VSAT (Very Small Aparture Terminal) Network Performance In Data Transmission Seismic In The BMKG Region III

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Abstract – Indonesia's geographical conditions consist of many islands, mountainous areas and oceans, if terrestrial communication is carried out it will be difficult. And to build this communication requires very large costs. To overcome this problem, Very Small Aparture Terminal (VSAT) technology was developed using satellites as the communication system. The Meteorology, Climatology and Geophysics Agency (BMKG) also uses VSAT as a seismic data transmission medium. In transmitting data from satellites to earth stations over very long distances. So the data transmission requires quite a bit of time. In this research, latency, downstream satellites and upstream satellites will be analyzed as the performance of the VSAT network. The results of latency observations on the VSAT network at the Center of Meteorology, Climatology and Geophysics Region III show a value below 750 ms, which indicates that is still in the good category. And the larger the downstream satellite value and the smaller the upstream satellite value, it means that the performance of the VSAT network is getting better. In general, VSAT performance for transmitting seismic data at the Center of Meteorology, Climatology and Geophysics Region III is in good condition.

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Keywords: **Satellite, VSAT, BMKG, Latency, Downstream, Upstream.**

INTRODUCTION

Technological developments are currently very rapid, especially regarding computerized systems and satellite technology for telecommunications purposes. With this technology, time can be utilized as well as possible so that work can be made easier in terms of collecting data and conveying information without being constrained by distance and time.

Apart from that, the condition of Indonesia which consists of many islands, mountainous areas and oceans means that the use of terrestrial telecommunications networks is very limited. With terrestrial networks, installation and maintenance costs are very expensive, and physical damage can occur because Indonesia is in the path of an earthquake. Therefore, a solution is needed so that the telecommunications system, data and information delivery can still be carried out as well as possible.

Satellite-based telecommunication systems are a solution to conditions in countries with terrestrial network problems. One of the satellite-based telecommunications systems in question is the Very Small Aperture Terminal (VSAT).

VSAT is a small earth station that connects two locations via satellite. By utilizing VSAT technology, long-distance telecommunications can be carried out without worrying about the structure of the earth and other areas such as mountainous areas and oceans.

BMKG is a non-ministerial state institution which, in carrying out its duties in the fields of Meteorology, Climatology and Geophysics, of course requires computer network technology that uses satellites as a data transmission medium. One of the data sent via the VSAT communication system is seismic data. Seismic data is a collection of seismic information which is a function that describes the amplitude of ground vibrations over time. The signal can also be expressed in the frequency region through a transformation. This signal is a collection of a number of harmonic waves that have a certain frequency, amplitude and phase [7]. Seismic data is very important data that will be processed by BMKG to become seismological information. Therefore, VSAT is one of the technologies used by BMKG in the process of collecting data, conveying information so that the data to be processed and informed can be accurate and timely.

Several previous studies discussed the reliability of VSAT IP technology, namely "Performance Analysis of VSAT IP and VSAT LINK in InterNet Data Access at PT. Lintasarta Pontianak Branch". This research explains the functions and benefits of the VSAT network as a satellite communications service that can provide a solution to meet internet data access needs. Bandwidth usage traffic is used as a parameter to measure the performance of the VSAT IP and VSAT Link used [3]. The next research is "VSAT as Alternate Source of InterNet Connectivity in remote areas of Arunachal Pradesh".

This research revealed that the development of Satellites as a telecommunications service is currently quite significant, by utilizing VSAT technology which is easy to install, it can be very useful for collecting and broadcasting signals in large areas with long reach, so that information in the form of audio, video and data can be widely reached and two-way interactive services for computer transactions, database requests, internet access can be carried out well [4]. Then the next research is "Performance Study of VSAT InterNet Network in Blank Spot Region in Enrekang District Using Fuzzy Logic Method". In this research, a study was carried out on the performance of the VSAT interNet network using the Fuzzy Logic method on the parameters of bandwidth, delay, packet loss and throughput. The software and application used in the research is Wireshark which is then input into fuzzy logic to produce three categories of network performance or quality, namely good, fair and poor [6]. This time the author will discuss the performance of the VSAT network in seismic data transmission in BMKG Region III (Center for Meteorology, Climatology and Geophysics, Region III).

