

4G Technology

Deepenti H. Deshmukh¹, Anup W. Burange², Vaishali S. Sarode³

¹(Information Tech., P.R.M.I.T&R/S.G.B.A.U, India)

²(Information Tech., P.R.M.I.T&R/S.G.B.A.U, India)

³(Information Tech., P.R.M.I.T&R/S.G.B.A.U, India)

ABSTRACT

Based on the study, 4G mobile technology is in a determining and standardization stage. Although 4G wireless technology offers higher data rates and the ability to roam across multiple heterogeneous wireless networks, several issues require further research and development. Since 4G is still in the cloud of the sensible standards creation, ITU and IEEE form several task forces to work on the possible completion for the 4G mobile standards as well. 3GPP LTE is an evolution standard from UMTS and WiMAX is another candidate from IEEE. These technologies have different characteristics and try to meet 4G characteristics to become a leading technology in the future market. Under these circumstances, this paper will present about the current trends and its underlying technologies to implement the 4G mobile technology. This paper also shows some of the possible scenarios that will benefit the 4th generation technology.

Keywords

4G Mobile Technologies, 3GPP Long Term Evolution, WiMAX, WiBro, Software Defined Radio, Open Architecture.

INTRODUCTION

Moving from basic analog to high-speed digital in a mere 25 years is quite a feat. Wireless networks are now advancing to third generation (3G) capabilities, providing increased data transfer rates that make it easier to access applications and the Internet from mobile devices. Continuous improvements in semiconductor and computing technologies encourage the wireless industry and consumers to automatically anticipate what's next. While service providers are just beginning to offer 3G-enabled services, the concept of fourth generation (4G) wireless networks is already under discussion. But, without a standard definition of 4G, there are many confusing claims about the capabilities, breakthroughs and the potential of so-called 4G technologies. Much of this can be attributed to the breadth of technology covered under the 4G banner, the wide range of business interests involved in creating the 4G vision and the uneven progress of the contributing factors that can make 4G real.

In a world of fast changing technology, there is a rising requirement for people to communicate and get connected with each other and have appropriate and timely access to information regardless of the location of the each individuals or the information. The increasing demands and requirements for wireless communication systems ubiquity have led to the need for a better understanding of fundamental issues in communication theory and electromagnetic and their implications for the design of highly-capable wireless systems. In continuous development of mobile environments, the major service providers in the wireless market kept on monitoring the growths of 4th generation (4G) mobile technology. 2G and 3G are well-established as the mainstream mobile technology around the world. 3G is stumbling to obtain market share for a different reasons and 4G is achieving some confidence. In 2010, the total mobile subscriber base in North America, Europe and Asia Pacific is expected to grow up to 2500 million and penetration will be over 50%. This kind of demand growth will require the support of higher capacity network

SOURCE: PIONEER CONSULTING GROUP, "THE WIMAX REPORT EMERGENCE OF FIXED & MOBILE SOLUTIONS", 2006

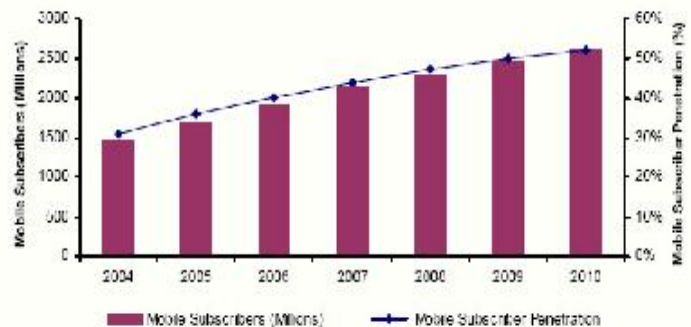


FIGURE 1 FORECAST COMBINED MOBILE SUBSCRIBER POPULATION

Given the technology at large, 4G mobile technology as an example, will give people a more convenience and ease in lifestyle. With the "anytime, anywhere, anything,"

capability, 4G wireless technology will benefit every individual regardless of time and place. Considering global standpoint, this technology stands to be the way to communicate and connect all the time with more ubiquitous means. Therefore, given the ubiquitous networking, e-commerce (or even m-commerce), unified messaging, and peer-to-peer networking, expansion to the mobile and wireless surroundings must reach its maximum possibilities. The trail going to 4G mobile technology embraces lots of significant trends. Major mobile players have been investing to 2G and the succeeding technology.

4G mobile technologies are perceived to provide fast and high data rate or bandwidth, and offer packetized data communications. Since 4G is still in the cloud of the sensible standards creation, ITU and IE EE form several task forces to work on the possible completion for the 4G mobile standards as well. Users' experiences of latest booming Internet forces industry to investigate means to provide high data rate regardless of mobility. 4G is being discussed as a solution to the inquiry and its vision and requirements are being standardized in various standardization bodies. 4G service vision is given from this research.

