

5G Demystified for the Common People

Yves Delphin*

*Pace University, USA.

Received May 04, 2021; Revised July 13, 2021; Accepted July 16, 2021

ABSTRACT

The network classified as 5G is mostly unknown or misunderstood by many people. It is the role of the government or the academia to explain it to the common people since it has so much repercussion in their lives. The ramification of this network is numerous. One should understand it before trying to interact with it. When it is thrust upon you without any explanation, it is incumbent to us to find out its benefits and its disadvantages. Unfortunately, many scientists will present their ideas. It will be up to us to accept their line of reasoning in the light of logic that all of us possess to a certain degree.

Abbreviations: M2M: Machine to Machine Communication; RAP: Radio Access Point; IoV: Internet of Vehicles, SDN: Software Defined Networking; RANaaS: Radio Access Network as a Service; IoT: Internet of Everything; RF: Radio Frequency

5G DEMYSTIFIED FOR THE COMMON PEOPLE

5G, the network modus operandi for the 21st century is around the corner for some of us and in operation for a few businesses. It has been there for a long time, since IPv6 has made its introduction into our computer lives. It is so unfortunate that IPv6 has not caught up yet with the mainstream academia and the industry. However, at long last it is ever present and has brought to us a lot of challenges. IoT would be nonexistent had V6 not been around. There are 3 kinds of 5G - low band, mid-band and high-band. and while the US put its bet on low and high, it turns out that mid-band is probably the best way to do it. T-Mobile has mid-band - that's the "ultra - capacity" stuff - but AT&T and Verizon had to wait for the C-band auction, which just ended, to get theirs. The question we should ask ourselves: Why 5G now? What are the challenges that it brings? What about the benefits and the controversies surrounding it? What do the scientists, including the medical personnel understand by 5G? What do we expect to see in the near future? Those pertinent questions will be all answered and will demystify the advent of this revolutionary 5G that will pervade our lives, whether we like it or not.

WHY 5G NOW? CONTROVERSIES AND CHALLENGES

We need an innovation, and it is happening right now. 5G is used for the fifth generation of mobile technology. It is used for most telecommunication companies, but has not been given the official standard for 5G. Hence the limitless possibilities of this network [1]. 5G will assemble the

existing wireless and the wired communications to an all IP (internet Protocol) wide performance worldwide network [2]. The world-Wide Wireless Web will be perfected at last [1]. Finally, the system capacity will be increased. The 5G technology will be subdivided into many layers to provide all - IP connectivity anytime, anywhere. That is the concept of what the scientists called flat IP. Another concept called cognitive radio represents the hallmark of this new network technology: cognitive radio. 5G will be able to achieve interoperability by recognizing the location, position and enable the users to choose a wide array of different wireless networks to establish communication [3]. In other words, we can characterize the cognitive radio as an intelligent telecommunication that understands its environment [4]. The challenges offered by 5G are numerous. Many articles have been written about 5G and the health of humanity. Some prominent people believe that the harmful effect of 5G will prevent its deployment, while others contest that idea. We must look into it and analyze it ourselves to see past someone else's bias. Professor Andrew Wood Sunburn team has been

Corresponding author: Yves Delphin, Pace University, USA, Tel: 9142755068; E-mail: ydelphin@pace.edu

Citation: Delphin Y. (2022) 5G Demystified for the Common People. J Forensic Res Criminal Investig, 3(1): 92-95.

