USE OF TEXT MESSAGING IN PUBLIC SAFETY ALERTS

Publisher
FICORA

DESCRIPTION
Date of publication
5 September 2005

Authors	Type of publication
SMS/CBS working group	Working group report
	Assigned by
	FICORA

Name of publication
WORKING GROUP REPORT 7/2005, USE OF TEXT MESSAGING IN PUBLIC SAFETY ALERTS

Abstract

The report deals with the use of text messaging as a means of issuing emergency alerts to the population.

The report covers two basic methods: normal text messages (SMS, Short Message Service) and cell broadcast transmissions (CBS, Cell Broadcast Service).

The SMS system functions in two stages. The first stage consists of identifying the mobile subscriptions in the target area. In the second stage a text message is transmitted to the mobile subscriptions. There are two possible ways to identify the mobile subscriptions in the target area. One method is to submit enqueries to the mobile telephone network registers and carry out positioning. The other method consists of exploiting a specific transaction collection database where all data on mobile subscriptions are held.

In the CBS system the messages are transmitted as a broadcast to the cell coverage areas which are in the target area. The mobile stations that are in the cell coverage area receive the message, provided that they are in the reception mode.

Both systems have their own advantages and disadvantages. The most significant benefit of the SMS system is that an emergency alert sent through it can be received by all mobile stations without any special arrangements. The greatest disadvantage is that the system is slow, and the greater the number of recipients, the greater the disadvantage. The greatest advantage of the CBS system is its speed. First of all, there is no need to separately locate the mobile subscriptions in the target area and, secondly, the message is received simultaneously by all the mobile stations in the emission cell coverage area. The greatest disadvantages are the need to reserve radio capacity in the network and the greater than usual consumption of current in the reception standby mode in the terminal equipment. The terminal equipment also has to be specifically activated to receive the emergency alerts.

The working group also researched the costs that the telecommunications operators would incur when constructing and using the systems.

Keywords
Public safety alert, text message, cellular broadcast, SMS, CBS

Serial name
FICORA publications/recommendations/GFI documents

Pages, total	Language	Price	Confidence status
19	English	€6.50	Public

Distributed by	Published by
FICORA	FICORA

Postal address	Visiting address	Telephone	E-mail
PO Box 313	Itämerenkatu 3 A	+358 9 69 661	info@ficora.fi
FI-00181 HELSINKI	00180 HELSINKI	Telefax	Homepage
FINLAND	Business ID 0709019-2	+358 9 6966 410	http://www.ficora.fi

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1 INTRODUCTION

It has long been possible to alert the population in various emergency and disaster situations via the mass communication networks, such as radio and television. In connection with the Asian tsunami disaster normal text messaging (SMS, Short Message Service) was used to convey emergency alerts (e.g. to inform about evacuation centres) from Finland to the mobile subscriptions of Finnish telecommunications operators, which were located in the area at the time. The text messages were sent applying the systems operated by the telecommunications operators. Some of the procedures had to be carried out 'manually' because there were no existing ready-made systems for the purpose. The system could be much more effectively exploited when sending warnings/instructions to various regions if these functions were automated. Another method for sending text messages has long been a standard in mobile networks. It is called the Cell Broadcast Service (CBS), and it could also be used for transmitting emergency alerts.

On the initiative of the Ministry of the Interior, a working group was appointed within the framework of the official working groups of the Finnish Communications Regulatory Authority, to prepare a report on the use of the SMS and CBS systems in emergency and public service communications. It was the mandate of the working group to study the characteristics of the systems concerned as well as the time frames and costs involved in the commissioning of the systems.

The working group's mandate was based on the following facts:

- The Act on the Protection of Privacy in Electronic Communications allows the use of both systems. The Government Bill to Parliament on the amendment of this Act was circulated for comments in the period 12.4 – 27.5.2005.

- The authorities will determine the content of the alert concerned as well as the target area, and they will transmit the data to the telecommunications operators. For the purpose of the present study, the emphasis will be on the systems applied by the telecommunications operators as well as the ways in which they can be developed in order to allow the efficient transmission of emergency alerts.

In addition to the Finnish Communications Regulatory Authority the following were represented in the working group: the Department for Rescue Services of the Ministry of the Interior, Elisa, Finnet Networks Ltd., TeliaSonera and Nokia. Representatives of Nokia and LogicaCMG were also invited to present their own implementation models in connection with some meetings of the working group. The working group convened a total of six times. The report of the working group was circulated for comments in the period 1.6.2005 - 12.8.2005.

2 INTERNATIONAL WORK

Several nations, for example Norway and Sweden, are in the process of studying the use of text messaging in issuing alerts to the general public. The matter is also on the table in several international forums, such as the working groups of ETSI.

The Commission has sent a letter to ETSI in which it requests that ETSI standardises the CBS system. The objective is to harmonise CBS standards with requirements issued by the authorities.

In most cases the work is only just being initiated. Consequently the working group was able to avail itself of very few results from other countries. Some data was obtained from an ongoing project in Sweden concerning cost estimates on the implementation of systems. The data is referred to in the section of the present report that concerns costs.

