

**IMPLEMENTATION OF AN SMS-BASED
EMERGENCY SERVICE IN FINLAND**

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Abstract <p>The report describes a system where the universal emergency number 112 is easily and reliably accessible also by means of a text message within the technical restrictions of the service. The system is intended for users with special needs (such as the people with hearing disability), but it may be useful for anyone in an emergency situation.</p> <p>The report presents a solution where all 112 emergency text messages are routed to one centralised answering point. The centralised answering point sends an acknowledgement message and locates the mobile phone by means of the positioning system for emergency calls. The emergency response centre appointed as the centralised answering point may deliver the 112 emergency text message or corresponding information to the nearest emergency response centre on the basis of the location data.</p>			
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1 FOREWORD

The directives on electronic communications, which in Finland have been implemented through the Communications Market Act, include a requirement that persons suffering from disability must have access to emergency services equivalent to that enjoyed by other users. This is also one of the key topics of the European Union's INCOM working group (INCOM=Inclusive Communications). The Finnish strategy for accessible communications, which has been through public consultation, contains several recommendations, one of which is to adopt an SMS-based service for the emergency number 112 by the end of 2005.

An SMS-based service for 112 is not a new issue as it has already been one of the targets of the Ministry of the Interior for the last decade. Until now, the deaf and the hard of hearing people have been able to make emergency calls by means of text telephones and by sending text messages to separate mobile phones placed with the individual emergency response centres. The numbers for these mobile phones were only given to those requiring the service among the disabled. From 2002, the Emergency Response Centre Administration has prepared the transition to a national emergency response service based on text messages. In this system, scheduled to be introduced in 2005, the general emergency number 112 would be easily and reliably accessible also by text messages. The service is expected to help all people in emergency situations, not only users with special needs.

The 112 short message number was reserved for emergency purposes in FICORA's numbering scheme some time ago. Also, barring of calls to the general emergency number 112 is prohibited through FICORA's regulations. Along with the adoption of SMS to 112, some adjustments may be necessary to the regulations.

This report was prepared in FICORA's working group for emergency communications and thereafter sent out for public consultation. The group investigated several technical alternatives to implement the SMS-based 112 service in Finland and decided to suggest a model which it is possible to implement by the end of 2005.

2 SMS-BASED EMERGENCY SERVICES ELSEWHERE IN EUROPE AND THE DEVELOPMENT OF STANDARDS

In 2003, Sweden published a report that deals with a test of SMS chat for the emergency number 112. Sweden has recently also started a broader project that deals with testing in both hypothetical and real situations.

There are no European standards for emergency text messages. The propositions of this report are based on the normal SMS-based service. For solutions exceeding the presented basic solution it is important to follow corresponding projects in other countries as well as the development of standards.

3 PRACTICAL IMPLEMENTATION OF AN SMS-BASED EMERGENCY SERVICE IN FINLAND

3.1 Basic solution

If emergency text messages were always routed directly to the nearest emergency response centre, short message service centres and possibly also other network elements would require additional functionalities. Therefore, direct routing does not seem to be a technically and economically feasible solution. Instead, it seems that the best way to handle 112 emergency text messages is to route all messages to one specified answering point where the calling mobile phone is located by means of the positioning system for emergency calls. The emergency response centre, which is to be determined later as being the answering point, then submits the emergency

text message or corresponding information to the emergency response centre nearest to the sender on the basis of location data.