Copyright: ©2022 Delphin Y. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

studying the “absorption pattern of electromagnetic energy in human tissue. This was the catalyst of international discussion on 5G safety regulation and design [6]. Many Scientists believe that the electromagnetic interference of 5G is harmful to our system. That is the reason why they do not want 5G to spring forward. As Wood explains: “There are also concerns that there could be more subtle effects, such as links between long-term exposure and certain types of cancer, but while there is some evidence from epidemiological and animal studies, these remain controversial.” [5]. Many other scientists share his concern. Some prominent academicians and many physicians who believe in safe technology agree with him. Among them is included Dr. Leszczynski in his presentation of 2019 on 5G and Health:” Gaps in knowledge at George River NSW, Australia in September 2019”. He explains the confusion around the development of 5G as it is being developed and deployed at the same time. His extensive research into radio frequency radiation and stress response, gene expression and the effects on the blood brain barrier supports RF radiation as a risk for brain cancer [6]. Dr. Joel Moskowitz echoes the same sentiment. After studying radio frequency, he published an article in scientific American in a 2019 article whereby he wrote:” We have no reason to believe that 5G is safe” [6]. New research by Newfield and Kuster in 2018 have presented significant tissue heating generated by 5G technology with rapid shorts of bursts of data transfer on a device.” [6]. This by no means is contradicted by Wood’s research which points out that. “The major hurdle is that the power levels involved in mobile and wireless telecommunications are incredibly low, which, at most, produce temperature rises in tissue of a few tenths of a degree. Picking up unambiguous biological changes is therefore very difficult.” [5]. As can be seen, the research on the harmful existence of 5G is highly controversial. While a few scientists would not recommend it because they claim that 5G causes harm to people, others disagree. It may well so place lower creature in harm’s way, but it is very controversial when it comes to humans. We do know that the 5G telecommunications uses 6 Gigahertz (GHz) Millimeter Sized Wavelength usually referred to as MMW. In vivo studies were conducted on mammals (mouse, rat, rabbit) and a few on humans. It was concluded that MMW can decrease the sensitivity to pain akin to the release of opioids [7]. More research needs to be done to come up with a definitive conclusion about the harmless or the harmful or aspect of 5G. Etan Siegel, a PhD astrophysicist in his article “The Science of why 5G is almost certainly safe for human” concurs with the Dr. Moskowitz’s idea. He understands that “If any study at all finds that any dose of a substance causes any spike in cancer in any creature - even in mice, even with a small sample size, even with marginal or dubious significance - this is the classification it gets. If you’re not afraid of coffee or thyme, or getting a nickel with your change, you shouldn’t be afraid of 5G, or Wi-Fi radiation in

general. [8]. Here is a graph from NASA explaining how radiation is penetrating the earth. As you can note, it is very minimal and less dangerous to humans. As he pointed out intelligently: “There are lower-energy signals such as microwaves, with wavelength between a millimeter and a meter, that bombard us constantly here on Earth. “. The different signals from GPS satellite, Wi-Fi, 3G, 4G, and today 5G are included. It has been reported that in UK the people who started placing the towers for the 5G networks were exposed to far more radiation than any of us would ever receive. Nevertheless “there is no evidence that they have higher rates of cancer or any other health problems that could possibly be attributable to Wi-Fi radiation than any other population of humans” [8].

Others researchers disagree. Dr. Ben-Ashai of the Department of Physics in Hebrew University explains how the millimeter and the submillimeter wavelength of 5G react with the sweat glands in our body. Another Dr. Yuri from the same university agrees with him that these **(Figure 1)** “waves will interact with human skin and lead to preferential layer absorption” [9] Research being conducted by the Chinese and the Russian defense agencies found out that the use of the millimeter as well as the submillimeter waves can be used to cause a burning sensation on the human skin to control crowds. It is used by the US army to disperse people in a crowd. This is called Active Denial Systems. The people standing within the range of this projecting beam will experience a burning sensation on their skin and run away from the source. [10] Among other problems faced by 5G, this is the main reason why the scientists do not want this network to be developed. We can understand that argument. However, will the benefits of this network outweigh its disadvantages?

BENEFITS OF 5G

If the benefits of 5G outweigh its disadvantages, we should look into incorporating into our lives 5G, otherwise we should abandon it whether it provides monetary or scientific benefits to us. 5G will use up to 6Ghz to transmit wirelessly. It will use multiple frequencies that are housed in cellphones and wireless devices but at higher frequencies. Yongpen Wu et al explained that 5G “will include the evolution of all parts of communications...it will introduce new and open security challenges, such as a flexible and scalable security architecture, lightweight security, and energy-efficient security [11]. The physical layer security will protect our confidentiality and according to Wu will enable secure communication over the wireless medium without an encryption key. Beyond the IoT, 5G introduces the IoV (Internet of vehicles) where the micro circuitry is included in practically all the newer car models. It has been said without any pedantry that the Tesla is a giant iPad and for obvious reason it can be called so since the whole engine is almost a mirror model of the iPad MAC technology on wheels.

According to Peter Ross, Carlos J Bernados, different factors explain why 5G networks face an exponential increase.

