PCMJ

Progress in Computer and Mathematics Journal (PCMJ)
volume 3 [November, 2025]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

EVALUATION OF WI-FI PERFORMANCE IN UITM JASIN FOR ONLINE MEETING

PRITY SHAHKIRA NASRUDIN
College of Computing, Informatics and Mathematics
UiTM Melaka, Campus Jasin, Melaka
prity.shahkira@gmail.com

SYAFNIDAR ABDUL HALIM*
College of Computing, Informatics and Mathematics
UiTM Melaka, Campus Jasin, Melaka
syafnidar@uitm.edu.my
**Corresponding author*

NOOR ASHITAH ABU OTHMAN
College of Computing, Informatics and Mathematics
UiTM Melaka, Campus Jasin, Melaka
noor2106@uitm.edu.my

Article Info

Abstract

Stable network performance is critical in educational institutions, particularly with the increasing adoption of online meetings for academic purposes. This study investigates the Wi-Fi performance at UiTM Jasin Residential College by analysing throughput, latency, and packet loss during Microsoft Teams sessions. Three experimental configurations were evaluated: (1) same distribution switch, (2) different distribution switches, and (3) multiple different distribution switches. Two laptops acted as clients and a tablet served as the host, while Wireshark was employed for real-time traffic capture. The same distribution switch setup achieved the lowest packet loss (0.009%) but exhibited low throughput (0.525 Mbps) and high latency (7.76 ms). The different distribution switches configuration provided balanced results, with higher throughput (0.763 Mbps) and reasonable latency (7.04 ms), though Laptop A recorded the highest latency (8.86 ms). The multiple distribution switches setup produced inconsistent performance, with Laptop B showing moderate throughput (0.633 Mbps) and latency (7.49 ms), while Laptop A recorded the highest packet loss (0.094%). Overall, packet loss remained low but increased with multiple switches or under congestion. The findings offer insights into network behaviour during peak usage and suggest potential Wi-Fi infrastructure optimizations to enhance the quality of online learning experiences.

Received: March 2025
Accepted: September 2025
Available Online: November 2025

Keyword: Wi-Fi performance, throughput, latency, packet loss, Microsoft Teams, educational networks.

INTRODUCTION

Online learning environments have been increasingly integrated in the past few years, especially on campus. The trend towards virtual communication points out the requirement for reliable and high-quality online meetings. On the other hand, the increasing use of real-time applications like video calls has highlighted the need for increased bandwidth (Chowdhury & Mahmud, 2013). Thus, it brings impacts to the network performance during online meetings and to the lecture sessions.

To support the campus-wide internet structure, UiTM Jasin uses a backbone network topology, also known as core network. It is the central core that links smaller networks to large computer networks (Neos Networks, 2024). This topology ensures reliable and centralized connectivity throughout UiTM Jasin network by connecting a variety of buildings, such as academic blocks, library, administration, and residential colleges. The backbone connects several LANs across the buildings in the campus area, providing a unified pathway for data transmission.

Since students and lecturers often use online platforms for lecture sessions, meetings, or seminars activities, ensuring reliable network performance for online meetings is essential. Internet speed fluctuations, network congestion and low bandwidth might hinder academic activities. To have the capability to support online meetings of high-quality, UiTM Jasin is required to meet certain network requirements. This is because the efficiency of online meetings depends mostly on the capacity of the underlying network infrastructure to fulfill the requirements that are necessary. As stated by Carter et al. (2021), it is crucial to have a reliable internet connection and large data usage to be able to utilize online streaming platforms. Understanding and fulfilling the network requirements is essential to ensure smooth and uninterrupted online meetings in such environments.

Therefore, the purpose of this study is to evaluate and compare the performance of Wi-Fi network at UiTM Jasin, identifying the factors that impact network reliability during online meetings, and providing insight into the performance of the networks.

LITERATURE REVIEW

Online Meetings

According to Pratama et al. (2020), online learning reinvents the education sector by utilizing technological advancements. Online meeting platforms are one of the ways for students and lecturers to collaborate for online classes. There are numerous free online meeting platforms available on internet such as Zoom, Google Meet, and Teams (Alkubaisi et al., 2022). Online meeting platforms have become necessary especially for students living at residential college because they offer essential tools for maintaining educational continuity and fostering education collaboration.

