BASED INTERNET NETWORK DESIGN
VSAT KU-BAND AT JANGGA DOLOK VILLAGE OFFICE

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Abstract. The number of islands and the size of Indonesia's territory is a problems in building telecommunications infrastructure. VSAT satellite technology is a solution and is useful when terrestrial relations experience issues. This is because not all regions are terrestrial and can reach all islands and mainland in Indonesia. In this study, the Ku-Band VSAT was used, and the Ku-Band VSAT installation location was in Jangga Dolok Village, Lumban Julu District, Toba Samosir Regency, North Sumatra Province. The research method involves needs analysis, design, implementation, and testing. The results showed that the quality of the network obtained showed a bandwidth of 024 Kbps, 637 ms delay, 0% packet loss, 1.84 Mbit/s download throughput, and 319.18 Kbit/s uploads. The measurement analysis results in the field show that the IP Config VSAT IP can be connected to the gateway, and the connection test shows the reply response. The transmission parameter output IDU downlink SQF is 168, and the uplink is 16 Apsk 1024 K 9/10, the upload, and download measurement results show the upload results of 1.8 Mbps and 0.3 Mbps upload. All the analysis results were carried out, and it showed promising results, and the VSAT-based internet network in Jangga Dolok village was feasible to use. Keywords: VSAT Ku-Band, Topology, satellite internet.

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Abstrak. Jumlah pulau dan luasnya wilayah Indonesia menjadi permasalahan dalam sulitnya membangun inftastruktur telekomunikasi. Teknologi satelit vsat menjadi solusi dan berdaya guna ketika hubungan terestrial mengalami masalah. Hal ini dikarenakan tidak semua daerah merupakan terestrial dapat menjangkau semua pulau dan daratan di Indonesia. Pada penelitian ini memakai VSAT Ku-Band dan lokasi pemasangan VSAT Ku-Band berada di desa Jangga Dolok Kecamatan Lumban Julu Kabupaten Toba Samosir Provinsi Sumatera Utara. Metode penelitian yang digunakan terdiri dari analisa kebutuhan, desain, implementasi dan testing. Hasil penelitian diperoleh kualitas jaringan yang didapat menunjukkan bandwidth 024 Kbps, delay 637 ms, packet loss 0%, troughput download 1,84 Mbit/s dan upload 319.18 Kbit/s. Hasil analisa pengukuran di lapangan menunjukkan IP Config VSAT IP dapat terhubung ke gateway, connection test menunjukkan respon reply, dan parameter transmisi hasil keluaran IDU downlink SQF

sebesar 168 dan uplink sebesar 16 Apsk 1024 K 9/10, hasil pengukuran upload dan download menunjukkan hasil upload sebesar 1.8 Mbps dan upload 0.3 Mbps. Untuk semua hasil analisa yang dilakukan menujukkan hasil yang bagus dan jaringan internet berbasis VSAT di desa Jangga Dolok layak untuk digunakan.

Kata kunci: VSAT Ku-Band, internet, satelit

BACKGROUND

The development of the world of telecommunications which is already so sophisticated, has affected the community's various needs for life services which are increasing, including in the field of telecommunications. Indonesia has a vast area, so not all of these areas are covered by an adequate terrestrial network due to geographical factors. The number of islands and the size of Indonesia's territory is a problem, namely the difficulty of building telecommunications infrastructure. Satellite technology using VSAT is a solution and is effective when terrestrial connections experience problems (Priyanto, 2021) from remote areas to big cities. Providing internet in rural areas, which are also remote, reduces the digital divide.

Research conducted by (Meilandi et al., 2022) with a strategy for developing the Panca Mandala village internet network infrastructure provider with vsat technology in opening the isolation. VSAT is also an inexpensive solution as a shared broadband IP backbone. VSAT offers a *bandwidth* of 40Mbps using TCP spoofing technology and an accelerator with minimum delay. Several parameters in the internet network quality with VSAT technology include delay, date rate, SLA quality, and optimization of network quality.

