A Brief Overview of 4G Cellular Communication

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Abstract—
The development of broadband wireless access technologies in recent years was the result of growing demand for mobile Internet and wireless multimedia applications. Mobile communication plays a most important role in telecommunications industry. Through a common wide-area radio-access technology and flexible network architecture WiMAX and LTE has enabled convergence of mobile and fixed broadband networks .fourth generation (4G) mobile technology, promises the full mobility with high speed data rates and high-capacity IP-based services and applications while maintaining full backward compatibility. This paper is provides technological features of an existing 4Gcommunication technology and its architecture to integrate the social networking process

***IndexTerms*—**4G Communication system Architecture; Social Networking Architecture; Adaptive Modulation and coding (AMC); Adaptive Hybrid ARQ; MIMO AND OFDM); Open Distributed Ad-Hoc Wireless Network.

Introduction

The mobile communication systems and the wireless communication technologies have been improving very fast day by day. Devices continue to shrink in size while growing in processing power. Consumers are demanding more advanced and useful applications. Hence, there is need of capacity improvements in wireless communications .In addition, wireless communications is active areas of technology development of our time. Several major cellular wireless communication techniques have been proposed in order to meet these user expectations. From all future 4G systems, the primary expectation is n- that they provide enormously high data rates to an excessive number of users at the same time.

First generation (1G) a wireless network was basically analog cellular systems with circuit switched network architecture. The main challenges of these wireless networks were basic voice telephony, low capacity and limited local and regional coverage. The increased demand for high frequency ranges in the telecommunications sector caused development in analog to digital transmission techniques. In the early 1990s, second generation (2G), arrived to meet the capacity demands of burgeoning voice plus telephony, text messaging and limited circuit switched data services. By utilizing digital system, the signal can be compressed much more efficiently than analog system, allows transmitting more packets into the same bandwidth and

propagates with less power. The third generation (3G) systems integrate voice and data applications. Vendors and operators started seeking ways for determining a new next generation wireless technology, namely fourth generation (4G) .In section II, we basically summarize need and opportunities for 4G system. We then present technologies being used in 4g networks to fulfill its requirement with research areas in section III and IV, respectively.

II. Forth Generation (4G)

4G is short for Fourth (4th) Generation Technology. 4G Technology is basically the extension in the 3G technology with more bandwidth and services offers in the 3G. But at this time nobody exactly knows the true 4G definition. Some people say that 4G technology is the future technologies that are mostly in their maturity period. The expectation for the 4G technology is basically the high quality audio/video streaming over end to end Internet Protocol. If the Internet Protocol (IP) multimedia sub-system movement achieves what it going to do, nothing of this possibly will matter. WiMAX or mobile structural design will become progressively more translucent, and therefore the acceptance of several architectures by a particular network operator ever more common. The main features of 4G services of interest to users are application adaptability and high dynamism users traffic, radio environment, air interfaces, and quality of service. [1] The 4G technology en suit with 802.16emobile version of WiMax (also known as WiBro), and HC-SDMA, Adoptive Modulation and coding (AMC), Adaptive Hybrid ARQ, MIMO and OFDM and Open distributed Ad-Hoc Wireless Network.

Need and opportunities for 4G

Fourth generation (4G) technology will offer many advancements to the wireless market, including downlink data rates well over 100 megabits per second (Mbps), low latency, very efficient spectrum use and low-cost

implementations with impressive network capabilities.

Applications could include

 4G Ultra high speed internet access - E-mail or general web browsing is available.

 4G Data intensive interactive user services - Services such as online satellite mapping will load instantly.

 4G Multiple User Video conferencing - subscribers can see as well as talk to more than one person.

III. WIMAX AND LTE AS NEXT GENERATION TECHNOLOGIES

Due to limitation in QOS and coverage range, Wi-Fi falls short as being wireless technology. The emergent 4G technologies such as WiMAX and LTE are stronger as compared to Wi-Fi. These technologies are having strong QOS and wider coverage. In some key aspect WiMAX and LTE resemble each other including operating in licensed spectrum bands, strong QOS support, wider coverage range.

