

VSAT TECHNOLOGY

CONTENTS

- Communication
 - Wireless Communication
- Satellite communication
- VSAT
 - Introduction
 - Advantages
 - Applications
 - Network Architecture
 - Multiple Access Techniques
- Distance Learning: an application

Types of Communication



Communication is reliable transmission of information over a channel.

Here we shall concentrate only on **wireless communication.**

Wireless Communication

- People need to be online all the time and therefore have no use of physical connectivity.

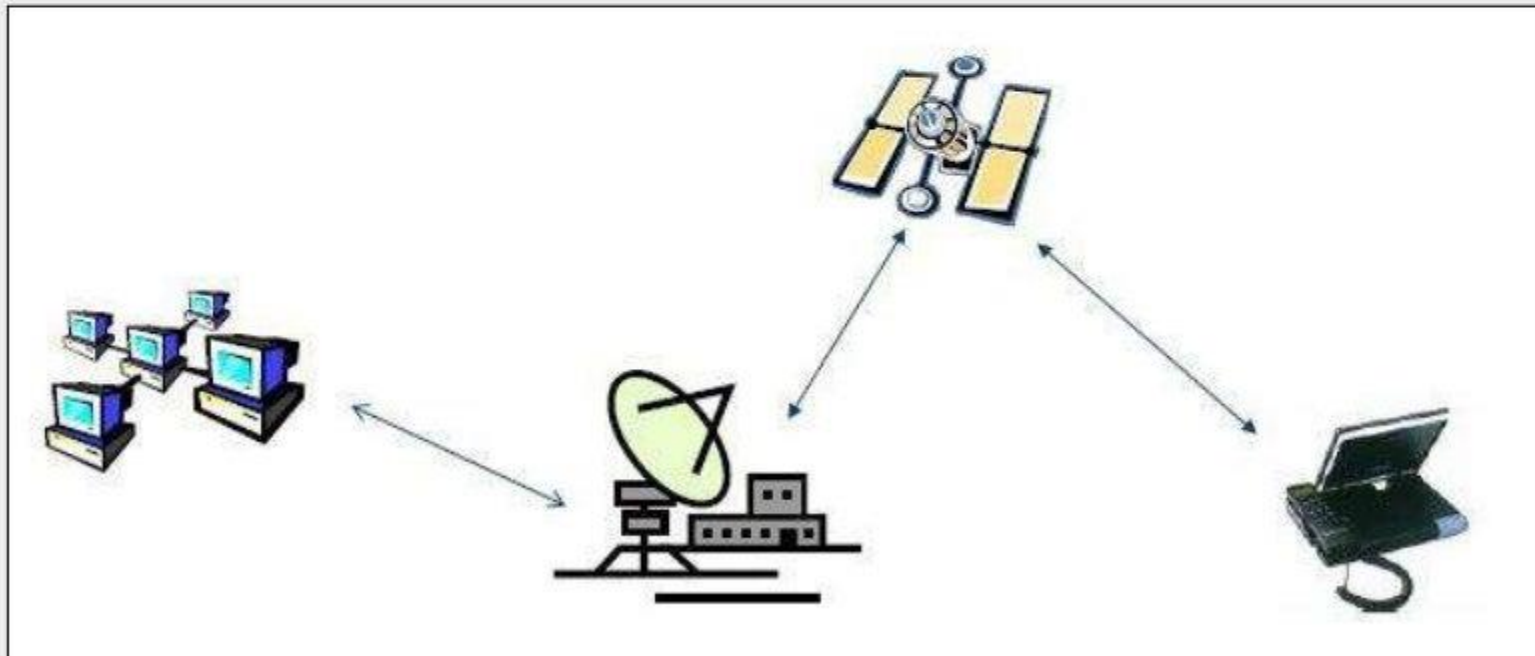
It is of two **types**:-

1. Microwave Communication
2. Satellite Communication

Since the microwaves travel in straight lines, if the towers are too far away then the earth gets in the way. For communicating at a far of distance high towers are needed which may be very expensive. Bands above 8GHz are absorbed by water. Due to all these reasons satellite communication is preferred.