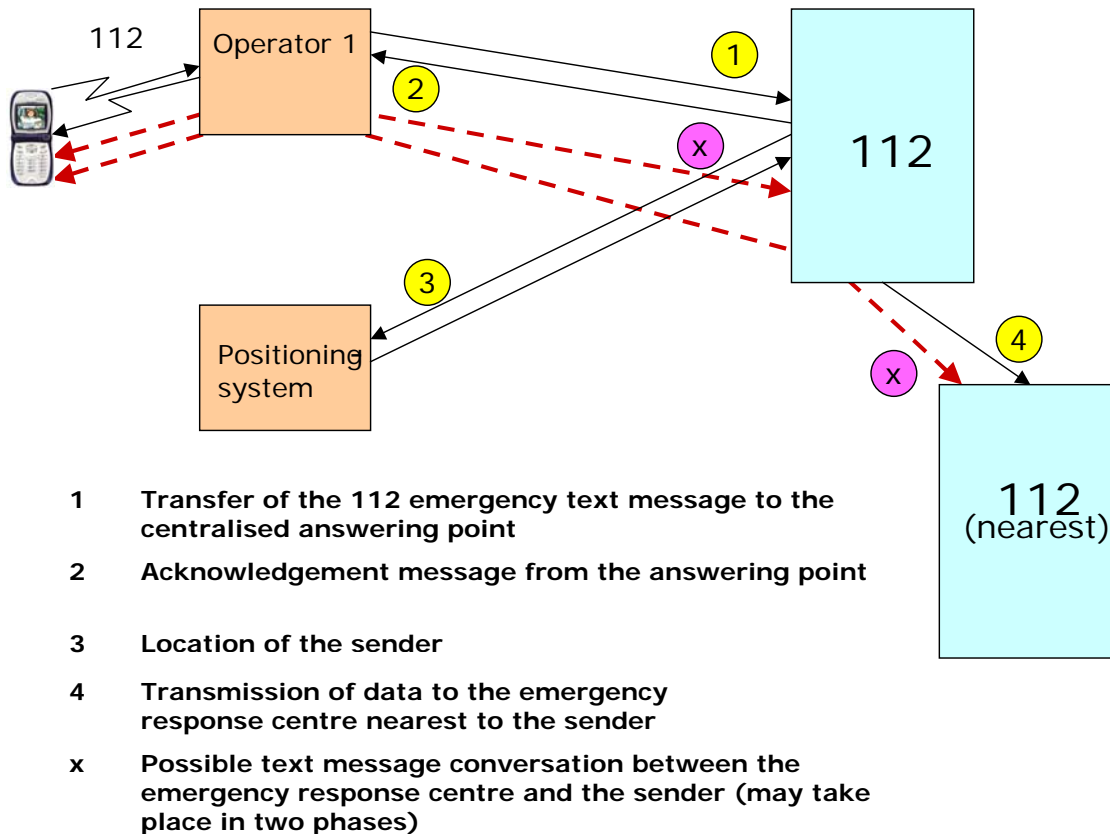


Figure 3.1 Basic solution for the SMS-based emergency service

The Emergency Response Centre Administration will designate the centralised answering point. This centralised model may be adopted, provided that the answering delay will not be too long. It is possible to keep the answering delay at a moderate level, when the first acknowledgement message is sent from the centralised answering point as soon as the sender of the emergency message is located. The new positioning system for emergency calls to be adopted at the beginning of 2005 will enable the location. To keep the delays short, it is appropriate to integrate the reception of 112 emergency messages and other related activities into the general emergency centre system. The situation can be further clarified through a text message conversation between the centralised answering point and the person needing emergency help. From the centralised answering point the emergency text message or related information can be transmitted to the emergency response centre nearest to the person needing emergency help. For the conversation between the nearest emergency response centre the person needing emergency help, some other number than 112 must be transmitted in the answering message from the nearest emergency response centre.

3.2 Restrictions in the SMS-based emergency service

Common restrictions or problems that may occur in the SMS-based emergency service are described below.

- The normal SMS-based service may be unreliable and slow.
 - Text messages are transmitted via the network rather reliably, operators estimate that reliability exceeds 99%.
 - Also when a message is not transmitted to the receiver, the reason for this is usually found in the terminal equipment.
 - Operators estimate that the average delay for text messages is 2 seconds, thus problems may occur in some special situations, such as mass votings.
- Text messages to 112 are barred in the cases described below:
 - Barring of All Outgoing Calls (BAOC) is activated. It bars not only calls but also text messages. The subscriber can activate this function on his or her telephone.
 - Barring of All Incoming Calls (BAIC) is activated. It bars not only calls but also text messages (this means that it is not possible to receive the acknowledgement message from the centralised answering point). The subscriber can activate this function on his or her telephone.
 - Operator Determined Barring of Outgoing Calls (OBO) is activated. It bars also text messages. The service operator may activate this function, for instance, when the limit for the call balance is reached.

Note: FICORA Regulation number 35 on barring categories in telecommunications contains the following point:

Traffic to the general emergency number 112, emergency number for the police 10022 and the operator's number for fault reports shall not be barred with any category.

