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ASSESSING THE IMPLICATIONS OF 5G TECHNOLOGY ON NETWORK ARCHITECTURE, IOT APPLICATIONS, AND DATA TRANSMISSION SPEEDS

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Abstract-This study demonstrated the implications of 5G technology in network architecture, data transmission speeds and IoT applications. Aim, objectives, literature review have been presented in this study. In addition to this, challenges and strategies of mitigation have been presented in this study. "Secondary qualitative data collection method" has been considered for conducting this research and gaining relevant information about a given topic of interest.

Keywords: 5G technology, Network architecture, IoT applications, Data transmissions speeds

I. INTRODUCTION

5G technology offers faster and reliable communication, transforming IoT that develops healthcare and revolutionising entertainment. This study focuses on investigation of implications of 5G technologies on network architecture, IoT applications and data transmissions speeds. 5G technology impacts on society that transforms into the "*Internet of Things*" (IoT). 5G networks offers for developing reliability with lower latency and wide range of network stability that makes it ideal for applications for real-time communications. Methodology, results and discussion of gathered information are determined in this study.

Aim

Main aim of this study is to examine implications of 5G technology in IoT applications, network architecture and data transmission speed.

Objectives

- To investigate influences of 5G technology on network architecture, IoT applications and data transmission speeds
- To examine challenges of 5G technology on network architecture, IoT applications and data transmission speeds
- To recommend strategies for implications of 5G technology on

network architecture, IoT applications and data transmission speeds

II. LITERATURE REVIEW

Influence of 5G technology on network architecture, IoT applications and data transmission speeds

Introduction of 5G technology enables real-time data transmission and processing to develop productivity and efficiency that influences "expansive bandwidth". Use of 5G networks requires higher numbers and density of base stations caused through capabilities of communication systems [1]. 5G networks influence users that are able to stream high quality of video, access "*Virtual Reality*" (VR) and "*Augmented Reality*" (AR) experiences. Use of 5G technology leads to immersive and interactive entertainment experiences that increase network architectures. Besides this, 5G designs with protracted capacity for empowering new development models of architectures and IoT applications through enabling next generation's users, data transmission speeds and delivering new services [2]. Following this, 5G is able to deliver faster and more secure data that is used for connecting with new range of IoT devices and applications for data transmissions. Therefore, 5G technology influences in terms of expansive bandwidth networks architecture, IoT applications and data transmissions speeds with expansive bandwidth.

Challenges of 5G technology on network architecture, IoT applications and data transmissions speeds

5G algorithms are more comprehensive than its predecessors that create issues vulnerable to cyberattacks. Increased connectivity and complexity in 5G networks creates "***security concern issue***" for organisations about cybersecurity involving risk of cyber attacks. Data security becomes a major issue during implications of 5G technology that decreases numbers of users of 5G networks [3]. Lack of data security in 5G technologies creates issues in the IoT applications, networks architectures and data transmissions speeds. On the other hand, ineffective infrastructure for the implications of 5G networks creates issues for network management [4]. "***Infrastructure investment***" is a major issue for the implications of 5G technology in network architecture, data transmission speeds and IoT applications. Developing essential infrastructure for 5G deployment are involving new cell towers and fibre optic networks. Thus, "data security" and "infrastructure" are main issues for the implications of 5G technology in IoT applications, data transmission speeds and network architecture.

Strategies for mitigating challenges about 5G technology

5G wireless technology delivers multi-GBPs speak data speeds that increase availability of

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experiences for more users. Cybersecurity helps to ensure security of information with network layers from different threats [5]. Issues of data security concerns can be mitigated through rapid development of "cybersecurity measures", "encryption technologies" and "implementation of robust security methods" about implications of 5G technology. Besides this, the government as a global leader focuses on 5G communications networks and wants to find resolutions of challenges [6]. Thus, cybersecurity measurement and government's involvement can overcome issues regarding the implications of 5G technologies in network architecture, IoT applications and data transmissions speeds.

Literature gap

From above information, this study has found gaps in previous literature that is limited information about challenges of 5G technology in networks architecture, IoT application and data transmission speeds. Peer-reviewed journal highlighted effective management of 5G technology in networks architecture but not focuses on challenges of 5G technology [2]. Hence, inadequate information about challenges for implications of 5G technology is the main gap of literature. Thus, this study has shed light on the challenges through the gathering of wide numbers of articles and journals for mitigating mentioned literature gaps.

