Chapter 8
Fourth Generation Networks: Adoption and Dangers

Jivesh Govil
Cisco Systems Inc., USA

Jivika Govil
Carnegie Mellon University, USA

ABSTRACT

Mobile researchers are witnessing burgeoning interest in 4G wireless networks that patronize global roaming across diverse wireless and mobile networks. The pith of 4G mobile systems lies in seamlessly integrating the existing wireless technologies including Wideband Code Division Multiple Access (WCDMA). High Speed Uplink Packet Access (HSUPA)/ High-Speed Downlink Packet Access (HSDPA). 1×Evolution Data Optimized, (1×EVDO). Wireless LAN, and Bluetooth. However, migrating current systems to 4G engenders enormous challenges. With ever-changing specification and standards, developing a prototype requires flexible process to provide 4G system capabilities. The 4G system has its own advantages and associated dangers. This chapter intends to deal with adoption issues of 4G, the fundamentals as well as issues pertaining to 4G networks, standards, terminals, services of 4G, and the vision of network operators and service providers. Besides, to overcome the challenges of sophisticated personal sessions and service mobility, advanced mobility management (MM) is needed to fulfill the need for seamless global roaming. The chapter endeavors to make an evaluation on development, transition, and roadmap for fourth generation mobile communication system with a perspective of wireless convergence domain in addition to mobility management. Lastly, open research issues in 4G are succinctly discussed.

INTRODUCTION

4G is short for fourth-generation cellular communication system. There is no set definition for the specifics of 4G (Young Kyun & Prasad, 2006). The 4G will be a fully IP-based integrated system of systems and network of networks, achieved after the convergence of wired and wireless networks as well as computer, consumer electronics, communication technology, and several other convergences. These will be capable of providing 100 Mbps and 1Gbps, respectively, in outdoor and indoor environments

DOI: 10.4018/978-1-61520-674-2.ch008

with end-to-end QoS and high security, offering any kind of services anytime, anywhere, at affordable cost and one billing (Dixit, S. (2008)). The Wireless World Research Forum (WWRF) defines 4G as a network that operates on Internet technology, combines it with other applications and technologies such as Wi-Fi and WiMAX, and runs at speeds ranging from 100 Mbps (in cell-phone networks) to 1 Gbps (in local Wi-Fi networks). 4G is not just one defined technology or standard, but rather a collection of technologies and protocols to enable the highest throughput and lowest cost wireless network possible (Chang, 2007).

Fourth generation networks are likely to use a combination of WiMAX and WiFi. Technologies employed by 4G may include SDR (Software-Defined Radio) receivers, OFDM (Orthogonal Frequency Division Multiplexing). OFDMA (Orthogonal Frequency Division Multiple Access). MIMO (multiple input/multiple output) technologies, UMTS (Universal Mobile Telecommunications Service) and TD-SCDMA (Time Division Synchronous Code Division Multiple Access). All of these delivery methods are typified by high rates of data transmission and packet-switched transmission protocols. 3G technologies, by contrast, are a mix of packet and circuit-switched networks. When fully implemented, 4G is expected to enable pervasive computing in which simultaneous connections to multiple high-speed networks provide seamless handoffs throughout a geographical area. Network operators may employ technologies such as cognitive radio and wireless mesh networks to ensure connectivity and efficiently distribute both network traffic and spectrum

Moreover, the objective to 4G is to offer seamless multimedia services to users accessing an all IP-based infrastructure through heterogeneous access technologies. IP is assumed to act as an adhesive for providing global connectivity and mobility among networks. 4G will more resemble a conglomerate of the existing technologies rather than an entirely new standard. An all IP-based 4G wireless network has inherent advantages over its predecessors. It is compatible with, and independent of the actual radio access technology. With IP, one basically gets rid of the lock-in between the core networking protocol and the radio protocol. IP tolerates a variety of radio protocols. It lets one design a core network that gives complete flexibility in the access network type.

The goal of this chapter is to study development, transition, and challenges in 4G implementation and mobility management issues. Mobility management has been recognized as one of the most important and challenges problems for a seamless access to wireless network and mobile service. It is the fundamental technology used to automatically support mobile terminals and join their services while simultaneously roaming freely without the disruption of communication. Mobility management operations are introduced, along with the discussions of key research issues and possible solutions.

4G MOBILE COMMUNICATION SYSTEMS

The success of Second-generation (2G) mobile systems in the previous decade prompted the development of third-generation (3G) mobile systems. While 2G systems such as GSM, IS-95, and cdmaOne were designed to carry speech and low-bit-rate data, 3G systems were designed to provide higher data-rate services. During the evolution from 2G to 3G, a range of wireless systems, including General Packet Radio Services (GPRS). International Mobile Telecommunications-2000 (IMT-2000). Bluetooth, WLAN, and HiperLAN, have been developed. All these systems were designed independently, targeting different service types, data rates, and users. As these systems have their own merits and demerits, there is no single system that is good enough to replace all the other technologies. Researchers are making efforts to establish 4G systems that integrate existing and newly developed wireless systems as a more