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Pandect of 5g Communication Technology in Context with Some Latest Researches

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----------ABSTRACT----------
This paper represents the overview of the 5G telecommunication features till date. It incorporates all the technological advancements from 0g to 5G. This paper deals with the evolution in the technology since 1970s.
1G to 5G telecommunication world has seen many improvements and advancements. user feedback mainly incorporates aspect of speed and data bandwidth. Hence the best feature of 5G is very high speed and unmatched data bandwidth which the user never exercised before.
The forthcoming technology will not only have the core network as internet but will also support IPv6 and flat IP .the fifth generation will offer many exquisite kind of services like documentation supporting electronic transactions. Hence we throw some light on the overview of the latest advanced and most popular technology by providing some of the latest and basic researches across the globe.
Keyword: *5G, bandwidth,1G, 2G 3G 4G, data rates, switching schemes.*

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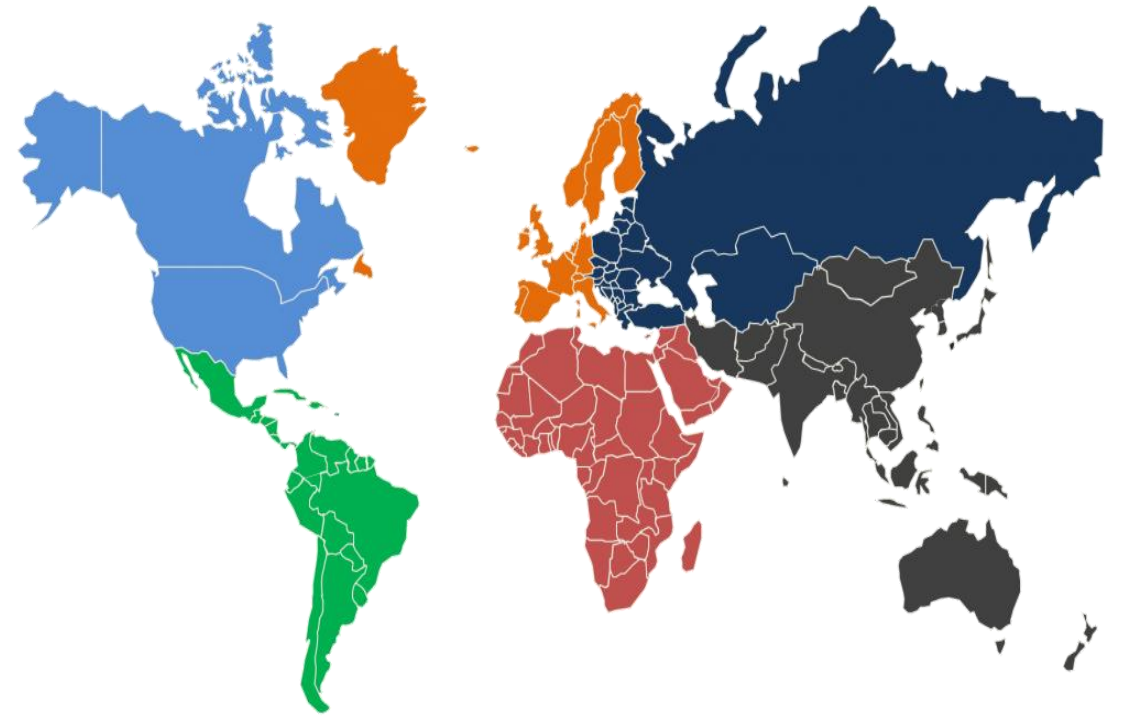
I. INTRODUCTION

Cellular generations differ in four main aspects: radio systems, data rates, bandwidth, and switching schemes.[1] If we're all to use our mobile stuff and play anywhere, we want streaming services and all our things instantly on device as small as a Smartphone or as large as the screen in the auditorium.[3] We're socially networked, 24 hours per day and that too 7 days a week. We want to share the versions of our stuff-photos, videos, data, whatever- with friends, colleagues, and customers-wherever they may be.[3] In the same way we don't buy software applications we don't need instead we rent applications we need to process our data for as long as we need them. This need for high speed connectivity is the common denominator as we look ahead to fifth generation or 5G mobile networks.[3] 5G offers enormous potential for both consumers and industry. As well as the prospect of being considerably faster than existing technologies, 5G holds the promise of applications with high social and economic value . The upcoming society, which might be termed as hyper connected society, will lead to mobile playing the most important role in one's life.[6] 5G as a consolidation of 1G, 2G, 3G, 4G, Wi-Fi and some other inventions is far more reliable and has greater coverage due to greater bandwidth. 5G is going beyond just voice and data. 5G technology will change the manner in which cellular plans are offered worldwide. A new revolution will soon begin. Fifth generation technology offers tremendous data capabilities and unrestricted call volumes and infinite data broadcast together within the latest mobile operating systems. Fifth generation would be more intelligent technology that interconnects the entire world without limits. This generation is expected to be released around 2020. The world of universal, uninterrupted access to information, entertainment and communication will open new dimensions to our lives and change our lifestyle significantly.

