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5G Network as a Technology to Fight Covid-19 Pandemic in Indonesia: a Review

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Abstract: Since March 2020 until now the Covid-19 pandemic has caused a very signifi-cant impact on people's lives in Indonesia. Based on August 2021 data, the num-ber of positive COVID-19 cases reached nearly 4 million cases and the number of recovered patients reached 3.2 million. the use of communication technology is an important part of efforts to overcome the pandemic and help people to access digital health services. Along with this pandemic, Indonesia has just launched 5G network technology with much better performance than 4G technology so that it can be used to create a better healthcare system for patients. This paper provides a review and opportunity for the use of 5G technology for the development of a digital health service system.

Keywords: 5G, covid-19, network

1. Introduction

Globally, the Covid-19 pandemic is still not over, especially in developed countries such as Indonesia, in recent times may have begun to experience a significant decline in cases so that the activities of their citizens tend to begin to gradually recover, alt-hough not yet fully normal. While in most developing countries, the struggle to con-tain the pandemic still faces major challenges. The regional quarantine policy and tightening of restrictions have not been able to significantly reduce the transmission rate. The governments of each country are still struggling to control the pandemic. Meanwhile, state health services are also overwhelmed by the new wave of spikes in Covid-19 cases. Lack of medicines and oxygen as well as shortages of doctors and medical personnel occur in many countries. Vaccination which is one of the key ef-forts in dealing with the pandemic also did not run smoothly. In addition to the avail-ability of vaccines, the reluctance of citizens to accept vaccines is a separate prob-lem.

During the Covid-19 pandemic, hospitals and patients are required to adapt and innovate in digital health services to accelerate services to patients and protect health workers from being infected with the corona virus. The role of information and communication technology (ICT) is to reduce the risk of transmission that can be caused by direct contact between patients and health workers. The novel ICT tech-nologies such as telehealth [1], 5G communication [2], Internet of Things, Artificial Intelligence (AI) [3], and cloud computing [4] have important role to provide digital health service and improve protection of patients and healt workers.

The 5G network system was built based on digital services such as telehealth. Quantitatively the performance parameters determined by ITU-R (International Telecommunication Union) on 5G technology through IMT-2020 Peak data rate: based on ideal conditions, the data rate that can be achieved is 20Gbps (downlink) and 10Gbps (uplink). User experience data rate: is the minimum data rate obtained by a user in an area. 100Mbps download (DL) and 50 Mbps for uplink (UL). Mobility: data traffic can run normally with maximum speed of 500km/hour. Latency: 4 ms for Enhanced Mobile Broadband (eMBB) services, and 1 ms for Ultra-Reliable and Low Latency Communications

(URLLC) services [5]. With these performance, 5G technology can provide digital health services to fight the Covid-19 pandemic in Indonesia.

2. 5G for Smart Healthcare

Since the Covid-19 pandemic, telecommunications and internet technologies have played an important role in all aspects of life such as work, school and shopping. Based on report by DaraReportal, there is an increase in the number of new internet users in Indonesia by 15.5% or 27 million users in 2020. In May 2021, 5G technology has officially been held in Indonesia. In the first stage of 5G commercialization, the service is available at several points in nine cities, namely Jakarta, Surabaya, Makas-sar, Bali, Batam, Medan, Solo, Balikpapan, and Bandung. 5G network can be combined with existing 4G network so cover a wider area and and reach more people.

5G was developed to be able to support different types of use cases and applications. Not only providing conventional services for mobile communication but also to support various types of industries so that it indirectly impacts on economic growth and people's lives [6]. All use cases and applications in 5G technology can be grouped into three main scenarios:

- Enhanced Mobile Broadband (eMBB): Is a usage scenario for data and multi-media communication services.
- Ultra-Reliable and Low Latency Communications (URLLC): Associated with applications that require very good network performance that sensitive to delay and latency.
- Massive Machine Type Communications (mMTC): Used in applications that use multiple devices. Each device is connected to the internet and sends data in small capacities that are not sensitive to delays.

