



Electronic Communications Committee (ECC)  
within the European Conference of Postal and Telecommunications Administrations (CEPT)

**SHORT MESSAGE SERVICE (SMS) IN FIXED  
AND  
MOBILE NETWORKS**

**Gothenburg, July 2004**

## **EXECUTIVE SUMMARY**

The Short Message Service (SMS) provides a means for sending a message of a limited size (160 characters) to and from terminal equipment. SMS was originally standardized and implemented in GSM networks, but SMS has also been introduced in fixed networks (PSTN/ISDN). SMS messages can also be initiated from the Internet.

New standards are being developed which will enable a higher degree of interworking between fixed and mobile networks for the delivery of SMS. Some interworking scenarios are based on existing GSM standards where the fixed network is emulating the behaviour of GSM systems (i.e. HLR) which require the allocation of numbering resources such as MNC.

Several service providers across Europe have experienced problems with getting pure SMS interconnection agreements or access to mobile networks for their own SMS service platforms. Arrangements for SMS based content provision are also sometimes made difficult due to lack of cooperation and interoperability among network operators.

Regulators should therefore encourage greater transparency and more open practices from network operators concerning SMS services.

## INDEX TABLE

<b>1</b>	<b>INTRODUCTION.....</b>	<b>4</b>
<b>2</b>	<b>STANDARDS .....</b>	<b>4</b>
2.1	USER BASED SOLUTION (UBS) .....	4
2.2	NETWORK BASED SOLUTION (NBS) .....	5
2.3	SMS INTERWORKING SCENARIOS .....	6
<b>3</b>	<b>SMS CONTENT PROVISION.....</b>	<b>7</b>
<b>4</b>	<b>REGULATORY ASPECTS.....</b>	<b>8</b>
4.1	HISTORY.....	8
4.2	NEW REGULATORY FRAMEWORK .....	8
<b>5</b>	<b>CONCLUSIONS.....</b>	<b>8</b>
<b>6</b>	<b>REFERENCES.....</b>	<b>9</b>
<b>7</b>	<b>ABBREVIATIONS.....</b>	<b>9</b>
	<b>ANNEX A: SMS INTERWORKING SCENARIOS BETWEEN DIFFERENT NETWORKS.....</b>	<b>10</b>
	<b>ANNEX B: EXTRACTS FROM COM-REC 080503 .....</b>	<b>14</b>

## 1 INTRODUCTION

The Short Message Service (SMS) provides a means for sending a message of a limited size (160 characters) to and from terminal equipment. SMS was originally standardized and implemented in GSM networks, but SMS interworking with fixed networks has also been introduced. SMS messages can also be initiated from the Internet.

In many European countries the SMS market has grown significantly over the last few years. The main application of SMS has been the exchange of text messages between mobile users, but many content providers have entered this market and a variety of services are now being offered. Examples of commercial content for SMS include:

- Personalization of mobile phones (e.g. tones, logo, screen saver)
- Directory services (e.g. telephone directory, public transport time tables)
- Dictionary (e.g. language translation)
- News and sport (e.g. notification of goals scored in football matches)
- Finance (e.g. stock market, currencies, bank services)
- Entertainment (games, competitions, quiz, interactive TV programs)
- Chat rooms (usually via TV)
- Dating services.

New services are being introduced continuously and SMS has stimulated a lot of innovation among service providers and content providers. Some network operators have developed specific platforms for SMS content provision including billing of the end user on behalf of the content provider.

## 2 STANDARDS

The standards for using SMS in mobile GSM networks are mature and stable. Work is now going on in ETSI to standardize SMS for fixed networks and fixed/mobile interworking.