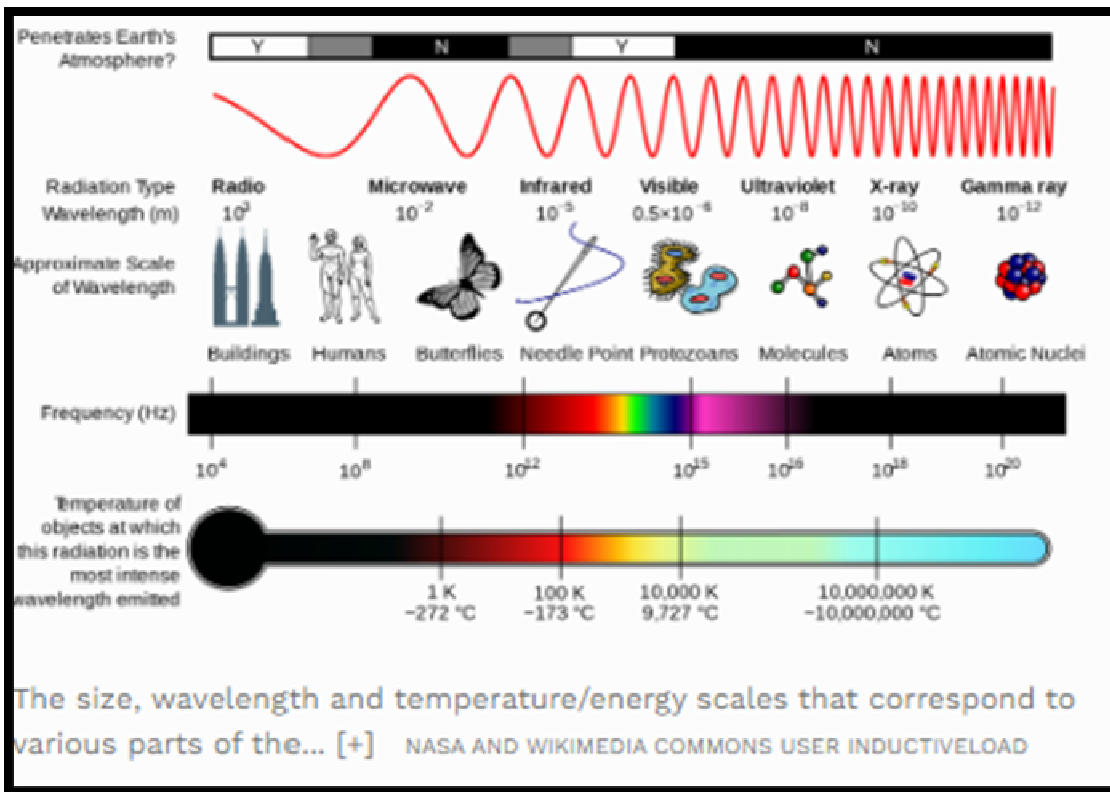


Figure 1. The size, wavelength and temperature/ energy scales that correspond to various parts of the... [+].

First, there are more devices accessing the Internet and the broadband services, which also include the M2M. The devices are more and more powerful, more diverse and use more bandwidth pervasively. They also are integrated into more areas of life and industry and finally the smartphones are generally tied to the cloud services. 5G will serve different purposes as far as reliability, throughput, volume, and latency is concerned. They will rely on two key enablers: ultra-dense deployment and flexible central processing [12]. How does an ultra-dense deployment work? The use of ultra-dense deployment, low power, small cell networks will allow data rate demand to be handled efficiently. The higher data rate is a direct result of the lower distance between the user and the radio access point (RAP). Because of the reuse of time-frequency across multiple cells, the spectrum is more frequently exploited [12]. Since the networks become denser, they increase with multi cell communication interference. There will be a need for resource management of algorithms which will allow resources coordination between different cells. This is where centralized processing comes in. As Peter Ross points it out, the centralized processing will “orchestrate and optimize ultra-dense networks”. Since this is centralized, the radio access network (RAN) will therefore function just like a cloud network, providing a similar

service. We will then have the Radio Access Network as a Service (RANaaS) which will encompass the basic characteristics of the cloud platform offering on demand provisioning, virtualization of the RAN services, resource polling, elasticity, service metering and multi-tenancy [12]. The article entitled “Towards Green and Soft: A 5G Perspective” written by China mobile identified 5 key approaches that are used in 5G technologies. They are energy and spectral efficiency, the second is the C-RAN approach where the processing is moved to the Internet Cloud. The third approach proposes the separation of data and control channels as defined by SDN (Software Defined Network) that are adopted in the wired network: the fourth one includes large antenna array MIMO (multiple input and output) to deal with the large amount of data today and the last approach includes transmission and reception in full duplex in the same frequencies simultaneously [13]. Another article written by the authors of Alcatel Lucent Bell -Lab’s technologies share the same thoughts but also include an intelligent terminal which is capable of mitigating interference and communication to other devices without any human interference. This is what we call the M2M (Machine to Machine interaction). As it stands now, the future mobile communication will include “context awareness, with knowledge of the user’s requirement, the

surrounding environment and the network” [13]. It is no wonder that the patterns of our lives are being so closely examined by our computer devices and the machine will tell us if it is time to go to work or to go to sleep or take a well-deserved vacation. A final article written by Alamouti and Fetteis entitled” 5G: Personal Mobile Internet Beyond What Cellular Did to Telephony.” explains the importance of high bandwidth content with speed exceeding 10 Gb/s. This is really what most of us know about the advent of 5G network. We do know about the low energy consumption and the very low data rate that makes the smartwatch or the hearing aid hold their power for about a week without being recharged.

