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AN EVALUATION OF THE POWER SUPPORT INTERNET INFRASTRUCTURE OF MAKASSAR CITY IN TELEMEDICINE FRAME

Figur Muhammad[1] , Andani Achmad[2] , Adnan[3] ,Abdul Mubarak[4] , Abdul Muis[5]

[1] Program Studi Sistem Informasi Universitas Megarezky
[2] Departemen Teknik Elektro Universitas Hasanuddin
[3] Departemen Teknik Informatika Universitas Hasanuddin
[4]Program Studi Teknik Informatika Universitas Khairun
[5] Program Studi Ilmu Komputer Universitas Megarezky

*Email: [1]figurmuhammad@unimerz.ac.id, [2]andani@unhas.ac.id, [3]adnan@unhas.ac.id, [4]amuba029@unkhair.ac.id, [5]abdulmuis.160674@unimerz.ac.id

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Abstract

This research aims to find the quality of the internet in Makassar City. It uses a 10 Mbps service from Indihome to support telemedicine. The study is a case study of sending raw MRI image data to the AWS cloud. The research uses a virtual server from the AWS cloud. It stores raw MRI image data. The data will be sent via the FTP client FileZilla. The tests were carried out eight times. They used the quality of service standard formula from TIPHON. The results come from 8 tests. In the tests, MRI image data was sent to the AWS cloud. The results show that the average throughput value was 4.53 Mbps with an index of 4. This result is excellent. Packet loss is low at 0.01% with an index of 4, which is very good. The delay is 1.7 ms with an index of 3, which is good. The jitter is 1.69 ms with an index of 3, which is good. The quality of service test results are based on TIPHON standards. They show that sending Raw MRI image data to the AWS cloud at 10 Mbps from Indihome in Makassar City is good.

Keywords: *Amazon Web Services (AWS), Bandwidth, Internet, MRI, Quality of Service.*

**Corresponding Author: Figur Muhammad*

1. INTRODUCTION

The progress of technology is very developing fast including in sector health nowadays. The availability of technology health will make it easier to power health To detect diseases in patients. Accurate patient setup is critical in radiotherapy [1]. One of the health technologies that are available in hospitals namely Magnetic Resonance Imaging (MRI).

Magnetic Resonance Imaging (MRI) images are black-and-white images resulting from the process of magnetic resonance exposed to the human body to show the inside of the body without doing an operation[2]

MRI creates the images using a strong and uniform static magnetic field and radio frequency pulses. When placed in a magnetic field, all substances are magnetized to a degree that depends on their magnetic susceptibility[3].

MRI of the hour of the day Work must in certain circumstances ready to use. During the machine's primary MRI and the computer cannot be deactivated. In its operation of course needed energy electricity For supplying voltage that MRI requires for properly working. Trade-offs between the material's magnetic susceptibility selection and electrical function should be considered[4]

Radiology departments are major energy consumers within a hospital through the operation of CT and MRI scanners, which require energy in the range of 0.5–30 kWh per examination, with peak consumption reaching beyond 100 kW for a short time period[5]. Energy consumption for three CT and four MRI scanners of 1.1 gigawatt-hours[6].

Shows that the average energy active of MRI is 4099 kWh and the average standby energy is 7,481 kWh. The room of MRI assumed to operate for 8 hours per day And for the other 16 hours every workday, during the weekend And days off keep it ON and

Ready used For case imaging rare emergency situation. With the assumption ratio 50% utilization will result in 86 hours of time patients per month, which is equivalent to performing 146 MRI services. In consequence, for a month with a total of 730 hours, 644 machine hours are in idle mode (MRI is on but not used) and consume 12.68 kW per hour, a total of 8,165 kWh per month or 56.02 kWh per patient. Then, One of the efforts To save electricity is to move to MRI computer used For reconstructing MRI images to the Cloud. Transferring MRI computer to the cloud can save usage electricity, too possible telemedicine become wider [7]. Such devices are capable of acquiring anatomical soft tissue images with high spatial and temporal resolution[8].

For support sending raw MRI data images to the cloud Power support internet infrastructure. The Internet (Inter-Network) is a bunch of networks A connecting computer between sites. Good for government sites, academic sites, and commercial[9]. With the network internet, communication activities to obtain information become easier[10].

The internet is a bunch of network computers that are connected to each other. Use Internet among generally usually used To connect academic sites, inter-government sites, commercial sites, etc. The Examples of services Internet most often used are e-mail And chat[11].