METHODS

In this research the author used a quantitative method, where the research carried out was systematic scientific research supported by quantitative data. Quantitative data is data that can be input into a statistical measurement scale. The facts and phenomena in this data are not expressed in natural language, but in numerical data [23]. From this method, the results of this research are to prove previously existing theories so that the author can analyze the performance of the VSAT IP network in the office of BMKG Region III.

VSAT Configuration

The principle of the VSAT communication system is that the satellite carries out the process of sending and receiving signals from computers located at the earth station which functions as a Hub System. The hub is responsible for controlling all operations on the network. All transmissions for communication between terminal users (Remote Station) must pass through a connecting station (Hub Station), then the hub will forward it to the satellite and then the satellite will forward it to other VSAT users, this can be seen in Figure 1 below.

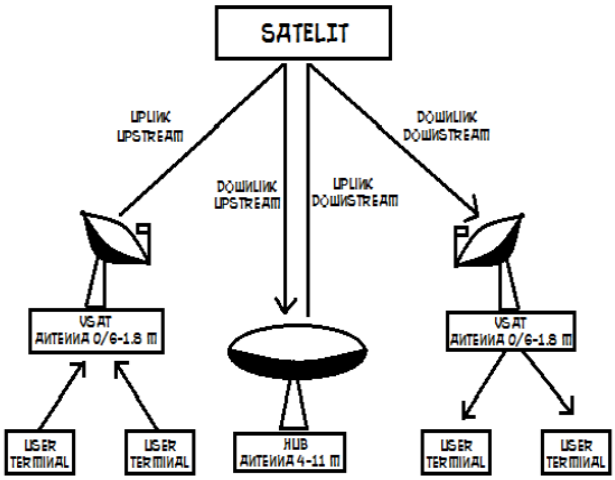


Figure 1. VSAT Configuration [24]

The signal from the remote station to the hub that passes through the satellite is called Upstream and the signal from the hub to the remote station that passes through the satellite is called Downstream [24].

1) *Uplink Upstream.* Conditions where signal transmission from the remote station to the VSAT antenna is then continued to the satellite.
2) *Downlink Upstream.*. The conditions in which the signal is transmitted from the satellite to the HUB antenna.
3) *Uplink Downstream.* The conditions in which the signal is transmitted from the satellite to the HUB antenna.
4) *Downlink Downstream.* Conditions where the signal is transmitted from the satellite to the VSAT antenna, then continues to the remote station

Seismic Signals.

This signal is a collection of a number of harmonic waves that have a certain frequency, amplitude and phase. A harmonic wave can be seen specifically through 3 wave characteristics, namely amplitude, frequency and phase. Thus, seismic signals can also be expressed in two spectra, namely amplitude versus frequency spectrum and phase versus frequency [7].

Latency

Latency is the time delay required in the delivery of data packets from the sender to the recipient. For latency on the VSAT network, it is 500 – 1100 ms. The higher the time lag or latency of the data packet delivery process, the higher the risk of access failure [25].

Research Flow

Figure 2 below shows the research flow that the author carried out.

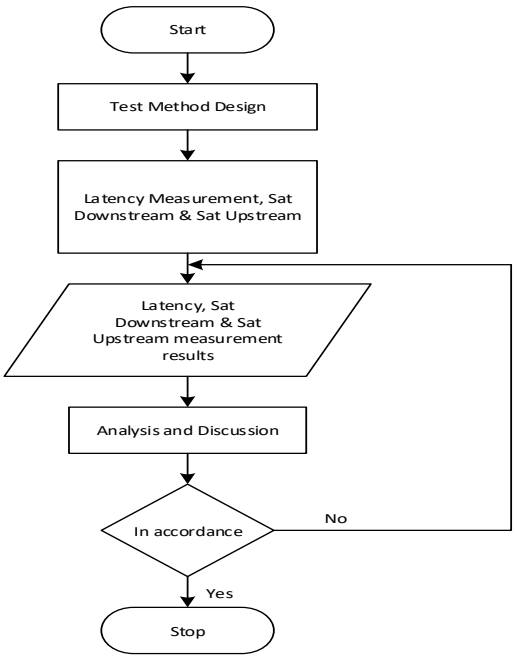


Figure 2. VSAT Testing Process Flow Diagram

The research begins with planning a flow chart to test the quality of the VSAT network to the process of analysis and drawing conclusions. Referring to the flow chart, the first stage the author did was make observations for 30 days starting on

November 8, 2021 to December 10, 2021, then taking latency data, downstream satellites and upstream satellites. Followed by analyzing the data obtained to reach a conclusion. The author carried out the data collection process on the VSAT network monitoring system at the office of the BMKG Region III.