CONCLUSION

This is by no mean an exhaustive explanation of 5G network. However, I believe it is sufficient for the lay people who do not know much about the technology involved in this network. Before we complain about this network, one should find out about the technology involved in it. So many mundane gadgets that we use today use and exploit this technology. In the next 5 years we will see an explosion of devices manipulating the benefits of this wonderful network. As we noted in the different research Drs Seigel and Wood agree on principle that 5G is definitely harmless while Drs. Benshi and Yuri disagree. We will need to adopt an attitude of wait and see for more research if we want to draw the right conclusions. As Sasha Segan explains it in PC magazine, on February, 2021 “5G is an investment for the next decade, and in previous mobile transitions, we've seen most of the big changes happening years after the first announcement. Take 4G, for instance. The first 4G phones in the US appeared in 2010, but the 4G applications that changed our world didn't appear until later. Snapchat came in 2012, and Uber became widespread in 2013. Video calls over LTE networks also became big in the US around 2013. In the meantime, following that plan, while we're getting fits and starts of 5G right now, you should expect the big 5G applications to crop up in 2022” [14-16].

REFERENCES

1. Suvarna P, Vipin P, Pallavi B (2012) A Review on 5G Technology. *Int J Eng Inv Tec* 1(1): 26-30.
2. Badoi CI, Prasad N, Croitiru V, Prasad R (2020) 5G Based on Cognitive Radio. *Wireless Personal Communications* 57: 441-464.
3. Tudzarov A, Janevski T (2011) Functional Architecture for 5G Mobile Networks. *Int J Adv Sci Tech* 32: 65-78.
4. Chen KC, Prasad R (2009) *Cognitive radio networks*. New York: Wiley.
5. Nature Research (2019) What 5G means for our health. Available online at: <https://www.nature.com/articles/d42473-01-00009-7>
6. Physicians for safe technology (2020) *Wireless technology and Public Health*. Available online at: <https://mdsafetech.org/featured-page-one/joinmdsafetech-org>
7. Myrtill S, Mats OM, (2019) 5G Wireless Communication and Health Effects- A pragmatic Review Based on Available Studies Regarding 6 to 100 GHz. *Int J Environ Res Public Health* 16(18): 3406.
8. Siegel E (2019) The Science of Why 5G is (almost) Certainly safe for Human. Available online at: <https://www.forbes.com/sites/startswithabang/2019/11/01/the-science-of-why-5g-is-almost-certainly-safe-for-humans/?sh=6aa6b3b070e3>
9. Feldman YD, Paul BI, Andreas C, Aharon JA (2008) Human skin as arrays of helical antennas in the millimeter and submillimeter wave range. *Phy Rev Let* 100: 128102-128104.
10. Joint Intermediate Force Capabilities Office.US Department of Nonlethal Weapons Program. *Active Denial Systems FAQ*. Available online at: <https://jnlwp.defense.gov>
11. Yongpeng W, Trung QD, Lee AS (2019) Safeguarding 5G-and-Beyond Networks with Physical Layer Security. *IEEE Wireless Communications* 26(5): 4-5.
12. Rost P, Bernados CJ, Domenico A, Girolamo M, Lalam M, et al. (2014) Cloud technologies for flexible 5G radio access networks. *IEEE Communication Magazine* 52(5): 68-76.
13. John T, Xiahu G, Hsiao CW, Ralf I, Hong J, et al. (2014) 5G Wireless communication systems: prospects and challenges. *IEEE Communication Magazine* 52(5): 62-64.
14. Feitis G, Alamouti S (2014) 5G: Personal Mobile Internet Beyond What Cellular did to Telephony. *IEEE Communications Magazine* 52(2): 140-145.
15. Nashville explosion.: Camper van blows up in intentional act on Christmas morning. Available online at: <https://www.bbc.com/news/world-us-canada-55448832>
16. Seagan S (2021) What is 5G. Accessed on: February 25, 2021. Available online at: <https://www.pcmag.com/news/what-is-5g> PC magazine