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ANALYSIS OF CABLE NETWORK READINESS FOR THE IMPLEMENTATION OF ERP (ENTERPRISE RESOURCE PLANNING) INFORMATION SYSTEMS AT THE FACULTY OF INDUSTRIAL ENGINEERING

Akbar Febriyanto[1], Umar Yunan Kurnia Septo Hediyanto, S.T., M.T. [2] , Muhammad Fathinuddin, S.Si., M.T. [3]

[1,2,3] Information Systems, School of Industrial Engineering, Telkom University

*Email: [1]akbarfebriyanto@student.telkomuniversity.ac.id, [2] umaryunan@telkomuniversity.ac.id, [3] muhammadfathinuddin@telkomuniversity.ac.id

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Abstract

This study evaluates the readiness of cable networks for ERP (Enterprise Resource Planning) system implementation at the Faculty of Industrial Engineering, Telkom University. The ERP system requires a robust network infrastructure to support essential functions like finance, manufacturing, and HR. The research utilizes the Network Development Life Cycle (NDLC). The study focuses on Quality of Service (QoS) metrics throughput, delay, jitter, and packet loss across three buildings: Building B Cacuk, TULT Building, and Mangudu Building. Data was gathered through observation, interviews, and network analysis using Wireshark, tested during different times (low, peak, and intermediate). The results indicate that the networks are generally ready for Odoo-based ERP implementation. Throughput meets minimum requirements, and delay is within acceptable limits per the TIPHON standard. Packet loss is minimal, but jitter remains a concern, potentially affecting overall service quality. However, the ERP system can operate effectively as it is not highly sensitive to jitter.

Keywords: *ERP, Quality of Service, Network Development Life Cycle, Cable Network*

**Corresponding Author*: *Akbar Febriyanto*

1. INTRODUCTION

1.1 Research Background

Technological advances today are developing very rapidly throughout the world. Today's society inevitably has to follow it otherwise it will become a person who is left behind by information. The use of technology today has been utilized by all communities around the world. Starting from the business sector, mining, agriculture, to education. The advancement of technology is also inseparable from the development of the internet which is getting better. Today's technological developments have penetrated into various technology sectors. For example, today's network technology encourages the use of wired and wireless networks. Both have the same use, namely as a connecting medium between devices. The difference between wired and wireless networks is how to connect between devices. Wired networks connect devices using cables while wireless networks connect devices using sensors contained in the device. Wired networks have the advantage of being able to maintain connection stability well. Wired networks will be maximized when implemented on a Local Area Network (LAN).

The existence of the internet has facilitated activities in several sectors, especially in the business sector. The results of the business sector ICT survey conducted by KOMINFO show that 86% of companies have used the internet to support their business activities. The internet supports business processes and communication between consumers, employees, and other business partners. Business process activities do not escape the use of Enterprise Resource Planning (ERP) software in carrying out a business process in a company. ERP is software used by companies or organizations to manage operational and business aspects. In operational and business aspects, ERP is able to manage financial functions, manufacturing, inventory, human resources, and many more. The benefits of a company or

organization using ERP can increase efficiency, productivity, and also the performance of all units in the company. Therefore, many companies use this ERP system to help the company's business activities.

Currently, this ERP software is widely used by large companies in Indonesia. To access this ERP, adequate bandwidth is needed. Bandwidth is a calculation of data consumption that can be transferred within a certain period of time in a telecommunication. Bandwidth is calculated using units of bits per second /bps. The ideal bandwidth requirement for running ERP software is at 500 Kbps - 2.0 Mbps, this is included in the high bandwidth usage category. In this research, researchers conducted a case study at Telkom University, especially at the Telkom Landmark Tower (TULT) Building, Building B Cacuk, and Mangudu Building to find out whether the three buildings can run the ERP system. The background of this research is based on the fact that no one has tested Quality of Service (QoS) between the three buildings, especially in access to ERP software. This research uses the Network Development Life Cycle (NDLC) method. This method is used because it is systematic and structured by dividing into several interrelated stages, making it easier for researchers to do research. The stages in the NDLC method can also be adjusted to the needs of the research by adding or reducing the stages carried out.

1.2 Literature Review

A. Bandwidth

Bandwidth is a calculation of data consumption requirements on a telecommunications network. Bandwidth can also be said to be a measure of information that can be sent from one place to another in one second. Bandwidth can be measured in bits per second (bps). Bandwidth is a bandwidth on a computer network that can determine the speed of computer network access[1].

B. Local Area Network

Local Area Network (LAN) is a network that can be used in a building such as a house, office, or multi-story building[2]. LANs are used to exchange information but the distance between devices is limited to no more than a few kilometers[2]. LAN networks are also referred to as intranet networks. The main difference between LAN and internet networks lies in their nature. On a LAN this network is private, which is only intended for special users within an organization, company, agency, or certain room. LANs can cover distances between 1 and 10 kilometers in the form of wired, wireless, or a combination of both[3] .