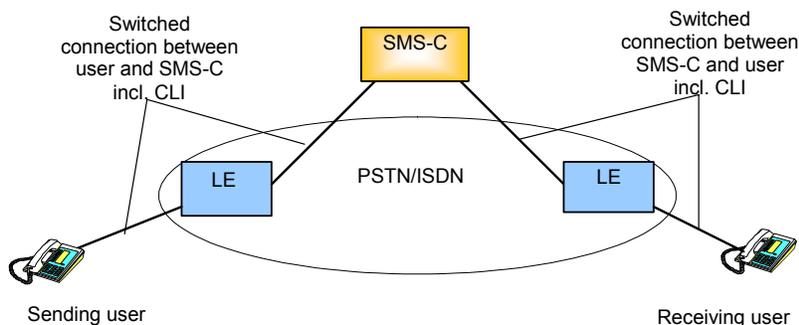
The SMS service description for fixed networks can be found in **ES 201 986** "*Short Message Service (SMS) for PSTN/ISDN; Service description*". The service can be realised in two ways, either as a user based solution or as a network based solution :

- a) User Based Solution (UBS): The service is offered as part of a function within the end-user equipment communicating via a normal voice call which does not require any specific short message transfer function inside the public network signalling system.
- b) Network Based Solution (NBS): The service is offered as part of a function within the public network, i.e. as a supplementary service implemented in the signalling system (this is how SMS is implemented in GSM).

### 2.1 User based solution (UBS)

In the User Based Solution (UBS), messages are transported via a Short Message Service Centre (SMS-C) over a normal voice call through the network using in-band data transmission. Only the basic call procedures within the public network and the CLI supplementary service are used. SMS messages are sent via an SMS-C using a store and forward principle. The provider of the SMS service does not necessarily have to be the operator of the public telecommunications network. However, a default SMS-C number is usually provided by the network operator and end-users need to be informed of the possibility to change service provider and the SMS-C number stored in their terminal equipment.

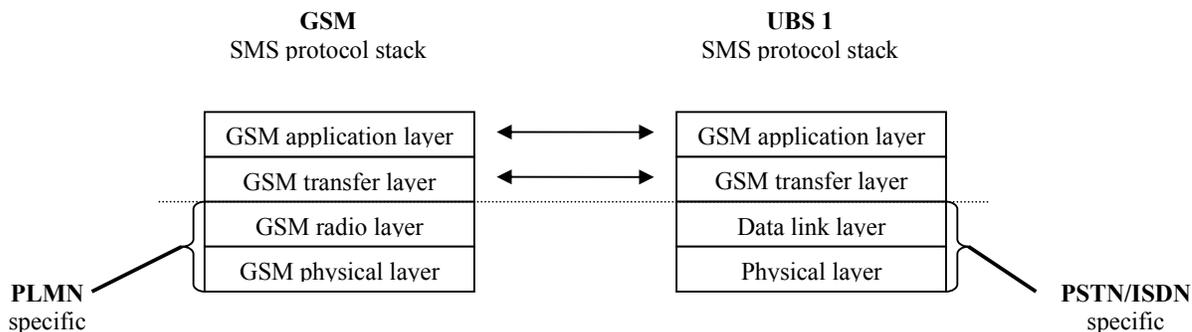
The CLI information of the calling user (1<sup>st</sup> leg) is used by the SMS-C to identify the originating user terminal. The CLI of the SMS-C (2<sup>nd</sup> leg) is used by the receiving user terminal to automatically initiate the built-in procedures for receiving and storing the SMS message.



### General principle of the user based solution (UBS)

For the User Based Solution, **ES 201 912** “Short Message Service (SMS) for PSTN/ISDN; Short Message Communication between a fixed network Short Message Terminal Equipment and a Short Message Service Centre” specifies two protocol options to provide SMS over PSTN/ISDN. Both options offer the opportunity to exchange short messages with other networks, e.g. GSM and with other services, e.g. email, fax.

- Protocol 1 (UBS1): Transfer and application layers are fully compliant with the corresponding GSM SMS service layers enabling the use of existing GSM SMS systems also in PSTN/ISDN.

