Cell Broadcast as an Option for Emergency Warning Systems

Maria Belesioti
OTE S.A., General Directorate for Technology, Greece

Ioannis Chochliouros
OTE S.A., General Directorate for Technology, Greece

George Heliotis
OTE S.A., General Directorate for Technology, Greece

Evangelia M. Georgiadou
OTE S.A., General Directorate for Technology, Greece

Elpida P. Chochliourou
General Prefectorial Hospital "G. Gennimatas", Greece

INTRODUCTION

The provision of efficient communication is one of the most significant duties of a public authority towards its citizens. A significant component required to meet this responsibility is the ability for state authorities to immediately and efficiently communicate with citizens during times of emergency. Authorities and emergency response teams need to warn and inform the public in times of crisis and therefore are required both to develop and to have effective, high quality communication methods and systems to meet this need.

After the 2004 Tsunami in Malaysia, a lot of effort has been spent on developing ways people could be informed in emergency cases such as hurricanes, earthquakes, floods, forest fires, landslides, and other natural disasters, chemical and industrial accidents, nuclear emergencies, transport accidents, technological disasters, and so forth, so as hundreds of lives to be saved. In the same context, due to recent international events of extreme criminal and terrorist activities, of specific importance becomes any opportunity for creating and properly exploiting various means for notification/warning of the public in cases of terrorist attacks and for civil protection. In fact, the European Union (EU) has developed specific strategic initiatives and has promoted several policies to efficiently deal with various kinds of disasters (European Commission, 1999).

The objective of the present work is to survey the benefits, for users and operators, of mobile networks' usage in emergency situations. In fact, mobile infrastructures (and related information society facilities) have been deployed worldwide and they now constitute a "common and basic element" of our every-day life. Since there are more than 2 billion mobile phones in use all over the world, of which 1.5 billion are GSM phones, it seems obvious to include mobile devices in public warning systems. Consequently, in the scope of the present work we will focus our approach on the global system for mobile communications (GSM) case, representing the well-known "second generation" mobile system. As millions of people (not only in the EU but worldwide) are current users of GSM facilities (European Commission, 2001) such systems can offer a good "opportunity" for the development of civil protection-oriented facilities, dealing with crisis management on hazardous events, and thus providing fast and reliable notification to the public.

In the scope of our work we "evaluate" the existing GSM system/infrastructure. Particular attention is given on how this system operates and on how it could be further deployed. Since the main advantage of cellular networks is the provision of ubiquitous connectivity along with the localization and a broadcasting option in their packets, fast and direct warning of people in emergency situations (of various nature) can be achieved.

Terrestrial communication networks continue to evolve very fast, promising critical advantages that may benefit civilians, governments, homeland security, and crisis management, in addition to the commercial market. The use of such systems can be very important because apart from the fact that they can save numerous lives by informing the people located in a certain area immediately, they can prevent accidents, can help in traffic problems (e.g., by informing about traffic jams), and of course can be used as a new way of advertisement, so that the telephone companies which use it can make a profit out of it (European Commission, 2001, 2002; Watson, 1993).

BASIC ARCHITECTURE OF CELLULAR NETWORKS

Telecommunication systems were not always an easy way for communication. In previous years the systems were analog and in order to make a simple phone call a time consuming procedure had to be followed. Originally the European Telecommunications Standards Institute (ETSI) organization defined "GSM" as a "European digital cellular model of telephony." The GSM network offers high voice quality, call privacy, and network security. Consequently, ETSI's GSM committee added a feature called "*Cell Broadcast*" to the GSM standard 100 years after the original invention of radio. This is contained in standards GSM 03.49 and others (ETSI, 1993). The fundamental feature has been presented in Paris (1997) and has been described as quite successful. By now, all GSM phones and base stations have this feature latent within them, though sometimes it is not "enabled" in the network. Before cell broadcasting, other methods of fast informing existed in real case scenarios (Redl, Weber, & Oliphant, 1995).

