

A Study of “4G Wireless System”

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ABSTRACT

The modern communication system is aims to reach the real world environment from virtual world via connecting resources of one with another through social network system. The Fourth generation wireless system is a packet switched wireless system with wide area coverage and high throughput. It is designed to be cost effective and provide high spectral efficiency. Worldwide many mobile operators, industry experts, and researchers have diverse visions of potential 4th generation (4G) features and its implementations. 4G networks will be incorporating advanced Internet Protocol version 6 (IPv6) protocol and the signalling will be done through Internet Protocol (IP). There are several key challenges in implementing 4G heterogeneous network.

The study of this report is to create High network capacity, Global access, service portability, and scalable mobile services and awareness among people about 4G technologies.

Keywords: OFDM: Orthogonal Frequency Division Multiplexing, UWB: Ultra Wide Radio Band, IP: Internet Protocol

Introduction

The Fourth generation wireless system is a packet switched wireless system with wide area coverage and high throughput. It is designed to be cost effective and provide high spectral efficiency. The 4G wireless uses Orthogonal Frequency Division Multiplexing (OFDM), Ultra Wide Radio Band (UWB), and Millimetre wireless. Data rate of 20mbps is employed. Mobile speed will be up to 200km/hr. The high performance is achieved by the use of long term channel prediction, in both time and frequency, scheduling among users and smart antennas combined with adaptive modulation and powercontrol. Frequency band is 2-8 GHz. It gives the ability for worldwide roaming to access cell anywhere. It is a successor to the 3G and 2G families of standards.

Accessing information anywhere, anytime, with a seamless connection to a wide range of information and services, and receiving a large volume of information, data, pictures, video, and so on, are the keys of the 4G infrastructures. The future 4G infrastructures will consist of a set of various networks using IP (Internet protocol) as a common protocol so that users are in control because they will be able to choose every application and environment. Based on the developing trends of mobile communication, 4G will have broader bandwidth, higher data rate, and smoother and quicker handoff and will focus on ensuring seamless service across a multitude of wireless systems and networks.

The 4G systems will interoperate with 2G and 3G systems, as well as with digital (broadband) broadcasting systems. Application adaptability and being highly dynamic are the main features of 4G services of interest to users. These features mean services can be delivered and be available to the personal preference of different users and support the users traffic, air interfaces, radio environment, and quality of service.

Objectives

- To provide High network capacity: more simultaneous users per cell
- To provide Global access, service portability, and scalable mobile services.
- To create awareness among people about 4G technologies.

Methodology of the study

• Area of Study

Survey of websites and physical office of Airtel.

• Tools And Techniques For The Data Collection

Questionnaire/Interview

Document Analysis

• Method(s) of Data Analysis

The contents of the research and findings were modified in the form of a research paper.

Hypothesis of the study

- Implementation Using 4G
- Challenges to 4G in India

- Applications Benefitted Most from 4G LTE Features
- Implementation Using 4G
- Transmission
- Wireless Technologies Used In 4G

IMPLEMENTATION USING 4G

The goal of 4G is to replace the current core mobile networks with a single worldwide core network standard, based on IP for control, video, packet data, and voice. This will provide uniform video, voice, and data services to the mobile host, based entirely on IP. [2]

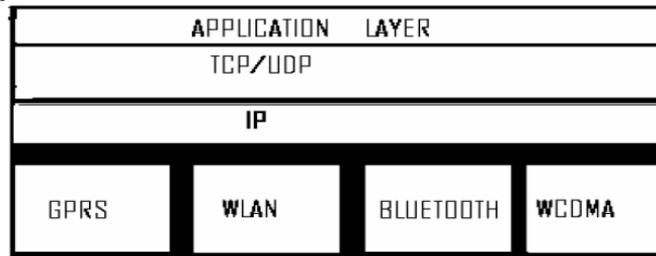


Figure 1 Application Layer [10]

Today, wireless communications are heavily biased toward voice, even though studies indicate that growth in Wireless data traffic is rising exponentially relative to demand for voice traffic. Because all IP core layer is easily scalable, it is ideally suited to meet this challenge. The goal is a merged Data/voice/multimedia network.