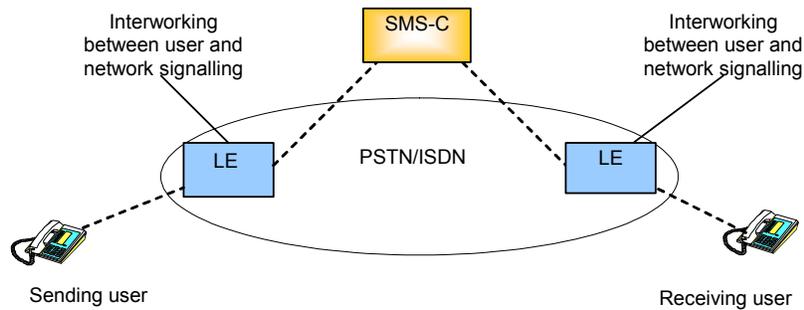


### Relationship between SMS protocol stacks for GSM and for UBS 1

- Protocol 2 (UBS2): This protocol has the advantage that it specifically focuses on the residential fixed network environment. The Transfer Layer of UBS2 provides a complete set of parameters to support features related to the PSTN/ISDN environment (e.g. concerning privacy aspects) and allows the transfer of a long text within the same message. It is also open to future extensions simply obtained by adding new parameters and information messages not provided in GSM.

## 2.2 Network based solution (NBS)

The Network Based Solution (NBS) is provided as part of a function within the public network and does not require the establishment of a bearer channel between the terminal and SMS-C. In this solution, SMS messages are transported via the signalling system and the service is provided independently of a call.



### General principle of the network based solution (NBS)

The Network Based Solution is specified in **ES 202 060** “*Short Message Service (SMS) for fixed networks. Network Based Solution*”. This document specifies how the transfer of SMS messages is supported by:

- ISDN Access protocol (DSS1)
- Network Access protocol (SS7)
- Interworking and mapping procedures between SS7 and DSS1.

For the transfer of SMS messages between different SMS-Centres, two main options exist:

- Via the SS7 signalling network using the SS7 protocol stack
- Via a separate data network using other protocols, e.g. SMPP over TCP/IP.

For compatibility between UBS and the NBS protocol solution, the UBS1 or UBS2 transfer layer can be encapsulated within the NBS network protocol messages, i.e. SS7 protocol layers.

### 2.3 SMS interworking scenarios

Different types of interfaces are applicable to SMS:

- The interface between the SMS terminal and the access node of the network / service provider (User Network Interface),
- The interface between network elements inside the network
- The interface between two or more SMS-Cs residing in the same network or in different networks
- The interface between a SMS-C from one network and an HLR from another network.

A subscriber has a sending user profile and a receiving user profile in the SMS-C, i.e. some supplementary services for the basic SMS service are related to the sending user and some are related to the receiving user. If both the sending and the receiving user are served by the same SMS service provider then the sending and receiving user profile may be provided in the same SMS-C. If the service provider implements a distributed SMS-C architecture then the sending user profile and the receiving user profile may be provided in different SMS-Cs.

If the sending and the receiving user are served by different national or international SMS service providers then the sending user profile is handled by a SMS-C of the service provider of the sending user while the receiving user profile is handled by a SMS-C of the service provider of the receiving user.

In order to reuse existing systems and protocols, a fixed network can interconnect with a GSM network through a standardized GSM interface by simulating the behaviour of an HLR. According to GSM standards (GSM 03.04 and GSM 09.02) the SS7 communication protocol (MAP) needs to use a mobile network code (MNC) to assure the reception of messages from mobile phones.

As shown in Annex A (PLMN – PSTN/ISDN scenario 2), on the PSTN side there is a “virtual HLR” acting as a true HLR. This HLR responds to the SMS-C of the originating network with a message where the IMSI-number is included. IMSI (International Mobile Subscriber Identity) is a three fields format number of maximum 15 digits, see below:

MCC (3 digits)	MNC (2 to 3 digits)	MSIN (up to 10 digits)
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**The structure of the IMSI-number**

The MNC is a numbering resource normally allocated by national regulators.