Google Meet and Microsoft Teams are one of the examples of online meeting applications that are frequently used in UiTM Jasin. Google Meet can add up to 100 participants in a single meeting with the free version of the platform. Google Meet is user-friendly and allows users to share a single window or tab, or the entire screen (Singh & Awasthi, 2020). Next, Microsoft Teams is one of the features that is included in Microsoft Office 365. Up to 300 individuals can attend a meeting that is hosted by the platform (Arul Vallarasi & Dr. Regi, 2020).

Online meetings are confronted with many kinds of difficulties. As stated by Blessy Paul & Kurian (2023), students experience a range of health problems and lose focus, eventually resulting in them losing focus and receiving lower grades. Additionally, students may have low digital literacy, online distractions, lacking interaction, difficulty accessing the resources they need to log in and finish remote learning, and disabilities or special needs (Anitha et al., 2022). Other than that, inconsistent Wi-Fi coverage is another common factor of network or connectivity issues, especially during peak usage times. Based on the research conducted by Simamora (2020), students noticed that issues like poor signal and slow internet networks can interfere with learning process.

Wireless LAN

Rapid advancements in cellular mobile networks and wireless LANs are being used widely to meet users' frequently evolving data needs (Srinivasa Rao & Berlin Hency, 2021). Wi-Fi networks are installed almost everywhere, such as office buildings, apartments, and public areas like malls, airports, and college campuses. Wireless LAN stands for wireless local area network, meanwhile it is defined to wirelessly provide several devices in a limited area (Beal, 2024). It uses high-frequency radio waves instead of wired connections and often has an Internet access point (AP). Wi-Fi is a widely known wireless LAN brand that uses the IEEE 802.11 standards.

There are several types of wireless networks, such as wireless LAN, wireless WAN, wireless, PAN, wireless MAN, cellular networks, satellite networks, and many more (Harahap et al., 2023). In a UiTM Jasin setting, students may use Wi-Fi that is provided by the campus for faster connectivity. Despite that, there is also a problem when Wi-Fi has slow connection which they must use their mobile data or also known as cellular networks to access the Internet. For example, wireless LANs are ideal for residential colleges and libraries since they provide internet access within buildings. In contrast, cellular networks are necessary for more connectivity and cover larger areas, though they might not perform well indoors.

Wireless LAN performance, reliability, and quality of service depend heavily on Wi-Fi standards. According to Ifeanyi Ikem et al. (2022), since it was initially made accessible to the public in 1997, the IEEE 802.11 standard has been through several stages of development. Nowadays, all IEEE standard amendments are designed to be backward compatible with previous versions, so latest devices can connect with older ones (IEEE Standards Association, 2023). The Wi-Fi standards that are commonly available include IEEE 802.11a, 802.11b, 802.11g, 802.11n (Wi-Fi 4), 802.11ac (Wi-Fi 5), 802.11ax (Wi-Fi 6) and 802.11be (Wi-Fi 7) (Phillips, 2023).

There are many types of wireless LAN topology such as IBSS (Independent Basic Service Set), BSS (Basic Service Set), ESS (Extended Service Set), and MBSS (Multi-BSS) (Harahap et al., 2023). UiTM Jasin campus uses an ESS topology to give extensive wireless coverage by connecting numerous access points spread throughout different buildings and open areas. This topology is important for UiTM Jasin campus as students need reliable and consistent network access.

As stated by Obelovska et al. (2021), both the increasing need for high quality multimedia transmission and the growth in Wi-Fi-enabled devices have prompted the search for new ways to enhance WLAN performance. Online meetings need stable network performance for real-time video and audio with minimal problems like low throughput, high latency, and packet loss. UiTM Jasin, with several users participating in online classrooms, seminars, and group discussions, needs a reliable network infrastructure to handle high traffic.

Network Performance Parameters

The effectiveness of a computer network, considering aspects such as dependability, speed, and data transfer efficiency, is measured by its network performance (Digital Samba, 2024). Hence, network performance parameters are essential metrics in assessing the effectiveness and reliability of Wireless LAN.

In network, throughput is an essential performance parameter, especially in assessing network effectiveness. Andi Risky Maulana et al. (2021) define the term "throughput" as the effective data transfer speed measured in bits per second (bps) via a network. It is a key indicator of network performance as it displays how much useful data is transmitted during a certain period. As technology evolves as time goes on, it is noticeable that there is an enormous increase in multimedia traffic, which means increased throughput demands.

