The Necessity for an EU-wide 112 Emergency Wireless Location System

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How might the timely response and effectiveness of 112 emergency operations and services be substantially improved? And in particular from the perspective of improving relevant (mobile) telecommunications and navigation, positioning and timing infrastructures, as well as operations and services? To answer these questions, we introduce this second in a series of articles. The focus here is on a recent review document evaluating 112 issues and answers within the context of introducing the necessity and requirements for an EU-wide 112 emergency wireless location system using insights and lessons learned from implementation of the E-911 system in the United States. In the previous edition of the European Journal of Navigation (August 2005) Olivier Paul-Morandini set a general scene describing Emergency Telecommunications covering communications between citizen and authority, between authorities, and between authority and citizen in case of emergency or disaster.

Emergency Wireless Location

Mobile phones are fast becoming the dominant means of voice communication across Europe. For this reason, the European Commission is currently urging Member States for the speedy implementation of an upgraded & harmonized EU-wide 112 emergency network & services infrastructure with emergency call technology (eCall) for calls made from mobile phones, in which the location of the caller would be provided automatically to the nearest Public Safety Answering Point (PSAP). In the United States the process of deploying such a system is well underway and scheduled for substantial completion by the end of 2005. The US system (called E-911) is modelled on a mandate issued in 1996 by the Federal Communication Commission (FCC) which specified required levels of location performance so that public-safety agencies could render assistance rapidly, without the caller needing to know their exact location.

Why Is It Needed?

In an emergency it is essential to render assistance as quickly and efficiently as possible. When a mobile phone user places an emergency call, emergency dispatchers currently have no way of accurately determining the caller's location and, as a result, must communicate with them to determine this. Frequently, callers do not know their whereabouts, are disoriented or may not speak the native language of the country in which they are. All of these factors can lead to delays that not only tie up valuable public-safety resources but can also hinder effective response in dire situations. Various studies suggest that victims of accidental trauma and other medical crises enjoy more positive outcomes when medical assistance is promptly administered. Patient survival rate and long-term prognosis may thus depend upon the rapidity with which emergency response teams can arrive at the scene of the call.

Already Saving Lives in the US

In the US emergency location systems are in place and saving lives, a result of the imposition by the US FCC of fairly stringent performance requirements on wireless operators, who have been made responsible for implementation and maintenance of the location systems. Currently only two technologies are capable of meeting the needs outlined by the FCC: U-TDOA (Uplink Time Difference of Arrival) and A-GPS (Assisted Global Positioning System). U-TDOA is a network-based technology that uses equipment installed on the mobile operator's network to triangulate the location of any mobile phone, current or future. All three major GSM operators in the US have selected U-TDOA for their networks. A-GPS, which is being implemented in CDMA networks in the US, uses the satellite-based Global Positioning System in conjunction with an A-GPS chip in the handset to pinpoint a location. Both technologies are approaching advanced stages of deployment across major markets in North America. Table 1 summarises the impact of these parameters on the performance of different cellular location technologies.

Next Steps for Europe

The review document [1]: E-112 Issues and Answers- Recommendations and Insight for the Optimal Planning and Implementation of E-112, Emer-

gency Wireless Location for the European Union recommends the early implementation of an EU-wide system using one or more location technologies to uniformly provide the location accuracy necessary for saving lives. Specific recommendations also include the adoption of a single call 112 number [2] (see news item in this edition of EJN) issued by the 112 European Emergency Number Association (EENA), petitioning the European Parliament for urgent implementation of a single 112 emergency call number across Europe. Ideally, this system would provide locations of consistent accuracy for all emergency callers, regardless of their position, whether urban, suburban, rural, or inside buildings. Regarding the latter, the European Group of Institutes of Navigation (EUGIN) has very much welcomed the initiative of EC - DG TREN, allowing European Radio Navigation Plan (ERNP) policy study [3]. This involves all the important European stakeholders such as users, governments and industry, giving very precise recommendations on the actions to be undertaken. The study awarded to Helios Technology Ltd was presented to the Commission at the end of 2004.

From a technical perspective, the EC, within the IST 6e Framework R&D Telematics program for Safety & Security, initiated an Integrated Project (IP) for Global System for Telematics (GST) with the objective of creating an open and standardised framework architecture for end-to-end telematics [4]. Within the scope of this article on the future implementation of new 112 emergency services, the sub-project RESCUE is very relevant. 'Openness' here relates to the ability of the architecture to support (multiple) existing and new bearers and protocols, as well as common mechanisms for the removal, updating and installation of new services and applications. Standards are necessary for the key interfaces, allowing hiding of the complexity and heterogeneity of supporting technologies. The total budget for this IP is € 21,5 million, with an EC contribution of € 11 million. The project started in March 2004 and will end in February 2007 (36 months).