Different interworking scenarios are outlined in more detail in Annex A.

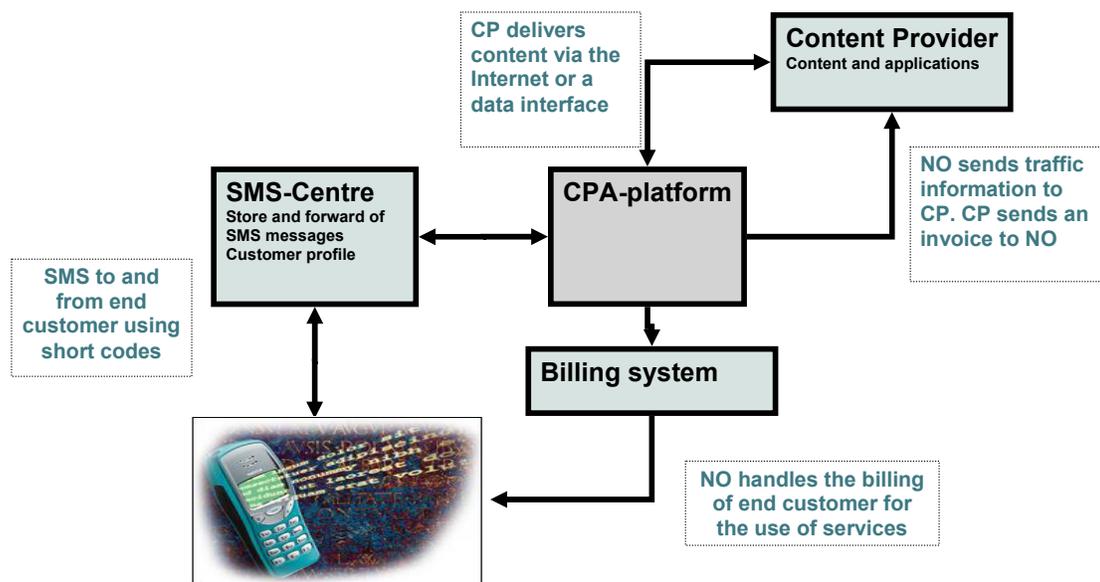
### 3 SMS CONTENT PROVISION

Many network operators have developed specific platforms for SMS content providers but arrangements differ. Content providers are sometimes connected directly to network operators, in other cases they are operating through a service provider acting as a broker.

Allocation of short number codes for selecting content is also handled differently in different countries. In some cases, network operators cooperate in allocating short numbers (with or without coordination by the NRA) in order to make content available across networks. In other cases, service providers (brokers) who provide access for SMS content providers are required to interconnect with all GSM networks.

Billing arrangements can also differ. Sometimes billing of the end user is done by the content provider while in other cases billing is done by the network operator. In the latter case, content providers charge the network operator for the content delivery.

An example of a service platform for SMS content provision is illustrated below indicating the functional relationship between a network operator (NO) and a content provider (CP):



**A platform for SMS Content Provider Access (source: Telenor)**

## 4 REGULATORY ASPECTS

In many European countries, there are service providers and content providers who now specialize in SMS based services. In order to produce the SMS service itself, and not just provide the content or act as brokers, some service providers are seeking network access for their own SMS server (SMS-C). Attaching external SMS-Cs to GSM networks for the purpose of exchanging SMS between end-users is not seen as a major technical problem but only a few cases are known where such access has been granted.

Interconnection solutions based on existing GSM standards need MNC allocation. MNCs are numbering resources with allocation criteria defined in the ITU-T recommendation E.212. For the moment this recommendation does not seem applicable to a "fixed environment". To enable allocation of MNCs to fixed networks, the scope of E.212 is now being reviewed by ITU-T SG2 and the necessary changes are expected to be approved.