II. EVOLUTION

From generation 1G to 2.5G and from 3G to 5G this world of telecommunication has seen a number of improvements along with improved performance with each passing day. In this era of communication fifth generation technology offers very high bandwidth that users never experienced before with various advanced features. Wireless communication started in early 1970s. In next four decades a mobile wireless technology has evolved from 1G to 5G generations. In this era of communication, fifth generation of technology offers very high bandwidth that users never experienced before with various advanced features.[5] In early 1980s wireless communication started with '0g' popularly known as radio wireless transmission technology which later evolved to 0.5G which had major improvements in voice clarity.[2] Later through major scientific research and hard work evolved the grand improvement known as 1st generation technology which provided data transfer facilities. It worked on analogue signals.

2nd generation acted revolutionary in wireless communication. It evolved in late 1980s i.e. 1990s. It used digital signal processing and had a speed of 64 kbps. It provided users with SMS facility and much improved bandwidth of 30khz to 200khz. Next to 2G, 2.5G system uses packet switched and circuit switched domain and provided data rate up to 144 kbps.[5] 3rd generation used wide brand wireless network with which clarity is increased. The data is sent through the technology known as packet switching. It had new services known as global roaming. It operates at a range of 2100 mhz and has bandwidth of 15-20mhz used for high-speed internet service. Fourth generation offers a downloading speed of 10mbps.it is same as 3G but the additional features services like multimedia newspaper, to watch TV programs with far more clarity and with much faster speed. LTE is considered as 4G technology. Then the final stage of communication is 5G communication with very high speed internet connectivity and very high bandwidth.



North America	Latin America	Western Europe	Middle East & Africa	Central & Eastern Europe	Asia Pacific
• Mobile data traffic to grow 7.6 fold at a compound annual growth rate of 50% from 2013 to 2018 • Video traffic to account for 2 Exabytes per month by 2018 accounting for 67% of mobile data traffic followed by audio streaming at 14%	• Mobile data traffic to grow 12.8 fold at a compound annual growth rate of 67%; an increase from 76.8 in 2013 to 986 Petabytes in 2018 • 55% of mobile connections will be smart connections by 2018, increase by 14% from 2013	• Mobile data traffic to grow at a compound annual growth rate of 50% accounting for 7.7 fold from 2013 to 2018 • Smart phones to account for 57% of total mobile data traffic	• Mobile data traffic to grow 14.9 fold at a compound annual growth rate of 72% from 2013 to 2018 • Smart phones to account for 72% of total mobile data traffic amounting to 1.1 Exabytes per month by 2018	• Mobile data traffic to grow 13.5 fold at a compound annual growth rate of 68%; an increase from 101 Petabytes in 2013 to 1.4 Exabytes in 2018 • Video streaming to dominate mobile data traffic at 64% followed by audio at 8%	• Mobile data traffic to grow 13.5 fold at a compound annual growth rate of 68% from 2013 to 2018 • Smart phones to account for 75% of total mobile data traffic amounting to 2,645 megabytes per month by 2018

** Stats from VNI Mobile forecast 2014-2019*

http://www.subex.com/blog/wp-content/uploads/2015/03/World.png

COMPARISON OF ALL THE GENERATIONS OF MOBILE WIRELESS TECHNOLOGIES

Table1: This table shows the comparison between all the technological advancements

