Interdisciplinary Journal of Advanced Research and Innovation
Volume 2 No. 2 2024 E-ISSN xxxx-xxxx
https://ijari.publicascientificsolution.com/index.php/rv

5G OPPORTUNITIES FOR FUTURE TECHNOLOGY

Julianus Gesuri Daud[1], Rinna Yuanita Kasenda[2], Leony Ariesta Wenno[3], Yonatan Tampi[4], Cisilia Masambe[5], Jeremy Tinggogoy[6], Wahyu Rumerung[7], Rivaldo Karenting[8], Abram Sanggel[9]
Politeknik Negeri Manado
nus_its@yahoo.com[1], rinnakasenda@unima.ac.id[2], leonywenno@elektro.polimdo.ac.id[3], natantampi01@gmail.com[4], cisiliasyalommasambe@gmail.com[5], jeremytinggogoy@gmail.com[6], wrumerung01@gmail.com[7], rivaldokarenting55@gmail.com[8], abramsanggel892@gmail.com[9]

Abstract:
5G technology is the next generation mobile phone technology and offers a significant opportunity for future technological developments. Against this background, we will discuss some of the key opportunities that 5G provides for future technological development. First, 5G provides unprecedented speed and communication quality. Second, the Internet of Things (IoT) will achieve rapid growth through 5G. Third, the advantages of 5G make our job easier. High-quality 4K video conferencing and instant collaboration become easier, making workdays more productive. Fourth, 5G also has significant potential in the healthcare field. Telemedicine will become more effective and more accessible and will provide better and more affordable care anytime and anywhere. Furthermore, 5G technology will enable remote patient monitoring, improving chronic disease management and overall healthcare management. Lastly, security is also a goal in the development of 5G technology. With increased connectivity capacity, data protection and privacy have become more important than ever. To maximize the benefits of implementing 5G, it is important to create a safe and reliable cybersecurity environment. Overall, 5G technology opens up new opportunities in various fields, including entertainment, transportation, and healthcare. The future of technology looks bright as infrastructure and other applications continue to improve.

Keywords: 5G, technology, Internet of Things (IoT)

Corresponding: Abram Sanggel
E-mail: abramsanggel892@gmail.com

INTRODUCTION

The use of mobile communication technology has brought about a remarkable transformation in how humans interact, work, and communicate. From the 1G era to 4G, each generation of cellular networks has introduced significant innovations in connectivity and access to information (Akhtar et al., 2020). However, we are currently on the verge of a greater revolution that will change the foundation of everything we know about wireless connectivity. This emerging technology is 5G, the latest cellular generation that promises fundamental changes in connecting to the digital world. The 5G network is not merely an upgrade from 4G; it is the foundation for the networks of the future that will accelerate communication, enable revolutionary new applications, and transform the technology landscape as a whole. However, to understand the potential and impact of 5G, it is essential for us to delve deeper into the fundamental concepts of this technology, its benefits, and the challenges it faces (Ezema et al., 2019). With a profound understanding of 5G, we will be able to harness this technology effectively, plan for a better future, and ensure that this technological change provides maximum benefits to the global community (Rejeb & Keogh, 2021).

Thus, let us embark on exploring the world of 5G, a new era of connectivity that brings limitless challenges and opportunities. Here are some 5G projects in Indonesia:

1) Telkomsel 5G: Telkomsel, one of the largest mobile service providers in Indonesia, has conducted 5G network trials in various major cities, including Jakarta. They have collaborated with global technology vendors to adopt 5G technology and run tests to measure its performance and benefits.
2) Indosat Ooredoo: Indosat Ooredoo has also conducted 5G technology trials in Indonesia. They are committed to developing 5G infrastructure and introducing this technology to the Indonesian market.
3) XL Axiata: XL Axiata is another mobile service provider in Indonesia interested in adopting 5G technology. They have also conducted trials to measure the performance and benefits of 5G in various locations.
4) Collaboration with Technology Vendors: Telecommunication operators in Indonesia, such as Telkomsel, Indosat Ooredoo, and XL Axiata, have partnered with global technology vendors like Huawei, Ericsson, and Nokia to support the development of 5G technology.
5) Research and Development Activities: The Indonesian government, through the Ministry of Communication and Information Technology, has supported research and development activities related to 5G technology. This includes allocating the necessary frequency spectrum for 5G and facilitating collaboration between the government, industry, and educational institutions.
6) Use Case Testing: In addition to network trials, testing of several potential 5G use cases, such as the use of 5G in industries, healthcare services, and transportation, has been carried out.
7) Involvement in the Industry 4.0 Revolution: The Indonesian government has identified 5G technology as a key element in the Industry 4.0 revolution and the digital economy. 5G technology is expected to enhance productivity and competitiveness across various sectors in Indonesia.