All of 5G uses case can be implemented in the hospital with telehealth application that can be used to fight the COVID-19 pandemic (Figure 1):

- Telehealth
  Telehealth is a smart healthcare service that provide supervition to the patient in a remote condition using internet network witch is integrated with remote clinical healthcare, health education, health administration trough smart gadgets such as smartphone, smartwatch, etc.) [7]. These gadgets gather patient information using sensors and biomedical application.
- Telemedicine
  Telemedicine is a remote clinical service to diagnosis and consultation with medi-cal doctor and healthcare professional [8]
- Telepharmacy
  Telepharmacy is a service which provide remote pharmaceutical care for delivery of prescription drugs via smartphone and internet network.
- Telesurgery
  This service will allows a sergeon to do surgical procedure over a remote distance using robot and 5G network [9].

Each use application have specific requirements for best performance as Table 1 bellow:

Table 1. Table captions should be placed above the tables [10][11].

Applications	Data Rates	Latency	Cell Types	Location
Telemedicine	<50 Mbps	<1-100 ms	Macro-Micro Cell	Indoor / Outdoor
Telenursing	<50 Mbps	<1-100 ms	Macro-Micro Cell	Indoor / Outdoor
Telepharmacy	<50 Mbps	<1000 ms	Macro-Micro Cell	Indoor / Outdoor
Telesurgery	137 Mbps > 1,6 Gbps	<1 ms	Pico-Femto Cell	Indoor

5G network using mmWave spectrum to deploy ultra-dense small cell network (Pico Cell and Femto Cell) at indoor environment which combined with massive MIMO antenna system to achive high data rates for extreme application such as telesurgery. To obtain architectural flexibility, heterogeneous network access capabilities, and vertical business line integration by utilizing SDN (Software Defined Network) and NFV (Network Functions Virtualization) technologies. To support various types of uses and applications, it is necessary to change some of the existing conventional networks by breaking down network elements or network functions (NF) into basic modules namely control plane (CP) and user plane (UP) so as to enable the formation of logical architectures through interconnection from CP and UP.

With existing 5G technology, a smart hospital can be built with telehealth services that are integrated with telemedicine, telenursing, telepharmacy and telesurgery ap-plications that serve COVID-19 patients in one city. This central hospital will be a reference for patient handling processes starting from health education, symptom recognition, diagnosis of COVID-19, emergency management, self-isolation patient services, and delivery of drugs and vitamins.

The use of cloud computing and big data technology will also greatly support the telehealth system for the process of handling COVID-19 patients [13], so that each case can be coordinated and handled in mutual cooperation by involving other hos-pitals and health centers located in each smaller administrative area.

