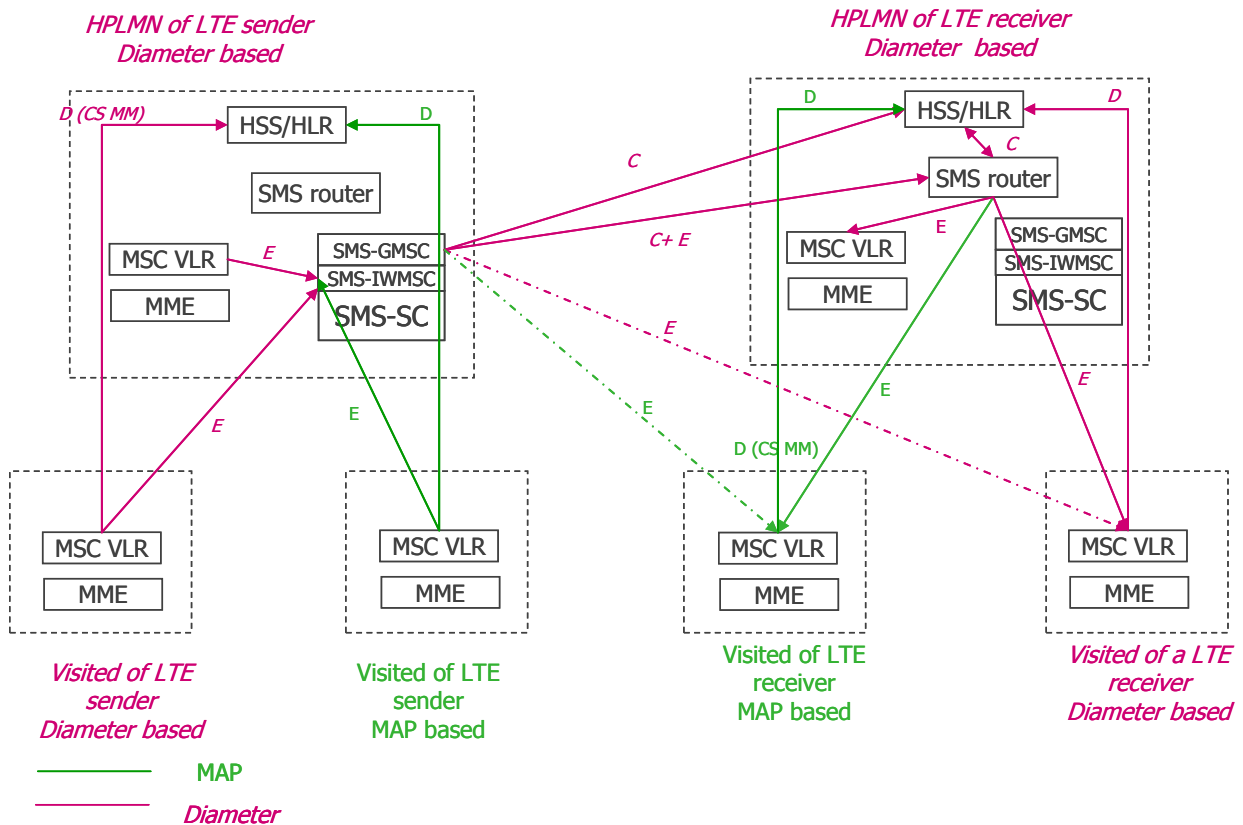


Figure 8.1.2-2; The alert procedure when the MS becomes reachable

### 8.1.3 Diameter based sending HPLMN and receiving HPLMN

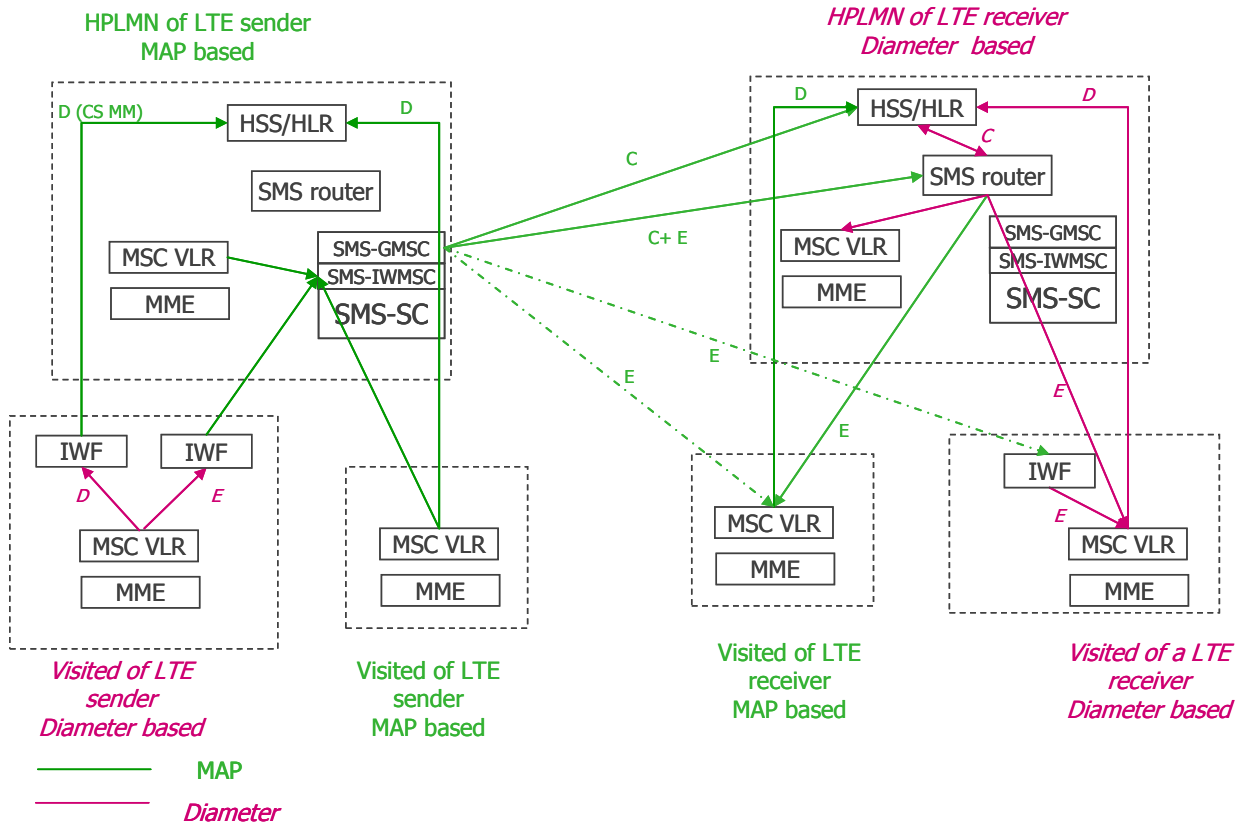


**Figure 8.1.3-1: Diameter based sending HPLMN and receiving HPLMN.**

SMS Router and HSS/HLR in the Diameter based HPLMN of the LTE sender have dual stacks (Diameter and MAP) to interface with visited MAP based PLMNs.

The SMS router, in addition to its SMS functionalities defined in 3GPP TS 23.040 [2] acts as an IWF between Diameter E and MAP E interfaces in the Diameter based HPLMN of the LTE receiver. No other IWFs are identified in this interworking use case.

### 8.1.4 MAP based sending HPLMN and Diameter based receiving HPLMN



**Figure 8.1.4-1: MAP based sending HPLMN and Diameter based receiving HPLMN interworking.**

Central SMS entities and SMS Router in the Diameter based HPLMN of the LTE receiver have dual stacks (Diameter and MAP) to interface with other PLMNs.

Regarding to the C interface, the HSS acts as an IWF when relaying the Send Routing Info for SM received over MAP to the SMS Router over Diameter. The SMS Router has to generate a MAP answer towards the SMS-GMSC when receiving the SRI for SM request received over Diameter from HSS.

**Editor’s note: this handling of the SRI for SM procedure in MAP and Diameter over the C interface requires further investigation.**

The SMS router, in addition to its SMS functionalities defined in 3GPP TS 23.040 [2] acts as an IWF between MAP E and Diameter E interfaces in the Diameter based HPLMN of the LTE receiver. If this SMS Router is not used for transiting, an IWF for the E interface is needed in the visited Diameter based PLMN of the LTE receiver.

For the case of an inbound LTE roamer visiting a Diameter based PLMN and belonging to a MAP based HPMLN, there are two IWFs in the Visited network to translate Diameter D and E interfaces into the corresponding MAP D and E interfaces.

The introduction of the IWFs does not modify the Stage 2 call flows as described in 3GPP TS 23.040 [2]; the IWF is only translating messages from a protocol to another.

