SMS (Short Message Service) -Technical Overview

This document provides an introduction to basic Short Message Service (SMS) concepts, networks and specifications, and covers SMS tools and services.

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Introduction

The SMS service is simply a digital network facility that allows digital phone users to receive text messages on their digital phones. Each message may be a maximum of 160 characters long. In this document, we provide an introduction to basic SMS concepts, networks and specifications, and SMS tools and services.

Short Message Service (SMS)

What is SMS? :

Short Message Service (SMS) is the transmission of short text messages to and from a mobile phone, fax machine, and/or IP address. Messages must be no longer than 160 alphanumeric characters and contain no images or graphics. SMS is a relatively simple messaging system provided by the mobile phone networks. SMS messages are supported by GSM, TDMA and CDMA based mobile phone networks currently in use. Although services based on SMS have been feasible for many years, the recent mobile phone penetration and large scale adoption of the existing services by users, have made the SMS based services even more attractive to service providers.

Once a message is sent, it is received by a Short Message Service Center (SMSC), which must then direct it to the appropriate mobile device. To do this, the SMSC sends a SMS

Request to the home location register (HLR) to find the roaming customer. Once the HLR receives the request, it will respond to the SMSC with the subscriber's status: 1) inactive or active 2) where subscriber is roaming. If the response is 'inactive', then the SMSC will hold onto the message for a period of time. When the subscriber accesses his device, the HLR sends a SMS Notification to the SMSC, and the SMSC will attempt delivery.

The SMSC transfers the message in a Short Message Delivery Point-to-Point format to the serving system. The system pages the device, and if it responds, the message gets delivered. The SMSC receives verification that the message was received by the end user, then categorizes the message as 'sent' and will not attempt to send again.

Although services enabled by WAP (Wireless Application Protocol) and UMTS (Universal Mobile Telecommunications System) will most probably replace SMS messages as the most popular media for wireless applications, there will still be a very large user base for a long time. The great market interest related to WAP and so-called mCommerce (mobile commerce) has made also SMS interesting as a service delivery channel. Operators and service providers are creating many new services. Wireless Application Service Provision (WASP) is a recent, interesting service architecture for providing SMS based services.

The basic principle is that there is only one SMSC (SMS Center) that encodes the messages to be submitted through the GSM network. The basic difficulty in developing SMS based services is the variety of protocols used in SMS Centers. The European Telecommunication Standards Institute (ETSI) has approved four SMSC protocols: SMPP (by Logica), CIMD (by Nokia), UCP/EMI (by CMG) and SMS2000 (by SEMA). All these protocols have slightly different functionalities and largely different character conversions. Supporting all these protocols is a demanding task for a service provider. There are several SMS gateways able to interact with some or all of the SMS protocols. However, there is no standard way for service providers to interact with the SMS gateways. Also, only few of the SMS gateways support all the SMSC protocols. This draft proposes a solution by introducing an easily adoptable interface to SMS Centers or SMS gateways for service providers. Most countries use the GSM standard, the United States is one of the few countries to favor use of CDMA and TDMA standards over GSM (though there are GSM networks throughout the US). CDMA and TDMA allow extremely limited SMS capabilities.

Short messages can be sent and received simultaneously with GSM voice, Data and Fax calls. This is possible because whereas voice, Data and Fax calls take over a dedicated radio channel for the duration of the call, short messages travel over and above the radio channel using the signaling path. As such, users of SMS rarely, if ever, get a busy or engaged signal as they do during peak network usage times.

Ways of sending multiple short messages are available. SMS concatenation (stringing several short messages together) and SMS compression (getting more than 160 characters of information within a single short message) have been defined and incorporated in the GSM SMS standards.

To use the Short Message Service, users need the relevant subscriptions and hardware, specifically:

- A subscription to a mobile telephone network that supports SMS
- A mobile phone that supports SMS.
- The use of SMS must be enabled for the user. (automatic access to the SMS is given by some mobile network operators, others charge a monthly subscription and require a specific opt-in to use the service)
- Knowledge of how to send or read a short message using the specific model of mobile phone.
- A destination to send a short message to, or receive a message from. This is usually another mobile phone but may be a fax machine, PC or Internet address.

