



AN ONLINE COMPARATIVE STUDY ON 4G TECHNOLOGIES SERVICE PROVIDERS IN INDIA

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Cite This Article: K. Krishna Prasad & P. S. Aithal, "An Online Comparative Study on 4G Technologies Service Providers in India", International Journal of Advanced Trends in Engineering and Technology, Page Number 96-101, Volume 1, Issue 1, 2016

Abstract:

The rapid development of wireless and communication technology is valid proof for the existence of 4G technology, which is proliferated through its lower generations as 3G, 2G and 1G. The evolution goal of 4G technology lies in high speed multimedia, internet services including on-demand video service, faster web browsing and downloading, which is customized, ubiquitous and flexible services. 5G technology is new generation wireless communication technology with greater services in all aspects and already evolved in some developed countries like U.S.A. In India even though many service providers launched 4G services, that are having some drawbacks like coverage or range only in a few major cities, high cost and problems in speed compared to services provided in western countries. This paper discusses the different service provider's services in terms of some characteristics like frequency spectrum, speed and network coverage etc. This paper analyses 4G services using ABCD analysis techniques based on different applications. Based on the analysis, this paper makes some recommendations to improve the 4G services in India. The widespread growth of 4G technology in India having application in diverse fields like entertainment, education, military and defence and health care. This paper could play active, supportive and a referential role in actual comparisons and research of 4G services in India.

Index Terms: 4G, 5G, LTE, ABCD Analysis & WiMax

1. Introduction:

Mobile Internet commerce has seen drastic changes over the past few years due to three rapidly growing sectors, mobile, internet and wireless communication technologies. The information and communication Technology (ICT) all over the world has knotted to bring what is available to networked computers to mobile devices using advanced wireless communication technologies like 4G technology [1]. The smart phone now available in the market having the ability to do all the functions that people can do olden days using their personal computers. The introduction of mobile communication technology modernization, innovation and globalization are increasingly driving the banking services to become ubiquitous, personalized, convenience, disseminative and secured. 4G is a fourth generation wireless mobile communication technology succeeding 3G and it should follow the standard specifications specified by International Telecommunication Unit (ITU) in International Mobile Telecommunications-Advanced (IMT-Advanced Standards) with two standards as Mobile WiMax and Long-Term Evolution (LTE) released first in the year of 2007 and 2009 respectively [2-3]. 4G wireless networks challenges in different issues as global roaming across multiple wireless and mobile networks, accessibility, handoff, coordination of location, resource coordination to add new users, support for multicasting, support for quality of service, wireless security and authentication, network failure and backup [4]. 4G is a convergence platform where wide-area (cellular) technology, Wireless metropolitan area network (WMAN) and Wireless local area network (WLAN) coexists together to form an ultra high network which fulfils user variety of services [5]. In India majority of mobile users upgraded their mobile network from 2G to 3G, due to two characteristics speed and no difference in terms of cost. The up gradations from 2G to 3G network can take place without more infrastructure or change in the architecture of the network system. Arshad, M. J. et.al., (2010) presented the detail comparison of the different generations of the mobile communication technologies starting from 1G, 2G, 3G and 4G in a tabular form by considering different factors as speed bandwidth, access technologies, frequency band and network architecture etc, to have an improved knowledge and understanding in the advancement of mobile communication systems [6]

In this paper the status of 4G services in India by different operators are compared and analyzed using different characteristics like bandwidth, speed and network coverage. In India 4G mobile wireless communication technology launched soon after the end of 4G spectrum auction on 19 May 2010. On April 2012 first time in India 4G service is launched by Airtel through dongles and modems using TD-LTE technology [7]. This paper also tries to give some recommendation for improvement of 4G services in India based on the analysis made in this study.

2. Present Status and Changing Perspective of 4G Technology in India:

With the invention of 4G technology, terminals or input device used for user interfaces also changed from keyboard, display and tablet to new interfaces based on speech, vision, biometrics, touch and soft buttons.

