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On The Next Generation Mobile Communication Services in Korea

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In this paper, we present a perspective of the next generation mobile communication services and its characteristics. As a preliminary research work on the next generation mobile communications and services, we exploit the next generation mobile services [1]. We define the next generation mobile services as strata of services consisting of three different service levels, *the service areas*, *the service functionalities*, and *the service technologies*. We derive these service levels by means of the scenario based analysis. Finally, we propose a conceptual network architecture that can support the next generation mobile services by placing network functions and service elements within the network.

Keywords: Mobile Communications, Next Generation Mobile, Scenario based Analysis

1. INTRODUCTION

The next-generation mobile communication, the so called the fourth generation, is a system that is able to provide a variety of multimedia services such as multimedia moving pictures, movies, and television broadcasts with high-speed and high quality via the converged network of wireless and wired infrastructures. Thus, a variety of video, audio, and data services will be possible with a number of service classes in addition to the conventional mobile services such as voice telephony. These include mobility based services such as an information services based on location of the user and an emergency call service that can send pictures and/or the location of the user. Besides, there are many services still to be discovered and created.

A number of research and development activities are being carried by related international organizations or research centers to take a initiative for the next generation mobile communications [2], [3], [4], [5]. However, the next generation mobile services have not been studied yet actively since there is no clear definition yet what the next generation mobile communication and its services will be. There is a pilot research effort on the next generation services being carried by the Wireless World Research Forum (WWRF)'s working group 2 (WG2) with focusing on development of business models for the future wireless world. In addition, they are dealing with the service architecture of the future wireless world [6].

In this paper, we describe a perspective of the next generation mobile communication services. We exploit and classify not only business based mobile services but also all possible service areas including non-profitable areas such as public services. We derive the next generation mobile service depending on maturity felt by user-side. We create many different service scenarios that may happen around year 2010 and extract the next generation mobile services by means of the scenario based analysis. Resulting three different service levels are; 8 service areas, the top level service (layer 3), 31 service functionalities, an intermediate service level (layer 2), and 32 service technologies, the bottom level services (layer 1). We also derive the characteristics of each service levels. Finally, we propose a conceptual network architecture that can supporting these services by placing network functions and service elements on four different network parts, *a user equipments and access part, a network service provisioning layer part, a network control layer part, and non-mobile network operator service part.*

This paper is organized as follows. In the next section, we review evolutional trend of the mobile communication technologies and services. In section 3, we suggest three different levels of the next generation mobile services derived from the scenario based analysis. In section 4, we propose a concept of a network architecture which is capable to support the next generation mobile services. Finally, we conclude this paper with giving a brief introduction of research and development activities and strategies for the next generation mobile communication system and services in Korea.

2. EVOLUTION OF THE MOBILE COMMUNICATIONS AND SERVICES

3G services already has been launched in few countries including Korea and Japan. However, there are many problems in provisioning of the 3G services. One of the main problem is that 3G has fewer exciting killer applications than 2G/2.5G services. Another

problems are the heavy investment for new 3G infrastructure (i.e., networks) and the inherent high call charges. As a result, many of 3G licensees in worldwide delay (or give up) the schedule of 3G commercial launches. Therefore, those who want to be served with higher data speed and higher capacity data services feel to use wireless-LAN services as alternative services. On the other hand, the mobile Internet service market grows explosively. For example, the total number of subscribers in worldwide is forecasted to increase explosively from 283 million in 2002 to about 1.2 billion in 2007.

ITU-R proposed a concept of a mobile communication system beyond 3G with its necessities including a high data rate, a low cost, use of IPv6, portability of numbers, and integration of wired and wireless communications. ITU-R also gives a concept of a new radio interface for systems beyond 3G that can support approximately up to 100Mbps of data transmission speed for mobile access and approximately 1Gbps for nomadic and local wireless access.

What would be the characteristics that distinguishes the next generation mobile system from the existing mobile systems including the 3G systems? These characteristics could be the increased data speed, use of new spectrum and bandwidth, multi-mode air interface, availability of mobile multimedia devices, ubiquitous mobile life, and new technologies for supporting these characteristics. Increased data speed will improved mobile and wireless Internet access and support faster download, browsing, streaming services. Broadband applications, global roaming, and asymmetric communication will be possible with use of new spectrum and Bandwidth. Multi-mode air interfaces will support integrated services by giving connection among heterogeneous mobile service areas and situations such as personal-area-networks (PANs), LANs, Hot Spot, and Wide Area. By using mobile multimedia devices, screen size and shape can be adjusted according to the radio environment and service capability. Furthermore, realistic audio and video services, storage capability, and multi-functional services will be available with these devices. Ubiquitous mobile life will be also possible through personalized and customized next generation services. To support newly introduced above characteristics of the next generation services, core technologies include Orthogonal Frequency Division Multiplexing (OFDM) technology,

which is considered the strongest candidate for radio access, Multi-input-multi-output (MIMO), and software defined radio (SDR) technologies should be developed. Other related technologies such as Ad Hoc networking, SIP based multimedia services, and all-IP based networking are also required.

