

NEXT GENERATION, 5G TECHNOLOGY FOR MOBILE COMMUNICATION

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ABSTRACT

The major contribution of this paper is the key provisions of mobile communication through 5G (Fifth Generation) technology of which is seen as consumer oriented. In 5G technology and mobile consumer has given top priority over others. 5G technology is to make use of mobile phones within very high bandwidth. The consumer never experienced the utmost valued technology as 5G. The 5G technologies comprise all types of sophisticated features which make 5G technology most governing technology in the vicinity of future. 5G technologies will change the way most high-bandwidth users access their phones. With 5G people will experience a level of call volume and data transmission never experienced before. 5G technology is offering the services in different fields like Documentation, supporting electronic transactions (e-Payments, e-transactions) etc. As the customer becomes more and more aware of the mobile phone technology, he or she will look for a decent package all together, including all the advanced features a cellular phone can have. The 5G design is based on user-centric mobile environment with many wireless and mobile technologies on the ground. WWW that is World Wide Wireless Web allows complete wireless communication with almost no limitation, Multi-Media Newspapers, watch TV programs with the clarity as to that of an HD TV.

Keywords: 5G Technology, WLAN, Evolution of wireless technologies, GSM, LTE.

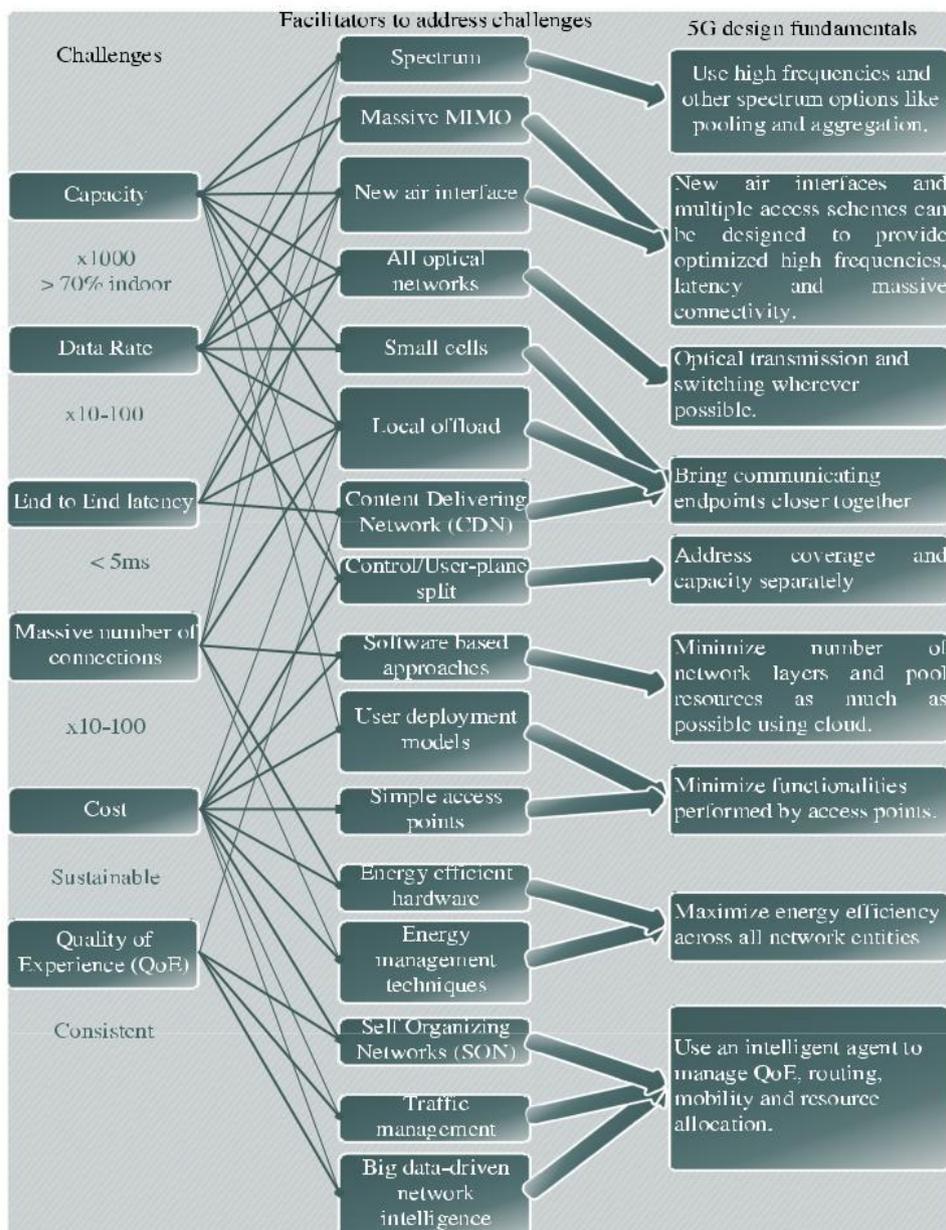
1. Introduction

Mobile and wireless networks have made significant improvement in the last few years. At the current time many mobile phones have also a WLAN adapter. One may expect that near soon many mobile phones will have Wax adapter too, besides their 3G, 2G, WLAN, Bluetooth etc. adapters. We are using IP for generations, 2.5G or 3G Public Land Mobile Networks (PLMN) on one side and

WLAN on the other, developed study on their incorporation. With reference to the 4G, its focal point is towards flawless integration of cellular networks such as GSM and 3G. The multiple consumers put plants as it should be for 4G, but private security mechanisms and private support for the operating system in the wireless test techniques remain. However, the application of a combination of different wireless networks (such as PLMN and WLAN) is in practice until the present time. Although, different wireless networks from only terminal are used absolutely, there is no combining of dissimilar wireless access technologies for an equal session (e.g., FTP download). The predictable Open Wireless Architecture (OWA) in is targeted to offer open baseband processing modules with open interface parameters. The OWA is related to MAC/PHY layers of future (4G) mobiles. New error-control schemes can be downloaded from the Internet and augmentation is seen towards the customer terminals as a focus on the 5G mobile networks. The 5G terminals will have software defined radios and modulation scheme and the 5G mobile terminals will have access to diverse wireless technologies at the same time. And also 5G mobile terminal should be proficient to merge special flows from different technologies. The 5G terminal will make the final selection among diverse mobile access network providers for a