Based on Armar et al. (2023), latency is defined as the amount of time that is transmitted between the sender and the recipient of a voice packet. Other than that, it is also known as the difference between a task's expected and actual completion time (Aslanpour et al., 2020). Low latency is essential for real-time communication in order to provide consistent audio and video transmission during online meetings at residential colleges. This is because high latency in meetings for online classes can lead to significant delays between the lecturer and the students, which results in disruption of the session flow. As a result, the amount of content taught to the students in each lesson reduced, which led the lecturers to completely change the lesson plans, adding their workload (Novikov, 2020).

Packet loss refers to data packet that is loss during transmission, which is caused by packet discarding, transmission errors, and network congestion (Armar et al., 2023). A study conducted by Andi Risky Maulana et al. (2021) mentioned that packet loss means the total number of packets that are not successfully transmitted caused by an increase of packets in a network. Packet loss is typically expressed in percentage of total packets sent. This results in missing data packets, video streams of the students and lecturers may encounter blurry images, low resolution, and screen freezes, making learning session challenging (Paul et al., 2023).

Benchmarks are crucial in measuring the network performance as they offer a standard or baseline to compare the observed parameters to anticipated values. Benchmarks provide a clear reference for evaluating whether the network is suitable for online meetings and act as a basis for evaluating the network performance. They assist in analyzing if a network satisfies the requirements for specific applications, like Microsoft Teams and Google Meet, that requires reliable and stable communication. Despite the lack of defined throughput (Mbps) standards in the literature, it is suggested that online meetings settings such as Microsoft Teams need at least 1.5 Mbps for smooth video communication (Cook, 2021). Table 1 and Table 2 below show the standards for latency and packet loss respectively.

Table 1: Category for Latency

Category	Latency (ms)
Excellent	< 150
Good	150 - 300
Average	300 - 450
Bad	> 450

Table 2: Category for Packet Loss

Category	Latency (ms)
Excellent	0
Good	3
Average	15
Bad	25

Firewall

Firewall is a computer network security system that limits internet traffic entering, exiting, or transmitting within a private network. It can be software or hardware. They provide a wall or barrier between untrusted external networks from controlled and secured internal networks that are trustworthy (Cisco, 2024). It operates by selectively restricting or accepting data packets.

There are different types of firewalls that exist today. Firstly, packet-filtering firewalls are the most traditional and simple type of network firewalls. Packet filter establishes checkpoints at network nodes, such as switches and routers, to operate as a firewall (Priya Mukkamala & Rajendran, 2020). Secondly, stateful inspection firewalls are one of the types of firewalls that combine the previous technologies, packet filtering and TCP handshake (Priya Mukkamala & Rajendran, 2020). Next one is unified threat management (UTM) firewall, and its devices integrate intrusion prevention, antivirus, and stateful inspection firewall functions in a loosely connected way (Cisco, 2024). Lastly, Next-Generation Firewalls (NGFWs) incorporate advanced features including application awareness, intrusion prevention systems (IPS), and deep packet inspection (DPI).

Firewalls are important tools for security purposes, but they might affect network performance parameters that are crucial for online meetings. Every packet that goes through a firewall is inspected to see if it should be allowed or blocked from entering the network. Online meeting traffic can be prioritized by firewall configuration, ensuring that certain data packets are sent before lesser priority traffic. The quality of the audio and video streams during online meetings can be maintained by setting firewalls to allow VoIP priority over other kinds of traffic.

Network Performance Measuring Tools

Tools for measuring and diagnosing network performance are important for keeping a check on and improving the network performance. Network performance measuring tools offer valuable information about the effectiveness of the network. Wireshark is a popular tool for analyzing network protocols. It records and examines the details of data packets as they pass through a network. In-depth network visibility is offered by Wireshark, which may also identify a variety of network problems. This tool operates on all platforms such as Windows, Linux, OS X, and UNIX, and has a helpful feature. With the right driver support, it can intercept air traffic and decrypt it into a format that helps administrators identify and address issues that cause poor performance and inconsistent connectivity (Jain & Anubha, 2021).

METHODOLOGY

This project utilizes the waterfall model as its framework, as shown in Figure 1. The method is separated into four stages: planning, experiment, analysis, and documentation.