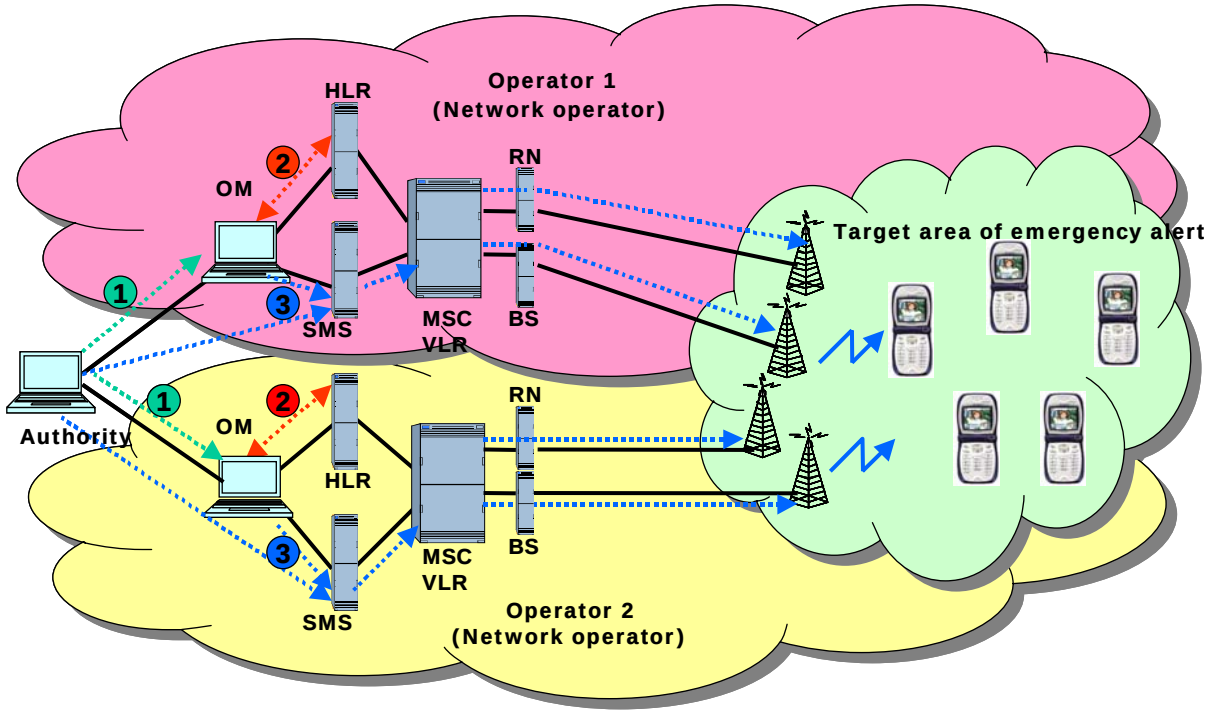
3 SUMMARY OF SYSTEMS

SMS and CBS are both standardised features of the GSM/UMTS network. The basic standards are listed in Annex 1.

3.1 SMS system operating principle

The SMS system functions in two stages. The first stage consists of identifying the mobile subscriptions in the target area. In the second stage a normal text message is transmitted to the mobile subscriptionss via a short message service centre (SMSC). The system is applicable in both GSM and UMTS techniques. The system works irrespective of the location of the mobile stations. This means that it can be used in respect of the mobile subscriptions of Finnish telecommunications operators that are located abroad at the time.

Figure 1 illustrates the operating principle of the SMS system.



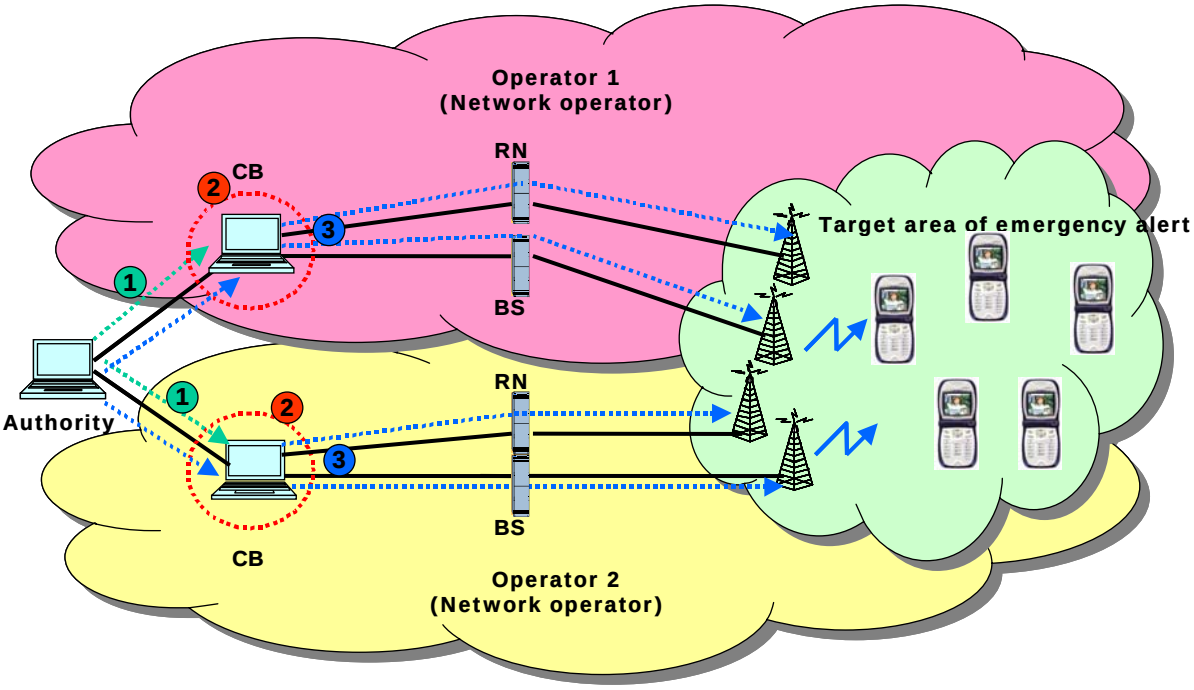
1. The authority submits a request to the telecommunications operators to transmit a text message to the subscriber connections within the target area.
2. Telecommunications operators locate the mobile subscriptions that they have in the area concerned.
3. Telecommunications operators send a text message to the mobile subscriptions via their own short message service centres. (Or the authority sends text messages via the short message service centres to the numbers that it has obtained from the telecommunications operators.