SATELLITE SYSTEM

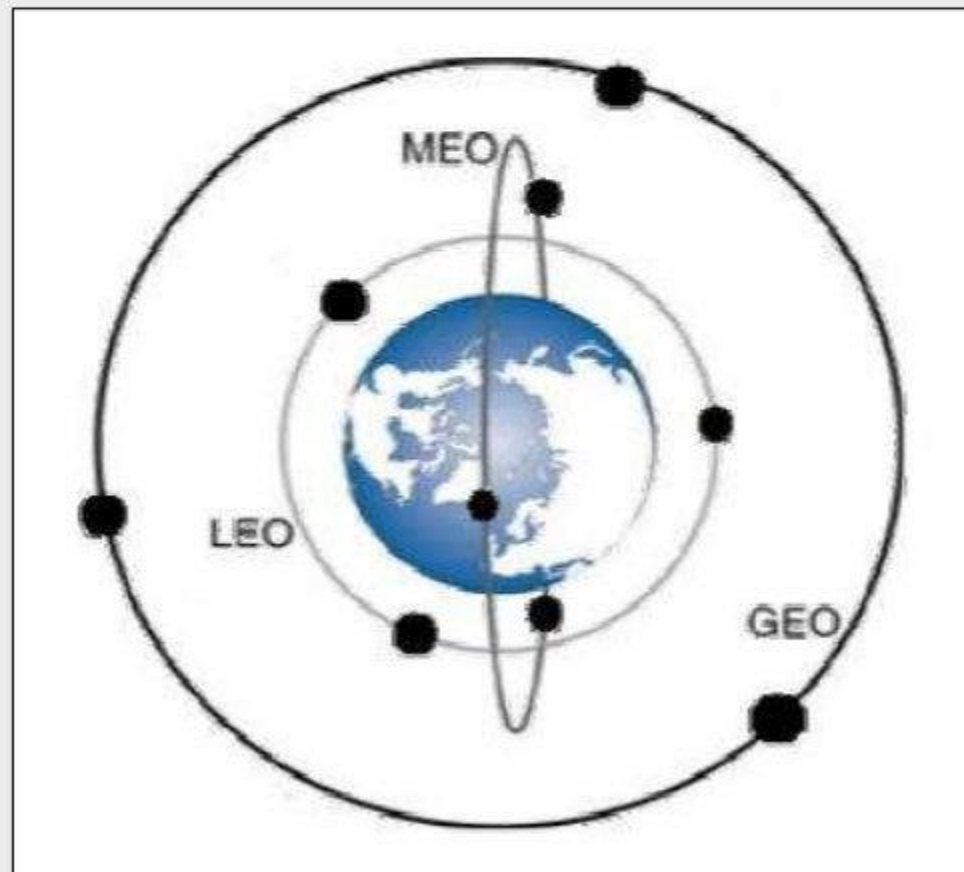
A satellite system consists basically of a satellite in space which links many earth stations to the ground. It contains several transponders each of which listens to some portion of the spectrum, amplifies the incoming signal and then rebroadcasts it at some other frequency to avoid interference with the incoming signal.



TYPES OF SATELLITES

According to orbit position satellites are of mainly three types:

- LEO(Low Earth Orbit satellite)
- MEO(Medium Earth Orbit satellite)
- GEO(Geosynchronous Equatorial Orbit satellite)



SATELLITE FREQUENCY BANDS

BAND	UP-LINK (GHz)	DOWN-LINK (GHz)	ISSUES
C	5.925-6.425	3.7-4.2	Interference with ground links, Large antenna size.
Ex-C	6.725-7.025	4.500-4.800	Weak signals, Large antenna size.
Ku	14.0-14.5	11.7-12.2	Attenuation due to rain.
Ka	27.5-30.5	17.7-21.7	High equipment cost.

- VSAT network mainly use **GEO** satellites in **Ku and Extended-C band** for their application purposes.
- VSAT transceivers integrate all necessary functions into a small, highly integrated out-door package which provides excellent reliability in a wide range of environments and functions.

