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Low Cost Broadband IP Satellite Backbone in Indonesia

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Abstract

This article will report on several IP-based satellite backbones in operation in Indonesia. Basically, shared VSAT IP service, such as Digital Video Broadcasting (DVB) service seems to be the favorite low cost solution for broadband IP satellite backbone compared to the more costly Single Channel Per Carrier (SCPC).

Answers to questions, such as typical configurations providing the service, will be described. Some of these services may be run without any government license. The receive-only IP VSAT service is one of these.

A one-way receive-only IP-based DVB VSAT service may be obtained for US $33-270 per month. Two-way DVB/RCS VSAT service is around US $700-800 monthly including the monthly VSAT rental and maintenance fee.

Having IP-based broadband backbone will enable many added value services, such as neighborhood or city-wide networks through WiFi (local broadband) 2.4 GHz infrastructure and VoIP (voice over Internet protocol) community networks. These community based services are described below.

Introduction

A typical question is "What would be the low cost dedicated IP solution for rural/remote sites or small cities?"

If one looks for the solution through Indonesian telecomm, one might find a charge of US $1 per hour through the carrier's dial-up services at 08 098 9999 numbers.

If one looks for dedicated IP connection to the Internet in remote Indonesia through an Indonesian telecomm service, one might find the calculation would be much simpler, i.e., 24 hours times 30 days times US $1/hour. Thus, the dedicated IP connection cost would be in the range of US $720/month. We hope the speed reaches the maximum dial-up speed of 56Kbps, which is the upper limit for most cases in remote / small cities.

To be honest, US $600-800/month for dedicated Internet connection would make teh service unaffordable for most Indonesians. Thus, the common solution would be shared access cost through neighborhood networks, school networks, office networks and so on to obtain an affordable US $15-30/month/house for 24 hours Internet connection. The operating cost calculation is quite straightforward, the monthly dedicated Internet connection cost (US $600-800/month) divided by the number of schools/neighbors/offices. A typical 20-30 neighborhood is sufficient to reduce the monthly cost to an affordable US $15-30 for individual users/households.

A neighborhood network is basically a cyber café technology with a proxy server or Network Address Translator (NAT) box to share a single Internet access to many computers behind the NAT box. Commonly used UTP (LAN) cables run across the neighborhood to connect all computers. Since UTP cable is limited to 100-200 meters, we normally put a hub or switch box every 100-200 meters, to act as a repeater for the LAN cables to reach longer distances.

Neighborhood networks have been a common solution for many Indonesian residential areas. Unfortunately, the government has been very slow in responding to the regulatory framework and has been considering such networks as not legal (but not really illegal).

In some cases, we need to deploy a city wide area network. A typical city wide area network must cover an area with a radius of 5-15 km (or about 25-150 km square). UTP/LAN based technology is not sufficient to cover such ranges. We normally used WiFi 2.4 GHz equipments to do the tasks. Taiwanese low cost WiFi 2.4 GHz is normally designed for indoor usage. Most of us enclose such equipment in plastics boxes, replace the default antenna using a high gain parabolic antenna and set it for 5-15 km outdoor operations.

The individual charges can be extremely low for Internet connection to schools through city wide area networks. Per school Internet access would cost about US $40-70/month by sharing the backbone access with several schools within the city. Considering typical schools would have 500-1,000 students, the final operating cost as well as investment for buying computers would be around US $0.20-0.50/student /month. The return on investment for the computer equipment would be around one to two years time.

The monthly cost in getting the community access as well as school access to the Internet can be reduced significantly to sub-US $1 level per month per student. The whole investment may be paid back within 1-2 years time. The most important aspect of the whole initiative is that communities and the schools don't have to rely on government funding or loans from the World Bank and IMF.

Thus, this plan solves most of our problems in getting low cost (and self-financed) access for neighborhood and city wide area networks. Most of the technology

components are very well documented and can be downloaded from such sites as, http://www.apjii.or.id, http://www.apc.org, and http://www.thewirelessroadshow.org.

Having solved the problem of how to build and finance the neighborhood and city wide area network, our next task is to find the solution for low cost national and international access. There are basically two (2) major competing technologies, i.e. satellite based and fiber optic based backbone infrastructure.

In major cities, it is quite easy to find the fiber optics backbone provided by Indonesian Telkom or XL (one of the Indonesian cellular operator).