C. Quality of Service

Quality of service can be defined as the ability of a network administrator to control bandwidth, delay, jitter, loss, and congestion of troughput in a network [4]. Qos is designed to meet the requirements of diverse services that use similar infrastructure, and to characterize the services provided in both quality and quantity [5]. Qos is designed to facilitate clients so that they can increase productivity by ensuring that users get good performance from the applications used[6]. The purpose of Qos is to get different service requirements but use the same infrastructure[6]. The following are the parameters that exist in QoS:

a. Throughput

Throughput is the result of the number of packets successfully transmitted in a given period, divided by the time required. Throughput can be defined as the rate of data within a certain duration. Throughput is usually measured in bits per second (bps), kilobits per second (kbps), megabits per second (Mbps), or gigabits per second (Gbps). The results of the throughput calculation can be related to the bandwidth in actual conditions[7]. The equation for calculating throughput is as follows:

$$Throughput = \frac{\text{Number of data sent}}{Delivery\ time} \quad (1)$$

b. Delay

Delay is the time it takes for the network to send packets from one computer to another. Delays in packet delivery can be caused by long queues of packets or the selection of packet paths to avoid path congestion. Factors that affect delay are distance, physical media, density on network routes, or the length of processing time [8]. Delay measurement can be calculated using the following equation [9]:

$$Delay = \frac{\text{Total delay}}{Number\ of\ packages} \quad (2)$$

The following table 1 describes the standardization of delay according to TIPHON:

Table 1 Delay Standardization

Delay Category	Delay	Indeks
Very good	<150 ms	4
Good	150 – 300 ms	3
Medium	300 – 400 ms	2
Poor	>450 ms	1

c. Jitter

Jitter or delay variation is the change in transmission delay or the difference between the first delay and the next delay. If the change in delay time is too large, it can affect the quality of the transmitted data. Jitter is very important in the context of QoS, especially for applications that require realtime data transmission [8]. The calculation of the amount of delay can use the following equation [9]:

$$Jitter = \frac{\text{Total delay variation}}{Number\ of\ packages} \quad (3)$$

The following table 2 describes the standardization of jitter according to TIPHON:

Table 2 Jitter Standardization

Jitter Category	Jitter	Indeks
Very good	0 ms	4
Good	0 – 75 ms	3
Medium	75 – 125 ms	2
Poor	125 – 225 ms	1

d. Packet Loss

Packet Loss is a parameter to describe the total packets lost due to congestion or collisions on the network [10]. Packet loss is usually presented in the form of a percentage of the results of lost packets. The following is the equation for calculating the amount of packet loss in a network [9].

$$Loss = \frac{\text{Package sent} - \text{Package received}}{Package\ sent}\ X\ 100\% \quad (4)$$

The following table 3 describes the standardization of jitter according to TIPHON:

Table 3 Packet Loss Standardization

Packet Loss Category	Packet Loss	Indeks
Very good	0 %	4
Good	3 %	3
Medium	15 %	2
Poor	15 %	1

D. Wireshark

Before it was known by its current name, Wireshark was known as Ethernal. This application was developed by Gerald Combs in 1988. This application is used as a tool to troubleshoot and analyze networks on computers. Wireshark can be run on both Windows and UNIX operating systems [11]. Wireshark is also an open-source application useful for analyzing the network being used[12]. In addition to analyzing networks, Wireshark can also be used for network debugging analysis[13].

2. RESEARCH METHOD

This research uses the NDLC method. Network Development Life Cycle (NDLC) is the definition of the development cycle of a network system [14]. NDLC has elements that describe specific stages or phases. The word cycle in NLDC is a descriptive keyword of the network system development cycle that describes the outline of the process that will be passed in the continuous network development stages [15]. This research uses the NDLC method, especially in the analysis stage in the NDLC cycle.

