

A survey on wireless communications – beyond 3G

Amit Tiwari
Assistant Systems Engineer
TCS Mumbai
amittiwari15@gmail.com

Preeti Diwan
Lecturer, Department of Comp. Sc. & Engg
OIST, Bhopal
diwantina@gmail.com

Abstract

Wireless access standards, like most other technological standards, generally evolve during their service life to offer enhanced performance and capabilities. The general impression behind diverse technology “generations” is that every new generation offers noteworthy “revolutions” in routine and capabilities compared to its predecessor. This often means that a new “overlay” network, likely in a new frequency band, is requisite for each technology generation.

Mobile operators need to recognize their spanning role as internet service providers (ISPs). No longer do they just provide cellular voice services; now they also provide high-speed Internet Protocol-based (IP) data services. So as to offer a wider array of services and content to their data subscribers, mobile operators are opening up their formerly closed networks to numerous other mobile operators, data networks and the public Internet.

Keywords: internet, broadband wireless, 3G, 4G.

INTRODUCTION

Wireless access standards, like most other technological standards, generally evolve during their service life to offer enhanced performance and capabilities. The general impression behind diverse technology “generations” is that every new generation offers noteworthy “revolutions” in performance and capabilities compared to its predecessor. This often means that a new “overlay” network, likely in a new frequency band, is requisite for each technology generation.

India, the world's fastest-growing wireless market, with about 490 million users, has been adding about 14 million subscribers each month. The government has penciled in revenue of 350 billion

rupees (\$7.6 billion) from the auction of 3G spectrum [8].

Mobile operators need to identify their spanning role as internet service providers (ISPs). No longer do they just provide cellular voice services; now they also provide high-speed Internet Protocol-based (IP) data services. So as to offer a wider array of services and content to their data subscribers, mobile operators are opening up their formerly closed networks to numerous other mobile operators, data networks and the public Internet.

3G is a short term for third generation wireless, and refers to near-future developments in personal and business wireless technology, especially mobile communications.

Less than a year after getting its 3G licenses, China Mobile, the world's top mobile carrier with 500 million subscribers, is already looking past 3G to the next generation, planning to build a trial LTE network in multiple cities next year, Chairman Wang Jianzhou said in a press conference on November 2009.[8]

Mobile operator's 3G networks are not only bare to all the virtual pathogens already in transmission, but also to mobile-specific viruses and Trojans, as well as to direct attacks such as Denial of Service (DoS) on their networks from hackers and/or criminal organizations. These types of attacks employ methods which wired ISPs have been dealing with for a much longer period of time. There are also variations on these attacks which exploit weaknesses in the architecture and some of the protocols used in 2.5G/3G cellular data networks.

However, the success of I-mode in Japan combined with the overall demand for continuing technological enhancements and customer demand for specific services such as mobile broadband access, suggests strongly that 3G networks must eventually take off elsewhere.[1]

Telecom mobile services were initially offered using analogue radio technologies and these were considered as the first generation systems. The definition of 2G was straight forward because analogue radio networks were replaced with digital ones in the 1990's. However the definition of 3G is not so simple because these various 2G digital networks have been extensively deployed throughout the world and have evolved significantly throughout their long service life to offer greatly improved performance and capabilities, particularly for data services [9].

The scope of this paper is to describe the evolution of 3G services and scope of 4G with the differences between 3G and 4G with respect to potential public use in the near future and beyond. The study will concentrate primarily on the fourth generation of mobile telecommunications and beyond. For the most part, it is believed that 4G will bring true multimedia capabilities such as high-speed data access and video conferencing to the handset. It is also envisioned that 4G systems will be deployed

EVOLUTION & REVOLUTION TO 3G

When the full promise of Third Generation (3G) wireless is realized, wireless users will have global access to a variety of voice, data and video services. Users will be able to access all their communications services easily from anywhere using any terminal. The distinctions between wire line, wireless and data services will blur until they're irrelevant. Users will simply choose the most convenient means to communicate, while network operators will choose the most efficient way to transport communications. Here 2G to 3G evolution has been described. The Table 1 and figure 1 describes the evolution for different generations in telecomm technologies [10] [6] [7].