3. THE NEXT GENERATION MOBILE SERVICES

Not only can provide almost all of the wired network based on line services such as Internet access and e-commerce, the mobile communications services is also expected to expand explosively so that it can be available for many different service areas of our life. It is also anticipated that advances in communication technologies and services will result in the ubiquitous revolution that may radically reform our life style by removing some of the limits of time and space. As a preliminary research work on the next generation mobile communications and services in this work, we exploit what the next generation mobile services will be [1]. We first define the next generation mobile services as strata of three different service levels. Then we derive the next generation mobile services for each layers through the scenario based analysis.

3.1 Strata of Mobile Services

In order to derive next generation mobile services, we first differentiate services from the core technologies as shown in figure 1. Then we classifies mobile services into three different levels, a bottom level (layer 1), a middle level (layer 2) and a top level (layer 3), according to characteristics and maturity of them. Definitions of each service levels are

- Layer 1: elementary service technologies that can support and realize a higher service layer by combining some of them. We call it the service technologies.
- Layer 2: services created by combining some of layer 1 services and can be directly used by users. We call it the service functionalities.
- Layer 3: service environments that a user can feel, use, and apply it for real situation. We call it the service areas.

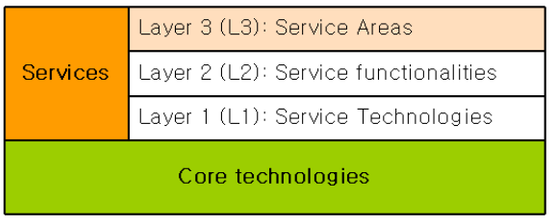

Fig. 1. Definitions of the service layers 1, 2, and 3, and relationship with core technologies.

3.2 The Scenario Based Analysis

In order to derive three different layers of mobile services, we first classify the mobile services into groups of layer 3 (service areas) according to their

application areas such as communication, business/commerce, mobility/traffic, telemedicine/ health, life, leisure/games, emergency/disaster, and broadcasting/weather/public services. Then we create a number of mobile service scenarios that may happen around year 2010. Next we divide each scenarios into several situations, and map each situation with a service. We call the service obtained by mapping of each situation a service functionality, a layer 2 service. Each obtained L2 service belongs to one of 8 L3 service areas. Finally, from the layer 2 services we extract layer 1 services (service technologies), the bottom level services, and core technologies. In addition, from the extracted L1 service technologies and/or core technologies we derive some network functions and/or service elements required to provide L1 services and support related core technologies. A concept of the scenario based analysis method and relation among scenarios, situations, L2 services, and L3 services are described in figure 2. Figure 3 describes the relationship among L1, L2, and L3 services.

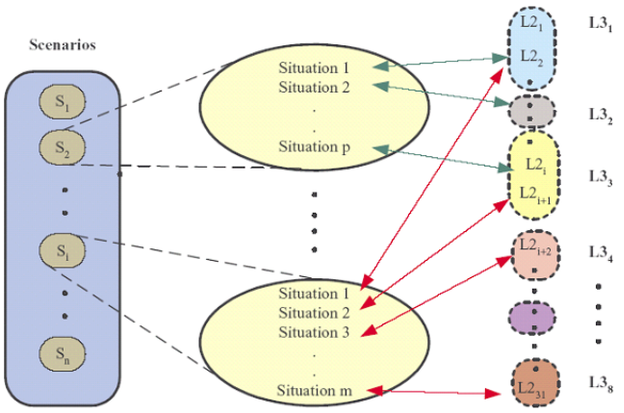

Fig. 2. A description of the scenario based analysis and mapping between situations and L2 service functionalities.

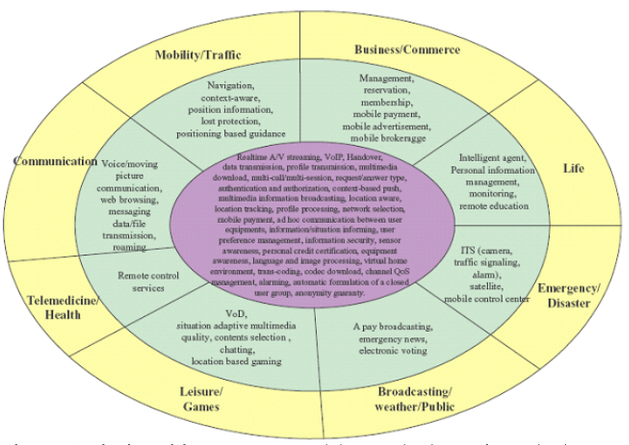

Fig. 3. Relationship among L1 (8), L2 (31), and L3 (32) services.

