5G Mobile Technologies of Wireless Communication-Challenges & Opportunities

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Abstract: The successful shift to next generation networks can only be achieved through strong industry-wide collaboration. A new revolution of 5G technology is about to begin because 5G technology going to give tough completion to normal computer and laptops whose marketplace value will be effected. 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 in affordable rates, high peak future and much reliability than its preceding technologies. In this briefly discussed to new challenges and opportunities and comparison of generations of Systems.

Key words: Transmission, Electromagnetic, Bluetooth, Multimedia.

I. INTRODUCTION

Mobile wireless technologies provides voice and data communication services to mobile users who use Smart phones, PDAs, Internet terminals, and related computing devices. The term wireless communication was introduced in the 19th century and wireless communication technology has developed over the subsequent years. It is one of the most important mediums of transmission of information from one device to other devices.

In this technology, the information can be transmitted through the air without requiring any cable or wires or other electronic conductors, by using electromagnetic waves like IR, RF, satellite, etc. In the present days, the wireless communication technology refers to a variety of wireless communication devices and technologies ranging from smart phones to computers, tabs, laptops, Bluetooth Technology, printers.

II. TYPES OF WIRELESS COMMUNICATIONS

Name	Description
Satellite Communication	Satellite communication is one type of self contained wireless communication technology; it is widely spread all over the world to allow users to stay connected almost anywhere on the earth. When the signal is sent near the satellite then, satellite amplifies the signal and sent it back to the antenna receiver which is located on the surface of the earth.
Infrared Communication	Infrared wireless communication communicates information in a device or systems through IR radiation. IR is electromagnetic energy at a wavelength that is longer than that of red light. It is used for security control, TV remote control and short range communications. In the electromagnetic spectrum, IR radiation lies between microwaves and visible light.
Broadcast Radio	The first wireless communication technology is the open radio communication to seek out widespread use, and it still serves a purpose nowadays. Handy multichannel radios permit a user to speak over short distances, whereas citizen's band and maritime radios offer communication services for sailors.
Microwave Communication	is an effective type of communication, mainly this transmission uses radio waves, and the wavelengths of radio waves are measured in centimeters. The main disadvantage of microwave signals is, they can be affected by bad weather, especially rain.
Wi-Fi	Wi-Fi is a low power wireless communication, that is used by various electronic devices like smart phones, laptops, etc. In this setup, a router works as a communication hub wirelessly.
Mobile Communication Systems	The advancement of mobile networks is enumerated by generations. Many users communicate across a single frequency band through mobile phones. Cellular and cordless phones are two examples of devices which make use of

	wireless signals.
Bluetooth Technology	The main function of the Bluetooth technology is that permits you to connect a various electronic devices wirelessly to a system for the transferring of data. Cell phones are connected to hands free earphones, mouse, wireless keyboard. By using Bluetooth device the information from one device to another device.

Table 1

A. Advantages & Disadvantages of wireless communication

- Any data or information can be transmitted faster and with a high speed
- Maintenance and installation is less cost for these networks.
- The internet can be accessed from anywhere wirelessly
- It is very helpful for workers, doctors working in remote areas as they can be in touch with medical centers.
- An unauthorized person can easily capture the wireless signals which spread through the air.
- It is very important to secure the wireless network so that the information cannot be misused by unauthorized users

B. Applications of wireless communication

Applications of wireless communication involve:

- Security systems
- Television remote control,
- Wi-Fi
- Cell phones
- Wireless power transfer
- Computer interface devices
- Various wireless communication based projects.

III. MOBILE MULTIMEDIA

Multimedia-enabled mobile devices such as smart phones and tablets are becoming the day-to-day computing device of choice for users of all ages; everyone expects that all mobile multimedia applications and services should be as smooth and as high-quality as the desktop experience. The grand challenge in delivering multimedia to mobile devices using the Internet is to ensure the quality of experience that meets the users' expectations, within reasonable costs, while supporting heterogeneous platforms and wireless network conditions. Mobile devices are becoming the most frequently used terminal to access the information through the Internet and social networks. More and more multimedia content is spreading over the network of mobile devices. This area is concerned with intelligent multimedia techniques to facilitate effort-free multimedia experiences on mobile devices, including media acquisition, editing, sharing, browsing, management, search, advertising, and related user interface.