Figure 1. SMS system operating principle

3.2 CBS system operating principle

In the CBS system the cells in question are selected and a message is transmitted to the coverage area of all the cells concerned, via the CBC (Cell Broadcast Centre) and the base station controllers (BSC/RNC) that are connected to it. The mobile stations that are in the cell coverage area receive the message, provided that they are in reception mode. The system is standardised in both the GSM and the UMTS techniques. However, so far it has not been implemented in the UMTS system, but will be included in a later version. The system is not used in national GSM networks. Because the CBS system is by definition an area/operator-specific system, it can only be used within a single country.

Figure 2 illustrates the operating principle of the CBS system.



1. The authority submits a request to the telecommunications operators to transmit a cell broadcast message to the target area.
2. Telecommunications operators define the cells which cover the area in question (or the authority defines the cells on the basis of data received from the telecommunications operators).
3. Telecommunications operators (or the authority) transmit a cell broadcast message via the applicable base station controllers

Figure 2. CBS system operating principle

4 DETAILED DESCRIPTION AND RESTRICTIONS – COMPARISON OF SYSTEMS

4.1 Target levels for area accuracy of systems

The aim is that emergency alerts are directed only at subscribers in a certain area. However, it is not particularly harmful if a slightly larger than intended group of recipients receive the alert. On the basis of the technical characteristics of the mobile networks the following accuracy levels in the transmission of emergency alerts were studied.

In Finland:
1. VLR (visiting location area) accuracy
2. LA/SA (location area/service area) accuracy
3. Cell accuracy

To another country covering entire country (Note: only SMS)

Three accuracy levels were studied in respect of SMS messages sent within Finland: LVR and LA/SA accuracies and cell accuracy. Because the networks of the different network operators vary, it is not possible to present any specific correspondences in terms of accuracy between geographical areas and coverage areas. However, with regard to GSM networks the following estimates can be made as to the size of the areas covered:

The VLR area (four to ten, depending on the operator) = about 0.5 to 2 provinces

The LA/SA area (40 to 150, depending on the operator) – the figures in the table refer to area diameter

Southern Finland	Central Finland	Northern Finland
20 km	20 to 100 km	>100 km (at maximum, one LA can cover the whole of northern Finland)

Cell coverage area (10 000 to 20 000, depending on operator) = area diameter 100 m to 20 km

Along with data on the cells, some operators also hold the codes for the emergency area, municipality and province, relating to all the cells. These codes give us directly the emergency area, the municipality and the province in which the cell in question is located. Furthermore, the postal code of some of the cells is also held. However, not all the operators hold the data in a format which will allow its use to determine the mobile subscriptions in a certain area. The correspondence between the technical codes used in the mobile networks and the areas that the emergency centre determines as constituting the target area of the emergency alert has to be defined for each operator separately.

When making the final decision on the desired target accuracy level, it should be noted that the more accurate the level, the more complex the procedures and correspondingly the higher the costs.

It should also be noted that it must be possible to repeat the transmission of an emergency alert. For example, in the case of a local accident or disaster the message should be sent to the same area several times over at regular intervals. This ensures that any new subscribers in the area will receive the emergency alert.

4.2 The SMS system

4.2.1 Positioning of mobile subscriptions

The positioning of the mobile subscriptions does not work in the same way in all the telecommunications operators. On the one hand, this is due to the different operating procedures applied by the different operators and, on the other hand, the different switching centre technologies applied (Nokia, Ericsson). The descriptions and development needs detailed in the following sections concentrate on the measures that are generally required, but some alternative measures are also given in certain cases.

4.2.1.1 Use within Finland

4.2.1.1.1 VLR accuracy

Positioning is based on the address of the mobile subscription's district switching centre (VLR) address which can be found in the home location register (HLR). The accuracy of the positioning entirely depends on the operator’s network configuration, and the VLR areas are fairly extensive.

