Next Generation Emergency Services – The EMYNOS project

This white paper addresses the current state of emergency services and the challenges linked to the evolution towards Next Generation emergency communications. The paper puts forward the vision of the H2020 EMYNOS project, aimed at designing and implementing a Next Generation emergency services framework.

Current emergency systems and 112 services are based on old-fashioned telecommunication technologies which cannot accommodate the agile, rich-media content communications currently used by European citizens in their everyday life. As telecom operators' networks are nowadays IP-based, emergency communication systems need to be adapted to fulfil regulatory requirements in terms of Next Generation emergency services. This becomes even more evident with the future deployment of 5G networks, expected to support a wide variety of applications and services with heterogeneous performance requirements. In that sense, the transition to 5G will constitute a huge challenge for emergency service operators.

Background

Telecommunication networks are currently the dominant infrastructure used by emergency services. It has been estimated that 320 million calls are issued annually in the European Union, 60 percent of them coming from mobile devices. The widespread use of mobile devices, and particularly smart phones, having already proved to be the easiest way for users to share information in various forms, are becoming an important factor to consider in emergency communications. This is mainly due to the rapid expansion of the mobile application market, with applications now using instant messaging, videos and picture along with social media networking. An emergency call placed by a smartphone with such capabilities can potentially increase the chance of a successful emergency response by providing along with the multimedia call, precise location information, and sensor data.

Current telecommunication networks, also known as "legacy" networks, are being replaced by Next Generation Networks (NGNs). The NGN technologies offer the best of both worlds: the flexibility, efficiency and innovativeness of IP networks, coupled with the quality of service (QoS), security, reliability, and customer-friendly featured of legacy networks. As a result, the emergency systems today will offer huge benefits if they are upgraded to fulfil the NGN regulatory requirements.

Current limitations and NGN requirements

The limitations of the current emergency communication systems can be summarized as follows:

- No Multimedia (e.g. Video, Text)

 Date of publication: 26/05/2018

- No Advanced features such as accurate caller location
- More and more emergency calls are from mobile phones
- No unified platform addressing daily emergency calls as well as disaster management
- No integration of social media. Social media integration will enable the involvement of the population at large in emergency situations, not only the first responders
- The eCall (emergency solution for vehicles in case of crash) technology is based on the Global System for Mobile Communications (GSM), which limits the amount of emergency data that can be sent.

On the other hand, emergency services based on NGNs will offer the following benefits:

- Improved natural disaster management including the prevention of, and response to potential terrorist actions
- Full support of new communication and information technologies for emergency services. Millions of cell phones and commercial vehicles are equipped with Global positioning System (GPS), and other communication systems can provide precise locations
- Enhancement of security mechanisms to prevent fake calls and protect the system against potential attacks
- Improved accessibility and compatibility to guarantee that all citizens, including those with disabilities, have access to the emergency service.

Current standardization efforts towards Next Generation emergency communications

A significant step toward achieving the vision of Next Generation emergency services is described in the EENA long-term definition (LTD) document. The LTD vision was achieved, in particular, in cooperation with the Internet Engineering Task Force (IETF) Emergency Context Resolution with Internet Technologies (ECRIT) Working Group, and discusses a framework based on existing protocols for emergency calling using internet multimedia. With other respects, the 3rd Generation Partnership Project (3GPP) enhanced the existing IP Multimedia Subsystem (IMS) with specialized tasks for emergency calls as well as location retrieval capabilities.

The EMYNOS project aimed from the beginning at putting in place the necessary mechanisms to influence the NG112 migration agendas. This was achieved by,

- taking the EENA NG112 LTD vision as a reference
- implementing and evaluating the related standards in terms of location, emergency calls routing, and service mapping
- implementing parts of the ETSI specifications in response to the European Commission mandate M493 for caller location determination

- participating in the 1st and 2nd ETSI NG112 plugtests to test the EMYNOS solution interoperability and validate it
- Proposing a standard set of messages, related to emergency communication, which can be depicted by using different AAC symbol systems such as Widgit Symbols™, PCS™, Blissymbols™, Makaton™.
- Participation at CEN TC278 WG 15, a working group enhancing existing standards for eCall and introducing new ones to reflect requirements of next generation eCall as developed within EMYNOS. The main focus from the EMYNOS perspective was the introduction of IMS

Bridging the gap - The EMYNOS Vision

The H2020 EMYNOS project aims at designing and implementing a Next Generation platform for emergency communication. The project focuses in particular, on the transition of the legacy emergency operation system to an operational IP-based model, capable of offering voice, video, Instant Messaging, and Real Time Text (RTT) services to PSAPs operators, and enhancing significantly their awareness about the emergencies. Optimizing coordination between first-responders, citizens and PSAPs provides the fastest way to deal with a disaster and save lives.

Some of the basic functionalities of Next Generation emergency systems as envisioned by EMYNOS include:

1/ Location Support: Caller location information is crucial for emergency services for two purposes:

- Determining the appropriate PSAP that can serve the user fast and efficiently based on the device location
- Enabling the PSAPs to get more accurate location information for dispatching units more efficiently.

Here, several location configuration protocols and technologies were implemented

2/ Multimodality for providing access to people with special needs. A Next Generation platform offering people with special needs full access to emergency services through the integration of communication methods and technologies used by people with disabilities.