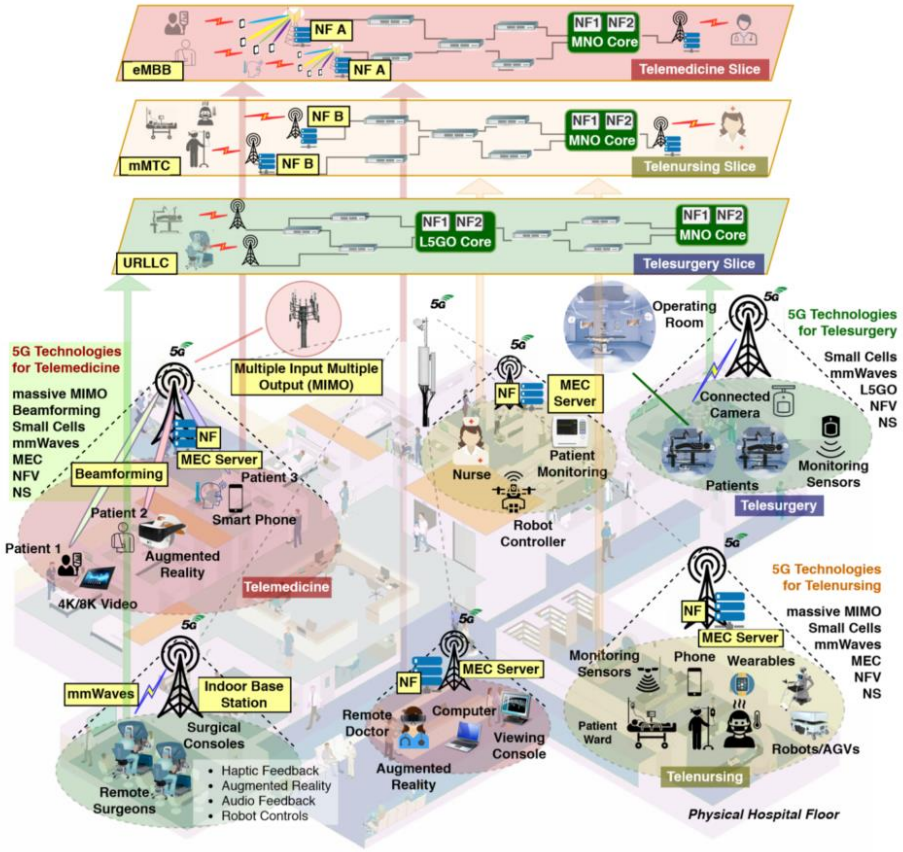

Figure 1. Telehealth system in a hospital [12].

3. Issues and Challenges

Although 5g technology can have a very large impact in the process of dealing with the COVID-19 pandemic, there are several obstacles and challenges in imple-menting the telehealth system:

- Connectivity : Currently, only 9 cities have built a 5g network and not all areas of the city are covered by the 5g network. to build a reliable telehealth system requires connec-tions for all medical devices for all patients.
- Energy and costs : The IoT devices used in this system require low energy consumption and low costs so that they can be purchased by everyone.

- Security : Security must be guaranteed in the telehealth system which includes user data, pri-vacy, data integrity and authentication processes during the communication pro-cess between user devices and applications in the cloud.
- Big Data : The application of big data analysis and deep learning algorithms will be able to as-sist the health department and medical doctors in making policies to fight the covid-19 pandemic.

5. Conclusions

This paper describes the opportunities for using 5G network technology for the de-velopment of a telehalth system with the integration of several health service applica-tions such as telemedicine, telenirsing, telepharmacy and telesurgery to fight the COVID-19 pandemic centered on smart hospitals. in its implementation, there are still several obstacles related to 5G networks that have not been built in all areas in Indo-nesia, energy challenges, and security challenges. In addition, the telehealth system can run well if it is supported by other technologies such as IoT, cloud computing and big data.

References

1. F. Boccardi, R. W. Heath, A. Lozano, T. L. Marzetta, P. Popovski, Five Disruptive Tech-nology Directions for 5G, *IEEE communications magazine*, 2014.
2. D. Soldani, F. Fadini, H. Rasanen, J. Duran, T. Niemela, D. Chandramouli, T. Hoglund, K. Doppler, T. Himanen, J. Laiho, N. Nanavaty, 5G Mobile Systems for Healthcare, in: *2017 IEEE 85th Vehicular Technology Conference*, 2017; pp. 1–5.
3. H. Kaur, M. A. Alam, R. Jameel, A. K. Mourya, V. Chang, A Proposed Solution and Future Direction for Blockchain-based Heterogeneous Medicare Data in Cloud Environment, *Journal of Medical Systems*, 2018.
4. M. Talal, A. Zaidan, B. Zaidan, A. Albahri, A. Alamoodi, O. Albahri, M. Alsalem, C. Lim, K. L. Tan, W. Shir, et al.: Smart Home-based IoT for Real-time and Secure Remote Health Monitoring of Triage and Priority System using Body Sensors: Multidriven Systematic Re-view, *Journal of Medical Systems*, 2019.
5. Patrick Marsch et al, 5G System Design, *Wiley*, 2018.
6. A. Osseiran, 5G Mobile and Wireless Communications Technology, *Cambridge University Press*, 2016.
7. A. Ahad, M. Tahir and K. -L. A. Yau, 5G-Based Smart Healthcare Network: Architecture, Taxonomy, Challenges and Future Research Directions, *IEEE Access*, vol. 7, 2019, pp. 100747-100762.
8. Y. S. Hau, J. K. Kim, J. Hur, M. C. Chang, How about Actively using Telemedicine during the COVID-19 Pandemic? , *Journal of Medical Systems*, 2020; pp 1–2.