

# Smart Terminal Technology for the 4G Mobile Communication Systems

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*Abstract: This paper proposes a key concept of smart terminal technology for the 4G mobile communication systems. The mobile terminal has to be capable of supporting various air interfaces and services to satisfy users' demand. Mobile terminal of the 4G system will have various kinds of characteristics. In the future design of the mobile terminal, the power reduction will be accomplished by software rather than by hardware technology.*

**Keywords:** smart terminal, 4G system

## I. INTRODUCTION

The rapid growth of wireless networks and services, accelerated by the third-generation mobile communication system (in short, hereafter, 3G system) research, is ushering in the era of the fourth-generation mobile communication system. Wireless communication systems are evolving to meet the ultimate goal, to allow 'anywhere, anytime, anything, by anyone' communication customized to a particular subscriber's preferences, location, and social behavior. To reach this goal, much effort is still underway.

From 1997, the 3G standards have been primarily driven by two international standardization organizations – 3GPP (Third Generation Partnership Project)

and 3GPP2 [1-3]. The 3GPP and 3GPP2 have made coordination and harmonization efforts aiming at a global IMT-2000 system. The 3GPP developed a standard based on WCDMA (wideband code division multiple access) and GSM-MAP, while the 3GPP2 established a standard based on cdma2000 and ANSI (American National Standards Institute) - 41.

Although the 3G system is designed to support data rates up to 2Mbps, it is hard to provide such a speed to every single user in each cell. Also, highly demanded is the unified provision of various kinds of services including the ones provided by systems such as POTS (plain old telephone system), LAN (local area network), xDSL (digital subscriber line, x: S (symmetric), A (asymmetric), V (very high-speed), H (high-speed)), and 3G systems [4,5].

In order to accommodate new needs of the subscribers, a great many efforts on a new wireless system (hereafter, we call it 4G system) are being made in many countries and organizations including Japan, U.S.A, and ETSI (European Telecommunication Standards Institute).

In this paper, we propose terminal implementation technology. The focus of the paper is to define and identify what the mobile terminal will be in the 4G system.

## II. CONCEPT OF MOBILE TERMINAL ASPECTS

The mobile terminal has to be capable of supporting various air interfaces and services to satisfy users' demand. Mobile terminal of the 4G system will have various kinds of characteristics such as high-speed data rate, broad bandwidth, various air interfaces and a variety of services, including support of QoS and user/terminal mobility. In order to support various air interfaces, the mobile terminal must guarantee software reconfigurability, which is achieved by software download. Software download will allow the reconfiguration of terminal, services and applications, and enable personalized services. Compared to the 3G mobile terminals, it is anticipated that the 4G terminals will have the following features:

- Higher interactivity (more comfortable interface between human and network worlds),
- Higher connectivity (networking with other wireless devices on an ad hoc basis),
- Multiple personalities (multiple functions such as cellular phone, pager, GPS locator, etc.),
- Dynamic self-reconfigurability (adaptation to changing service requirements and network conditions),
- Enhanced security function (e.g., Fingerprint chip embedded), and
- Enhanced voice recognition function.

## III. MOBILE TERMINAL TECHNOLOGY

Design of mobile terminals with low-power consumption has always been an interest in the wireless communication industry. It is well known that the improvements in power dissipation can be best attained

through algorithmic and architectural innovations, guided by the knowledge of hardware and circuit properties through the advanced RF and integrated circuit technologies. One way to reduce power is to simply use components that consume less power in the storage, processing, display, and wireless communication units of the mobile terminal. Another way is to use components that can enter into low-power modes by temporarily reducing the speed or functionality. In the future design of the mobile terminal, the power reduction will be accomplished by software rather than by hardware technology.

In Fig 1, the mobile terminal technology of the 4G terminal is shown in terms of Internet access, radio access, platform, display, and RF components. Since the future wireless terminals will be asked to integrate different kinds of traffic with different QoS, it is desirable that a lot of flexibility should be given to the mobile terminal. One of our visions to this mission is to apply 'terminal with knobs' where the lower layers can be reached down by reprogramming according to its needs. In this manner, 'on demand' services can be served by best matching application requirements. In Fig. 2 and Fig. 3, sample applications of the smart terminal such as internet access, radio access, and ad-hoc network are described.