### 4.1 History

In several cases, commercial negotiations for access to mobile networks have failed and disputes have been referred to the NRAs. In some cases, mobile operators have disputed their SMP status while in other cases the type of access requested has not been seen as "reasonable".

Traditionally, interconnection agreements in GSM networks have been established for voice services only. Terms and conditions for data services like the transfer of SMS messages have usually been added later, handled on an "ad hoc" basis or SMS messages have just been exchanged between networks without any proper agreement at all. One company offering mobile data services in several European countries has reported experiencing problems of obtaining non-voice interconnection agreements with European GSM operators and has therefore written to the Independent Regulators Group (IRG) with copies to the individual NRAs expressing its concern.

In a study carried out by IRG on the SMS market, greater transparency on the part of mobile operators is recommended regarding terms and agreements for content provider access, service interoperability and end-user practices. See ref. f).

### 4.2 New regulatory framework

In the new regulatory framework, fixed and mobile networks are both part of the wider concept of "electronic communication networks" where regulations in general should be made on a market basis and be technology neutral.

There is a general presumption in the new regulatory framework that "ex ante" regulation should only be considered and imposed if there is proven evidence of a market failure and where competition has not been effective. Hence in the new framework NRAs should only seek to intervene where there is evidence of a market failure

In COM-rec 080503 "*Commission Recommendation On Relevant Product and Service Markets within the electronic communications sector...*" the SMS retail and wholesale markets are analysed. In Annex B, relevant extracts from this document are provided.

The Commission argues that SMS, to some extent, can be considered as a reasonably close substitute to mobile telephone calls. Also, other data services (e.g MMS, Instant Messaging, Email) now being introduced in 2,5G and 3G networks will act as effective substitutes for SMS. The Commission recommends that no specific SMS market is defined, neither retail nor wholesale.

However, NRAs also have the power to secure, where commercial negotiation fails, adequate access and interconnection and interoperability of services in the interest of end-users. In particular, NRAs may ensure end-to-end connectivity by imposing proportionate obligations on undertakings that control access to end-users. Article 5.1 of the Access Directive states that NRAs shall be able to impose, to the extent that is necessary to ensure end-to-end connectivity, obligations on undertakings that control access to end-users, including in justified cases the obligation to interconnect their networks where this is not already the case.

## 5 CONCLUSIONS

The use of SMS has greatly increased over the last years. New standards are being developed which will enable a higher degree of interworking between fixed and mobile networks for the delivery of SMS. Some interworking scenarios are based on existing GSM standards where the fixed network is emulating the behaviour of GSM systems (i.e. HLR) which require the allocation of numbering resources such as MNC.

Several service providers across Europe have experienced problems with getting pure SMS interconnection agreements or access to mobile networks for their own SMS service platforms. Arrangements for SMS based content provision are also sometimes made difficult due to lack of cooperation and interoperability among network operators.

Regulators should therefore encourage greater transparency and more open practices from network operators concerning SMS services.

## 6 REFERENCES

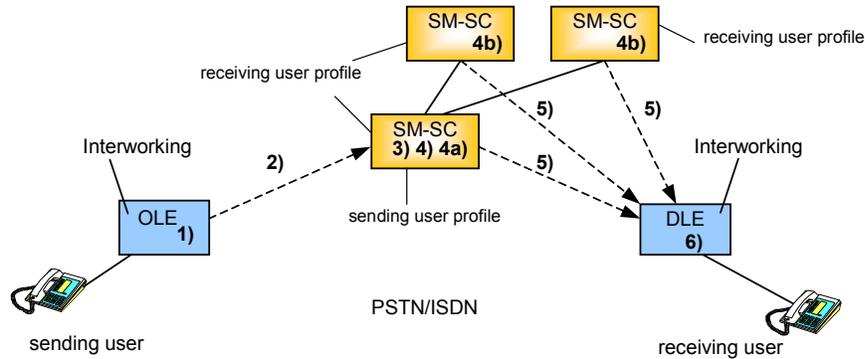
- a) ETSI ES 201 986 “Short Message Service (SMS) for PSTN/ISDN; Service description”.
- b) ETSI ES 201 912 “Short Message Service (SMS) for PSTN/ISDN; Short Message Communication between a fixed network Short Message Terminal Equipment and a Short Message Service Centre”
- c) ETSI ES 202 060 “Short Message Service (SMS) for fixed networks. Network Based Solution”
- d) COM-rec 080503 “Commission Recommendation On Relevant Product and Service Markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communication networks and services”
- e) CEPT/ECC report 029 “Service provider access in mobile networks”
- f) IRG CN (03)-52 “A study on value added SMS”

