

The Growth of 4G Technologies in India-Challenges and Opportunities

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ABSTRACT

The existence of 4G technologies is the indicator or valid proof of the rapid and massive growth of wireless communication technologies, which is propagated through 1G, 2G and 3G technology and 5G as an upcoming technology. 4G networks are introduced with the main intention of customization of a flexible and ubiquitous service provision in the middle of 2012 based on digital broadband packet and all IP very high throughput speed of 100-300 Mbps in peak. The widespread growth of the 4G technology in India will be driven by set of new services which will be made useful for the customers such as accessing the internet and video anywhere, any time and in any places with global roaming and full-fledged support for all other multimedia applications. In India even though 4G technology is introduced early in the year 2014, it's still not widespread due to some of the challenges faced by the mobile or wireless communication service providers. In this paper 4G technology with respect to the Indian market is analyzed using advantages, benefits, constraints and disadvantages. The different challenges include backhaul, voice over LTE, Regulatory challenge, Ecosystem related challenges, return on investment, chipset compatibility. Wish this paper could play an active role in actual research on 4G technology in India.

Keywords: LTE, 4G, ABCD Analysis, Backhaul, Ubiquitous

I. Introduction :

The rapid growth of the telecommunication industry along with wireless technology and internet created a new wireless communication channel named as 4G or fourth generation technology with characteristics as customized or personalized services, interactive multimedia, IP telephony, interactive games, high definition mobile TV, high speed broadband internet. In a simple way 4G is successor of third generation (3G) mobile communication technology standard with higher capacity and performance. The International Mobile Telecommunications Advanced (IMT-Advanced) specifies 4G, in terms of different features as speed of 100 Mbit/s or more while travelling and 1 Gbit/s while stationary, channel bandwidths of 5-20MHz or sometimes even up to 40MHz, all-IP based packet switching network and able to switch over multiple heterogeneous networks simultaneously [1].

Initially the 4G technology commercially introduced two forms as Mobile WiMAX standard (in 2006 in South Korea) and Long Term Evolution (LTE) standard (in 2009 in Oslo, Norway). Mobile WiMax or LTE was not available to all continents with same year of its invention due to the different frequency bands [2]. In India BSNL first launched a 4G service through 4G WiMAX Broadband in Kochi Kerala in 2011. But even today 4G wireless services have not spread to some rural areas of India other than some major cities.

In this paper, we discuss the growth of 4G technology in India. Challenges and opportunities of 4G technology in India are studied using the ABCD model. This paper will become a tool for the actual research and development of 4G technology in India.

II. Background

India will become a dominant market for 4G technology due to the development of telecommunication industry and increased population. One of the main obstacles for the future and growth of 4G technology in India is the reduced speed of the internet compared to the developed countries like USA. The introduction of 4G technologies in India is benefited to different sectors such as telecommunication, healthcare, education and entertainment. In India the increased use of smart phone users has positive impact on the popularity and growth of 4G technology. Network discovery, access technologies, network architectures, network conditions, charging and billing, large number of operators, security, congestion control are the some of the research challenges that need to solve for the development and advancement of the 4G networks [3-4].

In India almost everyone ended up upgrading 2G to 3G network, due to the faster availability of services and without more difference in terms of cost. The up gradations from 2G to 3G network do not require a complete reworking of the architecture of the network system. But in case of 4G network, it becomes necessary, adopting a new equipment or handset in order to avail new services. This becomes costly for the Indian customers, is also one of the hindrance to the growth of the 4G technology. In 2G and 3G spectrum band is uniform across different countries where as 4G is offered in different countries with different frequency bands [2]. Unlike 3G, 4G does not offer voice based services through mobile networks, instead it offers voice over internet protocol (VoIP) and it's based on packet switching technology. In India not all the service providers have the option to provide seamless 2G, 3G and 4G services using same spectrum band. In India 4G services are limited to data only without voice services. Portability and file clearing process are the two biggest obstacles or barrier for 4G implementation and development in India.

The mobile telecommunication service provider's who develops 4G networks exclusively and greatly depends upon advanced technologies and higher speed in order to dominate over their counterparts [5-6]. 4G requires a data transfer rate at least 100 megabits per second when the user is moving at high speed and 1giga bits per second when the user are stationary or in a fixed position [7].

In this paper with special reference to Indian 4G markets, we realized that it's become very essential to know the challenges and opportunities involved in 4G for the development and growth of 4G technology through the background study.

III. Challenges of 4G Technology

Deployment and growth of 4G technology in India is not easy due to several challenges faced by the telecommunication industry or 4G service providers.

A. Security: The 4G, LTE should focus on security objectives and corresponding technologies [8]. Howard, Walker and Wright, of the British company Vodafone quote some security principles for 3G, which hold good, even for 4G Technology as adequately protect information against misuse in different situation/users like while user generating or accessing information, worldwide interoperability and roaming between different operators, between user and provider. It should also ensure that the security features and mechanism can be extended and enhanced as and when required for advanced applications or services [6].