particular service. The network will be reliable for managing user-mobility. The paper gives the concept of intelligent Internet phone where the mobile can prefer the finest connections.

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2.Challenges In Migration From 4g To 5g

Presently, 5G is not a term officially used for any particular specifications.3GPP standard release beyond 4G and LTE [4]. 5G Technology is a name used in a range of research papers and projects to point to the next most significant stage of mobile communication values beyond the 4G standards. The execution of standards under a 5G umbrella would likely be around the year of 2020. The following are the main constraints for migrating from 4G to 5G.

1. Multi-mode user terminals

This trouble caused by means of 4G can be solved by using software radio approach. There will be an essential to design a single user terminal that can operate in different wireless networks and overcome the design troubles such as boundaries on the size of the device, its cost and power utilization.

2. Choice among various wireless systems

Every wireless system has its distinctive characteristics and roles. The choice of most suitable technology for a specific service at a specific place and at precise time will be applied by making the choice according to the best possible fit of consumer QoS (Quality of Service) requirements.

3. Security

Mechanisms with adaptive, reconfigurable, and lightweight protection should be designed.

4. Network infrastructure and QoS support

Integrating the current non-IP and IP-based systems and providing QoS assurance for end-to-end services that engage different systems is a challenge.

5. Charging and Billing

It is hard to accumulate, handle and accumulate the Consumers' account information from many service providers. Consumers' billing is also a difficult task. Attacks on Application Level Software applications will offer new feature to the consumer, but will commence new bugs.

6. Jamming and spoofing

Criminals can make use of such techniques. Jamming occurs when a transmitter sending out signals at the same frequency shifts a GPS signal. Spoofing is fake GPS signals being sent out, in which case the GPS receiver considers that the signals arrives from a satellite and computes the wrong coordinates Data Encryption. If a GPS receiver will communicate with the main transmitter then the communication link between these two is not tough to break and consumer must use encrypted data.