When this Regulation was being drafted, the function of 112 emergency text messages was not specifically investigated. Therefore, the contents of this point in the Regulation will be reviewed when the Regulation is updated.

- The limit for the prepaid account balance is reached (Note: some operators support free-of-charge SMS services, which means that also the SMS-based emergency service may be free and the service may be used although there is no balance for the Prepaid account).
- The SIM card is missing.
- The caller is in a shadow region of his or her own operator's network.
- All radio channels are busy in connection with mass events.
- Foreign roaming customers cannot use the service as text messages are routed to the short message service centre of these customers' home network.
- Malicious messages are possible.
 - Tracing malicious messages becomes easier as the emergency response centre can see the number of the sending mobile phone and locate the mobile phone of the person needing emergency help.
 - Malicious messages are, however, not regarded as a serious problem for the emergency response centre when they are sent via the Internet, anonymously or with a fault calling line number, as such sending is only possible towards a mobile phone (MT).

3.3 Detailed description of the solution

3.3.1 Transmission of the emergency text message to a joint answering point

Alternatives for the solution are: direct interface from each operator's short message service centre, routing via one adaptation point, or a MAP message to the interface centre for short messages. The alternatives and their advantages and shortcomings are given in more detail under the following points.

3.3.1.1 Direct service operator interfaces from each short message service centre

In Finland there are for the time being six operators that possess a short message service centre: TeliaSonera, Elisa, Finnet Verkot, Saunalahti and Tele2 as well as Ålands Mobiltelefon (ÅMT) on the Åland Islands. Customers of other service operators use the short message service centre of that particular network operator with whom the service operator has concluded an agreement. Each of the possessing operators transmits the text messages to the emergency response centre via the application interface. The answering point requires an interface from each operator's short message service centre. CIMD2 and UCP/EMI are typical interfaces in Finland and they can be used as the interface at the answering point from the short message service centres.

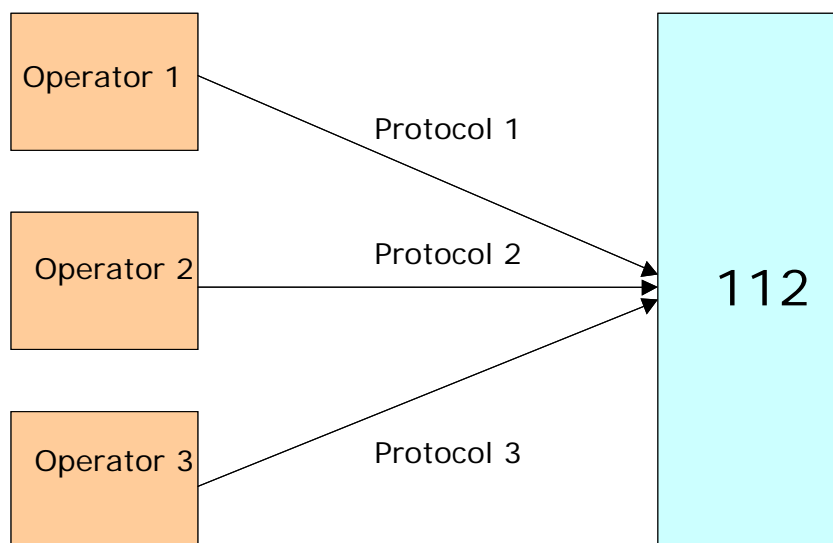


Figure 3.3.1.1 Interfaces to the answering point directly from the short message service centres

The advantages of the solution are:

- possible problems in one operator's system/connections do not affect other operators' performance;
- the operators may join the system at different times, i.e. when the emergency response centre has implemented the specific operator's interface.

The shortcomings of the solution are:

- the emergency response centre must adapt to several operator interfaces.

3.3.1.2 Connection service

The operators' application interfaces are gathered to a special server which transmits the messages to the emergency response centre for instance in http-format. Some operators may directly transmit the messages.