Figure 1: 2G to 3G evolution

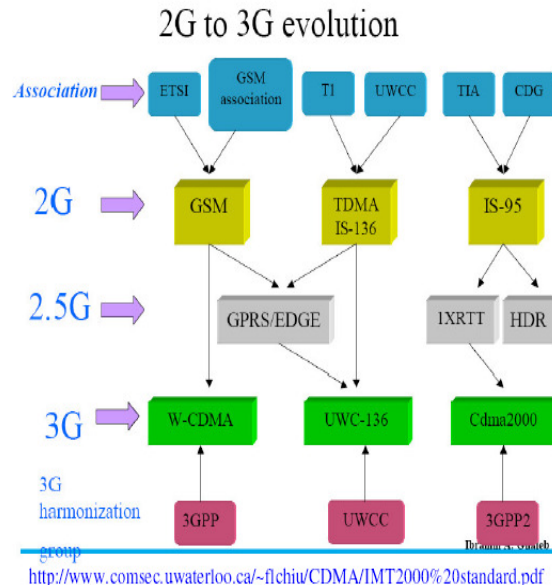


Table 1: Evolutions of 3G

Features	2G	2.5G	3G
Frequency Band	2G operate at multiple frequency bands. 800-900 MHz (cellular band) & 1.5-1.8 GHz(PCS band)	Same as 2G	Use of common global frequency band 1885-2025 MHz & 2210-2200 MHz
Roaming	Generally limited to specific region	Same as 2G	Improved in global roaming due to use of global roaming frequency.
Data Services	Good for voice but limited in data application: Less than 32 kbps	Good for voice and improved in data services by GPRS that can operate at 172 kbps	Perfect for voice, support many data services from at least 144 kbps in mobility till 2mbps indoor

TIME-LINE FOR G's:

The first generation of cellular networks, known as 1G, consisted of analog systems capable of carrying only voice. These first mobile phone systems were in use from the late 1970s through to

the 1980s, and were just recently 'retired'. 1G wireless was analog and supported the first generation of analog cell phones with the speeds up to 2.4kbps. The second generation, 2G system, fielded in the late 1980s and finished in the late 1990s, was planned mainly for voice transmission with digital signal and the speeds up to 64kbps. The third generation, 3G wireless system, was developed in the late 1990s and might be well-done in the late 2000s. 3G is not only provided the transmission speeds from 125kbps to 2Mbps, but also included many services, such as global roaming, superior voice quality and data always add-on. The fourth generation is a conceptual framework and a discussion point to address future needs of a high speed wireless network that can transmit multimedia and data to and interface with wire-line backbone network perfectly just raised in 2002. The speeds of 4G can theoretically be promised up to 1Gbps. The beyond will be 5G with incredible transmission speed with no limitation for access and zone size [4] [5] [10].

DIFFERENCES BETWEEN 3G AND 4G

The main distinguishing factors between 3G and 4G will be data rates, services, transmission ways, access technology to the Internet, the compatibility to interface with wire-line backbone network, quality of service and security. 4G should support at least 100 Mbps peak rates in full-mobility wide area coverage and 1Gbps in low-mobility local area coverage" [11]. The speeds of 3G can be up to 2Mbps, which is much slower than the speeds of 4G. For the service, 3G marketing is difficult to roam globally and interoperate across networks, yet 4G will be a global standard that provides global mobility and service portability so that service provider will no longer be limited by single-system [12]. In other words, 4G should be able to provided very smooth global roaming ubiquitously with lower cost. Furthermore, 3G is based on a wide-area concept applying circuit and packet switching for transmission with limited access technology. However, the 4G standard will base on broadband IP-based *8 entirely applying packet switching method of transmission with seamlessly access convergence [11]. It means that 4G integrated all access technologies, services and applications can unlimitedly be run through wireless backbone over wire-line backbone using IP address. In the other words, 4G will bring us almost perfect real world wireless or called "WWW: World Wide Wireless Web" [13]. The most interesting questions are how researchers and developers make 4G such a powerful standards and how 4G is

manipulated and implemented. Therefore, next section is focused on what technologies are used in 4G demonstrating its working theories.