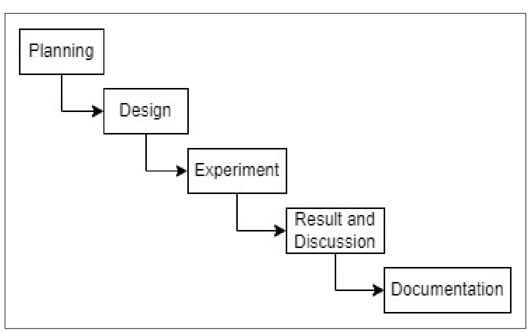

Figure 1: The Waterfall Model

The data collection for this project was conducted on Thursday, since online sessions on both days always stick to the same timetables and class schedules, ensuring that the conditions being measured remain consistent. On both days, data will be collected from 10:00 a.m. until 12:00 p.m. and 2 p.m. until 4:00 p.m. A tablet will serve as the host of the meeting to replicate the online meeting setting. Throughout the session, it will share a YouTube video screen, and the same YouTube link will be used for all experiments to maintain consistency. Two laptops will act as clients, joining the meetings and typing in the chat box to identify any packet losses during the session. As can be seen below, Table 3 and Table 4 outlined the hardware and software that are needed to execute the project respectively. Meanwhile Table 5 presented the Wi-Fi standards at each location in UiTM Jasin.

Table 3: Hardware Used for The Project

Hardware	Function	Description	Wi-Fi Standard
Laptop	Use as the testbed to execute this project and also serves as the client device for online meetings.	ASUS A Series Notebook A556U-RXX249T	802.11n
		DELL Latitude 5480	802.11ax
Access Point (AP)	Facilitate communication between devices and the distribution switches by wirelessly connecting them to Wi-Fi network	EnGenius Cloud Managed Wi-Fi 6 2×2 Indoor Access Point ECW230	802.11 ax
		Cisco Aironet 1600 Series Access Point with External Antennas	802.11n
Tablet	Act as a host for online meetings, used to share screens to simulate real-world scenarios	Apple iPad Air (5th Generation) Model A2588	802.11ax

Table 4: Software Used for The Project

Software	Function	Description
Wireshark	Capture network packets in real- time and provide statistics representations of video and audio traffic data	Operating systems:Windows, macOS, Linux, UNIX Protocols: TCP/IP, HTTP, DNS. FTP, and others. Stable release: Wireshark 4.0.6 Release date: 25th May 2024 https://www.wireshark.org/docs/relnotes/wireshark-4.0.6.html
Microsoft Teams	Serves as a platform to generate real-time video and audio traffic	Supported operating systems: Windows, Windows Server, macOS. Chrome OS Participants: Up to 300 https://learn.microsoft.com/en-us/microsoftteams/get-clients?tabs=Windows#browser- client
YouTube	Provides a video for sharing screens to replicate real-time online meetings between the host and clients.	Link that will be used to share screen: https://youtu.be/oIRkXulqJA4?feature=shared

Table 5: Wi-Fi Standards at UiTM Jasin

Hardware	Function
Residential College	802.11ax
FSKM Building	802.11n
Library	802.11n

The design phase assesses the project aspects and organizes workflow that is needed. This includes the flowchart of the project and experiment for data collection and analysis. This phase involves creating the flow that outlines each action needed to achieve the results. Figure 2 shows the flowchart of the project and Figure 3 shows the flowchart on how to set up and execute the experiments, respectively.

