Understanding Fifth Generation Communication and Internet of Things (IoT)

*Siddarth Kaul
**Anuj Jain
***Rajesh Saini

Abstract

The paper proposes to clearly elaborate the usefulness and necessity of IoT (Internet of Things) with 5G Communication. It is clearly known that the next generation networks and standards combine communication and computing together to put forward intelligent communication for the next generation. IoT (Internet of Things) requires extra care for its design from its various hardware of small objects, physical system, and network architecture. Various solutions of IoT (Internet of Things) have evolved from the traditional wireless networks and actuators and M2M communication in mission critical applications. The main aim of the paper is to understand the mission critical communication and availability and reliability of different smart objects in 5G communication by helping leverage the various key technology enablers like air interface and network architecture to help provide an overview to this new technology under development.

Keywords : Intelligent communication, Internet of Things (IoT), machine to machine communication

I. INTRODUCTION

Intelligent communication means the next level of communication beyond unified communication which involves the power of Artificial Intelligence and generation next 5G networks for powering communication beyond the service level enterprise working to intelligent level enterprise working. It is the next level of working of enterprise communication to combine relatively each platform to relatively one powerful platform which helps enterprise to achieve the goal of using one application for all its needs on a day to day basis.

II. INTERNET OF THINGS (IoT)

Internet of things means anytime, anywhere, anything - the physical devices at home or elsewhere to other devices to connect and exchange data [1]. The IoT relatively combines the embedded technologies with next generation communication networks for instant communication, IoT involves connectivity beyond standard devices like mobile, desktops, laptops to traditionally dumb, and non-networked devices to interact over the internet and be smartly controlled and monitored over apps.

III. HOW IoT WORKS

IoT (Internet of Things) consists of devices or the sensors based in devices which talk to hosted cloud of the devices over the internet once the data gets over the Cloud [2].The Cloud software processes it and then performs a set of actions by sending messages to the devices on which actions need to be performed.

Critical Uses of Internet of Things (IoT)

- ❖ Autonomous Vehicles
- ❖ UAV (Unmanned Ariel Vehicles) for advanced non-human warfare
- ❖ Responders and radar systems
- ❖ Robotic surgery

Manuscript received May 5, 2018; revised June 16, 2018; accepted June 17, 2018. Date of publication July 6, 2018.
*S. Kaul is Research Scholar withBhagwant University, Rajasthan, India - 305004. (email: siddarthkaul7@gmail.com)
**A. Jain is Assistant Professor with Department of Computer Science, Bhagwant University, Rajasthan, India - 305004. (email: a1978jain@gmail.com)
***R. Saini is Assistant Professor with Department of Computer Science, Government College Ateli, Haryana, India-12304. (email: rajesh.saini445@gmail.com)
DOI: 10.17010/ijcs/2018/v3/i4/131648