Table 2: Comparison between 3G and 4G

Attributes	3G Wireless Technology	4G wireless Technology
Speed	Up to 2Mbps Full-mobility:	up to 100Mbps Low-mobility: up to 1Gbps
Services	1. Difficult of global roaming 2. Expensive 3. good for voice transmission	1. roaming smoothly 2. inexpensive 3. good for any type of transmission
Core Network	1. Wide-area concept 2. Circuit and packet switching	1. broadband IP-based 2. Entirely packet switching
Technologies	1. WCDMA 2. CDMA 3. TD-SDMA	All access convergence Main: 1. OFDM 2. MC-CDMA 3. LAS-CDMA 4. UWB *7 5. Network-LMPS

CONCLUSION

Nowadays, wireless technology is getting popular and important in the telecommunication network and the Internet field.

4G networks may eventually deliver on all the promises. At times, it seems that technological advances are being made on a daily basis. These advances will make high speed data/voice-over-Internet-protocol (VoIP) networks a reality.

In this paper, I briefly introduced the evolution of 2G to 3G, surroundings of 1G to 5G, compared the differences of 3G and 4G, and describe how 4G may work for more expedient and prevailing in the future. 4G just right started from 2002 and there are many standards and technologies, which are still in upward procedure. Therefore, no one can really sure what the future 4G will look like and what services it will offer to people. However, we can get the broad-spectrum initiative about 4G from academic research; 4G is the evolution based on 3G's inadequacy and it will fulfill the idea of WWW, World Wide Wireless Web, contribution more services and smooth global roaming with economical cost.

REFERENCE

- [1] "Revenue Assurance, Fraud & Security in 3G Telecom Services" by Mark Johnson, VP business Development Visual, Journal of Economic Crime Management, Fall 2002, Volume 1, Issue 2
- [2] "3G_MobileSecurity", White Paper, January 2007
- [3] 3G Technology in Local Government: Case Examples of Business Process Change and Strategic Innovation, by Christopher P. Holland and Martin Cahill.
- [4] Mobile Malware Evolution: An Overview, Part 2, Kaspersky Labs, October 10, 2006, Alexander Gostev, Senior Virus Analyst.
- [5] Accenture (2004), "High performance in government".
http://www.accenture.com/xdoc/en/industries/government/gove_egov_value.pdf
- [6] McCarthy H. and P. Miller (2003), "London calling, how mobile technologies will transform our capital city", Demos Think Tank, <http://www.demos.co.uk>
- [7] 3G Technology Overview Cellular Mobile Systems and Services (TCOM1010) April 2009.
- [8] <http://computing.in.msn.com/article.aspx?cp-documentid=3453484>
- [9] www.itu.int/ITU-D/imt-2000/.../What_really_3G.pdf
- [10] www.conestogac.on.ca/~mkabir/TCOM1010.../Day-11_3G-Overview.pdf
- [11] "WCDMA and WLAN for 3G and Beyond. Retrieved" by Honkasalo, H. & Pehkonen, K. & Niemi, M. T. & Leino, A. A. (April 2002). June 11th, 2005
- [12] "Evolution Towards Broadband Wireless Systems.Retrieved" by Adachi, F.. June 11th, 2005, from the IEEEExplore Database from Wallance Library.
- [13] Didier Bourse (Motorola Labs) Beyond 3G / 4G Radio Access Technologies (RATs) and Standards Roadmaps, eMobility Technology Platform Whitepaper, Dec 2007