Method 1

HLR uses a single command to create a list of all the mobile subscriptions within one VLR area. This produces files in which the IMSIs (International Mobile Station Identity) of the subscribers are listed. Because SMS messages are transmitted using the MSISDN numbers of the mobile subscriptions, the IMSIs have to be converted into MSISDN numbers. The conversion requires searches of the subscriber database.

Applying current procedures, the timescale involves 30 minutes to search the IMSI data and 2 to 8 hours to convert the IMSI numbers into MSISDN numbers, depending on the quantity of subscribers involved. The procedures are, however, being constantly improved, and the expansion of so-called maintenance terminals means that some of the procedures are already markedly faster.

However, instead of the expansion of maintenance terminals, we need a tested and tried and maintainable function (MML command) which would use the VLR address to search the MSISDN numbers of the mobile subscriptions that are located in the VLR area concerned. In such a scenario, the MSISDN numbers would be available after the time that it takes to carry out the search (about 30 minutes).

Method 2

HLR does not incorporate a direct command whereby the mobile subscriptions with a VLR address could be listed. Unloading data from HLR requires a manual process which will also determine the VLR address.

A command may be used to make a physical disk copy of the HLR subscriber database. The database contains all subscriber-specific data. Management links are then used to transfer the file to a network management disk for further processing. The programme may be separately launched so that subscriber-specific data are output to an ASCII file.

The file containing the unloaded subscriber data is too large to process by normal office tools. The unloaded ASCII file is transferred from the management system to a reporting server for further processing. As a result, a listing is obtained on the MSISDN numbers of the mobile subscriptions in the VLR area.

The various procedures require time as follows:

Producing the HLR disk file	40 min
Transfer to OSS system	1 h
Unloading disk copy	1 h 40 min
Transfer to reporting server and running list of numbers	30 min

The following could be a target for development measures: HLR could be searched, perhaps every 24 hours, for information on the VLRs used by the mobile subscriptions, and the subscriber lists would be produced automatically. This would save time, but on the other hand the data would at worst be almost 24 hours out of date.

4.2.1.1.2 LA/SA accuracy

Method 1

The LA data of the target area are determined in the design of the operator's radio network. The result might incorporate an area which covers several VLR areas. The data have to be searched case by case.

The home location register is searched for those mobile subscriptions which are located in the VLR area serving the area concerned (or in an area served by several VLRs). A list of IMSI numbers is produced and the numbers on the list then have to be converted into MSISDN numbers. Up to this point the procedure is identical to that used in VLR accuracy.

A mobile subscription enquiry, based on the MSISDN number, is used to identify the location area of each connection. The results obtained for all the mobile subscriptions are sifted through to identify the connections located in a certain location area or areas.

Using existing procedures, the timescale involves 30 minutes to search the IMSI data and 2 to 8 hours to convert the IMSI numbers into MSISDN numbers. In addition, more time (can be several hours) is spent in a subscriber-specific LA search as well as the identification of the MSISDN numbers of the mobile subscriptions in the target area. The procedures are, however, being constantly improved, and the expansion of so-called maintenance terminals means that some of the procedures are already markedly faster.

A subject for development is the advance specification of the areas (such as the municipalities or provinces) to which the emergency alerts would be transmitted. A system could be constructed in which the data on the area exists for immediate use, or could be easily obtained. Another subject for development, instead of the expansion of maintenance terminals, is a tried and tested and maintainable operation (MML command) whereby VLR could be searched for subscriber data (e.g. MSISDN) on the basis of the LA code.

Method 2

In method 2 the procedure is identical to that used in VLR accuracy. Searches based on the LA code are not possible in the further processing carried out in the reporting server. Procedures to improve the operation are, however, being developed.

4.2.1.1.3 Cell accuracy

The procedures described in the chapters dealing with LA accuracy are applied to identify the MSISDN numbers of the mobile subscriptions that are located in the LA area corresponding to the target area. After that, the cell data of each individual mobile subscription is specified using the positioning system at the disposal of the telecommunications operators. For a large number of connections the positioning is a lengthy process as only about 10 queries a second can be run through the system. The results are then used to produce a list of mobile subscribtions that fall within the cell coverage area of the target area.

Additional development work should be undertaken to produce a positioning service which can handle an extensive quantity of subscriber numbers as well as a filter programme which picks out the mobile subscriptions in certain cell coverage areas.

Because the positioning service is designed for locating individual mobile subscriptions, the positioning of large quantities of connections is slow and, in the worst-case scenario, it could even clog up the network, unless the number of positioning operations is restricted. The applicability of the procedure is thus restricted to areas where it is known that the number of mobile subscriptions is small.

4.2.1.2 Coverage of another country

With regard to SMS messages to be sent to other countries, the basic approach is that the messages are sent to all the mobile subscriptions of Finnish telecommunications operators which are within the territory of that particular country. In practice, delimiting the area within the target country would require collaboration with all our roaming partners (positions/addresses of all the switching centres), and as such it would be well nigh impossible.

The procedures and the development targets are identical to those used in Finland applying to VLR accuracy. Any queries are carried out using the VLR numbers of the roaming partners, instead of our own VLR numbers.

