IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

4G Wireless Communication as an Emerging Revolutionary Technology

Dr. Mohammad Yousuf Khan[*1], MD Touseef Sumer[2]
[*1] Principal, MANUU, Hyderabad, India
[2] Assistant Professor,MANUU,Hyderabad, India
Yousuf_lect@yahoo.com

Abstract

4G Wireless Communication plays a vital role as it replaces 3G with high capacity, greater speed and at lower cost, 4G provides us 3 times faster speed than 3G technology.4G is the short name of fourth generation of wireless /mobile communication That will enable things like IP –based voice, data, gamming services, video calling & high quality streamed multimedia on portable devices with cable modem like transmission speed. It seems to be a very promising generation of wireless communication that will change the people's life in the wireless world. There are many striking attractive features proposed for 4G which ensures a very high data rate, global roaming etc .The telecommunication process is aggravated various infrastructural developments to reach in this current level such as 4G communication system. This paper provides a technological feature of an existing 4G communication technology and its applications like Wi-MAX, ZIG BEE . The main objective of this paper is to review the various reasons for implementing 4G and it becomes an emerging technology.

Keywords: 4G, WI-MAX, ZIGBEE

Introduction

Wireless communication is currently undergoing a fundamental transformation from the era of personal computers and wired Internet services to a new paradigm based on portable devices connecting wirelessly to the emerging mobile Internet. The mobile Internet represents the second wave of the wireless revolution which started with the remarkable adoption of cellular phones. 4G is a Mobile multimedia, anytime anywhere, Global mobility support, integrated wireless solution, and customized personal service network system. the primary Expectation is that they provide enormously high data rates to an excessive number of users at the same time. fourth-generation (4G) services starting around 2005, enabling a wide range of new anytime/anywhere computing and multimedia applications ranging from navigation and search to mobile video streaming. Mobile data services are currently experiencing rapid growth because of the popularity of Internet applications on mass-market mobile platforms including smart phones, net books, and laptops. The main features of 4G services of interest to users are application adaptability and high dynamism. It means services can be delivered and available to the personal preference of different users and support the users traffic, radio environment ,air interfaces, and quality of service.

Evolution of 4G

The development of 4G Networks and related technologies in today's scenario is imperative indicator of advancement in the field of wireless communication and technology. 4G will utilize most of the existing wireless communication infrastructure. The 4G Mobile communications will be based on the Open Wireless Architecture (OWA) to ensure the single terminal can seamlessly and automatically connect to the local high speed wireless access systems when the users are in the offices, homes, airports or shopping centers where the wireless access networks (i.e. Wireless LAN, Broadband Wireless Access, Wireless Local Loop, Home RF, Wireless ATM, etc) are available. When the users move to the mobile zone (i.e. Highway, Beach, Remote area, etc.), the same terminal can automatically switch to the wireless mobile networks (i.e. GPRS, W-CDMA, cdma2000,TD-SCDMA, etc.). Based on this OWA model, 4G mobile will deliver the best business cases to the wireless and mobile industries, i.e. cdma2000/WLAN/ GPRS 3-in-1 product, WCDMA/OFDM/ WLAN 3-in-1 product, etc. The converged wireless communications can provide the following advantages:
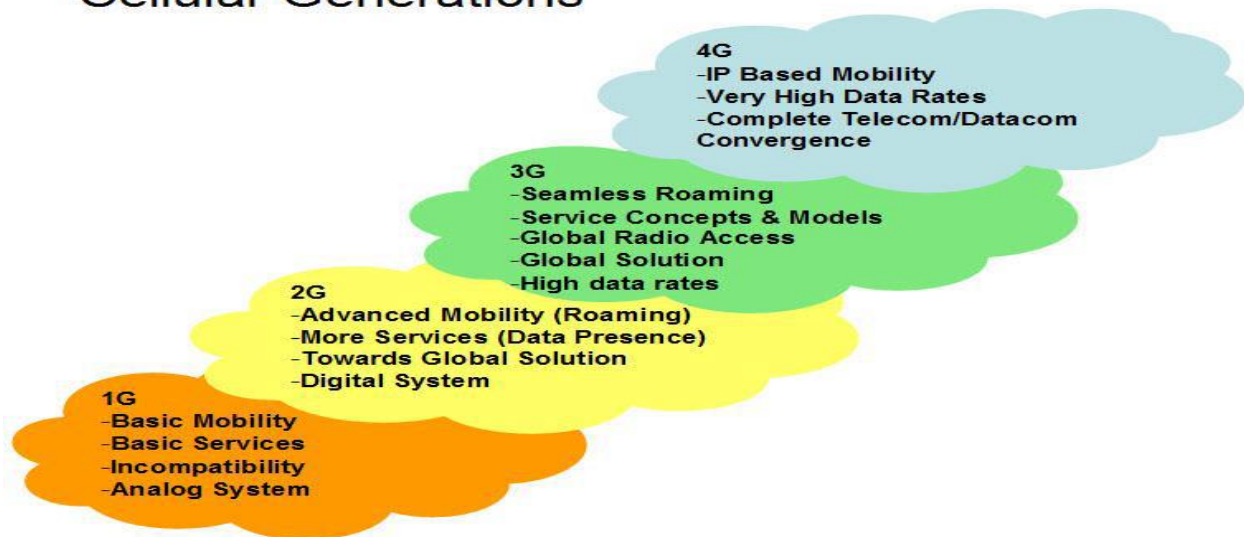1. Greatly increase the spectrum efficiency