4G technology is based on all IP-based and uses only packet switching network unlike 3G technology, which uses both circuit and packet switching network. 4G wireless systems deliver efficient multimedia services in two types as bursting and streaming video. When user requires real time video, video is played in user's display system without any buffering and delay is called streaming. One of the drawbacks of streaming video is, it does not take the full advantage of high bandwidth and played at a playback rate. Streaming has little memory requirement compared bursting video. While user downloading a file using buffer bursting concept is used at the highest data rate, which utilises full available bandwidth capacity. Virtual presence and virtual navigation are the two greatest applications of 4G technology, which are facilities available to user at all time, even when user is at off-site and can navigate and access database of the LAN, WAN and MAN networks with high speed data transmission rate. 4G has applications in different areas like telemedicine, tele-geoprocessing, crisis management and education. Through Telemedicine user gets videoconferencing assistants and consultation of doctor without actually visiting to hospital or clinic. By combining the features of Global Positioning System (GPS) and Geographical Information System (GIS) user can get the particular location by querying through tele-geoprocessing. In all over the world if any natural disaster or calamities occurs, it takes days or weeks to restore the broken down communication system. With the help of 4G technology, it is possible to restore communication system very quickly. 4G technology supports for online education through its ubiquitous or omnipresence nature. 4G LTE (Long Term Evolution) is fastest mobile wireless technology with download speed up to 100 Mbps. The speed of 4G networks depends on some factors like the devices user going to use the connection, and distance and obstructions or noise between the tower and the receiver. 4G LTE is joint venture by GSM and CDMA vendors to overcome problem of local or multiple standards and to develop single global common standard for mobile communications by utilizing orthogonal frequency division multiplexing (OFDM) scheme in order tackle issues related to multi in multi out propagation.

Early and in the mid of 2012, Bharathi Airtel was only one service provider, offered 4G services in India, limited to only Kolkata and Bengaluru circle. By the end of 2016, almost all the cities of India will be having coverage of 4G LTE services. At present Indian telecom operators are gearing up to provide better, effective and efficient 4G LTE services around the country. In the race of 4G telecom service providers list Vodafone India and Idea Cellular enrolled them and started providing 4G LTE services in the end of 2015.

3. Challenges of 4G Technology:

The challenges of 4G wireless mobile communication technology are discussed by considering different factors which includes security, backhaul, multiple frequencies, personalization and customization, energy saving, availability and advanced access technology, cost and affordability, global roaming, high performance streaming video.

Security: 4G Provides worldwide interoperability and global roaming between different operators leads to different security challenges. The nature and vast facilities of 4G network leads to an increased chance of security attacks. There is need for enhanced and sophisticated security features and mechanism for advanced video streaming and online financial transactions applications.

Backhaul: High bandwidth hungry applications requires maximum amount of data transfer between server and user applications. In order to meet the user's needs ubiquitously, there is a need for update or improvement in existing backhaul or bandwidth capacity by the service providers.

Multiple Frequencies: All over the world, 4G LTE network utilizes multiple frequency spectrums. This will arise some problems while switching between different operators in global roaming. As and when mobile wireless communication technology upgrades operators need to add more radio/spectrum other than existing spectrum band in their old or existing spectrum band, which will incur more and cost and complexity.

Personalisation and Customisation: 4G supports services based on user's requirements or user centric approach. There is a higher need and requirement to users taste and preferences, while considering variety of customer pool with varied interest and liking all over the world. 4G technology should meet high level of user expectations in fulfilling user's needs.

Energy Saving: A mobile network is formed by three main elements as core network, base stations and mobile terminals. Nearly three fourth of the energy is consumed by base stations compare to energy consumption of whole network. So there is a need for reduction of energy consumptions in base stations and there by reduce the overall energy consumption of wireless mobile network.

Availability: The existing wireless mobile communication technology having speed of more than 800MHz frequencies can penetrate to any extent with walls and any other solid objects to ensure wider coverage, still faces problems to reach some rural areas or while moving with very high speed in car or flights.

Advanced Access Technologies: The ever demanding services should be accessible by the user all over the world, anywhere, anytime without restriction in terms of location or place and time or while on move or stationary requires implementation of some sophisticated and advanced access technologies.

Cost and Affordability: The mobile service providers should focus more on introducing new tariff plans to attract more customers. Cost and affordability is one of the challenge or hindrance for the usage of new mobile wireless access technologies, especially in some developing and un-developed countries.

Global Roaming: User should be able to use mobile all over the world, when he is roaming in different countries without any barrier to locations. Even though it is supported in 4G, it is facing some challenges or not effectively implemented all over the world.

High Performance Streaming Video: Video content sent through wireless mobile communication technology displayed by the user real time without taking any extra time is not implemented effectively. So there is a need for enhancement or change in this aspect.

Integrating IP Devices: With the intention to provide better facility and better services with high data transfer rate and high bandwidth 4G technologies should integrate non-IP devices and IP devices. If this feature is effectively implemented, it is possible to integrate infrastructure of all current networks and user can benefit to access services and applications regardless of environment or device independent.