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What is an SMSC? :
SMS messages are transferred between mobile phones via a Short Message Service Center. The SMSC is software that resides in the operators network and manages the processes including queuing the messages, billing the sender and returning receipts if necessary. Many operators now offer web based interfaces to their SMSC so we can send short messages to any mobile phone from the web. Some websites now offer free SMS.

In North America, SMS was made available initially on digital wireless networks built by early pioneers such as BellSouth Mobility, PrimeCo, and Nextel, among others. These digital wireless networks are based on GSM, code division multiple access (CDMA), and time division multiple access (TDMA) standards.

Network consolidation from mergers and acquisitions has resulted in large wireless networks having nationwide or international coverage and sometimes supporting more than one wireless technology. This new class of service providers demands network-grade products that can reliably and easily provide a uniform solution, enable ease of operation and administration, and accommodate existing subscriber capacity, message throughput, future growth, and services. Short messaging service center (SMSC) solutions based on an intelligent network (IN) approach are well suited to satisfy these requirements, while adding all the benefits of IN implementations.

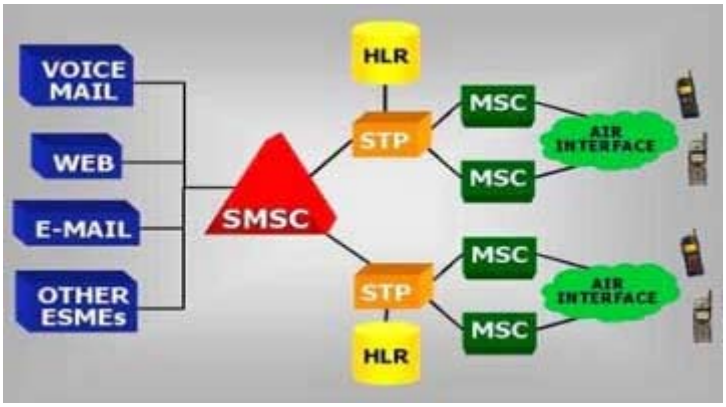

Fig:1

Figure 1 represents the basic network architecture for an IS-41 SMSC deployment handling multiple input sources, including a voice-mail system (VMS), Web-based messaging, e-mail integration, and other external short message entities (ESMEs). Communication with the wireless network elements such as the home location register (HLR) and mobile switching center (MSC) is achieved through the signal transfer point (STP).

SMS provides a mechanism for transmitting short messages to and from wireless devices. The service makes use of an SMSC, which acts as a store-and-forward system for short messages. The wireless network provides the mechanisms required to find the destination station(s) and transports short messages between the SMSCs and wireless stations. In contrast to other existing text-message transmission services such as alphanumeric paging, the service elements are designed to provide guaranteed delivery of text messages to the destination. Additionally, SMS supports several input mechanisms that allow interconnection with different message sources and destinations.

A distinguishing characteristic of the service is that an active mobile handset is able to receive or submit a short message at any time, independent of whether a voice or data call is in progress (in some implementations, this may depend on the MSC or SMSC capabilities). SMS also guarantees delivery of the short message by the network. Temporary failures due to unavailable receiving stations are identified, and the short message is stored in the SMSC until the destination device becomes available.

SMS is characterized by out-of-band packet delivery and low-bandwidth message transfer, which results in a highly efficient means for transmitting short bursts of data. Initial applications of SMS focused on eliminating alphanumeric pagers by permitting two-way general-purpose messaging and notification services, primarily for voice mail. As technology and networks evolved, a variety of services have been introduced, including e-mail, fax, and paging integration, interactive banking, information services such as stock quotes, and integration with Internet-based applications. Wireless data applications include downloading of subscriber identity module (SIM) cards for activation, debit, profile-editing purposes, wireless points of sale (POSs), and other field-service applications such as automatic meter reading, remote sensing, and location-based services. Additionally, integration with the Internet spurred the development of Web-

based messaging and other interactive applications such as instant messaging, gaming, and chatting.