Due to bureaucratic reasons and service commitment, many of us would prefer to use XL's fiber optics backbone infrastructure, ensuring high quality, high capacity, and reliable services. Combined with fixed wireless transmissions, VSAT, and submarine fiber optics, the network spans across Java, Bali, Lombok, Sumatra, Kalimantan, Sulawesi, and Singapore (as Business Solution's international Leased Line gateway).

Unfortunately, in many areas of Indonesian, it would be difficult to get access to fiber optics backbone. Thus, the solution would be satellite based backbone infrastructure. The cost structure must remain about US $600-800 per installation to reach an affordable US $15-30/month end user charges. In the next section, I will describe the situation with satellite based IP backbone in Indonesia. To be honest, some of these activities are currently considered as not legal. Although, it is not illegal either.

Overview of Satellite Based IP Backbone Technology

There are basically two (2) major commonly used satellite based IP backbone technologies, namely,

- Single Channel Per Carrier (SCPC)
- Digital Video Broadcasting (DVB)

SCPC technology is basically a dedicated medium, in which the satellite link is used for point to point only and not shared with other users. The quality of service of SCPC link is excellent. Unfortunately, a 64 Kbps SCPC link would cost us in Indonesia about US $2000-2500/month.

To save on cost, one must share the satellite bandwidth/access with others and divide the cost respectively. Digital Video Broadcasting (DVB) technology has the ability to share a single satellite downlink to many users. The end users need to decode the data transmitted from the satellite through a DVB card, costing about US $100-150, and plug in a Windows or Linux box that will act as a router

for the rest of the network. Thus, a DVB box is an incoming solution for the incoming traffic from the Internet to the neighborhood or city wide network.

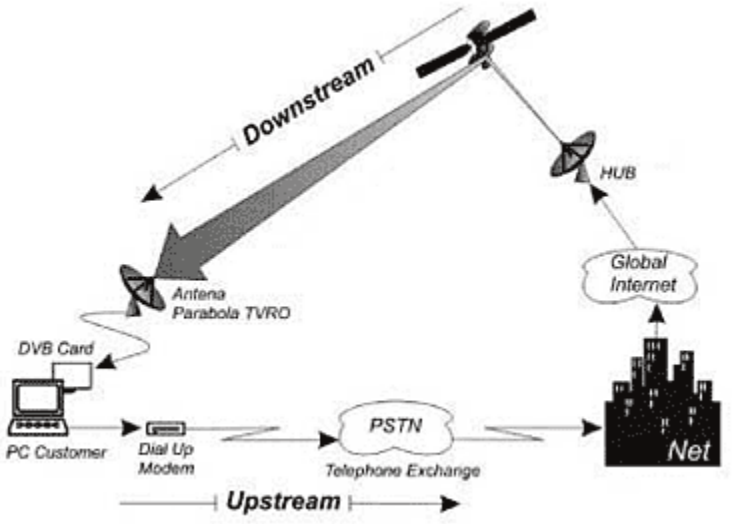
Some DVB technology uses the normal terrestrial network, such as, dial-up or 2.4 GHz WiFi, to route the outgoing traffic to the Internet.

In some cases, getting a dial-up or 2.4 GHz WiFi access to a local Internet Service Provider (ISP) is out of question. In such cases, we need satellite access for both incoming and out going traffic. The most commonly used DVB based technology for both incoming and outgoing traffic is the DVB/FTDMA technology. Both incoming and outgoing traffic is shared over the satellite link. For a 64Kbps DVB/FTDMA installation, shared access may cost US $200-700/month depending on whether we rent or have our own VSAT ground station.

It is common to see a US $700/month DVB/FTDMA VSAT access point shared in a city wide area network through WiFi 2.4 GHz City Wide Network, and then shared again through a UTP/LAN neighborhood network to reach US $15-30/month/house.

Let us now review some of the Satellite based IP backbone providers that run the service in Indonesia.

Receive-Only IP Based Satellite Access



Installing and running a receive-only satellite ground station requires no license from the Indonesian government.

Thus, receive-only IP based satellite access is the safest service that can be provided to the Indonesian communities without having the struggle of getting licensed by the government.

Shown in the figure (copied from Makmur Parabola) is the configuration of a typical receive-only broadband IP based satellite link as the downstream. It is fairly reliable and no license is required. The request (upstream traffic) may be directed through a dial-up modem, or ADSL connection, or WiFi connection to the Internet Service Provider.

Receive-only IP based Satellite Access is normally used to increase the system capacity especially for international traffic. It would be advisable to have a local Internet connection to the local Internet Exchange, such as, Indonesian Internet Exchange (IIX) before doing any receive-only IP based satellite access.