Jangga Dolok village is located in the Lumban Julu sub-district, Toba Samosir district, North Sumatra, which is a location where internet access is limited. The need for internet access is minimal, so it requires the installation of an internet network based on the VSAT-Ku band. The purpose of this research is to analyze the network results and the availability of internet services in the village of Jangga Dolok through VSAT device technology.

THEORETICAL STUDY

VSAT Technology

The Very Small Aperture Terminal is a station that receives signals from satellites through a dish-shaped antenna with a diameter of fewer than three meters (Ginano et al., 2015) facing a satellite above the earth. VSAT functions to receive and send data to the satellite and also as a signal forwarder. Geostationary satellites in orbit transmit information waves received by satellite receivers on the earth's surface for further transmission to consumers. VSAT stations are connected to geostationary satellites via radio frequency via *uplink* and *downlink.* There are two satellite frequency bands used for VSAT, namely C-Band frequency 5.9 - 6.4 GHz (uplink) and 3.7 - 4.2 GHz (downlink) and Ku-Band frequency 11.7 - 12.7 GHz (downlink) and 14 - 14.5 GHz (uplink).

RESEARCH METHODS

Requritment ⟩ Design ⟩ Implementation ⟩ testing

Requiretment

The need for internet through VSAT technology in Jangga Dolok village is adjusted to *bandwidth requirements*. In the design of the VSAT network, surveys are carried out related to ground condition checks, cable lines for VSAT antennas, placement of VSAT antennas, cable withdrawal, and power supply. The ground condition must be flat so that it does not affect the *installation* in an upright position. The use of a *waterpass* in checking soil conditions needs to be done. Path mapping is done so that it is known how long the cable will be used. The devices prepared in this design include a modem, laptop, UTP cable, antenna, BUC, LNB, IFL cable, router, and wireless LAN.

Design

The design phase is carried out by describing the network topology, applying IP addresses in the network, and the position of the devices used in the vsat network design.

Implementation

Implementation is carried out based on the design that has been made. Implementation involves making the foundation, installing devices, pointing, verifying, and provisioning by NPAE, router configuration, wireless LAN configuration, and internet activation. The purpose of making the foundation is to make the mounting support poles stand firm. Device installation includes a modem, wireless LAN, and router. The cable withdrawal was carried out using an IFL cable and installing ODU, freedhorn, BUC, and LNB antenna.

testing

Testing by measuring includes measuring bandwidth, delay, packet loss, and throughput.

RESULTS AND DISCUSSION

Network Topology Design

The hardware required for the design of the Ku-Band VSAT at the Jangga Dolok village office consists of an IDU (Indoor Unit), ODU (Outdoor Unit), and satellite, as shown in Figure 1.
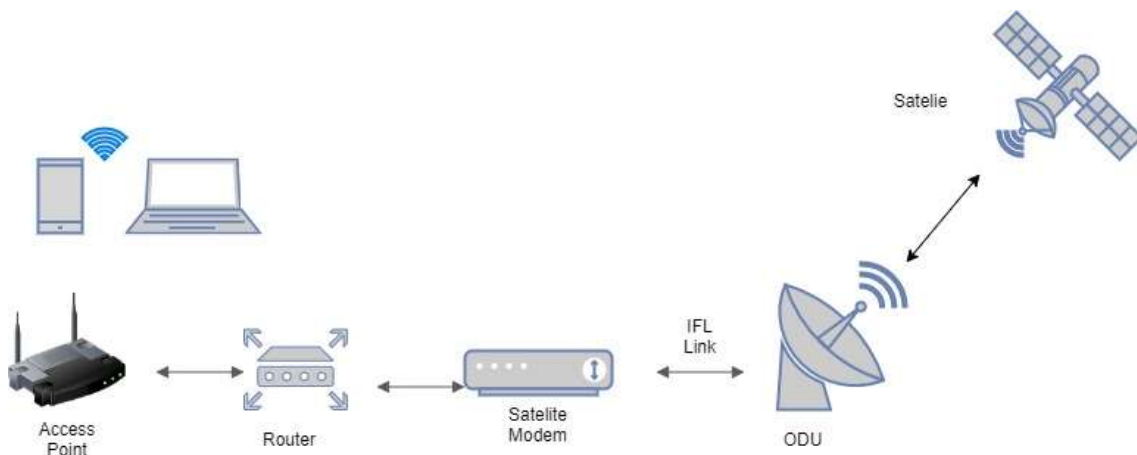