Technology /features	Start/ development	Data bandwidth	Technology	Service	Multiplexing	Switching
1G	It is the first gen technology that started in early 1970s and got established by late 1980s	It supported data bandwidth in 2kbps.	It worked on analog signals that is analog cellular technology	It is based on basic mobility that is basic telephony(voice calls)	FDMA	Circuit switching is used to interpret voice calls.
2G	It ranged from 1990 to 2004 for whole 14 years.	Bandwidth per frequency channel of 2G is 200khz. Generally it is 64kbps.	It is based on digital signals popularly known as digital cellular technology. It had no quality of service.	Digital voice, SMS, higher capacity packetized data	TDMA, CDMA	Circuit and packet
3G	It started in year 2004 and was termed as tri band 3G.	Bandwidth per frequency channel is 20mhz and the data bandwidth is 2mbps.	Cdma2000 (1*RTT,EVDO) UMTS,EDGE It also provided digital navigation.	Integrated high quality audio and video data. It also had seamless roaming. It had high data rates as well .	CDMA	Packet
4G	Now technically enabled and use d in certain nations. Still many countries are not in practice with 4G.development of 4G started in year 2000.	Bandwidth per frequency channel is up to 100mhz. Data bandwidth is technically 1Gbps in 4G communication.	Wi-Max LTE, Wi-Fi	4G provides dynamic information access, wearable devices . 4G provides high speed and high definition streaming and some additional features such as ultra broad band internet access which was not present in 3G .	CDMA	All packet
5G	It is still in the development phase. It will be evolved till 2020(as expected).	Bandwidth per frequency channel is 28 GHZ and the data bandwidth is more than 1Gbps.	WWWW (wireless world wide web)	It provides virtual private network. It provides virtual private network and bidirectional large bandwidth shaping. It provides dynamic information access wearable devices with artificial intelligence capabilities. Based on internet protocol ipv6. It can unlimited parties simultaneously. It has a core network of internet.	CDMA	All packet

RESEARCH

Key concepts suggested in scientific papers discussing 5G and beyond 4G wireless communications are:

IEEE Spectrum has a story about millimeter wave wireless communications as a viable means to support 5G .

- Radio propagation and channel models for millimeter wave wireless communications may be found in IEEE papers: Millimeter Wave Mobile Communications for 5G Cellular: It Will Work!" in IEEE Access, Vol. 1, May 2013; "Broadband Millimeter-Wave Propagation Measurements and Models Using Adaptive-Beam Antennas for Outdoor Urban Cellular Communications, in IEEE Trans. Antennas and Propagation, April 2013, and many other peer-reviewed conference and journal papers. Pearson/Prentice Hall has released a comprehensive text on "Millimeter Wave Wireless Communications," authored by Ted Rappaport, R. W Heath, Jr., Robert Daniels, and James Murdock. This text, over 700 pages in length, covers technical areas regarding potential 5G technologies, including major global 60 ghz wireless local area network (WLAN) and personal local area network (WPAN) standards.
- Massive Dense Networks also known as Massive Distributed MIMO providing green flexible small cells 5G Green Dense Small Cells. A transmission point equipped with a very large number of antennas that simultaneously serve multiple users. With massive MIMO multiple messages for several terminals can be transmitted on the same time-frequency resource, maximizing beam forming gain while minimizing interference.[10][11][12][13]

- Advanced interference and mobility management, achieved with the cooperation of different transmission points with overlapped coverage, and encompassing the option of a flexible usage of resources for uplink and downlink transmission in each cell, the option of direct device-to-device transmission and advanced interference cancellation techniques.[14][15][16]
- Pervasive networks providing Internet of things, wireless sensor networks and ubiquitous computing: The user can simultaneously be connected to several wireless access technologies and seamlessly move between them. These access technologies can be 2.5G, 3G, 4G, or 5G mobile networks, Wi-Fi, WPAN, or any other future access technology. In 5G, the concept may be further developed into multiple concurrent data transfer paths.[17]
- Multi-hop networks: A major issue in beyond 4G systems is to make the high bit rates available in a larger portion of the cell, especially to users in an exposed position in between several base stations. In current research, this issue is addressed by cellular repeaters and macro-diversity techniques, also known as group cooperative relay, where also users could be potential cooperative nodes thanks to the use of direct device-to-device (D2D) communications.[9]
- Wireless network virtualization: Virtualization will be extended to 5G mobile wireless networks. With wireless network virtualization, network infrastructure can be decoupled from the services that it provides, where differentiated services can coexist on the same infrastructure, maximizing its utilization. Consequently, multiple wireless virtual networks operated by different service providers (sps) can dynamically share the physical substrate wireless networks operated by mobile network operators (mnos). Since wireless network virtualization enables the sharing of infrastructure and radio spectrum resources, the capital expenses (capex) and operation expenses (opex) of wireless (radio) access networks (rans), as well as core networks (cns), can be reduced significantly. Moreover, mobile virtual network operators (mvnos) who may provide some specific telecom services (e.g., voip, video call, over-the-top services) can help mnos attract more users, while mnos can produce more revenue by leasing the isolated virtualized networks to them and evaluating some new services.[18]
- Cognitive radio technology, also known as smart-radio: allowing different radio technologies to share the same spectrum efficiently by adaptively finding unused spectrum and adapting the transmission scheme to the requirements of the technologies currently sharing the spectrum. This dynamic radio resource management is achieved in a distributed fashion, and relies on software-defined radio.[19][20]
- Dynamic Adhoc Wireless Networks (DAWN),[7] essentially identical to Mobile ad hoc network (MANET), Wireless mesh network (WMN) or wireless grids, combined with smart antennas, cooperative diversity and flexible modulation.[8]
- Vander monde-subspace frequency division multiplexing (VFDM): a modulation scheme to allow the co-existence of macro-cells and cognitive radio small-cells in a two-tiered LTE/4G network.[21]
- Ipv6, where a visiting care-of mobile IP address is assigned according to location and connected network.[17]
- Wearable devices with AI capabilities.[7] such as smart watches and optical head-mounted displays for augmented reality
- One unified global standard.[7]
- Real wireless world with no more limitation with access and zone issues.[17]
- User centric (or cell phone developer initiated) network concept instead of operator-initiated (as in 1G) or system developer initiated (as in 2G, 3G and 4G) standards[22]
- Li-Fi (a portmanteau of light and Wi-Fi) is a massive MIMO visible light communication network to advance 5G. Li-Fi uses light-emitting diodes to transmit data, rather than radio waves like Wi-Fi.[23]
- World Wide Wireless Web (WWWW), i.e. Comprehensive wireless-based web applications that include full multimedia capability beyond 4G speeds.[7]