III. RESEARCH METHODOLOGY

This study has referred to ***"interpretivism research philosophy"*** in terms of determining the type of data that has been analysed for answering research questions and satisfying research objectives. "Interpretivism research philosophy" revolves around understanding social reality [7]. This research has been selected as an "***inductive research approach***" as it allows researchers to gain a deep understanding about data and research phenomena. Unexplored perspective on hosting events in developing countries can be identified through acquisition of an "inductive research approach" [8]. On the other hand, this study has discarded the "deductive approach" as it can generate erroneous or biassed results due to the quality and quantity of information. Therefore, use of "***interpretivism philosophy***", "***inductive approach***" are appropriate for developing coherent and strong justification for arguments and research questions related to the implications of 5G technology.

"***Qualitative research strategy***" has been considered for reaching success for organisations. "Qualitative strategy" is beneficial to explore diverse perspectives of authors from existing literature. This study has been considered a "***secondary data collection method***" in terms of accumulating information and answering research questions. It helps to argue and justify claims, which in turn produce a

cohesive conclusion [9]. This study has used "Google scholar", "Researchgate" as a database for accumulating information. This study has considered "thematic analysis" and has developed four themes for evaluating information and answering research questions. "Thematic analysis" is beneficial in terms of gaining a clear understanding on the subject matter. Thus, it can be stated that "secondary qualitative data collection method" is appropriate for gaining relevant information about the implication of 5G technology in network architecture, IoT applications and data transmission speeds.

IV. RESULTS AND DISCUSSION

Theme 1: 5G technology increases data transmission speed and improves device connectivity on network architecture and IoT applications

5G technology has a positive impact on real-time data transmission that is important to increase efficiency of organisation based on bandwidth expansion. Higher bandwidth can be observed due to 5G technology that increases speed of data transmission [10]. It can also improve communication system of organisations that enable sharing of high-quality video and improve network architectures. Hence, innovation in network architecture can be observed due to 5G technology application that is important for improving device connectivity. On the other hand, 5G Technology supports mobile broadband that increases consumer experience [11]. Real-time data processing is another impact of 5G technology that is essential to process data accurately and faster. In addition, 5G technology can be implemented in city development such as traffic management and improving waste management, which is required for better social, and environmental sustainability that is a part of IoT application [11]. However, high infrastructure cost is required to implement 5G technology for traffic management and waste management. Broad applications of 5G technology can be observed in network architecture, data transmission speed and IoT applications that are important to provide a better experience to users by improving bandwidth.

Theme 2: Cybersecurity issues and infrastructure investment create challenges for implementing 5G Technology

Cyber security issues are highly observed due to implementation of 5G technology in an organisation that can negatively influence sensitive data protection. Privacy concerns and increasing complexity in devices due to 5G-technology inclusion can be observed to create security issues [12]. Cyber security issues can hack sensitive information of a company that may negatively influence network architecture and brand image in competitive market. In

addition, data privacy maintenance in IoT applications in 5G technology era is quite challenging due to privacy issues. Collecting huge volumes of data for a company and storing it separately with privacy concerns creates security challenges for 5G technology implementation in IoT applications. However, high cost of 5G technology investment creates challenges for a company to successfully implement the network [13]. Small businesses face financial struggles to implement high-cost 5G technology for improving data transmission speed due to its infrastructure cost. Moreover, ensuring compatibility of devices is also difficult for a company, as older systems may not support 5G technology. High cost of 5G technology implementation and maintenance along with device compatibility creates cost regarding challenges for its implementation.

Theme 3: Improvement in security measures, cost-effective solutions and data privacy framework can mitigate challenges of 5G technology implementation

Implementation of advanced security measures can enable a company to mitigate sensitive data protection issues that are important for maintaining brand reputation. Security measures are important in 5G-technology adoption as they prevent data loss, malware and cyber-attack [14]. Improving security measures can protect necessary information of a company while implementing 5G Technology, as it is important in wireless network architectures. However, data privacy framework needs to be also improved and this can be possible by following "General Data Protection Regulation (GDPR)" which is important for protecting human rights and privacy law [15]. It can protect sensitive information of companies, which is important while adapting 5G technology. Moreover, small companies for implementing 5G technology that can reduce financial challenges can receive cost-effective solutions. Government can provide subsidies for businesses to adopt 5G technology to improve data transmission speed through network architecture development and IoT application.