IV. 5G MOBILE TECHNOLOGY

None of the arising user needs that we outlined before can be met by any of the wireless technologies within the scope of the current standardization and network evolution frameworks. Satellite offers the wide broadcast coverage and high bandwidth but is challenged by latency for some applications, expense and saturation in areas with high user density, whereas terrestrial mobile achieves the connectivity to indoor and ground-mobile users but is economically challenged when user density is sparse or intermittent. It is thus necessary to research and develop new architecture concepts and technologies for accessing and delivering ultra-reliable, fast, ubiquitous, dependable and secure wireless services, as well as rethinking network services and their capabilities, in terms of identity, mobility, trace preventing and connection management, while taking advantage of the faster-than-Moore's law affordability growth of storage for end user media caching with suitable content management.

5G Technology stands for 5th Generation Mobile technology. 5G mobile technology has changed the means to use cell phones within very high bandwidth. User never experienced ever before such a high value technology. Nowadays mobile users have much awareness of the cell phone (mobile) technology. The 5G technologies include all type of advanced features which makes 5G mobile technology most powerful and in huge demand in near future.
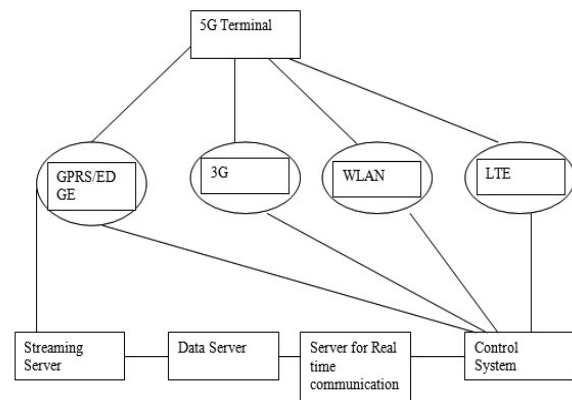

Fig. 1 ARCHITECTURE OF 5G

The gigantic array of innovative technology being built into new cell phones is stunning. 5G technologies which is on hand held phone offering more power and features than at least 1000 lunar modules. A user can also hook their 5G technology cell phone with their Laptop to get broadband internet access.

5G technology including camera, MP3 recording, video player, large phone memory, dialing speed, audio player and much more you never imagine. For children rocking fun Bluetooth technology and Piconets has become in market.

Features of 5G Technology

The following points briefs the features of 5G technologies

- 5G technology offer high resolution for crazy cell phone user and bi-directional large bandwidth shaping.
- The advanced billing interfaces of 5G technology makes it more attractive and effective.
- 5G technology also providing subscriber supervision tools for fast action.
- The high quality services of 5G technology based on Policy to avoid error.
- 5G technology is providing large broadcasting of data in Gigabit which supporting almost 65,000 connections.
- 5G technology offer transporter class gateway with unparalleled consistency.
- The traffic statistics by 5G technology makes it more accurate.
- Through remote management offered by 5G technology a user can get better and fast solution.
- The remote diagnostics also a great feature of 5G technology.
- The 5G technology is providing up to 25 Mbps connectivity speed.
- The 5G technology also support virtual private network.
- The new 5G technology will take all delivery service out of business prospect
- The uploading and downloading speed of 5G technology touching the peak.
- The 5G technology network offering enhanced and available connectivity just about the world
- Widely used to GSMA boards and committees, industry workshops, Mobile World.
- Education and rural development is the main features of 5G.
- This will also used to broadcast of forest and water management.
- Also used to fast development of mobile apps like game, educational, social networks and weather.