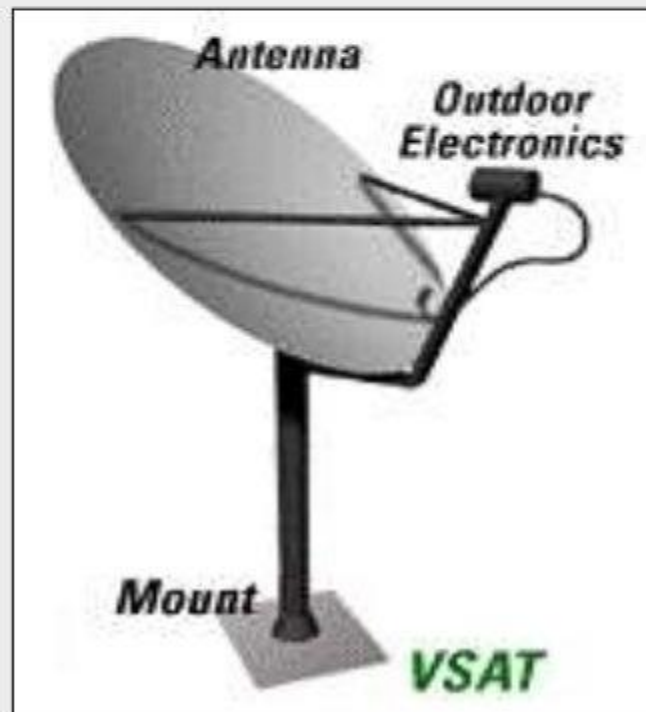
Introduction To VSAT



- A Very Small Aperture Terminal (VSAT) is a device known as a small private earth station - that is used to transmit & receive data signal through a satellite.
- **VSAT** stands for Very Small Aperture Terminal and refers to receive/transmit terminals installed at dispersed sites connecting to a central hub via satellite using small diameter antenna dishes (0.6 to 3.8 meter).
- VSAT is used for both broadcast & interactive applications of effective data, voice and video transfer.

VSAT INSTALLATION

- Information is produced at the hub having a very large 15 to 36 foot antenna. The hub controls and monitors the network through a network management system (NMS). Information is sent up to the communication satellite which receives, amplifies and beams it back to earth for reception by the remote VSATs.



Why VSAT?

- The dish is small, easily transportable and installation lead-time is much shorter if compared to terrestrial links.
- VSAT network allows rapid, low-cost network re-configuration and expansion to meet new or unexpected business requirements.
- Cost effective transmission and network operations are made possible by use of the Ex-C band satellite frequency and frequency times division multiple access (FTDMA), Frequency division multiple access (FDMA) or Time division multiple access (TDMA) transmission techniques.

ADVANTAGES

There are many advantages that VSAT offers, some of them are as follows:

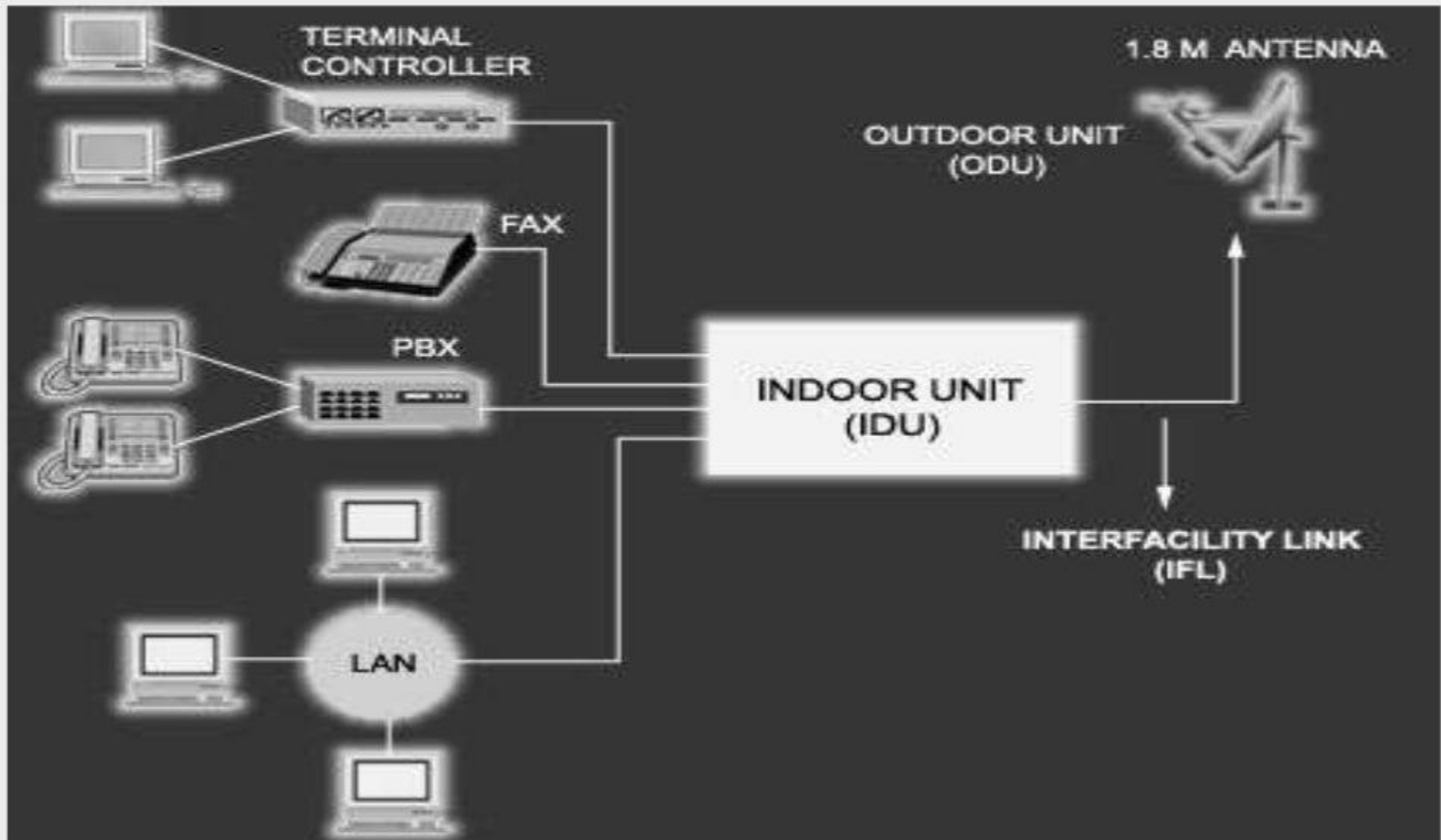
- Offer flexibility as adding a site is quick and easy.
- Service charges depend on the bandwidth, which is allocated to network in line with your requirements.
- VSAT terminals prices are falling.
- VSAT offers a wide of protocols and features, providing extraordinary flexibility and virtually unlimited expansion capabilities. VSAT network is typically engineered to achieve a minimum of 99.5% end-to-end availability for all locations.
- No last mile issues.
- As it is mobile, so be used for short term or emergency communications.
- Excellent for broadcast transmission.

APPLICATIONS

VSAT is an ideal satellite network that provides communications support for a wide range of applications:

- Distance Education
- Retail Networks
 - Point-of-Sale(PoS) transaction, banking, inventory, reservation system.
- Corporate Networks
 - Internet/Intranet access, corporate voice, file transfer, video-conferencing.
- High-speed Internet access
 - Browsing, E-mail, E-commerce .
- Financial Management