Cellular systems consist of mobile units which communicate among themselves via radio network using dedicated nonwireless lines to an infrastructure of switching equipment, interconnecting the different parts of the system and allowing access to the normal (fixed) public switched telephone network (PSTN) (Chochliouros & Spiliopoulou, 2005). At this point, in order to make clear the basic feature of cell broadcasting, we will briefly explain the "core structure" of a mobile network. In fact, a number of functions are needed for a GSM network to operate. The main "subsystems" of the GSM structure are:

- **The base station subsystem (BSS):** It manages the transmission between mobile stations and the network switching subsystem (NSS) (described as below) by checking and managing radio links. The BSS provides radio coverage in certain predefined areas, commonly known as "cells" and contains the necessary hardware for communication with the existing mobile stations. Operationally, the BSS is implemented by the base station controller (BSC) and the base transceiver station (BTS). A BSS subsystem can control multiple BTSs and consequently, it can serve many cells. The main parts of a BSS are: (i) the BSC, that is, a selective switching center, responsible for the wireless part of the mobile network and; (ii) the BTS which is used as a "connection" between the mobile phone and the rest of the network.
- **The network switching subsystem (NSS):** It consists of mobile switching center (MSC) which is a telecommunication switch or exchange within a cellular network architecture, capable of interworking with location databases. Home location register (HLR) is the database within a GSM network that stores all the subscriber data and is an important element in the roaming process. In addition, there is the visitor location register (VLR). This database is the operational unit of a network in which subscribers' data are stored; it changes every time the subscriber is located in a certain area, covered by one specific VLR of a MSC and authentication center (AUC). The latter is a protected database using algorithms for identity certification, as well as a kind of phone call cryptography for secure communication (ETSI, 1999b; Mouly & Pautet, 1992). For the protection of the mobile phone from stealing there is another database which is called equipment identity register (EIR). There exists the code of every phone being in use.
- **The operating services subsystem (OSS):** It is the part of the GSM which is practically responsible for the network maintenance; its main function is to oversee network operations*—with the help of intelligent error detection mechanisms*—and to inform the operator of any probable malfunctions.

In Figure 1 we demonstrate the connections between these systems and/or related functional modules.

Related Content

Iterative Usability Evaluation for an Online Educational Web Portal
Xin C. Wang, Borchuluun Yadamsuren, Anindita Paul, DeeAnna Adkins, George Laur, Andrew Tawfikand Sanda Erdelez (2010). *International Journal of Multimedia Data Engineering and Management (pp. 31-49).*
www.irma-international.org/article/iterative-usability-evaluation-online-educational/49148

Design Patterns for Integrating Digitally Augmented Pop-Ups With Community Engagement
Joel Fredericks, Martin Tomitschand Laura Stewart (2018). *Digital Multimedia: Concepts, Methodologies, Tools, and Applications (pp. 774-799).*
www.irma-international.org/chapter/design-patterns-for-integrating-digitally-augmented-pop-ups-with-community-engagement/189504

Quality of Experience Factors for Mobile TV Users
Dimitris N. Kanellopoulos (2018). *Digital Multimedia: Concepts, Methodologies, Tools, and Applications (pp. 473-496).*
www.irma-international.org/chapter/quality-of-experience-factors-for-mobile-tv-users/189488

An Image Quality Adjustment Framework for Object Detection on Embedded Cameras
Lingchao Kong, Ademola Ikusan, Rui Daiand Dara Ros (2021). *International Journal of Multimedia Data Engineering and Management (pp. 1-19).*
www.irma-international.org/article/an-image-quality-adjustment-framework-for-object-detection-on-embedded-cameras/291557

Task Modelling of Sports Events for Personalized Video Streaming Data in Augmentative and Alternative Communication
Lei Zheng, Zhiqiang Jia, Hui Guan, Liang Ma, Karthik Chandranand K. Deepa Thilak (2021). *International Journal of Multimedia Data Engineering and Management (pp. 1-19).*
www.irma-international.org/article/task-modelling-of-sports-events-for-personalized-video-streaming-data-in-augmentative-and-alternative-communication/301454