4.2.1.3 Development needs relating to switching systems

The study of the different procedures and the needs for development raised several points the effective improvement of which would require new software/functions to be added to the systems applied by the telecommunications operators. Some of the functions are already operational in the form of the extension of so-called maintenance terminals, but even they can only be operated more extensively through MML commands as independent functions. Relating to the switching systems, the following new functions (mainly the MML commands) are considered to be of prime importance:

1. A function which uses the VLR address to search directly for the MSISDN numbers of the mobile subscriptions that are located in the VLR area concerned.

The working group is informed that this is technologically feasible in at least one of the two switching systems in use (Nokia). The implementation does, however, require an order to be placed. The function is required whether the message is sent to Finland or abroad.

2. A function which can be used to search the subscriber data in the VLR (e.g. MSISDN) on the basis of the LA code.

The working group is informed that this is technologically feasible in at least one of the two switching systems in use (Nokia). The implementation does, however, require an order to be placed.

4.2.2 Use of the transaction collection system

In addition to direct queries directed at the elements of the mobile network, it is also possible to use a separate transaction collection system to identify the mobile subscriptions in the target area. An unambiguous picture of the national mobile subscription data quickly emerges when you use a real-time, subscriber-specific transaction collection database in connection with the GSM/UMTS network (e.g. Nokia NetAct Traffica (TM)). The system allows rapid data searches of a certain location area or several areas. If necessary, the system saves all positioning update requests in real-time, including both normal positioning updates and “periodical” positioning updates, in a homogenous networked database which allows quick searches. In this case the input data given to the system consists of the LAC values and the desired time frame that are relevant to the operator. Data that is received as a result of the query is sifted for the MSISDN numbers.

THE PROCESS

A. Input data from the authorities addressed to every national operator
* Geographical location data which each operator converts to the LAC values that correspond to its own network
* ASCII message that should be sent (when the operator sends the message)
* The timeframe that should be covered by the query

B. Query to the system and, if required, the transmission of SMS messages from each operator’s own SMSC

C. Response to the 112 centre *(emergency centre)*
* If the operator sends the message, a list of the MSISDN numbers to which the message has been sent.
* If the authority takes care of sending all the SMS messages, a list of the MSISDN numbers which are located in the area concerned.

It will be possible to set the system to monitor all new mobile subscriptions that enter the area concerned from the moment of submitting the query. This means that it will be necessary to submit the history query just once. All positioning updates can be carried out using the system’s online inference tree which, for example, activates the transmission of a new message. The monitoring can be continued until the authority decides to stop it.

The system gives subscription data with positions within a couple of minutes.

4.2.3 Transmission of SMS messages

The transmission of the SMS messages is via the short message service centres to the MSISDN numbers that have been obtained by the method described in sections 4.2.1 and 4.2.2 above. The transmission may be carried out either by each individual operator to its own MSISDN numbers (and to those of its service operators) or by the authority via the short message service centres to the MSISDN numbers obtained from the operators.

For flexibility of transmission, it is important that an application is available which identifies each MSISDN number in the list and is able to link the number to the message content that has been specified by the authority. Telecommunications operators are already able to avail themselves of such an application, but it requires further development to make it more automatic and user-friendly.

After the MSDISN *(sic)* listing and emergency alert are ready to use, a certain amount of time (5 to 60 minutes) is required to prepare for the operation. The transmission rate is estimated to be about 20 messages per second. It follows that it would take about 1.5 hours to transmit 100 000 messages. In terms of the loading of the short message service centres, it should also be borne in mind that unsuccessfully transmitted messages must be resent. The required period of validity of

the messages must also be determined. A feasible time span would be between 1 hour and one week, as required.

Furthermore, a decision should be made as to whether the emergency centre should be able to receive any replies that might be sent by the public, or block all public replies. It would also be possible to include in the emergency alert a separate source of further information (such as a radio or television channel, a teletext page, a telephone number or a web address). In certain cases, a specific request to reply could be included.

If replies are not welcome, instead of giving a number the sender could be identified as "emergency centre", or the operator's network could inform recipients that the application concerned will not accept replies (an automated reply text could be used). SMSs could also be blocked at SMSC, and the mobile subscriptions would then receive an error message, although this would result in calls to the customer service facility.

4.3 The CBS system

The CBS system is applicable only in the transmission of emergency alerts in Finland. The emergency alert can be sent immediately via all the necessary cells. Every mobile station located in the cell coverage area concerned will be able to receive the message. One requirement would be that the reception channel for emergency alerts is activated in the terminal equipment. The CBS system incorporates 1 000 different channels.

The basic premise in the implementation of the CBS system is that each network operator has its own CBC (Cell Broadcast Centre, e.g. LogicaCMG CBC Platform). The links with the operators' base station controllers go via the CBC. It is estimated that the transmission of messages will take about 20 seconds to 3 minutes, depending on whether the CBC has direct links to all the base station controllers (quickest way) or whether the links are centralised.

Real-time operator intervention is not particularly required in CBS, because the authorities can transmit the messages themselves via the CBC. It is necessary, however, that there is a database of the cell coverage areas, based on information obtained from the operators; in other words, the transmission areas of the emergency alerts must be pre-determined. In order to ensure that the transmission of messages can be started as quickly as possible, the database (the correspondence between the cell coverage areas and the transmission areas of the emergency alerts) must be pre-determined even if it is the operator that transmits the messages.