TYPICAL USAGE



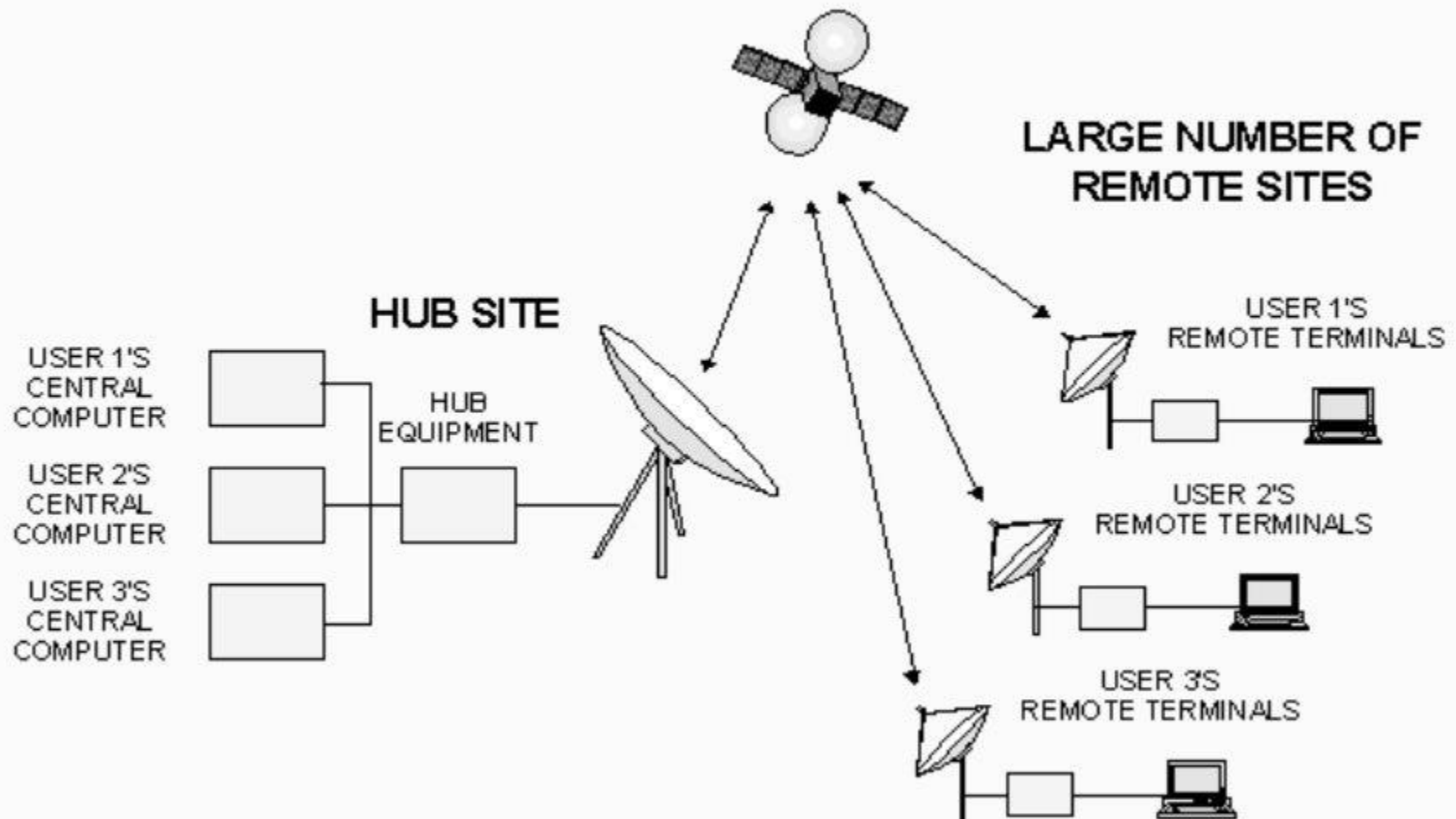
NETWORK ARCHITECTURE

VSAT network can be of following two types:

1. Hub type (VSAT StarNet with Star network topology)
2. Hubless type (VSAT DialNet and VSAT Direct with point-to-point or meshed network topology)

Most VSAT networks use a star configuration, which composes a **single Hub communicating with remote VSATs**. A VSAT Hub is a huge earth station that is responsible for controlling & monitoring all the activities of the geographical spread of VSATs. In some cases all the remote VSATs communicate to one central site, this central site is connected to the hub, as hub is the switching element. This service supports transmission bandwidth ranging from 9.6 kbps to 2 Mbps duplex.

