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Analysis of WLAN Network Quality Improvement at Bank Mandiri Palembang Sudirman Area using Per Connection Queue Method

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Abstract

With the internet's and information technology's rapid expansion, IT has emerged as a crucial component of many areas, particularly computer networks. Network monitoring is crucial because it can assist in locating network issues precisely, and ongoing monitoring can help spot any problems early on and take proactive measures to fix them before they negatively affect users. The purpose of this study is to track and evaluate the functionality of the Palembang Sudirman area's Bank Mandiri WLAN (Wireless Local Area Network). Three steps make up the action research approach used in this study: diagnosis, analysis, and assessment. This allows adjustments to be made to the scenario-specific protocols that could otherwise result in alterations. Based on Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) standards and Quality of Service (QoS), the analysis concludes that Bank Mandiri's WLAN is rated as exceptional. The delay value decreased from 32 ms to 8 ms and the number of packet losses decreased from 1.5% to 0 when the PCQ method was implemented.

Keywords

Quality Of Service (QoS), PCQ, WLAN, TIPHON

Introduction

The growing development of internet technology and information technology in various ways, such as the world of education, culture, economics, the field of data science (Putri et al., 2022), especially the use of computer networks (Danuri et al., 2019) and (Manalu et al., 2021) resulting in the need for access and communication provided by network operator services and Internet Service Providers (ISP) provide good service performance and offer convenient services to users (Khoirul Umam & Handoko, 2015).

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Networks are essential for a business, such as the work units of PT. Bank Mandiri (Persero) Tbk, to operate in today's industrialized world. This view shows that the work unit has an internet connection already, and that Bank Mandiri is located in the Palembang Sudirman neighborhood, which is served by a star topology within the Palembang Sudirman region. The network infrastructure is comprised of two distinct networks: a Local Area Network (LAN) that supports server performance, and a Wireless Local Area Network (WLAN) that caters to wirelessly connected devices.

The obstacle that often occurs is network utilization in terms of access speed due to delays and uneven bandwidth distribution, which causes the Wireless LAN network at Bank Mandiri in the Palembang Sudirman area to change frequently and be unstable under certain conditions. Given these problems, wireless network performance testing or QoS (Quality Of Service) will be carried out using the action research method (Khoirul Umam & Handoko, 2015), (Sarpico & Panjaitan, 2021.), in addition to monitoring and measuring network performance, an approach is needed that can reduce or overcome problems that cause delay and packet loss on the wireless LAN network so that it can further maximize the existing network performance at Bank Mandiri in the Palembang Sudirman area.

To monitor network performance using parameters according to the provisions of QoS (Quality Of Service)(Praja Mukti & Yani No, 2021) and choose several methods that can be used as a solution to overcoming the problem of delay and packet loss (Khoirul Umam & Handoko, 2015), for this reason in conducting this research the authors refer to several previous studies regarding the analysis of wireless LAN networks. In research (Hikam & Yusuf, 2021), using CBWFQ PCQ. Packet loss will cause high ping jitter and delay time, so the services provided do not run optimally. In research (Kaesar, 2011), the Axence NetTools (Axcence NetTools, 2023) application was used. Analysis of Wireless LAN Network Performance uses the QOS method with several predetermined parameters, and the results of the research show that the performance of the Wireless LAN network at the Lagaligo Bua Airport organizing unit office is quite good. In a study (Ilham, 2018), the Wireless Network used the NPAM application and Kali Linux at the Office of Investment and One-Stop Services (DPMPTSP) Luwu Regency. This study discusses the network in the investment service office and one-stop integrated services.

Methodology

PT Bank Mandiri Palembang Sudirman region served as the research site for this study. From February 1 to March 1, 2022, researchers participated in practical fieldwork there. The network technician sub-section of the General Section (general affairs) of PT Bank Mandiri Palembang Sudirman Area was identified as the data source for this investigation. Information is gathered by asking the officer in charge of that section directly. Utilizing the WIFI network at PT Bank Mandiri Palembang Sudirman area, data from tests of bandwidth speed and packet loss were conducted in the room.