RESULT AND DISCUSSION

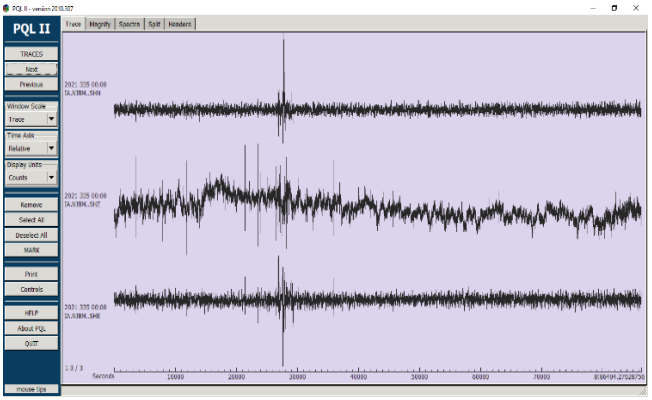
A. Results of Latency Observations, Downstream Satellites, Upstream Satellites and Seismic Signals

In this research, to test the performance of VSAT IP, observations were made on several parameters that can be observed directly from the VSAT monitoring system at the office of the Center for Meteorology, Climatology and Geophysics Region III, such as latency, downstream satellites and upstream satellites at 10 (ten) locations. Seismic sensor stations as shown in Table 1 below.

Table 1.
Latency Data, Downstream Satellite & Upstream Satellite

Station Code	SAT Downstream [KBits/Sec]	SAT Upstream[KBits/Sec]	Latency [ms]
NJBM	688.1632	2.7392	579.23
SBBM	688.1632	1.6928	563.58
JSBFM	688.1632	17.6608	562.74
WLTFM	688.0784	1.3056	554.83
OMBFM	688.1632	18.1472	579.03
KMNI	688.0144	6.5888	585.83
RNFM	688.136	17.9168	575.3
WEFM	688.1632	7.184	570.38
PAFM	688.1632	15.1008	569.98
LBNFM	688.0784	1.5232	557.55

Upstream and downstream satellites should have an influence on the amount of latency on the VSAT communication line [25], but this does not happen when seen from Table 1 above. So this shows that the VSAT network at the BMKG Region III is still in good condition.



Note: X axis: time (s), Y axis: amplitude

Figure 3. Example of a Seismic Signal

As explained above, the seismic signal is a function that describes the amplitude of ground vibrations over time. Seismic signals are generated by the presence of seismic waves which are energy propagations caused by disturbances in the earth's crust such as faults in the earth's plates. This will propagate to all parts of the earth recorded by the seismometer so that it is indicated that there is a seismic signal.

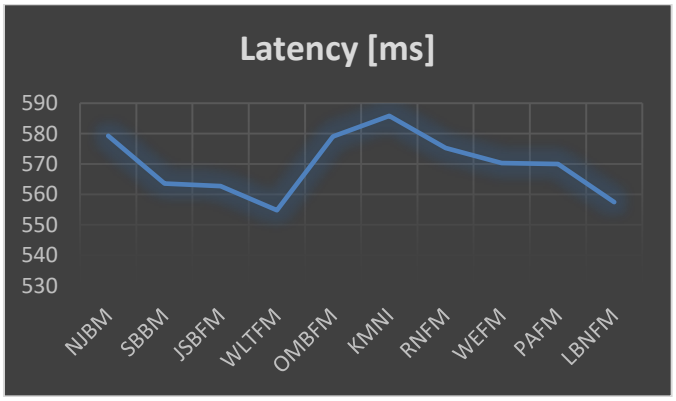
Figure 3 above shows an example of a seismic signal that uses VSAT for its transmission path. If the performance of the VSAT network is poor, seismic signal transmission will of course be interrupted. However, Figure 3 above shows that the seismic signal is in normal condition and there are no visible signal interruptions.

B. Analysis of Latency Observation Results, Downstream Satellites and Upstream Satellites.

1) Latency

Latency is an important factor that must be considered in data communication systems. Latency that occurs too long will of course have a very negative effect on the data transmission process.

Latency on the VSAT network whose server at the Center for Meteorology, Climatology and Geophysics Region III can be directly observed through the VSAT monitoring system. Based on Table 1 above, the average latency value of the ten stations connected to the VSAT IP network is ± 569,845 ms, with the largest downstream satellite with a value of 688,1632 KBits/Sec at several stations and the smallest upstream satellite at WLTFM station with a value of 1,3056 KBits /Sec.