3.Features Of 5g Technology

- [1]. In Capacity -1000x higher data volumes and 10-100x higher data rates to end user.
- [2]. Low Latency –Latency decrease by a factor of 5 in order to enable remote presence, tactile internet, etc.services.
- [3]. Increase in number of connected device- up to 300,000 will be served per access point.
- [4]. Increase in Efficiency- Energy, Spectrum like resource utilization higher.
- [5]. Increase in reliability- 5G will be deliver extremely reliable connections (Typically 99.999% Availability).
- [6]. 5G support to Internet of Thing, Smart Home Appliances, Autonomous Car and it also applicable in following
- [7]. Area- Health, Transport, Agriculture and Education.
- [8]. 5G provide uniform, uninterrupted, and consistent connectivity across the world.

4. Hardware Of 5g

- [1]. UWB Networks: higher bandwidth at low energy levels. This short-range radio technology is ideal for wireless personal area networks (WPANs). UWB complements existing longer range radio technologies –such as Wi-Fi, WiMAX, and cellular wide area communications – that bring in data and communications from the outside

world. UWB provides the needed cost-effective, power-efficient, high bandwidth solution for relaying data from host devices to devices in the immediate area (up to 10 meters or 30 feet).

[2]. Bandwidth: 4000 megabits per second, which is 400 times faster than today's wireless networks.

[3]. Smart antennas.

- a. Switched Beam Antennas: Switched Beam Antennas support radio positioning via Angle of Arrival (AOA) information collected from nearby devices.
- b. Adaptive Array Antennas: The use of adaptive antenna arrays is one area that shows promise for improving capacity of wireless systems and providing improved safety through position location capabilities. These arrays can be used for interference rejection through spatial _altering, position location through direction ending measurements, and developing improved channel models through angle of arrival channel sounding measurements.

[4]. Multiplexing: CDMA (Code Division Multiple Access) CDMA employs analog-to-digital conversion (ADC) in combination with spread spectrum technology. Audio input is first digitized into binary elements. The frequency of the transmitted signal is then made to vary according to a defined pattern (code), so it can be intercepted only by a receiver whose frequency response is programmed with the same code, so it follows exactly along with the transmitter frequency. There are trillions of possible frequency-sequencing codes, which enhance privacy and makes cloning difficult.

5. Software Of 5g

1) 5G will be single unified standard of different wireless networks, including LAN technologies, LAN/WAN, WWW - World Wide Wireless Web, unified IP & seamless combination of broadband.

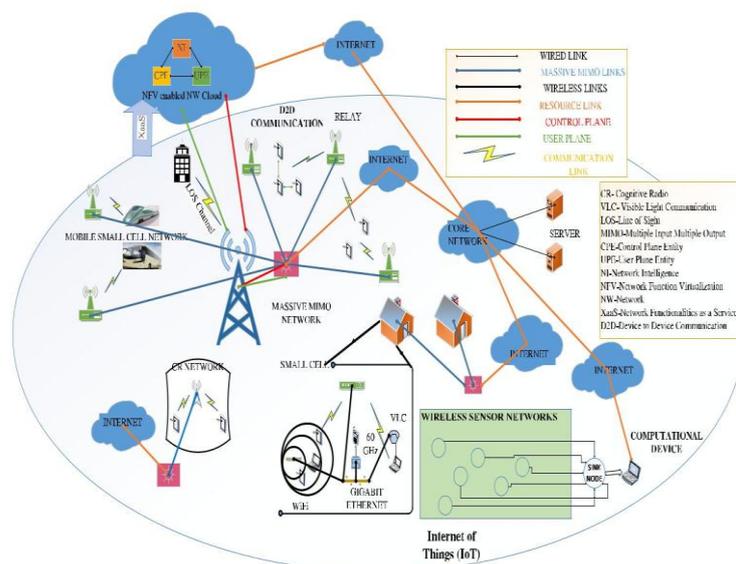
2) Software defined radio (SDR), Packet layer, Implementation of Packets, Encryption, Flexibility, Anti-Virus.

