

An Architecture and Protocol for Mobile Emergency Service

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ABSTRACT:

The existing wired emergency call such as 119, 112 have its own location information to serving immediate rescue service. For the case of wireless emergency call by mobile phone, the location information should be provided by wireless network. This paper describes the network architecture and protocol for mobile emergency service referring TIA/EIA/J-STD-036-A with reviews about technical issues, legacy factors and related researches. The mobile emergency service is divided into mobile emergency rescue service and mobile emergency alert service. The network reference model for mobile emergency rescue service is released in KOREA. In this paper, the interfaces between elements of the network reference model, and service scenarios, message flows are defined. Supplement to mobile emergency rescue service, the network reference model, interfaces and message flows for mobile emergency alert service are developed. The protocol is described by DTD, and the proposed works are on processing for domestic standard of TTA.

KEY WORDS: Mobile Emergency Service, Alert service, E-911, LBS, Location, PSAP, FCC

1. INTRODUCTION

There are about 35 million mobile phone subscribers in Korea. With the increasing number of mobile phone, the emergency call by mobile phone is increased, and the needs for mobile emergency service are increased for the level of public services. Recently the Location Information Act for privacy protection and usage of location information has been legislated on January 2005. The main contents of the legislation are designed to protect personal location information, regulate the use of location information for public purpose, and invigorate LBS industry. The major key of current appearance is a Location Information at emergency states. Now of days, the location information of wired 112, 119 emergency call is provided immediately by subscriber database of KT. But emergency call made by mobile phone should be ask location information to wireless network. The mobile emergency service is divided to mobile emergency rescue service and mobile emergency alert service. The mobile emergency rescue service is made available to mobile phone users in the emergencies and public safety. The mobile emergency alert service allows delivery to mobile subscribers of emergency information such as inclement weather or any life threatening incident information relevant to their current location. Emergency alert service notifies the wireless subscribers within a specific geographic location of emergency alerts. In this paper, we will look at the current status of the mobile emergency service technology and standardization in Korean and other countries. And then, we explain the development of the architecture and protocol of Mobile Emergency Services in Korea. The protocol is described by DTD, on processing for domestic standard of TTA (Telecommunications and Technology Association).

2. STATUS OF MOBILE EMERGENCY SERVICE TECHNOLOGY AND STANDARDIZITIONS

2.1 USA

In the United States, wireless phones by the number of 911 are an important public safety tool. The FCC(Federal Communications Commission) has taken a number of steps to increase public safety by encouraging and coordinating development of a nationwide, seamless communications system for emergency services that includes the provision of location information for wireless 911 calls. It has adopted wireless 911 rules. These rules are aimed at improving the reliability of wireless 911 services and identifying the location of wireless 911 callers to enable emergency response personnel to provide assistance to them much more quickly. The FCC's wireless 911 rules apply to all cellular licenses, broadband Personal Communications Service (PCS) licenses, and certain Specialized Mobile Radio licenses. (www.fcc.gov/911/enhanced.)

There is TIA/EIA/J-STD-036-A as a standard specifications related to emergency service in TIA(Telecommunication Industry Association). It defines the messaging required to support information transfer to identify and locate wireless emergency services callers. It provides a solution for handling of wireless Enhanced Emergency Calls that are applicable both for ANSI-41 and PCS1900 systems.

As shown in Figure 1 and Figure 2, Each System has different the network reference models of mobile emergency service. (Show the TIA/EIA/J-STD-036-A in details)