Learning from the US

The technology needed to accomplish this goal in GSM networks is now readily available and serving more than one hundred million wireless subscribers in the United States. However, the US wireless system reached its present status only after a great deal of litigation and negotiation between wireless operators and the FCC. The variety inherent in European languages, governmental structure, culture and technical infrastructure can only increase the difficulty of achieving the objective within Europe. In consequence, implementation of a common EU standard demands a high level of consultation, planning and co-operation between the various member states. Only a representative body comprised of the necessary technical, financial and political expertise could achieve accomplishment of the task. Membership of this proposed body would necessarily include wireless operators, PSAPs, Local Exchange Carriers, fixed & wireless audio, data & video telecommunication, as well as dedicated Positioning, Navigation & Time (PNT) network infrastructure suppliers, and other stakeholders in the wireless industry.

Funding the System

There are various options for financing the development and deployment of a comprehensive wireless location system, which may impose a capital burden on PSAPs, wireless operators, local telephone exchange carriers, and other stakeholders in the communication and PNT system. The importance of financial considerations concerning this effort was made evident in the development of a nationwide location system in the US; one mandated by the government without their providing any assistance with funding. This aspect became the central cause of delay in implementation in the US, and understand-

	U-TDOA	A-GPS	E-OTD/ Matrix	E-CID
SNR	Very good	Very poor	Very good	N/A
Integration time	Very high	High	Low	N/A
Bandwidth	500kHz	1,000kHz	250 kHz	N/A
Super-resolution	20-30% improvement	Not possible	Limited by capacity	N/A
Timing stability	20 nsec	5-10 nsec	Up to 1000 nsec	N/A
Geometry	Very good except for linear "string of pearls" distribution	Good only with clear view of sky	Very good at high cell density	Cell density can degrade accuracy
Number of measurements	30-50 antennas	8 satellites maximum	3 to 8 antennas	N/A
Additional Comments	Best accuracy in urban /suburban settings; drops off in rural areas	Poor accuracy & yield in urban canyons and in buildings	Synchronisation and integration time issues limit accuracy to about 150m	Low accuracy overall (550 m). No idle mode location. Poor yield in rural settings (>15km cell spacing)

Table 1 - Performance Factors in Wireless Location.

ing of these issues could help smooth the path toward institution of such a system within the EU.

In order for E-112 to be successfully deployed it is imperative that the initiative is driven with the co-operation and co-ordination of all parties involved: PSAPs, end users and operators. E-112 should be seen as a catalyst for the successful deployment of high-accuracy location-based services, as opposed to an overall impediment to the wireless industry. They may be further motivated by the knowledge that the subscribing European public, according to two recent studies [5], has indicated strong demand for E-112, as well as a strong interest in certain commercial location-based services, provided:

- they can get fast and reliable service each time they call for an application
- their basic rights of privacy are not violated
- the user interfaces are simple, straightforward and not time-consuming.

The surveyed consumers expressed a willingness to pay substantially for safety and security, and moderately for some simple LBS applications. In the most recent survey, 75% of participants indicated they would pay an average of 7.5 per month for E-112 directly, and 37% said they would be very likely to consider switching operators to take advantage of E-112. It should be noted, however, that both consumers (4%) and operators (56%) believed that national governments should fund E-112, on the grounds that it is a public service. Over two thirds of consumers believed that cellular operators should be mandated to offer high-accuracy E-112 services; pro-mandate sentiment was strongest in Germany and weakest in the UK. From this brief examination it could be concluded that European wireless operators would almost certainly support a movement toward EU-wide E-112, provided they are not faced with rigid mandates that require large expenditures on their part.

E-112 a High Priority

The review document [1] discussed in this article has examined a number of factors covering the development of a unified wireless E-112 system for the European Union. It proposes that:

- such a system is vital for saving numerous lives and PSAP resources each year
- it should be implemented expeditiously
- high-accuracy, high-yield, low-latency location systems provide the best assurance for prompt delivery of emergency services
- since high-accuracy systems are already available and in very wide use for emergency location, there are few impediments to immediate deployment within Europe
- a variety of funding mechanisms could be exploited to support implementation, and operators have an incentive to support an EU-wide system
- all segments of both public and private sectors affected by such implementation must be involved in its development and evolution
- issues of privacy, while a concern to the public, can be resolved by good policy.