## 7 ABBREVIATIONS

CLI	Calling Line Identity
DSS1	Digital Subscriber Signalling (ISDN protocol)
HLR	Home Location Register
IMSI	International Mobile Subscriber Identity
IRG	Independent Regulators Group
ISDN	Integrated Services Digital Network
IP	Internet Protocol
LE	Local Exchange
MAP	Mobile Application Part
MCC	Mobile Country Code
MNC	Mobile Network Code
MMS	Multimedia Message Service
MSIN	Mobile Subscriber Identity Number
NBS	Network Based Solution
NRA	National Regulatory Authority
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
SMS	Short Message Service
SMS-C	Short Message Service Centre
SMPP	Short Message Peer-to-Peer Protocol
SS7	Signalling System No. 7
TCP	Transmission Control Protocol
UBS	User Based Solution

**ANNEX A: SMS INTERWORKING SCENARIOS BETWEEN DIFFERENT NETWORKS**

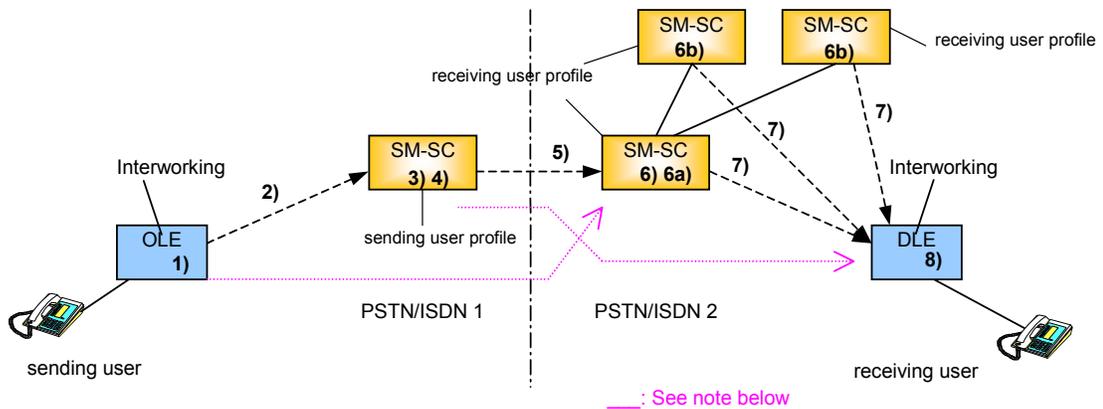
**Intra – PSTN**



**Intra - PSTN scenario**

- 1) Interworking to the network signalling protocol
- 2) SMS is sent to the SMSC of the SMS service provider of the sending user
- 3) SMS is handled according to the sending user service profile
- 4) The receiving user has a subscription by the **same** SMS service provider as the sending user, the SMS is sent to the receiving user either via the same SMSC or via a different one (e.g. regional distribution of the SMSCs).
  - 4a) same SMSC: a check of the receiving user profile is made.
  - 4b) different SMSC: the SMS is forwarded to the other SMSC; in the SMSC a check of the receiving user profile is made.
- 5) The SMS is forwarded to the destination local exchange.
- 6) Interworking to the user signalling protocol and delivery of the SMS receiving user.