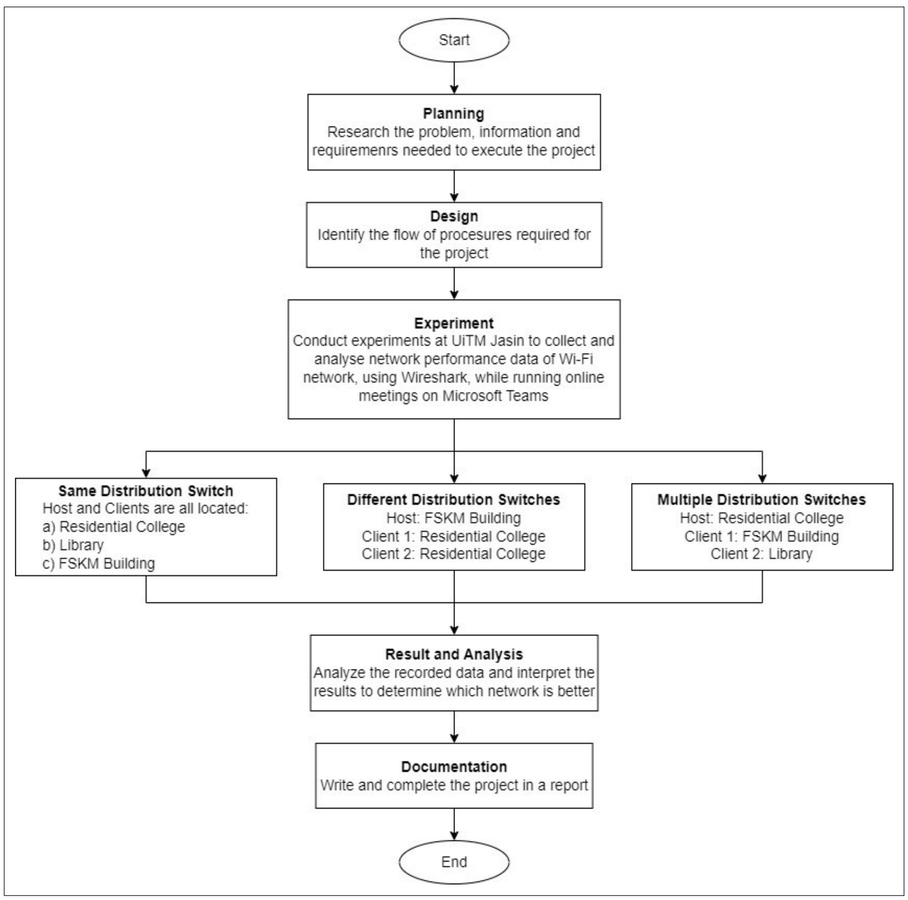

Figure 2: Flowchart of The Project

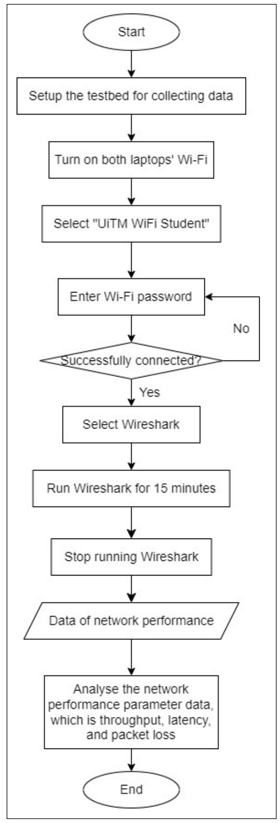

Figure 3: Flowchart of The Experiment Setups

To ensure precise and accurate measurement of network performance, the calculation of network performance parameters aims to give the mathematical formulas needed to calculate network performance parameters. Below are formulas of each parameter.

Calculation for throughput:

$$\text{TThrrrrrrrrhpprrpp} = \frac{\text{PPPPPPPPPppPP rrPPPPPPrrrrPPrr}}{\text{TTrrTTPP rroo rrPPppPP pprrPPttPPTTrrPPPPrrrrtt}}$$

Calculation for latency:

$$\text{LLPPppPPttPPLL} = \frac{\text{TTrrppPPTT rrPPTTPPLL}}{\text{TTrrppPPTT rrrrPPrrPPTTTT ppPPPPPPPPppPP}}$$

Calculation for packet loss:

$$\text{PPPPPPPPPpp TTrrPPPP} = \frac{(\text{PPPPPPPPPppPP PPPPttpp} - \text{PPPPPPPPPppPP rrPPPPPPrrrrPPrr})}{\text{PPPPPPPPPppPP rrPPPPPPrrrrPPrr}} \times 100\%$$

PCMJ
Progress in Computer and Mathematics Journal (PCMJ)
volume 3 [November, 2025]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

The results of the calculations were used to make comparisons between the benchmark and the performance of the network at each location in UiTM Jasin. After performing the calculations using the formulas, the data that has been analyzed was inserted in a table. It will contain the findings of the network performance parameters analysis, which include the measurements of throughput, packet loss and latency and their averages.

RESULT AND DISCUSSION

Bar and line graphs were used to visualize differences in average throughput, latency and packet loss for each experiment, which provided a clear visualization of the network's behavior under certain setups. The results will be compared with the benchmarks for network performance. These benchmarks serve as a guide for acceptable performance standards, like minimum throughput, maximum latency, and acceptable packet loss.