V. CONCLUSION

Based on the above information, it can be concluded that the implications of 5G technology on network architecture, data transmission speeds, and IoT applications focuses on growth of connection. This study has determined influences of 5G technology on network architecture, IoT applications and data transmissions speeds. This study has concluded that implications of 5G technology help to maintain networks architecture, data transmission speed and IoT applications.

REFERENCES

[1] Chang, K.C., Chu, K.C., Wang, H.C., Lin, Y.C. and Pan, J.S., (2020). Energy saving

technology of 5G base station based on internet of things collaborative control. *IEEE Access*, *8*, pp.32935-32946.

[2] Humayun, M., Jhanjhi, N.Z., Alruwaili, M., Amalathas, S.S., Balasubramanian, V. and Selvaraj, B., (2020). Privacy protection and energy optimization for 5G-aided industrial Internet of Things. *IEEE Access*, *8*, pp.183665-183677.

[3] Mazurczyk, W., Bisson, P., Jover, R.P., Nakao, K. and Cabaj, K., (2020). Challenges and novel solutions for 5G network security, privacy and trust. *IEEE Wireless Communications*, *27*(4), pp.6-7.

[4] Li, J., Chen, W., Chen, Y., Sheng, K., Du, S., Zhang, Y. and Wu, Y., (2021). A survey on investment demand assessment models for power grid infrastructure. *IEEE Access*, *9*, pp.9048-9054.

[5] Saleem, K., Alabduljabbar, G.M., Alrowais, N., Al-Muhtadi, J., Imran, M. and Rodrigues, J.J., (2020). Bio-inspired network security for 5G-enabled IoT applications. *IEEE Access*, *8*, pp.229152-229160.

[6] Patwary, M.N., Nawaz, S.J., Rahman, M.A., Sharma, S.K., Rashid, M.M. and Barnes, S.J., (2020). The potential short-and long-term disruptions and transformative impacts of 5G and beyond wireless networks: Lessons learnt from the development of a 5G testbed environment. *IEEE Access*, *8*, pp.11352-11379.

[7] Musa, W., Ponkratov, V., Karaev, A., Kuznetsov, N., Vatutina, L., Volkova, M., Shalina, O. and Masterov, A., (2022). Multi-cycle production development planning for sustainable power systems to maximize the use of renewable energy sources. *Civil Engineering Journal*, *8*(11), pp.2628-2639.

[8] Svenningsson, P. and Drubba, M., (2020). How to capture that business value everyone talks about?: An exploratory case study on business value in agile big data analytics organizations.

[9] Mirzababaei, B. and Pammer-Schindler, V., (2024). Facilitating the Learning Engineering Process for Educational Conversational Modules using Transformer-based Language Models. *IEEE Transactions on Learning Technologies*.

[10] Shafique, K., Khawaja, B.A., Sabir, F., Qazi, S. and Mustaqim, M., (2020). Internet of things (IoT) for next-generation smart systems: A review of current challenges, future trends and prospects for emerging 5G-IoT scenarios. *Ieee Access*, *8*, pp.23022-23040.

[11] Gomez-Barquero, D., Lee, J.Y., Ahn, S., Akamine, C., He, D., Montalaban, J., Wang, J., Li, W. and Wu, Y., (2020). IEEE transactions on broadcasting special issue on: Convergence of

broadcast and broadband in the 5G era. *IEEE Transactions on Broadcasting*, *66*(2), pp.383-389.

[12] Sullivan, S., Brighente, A., Kumar, S.A. and Conti, M., (2021). 5G security challenges and solutions: a review by OSI layers. *IEEE Access*, *9*, pp.116294-116314.

[13] Poorzare, R. and Augé, A.C., (2020). Challenges on the way of implementing TCP over 5G networks. *IEEE access*, *8*, pp.176393-176415.

[14] Sullivan, S., Brighente, A., Kumar, S.A. and Conti, M., (2021). 5G security challenges and solutions: a review by OSI layers. *IEEE Access*, *9*, pp.116294-116314.

[15] Caruccio, L., Desiato, D., Polese, G. and Tortora, G., (2020). GDPR compliant information confidentiality preservation in big data processing. *IEEE Access*, *8*, pp.205034-205050.