5G technology: The Key Enabler in Reaching the Unreached, Its Advantages and Initiatives Government Can Take to Emp ower Indians Compete Globally

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Abstract: - **A new revolution of the telecommunication is the 5G technology where various mobile phones will be able to leverage data anywhere, anytime that is expected to spread rapidly, over the coming years.In this paper the author is trying to portray its advantages over previous generations of internet, and some of the initiatives that can be taken by the government are discussed that can put 5G into mainstream ,this is necessary because the advancements in mobile technology and web technology with current old school 2G internet which majority of the rural Indians have, can be regarded as unusable internet and obsolete in nature because most needed features like e-Education, E-medication , E-commerce which lead to symbiotically beneficiary between rural and urban India is restricted by 2g internet there by proving just connecting people to the internet is not the solution for modern India instead it is the connecting people to the high-speed internet is the answer for which 5G will play a huge role.**

Keywords— 5G; India; Mobile Internet.

I. INTRODUCTION

Societal development will lead to changes in the way mobile and wireless communication systems are used. Essential services such as e-banking, e-learning, and e-health will continue to proliferate and become more mobile. On-demand information and entertainment (e.g., in the form of augmented reality) will progressively be delivered over mobile and wireless communication systems. These developments will lead to an avalanche of mobile and wireless traffic volume, predicted to increase a thousand-fold over the next decade The cellular wireless generation (G) refers to a change in the fundamental nature of the service, non-backward compatible transmission technology, and new frequency bands. Mobile communications and wireless networks are developing at an astounding speed, with evidence of significant growth in the areas of mobile subscribers and terminals, mobile and wireless access networks, and mobile services and applications. The fourth generation, 4G, of mobile networks that will supersede the 3G and 2G families of standards, is already upon us. A new mobile generation has appeared every 10th year since the first 1G system was first introduced in 1981, followed by the 2G system that started to roll out in 1992, and 3G, which appeared in 2001. [1,2]. The development of 4G systems began in 2002. The real new revolution started with 3GPP in December 1998. 3G systems are designed for multimedia communication: with them, person-to-person communication can be enhanced with high-quality images and video, and access to information and services on public and private networks will be strengthened by the higher data rates and new flexible communication capabilities of third generation systems [3].The 4G (fourth generation) communication systems will provide a broad range of new services, from high-quality voice to high definition video to high data rate wireless channels. 4G is intended to provide high speed, high capacity, low cost per bit, IP based services. The goal is to have data rates up to 20 Mbps, even when used in such scenarios as a vehicle traveling 200 kilometers per hour. New design techniques, however, are

needed to make this happen, regarding achieving 4G performance at the desired target of one-tenth the cost of 3G. That's the goal of 4G. In short, Fourth Generation (4G) mobile devices and services will transform wireless communications into online [5,6], real-time connectivity. 4G wireless technologies will allow an individual to have immediate access to location-specific services that offer information on demand at an amazingly high speed and low cost. Welcome to the world of fantastic realities of an amazingly high-speed data communication and mobile technology at a little cost. That's 4G. 5G is a packet switched wireless system with wide area coverage and high throughput.5G technology has changed the means to use cell phones within very high bandwidth 5G wireless uses OFDM and millimeter wireless that enables data rate of 20 Mbps frequency bandof2-8 GHz. The 5G communication system is envisioned as the real wireless band of 2-8 GHz.

Table 1: The generations of the cellular networks

Generations	Year	Features
1G	1980s	Analog signals for voice only communications
2G	1990s	Digital signals, voice communications, and text messaging
3G	1998-99	Voice communications, wireless mobile and fixed Internet access, video calls, and mobile television (TV)
4G	2008-09	Higher data rate (hundreds of megabits per second)
5G	2020	Mentioned in Section 1

II. BACKGROUND

The evolution of the cellular network generations is primarily influenced by a continuous growth in wireless user devices, data usage, and the need for a better quality of experience (QoE). It is expected that more than 50 billion connected devices will utilize the cellular network services by the end of the year 2020 [1], and it will result in an a tremendous increase in data traffic, as compared to the year 2014 [1,3]. However, stateof-the-art solutions are not sufficient for the challenges mentioned above. In short, the increase of 3D (Device, Data, and Data transfer rate) encourages the development of 5G networks.