2. Mostly ensure the highest data-rate to the wireless terminal

3. Best share the network resources and channel utilization

4. Optimally manage the service quality and multimedia applications with the appropriate combination of resources; it is possible for 4G Networks to create alternatives that exceed consumer and industry expectations. Therefore, 4G developers must consider the appropriate security measures; the promotion of high-speed data transmission across the network, this 4G is intended to replace the current 3G systems within few years. The ambitious goal of 4G is to allow everyone to access the Internet anytime and everywhere. The provided connection to Internet will allow users to access all type of services including text, databases, and multimedia. 4G, unlike 3G, is IP based, that is every user connected to the Internet will have an IP address. This feature makes it easier to integrate the infrastructure of all current networks and consequently it will be easier for users to access services and applications regardless of the environment. 4G will also provide higher bandwidth, data rate, lower authentication overhead, and will ensure that the service is constantly provided to the user without any disruption. Another key feature of 4G networks is high level of user friendly customization. That is, each user can choose the preferred level of quality of service, radio environment; etc. Accessing 4G networks will be possible virtually by using any wireless device such as PDAs, cell phones, and laptops. In various forms and at various levels connection with the network applications can be accomplished efficiently and correctly.

Cellular Generations

4G
- IP Based Mobility
- Very High Data Rates
- Complete Telecom/Datacom Convergence

3G
- Seamless Roaming
- Service Concepts & Models
- Global Radio Access
- Global Solution
- High data rates

2G
- Advanced Mobility (Roaming)
- More Services (Data Presence)
- Towards Global Solution
- Digital System

1G
- Basic Mobility
- Basic Services
- Incompatibility
- Analog System

4G Challenges and Features

The first step in analyzing cellular wireless security is to identify the security objectives. These are the goals that the security policy and corresponding technology should achieve. To ensure that information generated by or relating to a user is adequately protected against misuse or misappropriation. Ensure that the security features are compatible with world-wide availability. Also ensure that the security features are adequately Standardized to ensure world-wide interoperability and roaming between different providers. To ensure that the level of protection afforded to users and providers of services is considered to be better than that provided in contemporary fixed and mobile networks. the implementation of security features and mechanisms can be extended and enhanced as required by new threats and services. In 4G Networks, security measures must be established such that they enable data transmission to be as safe and secure as possible. The nature of the 4 G network, gives an increased likelihood of security attacks due to vast facilities. Hence, multiple levels

of security, including authentication, will be necessary to protect the data that gets transmitted across the network. Wireless systems face a number of security challenges, one of which comes from interference. As more wireless devices begin to use the same section of electromagnetic spectrum, the possibility of interference increases. This can result in a loss of signal for users. Moreover, an abuser can intentionally mount a denial-of-service attack (lowering availability) by jamming the frequencies used. Sos of 4G of the **features of 4G**

High usability and global roaming: The end user terminals should be compatible with any technology, at anytime, anywhere in the world. The basic idea is that the user should be able to take his mobile to any place, for example, from a place that uses CDMA to another place that employs GSM. *Multimedia support:* The user should be able to receive high data rate multimedia services. This demands higher bandwidth and higher data rate. *Personalization:* This means that any type of person should be able to access the service. The service providers should be able to provide customized services to different type of users.