In terms of required development measures, it must be noted that although CBS standards have been in existence for some years now the system has not been adopted in national GSM networks. In 3G networks the equipment manufacturers have not implemented CBS, although it will be implemented in later versions.

Because CBS will reserve one radio channel which is activated separately in each cell, there will be plenty of work involved in commissioning and maintenance. Methods need to be developed to make the activation and passivation procedures quicker and easier.

New procedures/functions are needed for safeguarding the updating of the correspondence of cell data and the emergency alert transmission areas in CBC.

At the European level a Commission mandate exists for the launching of further development work on the standards relating to the CBS system. The aim of the work is not to define new standards, but rather to determine the options to be selected from the existing basic standards. Consequently, because the CBS system continues to be developed, there is hope that some of the problems relating to its application will be resolved.

4.4 Other matters relating to the use of text messaging

In the course of its work the working group encountered various matters relating to the use of text message systems in public safety alerts. The following sections deal with these matters and detail the working group's views on them.

4.4.1 Languages used in emergency alerts

The emergency alert must be transmitted in languages specified by the authorities. In the SMS system the different language text versions should either be included within the same message or they can be sent using separate messages. In the CBS system the different language versions can be sent using different channels. In this case, the subscriber must activate in their own terminal equipment the emergency alert channel for the language version in which they wish to receive the alert.

4.4.2 Erroneous emergency alerts

Both the SMS and the CBS system must be configured not to allow the transmission of either intentional or accidental erroneous messages which appear to be genuine emergency alerts. The systems themselves must be sufficiently protected to prevent outsiders using them for the purpose of transmitting erroneous messages. A bigger problem is the fact that the content of the emergency alert, or its visual appearance in the display of the terminal equipment, does not give any unambiguous indication that it has been sent by the authorities. However, sending such messages with intent to mislead is a criminal offence, and this should be rigorously communicated to the public at the launch of the service.

4.4.3 Collection of traveller data

One option, in particular with regard to those travelling abroad, is to request the traveller to 'sign in' with a central body of some kind (such as an electronic system maintained by the Ministry of Foreign Affairs) in the country where they are travelling. This would allow the transmission of messages to the country concerned to be directed to mobile subscriptions that appear in the database that has been thus created. However, because the system would work on a voluntary basis, it would not necessarily represent very comprehensive coverage. We assume that the maintenance of such a database, or the transmission of SMS messages to it, would not be a job for the operators and as such this report does not deal with it further.

4.4.4 Transmission of an SMS message to all Finnish mobile subscriptions

In the working group the idea was also raised that by formulating the message conveniently it might be possible to send it to all Finnish mobile subscriptions. However, it was pointed out that, depending on the operator concerned, this would involve transmitting the message to up to two million mobile subscriptions. Although time would be saved in dispensing with the positioning work, merely transmitting the message would take dozens of hours.

5 TERMINAL EQUIPMENT

5.1 SMS

The reception of SMS messages constitutes the basic function of all modern mobile stations. However, there are various reasons due to either the terminal equipment or the subscriber which mean that the text message is either not received at all or its reception is ignored for a while. A few reasons:

- the terminal equipment is switched off, and the text message is only received when the equipment is connected to the network
- the terminal equipment is set to mute operation, so that the arrival of the text message is not heard
- the terminal equipment's text message memory is full, and new text messages cannot be received.

5.2 CBS

Most, but not all, terminal equipment has the option to receive CBS messages. However, the terminal equipment must be specifically set to receive CBS messages and the correct channel has to be selected. Depending on the terminal equipment, it can be very difficult to locate the function behind all sorts of menus. The terminal equipment also uses up slightly more current when it is on standby to receive CBS messages.

The reasons (due to the terminal equipment or the subscriber) for not receiving or ignoring messages are the same as in the case of SMS messages (in other words, the terminal equipment is switched off or it is set to work without sound). A full text message memory does not prevent the reception of CBS messages. CBS messages are, however, only received when the terminal equipment is in idle mode (in other words, no other messaging transaction, such as a voice call, is ongoing). This is one reason why a CBS message is generally sent repeatedly at short intervals.

6 COMPARISON OF THE SMS AND CBS SYSTEMS

The following table contains a summary of the fundamental differences between the SMS and CBS systems.

	SMS	CBS
Length of message	Max 160 characters (x3) = 480	Max 93 characters (x15) = 1395
Acknowledgement of message	Yes	No
Interface with network	Via short message service centre	Via base station controllers (cell broadcast centre required)
Mode of message transmission on radio path	Signalling channel	Separate channel (a channel converted for the purpose)
Loading on radio path	Other network loading has an impact	Other network loading does not have an impact (separate channel reserved all the time)
Loading on network	Fairly large (own message to each subscriber)	Smaller (one message between CBC and BSC, one message between BSC and cell, only one joint message to subscribers in one cell coverage area)
Current consumption of terminal equipment	Normal	Greater than normal (slightly)
Activation of terminal equipment	Normal	Has to be in special mode (activated channel)
Reception of message in terminal equipment	Always when terminal is on	Only in idle mode (e.g. not received when call is ongoing)
Appearance of message in terminal equipment	Standard (normal text message)	Differences in terminal equipment
Accuracy	VLR area/LA (location area)/cell accuracy	Cell accuracy
Speed	Slow (positioning + transmission, can be speeded up if automated)	Fast
Repeatability	More work (mobile subscriptions have to be identified each time separately or continuous monitoring)	Easy (basic idea is to define same message to be transmitted at certain intervals)
Coverage of system	Finland and abroad	Finland

Table 1. Differences between the SMS and CBS systems

7 ESTIMATED TIMETABLE FOR IMPLEMENTATION/BRINGING INTO OPERATION

The adoption of either system requires measures by both the authorities and the telecommunicaitons operators. This report will concentrate on the study of the measures that the telecommunications operators will have to undertake.