VSAT HUB NETWORK



VSAT Shared Hub Network Configuration

MULTIPLE ACCESS TECHNIQUES

1. SCPC (Single Channel Per Carrier)
 - (i) PAMA
 - (ii) DAMA
2. TDMA (Time Division Multiple Access)

PAMA (Pre Assigned Multiple Access)

PAMA is an access scheme where in when two VSATs want to communicate with each other a bandwidth is pre-assigned to them exclusively. This assigned bandwidth will be available to the VSAT's on a permanently basis.

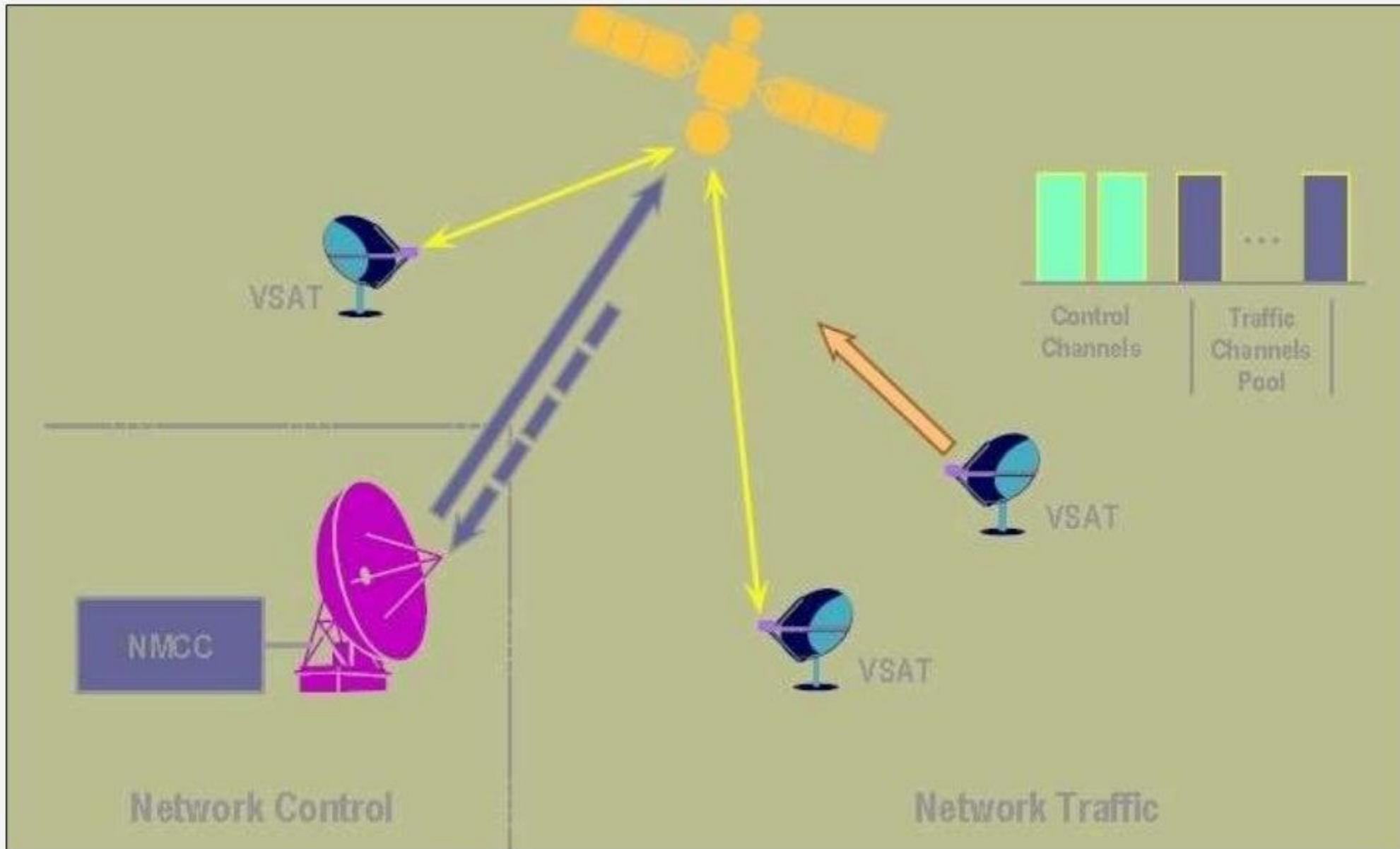
DAMA

(Demand Assigned Multiple Access)

This scheme is very similar to a telephone connection. The role of the telephone exchange is to connect you to the desired number. Remotes request a time slot or a frequency to transmit their traffic. The Hub plays the role of a telephone exchange, between any two VSAT's.

- NMS allocates each remote a time slot or a frequency to transmit this traffic.
- The attributed frequency or time slot will not be released until the end of the transmission. The hub plays the role of a telephone exchange, between any two VSAT's.
- The DAMA service addresses point to point voice, fax, and data communication requirements of remote sites.

DAMA



TDMA

(Time Division Multiple Access)

- In TDMA a number of earth stations take turns(slots) for transmitting through a common transponder. TDMA network operates in a Star topology.
- All the remote VSATs communicate to the central hub station, on a Time Division Multiple Access Modes. At the hub the signal is re-transmitted to the destination VSAT using TDM technology after amplification.
- All the remote VSAT's contend for a time divisional slot to transmit their packets to the hub.
- The channel used by the remotes to communicate to the hub is called the Return Link. Each of these return channels operates at a maximum of 128 Kbps.

VARIOUS VSAT PRODUCTS

Comparison of various VSAT Network Characteristics					