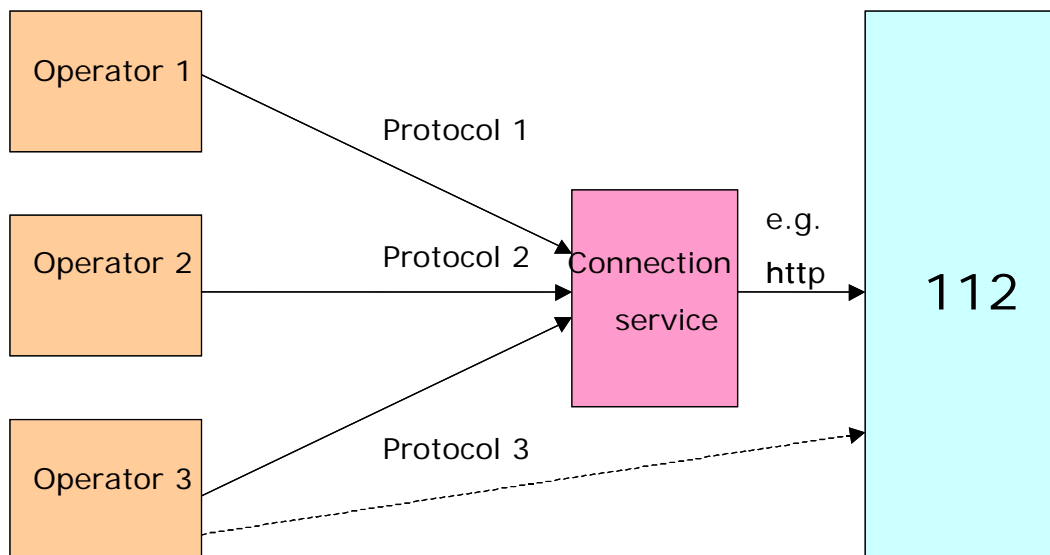


Figure 3.3.1.2 Connection service

The advantages of the solution are:

- at best, the emergency response centres only need one interface.

The shortcomings of the solution are:

- a separate connection service requires financial input and someone to carry out the service;
- the connection service is critical in terms of operation and therefore requires special measures.

This alternative corresponds to alternative 1, with the exception that the connection service in alternative 1 is an internal function in the emergency response centre's system, whereas in alternative 2 the connection service is provided by an external provider.

3.3.1.3 Routing of text messages through one network

Text messages are transferred in the signalling network (normal MAP protocol) to one operator who forwards them to the emergency response centre through the application interface. It is also possible to connect the alternatives with each other. For example: If the emergency response centre only adopts CIMD2 application, operator who does not have this interface may route the messages through another operator (MAP).

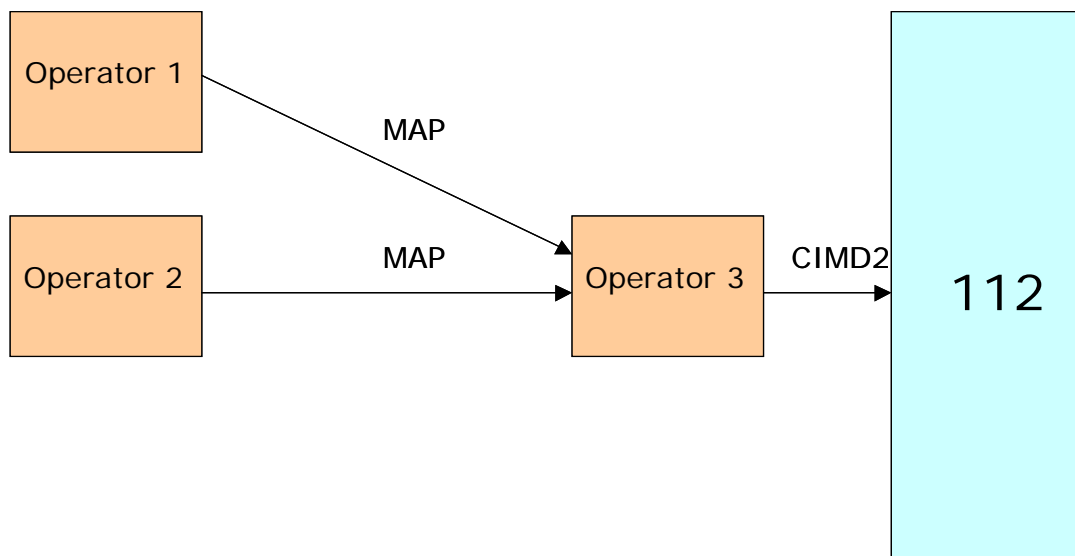


Figure 3.3.1.3 Routing of emergency text messages through one network

The advantages of the solution are:

- the emergency response centres only need one interface.