METHOD

The most recent generation of cellular networks, or 5G, provides more speedy internet access and more steady connections, as well as a rise in capacity compared to the 4G technology that most people use today. With 5G technology, the internet is up to 20 times the speed of the generation before. This enables users to download and upload data swiftly, even in substantial amounts. Furthermore, fast speeds, as well as 5G technology, offer a more dependable and stable relationship. There are presently just a few places in Indonesia where 5G networks are available. Jabodetabek, Bandung, Batam, Surabaya, Balikpapan, Makassar, Surakarta, Denpasar, and Medan are the only nine regions. In comparison to Indonesia's number of provinces and municipalities, this coverage is somewhat limited. Indonesia must divide the frequency spectrum into at least three layers—low band, middle band, and high band—in order to maximize 5G services. Because 5G technology is so adaptable, it may be used for both mobile broadband and fixed broadband services, also known as fixed wireless access (FWA).

RESULT AND DISCUSSION

Opportunities for 5G in Indonesia

In Indonesia, there are significant opportunities for 5G. Deploying 5G technology can bring various benefits, including improved Internet speeds, more stable connections, and the implementation of new technologies such as the Internet of Things (IoT), augmented reality, and virtual reality (Chettri & Bera, 2019; Torres Vega et al., 2020).

Some of the potential benefits of 5G in Indonesia include:

1) Improved Internet speed and quality: The use of 5G will significantly increase upload and download speeds, allowing access and better consumption of multimedia content.
2) IoT and Smart City Development: 5G will support the development of IoT-based infrastructure that can be used in various areas such as medical services, transportation and security.
3) Economic growth: The proliferation of 5G can bring new opportunities for start-ups in the Indonesian economy and technology, thereby increasing the country's economic competitiveness.
4) Innovation in Creative Industries: 5G brings new applications to creative industries, such as augmented reality (AR) and virtual reality (VR) for games, education, and entertainment.
5) Advances in Healthcare: With increased speed and connectivity, 5G can facilitate the development of remote health management and digital applications. However, the deployment of 5G still requires significant investments in business, including tower construction and general services. Additionally, additional rules and regulations are needed to ensure that 5G use in Indonesia is safe and effective.

Advantages of the 5G network

1) High speed and performance: 5G delivers significantly higher Internet speeds than previous technologies, enabling fast data downloads and uploads.
2) Low latency: 5G reduces data transfer response time (latency), delivering better real-time experiences in applications like online gaming and remote control.
3) Higher Capacity: 5G can handle more connected devices simultaneously in a geographical area, supporting the Internet of Things (IoT) and various smart applications that require high connectivity connections.
4) Increase productivity: With improved speed and latency, businesses and industries can optimize their operations by leveraging 5G connectivity for technologies like cloud computing, AR /VR and high-level data analytics.
5) Technological innovation: 5G opens the door for the development of new technologies such as autonomous vehicles, telemedicine, augmented reality and virtual reality with enhanced performance. Enhanced
6) User Experience: Users can access high-quality multimedia content, stream videos, and play online games without interruption or lag, thanks to 5G speeds.
7) Support new service deployment: 5G can help develop new services, including those based on advanced technologies such as IoT, smart cities and smart homes.
8) Increased network capacity: With 5G, operators can optimize spectrum usage, allowing more devices and data connected by the network to be managed.

However, it is important to remember that the deployment and benefits of 5G will depend on factors such as infrastructure investment, regulation and technology adoption by Indonesian society and industries (INSTIKI, 2022).

Disadvantages of the 5G network

Although 5G technology brings many advantages, it also has certain limitations. A major drawback is its limited penetration ability. Unlike its predecessors, 5G networks have difficulty effectively penetrating obstacles such as buildings, walls, concrete structures, and even trees. This can reduce signal strength and coverage, especially in urban environments with dense infrastructure. Additionally, the increased bandwidth used by 5G may result in narrower coverage compared to 4G. These limitations need to be considered when planning the deployment and use of 5G technology, as

they can affect its performance and range in various real-world scenarios (Narayanan, 2021). Radio frequency congestion is a concern when deploying 5G networks, especially when allocating frequencies up to 6 GHz. Radio frequency spectrum is already widely used, and the introduction of 5G could worsen the problem as it competes for available bandwidth.

Privacy and security are also important issues that need to be addressed with the advent of 5G technology. The ease and speed of high-quality data transmission certainly raise concerns about security vulnerabilities in 5G networks. Protecting user data and network integrity becomes paramount (Sicari et al., 2020). Another limitation of 5G technology is reduced penetration ability. Unlike previous generations, 5G networks are less effective at overcoming obstacles such as buildings, walls, concrete structures, and trees. This limitation affects the signal's ability to reach certain areas and can impact network performance in urban environments with dense infrastructure (INSTIKI, 2022).

Low band, Middle band and High band

Low-band, mid-band, and high-band refer to different frequency spectrums used in wireless network technologies such as 5G and 4G LTE. Each frequency band has unique characteristics that affect network coverage and capacity. Low band with frequencies below 1 GHz provides wide coverage and good penetration into buildings, making it suitable for rural and large urban areas. The mid-band, from 1 GHz to 6 GHz, combines good coverage with higher capacity, with frequencies above 6 GHz providing very high capacity but limited coverage. Combining these bands in 5G network development allows for a flexible and balanced approach to network design and mobile Broadband (Erunkulu et al., 2021).