Specifically, the fifth generation (5G) of the cellular networks will highlight and address three broad views, as:

(i) user-centric (by providing 24×7 device connectivity, uninterrupted communication services, and a smooth consumer experience),

(ii)service-provider-centric by providing a connected intelligent transportation systems, road-side service units, sensors, and mission-critical monitoring/tracking services),

(iii) network-operator-centric (by providing an energy-efficient, scalable,low-cost, uniformly-monitored, programmable, and secure communication infrastructure). Therefore,5G networks are perceived to materialize the three main features as below:

•Ubiquitous connectivity: In the future, many types of devices will connect ubiquitously and provide the an uninterrupted user experience. In fact, the user-centric view will be realized by ubiquitous connectivity.

•Zero latency: 5G networks will support life-critical systems and real-time applications and services with zero delay tolerance. Hence, it is envisioned that 5G networks will realize zero latency,i.e., very low latency of the order of 1 millisecond [2]. In fact, the service-provider-centric view will be recognized by the zero latency.
•High-speed Gigabit connection: The zero latency property could be achieved using a high-speed connection for fast data transfer
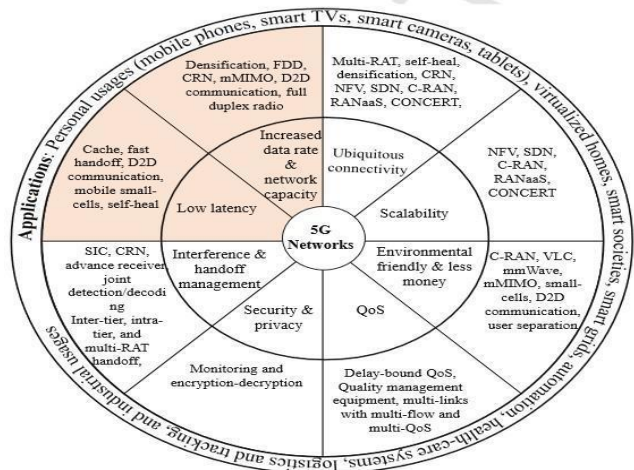
Figure 1: Requirements and proposed solutions for thedevelopment of 5G networks.The inner, middle, andoutermost layers present requirements,

solutions, andapplications of 5G networks, respectively. Two coloredwedges highlight primary features of 5G networks

Table 2 :comparision of 1G to 5G technologies

Technology	1G	2G/2.5G	3G	4G	5G
Deployment	1970/1984	1980/1999	1990/2002	2000/2010	2014/2015
Bandwidth	2kbps	14-64kbps	2mbps	200mbps	>1gbps
Technology	Analog cellular	Digital cellular	Broadbandwidth/ cdma/ip technology	Unified ip & seamless combo of LAN/WAN/WLAN/PAN	4G+WWWW
Service	Mobile telephony	Digital voice,short messaging	Integrated high quality audio, video & data	Dynamic information access, variable devices	Dynamic information access, variable devices with AI capabilities
Multiplexing	FDMA	TDMA/CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit/circuit for access network&air interface	Packet except for air interface	All packet	All packet
Core network	PSTN	PSTN	Packet network	Internet	Internet
Handoff	Horizontal	Horizontal	Horizontal	Horizontal&Vertical	Horizontal&Vertical

III. MAIN THRUST OF THE PAPER

In this part mainly 3 areas will be focused

1) Limitations of the Conventional Cellular Systems
2) requirements of the future 5G networks.
3) Initiatives government should take