Figure 1. VSAT-KU band network topology

The Indoor Unit is an interface to the customer terminal. The Indoor Unit consists of a modem (modulator-demodulator) and a subscriber terminal. The Indoor Unit device functions to receive data from the customer, modulate and send it to the outdoor unit for transmission, receive modulated data from the outdoor unit, demodulate and then send

the data back to the customer. Several components, namely the IFL (Inter Facility Link), connect the ODU and IDU with the F connector. The modem is used to connect the external unit to the IFL. The use of routers and access points as a link to end users with laptops or smartphones in accessing internet services.

Implementation

Based on the design stage, the implementation of the VSAT network is carried out. The first step is to make the base of the VSAT pole so that the mounting support pole is sturdy. The depth of pole is made as deep as 30 cm. After that, cement is given to the pole support, or the VSAT Ku-Band mounting is strong and sturdy. After the foundation is completed, the mount stands upright with a mounting level of 0° as measured by the *water level*. Next, install IDUs such as modems, routers, and wireless. IFL cable withdrawal and install ODU (Antenna, Freedhorn, BUC, and LNB).

Figure 2. Implementation of VPN devices and supports

Pointing the antenna is done to direct it to the satellite's position by determining the elevation angle, azimuth, and polarity. The result of the modem signal reception indicator in SQF is maximum.
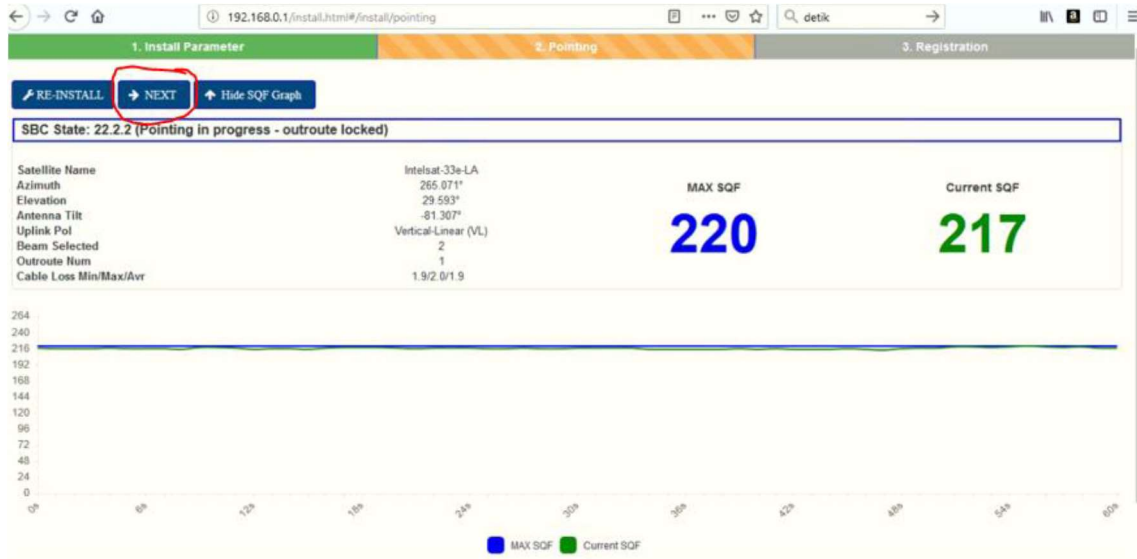