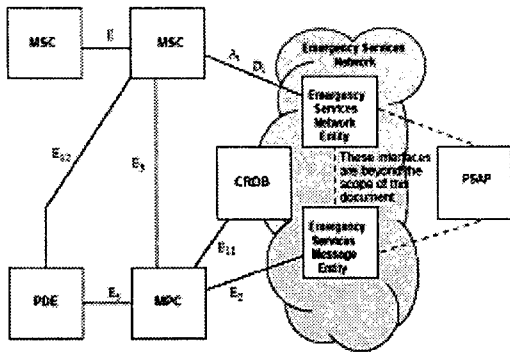


Figure 1. ANSI-41 Network Reference Model

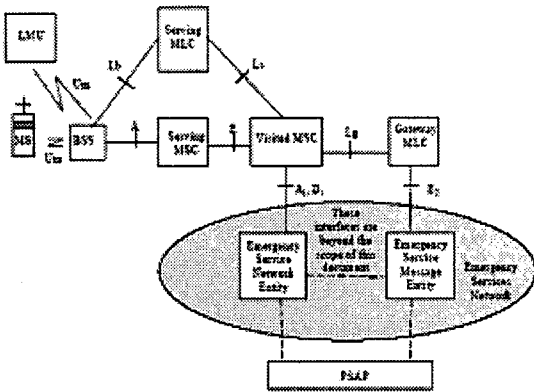


Figure 2. Condensed PCS1900 Network Reference Model

2.2 Europe

EC(European Commission) is considering recommendations for the implementation of an EU-wide emergency services system for calls made from mobile phones, in which the location of the caller would be provided automatically to the nearest the PSAP (Public Safety Answering Points). EC should consider wireless E-113 a high priority for saving lives that is now at risk. EC and organizations support development of a unified wireless E-112 network. They had excited LOCUS (LOcation Cellular Users for emergency Services) project and CCALIES (Coordination Group on Access to Location Information by Emergency Services) project. The Objective of LOCUS and CGALIES was to provide support and expertise to the EC regarding the definition of a future Emergency Call Service(ECS) in Europe taking into account the most important aspects of future implementation such as: user needs, institutional issues, technical and technological issues, future markets and convergence with other applications.

Recently, the E-MERGE(an EC Information Society Directorate General co-financed) project, which is working on the creation of a pan-European harmonised in-vehicle emergency call service working across Europe, is in final stage.

2.3 KOREA

2.3.1 Standardization Status

There is Mobile Emergency Services Stage1: Functional Requirements(TTAS-KO-06.0059) in TTA (Telecommunications and Technology Association). TTA is established to Perform IT standardization tasks efficiently to advance IT industries and related technologies and to contribute

to our national economy. This technical specification describes the scope and functional requirements for mobile emergency service under wireless network. The purpose of this specification is present a guide to support adequate emergency services for government, public organizations, wireless carriers, and industries concerning emergency services

The standard defines the functional requirement for emergency service between PSAP and MPC. It is referred the public safety service in 3GPP TS 22.071 v4.3.0 and J-STD-036. It was proposed the network reference model in Mobile Emergency Rescue Service as following Figure 3. But there is not defined the interfaces in detail.

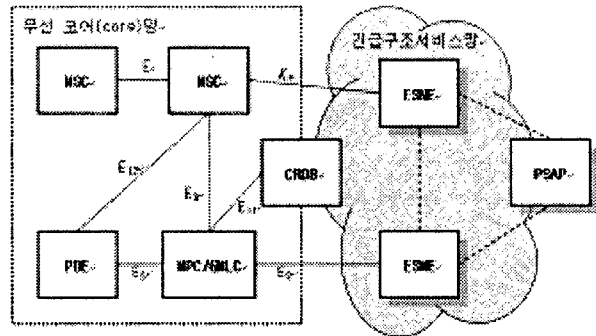


Figure 3. Network Reference Model in Mobile Emergency Rescue Service

2.3.2 Legislation Status

There was legislated Location Information Act for protecting and using location information in this year.

Under the legislation, the PSAP may request the location information service provider to offer the personal location information and danger warning, which may not be denied. The requirements for the PSAP to receive personal location information are to subscribe to a special telephone number service and to secure needed human resources, facilities and equipment for emergency rescue services using the location information.

When a location information service provider furnishes location information to a PSAP, it shall be restricted to the instance where an emergency service has been requested by the concerned customer to a special telephone number service such as 119 or 112 (similar to 911 in US)

When providing location information to a PSAP, the location information service provider must ensure to prevent any abuse or misuse by any persons, and must make it compulsory to provide any such information online via the location information system.