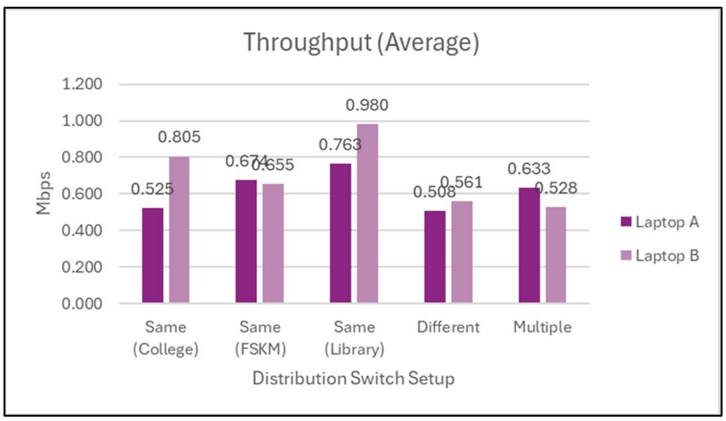

Figure 4: Bar Graph for Throughput

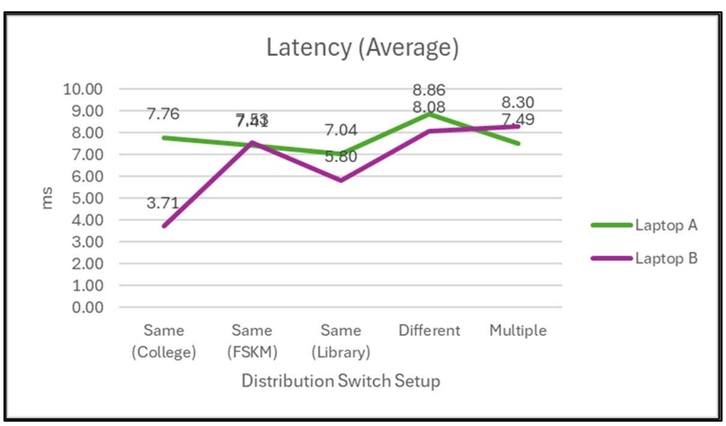

Figure 5: Line Graph for Latency

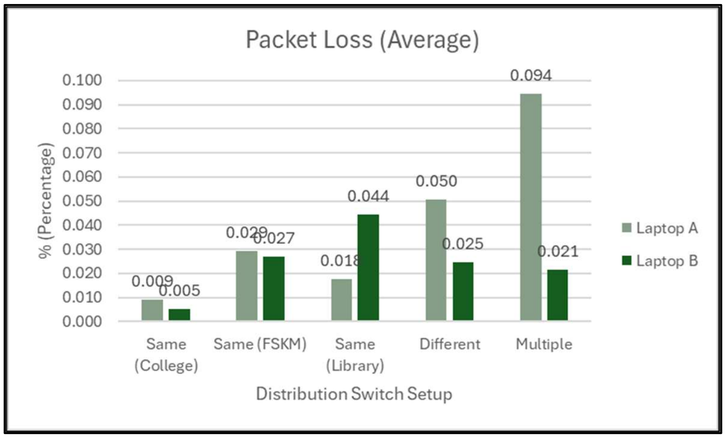

Figure 6: Line Graph for Packet Loss

Based on Figure 4, Figure 5, and Figure 6, the same distribution switch setup had the lowest packet loss (0.009%), but it also had high latency (7.76 ms) and low throughput (0.525 Mbps), which were probably caused by network congestion when many students connected to UiTM Wi-Fi in Residential College, if compared to FSKM Building and Library, where there were not as many students as in Residential College.

With the lowest latency (1.69 ms) and moderate throughput (1.354 Mbps), Different Distribution Switch setup demonstrated the highest overall performance, indicating improved distribution within UiTM Jasin. The reason for this is that UiTM Jasin connects its various buildings by fiber optic, which has a speed of 2 Gbps, makes the traffic from the host (Residential College) to the two clients in the two clients (FSKM Building) smooth during data transmission.

Although Multiple Distribution Switch setup had the highest throughput (1.783 Mbps), it also had the most packet loss (0.112%). It also had the highest packet loss out of every setup. This result could be an indicator of the variability caused by using multiple switches at once, which may increase latency because of additional routing overhead. Since FSKM Building and Library access points are still using 802.11n Wi-Fi standards, that made Residential College also using the same standards since its access point is backward compatible despite using the latest standards 802.11ax

For the benchmark, the throughput findings were compared with the benchmark value of 1.5 Mbps, which is the minimum needed for smooth video communication. However, most of the study’s throughput values were below the benchmark, suggesting potential challenges in ensuring the ideal video quality.