Long Term Evolution (LTE)

Long Term Evolution (LTE) technology has been developed by the Third Generation Partnership Project (3GPP) as an improvement to the current Universal Mobile Telecommunications System is sometimes called 3.9G or Super 3G. Based on point-to-multipoint connections, both WiMAX and LTE telecommunications technologies provide broadband wireless service. Through Base Station (BS), mobile subscribers (MS) such as smart phones/laptops get connected to internet, while BS controls the channel access of mobile subscribers. Frequency-division duplex (FDD) as well as time-division duplex (TDD) systems are being supported by both WiMAX and LTE.

In TDD systems, a cell operate on the same frequency, with separation in time in uplink and downlink transmissions.

More specifically, with small guard intervals in between each 4G radio frame in TDD mode is divided into two sub frames: a downlink sub frame (i.e., transmission from BS to MS) followed by an uplink sub frame (i.e., transmissions from MS to BS) . Both WiMAX and LTE as operating network has its own specified network architecture .In WiMAX network, for special requirement a number of component are specified including BS(base station), AAA server, HA server ,ASN gateway some other components. Similarly in LTE networks a number of components are also specified including eNodeB, Serving Gateway PDN Gateway, MME, HSS

IV. Orthogonal Frequency division Multiple Access in WIMAX and LTE.

Orthogonal frequency division multiple access (OFDMA) has been recently recognized as an excellent multiple access technique for the next generation of downlink receivers. A multi-carrier transmission technique for high speed bi-directional wireless data communication. All the proposals which have been considered for the fourth generation (4G) wireless technologies has adopted orthogonal frequency division multiple access. WiMAX and LTE are the two main contenders in the 4G marketplace. The two standards those are likely to dominate the 4G

Use of OFDM in WIMAX and LTE

A. Frame Structure

In WiMAX, frame duration of 5 ms along with time division duplexing (TDD) is used. The frame is partitioned into OFDM symbols (for e.g., 48) of which some are allocated for DL and the rest for UL transmissions. For preamble transmission, the first symbol in the frame is used. Sub channels are formed out of a group of subcarriers, used for control and data transmissions. To convey the DL and UL

allocation, the base station (BS) announces a schedule every frame period (i.e., 5 ms). In LTE, sub frames of 1 ms duration is formed by dividing the frame duration of 10 ms. A sub frame is used to formed two slots of 0.5ms duration each. The BS schedules transmissions every 1 ms and the subcarriers formed resource blocks for allocation on the DL.

B. Frequency Diversity

In WiMAX, in the PUSC(partially used subcarriers) sub channelization method, by grouping 24 subcarriers sub channels are formed which are present in different parts of the spectrum. This pseudorandom selection of the positions of the subcarriers over the entire band is dependent on the CELL_ID. Diversity based sub.

C. Interference Diversity

In WiMAX, the formation of sub channel depends on the CELL_ID. The different users will have different sub channels. Hence, interference diversity is likely to experience by the user which is likely to give better performance than the dominant interferer case. Note that only in the case of PUSC transmissions interference diversity can be leveraged. For the BAMC transmissions, interference diversity cannot be used. In LTE, to the users RBs are allocated independent of the CELL_ID, across RBs of neighboring cells the interference on the DL won't be randomly distributed. Thus, in LTE, there is no interference diversity on the DL.

Adaptive Modulation and Coding (AMC)

The principle of AMC is to change themodulation and coding format (transport format) in accordance with instantaneous variations in channel conditions, subject to system restrictions. AMC extends the system's ability to adapt to good channel conditions. Channel conditions should be estimated based on feedback from the receiver. AMC allows different data rates to be assigned to differentusers depending on

their channel conditions. Since the channel conditions vary over time, the receiver collects a set of channel statistics that are used by both the transmitter and receiver to optimize system parameters such as modulation and coding, signal bandwidth, signal power,training period, channel estimation filters, and automatic gain control[2]. This AMC helped to integrate the 2G , 3G architecture uses into the forth coming 4G devices.