1)Limitations of the Conventional Cellular Systems

4G networks are not substantial enough to support massively connected devices with low latency and significant spectral efficiency, which will be crucial in the future. In this section, we discuss a few key aspects in which conventional cellular networks lag behind, thereby motivating the evolution of 5G networks. No support for bursty data traffic. No support for bursty data traffic.Several mobile applications send heartbeat messages to their servers and occasionally ask for a very high data transfer speed for a very short duration. Such types of data transmission may consume more battery life of (mobile) user equipment (UEs) with increasing bursty data in the network, and hence, may crash the core network [1,2,3]. However, only one type of signaling/control mechanism is designed for all types of the traffic in the current systems, creating high overhead for bursty traffic Inefficient utilization of processing capabilities of a base-station. In the current cellular networks, the processing power of a base-station (BS) can only be used by its associated UEs, and they are designed to support peak time traffic.

However, a BS's processing power can be shared across a large geographical area when it is lightly loaded. For example:

(i) during the day, BSs in business areas are oversubscribed, while BSs in residential areas are almost idle, and vice versa, and (ii) BSs in residential areas are overloaded in weekends or holidays while BSs in business areas are almost idle. However, the almost idle BSs consume an identical amount of power as over-subscribed BSs. Hence, the overall cost of the network increases. Co-channel interference. A typical cellular network uses two separate channels, one as a transmission path from a UE to a BS, called uplink (UL), and the reverse path, called downlink (DL). The allocation of two different channels for a UE is not an efficient utilization of the frequency band. However, if both the channels operate at an identical frequency,i.e., a full duplex wireless radio, then a high level of co-channel interference (the interference between the signals using an identical frequency) in UL and DL channels is a major issue in 4G networks. It also prevents the network densification,i.e., the deployment of many BSs in a geographical area

No support for heterogeneous wireless networks.
.Heterogeneous wireless networks (HetNets) are composed of wireless networks of diverse access technologies,e.g., the third generation (3G), 4G, wireless local area networks (WLAN), WiFi, and Bluetooth. HetNets are already standardized in 4G; however, the underlying architecture was not intended to support them. Furthermore, the current cellular networks allow a UE to have a DL channel, and a UL channel must be associated with a single BS that prevents the maximum utilization of HetNets. In HetNets, a UE can select a UL channel and a DL channel from two different BSs belonging to two different wireless networks for performance improvement No separation of indoor and outdoor users. The current cellular networks have a single BS installed near the center of the cell and interact with all the UEs irrespective of the indoor or outdoor location of the UEs; while UEs stay indoors and outdoors for about 80% and 20% of the time, respectively. Furthermore, the communication between an indoor UE and an outside BS is not efficient in terms of data transfer rate, spectral efficiency, and energy-efficiency, due to the attenuation of signals passing through walls Latency.When a UE receives an access to the best candidate BS, it takes several hundreds of milliseconds in the current cellular networks and hence, they cannot support the zero latency property.

2)requirements of the future 5G networks

Dramatic upsurge in device scalability. A rapid growth of smartphones, gaming consoles, high-resolution TVs, cameras, home appliances, laptops, connected transportation systems, video surveillance systems, robots, sensors,and wearable devices (watches and glasses) is expected to continue exponentially shortly. Therefore, 5G135networks are perceived to support massively connected devices

Massive data streaming and high data rate.A vast growth in a number of wireless devices will of course result in a higher amount of data trading (e.g., videos, audio, Web browsing, social-media data, gaming, real-time signals, photos, bursty data, and multimedia) that will be 100-times more as compared to the year 2014 and would overburden the current network. Thus, it is mandatory to have matching data transfer capabilities in terms of new architectures, methods, technologies, and data distribution of indoor and outdoor users

Spectrum utilization. The two different channels (one for a UL and another for a DL) seem redundant from the point of view of the spectrum utilization [59]. Also, the currently allocated [5,6]sp[5ectrums have their significant portions under-utilized Hence, it is necessary to develop an access control method that can enhance the spectrum utilization. Furthermore, the spectrum use and efficiency have already been stretched to the maximum. It definitely requires spectrum broadening (above 3 GHz) along with novel spectrum utilization techniques