Quality of Service (QoS) is An architectureend-to-end and not A feature it has by network. QoS offers the ability To define attributes the service provided is good in a way qualitative or quantitative. As for the objective method of QOS, it depends on service needs. QoS is the most significant issue [12]. QoS is ideal to apply on the customer side rather than on the provider side[13].

Quality of Service (QoS) refers to techniques that function on a network to dependably execute high-priority applications and traffic reliably run high-priority applications and traffic even when the network's capacity is limited[14]. In healthcare applications, efficient computation of QoS is one of the mandatory requirements during the processing of medical records through smart measurement methods [15]. Quality of Service (QoS) can be said to be a term used to define the characteristics of a network service to determine how good the quality of the service is[16].

This research aims to determine the quality of internet in Makassar city that uses 10 Mbps service of Indihome provider in support of telemedicine with case studies sending Raw MRI image data to the AWS cloud.

2. RESEARCH METHOD

In this section, each of the researchers is expected to be able to make the most recent contribution related to the solution to the existing problems. The Researchers can also use images, diagrams, and flowcharts to explain the solutions to these problems.

In this research, there are some stages passed in Capable of collecting Quality of Service (QoS) data seen in Figure 1

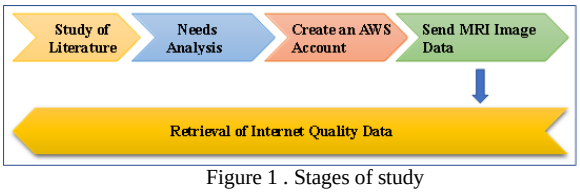

Figure 1 . Stages of study

Based on the study cases, This shows that the raw delivery image data to the AWS MRI cloud, then as for stages in this research that is on stage beginning, the researcher does literature studies from books as well as related journals with problem study, Which will be done of analysis need For sending raw image data to AWS Cloud start from hard device need until soft device need. After the need analysis has been done, it will be done by making an AWS account for getting access to cloud AWS. Then after making the AWS account has finished, next will done test send the raw data image to cloud AWS. On moment delivery currently ongoing, the researcher will do measurement internet quality based standard from TIPHON.

2.1 Trials And QoS Data Retrieval (Quality of Service).

On the test try this done with a method by sending Raw MRI data images to the AWS Cloud using an application namely Filezilla And capture medium protocol walk using application Wireshark when delivery currently taking place. This Delivery is done as many as 8 times to get maximum results. The steps for sending raw MRI data images to the AWS cloud and data collection is as follows:

1. Downloading citra MRI data

Figure 2 is MRI image data downloaded at www.mridata.org with data size 1.6 Gb

Figure 2. MRI image data

2. Measuring internet speed

Measure Internet speed is required For know on speed How many deliveries done. For testing internet speed can use method access https://www.speedtest.net/. following appearance

from page testing internet speed.

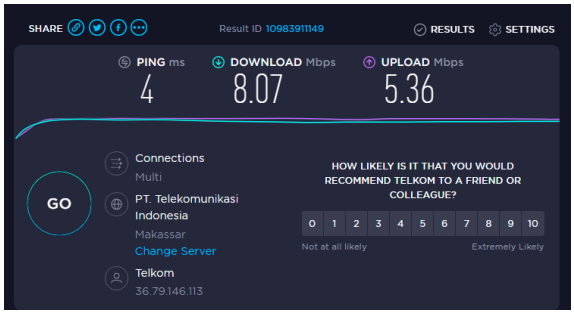

Figure 3 . Measurement of Internet speed

3. Sending raw MRI data images to the AWS cloud

Sending raw data images to the AWS cloud is done, so that the researchers can measure the Quality of service (QoS) of the network used for sending the data. Sending this data researcher uses the FileZilla application.

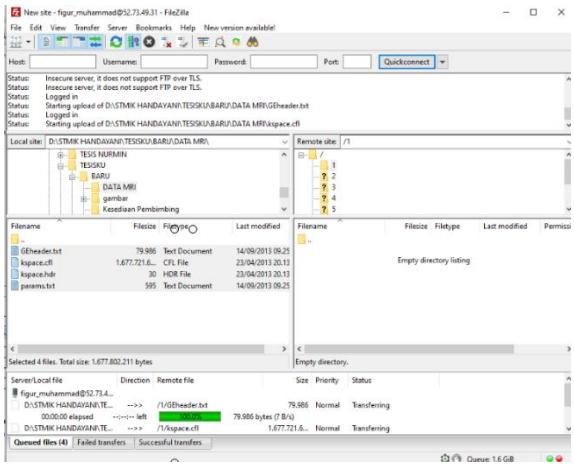

Figure 4 . Process of Sending MRI Image data to the AWS Cloud

4. Retrieval Data using the Wireshark application

This data retrieval is useful for determining network quality when sending raw MRI data images to the AWS Cloud.