SMS VS WAP

SMS is the short messaging service for GSM. It is also present on most other digital cellular networks and tends to operate in a similar fashion on each network. SMS enables 2-way short messages to be sent between GSM subscribers. Using gateways, it is also possible to interchange messages with other systems such as Internet email, the web etc. *So, SMS is essentially a messaging transport service to enable reliable 2-way messaging.*

WAP on the other hand is a "protocol set" aboard which various services can be delivered. Like any protocol, it states how devices can be made compatible ("speak the same language") in order to exchange information. Since SMS is a means for information to be transported, two devices could use SMS to exchange WAP-compliant data.

As well as being a transport service, SMS also has a protocol. However, as mentioned earlier, the SMS protocol is really only concerned with reliable 2-way messaging and so it is restricted to basic functionality. In protocol terms, this means a very basic command set such as "Send Message" and "Receive Message". Clearly for anything more sophisticated, this protocol is very limited. However, there's nothing to stop another protocol being added on top with more commands that just get sent using the Send and Receive of SMS. This is what WAP does.

So why does WAP do this? Well, to use the mobile phone to converse with any information-delivery system (such as the web or a database), the method of delivery needs to be tailored to the limitations of the phone - mainly the small text-only display, and the restrictive keyboard and navigation keys. So a part of WAP is concerned with sensible data formatting and navigation appropriate to these limitations. However, sending data over mobile air interfaces poses problems with delays and slow links. These can be overcome to an extent by optimizing the way in which the protocol is mapped to the interface (such as the SMS carrier or an ordinary GSM data call). Another part of WAP is concerned with efficient protocol transport.

So is SMS still needed after WAP? The answer is yes. Firstly there are many applications that simply do not need WAP. The simple send and receive primitives of SMS are sufficient. Also, there is often no need, or no context, to maintain an ongoing (connected) communications session over SMS and so SMS tends to get used in a connectionless mode, like sending a letter or an email - whereby immediate, or even any, response is not required (though it may be desirable at times).

Many SMS messages are alerts of one kind or another, used to notify the recipient of an event. These types of messages usually require follow-on action other than sending a reply using SMS. In these circumstances, SMS is sufficient and there is no need to move to WAP.

Secondly, WAP is not widely available yet and there are millions of phones that can handle SMS but not WAP. These will stay in circulation for some time.

WAP is particularly useful for interactive services on the handset. Interactive services can be realized using native SMS, but this is not as elegant as WAP. Using WAP, the user can be prompted for information and guided along the interactivity path, whereas while using only SMS, the user has to remember how to respond with any preset commands.

So, do we need SMS or WAP or both? The answer is both are needed and they have different uses and applications. SMS is particularly good for pushing out information to mobile phone users. In particular, Xsonic InTouch monitors a variety of data sources within the Microsoft Exchange messaging server and pushes out alerts, such as "new email from...", "appointment at..." etc. Xsonic DataNow also generates alerts from any data changes that occur within an SQL Server database.

Alerts can be followed up by a variety of actions. These may include SMS replies of one form or another. Additionally, SMS can be used to pull data from a database. This feature gets used in Xsonic InTouch to pull contact details from a user's personal contacts folder in the Exchange database. In this way a mobile worker could get the fax number of a customer, their address, home phone number etc. For many of these types of applications, the quick alert or prompt/pull operations of SMS are ideal. Indeed, an advantage of SMS is that it is quick.

The advantage of WAP is that it enables greater interactivity with the data source. This would be useful, for example in any operation that is multi-paged in nature (such as navigating through a hierarchy). Traversing an email Inbox is one such application. With Xsonic InTouch, a WAP phone could be used to receive SMS alerts (e.g. calendar reminders, email notification etc.) and the user could then elect to respond with short SMS commands and get a quick reply, or they could elect to connect to the server via a secure remote access point and navigate through the various Exchange folders.

SMS and WAP are different entities and are often complimentary. A well designed application would exploit the essential characteristics of SMS and WAP to suit the end-user requirements. For fast alert or quick-shot pull systems, SMS is a good solution. For any communications requiring ongoing interaction with a hierarchical data source, WAP is a good solution. Sometimes, both solutions can be used to get the best of both worlds.