**Inter – PSTN**



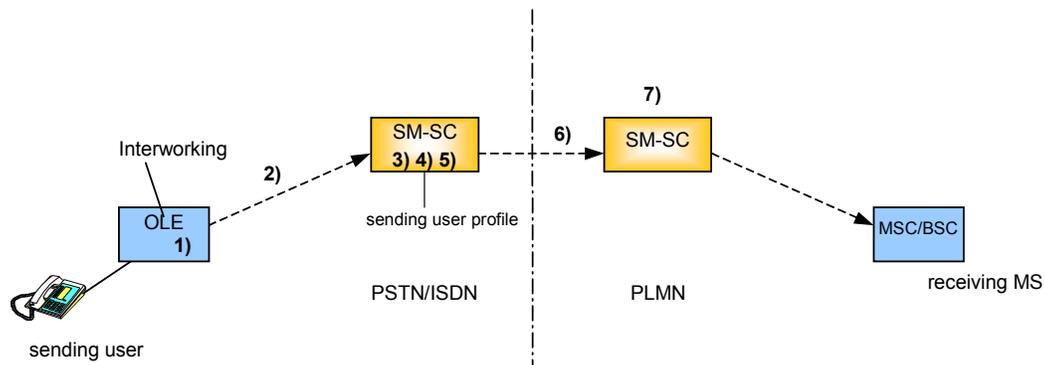
**Inter-PSTN scenario**

- 1) Interworking to the network signalling protocol
- 2) SMS is sent to the SMSC of the SMS service provider of the sending user
- 3) SMS is handled according to the sending user service profile
- 4) The receiving user has a subscription by **another** national or international SMS service provider
- 5) The SMS is forwarded to the SMSC of the service provider of the receiving user.

Note: It may be possible to allow users to interact directly with the SMSC of the receiving user, assuming the capability of re-direction is supported by step 4); bypassing the SMSC of the local access network.

- 6) The SMS is sent to the receiving user either via the same (incoming) SMSC or via a different one (e.g. regional distribution of the SMSCs).
  - 6a) same SMSC: a check of the receiving user profile is made.
  - 6b) different SMSC: the SMS is forwarded to the other SM-SC; in the SM-SC a check of the receiving user profile is made.
- 7) The SMS is forwarded to the destination local exchange.
- 8) Interworking to the user signalling protocol and delivery of the SMS receiving user.

### PSTN/ISDN – PLMN



### **PSTN/ISDN-PLMN Scenario**

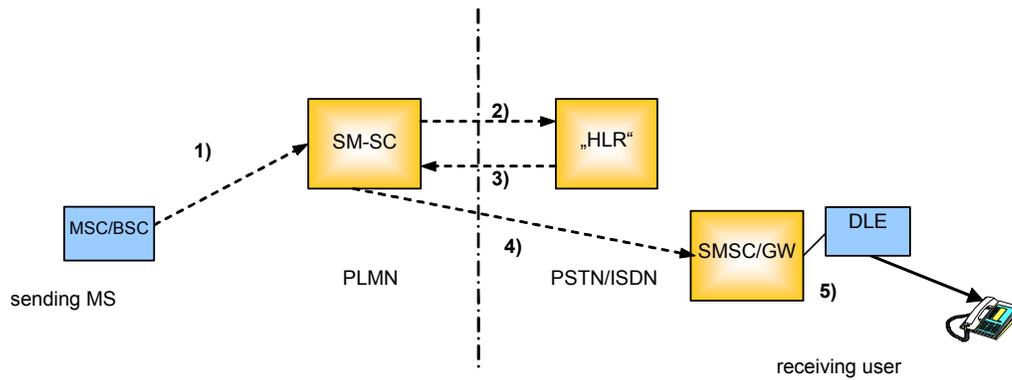
- 1) Interworking to the network signalling protocol
- 2) SMS is sent to the SMSC of the SMS service provider of the sending user
- 3) SMS is handled according to the sending user service profile
- 4) The SMS shall be sent to the PLMN.
- 5) Mapping of the protocol elements according to GSM requirements.
- 6) The SMS is forwarded to the SM-SC serving the receiving mobile station.