6. Architecture & Working Of 5g

It is necessary to look thoughtfully for 5G network in the market now, it is clear that the multiple access techniques in the network are still available and requires some improvement. The current technologies like OFDMA will be work at least for next 50 years. By taking this into consideration, it is not necessary to have a change in the wireless setup which had come about from 1G to 4G. Correspondingly, it only needs the improvement to be done at the fundamental network to fulfil user requirements. To fulfil user requirements and to reduce the challenges that has been introduced in the 5G system, an effective change in the technique of designing the 5G wireless cellular architecture is needed. According to observation of the researchers, most of the wireless users stay inside for up to 80% of time and outside for up to 20 % of the time. In these wireless cellular network architecture, for a mobile user wish to communicate either inside or outside, an outside base station located at the middle of a cell helps in communication. When the inside users wants to communicate with the outside base station, the signals has to travel through the walls of the indoors, and it will result in very high penetration loss, which alternatively reduced the spectral efficiency, data rate, and energy efficiency of wireless communications. To overcome these challenges, a new designing technique that has come in to market for implementing the 5G cellular architecture is to distinct outside and inside setups. With the help of this designing technique, the penetration loss through the walls of the building will be slightly reduced. This technique will be implemented with the help of some standard technologies like massive MIMO technology, which deployed geographically distributed array of antenna's which include tens or hundreds of antenna units. Not only MIMO systems are using either two or four antennas, but also the idea of massive MIMO systems has come up with utilization of the advantages of large array antenna

elements in terms of huge capacity gains. To implement a large massive MIMO network, basically it having two stages- First, the outside base stations will be attached with large antenna arrays and they are distributed around the some hexagonal cell and connected to the base station via optical fibre cables, which are aided with massive MIMO technologies. The mobile users present at outside are basically attached with few number of antenna units but a large virtual antenna array can be built with cooperation, which antenna arrays of base station will together form virtual massive MIMO links. Second, for every building their will be large antenna arrays from outside, to communicate with outdoor base stations using line of sight components. To communicate with indoor users the wireless access points being installed inside the building which will be connected with the large antenna arrays via cables. This will improve the energy efficiency, cell average throughput, data rate, and spectral efficiency of the cellular system but at the high rate of increased infrastructure cost. As larger antenna arrays remained installed outside the buildings, the inside users will only have to communicate with inside wireless access points. For small range communications (Indoor communication) having large data rates there are some of technologies like Wi-Fi, Small cell, ultra-wideband, millimetre wave communications, and visible light communications are very useful. But there are some of the technologies like millimetre wave and visible light communication they requires higher frequencies which are not useful for cellular communications. But these high frequency waves are not efficient for outside and long distance applications because these waves will not infiltrate from dense materials efficiently and can easily be dispersed by rain droplets, gases, and flora. As millimetre waves and visible light communication technologies come up with large bandwidth can improve the transmission data rate for indoor setups. As we seen with the introduction of new spectrum, which is not being efficiently used for wireless communication, there is one more method to solve the spectrum shortage problem by improving the spectrum utilization of current radio spectra through cognitive radio (CR) networks. The 5G cellular network architecture explained above, having equal importance in terms of front end and backhaul network. In this paper, we introduced general 5G cellular network architecture as shown in Fig. 1. It shows the interconnectivity between different emerging technologies will be like Massive MIMO network, Cognitive Radio network, and mobile and static small-cell networks. It also explains the role of network function virtualization (NFV) cloud in the 5G cellular network architecture. Similarly this 5G cellular network architecture has also included the concept of D2D communication, small cell access points and IoT. In short, this 5G cellular network architecture may provide a very good platform for future 5G standardization network

FIGURE 1. A general 5G cellular network architecture.



COMPARATIVELY STUDY OF 4G AND 5G
TABLE I.
TECHNICAL COMPARISON BETWEEN 4G AND 5G.

Sr. No.	Specification	4G (Fourth Generation)	5G (Fifth Generation)
1.	Data Bandwidth	Up to 100Mbps	Greater than 1Gbps
2.	Frequency Band	2GHz to 8GHz	3GHz to 300GHz
3.	Standards	OFDMA, MC-CDMA, N/W-LMPS	CDMA and BDMA
4.	Technologies	unified IP, seamless integration of broadband LAN/WAN/PAN and WLAN	4G and advanced technologies based on OFDM modulation used in 5G
5.	Service	Dynamic information access, wearable devices, HD streaming, global roaming	Dynamic information access, wearable devices, HD streaming, any demand of users with all Capabilities
16.	Multiple Access	CDMA	CDMA,BDMA
7.	Core Network	All IP network	Flatter IP network, 5G network Interfacing(5G-NI)
8.	Hand Off	Horizontal and vertical	Horizontal and vertical
9.	Initiation Form	year-2010	year-2015
10.	Multiplexing	CDMA	CDMA
11.	Switching	Packet	Packet
12.	Antenna Type	Sub wavelength antenna	Array antennas
13.	Radiation Pattern	Omnidirectional	Directional fan-beam
14.	Diversity and MIMO	Present	Present