Because of its potential for saving lives currently at risk, the EU should consider wireless E-112 a high priority. The European Commission and organisations representing the public-safety community have publicly recognised the need for this system. In addition, wireless subscribers, who will soon make up the majority of emergency callers, wish to see the system implemented and place very high value on this service. For all of the reasons given here, and because delay can only increase the complexity of the technical and political issues involved in implementing the much-needed 112 eCall system – it is strongly recommended, that both Member States of the EU as well as European industry simultaneously support the development of a unified wireless E-112 network and services infrastructure.

As part of the research that culminated in their final report of 2002, CGALIES [6] surveyed representatives from a number of EU member states to determine their (predicted) requirements for accuracy from an E-112 wireless location system. Table 2 shows the results of the survey.

Member State	Urban	Suburban	Rural	Indoor	Crossroads
1	20m	50m	100m	20m	100m
2	<10m	10-50m	100m	<10m	20-50m
3	FCC-like	FCC-like	FCC-like	FCC-like	FCC-like
4	50m	50m	100m	<50m	<100m
5	30m	100m	100m	5m	5m
6	10m	10m	10m	10m	10m
7	30m	50m	100m	30m	30m

Table 2 - E-112 Accuracy Guidelines Proposed by European Operators.

Location technology not only saves lives; it can help save time and resources by assisting in determining which type of response to dispatch. Deployment of an EU-wide wireless location system will offer citizens a highly accurate public-safety emergency notification service, while synergistically offering commercial benefits to the wireless operator via location-based services. Given the lessons learned from the US, the joint deployment of reliable high-accuracy location services (public-safety and commercial services) could help fund the initiative and offer a more collaborative, co-operative effort amongst those with a vested interest.

The benefits of location technology are clear, and the need, with the continued increase in mobile-phone use, will only continue. Wireless location has already proven beneficial in the US, and it has now provided a framework of experience for the EU to build upon to expedite the deployment of these life-saving systems. When implemented sensibly, wireless location technology has the potential for saving and improving the quality of people's lives.

References

[1] The review document (December 2004): *E-112 Issues and Answers- Recommendations and Insight for the Optimal Planning and Implementation of E-112, Emergency Wireless Location For the European Union* referred to in this article is a collaborative effort and contains contributions from location and emergency-services experts from around the globe. There are contributions from BWCS Research, Concise Insight, Cross Country Automotive Services EENA – European Emergency Number Association, Greater Harris County 9-1-1 Emergency Network, Helios Technology Ltd, Lancashire Ambulance Service, NENA – National Emergency Number Association, Spartanburg County PSAP case study, TruePosition, Inc.

[2] EC Recommendation release documents: Brussels, 25 July 2003, IP/03/1122- 'Commission pushes for rapid deployment of location enhanced 112 emergency services' and C (2003) 2657 Final – 'On the processing of caller location information in electronic communication networks for the purpose of location-enhanced emergency call services'.
As from 25th July 2003, under the Universal Service Directive 2002/22/EC, fixed and mobile network operators are required to provide caller-location information to emergency service centres responding to '112' calls in a manner best suited to the national organisation of emergency systems and within the technological possibilities of the networks.

[3] Submission in December 2004 to DG-TREN of EC-funded Policy study by Helios Technology Ltd for Recommendation of a 'European Radio Navigation Plan' (ERNP) see: www.helios-tech.co.uk/ernp or http://europa.eu.int/comm/dgs/energy_transport/galileo/whatsnew/index_en.htm.

[4] Contract N°: 507033, priority FP6-2002-IST-1: EU- IST 6e Framework R&D Telematics programme for Safety & Security resulting in an Integrated Project (IP) for a Global System for Telematics (GST)- Open Architectures with sub-projects *Rescue, Floating Car Data, Security, Service payments & Safety Channel)*, see: www.gstforum.org/en/downloads/public_documents/.

[5] Two studies: Wireless Location on Target, BWCS Research 2004. The research consisted of interviewing over 400 users and 25 mobile operators across Europe during May 2004 and Concise Insight, European Location-Based Services 2004.

[6] See: www.telematica.de/cgalies/.

Biography of the Author

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Arnold-Kees van Rongen studied law (Bachelor-degree level) at Erasmus University, Rotterdam and attended an Industrial Trade Delegate course at Klöckner & Co. Duisburg, Germany. He has also attended a variety of computer and office automation, marketing, sales and product-orientated seminars, training courses and workshops. Mr van Rongen, currently a managing partner at Mobi-Spot BV, started out in May 1996 as entrepreneur in founding TeleWave, Mobile Business Solutions BV, a Venture Capital & Mobile Telematics Consultancy/Interim Management services-company.●