Note: It may be possible to allow users to interact directly with the SM-SC of the receiving user, assuming the capability of re-direction is supported by step 5); bypassing the SM-SC of the local access network.

- 7) Further steps are according to the GSM standards.



**PLMN - PSTN/ISDN scenario 2**



**PLMN-PSTN/ISDN Scenario 2**

The steps 1) 2) 3) and 4) are according to the GSM standards:

- 1) Within the PLMN – originating network.
- 2) SM-SC sends to virtual HLR (“HLR”) a signalling message incl. the MSISDN of receiving user.
- 3) The “HLR” sends to SM-SC of originating network a signalling message informing about the “IMSI” and the destination switch.
- 4) SM-SC of originating network forwards directly the SMS to the SM-SC of the destination user.
- 5) Destination switch performs interworking to user signalling protocol and delivery of the SMS to receiving user.

**ANNEX B: EXTRACTS FROM COM-REC 080503****“Commission Recommendation On Relevant Product and Service Markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communication networks and services”*****Retail short message services***

Given the widespread development and growing use of new retail services such as SMS (short messaging service), the question arises as to whether additional retail markets can be defined. In certain circumstances SMS can be considered as a reasonably close (demand) substitute to a mobile call. In addition, a supplier of mobile voice calls could switch resources into supplying SMS in response to a price rise by a hypothetical monopolist. However, a supplier of SMS may not be able to similarly switch to provide voice services, so this asymmetry may argue in favour of separating the retail markets, although most users seem to buy SMS services as part of bundles of mobile telephony services. No specific retail SMS market is defined for the purposes of this Recommendation.

***Wholesale Data Services******SMS***

Wholesale SMS, including both SMS origination and SMS termination, or more generally narrowband mobile data services, exhibit a number of features which justify separate treatment from voice call origination and termination dealt with above. At the retail level, it is not clear whether users consider SMS a sufficient substitute for a voice call in sufficient numbers for short voice calls and SMS to be considered part of the same market. While there is undoubtedly some substitution possibilities these are unlikely to operate to the extent necessary to place SMS in the same market as voice. In order for two products to be in the same market it is not necessary that these products are perfect alternatives for all users, only that there is a sufficient number of users who find them sufficiently close substitutes to constrain a hypothetical monopolist from raising prices profitably. It seems likely that from both a demand and supply perspective, instant messaging services over mobile networks, multi-media messaging services and general new data services that are currently available on 2.5G networks and which will be developed further on 3G networks will act as effective substitutes for SMS services. This would imply that SMS might be considered part of a broader data market, at least from the perspective of narrowband services.

From an origination perspective there is, in addition to the normal competitive forces at work in voice call origination, a choice of different media to initiate SMS messages. These are developing and in addition to Internet other fixed line operators are entering this market.

However it is on the termination side that differences appear between mobile voice origination and SMS. In the first instance SMS is not time dependent in the same way as voice calls, and this creates a number of different routing possibilities for operators.

Furthermore, it also creates opportunities for different operators to enter the market and by aggregating demand to possibly create the kind of countervailing buyer power that is absent on the voice termination market. This may mitigate the degree of market power which MNOs enjoy in terminating SMS over their own networks. It is apparent that a large number of SMS origination generates an SMS response through for example, value added services which can typically entail the receiver of the message having to pay a price for the content of the message. In such circumstances senders of SMS are concerned with the cost of receiving an SMS since it is very often an explicit portion of the price paid for the service bought. It is clear that in this particular circumstances a receiving party pays dynamic is created and may restrain operators' ability to exercise market power.

No wholesale SMS market is identified for the purposes of this recommendation.