Adaptive Hybrid ARQ

A successful broadband wireless system must have an efficient co-designed medium access control (MAC) layer for reliable link performance over the lossy wireless channel. The corresponding MAC is designed so that the TCP/IP layer sees a high-quality link it expects. This is achieved by an automatic retransmission and fragmentation mechanism called automatic Repeat Request (ARQ), wherein the transmitter breaks up packets received from higher layers into smaller sub packets, which are transmitted sequentially. If a sub packet is received incorrectly, the transmitter is requested to retransmit it[4]. ARQ can be seen as a mechanism for introducing time diversity into the system due to its capability to recover from noise, interference, and fades. It will retain the quality of service in terms of data transmission [3].

V. Open Distributed AD-HOC Wireless Network

Routing infrastructure, including handsets, utilize intelligent routing capabilities to determine the best path for each transmission. Routing for the best path must be defined for least power. That is, network nodes must be able to calculate and update routing tables to send data packets through the paths with minimal power requirements [4]. This is different than network nodes associating with the physically closest available infrastructure. The 4G mobile system based on open wireless platform architecture will become the next wave in wireless

communications. The technology leads to integrate the computing network for human needs. At the same time, these technologies and the existing and upcoming 4G used to create the human network via computing devices. The social networking and it ecological issues are discussed below.

VI. Social Network System

A social network site is a web site that Acts as a destination hub for individuals to establish relationships with co-workers and by doing so, enable them to jointly build, or expand, their professional and social networks. It includes different tools for people to interact with each other, contribute information to the site, participate in different site activities, and build a sense of community in an informal and voluntary manner. It allows the user to define an online profile (or personal) , list their connections (e.g., friends and colleagues) , receive notifications on the activities of those connections participate in group or community activities , control permission, preference and privacy settings We define social network sites as webbased services that allow individuals to do the Following [1] construct a public or semi-public profile within a bounded system [2] articulate a list of other users with whom they share a connection, and [3] View and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site [5].
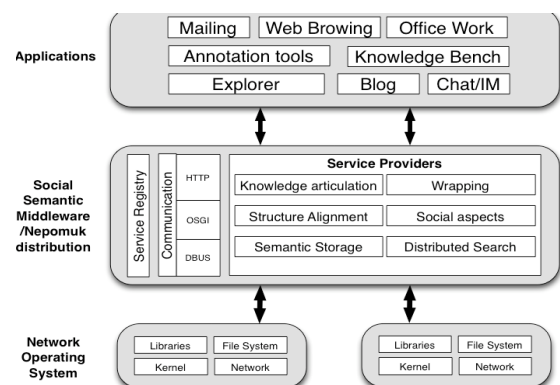

Fig.1 Social Network Architecture

In the existing social network sites are allowed to search the members, introduce the member, allow to send the message, share the photo , video and online chat etc. But the social networks are not realistic as we are interacting in a realistic work or environment. In the social network intermediate objects are skipped and an object member can establish the connection to the next member with its maximum degree level. This 4 G communication try to achieve the semantic technology application to the users. It is "Leveraging Semantic Technology . for Infrastructure Mediation", explored how to use machine-to-machine intelligence for large scale distributed computing networks, such as grids and cloud computing

Conclusion

4G communication system is dwell in many application of real time communication system with High speed network capacity, Fast/seamless handover across multiple networks, Wireless access technologies, MIMO and Multimedia support. The high end 4G communication architecture have flexibility to construct the social networking process in an effective manner to integrate the corporate , private and public network. This study provides the possible technology adaptation for the social networking effective process using 4G communication architecture. The study will lead to find the design architecture of secured and effective social networking information architecture using Hardware, Infrastructure, Software, platform, Communication , data storage service with Effective Quality of Services. The researcher aimed to construct the 4G based social network for the academic enhancement for the its stakeholders in India with the knowledge sharing portal using the above specified attributes.

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