Supplier	Hardware	Type	Inbound Data Rate (kb/s)	Outbound Data Rate (kb/s)	Modulation
Gilat/Spacenet	Skystar Advantage	TDM/TDMA	9.6, 19.2, 38.4, 56, 64, 76.8, 128	64, 128, 256, 512, 1024, 2048	DPSK or MSK
Hughes	ISBN/PES	TDM/TDMA	64, 128, 256	128, 512	BPSK
Indra Espacio	Arcanet	CDMA			
NEC	Nextar V	TDM/TDMA	64, 128, 256	64, 128, 256, 512, 768, 1536, 2048	BPSK/QPSK
STM	X.Star	TDM/TDMA	96, 192, 384	64, 128, 256, 512, 1024, 1544	BPSK
TSAT	TSAT 2000	TDM/TDMA	0.3, 0.6, 1.2, 2.4, 4.8	0.3, 0.6, 1.2, 2.4, 4.8	4FSK, 2-4PSK
TSAT	TSAT 2100	TDM/TDMA	2.4 - 9.6, 14.4, 16.8	2.4 - 9.6, 14.4, 16.8	QPSK
ViaSat	Sky Relay	TDM/TDMA			

INTERACTIVE VSAT

(DISTANCE LEARNING USING VSAT)

- Distance education is an innovation that allows educational content to be transmitted from area to area and provides students in rural areas also an opportunity to get education.
- Due to the need for high speed and high quality educational messages, communication satellites are often used more for efficient transmission.
- The main purpose of distance education is to provide people greater access to education without the limitations of distance and boundaries.

PROCESS OF DISTANCE LEARNING

- At the teacher end the audio and video input is fed to the Hub . A dummy student is also placed there to see whether the information is sent correctly and in order. Data from the hub is passed through the router to the central hub, wherefrom it is transmitted to the satellite.
- At the user end, the user is given a particular IP address and a login ID. Using this can access the remote earth station which receives the data from the central Hub via satellite.
- Distance education requires a network, which has broadband capability, so that the network is able to carry large amount of video and audio data. Satellite distribution can facilitate two-way transmission of dense data traffic at speeds equal to or faster than most wire-based systems.