B. Backhaul: While using the 4G network maximum amount of data transfer takes place between server and application due to the consumption of bandwidth hungry applications. In order to meet the advanced applications and user requirements operators need to upgrade their backhaul, or bandwidth capacity in exponential form.

C. Multiple Frequencies: One of the major challenges is 4G LTE network uses multiple frequency band or spectrum in different countries. Moreover, operators need to add more radios/ spectrum other than their 2G and 3G spectrum band, which will incur more cost and complexity.

D. Voice over LTE: LTE has the capacity to carry all types of voice, video and data traffic services. But in India most of the operators have given more emphasis for the deployment and development of only data traffic without proper voice and video services. Operators can provide voice over LTE service using three approaches, namely IMS based "one-voice" approach, Voice over LTE via Generic Access (VoLGA), and Circuit Switched Fallback (CSFB).

E. Price and Smart Phone: India is always priced sensitive market, due to these operators always introducing one or other new cost tariff plans for both data and voice. The price of the 4G network is more, is the one more challenge faced by the operators in India. Compared to the entire population of India only few customers have smart phones and in which all smart phones do not support LTE.

F. Quality of Service: In India the service providers or operators always struggled to provide quality of service, even though they do a lot of efforts due to the large and diverse need of the huge populations. Data coverage has a lot of inconsistency in the rural parts of the country. In 4G, service providers should satisfy the customer as LTE expected to consume heavy data content such as videos, games and stream content.

G. Application/content: With 4G, customers are more interested to watch online video while they are moving or traveling causes more consumption of online videos. As more and more

customer's uses HD videos, streaming of HD videos is going to put a huge stress on the LTE network for which operators or telecommunication industry needs to be prepared.

H. Chipset compatibility: LTE chipsets needs to be built based on eco-friendly is one of the barriers around selection of different technologies and in the improvement of chipset performance. While developing chipset vendors should focus on some key parameters like Support for multiple technical parameters, backward compatibility, and reducing power consumption and chip size.

I. Return on Investment (ROI): Migration from 3G technology to 4G LTE entails high capital investment for the service providers due to the high spectrum costs and upgrades in network infrastructure. The biggest risk, therefore for an operator is to justify the ROI and sustaining in the market, in LTE network deployment.

J. Widespread of LTE to rural: All the operators in India focusing their 4G services in some of the Metropolitan cities and urban towns. In order to improve the performance and to get a huge number of customers' operators should focus on deployment of 4G services even rural areas of India.

IV. Opportunities of 4G Technology

4G networks are designed to facilitate the development of different sectors like telecommunication, healthcare, education and entertainment to the existing 3G technologies in terms of quality, bandwidth and data and video transmission and accessing speeds [9]. Following are the different opportunities on 4G technologies.

A. Cost and affordability: When 4G communication technology and network coverage increases the competition between service providers also increases. This creates more demand and popularity in the market. 4G service cost can be reduced with the high demand and popularity of 4G technology [10]. 4G networks are designed in order to create an environment that supports embodied in speed, bandwidth, low cost, better network, efficiency, personalization and advanced access technologies. As the technology reaches more and more customers or public cost and affordability successfully reduces.

B. Personalization: The personalization requires an integration and organization of a user's preferences. 4G Technology adapts sensor network, user profile and databases in order implement personalization or customization of user requirements.

C. Advanced Access Technologies: 4G technology uses MIMO-OFDM (Multi in Multi out Orthogonal Frequency Division Multiplexing) to better distribute resources among available various clients [11-12].

D. Coverage and Availability: 4G signals with more than 800MHz super frequency can penetrate to any extent with walls and any object to ensure wider coverage. If the service provider deploys proper and advanced technologies it can be available ubiquitously without any barrier to time, place and locations [13].

E. M-learning Capability: Using the 4G network in m-learning model, students can login to their notebook through valid username and passwords and can get information in terms of different multimedia applications like plain text, pictures, audios and videos and at the same time authorized instructor can upload information or contents like homework, announcements, SMS and quizzes.

F. Improved Entertainment for an Individual: An individual can get the benefits of 4G technologies as watching video with HD quality, video calls with high quality and high quality gaming applications. Due to this more and more customers, start watching their hand set for different video purposes will increase the demand and market of smart phones.

G. Banking sectors gets benefited through mobile banking: By adopting 4G technology, banking services can reach to rural area customers with high security through their smart phones. So customers can able to access their banking services anywhere, anytime and anyplace.

H. Private and Public organization Performance Improvement: Private or public organization can improve their performance with the use of 4G technology by reducing their cost of travel, tracking the employees, instant update on all government projects implemented and by utilizing high quality of video conferencing.