Next, all the average latency values for the different experiment setups were lower than the benchmark of 150 ms, which is regarded as excellent for seamless online video communication. These average values show that even in various distribution switch setups, UiTM Jasin Wi-Fi network can provide fast connection.

TIPHON (1999), Pranata et al. (2016), and Andi Risky Maulana et al. (2021) stated that for online meetings to operate efficiently, packet loss should be maintained at 1%. All the experiment results show that average packet loss values satisfy the benchmark, earning the category "Excellent". This indicates that network for every distribution switch setup consistently support smooth and dependable online meetings, regardless of the different setups.

CONCLUSION

Based on the analysis, the network met or exceeded the benchmarks in all distribution switch setups, displaying excellent results in terms of latency and packet loss. This shows how well the network can maintain fast and stable communication. However, majority of the throughput values in every setup dropped below the 1.5 Mbps benchmark. This suggests that although UiTM Wi-Fi network is suitable for basic connection, there are occasions in which it is unable to support high-quality video communication for online meetings.

The results highlight the current infrastructure's strengths and limitations that provide a solid basis for future enhancements. Wi-Fi network at UiTM will be able to satisfy the increasing demand for online communication platforms, such as online meetings, by addressing throughput limits through infrastructure upgrades, bandwidth optimization, and traffic prioritization.

REFERENCES

Alkubaisi, G. A. A. J., Al-Saifi, N. S., & Al-Shidi, A. R. (2022). Recommended Improvements for Online Learning Platforms Based on Users' Experience in the Sultanate of Oman. *Higher Education Studies*, *12*(3), 114. https://doi.org/10.5539/hes.v12n3p114

Andi Risky Maulana, Hubbul Walidainy, Muhammad Irhamsyah, Fathurrahman, & Akhyar. (2021). *Analisis Quality of Service (QoS) Jaringan Internet Pada Website e-Learning Universitas Syiah Kuala Berbasis Wireshark* (Vol. 6, Issue 2).

Anitha, R., Cowsigan, S. P., Vanitha, U., Niranjana, M. I., Shadrach, F. D., & Raagavi, S. (2022). Performance Analysis of E-Learning System Using Data Mining Techniques. *2022 IEEE 2nd International Conference on Mobile Networks and Wireless Communications, ICMNWC 2022*. https://doi.org/10.1109/ICMNWC56175.2022.10031971

Armar, S., Sharma, R., & Raj, S. K. (2023). Performance Evaluation of VoIP Networks:

Simulation-Based Study and Analysis of Key Metrics. *2023 IEEE International Conference on Research Methodologies in Knowledge Management, Artificial Intelligence and Telecommunication Engineering, RMKMATE 2023*. https://doi.org/10.1109/RMKMATE59243.2023.10369975

Arul Vallarasi, S., & Dr. Regi, S. (2020). *Effective Virtual Platforms for Online Meeting*. https://www.researchgate.net/publication/358470543

Aslanpour, M. S., Gill, S. S., & Toosi, A. N. (2020). *Performance Evaluation Metrics for Cloud, Fog and Edge Computing: A Review, Taxonomy, Benchmarks and Standards for Future Research*.

Beal, V. (2024, April 28). *Wireless Local Area Network (WLAN)*. Techopedia. https://www.techopedia.com/definition/5107/wireless-local-area-network-wlan

Blessy Paul, P., & Kurian, C. (2023). Student performance prediction in e-learning system and evaluating effectiveness of online courses. *2023 International Conference on Advances in Intelligent Computing and Applications, AICAPS 2023*. https://doi.org/10.1109/AICAPS57044.2023.10074504

Carter, S. M., Shih, P., Williams, J., Degeling, C., & Mooney-Somers, J. (2021). Conducting Qualitative Research Online: Challenges and Solutions. *Patient*, *14*(6), 711–718. https://doi.org/10.1007/s40271-021-00528-w

Chowdhury, Md. S. H., & Mahmud, S. (2013). *QOS PERFORMANCE ANALYSIS: DESIGN AND DEVELOPMENT OF VOICE AND VIDEO MOBILITY OVER LONG TERM EVALUATION (LTE) MODEL*. www.bth.se.com

Cisco. (2024). *What Is a Firewall?* Cisco. https://www.cisco.com/c/en/us/products/security/firewalls/what-is-a-firewall.html