Let's consider a situation when a user visits a town where he or she want to find a restaurant while she is driving. This is a type of a context-aware service as an example of an L2 service. Since it is a context based service provided to users according to his or her location, preference, and environment, a number of L1 service technologies such as the context based push, request/answer (query) type, multimedia information broadcasting, location aware (human, machine, anything), location tracking, profile processing, information/situation informing, and user preference management are required to realize the L2 service. In this case, we can also derive some core technologies for each L1 service technologies. For example, from the location aware (human, machine, anything) service technologies, we can derive some core technologies such as Radio Frequency IDentification (RFID) tagging technology, wireless metering technology, Location Based Service) LBS middle-ware server technology, Global Positioning Service (GPS) technology. Required network elements are RFID tags, mobile handsets, location information server, contents server for map, traffic, points of interest, and LBS server. An example of the scenario based service analysis method and an example is shown in figure 4.

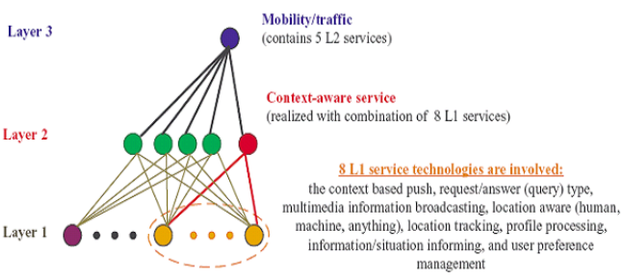

Fig. 4. An example of the scenario based analysis: the context-aware service case.

4. A PROPOSED NETWORK ARCHITECTURE

We suggest a concept of a wireless network architecture which can support the next generation mobile services derived in this paper. We designed the conceptual network architecture with focusing on the realization of the L1 service technologies through the network functions and service elements because it is the basic service layer realizes the higher level services, L2 and L3. We divide the network into four different parts, *a user equipments and access part, a network service provisioning layer part, a network control layer part, and non-mobile network operator service part.* Figure 5 describes a conceptual network architecture proposed to support the next generation mobile services derived in this paper.

5. CONCLUDING REMARKS

Since the work for the next generation mobile services presented in this paper is a preliminary work,

a more detailed and systematic research effort is needed to develop the next generation mobile communication system and realize the services. The next generation mobile communication system is being developed in Korea through a cooperative research work among various organizations including Electronics and telecommunications Research Institute (ETRI), universities, mobile service operators, and domestic manufacturers. This cooperative activity is led by ETRI with contributions from many participating organizations and collaborative work with international partnership. ETRI is currently developing core technologies for a beyond 3G mobile system, the high-speed portable internet (HPi), as well as the next generation mobile communications. As a preliminary research work for the next generation mobile communications and services, ETRI is developing the High-speed Mobile Multimedia (HMm) system by taking the research results presented in this paper. In detail, The HMm btestbed is being developed as a pilot research testbed to examine feasibility of the proposed conceptual network architecture shown in figure 4. In order to support such research activities and to establish the vision and strategies of the mobile service beyond 3G, Korean 4G vision committee was organized in January 2002. Research and development strategies and activities for the next generation mobile communications in Korea is described in figure 6.

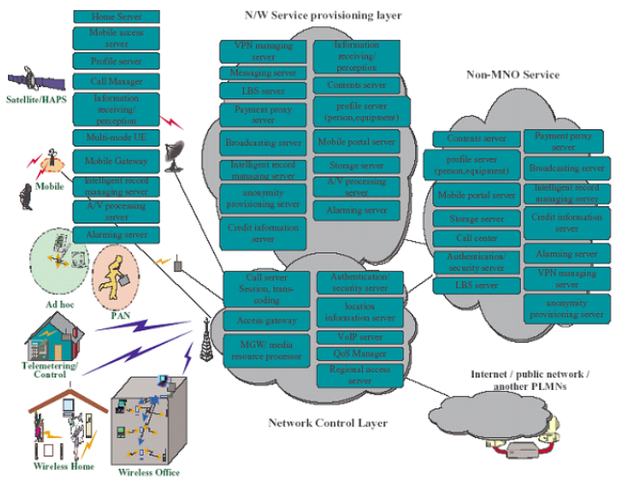

Fig. 5. Relationship among L1 (8), L2 (31), and L3 (32) services.

Fig. 5. A concept of a network architecture for provisioning of the next generation mobile services.

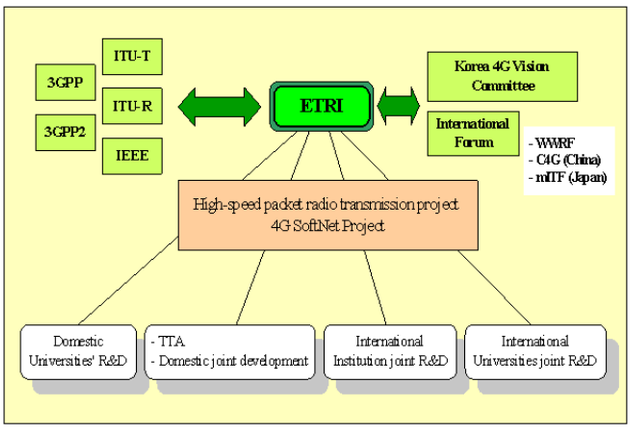

Fig. 6. Research and development strategies and activities for the next generation mobile communications in Korea.

6. REFERENCES

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