Ubiquitous connectivity.Ubiquitous connectivity requires UEs to support a variety of radios, RATs, and bands148due to the global non-identical operating bands. Also, the major market split between time division duplex (e.g., India and China) versus frequency division duplex (e.g., the US and Europe) so that UEs are required to support different duplex options. Hence, 5G networks are envisioned for seamless connectivity of UEs over HetNets

zero latency. The future mobile cellular networks are expected to assist numerous realtime applications, the tactile Internet and services with varying levels of quality of service (QoS) (regarding bandwidth, latency, jitter, packet loss, and packet delay) and QoE (regarding users' and network-providers' service satisfaction versus feedback). Hence, 5G networks are envisioned to realize real-time and delay-bound services with the optimal QoS and QoE experiences

Initiatives government can take

it can be seen that individual private companies like Reliance and Airtel are already laying the foundations of 5G internet and could easily establish eh monopoly over 5G internet hence government entities like BSNL has to come up and lay strong foundation for 5G internet speed. Shortly, the world will develop into world, where we, the citizens cannot always depend on the private companies to satisfy our daily needs, internet, jobs, etc..so the government should start laying the foundation to the 5g network as it provides jobs to many people, might reduce some percent of poverty therefore we people must be dependent on the government as it takes the decision-based on the public opinion the necessity for such technologies because the advancements in mobile technology and web technology the old school 2G internet which majority of the Indians have can be regarded as unusable internet and obsolete in nature proving just connecting people to the web is not the solution for modern India instead it is the connecting people to the highspeed internet is the answer for which 5G will play a huge role further applications can be seen in the future trends, if BSNL the oldest network of India start the 5g connectivity in India, it will receive a great response from its users as the rate is comparatively small than other internet providers and the people using 2g/3g services on BSNL will switch on to the latest technology of 5g.government can subsidies phones which are 5g ready in India so that foreign direct investment in India will increase and accelerate large-scale adoption of 5g internet in India .the government can even work in PPP model that is public-private partnership[4] to lay strong foundation for the 5G internet .This can advantageous as e-Education, E-medication , E-commerce which lead to symbiotically beneficiary between rural and urban India like ayurvedic herbal products can be sold into urban region, modern teaching methods can be accessed in rural areas empowering rural women, latest e-medication facilities to effectively delivery of children and treat heart patients and remotely attend emergency cases ,5G internet can also be used to skill rural India and provide employment opportunities which is urgent need in resent times.

IV. FUTURE TRENDS

All the top five emerging domains IoT, cloud, mobile application, artificial intelligence, Big data can exploit and take reap uses of the 5G internet.Shortly almost 40 billion connected devices are expected to be in use by 2020 hence 5G internet has many uses

Applications of 5G Networks The zero latency, high-speed data transfer, and ubiquitous connectivity are the salient features of 5G networks that are expected to serve a broad range of applications and services. In this section, we

enumerate the most prominent applications of 5G networks, as follows: Personal usages.This domain of 5G networks would be capable of supporting a broad range of UEs, from scalable to different devices. Also the data demands (e.g., multimedia data, voice communication, and Web surfing), would be satisfied while keeping the QoS requirements. Virtualized homes.Due to C-RAN architectures, users may have only low-cost UEs (e.g., the set-top box for TVs and residential gateways for accessing the Internet) with services of the physical and data link layers. All the other higher layers' applications may move to the cloud for universal access and outsourced computation services . Smart societies.It is an abstract term for connected virtualized homes, offices, and stores. Accordingly, every digital and electronic services/appliances,e.g., temperature maintenance, warning alarms, printers, LCDs, air conditioners, physical workout equipment, and door locks, would be interconnected in a way that the collaborative actions would enhance the user experience. Similarly, smart stores would assist in filtering out irrelevant product details, sale advertisements, and item suggestions on the Smart Grids.The smart grids would decentralize the energy distribution and better analyze the energy consumption. This would allow the smart grids to improve efficiency and economic benefits. The 5G networks would allow a rapid and frequent statistical data observation, analysis, and fetching from remote sensors and would adjust the energy distribution accordingly. The tactile Internet. The real Internet improves the user experience in a virtual environment to an extent of only milliseconds of interaction latency. The futuristic applications such as automated vehicle platooning, self-organizing transportation, the ability to acquire a virtual sense for physically challenged patients, synchronized remote smart-grids, remote robotics, and image processing with customized/panoramic view would use the tactile Internet protocols Automation. Self driving vehicles would take place shortly, and as a requirement, vehicles would communicate with each other in real-time. Moreover, they would communicate with other devices on the roads, homes, and offices with a requirement of almost zero latency. Hence, an interconnected vehicular environment would provide a safe and efficient integration with