Figure 3. SQF value results

To ensure that the BUC device has sent a signal to the hub station, it is ranging; meanwhile, a register is needed to register the modem, whether it has joined to the hub station or to the NMS. Ranging and registers have been successfully carried out, as shown in Figure 4.
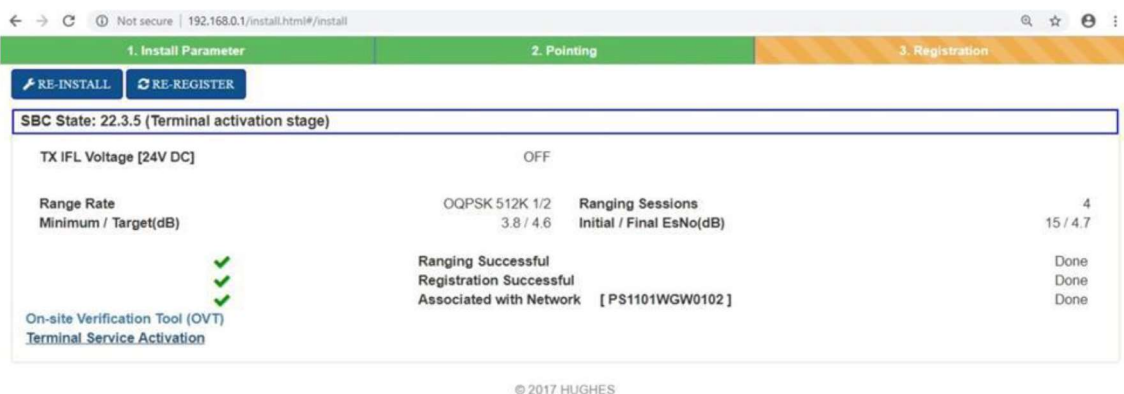

Figure 4. The process of ranging and registration

A proxy wireless router is a wireless LAN network so users can connect to the internet network. Clients can connect to the internet with a laptop or smartphone device by selecting the SSID available in the *WiFi network*.

Discussion

Analysis of the quality of the VSAT Ku-Band network is carried out by measuring bandwidth, measuring delay, measuring packet loss, throughput, and service level. Bandwidth analysis after being implemented in the village of Jangga Dolok shows the results of PING 613 ms, Jitter 14 ms, Download 1.8 Mbps, Upload 0.3 Mbps so that it produces a bandwidth value in the Jangga Dolok village office of 1024 Kbps, which shows perfect bandwidth results.
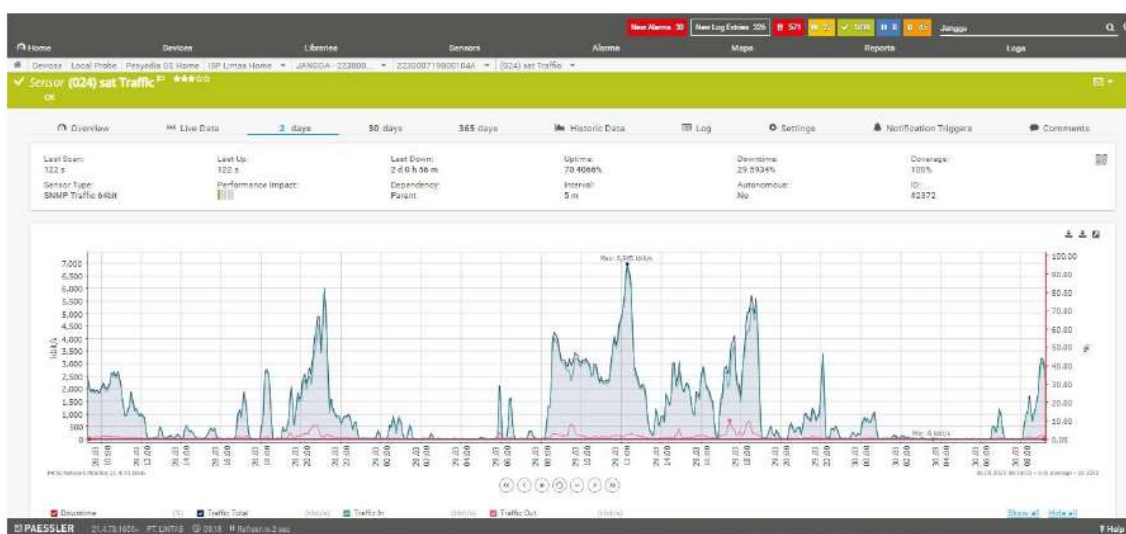