Provides wireless Internet access through mobile devices such as smartphones or tablets, connecting users anywhere within mobile network range (Lee & Sulaiman, 2019; Pahlavan & Krishnamurthy, 2021). It is often used for personal purposes and on the go. On the other hand, fixed wireless access or fixed broadband (FWA) is a wireless Internet service that provides a stable and strong Internet connection to a home or business through fixed antennas located at specific locations, similar to traditional cable wireless connections. FWA is very suitable for rural areas or places where it is difficult to deploy cable infrastructure. Choosing between these two solutions depends on the user's mobility needs and need for a stable and reliable Internet connection at home or in the office (Alimi et al., 2021).

In Indonesia, the opportunity for 5G is huge. Deploying 5G technology can bring many benefits, including faster Internet speeds, improved stability, and the implementation of new technologies such as the Internet of Things (IoT), augmented reality, and virtual reality. Some of the potential benefits of 5G in Indonesia include improving Internet speed and quality, developing IoT and smart cities, promoting economic growth by promoting technology start-ups, promoting innovation in the industry, and innovating and developing medical services through telemedicine and digital healthcare. However, the successful deployment of 5G also requires significant investment in infrastructure, including the construction of towers and comprehensive coverage. Additionally, additional regulations and policies must be implemented to ensure the optimal and safe use of 5G technology in Indonesia.

CONCLUSION

5G networks, or fifth-generation mobile networks, represent a significant development in mobile technology that will have a profound impact on the way we communicate and interact with devices. With its incredible high-speed capabilities, 5G enables fast data downloads and smooth video streaming, eliminating buffering issues that interrupted our experience. The low latency feature enables instant response in real-time applications like video calls and online gaming. With greater capacity, 5G supports the development of the Internet of Things (IoT), connecting many different smart devices to

the network. Additionally, 5G networks offer the potential for industrial transformation, from improving healthcare services to automating manufacturing. Emerging technologies such as augmented reality (AR) and virtual reality (VR) are also becoming more possible thanks to 5G. Despite the huge potential, challenges include inconsistent availability, significant infrastructure investment, and security and privacy considerations. The 5G network therefore constitutes an important step in technological development, but it must still undergo a process of continuous development and improvement

REFERENCES

Akhtar, Muhammad Waseem, Hassan, Syed Ali, Ghaffar, Rizwan, Jung, Haejoon, Garg, Sahil, & Hossain, M. Shamim. (2020). The shift to 6G communications: Vision and requirements. Human-Centric Computing and Information Sciences, 10, 1–27.

Alimi, I. A., Patel, R. K., Muga, N. J., Pinto, A. N., Teixeira, A. L., & Monteiro, P. P. (2021). Towards enhanced mobile broadband communications: A tutorial on enabling technologies, design considerations, and prospects of 5G and beyond fixed wireless access networks. Applied Sciences, 11(21), 10427.

Chettri, Lalit, & Bera, Rabindranath. (2019). A comprehensive survey on Internet of Things (IoT) toward 5G wireless systems. IEEE Internet of Things Journal, 7(1), 16–32.

Erunkulu, Olaonipekun Oluwafemi, Zungeru, Adamu Murtala, Lebekwe, Caspar K., Mosalaosi, Modisa, & Chuma, Joseph M. (2021). 5G mobile communication applications: A survey and comparison of use cases. IEEE Access, 9, 97251–97295.

Ezema, Modesta E., Okoye, Francis A., & Okwori, Anthony O. (2019). A framework of 5G networks as the foundation for IoTs technology for improved future network. International Journal of the Physical Sciences, 14(10), 97–107.

INSTIKI. (2022). Mengenal Teknologi 5G Serta Kelebihan dan Kelemahannya! Retrieved from https://instiki.ac.id/2022/12/13/mengenal-teknologi-5g-serta-kelebihan-dan-kelemahannya/

Lee, Thian Seng, & Sulaiman, Riza. (2019). Preliminary analysis of wireless collaborative network on mobile devices. Journal of Information and Communication Technology, 18(3), 327–343.

Narayanan, Arvind. (2021). A Comprehensive Examination of Emerging 5G Services: Challenges and Opportunities. University of Minnesota.

Pahlavan, Kaveh, & Krishnamurthy, Prashant. (2021). Evolution and impact of Wi-Fi technology and applications: A historical perspective. International Journal of Wireless Information Networks, 28, 3–19.

Rejeb, Abderahman, & Keogh, John G. (2021). 5G networks in the value chain. Wireless Personal Communications, 117, 1577–1599.

Sicari, Sabrina, Rizzardi, Alessandra, & Coen-Porisini, Alberto. (2020). 5G In the internet of things era: An overview on security and privacy challenges. Computer Networks, 179, 107345.

Torres Vega, Maria, Liaskos, Christos, Abadal, Sergi, Papapetrou, Evangelos, Jain, Akshay, Mouhouche, Belkacem, Kalem, Gökhan, Ergüt, Salih, Mach, Marian, & Sabol, Tomas. (2020). Immersive interconnected virtual and augmented reality: A 5G and IoT perspective. Journal of Network and Systems Management, 28, 796–826.