other information systems. Healthcare systems. A reliable, secure, and fast mobile communication can strengthen medical services,e.g., frequent data transfer from patients' body to the cloud or health care centres. Therefore, the

relevant and urgent medical services could be predicted and delivered to the patients very fast. Logistics and tracking. The future mobile communication would also assist in inventory or package tracking using location based information systems. The most popular way would be to embed a radio frequency identification (RFID) tag and to provide a continuous connectivity irrespective of the geographic locations. Industrial usages. The zero latency property of 5G networks would help robots, sensors, drones, mobile devices, users, and data collector devices to have real-time data without any delay, which would help to manage and operate industrial functions quickly while preserving energy

V. CONCLUSION

A new revolution of 5G technology has begun. 5G technology going to give tough completion to regular computer and laptops whose marketplace value will be affected. There are lots of improvements from 1G, 2G, 3G, and 4G to 5G in the world of telecommunications. The new coming 5G technology is available in the market at affordable rates, high peak future and much reliability than its other technologies 5G technology are designed as an open platform on different layers, from the physical layer up to the application. Presently, the current work is in the modules that shall offer the best Operating System and lowest cost for a specified service using one or more than one wireless technology at the same time from the 5G mobile. A new revolution of 5G technology is about to begin because 5G technology going to give tough completion to standard computer and laptops whose marketplace value will be affected. There are lots of improvements from 1G, 2G, 3G, and 4G to 5G in the world of mobile communication. The new coming 5G technology is available in the market at inexpensive rates, high peak expectations, and much reliability than its previous technologies.5G network technology will release a different age in mobile communication. The 5G mobiles will have access to various wireless technologies at the identical time, and the terminal should be able to merge different flows of different technologies. 5G technology offers high resolution for passionate mobile phone consumer. We can watch an HD TV channel on our cell phones without any disturbance. The 5G mobile phones will be a tablet PC. Many mobile embedded technologies will develop hence the initiatives the government can take to empower Indian citizens to compete globally were also discussed.

REFERENCES

[1]50billionconnecteddevices,Ericsson,whitepaper,2011.Av aila bleat:http : // www.1037ako s- rs.si /files /Telekomunikacije /Digitalna_agenda/Internetni_protok ol_Ipv6/1038Morethan-50-billion-connected devices.pdf.1039

[2] N. Panwar, S. Sharma and A. Singh, "A survey on 5G: The next generation of mobile communication", Physical Communication, vol. 18, pp. 64-84, 2016.

[3] 5G Reuse cases and requirements, Nokia Networks, white paper. Available at:http :// networks.nokia.com /sites /1042default /files /document /5 g_requirements_white_p aper.pdf.1043

[4] The next generation of communication networks and services, The 5G Infrastructure Public Private Partnership1044(5GPPP),European Commission,2015.

[5] Analysis Understanding 5G: Perspectives on future technological advancements in mobileGSMA intelligence, 2014.

[6] 5G: Vision for the next generation of connectivity, Qualcomm, 2017. Available at:https : // www.qualcomm.com /media /1056documents /files / whit epaper-5g-vision-for-thenext-generation-of connectivity.pdf.1057

VI. ACKNOWLEDGEMENT

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Bio-data