Hereafter some examples build upon the call flows figures from 3GPP TS 23 040[2] clause 10.

MAP based Home PLMN → ← Diameter based Visited based PLMN

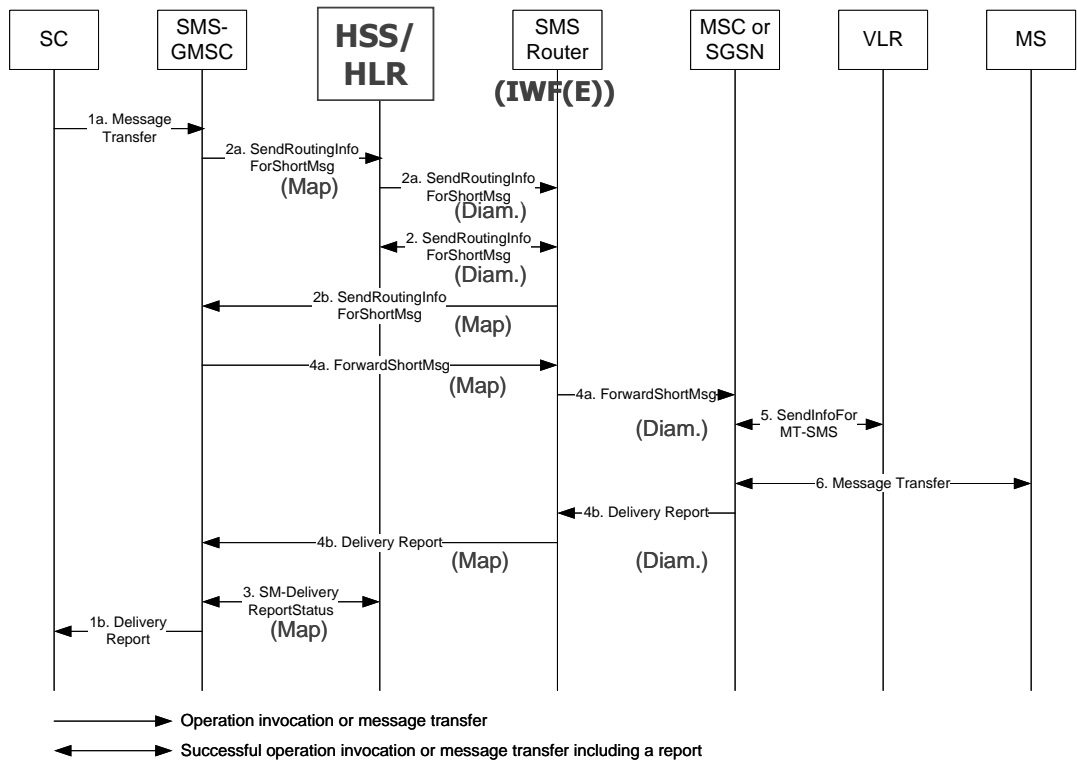


Figure 8.1.4-2; Successful MT short message transfer with SMS Router.

