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An Overview into Applications and Risks in 5G NR Technology

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Abstract – *A driving need for more bandwidth, speed and latency calls for innovation in the telecommunications sector – and newer technologies are being developed to answer that summoning. In this article, a brief highlight regarding 5G technologies is addressed in the form of shedding light onto many of the already existing applications, and how 5G can improve over 4G. Additionally, as with all new technologies, some of the risks are looked at – mainly concerning public health and cybersecurity.*

Keywords – *5G/4G, mmWave, URLLC, eMMB, 3GPP, Cybersecurity, Health Risks, Environmental Protection.*

I. INTRODUCTION

As newer technologies and concepts such as IoT and cloud were emerging – and as more mobile phone users entered the market, so did the speed and capacity demands. 4G was first introduced as a successor to the already established 3G and it made lots of promises; 5G New Radio (5GNR, commonly referred to as 5G) carried the same mantle. As the projected number of users and use cases increase, so to the demand for speed and capacity.

5G offers a thousand times the bandwidth of its predecessor, as well as ten times the speed and virtually no latency. That is due to 5G adopting the mmWave (millimeter wave) for its transmission – which requires less power to emit, but is broadcast at a much shorter distance; which requires tighter deployments of cells. [1]

There is a variety of applications that could harness the benefits of 5G technologies. Many fields ranging from various industries such as power, medical, smart cities.

II. APPLICATIONS

A. 5G and Smart Cities

3GPP developed a series of specifications to meet increasing future demands of interconnectivity. It is estimated that there will be 200B IoT devices by 2020's end.

Concrete examples of Smart City implementations are abundant. [2] One of them is smart waste management where sensors can attach to trash cans to determine if they are full – allowing for efficient garbage collection truck routing. Another example is smart energy management – where utility services can take meter readings without visiting homes. Smart parking is another example where low-power devices with sensors are installed in parking spots and collaborate in determining available parking space.

Chief among technologies concerning massive deployment of IoT devices are massive Machine-type Communication (mMTC). Although latency tolerant and low-bandwidth-based, mMTC has the capability to accommodate a massive number of devices.

B. 5G and Enterprise

Similarly, the enterprise environment has its set of standards —ultra-reliable low-latency connection (URLLC) that were accommodated by 3GPP. . This set of specifications enables mission-critical applications, such as industrial control systems like SCADA, to perform with high reliability. There are also application areas where latency is of utmost importance, like self-driving vehicles. URLLC promises latency that could compete with fiber connectivity.

C. 5G in the Medical Field

The benefits of 5G are not limited to the aforementioned, but also extend to even more critical areas of operation, such as hospitals. First responders are the first to see such utility. Having the patient in an ambulance connected to the hospital in real-time could play a huge role in saving lives. Additionally, the quick exchange of information between hospitals regarding what is in their inventory of medical supplies. Furthermore, surgeons could perform remotely on patients in other hospitals. All this could be achieved with URLLC and Enhanced Mobile Broadband (eMMB) in implementation.

III. RISKS

As technology advances, so does the risk associated with it. More so with wireless communications. There were several studies concerning Wi-Fi, Bluetooth, 4G LTE and their effects on the environment and human body. 5G is no exception.

A. Health Effects

One of the major concerns regarding 5G's implementation is the spectra of radio waves being used.

Although considered non-ionizing and nowhere near the levels of ionizing radiation caused by exposure to X-Ray or radioactive content – it is theorized that exposure to 6-10 GHz could cause human tissue to heat-up. [3]

Another study alludes to the adverse health effects of 5G, where it could stimulate toxins within the human body. The study concludes that some of the side effects could be: metabolic disturbance, neurodegeneration, infertility, cardiovascular issues, and many more. [4]

Additionally, some studies confirmed that cellular technology in general is directly linked to tissue and DNA damage. [5]

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) is the authority for anything radio-related. The ICNIRP published new guidelines that address these issues. First, ICNIRP verified that human tissue is heated, but they concluded that it does not cause ionization – thus it does not affect DNA. [6]

B. Cybersecurity

With concepts like IoT, it is safe to say that there will be a wide surface of attack left for hackers – especially with 5G promising to widen that area with more devices connected with mMTC.

Therefore, The 3rd Generation Partnership Project (3GPP) also addressed the cybersecurity aspect involved by drafting several standards. But there is much left to be desired. For example, 3GPP standards specify that end-to-end encryption must implemented – but it is up to the implementer where the cryptography occurs. [7]

IV. CONCLUSIONS

As technology improves, so does the risk along with it. In this article, we are bringing to light some of the existing applications that could be improved with 5G – as well as some of the risks that could be associated with the deployment of 5G to public health, as well as from a cybersecurity perspective.

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