The shortcomings of the solution are:

- only one centralised point which must be secured or whose capacity must be dimensioned so that there is enough capacity for emergency text messages also in situations where the network may be loaded;
- separate routings must be defined for operators and the detailed method of implementation and finance of the routings must be investigated;
- questions pertaining to interconnection fees must be examined.

One possibility would be that emergency text messages are routed directly from the mobile services switching centre to the interface operator's short message service centre. For the time being, this would be possible for some operators but not all.

3.3.1.4 Transmission of the 112 emergency text message to a joint answering point – proposal for implementation

After evaluating the alternatives, the working group suggests that the SMS-based emergency service be implemented according to alternative 3.3.1.1. The advantages of this arrangement would be the possibility to use systems which are already functioning in the mobile networks. Therefore, the operators would not have to make any investments – just to carry out testing and changes in routings. There would not be one specific centralised point (except for the centralised answering point) which, in case of fault, would prevent the functioning of the system to all operators. The system could be adopted operator by operator after the emergency response centre has implemented the application interface of the specific operator. The emergency response centre must implement three different application interfaces: CIMD2, UCP/EMI and SMPP (however, only one interface is necessary for an operator who manages short message service centres and who intends to join the system). The working group members also stated that software updates in short message service centres do not affect the access interface at all or the access interface is backwards compatible with the previous versions. This means that interfaces once implemented in the emergency response centres need changes very rarely.

The access interface protocols are transferred on the TCP/IP protocol. The transmission connections used between the centralised answering point and the operators' short message service centres must be examined for each operator. The aim is to use, where possible, transmission connections which have already been constructed for other purposes and which take into account information security and reliability. The public Internet must not be used for the implementation of transmission connections.

3.3.2 Acknowledgement of an emergency text message

The officer in duty at the emergency response centres' joint answering point sends an acknowledgement message back to the sender of the emergency text message as soon as the sender has been located. The acknowledgement message is sent via the same interface as the emergency text message was received.

In some situations it may be possible that the sender's mobile equipment is not capable of receiving the acknowledgement message, for instance, when the mobile equipment's SMS memory is full. For ensuring that the message has gone through to the sender, the emergency response centre may use a request for confirmation on whether the sent acknowledgement message has been delivered.

Such situations occur rarely, but they are possible. They are caused by the mobile station, and may be prevented by user's measures. Information about these kinds of problems as well as all other possible problem situations given in this report must be provided to potential users of the service at the time the service is adopted.

3.3.3 Mobile location

It is possible to locate the mobile equipment on the basis of the calling line number by means of a new positioning system for emergency calls which will be adopted at the beginning of 2005.

3.3.4 Transmission of the emergency text message to the emergency response centre nearest to the person needing help

On the basis of the location data, the person in duty at the centralised answering point sends the emergency text message or corresponding information to the emergency response centre which is nearest to the sender of the message.

3.3.5 Text message conversation

The working group decided that an acknowledgement message must be sent to the sender of the emergency text message already at the first phase of the implementation, as given in item 3.3.2. Later study, however, must include the possibilities to adopt a text message conversation in two phases: between the answering point and the sender of the emergency text message, and between the sender of the emergency text message and the nearest emergency response centre, in case the duty officer at the nearest emergency response centre needs additional information for directing the operation.

The text message conversation between the answering point and the sender may take place through the emergency number 112. The application in the answering point must then be able to tie all text messages coming from the same sender to the same emergency case on the basis of the calling line number.

A requirement for a text message conversation between the nearest emergency response centre and the sender is that in the acknowledgement message the person needing help receives another

number than 112 to which he or she then sends the text messages following the actual emergency text message. Such number could be, for instance, 112xx, where xx is the number of the emergency response centre nearest to the person needing help.