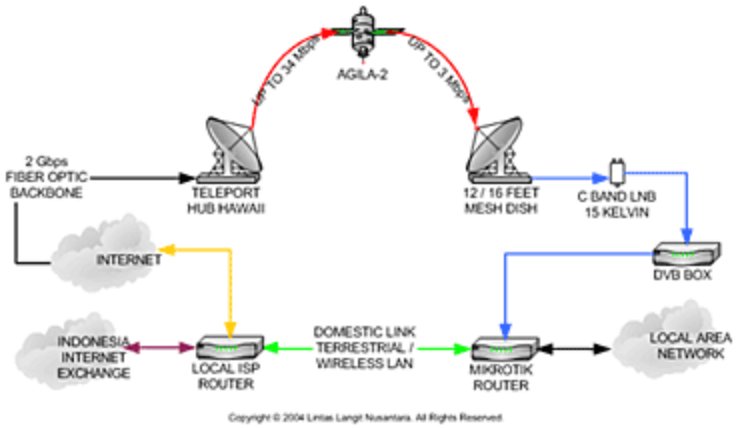
Such configurations are normally used by corporate users, including cyber cafes, hotels, and manufacturing industries, but also by personal/community networks, including apartment buildings, real estate developments and homes.

We need to set up a satellite ground station with a minimal parabolic antenna diameter of 180 cm including the Low Noise Amplifier (LNA) and coaxial cable (such as RG6) that costs about US $120-200 as shown in the figure from Makmur Parabola; a pentium III personal computer 256 Mb RAM and DVB Router with Windows or Linux operating system; Mikrotik router software; a dial-up 56Kbps modem for Internet dial-up connection, ADSL, cable modem or 2.4 GHz WiFi connection for uplink connection.

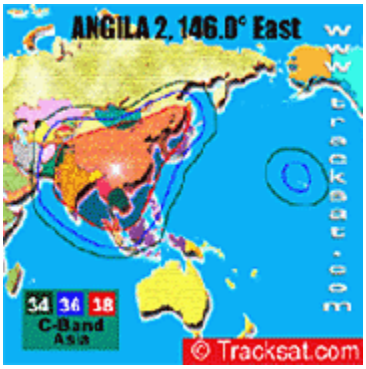
The key equipment would be a DirecPC™ or DVB card, such as Penta Value or Broadlogic 2030, that can decode downlink data from the satellite. A DirecPC™ or DVB card, including CD-ROM and manual would normally cost about US $250. A registration fee of US $100 is fairly typical to use the service.

There are several receive-only IP based satellite access providers that serve Indonesian clients, such as Makmur Parabola. Makmur Parabola is not a licensed telecommunication service provider. It is merely installing parabolic satellite receiving antennas. In addition, the company is reselling downstream only Internet access through Singapore Telecom 1 (88 East) satellite.

Shown in the figure is Singapore Telecom 1 (88 East) 40 dBW and 38 dBW coverage. DirectPC™ equipment is used for receiving the Internet downstream signal from the main hub located in Hong Kong. The monthly charges are quite affordable at US $33 (64 Kbps downstream), US $66 (128 Kbps downstream), and US $198 (256 Kbps downstream).



Lintas Langit Nusantara located in Malang on the eastern part of Jawa is an active group that supports the Indonesian wireless community at indowli@yahoogroups.com.



Lintas Langit also provides a receive- only IP based satellite link via Angila 2 (146 East) that covers the western part of Indonesia. The setup shown in the figure can be used to get a downstream signal of 34Mbps from a teleport hub in Hawaii. A typical monthly fee including the rent of the satellite ground station and dedicated public IP for 64Kbps downstream is around US $270/month.

Telesindo is a VSAT Provider located in Jakarta, that can provide broadband satellite access at 4.42 Mbps - 24 Mbps. It is an IP based system. No detail of its technology or topology is provided.

PalapaNet is a subsidiary of Satelindo. PalapaNet manages Palapa (Palapa C) Satellites. The company provides several IP based services including i-Cast (DVB/IP gateway) Point to Multipoint Concept for Internet and content distribution using a bandwidth sharing DVB/IP mechanism over the Palapa C satellite. No more detail is provided.