From the service aspects, the mobile terminal technology of the 4G system can be divided into three categories as follows:

### ii) Multimedia technology

- Moving picture technology such as MPEG (Moving Picture Experts Group)
- Multimedia input/output interface technology
- Various multimedia application service technology
- Efficient compression technology

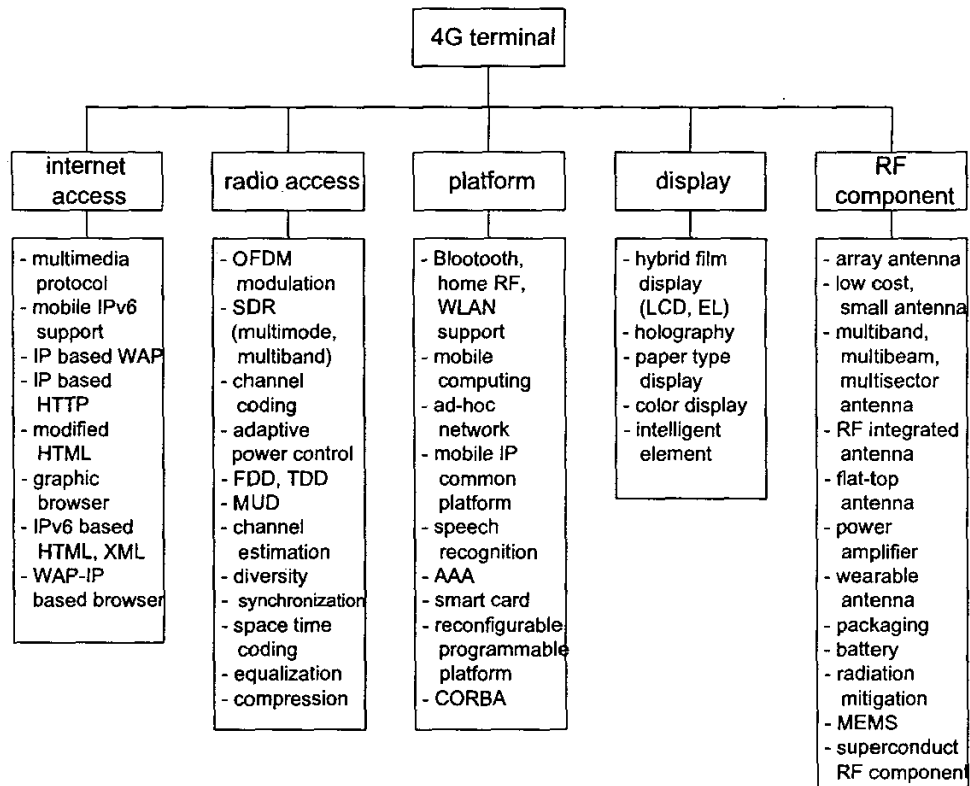


Fig. 1. Terminal technology for the 4G terminal.

- Support mobile-IP and VoIP
- GPS (global positioning system) technology to support location service
- Effective handover algorithm technology
- Authentication/security technology to guarantee high safety
- iii) User interface technology
  - Service and air interface selection technology
  - User interface reconfiguration technology
  - Interface technology between input/output devices and applications

Some of the listed contents may be overlapped with that of the 3G system. However, since the 4G system is fundamentally market (service) driven, the

4G terminal will be a kind of more enhanced, sophisticated, easy-to-handle one compared to the 3G terminal.

## □. CONCLUSIONS

In this paper, we have defined and proposed the concepts and features of the mobile terminal technology in the 4G system. Since it was practically impossible to address above fact, it was intended to initiate discussion on the 4G systems and networks.

In the era of the 4G systems, as witnessed in the 3G system, the different world regions need to cooperate particularly in the field of standardization, regulation, and spectrum allocation to ensure widespread availability of advanced and affordable wireless ser-

vices and applications. The national and regional borders should be more often transcended, and interconnection of the networks and interoperability of services should be highly encouraged with the objective of enhancement of quality of life in the ever-maturing information age.

### ACKNOWLEDGEMENT

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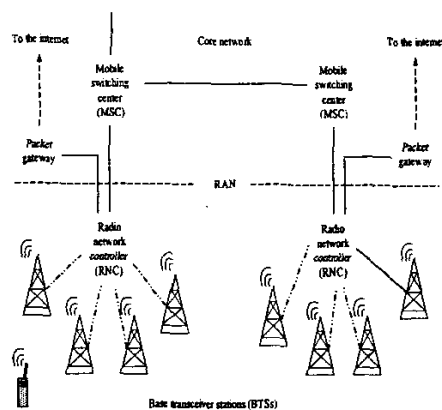


Fig.2. Radio access network architecture

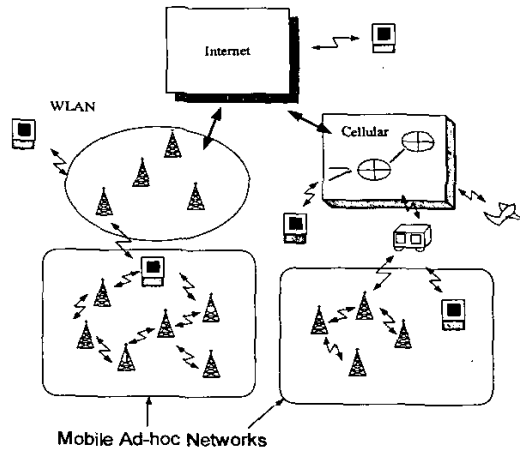


Fig. 3. Ad-hoc network.