The messages of the text message conversation are transmitted in both cases through the operator interface of the centralised answering point (i.e. through the same route as the original emergency text message and the acknowledgement message). For messages to the emergency response centre's number 112xx, the application of the centralised answering point can route the messages directly to the right emergency response centre.

3.3.6 Working group's proposal for solution

The working group suggests that the SMS-based 112 emergency service be implemented according to figure 3.3.6. If the text message conversation is also implemented between the sender of the emergency text message and the nearest emergency response centre, the implementation takes place according to figure 3.3.7.

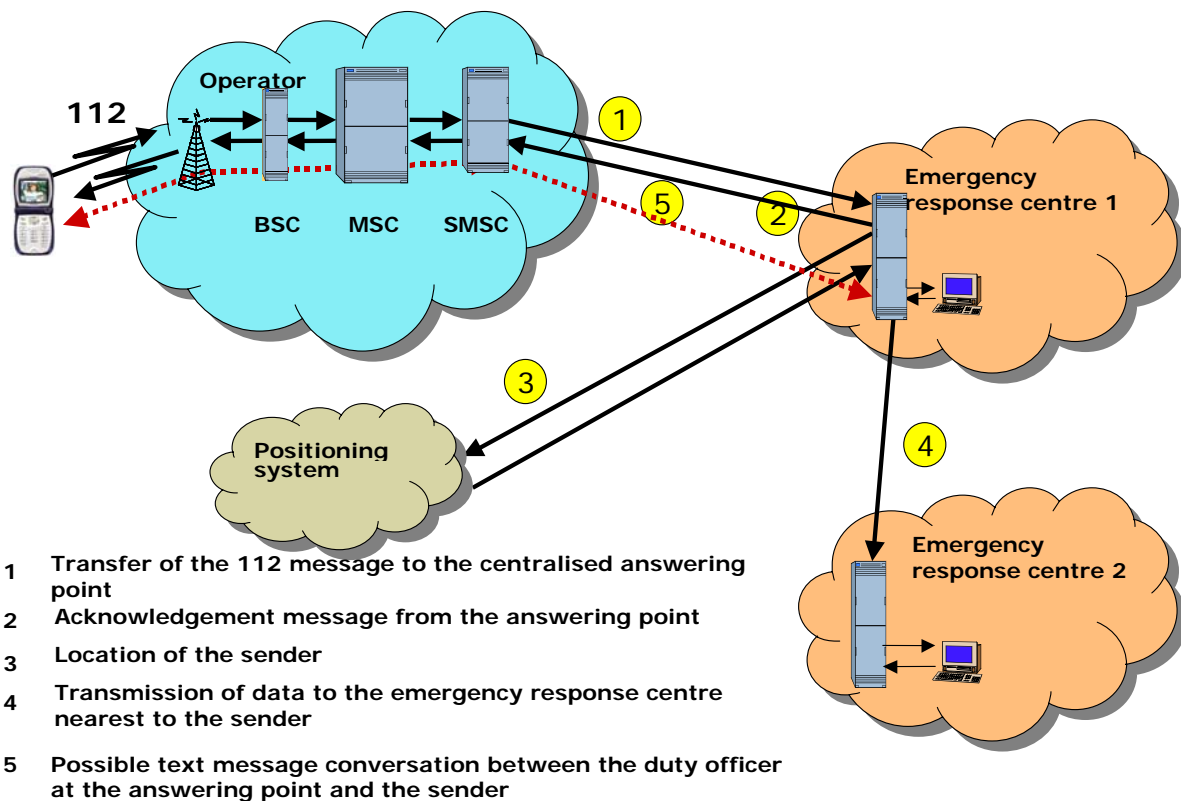


Figure 3.3.6. Implementation of the SMS-based 112 emergency service (possible text message conversation only from the centralised answering point)