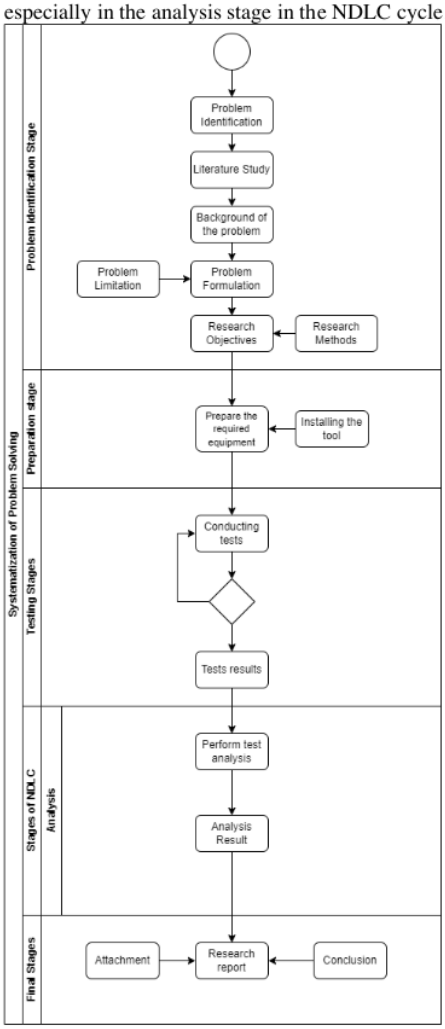

Figure 1 Problem Solving Statement

Figure 1 is the organized steps taken in this research. This stage is divided into six stages, namely the problem identification stage, problem identification stage, preparation stage, testing stage, analysis stage, and final stage. The following is a description of the stages in the problem solving statement:

1. Problem identification stage
   The initial stage of this research is to identify research problems, conduct literature studies, determine problem formulations, and determine research objectives.

2. Preparation Stage
   The preparation stage is related to the preparation of equipment for testing and installing the tools needed for testing.

3. Testing Stage
   The testing stage includes conducting tests and the results of the tests.

4. Analysis Stage
   The analysis stage includes test analysis activities which will later be used as analysis results.

5. Final Stage
   The final stage contains the final report on the results of the analysis which includes the results of the analysis calculation and the conclusion of the final report.

3. RESULT AND DISCUSSION

This analysis is carried out to determine the readiness of network infrastructure in the TULT Building, Mangudu Building, and Building B Cacuk in the implementation of the Odoo-based ERP system by calculating the results of throughput, packet loss, jitter, and delay from the results of data sampling that has been carried out in the TULT Building, Mangudu Building, and Building B Cacuk. Data samples can be grouped into 3 different time sections, namely low, peak, and intermediate. low time starts from 06.00 - 08.00 and 16.00 - 17.00. While the peak time starts from 09:00 - 11:00 and 13:00 - 15:00. Intermediate time can start from 12:00 - 13:00 and 15:00 - 16:00. The calculation is divided into two parts, namely calculations without using filters and calculations using port filters used in the SAP Logon application. The port used by SAP Logon is port 3206 with Ip Address 118.99.107.30. The following are the results of the average QoS calculation:

1. Table 4 shows the results average throughput calculation results without using filters

Table 4 Average Throughput Without Using Filters

	TULT Building	**Mangudu Building**	**Building B Cacuk**
Low	43,077 Kbps	51,531 Kbps	80,582 Kbps
Peak	50,923 Kbps	36,298 Kbps	60,322 Kbps
Intermediate	61,399 Kbps	43,655 Kbps	62,852 Kbps

2. Table 5 shows the results average throughput calculation results using filters

Table 5 average throughput using filters

	TULT Building	**Mangudu Building**	**Building B Cacuk**
Low	20,456 Kbps	32,172 Kbps	17,662 Kbps
Peak	24,820 Kbps	27,142Kbps	13,855 Kbps
Intermediate	40,136 Kbps	27,658 Kbps	28,200 Kbps

3. Table 6 shows the results average packet loss calculation results without using filters

Table 6 average packet loss without using filters

	TULT Building	**Mangudu Building**	**Building B Cacuk**
Low	0,42 %	1,57 %	0,59 %
Peak	0,50 %	0,70 %	0,40 %
Intermediate	0,65 %	1,54 %	0,51 %

4. Table 7 shows the results average packet loss calculation results using filters

Table 7 average packet loss using filters

	TULT Building	**Mangudu Building**	**Building B Cacuk**
Low	0,52 %	1,17 %	0,42 %
Peak	0,48 %	0,69 %	0,39 %
Intermediate	0,62 %	1,01 %	0,48 %

5. Table 8 shows the results average delay calculation results without using filters

Table 8 average delay calculation without using filters

	TULT Building	**Mangudu Building**	**Building B Cacuk**
Low	89,82 ms	124,52 ms	71,11 ms
Peak	61,10 ms	108,93 ms	30,18 ms
Intermediate	66,65 ms	115,35 ms	53,44 ms

6. Table 9 shows the results average delay calculation results using filters

Table 9 average delay calculation using filters

	TULT Building	Mangudu Building	Building B Cacuk
Low	301,98 ms	197,18 ms	344,28 ms
Peak	252,70 ms	190,56 ms	237,08 ms
Intermediate	152,12 ms	212,43 ms	228,41 ms

7. Table 10 shows the results average jitter calculation results without using filters

Table 10 average jitter using filters

	TULT Building	Mangudu Building	Building B Cacuk
Low	103,73 ms	217,60 ms	72,61 ms
Peak	71,23 ms	174,77 ms	42,15 ms
Intermediate	79,85 ms	208,97 ms	71,27 ms