In EMYNOS, the following scenarios are considered:

- **Deaf and hard of hearing users.** The usage of emergency services by Deaf and Hard of Hearing users is made possible or facilitated through a friendly user interface supporting audio, video, and Real Time Text.
- **Ambient Assisted Living (AAL):** To support blind or elderly people, the focus was put on a solution for fast and reliable triggering of a call from an AAL device. Providing a safe and an effective mechanism for establishing, and maintaining a call with a PSAP

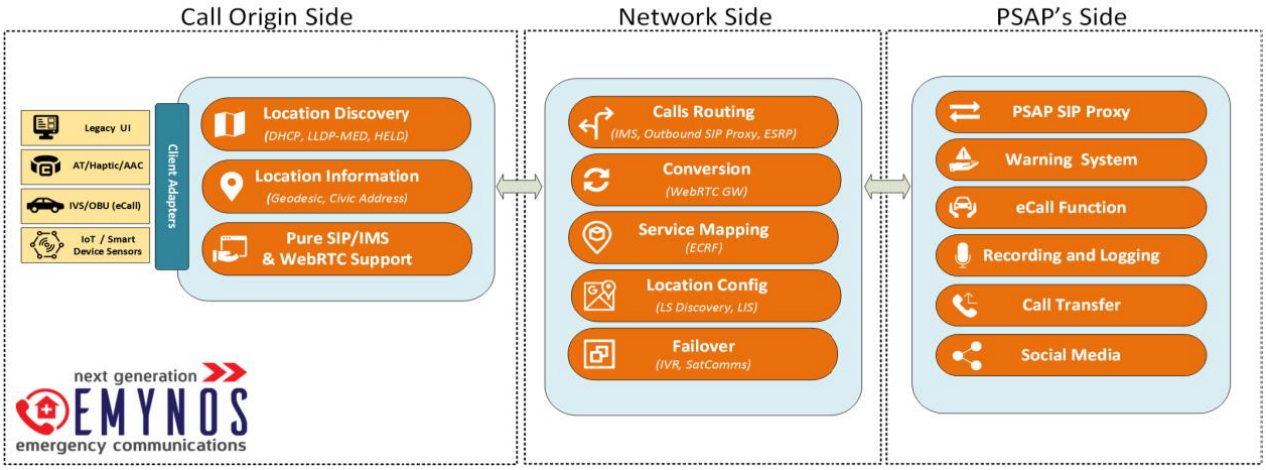
is extremely important for persons with disabilities. Easy and reliable access to emergency calls are granted by defining dedicated buttons or gestures.

- **Augmentative and Alternative Communication (AAC) users**. AAC assists persons with disabilities to form sentences by supporting the selection of individual words. Electronic communication aids such as special keyboards or dynamic communication grids allow the user to choose picture symbols to create messages that can later be transferred to text of synthesized speech.

- **Haptics:** Although audio-visual systems provide a user with a satisfactory impression of being present in a remote environment physical interaction and manipulation are not supported. True immersion in a networking environment requires the ability to physically interact with remote objects and to literally get in touch with other people. This can be accomplished by adding haptic modality to audio-visual systems. Haptic communications is a relatively young area of research that has the potential to substantially improve human-human and human-machine interaction.

3/ Social Media integration: Social media are continuous communication channels between emergency call centres and citizens, or between citizens. They can be a backup solution in the event of a failure of the telecommunication network. EMYNOS intends to design and develop a crowdsourcing mechanism that collects social media information for detecting emergency situations and techniques for summarizing and aggregating emergency information retrieved from the posted messages and a mechanism for classifying messages according to their importance.

EMYNOS architecture is based on three blocks depicted in the figure below.



Future challenges – 5G

The future deployment of 5G networks will have considerable implications for the emergency communications sector. The increased performance of the Next Generation wireless and mobile networks, the enhanced security and the improved device-to-device communications will open a realm of new possibilities, which have the potential to greatly

improve emergency responses and ultimately save more lives. The envisioned 5G features will, however, need to be tightly coupled with the strict operational and management requirements of emergency services, which need to be maintained.

Depending on the actual design of the 5G network, emergency communication is expected to support real-time, high priority total conversation services (voice, video, Real Time Text) and be more resilient to security threats that could potentially hinder the reaction time of the first responders. Additionally, device interconnectivity will increase the availability of the communication channels and the uplink capacity, while the "network-slicing" feature of the 5G network will enable the prioritization of first responder's communications over regular communications.

Future emergency communications will be heavily relying on sensors either spread in the (smart) cities or carried as wearables by first responders. Managing such an unprecedented amount of concurrent connections issued by these devices will be a challenge for future emergency services. In addition, in order to satisfy the strict requirements imposed by emergency communications and public protection and disaster relief services in general, the network operators will have to guarantee ultra-low latency, ultra-high availability and reliability for these services.

Bibliography

Directorate-General for Communications Networks, Content and Technology, EC, "COCOM 13-04 REV1 — Implementation of the European Emergency Number 112 — Results of the Ninth Data-Gathering Round," Mar. 2013; http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=1674

EENA, "Annual Report 2015," Jan. 2016; http://www.eena.org/download.asp?item_id=163

E. Markakis, I. Politis, A. Lykourgiotis, Y. Rebahi, G. Mastorakis, C. X. Mavromoustakis, and E. Pallis1 "Efficient Next Generation Emergency Communications over Multi-Access Edge Computing" IEEE Communications Magazine. November 2017

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 653762

 Date of publication: 26/05/2018