V. THE COMPARISON BETWEEN 1G Vs 2G Vs 3G Vs 4G Vs 5G

Generation (1G,2G,3G,4G,5G)	Definition	Through put/ Speed	Technology	Time period	Features
1G	Analog	14.4 Kbps (peak)	AMPS, NMT,TACS	1970 – 1980	During 1G Wirelessphones are used for voice only.
2G	Digital Narrow band circuit data	9.6/14.4 Kbps	TDMA ,CDMA	1990 to 2000	2G capabilities are achieved by allowing multiple users on a single channel via multiplexing.
2.5G	Packet Data	171.2 Kbps(peak)	GPRS	2001-2004	In 2.5G the internet becomes popular and
		20-40 Kbps			data becomes more relevant.2.5G
3G	Digital Broadb and Packet Data	3.1 Mbps (peak) 500-700 Kbps	CDMA 2000 (1xRTT, EVDO) UMTS, EDGE	2004-2005	3G has Multimedia services support along with streaming are more popular.
3.5G	Packet Data	14.4 Mbps (peak) 1-3 Mbps	HSPA	2006 – 2010	3.5G supports higher throughput and speeds to support higher data needs of the consumers.
4G	Digital Broadb and Packet All IP Very high throughput	100-300 Mbps (peak) 3-5 Mbps 100 Mbps (Wi-Fi)	WiMax LTE Wi-Fi	Now (Read more on Transitioning to 4G)	Speeds for 4G are further increased to keep up with data access demand used by various services.
5G	Not Yet	Probably gigabits	Not Yet	Soon (probably 2020)	Currently there is no 5G technology deployed. When this becomes available it will provide very high speeds to the consumers.

VI. CHALLENGES IN 5G TECHNOLOGIES

5G technologies will change the way most high-bandwidth users access their phones. With 5G pushed over a VOIP-enabled device, people will experience a level of call volume and data transmission never experienced before.5G technology is offering the services in Product Engineering, Documentation, supporting electronic transactions (e-Payments, e-transactions) etc.

A. Evolution of standards

Wireless communication standards have seen a rapid and multidirectional evolution since the start of the cellular era in the 1980s with the launch of the analogue cellular systems. Soon after, digital wireless communication systems emerged in a quest to satisfy mobility, quality of service and ever-growing data. Despite the large variety of existing communication systems, each development has been motivated by the same goal: to provide universal service facilities to users, while maintaining or increasing profitability. Backward compatibility, technology- and site-sharing, and convergence are key technological elements that — jointly with adequate regulatory

agreements — will enable ubiquity of communications on a highly personalized level. The vision of a 5G wireless communication system is one of universally deployable converging technologies that will enable wireless services and applications at a data rate of more than one terabit per second, with coverage extending from a city, to a country, to the continents and to the world that will enable user-centric mega-communications.

B. Myriad services

The challenges faced by standardization in relation to the next-generation wireless communication system (that is, 5G) are multifold. They are determined by the complexity of the emerging user and usage scenarios for which 5G must provide myriad high-quality services. Unlike single-purpose wireless systems, 5G will have the hard task of operating an ever-growing number of heterogeneous networked devices that can communicate with each other or with people or robots to satisfy dynamic and high-level user expectations. The efficient wireless communication system that is needed will be able to follow the user regardless of location, and be able to adapt its traffic capabilities on demand in order to satisfy user and service requirements. Standardization work faces the tough challenge of responding to the high public demand for universal, dynamic, user-centric and data-rich wireless applications. The user-centric concept here also includes protection of privacy and maintenance of trust.

C. Technological requirements

Both standardization and technology developers are facing the challenge of diverse 5G technological requirements carrying equal weight in the provision of 5G services and applications. Technological solutions for 5G should make it possible to eradicate or, at least, control the potentially dangerous aspects of ubiquitous communication, in particular those related to security, trust and the protection of personal data. Technological solutions should also offer reliability and dependability. Thus, 5G standardization must define uncertainties relating, for example, to new threats to cybersecurity, trust or privacy; trends in economic growth around the world; public acceptance of wireless and applied-field technologies; and legislative restrictions. These uncertainties then have to be taken into account in regard to long-term trends in technological innovation, such as the increase in distributed computing, the new forms of ultra-fast wireless connectivity, miniaturization and automation, and an increasing focus on cost containment.

D. Communication, navigation, sensing and services

Convergence of technologies, ultra-high capacity, universal coverage and maximal energy and cost-efficiency are key characteristics of the 5G wireless system concept. The enabling technologies converging into the 5G wireless system concept are communication, navigation, sensing and services. A determining factor for the first three is the availability of radio spectrum, through which information can be transmitted in relation to the service requested. Cognitive radio relies on sensing for better exploitation of the available spectrum, while high-frequency millimetre-wave bands used in terrestrial and

satellite communications are able to satisfy the 5G capacity requirements and represent a solution to the limited availability of radio-frequency spectrum.