8. Table 11 shows the results average jitter calculation results using filters

Table 11 average jitter using filters

	TULT Building	Mangudu Building	Building B Cacuk
Low	582,40 ms	377,10 ms	671,40 ms
Peak	484,22 ms	363,05 ms	459,83 ms
Intermediate	285,78 ms	413,08 ms	437,99 ms

4. CONCLUSION

Based on the results of the wired network analysis that has been carried out in Building B Cacuk, TULT Building, and Mangudu Building, it can be concluded that the networks in the three buildings can implement the Odoo-based ERP system. This is reinforced by the throughput results without using filters in the TULT Building at low, peak, and intermediate times, namely 45.296 Kbps, 50.923 Kbps, and 61.399 Kbps. While the throughput calculation using port filters in the TULT Building at low, peak, and intermediate times is 20,456 Kbps, 24,820 Kbps, and 40,136 Kbps. Packet Loss obtained in calculations without using filters at low, peak, and intermediate times in the TULT Building are 0.56%, 0.50%, and 0.65%. While the calculation of packet loss obtained in calculations using port filters at low, peak, and intermediate times in the TULT Building is 0.52%, 0.48%, and 0.62%. The results of delay without using filters in the TULT Building at low, peak, and intermediate times are 89.82 ms, 61.10 ms, and 66.65 ms. While the delay calculation using port filters in the TULT Building at low, peak, and intermediate times is 301.98 ms, 252.70 ms, and 152.12 ms. The calculation of jitter without using filters in the TULT Building at low, peak, and intermediate times is 103.73 ms, 71.23 ms, and 79.85 ms. While the calculation of jitter using port filters in the TULT Building at low, peak, and intermediate times is 582.40 ms, 484.22 ms, and 285,78 ms.

The throughput results without using filters in Mangudu Building at low, peak, and intermediate times are 51.531 Kbps, 36.298 Kbps, and 43.655 Kbps. While the calculation of throughput using port filters in the Mangudu Building at low, peak, and intermediate times is 32.172 Kbps, 27.142Kbps, and 27.658 Kbps. Packet Loss obtained in calculations without using filters at low, peak, and intermediate times in Mangudu Building are 1.57%, 0.70%, and 1.54%. While the calculation of packet loss obtained in calculations using port filters at low, peak, and intermediate times in Mangudu Building is 1.17%, 0.69%, and 1.01%. The results of delay without using filters in Mangudu Building at low, peak, and intermediate times are 124.52 ms, 108.93 ms, and 115.35 ms. While the delay calculation using the port filter in Mangudu Building at low, peak, and intermediate times is 197.18 ms, 190.56 ms, and 212.43 ms. Calculation of jitter without using filters in Mangudu Building at low, peak, and intermediate times, namely 217.60 ms, 174.77 ms, and 208.97 ms. While the calculation of jitter using port filters in Mangudu Building at low, peak, and intermediate times is 377.10 ms, 363.05 ms, and 413.08 ms.

The throughput results without using filters at Cacuk Building B during low, peak, and intermediate times were 80.582 Kbps, 60.322 Kbps, and 62.852 Kbps, respectively. Meanwhile, the throughput calculations using port filters at Cacuk Building B during low, peak, and intermediate times were 69.214 Kbps, 33.772 Kbps, and 49.084 Kbps, respectively. The packet loss obtained from calculations without using filters during low, peak, and intermediate times at Cacuk Building B was 0.59%, 0.40%, and 0.51%, respectively. Meanwhile, the packet loss obtained from calculations using port filters during low, peak, and intermediate times at Cacuk Building B was 0.89%, 0.85%, and 1.00%, respectively. The delay results without using filters at Cacuk Building B during low, peak, and intermediate times is 71.11 ms, 30.18 ms, and 53.44 ms, respectively. Meanwhile, the delay calculations using port filters at Mangudu Building during low, peak, and intermediate times is 85.99 ms, 118.78 ms, and 102.04 ms, respectively. The jitter calculations without using filters at Cacuk Building B during low, peak, and intermediate times is 72.61 ms, 42.15 ms, and 71.27 ms, respectively. Meanwhile, the jitter calculations using port filters at Cacuk Building B during low, peak, and intermediate times is 177.61 ms, 223.51 ms, and 185.08 ms.

The packet loss results without using filters and with port filters in the three buildings showed excellent results according to TIPHON standards. The delay calculations in the three buildings showed results ranging from very good to moderate according to TIPHON standards. However, the jitter analysis in the three buildings still showed poor results according to TIPHON standards. Despite the poor jitter analysis results in the three buildings, the Odoo-based ERP system continued to function well because ERP systems are generally not sensitive to poor jitter.

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