There still have large room for the purpose of service application vision: 3G is being delayed in its commercialization and about a decade of change is left for being delayed in its commercialization and about a decade of change is left for presenting our vision of 4G services In this paper, we also outline the current trend of next generation of wireless communications and investigate 4G candidate technologies. Based on this investigation, four scenarios will be discussed to predict and analyze 4G. The final section will provide some policy implications and issues.

The purpose of this paper is to:

- Clarify the definition of 4G from a technology perspective
- Present business benefits of 4G-enabled services
- Propose a realistic timeline for the adoption of a 4G standard.

I.1 THE CURRENT STATE OF 3G

Before beginning a discussion of 4G technologies and business applications, it is important to understand the current state of 3G networks. There is no official definition by a standards group of what constitutes 3G. The term evolved in the wireless industry and generally includes the International Standards Union's (ITU) IMT-

2000 technology definition and related features.

II. TREND OF 4G TECHNOLOGY

The idea of convergence means that the creation of the atmosphere that can eventually provide seamless and high-reliable and quality broadband mobile communication service and ubiquitous service through wired and wireless convergence networks without the space problem and terrestrial limitation, by means of ubiquitous connectivity. Convergence among industries is also accelerated by formation of alliances through participation in various projects to provide convergence services.

4G mobile systems will mainly be characterized by a horizontal communication model, where such different access technologies as cellular, cordless, wireless LAN type systems, short-range wireless connectivity, and wired systems will be combined on a common platform to complement each other in the best possible way for different service requirements and radio environments. The development is expected to inspire the trend of progressive information technologies a far from the current technical focus on fully mobile and widespread convergence of media. The trends from the service perspective include integration of services and convergence of service delivery mechanisms. In accordance with these trends, mobile network architecture will become flexible and versatile, and new services will be easy to deploy.

II.1.2. BROADBAND SERVICES

Broadband is a basis for the purpose of enabling multimedia communications including video service, which requires transmission of a large amount of data; it naturally calls media convergence aspect, based on packet transport, advocating the integration of various media on different qualities.

The increasing position of broadband services like Asymmetric Digital Subscriber Line (ADSL) and optical fiber access systems and office or home LANs is expected to lead to a demand for similar services in the mobile communication environment. 4G service application characteristics will give broadband service its advantages.

Low cost

To make broadband services available to the user to exchange various kinds of information, it is necessary to lower charges considerably in order to keep the cost at or below the cost of existing service.

Coverage of Wide Area

One feature of mobile communications is that it's availability and omnipresent. That advantage is important for future mobile communication as well. In particular, it is important to maintain the service area in which the terminals of the new system can be used during the transition from the existing system to a new system.

Wide Variety of Services Capability

Mobile communication is for various types of users. In the future, we expect to make the advanced system performance and functionality to introduce a variety of services not only the ordinary telephone service. Those services must be made easier for anyone to use.

III. ECONOMIC IMPACT

III.1 ADVANTAGES & DISADVANTAGES OF 4G

• **ADVANTAGES**

- *Higher bandwidth
- *Better reponstime.
- *Works at 2.6GHz frequency wich means better coverage even though it uses the same tower where the receiver and transmitter for 3G is.
- *Less time to buid 4G because it use the same tower and fibercables as 3Gs - they only have to upgrade the towers with 4G components.

III.2 PROBLEMS WITH THE CURRENT SYSTEM

One may then wonder why ubiquitous, high-speed wireless is not already available. After all, wireless providers are already moving in the direction of expanding the bandwidth of their cellular networks. Almost all of the major cell phone networks already provide data services beyond that offered in standard cell phones, as illustrated in Table 1. Unfortunately, the current cellular network does not have the available bandwidth necessary to handle data services well. Not only is data transfer slow at the speed of analog modems but the bandwidth that is available is not allocated efficiently for data. Data transfer tends to come in bursts rather than in the constant stream of voice data. Cellular providers are continuing to upgrade their networks in order to meet this higher demand by switching to different protocols that allow for faster access speeds and more efficient transfers. These are collectively referred to as third generation, or 3G, services. However, the way in which the companies are developing their networks is problematic all are currently proceeding in different directions with their technology improvements. the different technologies that are currently in use, and which technologies the providers plan to use.