III. OPPORTUNITIES FOR FURTHER EVOLUTION OF LTE

As a technology, LTE continues to develop . Operators are already making a considerable amount of progress in increasing the data speeds of their existing networks by adopting dual carrier LTE-A technologies, which can achieve theoretical downlink speeds of up to 300 Mbps. As of October 2014, some of the 22 operators had already launched LTE-A .LTE-A should be able to meet the mobile broadband demand (in terms of speed) for several years to come and will provide operators with increasing opportunities' to develop attractive and profitable 4G services. In addition, 3GPP is also working on optimizing congestion control for more efficient use of M2M on LTE networks.[6]

Why we need 5G?

5G is the wireless communication technique with very high speed, high capacity and has low cost per bit. It also supports interactive multimedia, voice, video, internet, and other broadband services, more effective and more attractive and has bidirectional and accurate traffic statistics. It also provides us with service portability facility as well as global access. It is the evolution of 4G communication so it offers very high error tolerance due to which it provides high quality services. It will surely provide large broadcasting capacity up to gigabit which might be supporting almost 65000 connections at a time. It directly uses remote management technology that user can get better and faster solutions. The downloading speed is very high due to very high data bandwidth. It also offers very high resolution for crazy cell phone users and bidirectional large bandwidth

shaping. It has unparallel consistency and majorly operators are working to provide latency less than 1ms.upcoming 5G technology will be the most important and fastest technology of the wireless communication world. It is a real wireless world with no more limitation with access and zone issues. It has core network internet. Hence it is the best technology till date in wireless communication fields and trends.[4][5]

The major difference from a user point of view between the current generations and expected 5G techniques must be something else than increased maximum throughout: other requirements include:[1]

- Lower battery consumption[1]
- Lower outage probability; better coverage and high data rates available at cell edge[1]
- Multiple concurrent data transfer paths[1]
- Around 1Gbps data rate in mobility.[1]
- More secure; better cognitive radio/SDR security.[1]
- Higher system level spectral efficiency.[1]
- Not harmful to human health.[1]
- Cheaper traffic fees due to low infrastructure development costs.[1]
- More applications combined with artificial intelligence (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones.[1]
- The most important of all Worldwide Wireless Web (WWWW), wireless based web applications that include full multimedia capability beyond 4G speeds.[1]

5G is to be new technology that will provide all the possible applications, by using only one universal device, and interconnecting most of the already existing communication infrastructures. The 5G mobile networks will focus on the development of the user terminals where the terminals will have the access to different wireless technologies at the same time and will combine different flows from different technologies.[1]

IV. CONCLUSION

In this paper we propose 5G mobile phone concept which is the main contribution of the paper.

This paper also focuses on the comparison of the latest technology with the technology used earlier like 1G, 2G, 3G and 4G.a new revolution is about to begin because the this mobile technology as it will give tough competition to normal computers and laptops which in turn will affect their sales.

5G technology will open up the new era in mobile communication technology. The 5G phones will the access to different wireless technologies at the same time. It offers high resolution for crazy cell phone users. It has cleared all the marks and barriers of internet connectivity and speed.[2]

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