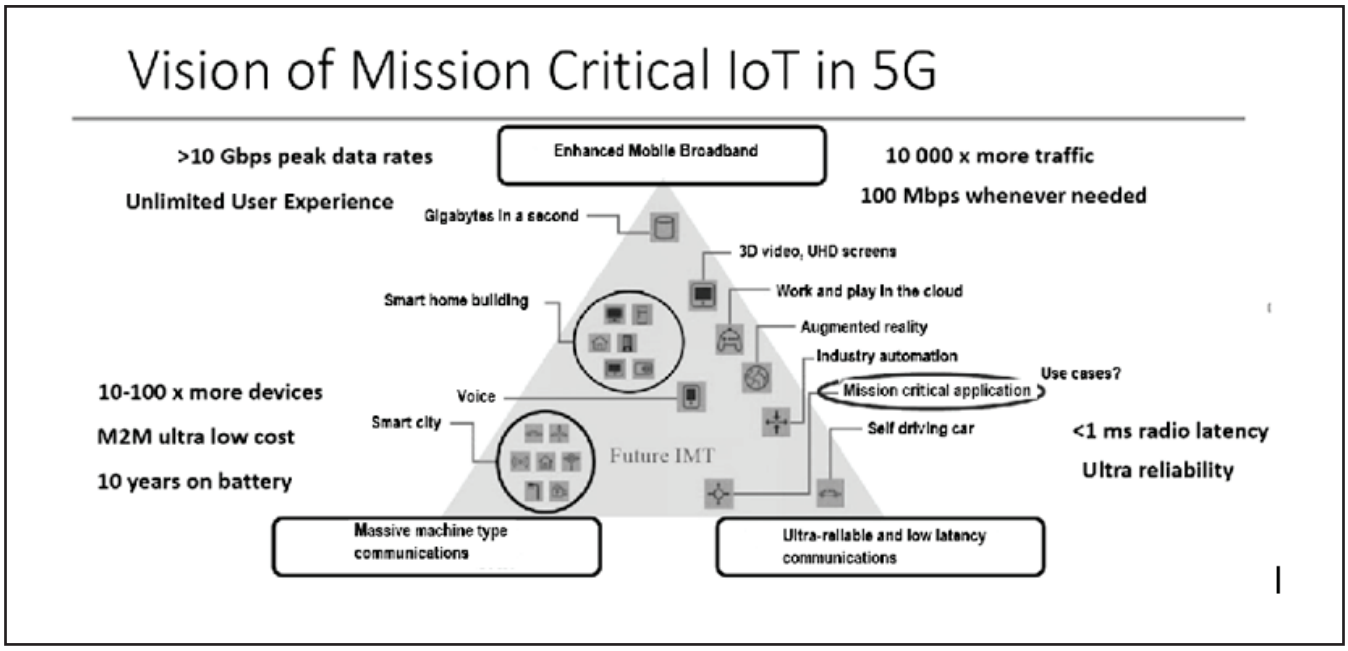

Fig.1. IoT Mission Critical Communication in 5G [3]