TABLE 1: CELLULAR PROVIDERS AND SERVICES

Cellular provider	Features
-------------------	----------

Sprint	e-mail, pictures, games, music, Internet
AT&T	e-mail, games, music
Verizon	e-mail, pictures, games, music, Internet
Nextel	e-mail, pictures, games, music, Internet
T-Mobile (Voice Stream)	e-mail, pictures, games, music, Internet
Cingular	text messaging

Although most technologies are similar, they are not all using the same protocol. In addition, 3G systems still have inherent flaws. They are not well-designed for data; they are improvements on a protocol that was originally designed for voice. Thus, they are inefficient with their use of the available spectrum bandwidth. A data-centered protocol is needed.

If one were to create two identical marketplaces in which cellular providers used 3G and 4G respectively, the improvements in 4G would be easy to see. Speaking on the topic of 3G, one of the worlds leading authorities on mobile communications.

IV. HOW 4G NETWORK WORKS

As the need for communication rather fastest communication is the foremost priority of present era also the need of quick data transfer. Distant business correspondence by sharing data becomes very important. Ever growing technology is the example of one such step towards the fastest transmission of data. 4G stands for fourth generation is the latest technology with high speed transferability of data with security measurements. It is coming with wireless broadband for the instant download.

Talking about the standard of 4G technology, still not defined as set standard, two technologies are supposed to be the based features of 4G.

- WiMAX
- LTE

ITU promotes the technologies against the defragmentation and incompatibilities in 4G technologies.

WiMAX stands for Worldwide Interoperability of Microwave Access previously worked as fixed wireless facility under the 802.16e band. Now the modified standard 802.16m has been developed with the properties of speed, wide spectrum, and increase band.

4G has an advantage of having the WiMAX as a product because IEEE introduces and releases it already therefore economic as no need to pay for its manufacturing price. 4G supports two basic equipments;

- WiMAX Network system (network infrastructure)
- mobile phone set

V. CONCLUSION

Consumers demand that software and hardware be user-friendly and perform well. Indeed, it seems part of our culture that customers expect the highest quality and the greatest features from what they buy. The cellular telephone industry, which now includes a myriad of wireless devices, is no exception. Meanwhile, competition in the industry is heating up. Providers are slashing prices while scrambling for the needed infrastructure to provide the latest features as incentives, often turning to various 3G solutions. Unfortunately, this will only serve to bewilder customers in an already confusing market. Customers want the features delivered to them, simple and straightforward. Wireless providers want to make money in a cutthroat industry. If the U.S. government wants to help, the best way to help all parties is to enforce 4G as the next wireless standard. The software that consumers desire is already in wide use. The transmission hardware to take it wireless is ready to go. And we have the security practices to make sure it all works safely. The government need only push in the right direction; the FCC need only standardize 4G in order to make the transition economically viable for all involved. This is a need that demands a solution. Today's wired society is going wireless, and it has a problem. 4G is the answer.

6. REFERENCES

- Al-Muhtadi, J., D. Mickunas, and R. Campbell. "A lightweight reconfigurable security mechanism for 3G/4G mobile devices." *IEEE Wireless Communications* 9.2 (2002): 60–65.
- ArrayComm. "IEC: Smart Antenna Systems." International Engineering Consortium (2003). 6 April 2003. <<http://www.iec.org/online/tutorials/smartant/topic01.html>>.
- Butcher, Mike. "UWB: widening the possibilities for wireless." *New Media Age*. 5 April 2003. <<http://www.uwb.org/news/articles/042002/NewMediaAgeApril402.pdf>>.
- Cefriel. "4th Generation Networks (4G)." Cefriel. 6 April 2003. <<http://www.cefriel.it/topics/interest/default.xml?id=106&tid=13>>.
- Christian, Bruce. "Intellectual Capital: William C.Y. Lee Looks Ahead to 4G Wireless." *Phone+*. 3 April 2003. <<http://www.phoneplusmag.com/articles/131feat3.html>>.
- Cravotta, Nicholas. "Ultrawideband: the next wireless panacea?." *EDN.com*. 5 April 2003. <<http://www.uwb.org/files/October2002/EDNOct1702.pdf>>.
- Dankers, J., T. Garefalakis, R. Schaffelhofer, and T. Wright. "Public key infrastructure

in mobile systems." *Electronics & Communication Engineering Journal* 14.5 (2002): 180–190.

Howard, P., M. Walker, and T. Wright. "Towards a coherent approach to third generation system security." *3G Mobile Communication Technologies* (2001): 21–27.

Leon-Garcia, Alberto and Indra Widjaja. *Communication Networks: Fundamental Concepts and Key Architectures*. Boston: McGraw Hill, 2000.

NIST. "Wireless Network Security." <[http://cs-www.ncsl.nist.gov/publications/nistpubs/800-48/NIST SP 800-48.pdf](http://cs-www.ncsl.nist.gov/publications/nistpubs/800-48/NIST%20SP%20800-48.pdf)>.