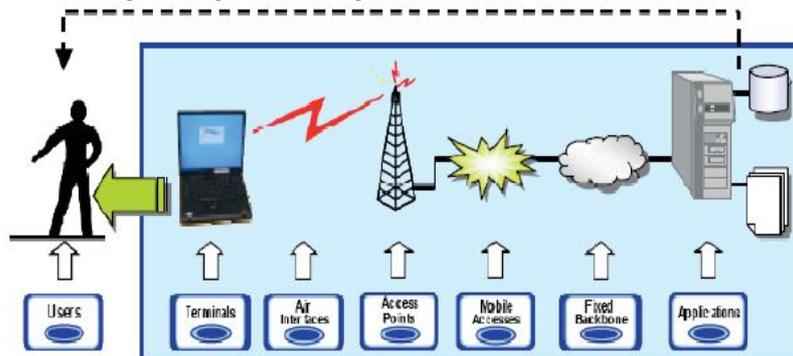


Figure 2 4G Mobile Communication Visions [10]

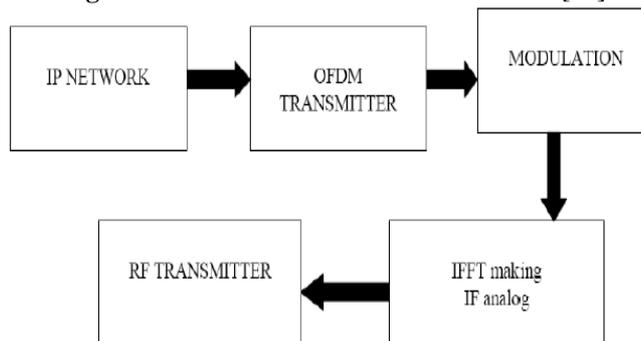


Figure 3 Transmission Media [2]

An OFDM transmitter accepts data from an IP network, converting and encoding the data prior to modulation. An IFFT (inverse fast Fourier transform) transforms the OFDM signal into an IF analog signal, which is sent to the RF transceiver. The receiver circuit reconstructs the data by reversing this process. With orthogonal sub-carriers, the receiver can separate and process - IP NETWORK, OFDM, TRANSMITTER, MODULATION, IFFT making, IF Analog, RF TRANSMITTER, OFDM provides better link and communication quality. [2]

WIRELESS TECHNOLOGIES USED IN 4G

1. ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING (OFDM)
2. ULTRA WIDE RADIO BAND (UWB)
3. MILLIMETER WIRELESS

4. SMART ANTENNAS
5. LONG TERM POWER PREDICTION
6. SHEDULING AMONG USERS
7. ADAPTIVE MODULATION AND POWER CONTROL

WHAT IS LTE ?

LTE, an abbreviation for **Long-Term Evolution**, commonly marketed as **4G LTE**, is a standard for wireless communication of high-speed data for mobile phones and data terminals. It is based on the GSM/EDGE and UMTS/HSPA network technologies, increasing the capacity and speed using a different radio interface together with core network improvements.

The goal of LTE was to increase the capacity and speed of wireless data networks using new DSP (digital signal processing) techniques and modulations that were developed around the turn of the millennium. A further goal was the redesign and simplification of the network architecture to an IP-based system with significantly reduced transfer latency compared to the 3G architecture. The LTE wireless interface is incompatible with 2G and 3G networks, so that it must be operated on a separate radio spectrum.

a) Implementation of 4G in India:

BhartiAirtel, India's top telecom provider has rolled out India's first 4G LTE service in Kolkata. 4G is the latest **4th Generation in Mobile Network Technology** providing speeds up to **100mbps** while **downloading**, and **40mbps** while **uploading**. That's right, it provides multiple times higher speed than current 3G network.[5]

Some features of Airtel 4G LTE:

- **Blazing fast wireless internet** – High-speed mobile internet access with speeds up to 100mbps while downloading, and 40mbps while uploading.
- **Mobile with a broadband experience** – Use LTE devices to access high-speed internet anywhere, at any time.
- Download and watch HD movies, photos , documents faster
- Play multiplayer online games with low latency
- Load web sites quickly
- Enjoy high-quality video services and calling with online video applications
- Access business applications that require higher speeds and last mile connectivity.