E. G business case

The 5G wireless communication system should seamlessly bridge the virtual and physical worlds, offering the same level of all-senses, context-based, rich communication experience over fixed and wireless networks. Because 5G will be a plethora of interworking technologies governed by separate specifications, it is important to find technological solutions and standardize interconnectivity in order to enable end-to-end telecommunication service provision across technologies and operators. The successful 5G business case must adopt an active integration strategy that merges the different realms of the enabling technologies with new business opportunities. Standardization then becomes an enabler for both a successful technological and business concept.

F. Academic role

5G standardization faces the task of bundling multi-radio, multi-band air interfaces to support portability and nomadic mobility in a dynamic ultra-high data rate communication environment using novel concepts and cognitive technologies. Here, academic research and participation in standardization can play a crucial role. Standardization work should also recognize the specifics of the scenarios in various world regions in order to stimulate profitable deployment and higher penetration worldwide.

VII. 5G TECHNOLOGY REQUIREMENTS

As a result of this blending of requirements, many of the industry initiatives that have progressed with work on identify a set of eight requirements:

- 1-10Gbps connections to end points in the field (i.e. not theoretical maximum)
- 1 millisecond end-to-end round trip delay (latency)
- 1000x bandwidth per unit area
- 10-100x number of connected devices
- (Perception of) 99.999% availability
- (Perception of) 100% coverage
- 90% reduction in network energy usage
- Up to ten year battery life for low power, machine-type devices

5G is an opportunity to develop a more sustainable operator investment model

If previous generations of mobile technology have taught us anything, it is it that, as with each preceding generation, 5G will unlock value in ways we cannot and will not anticipate. Services that were initially expected to have a negligible impact became hugely popular (e.g. SMS), while those expected to be the 'next big thing' have been slow to gain traction (e.g. video calling). Through the development of 5G, we as an industry can expect a paradigm shift in the way that all of the stakeholders in the mobile ecosystem play their role. Regulators especially can use this as an opportunity to create healthier

environments that stimulate continuing investment in next generation technology. Some of the business cases that have worked well for 3G and 4G technologies may not be the right ones for 5G. By actively conceiving and exploring 5G business cases at an earlier stage, operators will have greater potential to shape the new paradigm.

The GSMA will continue to work with its members to shape the future of 5G

Whichever form 5G eventually takes, the GSMA, as the association representing the mobile industry, looks forward to contributing to the development of a 5G ecosystem through collaboration and thought leadership. The GSMA's focus is on:

- GSMA Intelligence Understanding 5G
- working with its operator members to identify and develop commercially viable 5G applications
- collaborating in the work being undertaken in terms of research, development and definition of 5G technologies by industry groups such as 3GPP, NGMN and ITU-R, and contributing to the various working groups in these areas
- Identifying requirements around roaming and interconnect
- Driving the development of the regulatory framework for 5G by identifying suitable spectrum bands for its operation, and working with governments around the world to ensure international alignment within those bands
- Creating a forum for relevant parties to discuss 5G through e.g. GSMA boards and committees, industry workshops, Mobile World Congress etc.

The successful shift to next generation networks can only be achieved through strong industry-wide collaboration. The GSMA will continue communicating through subsequent papers to influence the strategic direction of 5G development, as the business case and technical requirements for 5G become clearer. In order to realise the immense opportunity that 5G represents for the industry, the GSMA will do all it can to ensure that the next generation of telecommunications deliver innovation and consumer benefits in an economically viable way.

VIII. CONCLUSION

5G technology is going to be a new revolution in wireless system market. The 5G mobile communications Challenges and opportunities identified. In this disused foreseen challenges such as high-data rate, accessibility, mobility, massive amount of devices, low latency and reliability. The integration of the new radio concepts such as Massive MIMO, Ultra-Dense Networks, Moving Networks, Direct Device-to-Device Communication, Ultra-Reliable Communication, and Massive Machine Communication, and others, and the exploitation of new spectrum bands will allow to support the expected dramatic increase in the mobile data volume while broadening the range of application domains that mobile communications can support beyond 2020. 5G will promote concept of super core, where all the network operators will be connected one single core and have one single infrastructure, regardless of their access technologies.

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