Cook, D. (2021, December 2). *WHAT THROUGHPUT IS REQUIRED FOR OPTIMAL WEB CONFERENCING AND HOW CAN YOU MONITOR IT?* https://www.linkedin.com/pulse/what-throughput-required-optimal-web-conferencing-how-don cook#:~:text=5%20Mbps%20is%20the%20general,1.8%20Mbps%20to%204.0%20Mbps

Digital Samba. (2024, May 15). *A Deep Dive into the Network Performance Monitoring Metrics*. Digital Samba. https://www.digitalsamba.com/blog/a-deep-dive-into-the-network-performance-metrics

Harahap, B. S. D., Silalahi, J., Saragih, A., Pandia, R. E., & Sitompul, D. (2023). *Wireless Networking How Wi-Fi Works and the Different Types of Wireless Networks*. https://www.researchgate.net/publication/367128043

IEEE Standards Association. (2023, May 16). *The Evolution of Wi-Fi Technology and Standards*. IEEE Standards Association (IEEE SA). https://standards.ieee.org/beyond-standards/the-evolution-of-wi-fi-technology-and-standards/

Ifeanyi Ikem, O., Eke, J., & Kalu, E. C. (2022). *Modeling Throughput Performance in 802.11 Wireless Local Area Network*. http://www.cisco.com/c/en/us/solutions/collateral/se

Jain, G., & Anubha. (2021). Application of SNORT and Wireshark in Network Traffic Analysis. *IOP Conference Series: Materials Science and Engineering*, *1119*(1), 012007. https://doi.org/10.1088/1757-899x/1119/1/012007

Neos Networks. (2024, March 27). *What is a backbone network?* Neos Networks. https://neosnetworks.com/resources/blog/what-is-backbone-network/

Novikov, P. (2020). Impact of COVID-19 Emergency Transition to On-line learning on International Students' Perceptions of Educational Process at Russian University. In *www.jsser.org Journal of Social Studies Education Research Sosyal Bilgiler Eğitimi Araştırmaları Dergisi* (Vol. 2020, Issue 3). www.jsser.org

Obelovska, K., Panova, O., & Karovič, V. (2021). Performance analysis of wireless local area network for a high-/low-priority traffic ratio at different numbers of access categories. *Symmetry*, *13*(4). https://doi.org/10.3390/sym13040693

Paul, G. A., Sharma, A., Jagnani, Y., Saxena, A., & Supraja, P. (2023). A Novel Pipeline for Compressing Image Buffers in Remote Education Video Conferencing using Harris Corner Detection and Pixel Map Array. *2023 5th International Conference on Electrical, Computer and Communication Technologies, ICECCT 2023*. https://doi.org/10.1109/ICECCT56650.2023.10179787

Phillips, G. (2023, December 6). *The Most Common Wi-Fi Standards and Types, Explained*. Make Use Of. https://www.makeuseof.com/tag/understanding-common-wifi-standards-technology-explained/

Pratama, H., Azman, M. N. A., Kassymova, G. K., & Duisenbayeva, S. S. (2020). The Trend in Using Online Meeting Applications for Learning During the Period of Pandemic COVID-19: A Literature Review. *Journal of Innovation in Educational and Cultural Research*, *1*(2), 58–68. https://doi.org/10.46843/jiecr.v1i2.15

Priya Mukkamala, P., & Rajendran, S. (2020). A SURVEY ON THE DIFFERENT FIREWALL TECHNOLOGIES. In *International Journal of Engineering Applied Sciences and Technology* (Vol. 5). http://www.ijeast.com

Simamora, R. M. (2020). *Studies in Learning and Teaching Studies in Learning and Teaching The Challenges of Online Learning during the COVID-19 Pandemic: An Essay Analysis of Performing Arts Education Students*. *1*(2), 86–103. https://doi.org/10.46627/silet

Singh, R., & Awasthi, S. (2020). *Updated Comparative Analysis on Video Conferencing Platforms-Zoom, Google Meet, Microsoft Teams, WebEx Teams and GoToMeetings*.

Srinivasa Rao, D., & Berlin Hency, V. (2021). Performance evaluation of congestion aware transmission opportunity scheduling scheme for 802.11 wireless LANs. *International Journal of Intelligent Networks*, *2*, 34–41. https://doi.org/10.1016/j.ijin.2021.04.001