5G Technology and How it will Boost IOT: A Survey

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Abstract: **In the near future smart devices will operate on ultra fast data speed with a peak of about 1000GB per second and that will be possible due to Fifth-generation (5G) broadband Technology. By 2020 it is assumed that the number of digital devices will increase dramatically to around 50 billion and much of which will be connected.The 5G technology will provide better bandwidth , cloud based storage, less jitter due to built in computing intelligence which will handle the data and series of connected devices and services efficiently[1]. In this paper we will see how 5G technology is different from 3G and 4G technology and how 5G is useful in various emerging applications of IoT like health care,Traffic control,Infrastructure, Automative and Mobility etc.**

Keywords: 3G , 4G , 5G , IoT.

I. INTRODUCTION

In last 20 years the world is witnessing rapid evolution in wireless technologies and the motivation comes from the increasing demand for bandwidth and lower latency. The technology evolved from Cellular technology of 2G Global system for Mobile (GSM) to 4G Evolution-Advanced system(LTE-A). The various factors which are taken into consideration for evolution in technology were jitter, connectivity of devices, Channel interference, scalability , energy-efficiency and compatibility with other networks. The world is demanding completely wireless and uninterrupted access to information anywhere and anytime at better quality and low cost. To satisfy this need, 5G will play an important role. Now it is assumed that by 2020 there will be dramatic increase in digital devices which will be connected to a global IP network. These devices will operate on ultra high speed technology which is called 5G Broadband Technology[2]. The distinctive feature of 5G will be

- a super efficient mobile network
- a super fast intelligent mobile network
- a super fiber-wireless network
- low latency
- back-end services
- World Wide Wireless Web (WWWW)
- Wide range of applications
- Faster response time
- Ubiquitous connectivity

I Comparison of various Technologies [3]

5G	4G	3G	Technology Features
2020(Probably)	2013	2004	DEPLOYMENT
IP broadband LAN/WAN/PAN/WWWW	LTE-TDD, LTE-FDD	UMTS,CDMA2000, TD-SDMA	STANDARDS
1 - 10 GBPS	100MBPS	384KBPS - 2MBPS	SPEED
3 to 300 GHZ	2- 8 GHZ	1.8 - 2.5 GHZ	FREQUENCY
1000X per unit area	5- 20 MHZ, optionally up to 40 MHZ	5 - 20 MHZ	BANDWIDTH
100MBPS	Up to 20Mbps or more	Up to 2Mbps	DATA RATES
LTE based OFDM	Multi carrier-CDMA or FDMA	Wideband CDMA	ACCESS
Connect people and devices anywhere anytime, Traffic control Infrastructure,Remote diagnostic, Visualizing universe, galaxies.	Mobile web access, IP technology,DVB, Wearable devices, smooth handover across heterogeneous networks.	Wireless voice technology, high speed internet access, video calls, navigation maps etc.	SERVICES

II. CHALLENGES AND KPI OF 5G

One of the key driver for the development of 5G infrastructure is the growing ecosystem of things around the end user which will produce and consume the data. 5G technology will be able to serve billions of connected devices in a single network and will address the Growing IoT market need.[9]

The above mentioned technology will have to meet some Key Performance indicators(KPIs) and also have to deal with the challenges.[10]

KPIs:
- Throughput: Should provide 1000x more available data throughput in aggregate.
- Latency: Provide service level latency down to 1ms.
- Energy efficiency: Future 5G network should meet requirement and challenges in energy efficient manner.
- Service creation time: Enable the creation of user from the application in a matter of seconds.
- Battery Lifetime: Provide 10x better battery lifetime for low throughput solutions such as sensors.
- Coverage: provide seamless coverage of 5G service anywhere anytime.

Challenges:
- QoS Challenge: 5G should provide differentiated services across various dimensions such as throughput, latency, cost per bit etc.
- Simplicity challenge : provide 5G user the best network services seamlessly without complex customer journey.
- Density challenge: increased number of devices should be connected in proximity.
- Mobility challenge: Support for unlimited seamless mobility across all networks/technologies.
- Open environment challenge: enable horizontal business models by opening the right business interfaces.
- Manageability:improve manageability of networks in order to reduce the need for manual management and reduce human involvement.

III. HOW 5G WILL ENABLE VARIOUS APPLICATIONS OF IoT

Internet of things (IoT) is a network of objects , machines, people and other devices that enables connectivity and communication to exchange data for applications and services[1]. The devices used by IoT are smartphone, tablets, vehicles, wearables, consumer electronics and sensors which are capable of IoT Communication.These devices will have different data requirement and the 5G network needs to support them all. Some applications of IoT and their high speed data requirement is discussed below.

A. e-Health care
With superfast connectivity , data capabilities and low latency 5G network will give new possibilities in health care sector which include imaging , data analytics and treatment[4]. IoT will provide various wearables and remote sensors and many other devices which will monitor and transmit data to the concerned person. IoT devices will also provide telemedicine diagnosis, treatments and high resolution video conferencing all at an affordable price. Few medical functions require high reliability and availability with very low latency which is just few milliseconds. 5G will make this possible and bring reliable and improved medical care. Today many applications require high bandwidth and reliable connectivity and all this will be the emerging 5G deployment cases.

B. Automotive and mobility
The 5G technology will boost the driver assistant system and in longer run autonomous driving cars which will promise less traffic congestion and less congested cities. The sensors will exchange the information in real time between thousands of cars connected in the same area. Most of the future predicted application cannot be implemented with today's communication system and hence there is a huge expectation with 5G[4]. For ex: one can envision tele-operated driving where a disabled individual could be driven with the help of a remote driver in areas where highly automated driving is not possible.

C. Media and Entertainment
Today media and entertainment data rate demands QOS as the number of users connected are increasing day by day. High quality and high resolution audio-visual services are the most important factor for increased downlink data rates and user generated content where as social media is the factor for higher uplink data rates[4]. In the near future 5G will seamlessly integrate different networks technologies including unicast , multicast and broadcast which will satisfy all Media and Entertainment requirements.

D. Energy
The Energy sector has developed over a decade but the demand side is largely separated from the supply side. With the rising cost of energy to end user and need of secured energy supply combined with environmental concerns, a major change is required in energy sector. The physical infrastructure will need to support a energy flow originating from the distributed energy resources which implies new need for communication technology. 5G will play a fundamental role to achieve this goal of energy sector.[4]

IV. CONCLUSION
The earlier technologies 2G-4G depends on so- called orthogonal multiple access. Such technologies will not be able to support IoT applications. In IoT we will have billions of devices and we have to assign different time slots and bandwidth to each device. This is why multiple orthogonal access won't work for 5G. Currently lot of research is going on how we can develop non-orthogonal multiple access by putting multiple users into a limited bandwidth.

Combination of technologies like non orthogonal multiple access , massive MIMO, cloud radio access networks, full duplexing etc. will solve the existing problem of spectrum crunch.

Special Issue - 2017

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
ICIATE - 2017 Conference Proceedings

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