The method used is the action research method (Mahmud, 2022); the following are the stages of the action research method:

1. Diagnosing, at this stage, identifies problems that exist in the research site, such as network topology, bandwidth quality, and others.

2. Action Planning gathers the measures to get over the obstacles encountered, which include evaluating the caliber of the current network at the study location. The equipment used in the research is classified into two types, hardware, and software. Such as Axecen NetTools, VirtualBox, WinBox, and ISO Mikrotik RouterBoard.
3. Measuring the latency, bandwidth, and packet loss values, and acting in accordance with the phases and plans that have been developed.
4. The process of assessing and learning involves assessing the outcomes of the completed tasks and going over the completed phases.

Results and Discussion

1. Network monitoring process at Bank Mandiri Palembang Sudirman area.

The network monitoring process was carried out for several days with the target IP, namely (192.168.1.100), as the target for monitoring network quality using the Axence NetTools v5 application/software to monitor/measure the network from the value of data bandwidth, delay, and packet loss.

a. Bandwidth

Monitoring results, measuring bandwidth values using Axence NetTools v5. From the measurement results through the effects of bandwidth monitoring at Bank Mandiri in the Palembang Sudirman area for five days, the results are in Figure 1 and Table 1.

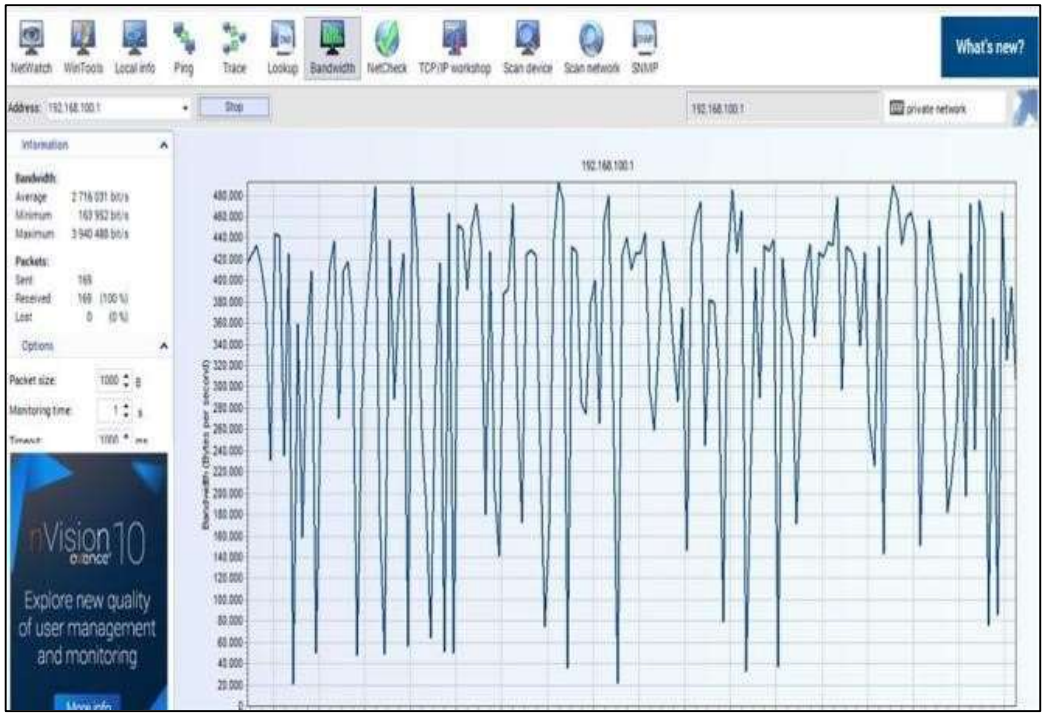

Figure 1. Bandwidth Value Day 1

Table 1. Results of bandwidth monitoring

No	Day/Date	Time	Bandwidth (Bps)		Average
			Max	Min	
1	Monday	09.30-11.30	3 940 488	163 952	2 716 031
	21/02/2022	14.00-15.00	3 420 536	104 808	1 555 822
2	Tuesday	09.30-11.30	4 010 432	20 776	1 521 475
	22/02/2022	14.00-15.00	4 010 432	20 776	1 543 291
3	Wednesday	09.30-11.30	4 036 320	2 007 255	29 008
	23/02/2022	14.00-15.00	4 036 320	24 096	1 648 524
4	Thursday	09.30-11.30	3 459 160	586 248	2 555 791
	24/02/2022	14.00-15.00	3 799 928	109 768	1 456 277
5	Friday	09.30-11.30	3 799 928	80 696	1 463 027
	25/02/2022	14.00-15.00	3 799 928	72 352	1 374 600

From the results of Table 1, the bandwidth condition observed for five days during busy hours, it can be concluded that the highest bandwidth value occurred on Monday morning, February 24, 2022, namely 2716031 bps. It usually happens because the hot weather is very supportive in measuring the transfer speed or the size of the type of data being transferred.

From the results, the lowest bandwidth value occurred on Wednesday. It is usually delayed because the weather is not supportive and cloudy. Rain or strong winds can hamper the radio wave frequency for data transactions and internet access. It is because the wave or signal gets resistance from a material; in this case, what is meant is raindrops (Khoirul Umam & Handoko, 2015).

b. Packet Loss

The results of the values for measuring Packet loss values using the Axence NetTools v5 application are seen in the image results as follows:

Figure 2. Packet Loss Value Day 1

Table 2. Monitoring Packet Loss Results for 5 Days

No	Day/Date	Time	Packet Loss %		(%) Lost
			Sent	Lost	
1	Monday	09.30-11.30	558	0	0
	21/02/2022	14.00-15.30	717	0	0
2	Tuesday	09.30-11.30	808	0	0
	22/02/2022	14.00-15.30	721	0	0
3	Wednesday	09.30-11.30	777	0	0
	23/02/2022	14.00-15.30	1461	0	0
4	Thursday	09.30-11.30	1619	0	0
	24/02/2022	14.00-15.30	276	0	0
5	Friday	09.30-11.30	403	0	0
	25/02/2022	14.00-15.30	513	0	0

In the Palembang Sudirman area, Bank Mandiri has standardized its packet loss monitoring system using TIPHON version, as demonstrated by Table 2. It is good if it is within range of 3% to 15%, terrible if it is 25% or more, and outstanding if it is 0% for the packet loss degradation category. One criterion that represents the total number of good packet losses on the network Wireless LAN Bank Mandiri Palembang Sudirman area is the packet loss category with a lost percentage of 0% for daily measurement results. This is included in the superb degradation parameter.

c. Delay

The results of the value for measuring the delay value using the Axence NetTools v5 application can be seen in Figure 3. From the results in Table 3 based on the delay value of the Bank Mandiri Palembang Sudirman area during busy hours, it is concluded that data overload, distance from the network data transmission media are measured, and also because the traffic load is quite significant because the network is very congested when the traffic is substantial, so when carrying out the process of sending packets to their destination causing delays. However, the average delay value is outstanding/good following the standardization determined by TIPHON, namely the delay value < 150ms.

2. Results of the Implementation of the Application of the PCQ Method in Reducing Delay and Packet Loss Values.

Below are the results before and after implementing the PCQ method, which was carried out to reduce the value of delay and packet loss, which was carried out for several days to measure or monitor before and after implementing the PCQ method.

Figure 3. Day 1 Delay Value

Table 3. Results of Monitoring Delay for 5 Days

No	Day/Date	Time	Last	Delay (ms)		Average
				Min	Max	
1	Monday	09.30-11.30	35	3	108	7
	21/02/2022	13.00-15.30	4	3	108	7
2	Tuesday	09.30-11.30	30	3	108	7
	22/02/2022	13.00-15.30	12	3	242	12
3	Wednesday	09.30-11.30	181	3	671	14
	23/02/2022	13.00-15.30	8	2	671	14
4	Thursday	09.30-11.30	7	2	671	13
	24/02/2022	13.00-15.30	8	3	299	17
5	Friday	09.30-11.30	124	3	299	14
	25/02/2022	13.00-15.30	50	3	299	15

a. The results of measuring the delay value before and after the application of the PCQ method. PCQ (Per Connection Queue) is a way of doing bandwidth management, where PCQ works with an algorithm that will divide the bandwidth evenly among all active users. The application of PCQ aims to prevent or reduce the value of delay and packet loss on the internet network so that it remains suitable and stable, as shown in the result before applying the PCQ in Table 4 and after applying PCQ in Table 5 with delay value.