4G Issues and Advantages:
- Access
- Handoff
- Location co-ordination
- Resource co-ordination to add new user
- Support for quality of Service.
- Wireless Securities & Authentication.
- Network failure & backup.
- Pricing and billing.

Advantages
- Support for interactive multimedia voice, streaming video, internet & other broadband services.
- IP based mobile system.
- High speed, high capacity & low cost per bit.
- Global access, service portability & scalable mobile services.
- Better scheduling and call admission control technique.
- Ad-hoc & multi-hop network.
- Better spectral efficiency.
- Seamless network of multiple protocols & air interfaces.
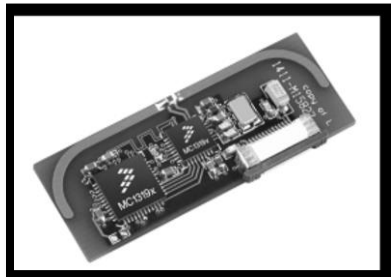
WiMAX Technology

Wi-MAX (World interoperability for Microwave Access) is a wireless technology mainly designed for bridging the last mile to the end user and providing him with a broadband connection. WiMAX is based on standards developed by IEEE and ETSI, notably the IEEE 802.16 range of standards and the HIPERMAN standards. WiMax can be used in different frequency bands in the range 2-66 GHz. It is claimed to be useful for urban, suburban and rural areas, sometimes with a non line of sight condition between base station antenna and subscriber station antenna. The 802.16 standard, the "Air Interface for Fixed Broadband Wireless Access Systems," is also known as the IEEE Wireless MAN air interface. This technology is designed from the ground up to provide wireless last-mile broadband access in the Metropolitan Area Network (MAN), delivering performance comparable to traditional cable, DSL, or T1 offerings. The principal advantages of systems based on 802.16 are multi-fold: the ability to quickly provision service, even in areas that are hard for wired infrastructure to reach; the avoidance of steep installation costs; and the ability to overcome the physical limitations of traditional wired infrastructure. Providing a wired broadband connection to a currently underserved area through cable or DSL can be a time-consuming, expensive process, with the result that a surprisingly large number of areas in the US and throughout the world do not have access to broadband connectivity. 802.16 wireless technologies provides a flexible, cost-effective, standards based means of filling existing gaps in broadband coverage, and creating new forms of broadband services not envisioned in a "wired" world. WiMax will be used in urban, suburban and rural areas, particularly where other broadband means are not available or installations are expensive. Competition to DSL will not be fierce in areas where it is already established due to its relatively low costs and high penetration. Furthermore, a high density of WiMax base stations will be needed in urban and suburban areas to serve customers with self-installable CPE and reasonable data rates. In fact, the cell sizes under these conditions are only a few hundred meters. WiMax is likely to play an important role in serving rural areas. There, cell sizes of 5-10 km are possible requiring outdoor antennas at the customer premises. The speed can be increased by strengthening the signals. For a fixed transmitting power and antenna gain, this means lower range. Thus, ranges are lower if more speed is desired, e.g., for 26 Mb/s the 1-2 km range for terrain type B would drop down to 700 mbps.
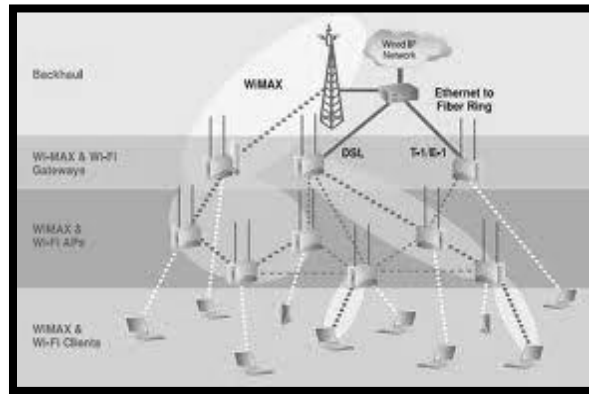
ZIGBEE Wireless Technology

ZigBee wireless mesh technology has been developed to address sensor and control applications with its promise of robust and reliable, self configuring and self-healing networks that provide a simple ,cost-effective and battery-efficient approach to adding wireless to any application, mobile, fixed or portable. A typical IEEE 802.15.4-based, ZigBee-

compliant device is shown in Figure 4.The IEEE standard at the PHY is the significant factor in determining the RF architecture and topology of ZigBee enabled transceivers. The IEEE standard brings with it the ability to uniquely identify. Every radio in a network as well as the method and format of communications between these radios, but does not specify beyond a peer-to-peer communications link a network topology, robust schemes or network growth and repair mechanisms.