7.1 The SMS system

The SMS system is already available for use, but it requires that several separate systems are used "manually". The system will have to be further developed, in particular as regards speed, in various ways before it can be deemed to be compatible for the transmission of emergency alerts.

Section 4 of this report mentions several issues which will have to be developed. The technical points that require development relate to new functions (MML commands) in the network elements of the mobile networks as well as to some new applications/the development of applications in the other systems of the telecommunications operators. A new transaction collection system needs to be acquired or the existing one improved.

New MML commands require placing an order with the equipment manufacturer as well as the implementation of the function and introduction into the network. Similarly, new applications/development of applications requires either that the telecommunications operators carry out the development themselves or that the application/development work is ordered from external providers.

It is estimated that the new acquisitions/functions will be ready for use in about six months from the order/decision.

Further development work is required in terms of the creation of efficient processes for the functions as well as the training of personnel to use them. The processes would vary somewhat from operator to operator. With some operators the functions could be centralised (one person to operate them all), while with others they would be decentralised due to the decentralisation of the network management operations. We would estimate that six months would be sufficient to implement this work.

7.2 The CBS system

Because CBS systems are not currently in use, adopting them would mean that the network operator would have to acquire CBC equipment, update network elements, construct links, determine alert areas, train personnel and carry out testing. It is estimated that the CBC equipment would be ready to use within six months of the order/decision. This is an entirely new system to the network and as such would require a multitude of measures to be carried out in the network itself. Consequently, we would estimate that the adoption of the CBS system as a whole into the GSM systems could take at least 12 months. As CBS systems cannot as yet be incorporated into UMTS systems, it is not possible to assess the procedure that would be required.

8 ESTIMATED COSTS OF SYSTEM IMPLEMENTATION

It is not possible to present any detailed estimates of the cost of implementing the systems because the operators' and equipment manufacturers' contracts vary, there are differences in the current network configurations of the operators, etc. However, the following sections give a few cost estimates for acquiring system components. The prices are indicative only. The costs relate to a single operator, and the total costs should be estimated in relation to the total number of operators involved. All employee costs are included in the operating costs. Various items are discussed with regard to operating costs, but no cost estimates are given for them.

8.1 The SMS system

Telecommunications operators will incur the following costs when using the SMS system for the transmission of emergency alerts:

ACQUISITION COSTS

HLR/VLR query method (alternative 1):

- new functions

1. searching VLR for subscriber data using LA codes

2. searching HLR for subscriber data using MSISDN numbers directly

There is no exact cost estimate, but it was estimated that the costs would be less than the software costs of the transaction collection system.

< €150,000

- introduction of functions into network and testing (the cost depends on whether the introduction is carried out in connection with other changes or separately on its own)

€10,000 to 50,000

- development of other applications used by the telecommunications operators (required if better positioning accuracy than LA accuracy is desired)

1. positioning service into which a large quantity of mobile subscription numbers may be input
2. filtering programme which picks out the subscriber connections in certain cell coverage areas

€100,000 to 300,000

Transaction data collection system (alternative 2):

Extra capacity to safeguard LUR (Location Update Register) statistics (one server per MSC + DCN amendments) – presuming that the operator is already using the basic system

€30,000/MSC

Software and hardware installed on top of basic software

€100,000 to 150,000
€30,000

OPERATING COSTS

- personnel resources (during working hours/outside working hours), training to use possible new network functions - costs vary greatly from operator to operator because with some operators the network management operations are already centralised, in which case one person is able to undertake all the functions, but with others they are decentralised, which means that different operations are carried out in different locations by different people

- transmission of SMS messages – costs depend on the number of messages transmitted, in other words on the frequency of use of the system and the size of the target group to whom the message is transmitted

- cost of updating the correspondence between geographical areas and location areas

- no exact cost estimate is given regarding operating costs because the costs depend fundamentally on the method of implementation of the system as well as usage; operating costs depend largely on whether the new system is implemented as a separate system or as part of current systems; opinions received for the draft report indicated that the operating costs may be significantly large.