4. Prominent 4G Service Providers in India:

In this study we compare some prominent service providers in India, which includes Airtel, Vodafone Essar, Idea Cellular, Reliance Jio Infocomm Limited, and Aircel. Airtel initially launched 4G services in India in Kolkata through dongle and Modems using TD-LTE technology. Even though, Airtel introduced 4G service in 2012, it introduced 4G services in mobile on 2014 [7]. On 8th of December 2015 Vodafone Essar launched 4G services at Kochi of Kerala state on 1800MHz band [8]. Idea Cellular initially started its 4G services in India on March 2016 across 10 telecom service areas [9]. Reliance Jio Infocomm Limited first launched Beta 4G LTE services to Jio Partners and its employees on 27th of December 2015 and commercially launched its services on 5th September of 2016 [10]. Aircel introduced 4G services in India across two states, Tamil Nadu and Jammu and Kashmir on August 2014 [11]. Many other service providers like Tata Docomo, BSNL, S-Tel soon planning to launch 4G services in India, but till today not launched in full fledged.

5. Tabular Comparisons of 4G Services Of Different Service Providers:

In Table-1, the prominent service provider that we have considered in our study is compared using different features like Speed, Frequency Band and Internet speed [7-11].

Table 1: Tabular comparisons of 4G services of different service providers

Service provider	Launched Year Month and Year	Frequency Band	Internet Speed
Airtel	April 2012	1800MHz	25 Mbps
Vodafone	December 2015	1800MHz	6.4 Mbps
Idea	March 2016	1800MHz	12.6 Mbps
Reliance Jio	September 2016	2300 MHz 1800 MHz	5 Mbps
Aircel	August 2014	2300 to 2400 MHz 1800 MHz	4 Mbps

The above table lists only approximate lowest internet downloading speed of different service providers. The speed varies from cities to cities depending on network coverage. High speed internet, streaming video, multimedia applications and voice calling are few common 4G services provided by almost all operators.

6. ABCD Analysis of 4G Services Based on Different Applications:

ABCD analysis is a new model to analyse new concepts using its advantages, benefits, constraints and disadvantages [13-14]. This analysis helps organisation to improve its services or revenue or profit depending on different scenario or with respect to different types of problems. In this analysis we consider different applications of 4G services in diverse fields like Entertainment, Multimedia, Education, cloud based applications, emergency response and telemedicine. In Entertainment 4G services are effectively used for different purposes. Most of the video games require live internet connection with Wi-Fi connectivity mode. 4G portable connection can be used effectively used for this purpose with five to eight different devices. 4G wireless mobile communication technologies provide many features, which can be effectively used to solve some of the challenges in video communications [15]. Using WiMax and LTE, 4G provides streaming video and high speed internet to handle broadcast quality video. With 4G, different applications can use data, software or hardware stored online or owned by others in cloud computing. These services are more reliable, cheaper and effective for the mobile users. Online education portal can be accessed ubiquitously using 4G services [16-17]. In medical applications 4G can be used to make prediction and analyses of different symptoms related to different medical problems or in assisting doctors in remote operations or in teleconferencing.

Advantages:

- ✓ Increased graphical support and visual affects for video games
- ✓ Effective clear streaming videos
- ✓ Fast and live news of different areas, anywhere, anytime and anyplace without any time limit
- ✓ Using smart and intelligent networks in 4G user can control some electronic device remotely.
- ✓ Online Graphical attractive videos can be played without any time delay with high speed.
- ✓ Private and public organisation can grow using 4G technology by reducing cost travelling cost, employee tracking cost.

- ✓ Though effective video conferencing a customer can able to communicate with another person situated in any other part of the world.
- ✓ A distance education student can avail educational material and content at any time whenever he/she is free.
- ✓ A user can get services based on interest, likings, preferences and tastes through 4G personalized and customised services.
- ✓ Learners can able to change the curriculum or content in online education by utilising 4G network.
- ✓ The software, hardware or any other resources can be shared or rented in 4G wireless mobile communication by utilising mobile cloud services.
- ✓ Learners have control over learning time and content creation.
- ✓ Quality of services can be improved highly using advanced access technologies, global roaming, high bandwidth and high data transfer rate.
- ✓ Patients can get medical services or consultancies or appointments from their home easily.
- ✓ Telemedicine is helpful for junior doctors to avail assistance or help from aged experienced and talented old expert's remote doctors while assisting, while operating patients.
- ✓ Through telemedicine and 4G technology hospital services can reach to remote areas, when ever there is a necessity.