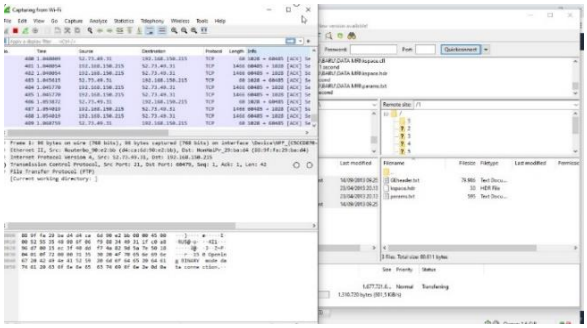

Figure 5. The process of retrieving QOS data using Wireshark

In Figure 5, the process of retrieving QoS data uses the Wireshark application during the sending process currently taking place. This retrieval data is useful for determining network quality when sending raw MRI data images to the AWS Cloud. As for results retrieval of data from Wireshark can seen in Figure 6 below.

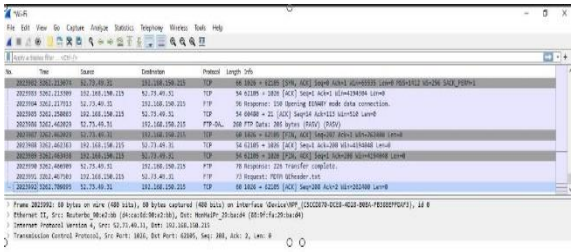

Figure 6. Results QOS data retrieval using Wireshark

Figure 6 shows seen results of QoS retrieval data using the Wireshark application. Furthermore, this data will be analyzed, then obtained the results of internet quality based on TIPHON standard

3. RESULT AND DISCUSSION

3. 1 Analysis of throughput

Mark throughput obtained based on the results of calculations using formula throughput as follows :

$$Thoughput = \frac{Total\ Package(KB)}{Delivery\ TIme(s)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

From the results of the calculations carried out as much 8 times, has obtained mark throughput on the Table 6 following.

Table 6. Throughput Value

No	Total Package (KBytes)	Total Delay (second)	Bandwidth(10 Mbps)		Throughput (Mbps)
			Downloads	Upload	
1	1934159.27	3076,970	9.01	5,11	5.02
2	1932542,904	3262,710	8.07	5.36	4.73
3	1903614,348	3034,939	7.49	5.27	5.01
4	1851968,061	3269,107	8.91	4.26	4.53
5	1883741,790	3206,699	9.30	5.53	4.69
6	1802079,414	3599,713	11.47	3.38	4.05
7	1800626,450	3683,174	11.41	3.55	3.91
8	1869798,637	3455,122	8.01	5.61	4.32
	Average		9.21	4.76	4.53

the first trial was 5.02 Mbps, the second trial as big as 4.73, the third trial that is 5.01, the fourth trial that is 4.53, the fifth trial that is 4.69, the sixth trial that is 4.05, the seventh trial that is 3.91, And the eighth trial as big as 4.32. From these results in averaged it gets markaverage throughput as big as 4.53 Mbps.

To get the percentage fromthroughput, so mark the average throughput shared with speed internet access uploadwhich has been tested using speed test, namely 4.76 Mbps. From these quotient results thepercentage throughput is as big as 95%.Based on the results of

these calculations, you can conclude that according to the Standardization of TYPHON Throughput Service Wifi Indihomeinto the Very Good category And get index value 4.

3. 2 Analysis of Loss Package

Mark Package Losses obtained based on the results of calculations using formula Package Loss as follows Equation (2).

$$Loss\ Package = \frac{Package\ Sent - Package\ Received}{Package\ sent}\ x\ 100 \ldots\ldots\ldots\ldots(2)$$

From the results calculation Which was done 8 times, the Package value has been obtained Losses on the table following:

Table 7. Loss Package Value

No	Amount Package sent	Amount Package accepted	Bandwidth (10MBps)		Package Losses(%)
			Downloads	Upload	
1	2042732	2042732	9.01	5,11	0
2	2023992	2023992	8.07	5.36	0
3	2001231	2001231	7.49	5.27	0
4	1942330	1942330	8.91	4.26	0
5	1972823	1972823	9.30	5.53	0
6	1874162	1874162	11.47	3.38	0
7	1861204	1859758	11.41	3.55	0.078
8	1953740	1953740	8.01	5.61	0
Average			9.21	4.76	0.01