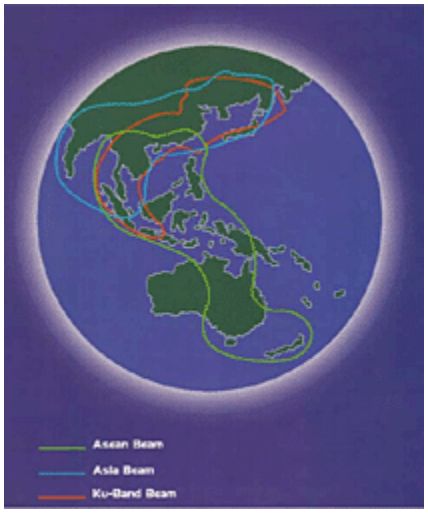
Two-Way IP Based Satellite Backbone

In some cases, we need two-way IP based satellite backbone connection to the Internet. To be able to transmit to the satellite, one needs to get the Internet service from an Indonesian licensed operator. As VSAT technology is fairly common, we may easily obtain an International VSAT service from a reseller or unlicensed operator. Such action may create a significant headache to the Indonesian telecommunication regulators, namely the Indonesian Post &

Telecommunication Authority. There are several competing two-way IP based satellite backbones namely. They are:

- Single Channel per Carrier (SCPC), the most expensive IP based satellite backbone. A satellite channel/carrier is a dedicated link to the client thus, can be quite expensive in the range of US $2000-2500/month for a 64Kbps dedicated link.
- Time Division Multiple Access (TDMA) was the early method to share a single satellite channel among many clients. The channel efficiency in TDMA is quite poor.
- Digital Video Broadcasting (DVB) is one of the latest and most efficient methods to share the downstream satellite link among several users/clients. The latest method to have a shared uplink to the satellite is Digital Video Broadcasting, Return Channel via Satellite (DVB/RCS). An earlier version such as Digital Video Broadcasting, Frequency/Time Division Multiple Access (DVB/FTDMA) (Gilat's proprietary technology) and DVB/SCPC has been used by several operators to provide two-way IP based satellite links to the Internet. Using the DVB based technology, the cost for two-way IP based satellite links may be reduced to US $600/month.

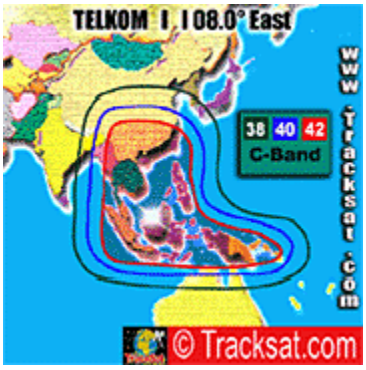
Most of the public IP infrastructures and services are now moving towards DVB based platforms to attain lower cost access for the end users. Some two-way DVB based IP services in Indonesia are:



Pasific Satellite Nusantara (PSN), physically located in Jakarta, offers two-way IP based DVB/FDTMA through the Palapa C1 satellite (footprint shown in the figure) on its ASEAN beam that covers all of Indonesia as well as Papua New Guinea and Northen Australia. PSN's DVB/FTDMA product is called BINA at infobina@pesat.net.id. Cost for a dedicated 64Kbps DVB/FTDMA is in the range of US $700/month.

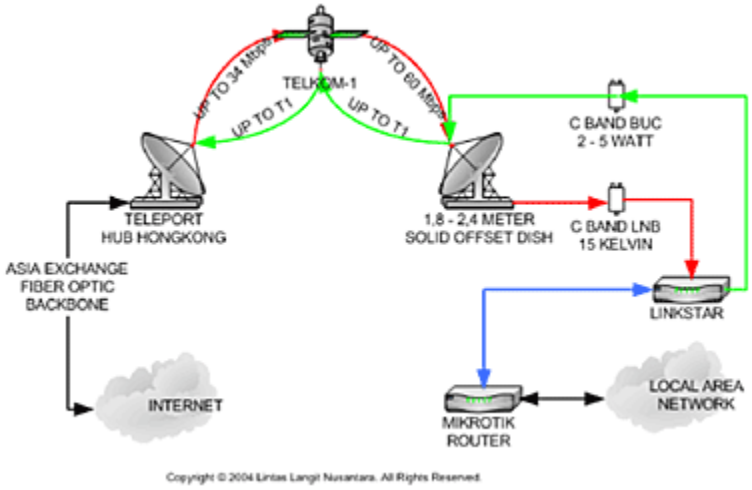
Infokom located in Jakarta is one of the old timers as a VSAT provider in Indonesia. Infokom offers many variant VSAT Services, such as Point to Point SCPC (Single Channel Per Carrier) and MCPC (Multiple Channel Per Carrier), Bandwidth On Demand (BOD) enabling us to increase link speed up to 2 Mbps when needed, TDMA and two (2) way broadband. Interestingly, Infokom provides IP based DVB/FTDMA VSAT service with an upgradeable outbound DVB-S data rate up to 52.5Mbps and inbound data rate up to 512 Kbps. It covers the whole of Indonesia. No satellite is specified in the service, we assume it uses one of the Palapa Satellite. In case of emergency, a redundant dial-up back-up service is provided.