15.	Deployment	2000-2010	By 2020
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8.Applications Of 5g Technology

The 5G technology applications are set to evolve in a multiplatform environment. 4G applications will be available across various wireless technologies like LTE, Wi-Fi, etc. and also in devices like cell phones, laptops-readers, digital cameras, printers and so on. 4G applications are very likely to be extended and improved versions of the existing 3G services, but it is still unclear what the capacity of 4G will hold for the mobile world. Some of the applications of 5G networks are;

- [1]. Education: For people who are interested in lifelong education, 4G provides a good opportunity. People anywhere in the world can continue their education through online in a cost effective manner.
- [2]. Crisis management: Natural disasters can cause breakdown in communication systems. In today's world it might take days or weeks to restore the system. But in 4G it is expected to restore such crisis issues in a few hours.
- [3]. Virtual Presence: This means that 5G provide user services at all times, even if the user is off-site. Virtual navigation: 4G provides users with virtual navigation through which a user can access a database of the streets, buildings etc. of large cities. This requires high speed data transmission.
- [4]. Security: This layer also branches across all the layers of the 5G network architecture which perform the function of authentication, authorization, encryption, establishment and implementation of service policy agreement between the various vendors.
- [5]. Tele-Medicine: 5G will support remote health monitoring of patients. A user need not go to the hospital instead a user can get videoconference assistance for a doctor at anytime and anywhere.
- [6]. Tele-geo processing applications: This is a combination of GIS (Geographical Information System) and GPS (Global Positioning System) in which a user can get the location by querying.
- [7]. Artificial Intelligence: More applications combined with artificial intelligent (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones.
- [8]. Travelling: Introducing the launch of new mobile phone apps; the use of Bluetooth & NFC technology integrated smartphones in the passenger travel process. Technology is likely to play a role in re-ordering these phases over the next decade, allowing, for example, people to experience a destination virtually before transit, or to seek inspiration and share information live, while they are travelling and experiencing a place.

9.Threats Of 5g Implementation

The Following Threats Are Expected From The Application Implementation Of 5G Network As A Future System.

- I). Since All The Network Operators And Service Providers Would Share A Common Core Network Infrastructure, Compromise Of A Single Operator Will Lead To The Collapse Of The Entire Network Infrastructure, If Not Carefully Guide Against.
- Ii). Third-Parties Can Masquerade As Legitimate Users Resulting In Theft Of Service And Billing Frauds Can Easily Arise.
- Iii). Since 5G Is A Secure IP Based Solution It Will Be Vulnerable To All The Security Threats As The Current Internet World.

Application Layer	Application(Services)
Presentation Layer	
Session Layer	Open Transport Protocol
Transport Layer	
Network Layer	Upper Network Layer
	Lower Network Layer
Data link Layer	Open Wireless Architecture
Physical Layer	

Table 2: OSI Layers in 5G Terminal Design.

Iv).On The Lines Of Email-Spam, The Spam Over Internet Telephony (SPIT), The New Spam Over Voip May Become Serious And Become Serious Threats.

V). Spooling Attacks Can Lead To Misdirected Communication And Internet Banking Related Frauds.

Vi).Eavesdropping And Interception Of Private Communications.

Vii). Phishing Attacks, Stealing Bank Account Details And Other Secured Information, Are More Likely.

10.Layers Of 5g Networks

As stated earlier, 5G will be completely user centric i.e. nothing is hidden from user. It will have new error prevention schemes that can be installed through internet anytime and have modulation methods and software defined radios.[25]5G will be a collaboration of networks and individual network handle user mobility. This network will be based on Open Wireless Architectures as it has Physical Access Control Layer i.e. OSI Layer. OSI layer are shown in table 2.

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