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Benifits of SMS

In today's competitive world, differentiation is a significant factor in the success of the service provider. Once the basic services, such as voice telephony, are deployed, SMS provides a powerful vehicle for service differentiation. If the market allows for it, SMS can also represent an additional source of revenue for the service provider.

The benefits of SMS to subscribers center around convenience, flexibility, and seamless integration of messaging services and data access. From this perspective, the primary benefit is the ability to use the handset as an extension of the computer. SMS also eliminates the need for separate devices for messaging because services can be integrated into a single wireless device- the mobile terminal. These benefits normally depend on the applications that the service provider offers.

At a minimum, SMS benefits include the following:

- Delivery of notifications and alerts
- Guaranteed message delivery
- Reliable, low-cost communication mechanism for concise information
- Ability to screen messages and return calls in a selective way
- Increased subscriber productivity

More sophisticated functionality provides the following enhanced subscriber benefits:

- Delivery of messages to multiple subscribers at a time
- Ability to receive diverse information
- E-mail generation
- Creation of user groups
- Integration with other data and Internet-based applications

The benefits of SMS to the Service Provider are as follows:

- Ability to increment average revenue per user (due to increased number of calls on wireless and wireline networks by leveraging the notification capabilities of SMS)
- An alternative to alphanumeric paging services, which may replace or complement an existing paging offer
- Ability to enable wireless data access for corporate users
- New revenue streams resulting from addition of value-added services such as e-mail, voice mail, fax, and Web-based application integration, reminder service, stock and currency quotes, and airline schedules
- Provision of key administrative services such as advice of charge, over-the-air downloading, and over-the-air service provisioning
- Protection of important network resources (such as voice channels), due to SMS' sparing use of the control and traffic channels
- Notification mechanisms for newer services such as those utilizing wireless application protocol (WAP)

All of these benefits are attainable quickly, with modest incremental cost and short payback periods, which make SMS an attractive investment for service providers.

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SMS Support on different Networks
Since its inclusion in the GSM standard, SMS has also been incorporated into many other mobile phone network standards, including Nordic Mobile Telephone (NMT), Code Division Multiple Access (CDMA) and Personal Digital Cellular (PDC) in Japan. Each of these standards implements SMS in slightly different ways and message lengths do vary. The availability and characteristics of SMS on different mobile network standards is:

Mobile network Standard	Type	SMS Availability	Message Length	Deployment
GSM 900	Digital	Yes	160	Widely
GSM 1800	Digital	Yes	160	Widely
GSM 1900	Digital	Yes	160	North America
TACS/ETACS	Analog	No	N/A	N/A
NMT	Analog	Yes	N/A	Eastern Europe
TDMA/D-AMPS	Digital	Yes	N/A	North America
NAMPS	Analog	Yes	14 alphanumeric32 numeric	North America
CDMA	Digital	Yes (MT only)	256	North America
PHS	Digital	Yes	N/A	Japan
PDC	Digital	Yes	N/A	Japan
IDEN/NEXTEL	Digital	Yes	140	North and South America
TETRA/ Dolphin	Digital	Yes	256	Parts of Europe
Globalstar	Satellite	Yes	160	Truly global

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SMS:Tools

eSMS-C :
The eSMS-C is Ericsson's SMS solution that offers short message functionality, message notification, e-mail. In addition, eSMS-C offers more advanced features such as:

- Information Services - Services providing information on, e.g. headline news, sport scores and stock quotes.

- Over-The-Air Services like activation and programming.
- Telemetry Applications such as vending machine alarms and remote meter readings.
- Mobile e-Commerce such as mobile banking, movie ticket purchases.

The eSMS-C supports GSM, TDMA, CDMA, and GPRS networks. It has been successfully interoperability tested in both Ericsson and Nokia environments. The capability of eSMS-C fits well in wireless networks due to the SMS capable cellular phones that are available.

By using any of the Ericsson supported interfaces, the eSMS-C connects directly with a Mobile-services Switching Center (MSC). The eSMS-C routes directly to the mobile end-user's hand set wherever it is, whether roaming or not by communicating directly with the Home Location Register.