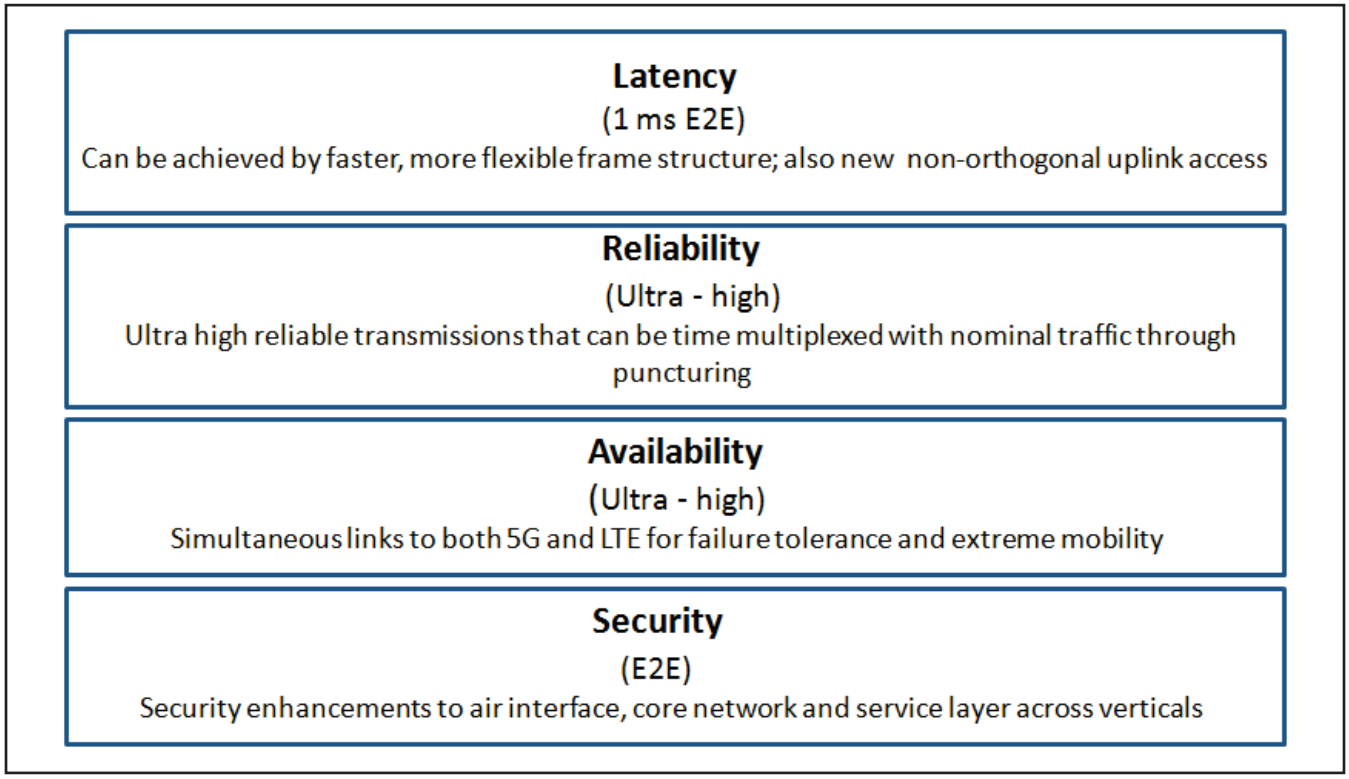

Fig.2. Factors for Critical IOT (Internet of Things Application) [3]

IV. RESEARCH OPPORTUNITIES IN INTERNET OF THINGS (IoT)

Advanced error coding can be applied to polar codes with Cyclic Redundancy Codes(CRC) to outperform Low Density Parity Checks (LDPC) [4].

Encoding and fast decoding algorithm can be used with short block size which is required to minimize latency. A better integration of Software Defined Networking(SDN) and Network Function Virtualization

(NFV) with edge networking should be studied considering the dynamic nature of components of the Fog.

V. NETWORK ARCHITECTURE FOR INTERNET OF THINGS

The use cases do have differentiated requirements for IoT in terms of reliability, latency, and others.

Network slicing is one of the key enabler technologies for the IoT (Internet of Things) concept. Each slice concept can be customized to match requirements for better network utilization.

Network slicing can leverage the Software Defined Networking(SDN), Network Function Virtualization (NFV), and other cloud technologies for providing an abstraction of the physical infrastructure to network programmability [5].

VI. FIFTH GENERATION COMMUNICATION

5G communication is expected to be the main driver for IoT as the 5G communication is expected to be unveiled soon[6]. It is built on the platforms of Long Term Evolution (LTE) and advanced LTE[7]. It is expected to carry Giga Byte data per second and almost 200 times faster than the present 4G Networks so you can expect Gbps (Giga Bytes Data Per second) anywhere relative to the location availability. As of now it looks to be

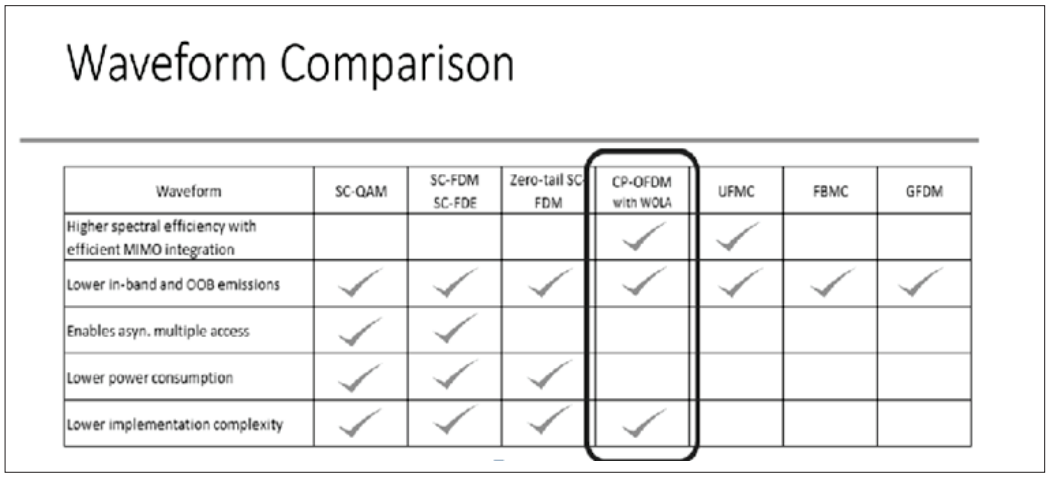

Fig.3. Waveform Comparisons [5]

