Exploring the Growth of Wireless Communications Systems and Challenges Facing 4G Networks

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INTRODUCTION

Wireless and Mobile Communications

In a traditional sense, wireless systems were considered as an auxiliary approach used in regions where it was difficult to build a connection by using typical wires and cables (Alderete & Gutiérrez, 2014). Firms operating in a competitive and global marketplace are relying more and more on the data that flows throughout their organization. As a means of enhancing supply chain management (SCM), firms are working to improve the integration level with suppliers and clients, materials and inventory regarding the production costs, influence of raw material prices, and the active request for changes by the client (Dharni, 2014; Gupta & Naqvi, 2014; Qrunfleh, Tarafdar, & Ragu-Nathan, 2012; Soon, Mahmood, Yin, Wan, Yuen, & Heng, 2015). Many organizations are seemingly more concerned with the identification of logistic issues as new opportunities arise. Even though changes in commercial activity are an important part of B2B (business-to-business) operations; for the most part, managers today do not comprehend insightful ways to deal with them. Many of the smaller firms that are integrated into a supply chain, lack the technological capacity to implement electronic operations of data processing, transmission of data, and reception of data (Qrunfleh, et al., 2012).

Originally, 1G-networks were introduced in the 1980s and were generally based on analog techniques. It built the basic structure of mobile communications and solved many fundamental problems. Some of these problems included cellular architecture adopting, multiplexing frequency band, roaming across domain, and non-interrupted communication. The only service of 1G was Speech Chat. Then, once implemented, 2G gained popular acceptance during the 1990s. It was based on digital signal processing techniques and regarded as a bridge from analog to digital technology. It introduced a new option of communication called text messaging, multimedia messaging or picture messaging, General Packet Radio Service, Wireless Application Protocol, Enhanced Data Rates for GSM Evolution, and Internet services. 2G's main contributions were the utilization of SIM (Subscriber Identity Module) cards and support capabilities for a large number of users (e.g., 2.5G was regarded as 3G services for 2G networks). This network extended the 2G network with data service and packet switching methods. 2.5G brought the Internet into mobile personal communications under the same networks with 2G, which was an important concept leading to different kinds and combinations of communications.

The 3G network, known as "the third generation mobile broadband data services", came with several incremental improvements in radio technology and command-and-control software.

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Radio advancements of the 3G network are referred to as antenna techniques or coding/modulation schemes. According to Akintoye (2013, p. 43), "Several new radio techniques are employed to achieve high rates and low latencies." These new radio techniques included Space Division Multiplexing (SDM) via Multiple Input/Multiple Output (MIMO), Space Time Coding (STC) using higher order of modulation, and encoding schemes, beam forming, beam directional control, and inter-cell interference techniques. These growths in wireless data services have placed higher demands on mobile wireless networks, and in response, wireless carriers are upgrading their networks to offer faster data rates (Latha & Suganthi, 2015; Sundarambal, Dhivya, & Anbalagan, 2010).

BACKGROUND

Mobile Systems and 4G

The use of mobile wireless data services continues to increase worldwide. Mobile systems focus on effortlessly integrating the current wireless technologies including global system for mobile communication, wireless local area networks, and Bluetooth. Ultimately, 4G systems support comprehensive and personalized services. These factors are essential in providing stable system performance and quality service. According to Akintoye (2013), the 4G platform as a mobile multimedia, universally available, global mobility support, integrated wireless, and e-customized service network system. It was designed to use a number of types of broadband wireless access communication systems and to work side-by-side cellular telephone systems.

The official 4G-based requirements are set and published by International Telecommunication Union (ITU). It specified a number 4G-based requirements that can be grouped into 5 types: data rates (i.e., cell spectral efficiency, peak spectral efficiency, cell-edge user spectral efficiency, mobility data rates), latency, handover interruption time, RF bandwidth, and number of active voice-over-Internet (VoI) protocol users (Yang, 2012). A 4G cellular system must have target peak data rates of up to approximately 100 Mbit/s for high mobility, such as mobile access. For low mobility, one needs data rates up to approximately 1 Gbit/s, such as local wireless access. The higher 4G data rates are available in those areas in which 4G cellular service is provided. They should provide scalable bandwidths of up to at least 40 MHz. A 4G system is expected to provide a comprehensive and secure all-IP based solution where facilities such as IP telephony, ultra-broadband Internet access, gaming services, and high-definition television streamed multimedia may be provided to users. It is very helpful for any organizations' compliance with e-Discovery requests.

In 4G networks, users are joining the network through add mobile routers to the network infrastructure. Wherever the concentration of customers is in more in one area, additional routes are created, enabling further access to network capacity. Hence, network capacity and coverage has dynamically shifted to make available more apts and high-speed connections available to suit changing user patterns. This enhanced flexibility permits the network to vigorously and routinely balance capacity and increase network utilization. As with web-based technologies, 4G is playing a significant role in promoting social networking and social media uses.

Business Audience for 4G

4G wireless communications are used in many businesses throughout the global economy and its vast communication networks to enhance and improve productivity. Each of the 5 major U.S. network operators (e.g., Verizon Wireless: 142.8 million (Q2 2016), AT&T Mobility: 133.3 million (Q3 2016), T-Mobile US: 69.4 million (Q3 2016), Sprint Corporation: 60.2 million (Q3 2016), U.S. Cellular: 4.9 million (Q2 2016)] ("List of United States wireless …" 2016) offers a slightly different version of 4G wireless communication services