Benefits:

- ✓ A company can improve its revenue and profits through high speed internet connection available with the help of 4G technology.
- ✓ Online education system can be effectively improved, because 4G technology is carrier of different services from one part of the world to another part of the world.
- ✓ Through 4G technology users can avail some services in their personal mobile device.
- ✓ Global or national wide expansion of services, goods and products using fast, high bandwidth and speed 4G technology.
- ✓ 4G inherits the growing popularity and standard of smart mobile phones.
- ✓ Mobile wireless communication service providers can promote their services along 4G network through scrolling or flash videos
- ✓ Online Education system can grow and improve through omnipresent and speed educational content video with the help of 4G technology
- ✓ The ability to get large customer base or no of customers increases due to ubiquitous nature of 4G technology
- ✓ Online, attractive graphical video game attracts youth customers.
- ✓ Cloud computing can work hand to hand and efficiently implement data, software and hardware public services to needy people without any high infrastructure cost or headaches.
- ✓ Multimedia and film industries can grow effectively by adopting 4G network in their profession.
- ✓ Robotic operation can be affectively implemented by getting assistance from expert doctors living in other parts of the world.
- ✓ Medical services can reach to remote places of India with the help of high speed 4G network.
- ✓ The problem of mobile portability and global roaming can be solved effectively by utilising 4G technology.
- ✓ 4G inbuilt security and authentication facility provides advanced billing services, which will reduce all the burden or hurdles of manual billing system

Constraints:

- ✓ Lack of research in implementing all features of 4G technology standard specified by ITU.
- ✓ The different frequency spectrum usage in different geographical locations leads to difficulties in implementing and managing 4G services for service providers.
- ✓ Especially in India, While moving from 3G technology to 4G technology customers have to buy new mobile handset becomes costly and reduces no of customers shifting to 4G technology.
- ✓ In India, Lack of new technology to maintain same speed and same bandwidth, when number of customers grows exponentially.
- ✓ In India, Government rules and regulation on spectrum band purchase and usage affects 4G service implementation and maintenance.
- ✓ Lack of face to face interaction and eye contact between teacher and student in online or e-learning system reduces adopting or using this new education mode in India.
- ✓ In India, some rural and undeveloped, uneducated persons region's people finds difficulty in using new technology.
- ✓ Lack of trained staff in mobile service providers server side in order to manage 4G services.
- ✓ In India even though lot of mobile service providers provides 2G or 3G services, many of them still not launched 4G services, becomes one of the constraint for the popularity or expansion of 4G technology.

Disadvantages:

- ✓ New frequency for providing 4G services becomes added component in service provider's tower.
- ✓ Online attractive and real-time imitative games, even though attracts youth population, the human interaction is reduced while on move in Road and airspace transportation system.
- ✓ In India, the high cost of frequency spectrum band becomes one of the hurdles for service providers in launching new generation technology.
- ✓ Student's interest and concentration in academic related activities reduces due to availability of attractive games and streaming videos of movies.
- ✓ In India, video and voice calling services are finding problems in lower or weak network coverage areas.
- ✓ Limited social interaction is one of the problem or hindrance for the development or popularity of online education.
- ✓ In India, government has not initiated providing 4G services through their public or owned company like BSNL.
- ✓ Portability and file clearing services in 4G technology becomes costly, especially in Indian scenario for ordinary customers.
- ✓ For service providers, Initial investment in new technology becomes costly.
- ✓ Service providers server side high memory and high end processor becomes costly.
- ✓ 4G is presently accessible only in conviened and limited cities of India.
- ✓

7. Recommendation of the Study:

Based on the different prominent 4G services providers services analysis made on this paper, few recommendations are proposed for the development and widespread usage of 4G services in India. The different recommendations are as follows:

- ✓ In India, government should start soon 4G services in full fledge through its owned service provider like BSNL.
- ✓ There is a need for wide range of research and developments in implementing and maintenance of 4G services, from the government side.
- ✓ Network coverage should be improved and available to all parts of the country with equal bandwidth and speed.
- ✓ There is a need for initiating or launching 4G services by all the service providers who provides either 2G or 3G services in India.
- ✓ In 4G services internet downloading and uploading speed should be improved.
- ✓ Government regulations and rules should change in availing and implementing 4G services for service providers.

8. Conclusion:

The exponential and rapid development of information and communication technology made revolution in mobile wireless communication technology generation from 3G to new 4G and also advances to future upcoming generation, 5G. In India even though many service providers launched 4G services, that are having some drawbacks like coverage or range only in a few major cities, high cost and problems in speed compared to services provided in western countries. In India Airtel initially launched 4G services and now only five to six service providers' offers 4G network. This paper discusses some prominent service providers like Airtel, Vodafone, Idea, Aircel and Reliance Jio 4G service in terms of launched year, frequency band, internet speed in India. This paper also analyses 4G services using ABCD framework with respect Indian service providers and customers. The widespread growth of 4G technology in India having application in diverse fields like entertainment, education, military and defence and health care. Based on the analysis this paper made some recommendation to improve 4G service widespread and improve quality in India.

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