Figure 5. Bandwidth usage traffic via PRTG

After the IP PING test was carried out at the Jangga Dolok village office, there was a visible delay, with a minimum result of 608 ms and a maximum of 688 ms. So that the average delay result in Jangga Dolok village is 637 ms. After the IP PING test, the packet loss value is 0%. This shows an excellent packet loss value, no problems, and is ready to use. The TIPHON standard defines a packet loss value of 0% as very good.
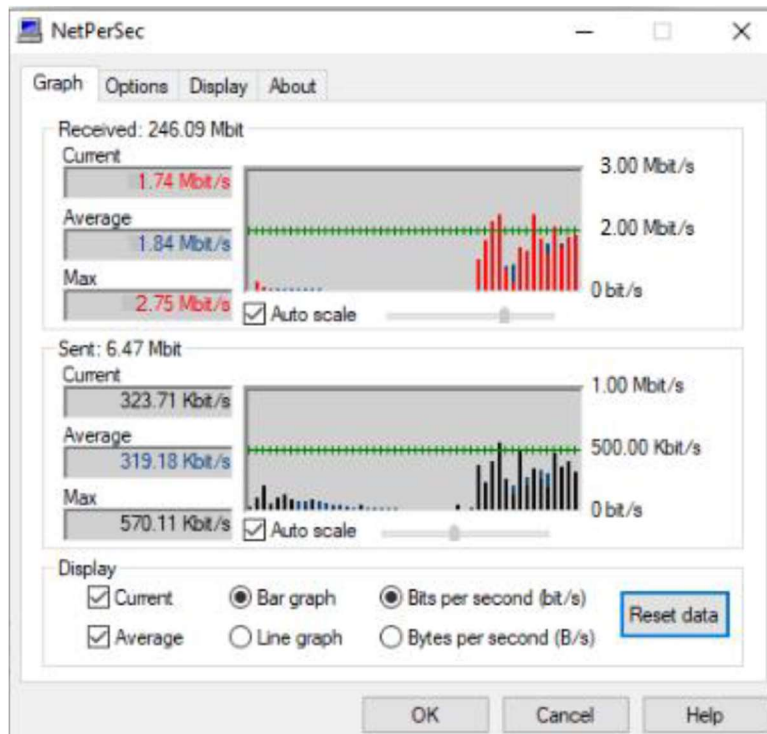
Figure 6. Throughput Value