Primacom Interbuana provides a broadband service that combines the secure-technology of TDM/TDMA and DVB (Digital Video Broadcast) technology that delivers broadband access up to 48 Mbps. No more detail is provided.



Lintas Langit Nusantara is the provider of LinkStar Internet Access based on DVB/RCS Time Division Multiple Access (TDMA) Multi Frequency (MF) to ensure a more equal bandwidth sharing mechanism to reach link capacity and a cost-effective dedicated link. Telkom-1 satellite (108 East) is used in the service via a teleport hub in Hong Kong.

For an upstream 6-32 Kbps and downstream 16-64 Kbps the monthly cost of this service is about US $350/month. Shown in the figure is the typical configuration of the DVB/RCS TDMA MF access. Another configuration offered by Lintas Langit Nusantara is DVB/SCPC via AGILA-2 satellite. DVB/SCPC service via AGILA-2 satellite at 64Kbps will have a monthly cost of about US $700/month.



PalapaNet is a subsidiary of Satelindo which manages Palapa Satellite C. Satelindo provides several IP based services including i-Connect. Shared Internet Link is a point to point Internet service designed for the small to midsize enterprise using the Internet gateway-sharing concept to provide efficiency and value to customers while maintaining high level service quality. No more detail is provided.

For those who wish to save more on cost, it may be done by buying one's own satellite ground station and removing the extra US $400-500/month for renting and maintenance fee of the VSAT ground station. DVB/RCS VSAT ground stations cost around US $1,500 in North America. Unfortunately, the DVB/RCS TDMA-MF VSAT ground station is around US $6,500 each in Indonesia.

Value Added Services over VSAT IP backbone

Having a dedicated broadband Internet access channel, one may be able to host value added services using VSAT IP backbone. Some of the value added providers are:

Satelkom provides MeteorVoice&trade VoIP service using a low density Internet Telephony Gateway, such as the VG 1002, that runs both VoIP protocols H.323 and SIP.

Infokom provides triple bundling, namely media, Internet and phone. Its services focus on media related VAS such as Premium call, premium short message services and televoting and telecommunications related VAS such as VOIP, interconnection settlement and call centers.

In many cases the satellite backbone (as well as fiber optics backbone if any) are shared with the surrounding neighborhood via UTP cables for short distances (100-200 meters) or WiFi 2.4 GHz infrastructure tuned for outdoor usage for city wide network. Today, we have more than 10,000+ WiFi outdoor links in Indonesia. Considering that many of these links are not legal (but also not illegal), the number of WiFi links can be exponentially high if the government can un-license the 2.4 GHz and 5.8 GHz band for Internet usage.

Having a dedicated connection to the Internet has enabled many free VoIP services.There are two major free VoIP infrastructures, namely, (1) H.323 based VoIP Merdeka at Root Gatekeeper 202.53.224.172 and (2) SIP based VoIP Rakyat at http://www.voiprakyat.net. Some of the Internet Telephony Gateways (ITG) using these free VoIP Infrastructures may reach PSTN numbers free of charges.

Final Remarks

It is our hope to see 200 million Indonesians have access to phone, and 100 million Indonesians connected to the Internet by 2015. To be honest, current Indonesian policy and regulatory framework does not aim to reach such explicit goal. In reality, low cost IP based satellite interconnected with WiFi 2.4 GHz city-wide broadband infrastructures may be the main vehicle to reach such a goal.

The strategic approach would be a self-financed process in which all 220,000+ Indonesian schools are connected to the Internet at US $10/school/month! Thus, such an arrangement would cost US $0.10-0.50/student/month, and will enable 48+ million future Indonesian students to get connected to the Information infrastructure as well as encouraging 100+ million parents to get connected. This whole process can be community self-financed without World Bank/IMF loans. The means to do it can be freely downloaded from http://www.bogor.net/.