Table 4. Results Before Applying the PCQ Method to delay value.

No	Day/Date	Time	Last	Delay (ms)		Average
				Min	Max	
1	Monday 16/05/2022	08.30-11.30	5	4	342	29
2	Tuesday 17/05/2022	08.30-11.30	4	3	907	29
3	Wednesday 18/05/2022	08.30-11.30	48	3	342	27
4	Thursday 19/05/2022	08.30-11.30	6	4	342	36
5	Friday 20/05/2022	08.30-11.30	125	4	159	39
Results Average Delay						32ms

Table 5. Results After Applying the PCQ Method to delay value.

No	Day/Date	Time	Last	Delay		Average
				Min	Max	
1	Saturday 21/05/2022	08.30-11.30	63	3	411	22
2	Sunday 22/05/2022	08.30-11.30	2	2	113	4
3	Monday 23/05/2022	08.30-11.30	5	2	113	4
4	Tuesday 24/05/2022	08.30-11.30	10	2	113	5
5	Wednesday 25/05/2022	08.30-11.30	9	2	133	5
Results in Average Delay						8ms

b. The results of measuring the packet loss value before and after applying the PCQ method with packet loss value are shown in Table 6 and Table 7.

Table 6. Results before applying the PCQ method to packet loss value.

No	Day/Date	Time	Sent	Packet Loss (%)	
				Lost	(%) Lost
1	Monday 16/05/2022	08.30-11.30	630	6	1
2	Tuesday 17/05/2022	08.30-11.30	2555	49	2
3	Wednesday 18/05/2022	08.30-11.30	776	6	1
4	Thursday 19/05/2022	08.30-11.30	402	6	1
5	Friday 20/05/2022	08.30-11.30	63	2	3
Average Packet Loss					1,6 %

Table 7. Results after applying the PCQ method to packet loss value.

No	Day/Date	Time	Sent	Packet Loss (%)	
				Lost	(%) Lost
1	Saturday 21/05/2022	08.30-11.30	1408	6	0
2	Sunday 22/05/2022	08.30-11.30	459	0	0
3	Monday 23/05/2022	08.30-11.30	563	0	0
4	Tuesday 24/05/2022	08.30-11.30	860	0	0
5	Wednesday 25/05/2022	08.30-11.30	1451	1	0
Average Packet Loss					0 %

Table 8 displays the findings from the comparison of the average values for five days prior to and following the PCQ installation. Table 8 shows a comparison of the delay values before and after PCQ implementation. The average delay value prior to PCQ implementation is 32 ms. It decreases to 8 ms after applying PCQ, and the average packet loss before and after PCQ implementation was 1.6% and 0%, respectively.

Table 8. Comparison of Delay and Packet Loss Values for the PCQ Method

QoS parameters	The average value of delay and packet loss		TIPHON	
	Before PCQ	After PCQ	Index	Information
Delay	32 *ms*	8 *ms*	4	Very good
Packet Loss	% lost : (1,4%)	% lost : (0%)	4	Very good

Conclusions

Based on TIPHON criteria, the WLAN network quality analysis results in the Mandiri Sudirman area fall into a flawless category. In accordance with Quality of Service (QoS), and in the context of applying the PCQ method, the average packet loss prior to and following PCQ implementation was 1.5% and 0%, respectively, and the delay value before and after PCQ implementation was 32 ms and 8 ms, respectively. It indicates that packet loss or the likelihood of packet loss during data transmission can be avoided or lessened by implementing bandwidth control utilizing the PCQ technique. As a result, packets can go from the sender to the recipient and back.

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