Furthermore, the PSAP must possess the appropriate equipment and facilities to receive location information and give danger warnings

3. DEVELOPMENT OF ARCHITECTURE AND PROTOCOL OF MOBILE EMERGENCY SERVICE

We extend the mobile emergency rescue service specification which was not defined in the preview standard and define the mobile emergency alert service protocol. It is considered a standard (that is Mobile Emergency Services Stage1: Functional Requirements, TTAS.KO-06.0059) and components in domestic network environment. The detail contents are following.

3.1 Extension of Mobile Emergency Rescue Service

In preview standard (TTAS.KO-06.0059), it was defined the interfaces and entities for emergency rescue service but not defined K₁ interface, E₂ interface and E₁₁ interface. We defined the three interfaces in the figure 3 that is following table 3. And it is designed the data types and scenarios for location information request/response in emergency environment by the XML DTD(Document Type Definitions).

As an example, it is a element name and description for ESPM's Root element in figure 4. And we setup scenarios through CAS(Call Association Signalling) and NCAS(Non-Call Associated Signalling) for emergency rescue service. Figure 5 shows the call flows for emergency location information request/response by CAS push. The position information may be delivered to the emergency services network in tow basic ways: with the call as part of the call setup information or through a separate data service. The former is known as CAS since the position information is delivered in the call signalling. The latter is NCAS and the message delivered by the data service must be correlated with the call by parameters carried in the message

With CAS, the wireless network pushes the position information to an Emergency Services Network Entity (ESNE). With NCAS, an Emergency Services Message Entity (ESME) pulls the position information from the wireless network. Call setup may be delayed while position information is being determined if it will be sent in a CAS push or used for routing. The maximum period of time that a call will be held up is provisionable on a per system basis.

Table 1. Interfaces and entities in emergency rescue service

Interface	entities	protocol	message
K1	MSC-ESNE	ESPP	ESPPM
E2	MPC-ESME	ESP	ESPR ESPRR ESPRRER
E11	CRDB-MPC	RLP	RLR RLRR RLRRER

Element 이름	설명	비고
espm	ESPM의 Root Element	
digits_dialed	긴급구조 호임을 판별할 수 있는 부분번호(예, 119, 11*)	
call_mdn	긴급구조 요청자 정보	
Digits_dialed	서비스 요구자 정보	
coord	좌표(경도, 위도)로 표현되는 긴급구조 위치정보	
Address	주소로 표현되는 긴급구조 위치정보	

Figure 4. A case of ESPM's Root Element

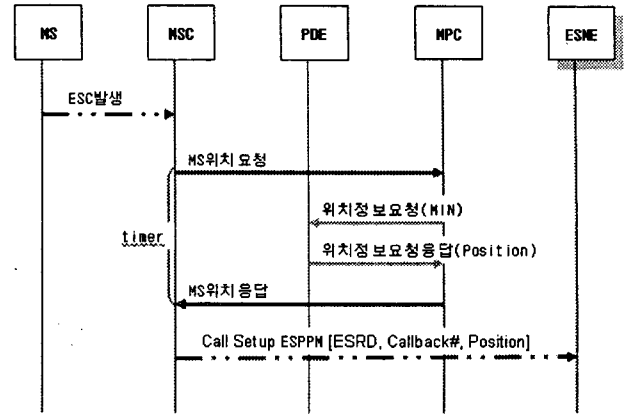


Figure 5. Call flows for location information request/response by CAS push

3.2 Development of Emergency Alert Service

The mobile emergency alert service allows delivery to mobile subscribers of emergency information such as inclement weather or any life threatening incident information relevant to their current location. In case of emergency alert service, it was not defined any network reference model or related interfaces. So we develop the network reference model base on 3GPP TS 25- or 23- release series in Figure 6.