Note: X axis: latency value (ms), Y axis: seismic station code

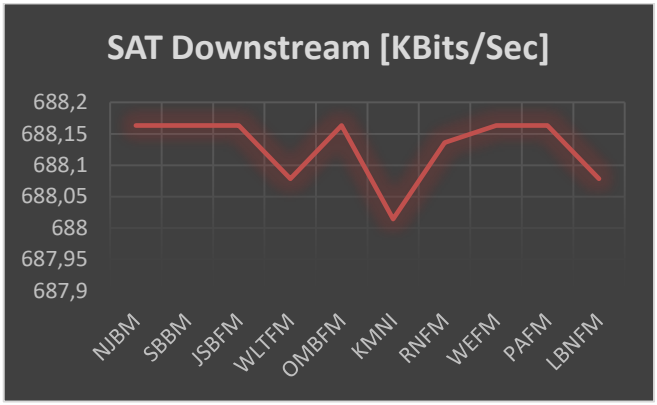
Figure 4. VSAT IP Network Latency Graph

Table 1 above shows that the largest latency is owned by the KMNI station with a value of 585.83 ms, but in general, if you look at the latency with a long observation period of 1 (one) month, the VSAT IP network capability is still in good condition, because there is no latency value. which has a very large value, almost all ten stations still below 750 ms [25]. The smaller the latency value, the better the quality of the VSAT IP network used.

2. Downstream Satellite

Downstream Satellite is a data transfer capability or data stream from VSAT to receive or download data from data sources sent via satellite. The magnitude of the downstream value of the VSAT will determine whether the VSAT network is good or bad.

The NJBM, SBBM, JSBFM, OMBFM, WEFM and PAFM seismic sensor stations have the same downstream values even though they are at different distances from the VSAT server. Stable downstream conditions are also supported by weather conditions because attenuation due to weather almost does not occur.

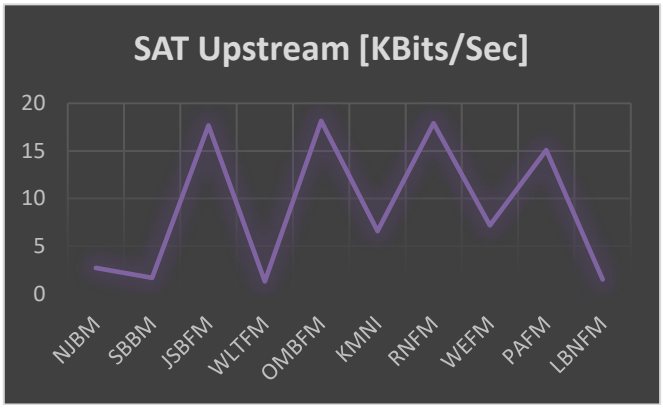


Note: X axis: Downstream Sat value (Kbits/sec), Y axis: seismic station code

Figure 5. Downstream Satellite Chart

3. Upstream Satellite

Upstream Satellite is a data transfer capability or data flow from a data source or seismic sensor station via satellite to a VSAT server.



Note : X axis : Upstream Sat value (Kbits/sec), Y axis : seismic station code

Figure 6. Upstream Satellite Chart

The smaller the upstream value, the faster the seismic data will be sent to the VSAT server via satellite. In Table 1, it can be seen that there are fluctuations in upstream data, this is caused by the condition of the seismic sensors which are located at different locations. It can be seen that the smallest upstream satellite value is owned by the WLTFM station, namely 1.3056 Kbits/Sec and the largest is owned by the RFFM station, namely 17.9168 Kbit/Sec.

CONCLUSION

From the series of discussions presented above, it can be concluded that:

1. Observation results of latency on the VSAT network at the BMKG Region III show good values. Latency is a very important
2. factor in data communication systems, which in this case are seismic data transmission systems.
3. The VSAT network system of the BMKG Region III is classified as good because the latency value is not too large or the data transmission process from the data source to the VSAT server is not too long, namely <750 Kbits/Sec.
4. The greater the Downstream Satellite value, the better the VSAT network at the BMKG Region III, and vice versa, the smaller the upstream satellite value, then the VSAT network is also getting better.
5. In general, the performance of VSAT for transmitting seismic data at the BMKG Region III is in good condition.

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