Supported interfaces include:

- *SMPP* - Short Message Protocol Peer to Peer is a defacto standard for short messaging. SMPP provides an interface to a variety of applications including "push" and pull type services as well as WAP Gateways and EMS.
- *CAPII* - Computer Access Protocol II is an Ericsson short message protocol that offers some advantages in creating Web based applications.
- *SMTP* - Simple Mail Transfer Protocol is an E-mail protocol that allows the eSMS-C to convert an SMS to e-mail and vice versa.

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SMS-JDK :
www.noctor.com has developed a JDK for SMS. The SMS-JDK provides a simple and effective interface to the world of wireless short messaging, hiding all the protocol complexities from the application developer and so allow the developer to focus on the application's service. This significantly reduces the development time-frame, maintenance overhead and cost. The SMS-JDK is 100% Java.

Nokia PC Connectivity SDK :
The Nokia PC Connectivity SDK is a sophisticated and easy-to-use programming interface for Nokia GSM and TDMA phones. The SDK allows communication with Nokia GSM and TDMA phones and development of PC applications that utilize the features supported by the phones.

The Nokia PC Connectivity SDK library consists of several separate libraries, each performing a special set of tasks related to GSM or TDMA phone functionalities. The included libraries are:

- General Settings Library

- SMS Library
- Phonebook Memory Library
- WAP Library

SMS Gateway (www.winsms.com) :
SMS Gateway is a 32 Bit Windows utility that enables you to send and receive text and binary "Short Messages" over GSM digital cellular telephone networks. The package consists of both an interactive messaging application (with full source code), and a stand-alone messaging gateway to other Windows applications through the use of DDE, OLE, and Command Line Interface. SMS Gateway also supports POP3 for message transmission, and SMTP for message reception, so it may be used in almost any environment without need for custom development.

SMS Applications
SMS was initially designed to support limited-size messages, mostly notifications and numeric or alphanumeric pages. While these applications are and will continue to be widely used, there are more recent niches that SMS still can exploit.

Short bursts of data are at the heart of many applications that were restricted to the world of data networks with fixed terminals attached to a local-area network (LAN) or wide-area network (WAN). However, many of these applications are better served if data communication capabilities could be added to the mobility of the station. Thus, a waiter who can charge a customer's credit card right at the table, at any time, instead of going to a fixed POS terminal located by the register will be able to help customers in a faster, more convenient way.

Also, the ability to track the location of a moving asset such as a truck or its load is very valuable for both providers and clients. This application, again, just needs to interchange small amounts of information, such as the longitude and latitude at a current time of the day, and perhaps other parameters like temperature or humidity.

This application does not necessarily require the monitored entity to be in movement. The requirements are basically short, bursty data and a location that has digital network coverage. For example, in a neighborhood, it would be faster, easier, and cheaper to drive a truck from the local power company, which interrogates intelligent meters to obtain their current readings and then forwards them via short message to a central data processing center to generate the billing. Similarly, delivery trucks could be alerted of the inventory of a customer running low, when the truck is close to the customer’s facilities. The truck driver could place a quick phone call to the customer to offer a short-time replenishment at a low cost for the distributor.

Another family of applications that can use SMS as a data transport mechanism is banking. It is no secret that automated teller machine (ATM) and Internet transactions are less costly than transactions completed at a branch. Internet transactions are even cheaper than ATM transactions. Therefore, enabling wireless subscribers to check their balances,

transfer funds between accounts, pay their bills and credit cards is valuable, not only for the subscriber but also for financial institutions.

Entertainment applications are also good drivers of SMS usage. Examples of these are simple short message exchanges between two parties ("texting") or between multiple participants ("chat"). Also, delivery of information that the subscriber can tailor to his or her lifestyle represents an attractive proposition for wireless users.

Wireless Web browsing allows the users to search for information without the physical restrictions of a PC. College students certainly appreciate not having to go to the computer lab or their dorm to check e-mail or find out what the required book is for the semester that is about to start.

E-mail continues to be by far the most used wireless data application. However, handsets are evolving quickly and are including more and more functionality that supports newer applications at the same time that user friendliness increases. Probably the next big success beyond wireless Web will be Internet shopping and other e-commerce applications such as electronic coupons, advertising, etc.

The potential for applications is enormous, and new needs appear to arise constantly, demanding a solution that may travel over SMS.

For More Information