IEEE 802.15.4 PHY/MAC and Zig Bee's layers

The IEEE 802.15.4 PHY layer includes features such as receiver energy detection (ED), link quality indication (LQI) and clear channel assessment(CCA).The network addressing follows 64-bit IEEE and 16-bit short addressing, supporting over65,000 nodes per network. The IEEE 802.15.4 MAC sub layer controls the access to the radio channel using unslotted CSMA-CA (Carrier Sense Multiple Access **ZigBee Applications:** ZigBee networks handle multiple traffic types with their own

unique characteristics, including periodic data, intermittent data, and repetitive low latency data. The characteristics of each are as follows: 1) **Periodic data** – application defined rate (e.g. wireless sensor or meter). Data is typically handled using a beaconing system whereby the sensor wakes up at a set time and checks for the beacon from the PAN coordinator, it then requests to join the network. If the coordinator accepts it, data is passed by the sensor before it goes to sleep again. This capability provides for very low duty cycles. (2) **Intermittent data** – either application or external stimulus defined rate (e.g. Wireless light switch). Data can be handled in a beaconless system or disconnected. In disconnected operation, the device will only attach to the network when communications is required thus saving Considerable energy. (3) **Repetitive low latency data** – Allocations of time slots. (e .g. medical alerts and security systems). These applications may use the guaranteed time slot (GTS) capability when timeliness and critical data passage is required. GTS is a method of QoS that allows each device a specific duration of time as defined by the PAN coordinator in the Super frame to do whatever it requires without contention or latency.

Conclusions

This paper has described the fundamentals of 4G Wireless communication, Wi MAX and ZigBee networking. Persistent technological evolution in wireless communications is needed mainly due to emerging demands for broadband packet-based services. In this paper, we briefly discussed the current advancements in 4G wireless communication. The use of4G technology Users access the information from the departments, hostels and computer centers and also from the libraries. We are witnessing today the emergence of global network infrastructure, Furthermore, a high density

of Wi MAX base stations will be needed in urban and suburban areas to serve customers with self-installable CPE and reasonable data rates. Currently the interoperability between ZigBee implementations is an issue. There are no standards governing mesh networks. Bridges must be constructed between the different mesh networks4G issues advantages also discuss in a brief.

.

References

[1] Bill Krenik "4G Wireless Technologies: When will it happen? What does it offer?" IEEE Asian Solid- State Circuits Conference November 3-5, 2008

[2] Ahmet AKAN, C¸ agatay EDEMEN "Path to 4G Wireless Networks" 2010 IEEE 21st International Symposium on Personal.

[3] Augustine C. Odinma, Lawrence I. Oborkhale and Muhammadou M.O. Kah, "The Trends in Broadband Wireless Networks Technologies ",The Pacific Journal of Science and Technology, Volume 8. Number 1. May 2007

[4] Odinma, A.C. 2006. "Next Generation Networks: Whence, Where and Thence". Pacific Journal of Science and Technology.7(1):10-16.

[5] J. Chen, M. Jiang, and Y. Liu, "Wireless LAN security and IEEE802.11i,"IEEE Wireless Communications, vol. 12, pp. 27–36, 2005.

[6] Y. C. Hu, A. Per rig, and D. B. Johnson, "A secure on-demand routing protocol for ad hoc networks," In Proc. of MobiCom, 2002

[7] Ghosh, Arunabha; Wolter, David R; Andrews, Jeffrey G. & Chen, Runhua. Broadband wireless access with WiMax/802.16: Current performance benchmarks and future potential. IEEE Commun. Mag., 2005, 43(2), 129-36

[8] Various authors, Zig Bee Specification, Zig Bee Alliance, 14 December 2004.

[9] McInnis, M. editor-in-chief, 802.15.4 – IEEE Standard for Information Technology, Institute of Electrical and Electronic Engineers, New York, 1 October 2003.

[10] Current advancements in wireless communication technology –ICETEM-2013 proceedings pg no 85 to 90