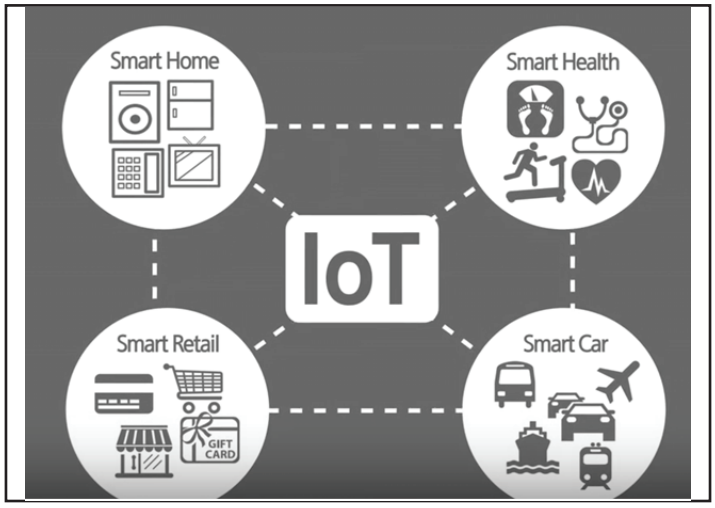

Fig.4. Illustration of 5G powering up IoT [12][13].

M2M	IoT
Point-to-point communication usually embedded within hardware at the customer site	Devices communicate using IP networks, incorporating with varying communication protocols
Many devices use cellular or wired networks	Data delivery is relayed through a middle layer hosted in the cloud
Devices do not necessarily rely on an internet connection	In the majority of cases, devices require an active internet connection
Limited integration options, as devices must have corresponding communication standards	Unlimited integration options, but require a solution that can manage all of the communications

Fig. 5. FM2M and IoT Difference [14]

commercialized by 2020. However, currently the maximum speed for advanced LTE is 225 Megabits per second. It is expected that once 5G is introduced, it would be possible to make 3D video calls and multimedia communications in advance 3D formats, 5G will be the foundation to Virtual reality, autonomous traffic driving and IoT [8].

It is also expected that once such lightning fast communication speed is achieved, IOT (Internet of Things) will be a reality powering Smart homes, Smart Health care, Smart Retail, and Smart Cars, a virtual reality of our day to day lives [9].

It is expected that new technologies like Millimeter waves, Small Cells , Massive Multiple Input – Multiple Output (MIMO), Beamforming, and Full Duplex will power the next generation 5G networks [10].

Network Slicing is also one of the techniques of creation of separate wireless networks on the cloud allowing respective users to use their own network, network slicing is a powerful capability of virtualization to allow different logical networks to be created on a physical infrastructure [11].It is expected that Network Slicing will help 5G to run with relatively low latency and power IoT (Internet of Things), mobile broadband, and high speed Intelligent communication.

VII. 5G KEY POINTS

1) Speeds up to 10 to 100 times faster than 4G and Advanced 4G LTE.

2) 4G antennas broadcast in all directions, 5G antennas will broadcast beams directly to devices [12].

3) 5G is relatively about super quick response times as compared to 4G and it will also use a new set of radio waves which are not used till today. It is expected to broadcast on shorter millimeter waves[13].

VIII. MACHINE TO MACHINE COMMUNICATION (M2M)

Machine to Machine (M2M) / IoT is going to be the next generation of communication connecting more and more devices to the internet, M2M will lead to a revolution by providing next level of automation and Intelligence to end devices to be used in Internet of Things (IoT). M2M will be one of the key drivers to IoT devices over 5G networks which will help power smart nations, Smart Grids , Smart HealthCare, and other day to day effective communication needs [14].