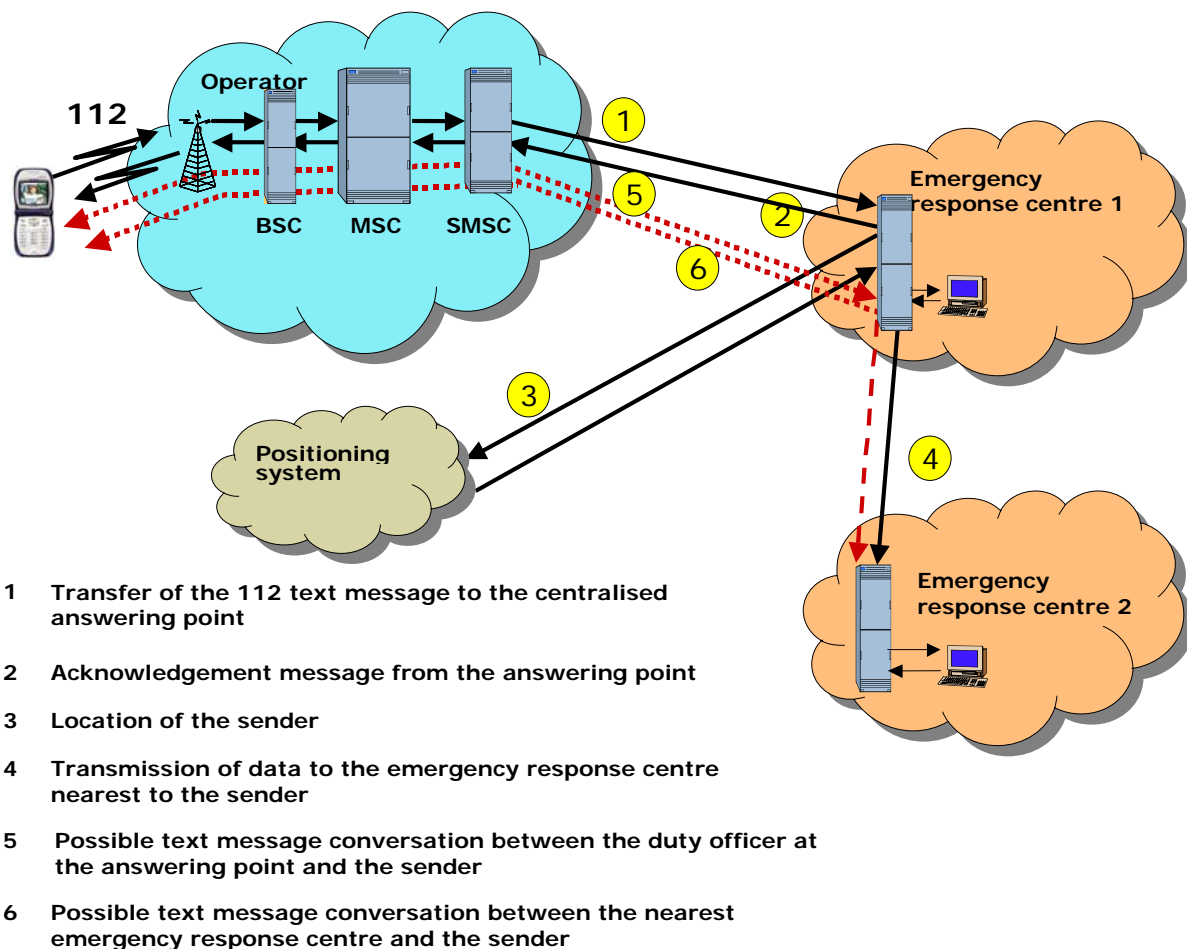


Figure 3.3.7. Implementation of the SMS-based 112 emergency service (possible text message conversation also from the nearest emergency response centre)

4 COSTS FOR THE PROVISION OF EMERGENCY TEXT MESSAGES AND CALL ITEMIZATION

Users can send emergency text messages to 112 free of charge and text messages to 112 must not be included in the call itemization of a bill.

These requirements are based on section 55 of the Communications Market Act (393/2003), which states that users must be able to access the universal emergency call number 112 free of charge. According to the preamble to the Act, this means calling an emergency number or, for instance, sending a text message to an emergency number, if it is technically possible, or some other technical way to connect an emergency number which may be provided in the future. According to section 24 of the Act on the Protection of Privacy in Electronic Communications (516/2004), a call itemization for a subscriber connection may not contain identification data for services for which no fee is charged.

The acknowledgement message of an emergency text message can be compared to call back, which in some cases is used in connection with a normal emergency call. This call-back is a normal call for which a fee is charged, and therefore also the acknowledgement message is a normal chargeable text message.