8.2 The CBS system

Telecommunications operators will incur the following costs when using the CBS system for the transmission of emergency alerts:

ACQUISITION COSTS

- implementation of facility in all BSCs (total amount depends on the number of BSCs)

> €1 million

- CBC (cell broadcast centre) – it is assumed that each operator will have their own CBC; costs depend on the degree of system protection that is desired

€250,000 to 600,000

- connections between BSC and CBC (costs depend on the number of connections)

> €150,000

- modifications in BSS

> €10,000

OPERATING COSTS

- personnel resources (during working hours/outside working hours), training to use possible new network functions

- cost of radio capacity reserved for CBS use; the working group estimated that the calculated costs of the reservation could be significantly high in relation to other costs

- costs of updating the correspondence between the geographical areas and the location areas

- in research carried out in Sweden radio capacity is included in the acquisition costs, and even so the operating costs are estimated to reach €1.5 – 3 million annually for a total of three operators; because the estimated acquisition costs (excluding radio capacity) in Finland and Sweden are roughly the same, the Swedish operating cost estimate can be applied to Finland, as well.

9 CONCLUSION

The working group studied the use of the SMS and CBS systems in the transmission of emergency alerts. The SMS system functions in two stages. The first stage consists of identifying the mobile subscriptions in the target area. In the second stage a text message is transmitted to the mobile subscriptions. There are two possible ways to identify the mobile subscriptions in the target area. One method is to submit VLR/HLR queries and carry out positioning. The other method consists of identifying the mobile subscriptions via a special transaction collection database. In the CBS system the messages are transmitted directly to the cells which cover the target area. The SMS system can be used to send emergency alerts to the mobile subscriptions of Finnish mobile operators which are located both in Finland and abroad. The CBS system is applicable only in the transmission of emergency alerts in Finland.

Both systems have their own advantages and disadvantages. The most significant benefit of the SMS system is that an emergency alert sent through it can be received in all mobile stations without any special arrangements. The greatest disadvantage is that the system is slow, and the greater the number of recipients, the greater the disadvantage. The greatest advantage of the CBS system is its speed. First of all, there is no need to separately locate the mobile subscriptions in the target area and, secondly, the message is received simultaneously by all the mobile stations in the emission cell area. The greatest disadvantage in the networks is the need to reserve radio capacity and in the terminal equipment the greater than usual consumption of current in the reception standby mode. The terminal equipment also has to be specifically activated to receive the emergency alerts.

The SMS system is already operational, but the positioning requires awkward, partly manual procedures. The construction of a practical system requires that existing systems are supplemented with various other software solutions which would have to be purchased. The acquisitions to improve the positioning procedure will be required irrespective of whether the method exploiting VLR/HLR data or the method using the transaction collection database is used. Because the telecommunications companies already apply appropriate systems for the transmission of SMS messages, the actual transmission of emergency messages using the SMS system will not incur any significant additional cost. At present, the CBS system is not used in any shape or form, and its implementation would require the acquisition of entirely new network elements/functionalities.

The report presents indicative estimates of the acquisition costs of the systems. It is possible that these estimates do not reflect reality. The exact costs will not be clear until the system has been selected. However, it is possible to compare the costs of the two systems on the basis of the estimates given in this report. When comparing the SMS and CBS systems, it is clear that SMS (about €0.5 million per operator) is much less expensive to implement than CBS (about €1.5 to 2 million per operator). The estimated total acquisition prices for three operators are €1.5 million (SMS) and €4.5 to 6 million (CBS). With regard to the SMS system, it is difficult to carry out a comparison, on the one hand, of the method that exploits the VLR/HLR query method and, on the other, the one that exploits the transaction collection database, because the VLR/HLR query method can be developed in sections, whereas the method exploiting the transaction collection database must be implemented as a single investment. Remembering that the estimated amounts are indicative only, we can assume that the total acquisition costs of the two SMS alternatives, when fully implemented, are roughly equal. The operating costs depend entirely on the way in which the system is implemented and the usage it gets. In the CBS system the costs relating to the reserved radio capacity must be taken into account. Operating costs could reach significant levels. A study carried out in Sweden put the operating costs (excluding radio capacity costs) of the CBS system at about €1.5 to 3 million per annum. The SMS system is the only option for emergency alerts to the subscriptions of Finnish mobile operators which are located abroad. If the SMS system is automated for the transmission of emergency alerts abroad, some of the required acquisitions can be exploited in the transmission of alerts within Finland.

The adoption of the CBS system has been raised at EU level, and the Commission has sent a letter to ETSI concerning the standardisation of the system. It is likely that at least some of the problems encountered in connection with the system will be eliminated in the near future. If the

CBS system is adopted extensively in Europe and elsewhere, we can expect costs to decrease. We must also bear in mind that CBS is the only option if very stringent speed requirements with regard to messages sent to a large number of mobile subscriptions are set for the selected system.

This report has concentrated on the technical alternatives for the implementation of a text messaging system in the transmission of emergency alerts. The report also gives some estimates on the cost of implementation as well as the time frame for adoption. A different approach would have been to set the requirements for the system, such as the sizes of the target areas, speed, reliability, etc. These requirements will have to be set before any final decision is made on the system, and they must be defined by the future users of the system.

ANNEX 1 standards

SMS

ETSI TS 123 040 V3.5.0 (2000-07)	Digital cellular telecommunications system (GSM);Universal Mobile Telecommunications System (UMTS);Technical realization of the Short Message Service (SMS);(3G TS 23.040 version 3.5.0 Release 1999)

CBS

3GPP TS 23.041 V3.5.0 (2002-06)	3rd Generation Partnership Project; Technical Specification Group Terminals; Technical realization of Cell Broadcast Service (CBS) (Release 1999)