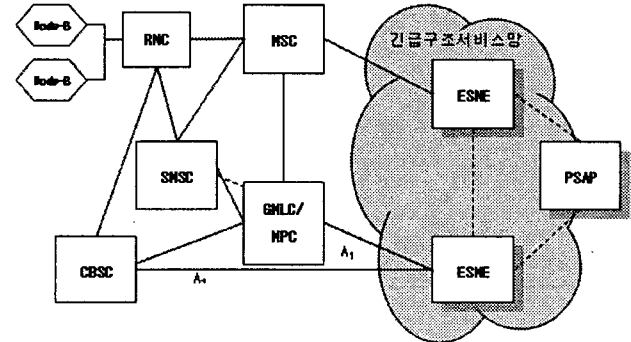


Figure 6. Network Reference Model in Mobile Emergency Alert Service

We define the A1 interface and messages between GMLC(Gateway Mobile Location Center)/MPC(Mobile Positioning Center) and ESME(or CBSC and ESME). The message is moved to SMSC(Short Message Service Center) or CBSC(Cell Broadcast Service Center) through SMS(Short Message System) in core wireless network. The emergency alert message sends to User Equipment in the special area by this specification. A1 interface is newly defined in this study, and divides two messages that is Emergency Alert Request(EAR) and Emergency Alert Request Response(EARR) for mobile subscribers within a specific geographic location of emergency alerts. So we develop the scenarios for CBS and SMS emergency alert broadcasting. In Figure 7, there are DTD components and Elements for EAR.

If it is provided by emergency alert service for CBS broadcasting, User Equipment only could be providing the service through on calling process.

● DTD 구성

<!--EASP ear -->		
<ENTITY % extension.param -->		
<ELEMENT	ear	(send_info, svc_info, msg_info %extension.param :)
<!ATTLIST	ear	
	ver CDATA	#FIXED "1.0.0">
<!ELEMENT	sendtype	(snd_count, title?)>
<!ATTLIST	sendtype	
	type(IM RV)	"IM" >
<ELEMENT	snd_count	{#PCDATA}>
<ELEMENT	svc_info	(svc_type, (coord Address), svc_radius, svc_dist)>
<ELEMENT	svc_type	{#PCDATA}>
<ELEMENT	msg_info	(msg_type, msg_title, (msg_contents, msg_level)*)>
<ELEMENT	msg_type	{#PCDATA}>
<ELEMENT	msg_title	{#PCDATA}>
<ELEMENT	msg_contents	{#PCDATA}>
<ELEMENT	msg_level	{#PCDATA}>

● Element 내역

Element 이름	설명	비고
ear	EAR 메시지의 Root Element	
sendtype	경계령 전송 형태 (즉시전송 또는 예약전송)	
snd_count	전송횟수	
svc_info	서비스 정보로서 서비스 형태 및 서비스 지역을 포함, 반경(Km단위), 지역유형구분(일반, 도심, 해안, 산간)	
svc_type	경계 메시지를 발송하는 단위로 구분	
msg_info	경계령 메시지 정보	
msg_type	경계 메시지의 카테고리	
msg_title	메시지 제목	
msg_contents	메시지 내용	
msg_level	메시지 등급	

Figure 7. DTD components and Elements for EAR

4. CONCLUSION

The location information of wired 112, 119 emergency call is provided immediately by subscriber database of KT. But emergency call made by mobile phone should be ask location information to wireless network. (Wireless network contains cellular, PCS(Personal Communication Service), Satellite, and Commercial Mobile Radio Service. It does not contain Private Radio System and Cordless telephone.)

The European Commission is currently considering recommendations for the implementation of an EU-wide emergency services system 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 under way and is scheduled for substantial completion by the end of 2005. The US system (called E-911) is modelled upon 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.

This paper proposes the network protocol for mobile emergency service refer to TIA/EIA/J-STD-036-A with reviews about technical issues, legacy factors and related researches. We explain the development of the architecture and protocol of Mobile Emergency Services in Korea. The protocol is described by DTD, on processing for domestic standard of TTA(Telecommunications and Technology Association). This technical specification describes the scope and functional

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