In a text message conversation, messages sent to 112xx by the person needing help are also emergency text messages for which no fee is charged.

In a text message conversation, the emergency response centre's messages to a normal subscriber number are text messages for which a normal fee is charged.

According to FICORA's interpretation, the emergency response centre does not pay compensation to operators for those 112-calls which are cost-free for users. The same principle applies to 112 emergency text messages.

The emergency text messages are routed from each operator's short message service centre directly to the emergency response centres' centralised answering point, which means that there will be no inter-operator text message fees. If, however, such costs should occur, the operators must mutually agree upon them.

5 IMPLEMENTATION AND MAINTENANCE COSTS

Costs for the implementation and maintenance of the SMS-based emergency service are mainly composed of four parts:

1. changes that operators must make for routing 112 text messages to short message service centres – the working group sees that these costs form a part of the normal operation costs and do not cause any additional costs;
2. transmission connections from short message service centres to the centralised answering point – the aim is to use existing (IP) connections between the emergency response centres and the operators, but costs may occur for VPN specifications; if there are no usable connections they must be acquired;
3. acquirement and maintenance of receiving interface and/or adaptor at the emergency response centre (update as necessary, probably not very frequently);
4. personnel costs at the emergency response centres (training, etc.).

Items 1 and 2 involve costs which may be compensated to operators. As stated above, item 1 does not cause any costs. Item 2 causes some costs which, however, can be defined more precisely after the Emergency Response Centre Administration decides which transmission connections are adopted and selects the centralised answering point.

Costs incurred of items 3 and 4 are emergency response centres' own costs and the Emergency Response Centre Administration is best aware of these costs. Costs for item 3 depend on the solution decided by the Emergency Response Centre Administration (interface software as part of the emergency response centres' own system / separate adaptor).

6 IMPLEMENTATION SCHEDULE

The aim is that the first phase of the service with the known restrictions can be adopted by the end of 2005. The first phase includes: transmission of the 112 emergency text message to the centralised answering point, acknowledgement of the emergency text message, location of the mobile phone, and transfer of information to the nearest emergency response centre, where necessary. For text message conversation, the schedule is open and a more precise schedule can be done only after the first phase has been put into practice.

From the operators' point of view, the implementation in this time frame was regarded as realistic at the time this report was published. Question about the interface/adaptor implementation requires fast decision-making on the technical details at the Emergency Response Centre Administration.

7 FURTHER DEVELOPMENT

The aim of the SMS-based emergency service is to implement a first-phase system which would be as covering as possible by the end of 2005. There will be some restrictions and problems in this first-phase implementation, but some of them may be abolished on longer term. Some of the restrictions and problems require that amendments are made to international standards or other international agreements. FICORA's working group for emergency communications follows the international development both in standardisation and in other countries' solutions (e.g. Sweden) and contributes to international development as necessary.

The adoption of the first phase will probably bring about new problems for which a solution is sought in the working group for emergency communications. The following list contains those restrictions and problems that have been discovered during the time this report was drawn up:

- reliability and delays of 112 text messages;
- effect of barrings on 112 text messages;
- other reasons that prevent the sending of 112 text messages;
- routing of 112 text messages in special cases (foreign roaming customers in Finland – the messages are routed to short message service centres of these customers' home networks; Finnish roaming customers abroad – the messages are routed to short message service centres of these customers' home networks and from there to the centralised answering point in case of those operators that take part in the SMS-based emergency service);
- service operators who provide short message services to Finnish customers but whose short message service centre is located abroad and who do not want to join the system (such cases are not known for the time being, but may occur in the future);
- dimensioning/expansion of the system in case of a dramatic increase in the use.

Implementation of the SMS-based emergency service on Åland Islands was also considered in the working group. The following facts were stated:

1. Text messages of Ålands Mobiltelefon's subscribers are routed to ÅMT's short message service centre, and therefore the interface to the emergency response centre system must be resolved (to the emergency response centre of the Åland Islands / to the centralised answering point).
2. Text messages of other operators' customers visiting the Åland Islands are routed to those operators' short message service centres and from there to the centralised answering point. Over a longer term, connections between the centralised answering point and Åland's emergency response centre must be considered for mobile phones located to Åland Islands (current solution for transmission of information is a normal phone call).