Figure 4 Airtel Tariff

Cost Affordability and Managing User Accounts:

With 4G networks, maintaining user accounts has become complicated. Due to heterogeneity of 4G networks and the frequent interaction of service providers, the billing system is not able to be figured out and managed. In terms of 4G Network cost and affordability, there are a number of issues to consider that reflect some degree of risk, as well as opportunity, so that these networks are successful once rolled out to the general public, and in general, 4G Networks are designed in order to create an environment that supports high-speed data transmission and increased profit margins for organizations that utilize these capabilities. Developing a successful 4G Network platform is a positive step towards the creation of a wireless and broadband environment that possesses rapid transmission speeds, data integrity modules, and other related events that encourage users to take additional risks in promoting successful utilization of these 4G tools. [5]

Quality of Service (QoS) Provision in 4G Wireless Networks: [4]

There is plenty of related research on providing QoS in 4G networks because cellular networks are shifting from voice centric to flexible data centric networks. This paper provides a review of some of the popular solutions for providing QoS in 4G networks. Although several proposals exist, implementing QoS in real world 4G networks is challenging due to heterogeneity of networks, fast handoff, varying bit rates, propagation conditions and variety of applications. Voice traffic is growing linearly whereas data traffic is growing exponentially. QoS and signalling protocols are able to handle voice over IP in 4G networks. To support big data over 4G networks, IP needs traffic engineering. The QoS plane should receive hand over notifications. Proposed architectures would be practical if mobility model and traffic model are taken into consideration. Various QoS mechanisms available for particular applications may be investigated further.

MAJOR FINDINGS OF THE STUDY

4G coverage to surpass a third of global population this year [8]

4G networks will cover over a third of the world's population by the end of this year. 4G availability will rise from 27% of the global population last year to 35% by December 2015. Since the first commercial LTE networks were launched in 2009, the number of operators offering 4G services has risen to more than 350 and the number of unique connections has also more than doubled from around 200 million in 2013 to 490 million in December 2014. As of December, 7% of all mobile connections in the world were 4G, and the number will increase to a worldwide total of 875 million by the end of 2015, representing 12% of all mobile connections. 47% of world's 4G connections are in the Asia-Pacific region and predominantly in South Korea, Japan and China. North America has 44% of all 4G connections. [6]

Table 1: 4G Coverage in the world [6]

	# 4G Operators (Jan 2015)	# 4G Connections (millions)	% Total connections	% Global 4G Connections
Asia Pacific	62	232	6%	47%
North America	47	157	44%	32%
Europe	108	69	10%	14%
Latin America	55	12	2%	2%
CIS	22	11	3%	2%
Middle East/North Africa	26	6	1%	1%
Sub-Saharan Africa	32	3	0.4%	1%
TOTAL	352	490	7%	100%

China set to become world's largest 4G market:

Europe is currently home to the most individual 4G operators (108). However, almost half (47 per cent) of the world's 4G connections are based in Asia Pacific, concentrated in markets such as South Korea, Japan and, increasingly, China. South Korea can be considered the most advanced mobile market in the world, with two-thirds of the country's mobile connections running on 4G. On a regional (rather than country) basis, North America has the largest proportion of connections on 4G (44 per cent of the total).

Despite only launching its first commercial 4G network in late 2013, China is on track to reach 300 million 4G connections by the end of this year, overtaking the US to become the world's largest 4G market. At the end of 2014, China Mobile had 90 million 4G connections, establishing it as the world's largest 4G operator.