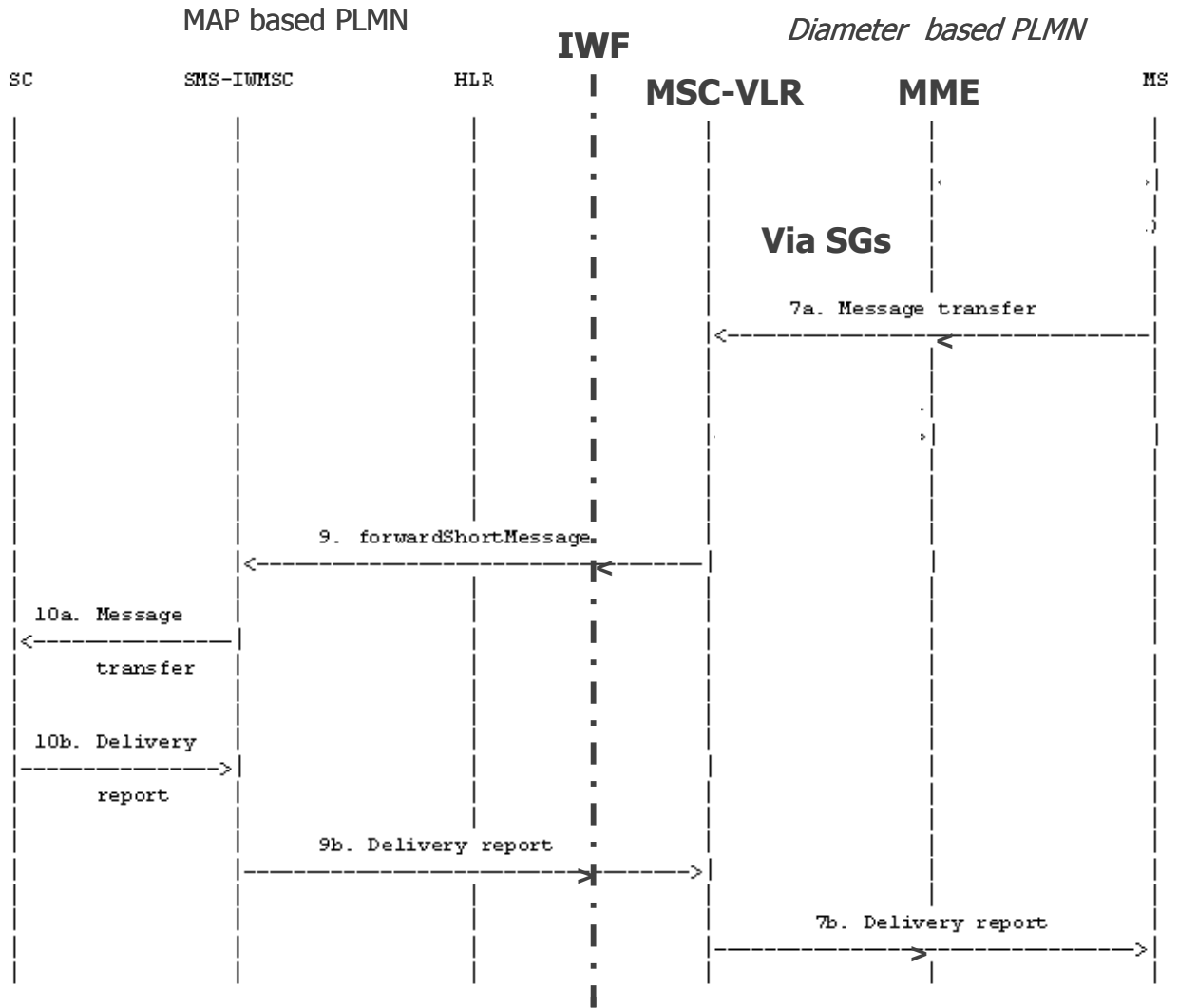
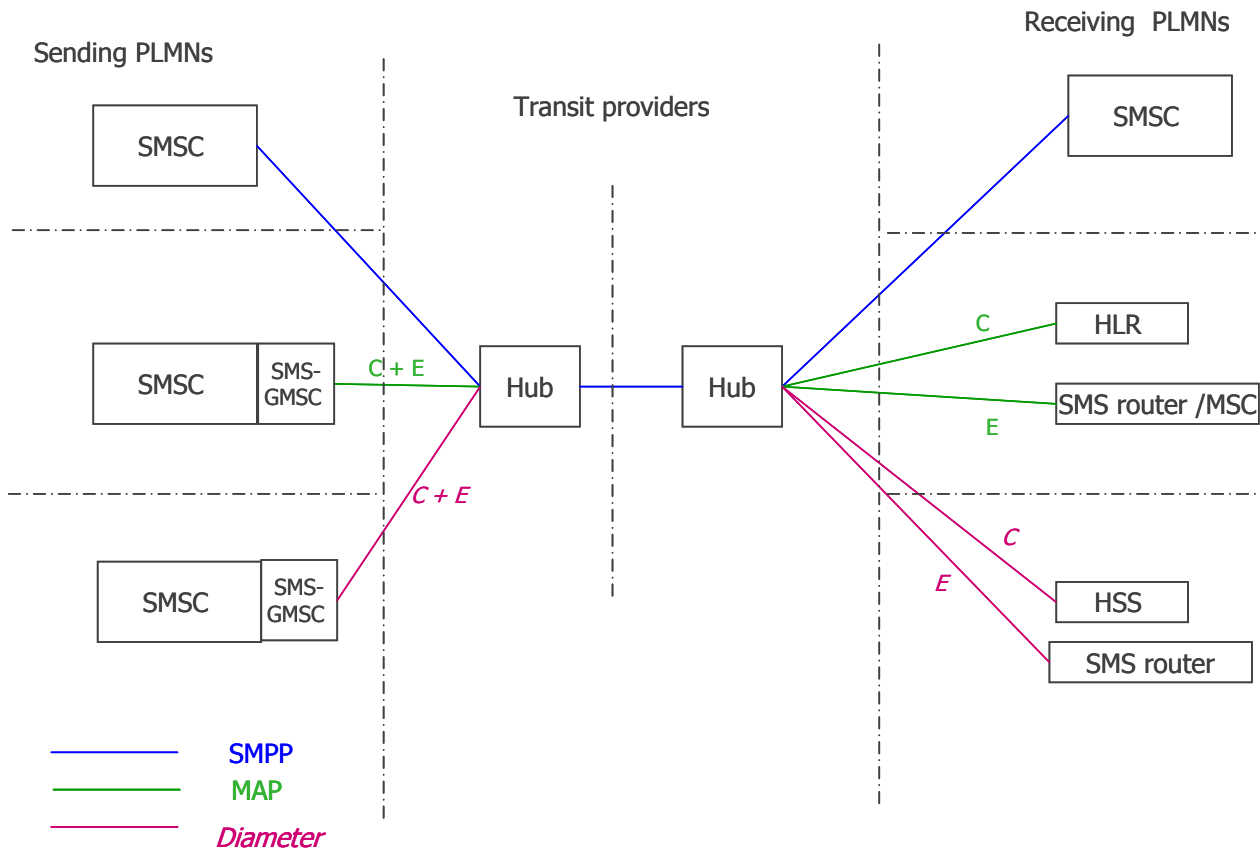