REFERENCES

[1] E. *Brown,* "Who Needs the Internet of Things?," 2016. [Online]. Available: *https://www.linux.com/news/who-needs-internet-things*23 October 2016

[2] C. McClelland, "What is an IoT Platform," 2018. [Online]. Available: https://www.iotforall.com/what-is-an-iot-platform/

[3] D. Miorandi, S. Sicari, F. D. Pellegrini, and I. Chlamtaca, "Internet of things: Vision, applications, and research challenges," Adhoc Networks, vol. 10, no. 7, 2012. [Online]. Available: http://www.dicom.uninsubria.it/~sabrina.sicari/public/documents/journal/2012_IoT _vision.pdf

[4] A. Sarma, and J.Girao, "Identities in future Internet of Things," Wireless and Personal Communication , vol. *49*, no. *3*, 2009.

[5] Y. Liu, X. Chen, Z. Zong, B. Ai, D. Miao, Z. Zhao, J. Sun, Y. Teng, and H. Guan, "Waveform Candidates for 5G Networks: Analysis and Comparison," 2016. [Online]. Available: https://arxiv.org/pdf/1609.02427.pdf

[6] L. Atzori, A. Iera, and G. Morabito, "The internet of things: A survey," *Comput. Networks: The Int. J. of and Telecommun. Networking*, vol. *54*, no. *15*, pp. 2787- 2805. doi: 10.1016/j.comnet.2010.05.010
[7] Wireless One,"5G NR Only 25% to 50% Faster, Not Truly a New Generation," 2018. [Online]. Available: http://wirelessone.news/10-r/1036-5g-nr-only-25-to-50- faster-not-truly-a-new-generation
[8] D. Evans, "The internet of things," 2011, Cisco Business Solutions Group.
[9] M. Ferranti, "Beyond the hype :Internet of things shows up strong at Mobile World Congress," 2014, *PC World*.
[10] ITU-T Technology Watch, "The tactile Internet ITU-T Technology watch report," August, 2014. [Online]. Available: https://www.itu.int/dms_pub/itu-t/opb/gen/T-GEN-TWATCH-2014-1-PDF-E.pdf
[11] Metis, "2020 Mobile and wireless communication enablers for the twenty-twenty Information society," [Online].
Available:https://docbox.etsi.org/workshop/2013/201310_eeworkshop/00_posters/metis.pdf
[12] 5G NOW, "5GNOW-5thgeneration non-orthogonal waveforms for asynchronous signalling," 2015. [Online]. Available: https: GC-WS-2014-5GNOW_final.pdf
[13] Qualcomm Technologies Inc.,"5G Waveform & Multiple Access Techniques," 2015 [Online]. Available: https://www.qualcomm.com/media/documents/files/5g-research-on-waveform-and-multiple-access-techniques.pdf
[14] Incognito, "IoT and M2M, What's the Difference?," [Online]. Available: https://www.incognito.com/blog/iot-and-m2m-whats-the-difference/

About the Authors

Siddarth Kaul received his Diploma in Electronics and Communication Engineering from Board of Technical Education, Delhi, India, and B.Tech degree in Electronics and Communication Engineering from Guru Gobind Singh Indraprastha University, Delhi India in 2011, PGDCA from Sam Higgin bottom Institute of Agriculture, Technology and Sciences, Allahabad, India , M.Sc. (IT) from Lovely Professional University, Punjab, India and M.Tech degree in Software Engineering from Singhania University, Rajasthan, India in 2013.He is presently pursuing Ph.D. in Computer Science Engineering from Bhagwat University, Ajmer, Rajasthan, India. He is a certified CCNA (Voice) professional and he has worked with TCIL (Telecommunication Consultants India Limited) on overseas project for two years as VSAT Engineer. He has also worked on Panterra Networks.He had worked as Voice Engineer with Polycom, India before Joining Atkins.

Dr. Anuj Jain is working as Assistant Professor with Department of Computer Science, Bhagwant University, India. He received his Ph.D. Degree in Electronics and Communication from Mewar University, Rajasthan, India.

Dr. Rajesh Saini is working as Assistant Professor in Government College,Ateli, Haryana. He received his B.Tech. in Information Technology from M.D. University, Rohtak,M.Tech Degree in Information Technology from Singhania University, Rajasthan, India in 2013, and Ph.D. Degree in Computer Science Engineering from OPJS University, Rajasthan, India. He has worked with TTC, Delhi and HCL Infosystem, Noida.