Difficulties In Implementing 4G in India:

Device support is lacking. 4G remains a data only service in India; VoIP is yet to arrive. [1]

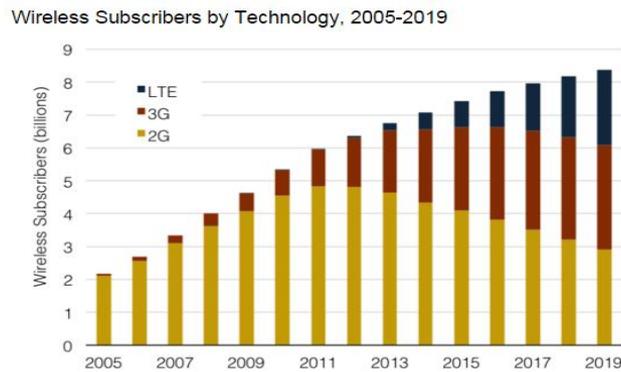


Figure 2 Estimation of Global Wireless Subscriber Growth

Use case characterization

Five main characteristics are important when considering the applicability of 4G LTE to a given use case: [3]

- ‘Application breadth’ – how many business applications need to be made available?
- ‘Degree of mobility’ – is use limited to one location, is it nomadic (the user moves between locations, but is generally stationary while using the application) or is it fully mobile?
- ‘Richness/data intensity’ – what kind and size of data, files, or media are needed for the application?
- ‘Responsiveness’ – does the application need immediate delivery of data, regardless of the amount of data? For example, real-time voice and video communication and some transaction processes require low network latency.
- ‘Application criticality’ – what impact will a failure of the application or its communications platform have?

ADVANTAGES OF 4G WIRELESS SYSTEM

1. It support for interactive multimedia, voice, streaming video, Internet, and other Broad band services
2. 4G provides IP based mobile system
3. High speed, high capacity, and low cost-per-bit
4. Global access, service portability, and scalable mobile services
5. Better scheduling and call-admission-control techniques
6. Better spectral efficiency
7. An infrastructure to handle pre-existing 3G systems along with other wireless Technologies some of which are currently under development.

SECURITY:

Security is a major issue in today’s convergence communication world what securities does 4G provide to us they are as follows: [6]

- a) The heterogeneity of wireless networks complicates the security issue.
- b) Dynamic reconfigurable, adaptive, and lightweight security mechanisms should be developed.
- c) Security in wireless networks mainly involves authentication, confidentiality integrity and authorization for the access of network connectivity and QOS (Quality of Service) resources for the mobile nodes flow.
- d) AAA (Authentication Authorization Auditing) protocols provide a framework for such suffered especially for control plane functions and installing security policies in the mobile node such as encryption, decryption and filtering.

CONCLUSION:

According to the study the conclusion which has been derived are as follows:

- 4G is provided with a very efficient and reliable wireless communication system for seamless roaming over various network including internet which uses IP network.
- It will be implemented in the coming years which will be a miracle in the field of communication engineering technology.
- It will dominate the wireless communications, and its converged system will replace most conventional wireless infrastructure.

References:

- [1] Indian aspect on 4G: Difficulties in implementing 4G network in India by Sunil Ph.D. Research Scholar, Department of Electronics and Comm. Engg., Singhania University, Rajasthan. Volume: 1 | Issue: 6 | Nov 2012 • ISSN No 2277 - 8179 Research accessed on 25.09.2015.
- [2] 4G Wireless System Vishveshwaraiyah Technology University, SDMCET, CSE Dept. accessed on 11.08.2015

- [3] THE BUSINESS BENEFITS OF 4G LTE accessed on 10.10.2015
- [4] 'A Survey on Quality of Service Provisions in 4G Wireless Networks'. International Journal of Advanced Research in Computer and Communication Engineering. Vol 3, Issue 7, July 2014.
- [5] www.adl.com/4G_LTE_Benefits accessed on 01.10.2015
- [6] www.gsma.com accessed on 17.08.2015
- [7] opensignal.com accessed on 10.10.2015
- [8] opensignal.com accessed on 10.10.2017
- [9] <http://www.airtel.in/4g/index#!attractive-plans>
- [10] <https://www.scribd.com/document/357204920/4g-Wireless-Sys> accessed on 1.11.2017



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