V. ABCD Analysis of the 4G Technology

The 4G technology are analyzed using Advantages, Benefits, Constraints and Disadvantages (ABCD) analysis by considering different issues, which includes security, bandwidth, multiple frequencies, voice over LTE, quality of service, application/content, chipset compatibility, return on investment (ROI), widespread of LTE to rural, cost, affordability, personalization, advanced access technologies, availability, m-learning capability, improved entertainment for an individual, mobile banking and private and public organization performance improvement [14].

Advantages:

- Increased security helps to improve the customer trust over new technology, authentication. There will not be any altering or changes in data during transmission and user cannot deny not sending the message because only sender and receiver will have a unique pair of password or OTP.
- When bandwidth is increased more data can be transmitted between sender and receiver. The user will be satisfied because of high bandwidth while accessing the internet or HD videos. Quickly download a file over the internet, easy access internet or multimedia files and HD videos.
- Implementing standard global frequencies will reduce the cost of the service provider and in a single stream able to deploy 2G, 3G and 4G services.
- Voice over LTE will increase the capacity to carry all types of voice, video and data traffic services; due to this more and more customers are attracted to new technology.

- Quality of services will be improved with the adaptation of proper advanced technologies in terms of availability of audio, HD video, data services ubiquitously.
- Extremely high voice quality and HD video ubiquitously due content/application services.
- Services based on user habit, preferences and needs can be provided due to personalization or customization of services.
- 4G communication technology provides some intelligent networks like open distributed AD-HOC wireless network and software defined radio.
- Through 4G technology Learners can control their own learning time by portable mobile devices. Mobile learning is more helpful for someone who are no longer restricted to time, place and locations.
- Private and public organization can grow due to 4G technology by reducing their cost of travel, tracking the employees, instant update on all government projects implemented and by utilizing high quality of video conferencing.
- With the adaptation of 4G technology, banking institution can provide banking services to its customers in rural areas through mobile banking services.
- When 4G communication technology and network coverage increases the competition between service providers also increases. This creates more demand and popularity in the market.

Benefits

- 4G are very easy to install and maintain.
- Due to higher security, service provider or operators gets more profit and popularity and advancement of the new technology also improved.
- Global or national wide expansion of 4G services
- The ability to obtain a larger customer base due to ubiquitous services.
- The ability to take advantage of the growing popularity of Smart Phone banking
- Enhances reputation of the operators by providing fast and secured services to its customer.
- Expansion of Smart Phone users.
- Banks can able to attract business people, software engineers or other tight scheduled customer pool due to their nature of professions for mobile banking services.
- High quality of services.

Constraints

- Lack of newer technology support.
- Possible failure of new technology due to non-acceptance of customer.
- General competitiveness of the service providers.
- Mandatory of smart phones or shifting of new equipments cost more for the customer reduces the 4G usage in India.
- Government policies will affect on usage of 4G services.

- Different frequencies are used for 4G services in different countries creates an extra burden for service providers.

Disadvantages

- New frequency requires added components in the service provider's tower.
- 4G does not offer voice services through mobile phone rather than it uses voice over internet protocol (VoIP). When the user logged on to 4G services will be transferred to 3G services, when the user receives a voice call.
- Voice over LTE (VoLTE) new services of VoIP in 4G technology, is not widespread or it's in infant stage.
- Portability and file clearing in 4G technology is a lengthy process, which is very costly, not affordable by ordinary customer.
- Requirement of high memory and processors at service provider's servers.
- Lack of technology support.
- Initial investment in technology will be expensive.
- Lack of trained staff.

VI. Conclusion

4G wireless technologies provides a wide variety of services, which includes improved bandwidth, advanced personalization or customization, high speed HD video and multimedia services. With the deployment of 4G technology Indian Telecommunication industry and Information technology witnessed massive significant transformations. In this paper we have discussed the some of the challenges in terms of Security, Bandwidth, Multiple Frequencies, Voice over LTE, Price and Smart Phone, Quality of Service, Application/content, Chipset compatibility, Return on Investment (ROI), Widespread of LTE to rural area. We have also discussed opportunities of 4G technology in India in terms of Cost and affordability, Personalization, Advanced Access Technologies, Coverage and Availability, M-learning Capability, Improved Entertainment for an Individual, mobile banking, Private and Public organization Performance Improvement.

The 4G technology is analyzed using the ABCD model which explains the advantages, benefits, constraints and disadvantages of 4G technology with special reference to Indian market. A nationwide drive in the form of marketing campaign by the regulator or service provider will enhance the growth of 4G technology. The government should pass a standard regulation for the development of 4G technology. More emphasis should be given for wider coverage, voice call, increased bandwidth and speed for multimedia services. The operator should also give importance for customization and personalization of 4G services along with the scalability issue for new usage patterns like social networking and peer to peer services. The Indian market will play a significant role in the future growth of 4G technology due to its population and a wide variety of customer requirements. Wish this paper could play an active role in actual research on 4G technology in India.

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