The throughput value at the Jangga Dolok village office received or downloaded an average of 1.84 Mbit/s, for sent or uploaded an average of 319.18 Kbit/s. The results obtained with the Net Per Second tool can be categorized as good because received or downloaded must be above 500.00 Kbit/s and sent or uploaded must be above 200.00 Kbit/s so that there are no problems accessing the internet at the Jangga Dolok village office.
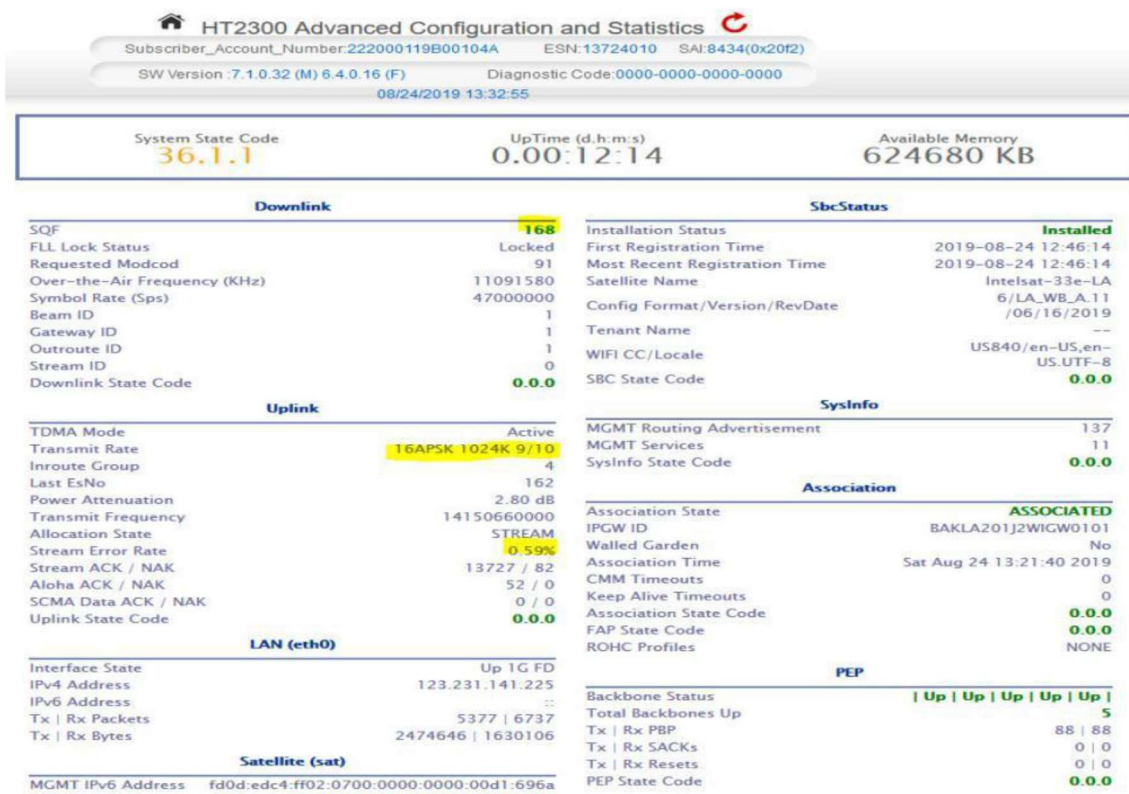
Figure 7. Satellite Statistics *Summary*

This study resulted in a downlink SQF of 168 and an uplink of 16 APSK 1024 K 9/10. This can be categorized as very good because the downlink standard is at least 150.

CONCLUSIONS AND RECOMMENDATIONS

The results of the delay at the Jangga Dolok village office, with an average of 637 ms, can be categorized as good and do not experience problems with internet access delays. But according to TIPHON > 450 ms is classified as bad, specifically for radio devices. Whereas usually, for VSAT devices < 1000 ms can be good and did not experience delays in internet access problems. The quality analysis results are the bandwidth of 1024 Kbps, delay of 637 ms, packet loss of 0%, download throughput of 1.84 Mbit/s, and upload of 3.19.18 Mbit/s and are categorized as very good. The results of field measurement analysis in the form of a connection test show a reply response which means the remote site is already connected to the gateway. The effects of the IDU output transmission parameters downlink SQF 168 and uplink 16 Apsk 1024 K 9/10.

Measurement results upload 1.8 Mbps and download data 0.3 Mbps. Suggestions for future development are the use of VSAT Ku-Band can be replaced with VSAT Ka-Band and HTS (High Throughput Satellite). In addition to a more efficient budget, the network can include more users or users.

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