The First trial as big as 0%, the second trial as big as 0%, the third trial as big as 0%, the fourth trial by 0%, the fifth trial big as 0%, the sixth trial as big as 0% the seventh trial as big as 0.078% and the eighth experiment was 0%. From the results, they obtained an average package loss of 0.01%. According to TIPHON standardization about the packet loss category can be concluded that the enter-in category is very good And gets a mark index of 4.

3. 3 Analysis of Delay

Mark delay is obtained based on the results of calculations using formula (3) delay as follows:

$$Average\ delay = \frac{Total\ delay}{Total\ Package\ Received} \ldots\ldots\ldots\ldots(3)$$

From the results calculation Which was done 8 times, the delay value has been obtained in the table following.

Table 8 . Delay Value

No	Total Package Which accepted	Total Delay (second)	Bandwidth (10 MBps)		Average Delay (ms)
			Downloads	Upload	
1	2042732	3076,970	9.01	5,11	1.50
2	2023992	3262,710	8.07	5.36	1.61
3	2001231	3034,939	7.49	5.27	1.52
4	1942330	3269,107	8.91	4.26	1.68
5	1972823	3206,699	9.30	5.53	1.63
6	1874162	3599,713	11.47	3.38	1.92
7	1861204	3683,174	11.41	3.55	1.97
8	1953740	3455,122	8.01	5.61	1.77
Average			9.21	4.76	1.7

The first trial got a delay as big as 1.5 ms, the second experiment was 1.51 ms, the third experiment as big as 1.52 ms, the fourth trial as big as 1.68 m s, the fifth trial as big as 1.63 ms, the sixth trial amounted to 1.92 ms, the seventh experiment amounted to 1.97 ms, the eighth experiment was 1.76 ms. From the results, the obtained average delay is as big as 1.7Ms. According to standardization by TYPHON, mark the enter in category Good And get index value 3.

3. 4 Analysis of Jitter

The jitter value is obtained based on the results of calculations using the formula jitter as follows:

$$Average\ jitter = \frac{Total\ jitter}{Total\ Package\ Received} \ldots\ldots\ldots\ldots(4)$$

From the results calculation Which was done 8 times, the delay value has been obtained on the table following:

Table 9. Jitter Value

No	Total Package Which accepted	Total Jitter (second)	Bandwidth (10 MBps)		Average Jitter(ms)
			Downloads	Upload	
1	2042732	3077,188	9.01	5,11	1.50
2	2023992	3262,941	8.07	5.36	1.61
3	2001231	3044,487	7.49	5.27	1.52
4	1942330	3266,204	8.91	4.26	1.68
5	972823	3206,528	9.30	5.53	1.63
6	1874162	3599,751	11.47	3.38	1.92
7	1861204	3683,172	11.41	3.55	1.97
8	1953740	3455,121	8.01	5.61	1.77
Average			9.21	4.76	1.69

In first Experiment produced a value of 1.5 ms, the second trial of 1.61 ms, the third trial as big as 1.52 ms, the fourth trial as big as 1.68 ms, the fifth trial as big as 1.63 ms, the sixth experiment was 1.92 ms, the seventh experiment amounted to 1.97 ms and the eighth trial amounted to 1.76 Ms. Based on mark the obtained an average jitter of 1.69 ms. According to TIPHON standardization, this value in the category Good And getmark index 3.

4. CONCLUSION

Based on the results study, Sending of raw MRI data image with measurements of 1.6 GB to the AWS cloud for 8 attempts using service 10 Mbps from Indihome providers, it can concluded that the average value average throughput of 4.53 Mbps, value index 4 And including in very Good category, average package loss as big as 0.01%, mark index 4 And include in category very Good, flat-flat delay as big as 1.7 ms, mark index 3 And include in Good category, And the average of jitter as big as 1.69 ms, mark index 3 And included in the good category. From the average index results above, so the quality of the Internet in sending MRI data images is 1.6 GB to the cloud AWS uses service 10 Mbps providers indihome enter deep category satisfying. Besides that, based on the results study Also can concluded that Indihome provider with 10 services Mbps is included in the good category to be used in sending MRI data images with a size of 1.6 GB to the cloud AWS.

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