Figure 8.1.4-3; Successful MO short message transfer.

### 8.1.5 Interworking with SMPP protocol

Although SMPP protocol use for SMS interworking between PLMNs is outside 3GPP scope, it is here presented in this Technical Report to analyse the possible impacts of the introduction of Diameter based PLMNSs when interworking is using SMPP protocol.

The hereafter figure gives a high level view of the architecture when PLMNs use the SMPP protocol for SMS interworking. It indicates the possible protocols SMPP or MAP that may be used on the various interfaces and it introduces the possible use of Diameter over C and E interfaces.



**Figure 8.1.5-1: Interworking with the SMPP protocol.**

Hubs functional entities may, according to the use cases, behave as a virtual HLR/HSS and/or MSC-VLR and/or SMS-GSMC.

A Diameter based PLMN may use the Diameter C and E interfaces if supported by Hubs, otherwise such a PLMN can use MAP or SMPP for interworking.

The use of MAP or Diameter for interworking may be suppressed when the SMS-SC of a PLMN directly supports SMPP.

It is not foreseen specific points due to the introduction of Diameter.

*Editor's note: It is to be further investigated if the introduction of Diameter raises specific points in this interworking use case.*

## 8.1.6 Conclusions on interworking use cases

Through the presentation of the different use cases of interworking of Diameter based PLMNs with other PLMNs, the following conclusions are drawn:

- if SMS Central functions (SMS-IWMSC, SMS-GMSC SMS Router) and HSS /HLR still support MAP interfaces besides the Diameter ones, the interconnection with other MAP based PLMNs networks is ensured without requiring specific IWFs.
- IWFs should be introduced for the Diameter D and E interfaces of the Diameter based MSC-VLR for inbound LTE roamers belonging to a MAP based PLMN supporting the SMS over SGs architecture. The description of the mapping between Diameter and MAP protocols in subclause 8.2 will be limited to these IWFs cases.
- The introduction of a SMS Router in the Diameter based HPLMNs is recommended for MT SMs as, in addition to its SMS functionalities, it behaves as an IWF for some use cases.

*Editor's note: Presented conclusions have to be reassessed and confirmed; other conclusions may be added.*



## 8.2 Interworking Function with alternative protocols

### 8.2.1 Interworking Function with Diameter

*This subclause will describe the IWF cases that should be supported according to the interface and the mapping of*

*some MAP procedures into their Diameter equivalent*

### 8.3 Comparison of protocol alternatives

*This subclause will do a comparison of the protocol alternatives regarding the interworking function.*

## 8 Comparison of solutions

*This subclause will summarise the comparison of the solutions with alternative protocols done in the previous clauses and draw conclusions.*

## 9 Recommendations

*This subclause describes the recommendations of the technical report.*

## Annex A (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2012-02	CT4 #56	C4-120568			Skeleton C4-120468, C4-120469, C4-120470, C4-120546, C4-120547, C4-120548, C4-120549		0.1.0
2012-03					Corrupted table 4.1-2 fixed.	0.1.0	0.1.1